

An abstract graph structure composed of dark grey nodes and thin grey lines connecting them, forming a complex network on the left side of the slide.

Agentic GraphRAG

Memgraph 3.0

Memgraph 3.0

Production ready 🧠

Vector Search

Production ready 🚀

High availability

Improving support 😎

**Dynamic
algorithms**



Overview

1. **GraphRAG**
 - a. LLMs
 - b. RAG
 - c. Memgraph GraphRAG
2. **Agent**
 - a. Agentic application
3. **Memgraph Agentic GraphRAG**
4. **Demo**



GraphRAG

Graph Retrieval-Augmented Generation





LLMs

Prompt

Can you generate lorem ipsum placeholder text, but in English?

LLM



Response

Here's a placeholder text made up of English words:

"Insert random text here to fill the space and make sure that everything looks just right. This is a string of words that hold no real meaning, but serve as a stand-in for actual content that will be placed in this location. Continue adding more sentences to ensure that the layout behaves as expected. Test the length, appearance, and general feel of the text block as the design unfolds. Keep an eye on spacing and alignment to achieve a balanced and polished look."

LANGUAGE

LARGE MODEL

LANGUAGE



LLMs

Prompt

Which patients had similar symptoms to patient Mark and how were the treatments concluded?



+ All medical records

LLM



Response

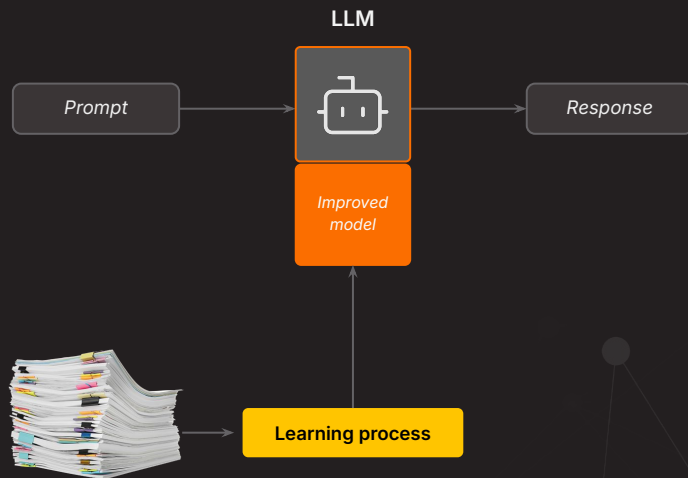
?

Context window

Attention

LLMs

Fine-tuning the Model

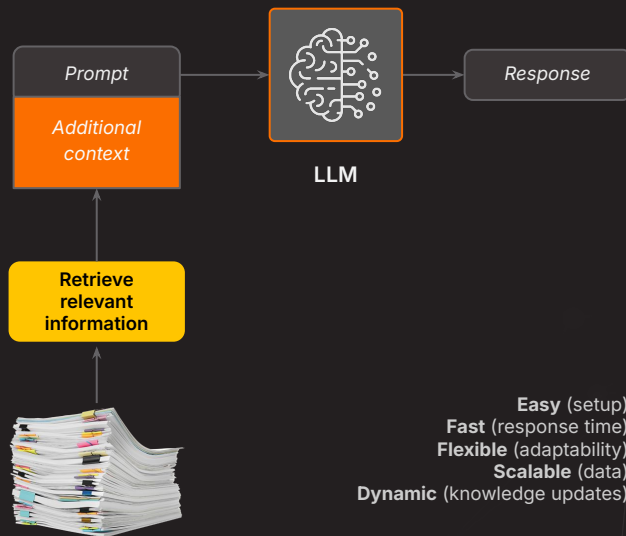


Static (fixed knowledge)
Expensive and slow training (resources)
Expensive running (resources)
Accurate (task- specific knowledge)
Hard to set up



RAG

Retrieval-augmented generation (RAG)



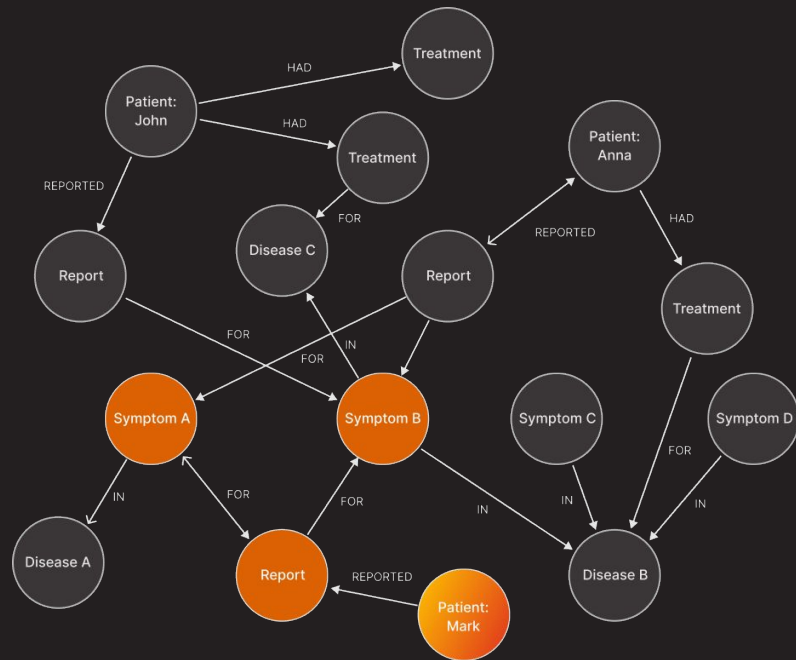
Retrieval Augmented Generation (RAG) is a way to make LLMs more accurate and personalized to your specific data.

Easy (setup)
Fast (response time)
Flexible (adaptability)
Scalable (data)
Dynamic (knowledge updates)



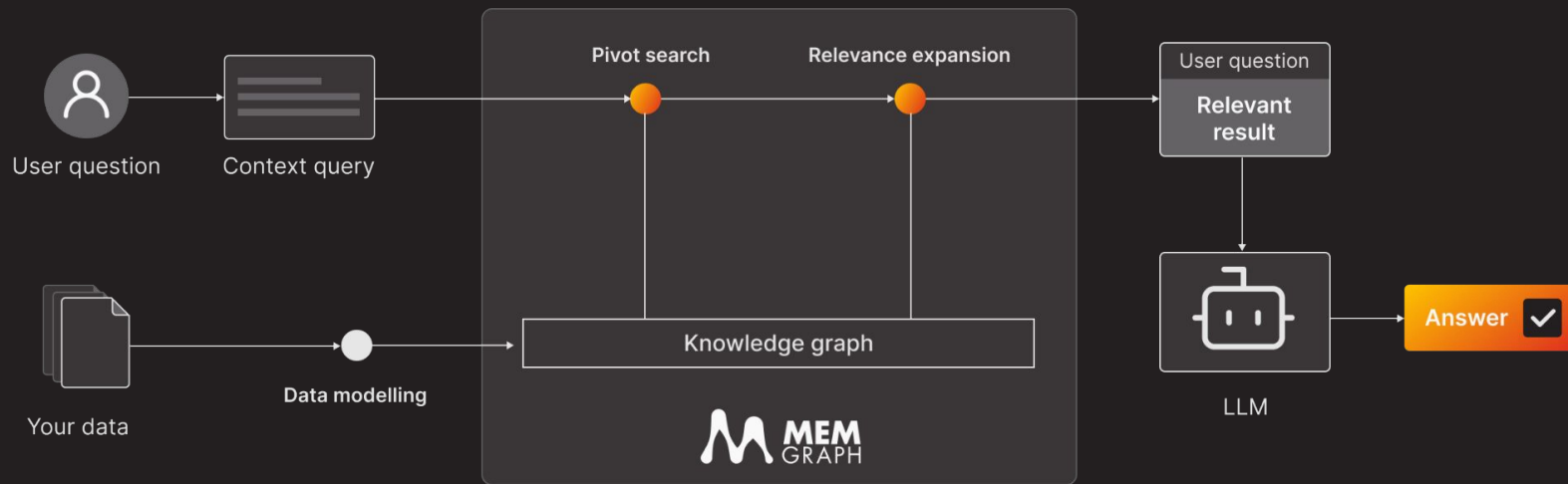
GraphRAG

- **Graph Retrieval Augmented Generation (GraphRAG):** By leveraging Knowledge Graph LLMs gets more relevant and connected context
- Initially developed by the [Microsoft](#) to perform GraphRAG on unstructured data and documents by leveraging Knowledge graph.
- **Not limited to unstructured data!**



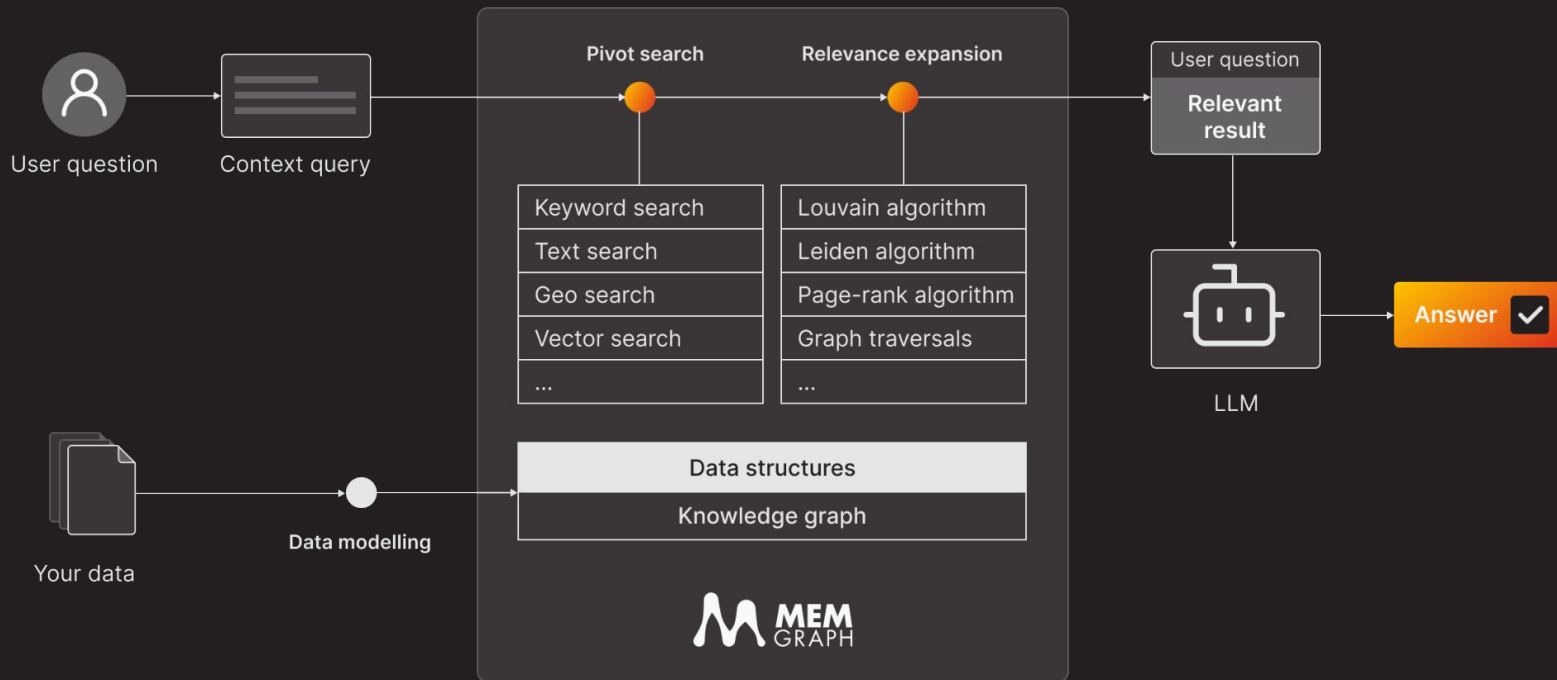


Memgraph GraphRAG





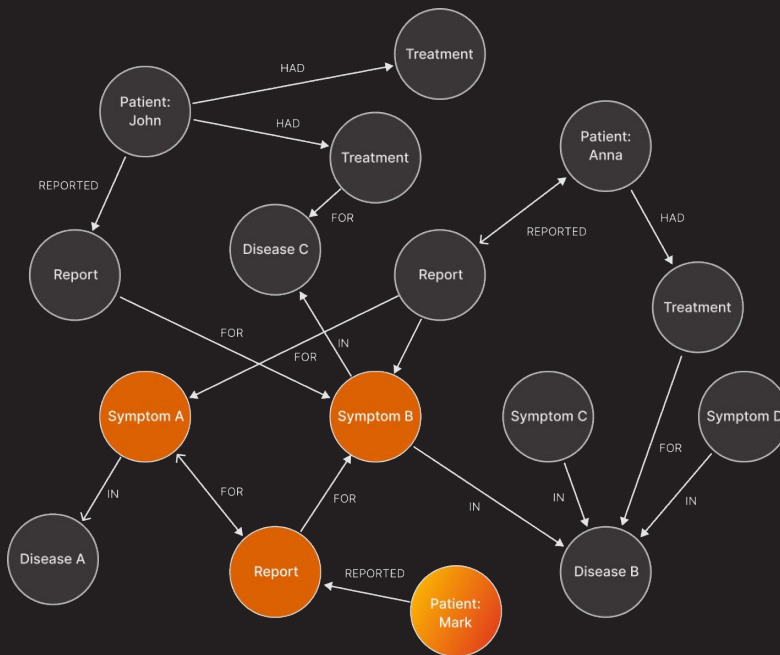
Memgraph GraphRAG





Memgraph GraphRAG

- **Vector search + Graph retrieval** (BFS, DFS..)
- Part of the structure question (later in the demo)



Agent

Graph Retrieval-Augmented Generation





Agent

- **Agent** is a system component that interacts with a large language model (LLM) and external knowledge sources to dynamically retrieve, process, and generate responses based on **contextual** information.
- Agent steps:
 - **Receives input** (such as user queries).
 - **Decides on an action** (e.g., retrieving data, executing a tool, or generating a response).
 - **Interacts with external knowledge sources** (like search engines, APIs, databases, or vector stores).
 - **Produces a response** based on reasoning and retrieved knowledge.
- **TL;DR: LLM call** with **specific** prompt and **contextual** information that makes some **decision**, it can have multiple steps



Question Classification Agent

Prompt:

Classify the question into one of the following types:

Retrieval (direct lookup, specific entity)

Structure (graph relationships or properties)

Global (overall graph trends or importance)

Database (database statistics/config)

Example Input:

📌 "How old is a person named John?"

Agent Response:

📌 **Retrieval** — The query seeks information about a specific entity (John) and its property (age).



Question Classification Agent

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Example Input:

📌 "Does Memgraph has SHOW SCHEMA INFO enabled?"

Agent Response:

📌 **Database** - The question is about database configuration



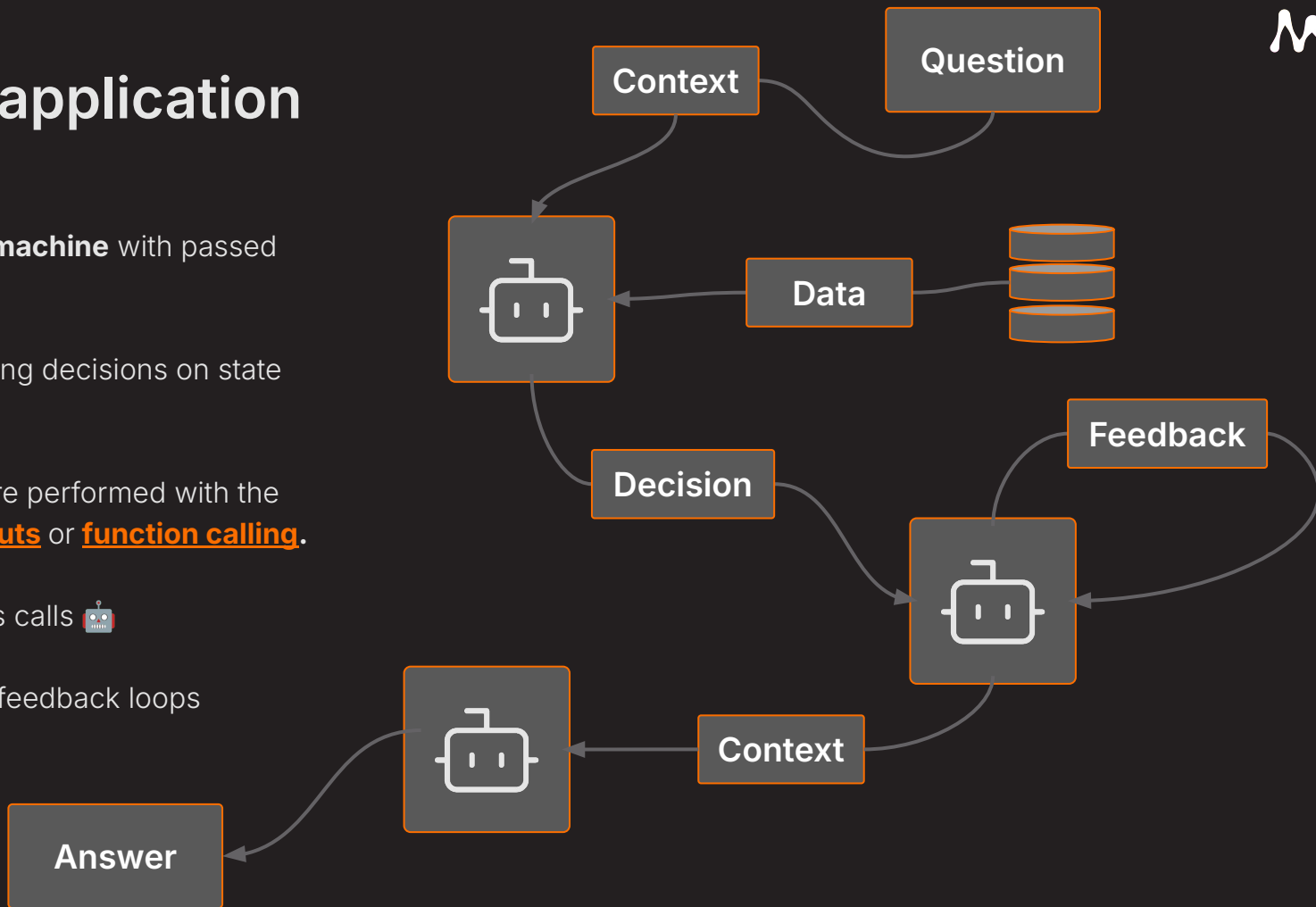
Agentic application

- **Agentic application** is a system that dynamically interacts with external tools, databases, APIs, or other systems to achieve complex goals with minimal human intervention.
- Agentic application steps:
 - Autonomously plans and execute tasks
 - Retrieves and process data from external sources
 - Reason and makes decision on how to answer
 - Iterate and refine output
 - Use memory/context awareness
- **TL;DR: Multiple chained LLM calls** each has specific tasks to accomplish, **context** is being shared across multiple LLM calls. It is like a **state machine** that LLM traverse and shares context.



Agentic application

- It is **finite state machine** with passed context!
- **Agents** are making decisions on state change
- State changes are performed with the structured outputs or function calling.
- A bunch of LLMs calls 🤖
- There are some feedback loops





Agentic GraphRAG

Memgraph

Memgraph Agentic GraphRAG



- Not all GraphRAG tools respond to **all questions!**
- Question **defines** the tool
- Tool is **modeled** by agent automatically
- Tool **responses** are being validated





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```
# Agent response to the user question
class QuestionType(BaseModel):
    type: str
    explanation: str

# Rest of the code omitted
user_question = f"<Question>{user_question}</Question>"
completion = openai_client.beta.chat.completions.parse(
    model=MODEL["name"],
    messages=[
        {"role": "developer", "content": prompt},
        {"role": "user", "content": user_question},
    ],
    response_format=QuestionType,
)

return completion.choices[0].message.parsed
```



Retrieval PageRank Agent

```
def page_rank_tool(db_client, openai_client, user_question) -> ToolResponse:

    prompt_developer = f"""
    Based on the provided question, try to guess how many nodes should be returned from the
    PageRank.

    The question is in <Question> </Question> format.
    """

    messages = [
        {"role": "developer", "content": prompt_developer},
        {"role": "user", "content": "<Question>" + user_question + "</Question>"},
    ]

    choice = page_rank_choice(openai_client, user_question)
    # Rest of the code removed
```



Memgraph Agentic GraphRAG

- Demo is publicly available and dataset agnostic
- Agentic GraphRAG
 - Operates fully autonomously
 - Based on question type, runs specific tools
 - Retrieves data from Memgraph
 - Based on the retrieved data makes decision and reiterates
 - Provides an answer
- Memgraph 3.0:
 - Vector search
 - Text to Cypher
 - SHOW SCHEMA INFO
 - Community detection
 - Page Rank
 - BFS ...
- No frameworks (Langchain, LlamaIndex)

Demo

Shoutout to Robert Caulk <https://asknews.app/en> for providing dataset

 AskNews



Feedback loop

INFO - ### Cypher Query:

```
INFO - MATCH (c:Entity:organization {id: 'Coca cola'}) RETURN
c.main_type, c.detailed_type, c.embedding
```

ERROR - ValueError in running the query:

ERROR - The query did not return any results. There is a possible issue with the query labels and parameters, if you are matching strings consider matching them in the case-insensitive way.

```
HTTP Request: POST https://api.openai.com/v1/chat/completions
"HTTP/1.1 200 OK"
```

INFO - ### Corrected Cypher Query:

```
INFO - MATCH (c:Entity:organization) WHERE toLower(c.id) =
toLower('Coca cola') RETURN c.main_type, c.detailed_type,
c.embedding
```

INFO - First pick: 'Cypher' succeeded.

```
INFO - HTTP Request: POST https://api.openai.com/v1/chat/completions
"HTTP/1.1 200 OK"
```

Agentic GraphRAG with Memgraph

Enter your question about the dataset:

What can you tell me about Coca cola?

Run GraphRAG Pipeline

Classifying Question type...

Question Type:

Type: Retrieval

Explanation: The question asks for specific information about the entity 'Coca Cola', which indicates it is looking for direct facts or details about that particular entity within the graph. It's a Retrieval type question because it seeks specific information rather than exploring relationships or the structure of the graph.

Running the tool selection...

Tools selected:

Tool 1: Cypher

Tool 2: Vector Relevance Expansion

Tool 1: 'Cypher' has succeeded.

Tool Execution Completed.

Tool Response:

{ ... }

Generating Final Response...

Final Response:

Coca-Cola is a company that falls under the category of a consumer goods company.



Future improvements

- All possible Memgraph tools (Geo, Text, Dynamic algos)
- **Fully automatic tool selection**
- **Specific agent** for each of tools
- Universal Memgraph knowledge retrieval agent 
- GraphChat == textToCypher agent



Memgraph 3.0 Events

February 13th
6PM CET

Memgraph Agentic **GraphRAG**

February 18th
6PM CET

REDFIELD

GraphRAG Global Search With
Hierarchical Modelling

February 20th
6PM CET

Intro to Memgraph **Lab 3.0**
and Demo

February 27th
6PM CET

FI CONSULTING

Memgraph + DeepSeek for
Retrieval Augmented
Generation (RAG)



Q&A

Thank you



www.memgraph.com