MEM GRAPH

Graph analytics and graph databases in Python

This is Ivan

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- Currently pursuing a PhD
- I work as a Developer Relations Engineer at Memgraph
- I love to travel, cook and watch Netflix too much

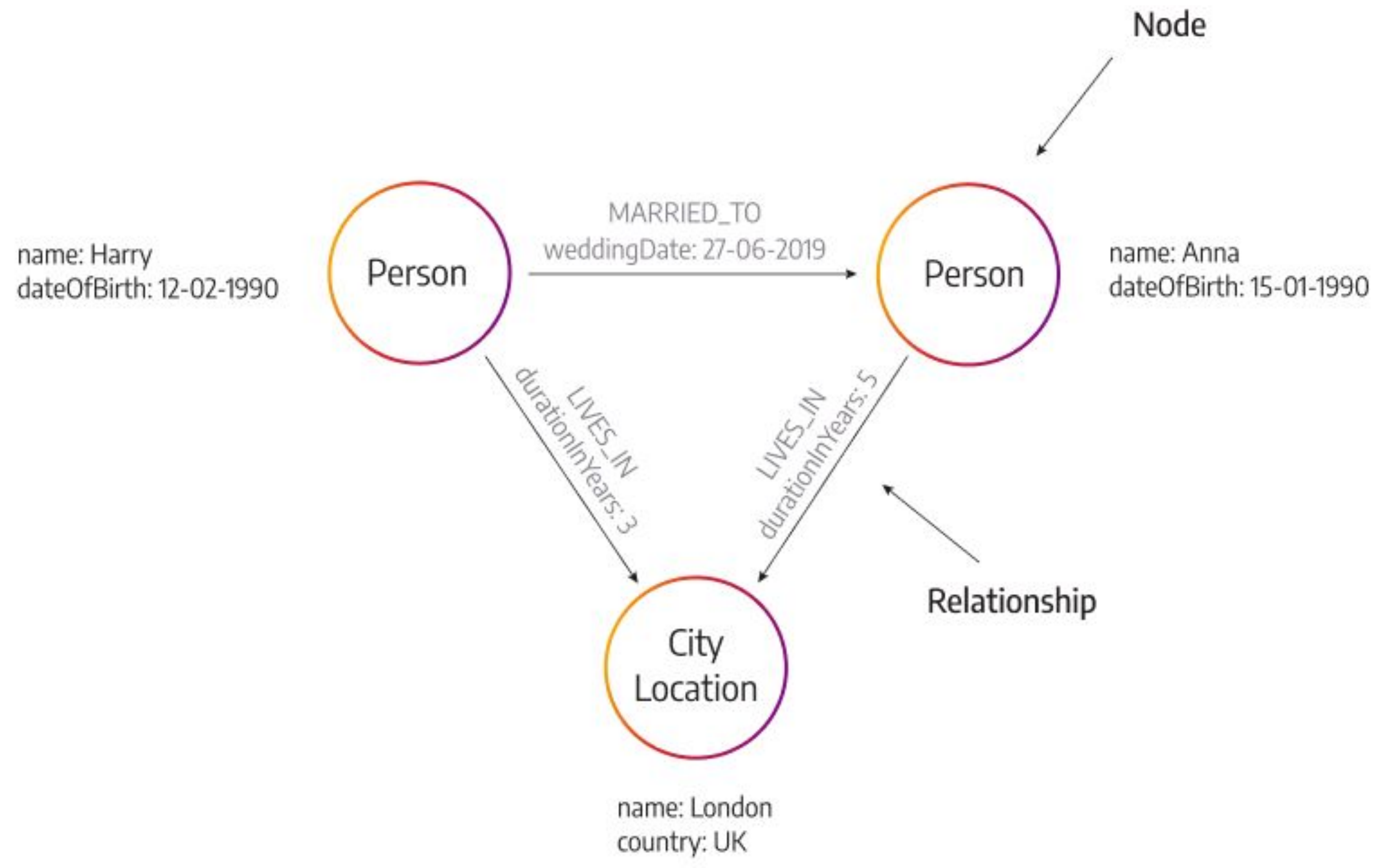
The graph data model

What are graphs and how to model data in a graph database?

What are graphs?

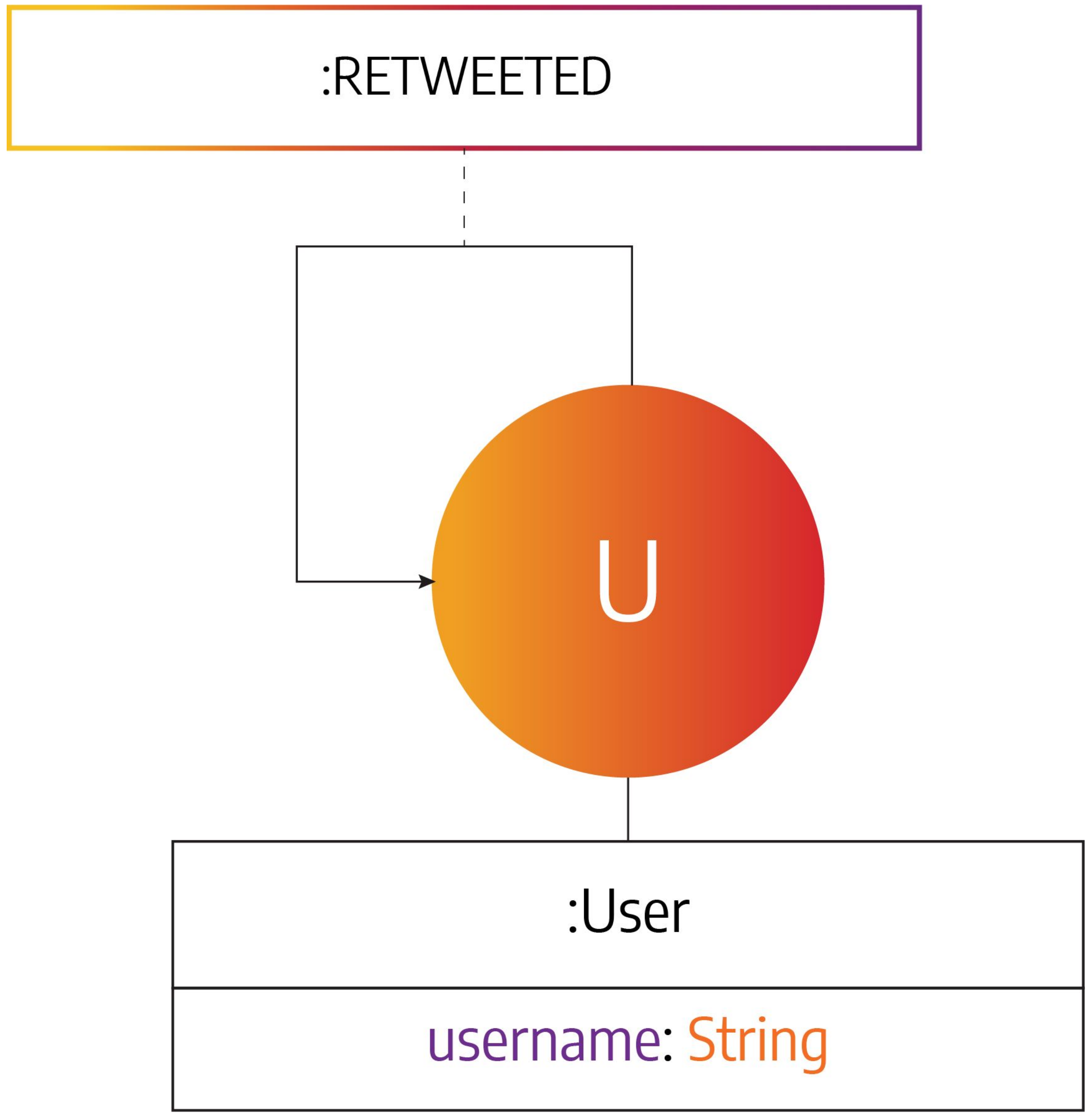
A graph is a network structure that consists of a set of nodes (vertices) and a set of relationships (edges) connecting them.

- **Nodes** - structures that represent entities
- **Relationships** - connections between these entities
- **Properties** - associated values (key-value pairs) belonging to either nodes or relationships



Labeled property graph model

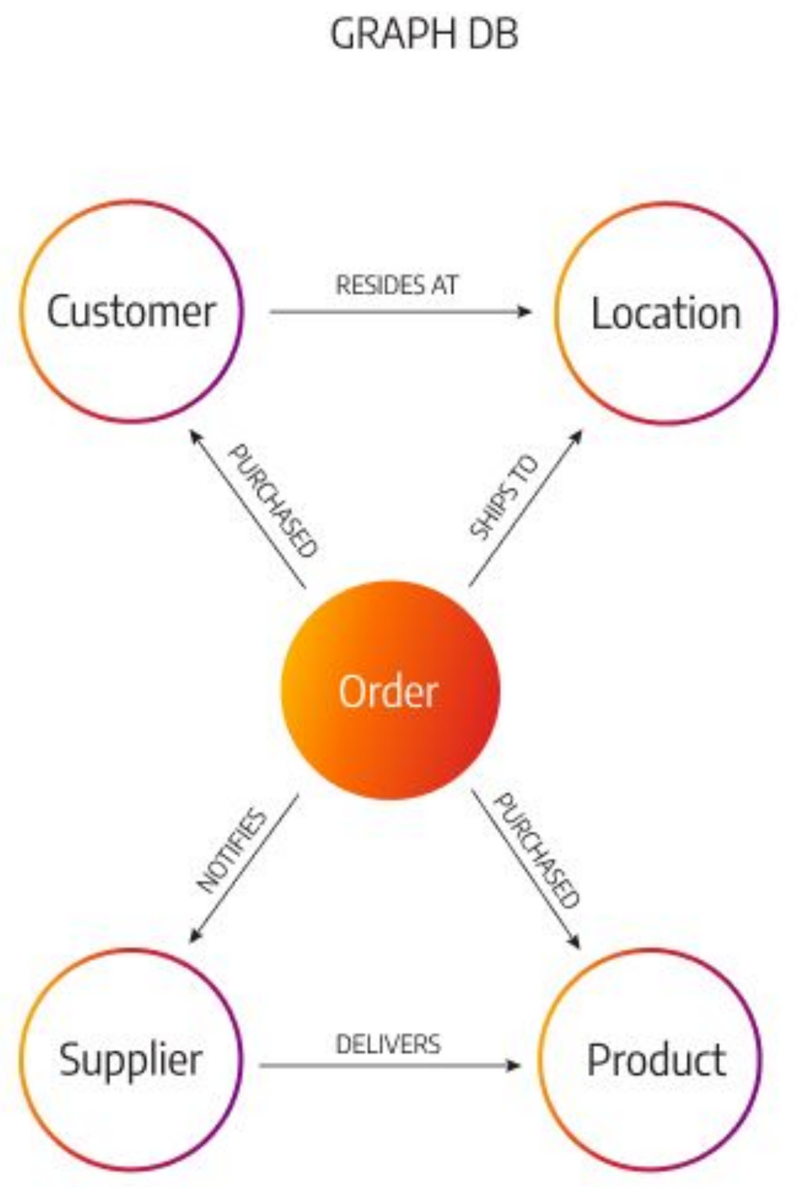
A simple Twitter graph data model

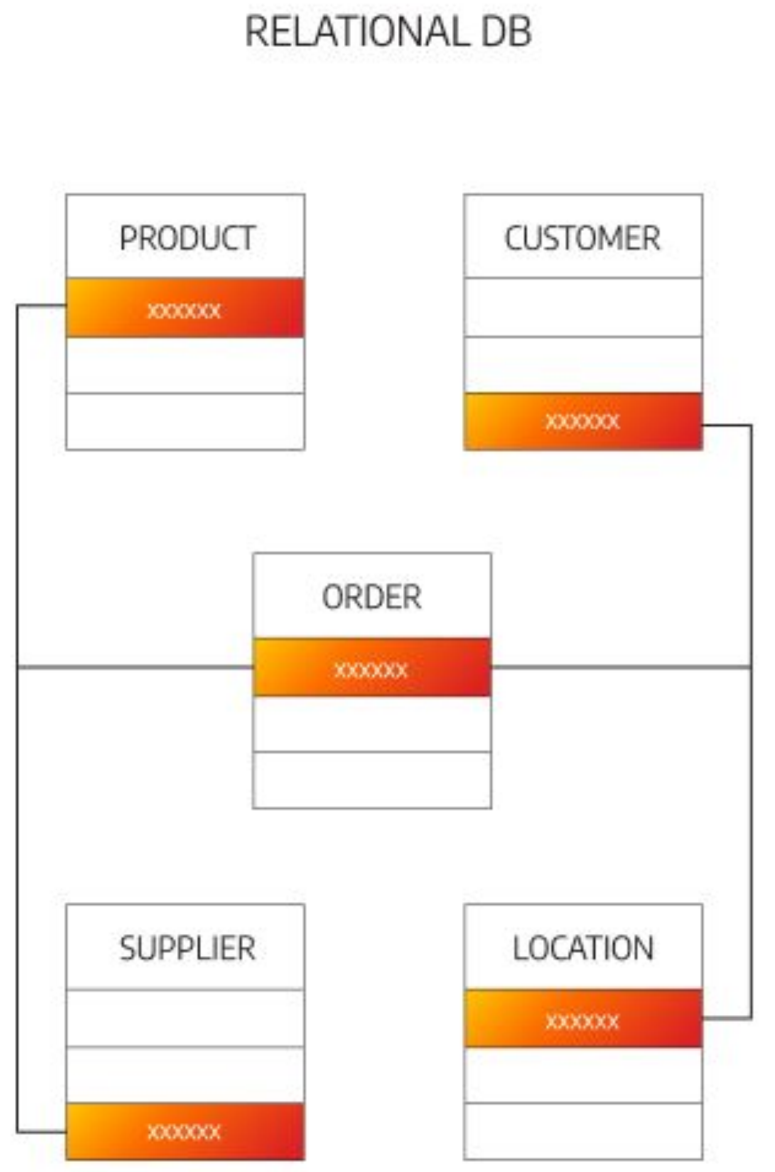


Graph vs relational databases

How does a graph database differ from a relational database?

Graph database vs relational database





Cypher query language

Cypher is the most widely adopted, fully-specified, and open query language for property graph databases. It provides an intuitive way to work with property graphs.

Cypher contains:

- clauses such as `MATCH`, `DELETE`, `SET`, `RETURN`...
- functions such as `round()`, `cos()`, `toString()`...
- custom procedures written in Python, C/C++ and Rust

Cypher query language

```
MATCH (u:Customer{customer_id:'customer-one'})-[:BOUGHT]->
(p:Product)<-[:BOUGHT]-(peer:Customer)-[:BOUGHT]->
(reco:Product)
WHERE not (u)-[:BOUGHT]->(reco)
RETURN reco as Recommendation, count(*) as Frequency ORDER
BY Frequency DESC LIMIT 5;
```

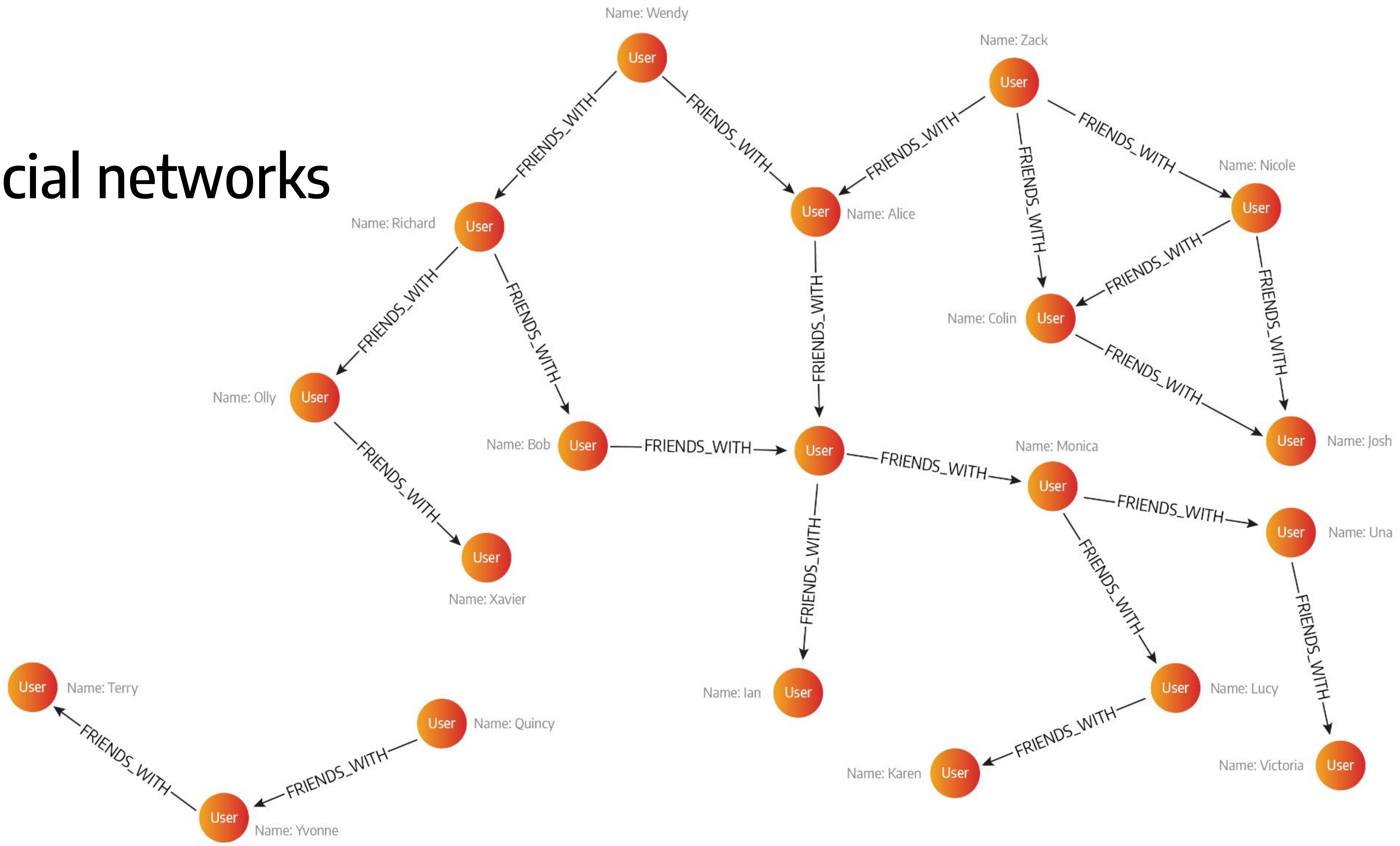
SQL

```
SELECT product.product_name as Recommendation, count(1) as
Frequency
FROM product, customer_product_mapping, (SELECT
cpm3.product_id, cpm3.customer_id
FROM Customer_product_mapping cpm,
Customer_product_mapping cpm2, Customer_product_mapping
cpm3
WHERE cpm.customer_id = ‘customer-one’
and cpm.product_id = cpm2.product_id
and cpm2.customer_id != ‘customer-one’
and cpm3.customer_id = cpm2.customer_id
and cpm3.product_id not in (select distinct product_id
FROM Customer_product_mapping cpm
WHERE cpm.customer_id = ‘customer-one’)
) recommended_products
WHERE customer_product_mapping.product_id =
product.product_id
and customer_product_mapping.product_id in
recommended_products.product_id
and customer_product_mapping.customer_id =
recommended_products.customer_id
GROUP BY product.product_name
ORDER BY Frequency desc
```

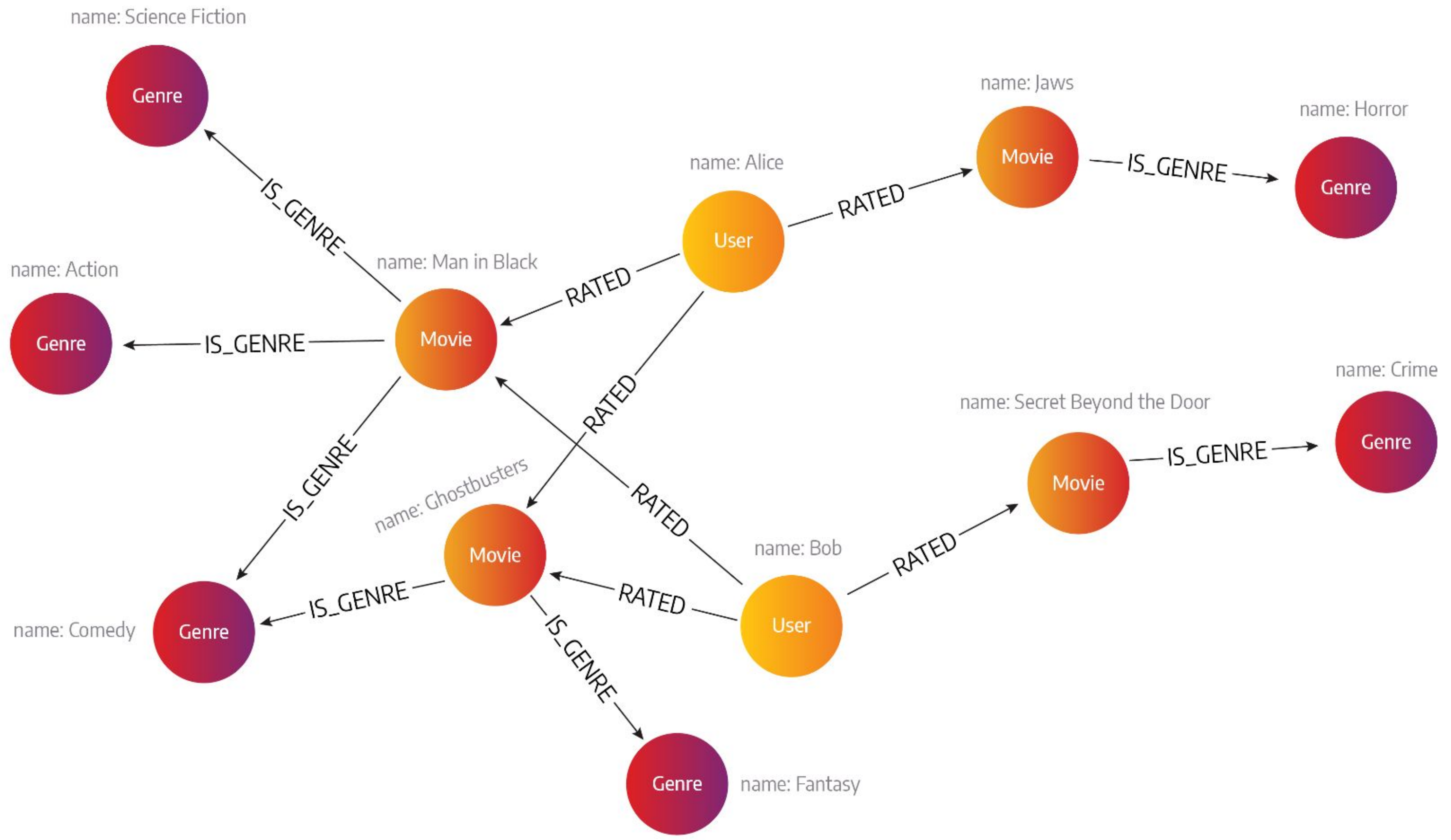
Graph database use cases

When to use a graph database?

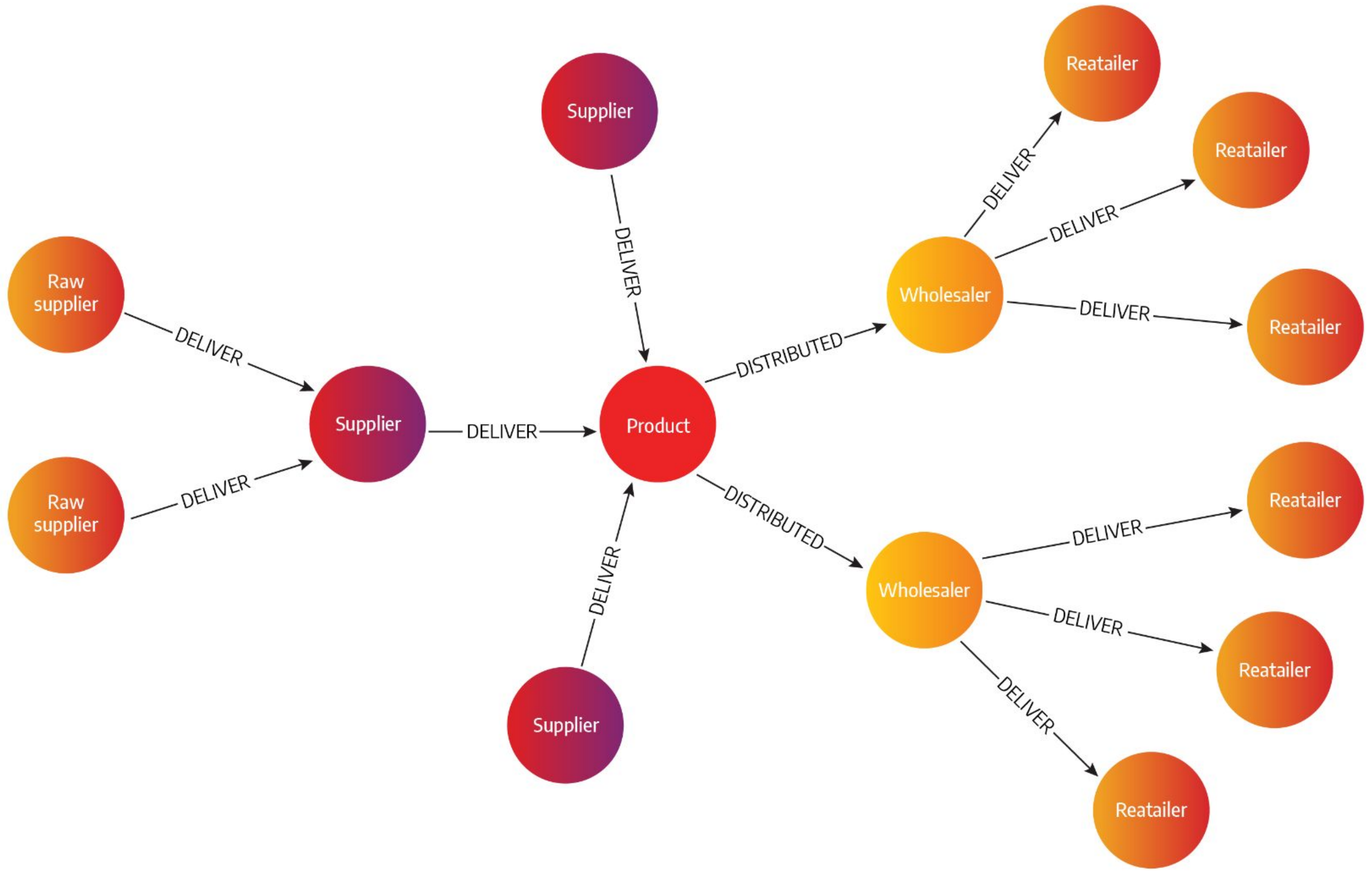
Social networks



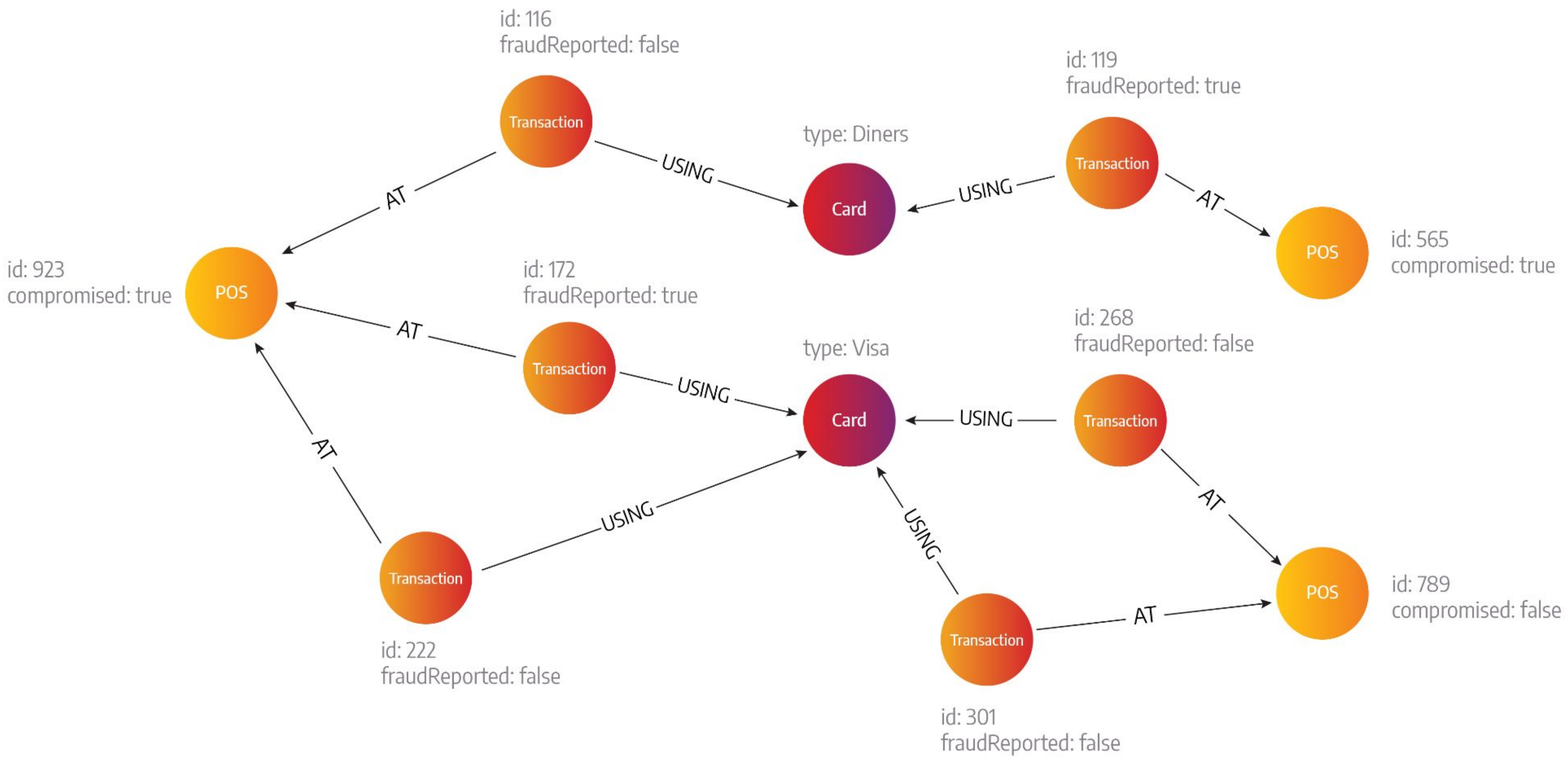
Recommendation engines



Supply chain management



Fraud detection



facebook
December 2010

Memgraph Ecosystem

What is Memgraph?

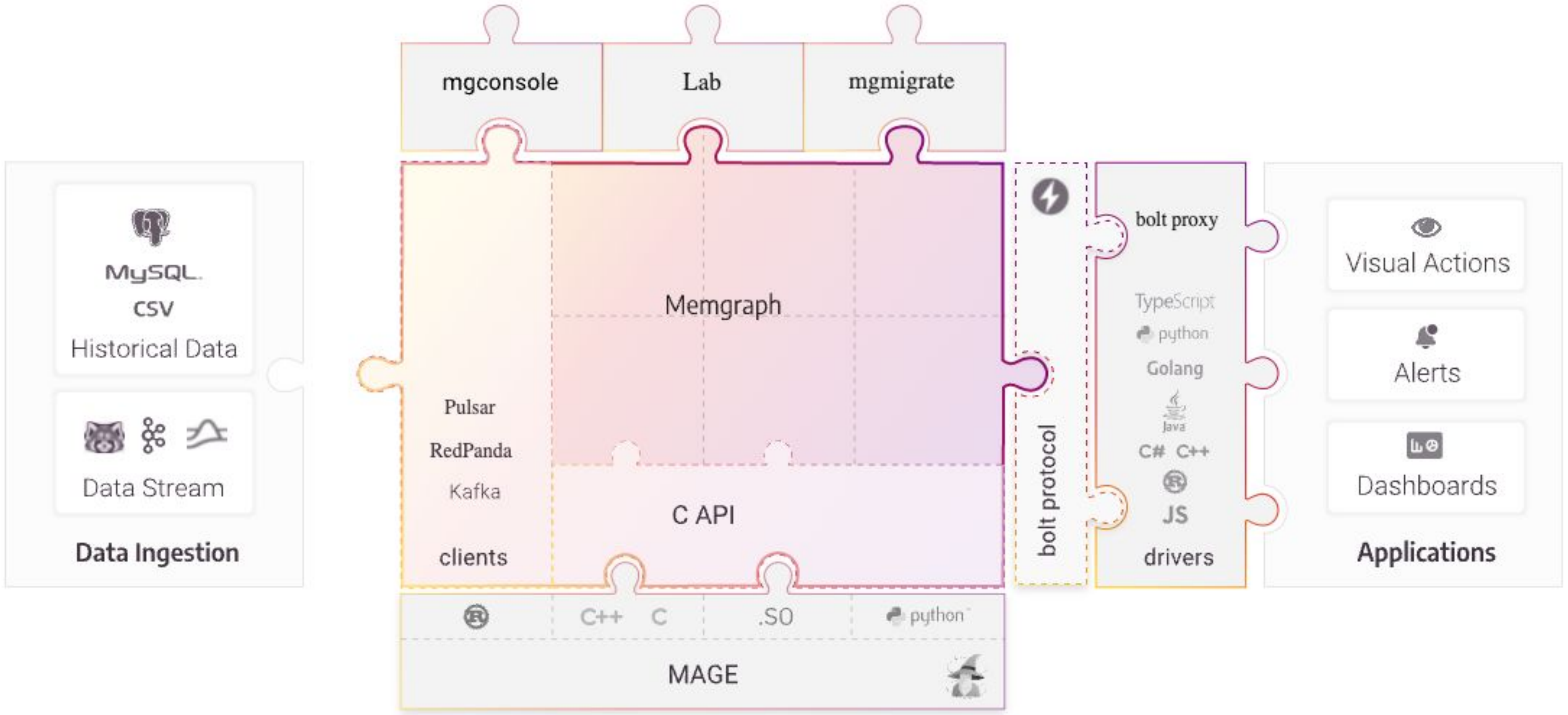
Memgraph

Memgraph is a platform for **graph computation on streaming data** powered by an in-memory graph database.

Memgraph is used to:

- Store graph data in memory
- Run graph analytics
- Analyze streaming data

Memgraph Ecosystem

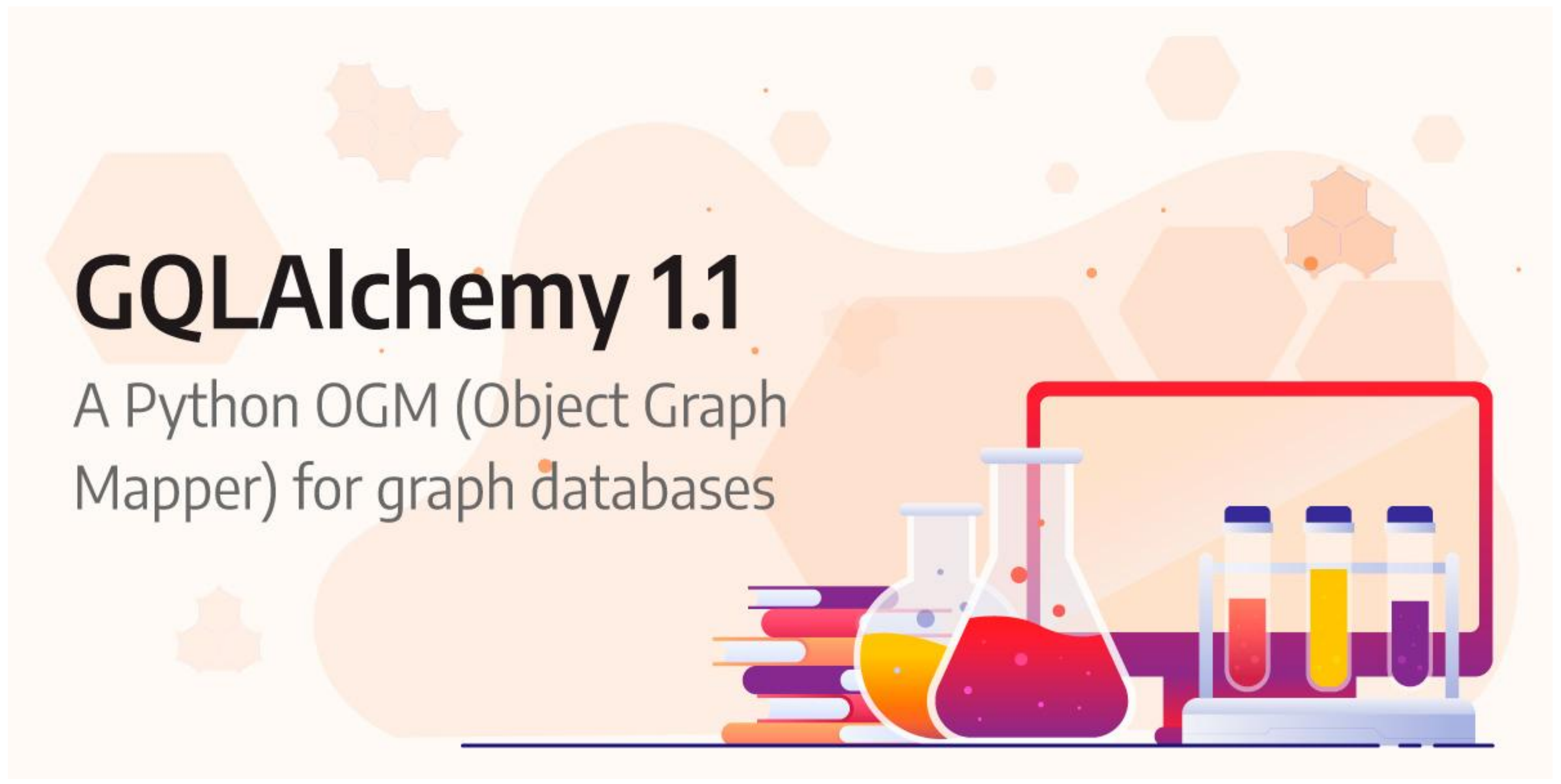


GQLAlchemy

GQLAlchemy is a fully open-source **Python library.** It is an Object Graph Mapper (OGM) - a link between Graph Database objects and Python objects.

GQLAlchemy includes:

- OGM capabilities
- Query builder
- On-disk storage
- Graph schema validation

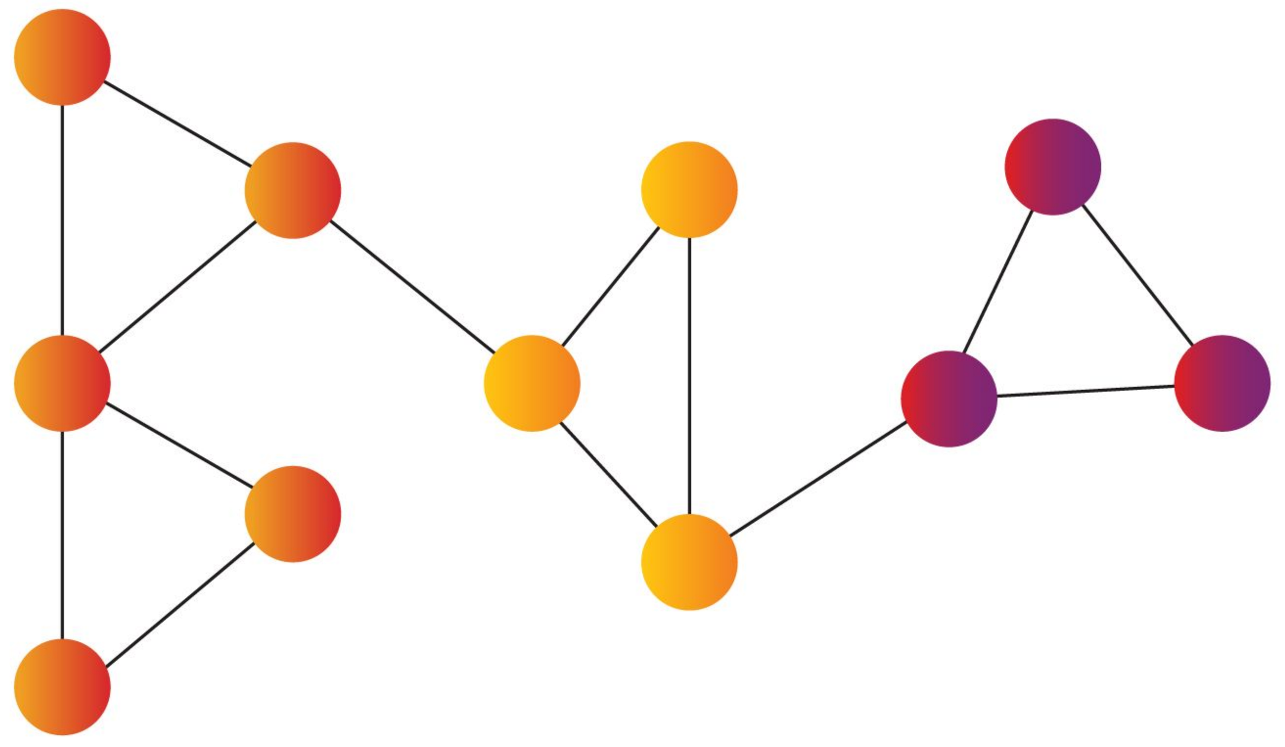


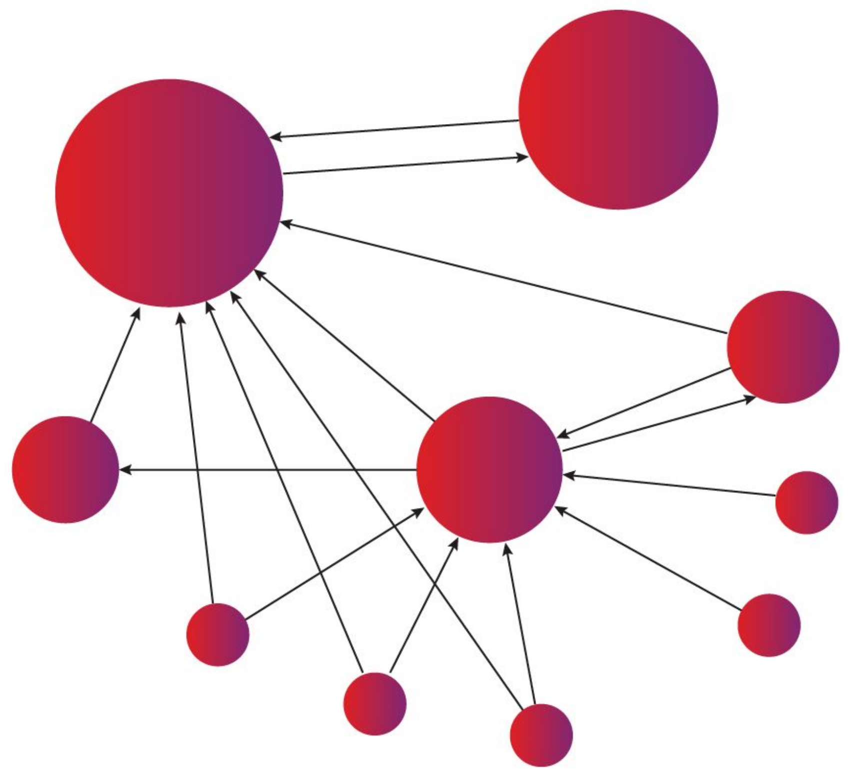
Graph analytics

Graph analytics, also called network analysis, generates insights hidden in the relationships of the network structure.

Some common algorithms include:

- Clustering & community detection
- Connected components
- PageRank
- Shortest path
- BFS & DFS





MAGE (Memgraph Advanced Graph Extensions)

- Open-source repository containing all available user-defined graph analytics modules and procedures
- Extends Cypher query language
- Implements popular graph algorithms such as PageRank, betweenness centrality, community detection, etc.
- Besides traditional graph algorithms, it also implements dynamic graph algorithms

Graph analytics in action

Google was built on the **PageRank** algorithm measuring the importance of web pages.

Facebook's social graph uses **Community Detection** to infer unknown data about their users based on similar network behavior of other users to power their ad-targeting engine.

Amazon uses **Collaborative Filtering** to deliver high quality real-time product recommendations.

Pinterest uses **Random Walks** and **Graph-Machine Learning** to deliver high-quality personalized recommendations responsible for more than 80% of all user engagements.

"**Graph-Machine Learning** features proved the most valuable of all other features when determining the quality and relevancy of our dish and restaurant recommendations."

Let’s do some coding!

Jupyter Notebook Workshop

What we've learned?

- We use **graph databases** when the data is highly connected and when we have lots of many-to-many relationships.
- Memgraph is a platform for **graph computation on streaming data** powered by an in-memory graph database.
- Before importing the data, we first have to create a **graph model.**
- The easiest way to import data is using the **`LOAD CSV`** Cypher clause.
- For Python developers, it's best to use **GQLAlchemy** to query Memgraph.
- If we want to get some valuable insights from the data, we can perform different kinds of **graph algorithms**, such as PageRank, betweenness centrality, etc.

MEMGRAPH

Thank you for your attention!

If you like what we do,
throw us a star! ⭐

https://github.com/memgraph/memgraph

GQLAlchemy is an open-source library!
Feel free to contribute! 🧪

https://github.com/memgraph/gqlalchemy

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