

# Graph-Powered AI:

Unlocking Insights with  
Knowledge Graphs

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# Agenda

Understanding Graphs & Relationships

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Introduction to Knowledge Graphs

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Neo4j as a Knowledge Graph Platform

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Explore Graph RAG with Knowledge Graph

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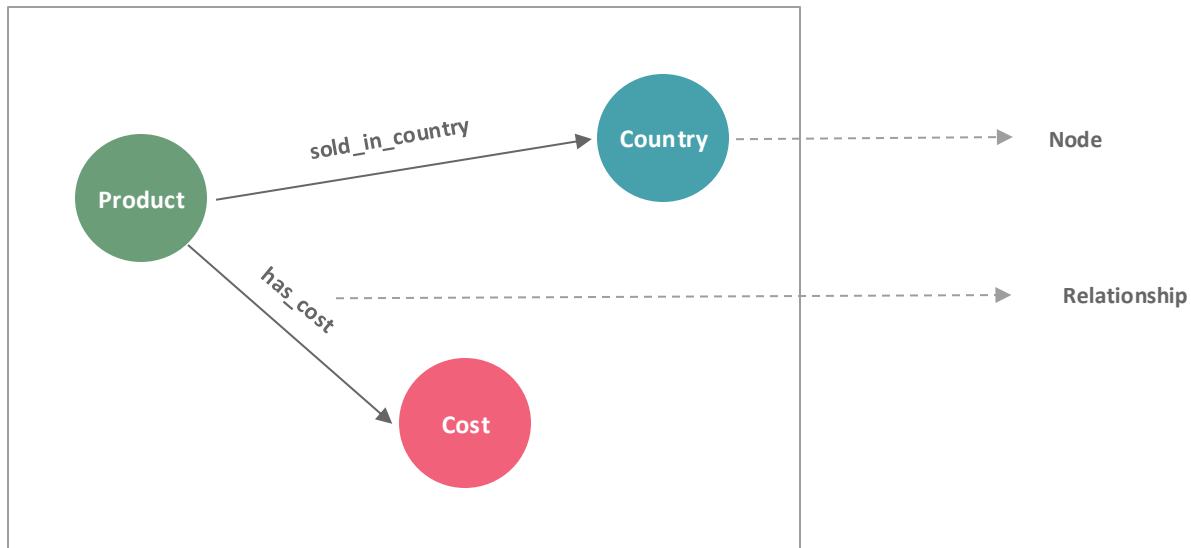
Graph RAG Demo

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# Understanding Graphs & Relationships

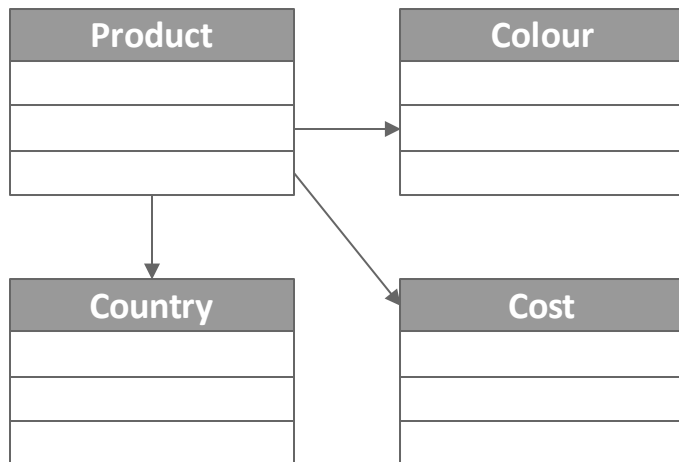
# Graph DB

A type of database that stores data in the form of nodes connected with relationships.

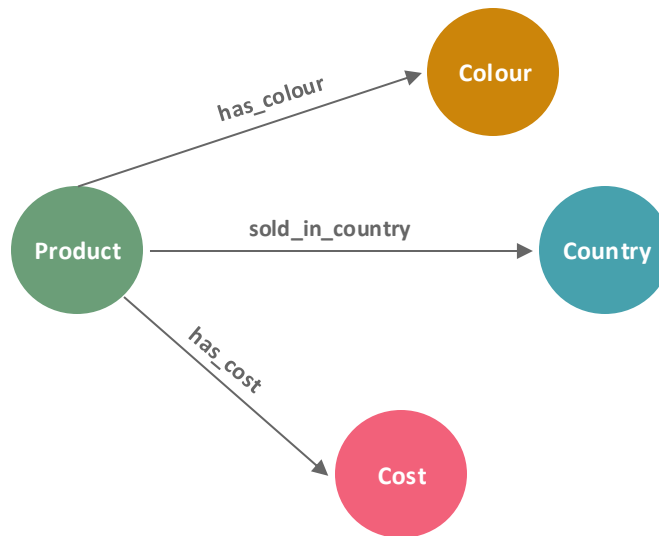


# Relational DB vs Graph DB

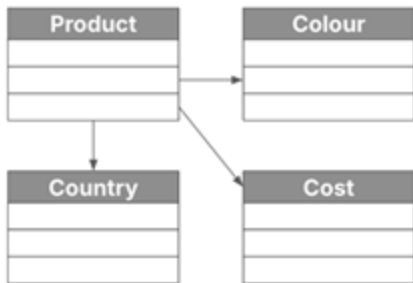
Relational DB



Graph DB



# Cypher Query



## SQL

```
SELECT p.ProductName, c.ColorName, co.CostAmount, cn.CountryName
FROM ProductTable p, ColorTable c, CostTable co, CountryTable cn
WHERE
    p.ColorID = c.ColorID
    AND p.CostID = co.CostID
    AND p.CountryID = cn.CountryID;
```



## Cypher

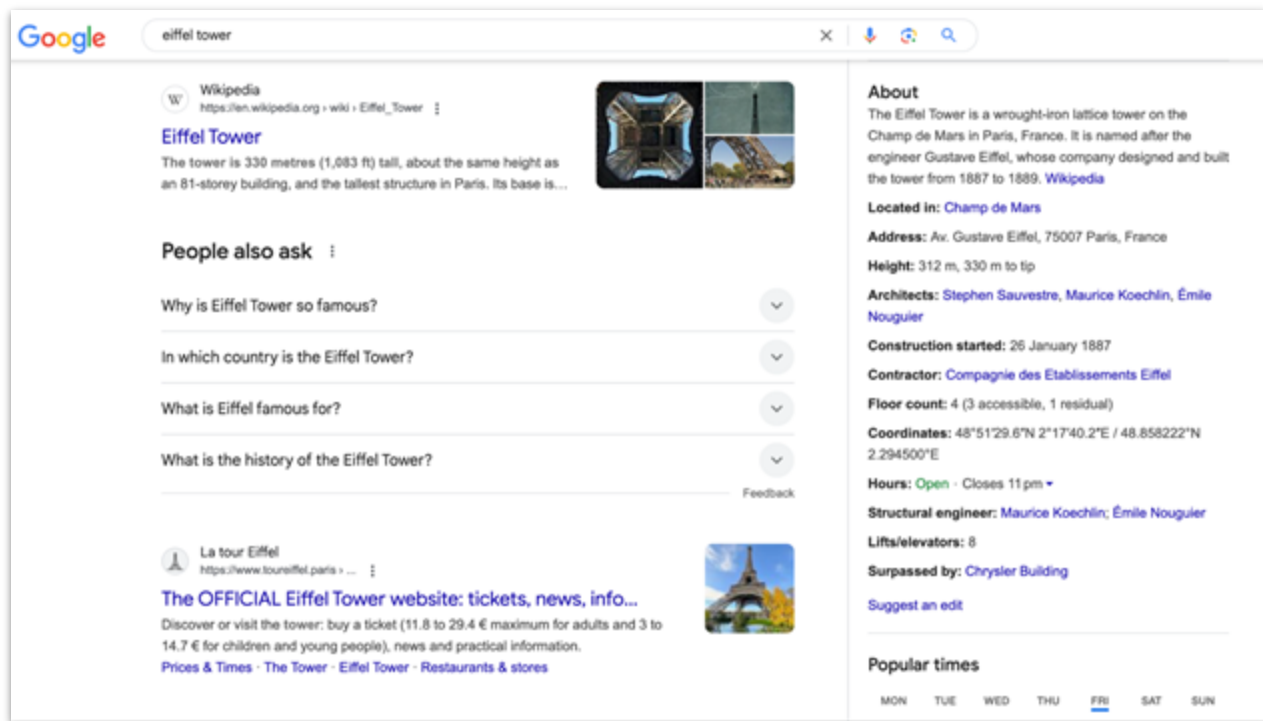
```
MATCH (p:Product)-[:HAS_COLOUR]->(c:Color),
      (p)-[:HAS_COST]->(co:Cost),
      (p)-[:SOLD_IN_COUNTRY]->(cn:Country)
RETURN p, c, co, cn;
```

Other Graph Query Languages - *Gremlin, SparQL, GQL*

Cypher's Advantage - *Declarative nature, rich ecosystem, optimised for deeper traversals*

# Introduction to Knowledge Graphs

# Knowledge Graph - Things, not Strings



The screenshot shows a Google search for "eiffel tower". The search bar at the top contains the text "eiffel tower". Below the search bar, the Knowledge Graph results are displayed. On the left, there is a Wikipedia entry for "Eiffel Tower" with a small image of the tower. Below this, there is a section titled "People also ask" with four questions: "Why is Eiffel Tower so famous?", "In which country is the Eiffel Tower?", "What is Eiffel famous for?", and "What is the history of the Eiffel Tower?". Each question has a dropdown arrow next to it. Below the "People also ask" section, there is a link to "La tour Eiffel" with a small image of the tower. On the right, there is a detailed "About" section for the Eiffel Tower, including its location, address, height, architects, construction start date, contractor, floor count, coordinates, hours, structural engineer, lifts/elevators, and the building it is surpassed by. At the bottom right, there is a "Popular times" section with a bar chart showing the popularity of the tower throughout the week, with Friday being the most popular day.

Google eiffel tower

Wikipedia  
https://en.wikipedia.org/wiki/Eiffel\_Tower

**Eiffel Tower**  
The tower is 330 metres (1,083 ft) tall, about the same height as an 81-storey building, and the tallest structure in Paris. Its base is...

**People also ask**

Why is Eiffel Tower so famous?

In which country is the Eiffel Tower?

What is Eiffel famous for?

What is the history of the Eiffel Tower?

Feedback

La tour Eiffel  
https://www.toureiffel.paris/...

**The OFFICIAL Eiffel Tower website: tickets, news, info...**  
Discover or visit the tower: buy a ticket (11.8 to 29.4 € maximum for adults and 3 to 14.7 € for children and young people), news and practical information.  
[Prices & Times](#) · [The Tower](#) · [Eiffel Tower](#) · [Restaurants & stores](#)

**About**  
The Eiffel Tower is a wrought-iron lattice tower on the Champ de Mars in Paris, France. It is named after the engineer Gustave Eiffel, whose company designed and built the tower from 1887 to 1889. [Wikipedia](#)

**Located in:** [Champ de Mars](#)

**Address:** Av. Gustave Eiffel, 75007 Paris, France

**Height:** 312 m, 330 m to tip

**Architects:** [Stephen Sauvestre](#), [Maurice Koechlin](#), [Émile Nougier](#)

**Construction started:** 26 January 1887

**Contractor:** [Compagnie des Etablissements Eiffel](#)

**Floor count:** 4 (3 accessible, 1 residual)

**Coordinates:** 48°51'29.6"N 2°17'40.2"E / 48.858222°N 2.294500°E

**Hours:** [Open](#) · Closes 11pm

**Structural engineer:** [Maurice Koechlin](#); [Émile Nougier](#)

**Lifts/elevators:** 8

**Surpassed by:** [Chrysler Building](#)

[Suggest an edit](#)

**Popular times**

MON TUE WED THU **FRI** SAT SUN

Ref: <https://blog.google/products/search/introducing-knowledge-graph-things-not/>



# Knowledge Graphs

**Graph Database** efficiently stores and queries relationships

**Knowledge Graph** goes beyond by **adding meaning, semantics, and reasoning** to the data.

## Components of Knowledge Graphs:

- 1 **Nodes** - Entities
- 2 **Relationships** - between entities
- 3 **Organising Principles** - Concept map

*Taxonomy -[WILL\_DERIVE] -> OrganisingPrinciple*

Product Recommendation System => Product Taxonomy is the Organising Principle

## Why This Matters for AI?

- ✓ **Enhanced Search & Recommendations**
- ✓ **AI-powered Insights & Predictions**
- ✓ **Automated Reasoning & Decision-Making**



"A Graph Database tells you what exists, but a Knowledge Graph helps you understand and reason about it!"

# Neo4J as a Knowledge Graph Platform

# Neo4J

Neo4j is a leading native graph database platform designed to store and query highly connected data efficiently.

## **Key Features:**

- **Native Graph Storage**
- **Cypher Query Language**
- **Fully managed cloud-based offering : Neo4j Aura**

## **Other Graph DB Offerings :**

- Azure Cosmos DB, Amazon Neptune, Tiger Graph, Arango DB

**Let's have a quick look at Neo4J**

# Our Journey with Neo4J

BigQuery and BOM Data. The application's performance began to decline as the volume of data increased.

## Challenges Faced:

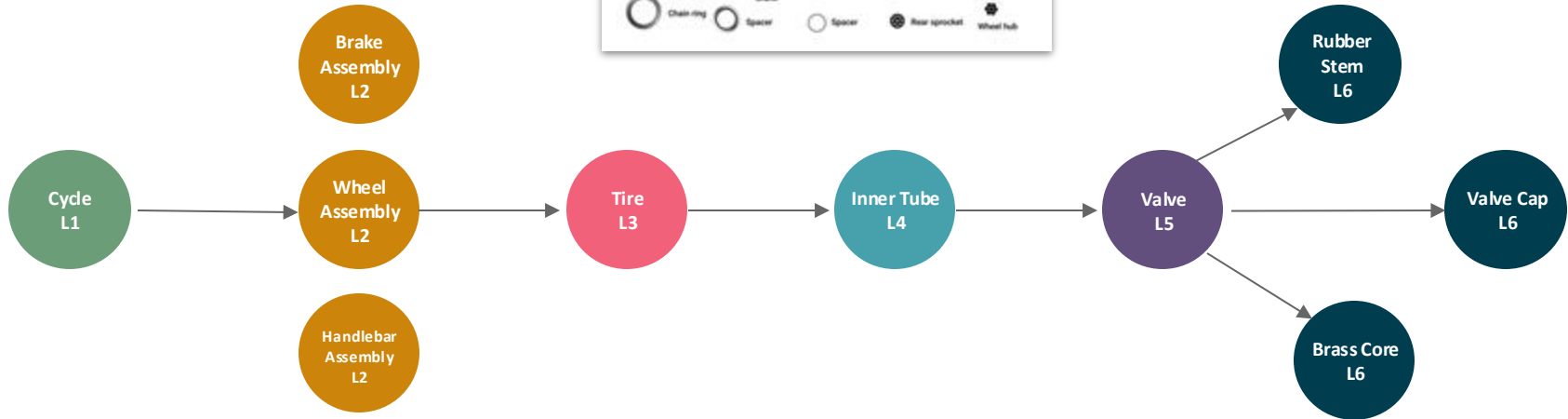
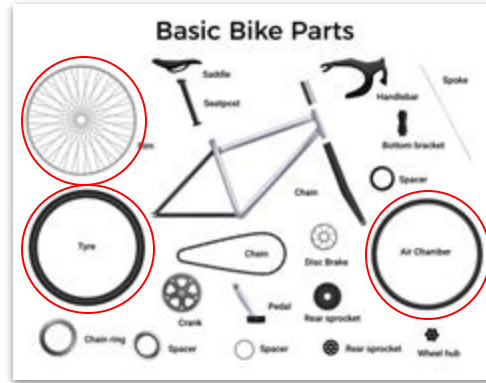
- **Performance Issues:** Recursively querying hierarchical BOM data in SQL caused significant delays and large joins across tables impacted query performance and readability.
- **Complexity:** Difficult to visualize data relationships directly.
- **Scalability Concerns:** As data grew, SQL query execution times worsened.



Designed by Freepik

BOM (Bill of Materials) is a hierarchical structure of assemblies, sub-assemblies, and parts, often used in manufacturing.

# Hierarchical BOM Data



# Neo4J vs BigQuery

Neo4j's significant edge in scenarios requiring deep, recursive traversals

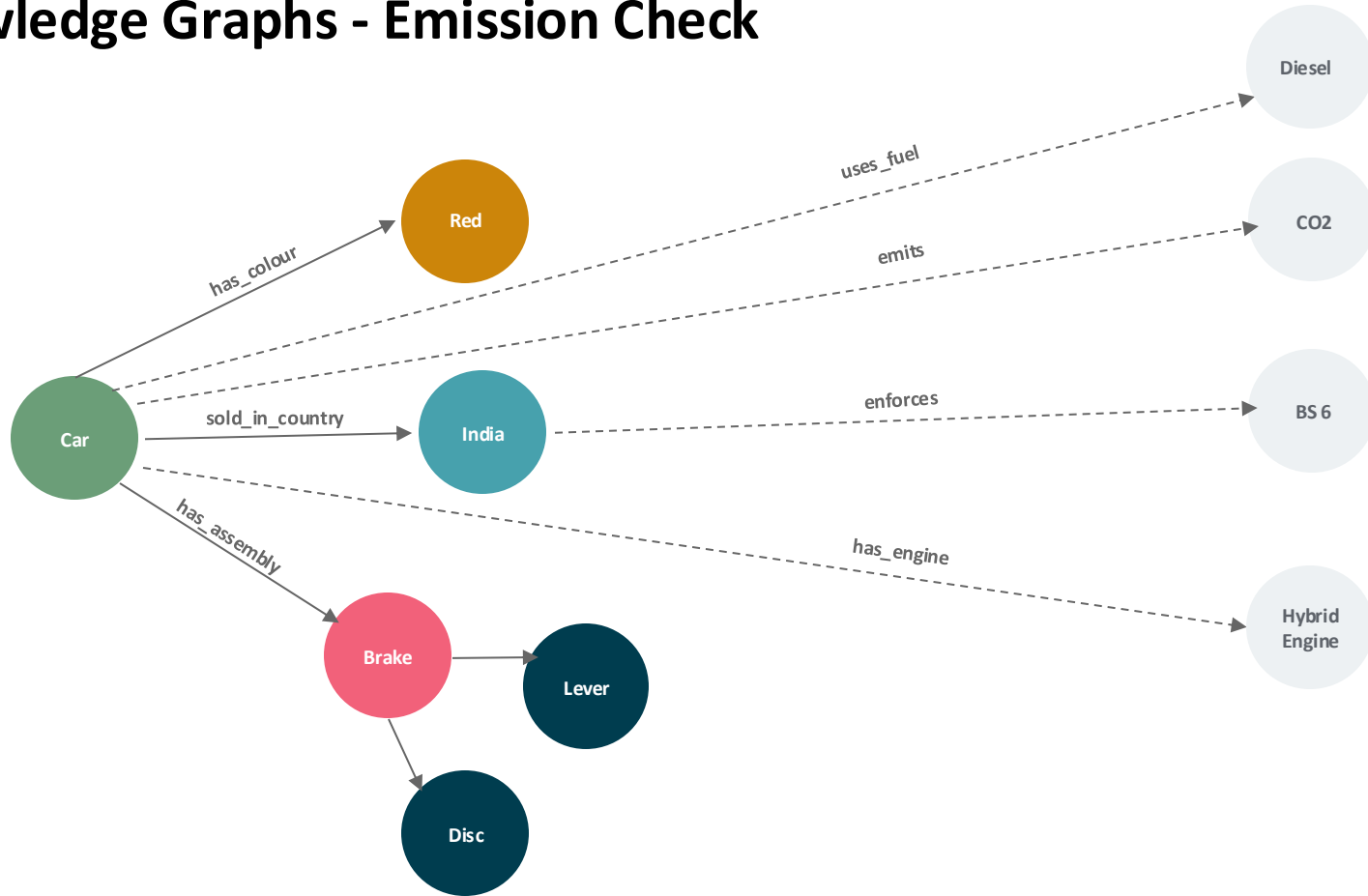
Metric	BigQuery (SQL)	Neo4j (Graph)
Traversal Depth	2 levels: ~2 second	2 levels: ~150 ms
	5 levels: ~15 seconds	5 levels: ~300 ms
	7 levels: ~40+ seconds	7 levels: ~600 ms
Scalability	Exponential increase in query time	Linear increase in query time
Reason for Difference	Intermediate joins and computation	Direct node and relationship traversal

*Data size - ~5 million nodes and ~10 million relationships*

# Building a Knowledge Graph



# Knowledge Graphs - Emission Check

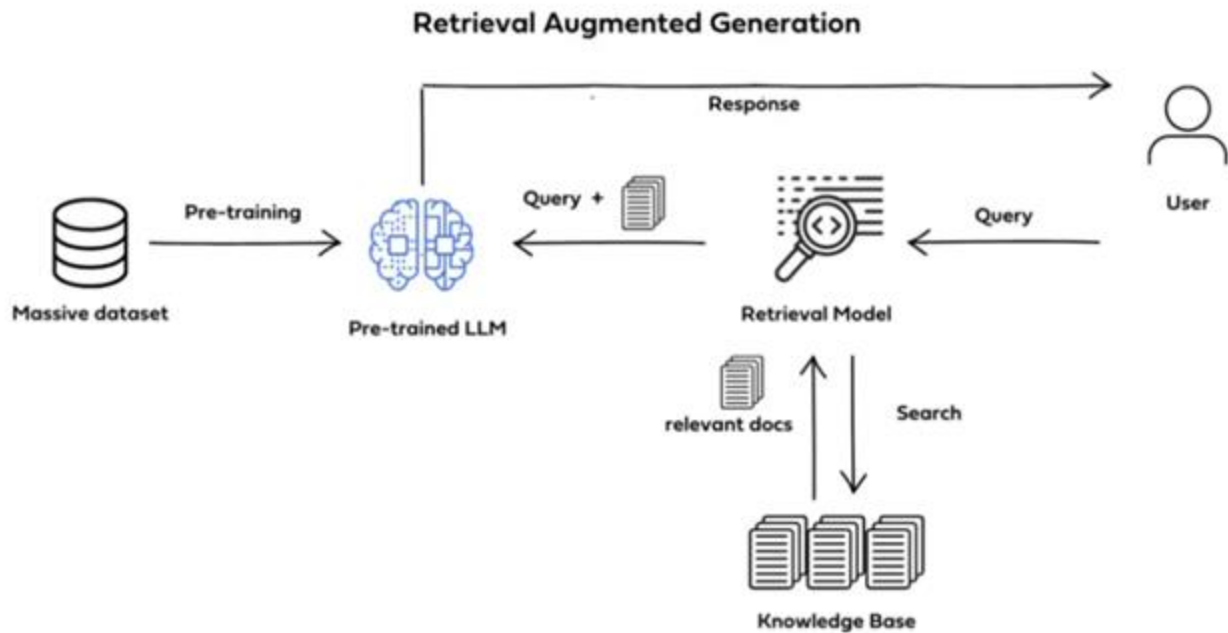


This transforms your **basic Graph Database** into a **true Knowledge Graph**, making it more **intelligent, inferential, and useful for AI-driven applications**.

# Explore Graph RAG with Knowledge Graph

# RAG

appropriate responses



Enterprise Data

# Vector and Graph

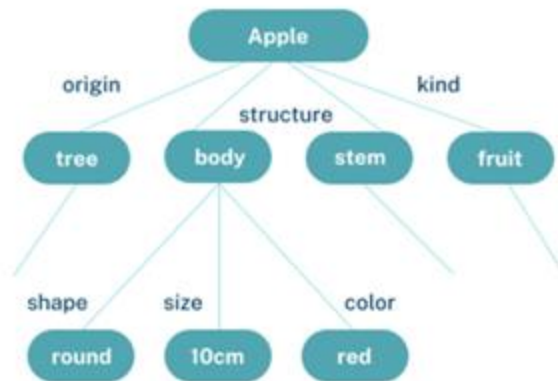
Human View of  
an Apple



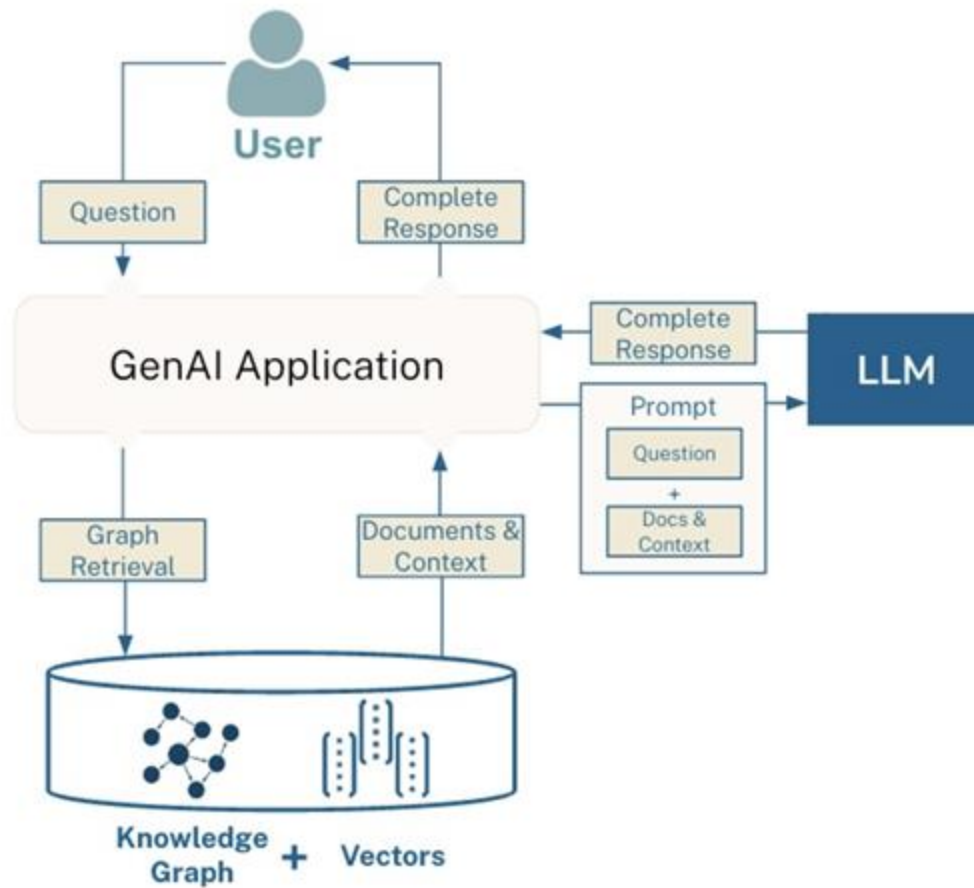
Vector View of  
an Apple



Knowledge Graph  
View of an Apple



# Graph RAG



# DEMO

# Reference / Further Reading

<https://neo4j.com/docs/getting-started/>

<https://neo4j.com/use-cases/knowledge-graph/>

<https://github.com/docker/genai-stack>

<https://neo4j.com/blog/graphrag-manifesto/>

**Thank you.**