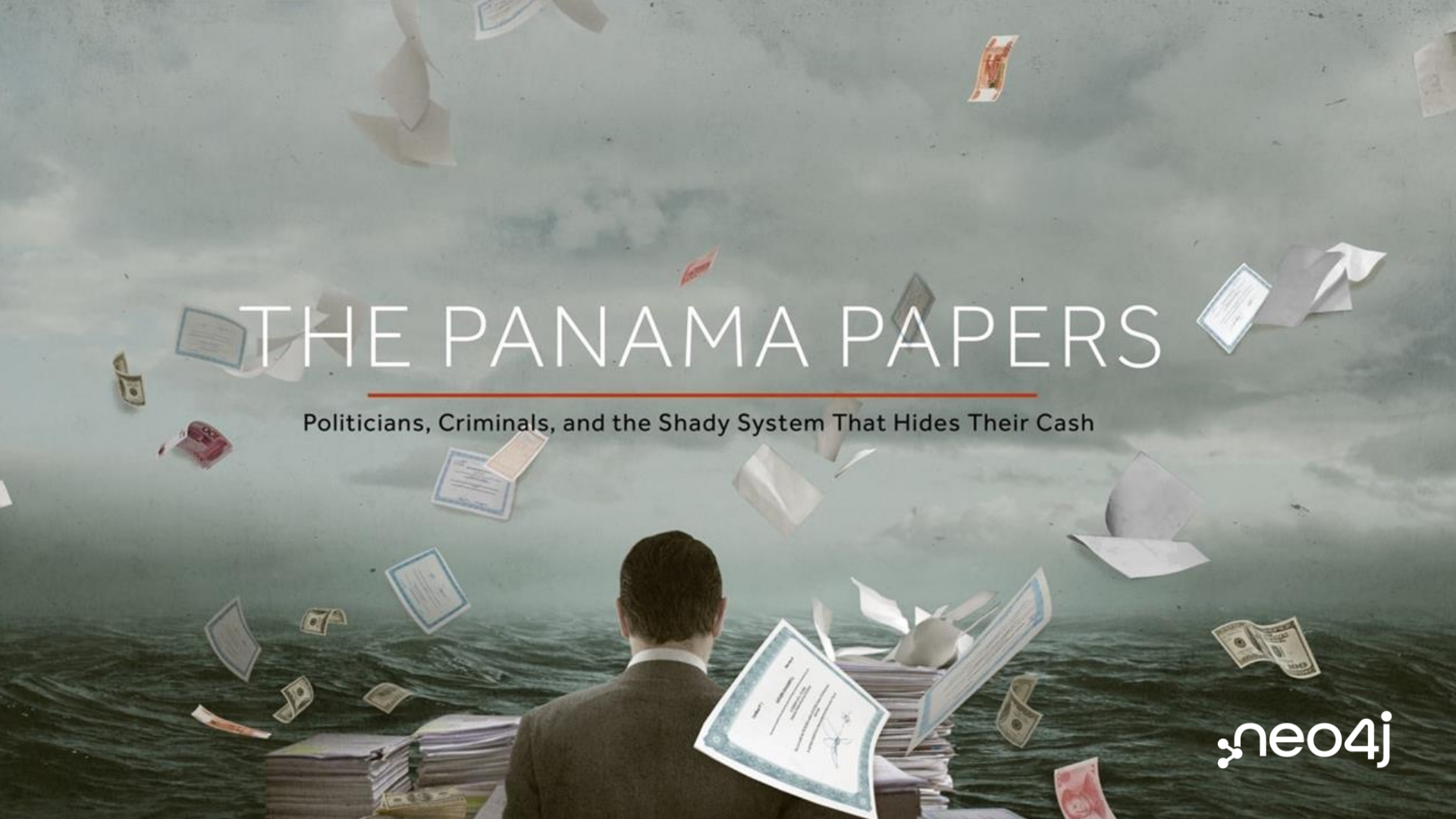
Knowledge Graphs for Transformation: Dynamic Context for the Intelligent Enterprise

Laxman Singh
Head, ASEAN & INDIA, Neo4j


THE PANAMA PAPERS
Politicians, Criminals, and the Shady System That Hides Their Cash
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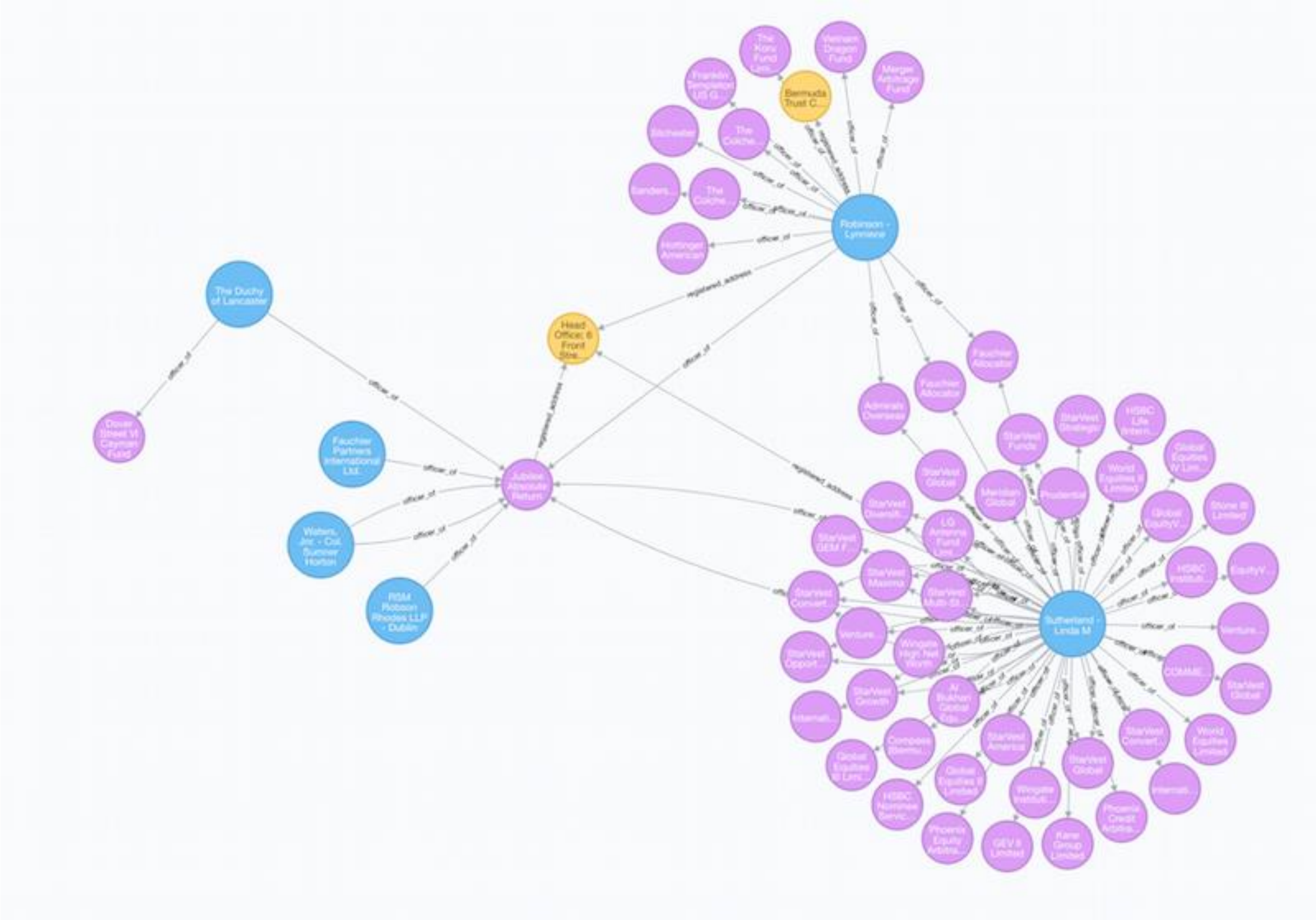
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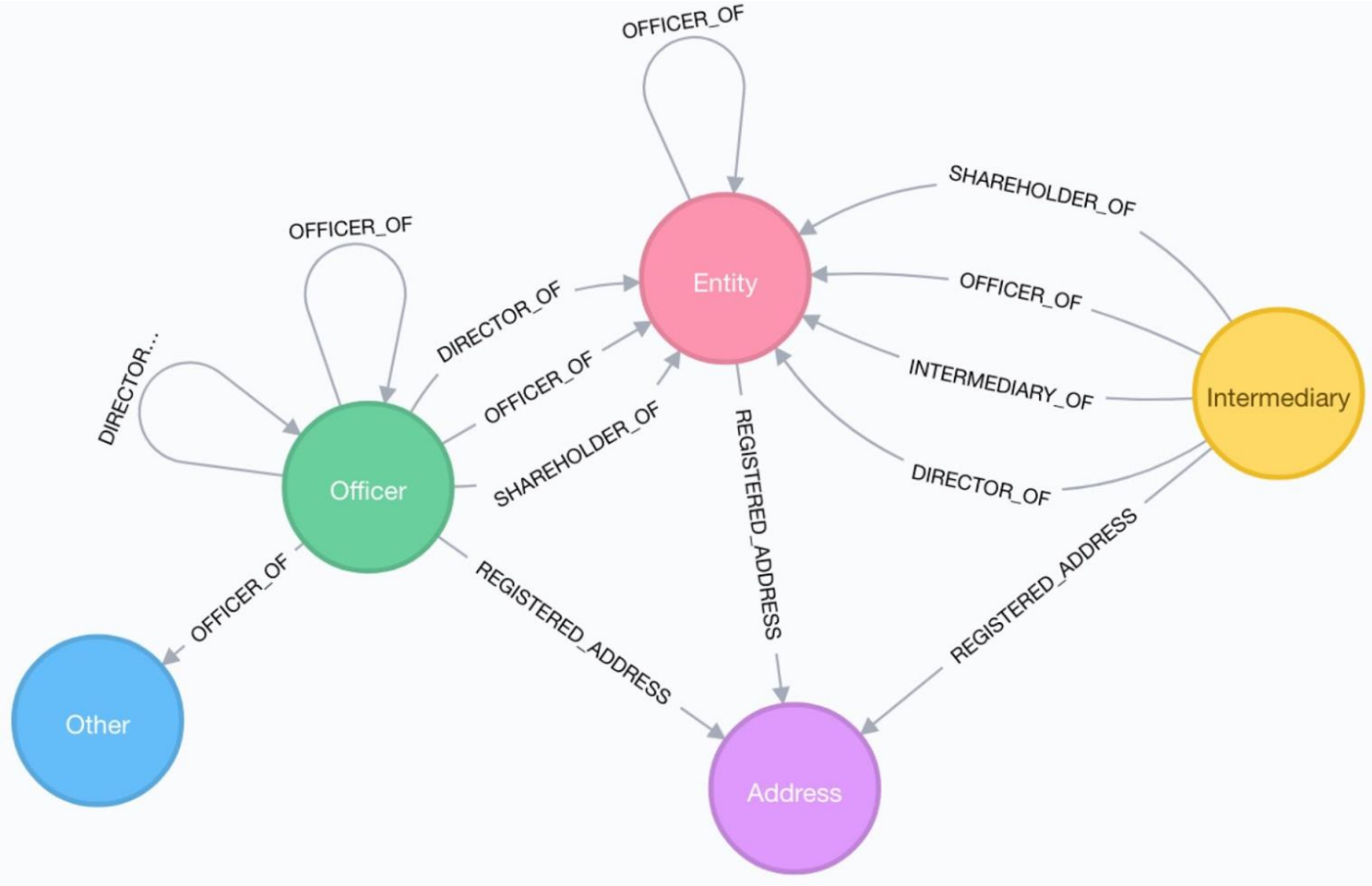
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UBS
LEVI STRAUSS & CO.
Danish Business Authority
SEGITEL
ebay
meredith
Microsoft
NOVARTIS
DB
C&S Wholesale Grocers
CISCO
FT
FINANCIAL TIMES
TODO 1
FACEIT
CHALLENGE YOUR GAME
Transparency One
trust-hub
The Orchard
orange
Vanguard
FUJITSU
MERCK
NTT COMWARE
legalzoom
LUCINITY
SIEMENS
pwc
浙商银行
CZBANK
GENERALI
BANCO PICHINCHA
En confianza.
MONSANTO
intel
COMCAST
AkerBP
中国电信
CHINA TELECOM
THRIVENT FINANCIAL
Santander
PRIORITY PAYMENT SYSTEMS
citi
BOSA
Federal Public Service Policy and Support
StarHub
adeo
Worldline
WESTERN UNION
EY
BMO
Itaú
Allianz
Maritz
SAMSUNG
RoyalCaribbean INTERNATIONAL
Bell
unified
ZURICH
scribestar
Tabcorp
Department for Education
novo nordisk
Boston Scientific
Advancing science for life™
K12
die Bayerische
HRI
Honda Research Institute
LAZARD
ASSET MANAGEMENT
precisely
Current
招商局集團
CHINA MERCHANTS GROUP
CATERPILLAR
dun & bradstreet
telenor
VOLVO
ERIKS digital
Discovery
Airbus
MediaMath
APIAX
Deloitte.
IBM
BASF
The Chemical Company
LOCKHEED MARTIN

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Pulse Survey, 2020

88%

CXOs believe knowledge graphs will significantly improve bottom line

Customer Segmentation Analysis, 2020

Two-thirds

of Neo4j customers have implemented knowledge graphs

Every

[graph] use case starts with a knowledge graph

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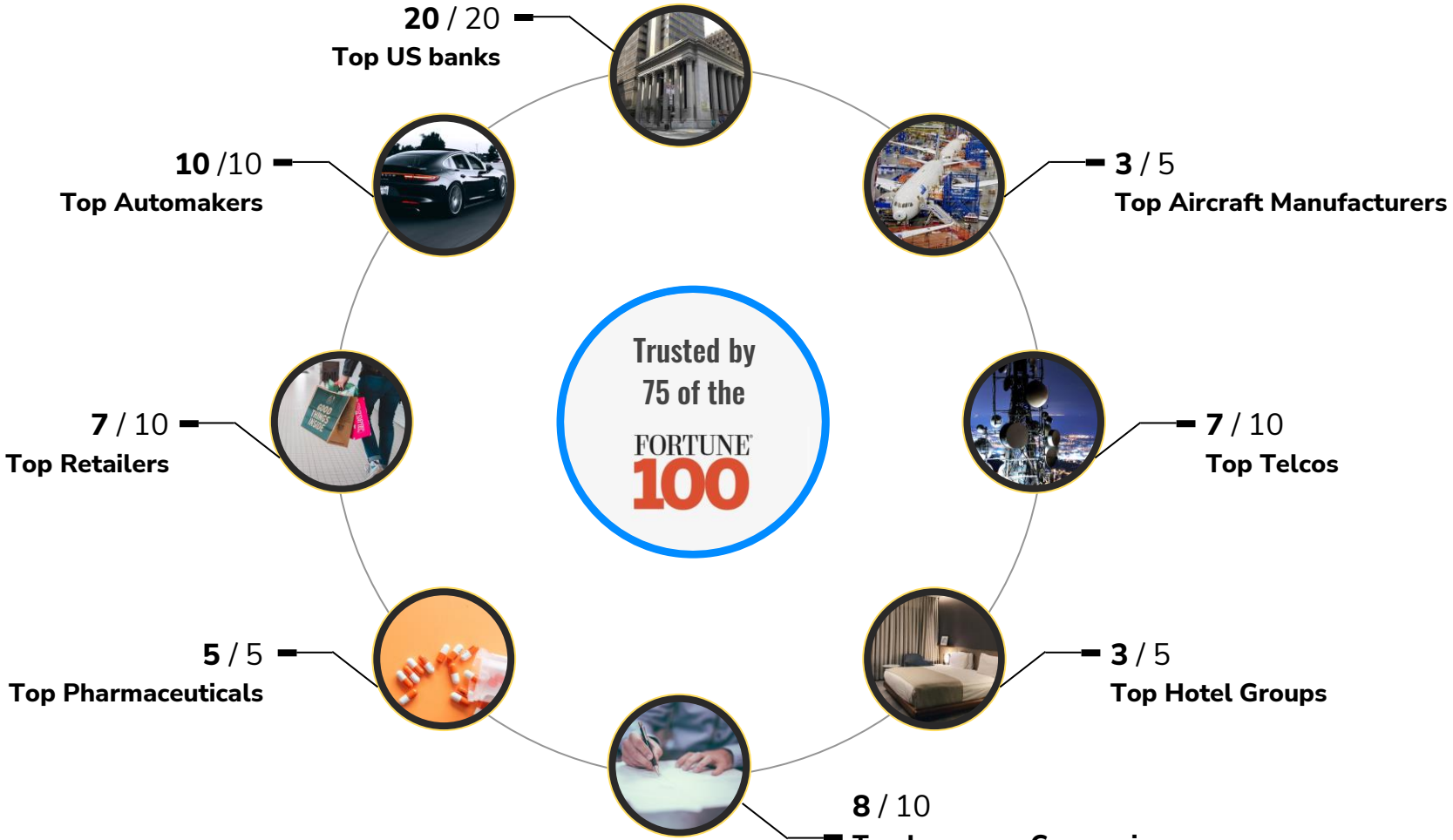


By 2025, graph will be used in 80% of data and analytics innovations

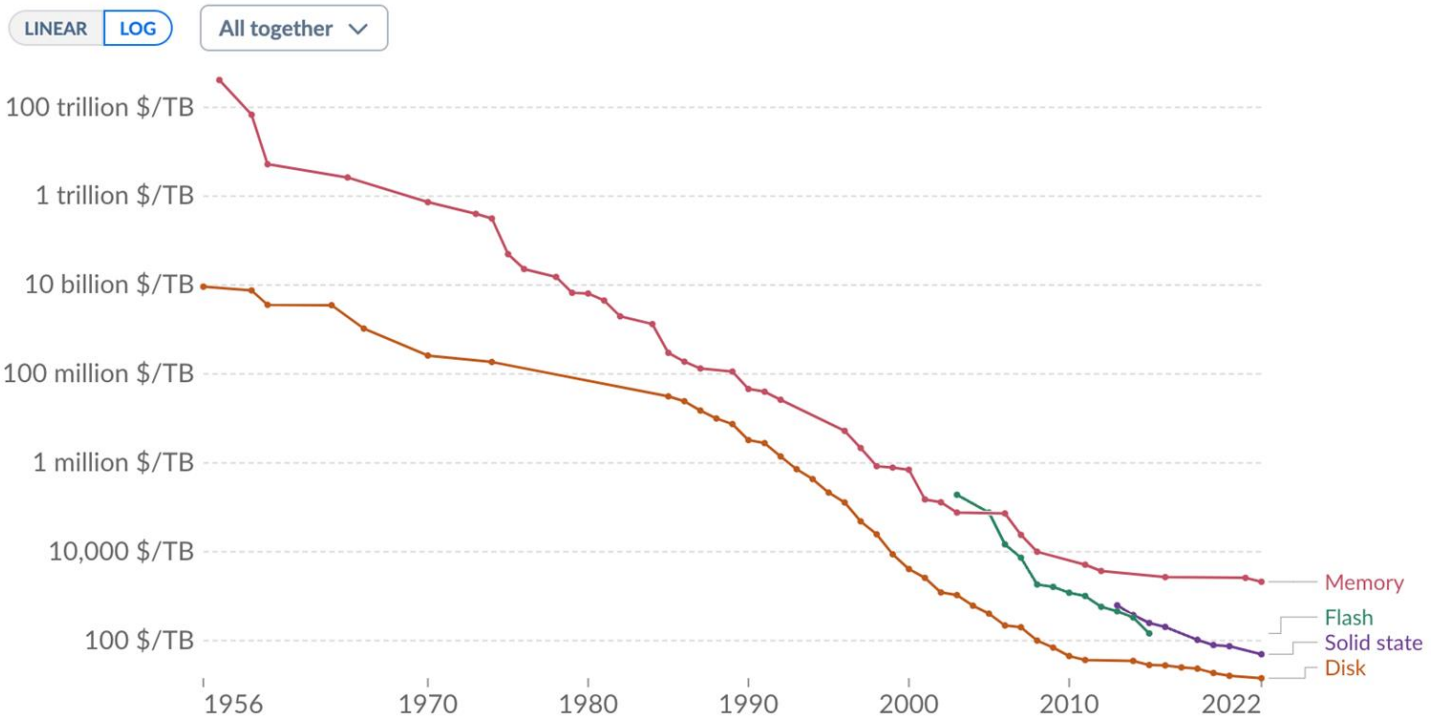
Gartner

neo4j

Historical cost of computer memory and storage

This data is expressed in US dollars per terabyte (TB). It is not adjusted for inflation.

Our World in Data



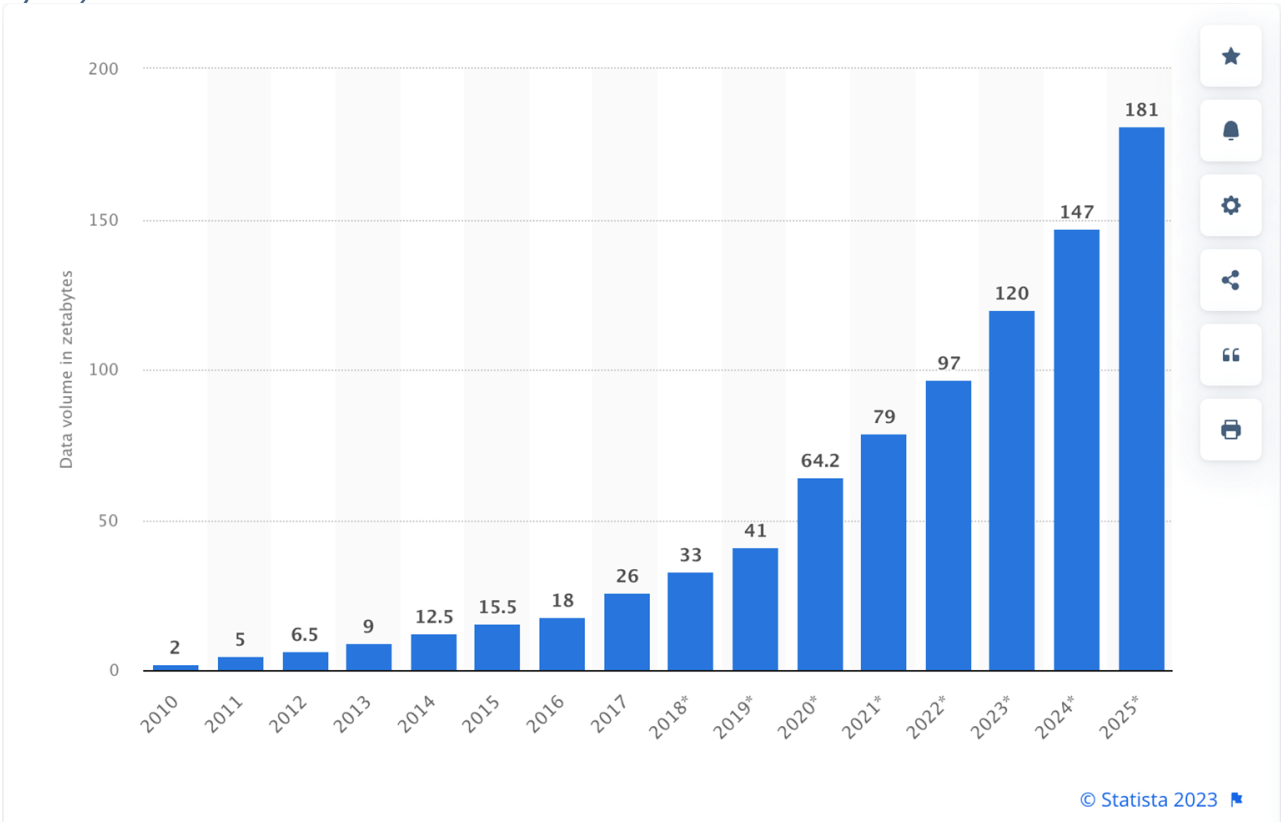
Source: John C. McCallum (2022)

Note: For each year, the time series shows the cheapest historical price recorded until that year.

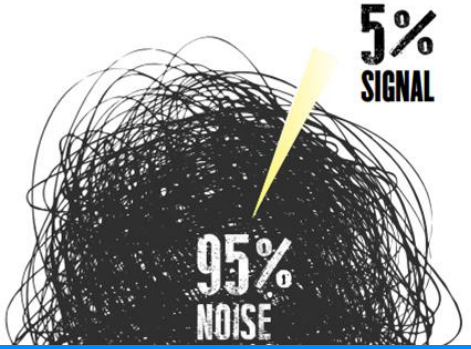
OurWorldInData.org/technological-change • CC BY

Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2020, with forecasts from 2021 to 2025

(in zettabytes)



938 of Fortune 1000
had a T1-2 supplier impacted by the pandemic



75% of executives aren't confident in their data quality

Good forecasts are just **less bad forecasts**

Opportunities from 2020

Brittleness
→ Antifragile

Unintended consequences
→ Uncovered dependencies

Low signal
→ Relevancy

Perishable insights
→ Responsiveness

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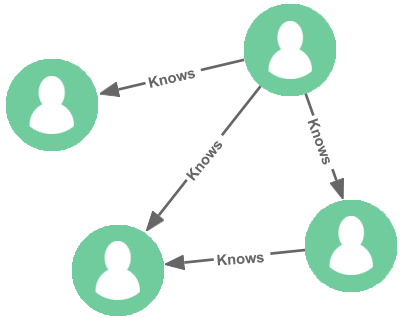
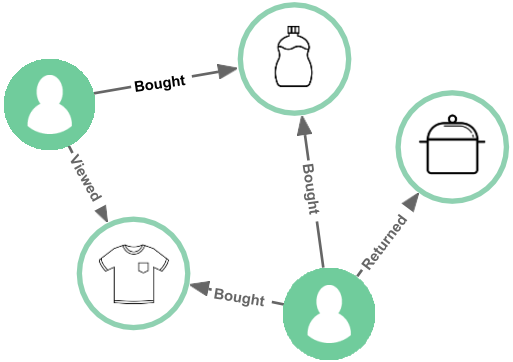
The Connected Data Imperative

Connections in the data are as valuable as the data itself



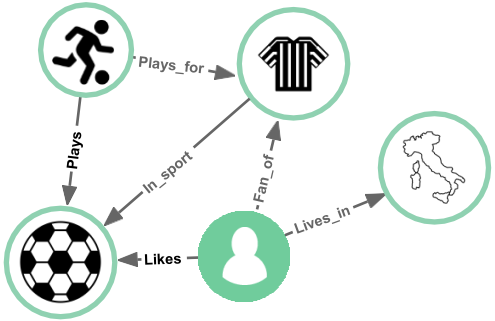
Networks of People

E.g., Employees, Customers, Suppliers, Partners, Influencers



Transaction Networks

E.g., Risk management, Supply chain, Payments



Knowledge Networks

E.g., Enterprise content, Domain specific content, eCommerce content

Every Decision Depends on Context

Humans make tens of thousands of decisions every daily.

We depend on context.

Machine learning and AI also needs this connected information.

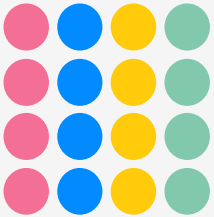
Our challenge is to make context practical and actionable.

Driving Intelligence into Data with Knowledge Graphs

Data
Ingestion

No Context

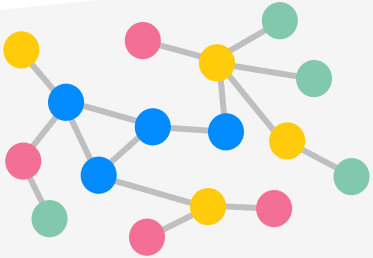
CONTEXT



Knowledge Base
Semantics

Static
Shallow
Context

GRAPH



Knowledge Graph
Graph Queries
Graph Algorithms & ML
Graph Visualization

Dynamic
Deep Context

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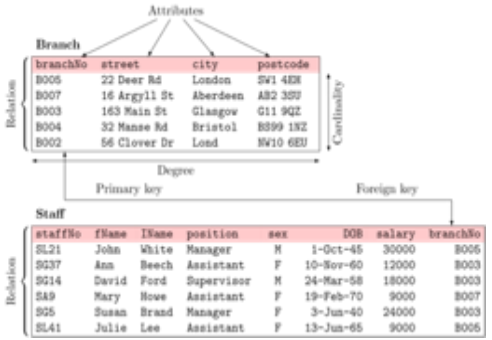
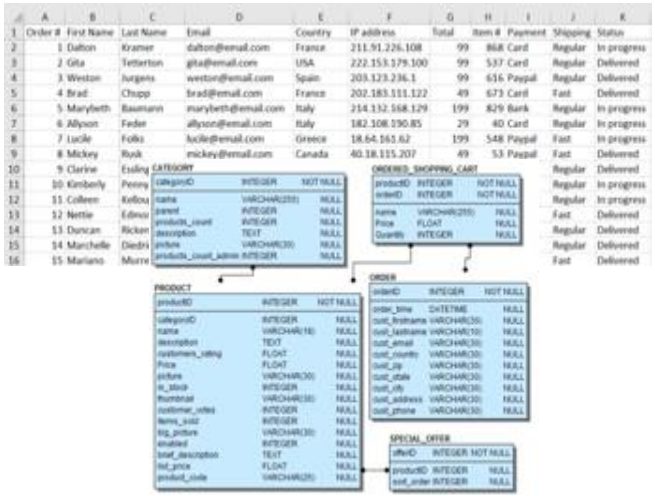
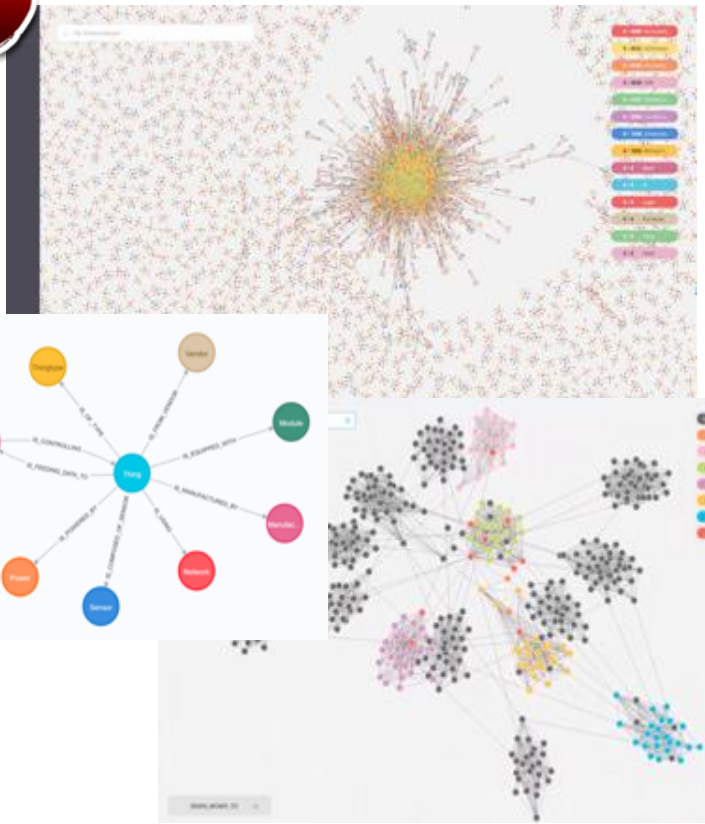
Traditional Database





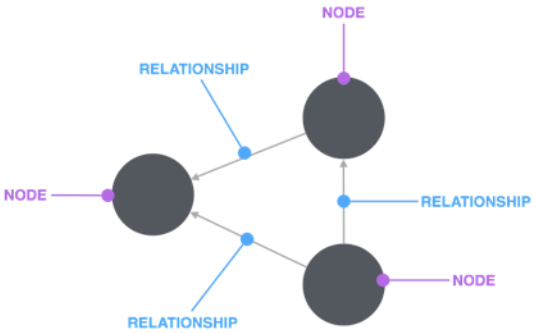
VS

Graph Database



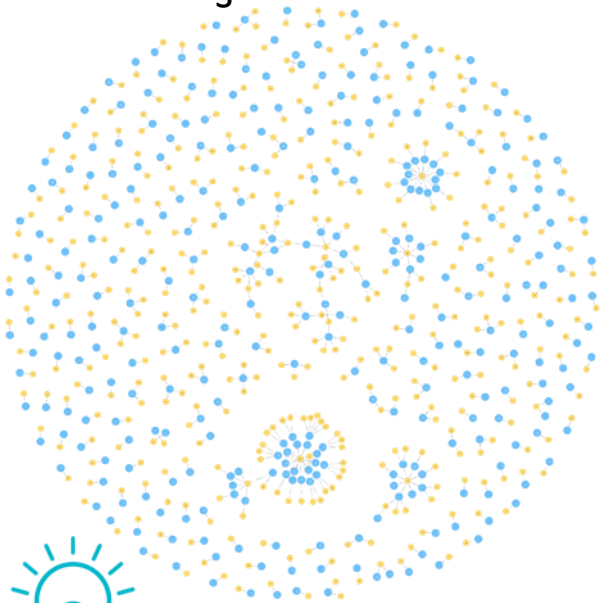
Graph Databases

Relationships



Context

Patterns



Actionable Insight at Lightning Speeds

Neo4j - The Graph Company

The Industry's Largest Dedicated Investment in Graphs

Creator of the **Property Graph** and **Cypher** language at the core of the **GQL** ISO project

Thousands of Customers World-Wide

HQ in **Silicon Valley**, offices include **London**, **Munich**, **Paris** & **Malmo**

Industry Leaders use Neo4j

20/25 Top Financial Firms

7/10 Top Retail Firms

7/10 Top Software Vendors

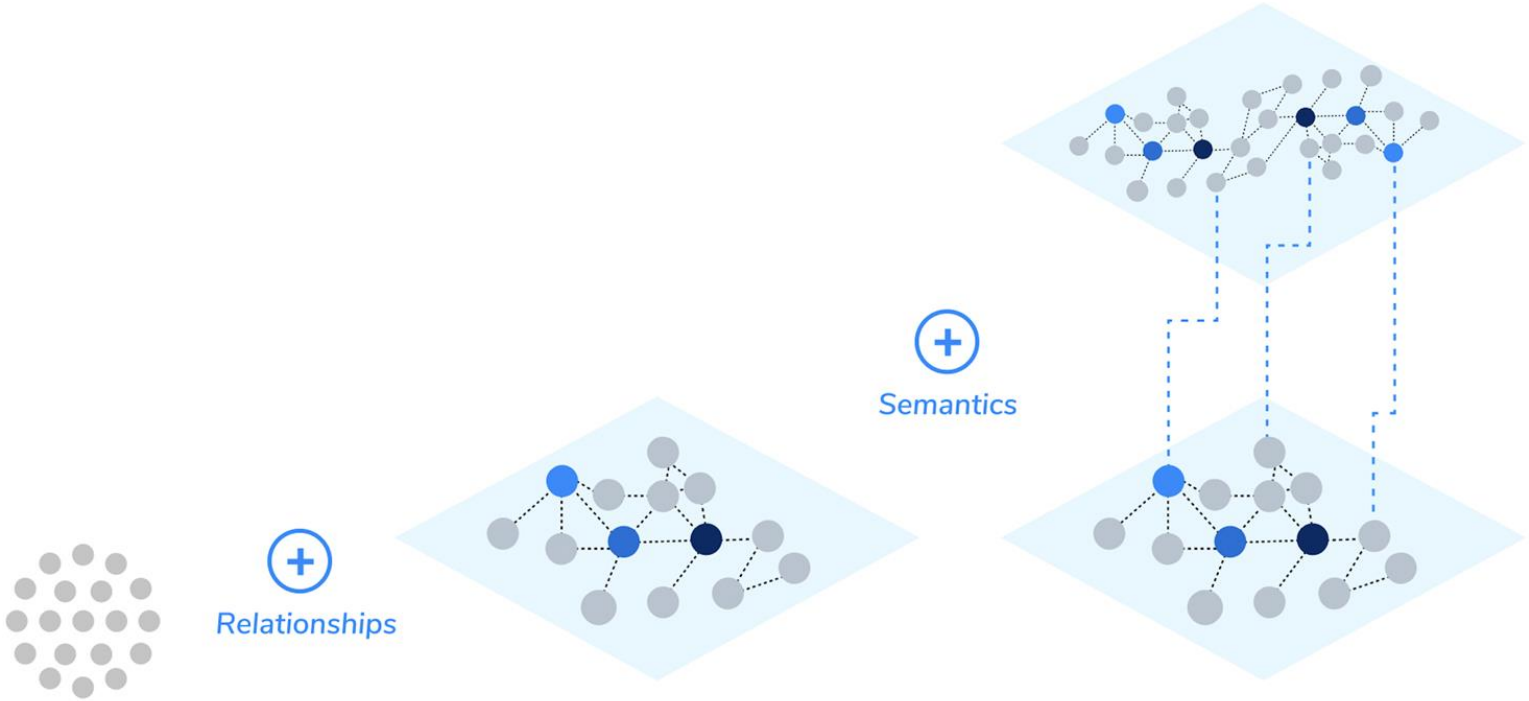
Anyway You Like It

On-Prem

In the Cloud

DB-as-a-Service

Driving Intelligence into Data with Knowledge Graphs



Data

Graph
Dynamic Context

Knowledge Graph
Deep Dynamic Context

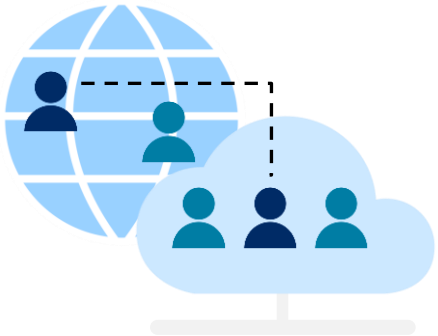
What is Semantics?

Controlled Vocabularies

Synonym Rings	Taxonomy	Thesaurus	Ontology

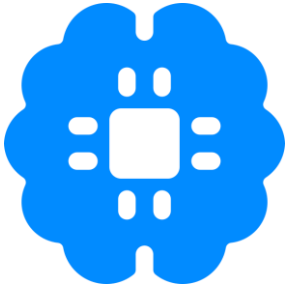
C O M P L E X I T Y

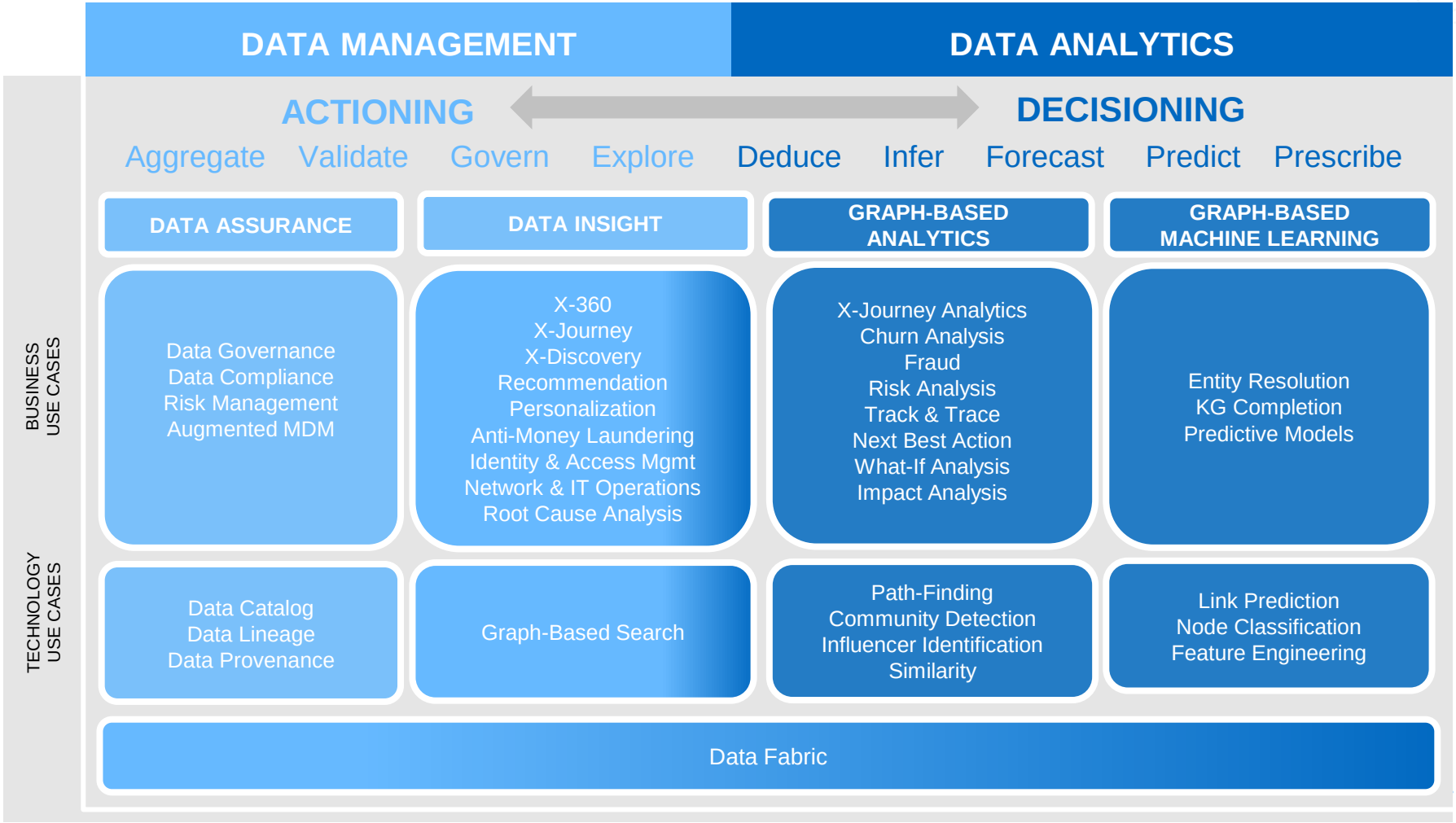
Entity Resolution & Analysis



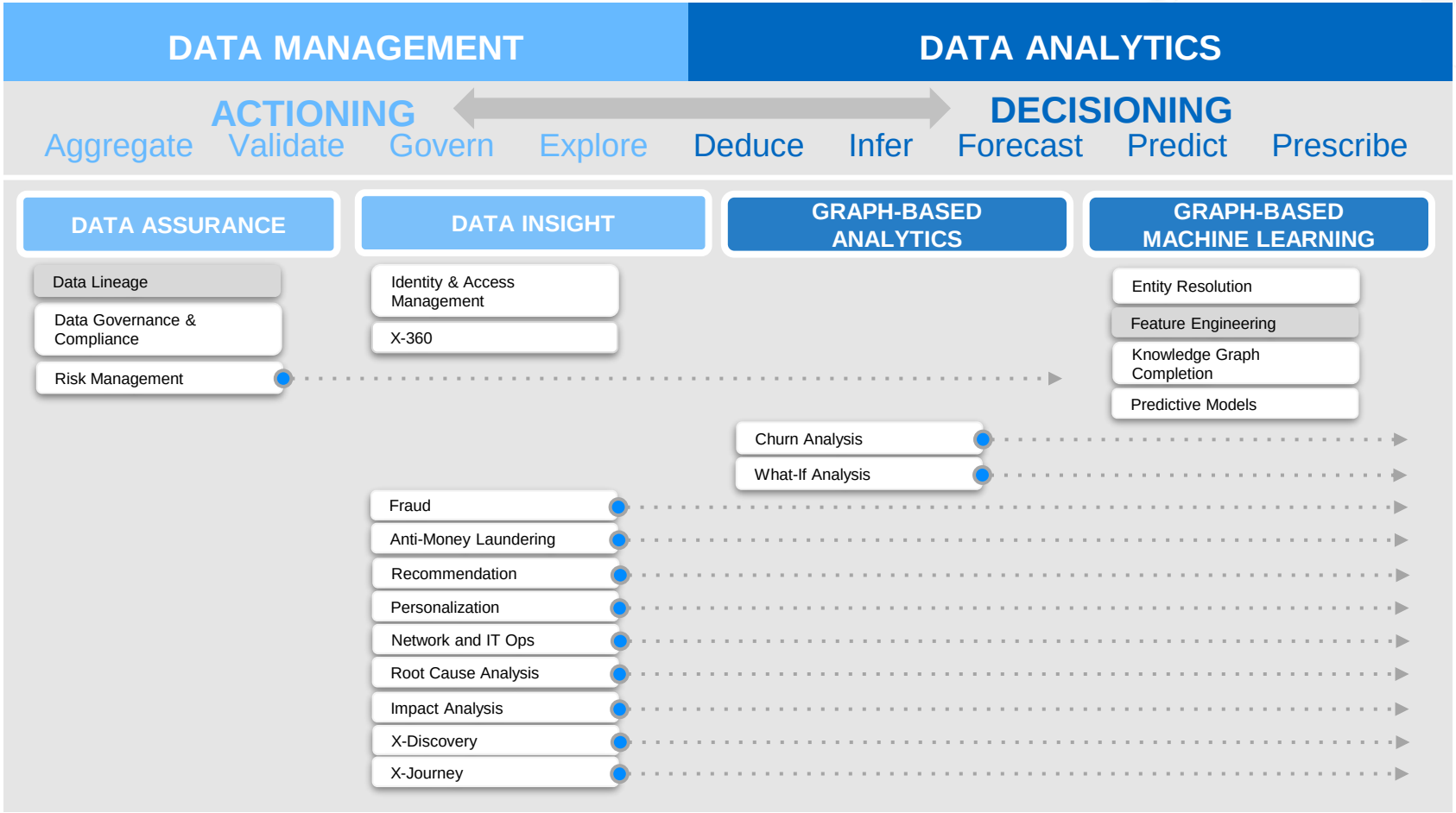
Classification & Tagging

Artificial Intelligence

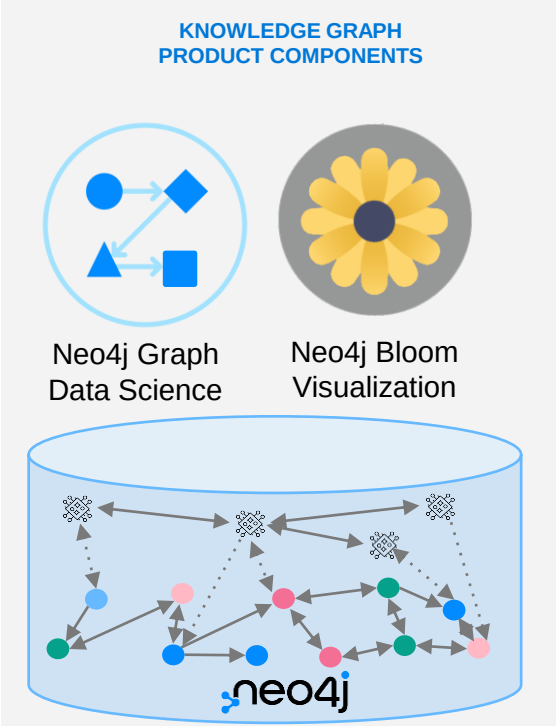



DATA MANAGEMENT
DATA ANALYTICS
ACTIONING
DECISIONING
Aggregate
Validate
Govern
Explore
Deduce
Infer
Forecast
Predict
Prescribe
DATA ASSURANCE
DATA INSIGHT
GRAPH-BASED ANALYTICS
GRAPH-BASED MACHINE LEARNING
BUSINESS USE CASES
Data Governance
Data Compliance
Risk Management
Augmented MDM
X-360
X-Journey
X-Discovery
Recommendation
Personalization
Anti-Money Laundering
Identity & Access Mgmt
Network & IT Operations
Root Cause Analysis
X-Journey Analytics
Churn Analysis
Fraud
Risk Analysis
Track & Trace
Next Best Action
What-If Analysis
Impact Analysis
Entity Resolution
KG Completion
Predictive Models
TECHNOLOGY USE CASES
Data Catalog
Data Lineage
Data Provenance
Graph-Based Search
Path-Finding
Community Detection
Influencer Identification
Similarity
Link Prediction
Node Classification
Feature Engineering
Data Fabric

Knowledge Graph Use Case Spectrum

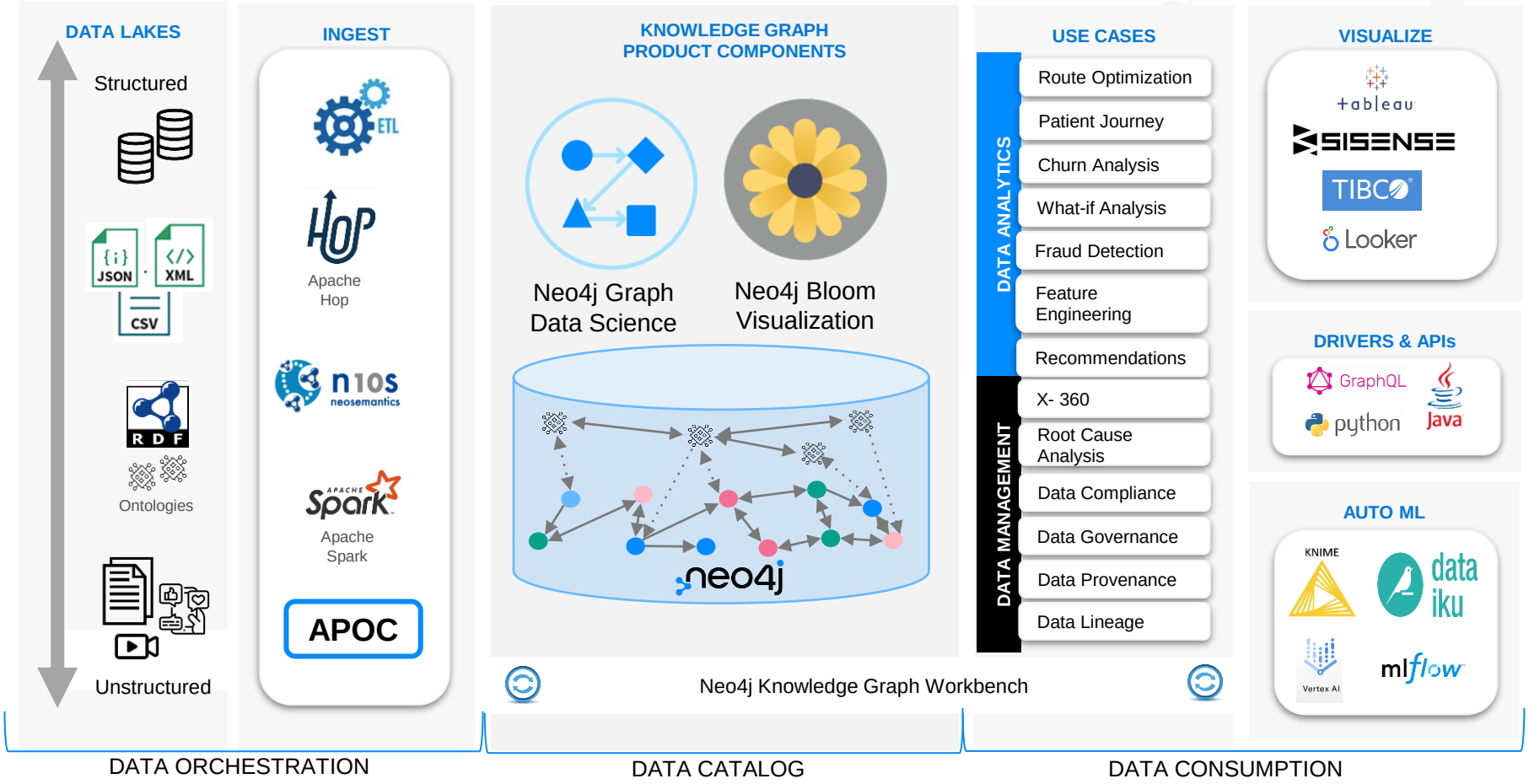


The Neo4j Knowledge Graph Product Components

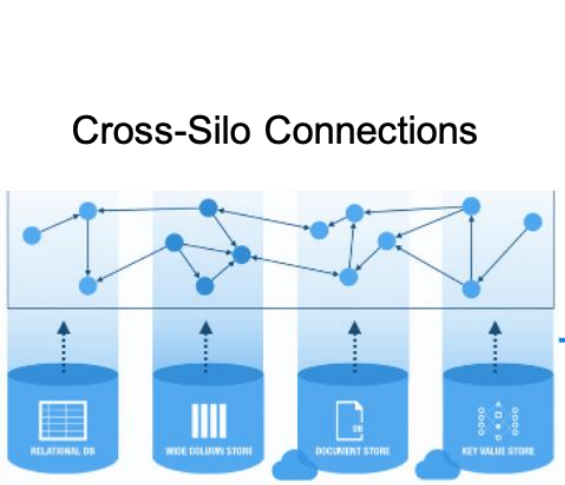


Neo4j Knowledge Graph Workbench

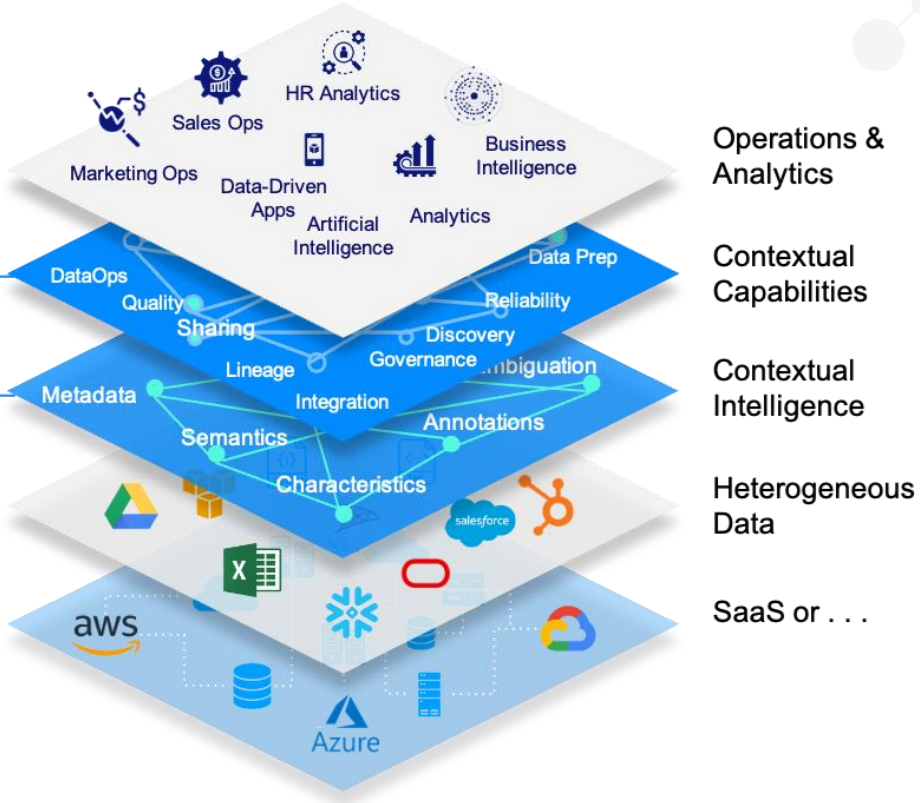
Knowledge Graphs Connect the Ecosystem



How do you Transform leveraging Knowledge Graph



From Bridging Silos….



To Building a Data Fabric

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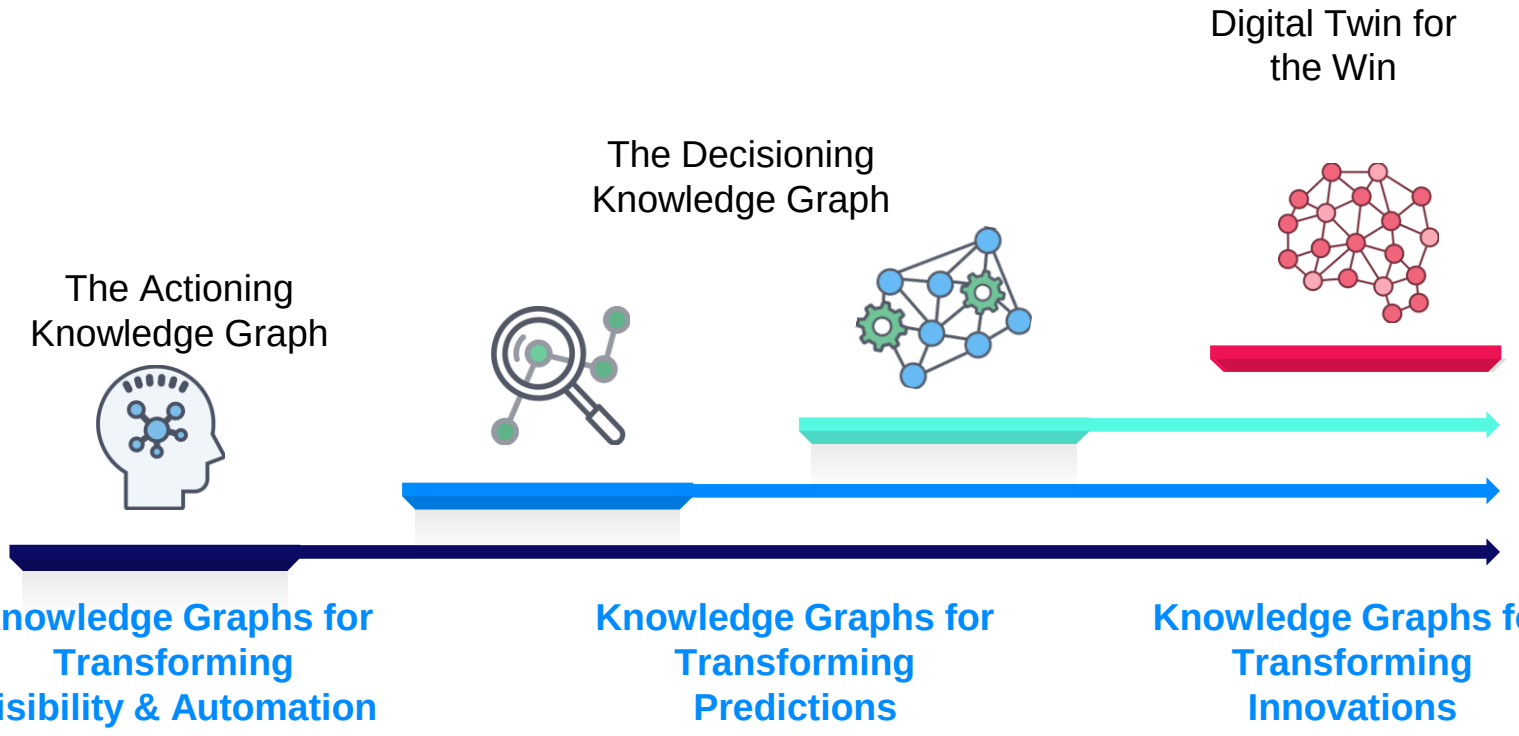
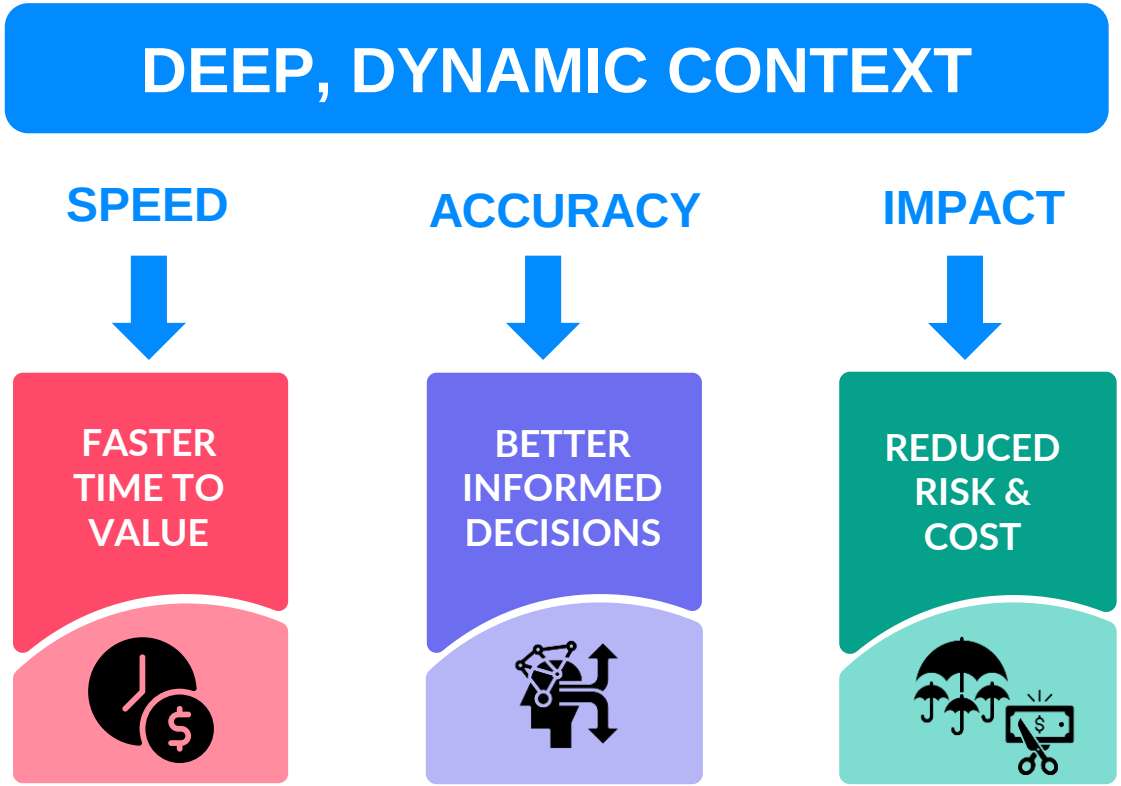
Continued…



A Force Multiplier for Businesses



Knowledge Graphs at Work

NASA Data Discovery

Using a knowledge graph, NASA engineer working on the Orion mission found information from the Apollo project which prevented an issue and **saved 2 years of work and $1m.**

Astra Zeneca Patient Journey

Using a knowledge graph , Astra Zeneca identified influential touch points at the earliest moment in a patient's journey to make a **significant impact to patient lives and improve patient outcomes.**

UBS Data Governance

Using a knowledge graph, UBS has built a data lineage tool that provides complete visibility and transparency of their data flows **in compliance with BCBS 239 regulations.**

Faster Time To Value

Better Informed Decisions

Reduced Risk and Cost

GenAI and how are Knowledge Graphs Relevant?

Generative AI

A branch of artificial intelligence that focuses on creating models and algorithms capable of generating **new and original content**. Unlike traditional AI models that are typically designed for specific tasks and rely on pre-existing data, generative AI aims to **generate novel outputs** based on learned patterns and insights from training data.

ChatGPT is a well known example of a generative AI.

ChatGPT, write me a poem about Sales Development Reps selling Neo4j:

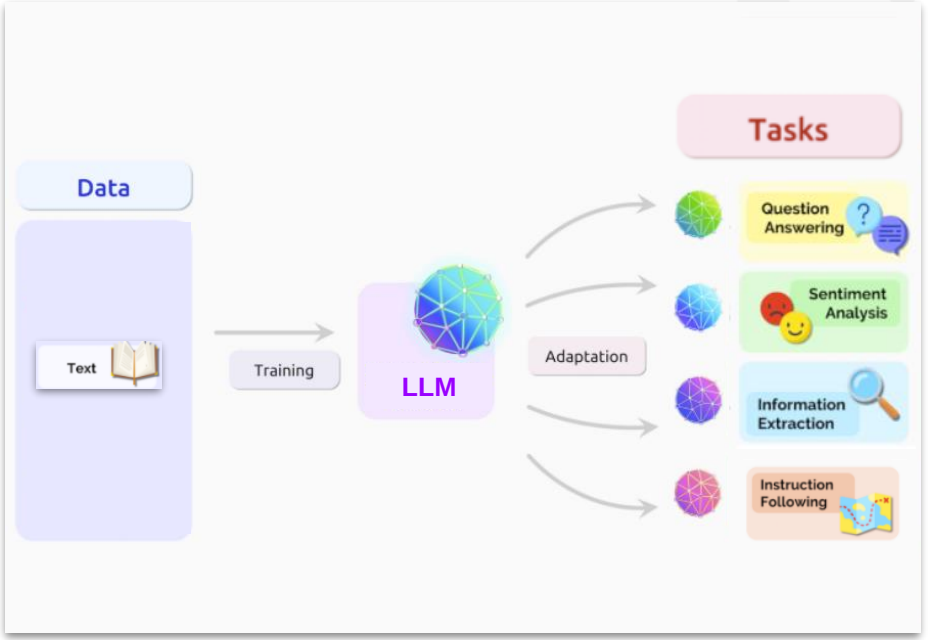
In the realm of data's boundless might,
Sales Development Reps take flight,
With Neo4j, their vision's bright,
They weave a tale, selling it just right.

Large Language Model (LLM)

A type of Generative AI that is trained on vast amounts of content.

Currently seen as the “**GenAI for language/text**”.

ChatGPT is a Large Language Model.



Why are LLMs so hot right now?

Enterprises see an opportunity to:

1. Automate data retrieval tasks
2. Improve customer service experiences
3. Expedite reading, understanding, and summarizing
4. Content & code generation

… save time and money, improve growth and retention

LLM Challenges

Why the Challenge With LLMs?

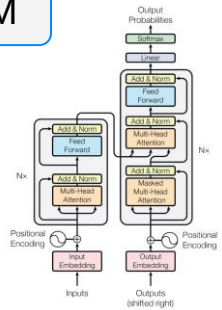
Core function is predicting what words come next - not whether those words are accurate/factual

- GPT training focuses primarily on predict the probability of which text comes next in a sequence based on widely sourced text corpora
- Some supervised fine-tuning for specialized tasks are included, but it is a relatively small piece

Input

When you play the game of thrones….

LLM



Output

, you win or you die. There is no middle ground.

Top Challenges with LLMs in the Enterprise

1. Knowledge cut-off because of how long training takes (i.e. OpenAI 2021)
2. Hallucinations:
   - Reasonable answers, not always accurate
   - Can inherit bias through training data
   - Lack of enterprise domain knowledge
3. Inability to verify or attribute sources
4. Knowledge Drain and time spent on training with your data since Enterprises will Adopt multiple LLMs
5. Auditability

LLMs:

Great language understanding
Issues with factual accuracy and consistency

	Parrot	ChatGPT
		
Learns random sentences from random people	✓	✓
Talks like a person but doesn't really understand what it's saying	✓	✓
Occasionally speaks absolute non sense	✓	✓
Is a cute little bird	✓	✗

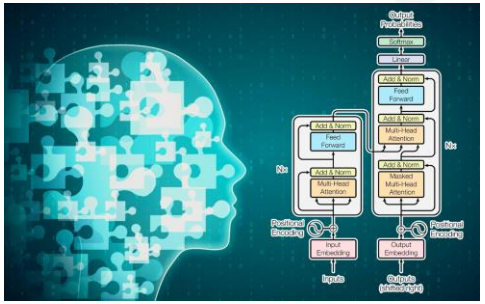
How can Neo4j help

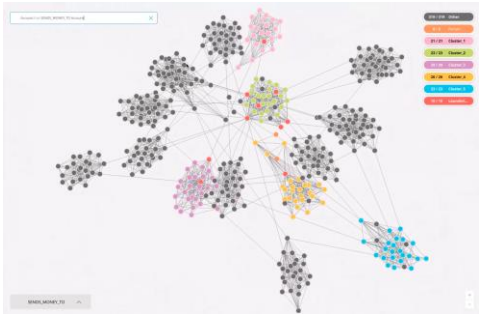
Neo4j & Generative AI

Unlock Enterprise Data: Large Language Models (LLMs) + Knowledge Graph

neo4j.com/generativeai/

1. **Generative AI Tailored to Your Organization:** Use Neo4j to tailor GenAI to your enterprise, improve accuracy, and reduce errors
2. **Vectors+GraphDB** Together
3. **Retain** Enterprise Domain **Knowledge**
4. **Future proof** your Enterprise **with Interoperability**
5. **Explaibility & Regulatory Auditability**
6. **Jumpstart Knowledge Graphs with LLM:** Use LLMs with Neo4j for entity extraction and Knowledge Graph creation
7. **Deep Partnerships with Generative AI Cloud Providers**



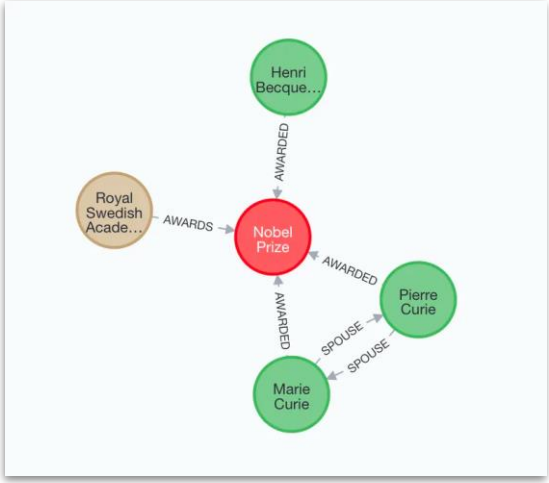


Creating a Knowledge Graph From Unstructured Text is Difficult

Involves:

1. **Entity Extraction**: Process of identifying entities from words/phrases in unstructured text and classifying them as belonging to specific classes/types - a.k.a Named Entity Recognition (NER)

2. **Relationship Extraction:** Process of identifying relationships between pairs of entities based on unstructured text



Creating a Knowledge Graph From Unstructured Text is Difficult

Traditional entity extraction pipelines can be

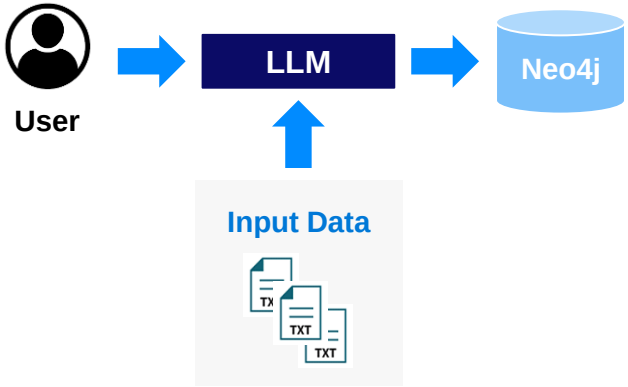
- resource intensive
- difficult to transfer/generalize:
  - specialized NLP libraries/tools
  - domain specific
  - require subject matter expertise
  - lots of trial & error
  - Mix of business rules, machine learning, and custom hand-rolled logic

LLMs can Jumpstart Knowledge Graph Creation

LLMs can be prompted to:

1. **Extract data from unstructured text**
   - Entity extraction, including pronouns and partial references
   - Entity disambiguation
   - Extraction of semantic relationships

1. **Aide or directly perform graph ingestion**
   - Generate Cypher for ingesting extracted data
   - Structure extracted data (triples, json, csv) to work with Cypher insert templates



Neo4j integrations with partner GenAI/ML offerings

Deep Partnerships with Generative AI Providers

LangChain

LlamaIndex

MICROSOFT — OpenAI & Azure ML

GOOGLE — Bard & Vertex AI

AMAZON AWS — Bedrock & SageMaker

neo4j

Three massive opportunities

Apps

High-performance, agile data model with ACID transactions for mission critical systems.

Analytics

Fast processing of billions of connected data points with industry-standard algorithms.

GenAI

Knowledge graphs.+ LLM.

Thank You!