:neo4j graphsummit

Hands-On GraphRAG Workshop

Building Smarter GenAI Apps with Knowledge Graphs

Chris Booth
Solutions Engineer
chris.booth@neo4j.com

Abe Mauleon
AI West Founder and total legend
info@aiwest.co.uk

Workshop Rules

- Ask questions straight away, this is an interactive session
- Raise your hand if you are stuck
- Have fun

Before We Start

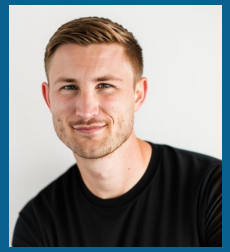
1. Set up a blank sandbox **https://sandbox.neo4j.com/**

2. Download the repo **https://github.com/cbooth-neo4j/AI_WEST_WORKSHOP**

3. Open with your IDE and **follow the README.md** to set up a new virtual environment

Agenda

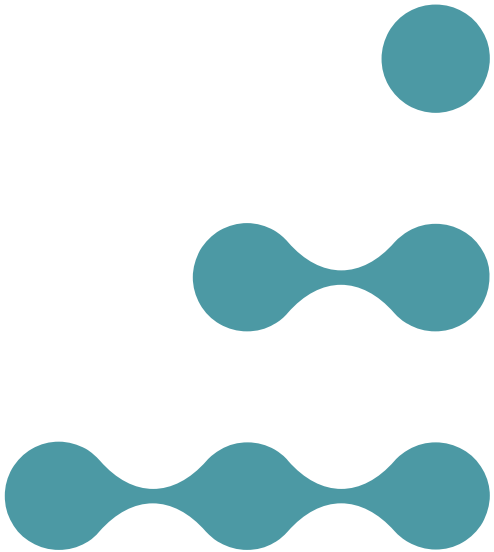
1. What are AI agents
2. What is GraphRAG
3. Get building!



Chris Booth

- Solutions Engineer @ neo4j
- 10 years NLP experience
- 4 years NatWest Group as ML Product Owner for bank's chatbot Cora

Generative AI use cases



Text Generation

Talk to your documents (RAG)

Workflow Automation (AI Agents)

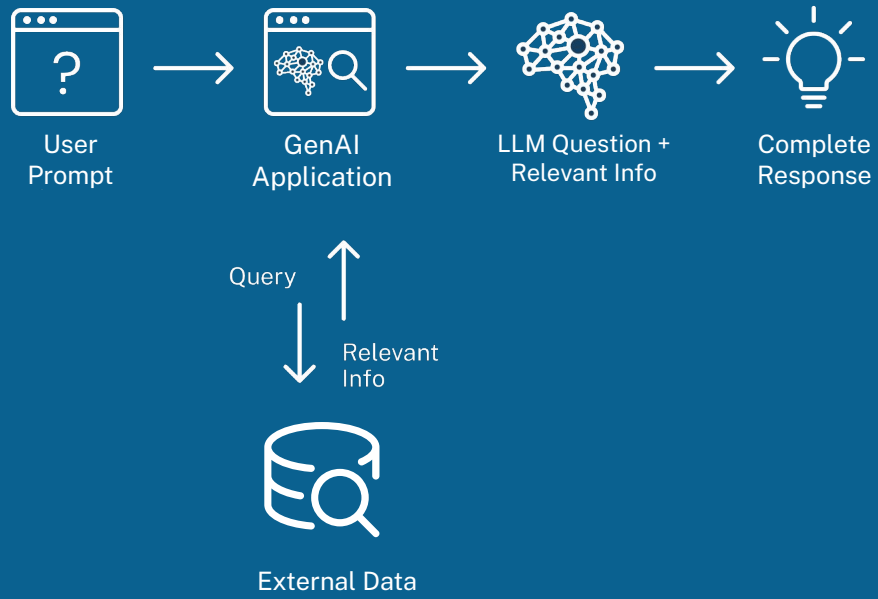
RAG augments the LLM flow by

1. intercepting a **user's prompt**,

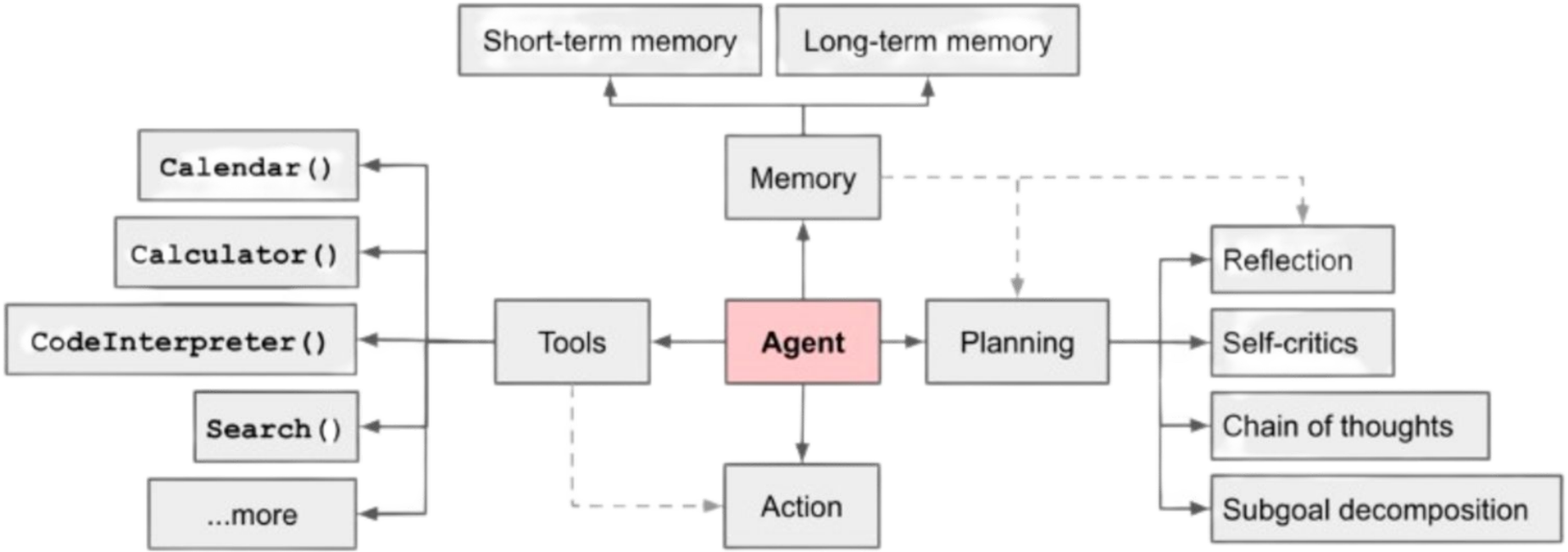
2. making a **query to external data**,

3. passing relevant results from the query back to the LLM

4. for a **complete, curated response.**



Inside an autonomous agent



GraphRAG Higher Accuracy (data.world)

3X

A Knowledge Graph improves the accuracy of LLM responses by 54.2%, an average of 3x better than SQL alone

More Validating Research @
graphrag.com/appendices/research

A BENCHMARK TO UNDERSTAND THE ROLE OF KNOWLEDGE GRAPHS ON LARGE LANGUAGE MODEL'S ACCURACY FOR QUESTION ANSWERING ON ENTERPRISE SQL DATABASES

TECHNICAL REPORT

Juan F. Sequeda
data.world
juan@data.world

Dean Allemang
data.world
dean.allemang@data.world

Bryon Jacob
data.world
bryon@data.world

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ABSTRACT

Enterprise applications of Large Language Models (LLMs) hold promise for question answering on enterprise SQL databases. However, the extent to which LLMs can accurately respond to enterprise questions in such databases remains unclear, given the absence of suitable Text-to-SQL benchmarks tailored to enterprise settings. Additionally, the potential of Knowledge Graphs (KGs) to enhance LLM-based question answering by providing business context is not well understood. This study aims to evaluate the accuracy of LLM-powered question answering systems in the context of enterprise questions and SQL databases, while also exploring the role of knowledge graphs in improving accuracy. To achieve this, we introduce a benchmark comprising an enterprise SQL schema in the insurance domain, a range of enterprise queries encompassing reporting to metrics, and a contextual layer incorporating an ontology and mappings that define a knowledge graph. Our primary finding reveals that question answering using GPT-4, with zero-shot prompts directly on SQL databases, achieves an accuracy of 16%. Notably, this accuracy increases to 54% when questions are posed over a Knowledge Graph representation of the enterprise SQL database. Therefore, investing in Knowledge Graph provides higher accuracy for LLM powered question answering systems.

Keywords Knowledge Graphs · Large Language Models · Question Answering · SQL Databases · Benchmark · Retrieval Augmented Generation (RAG)

1 Introduction

Question answering, the ability to interact with data using natural language questions and obtaining accurate results, has been a long-standing challenge in computer science dating back to the 1960s[8, 9, 20, 10]. The field has advanced throughout the past decades [3, 22, 17], through Text-to-SQL approaches, as a means of facilitating chatting with the data that is stored in SQL databases[13, 12, 16, 1, 6, 19]. With the rise of Generaiive AI and Large Language Models (LLMs), the interest continues to increase. These question answering systems hold tremendous potential for transforming the way data-driven decision making is executed within enterprises.

While question answering systems have shown remarkable performance in several Text-to-SQL benchmarks [4, 2], such as Spider [18], WikiSQL[19], KaggleDBQA[11] their implications relating to enterprise SQL databases remain relatively obscure. [1] We argue that existing Question Answering and Text-to-SQL benchmarks, although valuable, are often misaligned with real-world enterprise settings:

1. these benchmarks typically overlook complex database schemas representing enterprise domains, which likely comprise hundreds of tables.

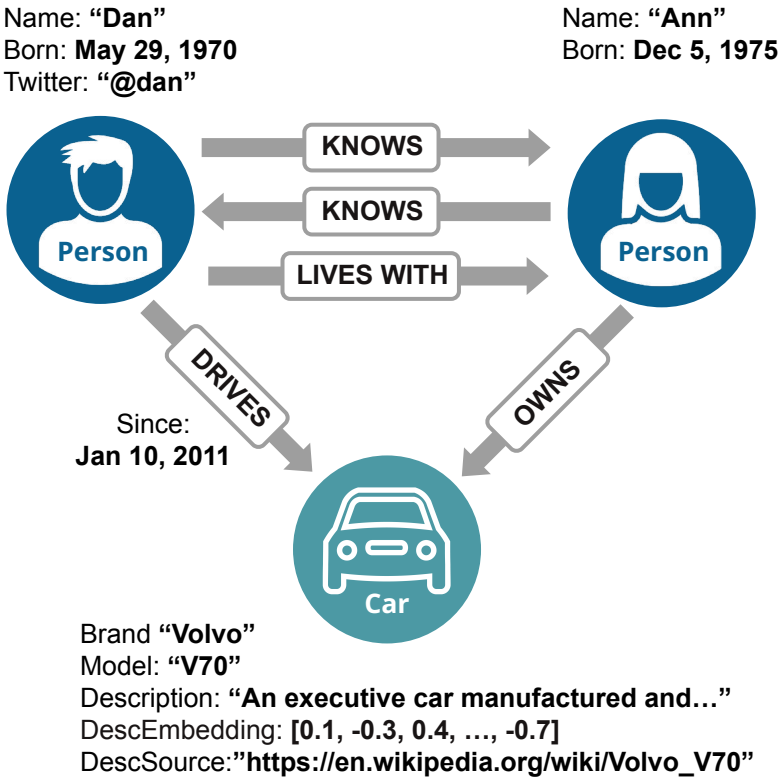
[1] A full survey on existing Text-to-SQL benchmarks is outside the scope of this work. We do believe it would be beneficial for the community.

Knowledge Graph Components

Nodes represent entities in the graph

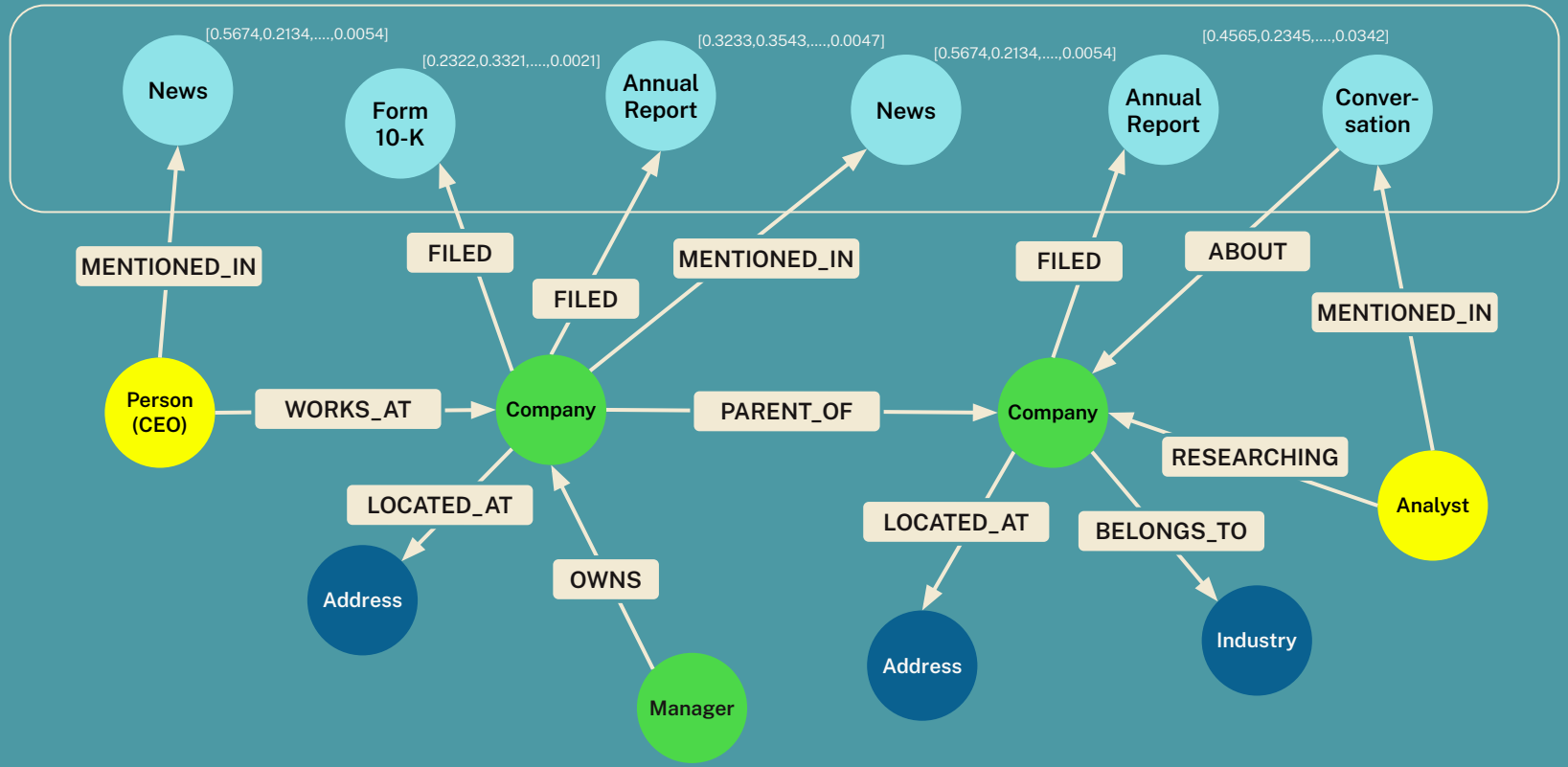
Relationships represent associations or interactions between nodes

Properties represent attributes of nodes or relationships including vectors, can be *indexed*

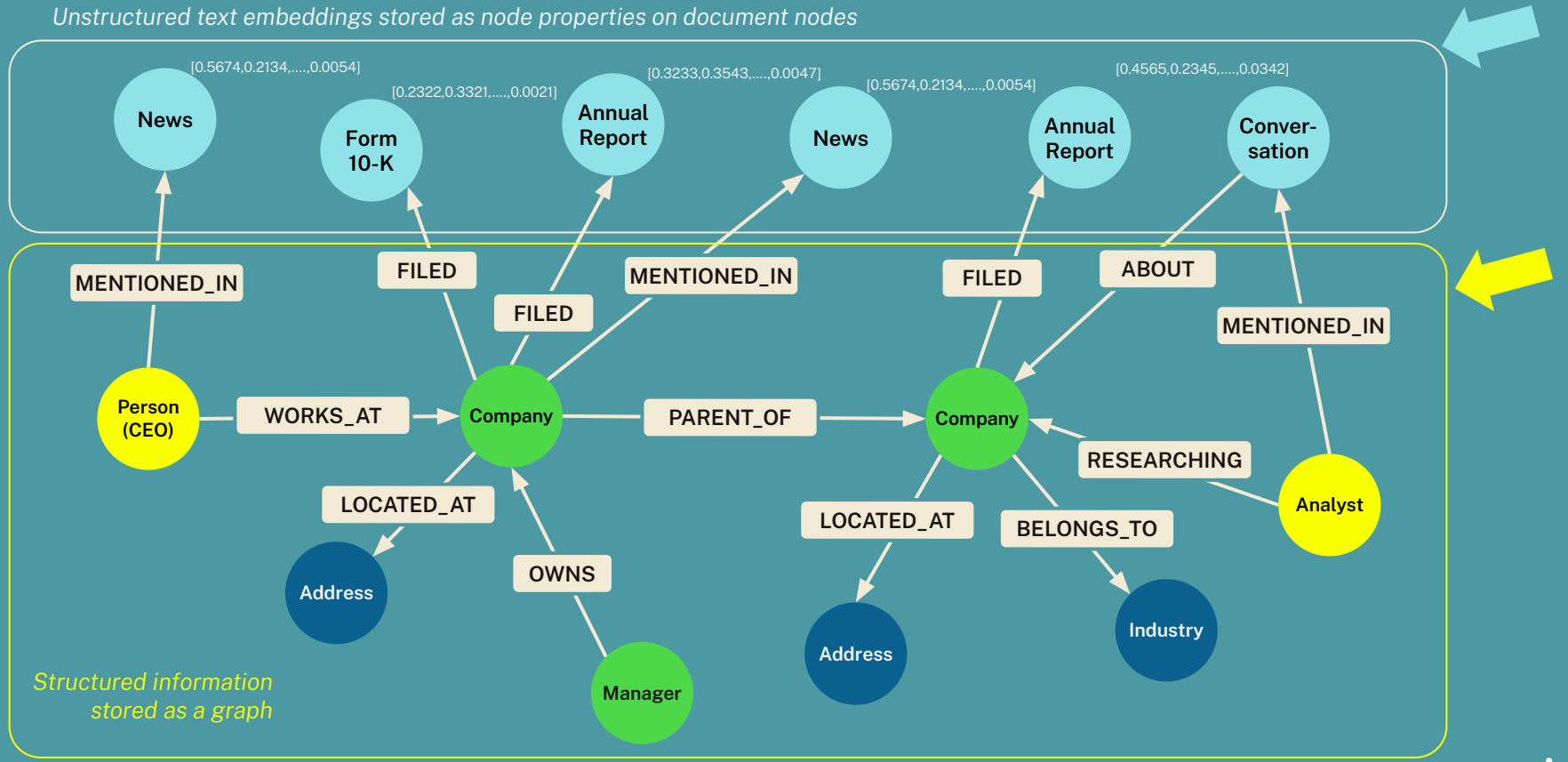


Combine Structured & Unstructured Knowledge

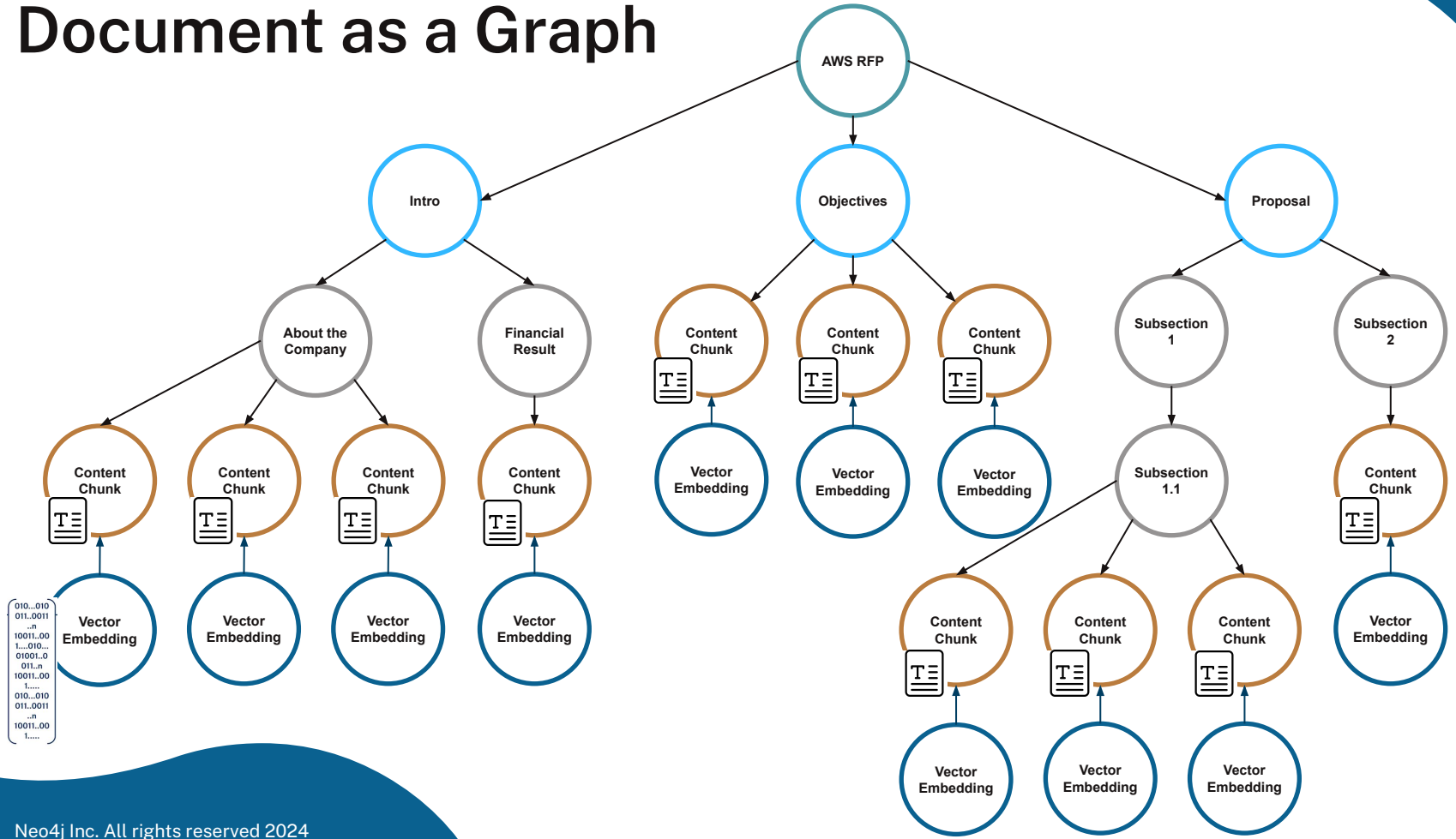
Unstructured text embeddings stored as node properties on document nodes



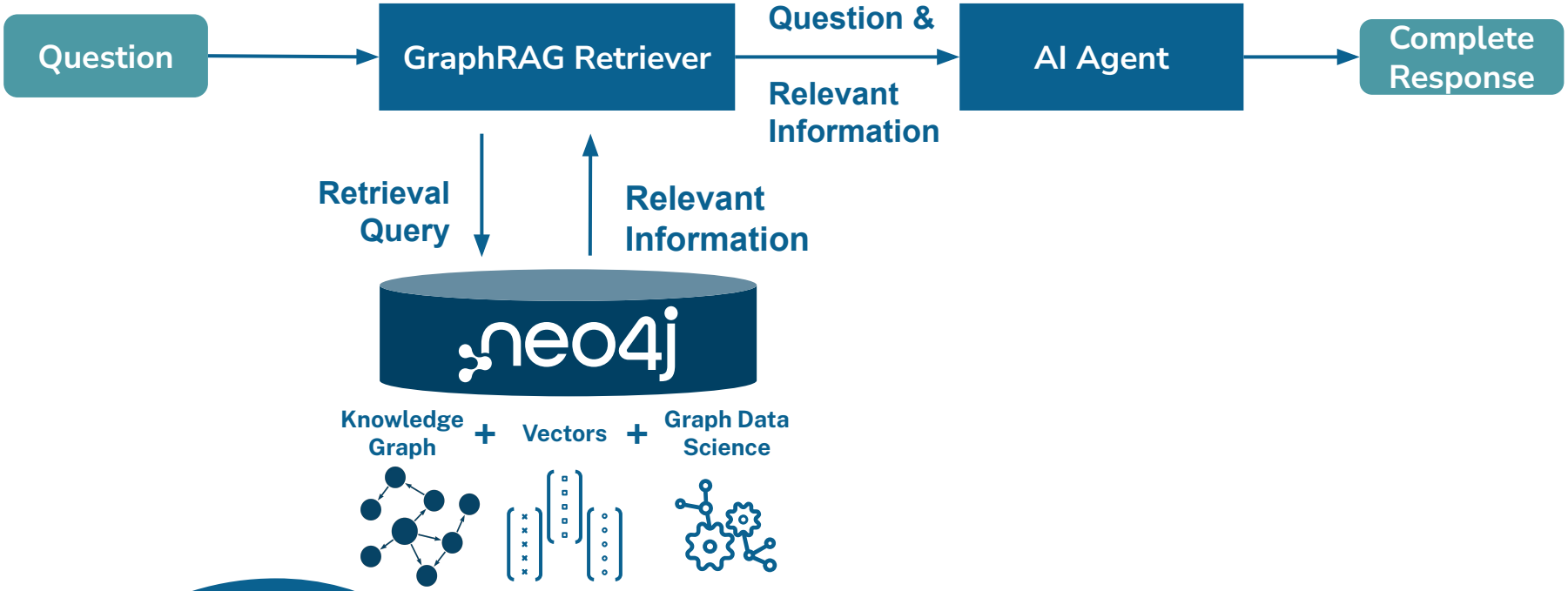
Combine Structured & Unstructured Knowledge



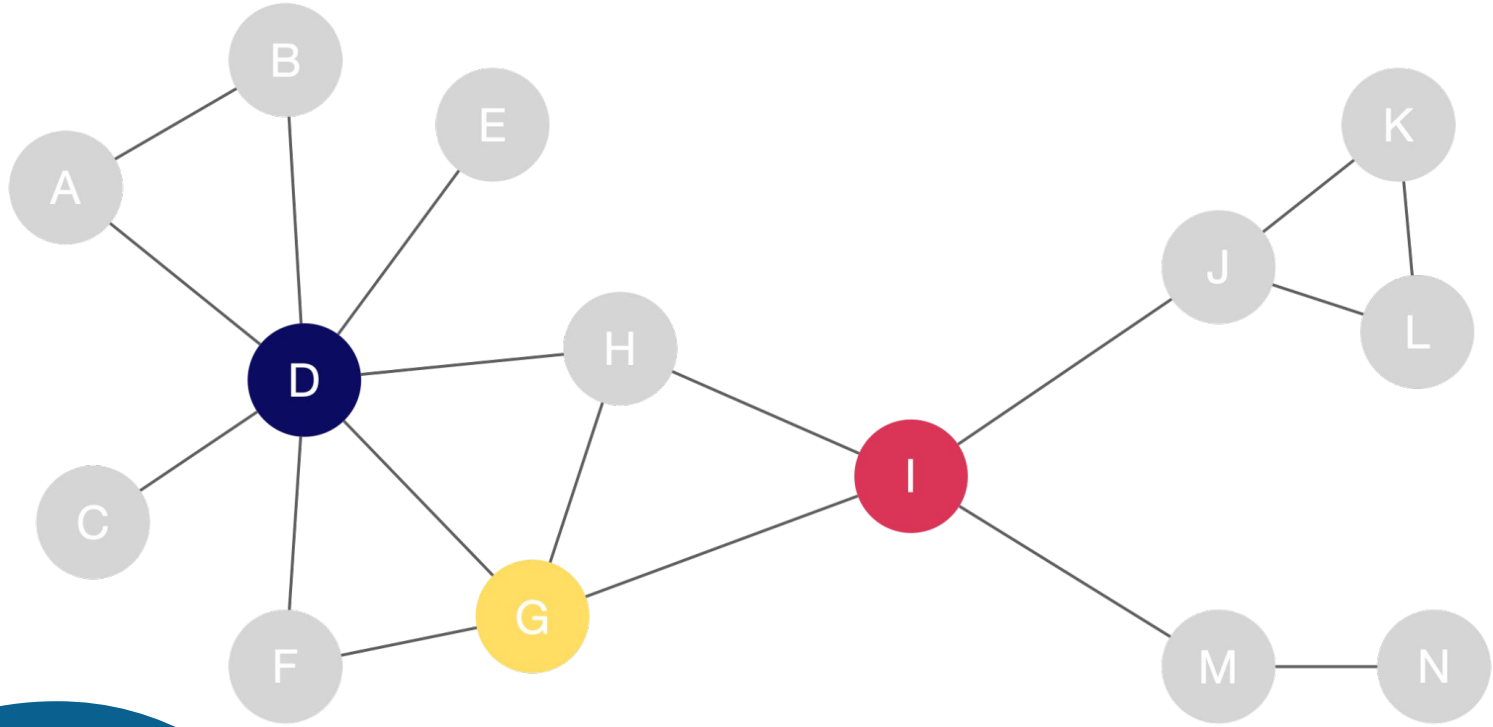
Document as a Graph



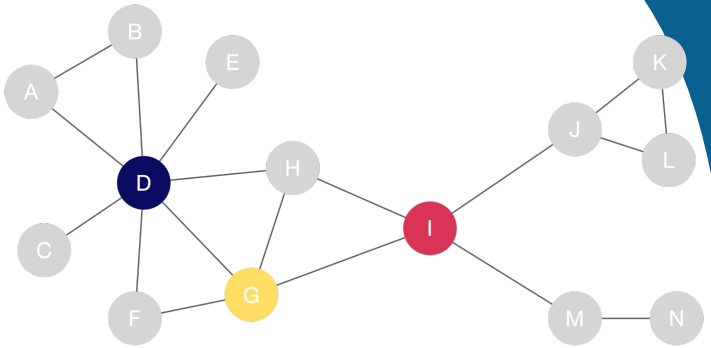
GraphRAG Pattern



Which of the colored nodes would be considered the most ‘important'?



Most important...? - All depends...



D

D has the highest valence
This is the most connected individual in the network. If importance is how well you are personally known, you pick D.

G

Node G has the highest closeness centrality (0.52).
Information will disperse through the network more quickly through this individual. If you need to get a message out rapidly, choose them.

I

Node I has the highest betweenness centrality (0.59).
This person is an efficient connector of other people. Risk of disruption is higher if you lose this individual.


Goal:
Build a Talent & skills management AI

This AI will be able to:

- Search for people and their skills
- Match similar people based on their skills
- Find communities of people & skills
- Make recommendations for projects based on tech stack requirements

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Knowledge Graph Basics

Go to module_01

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Unstructured data

Go to module_02

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AI agents & GraphRAG

Go to module_03

You did it!

Connect with me:

Thank you!

chris.booth@neo4j.com