



HOW TO BUILD A CHATBOT

Session 2 -
Introduction to
LangChain

SESSION 2

AGENDA



1

Langchain Ecosystem

2

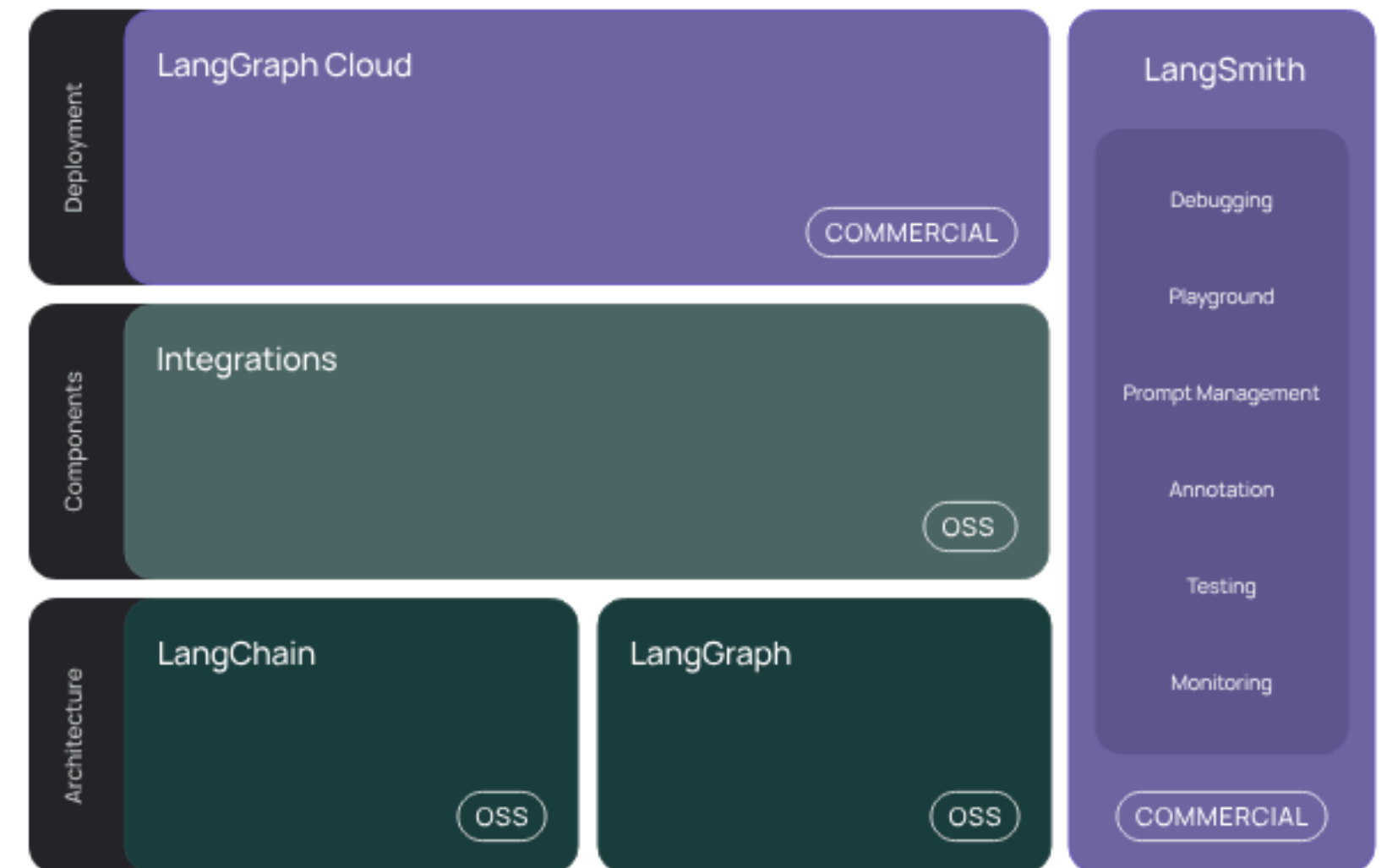
Introduction of LangChain

3

Key Components of LangChain

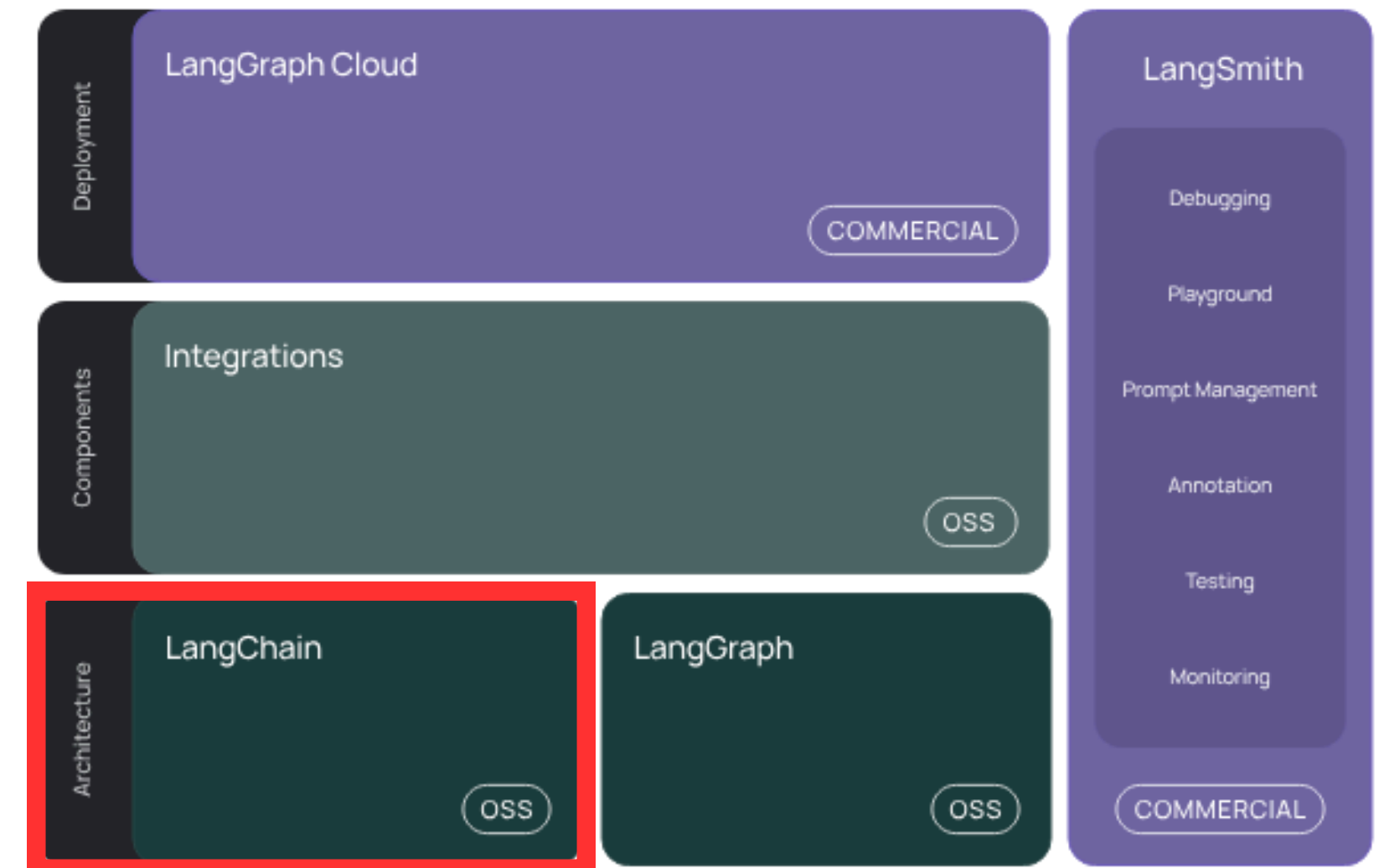
LANGCHAIN ECOSYSTEM

- **LangChain:** Core framework for building LLM-powered apps with modular components.
- **LangGraph:** Visualizes and organizes connections between chains and agents.
- **Integrations:** Connects LLMs with external services and data sources.
- **LangSmith:** Tool for testing, debugging, and optimizing LLM applications.
- **LangGraph Cloud:** Cloud platform for managing and deploying LLM workflows.



INTRODUCTION LANGCHAIN

- Open-source Python framework, 2022
- Modular, easy-to-use, LLM integration, external data sources, services.
- Reusable components, pre-assembled chains, sophisticated LLM apps.
- Unified interface, complex workflows, LLM access, external services.
- Prompt engineering, bias mitigation, productionizing, external data integration, reduced learning curve.



INTRODUCTION LANGCHAIN

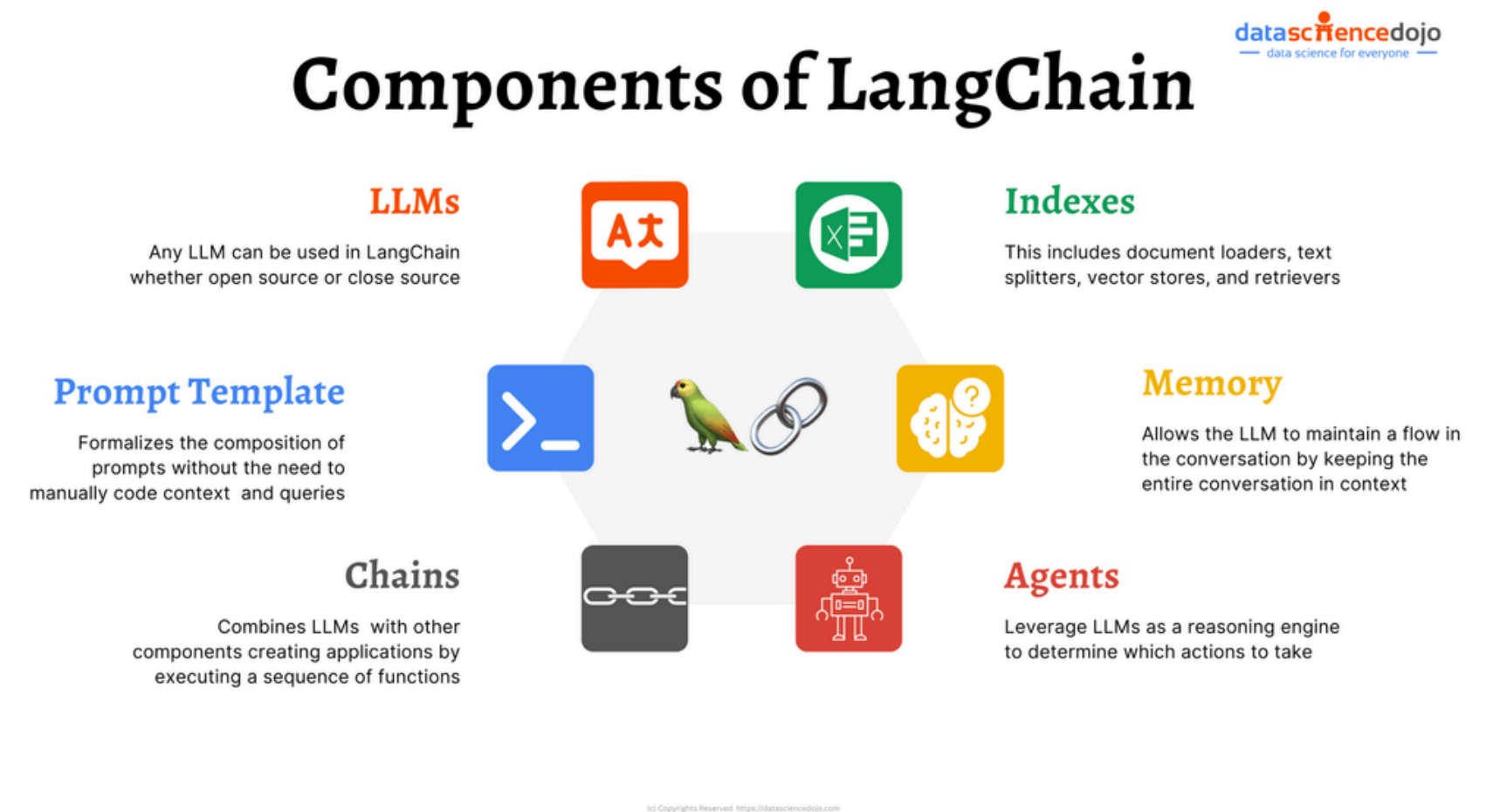
Typical Use Cases:

- Chatbots and Virtual Assistants (e.g. Customer Support)
- Intelligent search engines (e.g. natural language search)
- Automated content creation (e.g. articles)
- Question Answering Systems
- Sentiment Analysis



KEY COMPONENTS OF LANGCHAIN

- LLMs / Chat Models
- Prompt Templates
- Chains
- Agents
- Memory
- Tools / Toolkits



KEY COMPONENTS OF LANGCHAIN

Integration of different language model types

LLMs

Language model for various text-based tasks (e.g., translation, summarization)



Chat Models

Language model optimized for dialogue and maintaining context in conversations.



```
from langchain_openai import ChatOpenAI

llm = ChatOpenAI(
    model="gpt-4o",
    temperature=0,
    max_tokens=None,
    timeout=None,
    max_retries=2,
    # api_key="...", # if you prefer to pass api key in directly instead of using env vars
    # base_url="...",
    # organization="...",
    # other params...
)
```


KEY COMPONENTS OF LANGCHAIN

Prompt Templates - Structure LLM Input

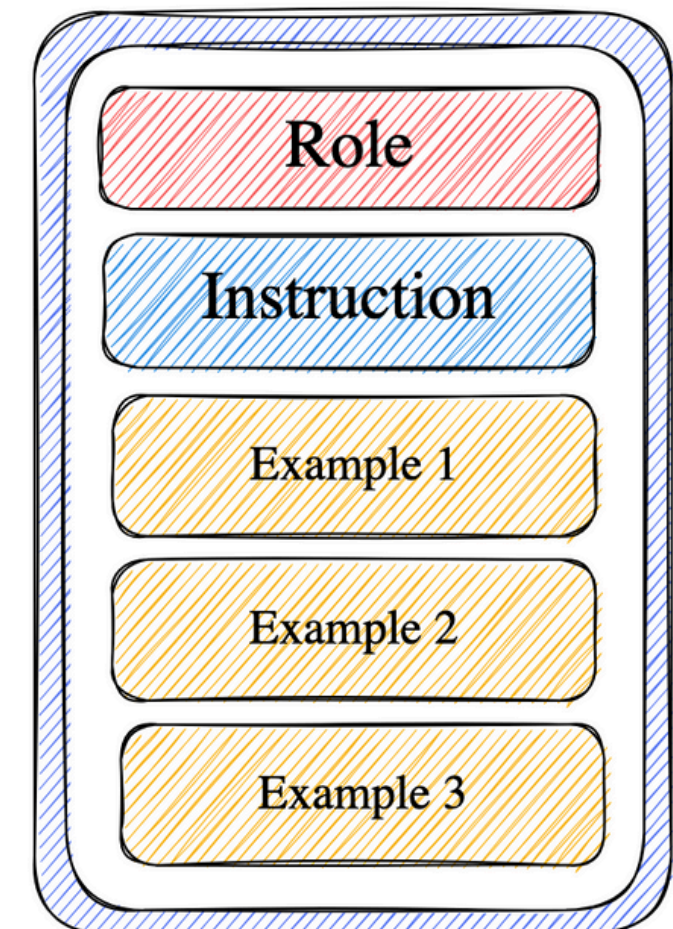
```
# In addition to Human/AI/Tool/Function messages,
# you can initialize the template with a MessagesPlaceholder
# either using the class directly or with the shorthand tuple syntax:

template = ChatPromptTemplate([
    ("system", "You are a helpful AI bot."),
    # Means the template will receive an optional list of messages under
    # the "conversation" key
    ("placeholder", "{conversation}")
    # Equivalently:
    # MessagesPlaceholder(variable_name="conversation", optional=True)
])

prompt_value = template.invoke(
    {
        "conversation": [
            ("human", "Hi!"),
            ("ai", "How can I assist you today?"),
            ("human", "Can you make me an ice cream sundae?"),
            ("ai", "No.")
        ]
    }
)

# Output:
# ChatPromptValue(
#   messages=[
#     SystemMessage(content='You are a helpful AI bot.'),
#     HumanMessage(content='Hi!'),
#     AIMessage(content='How can I assist you today?'),
#     HumanMessage(content='Can you make me an ice cream sundae?'),
#     AIMessage(content='No.'),
#   ]
#)
```

A Combined Techniques Prompt



KEY COMPONENTS OF LANGCHAIN

Tools - Enhance LLM Functionality

- Tools provide modular interfaces to integrate external services like databases and APIs.
- Toolkits group tools that share resources.
- Tools can be combined with models to extend their capability.
- LangChain offers tools like search engines, code interpreter, office365, web browsing, data bases, wheater APIs, stock APIs, ...

Name	Description
AINetwork Toolkit	AI Network is a layer 1 blockchain designed to accommodate large-scal...
Alpha Vantage	Alpha Vantage Alpha Vantage provides realtime and historical financia...
Amadeus Toolkit	This notebook walks you through connecting LangChain to the Amadeus t...
ArXiv	This notebook goes over how to use the arxiv tool with an agent.
AskNews	AskNews infuses any LLM with the latest global news (or historical ne...
AWS Lambda	Amazon AWS Lambda is a serverless computing service provided by Amazo...
Azure AI Services Toolkit	This toolkit is used to interact with the Azure AI Services API to ac...
Azure Cognitive Services Toolkit	This toolkit is used to interact with the Azure Cognitive Services AP...
Azure Container Apps dynamic sessions	Azure Container Apps dynamic sessions provides a secure and scalable ...
Shell (bash)	Giving agents access to the shell is powerful (though risky outside a...
Bearly Code Interpreter	Bearly Code Interpreter allows for remote execution of code. This mak...
Bing Search	Bing Search is an Azure service and enables safe, ad-free, location-a...
Brave Search	This notebook goes over how to use the Brave Search tool.

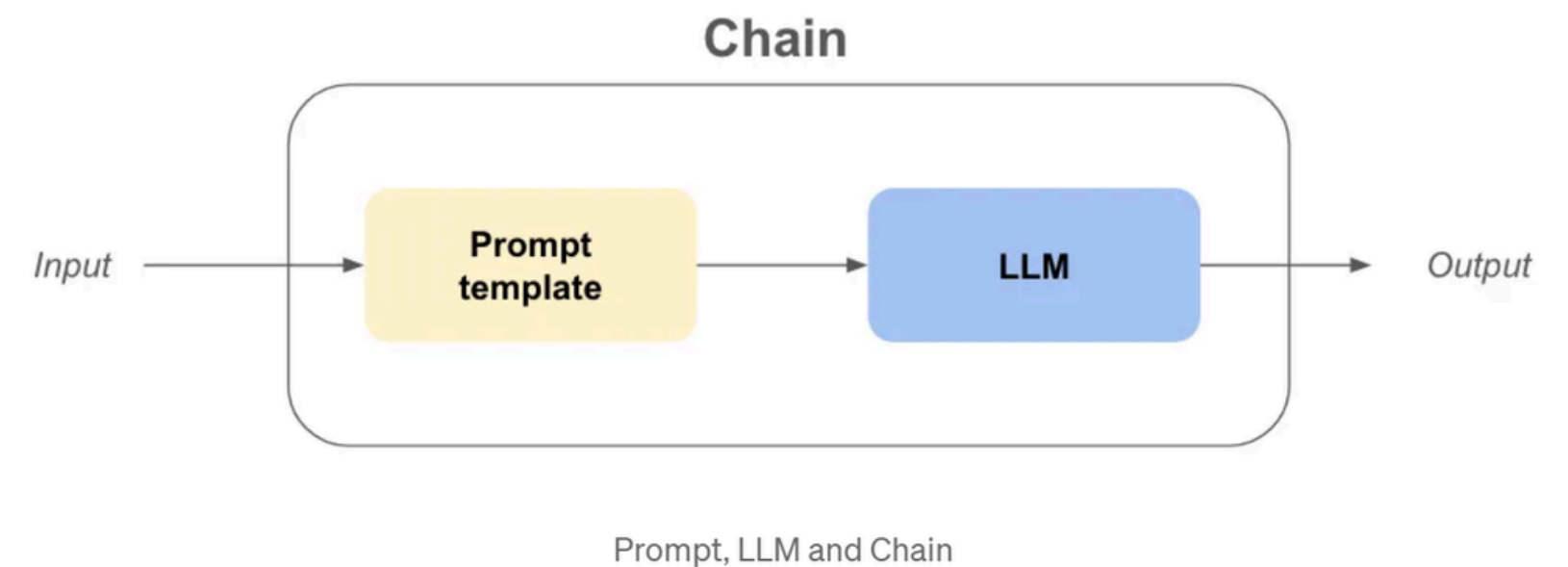
KEY COMPONENTS OF LANGCHAIN

Chains - Streamline LLM pipelines

- Compose modular logic components into reusable pipelines.
- Chains are sequences of components with calls to components
- Steps can be added, removed, and swapped.
- Easily incorporate LLMs, databases, APIs, tools, etc.
- Chains can enforce policies like moderating toxic outputs or aligning with ethical principles.
- Use pre-built chains or implement custom chains

Example:

A simple chain might involve passing a formatted prompt to an LLM.



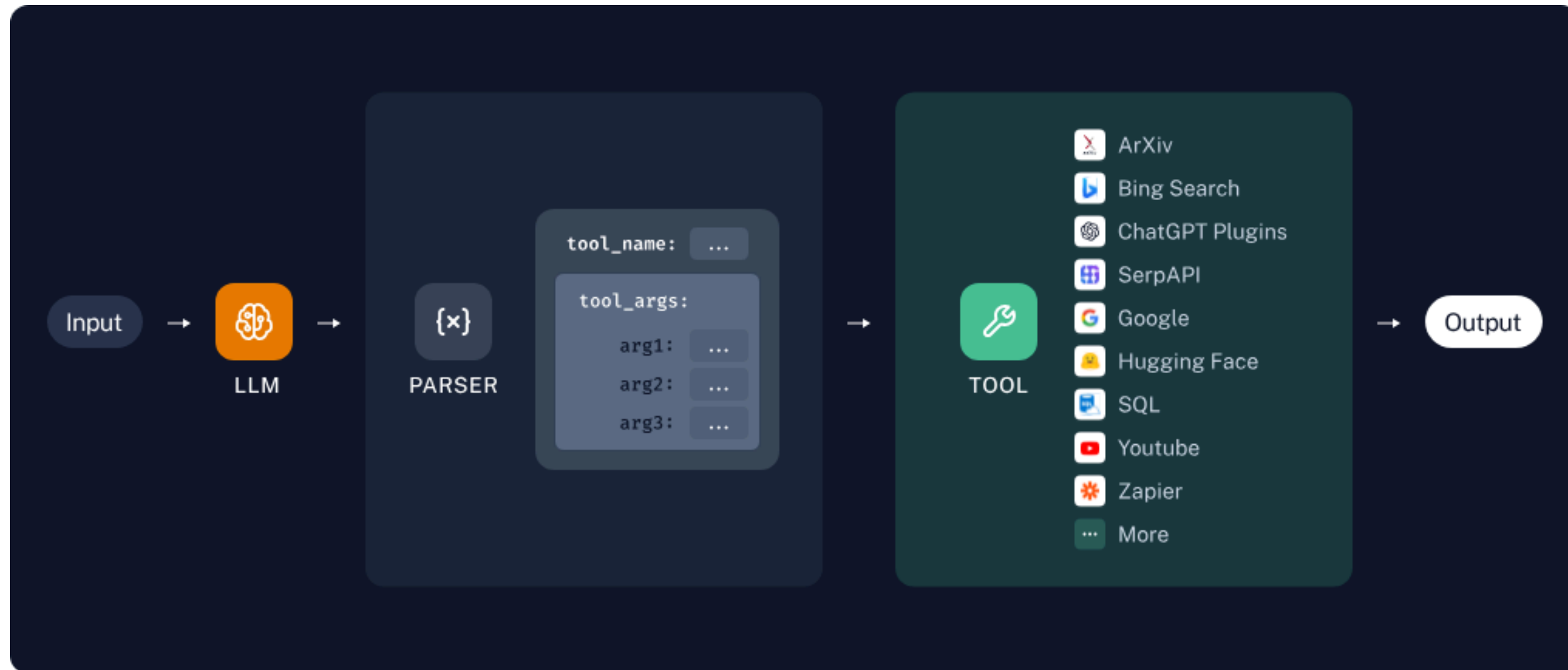
```
from langchain_core.output_parsers import StrOutputParser
from langchain_core.prompts import ChatPromptTemplate

prompt = ChatPromptTemplate.from_template("tell me a joke about {topic}")

chain = prompt | model | StrOutputParser()
```

KEY COMPONENTS OF LANGCHAIN

Chains - Tool Integration

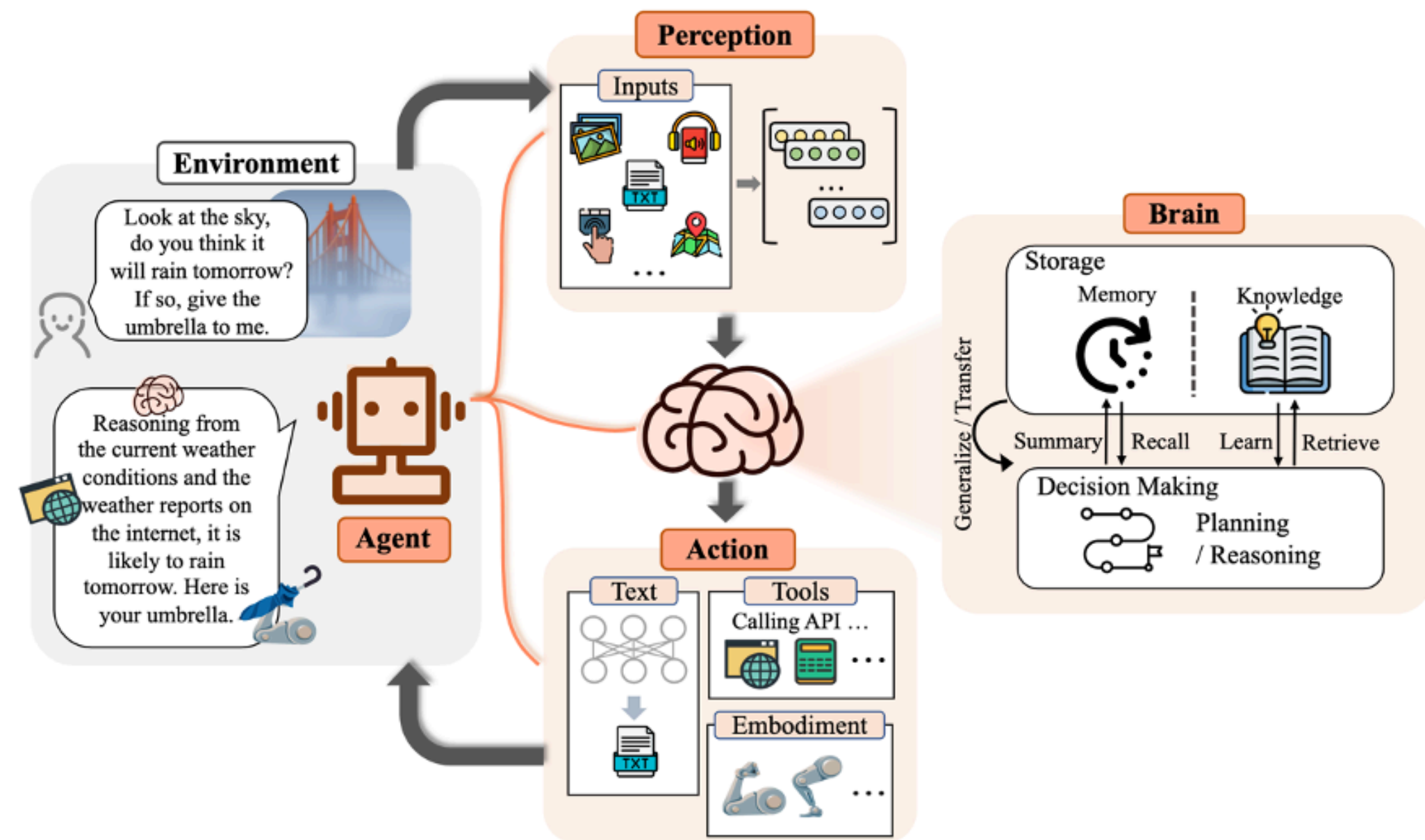


-> great when we know the specific sequence of tool usage needed for any user input

KEY COMPONENTS OF LANGCHAIN

Agents - Principle of LLM based Agents

- **Agent:** autonomous software entities that can interact dynamically with users and environments.
- **Brain:** Core of AI agent, primary composed of an LLM, Tasks are memorizing, thinking, planning and decision making
- **Perception:** Broaden agents perception space from text-only domain to multimodal sphere, Perceives and processes multimodal information
- **Action:** Expand action space of agent using tools to adapt to environment changes



KEY COMPONENTS OF LANGCHAIN

Agents - Tool Integration



-> great when how many times we use tools depends on the input,
we want to let the model itself decide how many times to use tools and in what order

KEY COMPONENTS OF LANGCHAIN

1. Implement Tools

```
from langchain_core.tools import tool

@tool
def multiply(first_int: int, second_int: int) -> int:
    """Multiply two integers together."""
    return first_int * second_int

@tool
def add(first_int: int, second_int: int) -> int:
    "Add two integers."
    return first_int + second_int

@tool
def exponentiate(base: int, exponent: int) -> int:
    "Exponentiate the base to the exponent power."
    return base**exponent

tools = [multiply, add, exponentiate]
```

2. Create and invoke Agent

```
# Construct the tool calling agent
agent = create_tool_calling_agent(llm, tools, prompt)
```

```
# Create an agent executor by passing in the agent and tools
agent_executor = AgentExecutor(agent=agent, tools=tools, verbose=True)
```

```
agent_executor.invoke(
    {
        "input": "Take 3 to the fifth power and multiply that by the sum of twelve and three, then"
    }
)
```

Agents - Tool Integration

3. Agent Output

```
[1m> Entering new AgentExecutor chain... [0m
[32;1m [1;3m
Invoking: `exponentiate` with `{'base': 3, 'exponent': 5}`
responded: [{'text': "Okay, let's break this down step-by-step:", 'type': 'text'}, {'id': 'toolu_01Cj

[0m [38;5;200m [1;3m243 [0m [32;1m [1;3m
Invoking: `add` with `{'first_int': 12, 'second_int': 3}`
responded: [{'text': '3 to the 5th power is 243.', 'type': 'text'}, {'id': 'toolu_01EKqn4E5w3Zj7bQ8s8

[0m [33;1m [1;3m15 [0m [32;1m [1;3m
Invoking: `multiply` with `{'first_int': 243, 'second_int': 15}`
responded: [{'text': '12 + 3 = 15', 'type': 'text'}, {'id': 'toolu_017VZJgZBYbwMo2KGD6o6hsQ', 'input'

[0m [36;1m [1;3m3645 [0m [32;1m [1;3m
Invoking: `multiply` with `{'first_int': 3645, 'second_int': 3645}`
responded: [{'text': '243 * 15 = 3645', 'type': 'text'}, {'id': 'toolu_01RtFCcQgbVGya3NVDgTYKTa', 'in

[0m [36;1m [1;3m13286025 [0m [32;1m [1;3mSo 3645 squared is 13,286,025.

Therefore, the final result of taking 3 to the 5th power (243), multiplying by 12 + 3 (15), and then

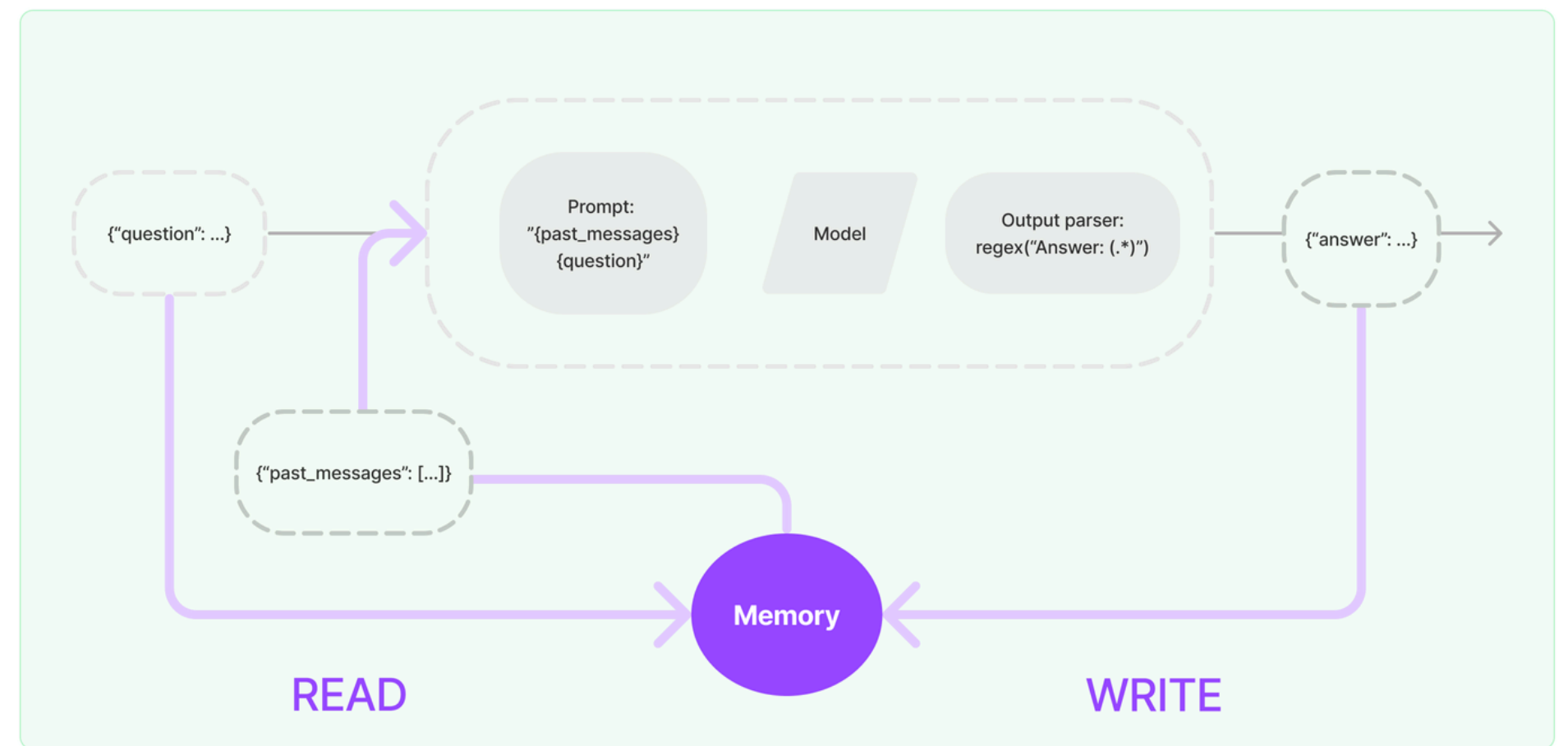
[1m> Finished chain. [0m
```

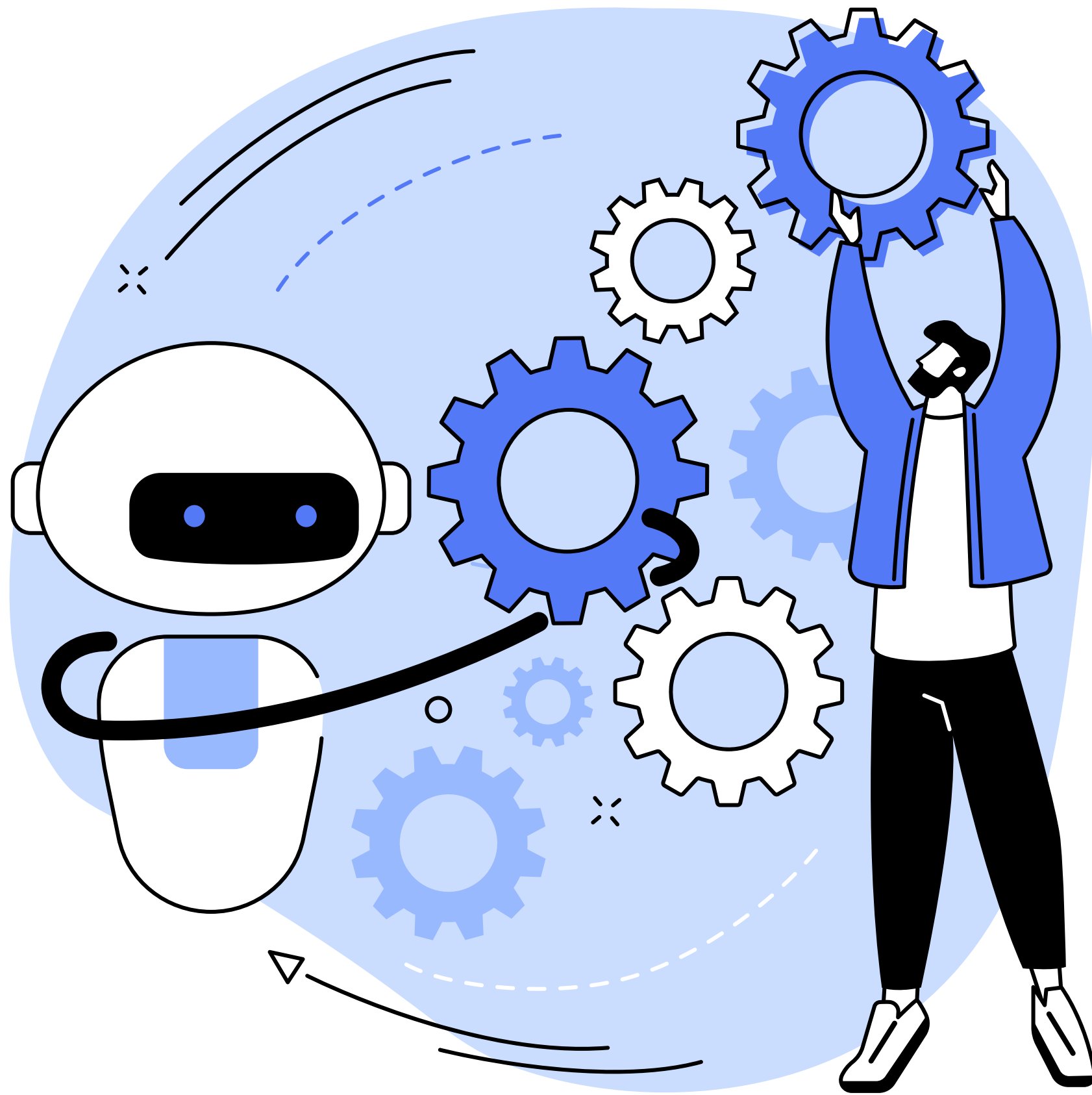


KEY COMPONENTS OF LANGCHAIN

Memory - Enhancing Conversational Applications

- Ability to persist information between interactions.
- Enables more coherent, context-aware, and efficient applications.
- Memory improves LLM responses by providing relevant historical information.
- Agents can track progress on multi-step goals and remember facts about the world.
- Memory reduces redundant LLM calls, saving costs and improving performance.
- Storage in-memory or in databases





IT'S YOUR TURN