

Enable the Power of Connect Data in Finance using Graph Technology

Marco De Luca
Principal Solutions Architect

Frankfurt, May 8th 2023





Agenda

- Who we are and what we do
- What the hell is Graph Technology?
- Let's look at use cases in financial services companies
- Where is the money?
- Demo - Finding Anti Money Laundry (AML) fraudsters
- What's the future of Graph?
- How can YOU start?
- Q & A



The first-ever **graph database**

Creator of the **market category**

Continued market **leader**

100%

developed in Europe

\$500M

in funding

170+

Global partner
ecosystem

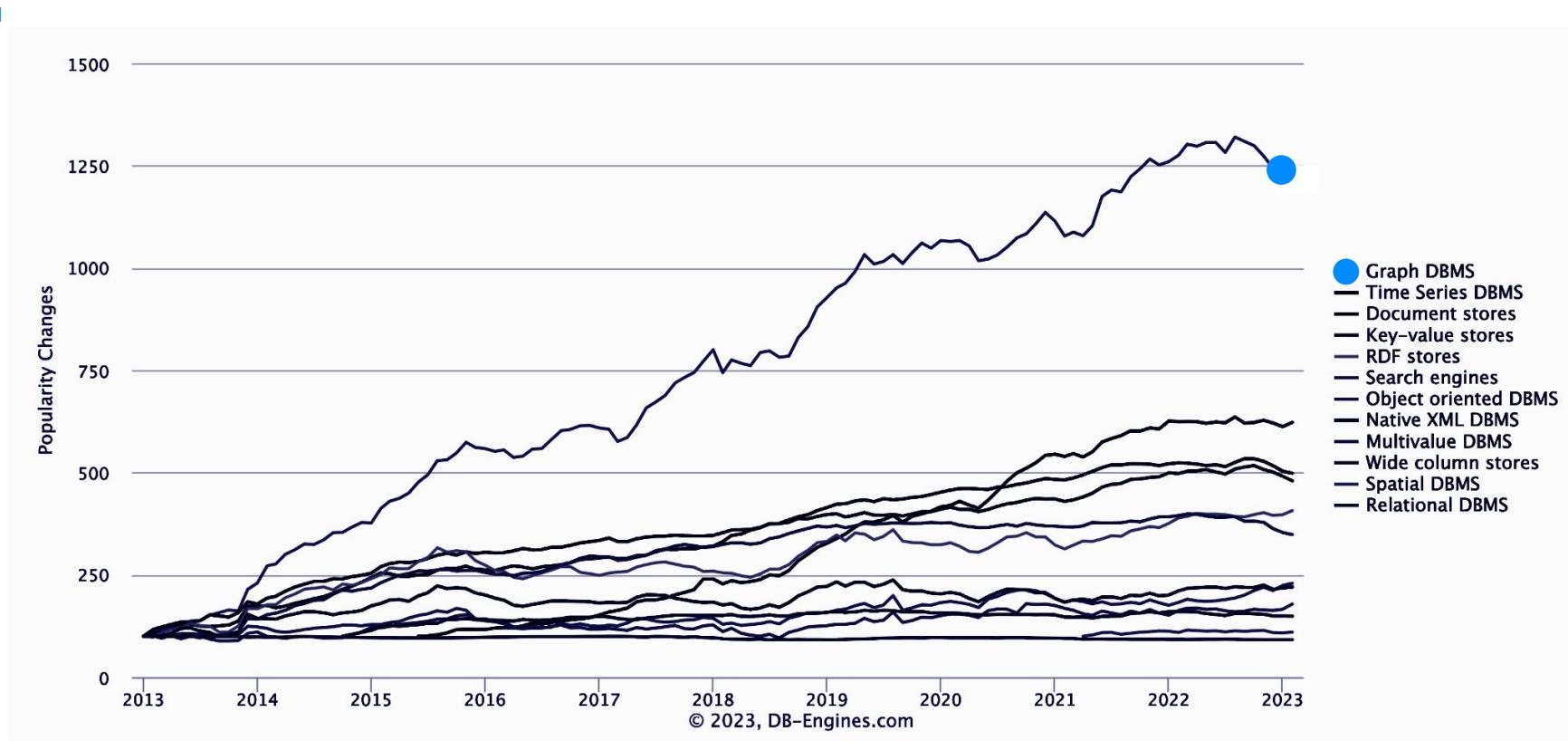
250K

Community of developers
and data pros

140M+

Downloads

THE FASTEST GROWING DATABASE CATEGORY FOR 10 YEARS





The #1 Platform for Connected Data

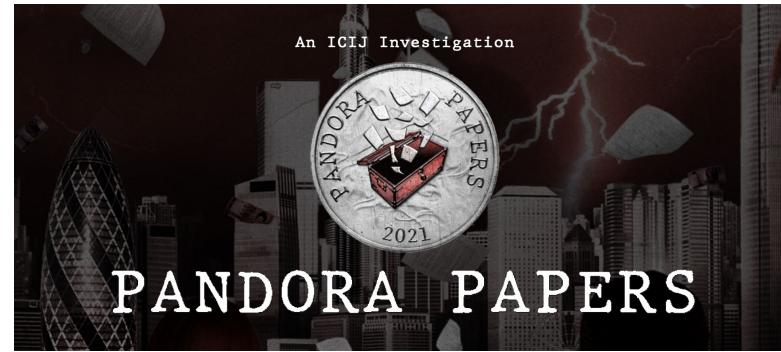
Case Study



The International Consortium of Investigative Journalists (ICIJ)
Neo4j Enables Pulitzer Prize-Winning
Investigation into Global Tax Evasion

With the Panama Papers investigation, the ICIJ encountered an overwhelming 40 years' worth of confidential documents to research and find connections. They used Neo4j to analyze at least 11.5 million documents, exposing tax evasion ranging from country Presidents and Prime Ministers to drug traffickers.

Panama Papers Case Study



Pandora Papers (Neo4j mentioned as Platform)

Pandora Paper Case Study

Analysing the FINCEN Files with Neo4j

An ICIJ investigation
FINCEN FILES

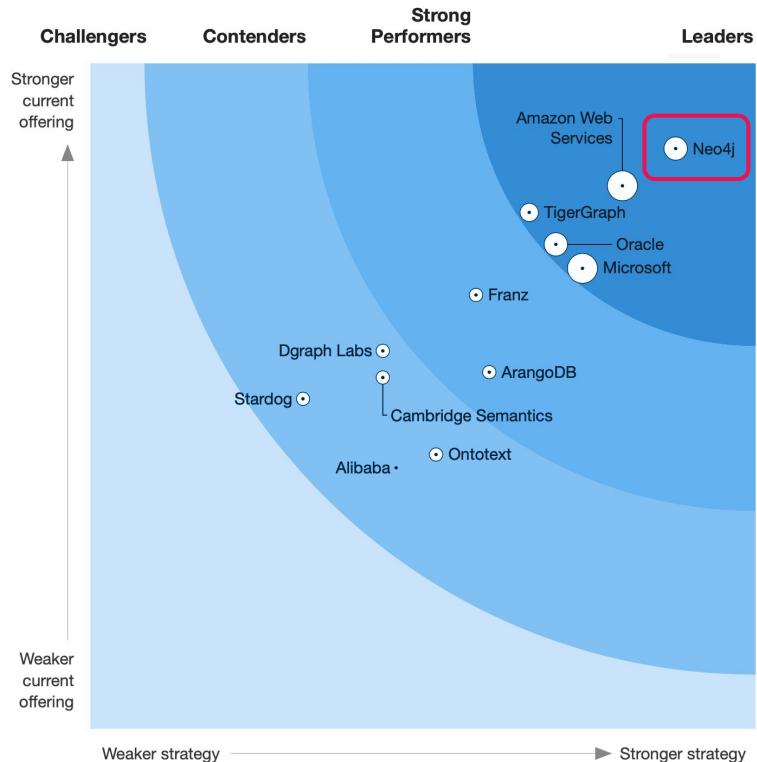
An ICIJ investigation reveals the role of global banks in industrial-scale money laundering – and the bloodshed and suffering that flow in its wake.

NEO4J: WE'RE LEADING THE GRAPH MARKET

Highest possible scores across:

- Scalability
- Performance
- Workloads
- Deployment
- Use cases
- Data Management
- Loading & Ingestion

The Forrester Wave™ For Graph Data Platforms, Q4 2020



REVEALING NEW WAYS TO SOLVE THE WORLD'S MOST PRESSING BUSINESS PROBLEMS



Real-Time
Recommendations



Fraud
Detection



Network &
IT Operations



Master Data
Management



Risk &
Compliance



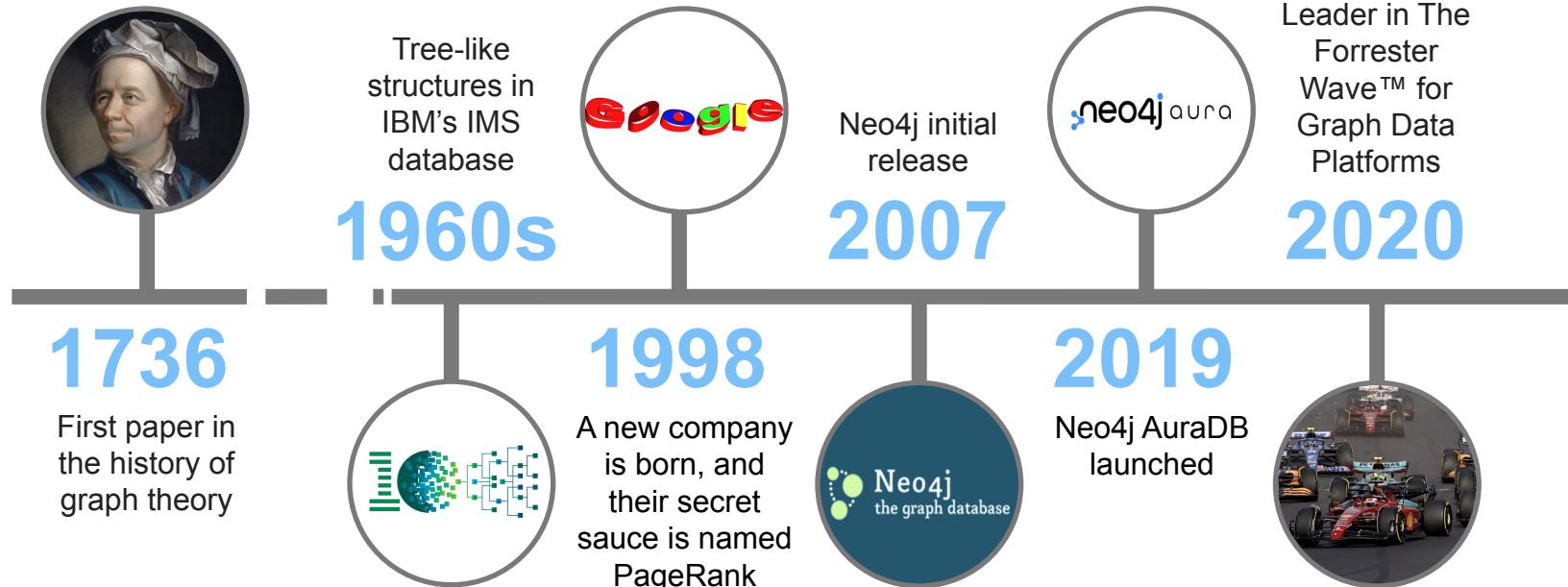
Identity & Access
Management



What the hell is Graph Technology?



A bit of history



Graphs - you may think about Charts now

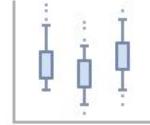
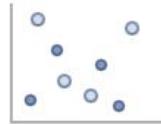
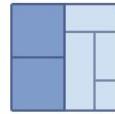
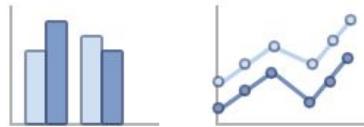


Charts

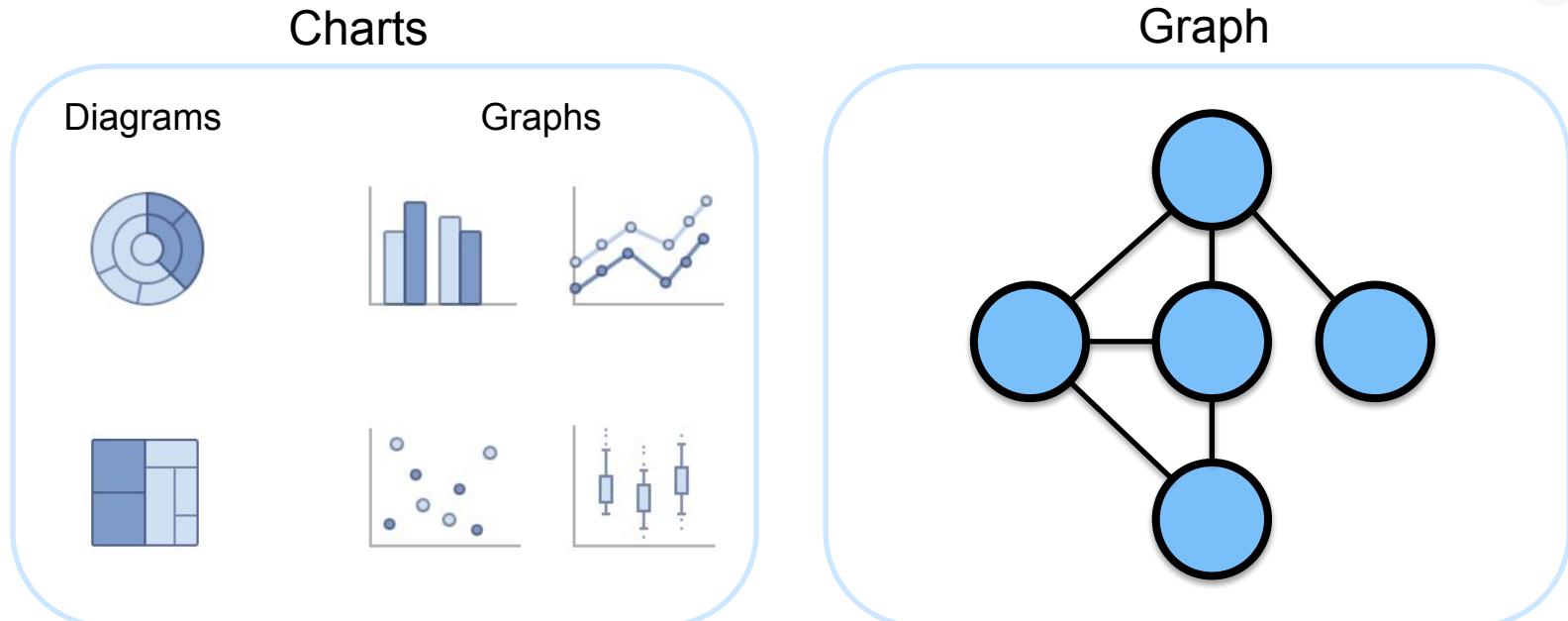
Diagrams



Graphs

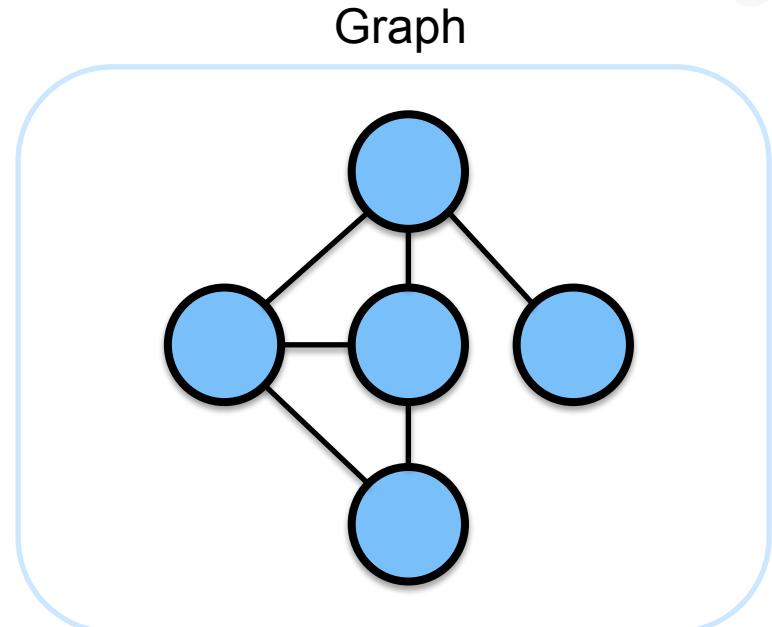


Graphs - but we talk about a graph like that (right)



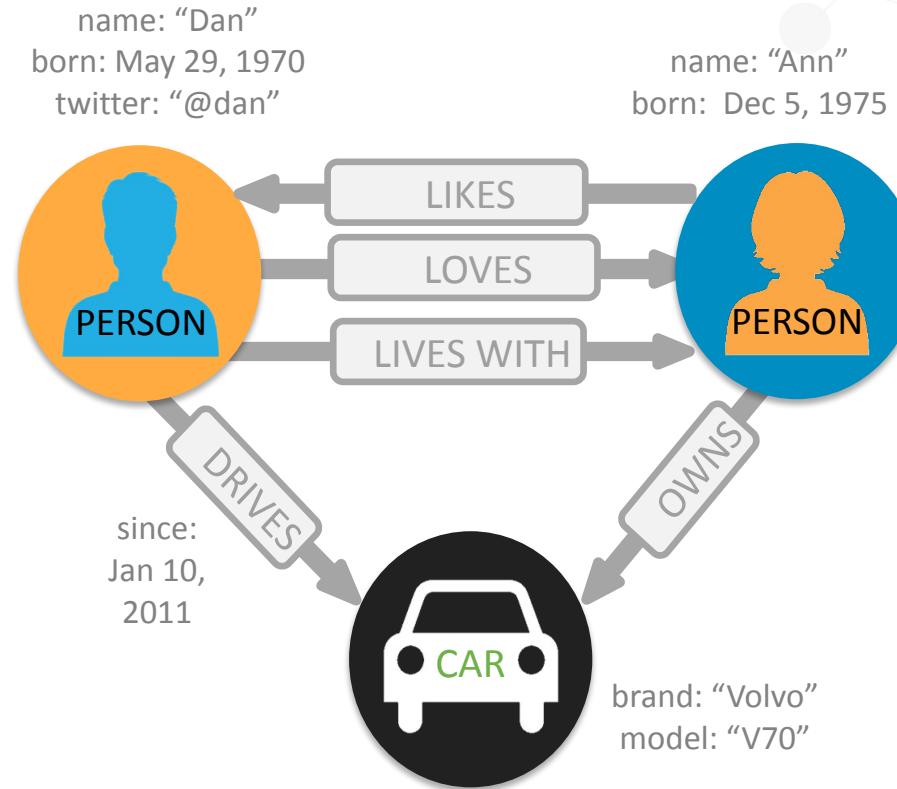
It is called “Labeled Property Graph” (LPG)

- **Nodes**
 - Represent objects in the graph
- **Relationships**
 - Relate nodes by type and direction
- **Properties**
 - Name-value pairs on nodes and relationships
- **Labels**
 - Group nodes
 - Shape the domain



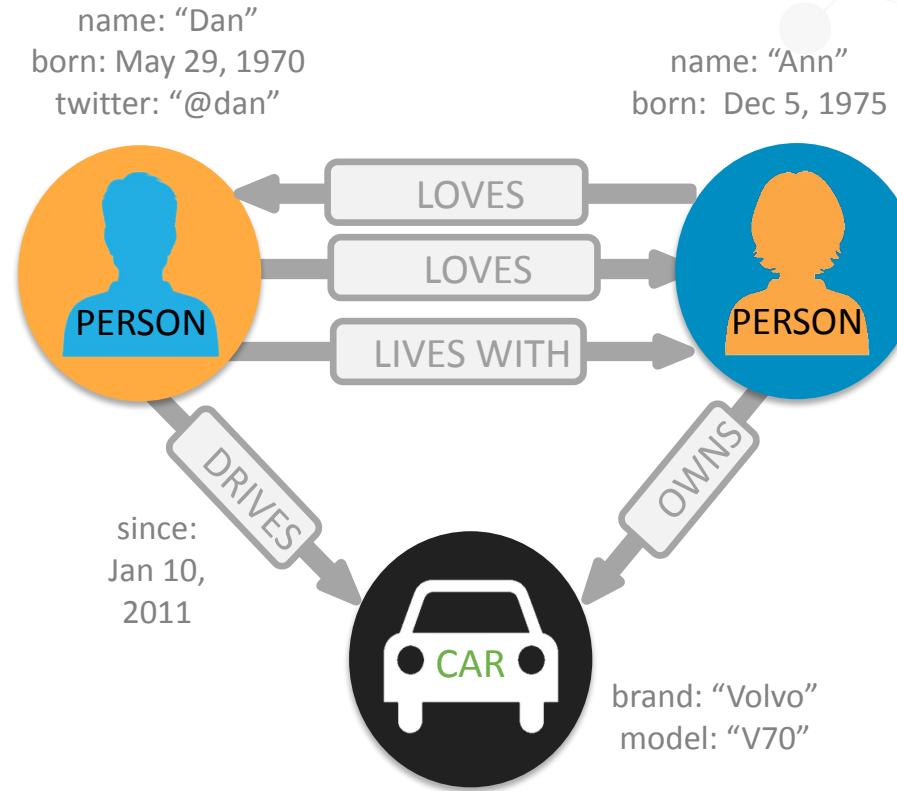
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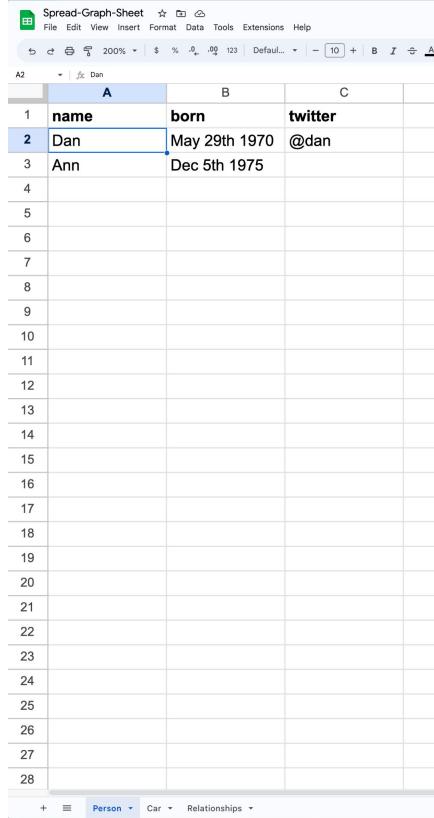


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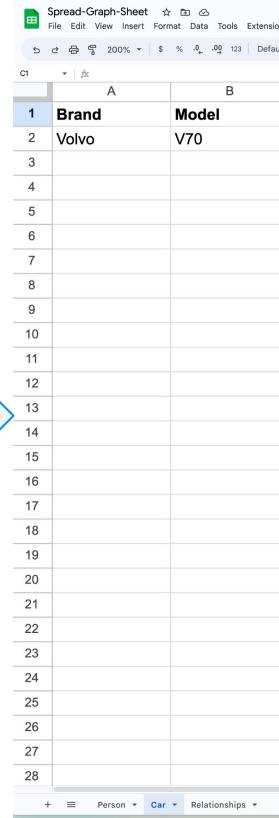


Neo4j Data vs. Spreadsheet Data 🤔 - What's missing?



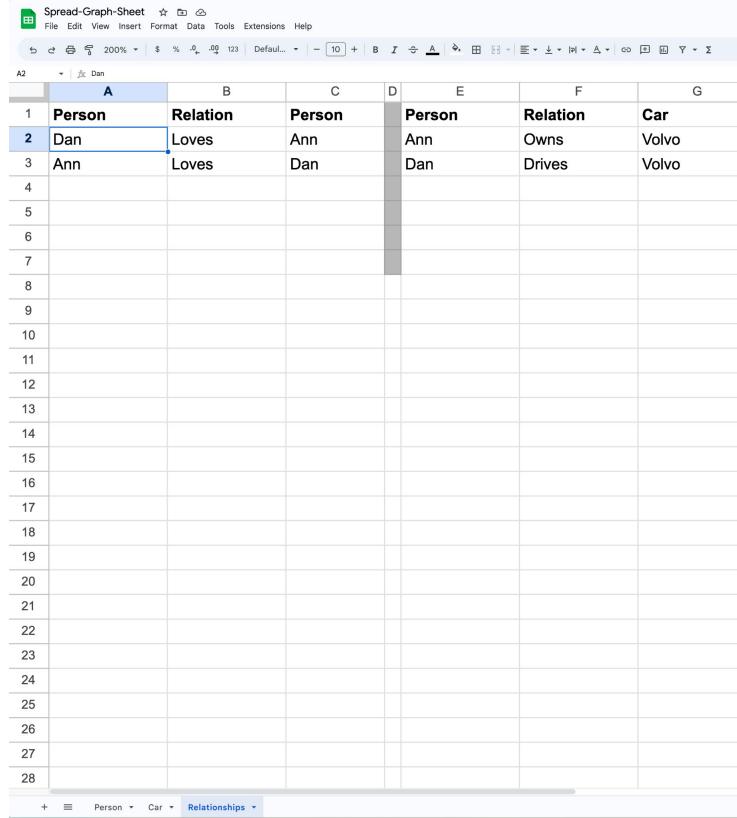
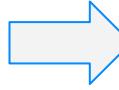
Spread-Graph-Sheet

A	B	C
1 name	born	twitter
2 Dan	May 29th 1970	@dan
3 Ann	Dec 5th 1975	
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		



Spread-Graph-Sheet

A	B
1 Brand	Model
2 Volvo	V70
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
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21	
22	
23	
24	
25	
26	
27	
28	



Spread-Graph-Sheet

A	B	C	D	E	F	G
1 Person	Relation	Person	Person	Relation	Car	
2 Dan	Loves	Ann	Ann	Owns	Volvo	
3 Ann	Loves	Dan	Dan	Drives	Volvo	
4						
5						
6						
7						
8						
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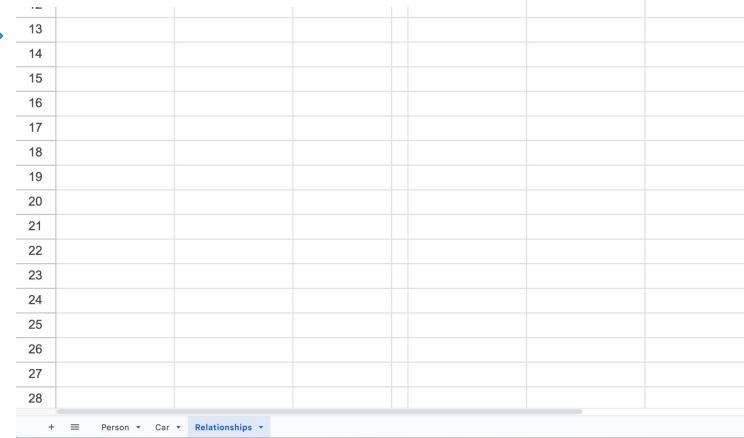
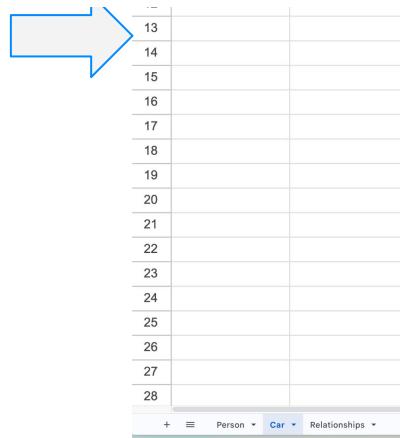
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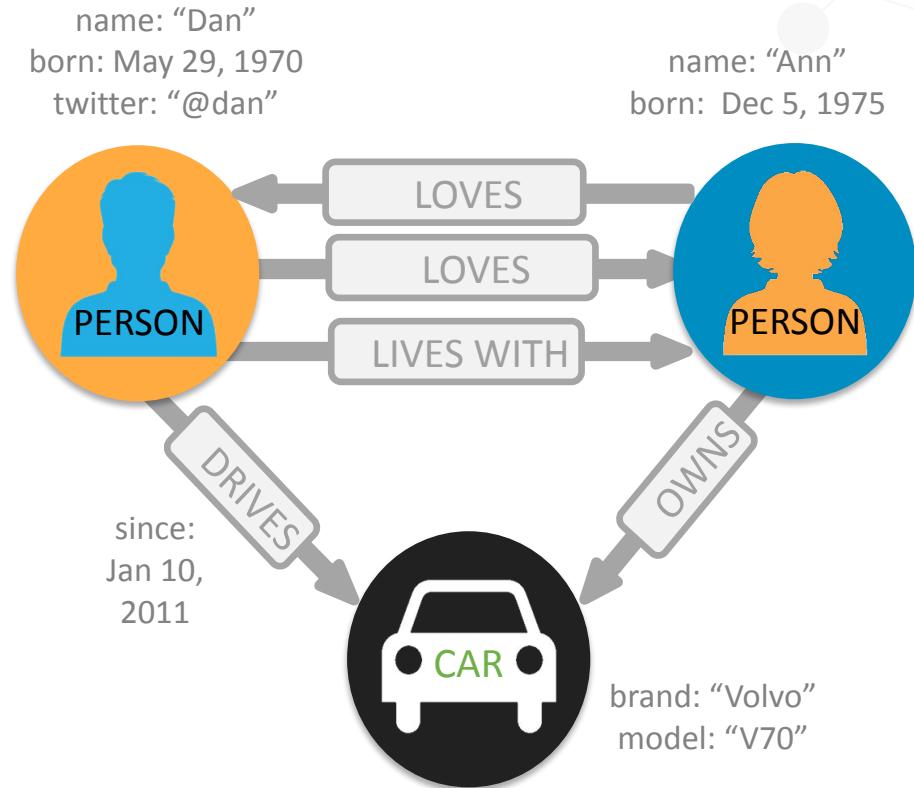
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1 Person	Relation	Person	Person	Person	Relation	Car
2 Dan	Loves	Ann	Ann	Ann	Owns	Volvo
3 Ann	Loves	Dan	Dan	Dan	Drives	Volvo
4						
5						
6						
7						

Relationships + Relationship Properties!

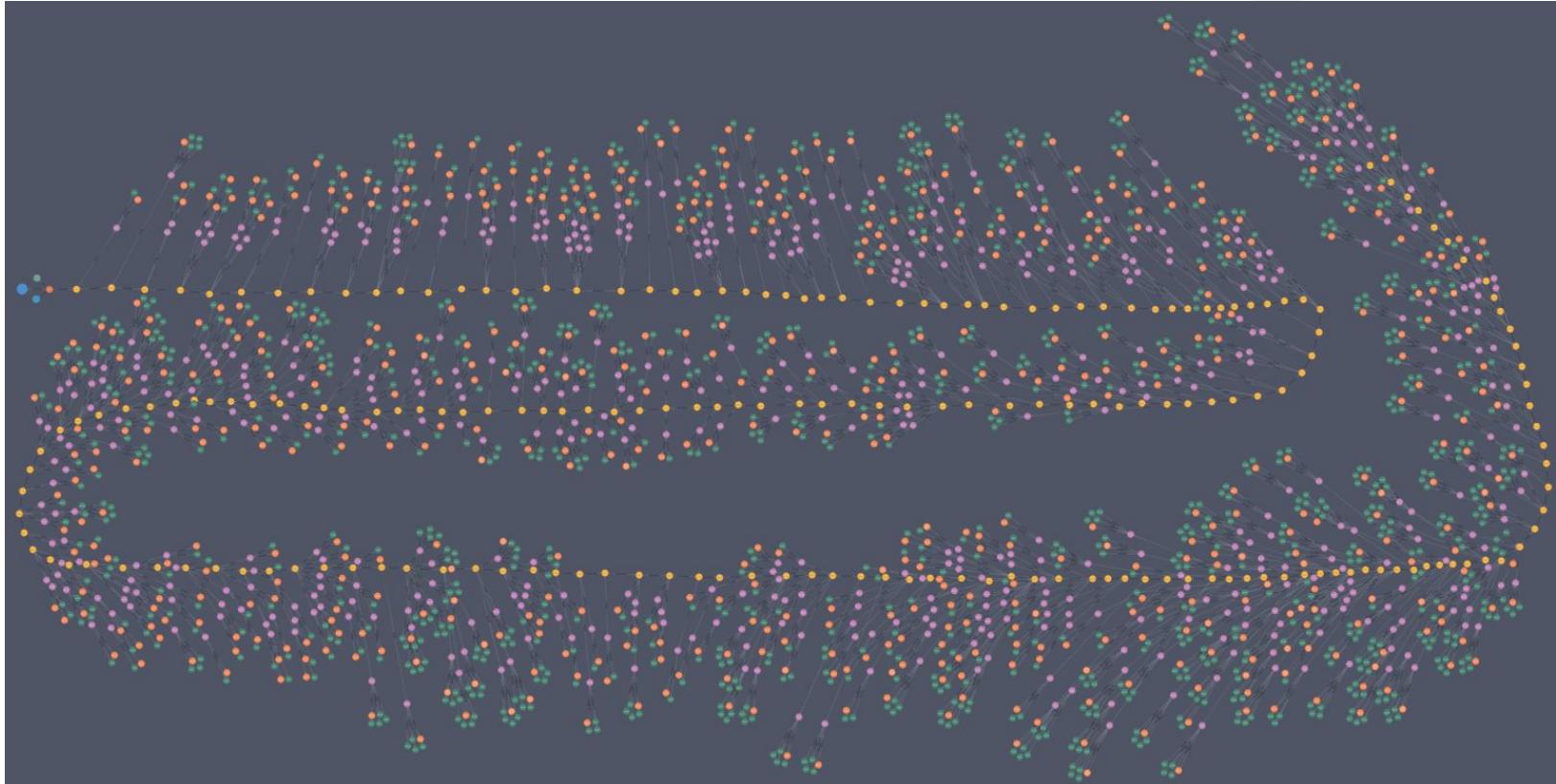


Labeled Property Graph (LPG) - Very simple ONE!

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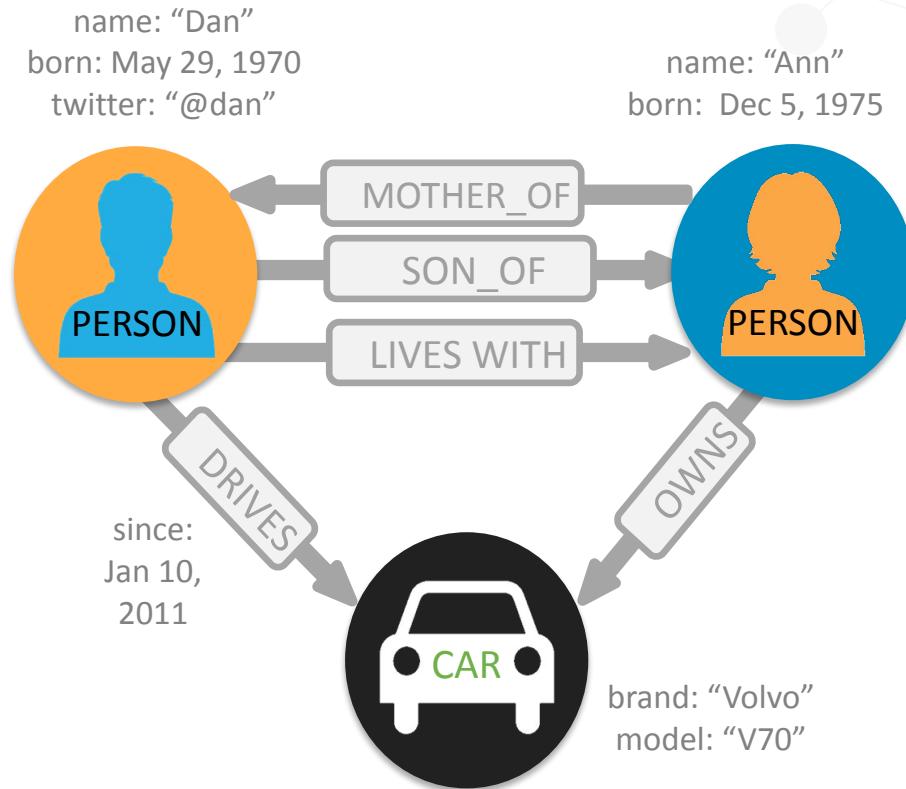
This is a **Neo4j** Graph*, any thoughts what that could be?



* <https://www.graphable.ai/blog/patient-journey-mapping/>

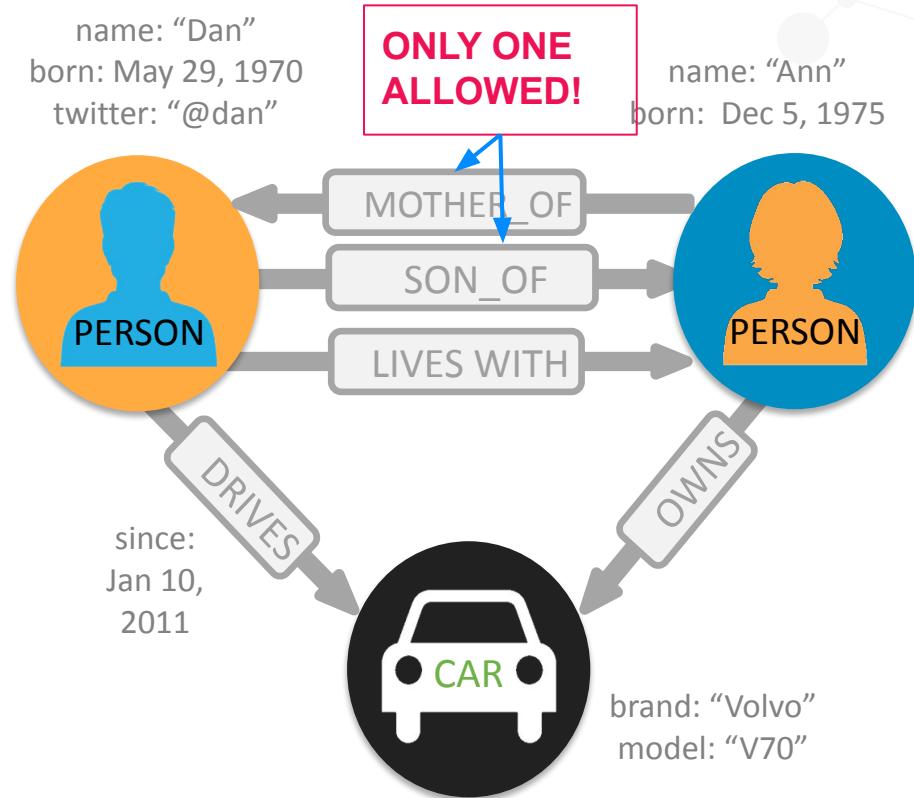
Labeled Property Graph (LPG) - Semantics is important

- **Nodes**
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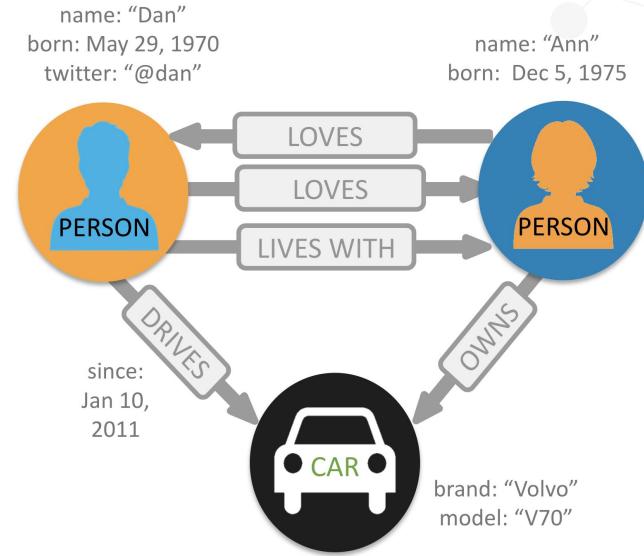
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- **Nodes**
 - Represent objects in the graph
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 - Name-value pairs on nodes and relationships
- **Labels**
 - Group nodes
 - Shape the domain



The only thing you should remember for now!

- **Nodes**
 - Represent **objects** (or **categories**) in the graph
- **Relationships**
 - Relate nodes by **type** and **direction**, the latter does not prevent you from reading the graph against the direction!
- **Properties**
 - Name-value pairs on nodes and relationships that **store** your data
- **Labels**
 - Group nodes and can be used building “Sub-Category”
 - Shape the domain, e.g. “Social Network”



Graph technology benefits



1

Enable new
use-cases

2

Increase
business agility

3

Reduce time to
market

4

Less translation
needed

5

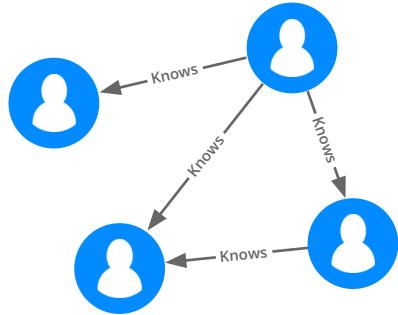
Do more with less



1

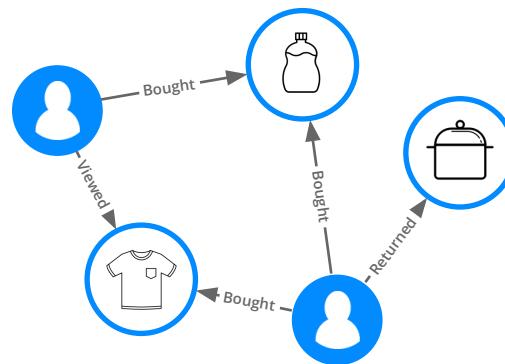
Enable new
use-cases

Connections in data are as valuable as the data itself



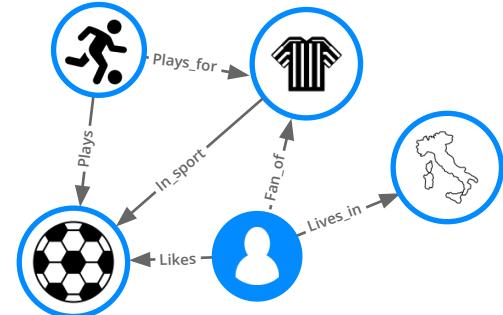
Networks of People

Employees, Customers,
Suppliers, Partners,
Influencers



Transaction Networks

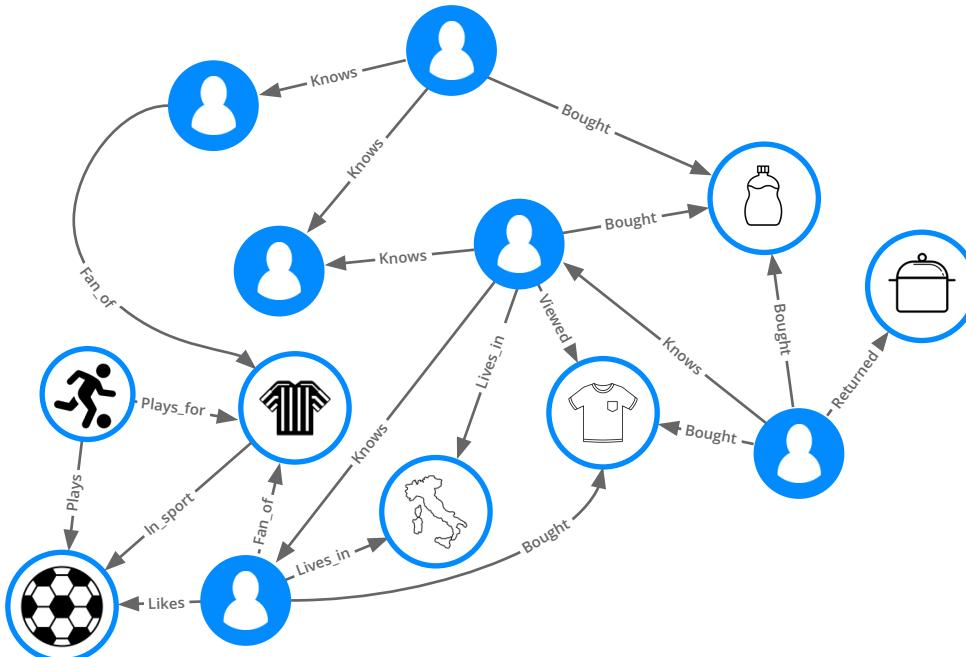
Recommendations, Risk
management, Supply chain,
Payments



Knowledge Networks

Enterprise content, Domain
specific content,
eCommerce content

Connections in data are as valuable as the data itself





2

Increase
business agility

The Agile Manifesto*



Responding to change over following a plan



Reduce time to
market

3

Cypher

```
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
```

4

Less translation
needed



Intuitive?

Name	Part	Qty
A	Wood Dowel	8
B	Cam Post	18
C	Cam Fastener	18
D	Cam Sticker	18
E	Grommet	2
F	Leveler	4
J	Table Leg	2
K	Modesty Panel	2
L	Top	1

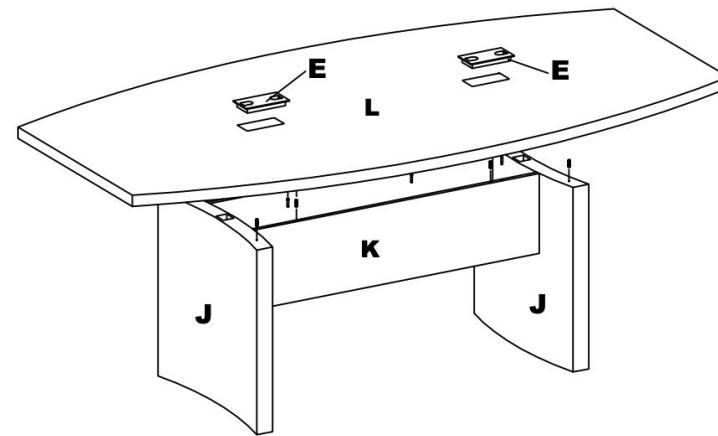
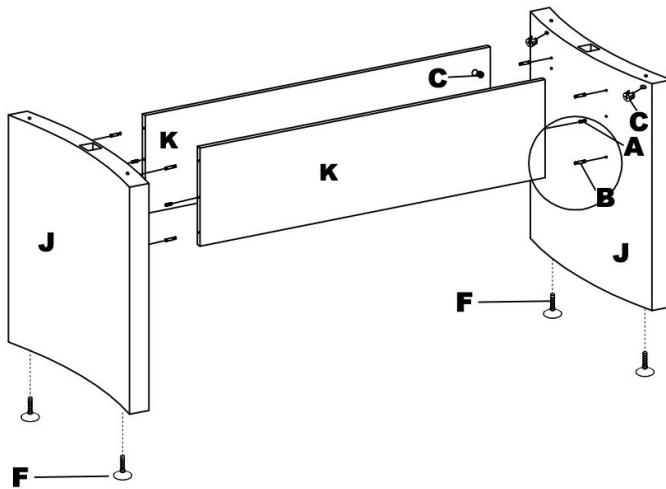
Assembly Instructions

1. DO NOT assemble table with top to floor. Table must be assembled in an upright position only.
2. Insert Wood Dowels (A) and Cams (C) into Modesty Panels (K). Install Leveler (F) and Cams (C) into Legs (J). Install Cam Posts (B) into threaded inserts in Table Legs (J). Secure Modesty Panels (K) to Table Legs (J) by turning Cams (C).
3. Insert Wood Dowels (A) into the top of the Table Legs (J) and Modesty Panels (K). Insert Cams into the Modesty Panels (K). Install Cam Posts (B) into threaded inserts in the underside of the Top (L). Secure Top (L) to Modesty Panels (K) by turning Cams (C). Apply Cam Stickers (D) to exposed Cams (C). Install Cap and Grommet (E).

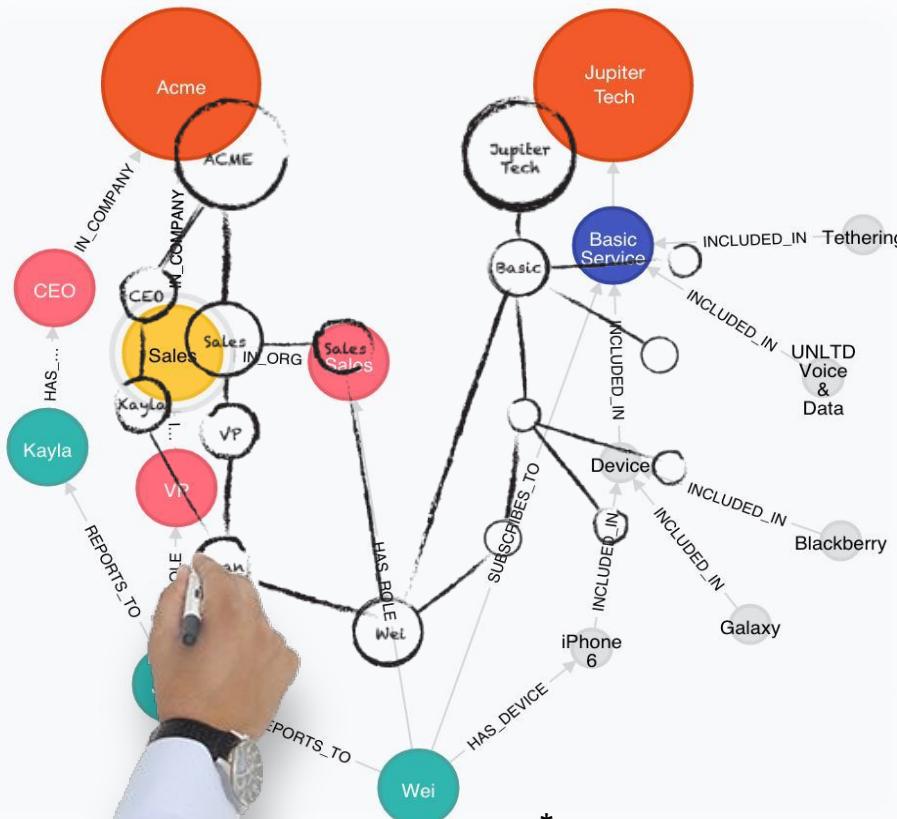
NOTE: The arrow on the face of the Cam (C) should point towards the Cam Post (B) for proper alignment.

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Intuitive!



The whiteboard model* = the physical data model



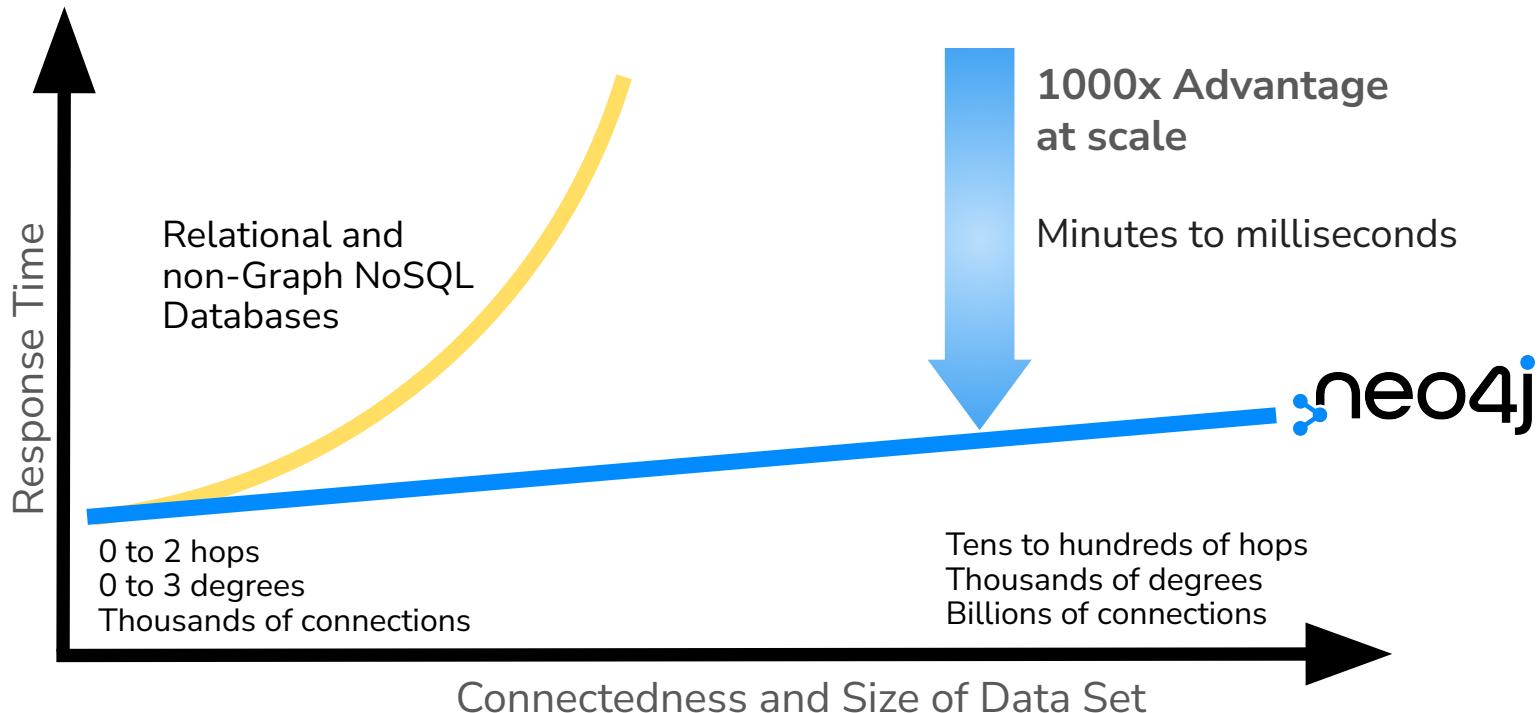
* [Arrows.app --> Data Model White Boarding Tool](#)

5

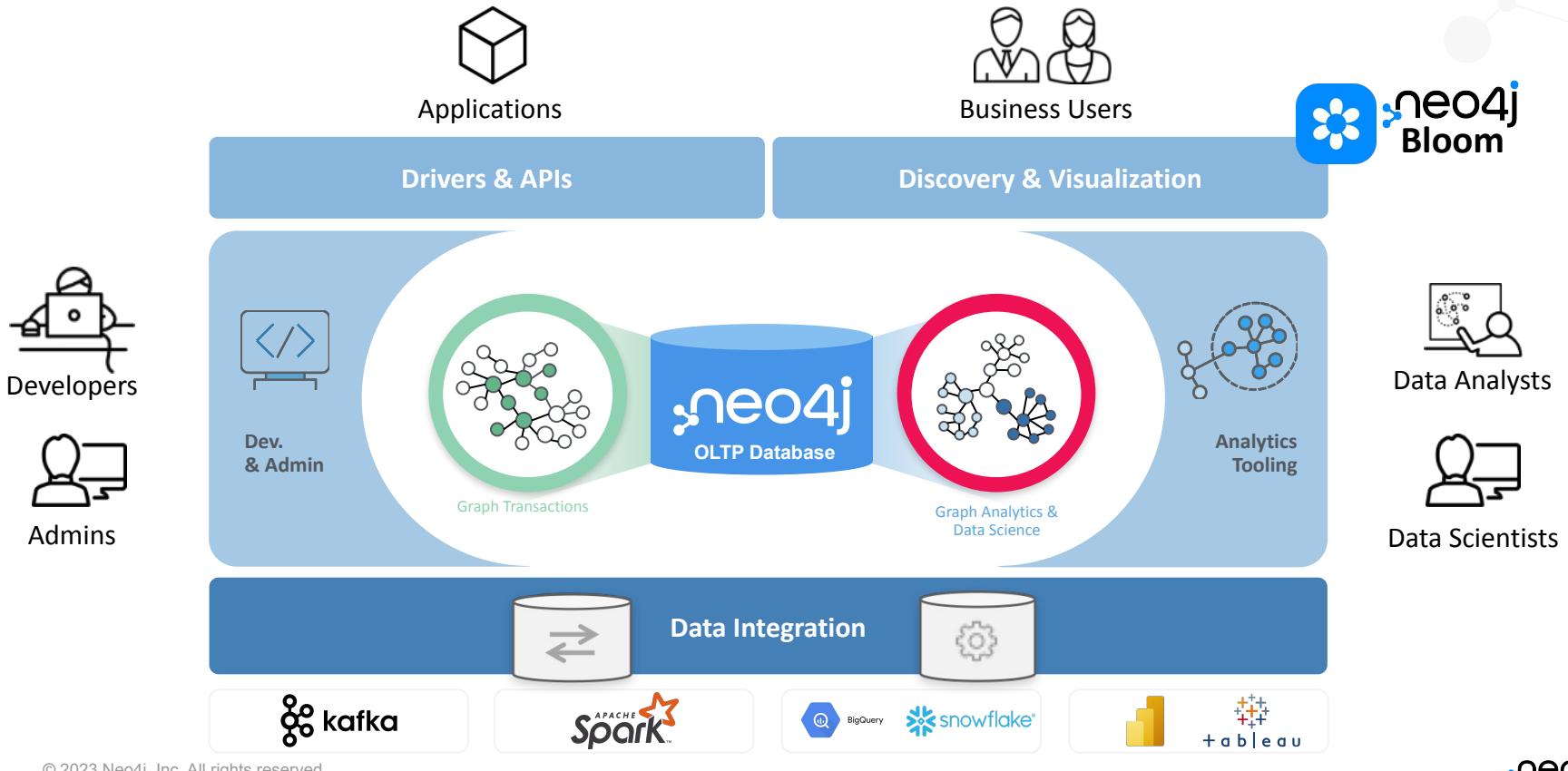
Do more with less



Performance and scale



Native graph technology for apps & analytics



Use Cases in financial customers

Partial FSI References - Most Common Use Cases

- Product / Customer 360°
- Recommendation Engines
- Identity & Access Management
- Fraud Detection
- Network & IT Management
- Master Data Management
- Risk Management
- Knowledge Graph
- Churn Prediction
- Customer Journey
- Customer 360 View
- Cybersecurity
- Application Modernization

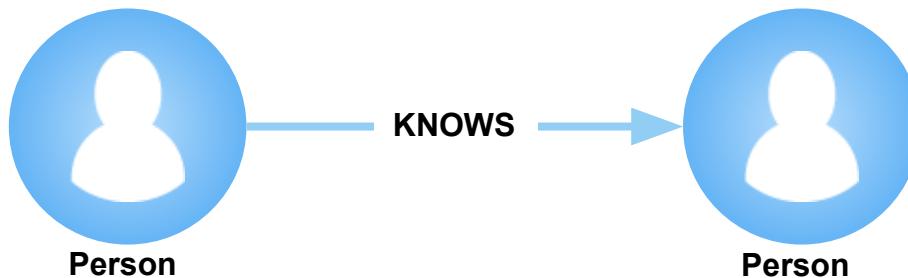


Where is the money?

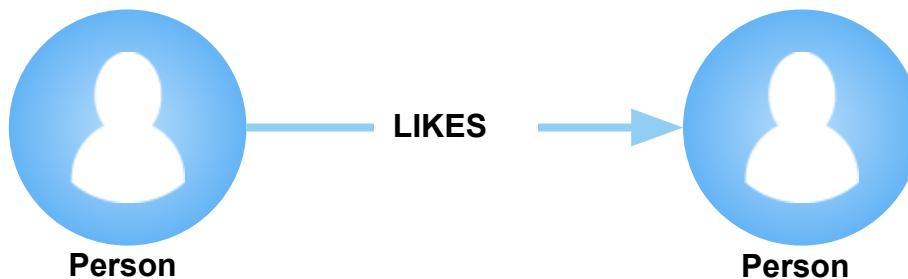
Anti Money Laundry detection using Graph Technology



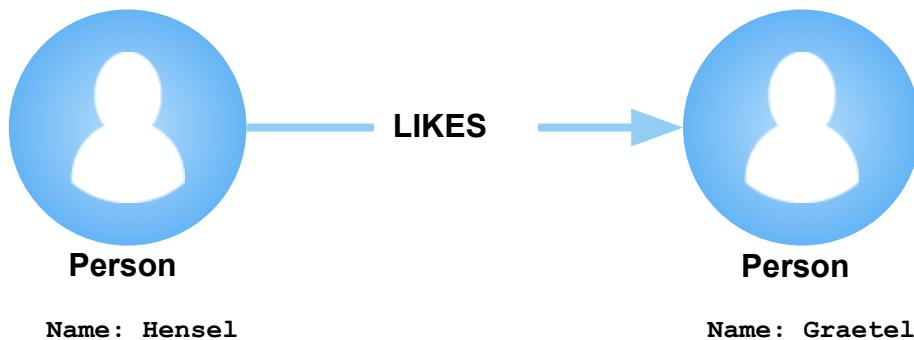
What is a Graph*



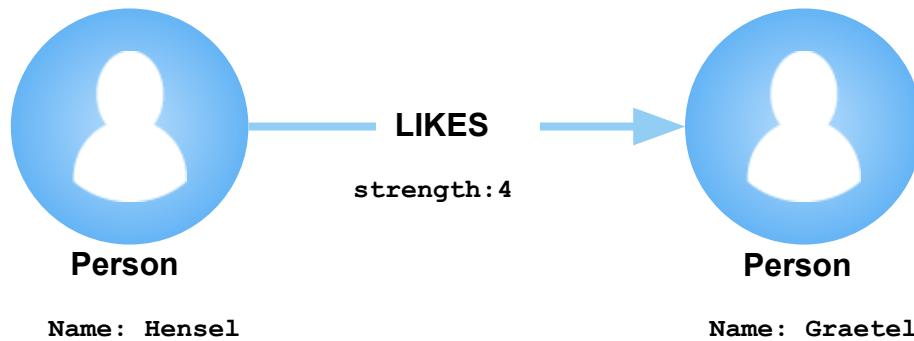
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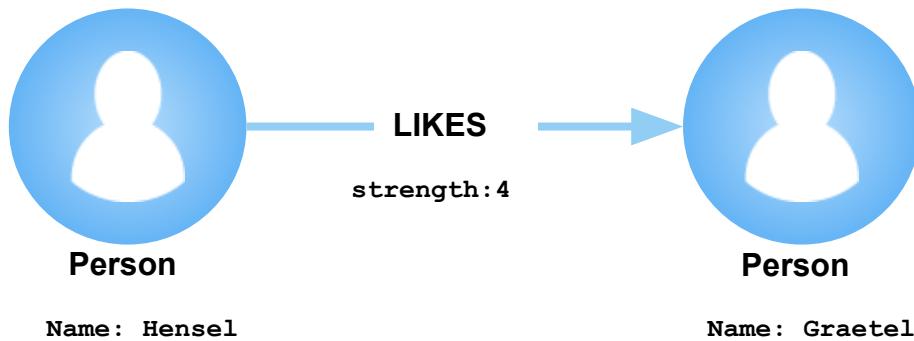
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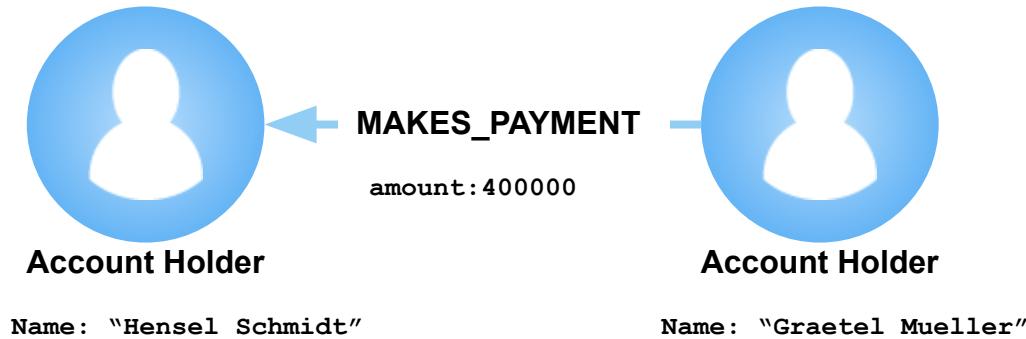
What is a Graph*? → This is already a Data Model!



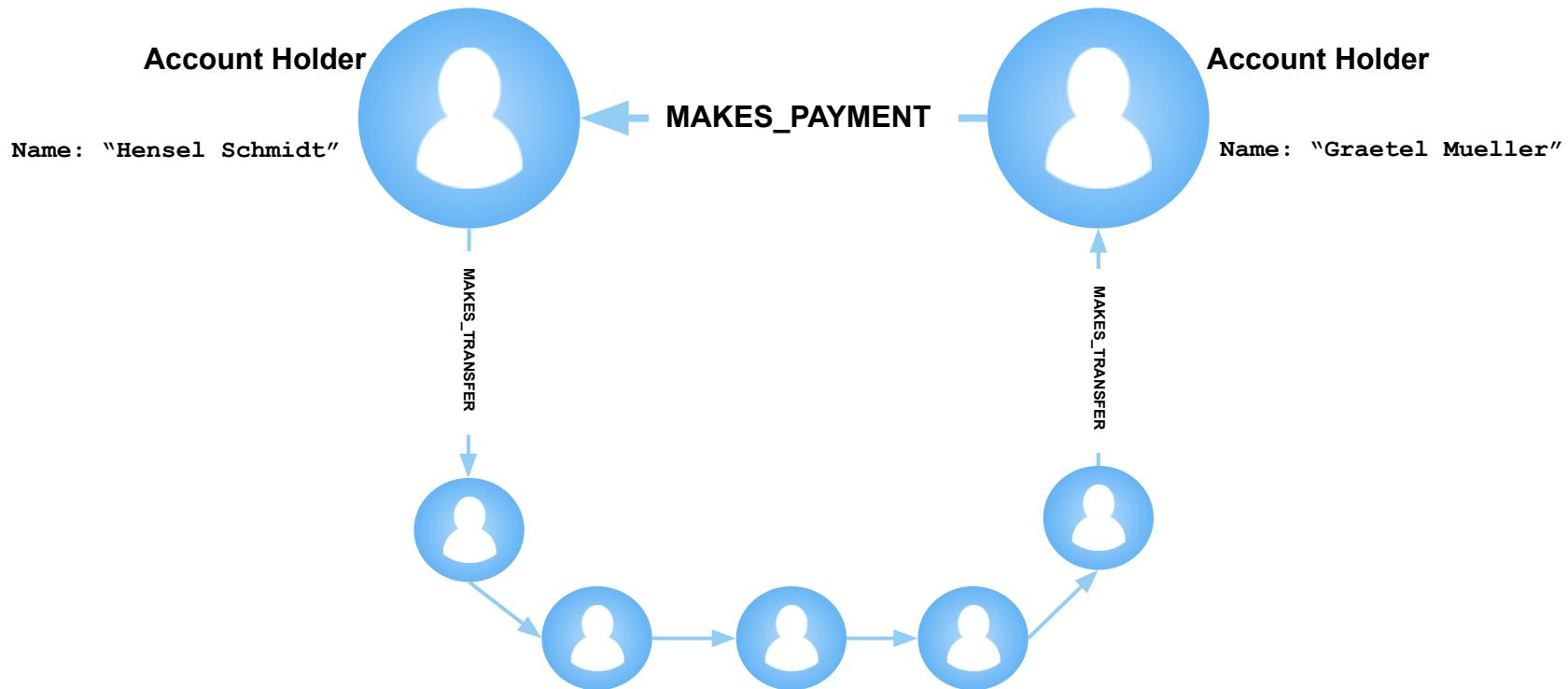
How can it be important for e.g. Anti Money Laundry?



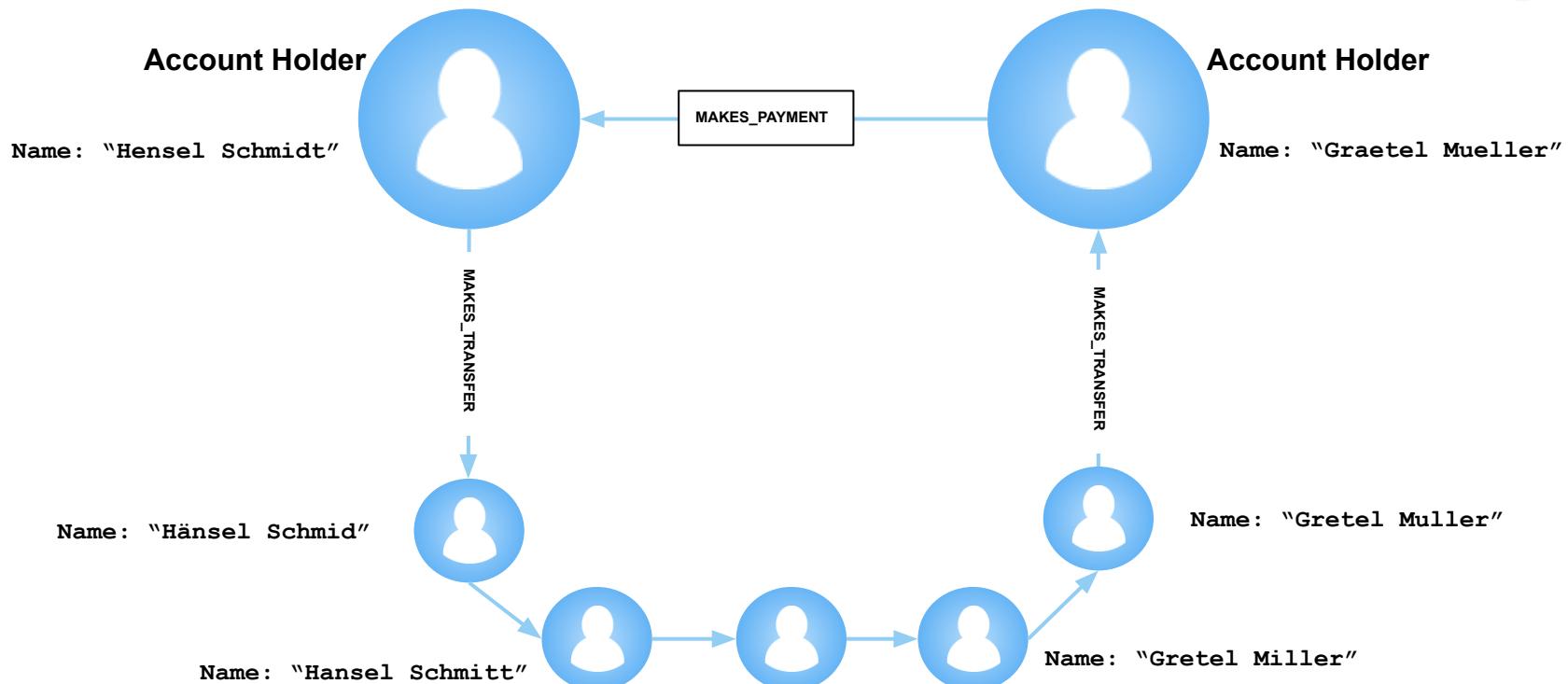
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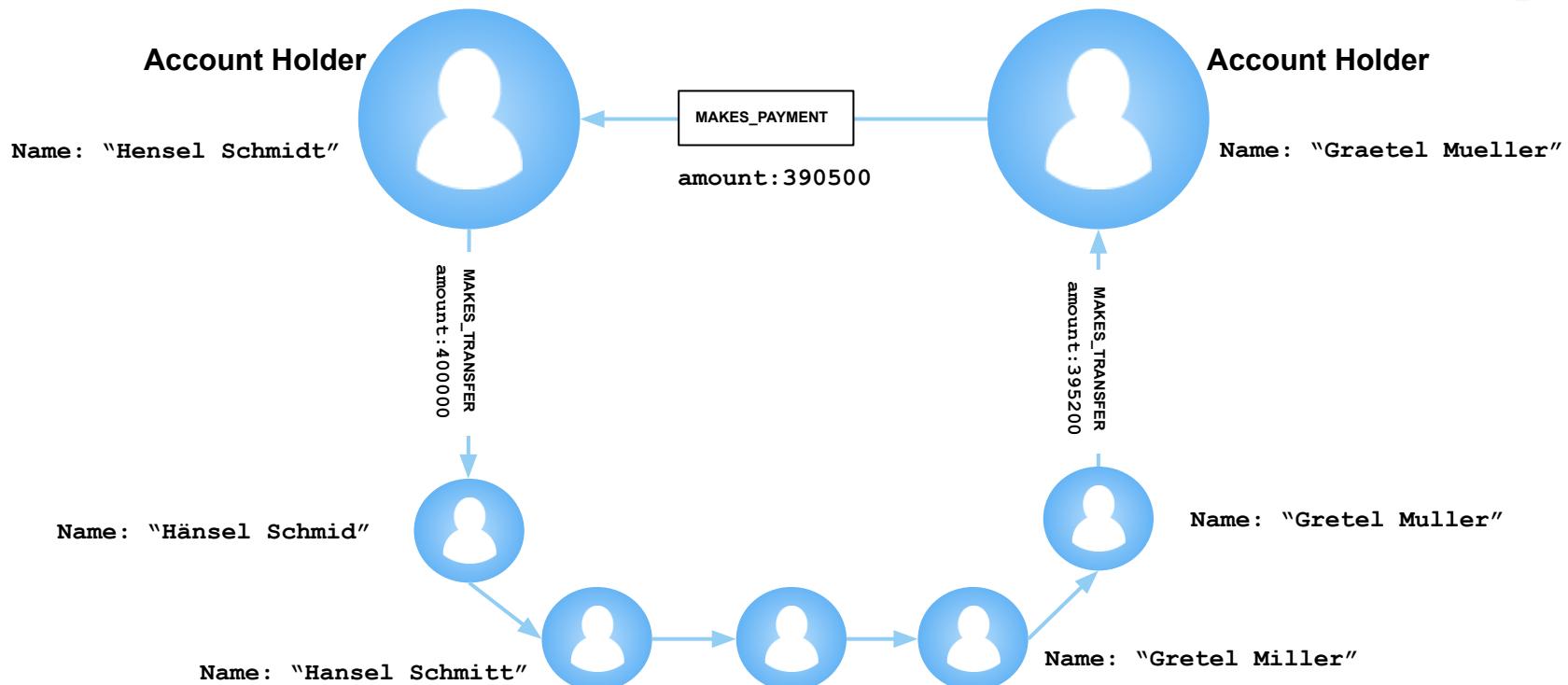
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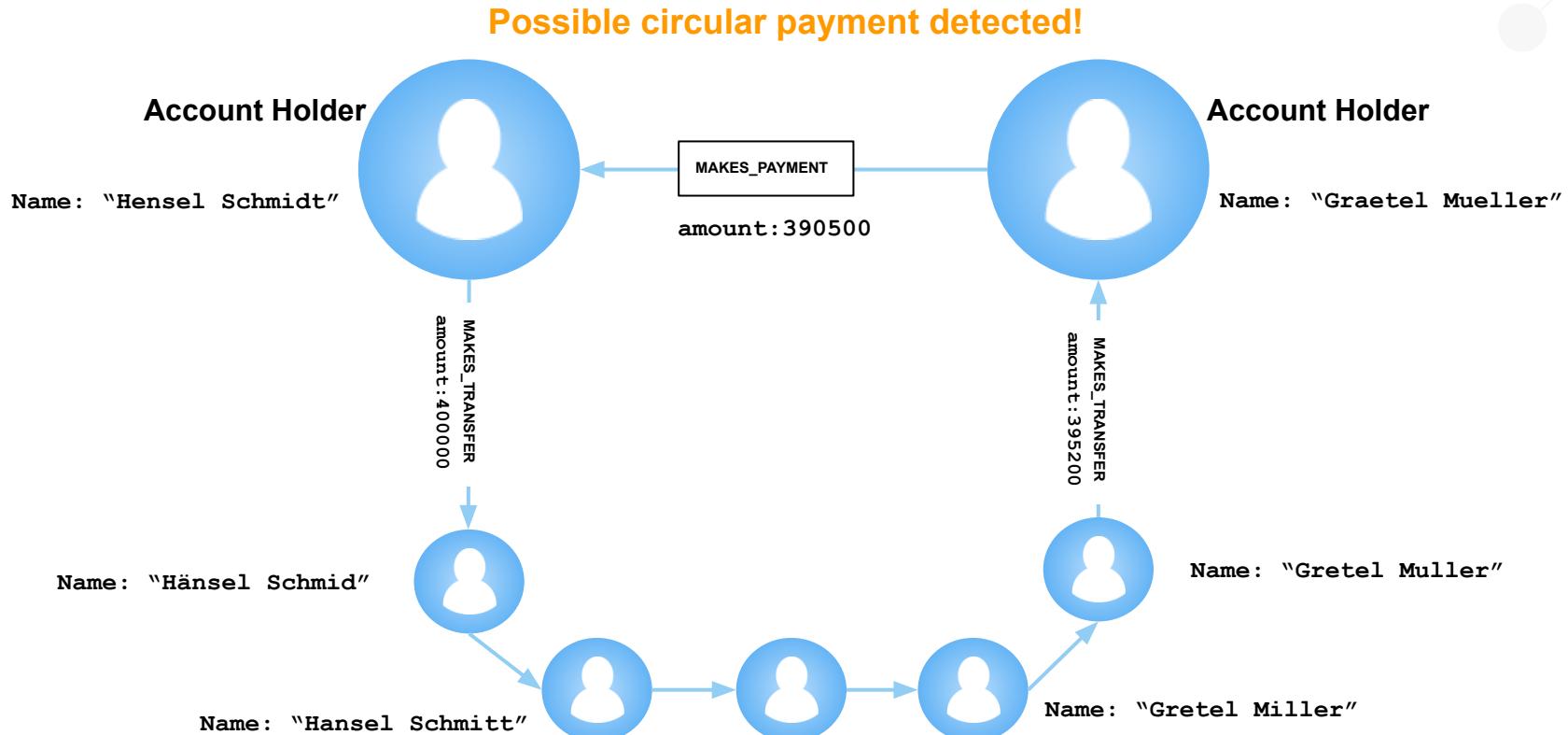
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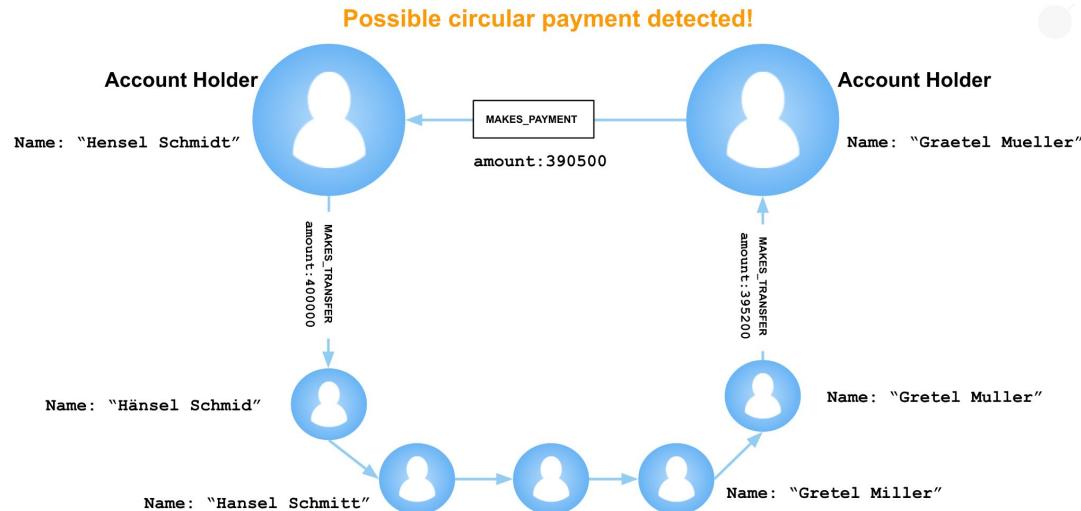
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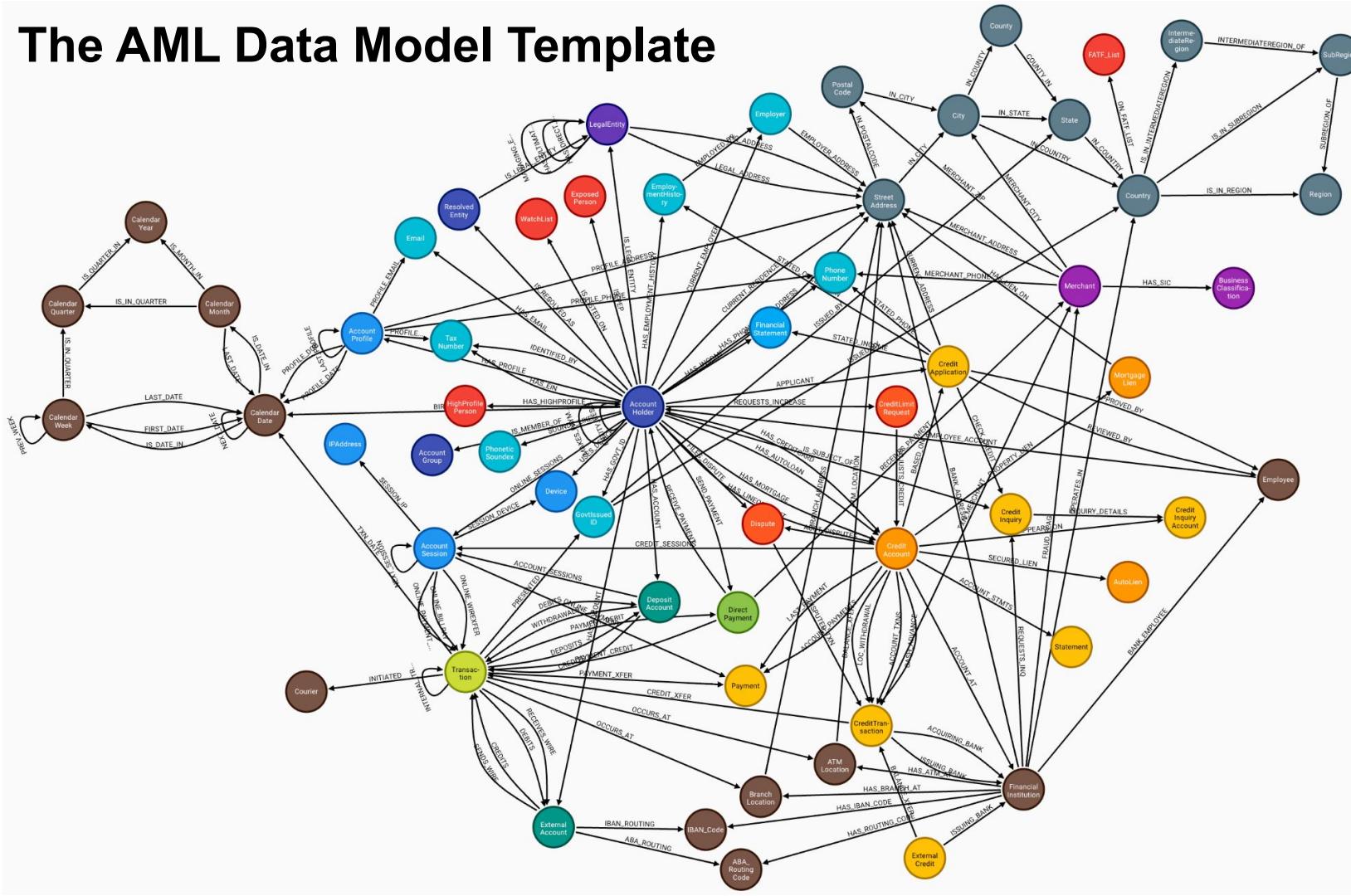
To gain business value, more **siloed data** is required!

For example:

- Personal Identifying Information (PII)
- Location Information (Geo information)
- Txn Information (cash flow)
- Temporal Information (Time of Txn)
- Access Information
- Similarity scoring
- ... and more!



The AML Data Model Template



DEMO TIME!

May the demo-god be with us! ;-)



What is the future of Graph Technology?





By 2025, **graph will be
used in 80% of data and
analytics innovations**

Gartner®

Neo4j Graph Data Science (GDS) Overview

Pathfinding & Search

- Shortest Path
- Single-Source Shortest Path
- All Pairs Shortest Path
- A* Shortest Path
- Yen's K Shortest Path
- Minimum Weight Spanning Tree
- K-Spanning Tree (MST)
- Random Walk
- Breadth & Depth First Search

Centrality & Importance

- Degree Centrality
- Closeness Centrality
- Harmonic Centrality
- Betweenness Centrality & Approx.
- PageRank
- Personalized PageRank
- ArticleRank
- Eigenvector Centrality
- Hyperlink Induced Topic Search (HITS)
- Influence Maximization (Greedy, CELF)

Community Detection

- Triangle Count
- Local Clustering Coefficient
- Connected Components (Union Find)
- Strongly Connected Components
- Label Propagation
- Louvain Modularity
- K-1 Coloring
- Modularity Optimization
- Speaker Listener Label Propagation

Supervised Machine Learning

- Node Classification
- Link Prediction



... and more!

Heuristic Link Prediction

- Adamic Adar
- Common Neighbors
- Preferential Attachment
- Resource Allocations
- Same Community
- Total Neighbors

Similarity

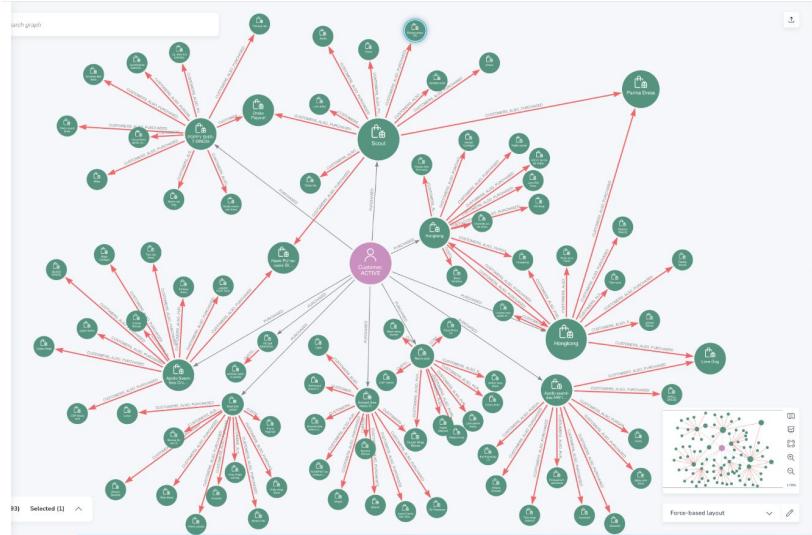
- Node Similarity
- K-Nearest Neighbors (KNN)
- Jaccard Similarity
- Cosine Similarity
- Pearson Similarity
- Euclidean Distance
- Approximate Nearest Neighbors (ANN)

Graph Embeddings

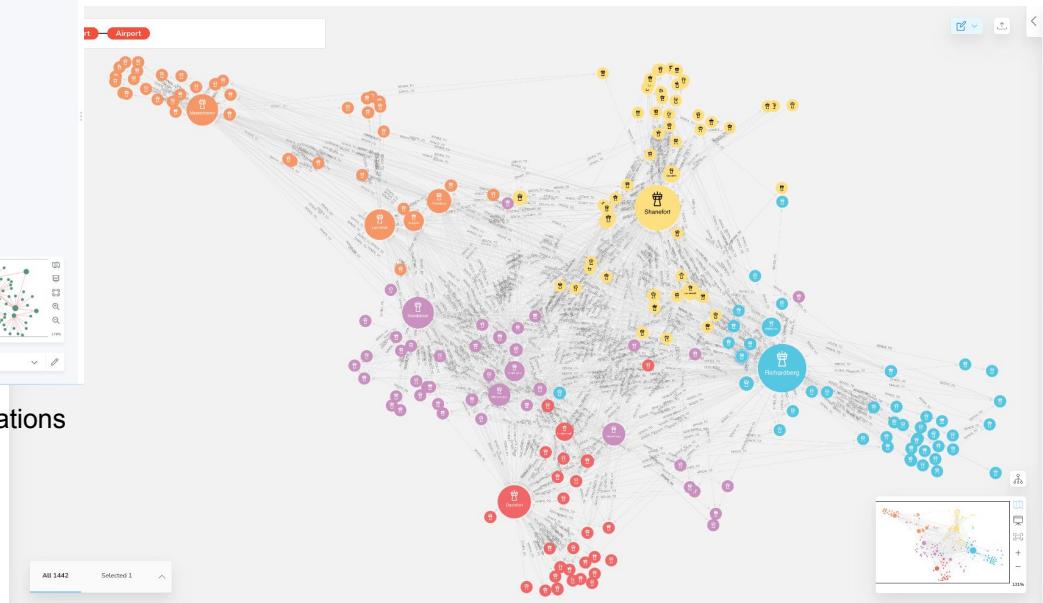
- Node2Vec
- FastRP
- FastRPExtended
- GraphSAGE

- Synthetic Graph Generation
- Scale Properties
- Collapse Paths
- One Hot Encoding
- Split Relationships
- Graph Export
- Pregel API (write your own algos)

Visualizations Make analysis easy to understand

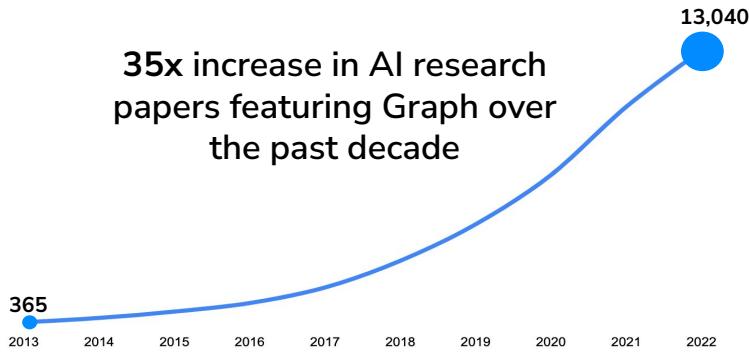


Recommendations from shared user interactions and associations



View the most well connected and influential nodes

More about why Graph starts to rock



“50% of Gartner inquiries about AI refer to the use of graph technology!”

An example of what Gartner mentioned

Helping the WHO to monitor health emergencies by monitoring data from world wide data sources and understand possible health emergencies

A presentation slide for the World Health Organization. The background is dark blue with a grid of light blue plus signs. In the center-left, the text reads "Knowledge Representation and Reasoning". Below it is a subtitle: "Timely and effective surveillance and intelligence for prevention of health emergencies". At the bottom left is the WHO logo and the text "World Health Organization". On the right side, there is a graphic of the Earth with a complex network of white lines connecting various points, symbolizing global connectivity or surveillance.

[Find the complete slides set here ...](#)

... and another Example

Search OpenSanctions

Search people, companies and other entities of interest...

Vladimir Vladimirovich Putin

Position · Spy · Sanctioned entity

Vladimir Vladimirovich Putin is subject to sanctions. See the individual program listings below. They are also a politically exposed person.

Facsheet Descriptions Relationships Data sources

OpenSanctions is free for non-commercial users. Businesses must acquire a data license to use the dataset.

Use the API License in bulk

Type Person

Name PUTIN Vladimir Vladimirovich · PUTIN, Vladimir Vladimirovich · Putin Vladimir Vladimirovich · Vladimir Putin · Vladimir Vladimirovich POUTINE · 9 more...

Other name Bladimir Putin · Vladimir Putin · PUTIN, Vladimir · Poulin Volodymyr Volodymyrovych · Poutine · 155 more...

Weak alias Platov, Платов · 253 more...

Birth date 1952-10-07

Place of birth Leningrad (now Saint-Petersburg) · Leningrad, Russia · Leningrad, adjourned Saint-Petersburg · Moscow, Russia · Saint Petersburg · 8 more...

Gender male

Nationality Russia · Soviet Union

Country Russia

First name Vladimir · Vladimir Vladimirovich · Braslavskiy · Braslaw

INN 71121108841

Keywords National government · Всеволода Краса · Погодина · Арефий Григорьевич · 19 more...

Last name POUTINE · PUTIN · Putin · Путин · Путин

Patronymic Vladimirovich

Second name ifeng.poutine@outlook.ru · putin.vladimir.v@yandex.ru

Loaded & Enriched

#3367047 Bashar Al-Assad

Legality Person SanctionedEntity

Search in the properties

alias AL ASSAD, Bashar Hafez; Bashar Hafiz Al Asad, ALASSAD, Bashar, alif al-Asad; Bashar Al-Assad; بشار الاسد · 7 یو · ۷۹ · بشار ال‌اسد

birthdate 1965-09-11

bvid

Missing value

caption Bashar Al-Assad

country SY

deathdate

Missing value

dissolutionDate

Missing value

dnsCode

Missing value

id NK-ac0z95528bz4SUbdnHdveJ

idNumber D1903

incorporationDate

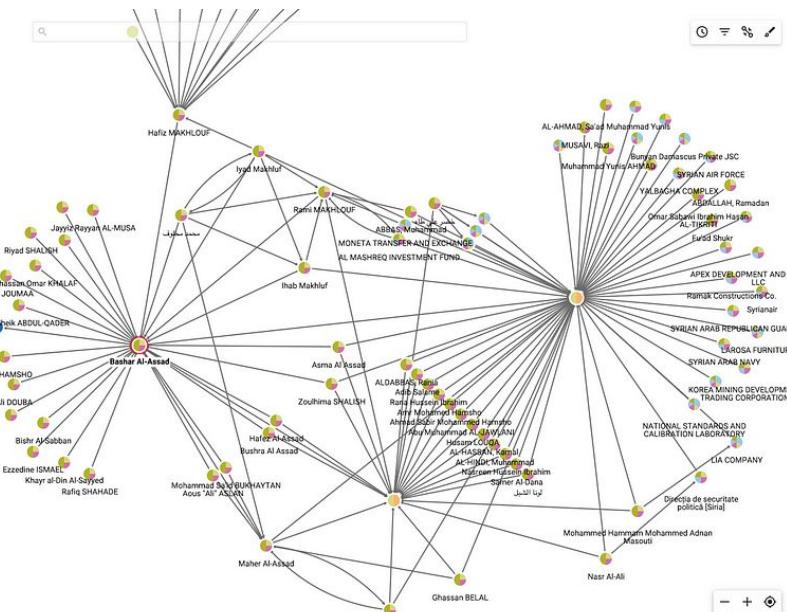
Missing value

innCode

Not saved



Analyzed & Visualized



Open Sanction List Talk

How can YOU start?

Some nice resources for a smooth start with Graph Technology



Continue your graph journey

Connect with passionate graphistas

Free Neo4j databases

- <https://sandbox.neo4j.com>
- <https://neo4j.com/cloud/aura-free/>

Free online training and certification

- dev.neo4j.com/learn
- dev.neo4j.com/datasets

Graph expert group - The Ninjas

- dev.neo4j.com/ninjas

Connect with the community:

- dev.neo4j.com/chat
- dev.neo4j.com/forum
- dev.neo4j.com/newsletter

Next developer events

- Live Streams - Weekly & Online
- Local Meetups neo4j.com/events



Other Neo4j Resources



[Cypher Style Guide](#)

- The cypher style guide provide recommendations for building clean, easy to read Cypher queries
- [Link to Cypher style guide](#)

[APOC Documentation](#)

- APOC is a great plugin to level up your cypher
- This documentation outlines different commands one could use
- [Link to APOC documentation](#)

[GraphGists](#)

- GraphGists has many different use cases and examples for specific industries
- [Link to GraphGists](#)

[Cypher Cheat Sheet](#)

- This page gives quick examples of how to write different queries within Cypher
- [Link to Cypher cheat sheet](#)

[Neo4j Graph Data Science Documentation](#)

- Neo4j Graph Data Science documentation is a great reference to see which algorithms to use
- Show how to use different algorithms
- [Link to Graph Data Science documentation](#)

[Arrows App](#)

- The Arrows app allows one to design a graph without using Cypher
- [Link to Arrows app](#)

[Neo4j Cypher Manual](#)

- The Cypher manual can be used to get more information about Cypher commands
- [Link to cypher manual](#)

[Neo4j Driver Manual](#)

- The driver manual provides the official drivers that are supported by Neo4j
- [Link to Neo4j driver manual](#)

[Neo4j Sandbox](#)

- The Neo4j sandbox provides a quick deployment of a Neo4j server
- It does not require a download
- Comes with example projects
- [Link to Neo4j Sandbox](#)

Meet the Neo4j Ninjas

Masters of Graphs

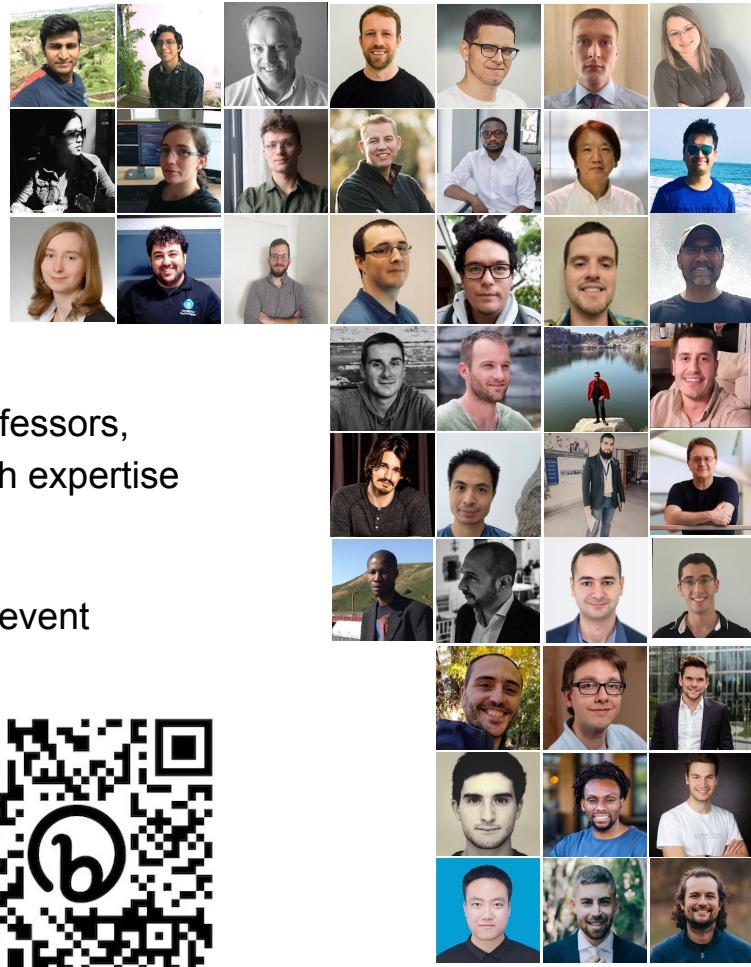
Ninjas are:

Active graph bloggers, presenters, GitHub contributors, professors, user group leaders, and researchers - all sharing their graph expertise

Benefits:

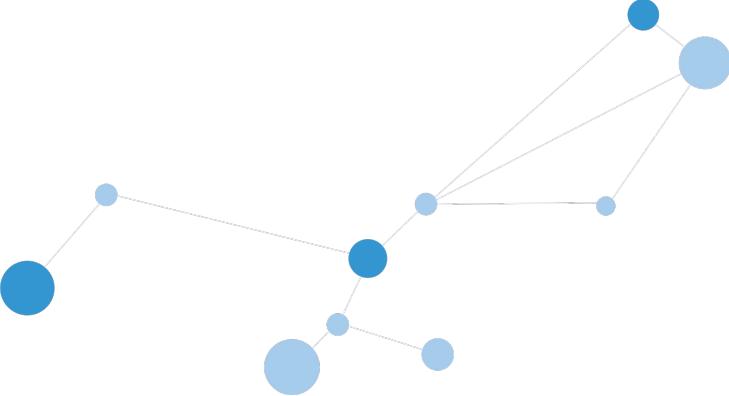
Ninjas benefit from exclusive access to Neo4j experts, VIP event experience, special giveaways and much more

Interested? For more information visit:



Q & A





Thanks for your time!

