Search, Search, Search

APEX World 2024

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Dimitri Gielis

- Founder & CEO of **United Codes**
- 25+ years of Oracle Experience (OCP & APEX Certified)
- Oracle ACE Director
- “APEX Developer of the year 2009” by Oracle Magazine
- “Oracle Developer Choice award (ORDS)” in 2015
- Author Expert **Oracle APEX**
- Presenter at Conferences

www.united-codes.com

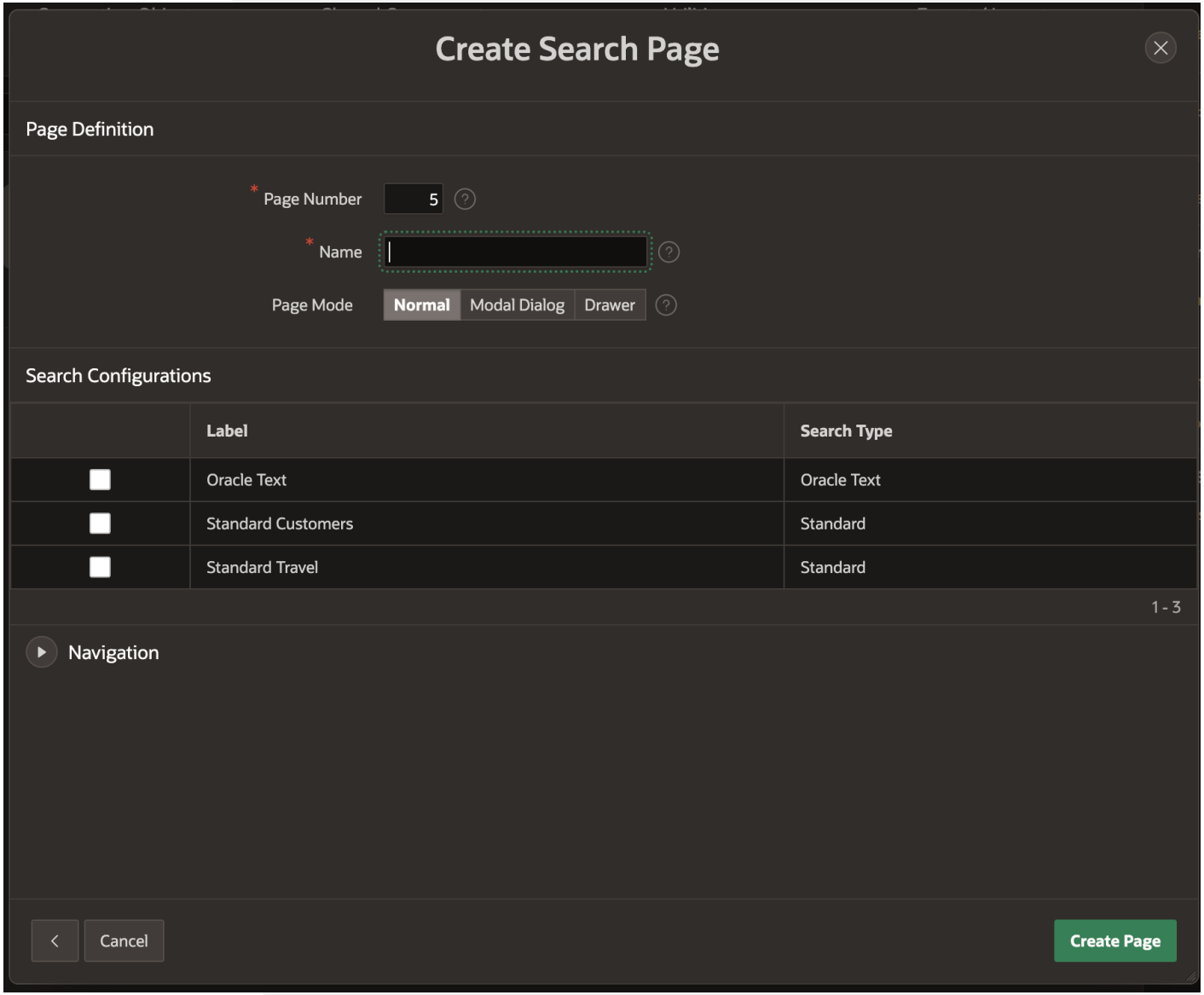
2023… me talking about… **Search**

How to do Google like searches?

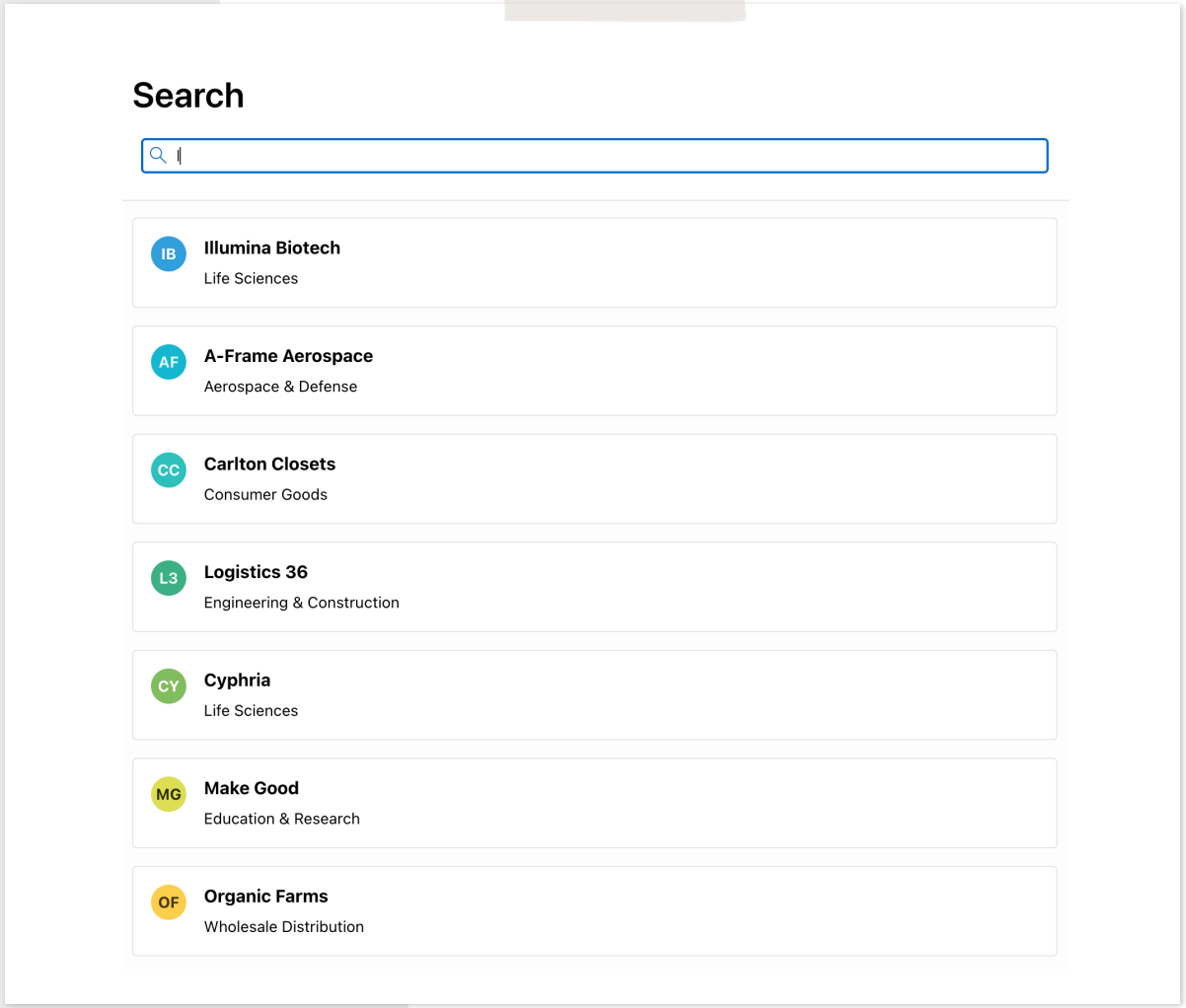
New in APEX 22.2

Create Search Page

Based on Shared Components > Search Configurations
- Simple
- Oracle Text
- Lists

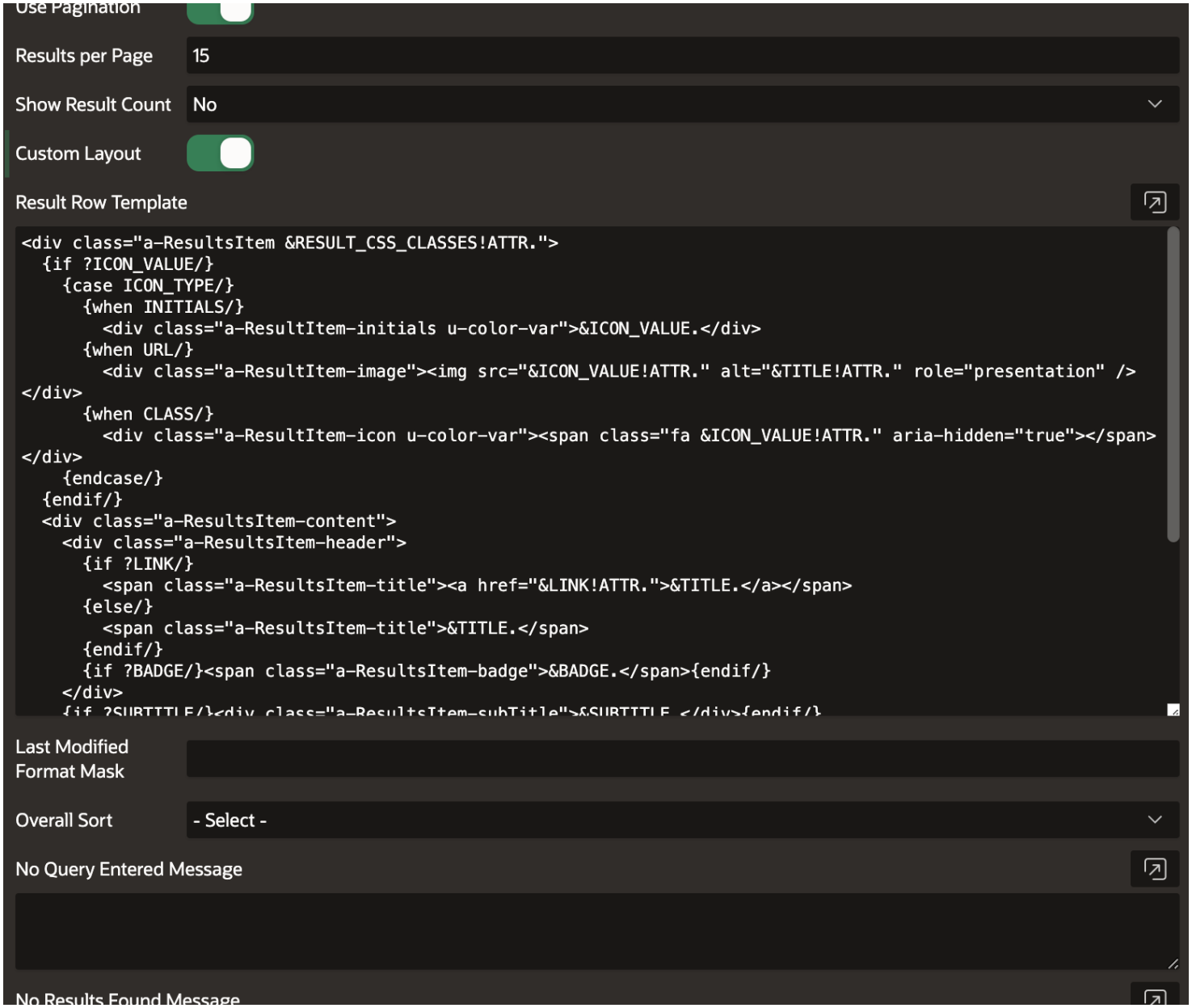


Example


Search
IB
Illumina Biotech
Life Sciences
AF
A-Frame Aerospace
Aerospace & Defense
CC
Carlton Closets
Consumer Goods
L3
Logistics 36
Engineering & Construction
CY
Cyphria
Life Sciences
MG
Make Good
Education & Research
OF
Organic Farms
Wholesale Distribution

Custom Layout with Template Directives

For example
- {if ?ICON_VALUE/}
- {case ICON_TYPE/}



PL/SQL API

```
select config_label, title, subtitle, badge
    from table( apex_search.search(
                   p_search_static_ids => apex_t_varchar2( 'PRODUCTS', 'CUSTOMERS' ),
                   p_search_expression => 'oracle APEX',
                   p_apply_order_bys   => 'N' ) );

CONFIG_LABEL   TITLE               SUBTITLE                 BADGE
-------------- ------------------- ------------------------ -------
Products       APEX vacation app   Subscription Based App
Products       APEX time entry     On-Premises License

:

Customers      John Doe Corp       Software Development     5000
Customers      Development Corp    Software Development     1000

:
```

https://docs.oracle.com/en/database/oracle/apex/22.2/aeapi/APEX_SEARCH.SEARCH-Function.html

Oracle Text

Create a text index

```
create index eba_project_tasks_ctx
on eba_project_tasks(description)
indextype is ctxsys.context;
```

Use the index

```
select *
from eba_project_tasks
where contains(description, 'web') > 0
```

Oracle Text Queries

Combine Query Terms
... where **contains**(text, 'dog AND cat') >0

Use Wild Cards
... where contains(text, 'do% AND c_t') >0

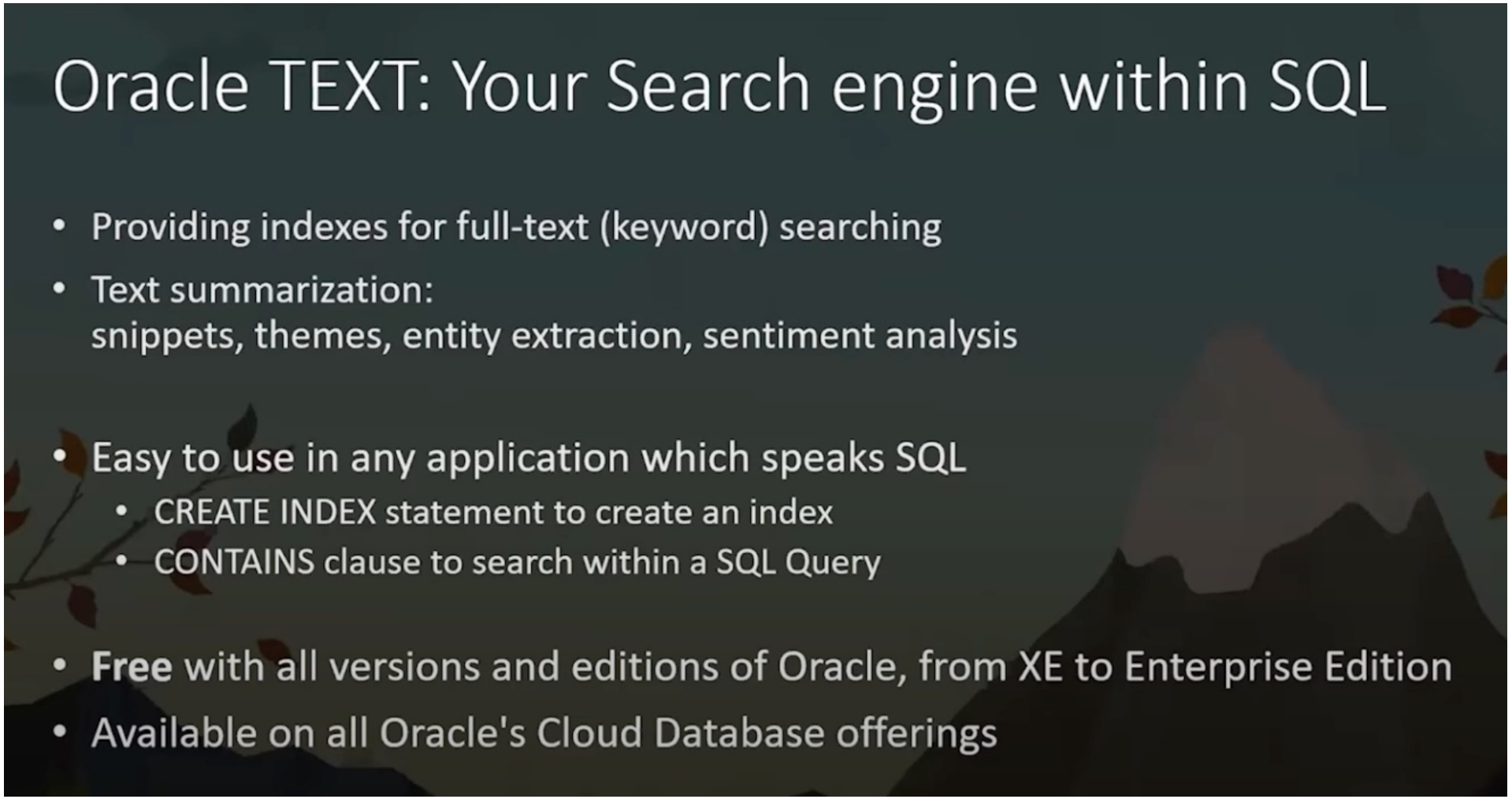
Powerful Name Searching
... where contains(text, 'NDATA(name, lary elisn)') >0

Fuzzy matching
... where contains(text, '?apeks') >0

Multi Lingual Stemming
... where contains(text, '$runs') >0

Create a User Data Store on relational data

```
create or replace procedure eba_cus_search_uds (rid in rowid, tlob in out nocopy clob)
is
begin
  for r in (select c.customer_name, c.summary, t.name, t.title
              from eba_cust_customers c
              join eba_cust_contacts t on c.id = t.customer_id
             where c.rowid = rid)
  loop
    tlob := tlob || ' ' ||
            '<CUST_NAME>' || r.customer_name || '</CUST_NAME>' ||
            '<CUST_DESC>' || r.summary || '</CUST_DESC>' ||
            '<CONT_NAME>' || r.name || '</CONT_NAME>' ||
            '<CONT_DESC>' || r.title || '</CONT_DESC>';
  end loop;
end eba_cus_search_uds;
```



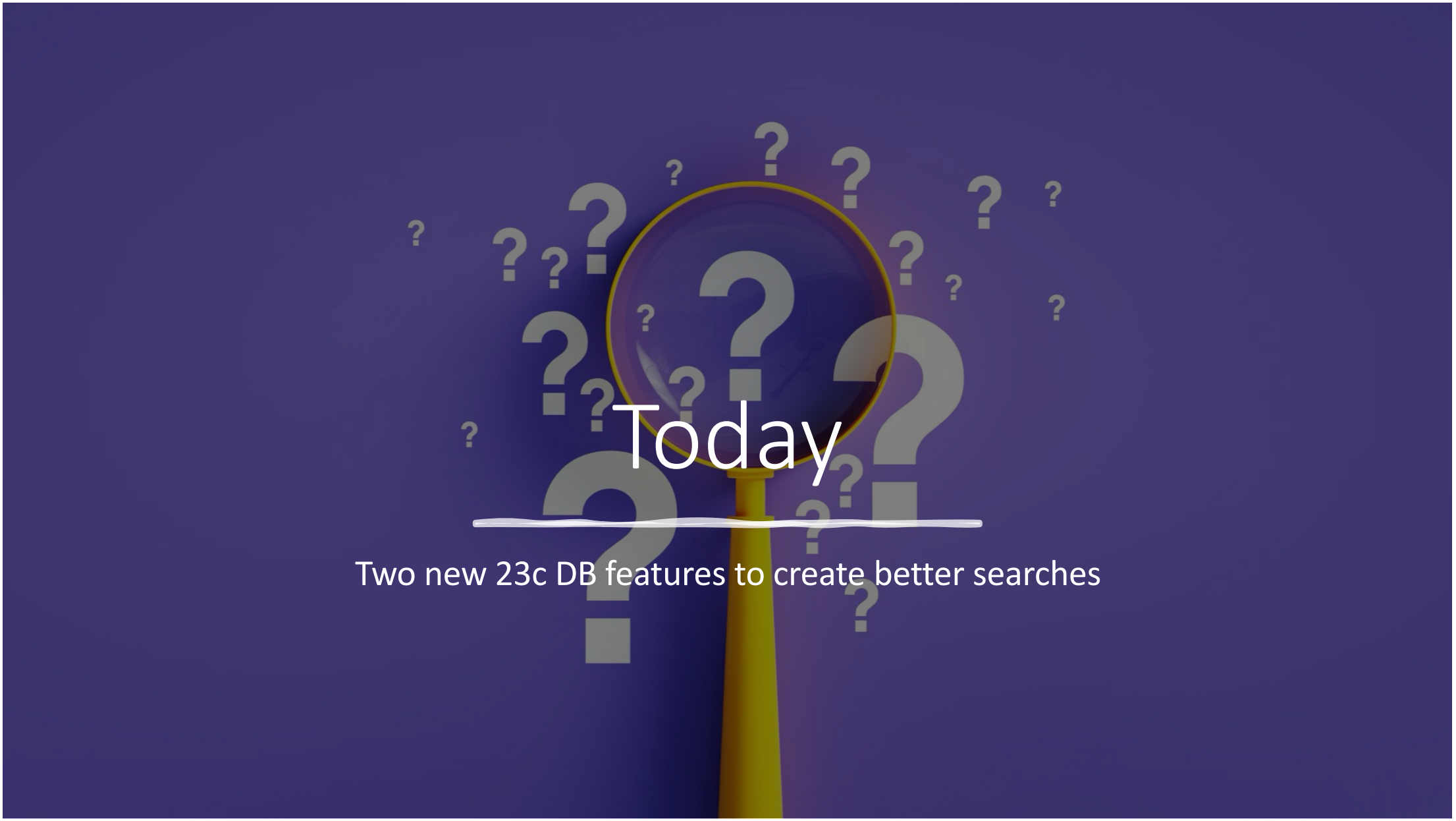
* From video Office Hours

Oracle TEXT: Your Search engine within SQL

- Multilingual (48+ languages) with many document formats (150+ types)
- Not just an indexed equivalent of the LIKE operator (20+ query operators)
  Stemming, Fuzzy, Name Searching, and much more…

- Flexible indexing of data
  - Index and Search on a **single column**
  - Index and Search on **multiple Columns in the same table** (Multicolumn Datastore)
  - Index and Search on **multiple Columns in different tables (**User Datastore)

* From video Office Hours


Today
Two new 23c DB features to create better searches

Ubiquitous Database Search

new in Oracle Database 23c
new in Oracle APEX 23.2

Oracle Text on steroids!

Step 1: Index Creation for Ubiquitous DB Search

```
begin
  dbms_search.create_index(index_name => 'UDS_SEARCH_PRODUCTS');
end;
/
```

```
SQL> desc UDS_SEARCH_PRODUCTS

 Name           Null?    Type
 -------------- -------- --------------
 METADATA       NOT NULL JSON
 DATA                    JSON
 OWNER                   VARCHAR2(128)
 SOURCE                  VARCHAR2(128)
 KEY                     VARCHAR2(1024)
```

Step 2: Add Data Sources

```
begin
  dbms_search.add_source(
    index_name  => 'UDS_SEARCH_PRODUCTS',
    source_name => 'SHIPMENTS');

  dbms_search.add_source(
    index_name  => 'UDS_SEARCH_PRODUCTS',
    source_name => 'STORES');
end;
/
```

!!! Primary key required on table
All columns indexed of table, external table, or view
Sync on commit by default

Step 3: Review the virtual document

```
SQL> select dbms_search.get_document(
              index_name        => 'UDS_SEARCH_PRODUCTS',
              document_metadata => metadata) output
       from UDS_SEARCH_PRODUCTS;

OUTPUT
--------------------------------------------------------------------------------
{"CO":{"STORES":{"LOGO_CHARSET":null,"LOGO_FILENAME":null,"LONGITUDE":34.8621
38,"STORE_ID":23,"LOGO":null,"LOGO_MIME_TYPE":null,"LATITUDE":32.100664,"STOR
E_NAME":"Tel Aviv","LOGO_LAST_UPDATED":null,"WEB_ADDRESS":null}}}
...
```

Step 4: Run queries against your index

```
SQL> select metadata
       from UDS_SEARCH_PRODUCTS
      where contains(data, 'fuzzy(los)') > 0;

METADATA
--------------------------------------------------------------------
{"OWNER":"CO","SOURCE":"STORES","KEY":{"STORE_ID":10}}
{"OWNER":"CO","SOURCE":"SHIPMENTS","KEY":{"SHIPMENT_ID":976}}

-- let's check
SQL> select * from STORES where store_id=10;

PHYSICAL_ADDRESS
--------------------
C/ Echegaray 6B, Las Rozas

SQL> select * from SHIPMENTS where shipment_id=976;

DELIVERY_ADDRESS
-------------------------
Los Angeles, CA 90026 USA
```

Step 4: Run queries against your index (JSON)

```
SQL> select metadata
       from UDS_SEARCH_PRODUCTS
      where json_textcontains(
              data,
              '$.CO.STORES.PHYSICAL_ADDRESS',
              'fuzzy(los)');

METADATA
---------
{"OWNER":"CO","SOURCE":"STORES","KEY":{"STORE_ID":10}}
```

Step 4: Run queries against your index (JSON)

```
SQL> select metadata
       from UDS_SEARCH_PRODUCTS
      where json_exists(
              data,
              '$.CO.STORES?(@.STORE_ID <= 100)');


METADATA
---------
{"OWNER":"CO","SOURCE":"STORES","KEY":{"STORE_ID":10}}
```

Ubiquitous Database Search

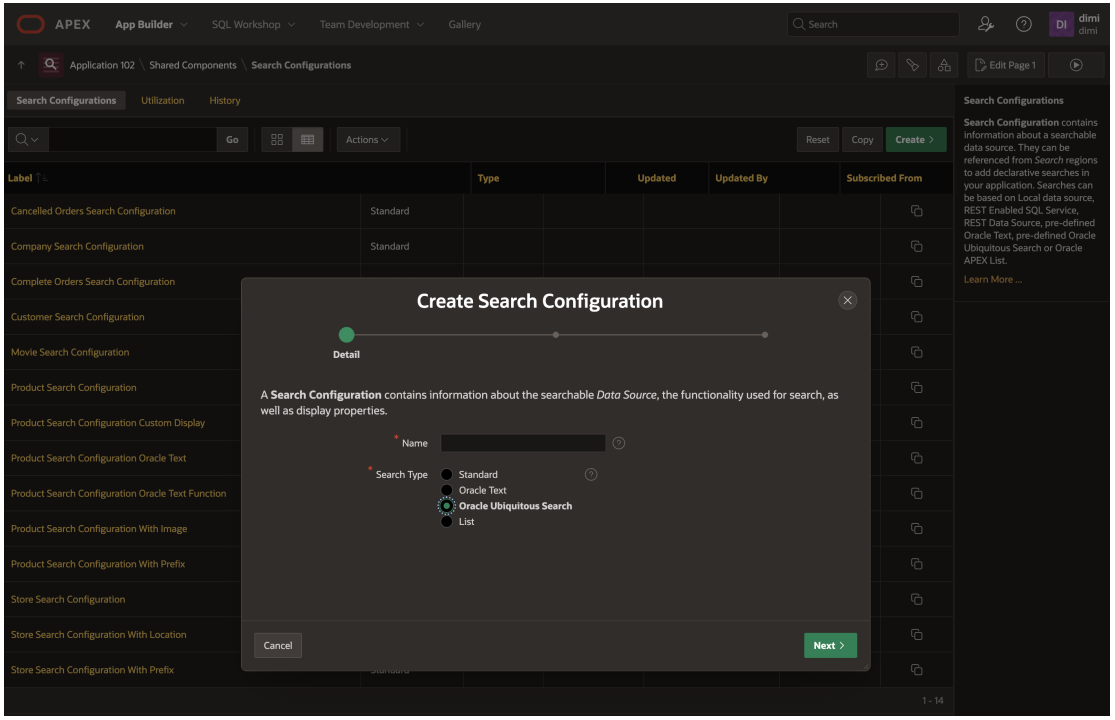
- Easier (and more powerful) than previous with Oracle Text
- Very useful to search on things you don't know where they are
- Ability to do sophisticated searching and Google like search (useful parser function?)
- Integrated with APEX Search

- (!) Need partitioning enabled –> License EE + Partitioning
- (!) Impact: 30%-50% of data, extra disk space

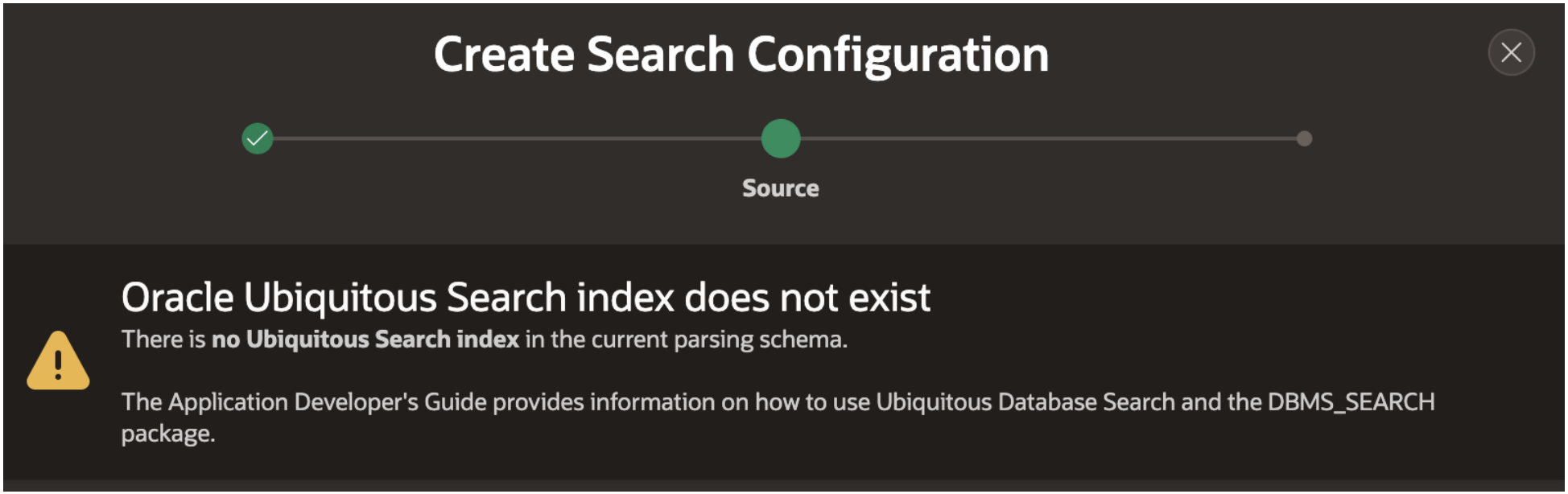
More info

- New full-text search in 23c: Ubiquitous Database Search
  https://blogs.oracle.com/coretec/post/ubiquitous-database-search-in-23c
- Easy Database Search with APEX in 23c
  https://blogs.oracle.com/coretec/post/easy-database-search-with-apex-in-23c
- Learn about Oracle Text
  https://blogs.oracle.com/database/post/learn-about-oracle-text
- Part 3: APEX and Ubiquitous Database Search in Oracle Database 23c
  https://www.youtube.com/watch?v=QzcsHrzYC98

Oracle APEX integration – Database 23c



When no index exists

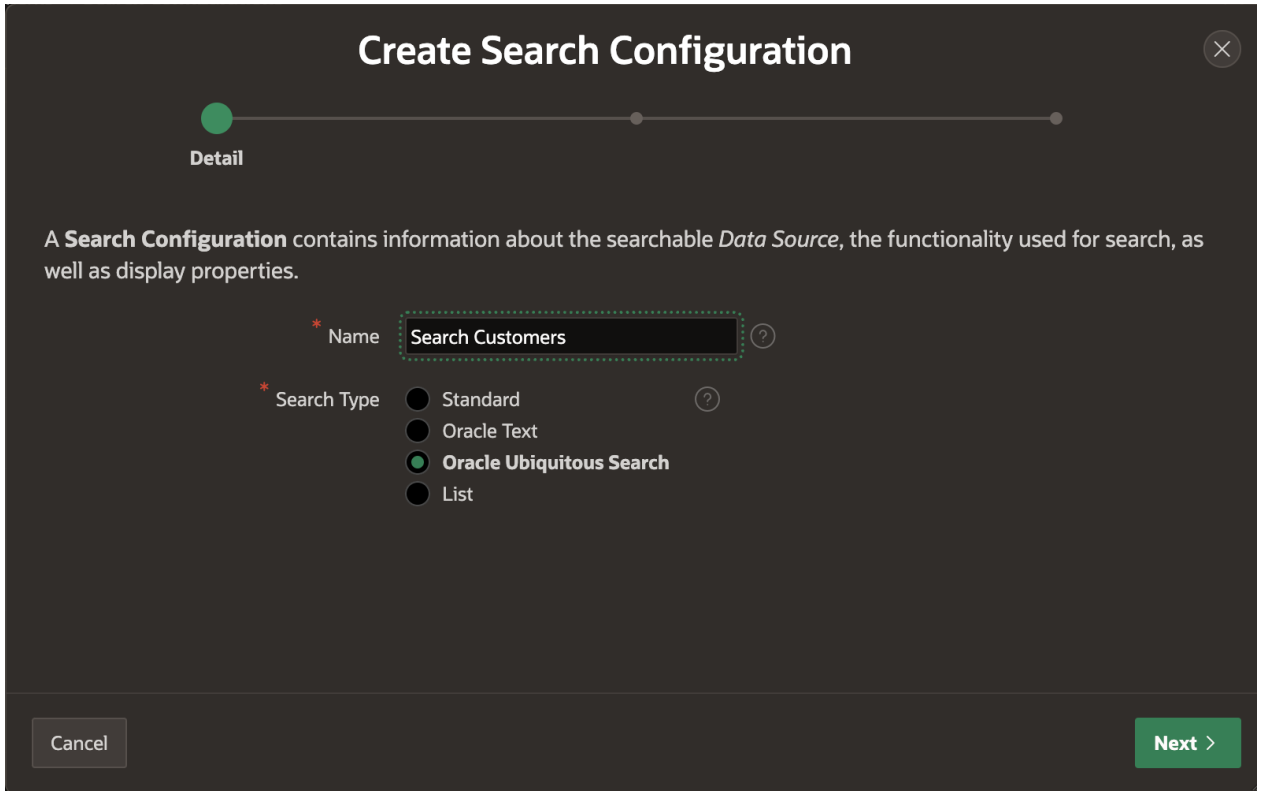


When not the right database features enabled

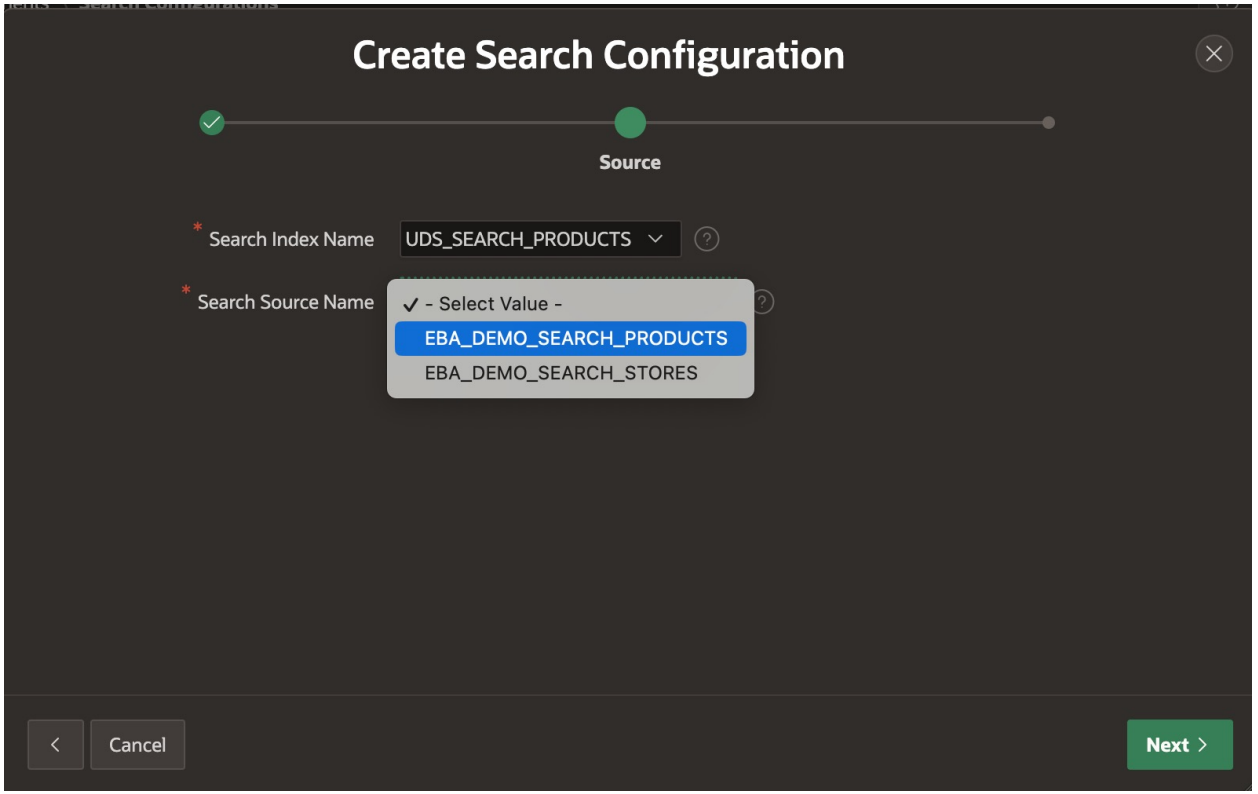
```
ORA-00439: feature not enabled: Partitioning
ORA-06512: at "CTXSYS.DBMS_SEARCH", line 400
ORA-06512: at line 2


2.  dbms_search.create_index(index_name => 'UDS_SEARCH_PRODUCTS');
3. end;
```

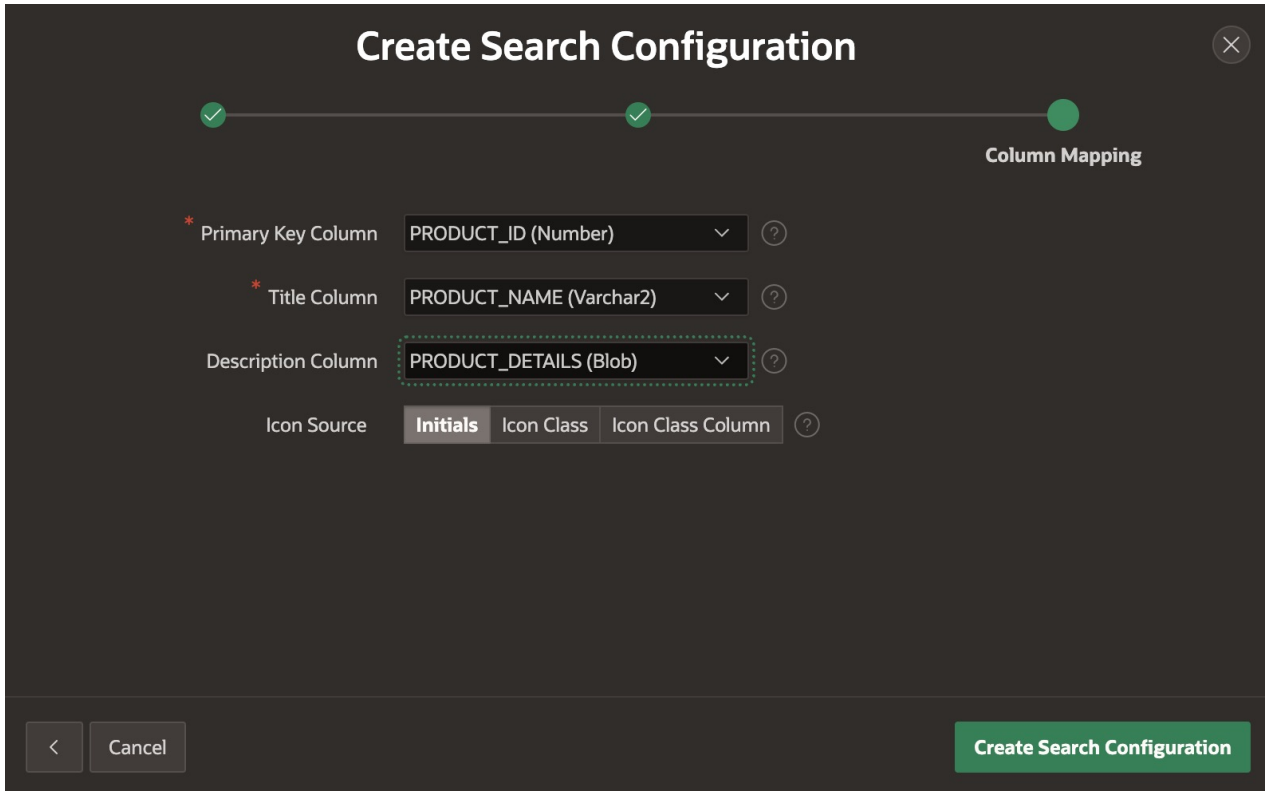
Following the wizard to create Ubiquitous Search



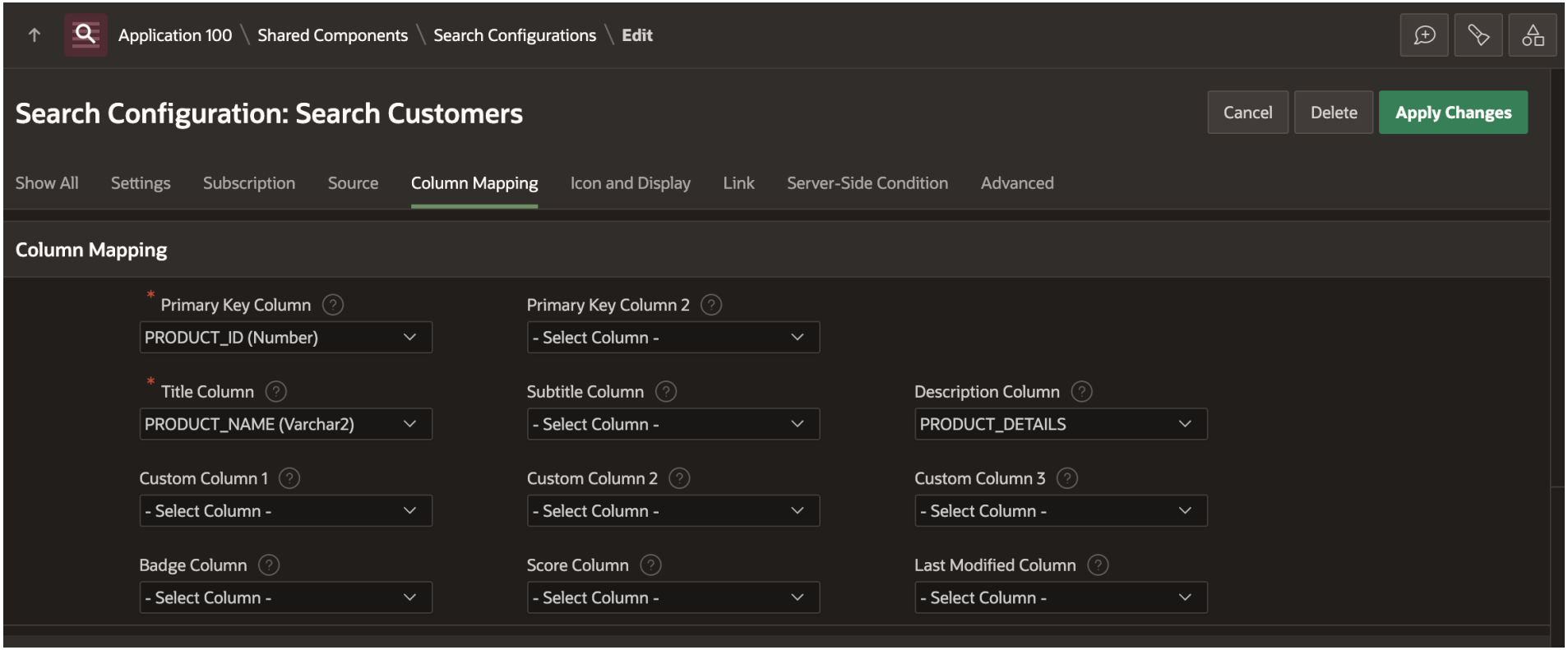
Select Index + Source



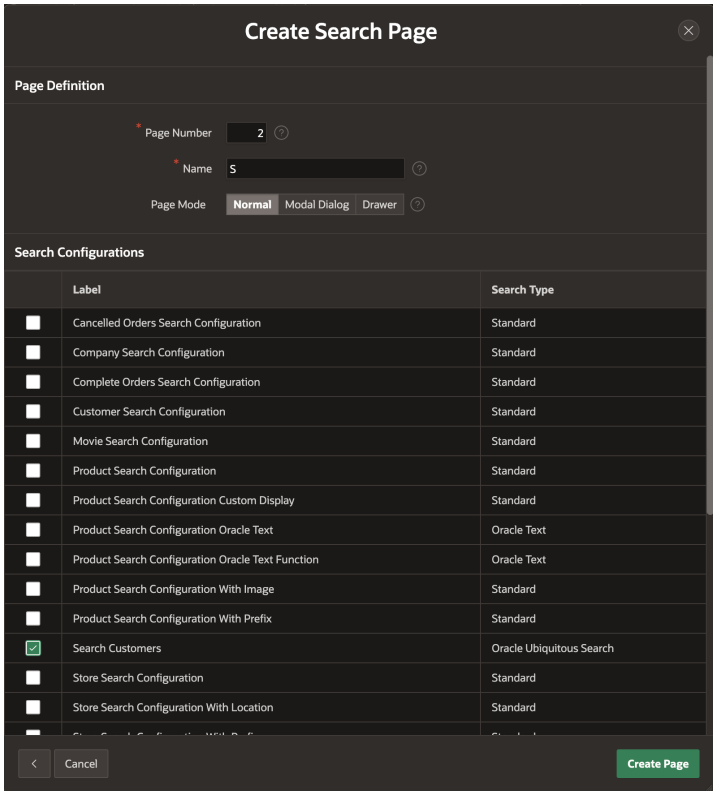
Map the columns



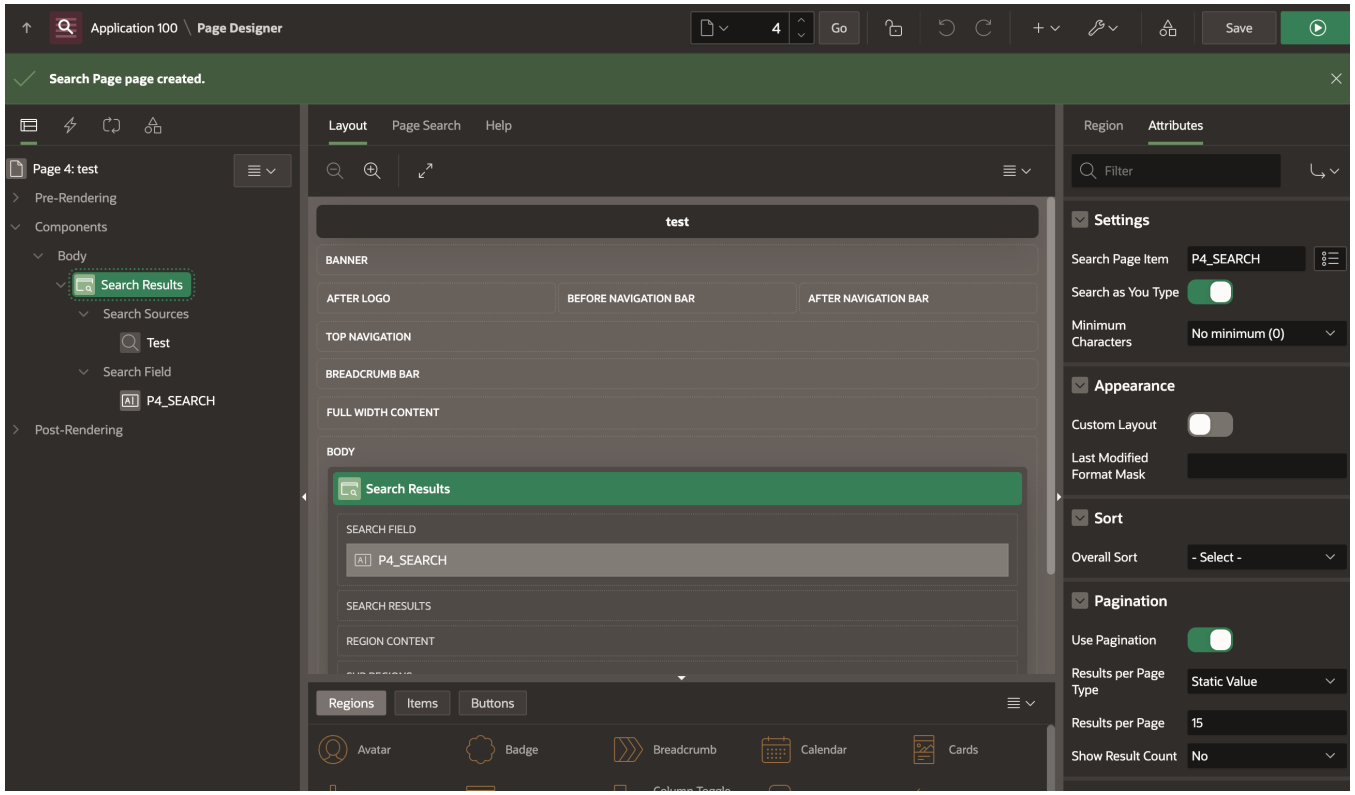
Customize


Application 100 \ Shared Components \ Search Configurations \ Edit
Search Configuration: Search Customers
Cancel
Delete
Apply Changes
Show All
Settings
Subscription
Source
Column Mapping
Icon and Display
Link
Server-Side Condition
Advanced
Column Mapping
* Primary Key Column
PRODUCT_ID (Number)
Primary Key Column 2
- Select Column -
* Title Column
PRODUCT_NAME (Varchar2)
Subtitle Column
- Select Column -
Description Column
PRODUCT_DETAILS
Custom Column 1
- Select Column -
Custom Column 2
- Select Column -
Custom Column 3
- Select Column -
Badge Column
- Select Column -
Score Column
- Select Column -
Last Modified Column
- Select Column -

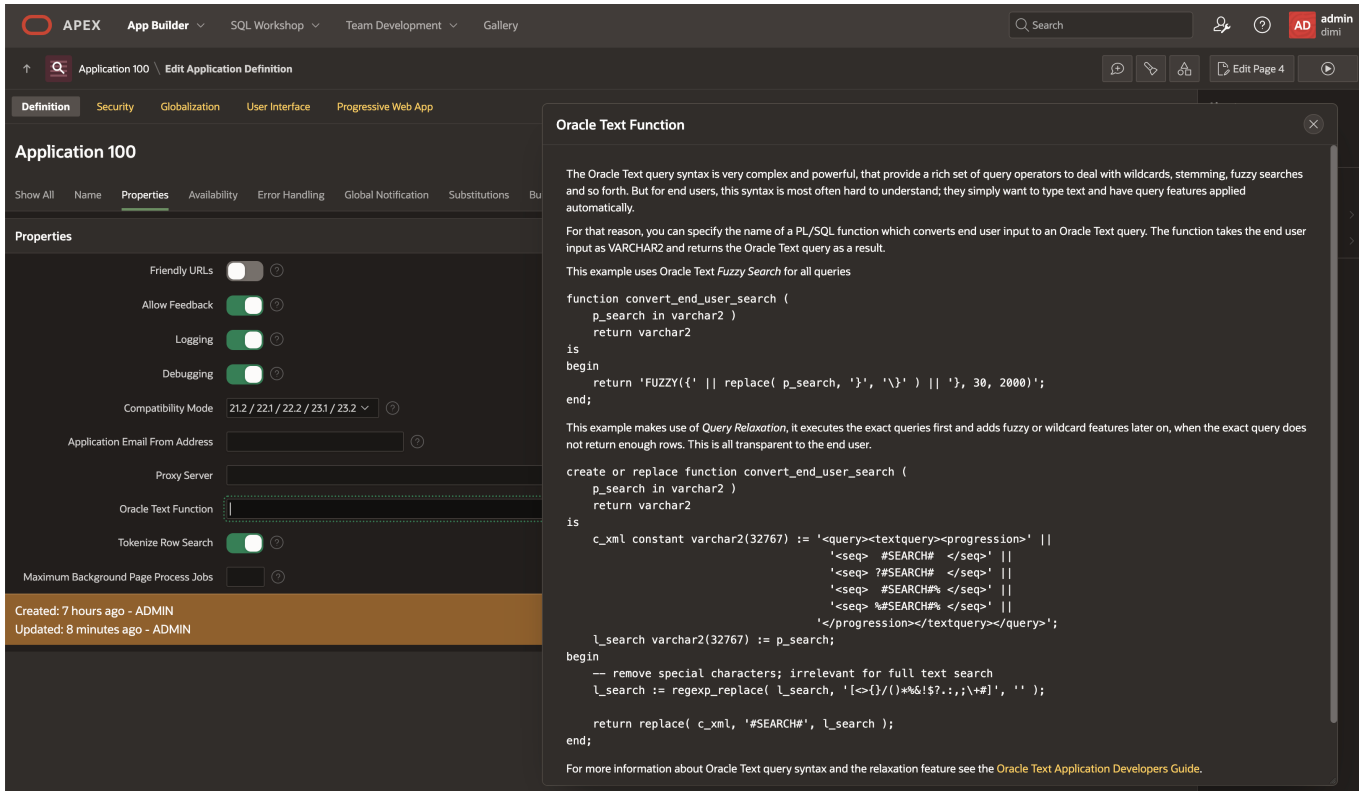
Create Search Page



Customize (Region Attributes)



Customize (Application Definition)



Result

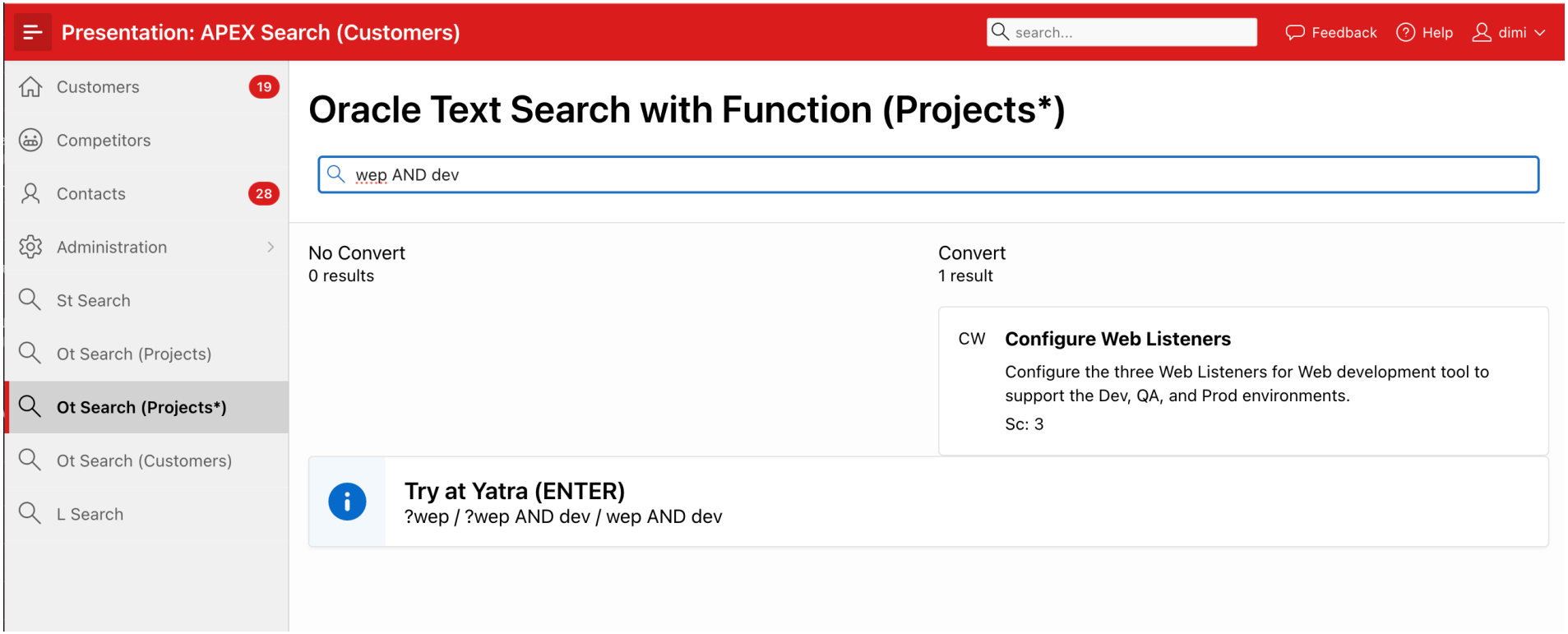
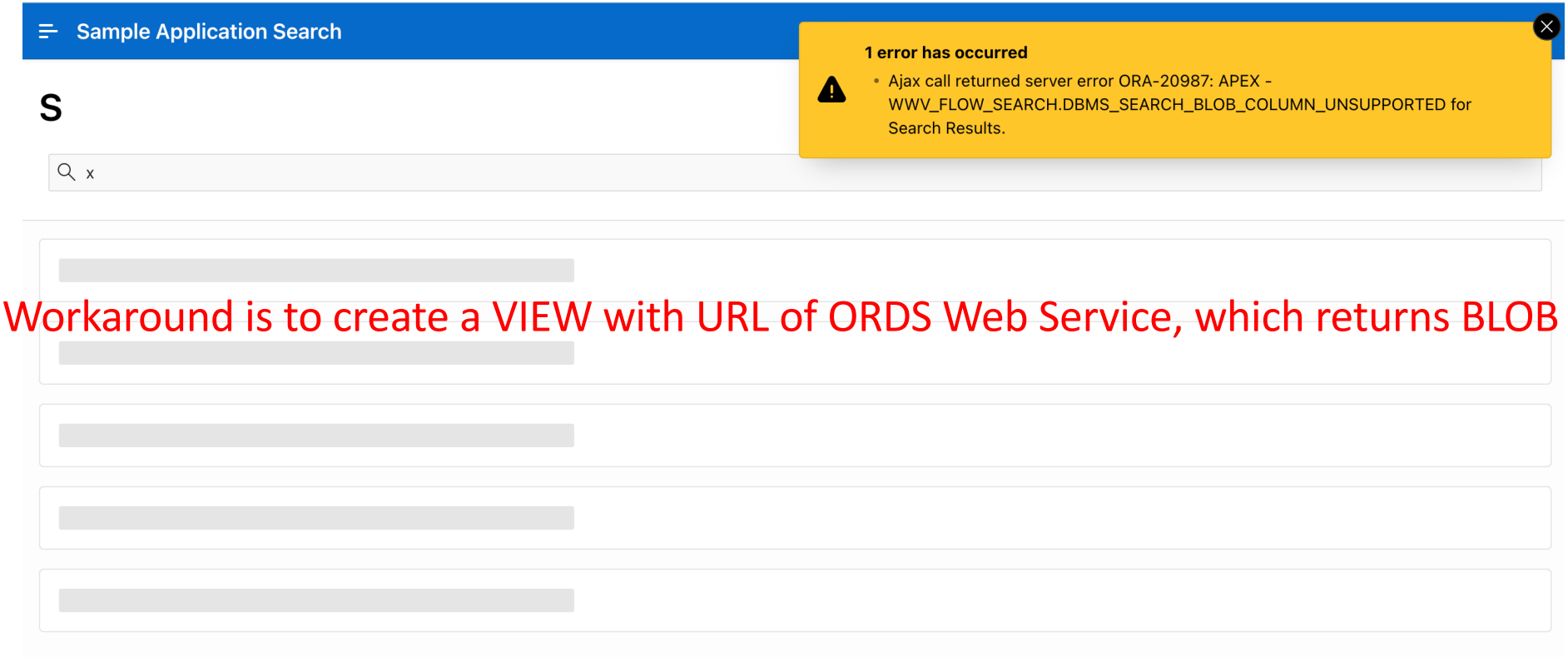

Presentation: APEX Search (Customers)
search...
Feedback
Help
dimi
Customers
19
Competitors
Contacts
28
Administration
St Search
Ot Search (Projects)
Ot Search (Projects*)
Ot Search (Customers)
L Search
Oracle Text Search with Function (Projects*)
wep AND dev
No Convert
0 results
Convert
1 result
CW
Configure Web Listeners
Configure the three Web Listeners for Web development tool to support the Dev, QA, and Prod environments.
Sc: 3
Try at Yatra (ENTER)
?wep / ?wep AND dev / wep AND dev

Table with BLOB?
“Limitation” in APEX 23.2(.5)



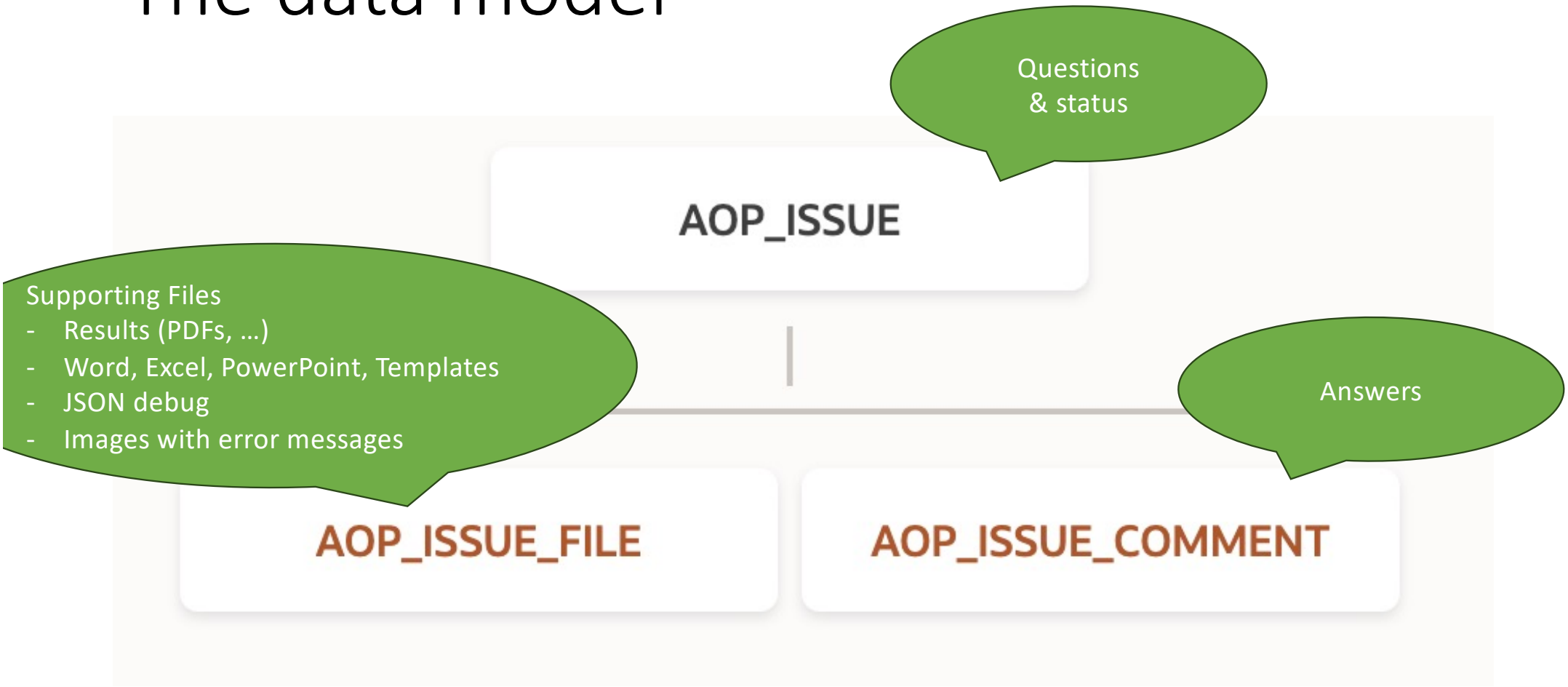
Workaround is to create a VIEW with URL of ORDS Web Service, which returns BLOB

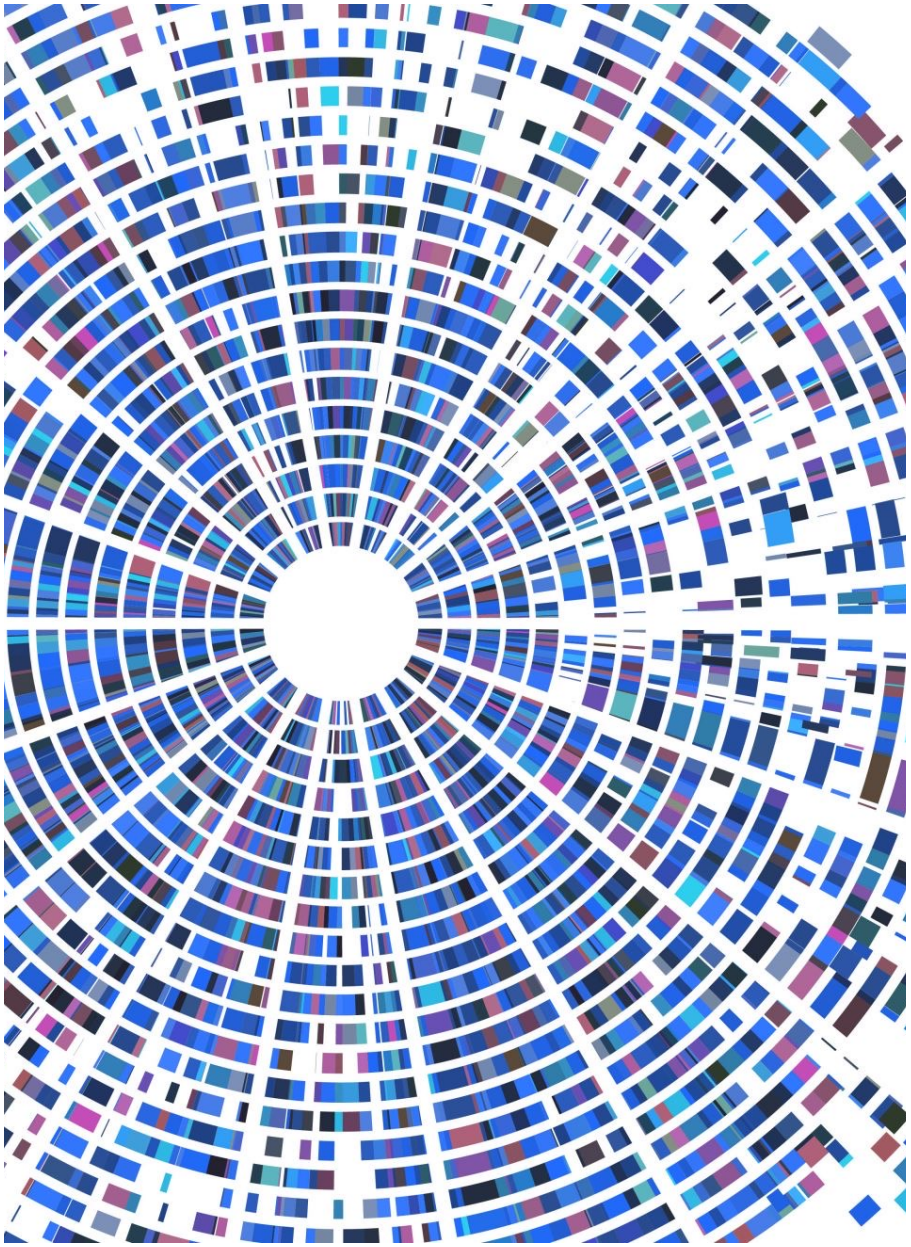
How to improve the AOP Support Portal?

AI Vector Search

new in Oracle Database 23c (23.4)

The data model





Searching in unstructured data!

Vectors in AI represent semantics of unstructured data such as images, documents, videos, etc.

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

Vectors represent the semantic content of data, not the underlying words or pixels

The mathematical distance between two vectors indicates how similar they are

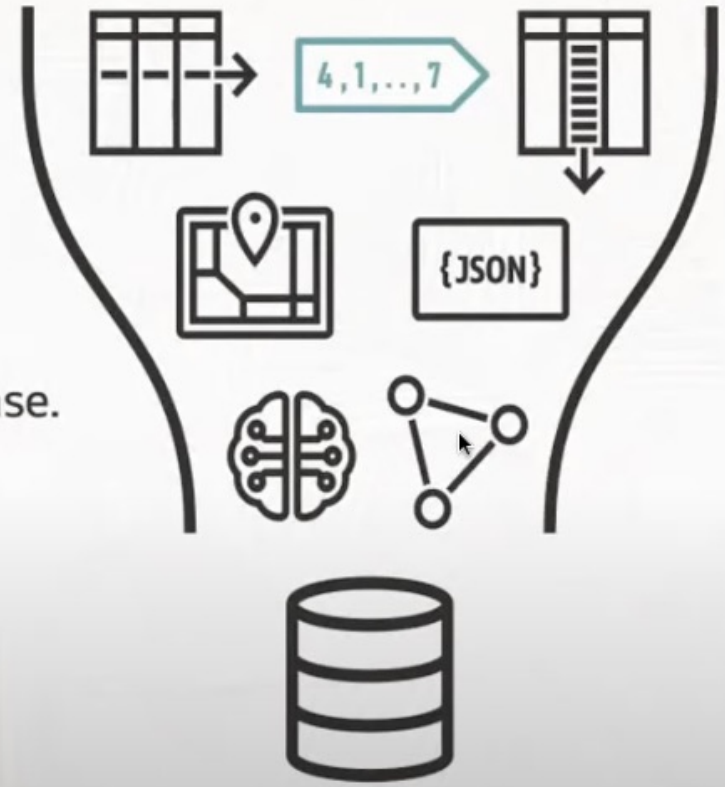
* source: Oracle presentation

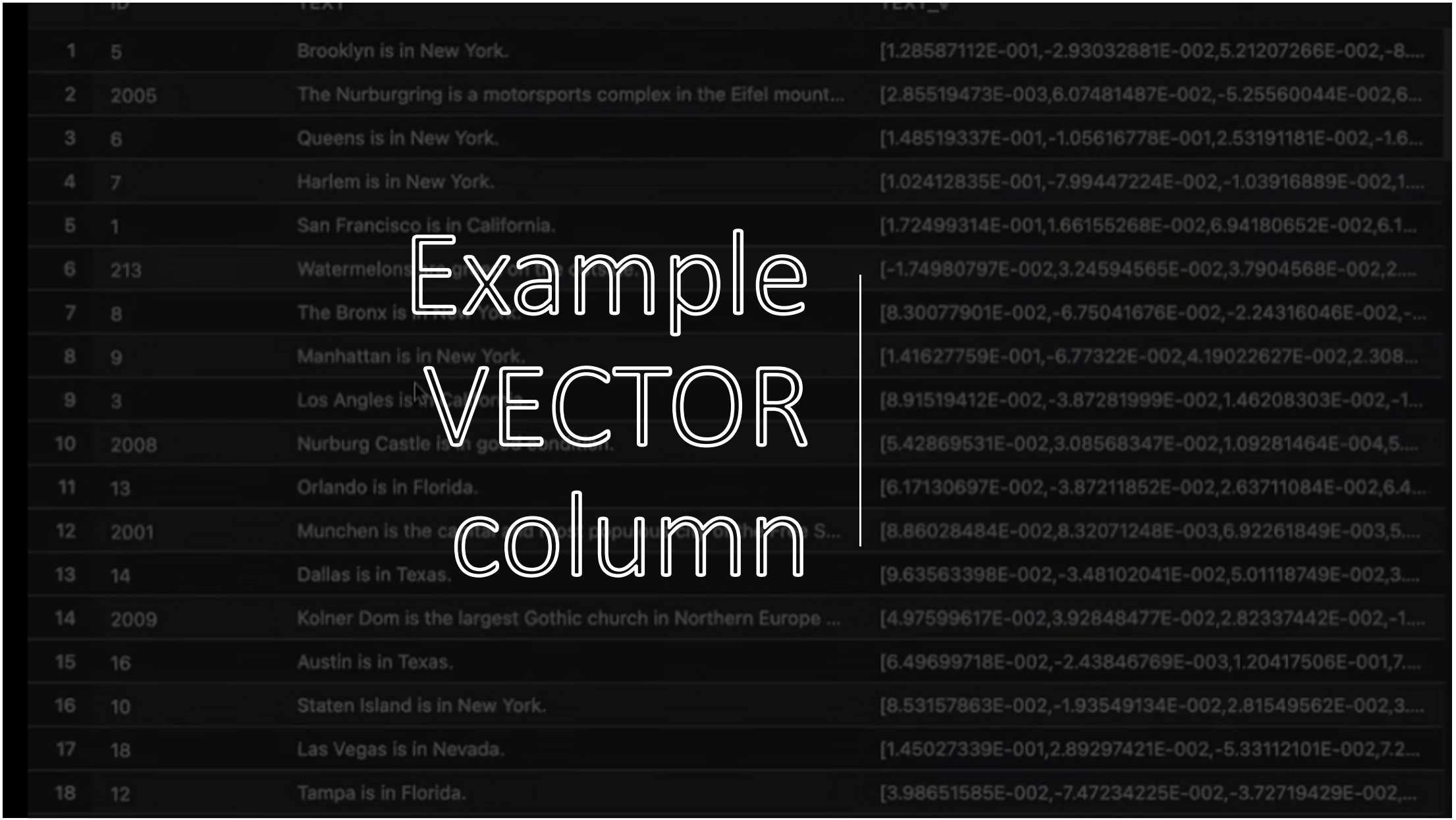
Oracle AI Vector Search

AI Vector Search will be in the 23.4 Release early this year

Designed to be simple to use and easy to understand

- **New** VECTOR data type for storing vector embeddings
  - `Create table docs (doc_id NUMBER, doc_vec VECTOR);`
- **New** SQL syntax & functions expresses similarity search with ease.
  - `Select id from docs order by vector_distance(doc_vec, :query_vec) fetch approximate first 10 rows only;`
- **New** Approximate search indexes packaged and tuned for high performance and quality.
  - `Create vector index doc_idx on docs(doc_vec) organization inmemory neighbor graph`




Example
VECTOR
column

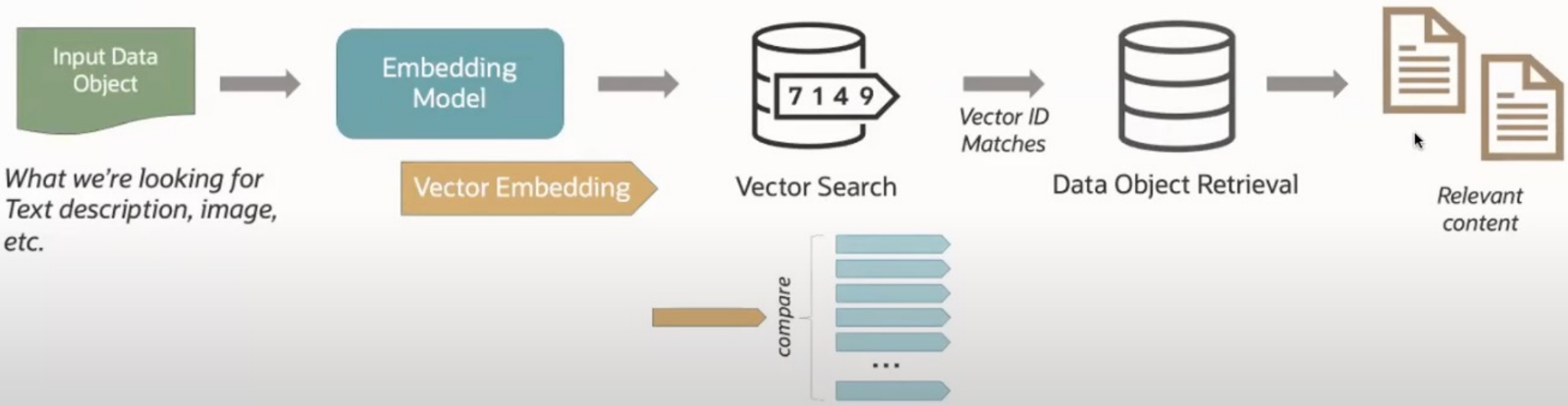
How to fill the VECTOR column?

- Text
  - `VECTOR_EMBEDDING(demo_model USING txt AS DATA)`
- Image
  - `VECTOR_EMBEDDING(resnet_50 USING img)`
- Documents (break in chunks e.g. pages)
  - `DBMS_VECTOR.UTL_TO_TEXT()`
  - `DBMS_VECTOR.UTL_TO_CHUNKS()`
  - `DBMS_VECTOR.UTL_TO_EMBED()`

  - `DBMS_ORACHAIN.UTL_TO_TEXT()`
  - `DBMS_ORACHAIN.UTL_TO_CHUNKS()`
  - `DBMS_ORACHAIN.UTL_TO_EMBEDDINGS()`

Similarity Search

Simple Pipeline



Allows finding data that is semantically similar to an input

Find houses that are similar to this picture

```
SELECT   …
FROM     house_for_sale
ORDER BY vector_distance(house_vector, :input_vector);
```

The future of data and app dev—Juan Loaiza keynote | Oracle CloudWorld 2023

Share Info

The distance between the vectors is proportional to their semantic similarity

MORE VIDEOS

Oracle AI Vector Search

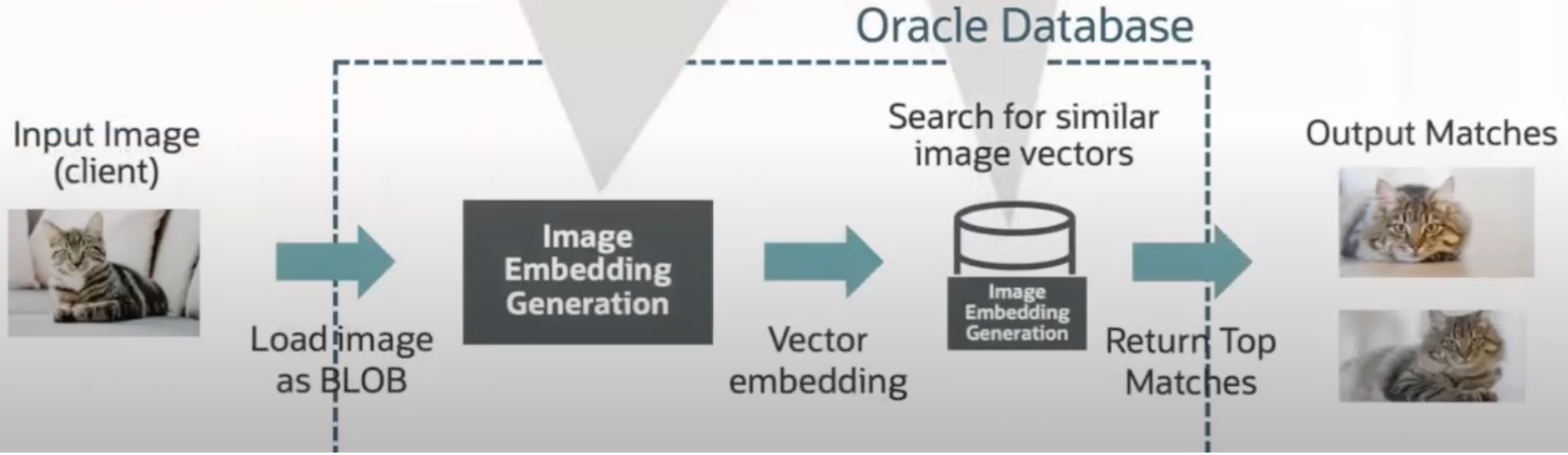
Native support for generating vectors – New SQL VECTOR_EMBEDDING Function

Images in database are embedded into vectors and stored:

```
VECTOR_EMBEDDING(resnet_50 USING data_img)
```

Input image is embedded into vector:

```
VECTOR_EMBEDDING(resnet_50 USING input_img)
```



Oracle Building Blocks for Gen-AI Pipeline with DBMS_VECTOR

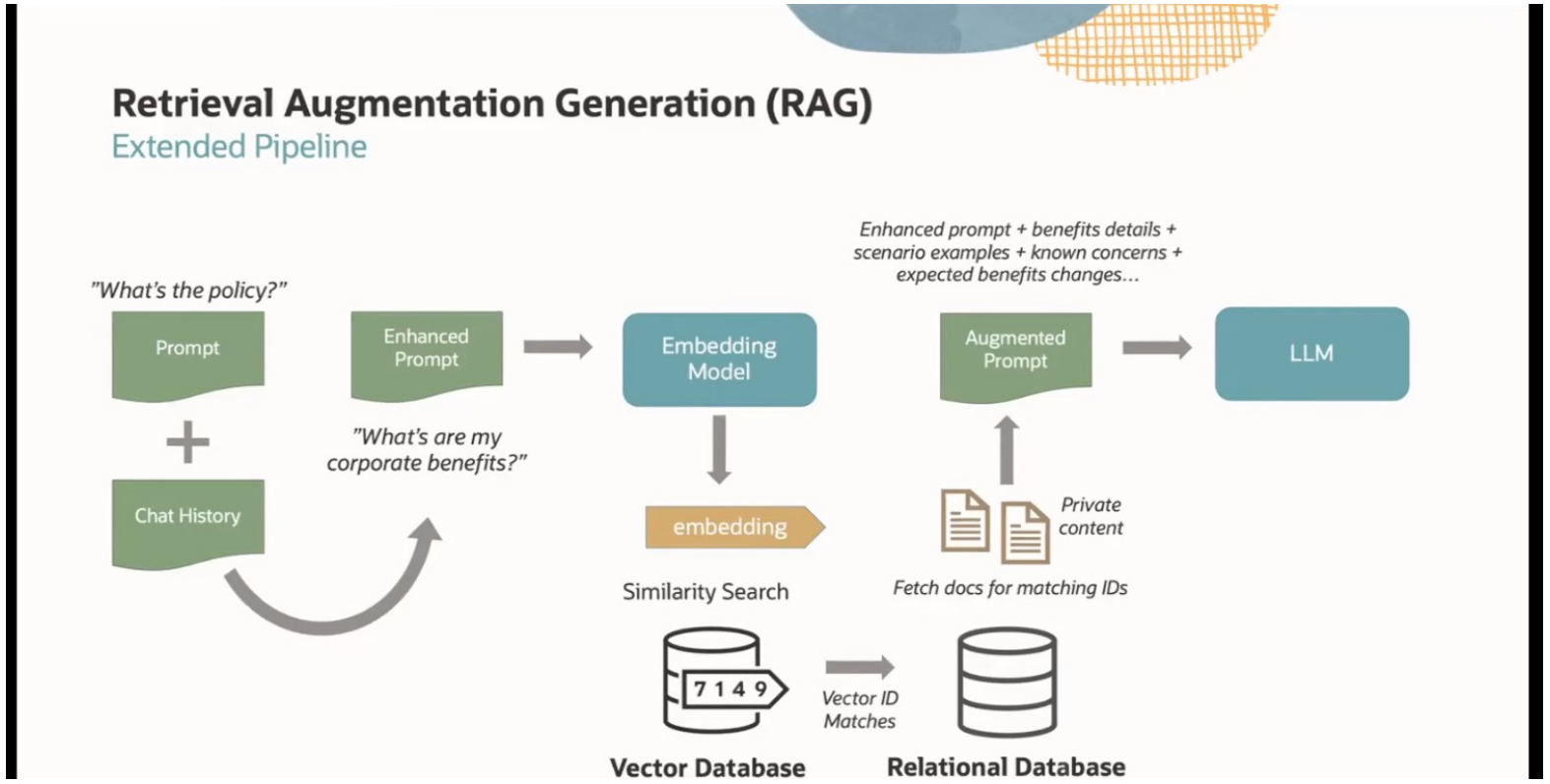
1. Load Documents
2. Document to Text
3. Text to Chunks
4. Chunks to Vectors

AOP Support Portal

- Question + VECTOR
- ANSWERS + VECTOR
- FILES + VECTOR
  - for documents chunk by page + VECTOR

- USER INPUT
  - QUESTION => MAKE VECTOR => COMPARE TO OTHER QUESTIONS VECTOR
  - FILES => MAKE VECTOR => COMPARE TO OTHER FILES VECTOR
  - => SHOW SIMILAR QUESTIONS AND ANSWERS…

Need even more? → connect to LLM!



AOP Support Portal

- NOT ONLY RELEVANT OTHER QUESTIONS
  => REAL ANSWERS, POSSIBLY COMBINED

- Challenges?
  - How to remove specific customer data or annomize?
  - How to make it learn?
  - Check made-up answers (hallucinations ☺).

  - For now: use AI only internally as suggestion, but verify by AOP Support team

More info

- Fast and Precise Business and Semantic Data Search with AI Vector Search
  https://www.youtube.com/watch?v=TuLc3pK1Ay8
- GitHub examples in Python
  https://github.com/luigisaetta/llamaindex_oracle
- 5 advantages of using an integrated vector database for AI development
  https://www.oracle.com/database/integrated-vector-database-advantages-ai-development/
- Research Vector (35’)
  https://www.youtube.com/watch?v=irtZOznG1Z8

Q&A

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