

What is GraphRAG? (...and how you can build a GraphRAG solution quickly!) | Amazon Web Services



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In this video, you'll have an overview of GraphRAG implementation options on AWS, enabling you to implement GraphRAG solutions that extract meaningful answers from your organisational data through natural language interactions using Amazon Neptune.

NEPTUNE SNACKABLES

What is GraphRAG? (...and how you can build a GraphRAG solution quickly!)

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Amazon Web Services

Agenda

ENHANCING GENERATIVE AI WITH GRAPHS

Learning how to leverage both Generative AI and Graphs to build solutions

EXPLORING GRAPHRAG

How does GraphRAG differ from traditional RAG?

BUILDING A GRAPHRAG SOLUTION USING AMAZON NEPTUNE

A walkthrough of the tools available to build your own GraphRAG solution using Amazon Neptune

NEXT STEPS

Time to get started with your GraphRAG solution

Enhancing Generative AI with Graphs

Leveraging GenAI with Graphs

GenAI enhances Graph accessibility



Open Domain Question Answering

Convert Natural Language Questions into graph queries



Defined Domain Question Answering

Extract key identifiers from a natural language question and use that information to answer predefined questions

Graph enhances GenAI Applications



Knowledge Graph Generation

Generate a graph from a given corpus of structured or unstructured data



Graph Enhanced RAG (GraphRAG)

Enhance a RAG application with relevant information to provide more comprehensive and explainable answers

Exploring GraphRAG

Sometimes the most relevant information to answering a question is not the closest in meaning.

What do graphs provide to RAG applications?

Vectors allow you to find relevant information that *is similar in language*.

Comparable sentences will be *highly similar* in vector space.

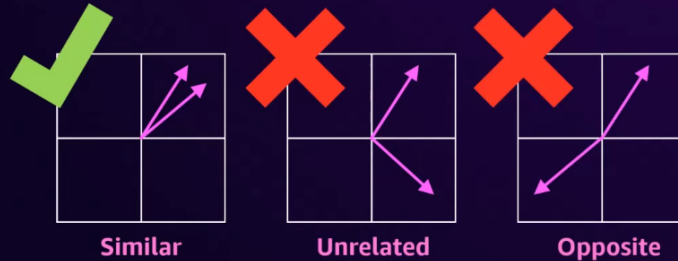
Graphs allow you to find relevant information that *are connected/related concepts*.

Comparable concepts will be *closely connected* in graph space.

Baseline (vector) RAG

Information access

- Primarily through vector **similarity search**
 - Information **similar** to the question is structurally **available**
 - Information **dissimilar** to question is structurally **unavailable**
- Unable to retrieve all **relevant** information



Finding *relevant* but *dissimilar* information

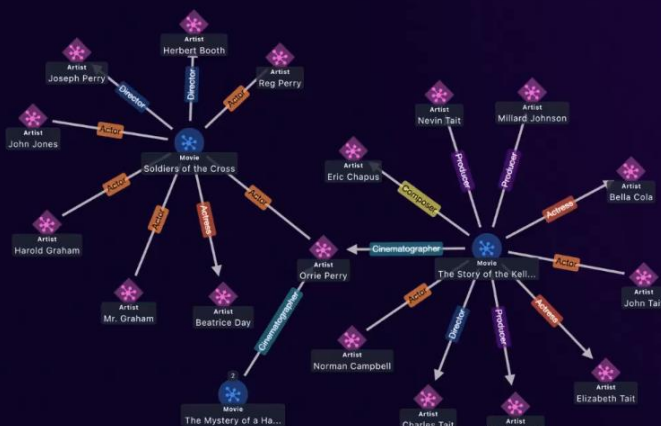
Relevant information

- Related to the topic at hand

Multiple ways in which things are related...

- Parent-child
- Cause-effect
- Contiguity in time/space
- Social, organizational, legal, taxonomic relations
- ...
- Semantic similarity

Graphs represent connections in data



Nodes

- Entities
- Concepts
- Properties – entity attributes

Edges

- Relationships between entities
- Semantics
- Properties – weight, metadata

A GraphRAG example

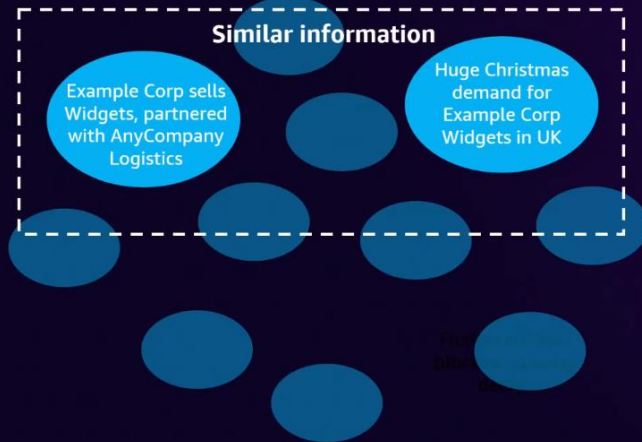
Vector RAG response

What are the sales prospects for Example Corp in the UK?



Vector RAG response

What are the sales prospects for Example Corp in the UK?



Graph RAG response

What are the sales prospects for Example Corp in the UK?

Related information

Example Corp sells Widgets, partnered with AnyCompany Logistics

Huge Christmas demand for Example Corp Widgets in UK

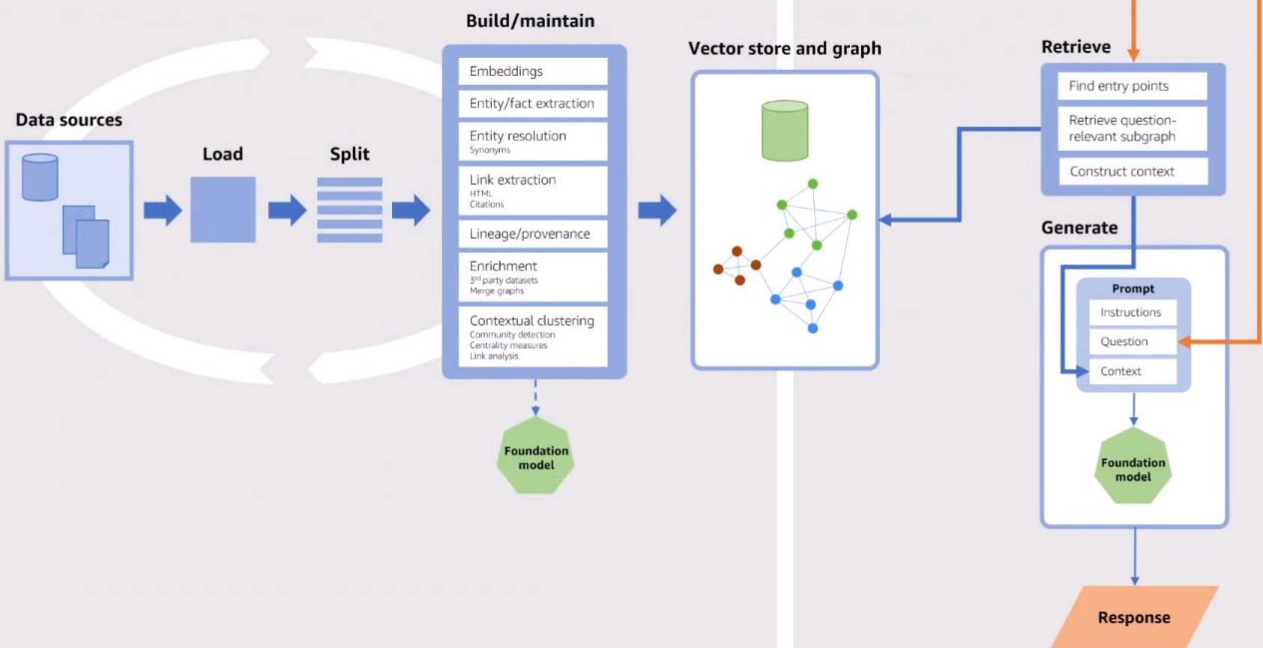
AnyCompany Logistics cutting shipping times via Fictitious Canal

Fictitious Canal blocked, causing delays

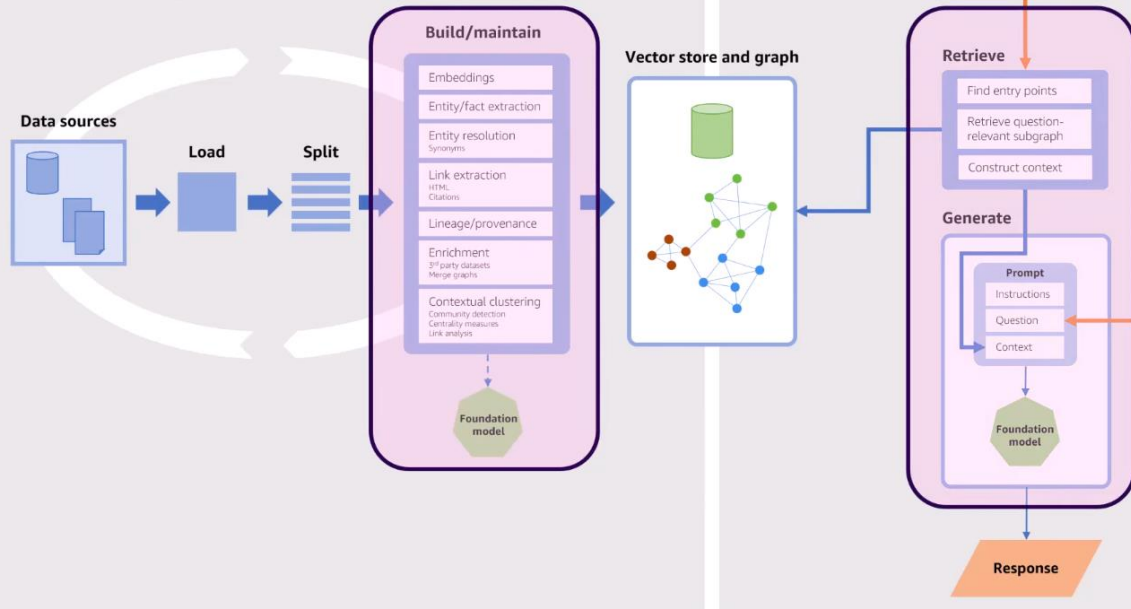
Actually, sales are likely to be negatively impacted by logistics issues



How GraphRAG works



How GraphRAG works



How to build GraphRAG solutions using Amazon Neptune

Available GraphRAG solutions using Neptune

Fully Managed GraphRAG offering using Bedrock and Neptune



Neptune Analytics



Amazon Bedrock

Fully managed AWS solution
Seamless integration within the AWS ecosystem for high security and performance.

Open-source GraphRAG toolkit (GitHub)



Neptune Analytics



Amazon Bedrock

Flexible, adaptable solution for organizations that prefer open-source options and customizability. It will be released in AWS Labs

Amazon Bedrock Knowledge Bases GraphRAG

Generate more relevant responses for RAG applications using knowledge graphs

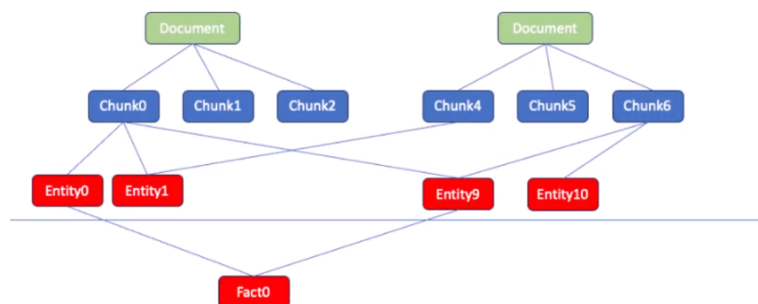
Generate knowledge graphs to link relationships across data sources

Build more comprehensive, explainable generative AI applications

Enhance transparency of source information for better fact verification

The GraphRAG graph data model

The representation the Graph constructed and stored in Neptune Analytics as part of reinvent GraphRAG offering:



Embeddings and entities are generated from data chunks, and edges establish connections between them

GraphRAG solutions using Neptune GraphRAG Toolkit (available on GitHub)

Python toolkit for building GraphRAG applications

Provides a framework for automating construction of graphs from unstructured data

Compose question-answering strategies to query the graph

Uses LlamaIndex components to construct the graph

Lexical graph

Graph index of words and phrases

3 tiers

- Lineage
- Summarisation
- Entity-Relationship



Choosing Managed vs Open Source GraphRAG

Fully Managed GraphRAG offering using Bedrock and Neptune



Neptune Analytics



Amazon Bedrock

Scalability and Performance
Security and Compliance
Operational Ease

Open-source GraphRAG toolkit (GitHub)



Neptune Analytics



Amazon Bedrock

Customisability
Open Integration

GraphRAG Resources

Developer Resources

- GraphRAG Toolkit
 - <https://github.com/awslabs/graphrag-toolkit/>
- Build a knowledge base with graphs from Amazon Neptune
 - <https://docs.aws.amazon.com/bedrock/latest/userguide/knowledge-base-build-graphs.html>
- Amazon Neptune MCP Server (AWS Labs)
 - <https://github.com/awslabs/mcp/tree/main/src/amazon-neptune-mcp-server>

Videos

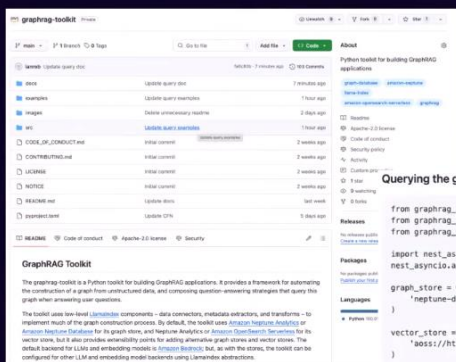
- Discover a Graph Data Model Using Generative AI and Diagram as Code
 - <https://www.youtube.com/watch?v=LvghO60B79ko>
- Amazon Neptune: Simplifying Graph Queries With LLMs and LangChain
 - <https://www.youtube.com/watch?v=B7GtC1lelUA>

Blogs

- Introducing the GraphRAG toolkit
 - <https://aws.amazon.com/blogs/database/introducing-the-graphrag-toolkit/>
- Amazon Neptune + MCP Server
 - <https://medium.com/@bechbd/simplifying-amazon-neptune-integration-with-mcp-servers-8693d78063ae>

GraphRAG Toolkit

Open source Python toolkit for building GraphRAG applications



Querying the graph

```
from graphrag_toolkit import LexicalGraphQueryEngine
from graphrag_toolkit.storage import GraphStoreFactory
from graphrag_toolkit.storage import VectorStoreFactory

import nest_asyncio
nest_asyncio.apply()

graph_store = GraphStoreFactory.for_graph_store(
    'neptune-db://my-graph-cluster-abcdefghijkl.us-east-1.neptune.amazonaws.com'
)

vector_store = VectorStoreFactory.for_vector_store(
    'aws://https://abcdefghijkl.us-east-1.s3.amazonaws.com'
)

query_engine = LexicalGraphQueryEngine.for_traversal_based_search(
    graph_store,
    vector_store
)

response = query_engine.query("What are the differences between Neptune Database and Neptune A")
print(response.response)
```

