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GraphGeeks.org

# Agentic Workflows for Graph RAG: Designing for Production

Virtual | July 16-31

# AGENTIC AI SUMMIT



**'Just as the universe and human thought are built on networks of connection, so too must AI be grounded in richly connected data — because intelligence emerges from the patterns and relationships within that data.'**

-paraphrased from The Principles of Data-Centric AI

# RAG Bridges Knowledge Gaps

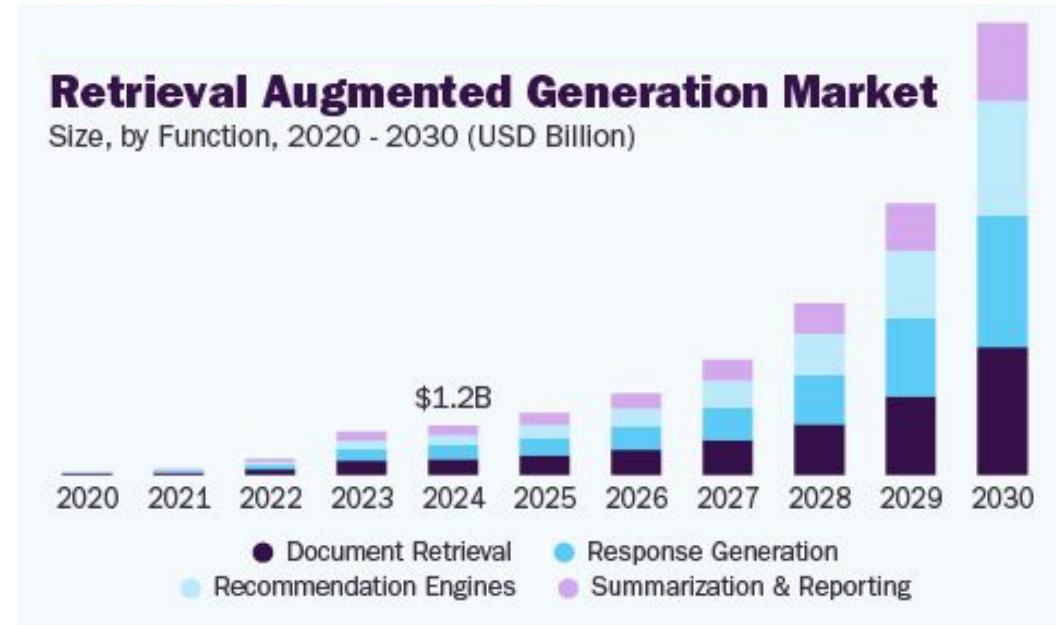
Intertwined with the future of AI

Augments LLMs with external and updated data

Improves accuracy, enhances context, & supports niche info

Struggles with understanding meaning, ambiguity & long tails

Limited by context windows



Source: RAG Market Size, Trend, and Analysis Report  
[grandviewresearch.com/industry-analysis/retrieval-augmented-generation-rag-market-report](http://grandviewresearch.com/industry-analysis/retrieval-augmented-generation-rag-market-report)

# Overcoming the RAG Plateau

**Connections Matter** (in 4 out of 5 innovations below)

- Semantic Gap → Rise of **Graph RAG** to leverage structured knowledge graphs
- Data Quality & Diversity → Multimodal and better parsing
- Retrieval Effectiveness → **Hybrid Search/RAG** & Reranking
- Latency & Efficiency → Late Interaction Models
- Multi-step Reasoning & Context → Agentic RAG, hierarchical indexing, graph memory

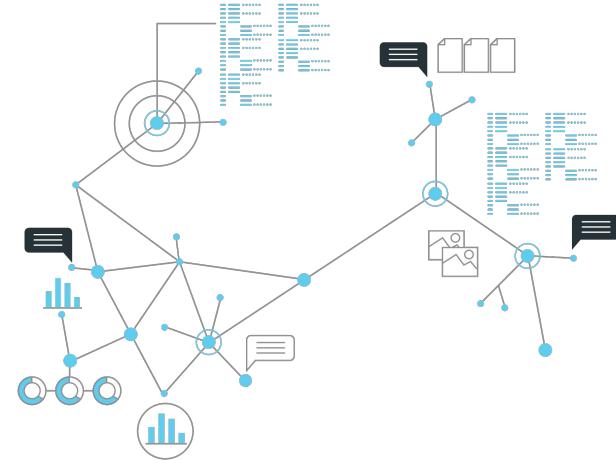


Source: Halfway Through 2025 - A RAG Progress Report  
[ragflow.io/blog/halfway-through-2025-rag-progress-report](https://ragflow.io/blog/halfway-through-2025-rag-progress-report)

# Graph RAG Adds More Than Accuracy

You gain structure

- Structured and relationship-rich retrieval
- Multi-hop reasoning
- Handle multi-document & iterative tasks
- Incorporate multiple data types
- Efficiencies for relationship-based queries
- Explainability with contextual interpretations



LinkedIn uses Graph RAG to cut customer support resolution time by 29.6%

<https://arxiv.org/pdf/2404.17723>

Sequeda & Allemand updated previous work to reduce error rates by 20%

<https://arxiv.org/pdf/2405.11706>

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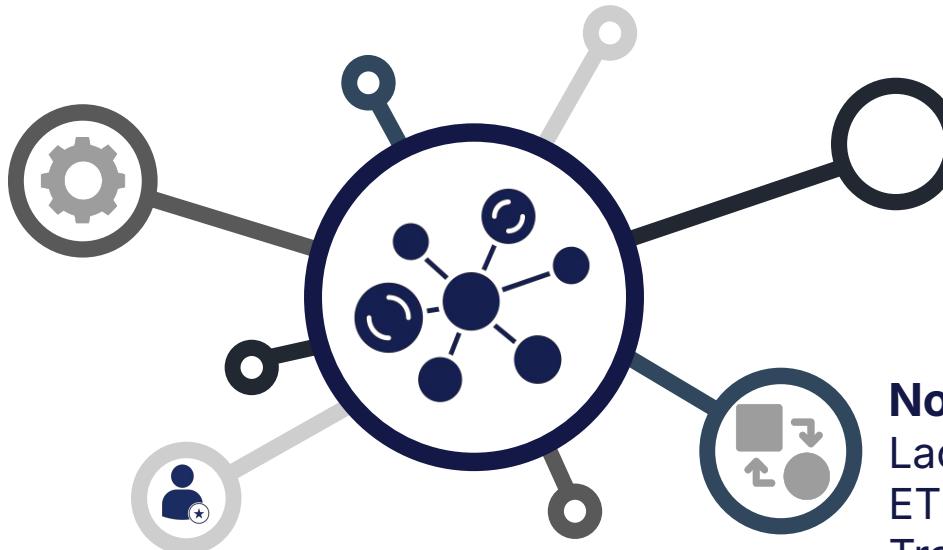
# Production Challenge: Building Quality Graphs

# Building Quality Graphs is Nuanced

No One Size Fits All

## Schema & Graph Modeling

Needs experience  
Many choices  
Specific to use



**Lack of Expertise**  
Graph experience  
(different types)  
Domain SME  
Ontology/Schema

**Not Fluid**  
Lack of interoperability  
ETL/ELT needs auto  
Transforms are onerous  
Hard to blend data

# Is Our Graph RAG Any Good?

Unstructured Data → Graphs → RAG



## Graph RAG disappointment

- Garbage In → Out
- Inconsistent results



## How to measure quality?

- We need benchmarks!
- Monitoring and evaluation in production is still developing

## Unexpected Challenges

- Inexact match = empty response
- Dynamic data and concept drift

# Graph RAG Is Inherently Agentic

Build to orchestrate the steps that enhance graph-based retrieval

Route the query to the appropriate tool or workflow  
E.g. text2cypher or templated Cypher with parameters



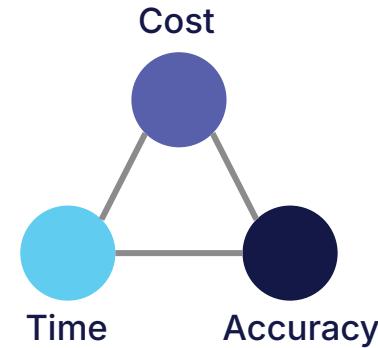
Reduce likelihood and impact of empty responses  
If the LLM doesn't see the data, we can monitor and augment with fuzzy searches

Error handling and recovery  
E.g. incorrect Cypher syntax for queries written by the LLM

Reranking results using graphs  
E.g. prioritized results based on centrality

# Should Everything Be Fully Agentic?

Orchestrated Agents, Adaptation, Human in the Loop



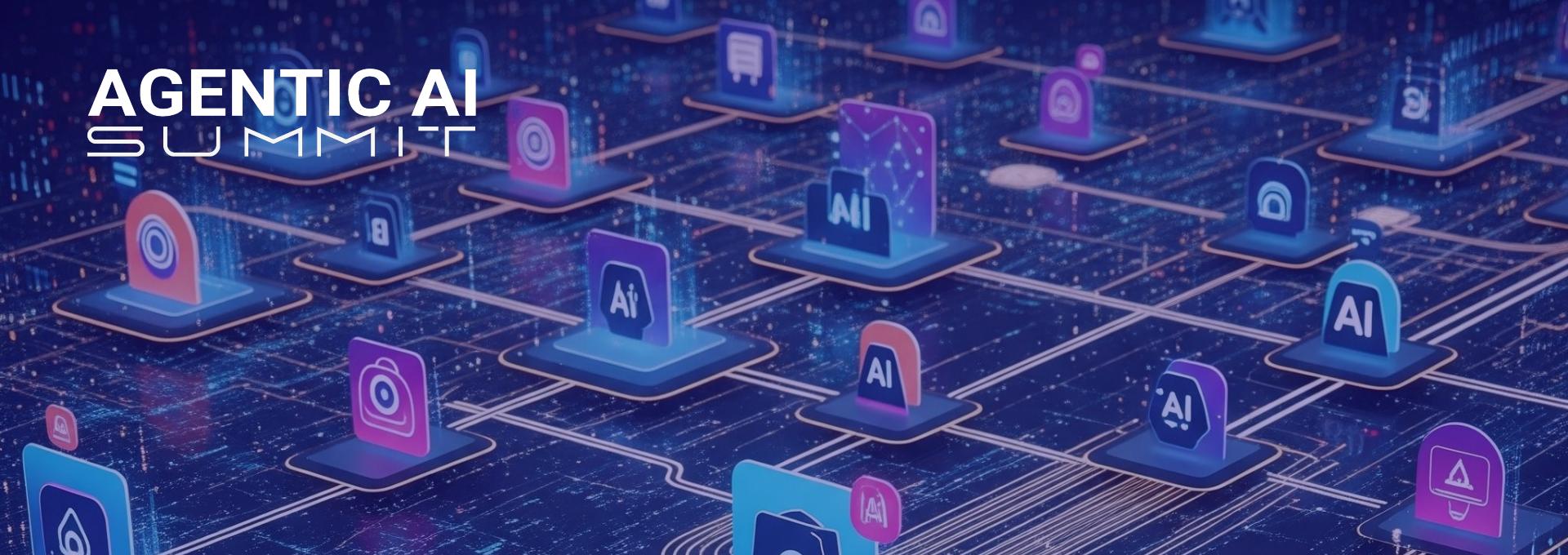
Agentic applications provide a sliding scale of autonomy

- Intelligent abstraction & improved grounding
- Data validation & ensuring consistency
- SME for orchestration can results in better answers
- Be cognizant of tradeoffs

# 3 Trainings: Agentic Workflows for Graph RAG

- Today: Designing for Production
  - Need for Agentic Workflows
  - Agentic for Graph Schemas
  - Intro to BAML
- July 24: Building Production-Ready Knowledge Graphs
  - Hands-on implementation
  - Full Graph RAG loop
  - Intro to Kuzu, LanceDB
- July 30: Evaluating & Benchmarking Results
  - How to measure success
  - Monitoring and improvement
  - Intro to Opik and ADK





# Systematic Approach: Schemas & Agentic Workflows

# LLMs/Agents → Graph & Schema → RAG

Beware an infinite loop of garbage in & out & in & out...

Cautiously use LLMs & Agents for assisting with schema and graph creation



- Suggest/generate schema definitions
- Extract and load entities & relationships
- Suggest properties by inferring attributes

Maintain human oversight for true understanding and SME

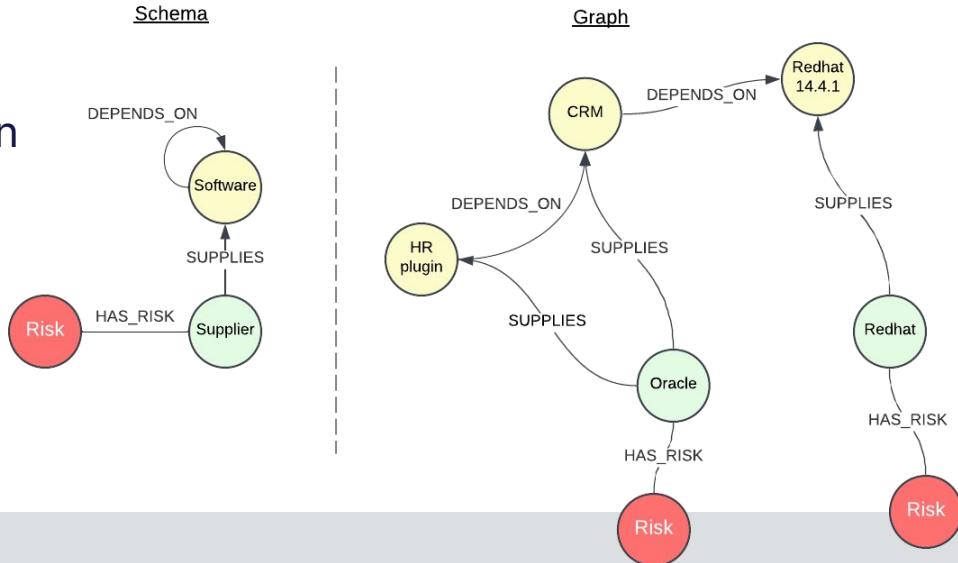


- Incorrect models have rippling effects
- Resolving ambiguities need human imagination to consider impacts
- Complex modeling requires nuance to untangle intricate relationships

# Design Graph Schemas for Production

## Human in the Loop

1. Fit to purpose
2. Define relationship types & direction
3. Balance nodes & properties
4. Granularity & normalization
5. Consistency & constraints
6. Model for query optimization
7. Start simple, iterate, & evolve



## Resources

- [Graph Modeling for Perf](#) by Max DeMarzi
- [GSQL Schema Design](#) by TigerGraph
- [Getting Started](#) by Neo4j
- [Schema.org](#)

**The Side by Side Method by Max Lately**  
<https://www.youtube.com/watch?v=gfLt5YU7Yak>

# Our Use Case: Patient Questions

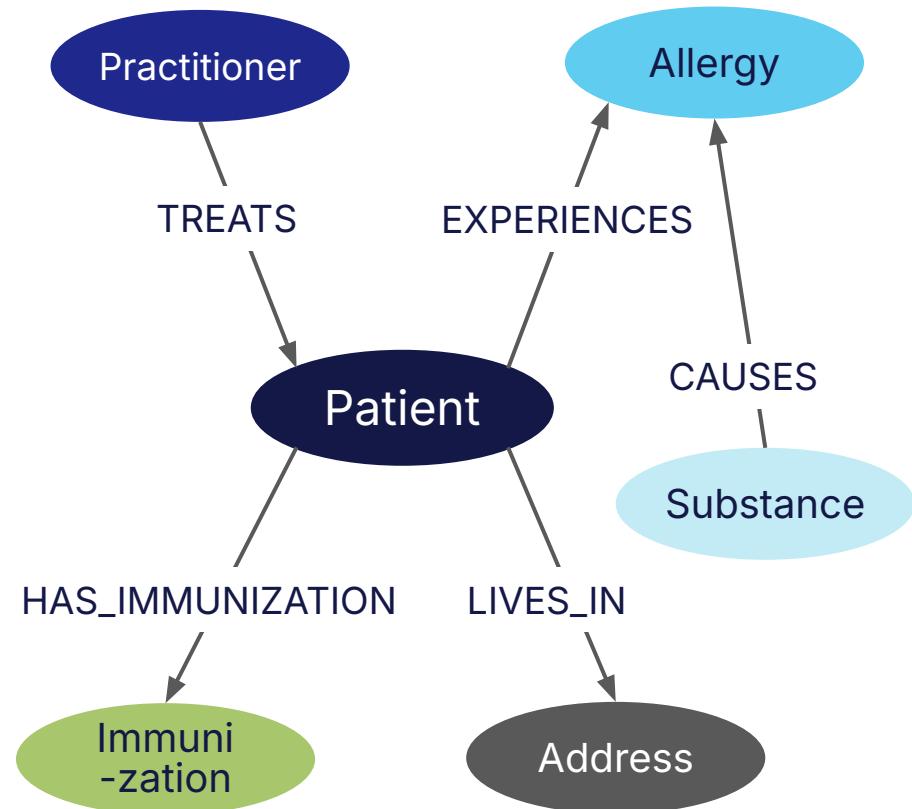
Does graph RAG improve answers?



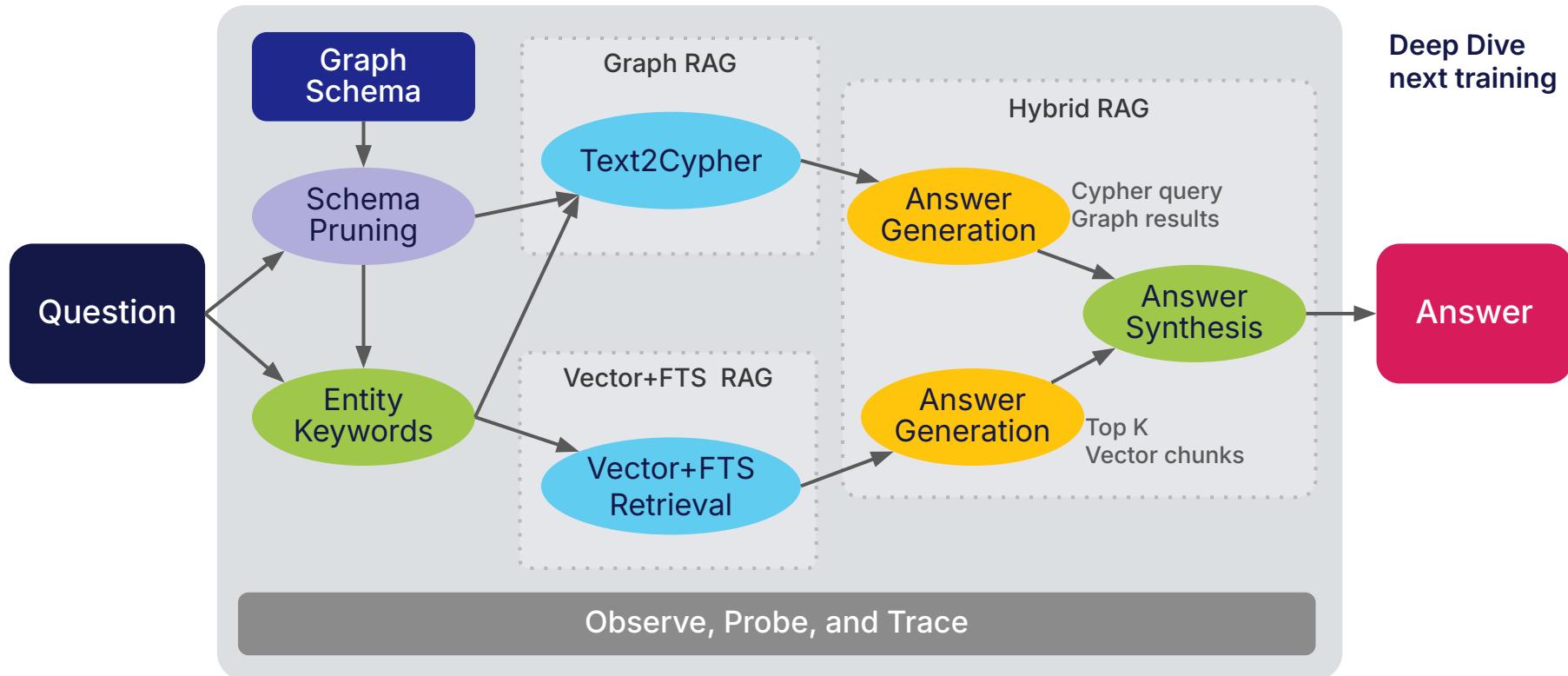
## Hugging Face

[kishanbodybrain/test-fhir](https://kishanbodybrain/test-fhir)

- Synthetic patient data
  - Messy text entries (notes)
  - Nested data elements
- Used to test and verify logic of mixing RAG components

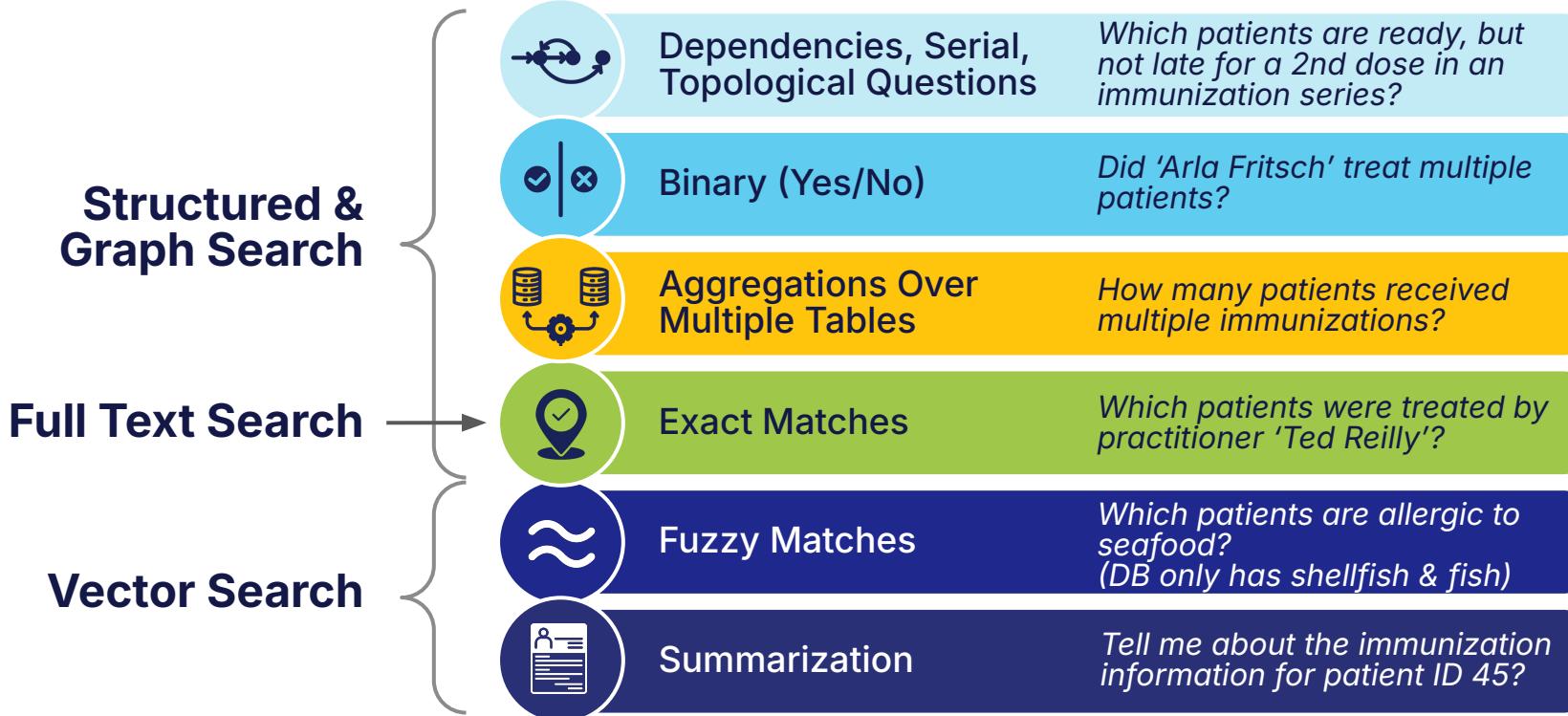


# Our Graph & Hybrid RAG Workflow



# Good RAG Has Multiple Components

Best tools for the job also happen to be better together



# Boundary BAML

Expressive Language for predictable & usable outputs from LLMs



- Parser for structured outputs
- Tool calling for multiple use cases across models and languages
- Prompt engineering as coding (type-safe)

## Addresses the Production Need for Building Quality Graphs

- Schema definition and coercion
- Multiple data sources as inputs for graph creation
- Contextually relevant info used
- Multistep orchestration

# Boundary BAML

This is about Mr. Fernando Amos Breitenberg. He's married. Now let's talk about his medical encounters.  
The main one is a well child visit. This happened at the clinic. The visit started on December 23, 1992, at 01:08:42 and ended on the same day at 01:23:42, with timezone being +01:00. Mr. Breitenberg was looked after by Dr. Trent Krajcik. He was the one who did the whole procedure.  
Moving on, Mr. Breitenberg has an allergy. It's active and confirmed. He's allergic to shellfish. We've known this since April 2, 1994, at 12:08:42, with timezone as +02:00.  
Finally, all this happened at our healthcare provider in Quincy. It's located at 300 CONGRESS ST STE 203, Quincy, MA, 021690907, US.

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```
class PersonNameAndTitle {  
    family string? @alias("surname") @description("Surname of the patient")  
    given string[]? @alias("givenName") @description("Given name(s) of the patient")  
    prefix string? @alias("title") @description("Title of the patient")  
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```
{  
    "name": {  
        "family": "Breitenberg",  
        "given": [  
            "Fernando",  
            "Amos"  
        ],  
        "prefix": "Mr."  
    },  
    "age": null,  
    "gender": null,  
    "birthDate": null,  
    "address": null,  
    "phone": null,  
    "email": null,  
    "maritalStatus": "Married",  
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    category "environment" | "food" | "medication" | "other"  
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```

"address": null,
"phone": null,
"email": null,
"maritalStatus": "Married",
"primaryLanguage": null,
"allergy": [
    "substance": [
        {
            "category": "food",
            "name": "shellfish",
            "manifestation": null
        }
    ]
}

```

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Move Into Production

# Agentic Workflows for Graph RAG

## Design-Build-Evaluate-Expand

### Design

Robust graph schemas are the bedrock

Agent workflows provide higher quality results

Use a sliding scale for agentic systems and tailor for needs

### Build

Enforce structure

Build composable workflows

Test full pipeline and iterate

Plug into observability tools

### Evaluate

Deterministic evaluations (factual answers)

LLM evaluation (qualitative)

Probe and test intermediate stages

Monitor for failure mechanisms

### Expand

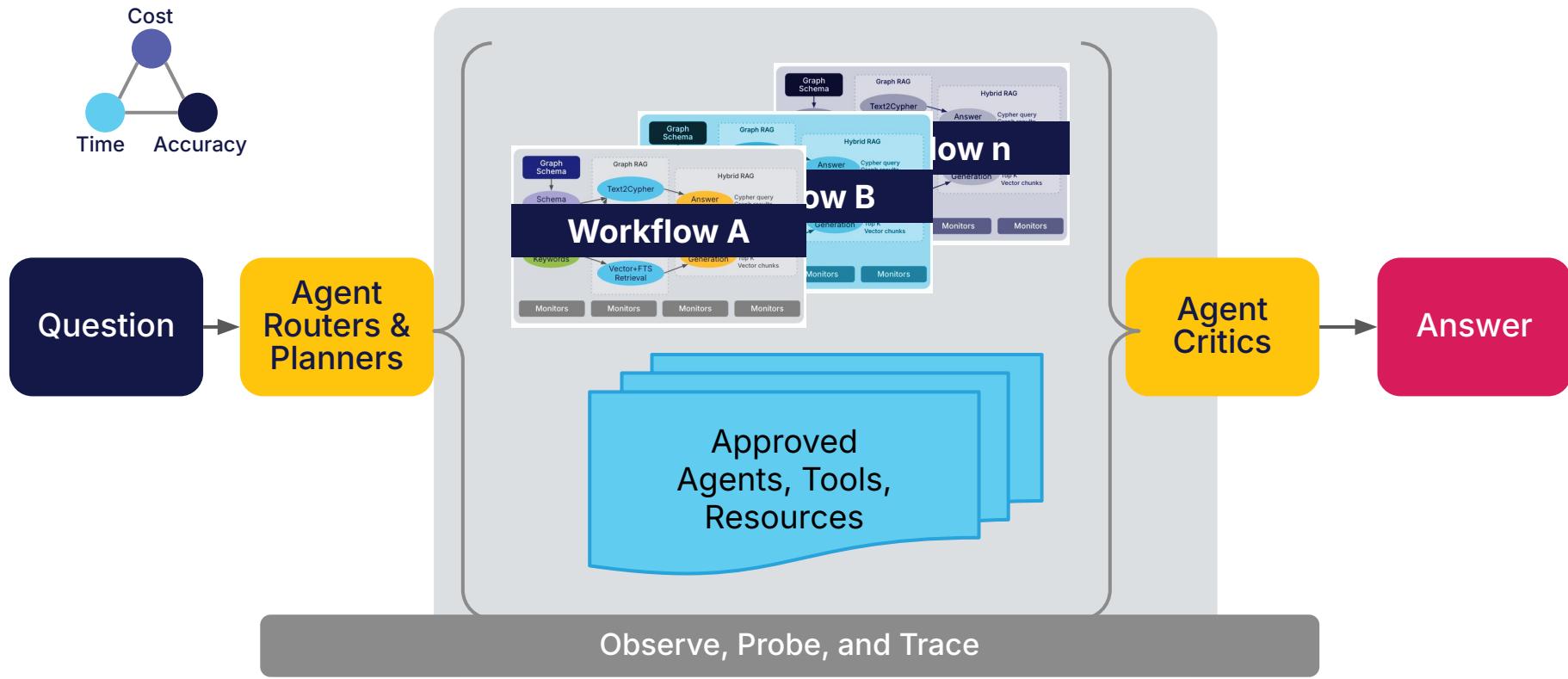
Gradually increase autonomy by component

Evaluate with respect to baseline

Add new tools, workflows & agents

Expand generalizability

# Vision: Increasing Agentic Control



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[tiny.graphgeeks.org/Agentic-Summit](https://tiny.graphgeeks.org/Agentic-Summit)

Jul 24 - Building Production-Ready Knowledge Graphs

Jul 30 - Evaluating & Benchmarking



October: San Francisco

2026: East Coast, Europe ++



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A vendor-neutral community for  
graph practitioners & enthusiasts



Amy Hodler