

ORACLE

Data Deep Dive
at AI World

Knowledge Graphs and AI Vector Search

to Trace Linkages in Data in Oracle AI Database

Phani Chilakapati

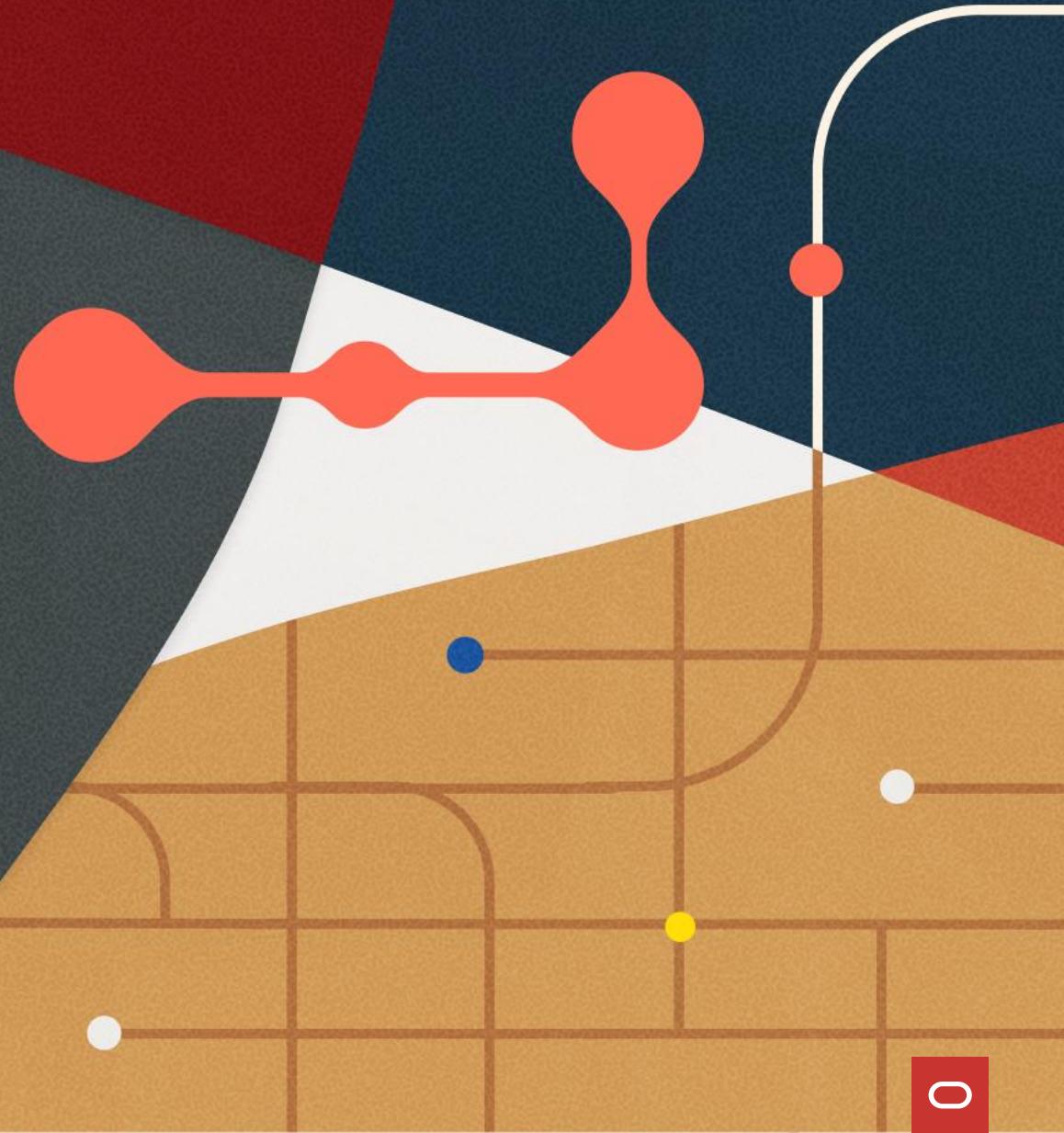
Senior Director, Data Architecture

Industrial Scientific

Ramu Murakami, Denise Myrick, and Rahul Tasker

Product Management

Oracle Graph



Agenda

1 Welcome and introduction

2 Part 1: Why Graphs?

Phani Chilakapati

Senior Director, Data Architecture
Industrial Scientific

3 Part 2: Hands on Lab

Ramu Murakami, Denise Myrick, Rahul Tasker
Oracle Graph Product Management

4 Wrap up and next steps

Oracle Database 26ai Graph + APEX

At Industrial Scientific

Phani Chilakapati

Senior Director, Data Architecture
Industrial Scientific



Agenda – Part 2

- 1 Overview of knowledge graphs and AI vector search
- 2 Introduction to workshop environment
- 3 Wrap up and next steps

Speakers

Ramu Murakami Gutierrez
Senior Product Manager

Denise Myrick
Senior Product Manager

Rahul Tasker
Principal Product Manager

Provision your environment

Knowledge Graphs and AI Vector Search



Oracle LiveLabs

Showcasing how Oracle's solutions solve your business problems — available 24/7 for free!



1000+

events run using
LiveLabs
workshops



10 million
people have already visited
LiveLabs



700+

free workshops,
available or in
development



Requirements for running a Hands-on Lab



Laptop



Oracle Account

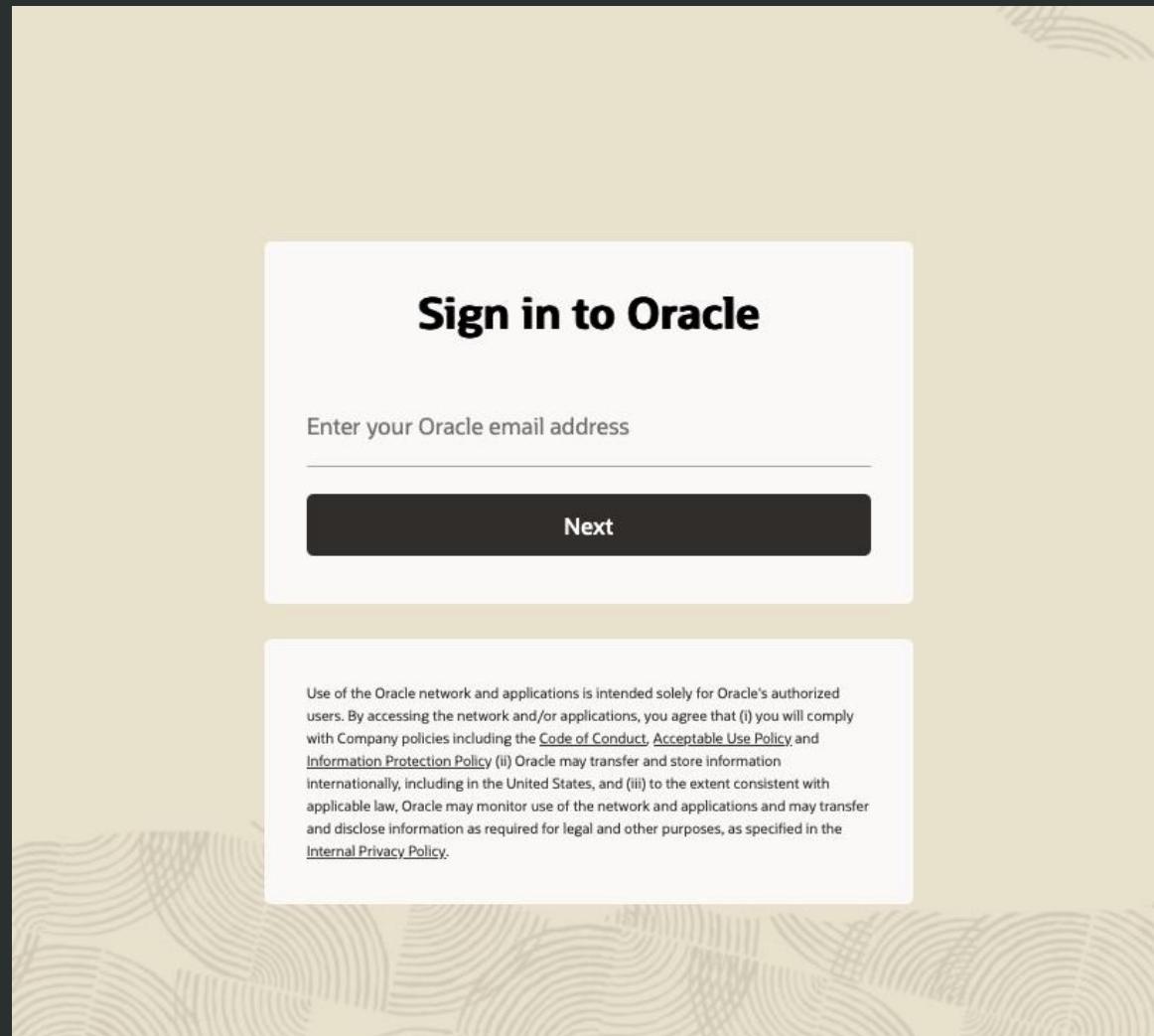
Let's get started

<http://livelabs.oracle.com/ai-world25/HOL2813>

1. Open a web browser
2. Navigate to the provided URL
3. Use your Oracle SSO account to log in

Note:

This is NOT your Oracle Cloud Infrastructure account



Let's get started

<http://livelabs.oracle.com/ai-world25/HOL2813>

1. Click the **Start** button to access the HOL
2. Click **Run on LiveLabs Sandbox**
3. Toggle the **Start Workshop Now** radio button
4. Check the consent box
5. Click **Submit Reservation**

The screenshot shows the Oracle LiveLabs interface for a workshop titled "Knowledge Graphs and AI Vector Search to Trace Linkages in Data in Oracle 23ai". At the top right, there are "Share" and "Start" buttons. A red box highlights the "Run on LiveLabs" button, which is described in a tooltip as "The Run on LiveLabs button will dynamically create resources in an Oracle-owned tenancy for you to use for free! Oracle account help | Oracle account signup". Below this is a green "Run on LiveLabs Sandbox" button. To the right, there is a "Preview Sandbox Instructions" button and a "Prerequisites" section with a bulleted list. A red arrow points from the "Run on LiveLabs" button to the tooltip. A modal window titled "Reserve Workshop" is open at the bottom left, asking for "Attendee Email Address" (ramu.murakami.gutierrez@oracle.com) and "Attendee Timezone" (Canada/Atlantic (-03:00)). It includes a toggle for "Start Workshop Now?", a checked consent checkbox, and "Preview Sandbox Instructions" and "Submit Reservation" buttons.

LiveLab Link

<http://livelabs.oracle.com/ai-world25/HOL2813>

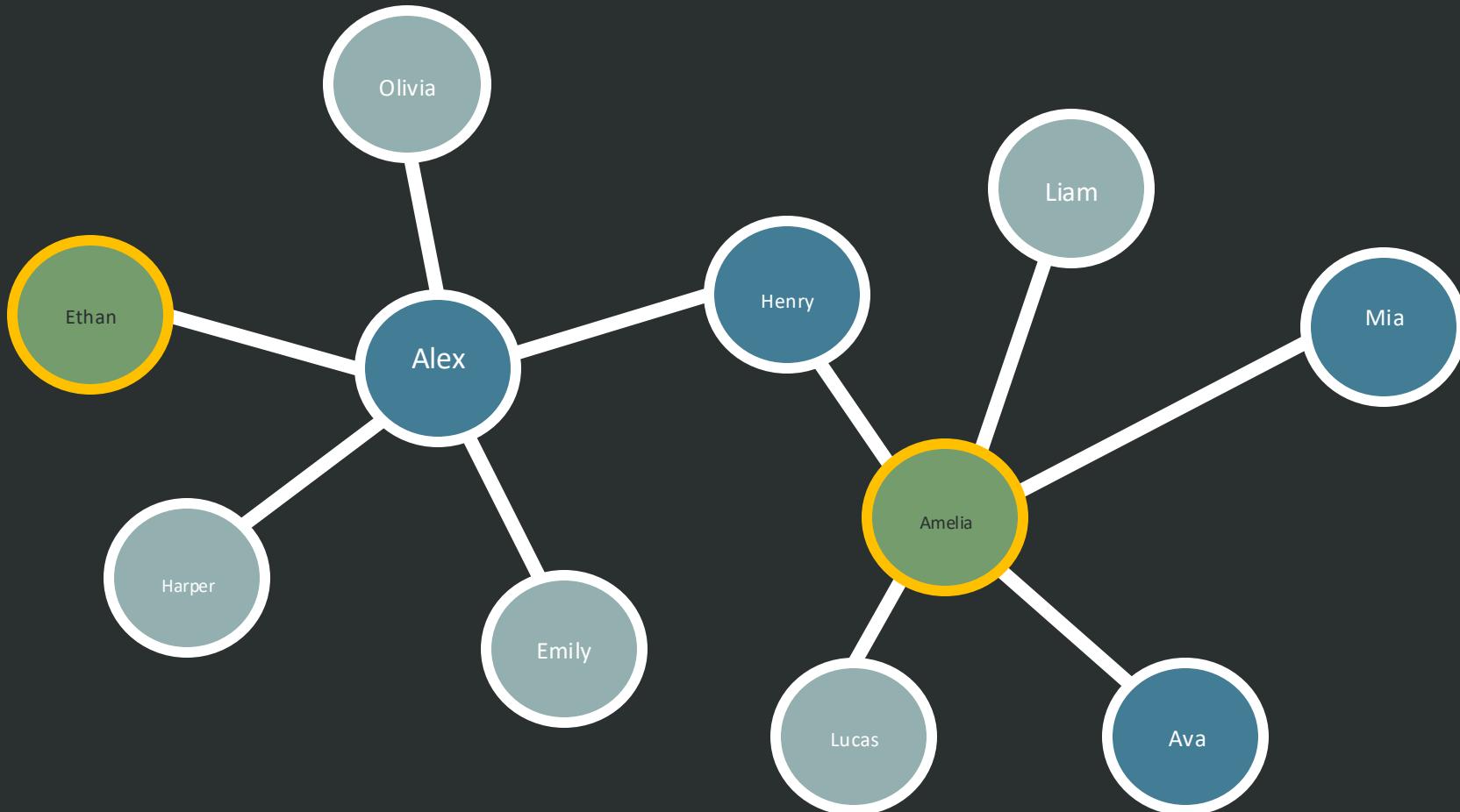
Your Hands-on-lab

Knowledge Graph Feature Overview

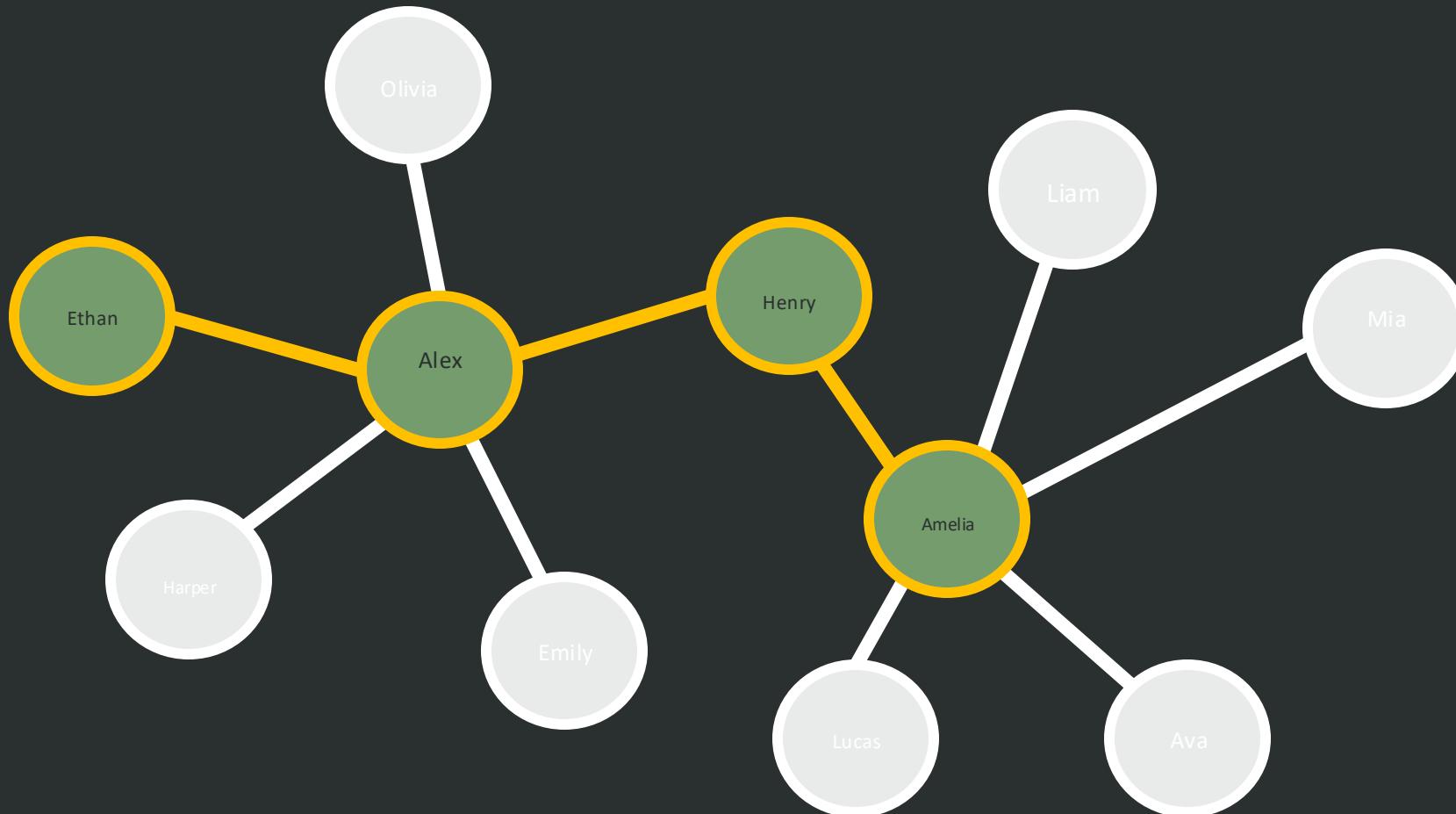
Knowledge Graphs and AI Vector Search



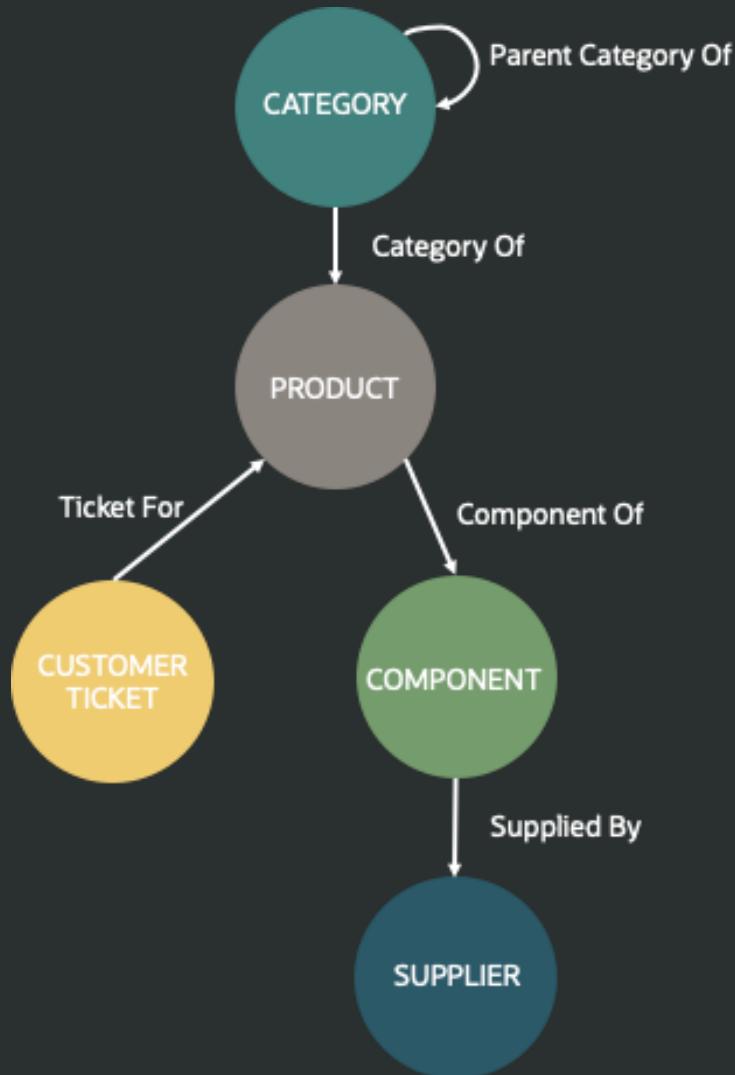
Are you connected to someone you met here?



Are you connected to someone you met here?



Relationships (edges) in our graph



- Categories can have subcategories
- Products belong to one or multiple categories
- Customer tickets are associated with specific products
- Products are built from one or multiple components
- Suppliers supply components

Create a Graph View of Data

CATEGORY

CAT_ID	CAT_NAME	...
1	Light	...
2	Door	...
3	Mirror	...
4	AC	...
...

PRODUCT

PROD_ID	CAT_ID	...
1	1	...
2	2	...
3	2	...
4	3	...
...

CUSTOMER TICKET

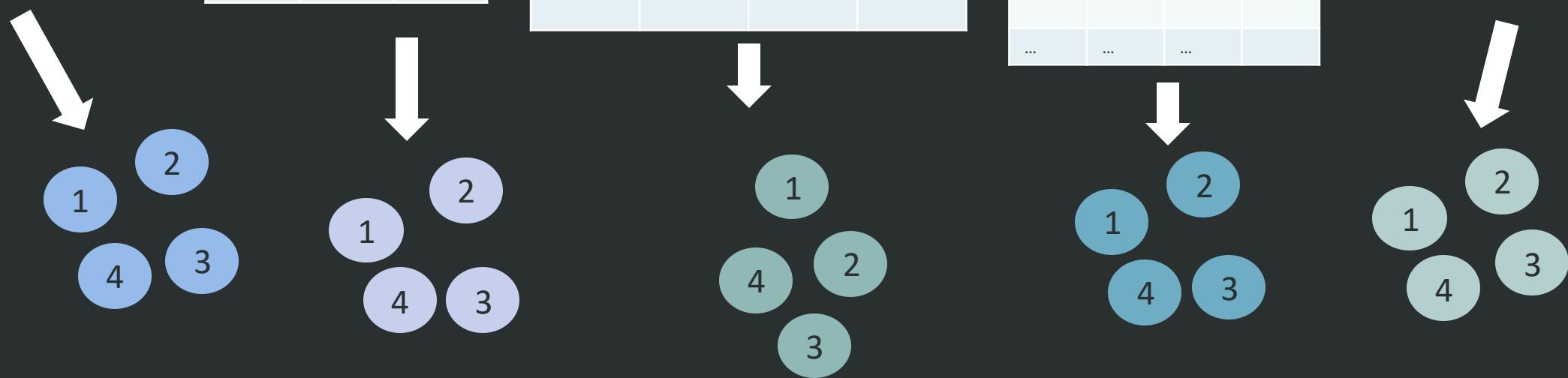
TICKET_ID	CUST_ID	PROD_ID	...
3	4	1	...
4	1	1	...
2	1	3	...
4	2	4	...
...

COMPONENT

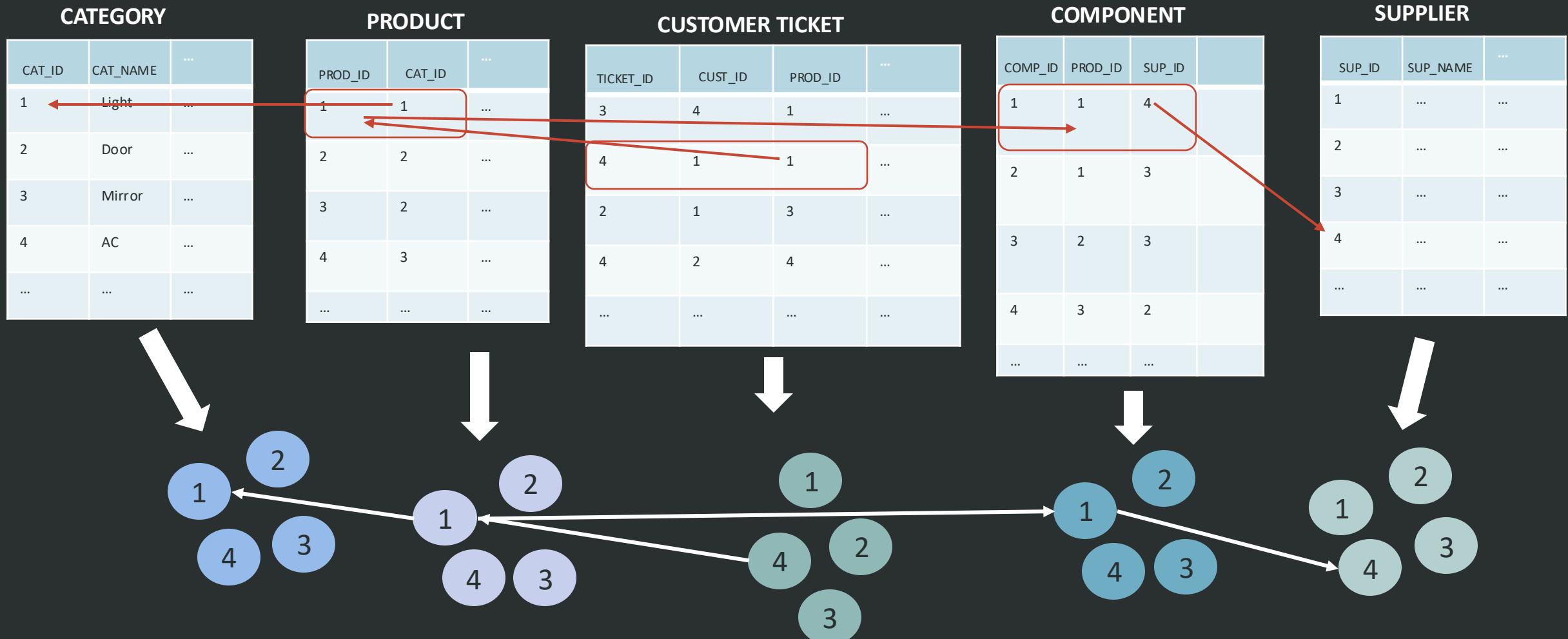
COMP_ID	PROD_ID	SUP_ID	...
1	1	4	
2	1	3	
3	2	3	
4	3	2	
...	

SUPPLIER

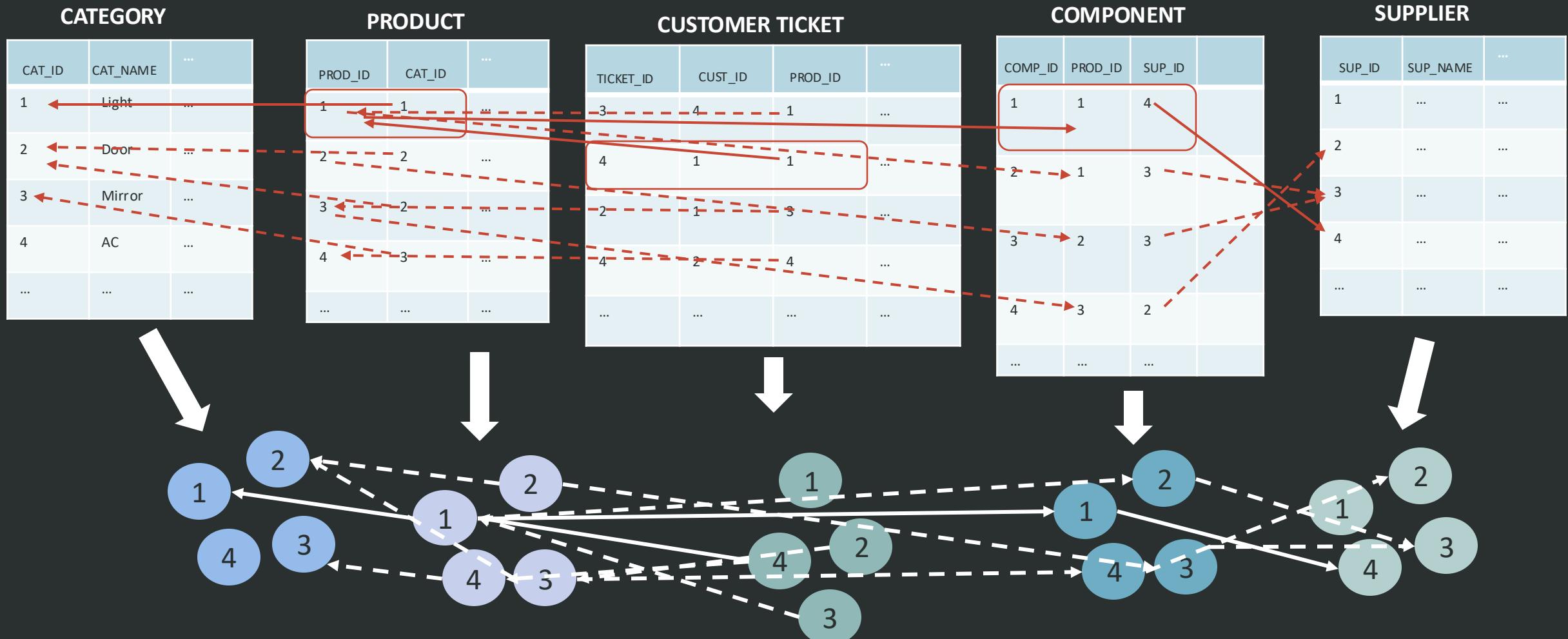
SUP_ID	SUP_NAME	...
1
2
3
4
...



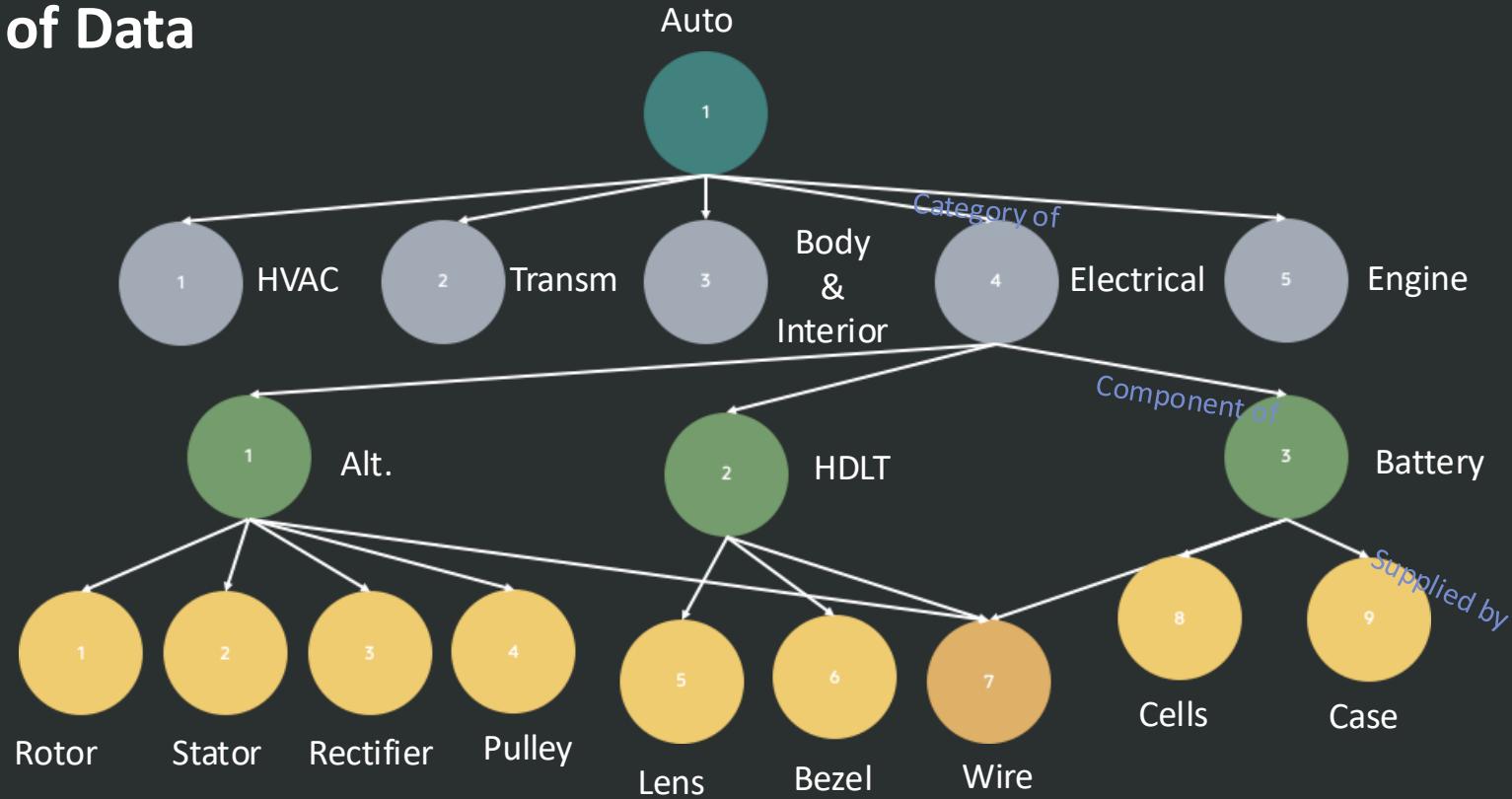
Create a Graph View of Data



Create a Graph View of Data



Graph View of Data



Vertices can have properties (columns from the table)
Edges can have properties (columns from the table)

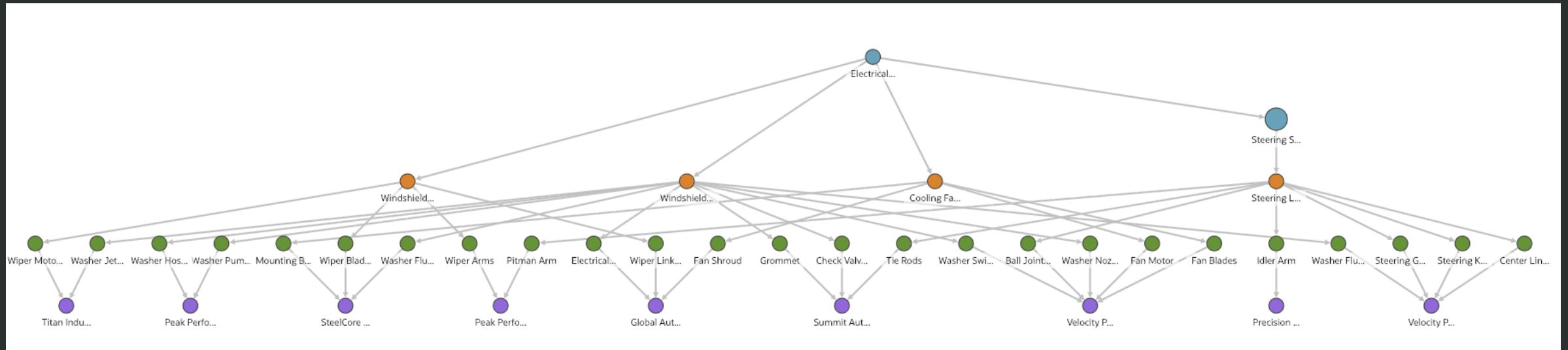
Graph View on Relational Tables

- No data copy – graph is a view on relational tables
- Insert/update/delete in underlying tables instantly available in graph
- Fast, concurrent updates
- Well-suited for operational workloads

Graph Query Example

```
SELECT *
FROM GRAPH_TABLE (auto_graph
  MATCH (a IS CATEGORY) - [] ->{1,4} (c)
  WHERE a.category = 'Electrical System'
  ONE ROW PER STEP (src, e, dst)
  COLUMNS (vertex_id(src) as src, edge_id(e) as e, vertex_id(dst) as dst)
);
```

New syntax in the SQL:2023 standard



Use Output of Graph Queries as Table

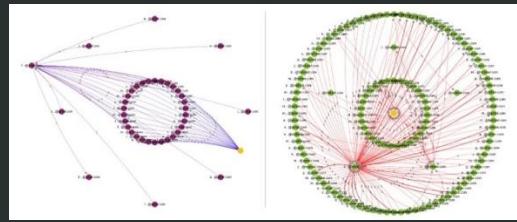
Output of a graph query can be a table

Combine with other relational tables in the database

Combine with other features in the database

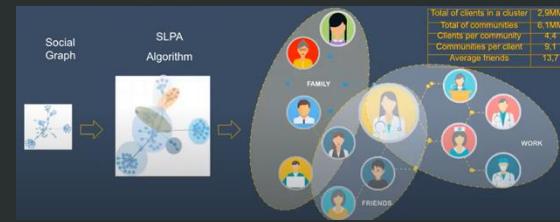
- Vector, Geospatial, JSON, etc.

Other Graph Use Cases



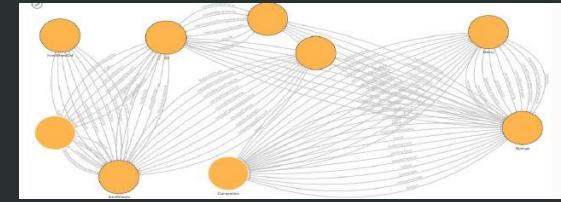
Fraud detection in financial transfers – detect anomalous patterns with graph queries

Image courtesy: Paysafe

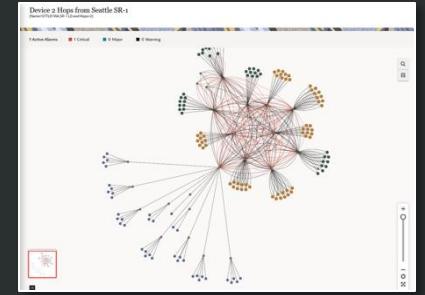


Identify communities using graph clustering algorithms

Image courtesy: Caixabank



Create a digital thread across linked components in manufacturing



Root cause analysis, assess impact of a node failure

Image courtesy:
Oracle Communications

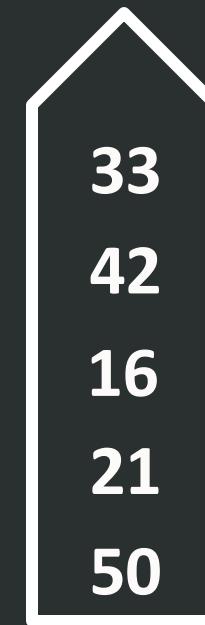
AI Vector Search Overview

Knowledge Graphs and AI Vector Search



AI Vector Search

Vectors represent the semantic content of images, documents, videos, etc.



Vector

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

Vector Query Example

```
SELECT DISTINCT ticket_id, component_id, component_name, ticket_description, vector_distance(ticket_vector,  
component_vector, COSINE) as vec_distance  
FROM GRAPH_TABLE (auto_graph  
    MATCH (t IS CUSTUMER_TICKET) - [e] -> (p is PRODUCT) - [f] -> (c is COMPONENT)  
    WHERE p.product_id = 11 AND t.product_id=11  
    COLUMNS (t.ticket_id as ticket_id, t.ticket_vec as ticket_vector, t.description as ticket_description,  
c.component_name_vec as component_vector, c.component_Id as component_id, c.component_name as component_name)  
)  
WHERE vector_distance(ticket_vector, component_vector, COSINE) <.45  
ORDER BY vec_dist;
```

Match the component names with the customer tickets to identify the faulty component

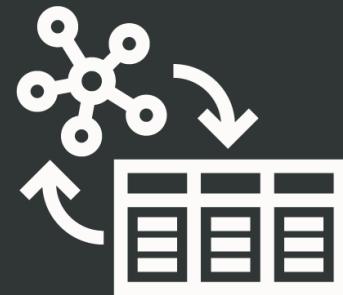
TICKET_ID	COMPONENT_ID	COMPONENT_NAME	TICKET_DESCRIPTION	VEC_DIST
73	1220	Oil Pump	Oil pump issue - please fix	0.17679381551631823
57	1220	Oil Pump	Oil Pump is defective, please send a new one	0.23156266244122026
14	1220	Oil Pump	Hello, I noticed an issue with the Oil Pump in my vehicle. Could you please assist?	0.2522085201548133
19	1220	Oil Pump	Hello, I noticed an issue with the Oil Pump in my vehicle. Could you please assist?	0.2522085201548133
58	1220	Oil Pump	My car won't work with this defective oil pump - I can't get to work without my car, this is unacceptable!!	0.2541787631831328



Oracle AI Database 26ai

One part of an app can treat the data as **relational**, while other parts treat the **same data** as a **graph** and unify with **AI**.

Unification of Graph and Relational



Unification of AI and Databases



Overview: Knowledge Graphs and AI Vector Search

Knowledge Graphs and AI Vector Search



Technologies



We will use two database features

Vector Search

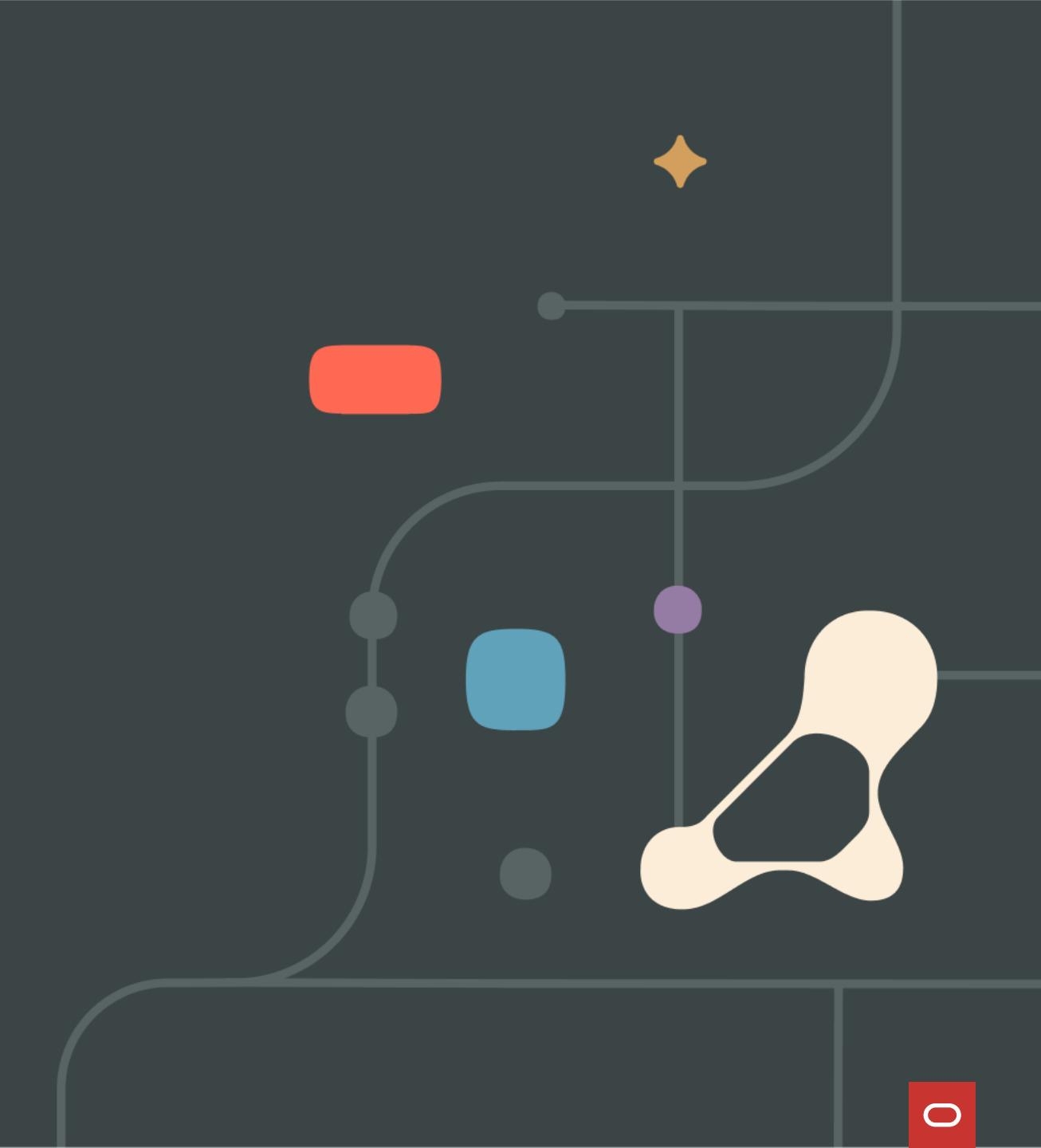
- To match customer sentiments to products

Graph Queries

- To discover how customers are related to products, and how products are related to suppliers
- (CUSTOMER) -> (PRODUCT)
- (PRODUCT) -> (SUPPLIER)

Let's get started!

Knowledge Graphs and AI Vector Search



Trace the linkage between products, components, and suppliers

Monday Morning

Imagine logging into your computer one Monday morning and finding a notification from your manager asking you to let her know when you have some time.

You get yourself a cup of coffee and message her back.

Your manager lets you know she noticed an uptick in negative customer sentiments that popped up on her dashboard. She wants you to investigate it.

Trace the linkage between products, components, and suppliers

Monday Morning

You decide to start by looking at all the sentiments using vector search and find that there are a surprisingly high number are negative.

Strangely, the customers are complaining about different products, so it doesn't make sense.

You decide to create a graph to track the components and sub-components of each product to identify whether a particular sub-component is the problem.

You then connect the graph to the suppliers to uncover any interesting insights.

You discover that components with issues can all be traced back to one supplier.

Bingo.

Trace the linkage between products, components, and suppliers

Monday Afternoon

You put together a dashboard for your manager so that she can ask questions in natural language.

Armed with data to back it up, your manager gets on the phone with the vendor to start getting these components replaced in the supply chain.

Workshop Steps

OCI Gen AI Services

- Use Gen AI to analyze the description of the customer tickets and categorize the sentiment as positive, negative, slightly positive, slightly negative, or neutral

Graph Query

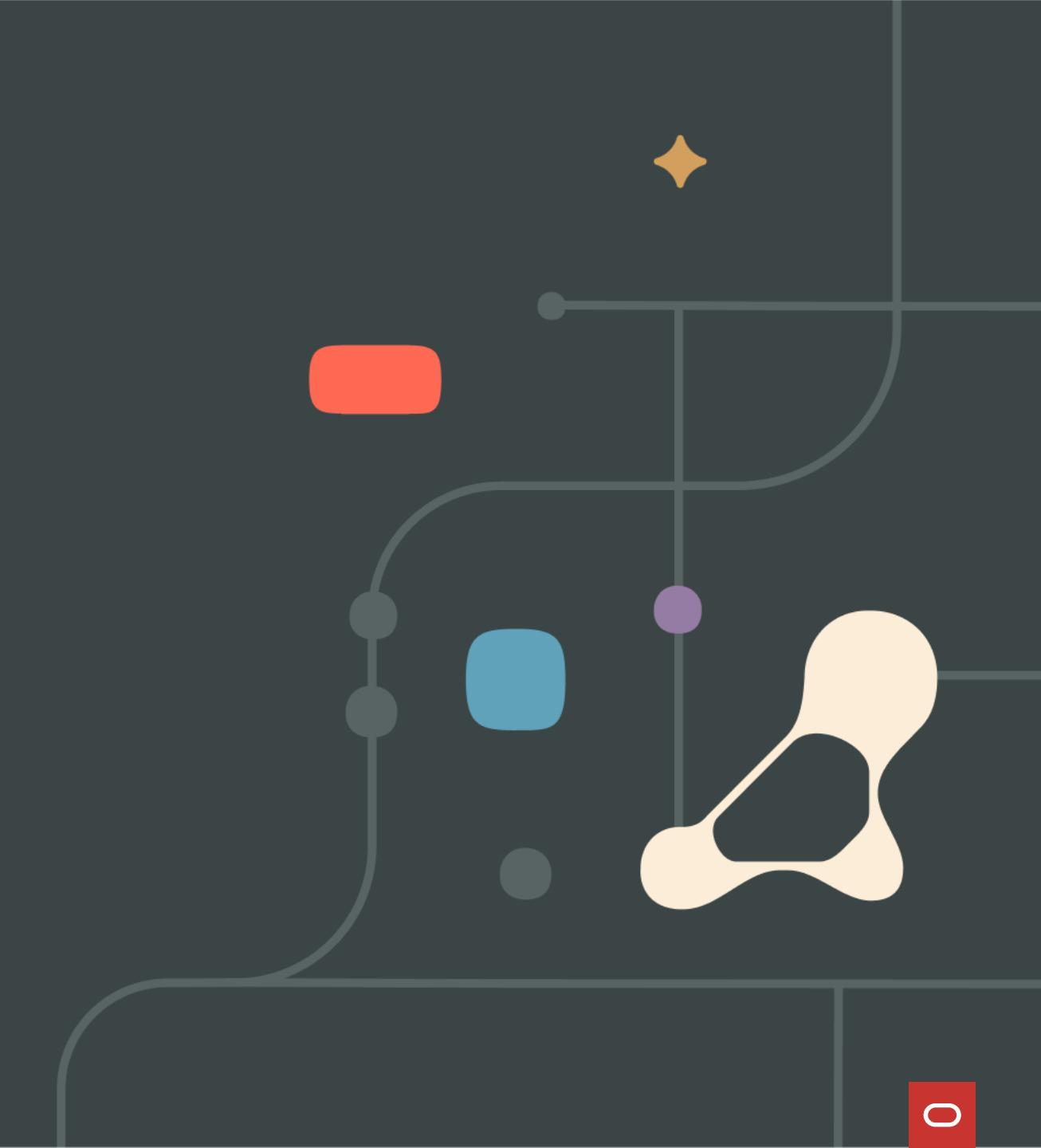
- Use graphs to identify products with the highest number of negative sentiment tickets and their associated components

Vector Search

- Use vectors to match the component names to the language used by customers to file their customer support tickets

LiveLab Walkthrough

Knowledge Graphs and AI Vector Search



Let's get started

<http://livelabs.oracle.com/ai-world25/HOL2813>

Click **Launch Workshop** once
available

Note:

The environments are available in a couple of minutes.

Refresh the page

My Reservations

All your current workshop reservations are shown below. You can edit active or pending reservations, view workshop details, attend an available workshop, or delete a reservation.

Note: The status of your reservations will be emailed to you. Check your mail for any status updates.

Knowledge Graphs and AI Vector Search to Trace Linkages in Data in Oracle 23ai 
Friday October 3rd, 5:17pm (17:17) Canada/Atlantic

Launch Workshop  

To access this page again click the user dropdown in the top right corner and select **My Reservations**

Let's get started

<http://livelabs.oracle.com/ai-world25/HOL2813>

1. Click **View Login Info**
2. Click **Launch OCI** to proceed to your workshop environment

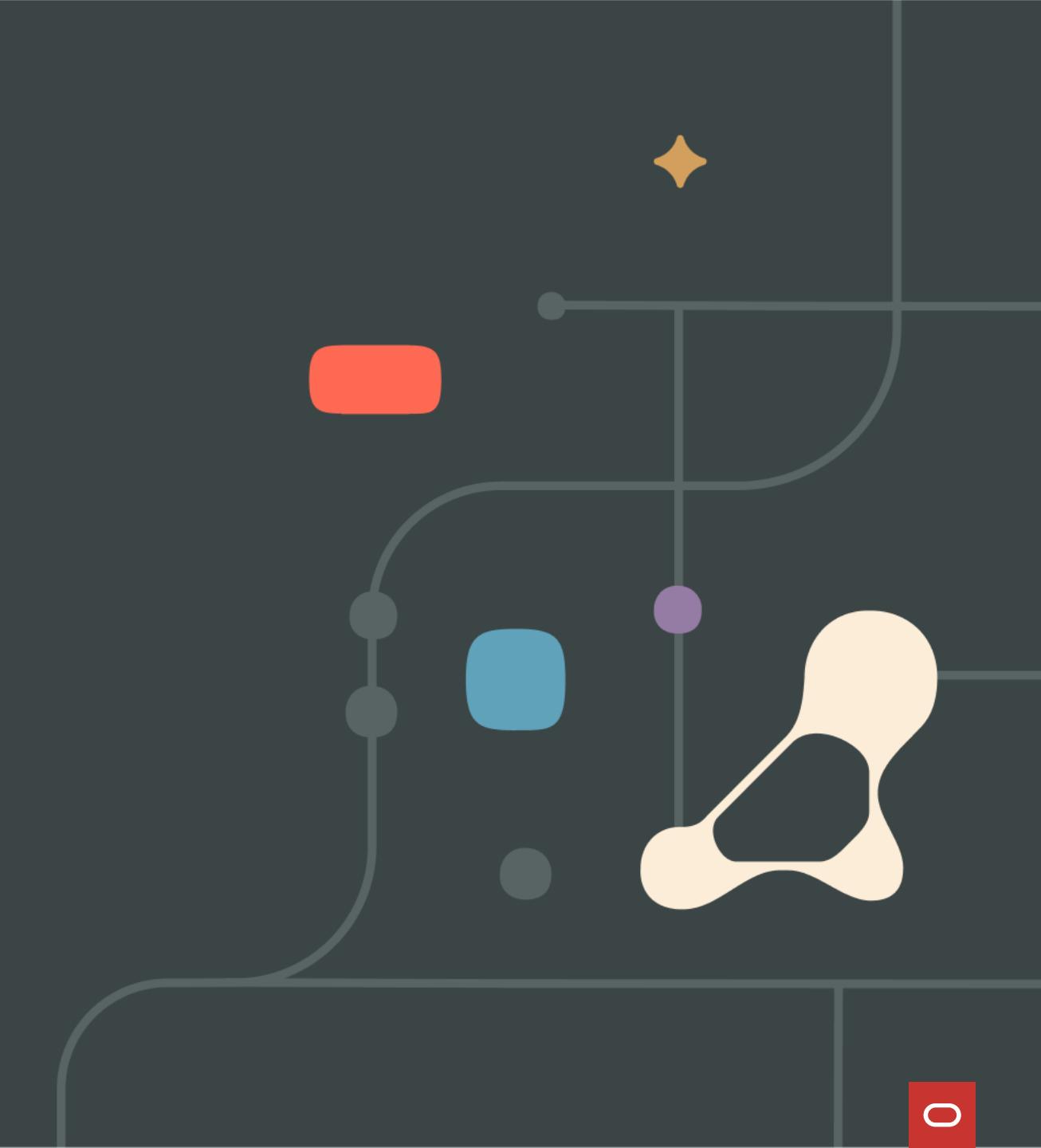
The screenshot shows the Oracle LiveLabs interface. On the left, there is a sidebar with navigation links: Home, Workshops, Graph Center, Graph API, GraphDB, Analytics, and Help Center. The main content area has a title "Knowledge Graphs and AI Vector Search to Trace Links" and a sub-section "About This Workshop". Below this are sections for "Get Started", "Lab 1: Import Notebook", "Lab 2: Query and visualize the property graph", and "Need Help?".

A modal window titled "Reservation Information" is open on the right. It contains the following details:

Tenancy Name	Region
devrellivelabs	Germany Central (Frankfurt) (eu-frankfurt-1)
Username	Password
LL163622-USER	soTu9t2n,
Reset Password	
Compartments	Copy Compartment OCID
LL163622-COMPARTMENT	ocid1.compartment.oc1..aaaaaaaaayrkbx5weszpkysoc25rhv3oolktuqimuticxqcuuvteocwbo6q
Generative AI Endpoint Region	
Germany Central (Frankfurt) (eu-frankfurt-1)	
Terraform Values	
Autonomous Database	: 861fE5i7TyWEHHeu <input type="button" value="Copy value"/>
Graph Password	: 69q0fgEYHKD4 <input type="button" value="Copy value"/>
Graph Username	: GRAPHUSER <input type="button" value="Copy value"/>
Region Identifier	: eu-frankfurt-1 <input type="button" value="Copy value"/>
Tenancy OCID	: ocid1.tenancy.oc1..aaaaaaaaayz6bptazeg7qiqy4rt4k3otxi5umailp3rzejio6cc3ubub2 <input type="button" value="Copy value"/>
User OCID	: ocid1.user.oc1..aaaaaaaaacfzh67jprbkwmus5knkgtgmfrzncc4yve3jvws2umljrjrvf2wc6nq <input type="button" value="Copy value"/>

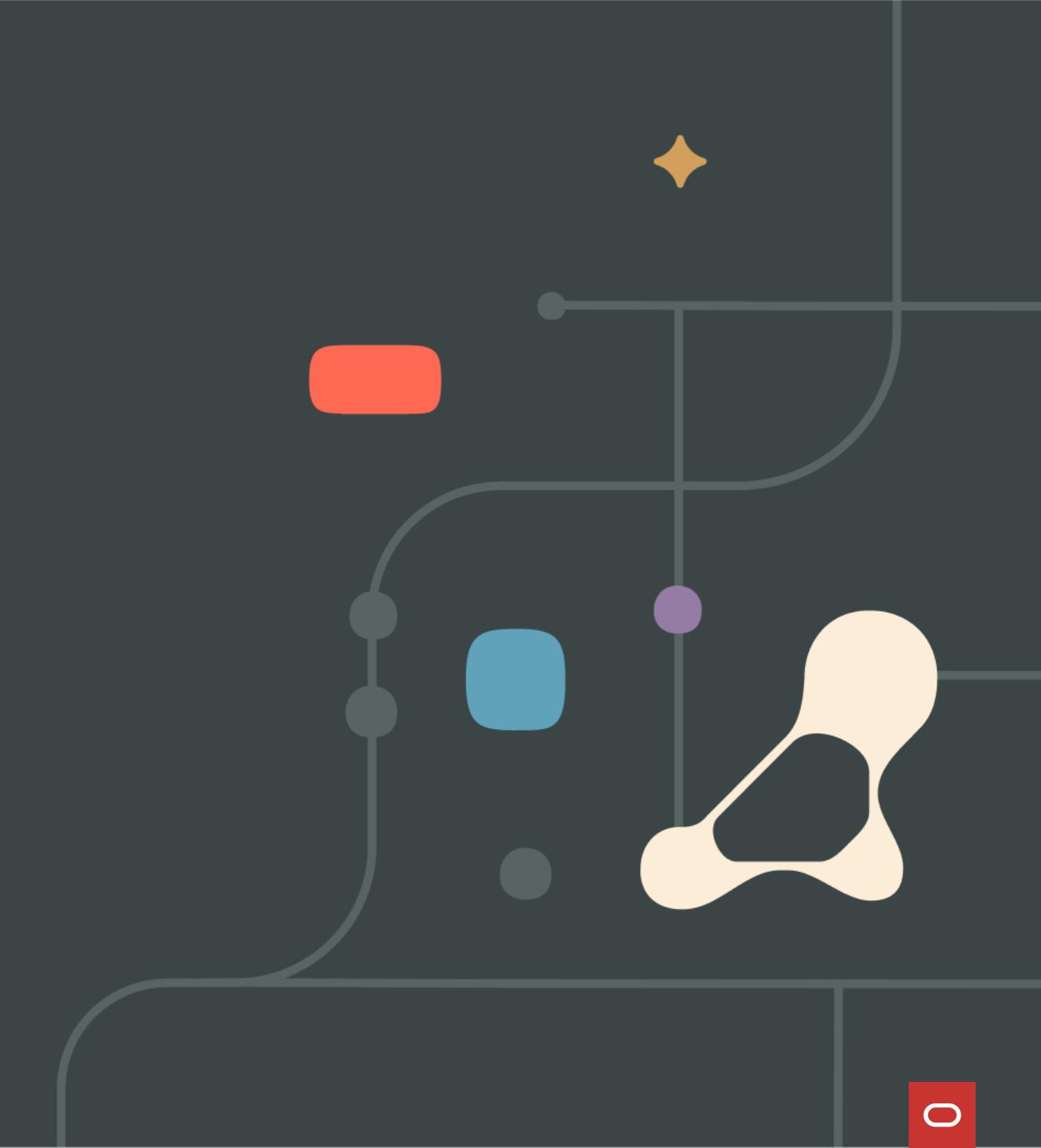
It's Your Turn!

Knowledge Graphs and AI Vector Search



Need Help?

Knowledge Graphs and AI Vector Search



I Need Help!



+ Lab 1: Environment Setup
+ Lab 2: Initialize Environment
+ Lab 3: Generate AWR Snapshot
- Lab 4: Capture and Preserve SQL
Introduction
Task 1: Collect statements from AWR
Task 2: Collect statements from Cursor Cache
Task 3: Optional - export AWR
Learn More
Acknowledgements
+ Lab 5: AutoUpgrade Report
+ Lab 6: AWR Compare Report
+ Lab 7: SQL Performance Analyzer
+ Lab 8: SQL Plan Management
+ Lab 9: SQL Tuning Advisor

Capture and preserve SQL

Watch on YouTube

About SQL Tuning Sets
A SQL tuning set (STS) is a database object that you can use as input to tuning tools. An STS includes:

- A set of SQL statements
- Associated execution context, such as a user schema, application module name and action, list of bind values, and
- Associated basic execution statistics, such as elapsed time, CPU time, buffer gets, disk reads, rows processed, curs
- Associated execution plans and row source statistics for each SQL statement (optional)

Need help?

Introduction

This page is designed to help you solve some common problems users face in this LiveLab.

After reading those troubleshooting tips, if you still find yourself stuck or would like to report an issue, question mark icon in the upper right corner to contact the LiveLabs team directly via email.



For more about getting support using our email, click [here](#).

Common Issues Table of Contents

- Can't Log in to Oracle Cloud
- Can't Create an Oracle Database? Nothing in Your Compartment?
- Connectivity Issues? Unable to Upload Data or Connect to the Database? Hmm... can't reach open to gain access to the workshop?
- Cannot Access Cloud Shell?
- Cannot Connect to the Marketplace Compute Instance Using a Private SSH Key?
- Cannot Create Passwords for Database Users?

Expand All Tasks

+ How to Format Your Support Email Request



Self-Service

Watch the videos in beginning of each lab

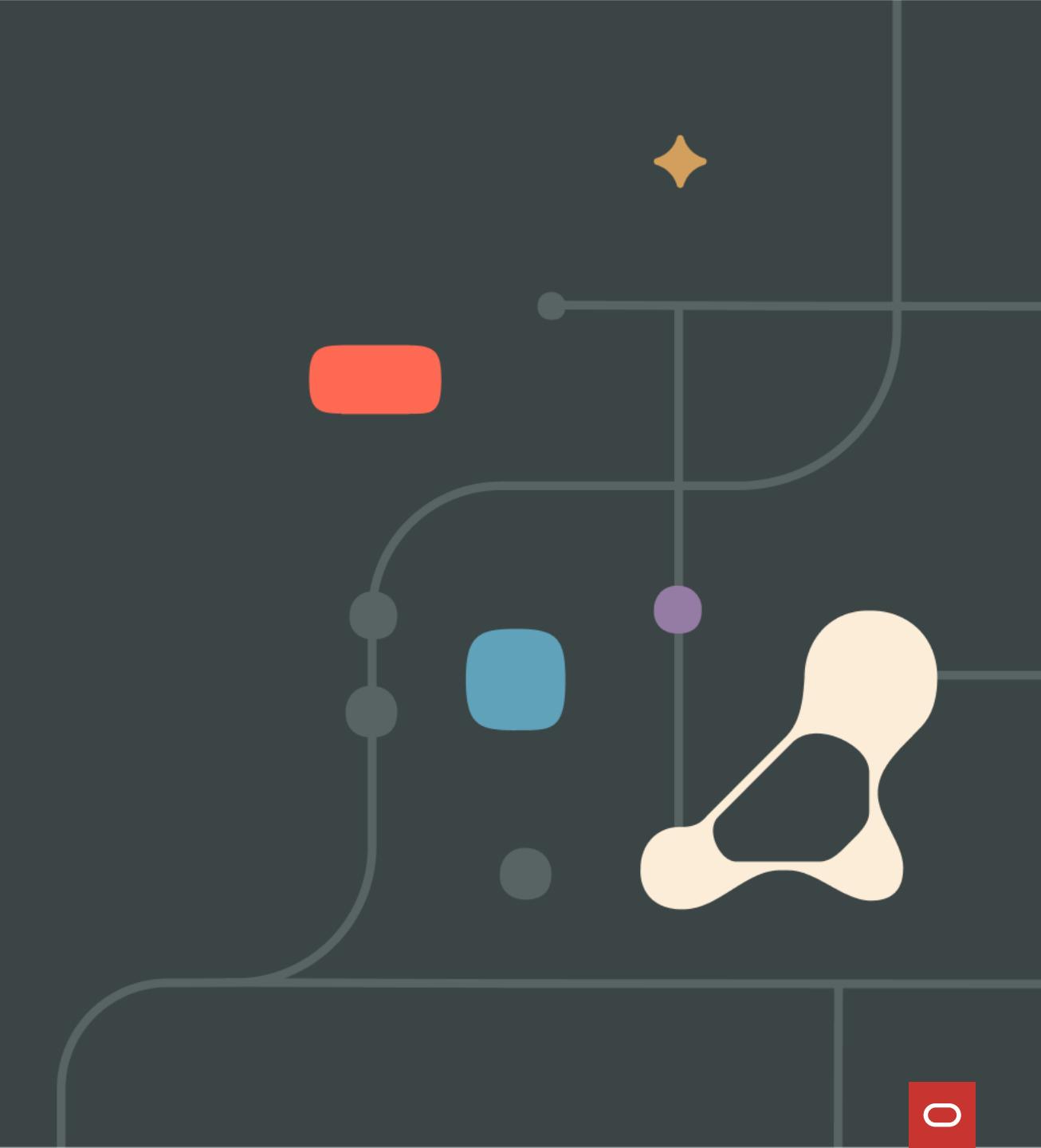
Get help — Self-Service

Find the ‘Need help?’ section in the sidebar of the workshop

Ask us!

Import Notebook

Knowledge Graphs and AI Vector Search



15:00

Query and visualize the graph

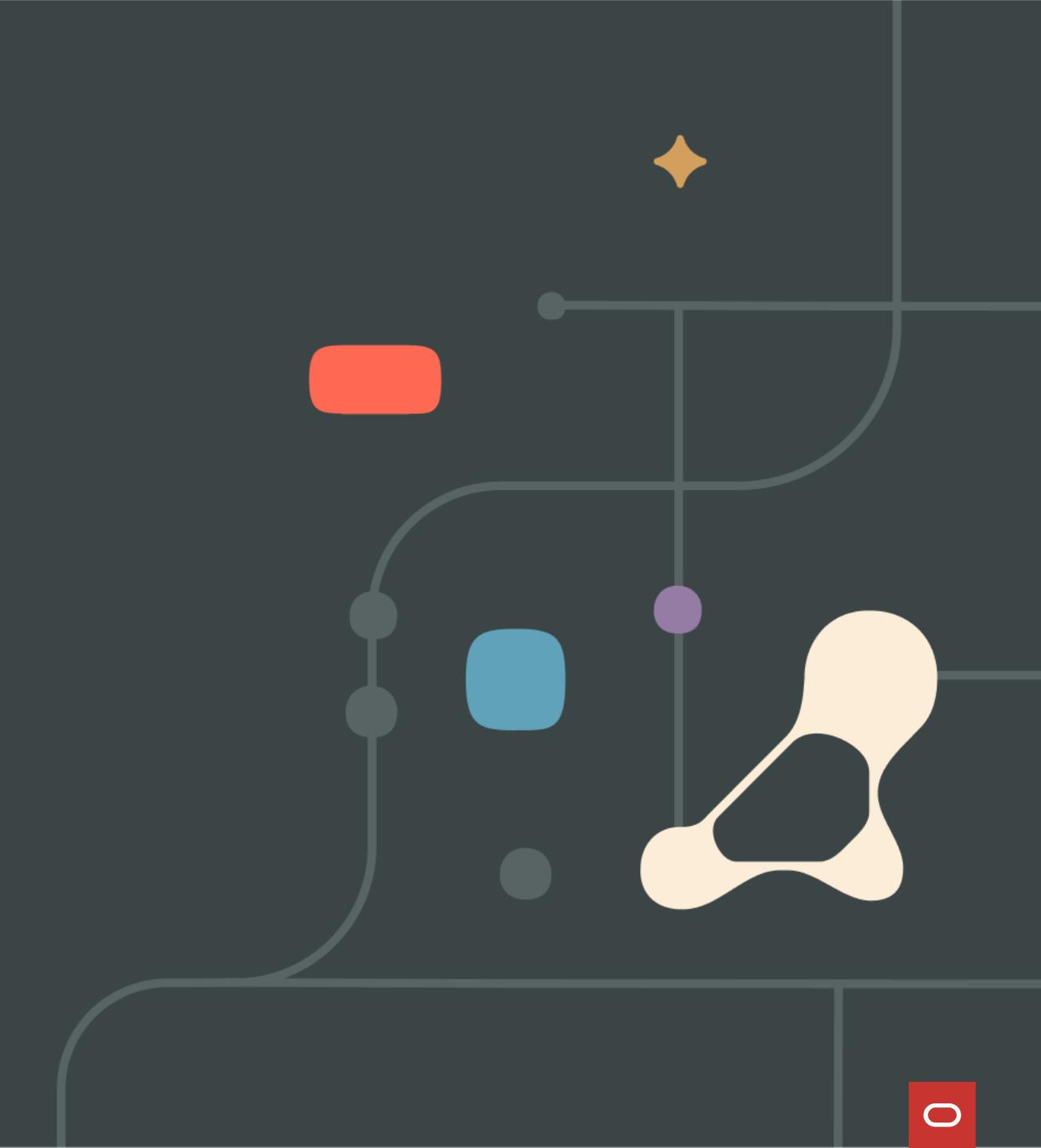
Knowledge Graphs and AI Vector Search



30:00

Create an APEX App

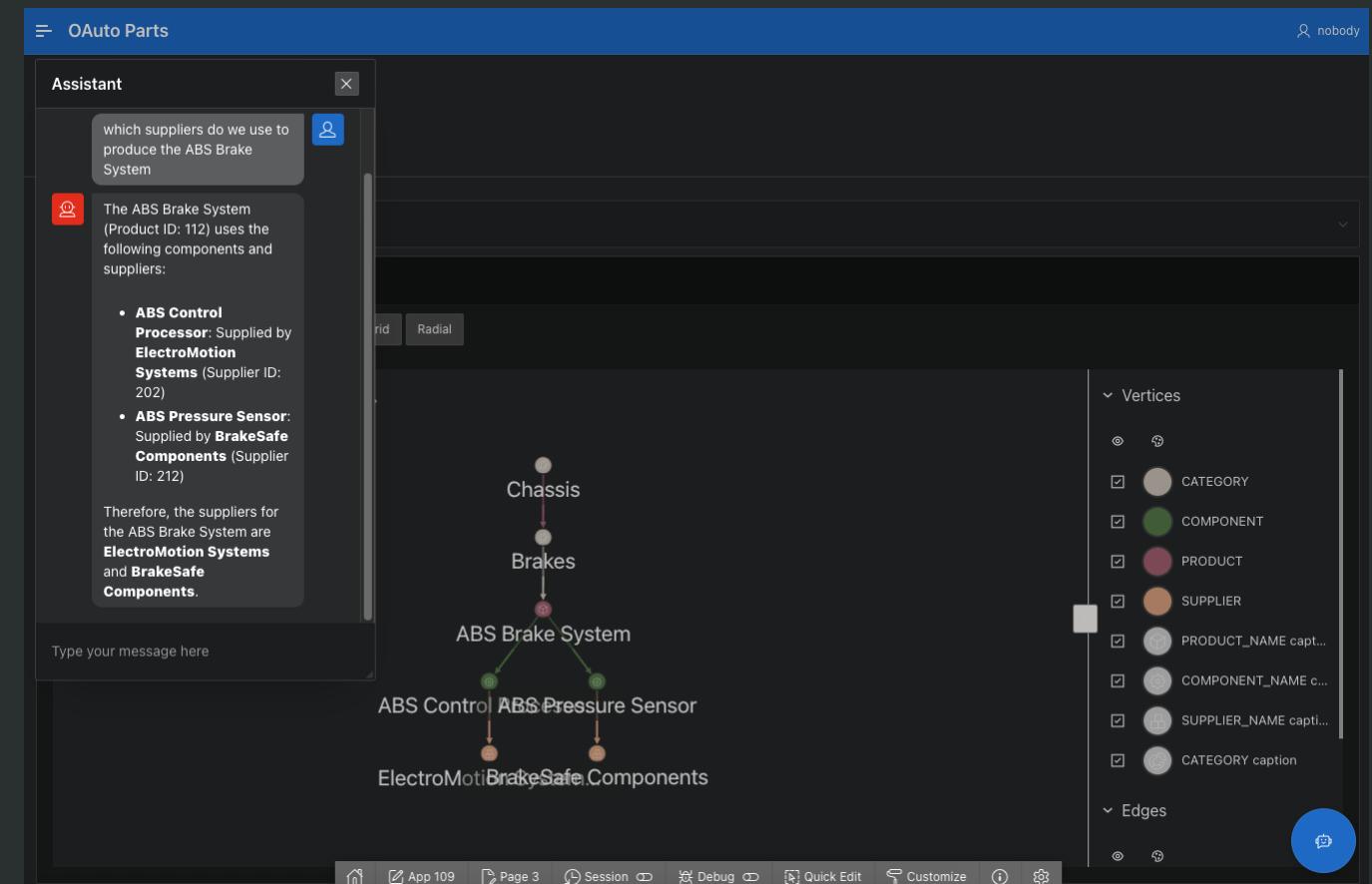
Knowledge Graphs and AI Vector Search



Graph RAG in APEX

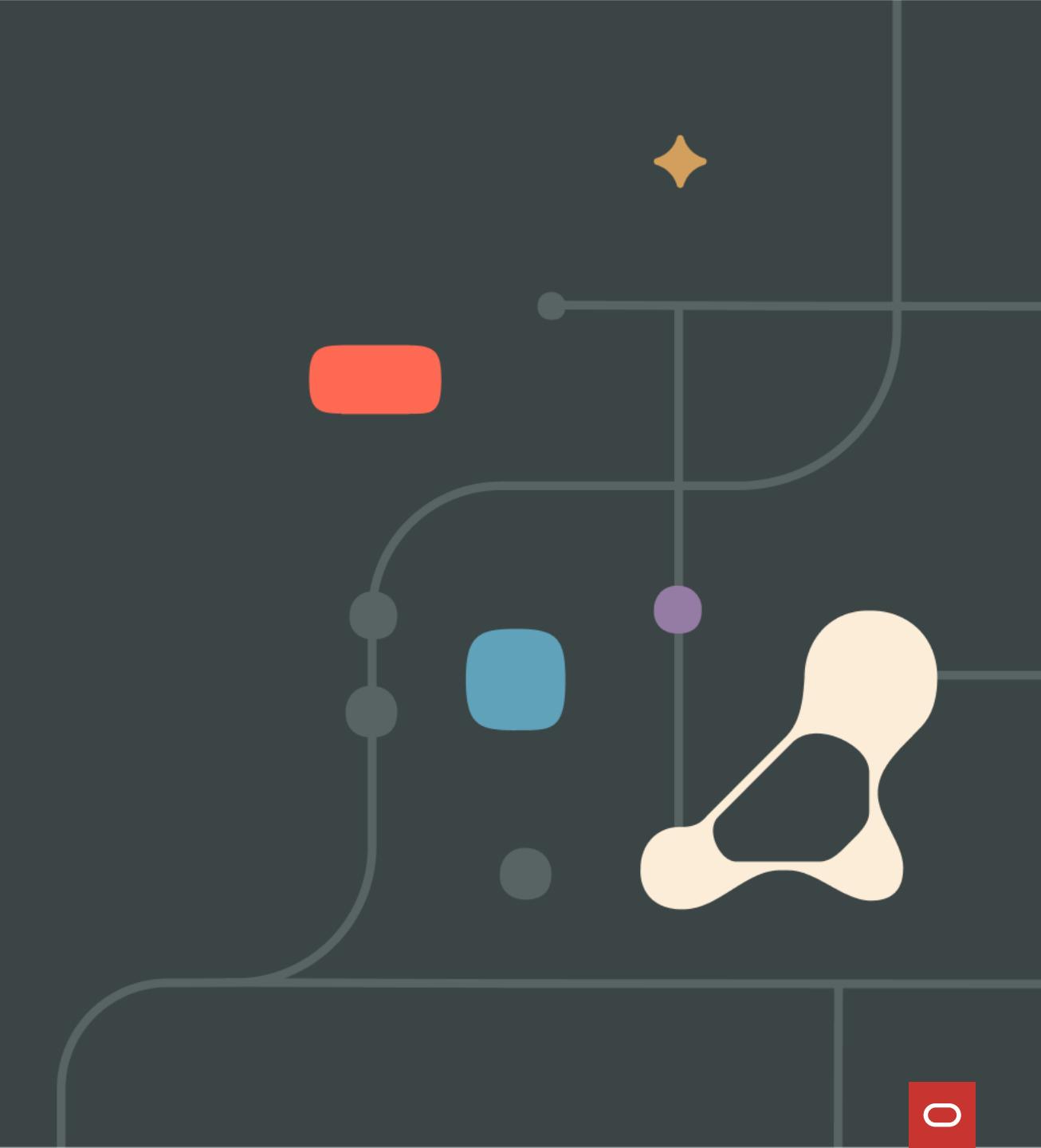
<http://livelabs.oracle.com/ai-world25/HOL2813>

1. You can visualize graphs in APEX using the Graph Visualization Plug-in
2. Use SQL PG as the RAG source and ask questions about your graph in natural language



Wrap Up and Next Steps

Knowledge Graphs and AI Vector Search





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[@oracleace](https://twitter.com/oracleace)



Oracle ACE
Nominate
yourself or someone you know:
ace.oracle.com/nominate

Thank you

Ramu, Denise, and Rahul

Your feedback is important.

**Scan this QR Code or use the
Mobile App to share your
thoughts on this session.**



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