ORACLE

Demystifying Graph Analytics For The Non-Expert

Peter Jeffcock

Product Marketing
Cloud Business Group

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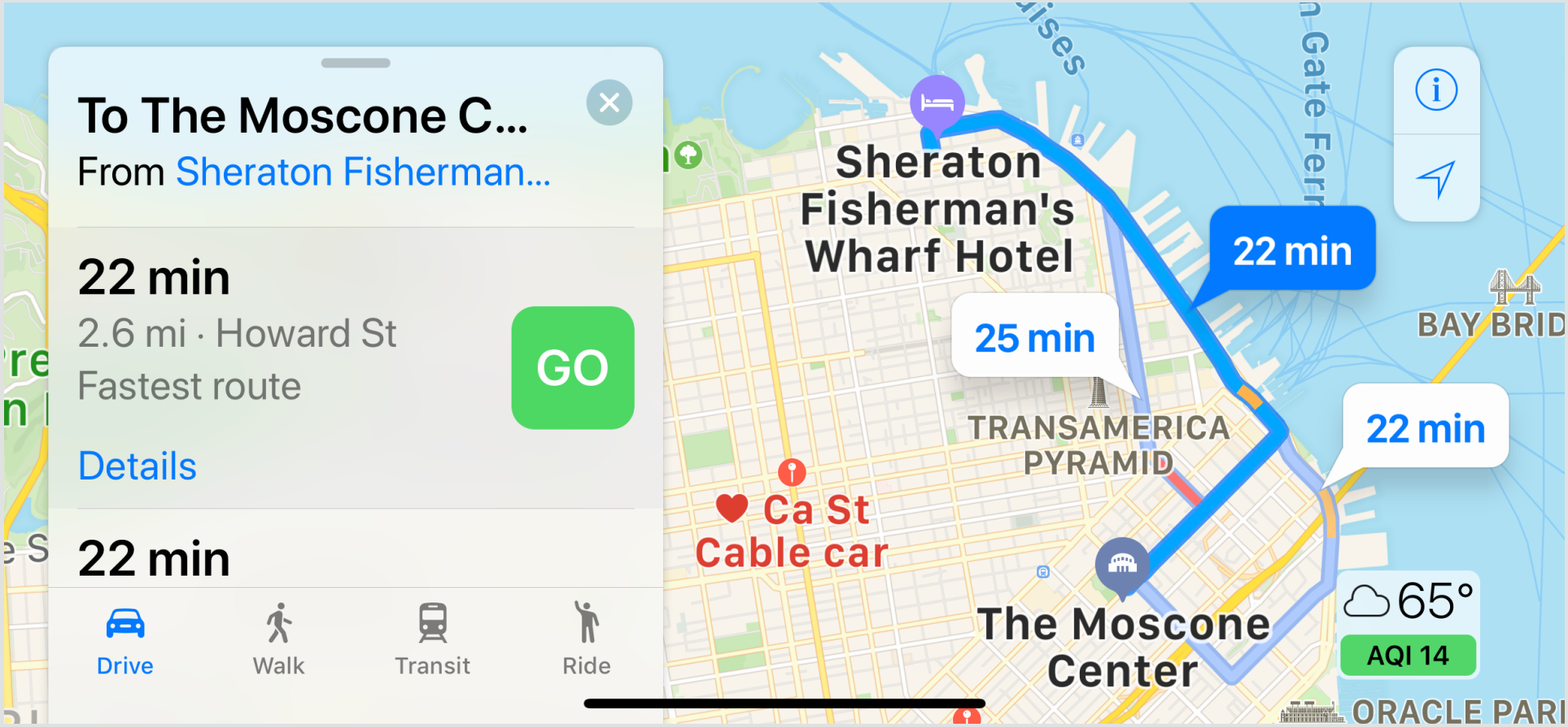
Are there any graph experts?

Have you ever used graph analytics?



The River Wild

Acted in

Lemony Snicket

Acted in

Acted in

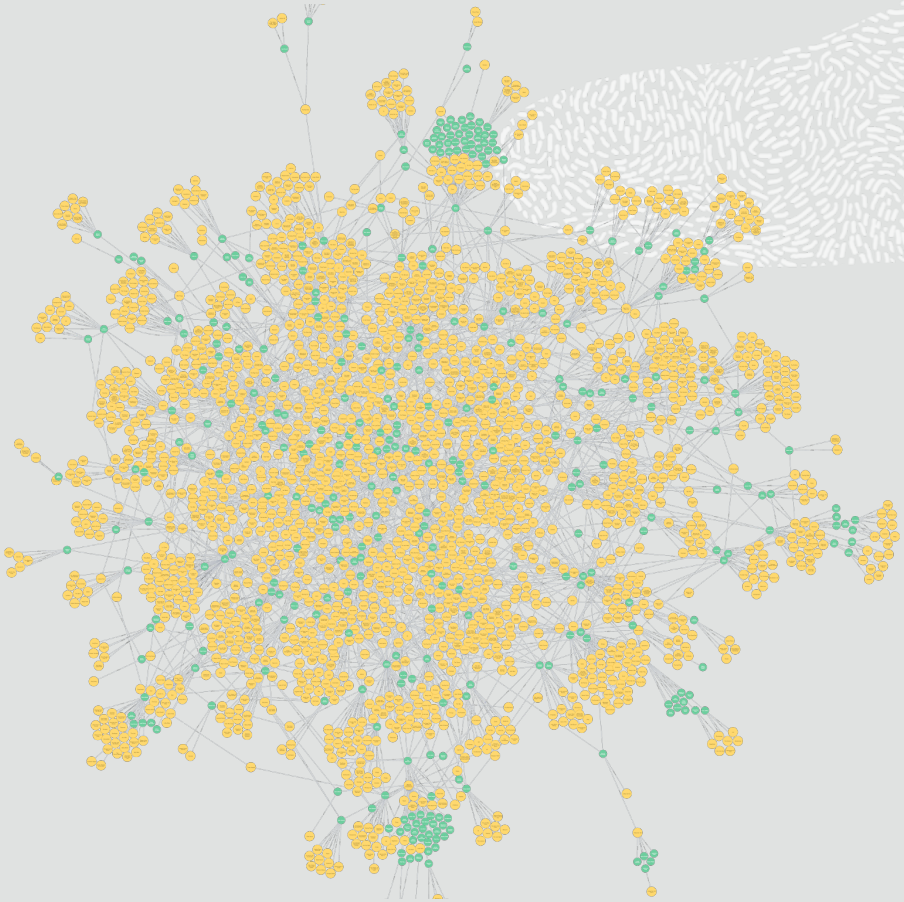
Muppet Treasure Island

Acted in

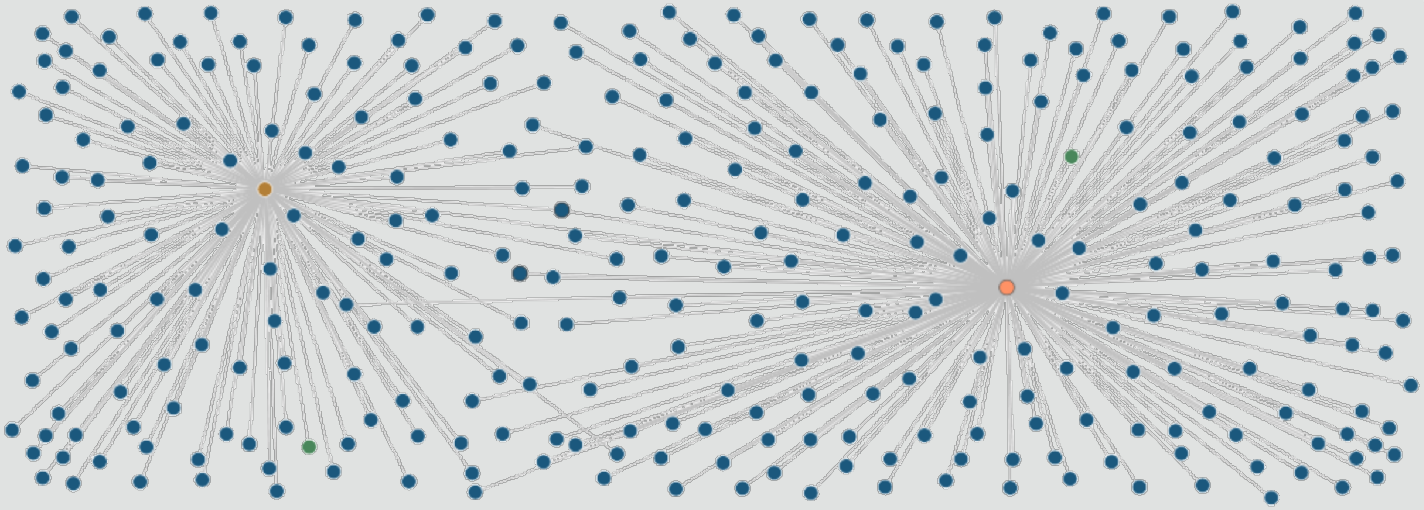
Node and Graph Properties

https://www.kenflerlage.com/2017/04/six-degrees-of-kevin-bacon-with-graph.html

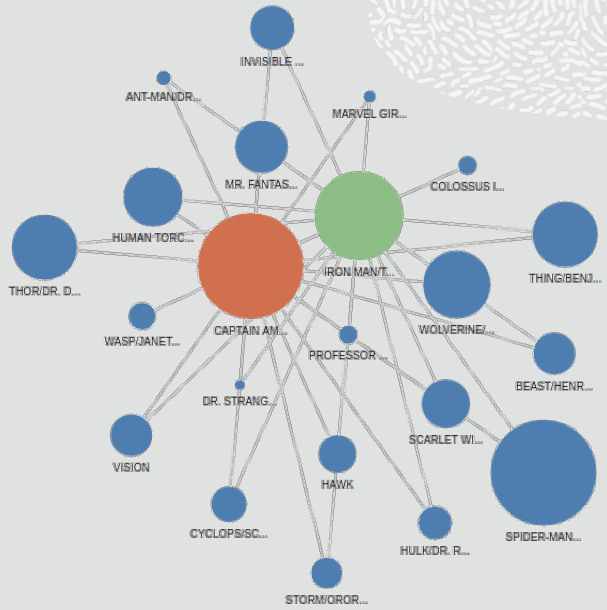
Closeness Centrality



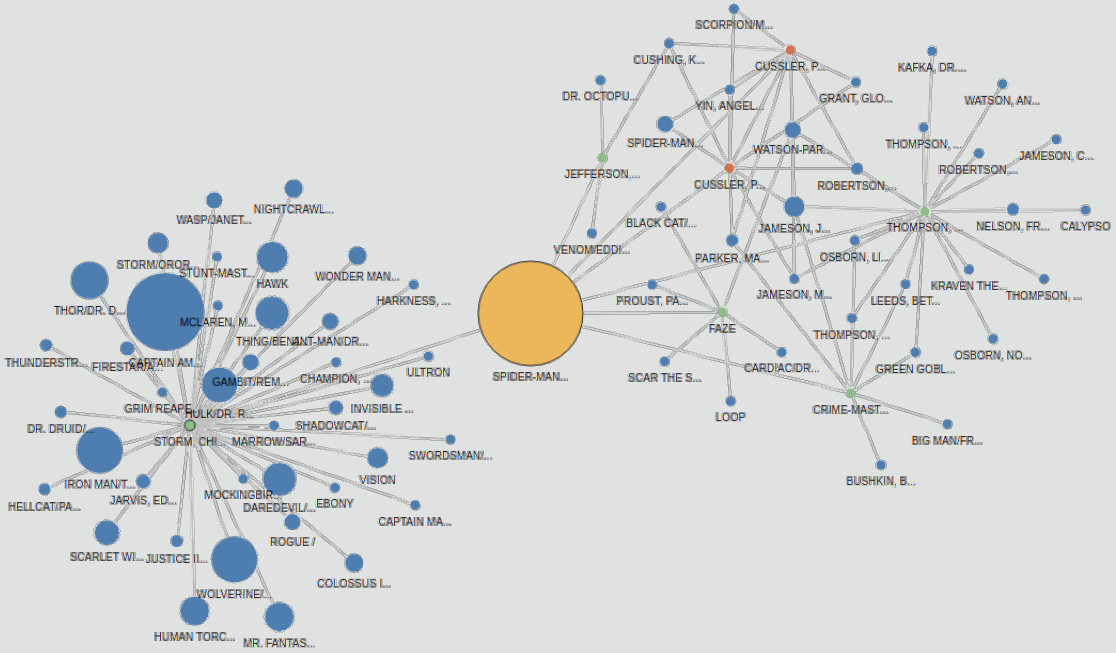
Degree Centrality



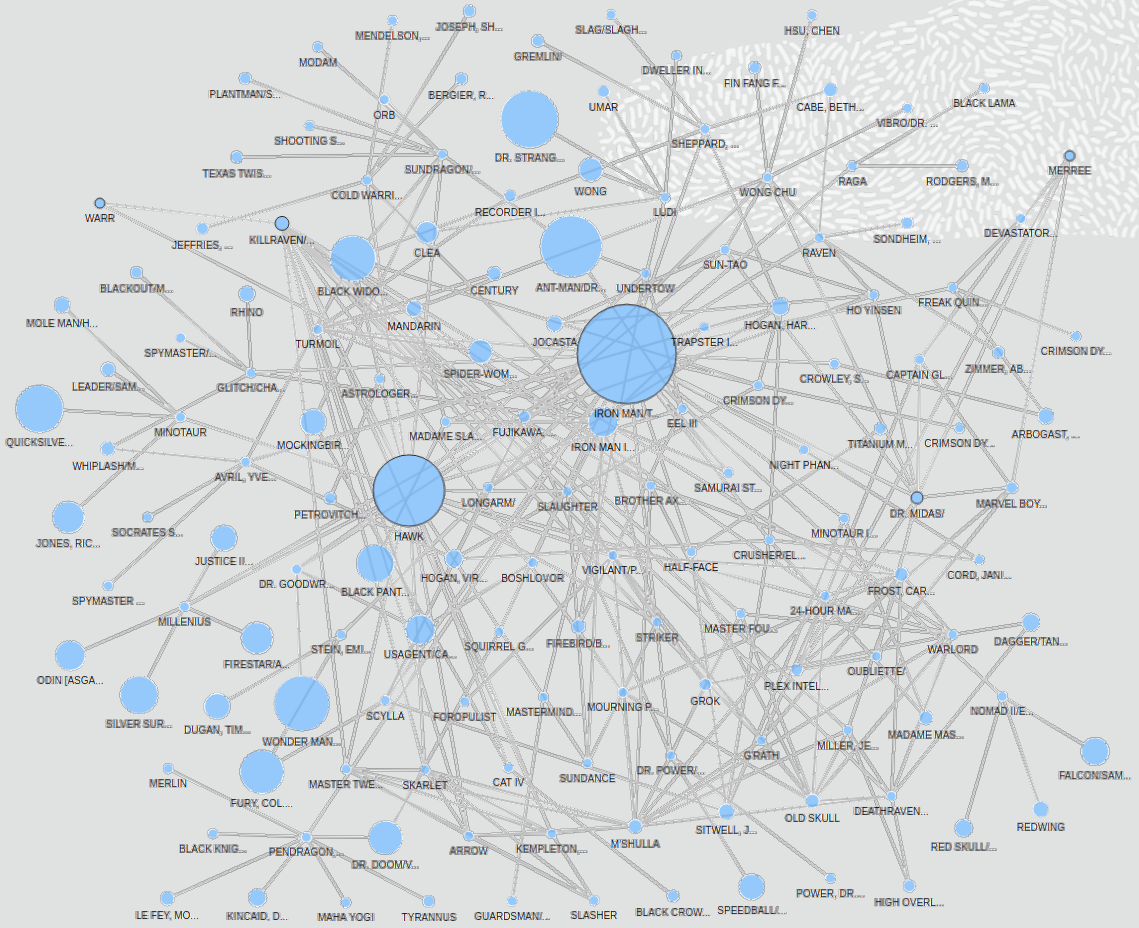
PageRank



Betweenness Centrality



Graph Diameter



Querying And Analyzing A Graph

Finding Connected Actors

PGQL:

```
PATH shares_movie_with AS (from) <- (acted_in) -> (to)
SELECT y.name
MATCH (x:Actor) -/:shares_movie*/->(y:Actor)
WHERE x.name = 'Iron Man'
AND x <> y
```

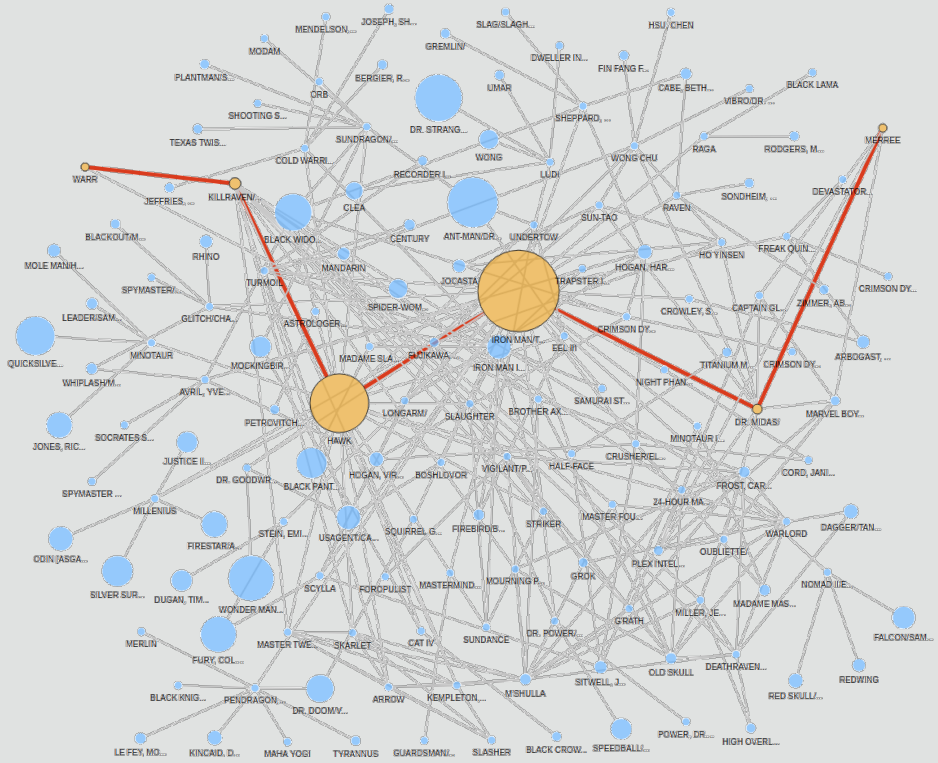
SQL Equivalent:

```
WITH temp(actor_id, actor_name) AS (
—Anchor member:
SELECT actor_id, name
FROM Devices
WHERE name = 'Iron Man'
UNION ALL
—Recursive member:
SELECT Actors.actor_id, Actors.name
FROM temp, Actors, Connections conn 1,
  Connections conn2, Movies
WHERE temp.actor_id = conn1.to_actor_id
  AND conn1.from_acted_in_id = Connectors.movies_id
  AND Connectors.movie_id = conn2.from_movie_id
  AND conn2.to_actor_id = Devices.actor_id
  AND temp.actor_id != Actors.actor_id)
CYCLE actor_id SET cycle TO 1 DEFAULT 0
SELECT DISTINCT actor_name
FROM temp
WHERE cycle = 0
AND actor_name <> 'Iron Man'
```

Finding the shortest path

Java:

```
src = g.getVertex("WARR") // CHAKRA II
System.out.println(src);
dst = g.getVertex("MERREE") // JAKAL
System.out.println(dst);
path = analyst.shortestPathDijkstra(g,src,dst,w)
```



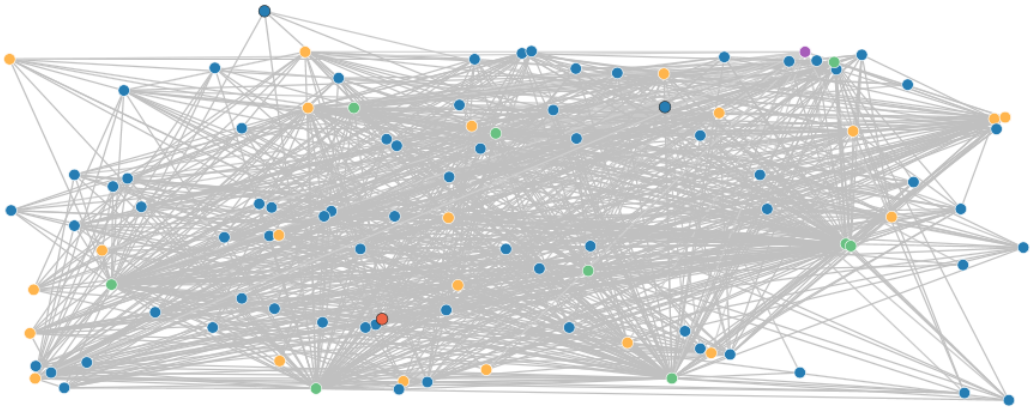
More Complex Queries

PGQL Graph Query

```
1 SELECT a,b,c,d,e,f,g,h,i MATCH (a)-[b]-(c)-[d]-(e)-[f]-(g)-[h]-(i) WHERE a='CAPTAIN AMERICA' AND c='MIRAGE' AND i='GOG'
```

Graph

sub-graph_6 | Run | Settings



Graph Attributes

Vertices

e,g a,e
e i
g c

Edges

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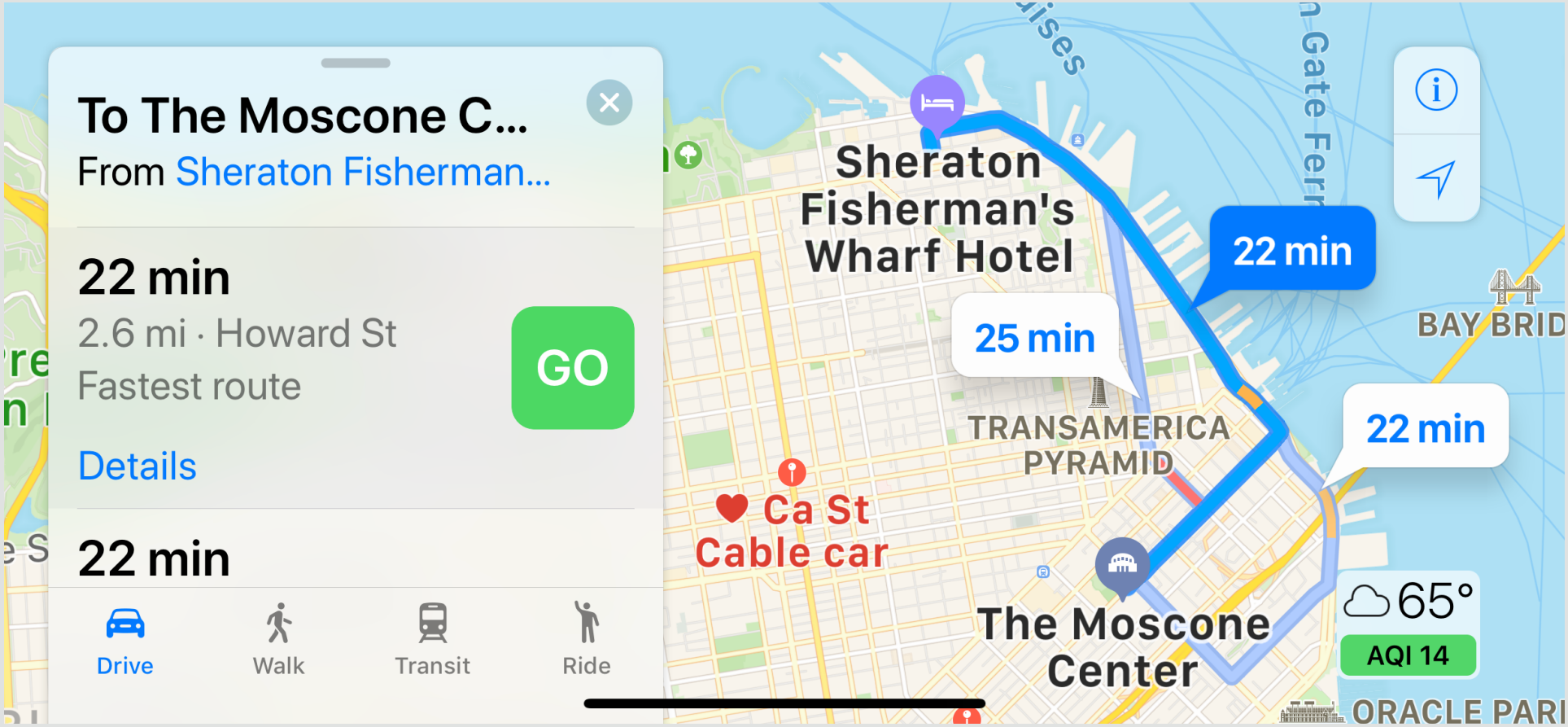
The Graph Behind The Map



The Graph Behind The Map

Node (Vertex)
Unique identifier
Collection of properties
- Name
- Type (lights, stop signs…)
- Latitude/longitude
- …

Link (Edge)
Outgoing vertex
Incoming vertex
Label describing relationship
Collection of properties
- Time to traverse
- Type of road
- Traffic level
- …

Storing Graphs

Link table

Source ID, Destination ID, label, key, property

a, b, “is connected to”, string, “regular street”

a, b, “is connected to”, time, “75 seconds”

…

Node table

Unique ID, label, key, property

1, “a”, latitude, 37.7843

1, “a”, longitude, -122.4007

…

Actual Map Data

Node Table

Name	Type
Node_ID	NUMBER
Geometry	MDSYS.SDO_GEOMETRY
Partition_ID	NUMBER

SDO_GTYPE	NUMBER
SDO_SRID	NUMBER
SDO_POINT	SDO_POINT_TYPE
SDO_ELEM_INFO	SDO_ELEM_INFO_ARRAY
SDO_ORDINATES	SDO_ORDINATE_ARRAY

Link Table

Name	Type
Link_ID	NUMBER
Start_Node_ID	NUMBER
End_Node_ID	NUMBER
Partition_ID	NUMBER
Func_Class	NUMBER
Length	NUMBER
Speed_Limit	NUMBER
Geometry	MDSYS.SDO_GEOMETRY
Name	VARCHAR2 (128)
Divider	VARCHAR2 (1)

Signpost Table

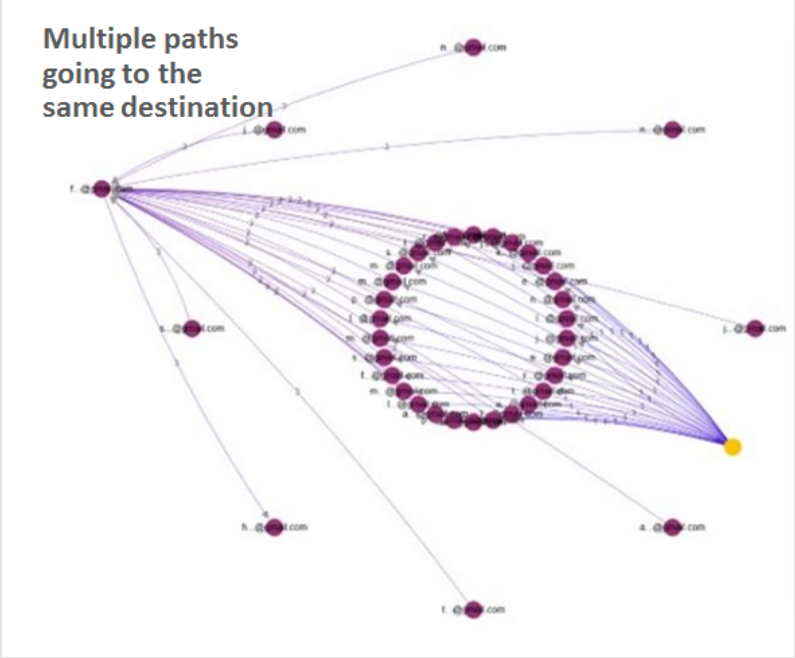
Name	Type	Example
From_Edge_ID	NUMBER	Link containing the sign
To_Edge_ID	NUMBER	Link the sign points to
Ramp	VARCHAR2 (64)	Text (eg I5 North)
Exit	VARCHAR2 (8)	Exit number (297)
Toward	VARCHAR2 (64)	Terwiliger Boulevard
Language	CHAR (3)	Eng, Fre, Spa…

+ Partition table
+ Geocoding (9 tables)
+ Turn restrictions (3 tables)
+ Trucking data (4 tables)
+ Timezone data (4 tables)
+ Traffic table

https://docs.oracle.com/en/database/oracle/oracle-database/19/spatl/routing-engine-concepts.html#GUID-22403E02-1569-4D9E-8D04-02003D70C1B7

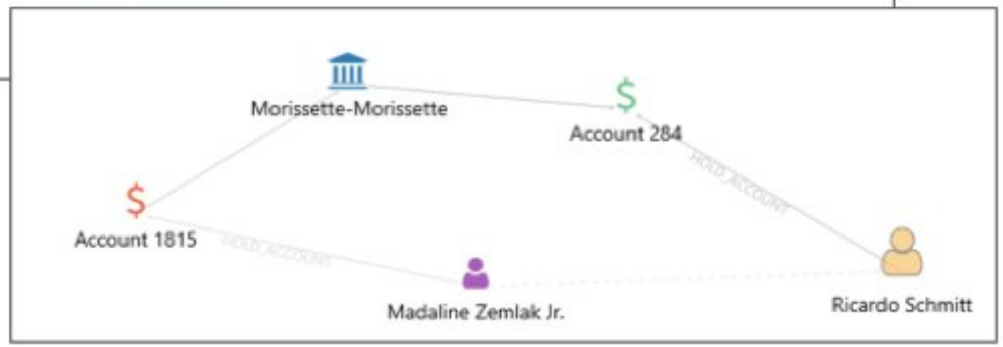
Use Cases

Financial Services: Hiding A Transaction

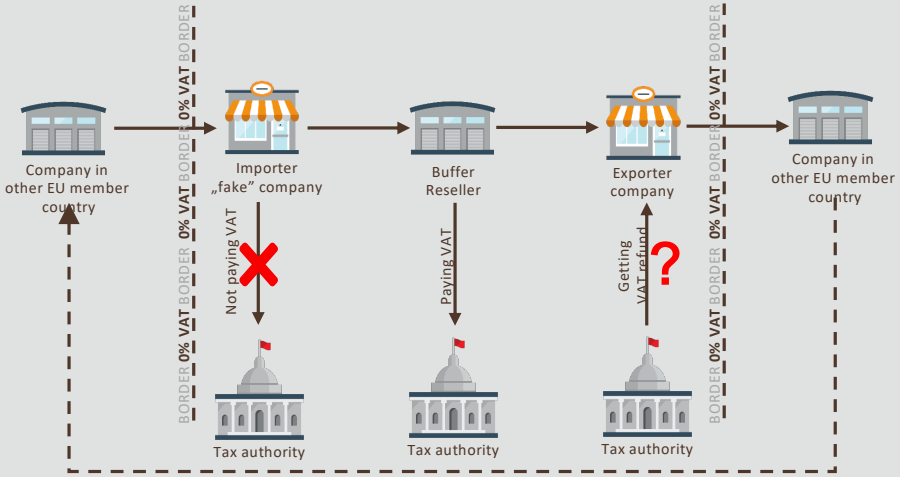


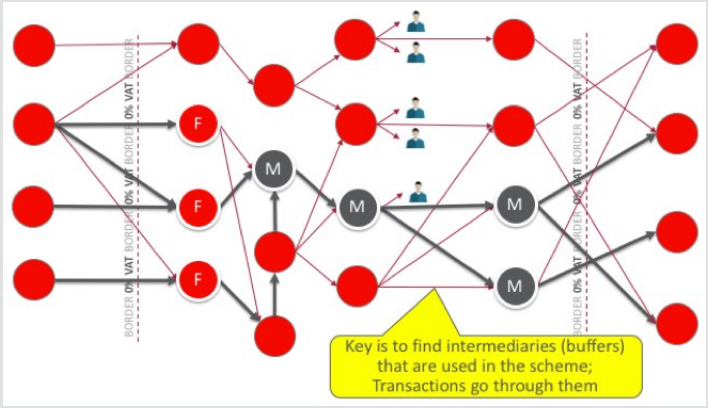
Financial Services: Circular Payments

```
PATH p := () -[with SAME_INFO=true]->  ()
SELECT  c1, a1, en, a2, c2
WHERE
   (c1:CUSTOMER) -> (a1:ACCOUNT) -> (en:ENTITY) ->(a2:ACCOUNT) <- (c2:CUSTOMER),
   (c1) -/:p*/-> (c2)
```

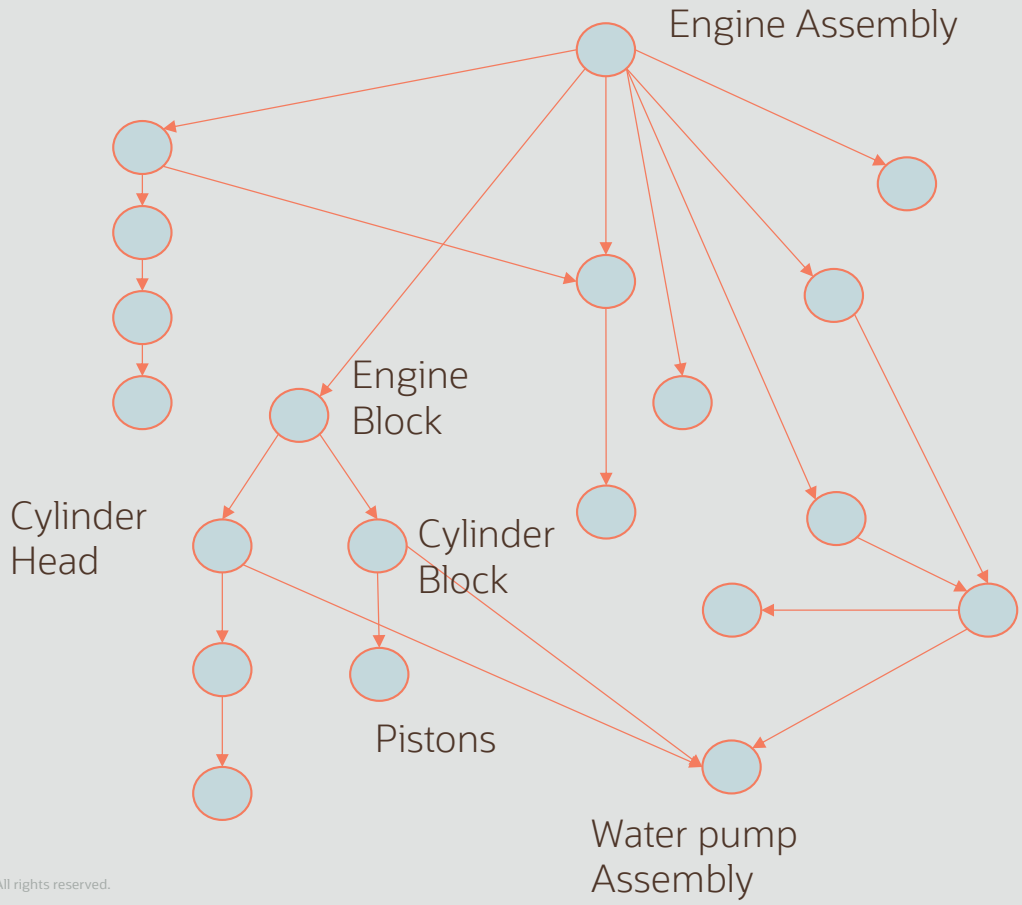


EU VAT Fraud Detection



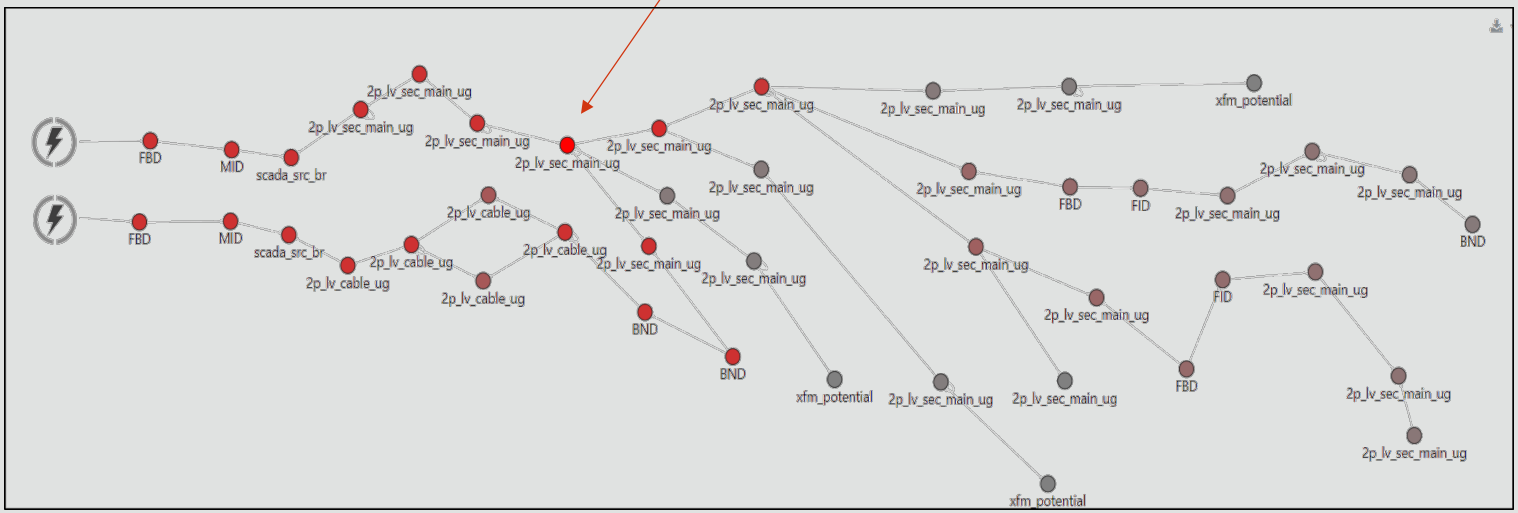


Manufacturing: Bill of Materials

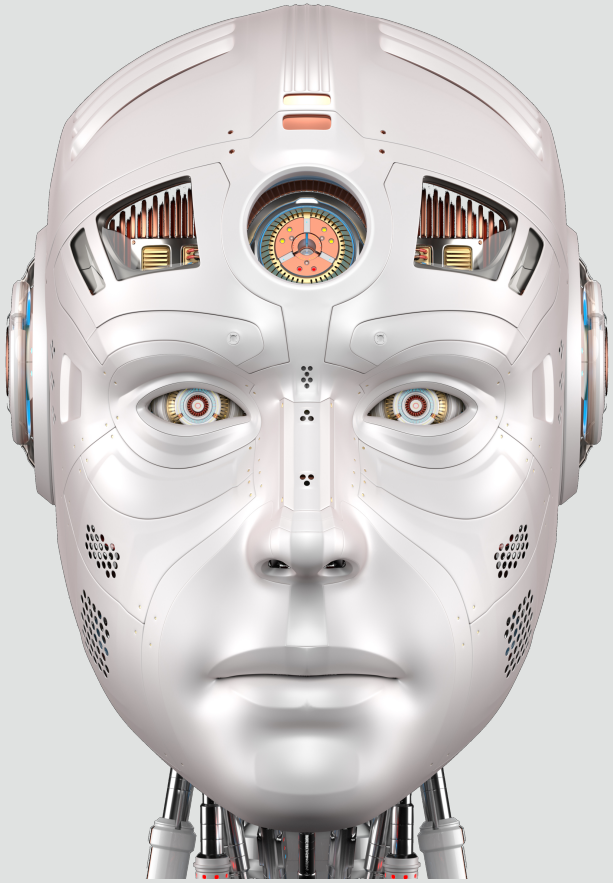


Utility Network Analysis

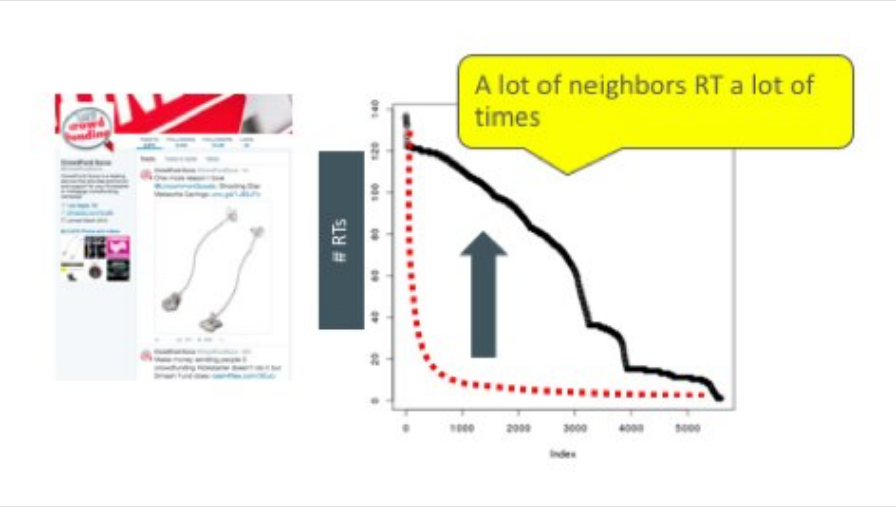
- Utilities searching for weak spots or choke points in physical networks

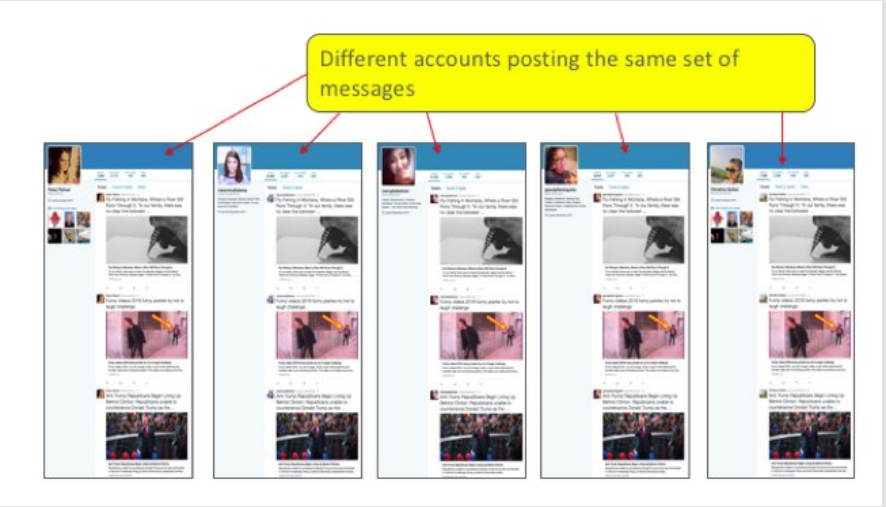


Social Network Analysis



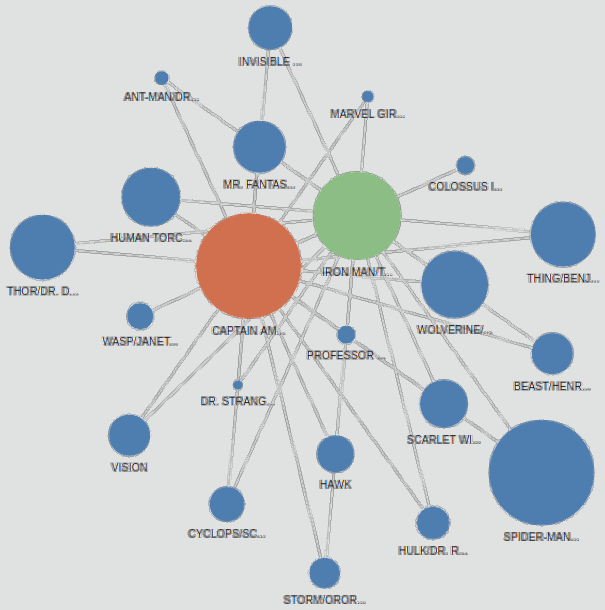
Social Network Analysis





https://blogs.oracle.com/bigdata/fraud-detection-use-cases-graph-technology

Customer Churn



Resources

Resources - Get Started

Oracle Property Graph product pages
oracle.com/technetwork/database/options/spatialandgraph

YouTube channel youtube.com/c/OracleSpatialandGraph

Blog – examples, tips & tricks
blogs.oracle.com/oraclespatial | blogs.oracle.com/bigdataspatialgraph

@SpatialHannes

Oracle Spatial and Graph Group

Graph at OOW and Code One 2019 (Today, Wednesday)

View list at bit.ly/SpatialGraphOOW19

Sessions

Date/Time	Title	Location
1:30 p.m. - 2:15 p.m.	**Traversing and Querying Graphs with PGQL and Gremlin with Oracle Spatial and Graph [DEV4084]**	Moscone South - Room 202

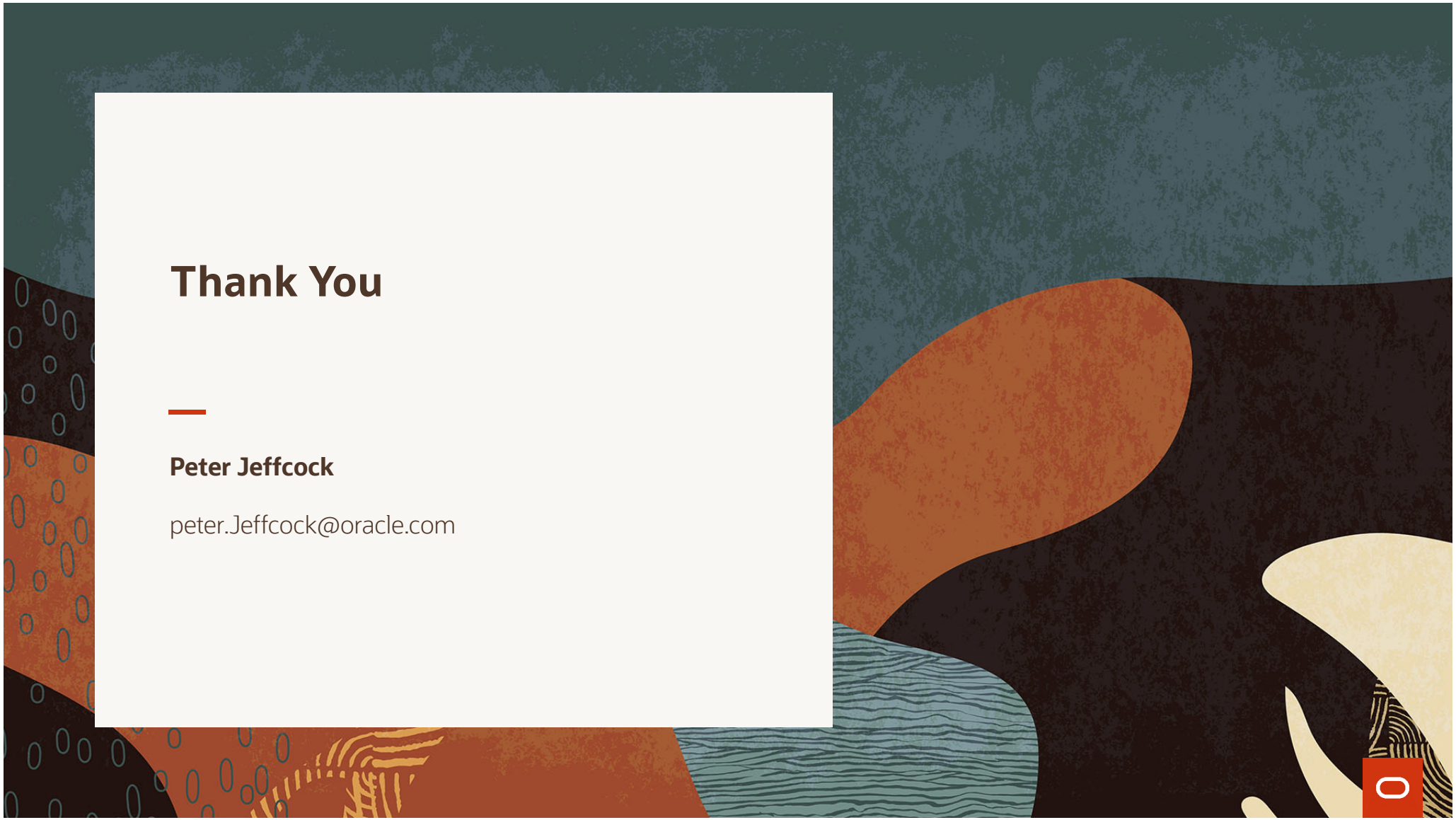
Meet the Experts

At the Code One Groundbreakers Hub, Moscone South Level 1

Date/Time	Title	Location
1:30 pm - 2:20 pm	**Graph Database and Analysis**	Lounge C, Code One Groundbreakers Hub, Moscone South level 1
2:30 pm - 3:20 pm	**Graph Cloud Service: Automating Graph Analysis**	

Demos

Date/Time	Title	Location
10:00 a.m. – 4:30 p.m.	**Spatial and Graph: Database, Analytics and Cloud**	Moscone South – Exhibit Hall Oracle Demogrounds: ODB-017


Thank You
Peter Jeffcock
peter.Jeffcock@oracle.com

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