Overview

Open-source developer framework for building LLM applications

Python and TypeScript packages

Focused on composition and modularity

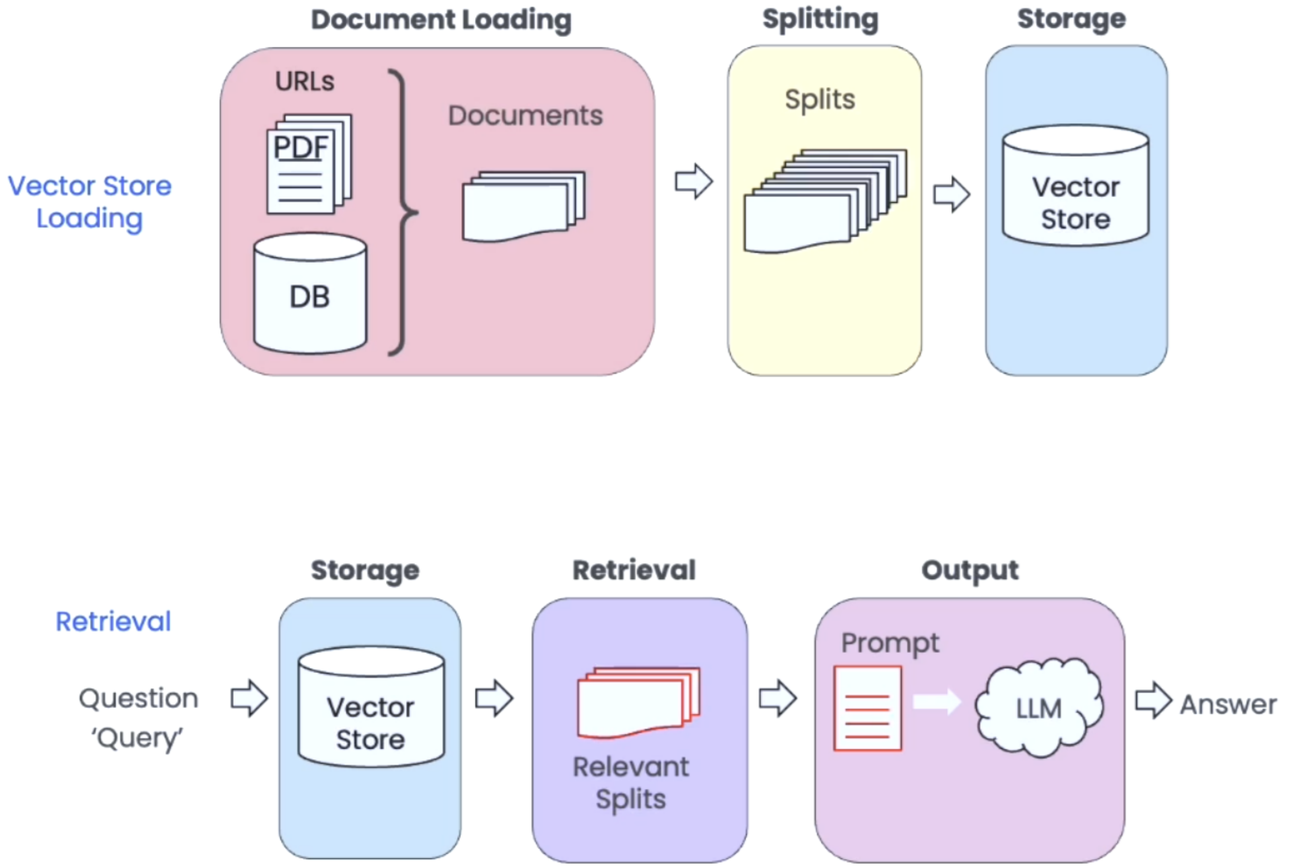
Key value adds:

1. Modular components (and implementations of those components)
2. Use cases - common ways to combine those components together

Components

- Prompts
  - Prompt Templates
  - Output Parsers: 5+ implementations
    - Retry/fixing logic
  - Example Selectors: 5+ implementations
- Models
  - LLM's: 20+ integrations
  - Chat Models
  - Text Embedding Models: 10+ integrations
- Indexes
  - Document Loaders: 50+ implementations
  - Text Splitters: 10+ implementations
  - Vector stores: 10+ integrations
  - Retrievers: 5+ integrations/implementations
- Chains
  - Can be used as building blocks for other chains
  - More application specific chains: 20+ different types
- Agents
  - Agent Types: 5+ types
    - Algorithms for getting LLMs to use tools
  - Agent Toolkits: 10+ implementations
    - Agents armed with specific tools for a specific application

Retrieval Augmented Generation

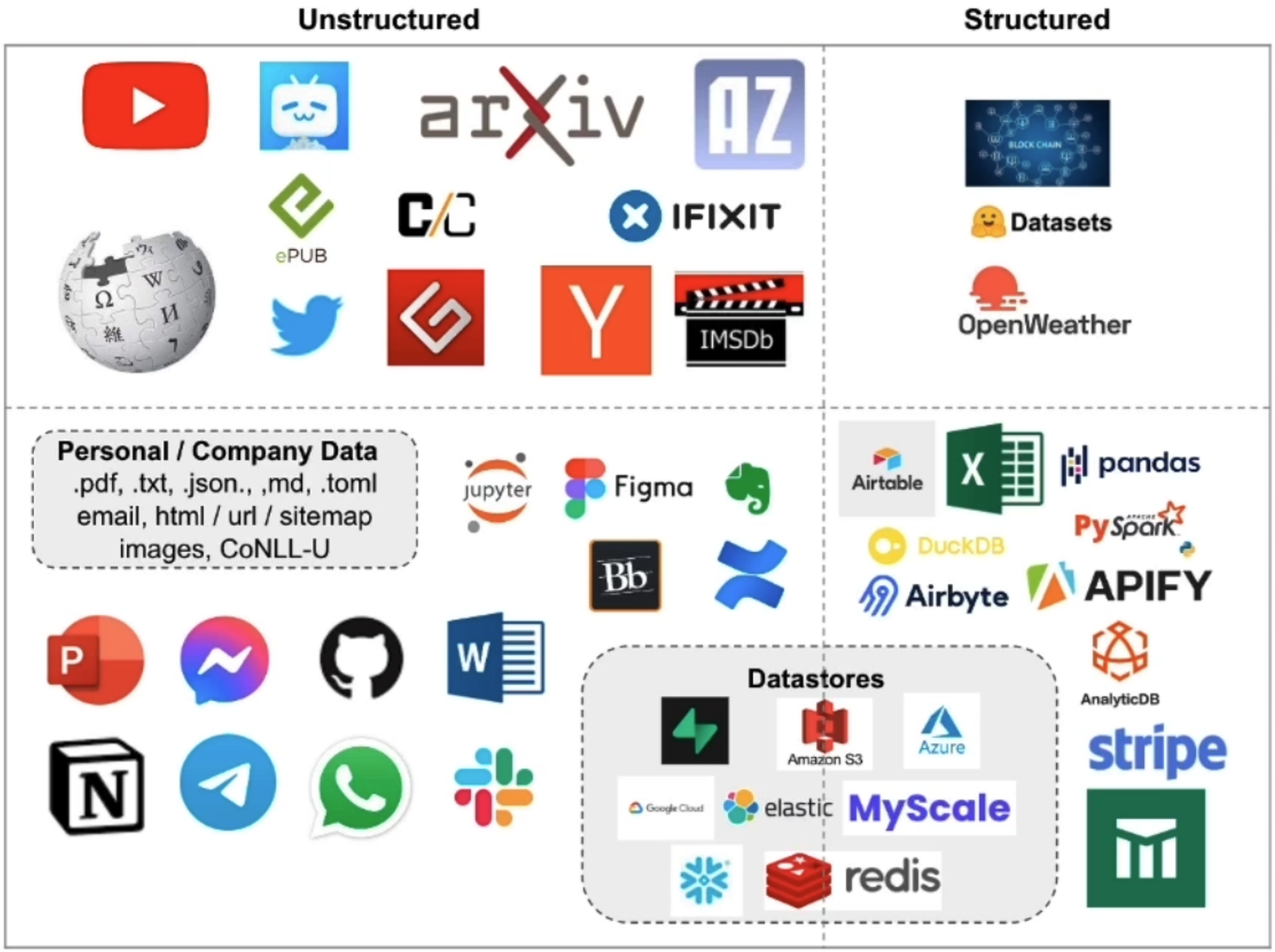


Loaders

- Loaders deal with the specifics of accessing and converting data
  - Accessing
    - Web Sites
    - Data Bases
    - YouTube
    - arXiv
    - ...
  - Data Types
    - PDF
    - HTML
    - JSON
    - Word, PowerPoint...
- Returns a list of `Document` objects:

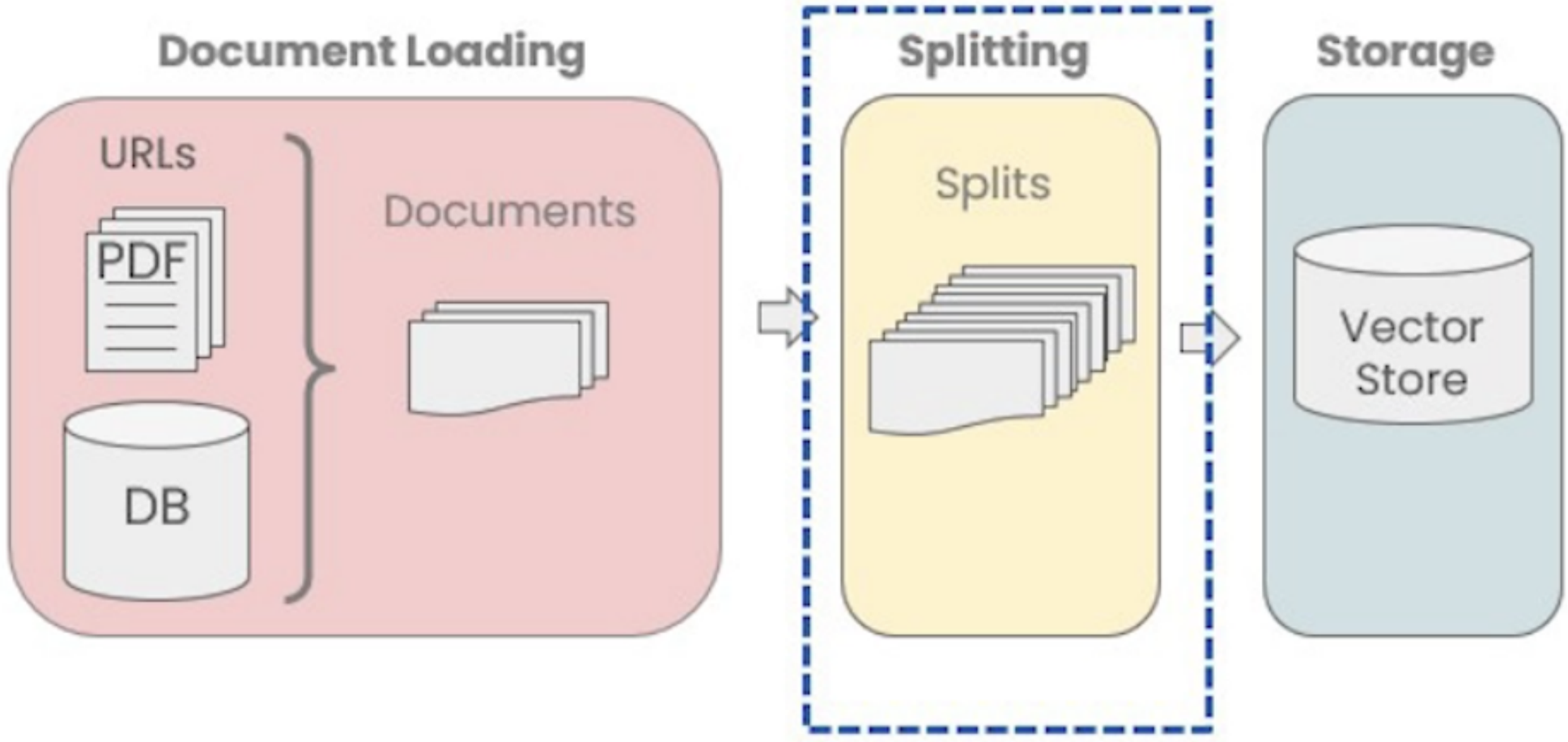
```
[
Document(page_content='MachineLearning-Lecture01 \nInstructor (Andrew Ng): Okay. Good morning. Welcome to CS229....',
metadata={'source': 'docs/cs229_lectures/MachineLearning-Lecture01.pdf', 'page': 0})
...
 Document(page_content='[End of Audio]  \nDuration: 69 minutes  ',
 metadata={'source': 'docs/cs229_lectures/MachineLearning-Lecture01.pdf', 'page': 21})
]
```

Document Loaders



Document Splitting

- Splitting Documents into smaller chunks
  - Retaining meaningful relationships!



...
on this model. The Toyota Camry has a head-snapping
80 HP and an eight-speed automatic transmission that will
...

Chunk 1: on this model. The Toyota Camry has a head-snapping

Chunk 2: 80 HP and an eight-speed automatic transmission that will

Question: What are the specifications on the Camry?

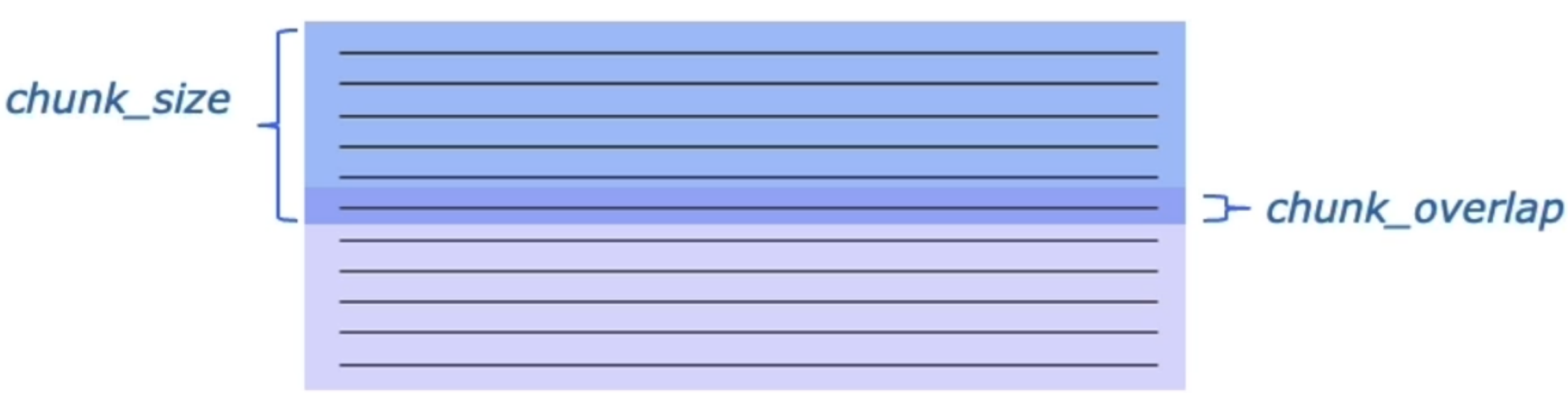
Example Splitter

```
langchain.text_splitter.CharacterTextSplitter(
    separator: str = "\n\n"
    chunk_size=4000,
    chunk_overlap=200,
    length_function=<builtin function len>,
)
```

Methods:

create_documents() - Create documents from a list of texts.

split_documents() - Split documents.

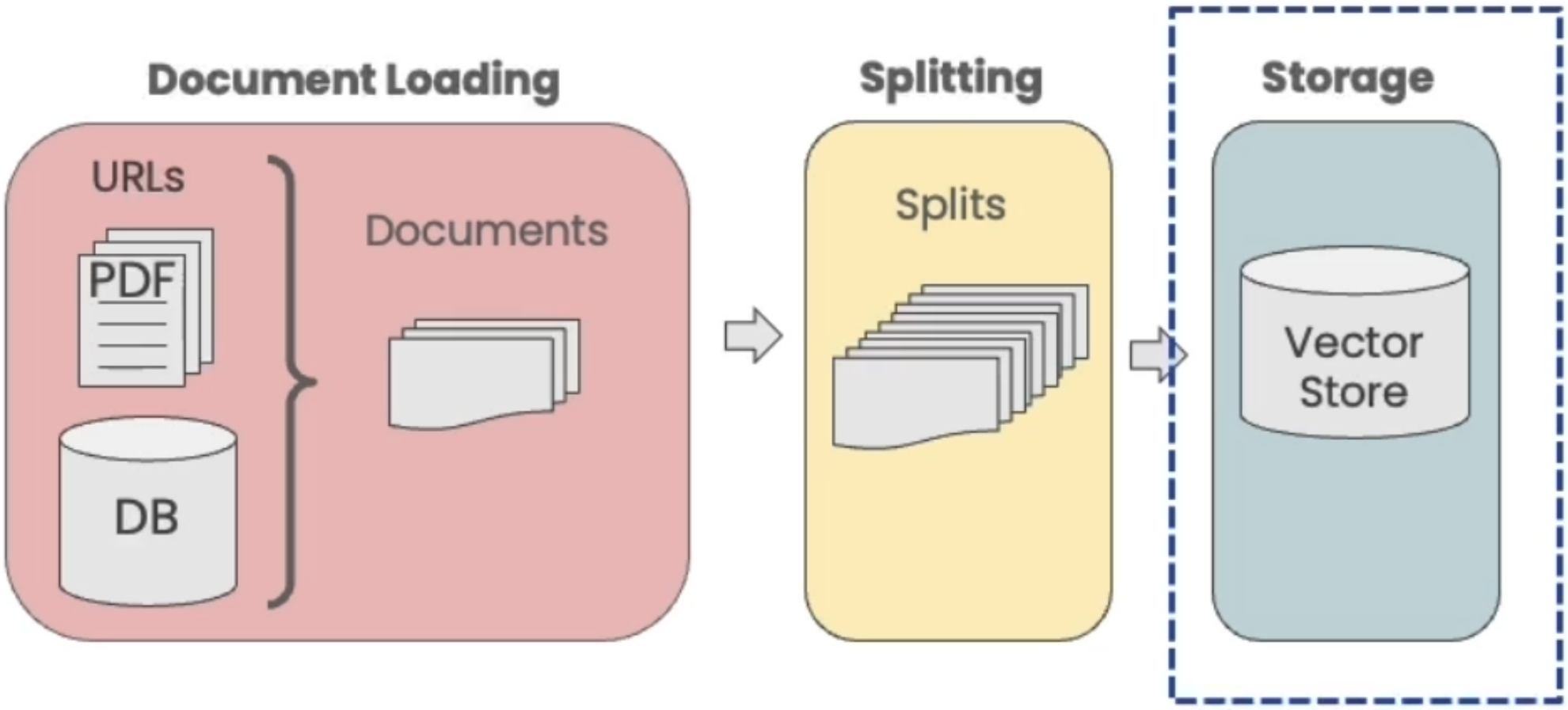


Types of splitters

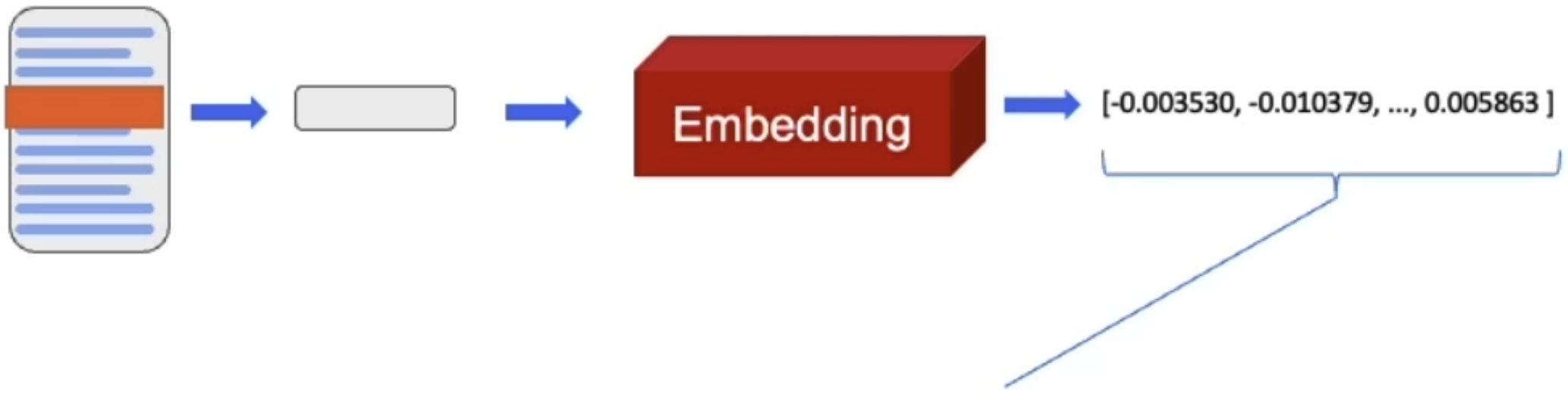
langchain.text_splitter.

- **CharacterTextSplitter()**- Implementation of splitting text that looks at characters.
- **MarkdownHeaderTextSplitter**() - Implementation of splitting markdown files based on specified headers.
- **TokenTextSplitter**() - Implementation of splitting text that looks at tokens.
- **SentenceTransformersTokenTextSplitter**() - Implementation of splitting text that looks at tokens.
- ***RecursiveCharacterTextSplitter()*** **-** Implementation of splitting text that looks at characters. Recursively tries to split by different characters to find one that works.
- **Language()** – for CPP, Python, Ruby, Markdown etc
- **NLTKTextSplitter**() - Implementation of splitting text that looks at sentences using NLTK (Natural Language Tool Kit)
- **SpacyTextSplitter() -** Implementation of splitting text that looks at sentences using Spacy

Vector Stores

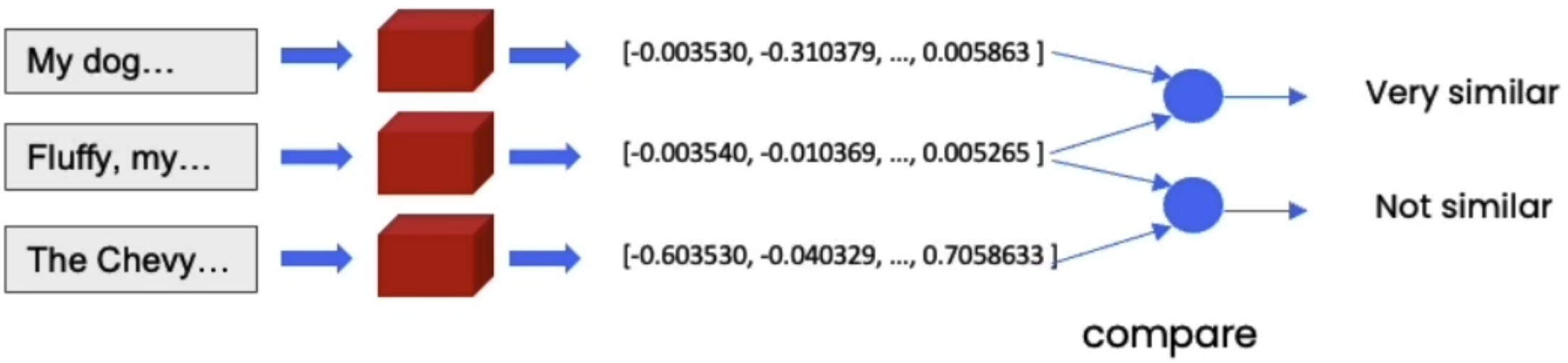


Embeddings

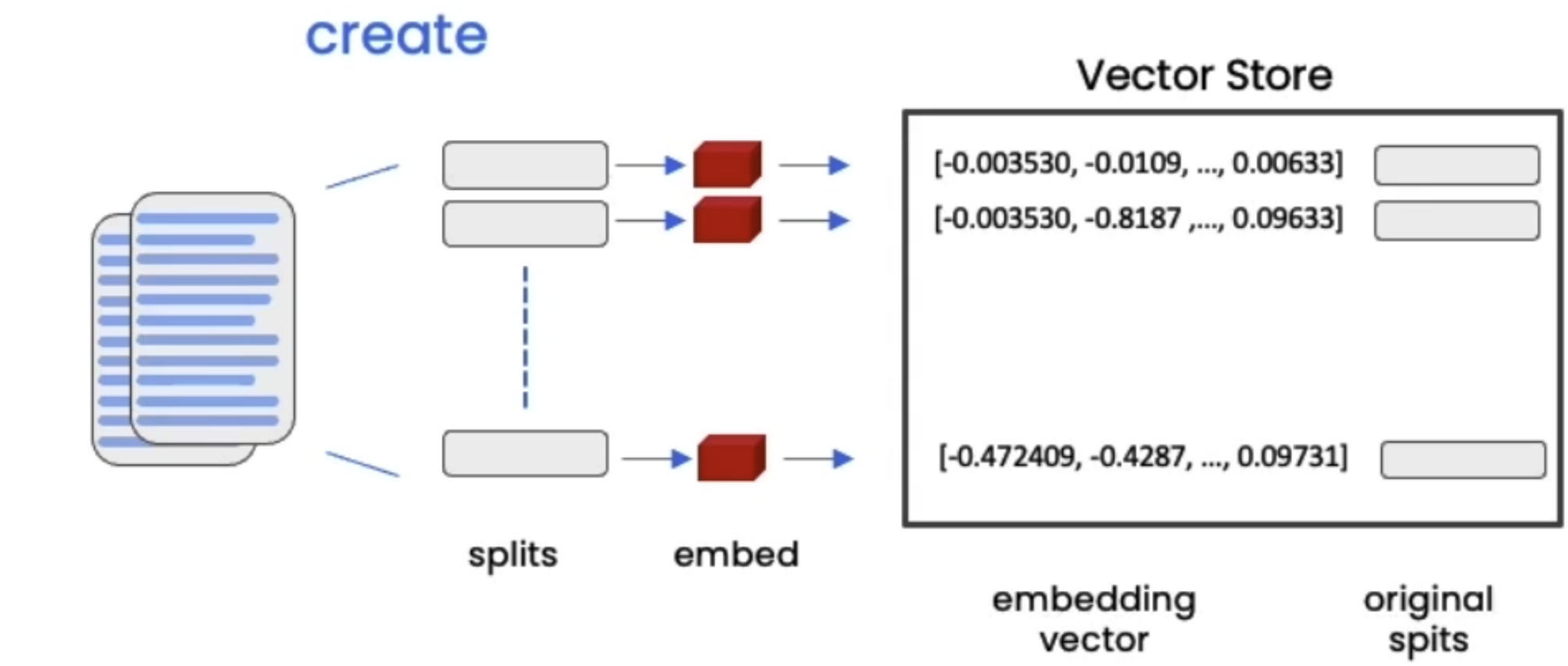


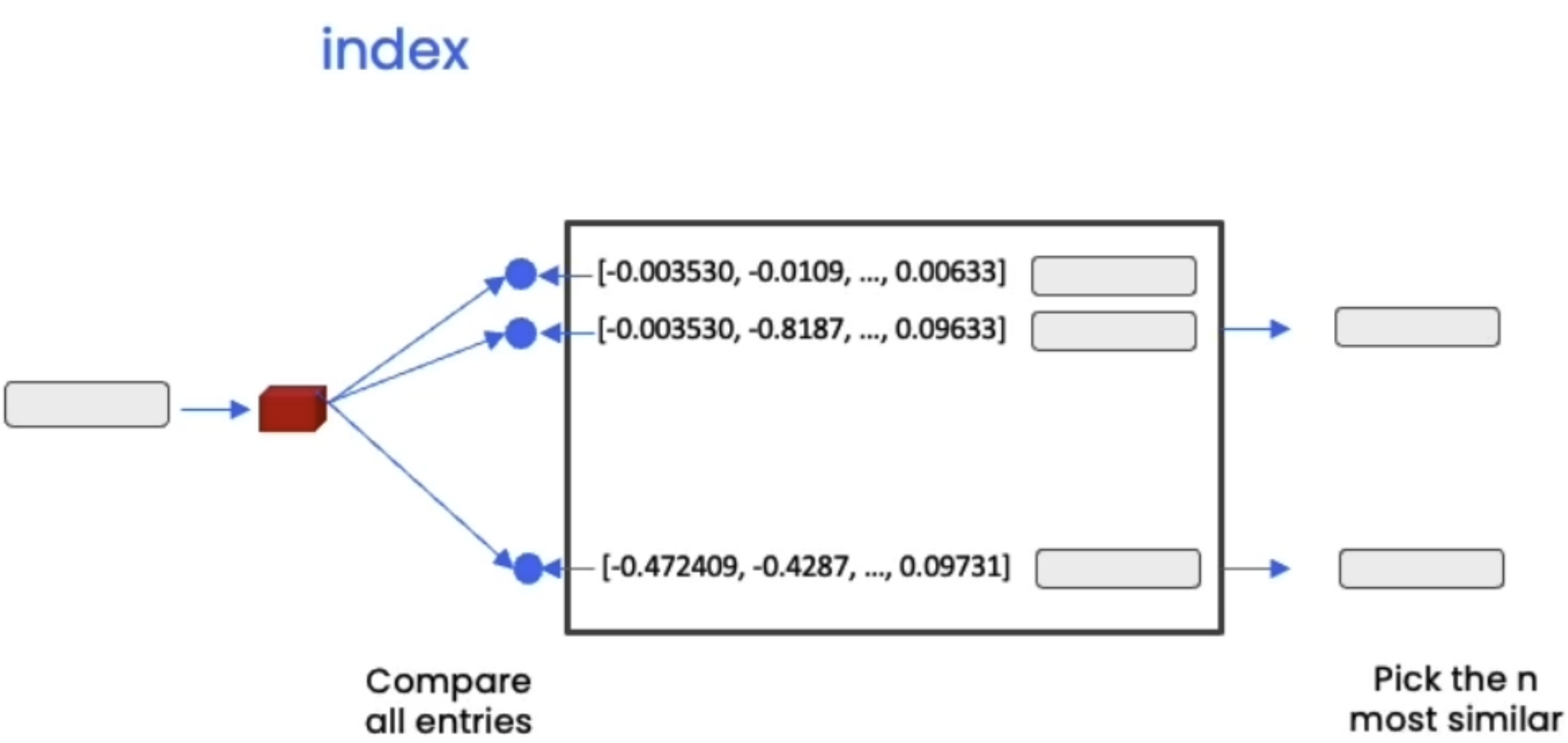
- Embedding vector captures content/meaning
- Text with similar content will have similar vectors

1) My dog Rover likes to chase squirrels.
2) Fluffy, my cat, refuses to eat from a can.
3) The Chevy Bolt accelerates to 60 mph in 6.7 seconds.



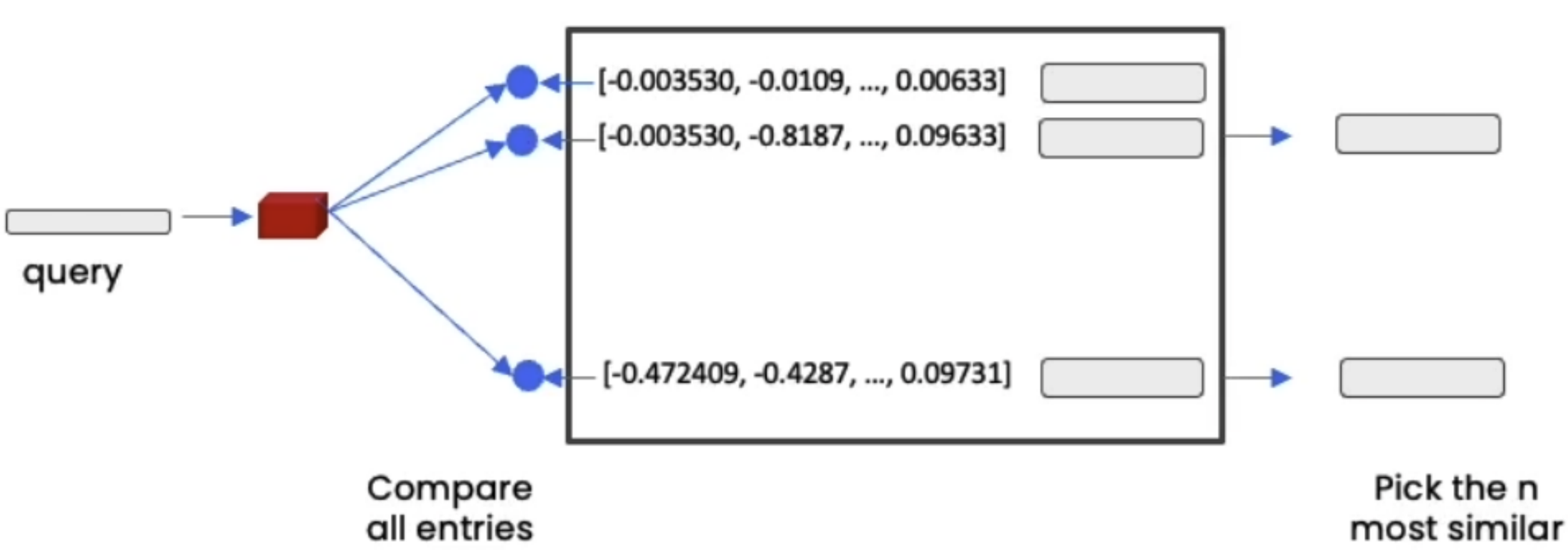
Vector Store





Vector Store/Database

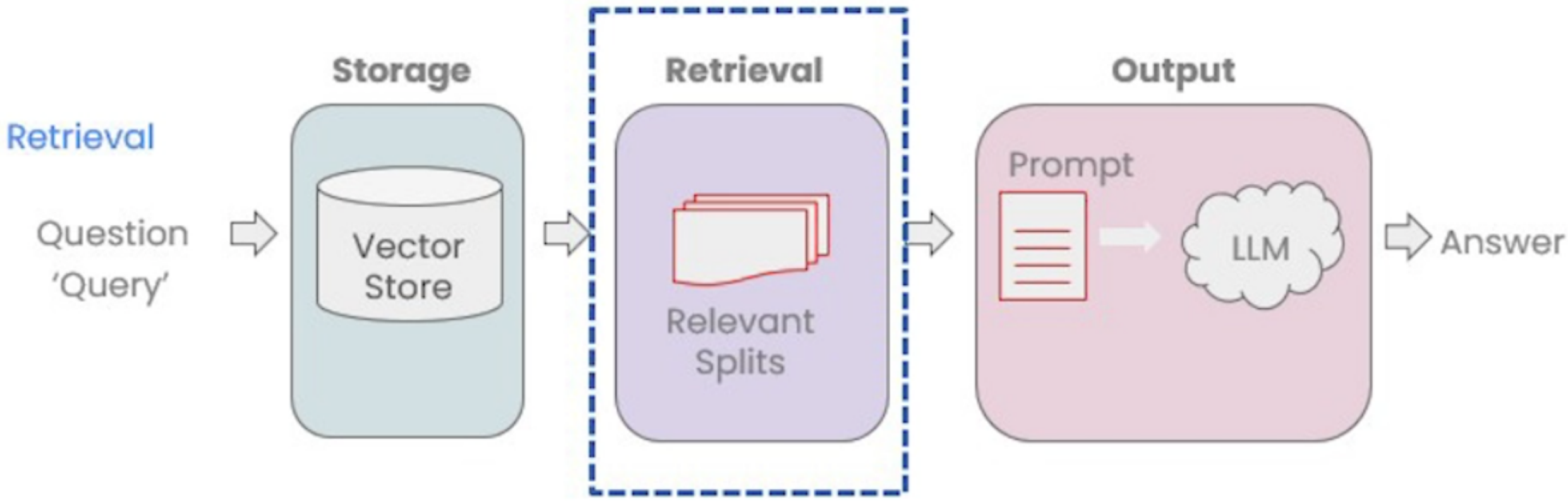
index



Process with llm

The returned values can now fit in the LLM context

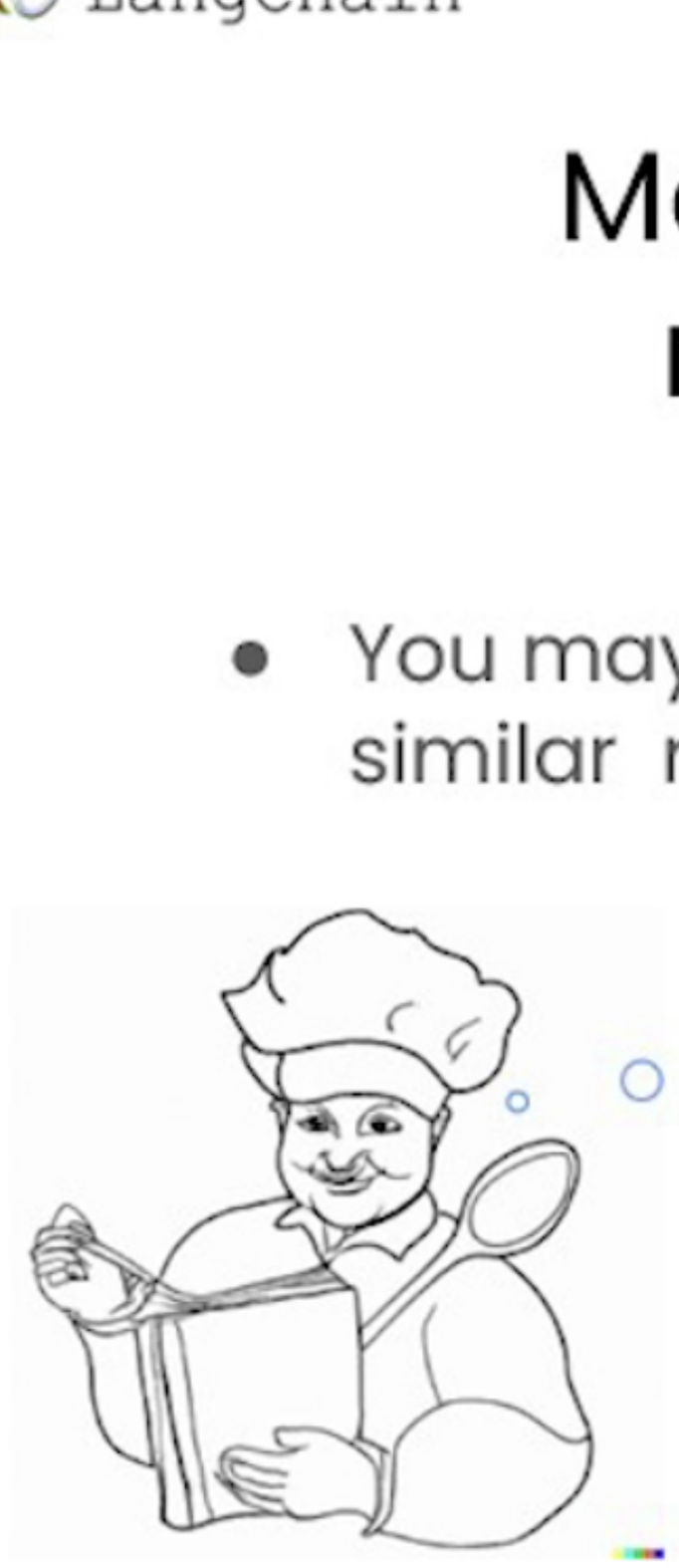
Retrieval



- Accessing/indexing the data in the vector store
  - Basic semantic similarity
  - Maximum marginal relevance
  - Including Metadata
- LLM Aided Retrieval

Maximum marginal relevance(MMR)

- You may not always want to choose the most similar responses



The Amanita phalloides has a large and imposing epigeous (aboveground) fruiting body (basidiocarp).

A mushroom with a large fruiting body is the Amanita phalloides. Some varieties are all-white.

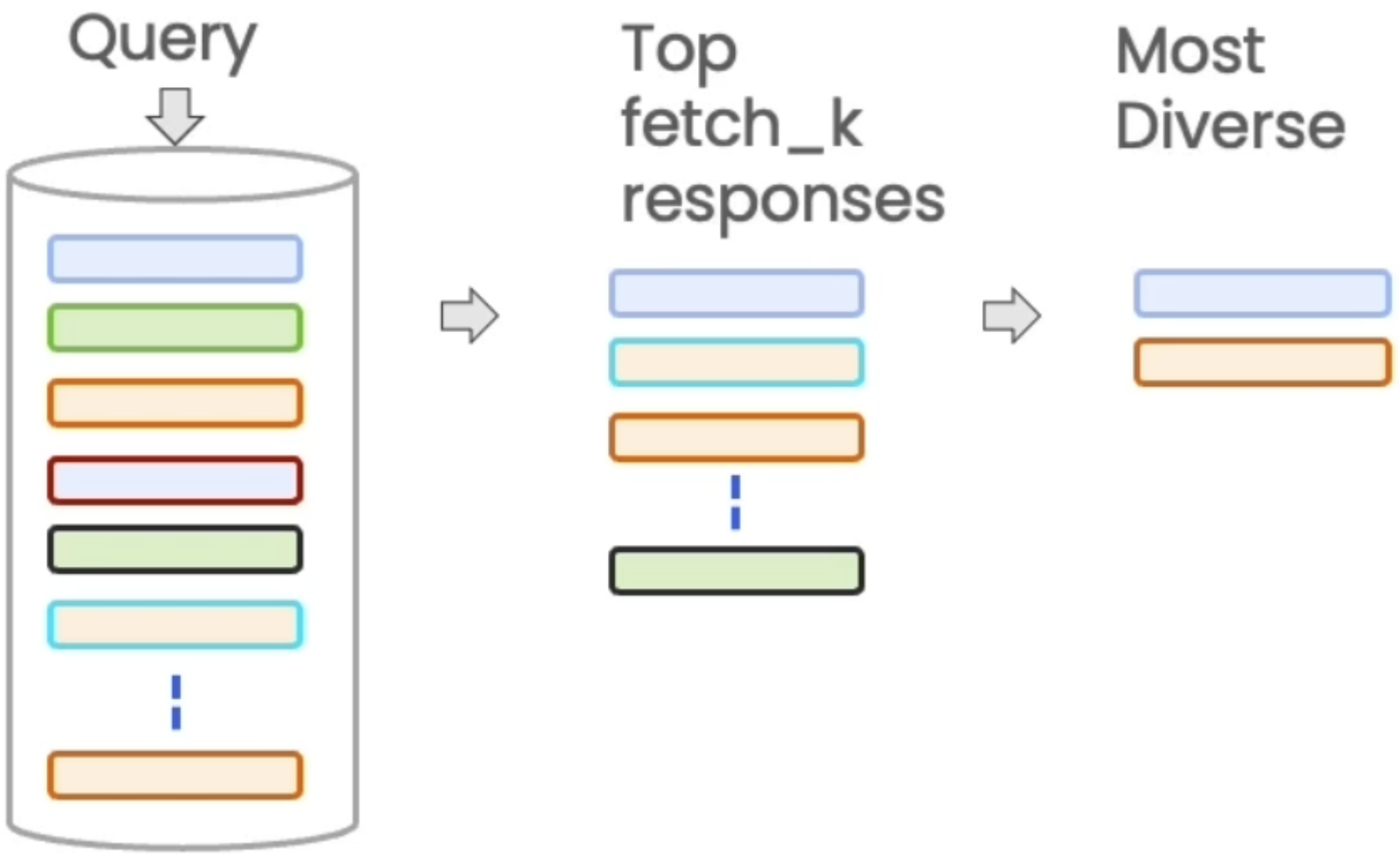
AA. phalloides, a.k.a Death Cap, is one of the most poisonous of all known mushrooms.

Most Similar

MMR

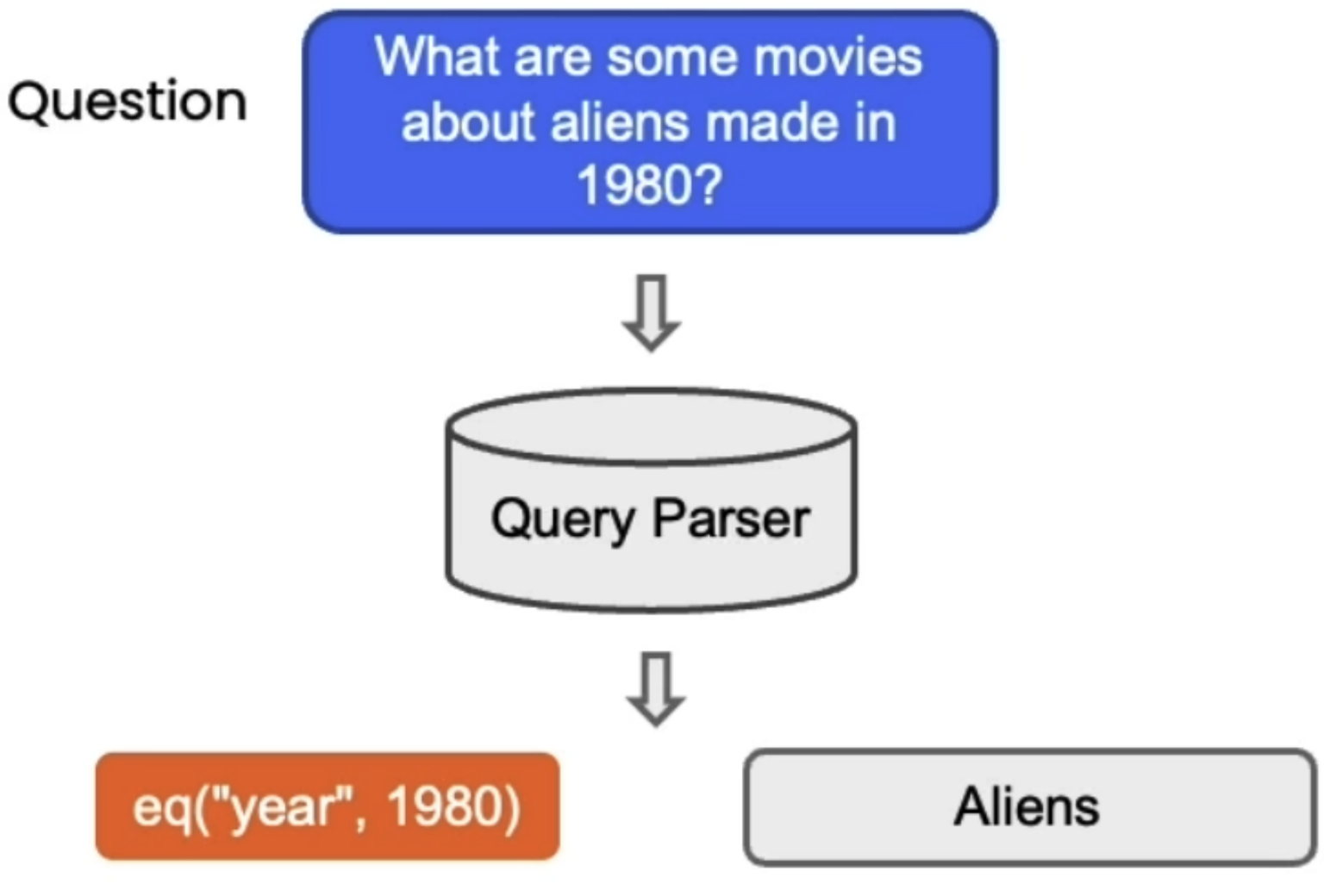
MMR algorithm

- Query the Vector Store
- Choose the `fetch_k` most similar responses
- Within those responses choose the `k` most diverse



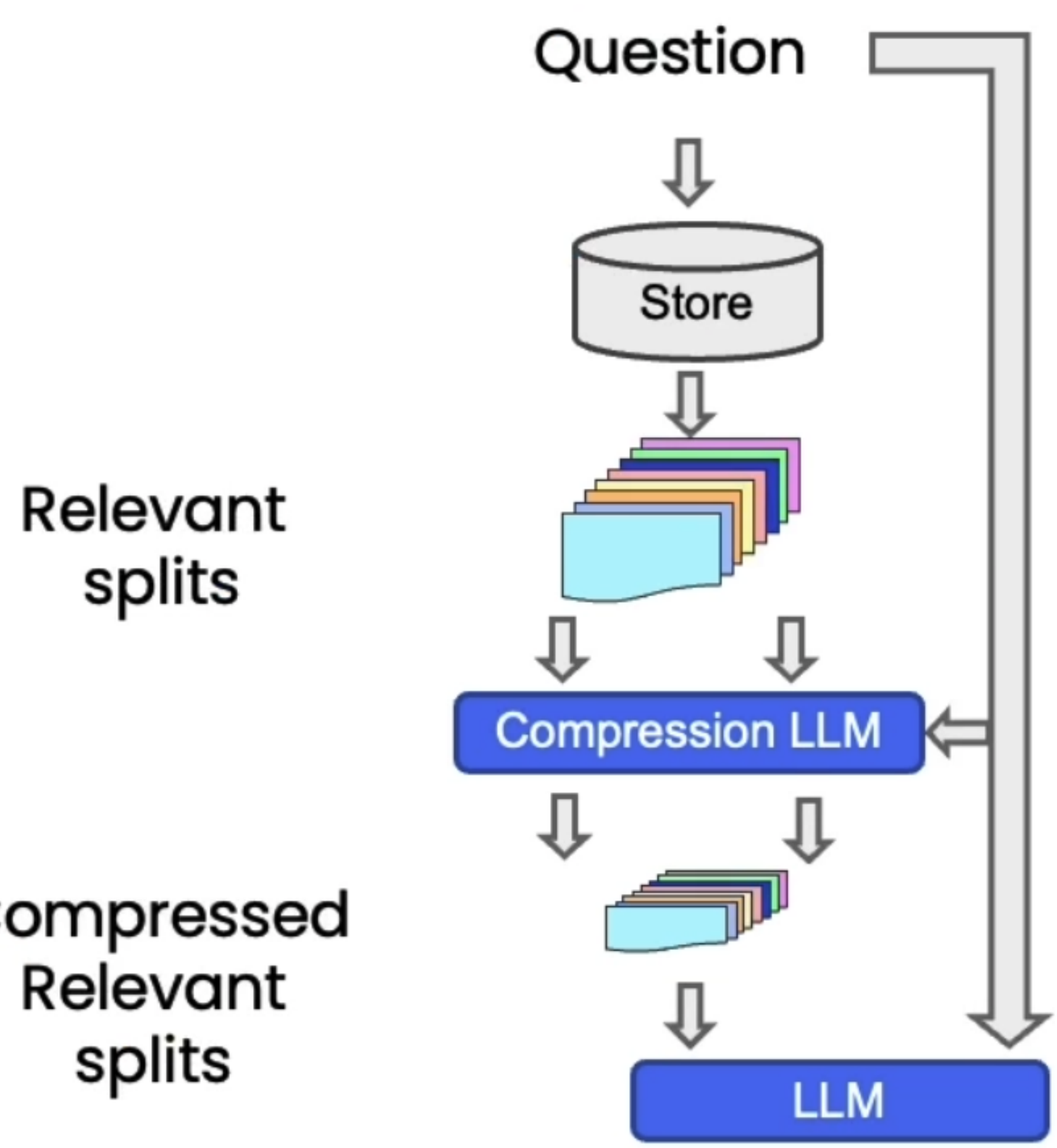
LLM Aided Retrieval

- There are several situations where the Query applied to the DB is more than just the Question asked.
- One is SelfQuery, where we use an LLM to convert the user question into a query



Compression

- Increase the number of results you can put in the context by shrinking the responses to only the relevant information.

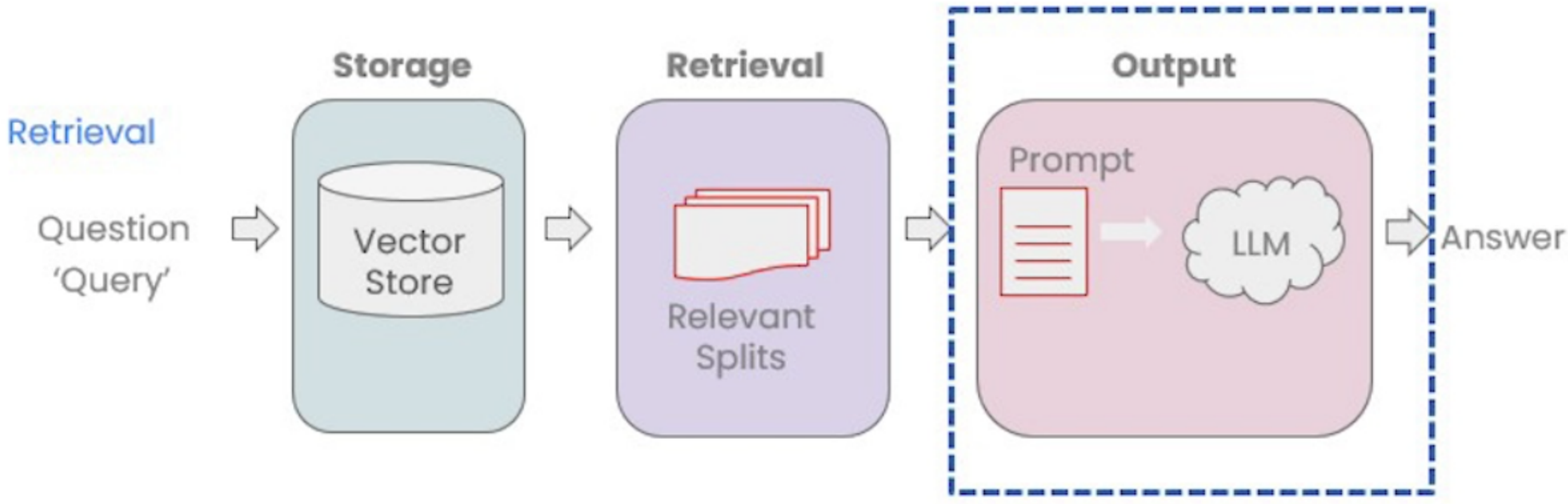


Other types of retrieval

Not using a vector database, such as:

- SVM
- TF-IDF
- ...

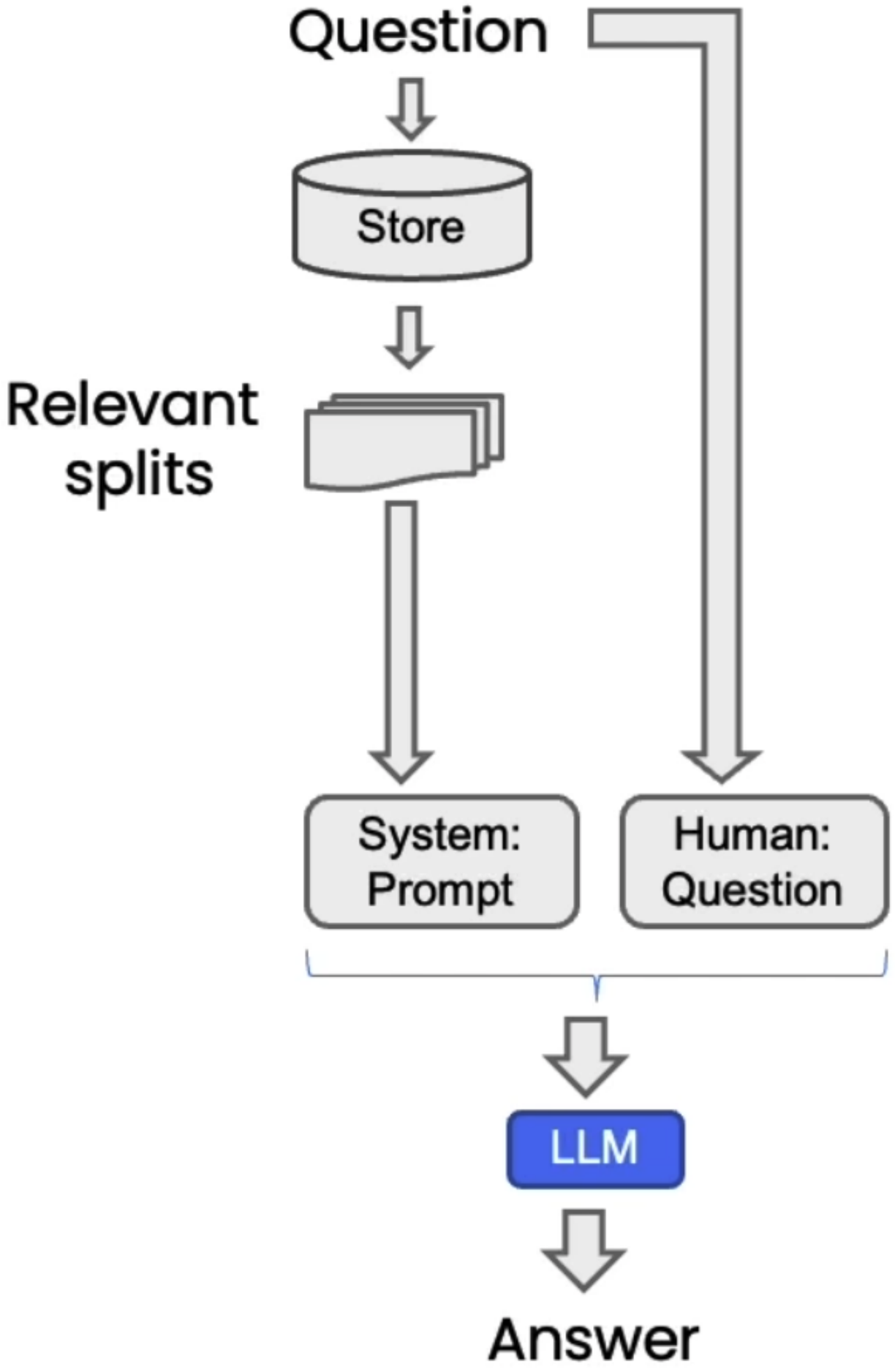
Question Answering



- Multiple relevant documents have been retrieved from the vector store
- Potentially compress the relevant splits to fit into the LLM context
- Send the information along with our question to an LLM to select and format an answer

RetrievalQA chain

RetrievalQA.from_chain_type(, chain_type="stuff",...)



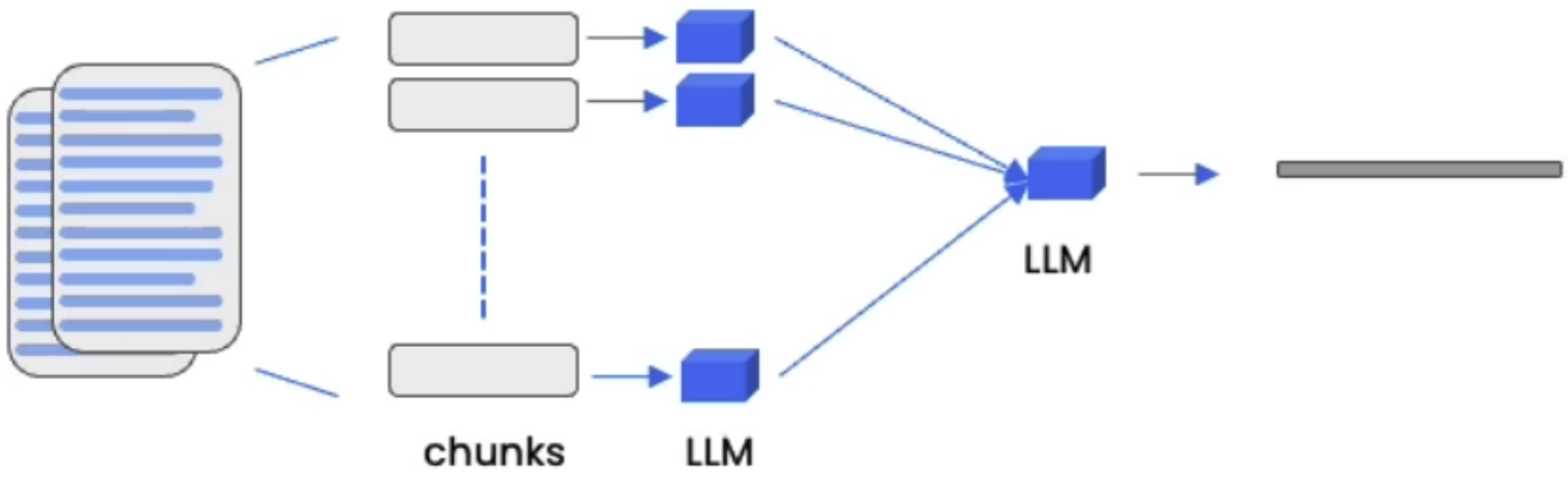
Question is applied to the Vector Store as a query

Vector store provides k relevant documents

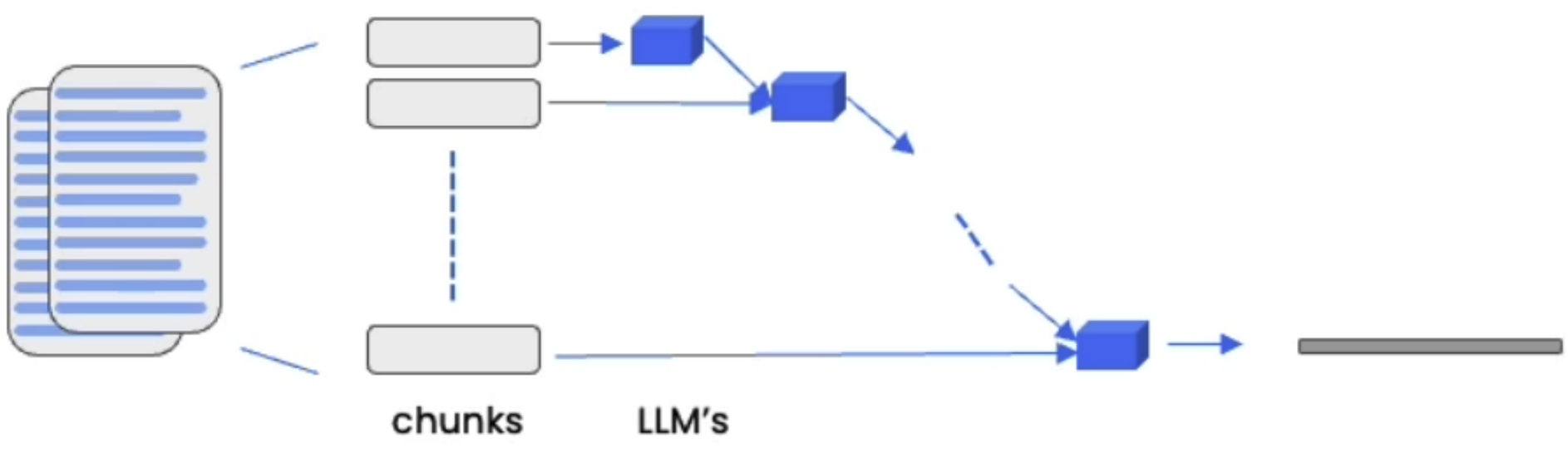
Docs and original question are sent to an LLM

3 additional methods

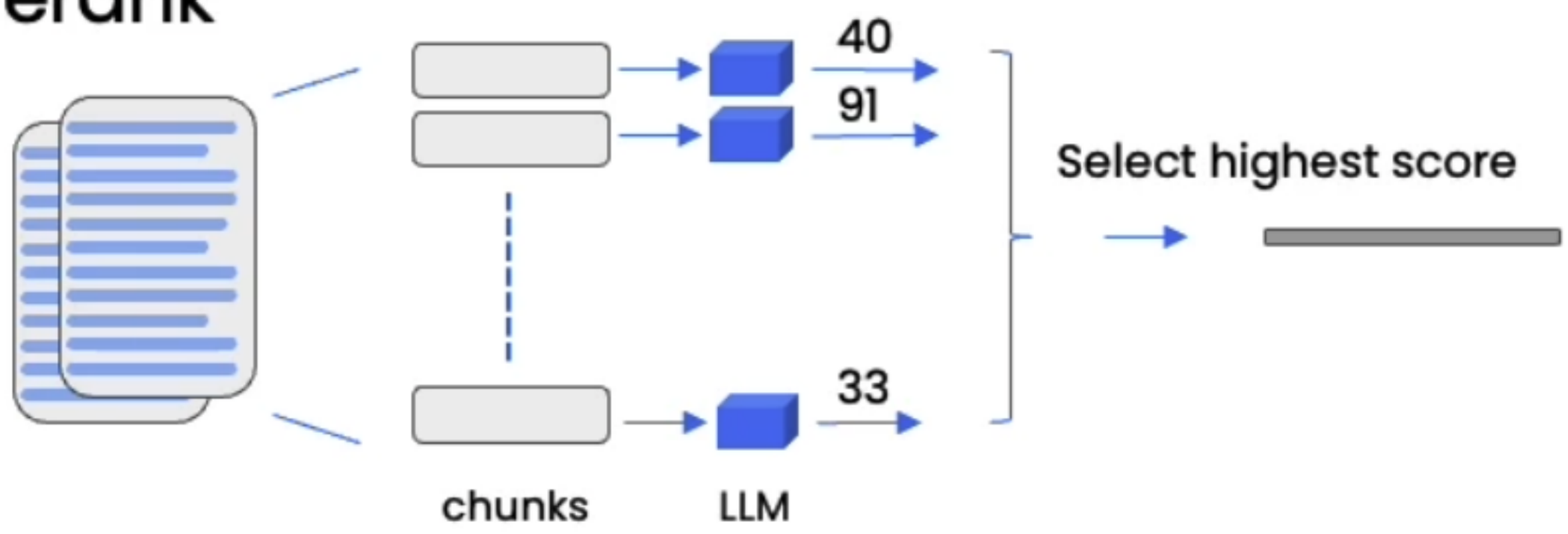
1. Map_reduce



2. Refine

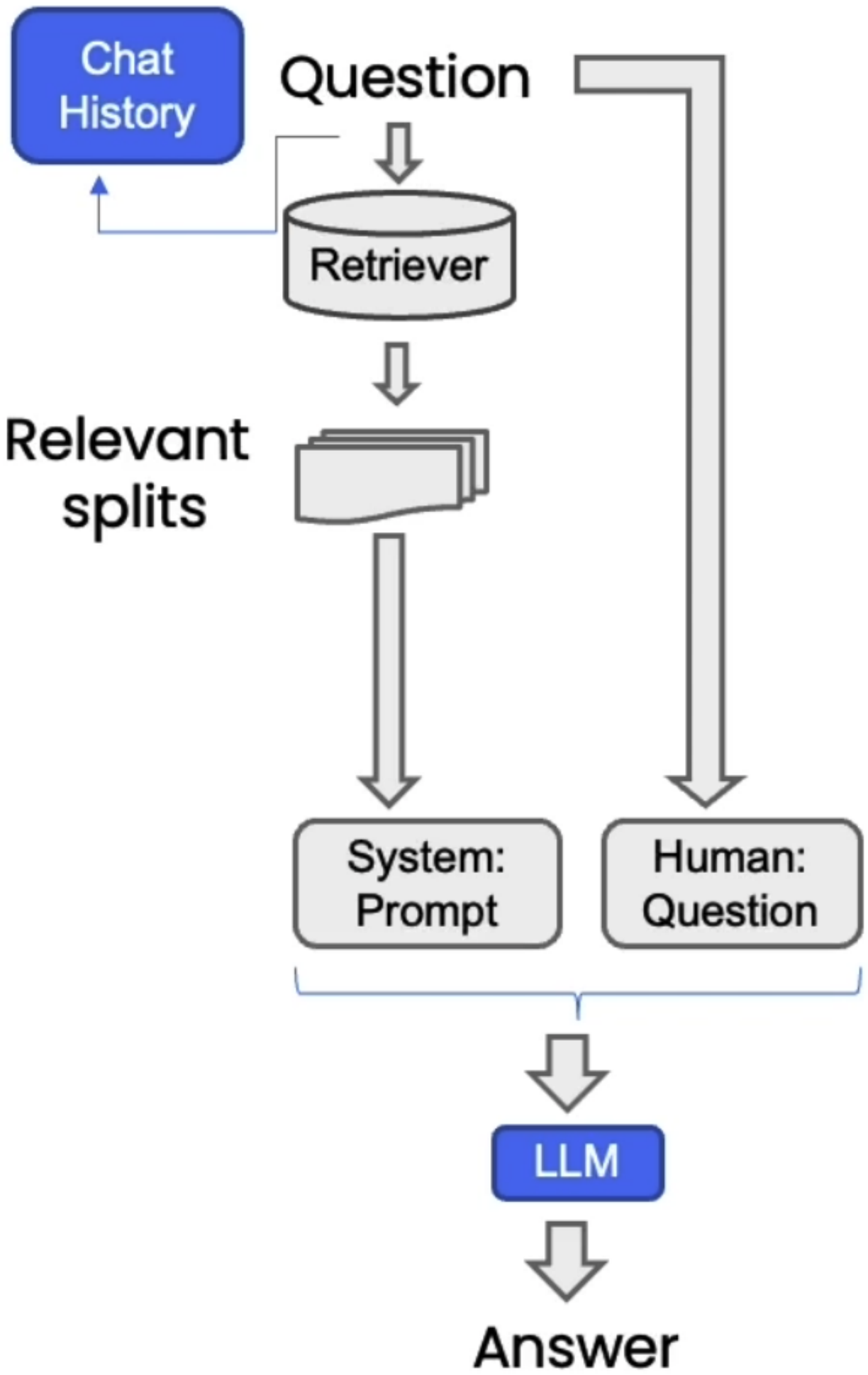


3. Map_rerank

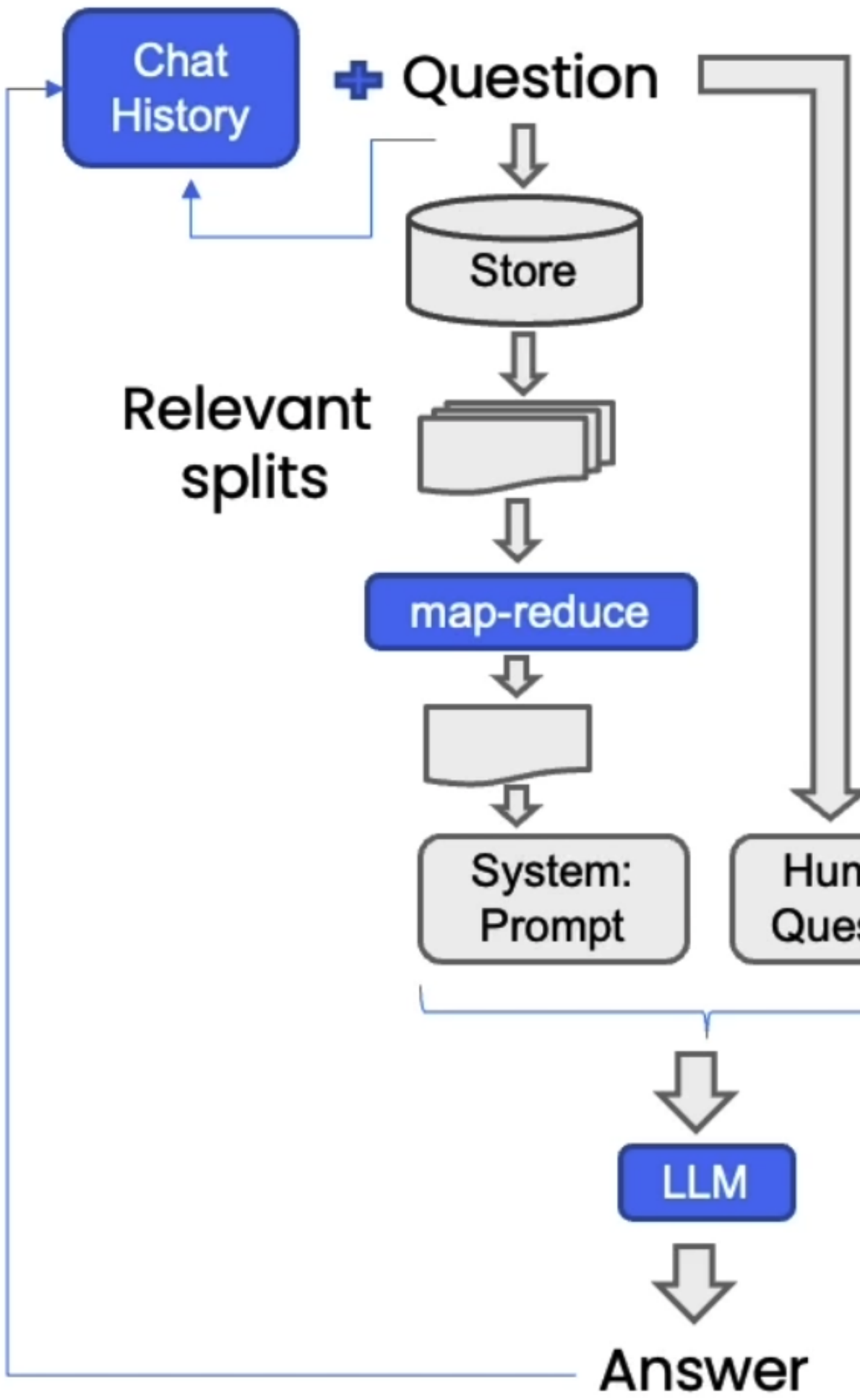


ConversationalRetrievalChain

```
qa = ConversationalRetrievalChain.from_llm(ChatOpenAI(temperature=0),
vectorstore.as_retriever(), memory=memory)
```



ConversationalRetrievalChain



You can add additional Retriever and compression features as needed

LangChain
Chat with Your Data