

ANALYTICS AND DATA

TechCasts

Exploring Relationships in Your Data With Oracle Analytic Cloud (OAC)

Melli Annamalai

Distinguished Product Manager, Oracle

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Vice President, Product Management, Oracle

Gautam Pisharam

Principal Product Manager, Oracle

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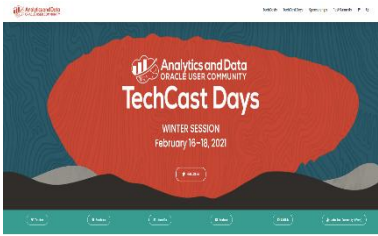
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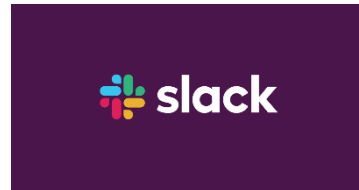


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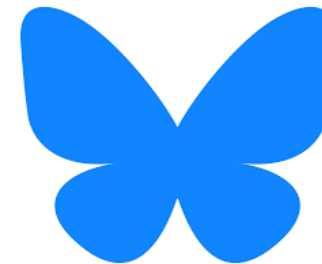


Spatial + Graph SIG

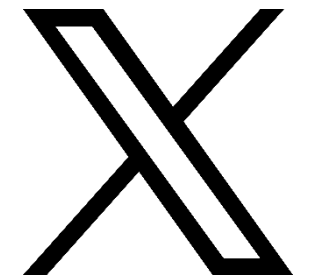
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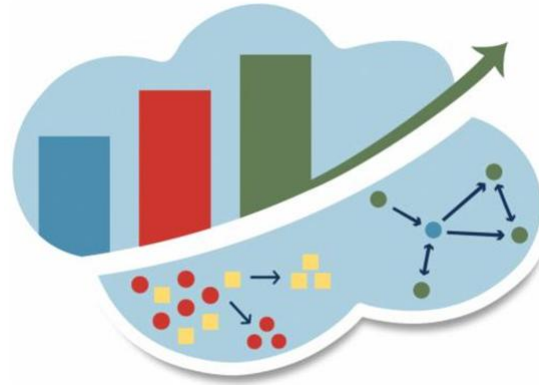


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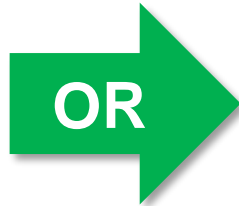
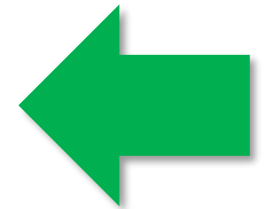
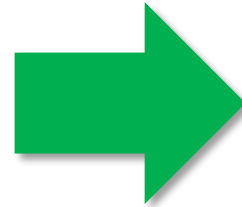


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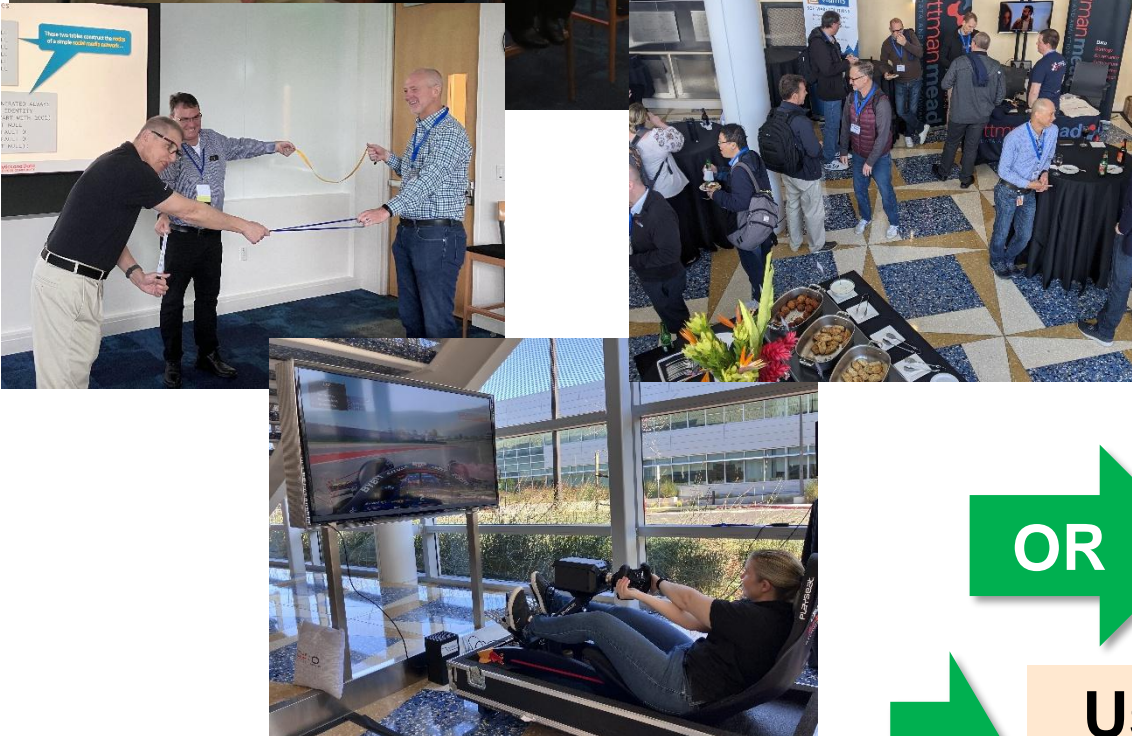
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ORACLE

Exploring Relationships in Your Data Using Oracle Analytics Cloud (OAC)

Melli Annamalai, Philippe Lions, Gautam Pisharam

Product Management
Oracle



Who Are We?



Melli Annamalai
Distinguished Product Manager

Nashua, NH, USA



Philippe Lions
Vice President, Product Management

Paris, France



Gautam Pisharam
Principal Product Manager

Bengaluru, India

Agenda

What are graphs and the power of graph analytics

Helping business users get value from graph queries

- How Oracle Analytics Cloud can help

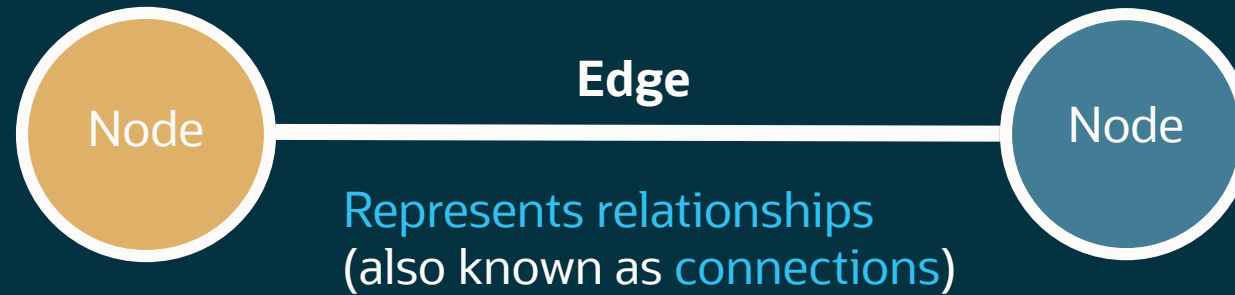
Q&A



What is a Graph?

—
Graph data model captures how data is connected

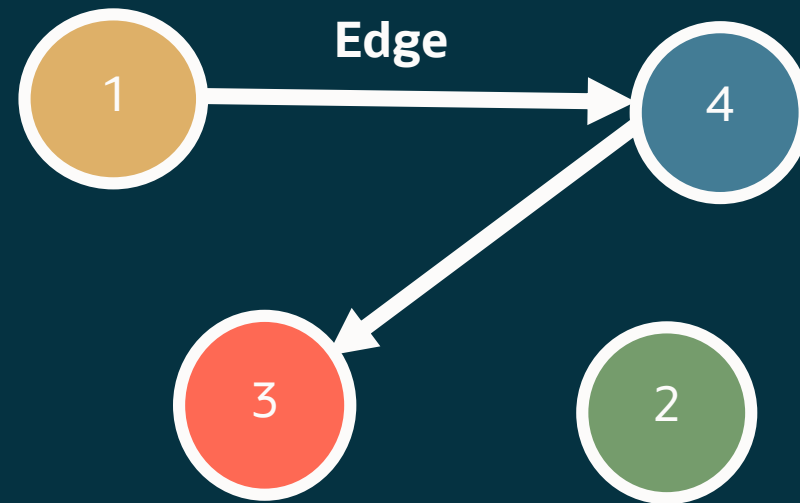
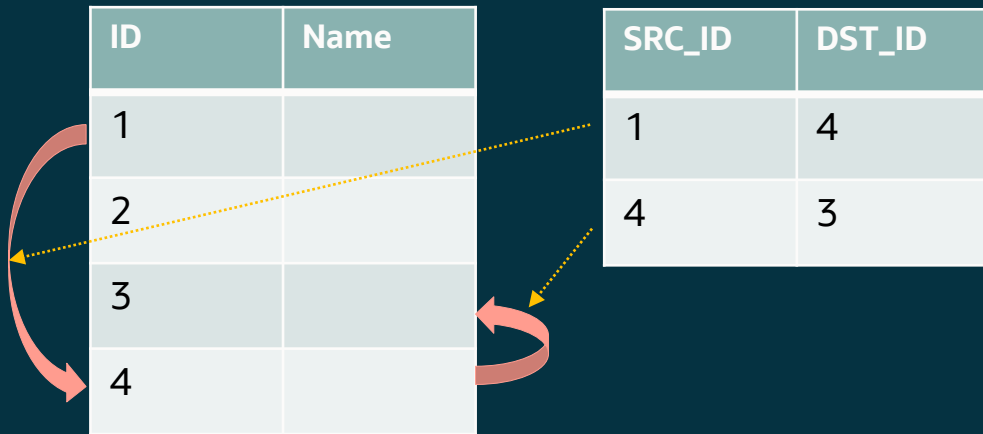
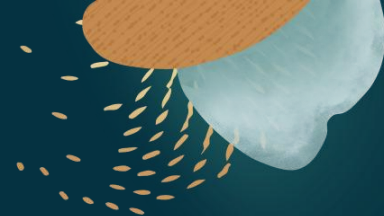
What is a graph?



Also known as a Vertex
Represents entities in data

Also known as a Vertex
Represents entities in data

What is a graph?



Railway Network: What is a route between **BCA** and **JAJ**?

Data is typically in tables

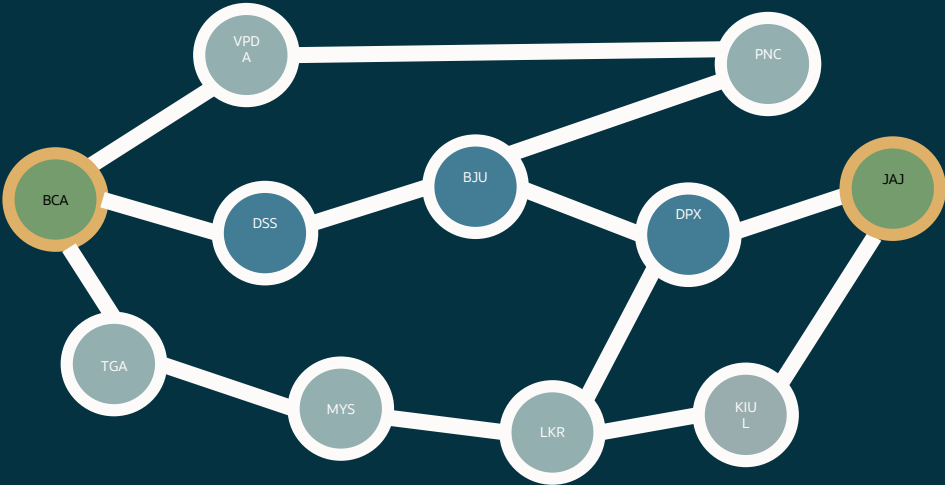
STATIONS

ID	Station_Name
1	BCA
2	BJU
3	PNC
...	...
10	JAJ
...	...
...	...
...	...
...	...
...	...
...	...
...	...
...	...

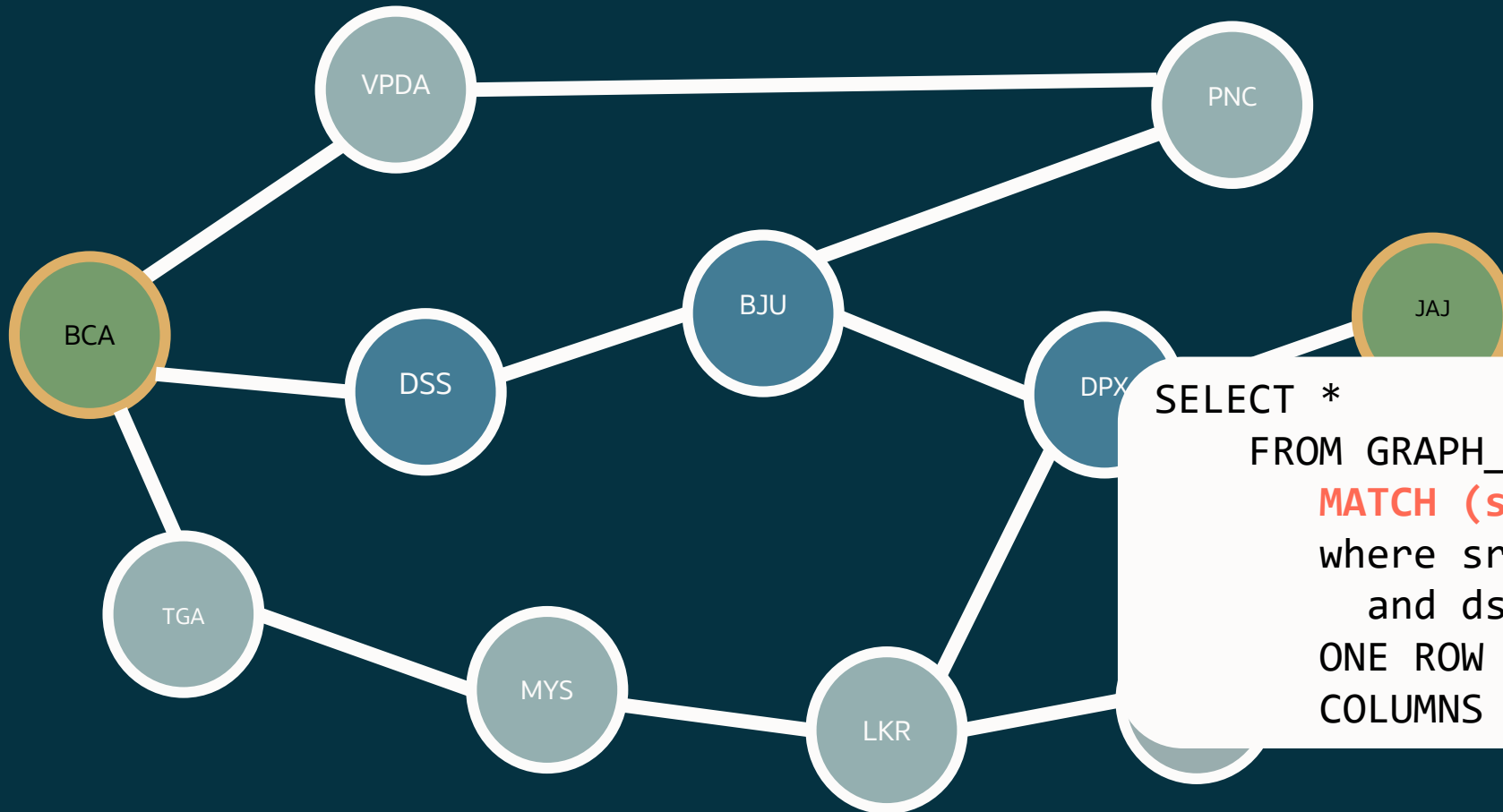
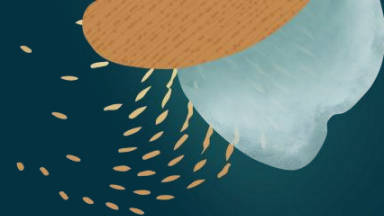
RAILWAY_ROUTES

SOURCE	DESTINATION	...
BCA	VPDA	...
BCA	TGA	...
BCA	DSS	...
...
...
DPX	JAJ	...
KIUL	JAJ	...
...
...
...
...
...
...
...

Is station **BCA** connected to station **JAJ**, when using information in these tables?



Railway Network: Stations and Routes



What are the routes with no more than 4 segments between BCA and JAJ?

```
SELECT *  
FROM GRAPH_TABLE(RAILWAYS_GRAPH  
MATCH (src)-[e]->{4}(dst)  
where src.station_name = 'BCA'  
and dst.station_name = 'JAJ'  
ONE ROW PER STEP (v1, ed, v2)  
COLUMNS (...)) );
```



Graph Studio Notebook

Graph Studio

ATTACHED GRAPHUSER

Notebooks > IndianRailways

Jump to paragraph Versioning

```
%sql
SELECT id_src, id_v1, id_v2, id_dst, v1_id, v2_id, ed_id
FROM GRAPH_TABLE(RAILWAYS_GRAPH
MATCH (src)-[e]->(4)(dst)
where src.id = 1 and dst.id = 10
ONE ROW PER STEP (v1, ed, v2)
COLUMNS (LISTAGG(e.source, ', ') as path_ids, src.station_name as id_src, v1.station_name as id_v1, v2.station_name as id_v2, dst.station_name as id_dst, vertex_id(v1) as v1_id, edge_id(ed) as ed_id, vertex_id(v2) as v2_id)
);
```

Page 1 of 1

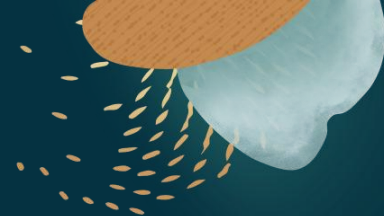
Vertices

- STATIONS

Edges

- RAILWAY_ROUTES

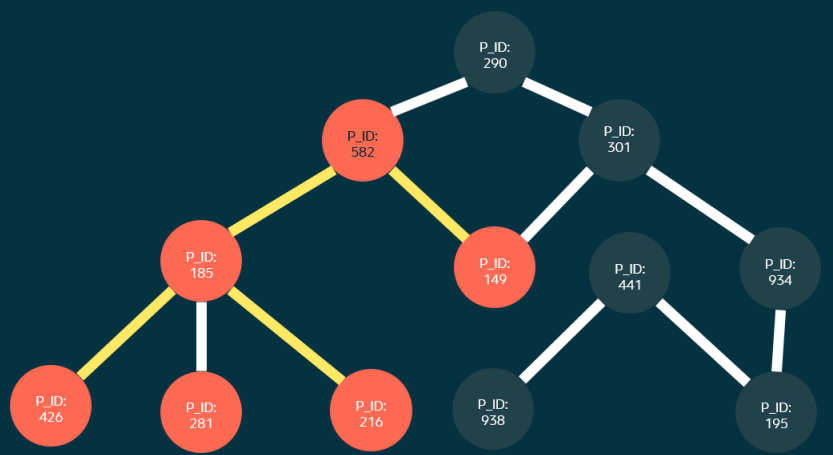




Rail/Road/Air Networks are Natural Graphs

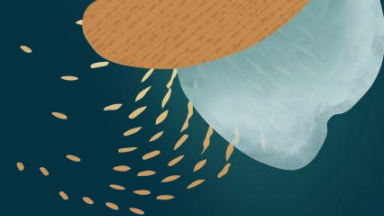
..... Many other types of data can be expressed as graphs as well, for new insights

Analyze product dependencies in Manufacturing



Components are nodes and dependencies between them are edges

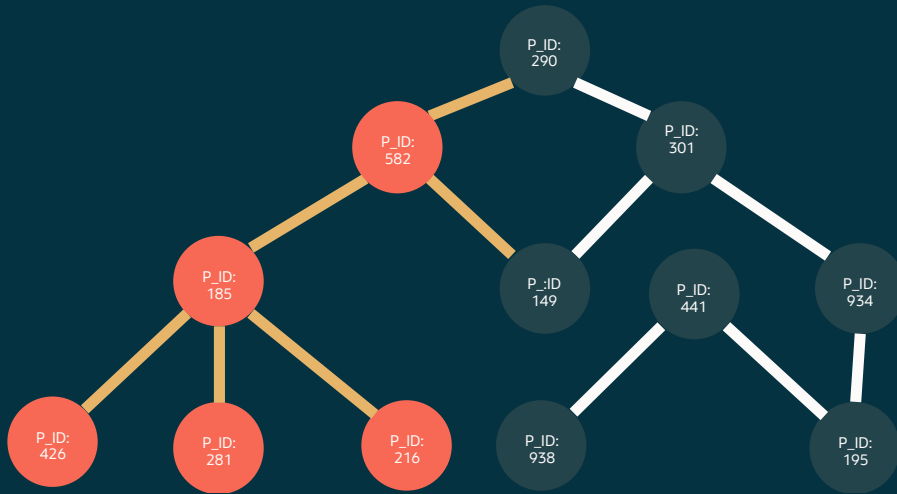




Rail/Road/Air Networks are Natural Graphs

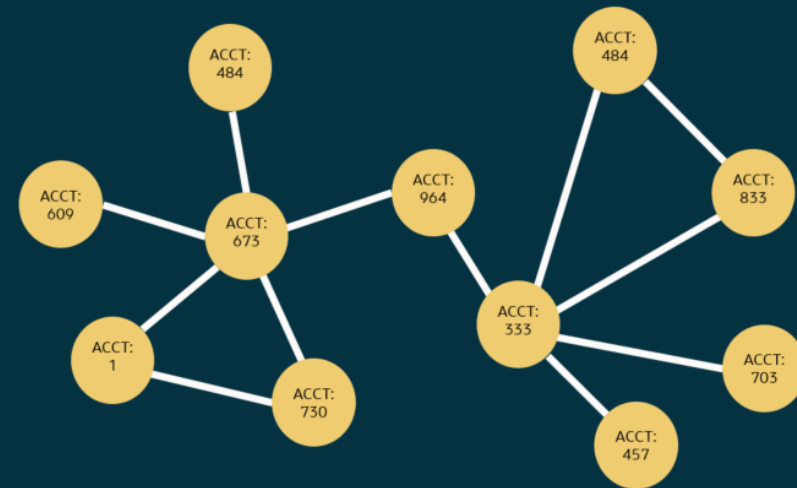
..... Many other types of data can be expressed as graphs as well, for new insights

Analyze product dependencies in Manufacturing



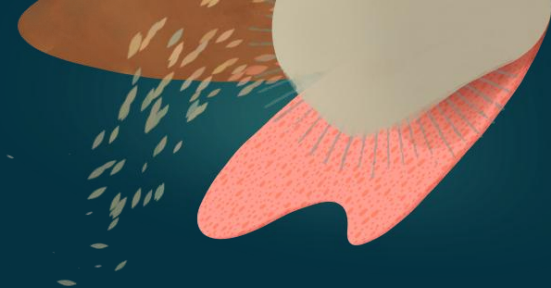
Components are nodes and dependencies between them are edges

Find anomalous patterns in financial transactions



Bank accounts are nodes and money transfer relationships are edges

Financial Transactions: Is Acct 1 Connected to Acct 833?



BANK_ACCOUNTS

ID	Name
1	
2	
3	
...	
672	
673	
674	
...	
831	
832	
833	
...	

?

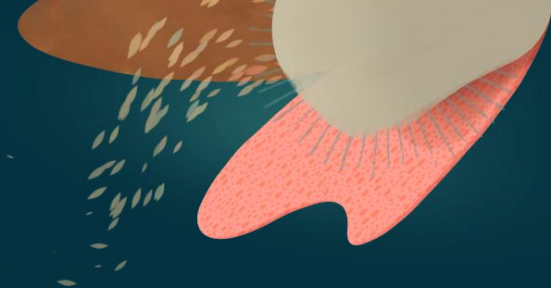
BANK_TRANSFERS

SRC_ACCT_ID	DST_ACCT_ID	AMOUNT
1	672	1000
1	584	1000
1	259	100000
2	833	5001
2	840	7050
2	493	4363
...
672	831	5425
...
831	833	256
...

Is ID 1 connected to ID 833, when using information in these tables?



Financial Transactions: Is Acct 1 Connected to Acct 833?



?

BANK_ACCOUNTS

ID	Name
1	
2	
3	
...	
672	
673	
674	
...	
831	
832	
833	
...	

BANK_TRANSFERS

SRC_ACCT_ID	DST_ACCT_ID	AMOUNT
1	672	1000
1	584	1000
1	259	100000
2	833	5001
2	840	7050
2	493	4363
...
672	831	5425
...
831	833	256
...

Is ID 1 connected to ID 833, when using information in these tables?



Financial Transactions: Is Acct 1 Connected to Acct 833?

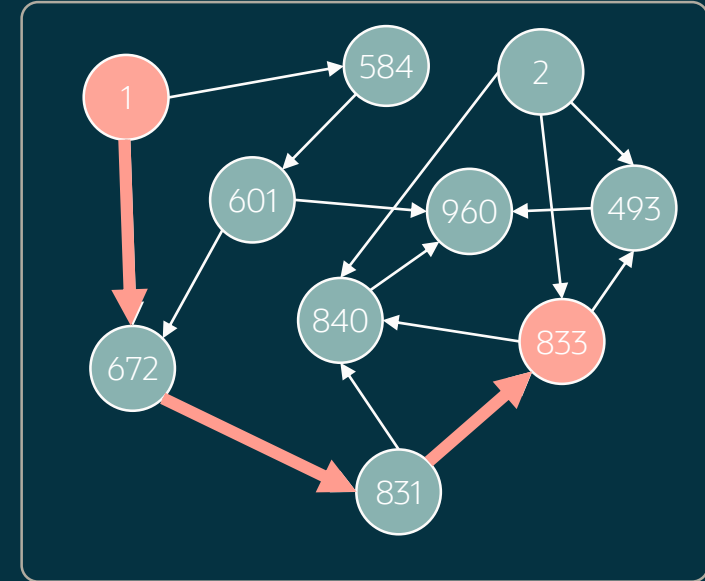
BANK_ACCOUNTS

ID	Name
1	
2	
3	
...	
672	
673	
674	
...	
831	
832	
833	
...	

BANK_TRANSFERS

SRC_ACCT_ID	DST_ACCT_ID	AMOUNT
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1	259	100000
2	833	5001
2	840	7050
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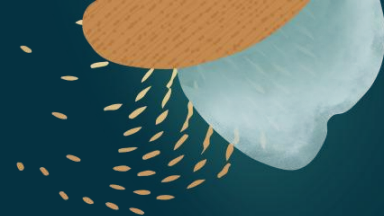
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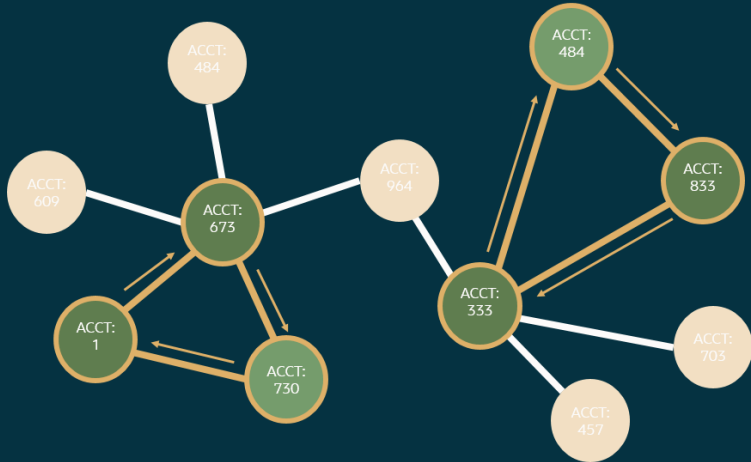
Graph view of data

- Nodes
- Edges

Financial Transactions



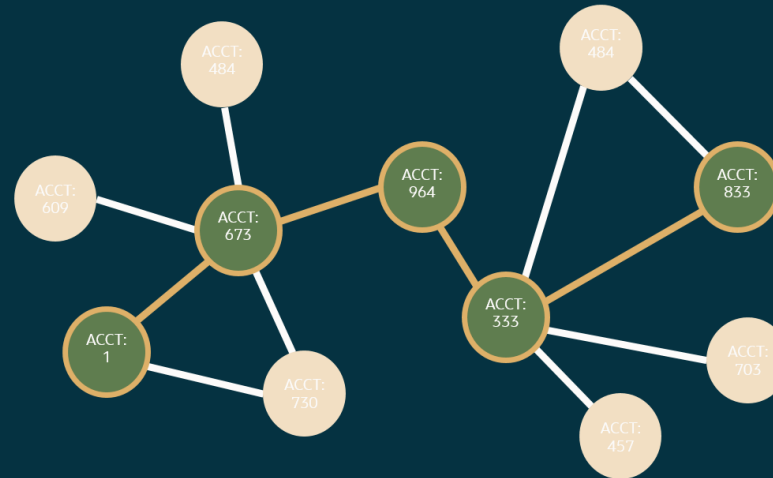
Find anomalous patterns in financial transactions



Are there money transfer patterns that are cycles?

```
SELECT acct_id
FROM graph_table (BANK_GRAPH
MATCH (src) - []->{3} (src)
COLUMNS (..) );
```

Find paths between entities

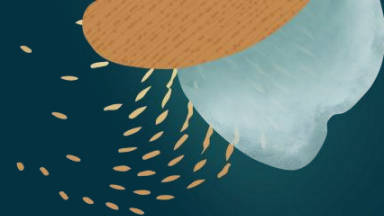


Is there a *path* between Acct 1 and Acct 833?

```
SELECT acct_id
FROM graph_table (BANK_GRAPH
MATCH (src) - []->{4} (dst)
WHERE src.id = 1 and src.id = 833
ONE ROW PER STEP (v1, ed, v2)
COLUMNS (..) );
```



Graph Studio Notebook



Graph Studio ATTACHED GRAPHUSER

Notebooks > BANK_GRAPH_23ai_alg

```
%pgql-pgx
SELECT *
FROM graph_table (BANK_GRAPH
  MATCH (src) - []->{4} (src)
  WHERE src.name = 'RUSSELL RIVERA'
  ONE ROW PER STEP ( v1, e1, v2 )
  COLUMNS (src.id AS acct_id, vertex_id(src) as src_id, vertex_id(v1) as v1_id, edge_id(e1) as e1_id, vertex_id(v2) as v2_id )
)
```

Graph visualization showing nodes and edges. Nodes are labeled with IDs: 397, 325, 406, 934, 597, 999, 313, 330, 348.

Legend:

- Vertices
 - BANK_ACCOUNTS
- Edges
 - BANK_TRANSFERS



Graph use cases are part of every industry



Find Communities

- Healthcare
 - Find patient communities
- Retail
 - Cluster customers based on connections to other customers and products
 - For cross-sell and upsell



Financial Services

- Find anomalous patterns
 - Detect money laundering
 - Uncover Fraud



Manufacturing

- Components and sub-components dependency analysis
- Supply chain analysis
- Digital thread connecting related components



Analyze Networks

- Telecommunications
- Transportation
 - What-if analysis
 - Root cause analysis of failures
 - Re-routing during outage

SQL syntax for graphs in SQL:2023

ISO/IEC 9075-16:2023

Information technology

Database languages SQL

Part 16: Property Graph Queries (SQL/PGQ)

Status : **Published**

SQL syntax for DDL operations


- Create a property graph
- Drop property graph

SQL syntax for DML operations

- Queries



A graph is like a **View** of Relational Tables

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



Key Graph Features in Oracle Database 23ai

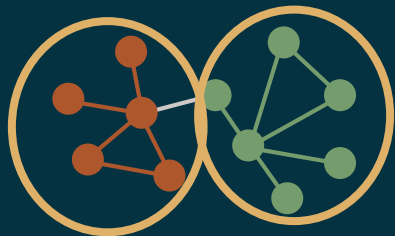


SQL syntax for creating and querying graphs (SQL:2023 standard)

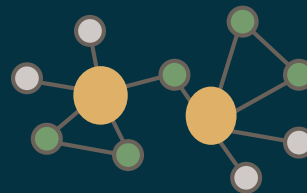
- Any SQL tool or development environment can be used to run graph queries

```
SELECT acct_id
FROM graph_table (BANK_GRAPH
MATCH (src) - []->{4} (dst)
WHERE src.id = 1 and src.id = 833
ONE ROW PER STEP (v1, ed, v2)
COLUMNS (..) );
```

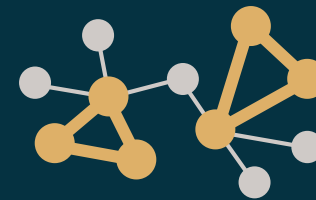
Graph algorithms for the Data Scientist



Detect communities
Which are the customers with similar behavioral patterns?



Find important nodes
Who are the influencers in this social network?

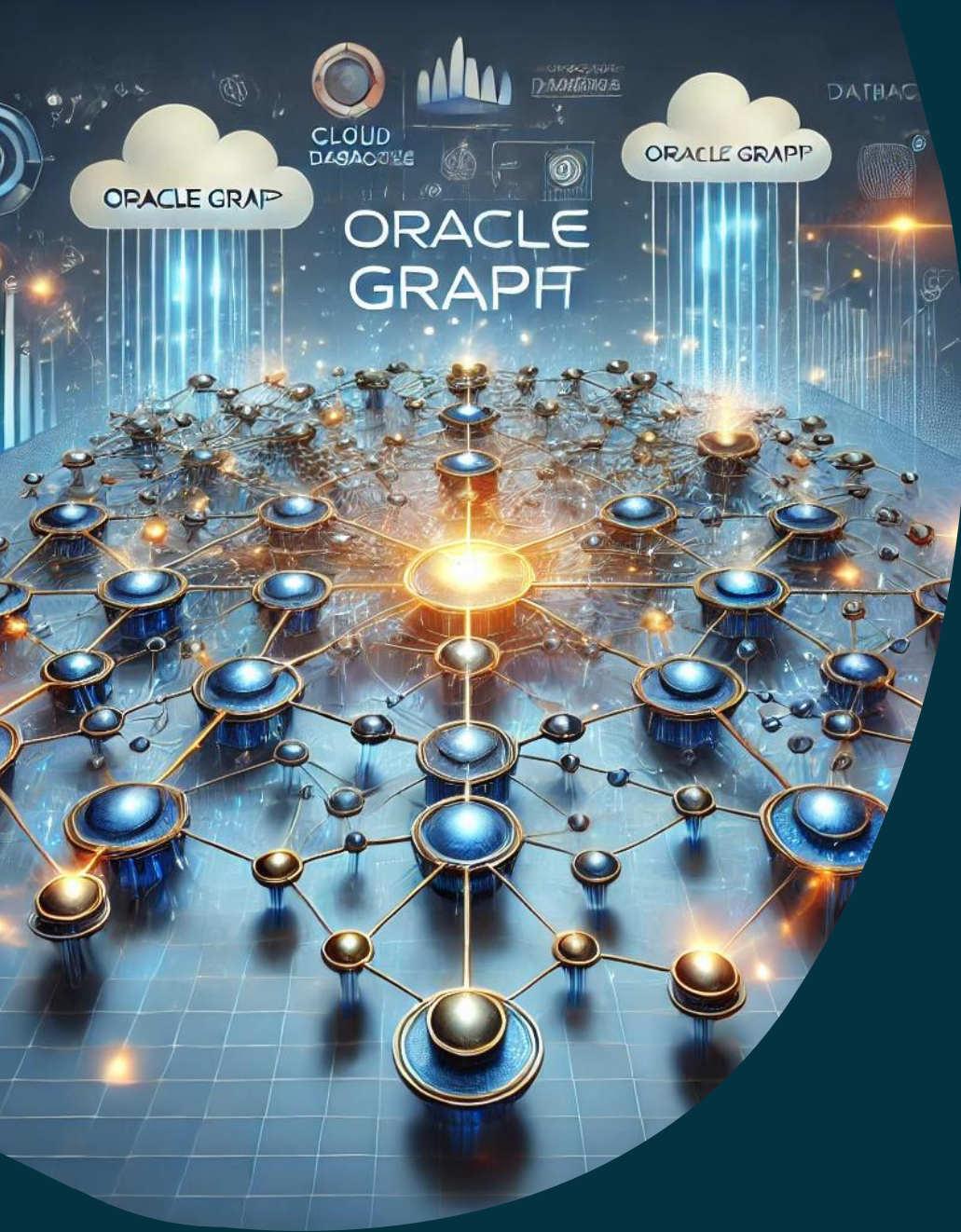


Identifying structures
What patterns match known fraudulent transactions

For Business Users



Graph Queries in Oracle Analytics Cloud



Key Takeaways

- 1 New SQL syntax in Oracle Database 23ai makes it easy to create and query graphs to navigate relationships in data
- 2 The *same* data can be queried as tables or as a graph
- 3 **Products like Oracle Analytics Cloud can run graph queries, because it is in SQL**

Oracle Graph Resources



oracle.com/database/graph/



oracle.com/livelabs search for 'graph'



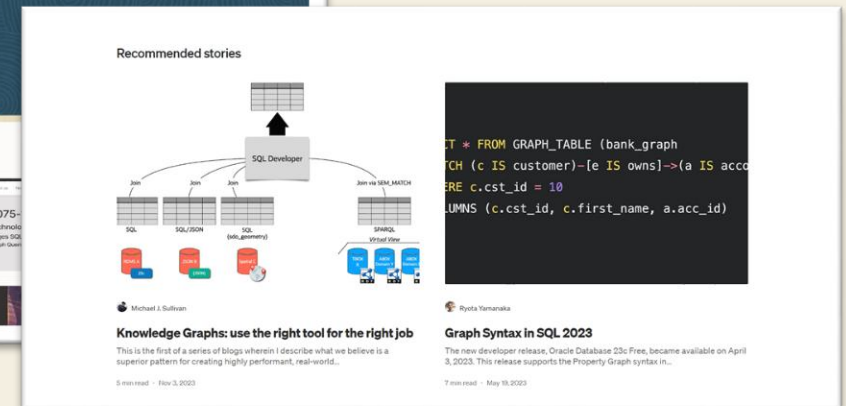
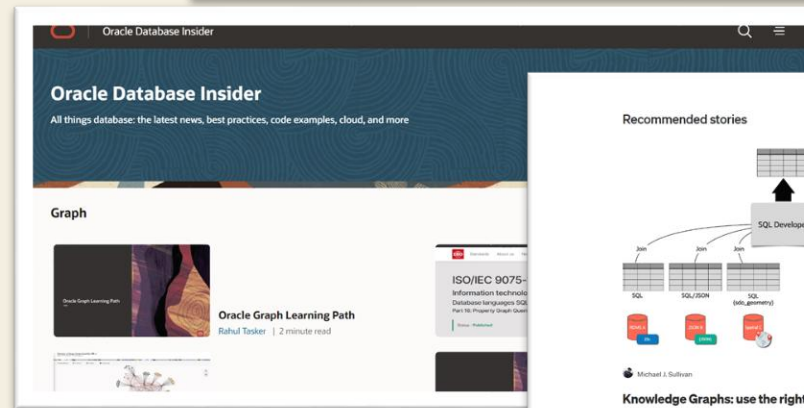
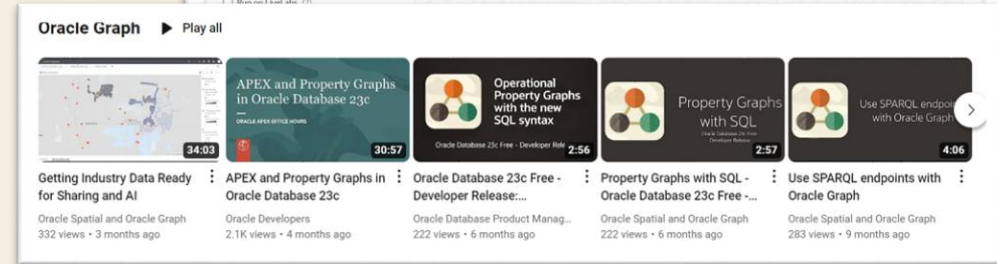
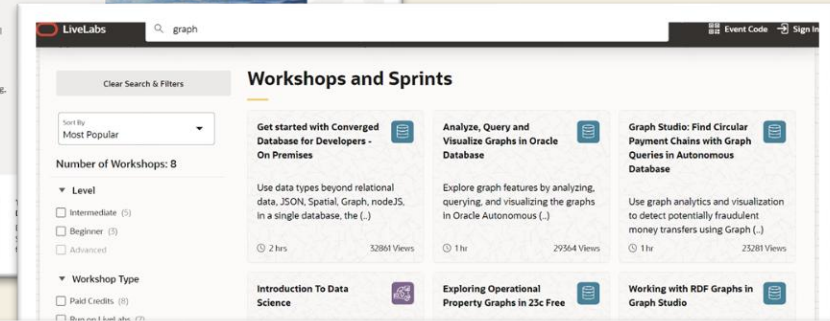
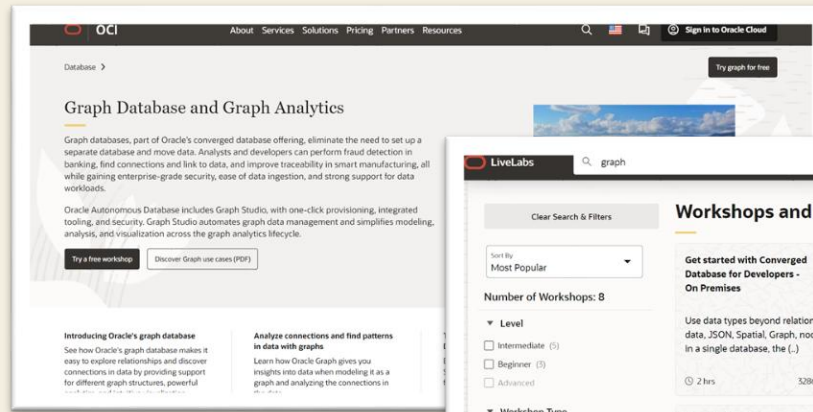
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OAC NEW FEATURES DOCUMENTATION BY ORACLE:

<https://docs.oracle.com/en/cloud/paas/analytics-cloud/acswn/index.html#GUID-CFF90F44-BCEB-49EE-B40B-8D040F02D476>

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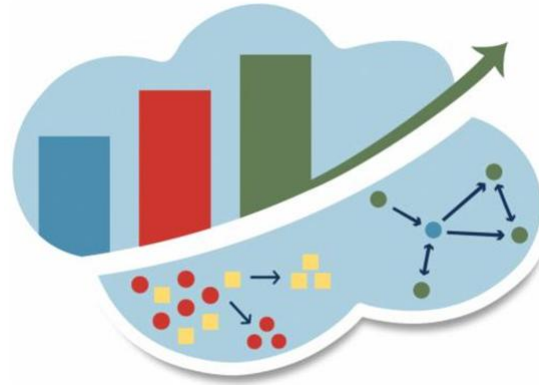
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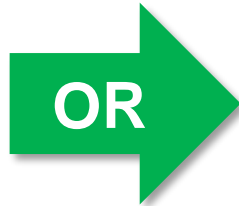
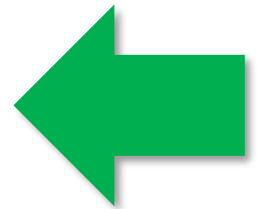
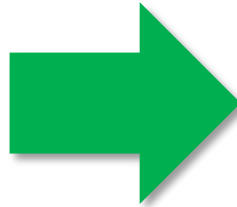


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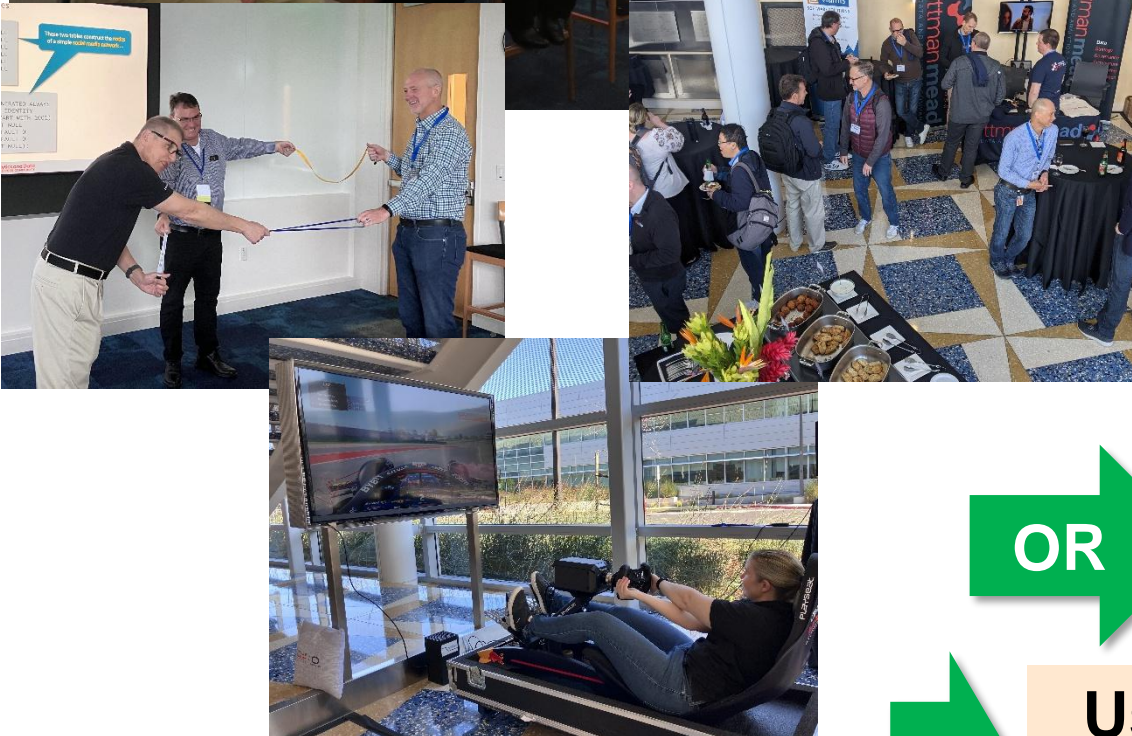
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It's now time for Q&A

Got any questions?

Your Name

melliyal.annamalai@oracle.com

[linkedin.com/in/melliyal](https://www.linkedin.com/in/melliyal)