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Machine Learning with Oracle Graph

Natwest Developer General Session

March 2021

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> “Our mission is to become the trusted advisors for Developers through inspiration and engagement”

DevRel Team

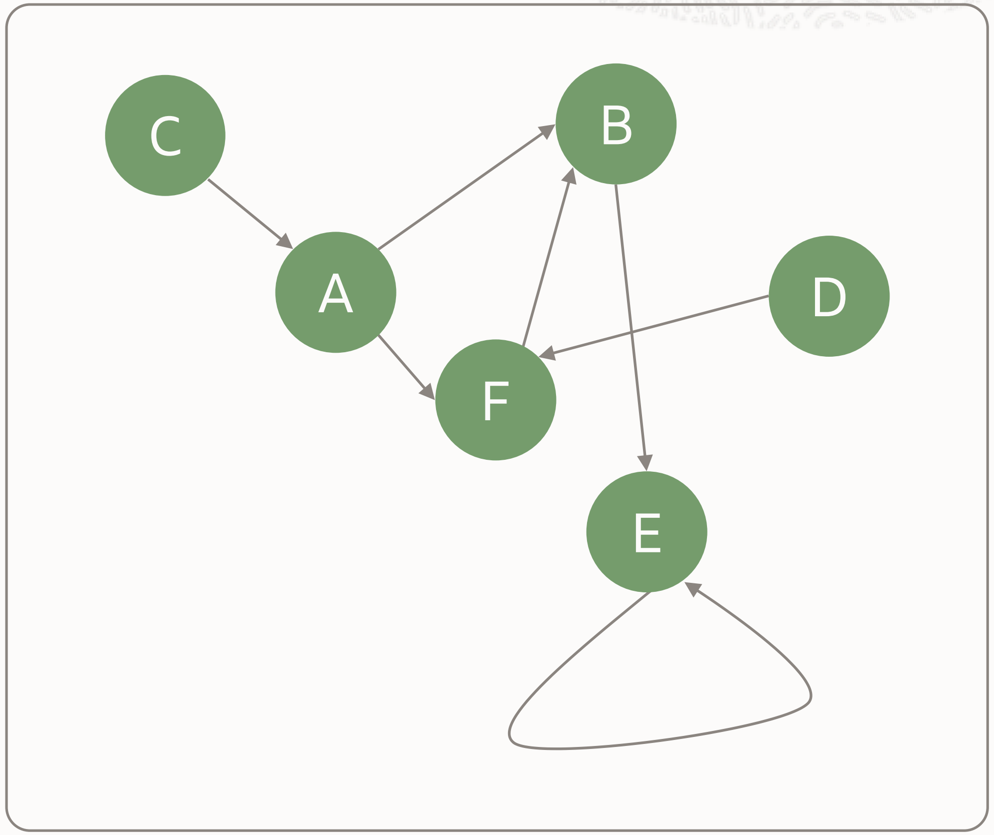
Graph data model

What is a graph?

- Data model representing entities as vertices and relationships as edges
- Optionally including attributes

What are typical graphs?

- Social networks
  - LinkedIn, Facebook, Twitter, …
- Physical networks, supplier networks, …
- Dependency graphs
  - Part hierarchies, data lineage, org charts, …
- Workflows
- Knowledge graphs
  - Associating related entities, eg. in public safety



Why are graphs so popular?

Easy data modeling

- All you need is pen and paper

Flexible data model

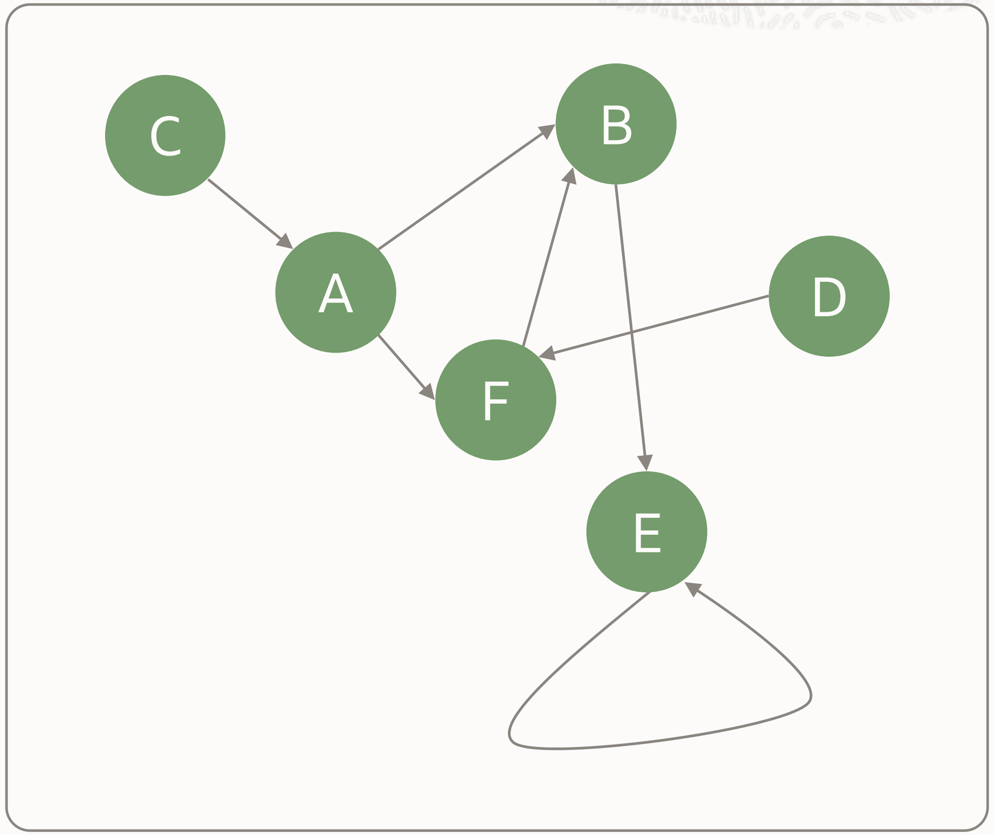
- No predefined schema, easily extensible
- Particularly useful for sparse data

Insight from graphical representation

- Intuitive visualization

Enable new kinds of analysis

- Graphs store rather than compute relationships so traversals (friend-of-a-friend, is there a path) are quick
- Additional features for Machine Learning

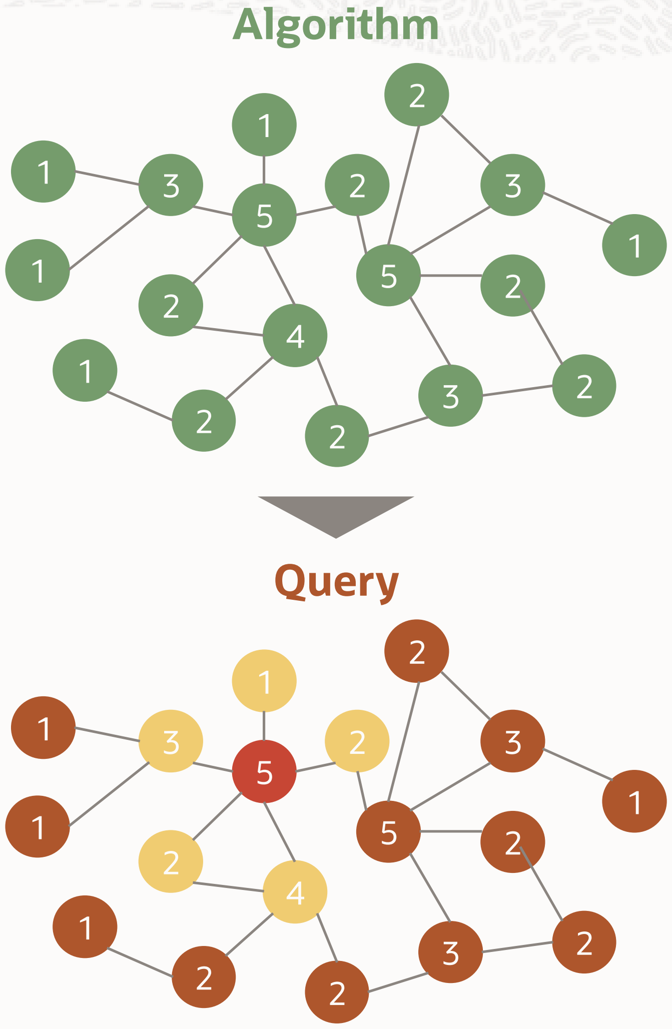


Two types of processing in graph analytics

Oracle’s Graph Engine can execute both queries and algorithms, and combinations of the two

- Query (PGQL)
- Algorithm
- Mutation

Which node up to 3 hops from a given node has the highest importance (e.g. degree centrality, page rank, betweenness centrality, …)?



Pattern matching–PGQL queries

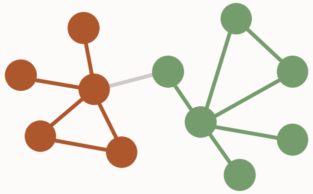
PGQL MATCH clause describes graph pattern

```
SELECT p.name
FROM MATCH (m:Person)-[:likes]->(p:Person)
WHERE m.name = 'Mario'
```

Find common ancestors of Mario and Luigi

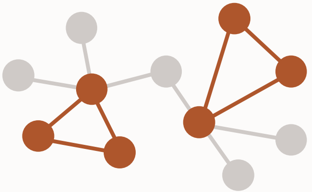
```
PATH has_parent AS () -[:has_father|has_mother]-> (:Person)
SELECT ancestor.name
FROM MATCH (p1:Person) -/:has_parent+/-> (ancestor)
   , MATCH (p2:Person) -/:has_parent+/-> (ancestor)
WHERE p1.name = 'Mario’
  AND p2.name = 'Luigi'
```

Graph analytics: 60+ parallelized, in-memory algorithms out-of-the-box



Detecting components and communities

Strongly Connected Components,
Weakly Connected Components,
Label Propagation,
Conductance Minimization,
Infomap

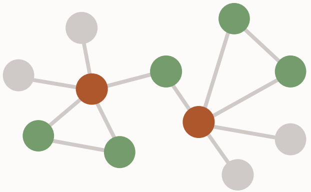


Evaluating structures

Adamic-Adar Index, Conductance,
Cycle Detection, Degree Distribution,
Eccentricity, K-Core, LCC, Modularity,
Reachability Topological Ordering,
Triangle Counting

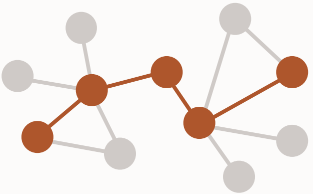
Link prediction and others

WTF (Who to follow)
Minimum Spanning-Tree,
Matrix Factorization



Ranking and walking

PageRank, Personalized PageRank,
Degree Centrality, Closeness Centrality,
Vertex Betweenness Centrality,
Eigenvector Centrality, HITS, SALSA,
Random Walk with Restart



Path-finding

Shortest Path (Bellman-Ford, Dijkstra,
Bidirectional Dijkstra), Fattest Path,
Compute Distance Index,
Enumerate Simple Paths,
Fast Path Finding, Hop Distance

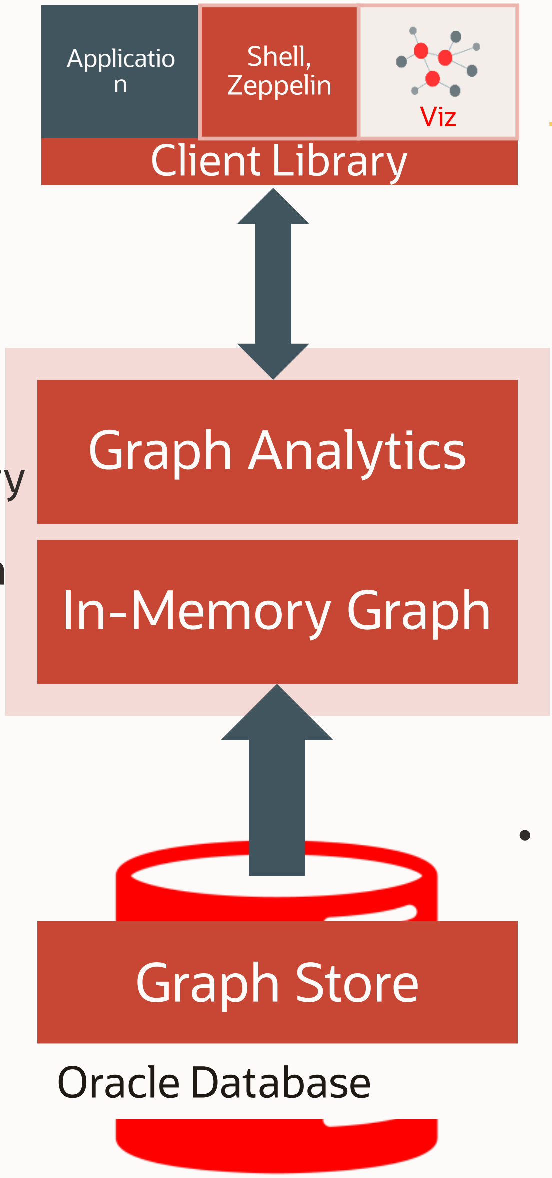
Machine learning

DeepWalk *
Supervised GraphWise *
Pg2Vec *

*on-premises, not yet in Graph Studio

Oracle Database Spatial and Graph

- In-memory parallel graph analytics server (PGX)
  - Load graph into memory for analysis
  - Automate graph refresh



Applicatio n

Shell, Zeppelin

Viz

Client Library

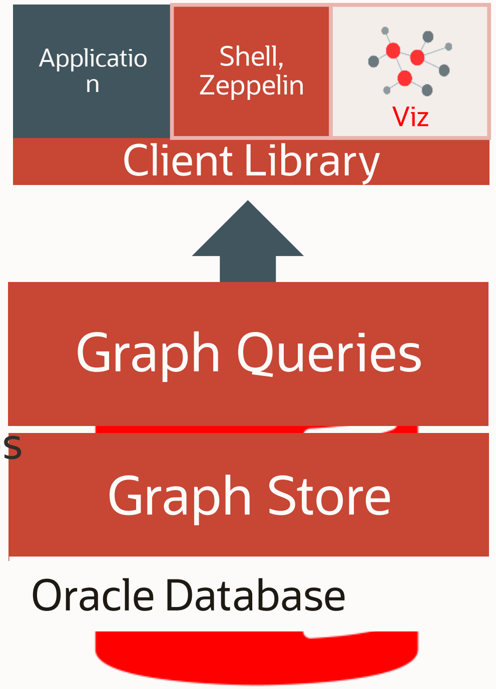
Graph Analytics

In-Memory Graph

Graph Store

Oracle Database

- Client libraries
  - Java API to develop applications
  - Command-line submission of graph queries
  - Graph visualization tool
  - APIs to update graph store



Applicatio n

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Viz

Client Library

Graph Queries

Graph Store

Oracle Database

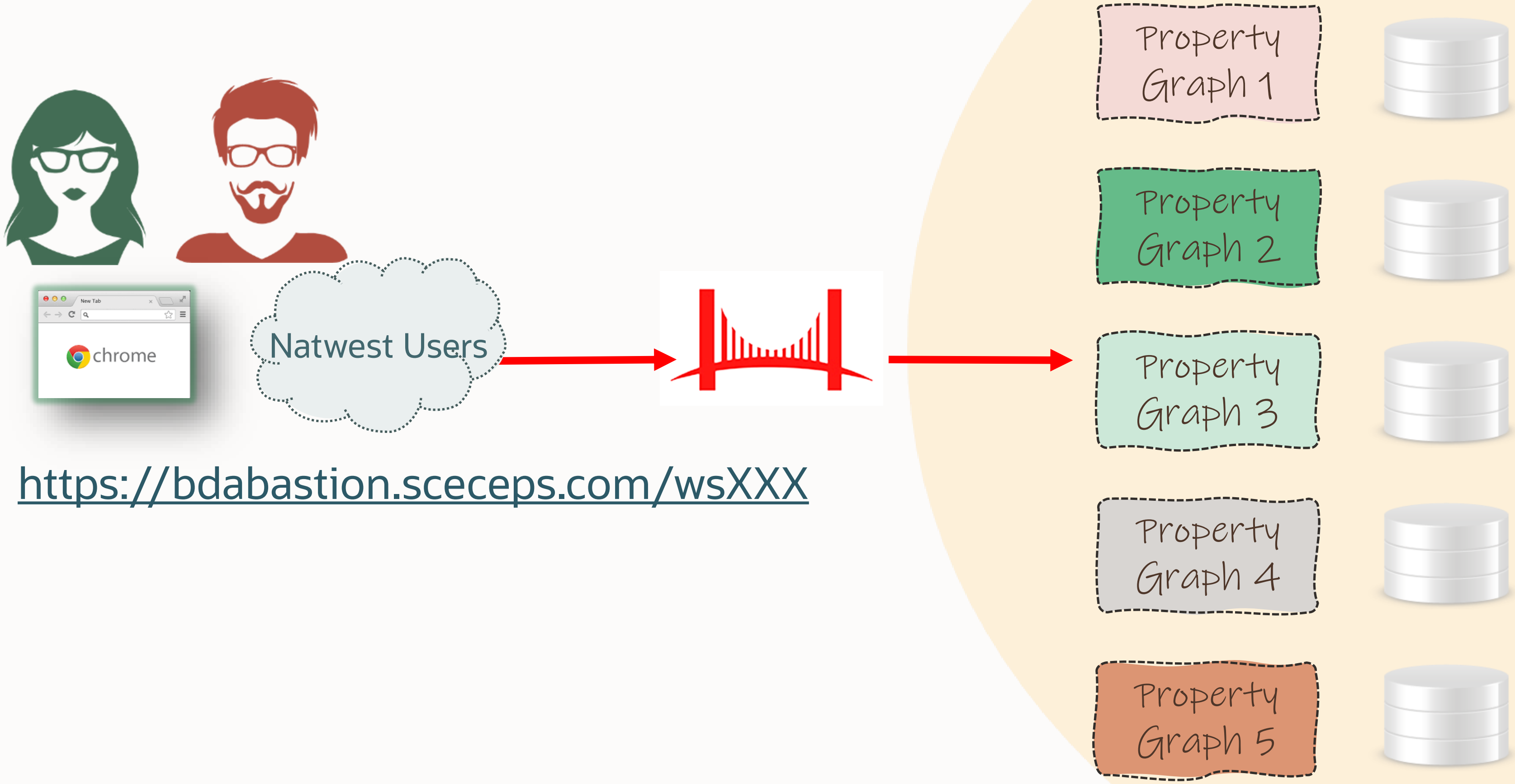
- In-database parallel graph traversal
  - Run PGQL queries in the database

Interaction with the Property Graph

- Access through APIs
  - Implementation of Apache Tinkerpop Blueprints APIs
  - Based on Java, REST plus SolR Cloud/Lucene support for text search
- Scripting
  - Groovy, Python, JavaScript, …
  - Apache Zeppelin integration, JavaScript (node.js) language binding
- Graphical UIs
  - Cytoscape, plug-in available
  - Commercial tools such as TomSawyer Perspectives
  - Vis.js and D3 among others

Labs Environment

ORACLE Cloud Infrastructure



https://bdabastion.sceceps.com/wsXXX

Materials & Documentation https://github.com/operard/mlgraph

Workshop / Hands-on Labs
Breakout Rooms

Room 1

Olivier Perard

Data Scientist Advocate

Room 2

Andrea Marchesini

Head of Innovation and
Educational Programs

Room 3

Francisco Alvarez

Principal Technology Architect

Room 4

Ismail Syed

Cloud Specialist Engineer

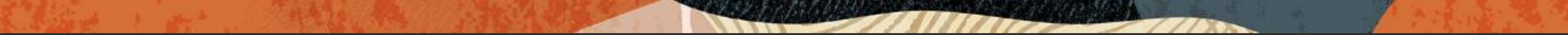
Room 5

Eric Steele

OCI PM EMEA

Thank You

DevRel Team



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