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SOUG Day Zurich – Oracle Hackathon

Eine fertige (KI-) App in wenigen Minuten mit Oracle
APEX und AI Vector Search?

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Oracle



Agenda

1. APEX and AI
2. AI Vector Search
3. Hackathon: ready – steady – go!

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APEX and AI

Bots everywhere



What Is Oracle APEX?



A low-code development platform that enables you to build scalable and secure enterprise apps with world-class features that can be deployed anywhere.



Oracle APEX

Database-centric web application development framework



Develop desktop and
mobile web apps

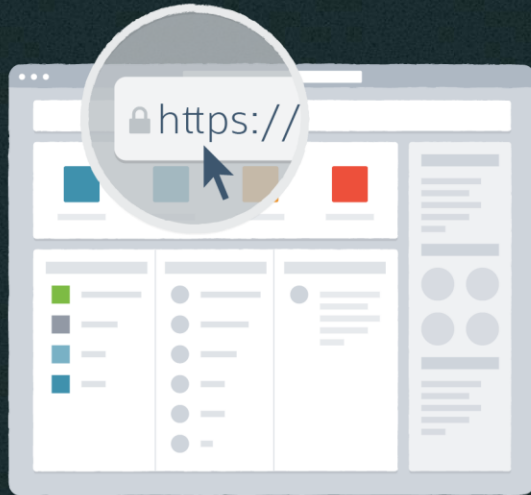


Visualize and maintain
database data



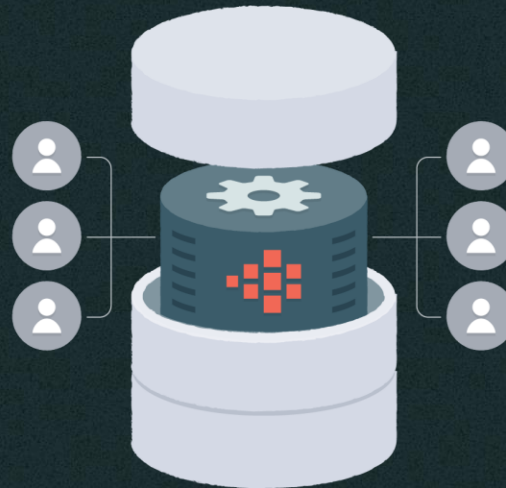
Leverage SQL Skills and database
capabilities

Distinguishing Characteristics



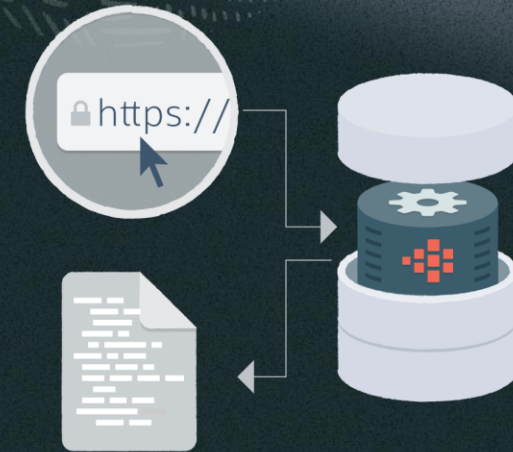
App Development IDE is a web browser.

No client software needed



App definitions are stored in the database as meta data.

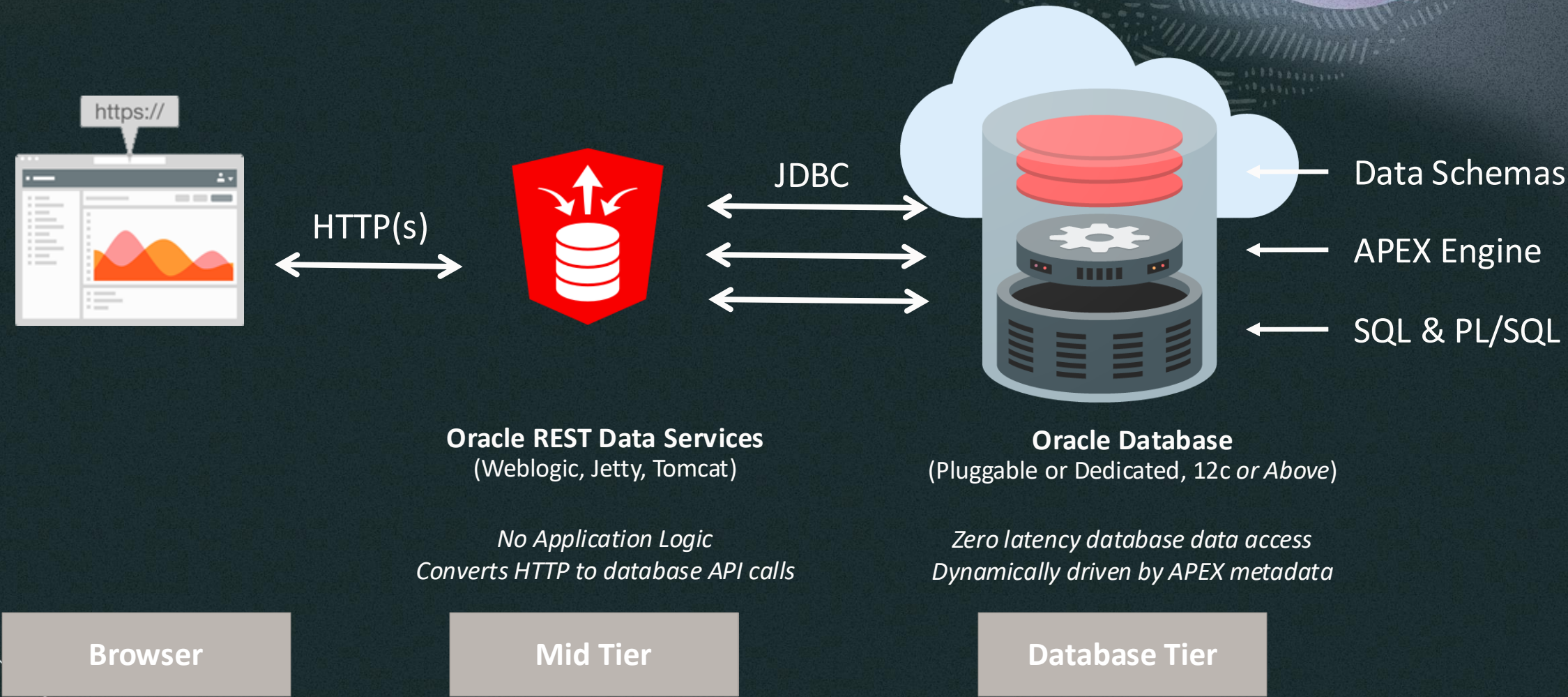
**Declarative –
No code generation**



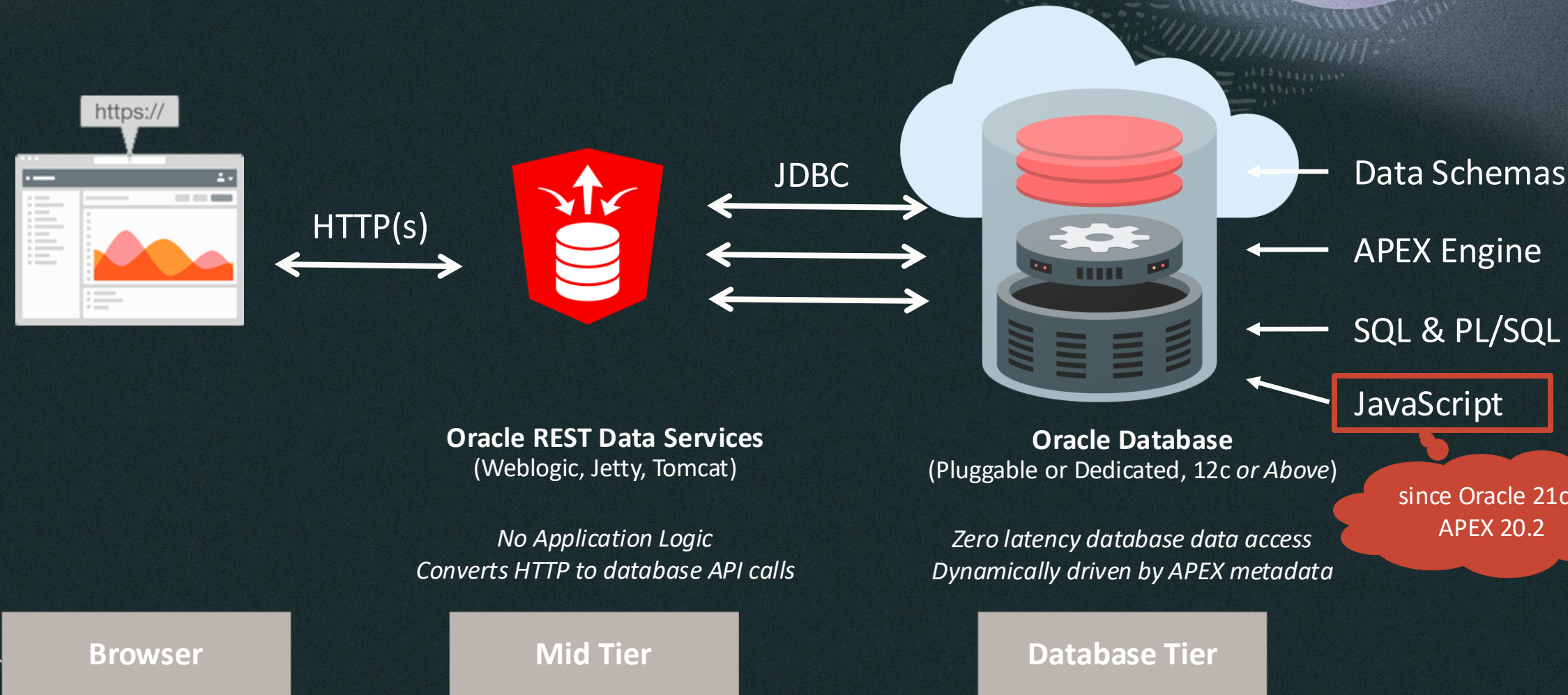
Page generation is efficient with only one request and one response.

**Data processing done
in the Database**

APEX Architecture



APEX Architecture with MLE/JavaScript

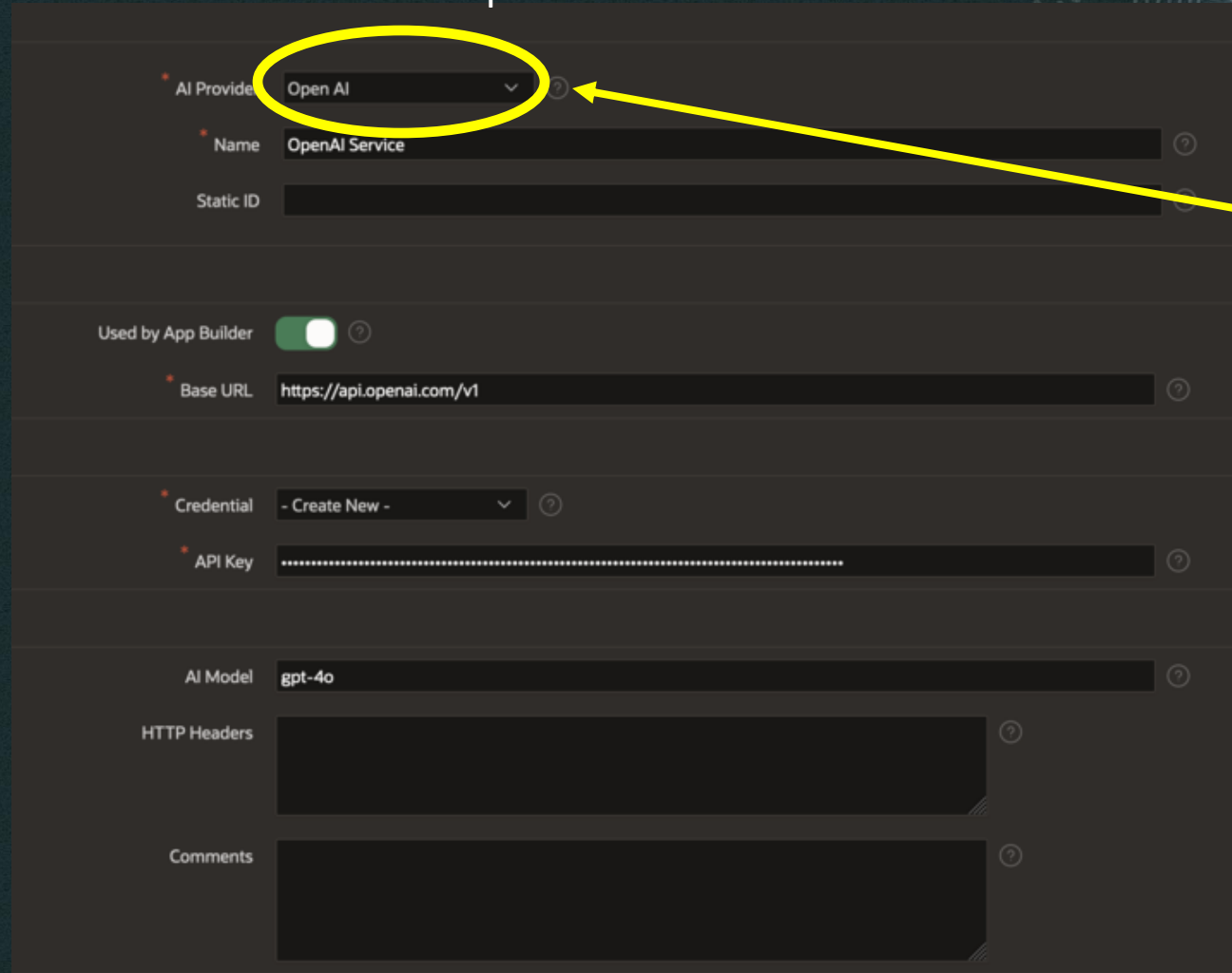


since Oracle 21c /
APEX 20.2



APEX and AI - Setup

All Workspace Utilities → Generative AI



The screenshot shows the 'Generative AI' setup page in APEX. The 'AI Provider' dropdown is highlighted with a yellow circle. Below it, the 'Name' field is set to 'OpenAI Service', and the 'Static ID' field is empty. The 'Used by App Builder' toggle is turned on. The 'Base URL' field contains 'https://api.openai.com/v1'. The 'Credential' dropdown is set to '- Create New -', and the 'API Key' field is masked with dots. The 'AI Model' field is set to 'gpt-4o'. The 'HTTP Headers' and 'Comments' fields are empty.

AI Provider	Open AI
Name	OpenAI Service
Static ID	
Used by App Builder	<input checked="" type="checkbox"/>
Base URL	https://api.openai.com/v1
Credential	- Create New -
API Key
AI Model	gpt-4o
HTTP Headers	
Comments	

Newest APEX patch version
now also supports OCI GenAI
engine 😊

APEX and AI – SQL Commands General Assistant

Is unaware of your database schema, but can answer all kinds of questions about APEX, PL/SQL, JavaScript, etc. based on knowledge from the web.

Very good for formatting and syntax correction as well as answering general questions.

General Assistance ▾

Please note that AI-generated code may contain errors or security risks. Always review and validate all code before use.

Clear chat

How may I assist you?

How can I query all tables in my schema? LB

To query all tables in your schema, you can use the `ALL_TABLES` or `USER_TABLES` dictionary views. Here's a query to list all tables in your current schema using the `USER_TABLES` view:

```
sql
select table_name
from user_tables
```

If you want to list all tables you have access to, including those from other schemas, you can use the `ALL_TABLES` view:

```
sql
select owner,
       table_name
from all_tables
where owner = user
```

These queries will list the table names from the respective views.

What's wrong with the following query: Select ename, sal from emp where (sal > 200) LB

There are a few issues with your query. Let's address them one by one:

- Misspelled Table Name:** It appears that `emp` should likely be `emp`.
- Unclosed Parenthesis:** The condition in the `where` clause has an unclosed parenthesis `(`.
- Missing Closing Quote for sal Value:** The value `200` should not be enclosed in a parenthesis.

Here's the corrected query:

```
sql
select ename,
       sal
from emp
where sal > 200
```

This query selects the `ename` and `sal` columns from the `emp` table where the `sal` value is greater than `200`.

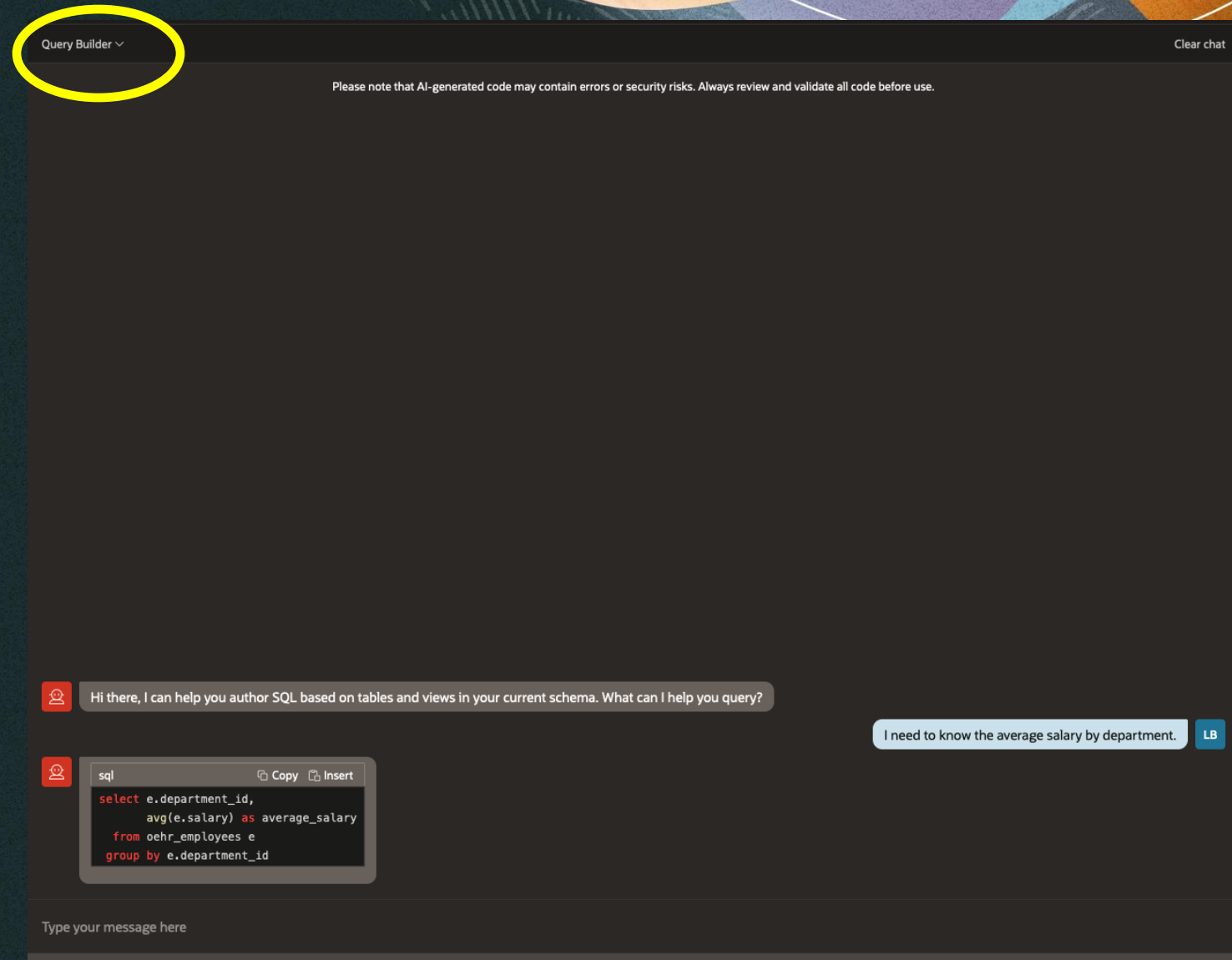
Type your message here



APEX and AI – SQL Commands Query Builder

APEX enhances the prompt with additional knowledge about the database schema (table names, views, column names, etc.)

Always creates a SQL query (no DML, no PL/SQL) as a response.



APEX and AI – Creating an AI bot within your app

Page with Page Items for German to Swiss translation:

- new page with new page region
- two text areas within the region body
- a button within the region body
- a dynamic action action within the button and an AI action

The 'Create Blank Page' dialog is shown with the following details:

- Page Definition:**
 - Page Number: 6
 - Name: Translator
 - Page Mode: Normal (selected), Modal Dialog, Drawer
- Navigation:**
 - Use Breadcrumb: ☒
 - Breadcrumb Parent Entry: (empty dropdown)
 - Use Navigation: ☒
 - Navigation Preference: Create a new entry
 - Parent Navigation Menu Entry: - No parent selected -
 - Icon: fa-file-o

Buttons: < Cancel, Create Page

A context menu is displayed over the 'New' dynamic action in the page editor. The menu options are:

- Create TRUE Action
- Expand All Below
- Collapse All Below

The page editor for 'Page 6: Translator' shows the following structure:

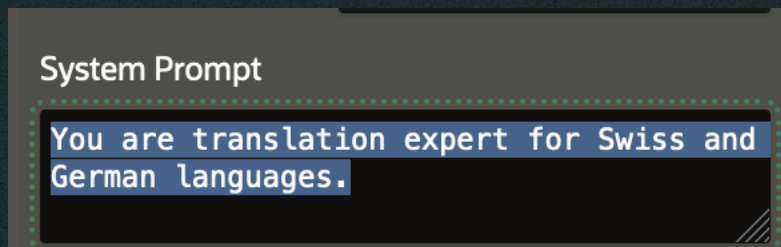
- Pre-Rendering
- Components
 - Breadcrumb Bar
 - Breadcrumb
 - Body
 - New
 - Region Body
 - P6_GERMAN
 - P6_SWISS
 - Translate
 - Dynamic Actions
 - New
 - True
 - Open AI As
 - False
 - Post-Rendering

APEX and AI – Creating an AI bot within your app (2)

Configuring the Bot: system and immediate action prompt

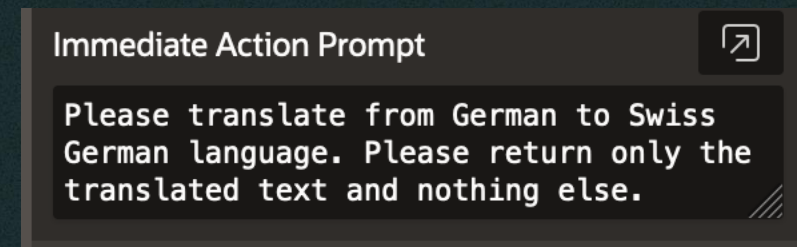
System Prompt:

set the context for the entire conversation with the bot



Immediate Action Prompt:

Set the immediate context for the next, immediate question to be asked.



APEX and AI – Running the AI Bot

The screenshot displays an APEX application interface. On the left, a 'Translator' page is visible with a 'New' section containing a text area with the word 'klettern' and a 'Translate' button. To the right, an 'Assistant' modal is open. The modal contains a text area with the instruction: 'Please translate from German to Swiss German language. Please return only the translated text and nothing else.' Below this, the word 'klettern' is entered. A yellow arrow points from the text area to the 'Assistant' modal. At the bottom of the modal, a suggestion box shows the word 'chlättère' with a 'Use this' button, which is circled in yellow.

This will accept the translated value, paste it into the “Swiss” text field and close the assistant.

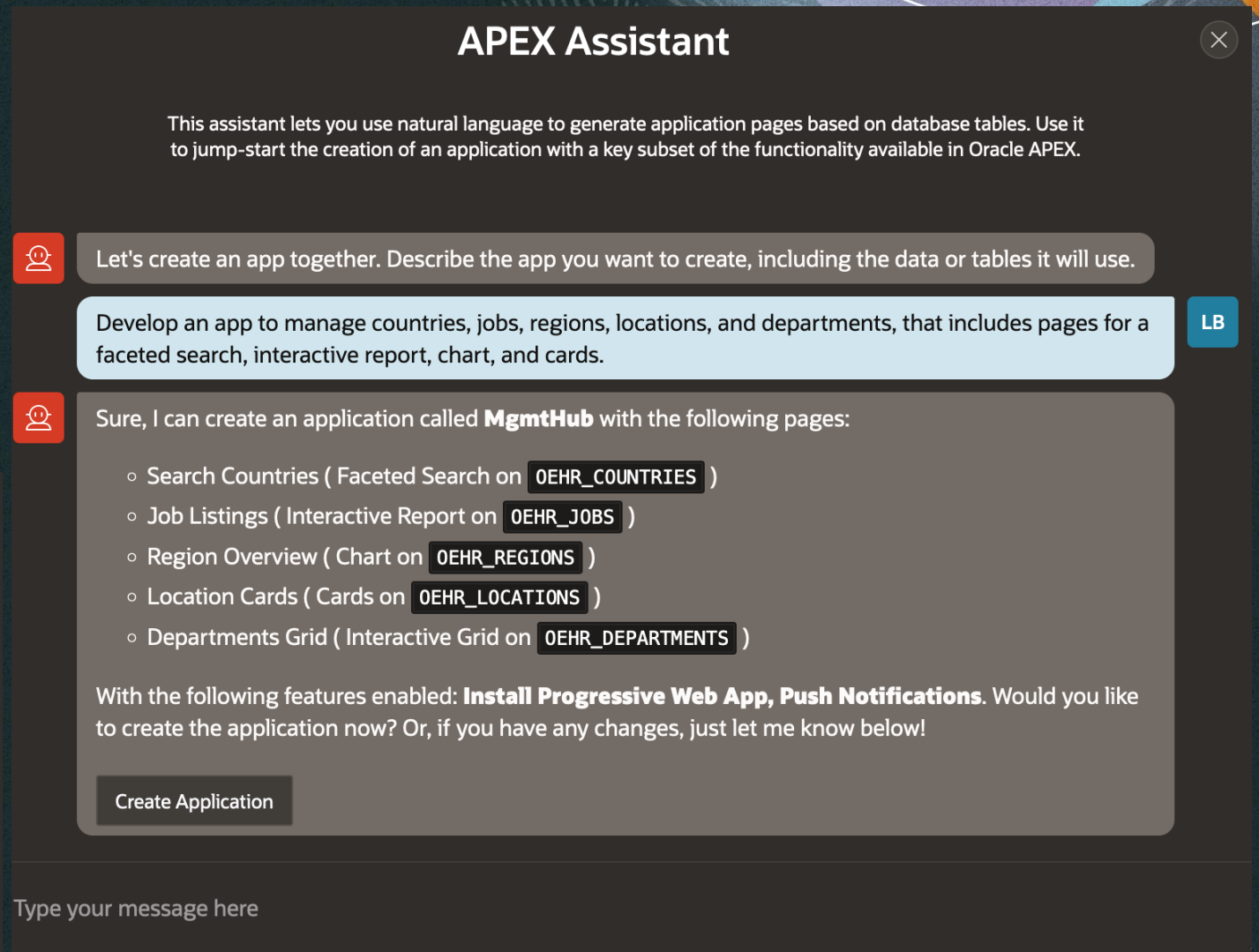
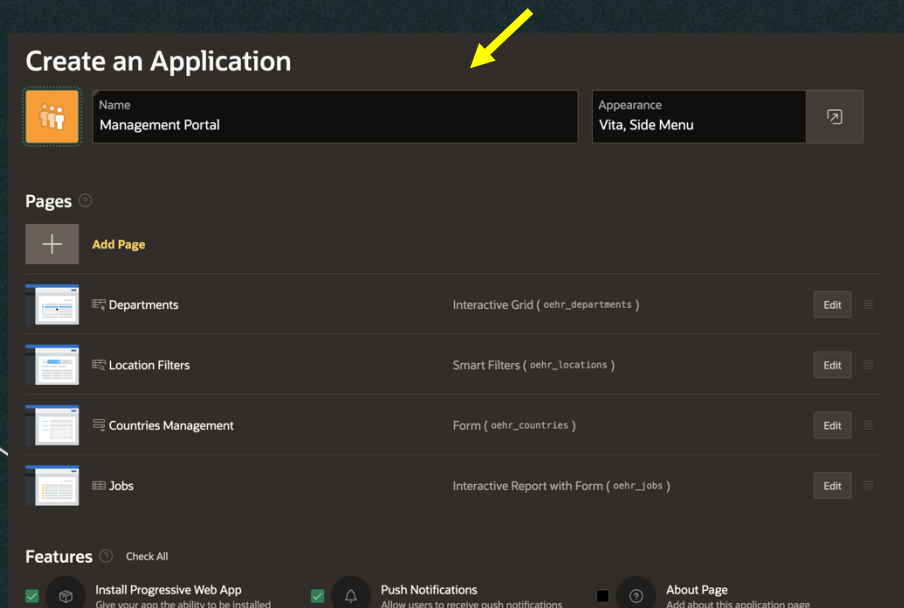
If you don’t like the translation, you can communicate with the bot further to get better values...

If you want to have that bot be run automatically in the background, use the APEX_AI PL/SQL package for AI assistant.

APEX and AI – Create an entire app by AI

App Builder → CREATE
→ CREATE APP USING GENERATIVE AI

- Write your prompt yourself or use one of the pre-defined examples.
- "Create Application" then serves the regular "Create App Wizard"



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AI Vector Search

Use AI within your database



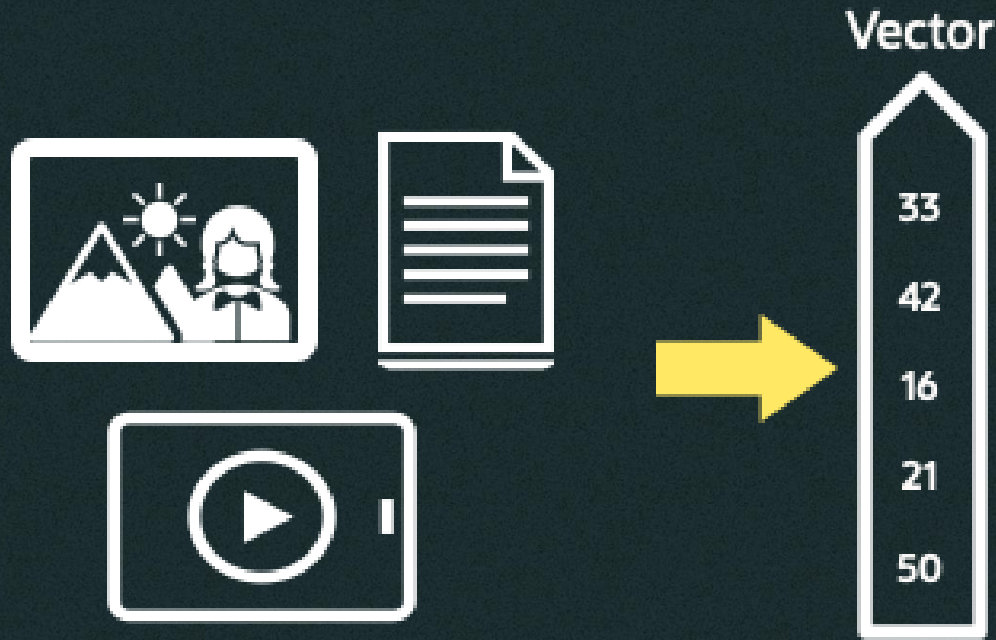
Vector Search

A new technology that enhances information retrieval by mapping queries to relevant data in your database based on semantics, instead of precise matches, using vectors to measure similarity



Similarity Search

Vectors are used in AI to capture the semantics of data: Images, documents, videos, or even structured data

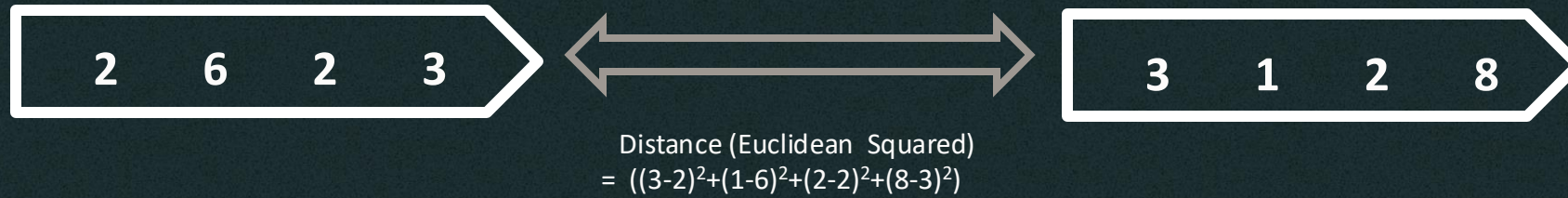


A vector is a sequence of numbers, called dimensions, used to capture the important “features” of the data

Represent the **semantic content** of data, not the actual words in a document or pixels in an image

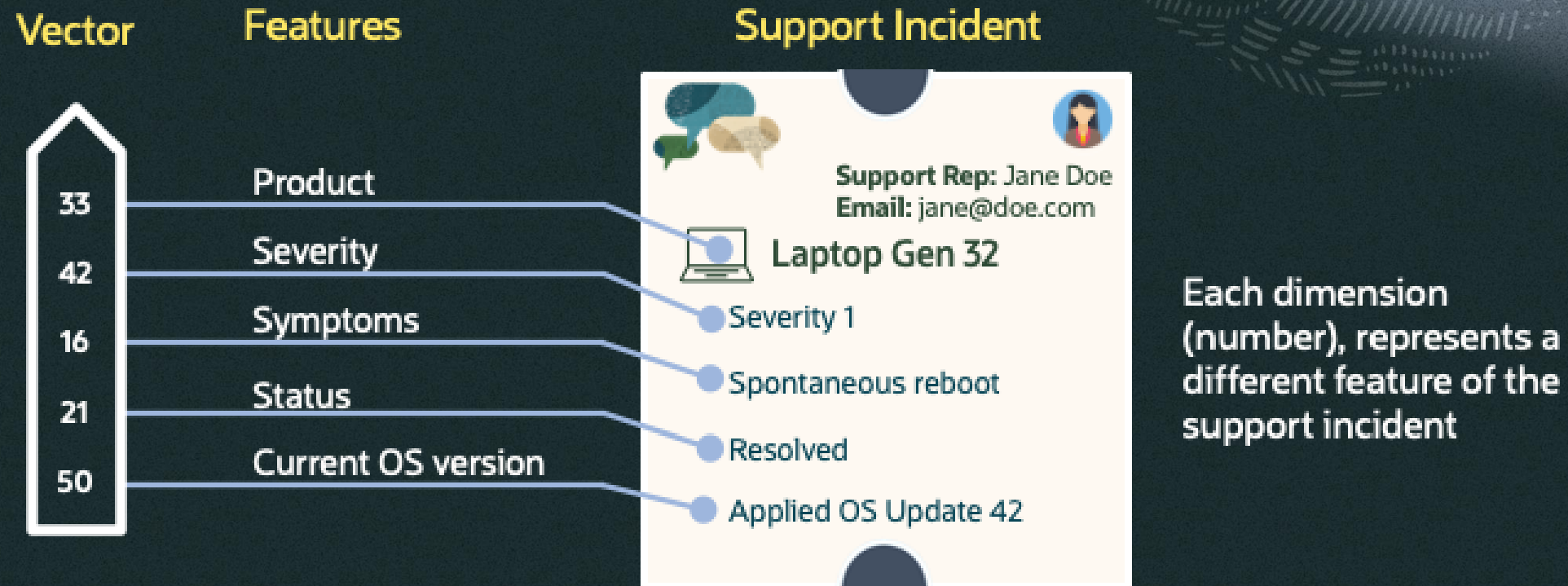
Produced by AI Deep Learning Models known as Embedding Models

The main operation on vectors is the Mathematical Distance between them



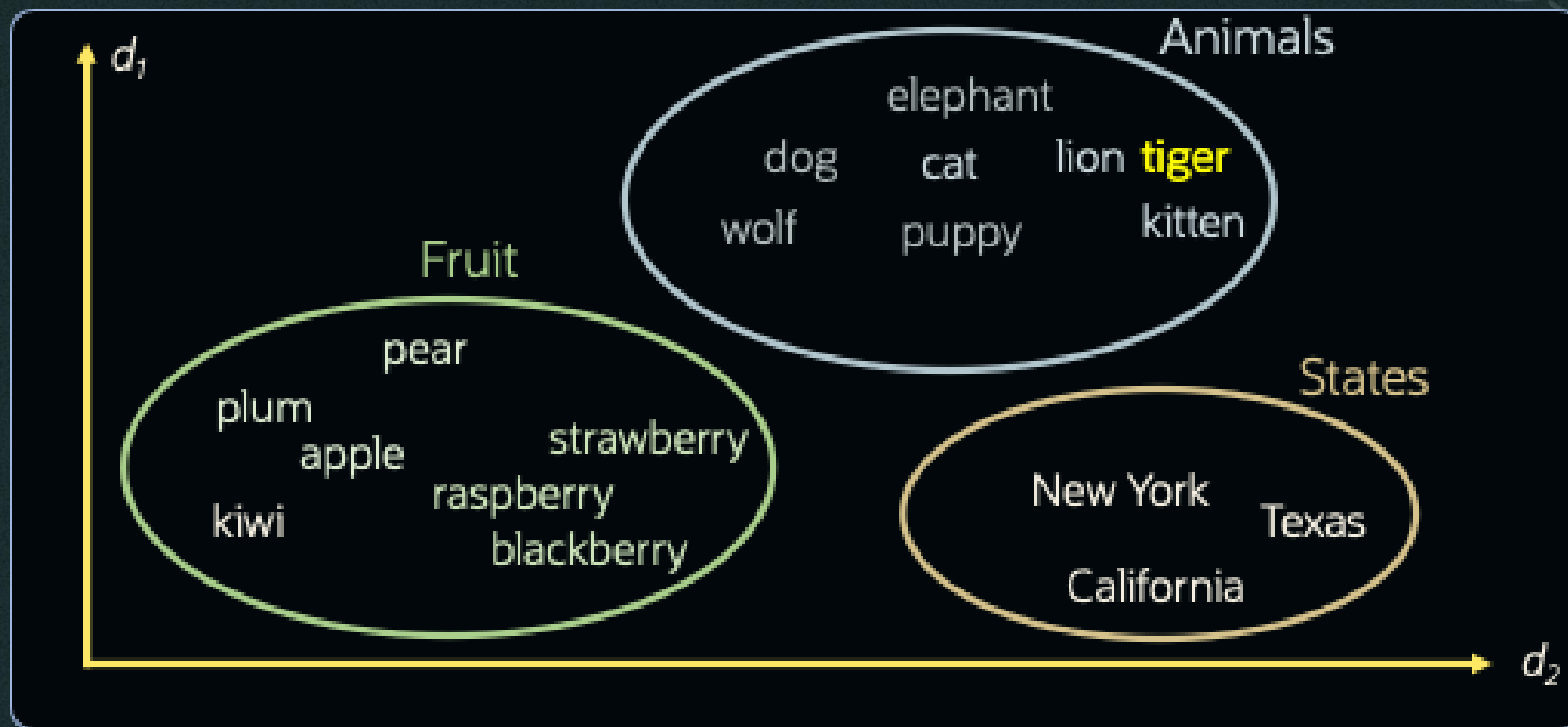
There are many mathematical distance formulas

An Example Business Scenario: The vector for a support incident could be ...



Note: Features are often chosen by ML algorithms and are not as simple as shown here

Similarity Property: The more similar two entities, the smaller the distance between their vectors

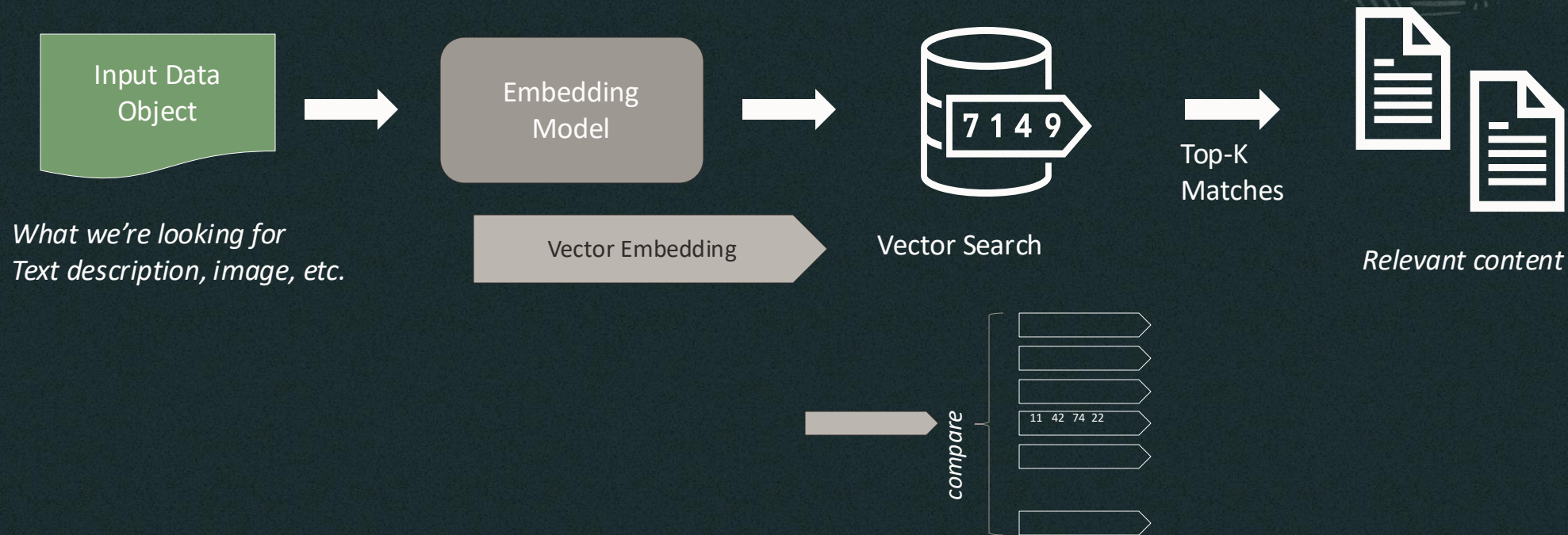


Documents and images also work the same way


Document vectors that represent similar content are closer than those representing dissimilar content

AI Vector Search is based on the Similarity Property

Search Data by Semantic Similarity rather than by Values



Create table with new VECTOR Datatype & insert some sample data


 **APEX** App Builder ▾ **SQL Workshop** ▾

↑ SQL Scripts \ **Script Editor**

Script Name

↶ ↷ 🔍 A:: APEX Assistant

```
1 CREATE TABLE "MY_DATA"
2   ( ("ID" NUMBER,
3     "INFO" VARCHAR2(128),
4     "V" VECTOR
5   );
```

 **APEX** App Builder ▾ **SQL Workshop** ▾ Team Development ▾ Gallery


↑ SQL Scripts \ **Script Editor**

Script Name

↶ ↷ 🔍 A:: APEX Assistant





```
1 Insert into "MY_DATA" (ID,INFO,V) values (10,'Staten Island is in New York.', NULL);
2 Insert into "MY_DATA" (ID,INFO,V) values (11,'Miami is in Florida.', NULL);
3 Insert into "MY_DATA" (ID,INFO,V) values (12,'Tampa is in Florida.', NULL);
4 Insert into "MY_DATA" (ID,INFO,V) values (13,'Orlando is in Florida.', NULL);
5 Insert into "MY_DATA" (ID,INFO,V) values (14,'Dallas is in Texas.', NULL);
6 Insert into "MY_DATA" (ID,INFO,V) values (15,'Huston is in Texas.', NULL);
7 Insert into "MY_DATA" (ID,INFO,V) values (16,'Austin is in Texas.', NULL);
8 Insert into "MY_DATA" (ID,INFO,V) values (17,'Phoenix is in Arizona.', NULL);
9 Insert into "MY_DATA" (ID,INFO,V) values (1,'San Francisco is in California.', NULL);
10 Insert into "MY_DATA" (ID,INFO,V) values (104,'Dodge Vipers are wide.', NULL);
11 Insert into "MY_DATA" (ID,INFO,V) values (904,'Oracle CloudWorld Mumbai is on 14 February 2024', NULL);
```


Vectorize the info column

 **APEX** App Builder ▾ **SQL Workshop** ▾ Team Development ▾ Gallery

↑ SQL Scripts \ Script Editor

Script Name ?

   A::  APEX Assistant

```
1 BEGIN
2   FOR rec IN (SELECT * FROM my_data) LOOP
3     UPDATE my_data SET my_data.v =
4       (SELECT TO_VECTOR(VECTOR_EMBEDDING(ALL_MINILM_L6_V2 USING my_data.info as data)) as embedding)
5     WHERE ID = my_data.id;
6   END LOOP;
7   --COMMIT;
8 END;
```


Query your data with the query vector & the new vector functions

APEX

App Builder

SQL Workshop

Team Development

Gallery

↑ SQL Commands

Language

SQL

Rows

10

Clear Command

Find Tables

APEX Assistant

1

select

2

... info

3

... from my_data

4

... order by vector_distance(v, to_vector(vector_embedding(ALL_MINILM_L6_V2 using :P1_SEARCH2 as data)), COSINE)

5

... fetch first 5 rows only;

Results

Explain

Describe

Saved SQL

History

5 rows returned in 0.21 seconds

Download

Enter Bind Variables

g804665064bd608-joyrgvmkv2b3lgz9.adb.us-ashburn-1.oraclecloudap...

Submit

Bind Variable	Value
:P1_SEARCH2	fruits

New vector functions

Query vector

Ripe raspberries are red.

Watermelons are green on the outside.

Watermelons are red on the outside.

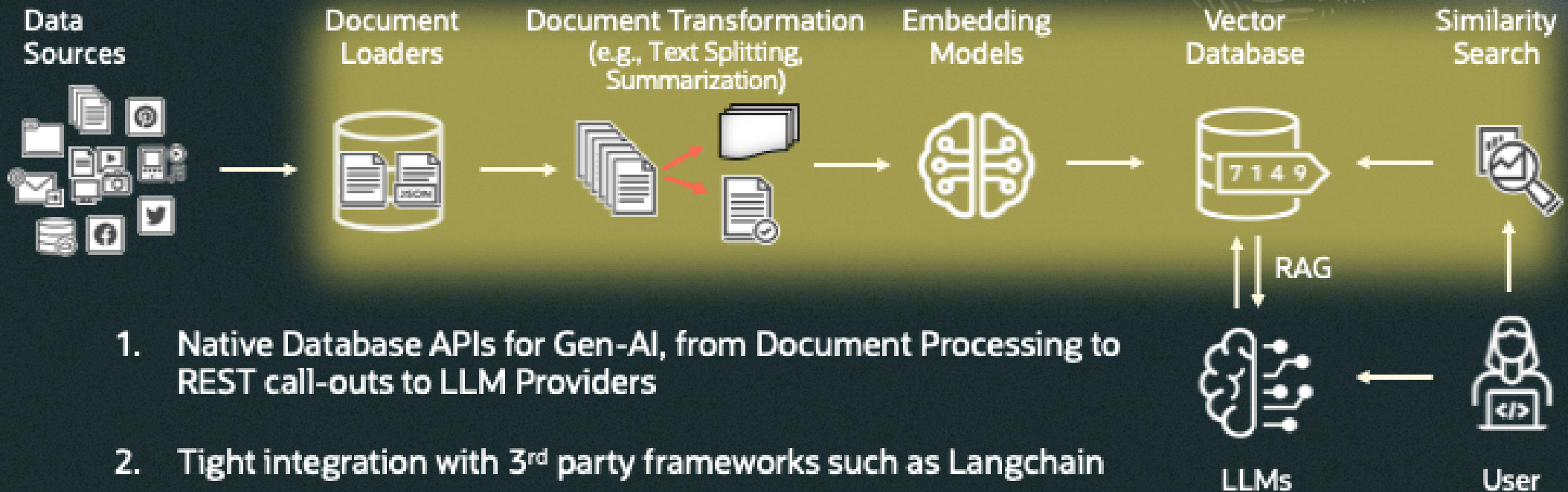
Bananas are yellow.

Peaches can be yellow, orange or red.



AI Vector Search powers Complete Gen AI pipeline

AI Vector Search in Oracle 23ai Database



Run the prepared LiveLab

← → ↻ 🔍 g804665064bd608-joyrgvmkv2b3lgz9.adb.us-ashburn-1.oraclecloudapps.com/ords/r/mkissling/vector-application-upload-dov

≡ RAG Application Using APEX And Oracle AI Vector Search On ADB

↶ Reset

Upload File >

* Object Storage

oracle-ai-vector-search-users-guic ▾

☐ Show Preview

File Selected **oracle-ai-vector-search-users-guide23a4Aug2024.pdf**

Chat

Clear Chat

Question

Answer

Vector search is an advanced search technique used to find similar items in a dataset based on vector representations of the items. In this context, the vector representation of an item is often generated using various machine learning models, which convert textual or other forms of data into numerical vectors. These vectors can then be compared using different similarity metrics to determine how close or similar the items are to one another.

The concept of vector search is particularly useful in scenarios involving approximate similarity searches, where you are aiming to find items that are similar but not necessarily identical. The Oracle Database, for instance, uses vector indexes to optimize these types of searches. Users can employ commands such as "EXPLAIN PLAN" to understand how the database's optimizer resolves queries involving vector searches and assess the efficiency of these operations. The similarity metrics used in these searches can vary, with common ones including Euclidean distance, cosine similarity, and, as mentioned in the given text, Hamming distance for binary vectors.

In the provided text, there is also an example of items (represented as documents) about different galaxies, which could be candidates for such vector searches. By converting these documents into vectors and applying similarity measures, one could find documents that are similar to a given document based on the content represented in vector form.



APEX Assistant and OpenAI – add the missing vector functions

The screenshot displays the APEX Assistant interface. On the left, a SQL query is written in a dark-themed editor:

```
1 select
2     info
3 from my_data
4 order by vector_distance(v, ), COSINE)
5 fetch first 5 rows only;
```

The 'APEX Assistant' button in the top toolbar is circled in yellow. On the right, a chat window titled 'New conversation started' shows a conversation. The user's message is 'add the missing vector functions'. The assistant's response is a SQL query that includes the missing vector functions:

```
sql
select info
from my_data
order by vector_distance(v, to_vector(vector_embedding(ALL_MI
fetch first 5 rows only
```

The chat interface also includes a 'Type your message here' input field at the bottom.

Hackathon Overview

Mission

- Team up (1-2 people per team)
- 14.45 – 15.15: **Create an end-to-end App:** can be simple, but must run
- 15.15 – 15.45: **Present the app:** 2-minutes live demo, no slides (random order)



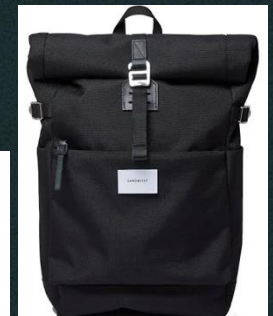
Scoring

- must use AI service or vector search/RAG (or both)
- extend current app or create a new one from scratch
- credits for creativity and scope of the application (we'll vote)



Prizes

1. Sandqvist Rucksack, Airpods von Swisscom und Moleskin Notizbuch von Tradeware
2. Promatis Lunch Set mit Kaffeetasse und 1 Kilo feinsten Kaffee von EKO
3. Irix Trinkflasche und Schweizer Taschenmesser von dbi
4. Badetuch und Bauchtasche von Robotron
5. SOUG T-shirts for everybody!



Questions?



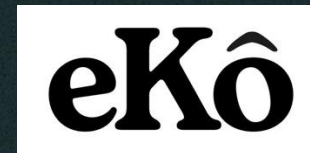
Ready – steady – go!

- Check your email
 - APEX instance and login credentials
 - Further instructions (this presentation, app code, etc.)
- Ask as for help! Every question is valid.
- When uploading documents, make your userid part of the file name (not to confuse with others).
- You can install demo sample sets:
SQL Workshop → Utilities → Sample Sets
- Further reading:
 - [Live Lab for the sample app](#)
 - [Blog Post](#)

Good luck!

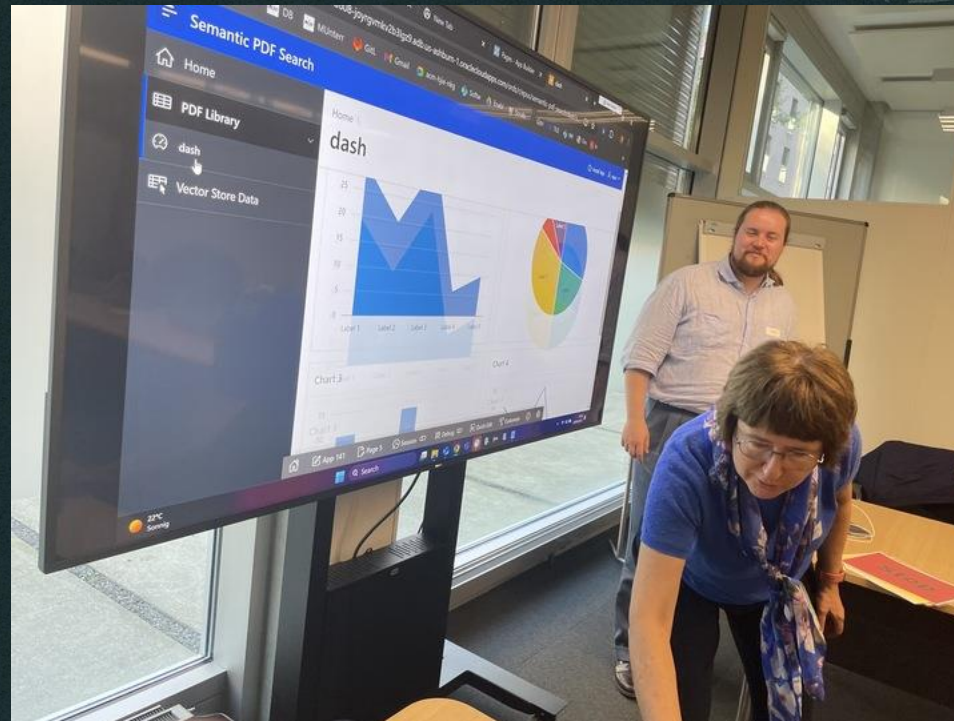


Big THANK YOU to the hackathon sponsors!



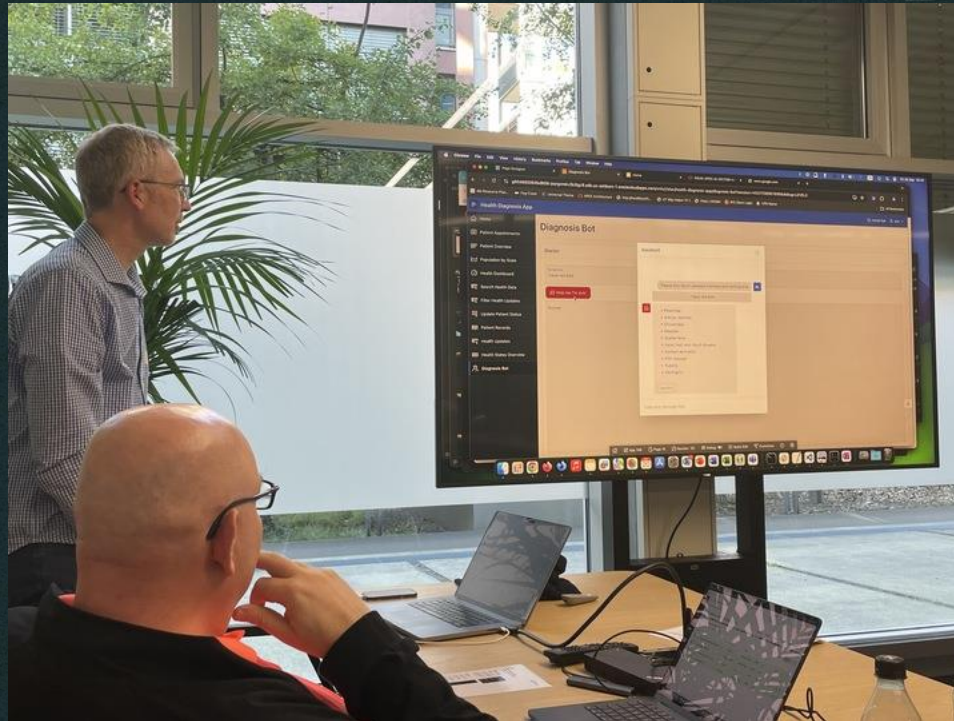
Hackathon Winners – 4. Platz

- Preis: Badetuch und Bauchtasche von Robotron
- Winners:
 - Elzbieta Pustulka-Hunt
 - Patrick Hollming



Hackathon Winners – 3. Platz

- Preis: Irix Trinkflasche und Schweizer Taschenmesser von dbi
- Winners:
 - Alain LACOUR



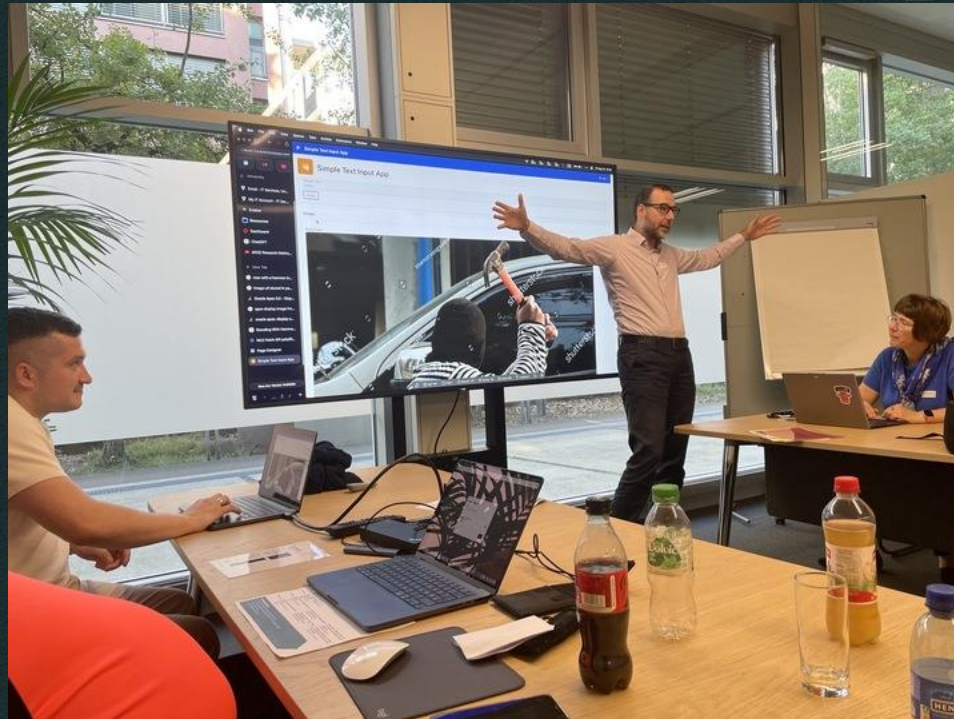
Hackathon Winners – 2. Platz

- Preis: Promatis Lunch Set mit Kaffeetasse und 1 Kilo feinster Kaffee von EKO
- Winners:
 - Philipp Manser
 - Marc Pfister



Hackathon Winners – 1. Platz

- Preis: Sandqvist Rucksack, AirPods von Swisscom und Moleskin Notizbuch von Tradeware
- Winners:
 - Romans Stepanovs
 - Matthias Vogel



Big THANK YOU to the hackathon
sponsors!



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