

# Building Advanced RAG Over Complex Documents

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**Jerry Liu**  
June 11, 2024

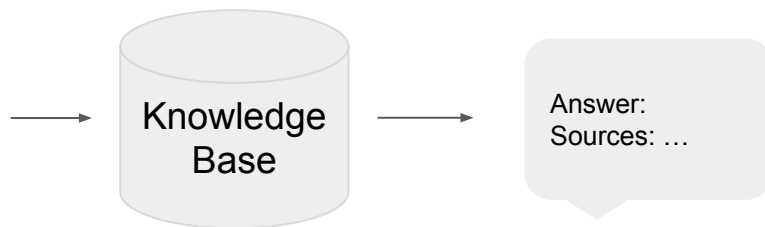
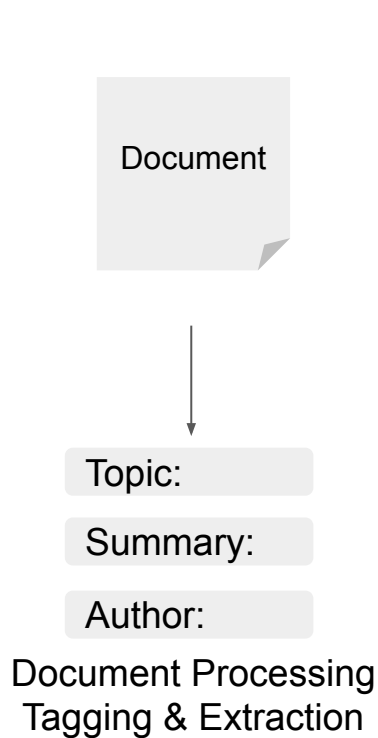


# Agenda

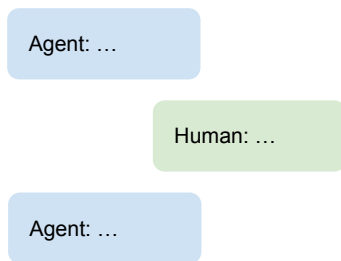
1. Building a Knowledge Assistant
2. RAG Overview: Basic RAG and where it goes wrong
3. Improving Data Quality:
  - Improve LLM reasoning over complex data
  - **Workshop:** LlamaParse over Complex Documents
4. Improving Query Complexity: from RAG to agents
  - **Workshop:** LlamaParse-powered document agent
5. What's next?

# Enterprise Use Cases

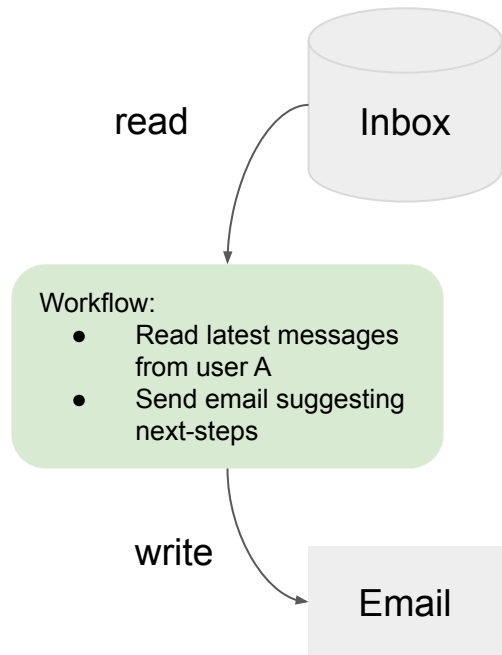
# Enterprise Use Cases



## Knowledge Search & QA (RAG)

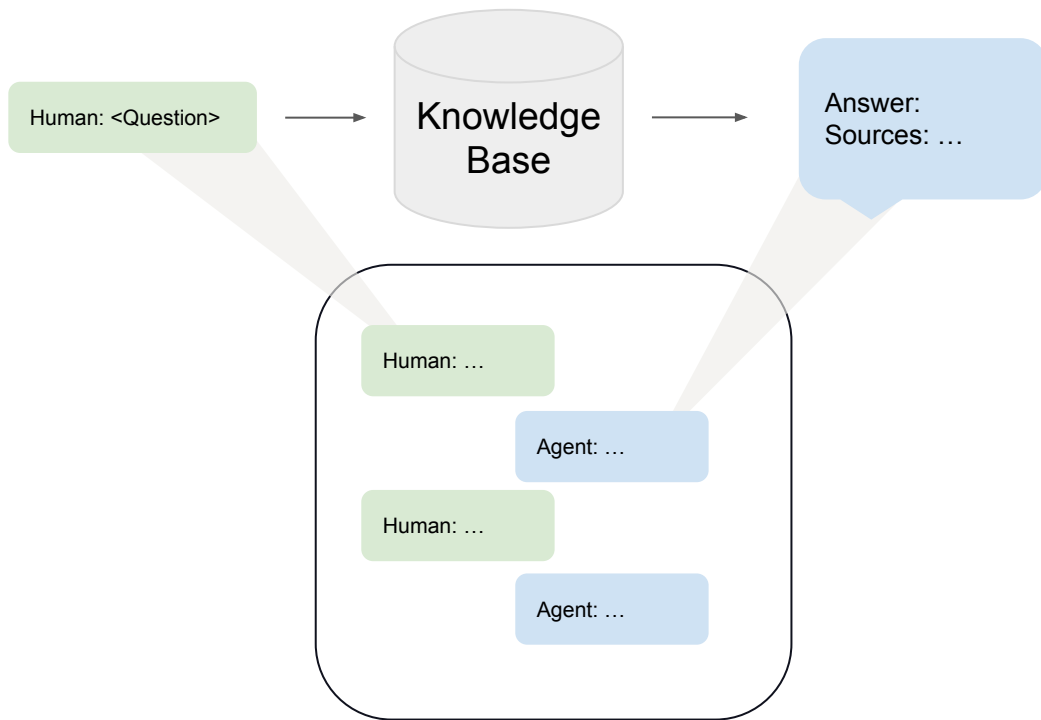


## Conversational Agent

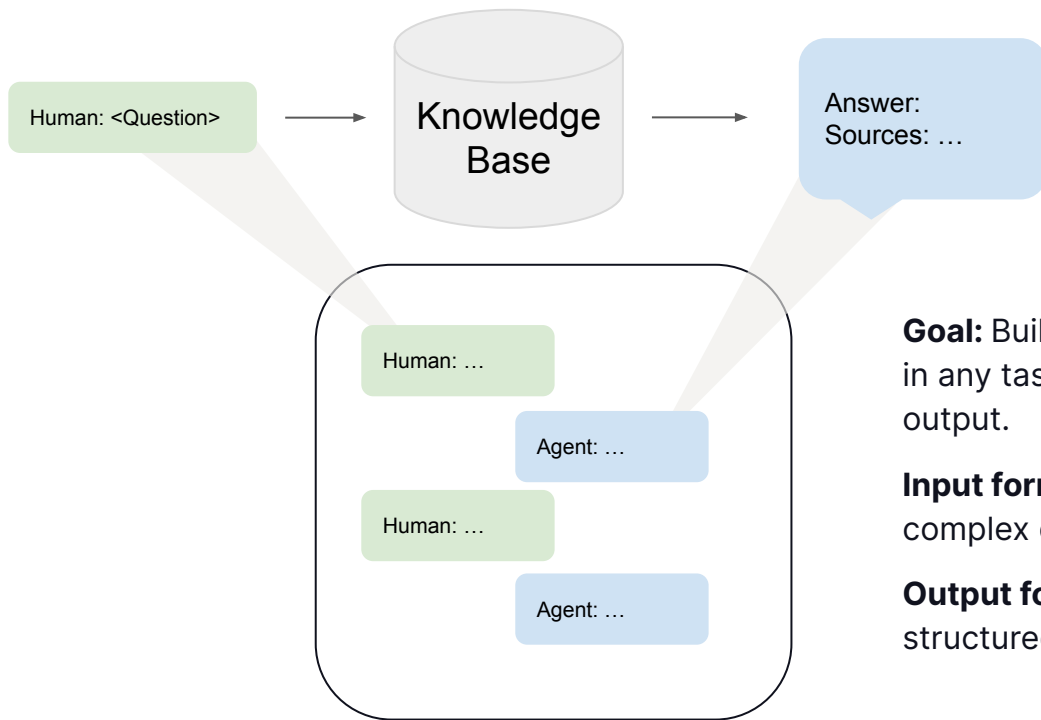


## Workflow Automation

# Building a Knowledge Assistant



# Building a Knowledge Assistant



**Goal:** Build an interface that can take in any task as input and give back an output.

**Input forms:** simple questions, complex questions, research tasks

**Output forms:** short answer, structured output, research report

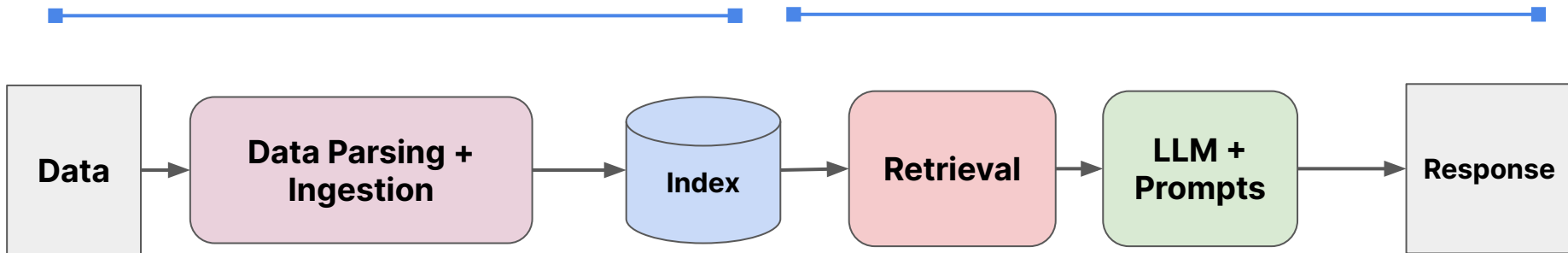
# RAG

# Retrieval Augmented Generation (RAG)

An overview of a RAG Pipeline

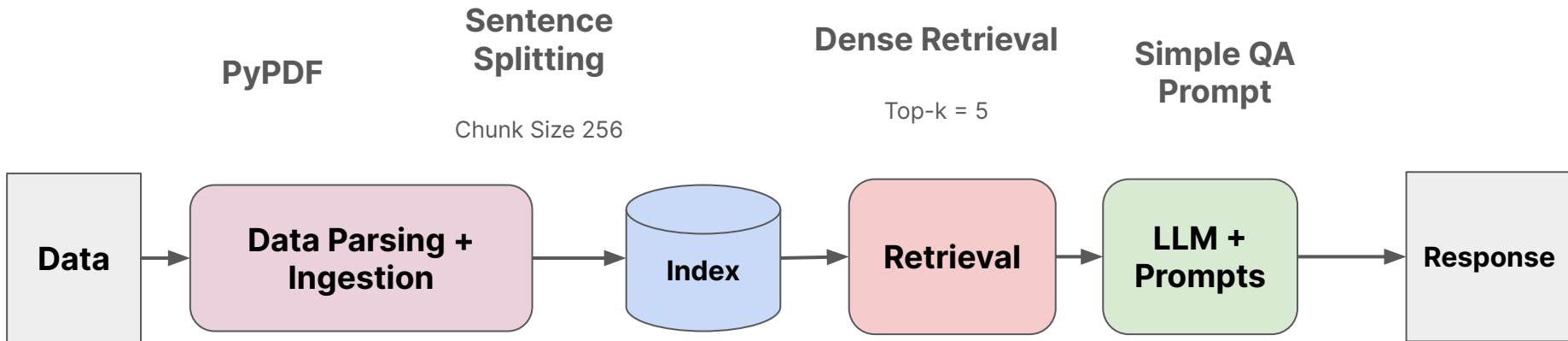
Data Parsing & Ingestion

Data Querying





# Naive RAG



# Challenges with Naive RAG

# Easy to Prototype, Hard to Productionize

Naive RAG approaches tend to work well for **simple** questions over a **simple, small** set of documents.

- “What are the main risk factors for Tesla?” (over Tesla 2021 10K)
- “What did the author do during his time at YC?” (Paul Graham essay)

# Easy to Prototype, Hard to Productionize

But productionizing RAG over more questions and a larger set of data **is hard!**

# Easy to Prototype, Hard to Productionize

## Failure Modes:

- Simple Questions over Complex Data
- Simple Questions over Multiple Documents
- Complex Questions

# Easy to Prototype, Hard to Productionize

## Failure Modes:

- Simple Questions over Complex Data
- Simple Questions over Multiple Documents
- Complex Questions

The top priority goal should be figuring out how to **get high-response quality** from the set of representative questions you want to ask.

# Can we do more?

In the naive setting, RAG is boring.

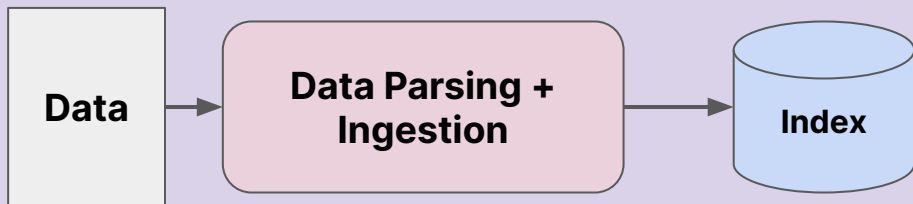
- ❌ It's just a glorified search system
- ❌ There's many questions/tasks that naive RAG can't give an answer to.



Can we go beyond simple search/QA to building a general  
**context-augmented research assistant?**

# Main Focus Areas

## Improving Data Quality



## Improving Query Complexity



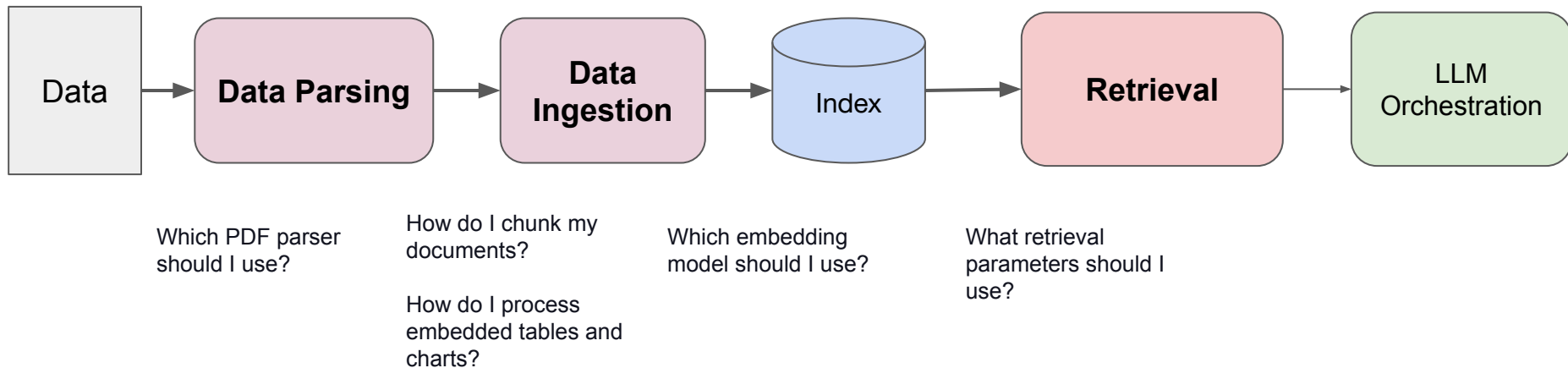


# Improving Data Quality

# RAG is only as Good as your Data

Garbage in = Garbage Out

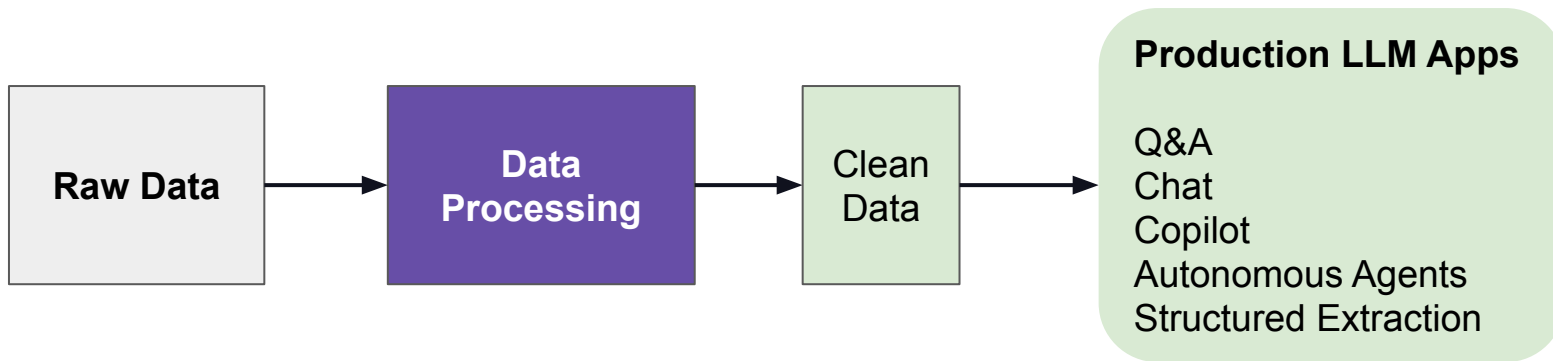
There's too many parameters for developers to figure out.



# RAG is only as Good as your Data

Garbage in = garbage out

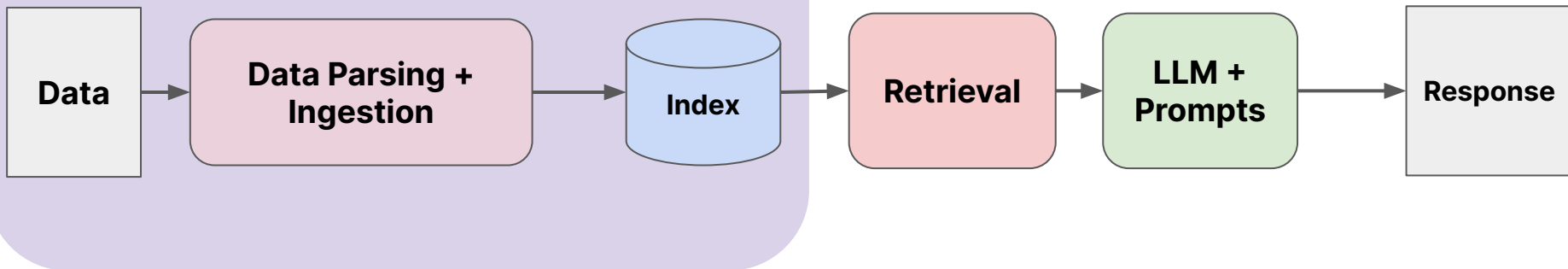
Good data quality is a **necessary** component of any production LLM app.



# RAG is only as Good as your Data

## Main Components of Data Processing:

- Parsing
- Chunking
- Indexing



# General Principles

## Parsing:

- Bad parsers are a key cause of garbage in == garbage out.
- Badly formatted text/tables confuse even the best LLMs

## Chunking:

- Try to preserve semantically similar content.
  - 5 Levels of Text Splitting
- **Strong baseline:** page-level chunking.

## Indexing:

- Raw text oftentimes confuse the embedding model.
- Don't just embed the raw text, embed **references**.
- Having multiple embeddings point to the same chunk is a **good practice!**

# Case Study: Complex Documents

A lot of documents can be classified as **complex**:

- Embedded Tables, Charts, Images
- Irregular Layouts
- Headers/Footers

Naive RAG indexing pipelines fail over these documents.

Let's build an **advanced RAG indexing pipeline**.

## Liabilities

(in 000's of CHF)

Item	31 Dec 2022	31 Dec 2021	Change
Payables and accruals	4,685	4,066	619
Employee benefits	127,215	84,676	42,539
Contributions received in advance	6,975	10,192	(3,217)
Unearned revenue from exchange transactions	20	651	(631)
Deferred Revenue	71,301	55,737	15,564
Borrowings	28,229	29,002	(773)
Funds held in trust	30,373	29,014	1,359
Provisions	1,706	1,910	(204)
<b>Total Liabilities</b>	<b>270,504</b>	<b>215,248</b>	<b>55,256</b>

# Most PDF Parsing is Inadequate

Extracts into a messy format that is impossible to pass down into more advanced ingestion/retrieval algorithms.

Please find below AXA's rankings and market shares in the main countries where it operates:

	Property & Casualty		Life & Savings		Sources
	Ranking	Market share (in %)	Ranking	Market share (in %)	
Main Developed Markets	France	2	12.9	3	8.4 "France Assureurs" as of December 31, 2022. Market share based on statutory premiums and market estimations by SIA (Swiss Insurance Association) figures as of January 31, 2023.
	Switzerland	1	13.3	4	7.8 GDV (German association of Insurance companies) as of December 31, 2021.
	Germany	6	4.8	8	3.4 Assuralia (Belgium Professional Union of Insurance companies) based on gross written premium as of September 30, 2022.
	Belgium	1	17.7	4	8.7 UK General Insurance: Competitor Analytics 2021, Global Data, as of December 31, 2021.
	United Kingdom	4	8.2	n/a	n/a
	Ireland	1	31.9	n/a	n/a Insurance Ireland P&C Statistics 2021 as of December 31, 2021.
	Spain	5	4.9	9	3.1 Spanish Association of Insurance Companies, ICEA as of December 31, 2022.
	Italy	5	5.8	9	3.9 Associazione Nazionale Imprese Assicuratrici (ANIA) as of December 31, 2021.
	Japan	13	0.6	9	5.0 Disclosed financial reports (excluding Kambo Life) for the 12 months ended September 30, 2022.
	Hong Kong	1	7.0	7	5.0 Insurance Authority statistics based on gross written premiums as of September 30, 2022.
Main Emerging Markets	XL Insurance in the United States	16	1.8	n/a	n/a AM Best 2021 as of December 31, 2021, in the United States in Commercial lines.
	XL Reinsurance worldwide	14	2.3	n/a	n/a AM Best 2021 as of December 31, 2021.
	Thailand	18	1.8	5	7.2 TGIA (Thai General Insurance Association) as of December 31, 2022 and TLAA (Thai Life Assurance Association) as of November 30, 2022.
	Indonesia	n/a	n/a	2	8.7 AAJI Statistic measured on Weighted New Business Premium as of September 30, 2022.
	Philippines	n/a	n/a	6	8.6 Insurance Commission measured on total premium income as of June 30, 2022.
	China	n/a	0.4	n/a	n/a CBIRC (China Banking and Insurance Regulatory Commission) as of December 31, 2022.
	Mexico	3	8.0	12	2.0 AMIS (Asociación Mexicana de Instituciones de Seguros) as of September 30, 2022.
	Brazil	15	1.4	n/a	n/a SUSEP (Superintendência de Seguros Privados) as of September 2022.

(a) For Property & Casualty insurance market, CBIRC did not disclose information on ranking. For Life & Savings insurance market, CBIRC did not disclose information on market shares and ranking.

## PyPDF

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1 Please find below AXA's rankings and market shares in the main countries where it operates:
2 Property & Casualty Life & Savings
3 Market
4 share
5 (in %) Market
6 share
7 (in %) Ranking Ranking Sources
8 France 2 12.9 3 8.4 "France Assureurs" as of December 31, 2022.
9 Market share based on statutory premiums and market
10 estimations by SIA (Swiss Insurance Association) figures
11 as of January 31, 2023. Switzerland 1 13.3 4 7.8
12 GDV (German association of Insurance companies)
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14 Assuralia (Belgium Professional Union of Insurance
15 companies) based on gross written premium
16 as of September 30, 2022. Belgium 1 17.7 4 8.7
17 UK General Insurance: Competitor Analytics 2021, Global Data,
18 as of December 31, 2021. United Kingdom 4 8.2 n/a
19 Ireland 1 31.9 n/a Insurance Ireland P&C Statistics 2021 as of December 31, 2021.
20 Spain 5 4.9 9 3.1
21 Spanish Association of Insurance Companies, ICEA
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27 Insurance Authority statistics based on gross written premiums
28 as of September 30, 2022. Hong Kong 1 7.0 7 5.0
29 XL Insurance in
30 the United States
31 AM Best 2021 as of December 31, 2021, in the United States in Commercial lines. 1
32 6 1.8 n/a n/a
33 XL Reinsurance worldwide 14 2.3 n/a n/a AM Best 2021 as of December 31, 2021.
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36 Assurance Association) as of November 30, 2022. ts e rk ing Ma g Emer Main
37 Indonesia n/a n/a 2 8.7 AAJI Statistic measured on Weighted New Business Premium as of Sep tember 30, 2022.
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42 Mexico 3 8.0 12 2.0 AMIS (Asociación Mexicana de Instituciones de Seguros) as of Sept
43 ember 30, 2022.
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```

# LlamaParse

A special **Document Parser** designed to let you build RAG over Complex docs

[https://github.com/run-llama/llama\\_parse](https://github.com/run-llama/llama_parse)

The screenshot shows the GitHub repository for llama\_parse. The repository is owned by logan-markewich and is public. It has 5 branches, 0 tags, 4 watchers, 0 forks, and 2 stars. The repository contains a README, a MIT license, and several files including examples, llama\_parse, tests, .gitignore, LICENSE, README.md, poetry.lock, and pyproject.toml. The README is currently selected and shows the following content:

## LlamaParse (Preview)

LlamaParse is an API created by LlamaIndex to efficiently parse and represent files for efficient retrieval and context augmentation using LlamaIndex frameworks.

LlamaParse directly integrates with [LlamaIndex](#).

Currently available in preview mode for **free**. Try it out today!

**NOTE:** Currently, only PDF files are supported.

### Getting Started

The right sidebar of the repository page shows the following sections:

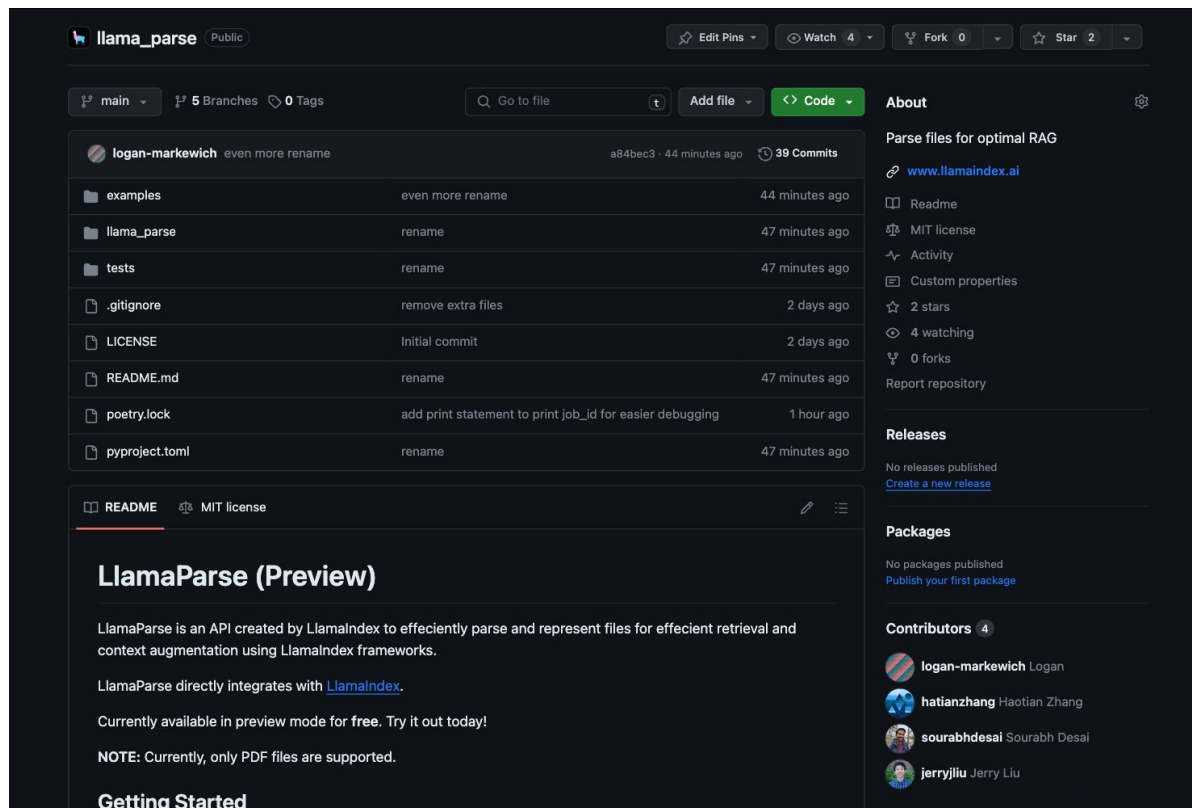
- About**: Parse files for optimal RAG. Links to [www.llamaindex.ai](https://www.llamaindex.ai), Readme, MIT license, Activity, Custom properties, 2 stars, 4 watching, 0 forks, and Report repository.
- Releases**: No releases published. [Create a new release](#).
- Packages**: No packages published. [Publish your first package](#).
- Contributors**: 4 contributors listed: logan-markewich, hatianzhang, sourabhdesai, and jerryliu.



# LlamaParse

## Capabilities

- ✓ Extracts tables / charts
- ✓ Input natural language parsing instructions
- ✓ JSON mode
- ✓ Image Extraction
- ✓ Support for ~10+ document types (.pdf, .pptx, .docx, .xml)



# LlamaParse Results

Expanded:

## LlamaParse

Apple Inc.  
COMBINED CONSOLIDATED STATEMENTS OF OPERATIONS (Continued)  
(In US \$ mil., except number of shares, which are reflected in thousands, and per share amounts)

	Three Months Ended		Three Months Ended	
	September 30, 2023	September 30, 2022	September 30, 2023	September 30, 2022
Revenue				
Products	\$ 42,884	\$ 35,838	\$ 236,035	\$ 243,169
Services	27,786	36,781	1,617,915	1,581,761
Total revenue 1	70,670	72,619	2,853,950	2,824,930

Cost of sales	42,496	48,487	199,852	207,471
Services	4,985	3,661	24,882	23,875
Total cost of sales	47,481	52,148	224,734	231,346
Gross margin	23,189	20,471	1,629,216	1,593,584

Operating expenses				
Research and development	7,987	6,781	59,495	56,574
Selling, general and administrative	8,373	8,188	59,932	55,584
Total operating expenses	16,360	14,969	119,427	112,158

Operating income	7,829	5,502	1,509,789	1,481,426
Other income (expense), net	39	(273)	(883)	317
Income before income tax	7,868	5,229	1,508,906	1,481,743
Provision for income taxes	823	283	5,921	15,352
Net income	\$ 7,045	\$ 4,946	\$ 1,502,985	\$ 1,466,391

Earnings per share				
Basic	\$ 0.17	\$ 0.13	\$ 4.16	\$ 4.15
Diluted	\$ 0.16	\$ 0.12	\$ 4.10	\$ 4.01

Discontinued operating activity, net of income tax				
Basic	76,896,531	16,833,382	76,896,531	16,833,382
Diluted	76,896,531	16,833,382	76,896,531	16,833,382

Key value by segment category				
Revenue	\$ 47,161	\$ 38,668	\$ 257,336	\$ 264,716
Services	23,462	32,321	1,617,915	1,581,761
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## PyPDF

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## Textract

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## PdfMiner

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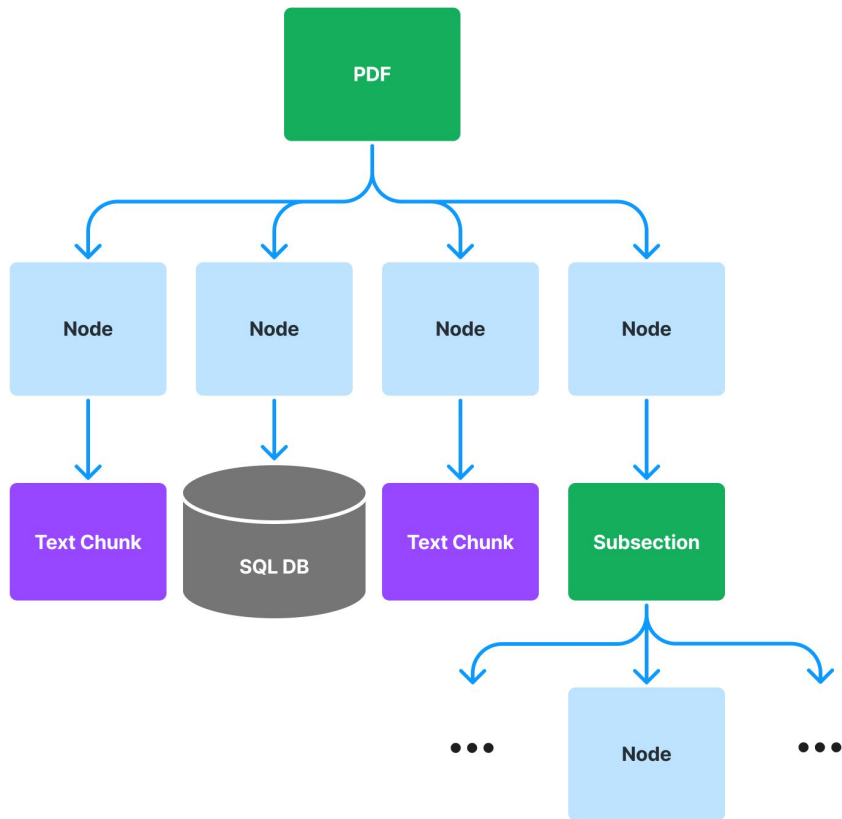
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Diluted	76,896,531	16,833,382	76,896,531	16,833,382

Key value by segment category				
Revenue	\$ 47,161	\$ 38,668	\$ 257,336	\$ 264,716
Services	23,462	32,321	1,617,915	1,581,761
Operating income	17,486	14,716	1,509,789	1,481,426
Net income	8,236	5,786	1,502,985	1,466,391

Key value by segment				
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Operating income	17,486	14,716	1,509,789	1,481,426
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# LlamaParse + Advanced Indexing

1. Use LlamaParse to parse a document into a semi-structured markdown representation (text + tables)
2. Use a markdown parser to extract out text and table chunks
3. Use an LLM to extract a summary from each table → link to underlying table chunk.
4. Index a **graph** of text and table chunks.



# Advanced Table Understanding

[https://github.com/run-llama/llama\\_parse/blob/main/examples/demo\\_advanced.ipynb](https://github.com/run-llama/llama_parse/blob/main/examples/demo_advanced.ipynb)

```
[54]: query = "what is the Repayments of debt in the Cash flows from financing activities for Netflix?"
```

```
response_0 = baseline_pdf_query_engine.query(query)
print("*****Baseline PDF Query Engine*****")
print(response_0)
```

```
response_1 = raw_query_engine.query(query)
print("\n*****New LlamaParse+ Basic Query Engine*****")
print(response_1)
```

```
response_2 = recursive_query_engine.query(query)
print("\n*****New LlamaParse+ Recursive Retriever Query Engine*****")
print(response_2)
```

\*\*\*\*\*Baseline PDF Query Engine\*\*\*\*\*

The Repayments of debt in the Cash flows from financing activities for Netflix is not provided in the given information.

\*\*\*\*\*New LlamaParse+ Basic Query Engine\*\*\*\*\*

The repayments of debt for Netflix in the Cash flows from financing activities were \$700,000 for the year ended as of December 31, 2022, and \$500,000 for the year ended as of December 31, 2021.

\*\*\*\*\*New LlamaParse+ Recursive Retriever Query Engine\*\*\*\*\*

The repayments of debt in the cash flows from financing activities for the year ended December 31, 2021 was \$500,000.

Net cash provided by operating activities			
Cash flows from investing activities:			
Purchases of property and equipment	( 407,729 )	( 524,585 )	( 497,923 )
Change in other assets	—	( 26,919 )	( 7,431 )
Acquisitions	( 757,387 )	( 788,349 )	—
Purchases of short-term investments	( 911,276 )	—	—
Net cash used in investing activities	( 2,076,392 )	( 1,339,853 )	( 505,354 )
Cash flows from financing activities:			
Proceeds from issuance of debt	—	—	1,009,464
Debt issuance costs	—	—	( 7,559 )
Repayments of debt	( 700,000 )	( 500,000 )	—
Proceeds from issuance of common stock	35,746	174,414	235,406
Repurchases of common stock	—	( 600,022 )	—
Taxes paid related to net share settlement of equity awards	—	( 224,168 )	—
Net cash provided by (used in) financing activities	( 664,254 )	( 1,149,776 )	1,237,311

# Parsing Instructions

<https://colab.research.google.com/drive/1dO2cwDCXjj9pS9yQDZ2vjg-0b5sRXQYo?usp=sharing>

## CALCULATING THE DERIVATIVE OF A CONSTANT, LINEAR, OR QUADRATIC FUNCTION

1. Let's find the derivative of constant function  $f(x) = \alpha$ . The differential coefficient of  $f(x)$  at  $x = a$  is

$$\lim_{\varepsilon \rightarrow 0} \frac{f(a + \varepsilon) - f(a)}{\varepsilon} = \lim_{\varepsilon \rightarrow 0} \frac{\alpha - \alpha}{\varepsilon} = \lim_{\varepsilon \rightarrow 0} 0 = 0$$

Thus, the derivative of  $f(x)$  is  $f'(x) = 0$ . This makes sense, since our function is constant—the rate of change is 0.

To parse this, we take the same instructions as before and add one sentence: Output any math equation in LATEX markdown (between  $\$$  $\$$ ). The result of parsing is clear LaTeX instructions, which render the equations perfectly:

## Calculating the Derivative of a Constant, Linear, or Quadratic Function

1. Let's find the derivative of constant function  $f(x) = \alpha$ . The differential coefficient of  $f(x)$  at  $x = a$  is

$$\lim_{\varepsilon \rightarrow 0} \left( \frac{f(a + \varepsilon) - f(a)}{\varepsilon} \right) = \lim_{\varepsilon \rightarrow 0} \left( \frac{\alpha - \alpha}{\varepsilon} \right) = \lim_{\varepsilon \rightarrow 0} 0 = 0$$

Thus, the derivative of  $f(x)$  is  $f'(x) = 0$ . This makes sense, since our function is constant—the rate of change is 0.

# JSON Mode

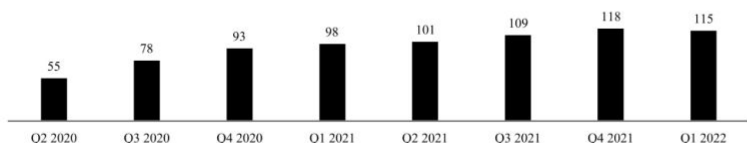
[https://github.com/run-llama/llama\\_parse/blob/main/examples/demo\\_json.ipynb](https://github.com/run-llama/llama_parse/blob/main/examples/demo_json.ipynb)

## Certain Key Metrics and Non-GAAP Financial Measures

*Adjusted EBITDA, revenue growth rates in constant currency and free cash flow are non-GAAP financial measures. For more information about how we use these non-GAAP financial measures in our business, the limitations of these measures, and reconciliations of these measures to the most directly comparable GAAP financial measures, see the section titled "Reconciliations of Non-GAAP Financial Measures."*

**Monthly Active Platform Consumers.** MAPCs is the number of unique consumers who completed a Mobility or New Mobility ride or received a Delivery order on our platform at least once in a given month, averaged over each month in the quarter. While a unique consumer can use multiple product offerings on our platform in a given month, that unique consumer is counted as only one MAPC. We use MAPCs to assess the adoption of our platform and frequency of transactions, which are key factors in our penetration of the countries in which we operate.

Monthly Active Platform Consumers (in millions)



Multi-modal Model  
claude-3-opus-20240229

Text  
Doc

RAG Pipeline

# RAG over Powerpoints

[https://github.com/run-llama/llama\\_parse/blob/main/examples/other\\_files/demo\\_ppt\\_financial.ipynb](https://github.com/run-llama/llama_parse/blob/main/examples/other_files/demo_ppt_financial.ipynb)

```
[27]: print(llama_parse_documents[0].get_content() [-2800:-2300])
```

```
ation and mitigation
---
|Item|31 Dec 2022|31 Dec 2021|Change|
|---|---|---|---|
|Payables and accruals|4,685|4,066|619|
|Employee benefits|127,215|84,676|42,539|
|Contributions received in advance|6,975|10,192|(3,217)|
|Unearned revenue from exchange transactions|20|651|(631)|
|Deferred Revenue|71,301|55,737|15,564|
|Borrowings|28,229|29,002|(773)|
|Funds held in trust|30,373|29,014|1,359|
|Provisions|1,706|1,910|(204)|
|Total Liabilities|270,504|215,248|55,256|
---
## Liabilities
```

Employee Ben

Compared against the original slide image.

## Liabilities

(in 000's of CHF)

Item	31 Dec 2022	31 Dec 2021	Change
Payables and accruals	4,685	4,066	619
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Provisions	1,706	1,910	(204)
<b>Total Liabilities</b>	<b>270,504</b>	<b>215,248</b>	<b>55,256</b>

# Workshop

Let's build a RAG pipeline with Databricks LLMs + local embeddings

<https://colab.research.google.com/drive/1iB3HPOZPpY4qMFpw1Dtr1rJDb44k1TL2?usp=sharing>





# Improving Query Complexity

# Complex Questions

There's certain questions we want to ask where naive RAG will fail.

Examples:

- **Summarization Questions:** "Give me a summary of the entire <company> 10K annual report"

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Examples:

- **Summarization Questions:** "Give me a summary of the entire <company> 10K annual report"
- **Comparison Questions:** "Compare the open-source contributions of candidate A and candidate B"
- **Structured Analytics + Semantic Search:** "Tell me about the risk factors of the highest-performing rideshare company in the US"

# Complex Questions

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Examples:

- **Summarization Questions:** "Give me a summary of the entire <company> 10K annual report"
- **Comparison Questions:** "Compare the open-source contributions of candidate A and candidate B"
- **Structured Analytics + Semantic Search:** "Tell me about the risk factors of the highest-performing rideshare company in the US"
- **General Multi-part Questions:** "Tell me about the pro-X arguments in article A, and tell me about the pro-Y arguments in article B, make a table based on our internal style guide, then generate your own conclusion based on these facts."

# From RAG to Agents



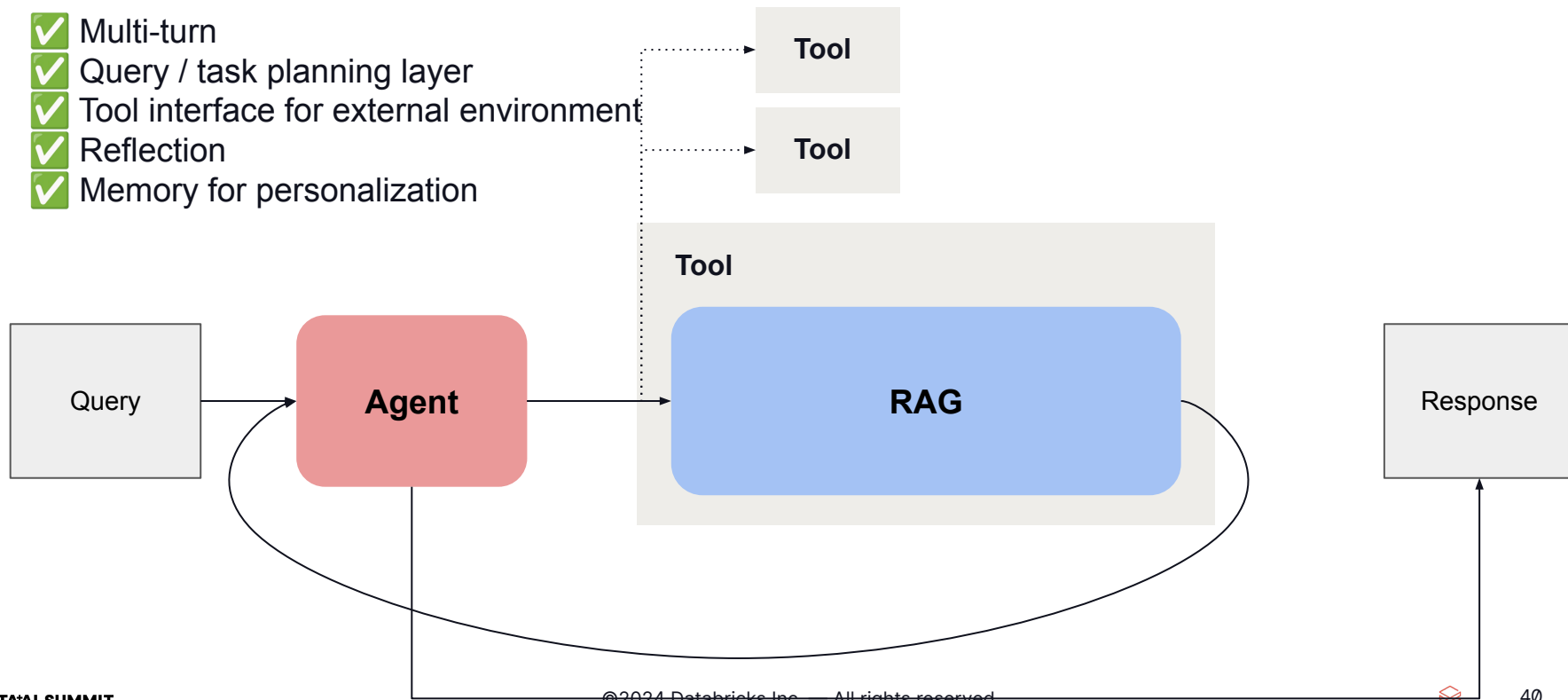
# From RAG to Agents



- ! Single-shot
- ! No query understanding/planning
- ! No tool use
- ! No reflection, error correction
- ! No memory (stateless)

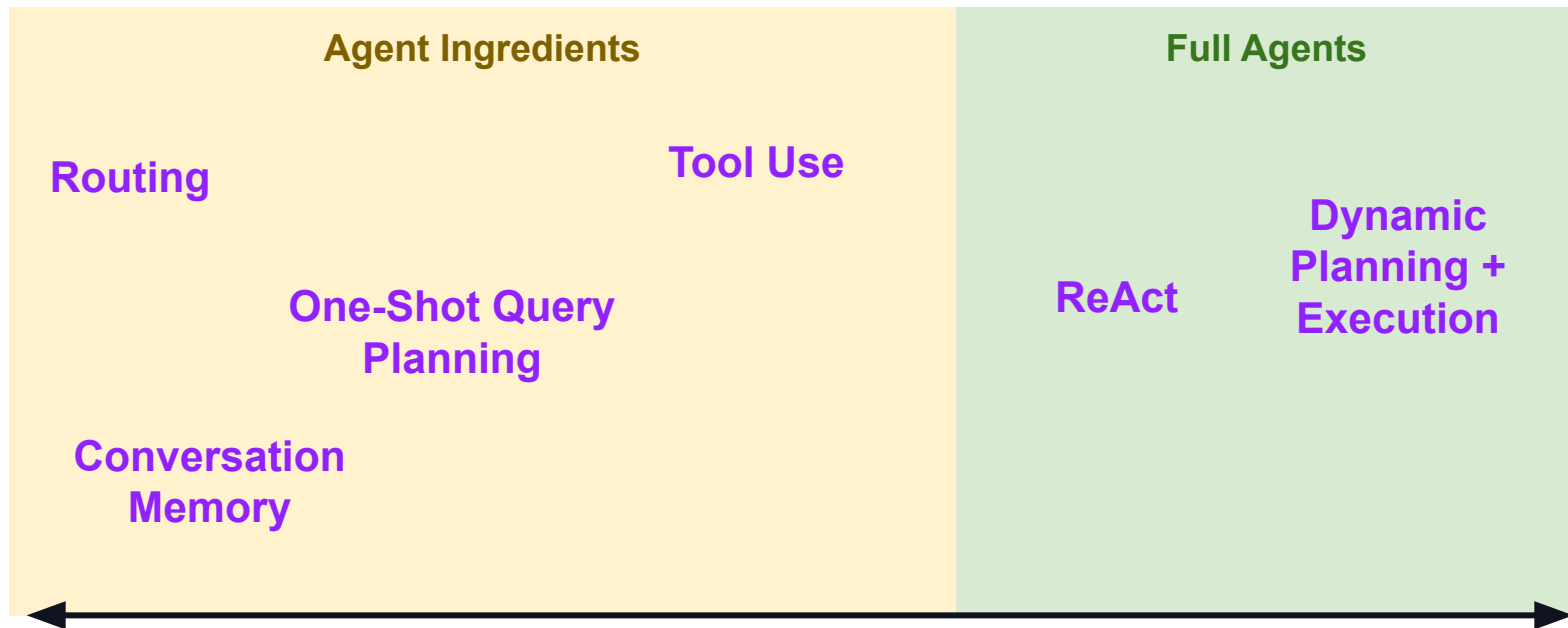
# From RAG to Agents

- ✓ Multi-turn
- ✓ Query / task planning layer
- ✓ Tool interface for external environment
- ✓ Reflection
- ✓ Memory for personalization





# From Simple to Advanced Agents



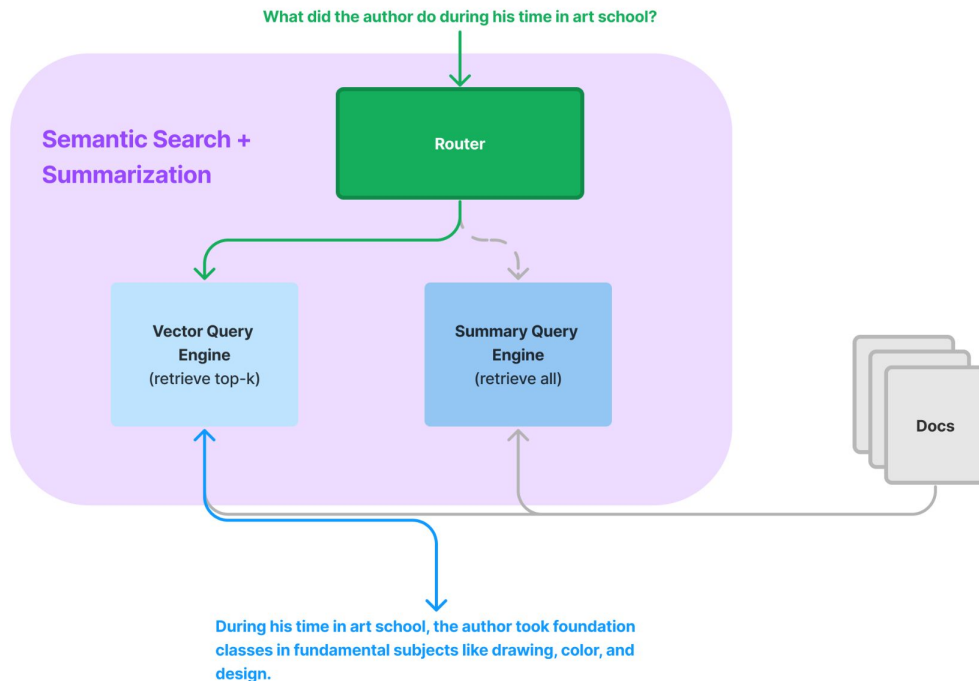
Simple  
Lower Cost  
Lower Latency

Advanced  
Higher Cost  
Higher Latency

# Routing

Simplest form of agentic reasoning.

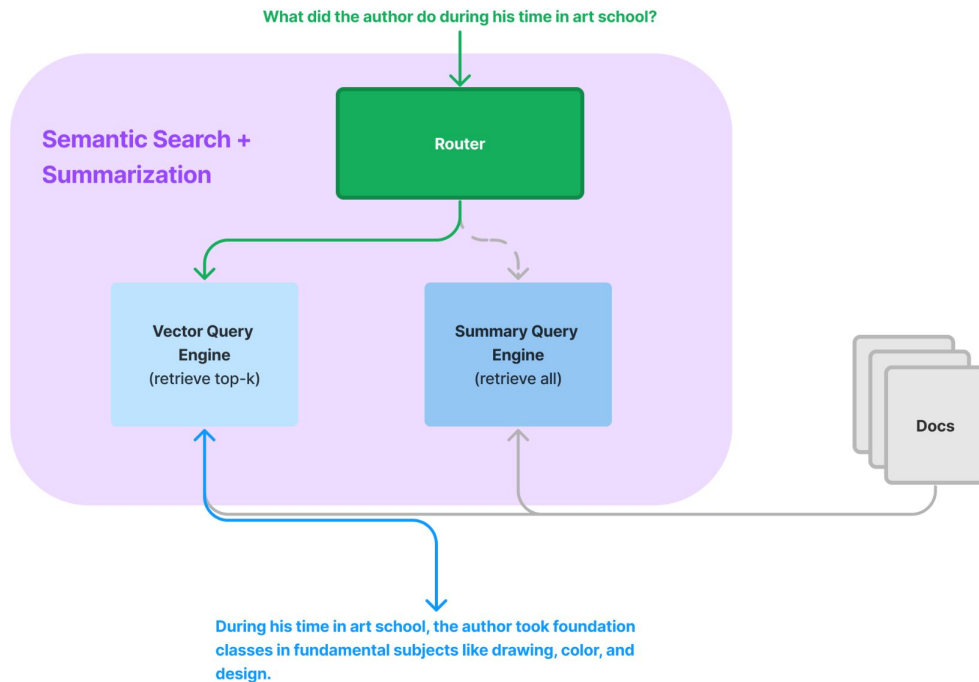
Given user query and set of choices, output subset of choices to route query to.



# Routing

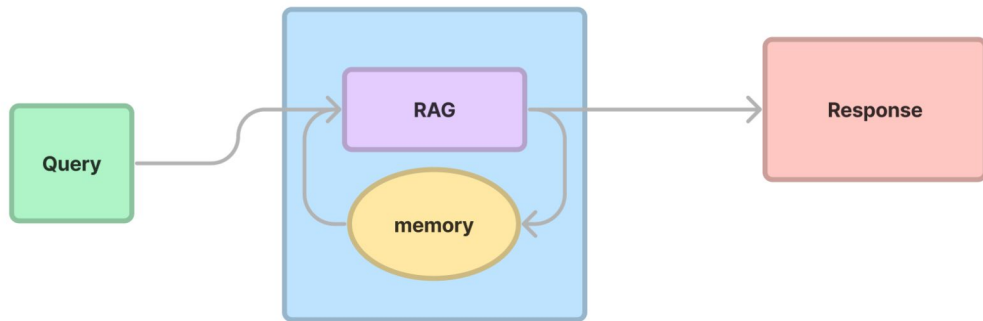
## Use Case: Joint QA and Summarization

### Guide



# Conversation Memory

In addition to current query, take into account **conversation history** as input to your RAG pipeline.

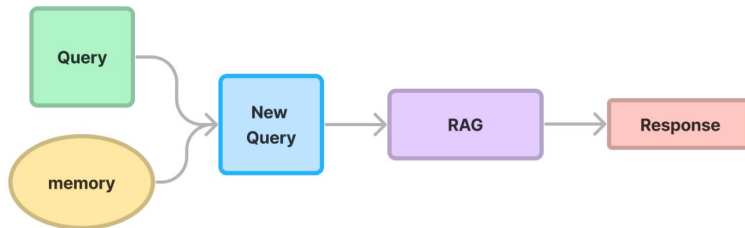


# Conversation Memory

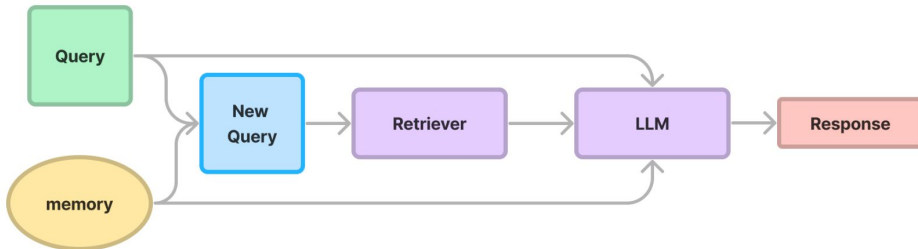
How to account for conversation history in a RAG pipeline?

- Condense question
- Condense question + context

Condense Question

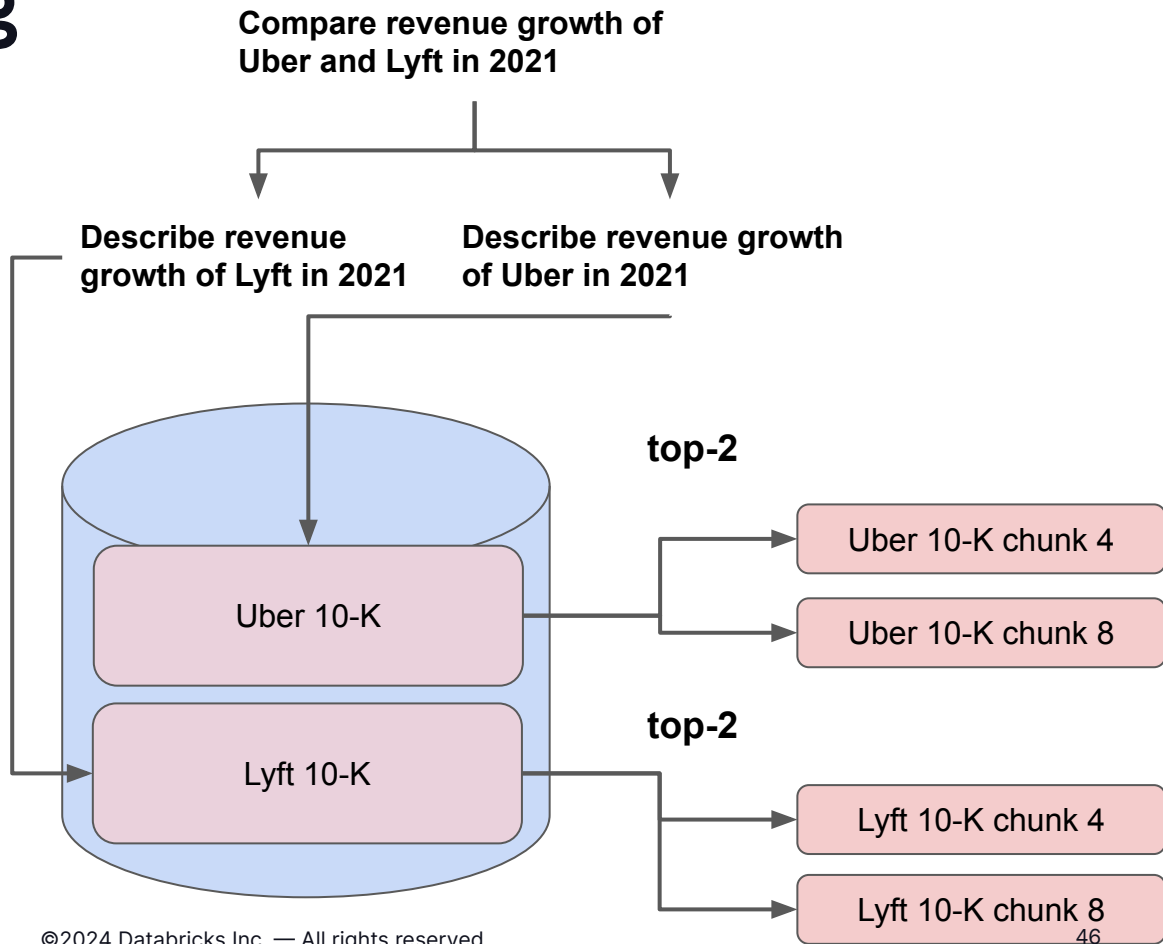


Condense Question for Context Retrieval



# Query Planning

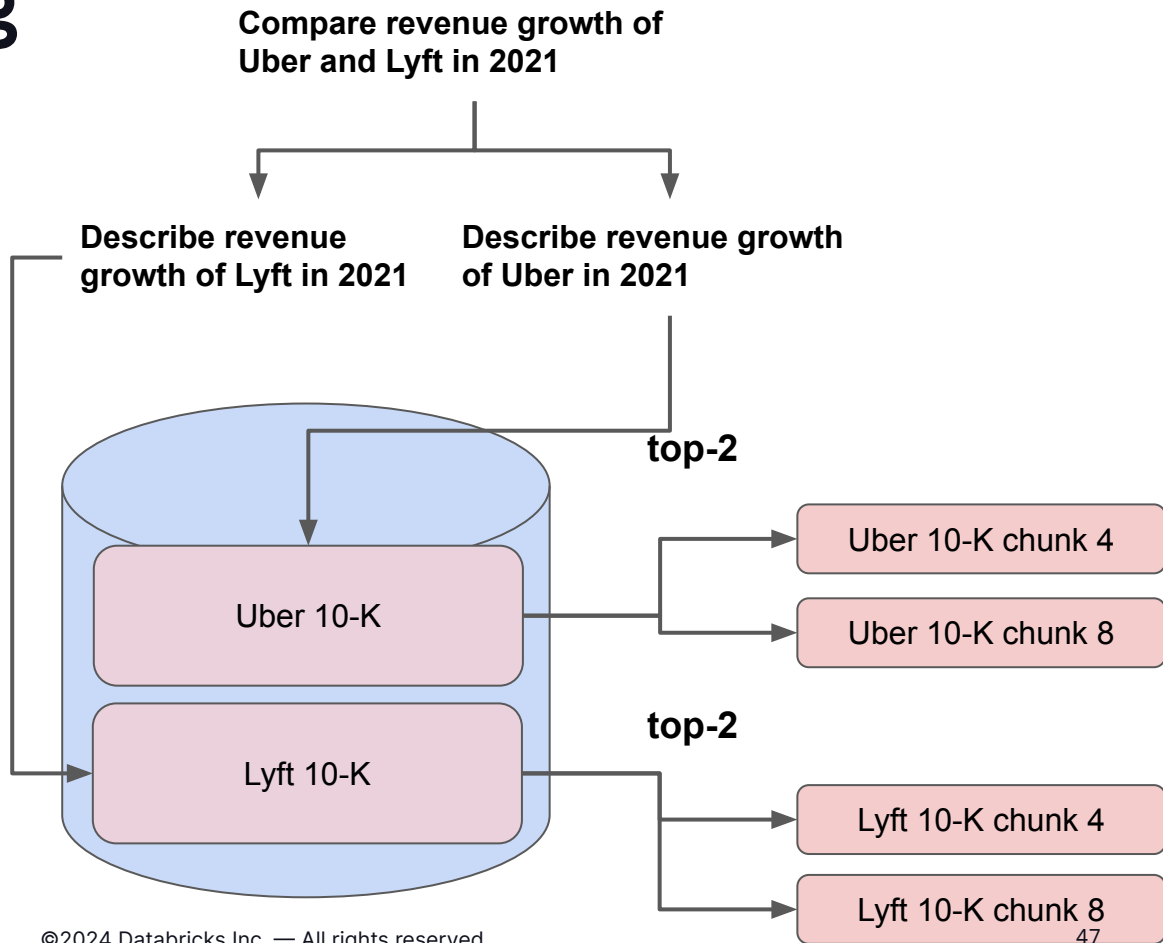
Break down query into parallelizable sub-queries.  
Each sub-query can be executed against any set of RAG pipelines



# Query Planning

**Example:** Compare revenue of Uber and Lyft in 2021

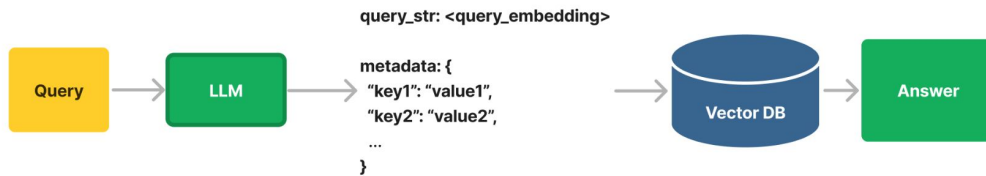
## Query Planning Guide



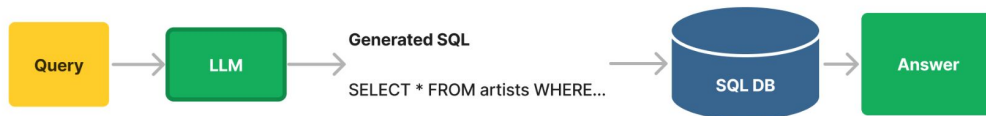
# Tool Use

Use an LLM to call an API  
Infer the parameters of that  
API

## Auto-Retrieval



## Text-to-SQL



## Calendar





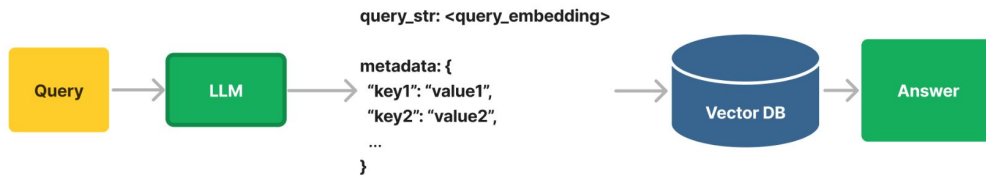
# Tool Use

In normal RAG you just pass through the query.

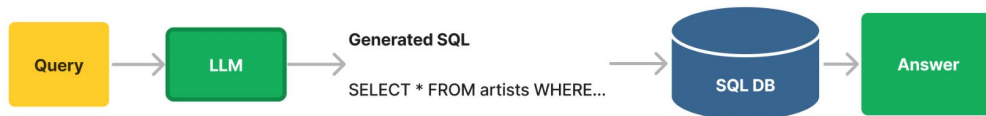
But what if you used the LLM to infer all the parameters for the API interface?

A key capability in many QA use cases (auto-retrieval, text-to-SQL, and more)

## Auto-Retrieval



## Text-to-SQL



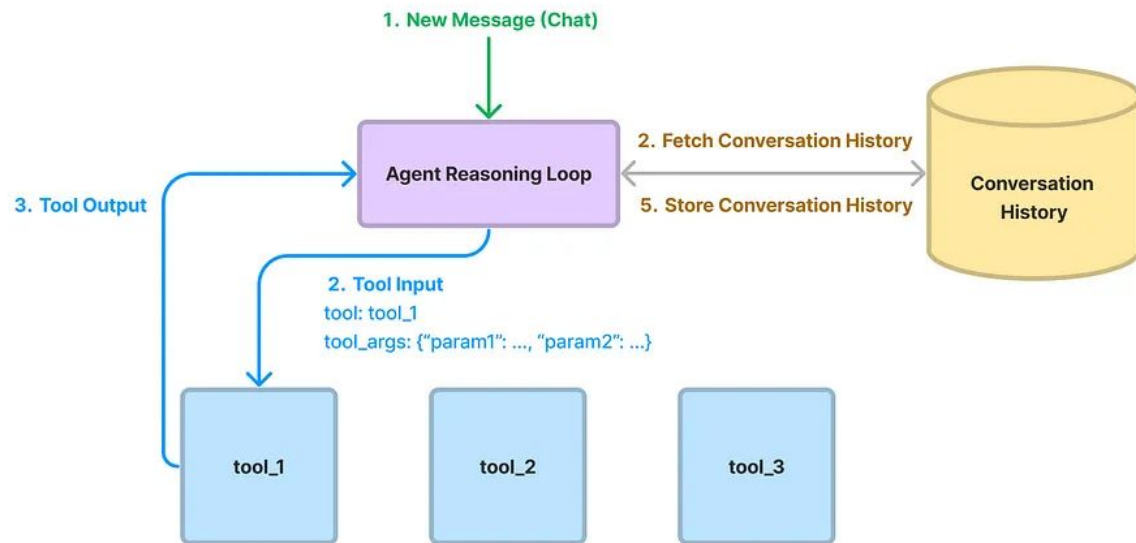
## Calendar



# Let's put them together

- All of these are **agent ingredients**
- Let's put them together for a full agent system
  - Query planning
  - Memory
  - Tool Use
- Let's add additional components
  - Reflection
  - Controllability
  - Observability

# Core Components of a Full Agent



Minimum necessary ingredients:

- Query planning
- Memory
- Tool Use

# Agent Reasoning Loops

**Sequential:** Generate next step given previous steps (chain-of-thought prompt)

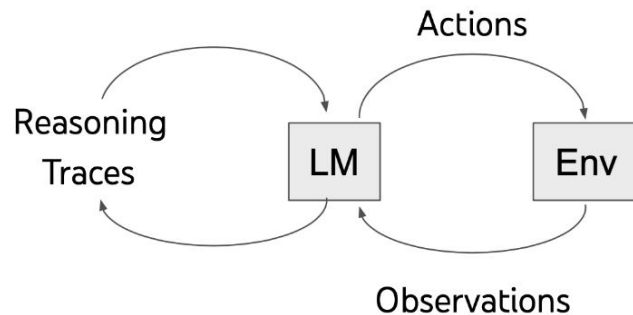
**DAG-based planning (deterministic):** Generate a deterministic DAG of steps. Replan if steps don't reach desired state.

**Tree-based planning (stochastic):** Sample multiple future states at each step. Run Monte-Carlo Tree Search (MCTS) to balance exploration vs. exploitation.

# Agent Reasoning: Sequential

**ReAct:** Chain-of-thought and tool use through prompting.

**Function Calling Loop:** Call LLM Function Calling APIs in a loop until done.



**ReAct** (Reason + Act)

ReAct + RAG Guide

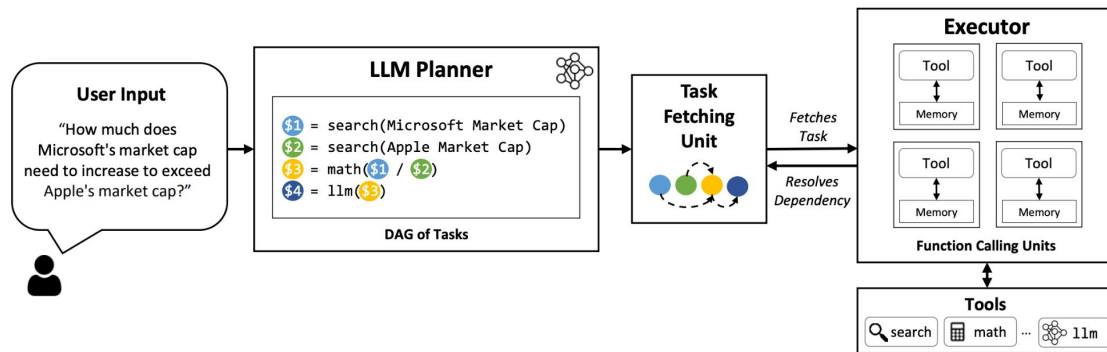
Function Calling Anthropic Agent

# Agent Reasoning: DAG-based Planning

**LLM Compiler (Kim et al. 2023):** An agent compiler for parallel multi-function planning + execution.

LLMCompiler Agent

Structured Planner Agent



# Agent Reasoning: Tree-based Planning

Tree of Thoughts (Yao et al. 2023)

Reasoning via Planning (Hao et al. 2023)

Language Agent Tree Search (Zhou et al. 2023)

## LATS Guide

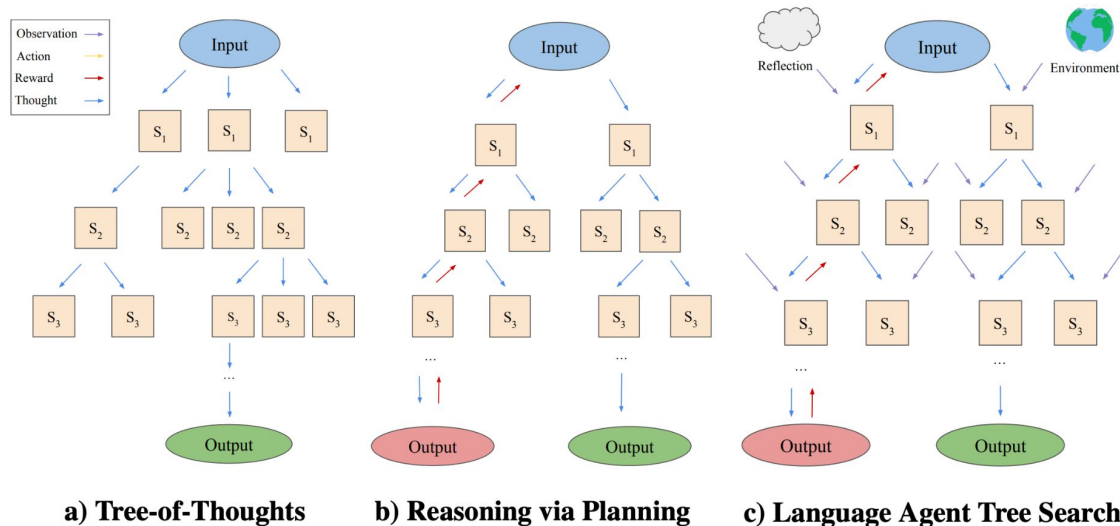


Figure 2: An overview of the differences between LATS and recently proposed LM search algorithms ToT (Yao et al., 2023a) and RAP (Hao et al., 2023). LATS leverages environmental feedback and self-reflection to further adapt search and improve performance.

# Self-Reflection

Use feedback to improve agent execution and reduce errors

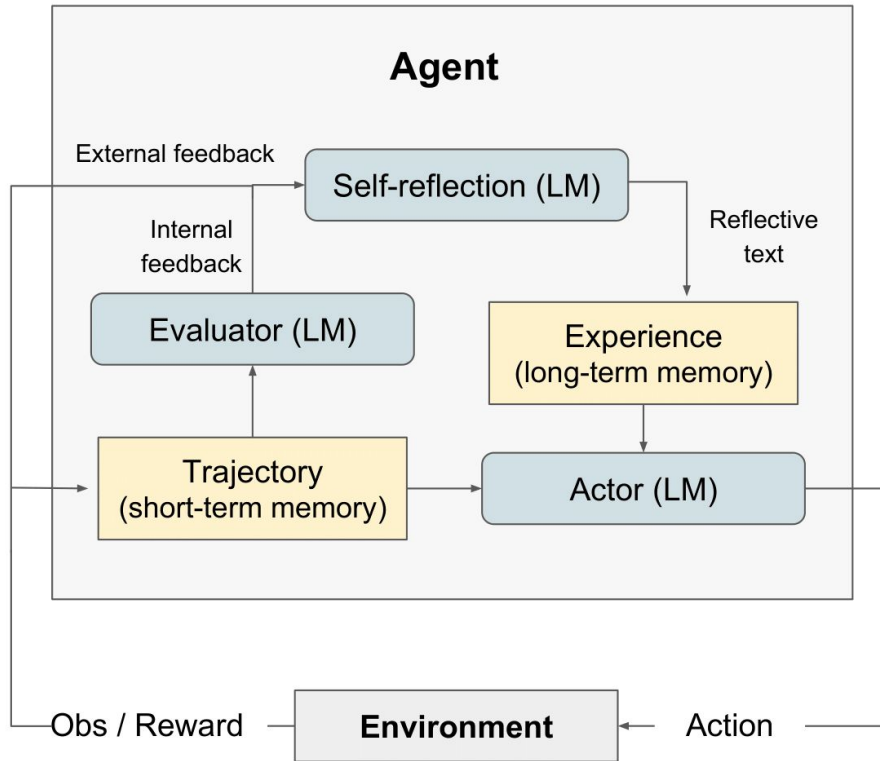


Human feedback



LLM feedback

**Use few-shot examples instead of retraining the model!**



Reflexion: Language Agents with Verbal Reinforcement Learning, by Shinn et al. (2023)



# Additional Requirements

- **Observability:** see the full trace of the agent
  - [Observability Guide](#)
- **Control:** Be able to guide the intermediate steps of an agent *step-by-step*
  - [Lower-Level Agent API](#)
- **Customizability:** Define your own agentic logic around any set of tools.
  - [Custom Agent Guide](#)
  - [Custom Agent with Query Pipeline Guide](#)
- **Multi-agents:** Define multi-agent interactions!
  - Synchronously: Define an explicit flow between agents
  - Asynchronously: Treat each agent as a microservice that can communicate with each other.
  - Current Frameworks: Autogen, CrewAI

# Workshop

Let's extend our RAG pipeline into an agent!

<https://colab.research.google.com/drive/18RUkf8lpHVSJF-rDh8cOj0QJ6UwQonfh?usp=sharing>



# LlamaCloud for Advanced RAG

Building RAG/agents in an enterprise setting? We'd love to chat!

