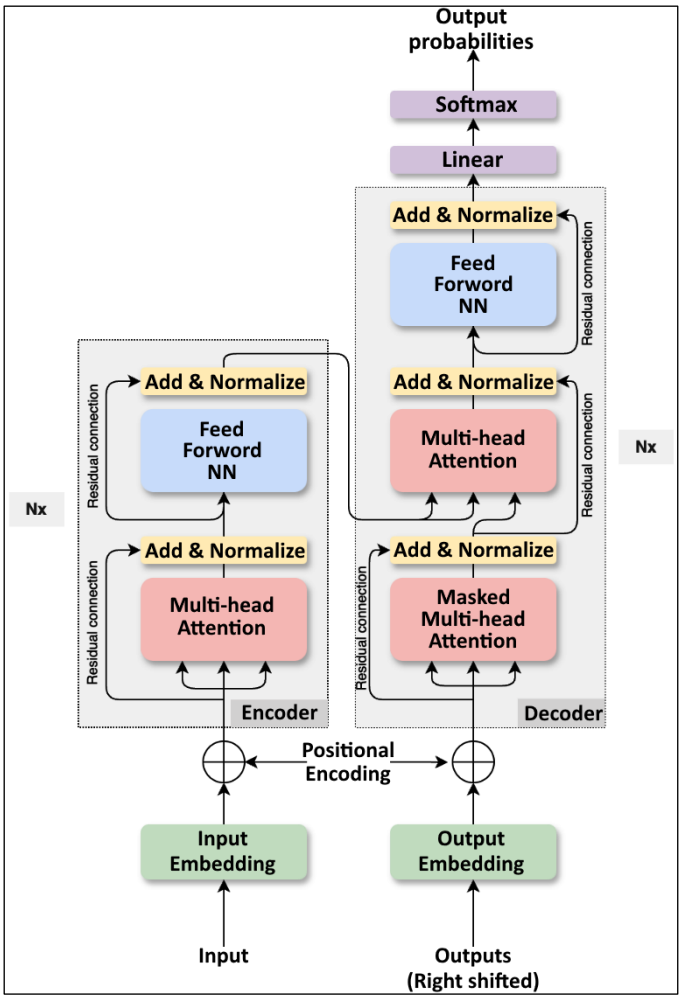
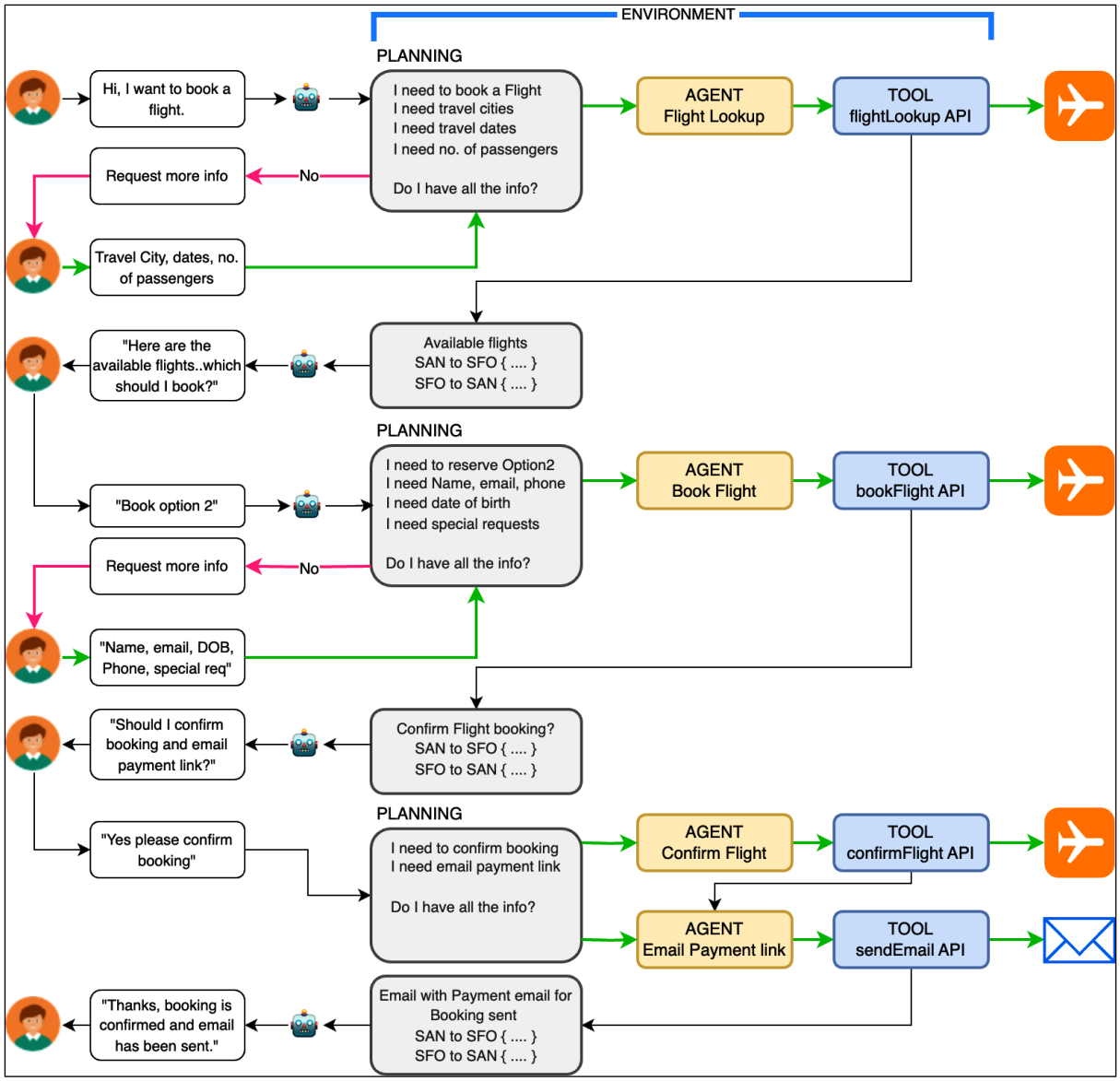
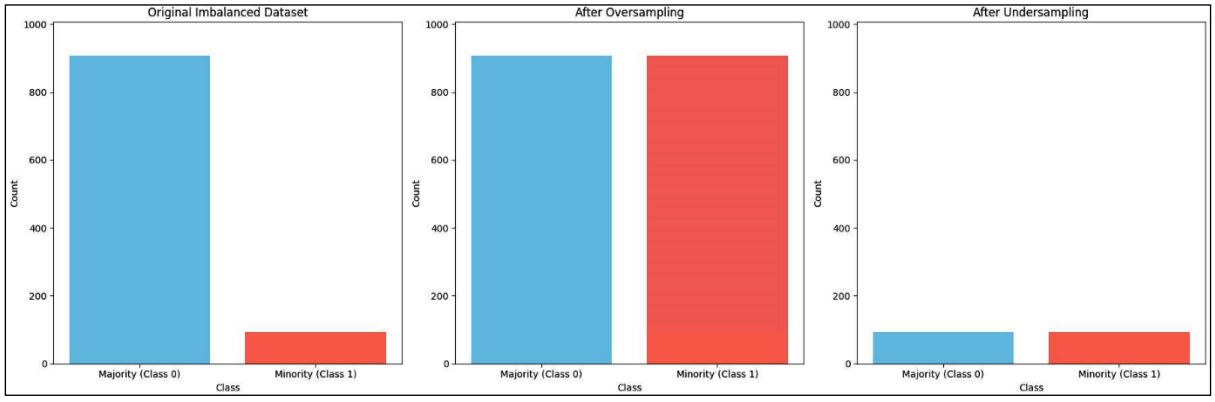
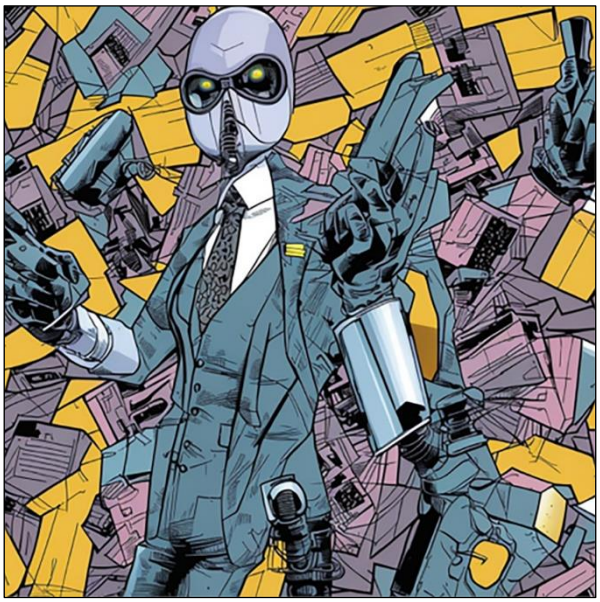
Chapter 1: Fundamentals of Generative AI

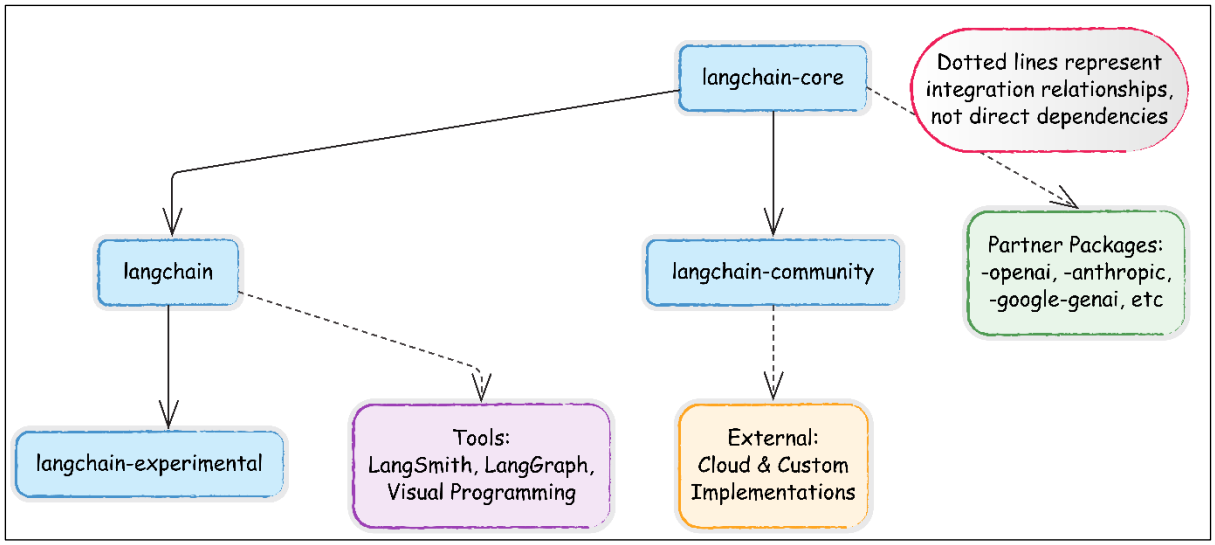


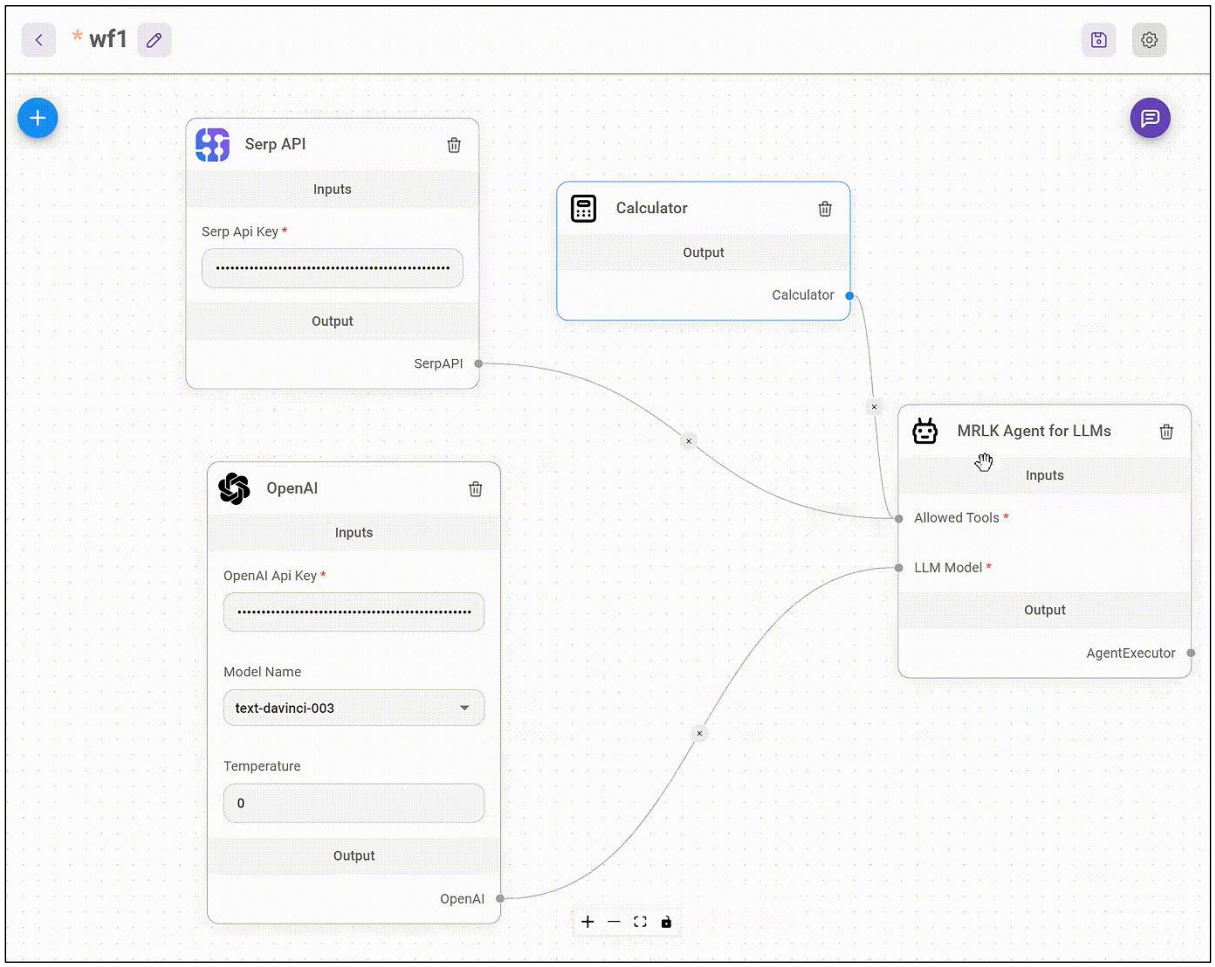

ENVIRONMENT
PLANNING
Hi, I want to book a flight.
I need to book a Flight
I need travel cities
I need travel dates
I need no. of passengers
Do I have all the info?
No
Request more info
Travel City, dates, no. of passengers
AGENT
Flight Lookup
TOOL
flightLookup API
Available flights
SAN to SFO { .... }
SFO to SAN { .... }
"Here are the available flights..which should I book?"
PLANNING
"Book option 2"
I need to reserve Option2
I need Name, email, phone
I need date of birth
I need special requests
Do I have all the info?
No
Request more info
"Name, email, DOB, Phone, special req"
AGENT
Book Flight
TOOL
bookFlight API
Confirm Flight booking?
SAN to SFO { .... }
SFO to SAN { .... }
"Should I confirm booking and email payment link?"
PLANNING
"Yes please confirm booking"
I need to confirm booking
I need email payment link
Do I have all the info?
AGENT
Confirm Flight
TOOL
confirmFlight API
AGENT
Email Payment link
TOOL
sendEmail API
Email with Payment email for Booking sent
SAN to SFO { .... }
SFO to SAN { .... }
"Thanks, booking is confirmed and email has been sent."


Original Imbalanced Dataset
After Oversampling
After Undersampling
Count
Class
Majority (Class 0)
Minority (Class 1)
0
200
400
600
800
1000

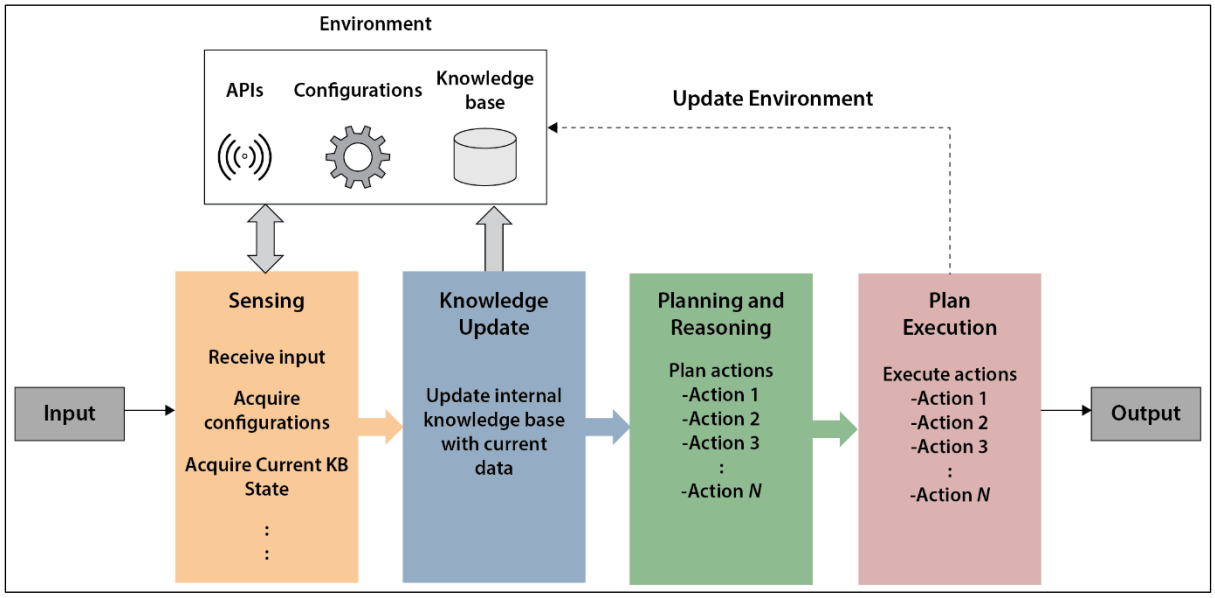


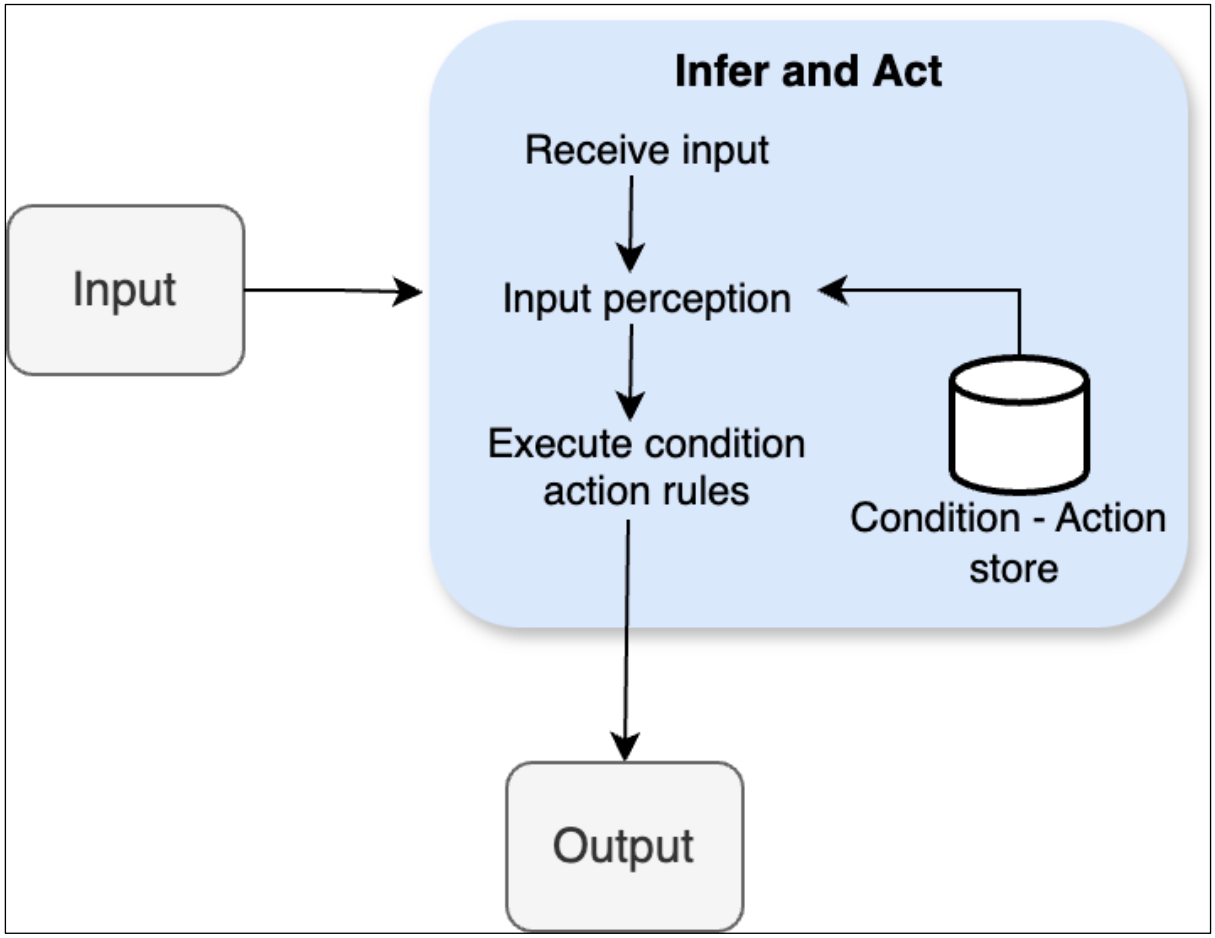


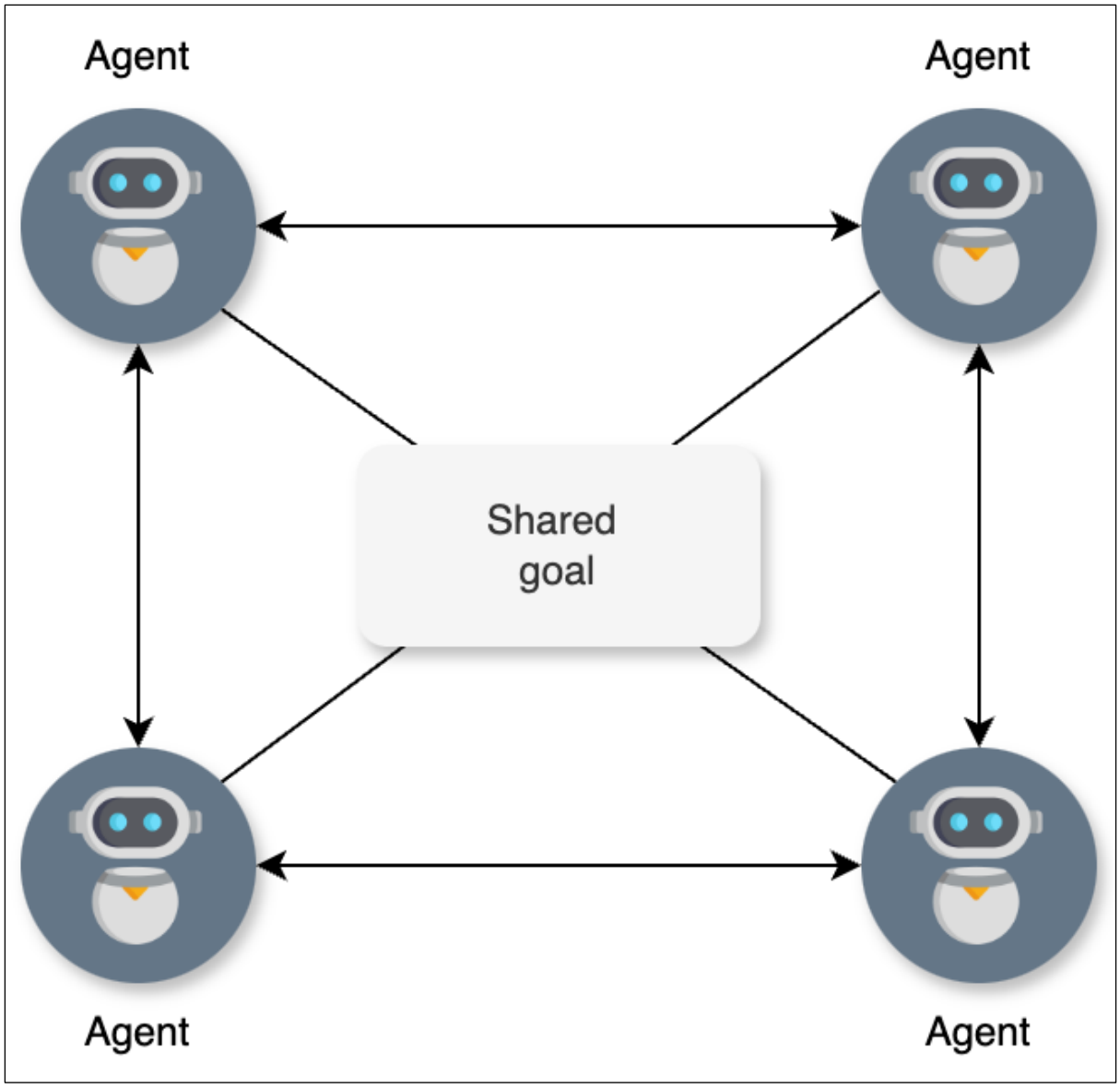

langchain-core
Dotted lines represent integration relationships, not direct dependencies
langchain
langchain-community
Partner Packages: -openai, -anthropic, -google-genai, etc
langchain-experimental
Tools: LangSmith, LangGraph, Visual Programming
External: Cloud & Custom Implementations

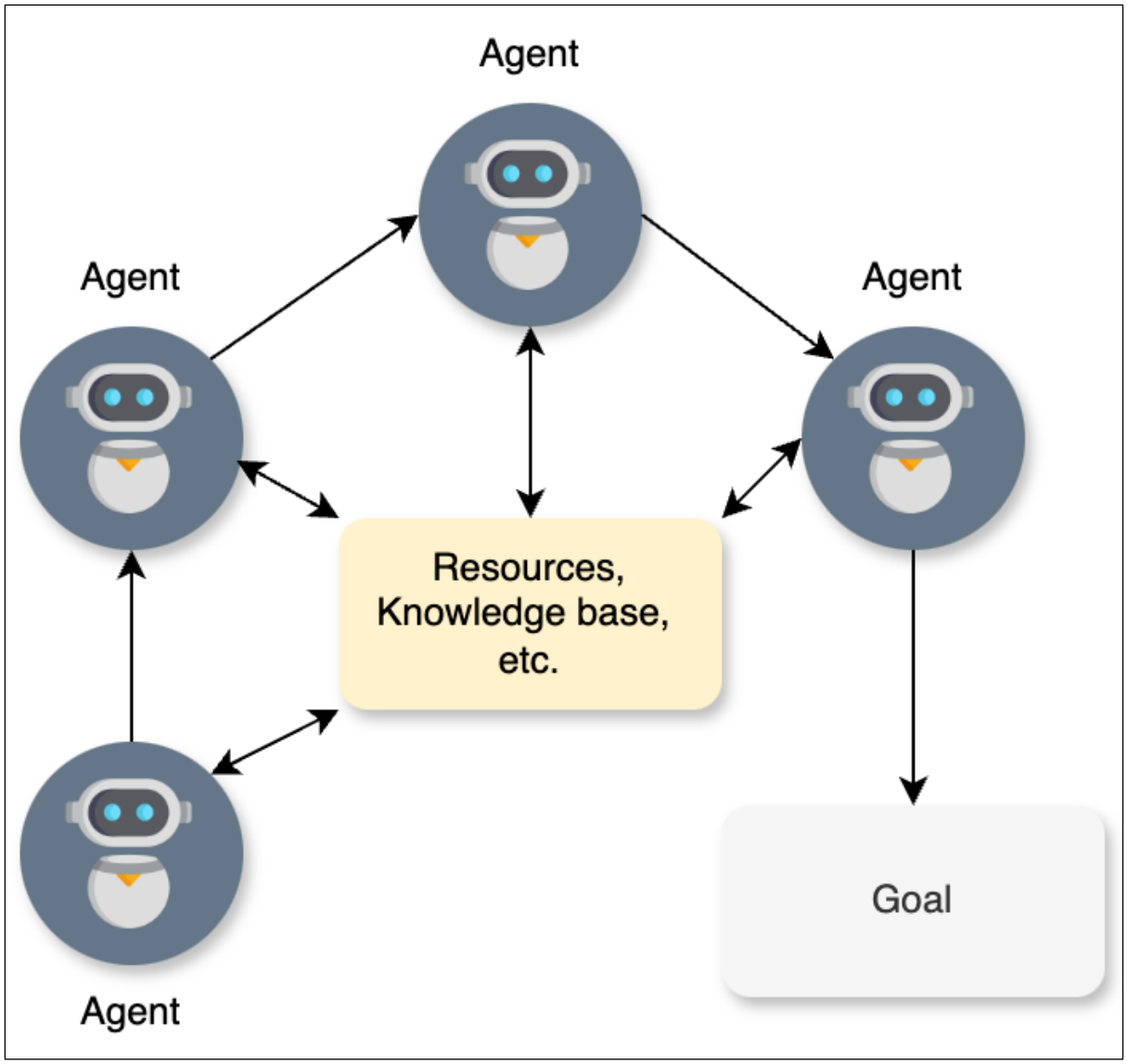

* wf1
Serp API
Inputs
Serp Api Key *
Output
SerpAPI
Calculator
Output
Calculator
MRLK Agent for LLMs
Inputs
Allowed Tools *
LLM Model *
Output
AgentExecutor
OpenAI
Inputs
OpenAI Api Key *
Model Name
text-davinci-003
Temperature
0
Output
OpenAI

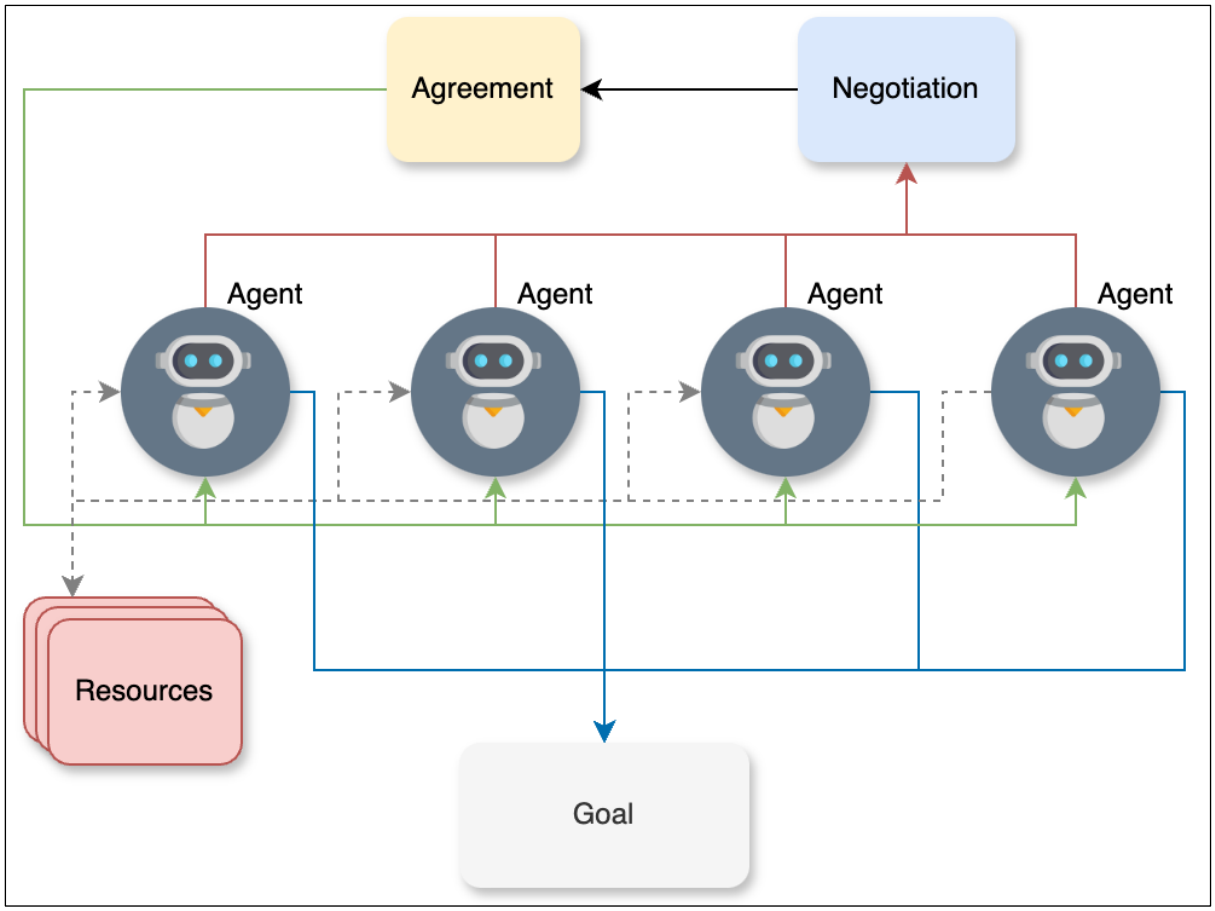
Chapter 2: Principles of Agentic Systems

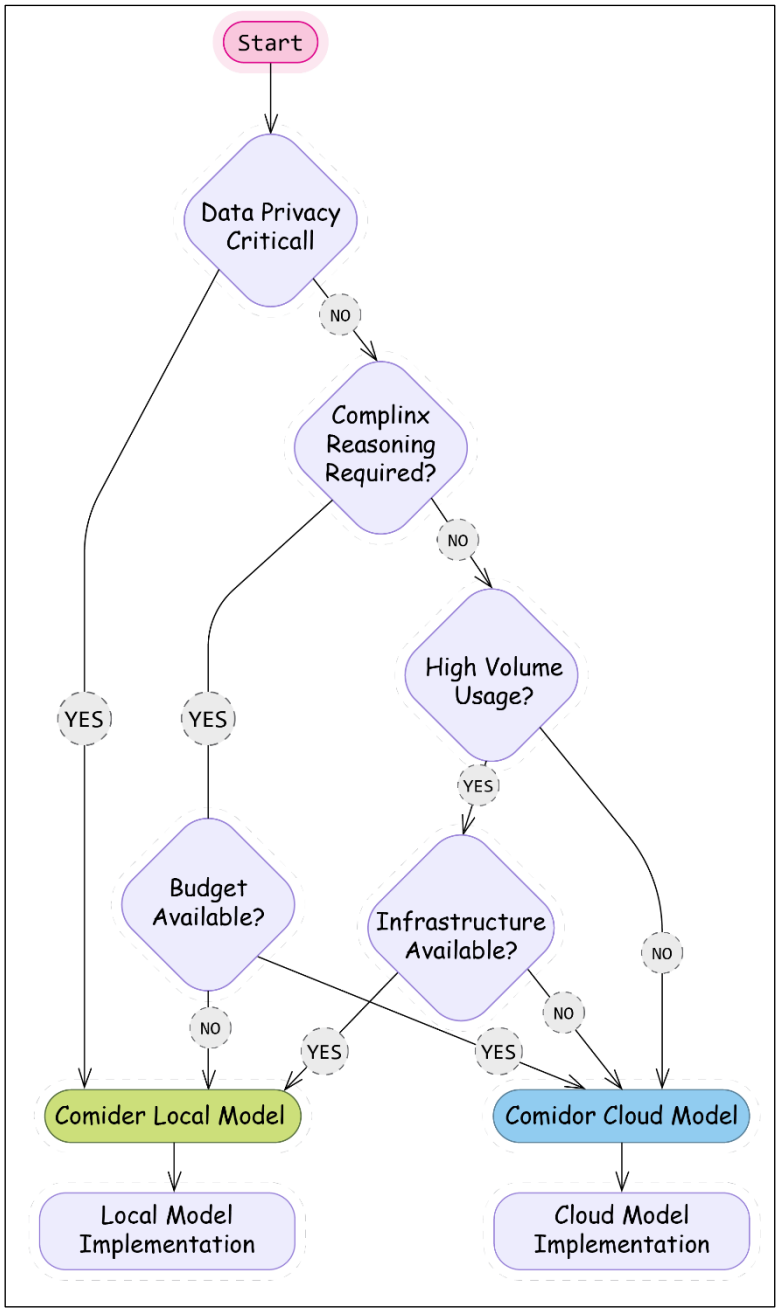


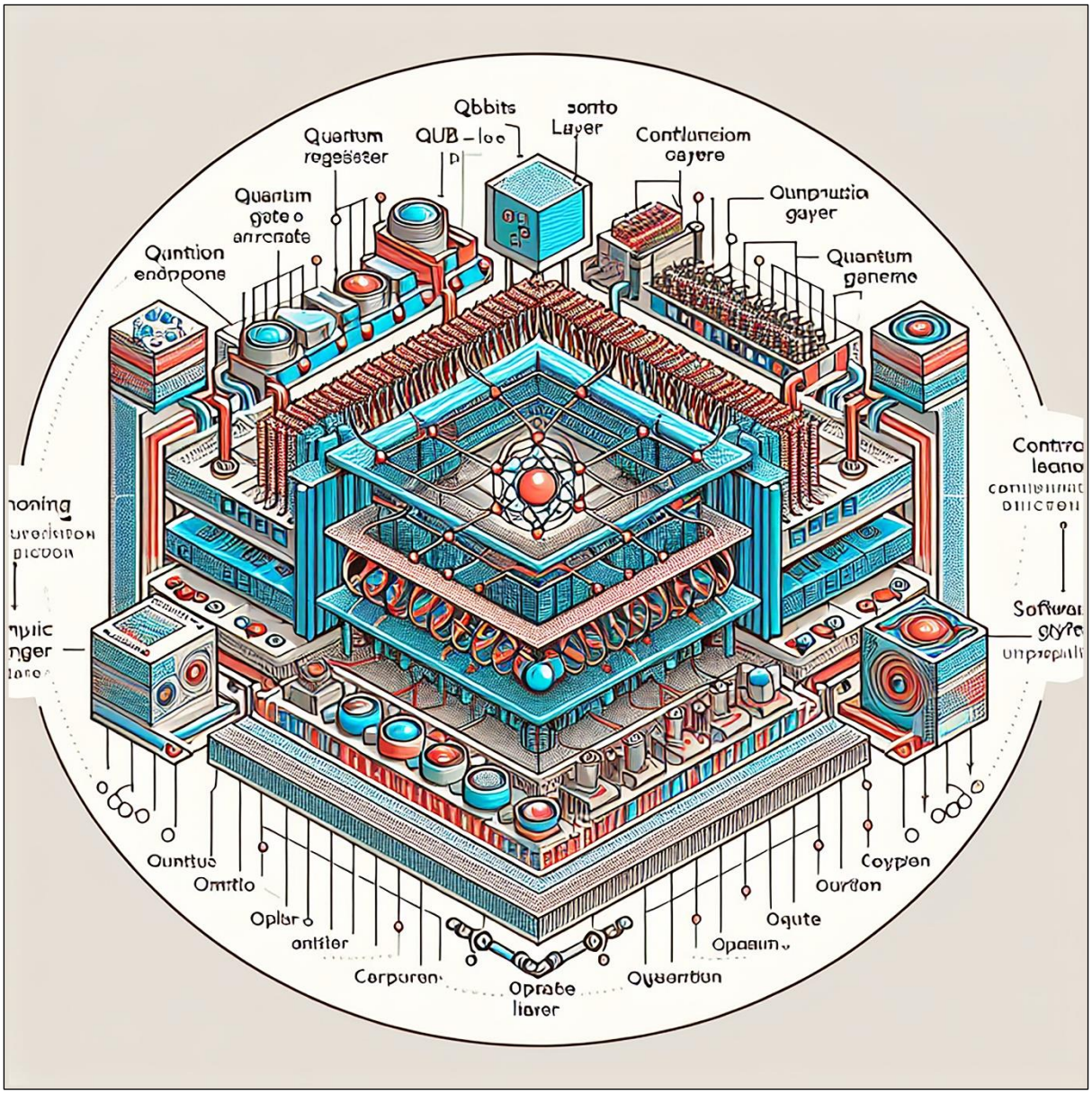


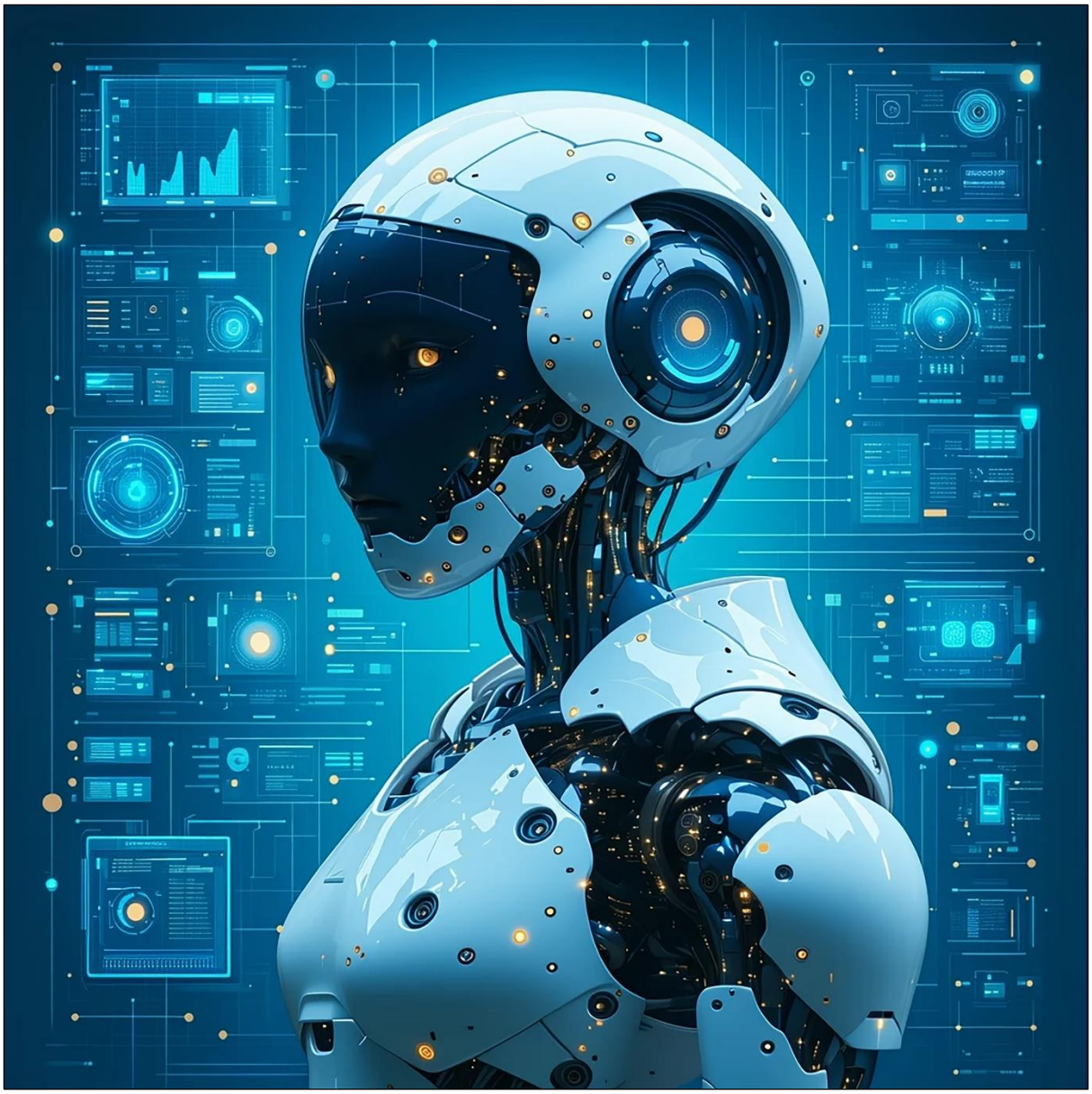

Agent
Agent
Shared
goal
Agent
Agent


Agent
Agent
Agent
Resources,
Knowledge base,
etc.
Goal
Agent

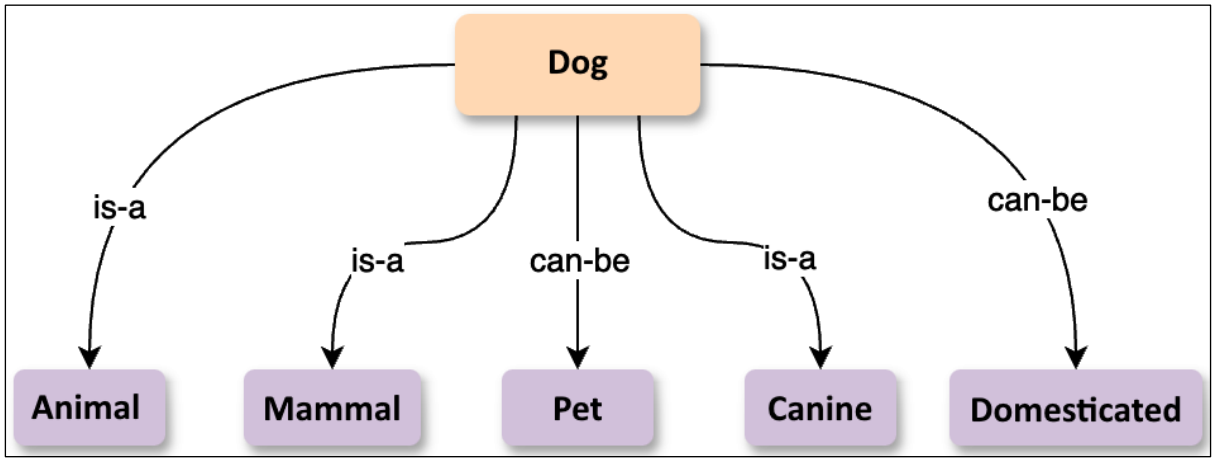

Agreement
Negotiation
Agent
Agent
Agent
Agent
Resources
Goal

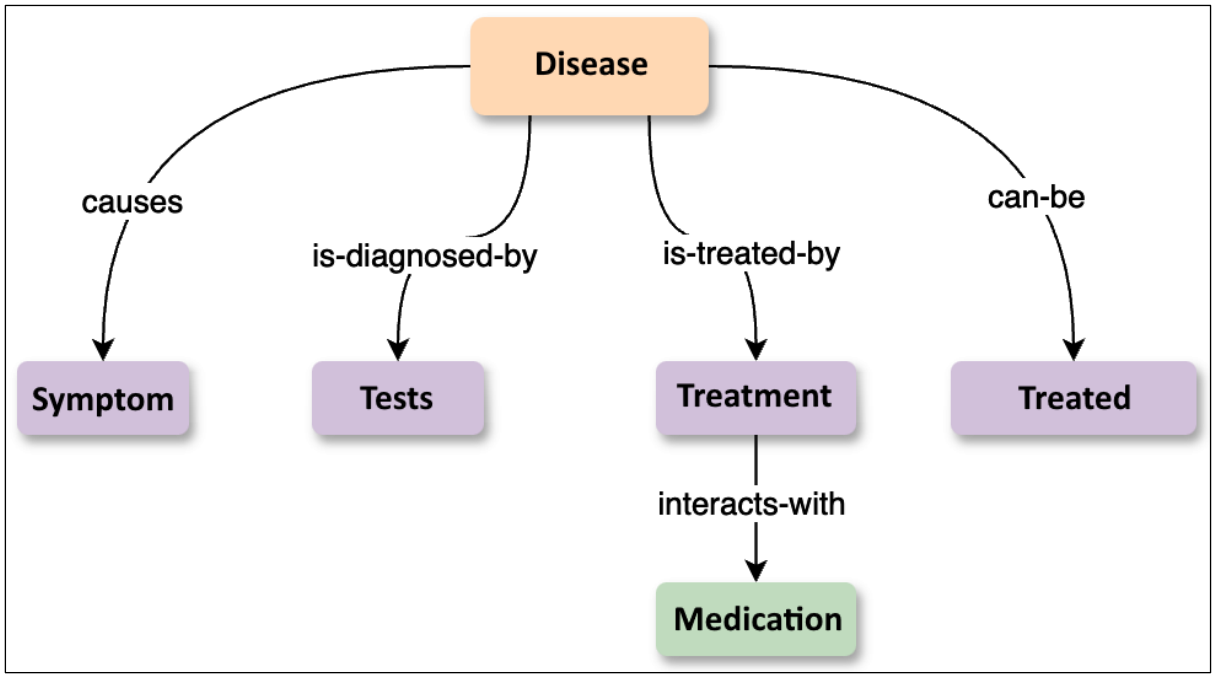

Start
Data Privacy Criticall
NO
Complinx Reasoning Required?
NO
High Volume Usage?
YES
YES
YES
Budget Available?
Infrastructure Available?
NO
NO
NO
YES
YES
Comider Local Model
Comidor Cloud Model
Local Model Implementation
Cloud Model Implementation

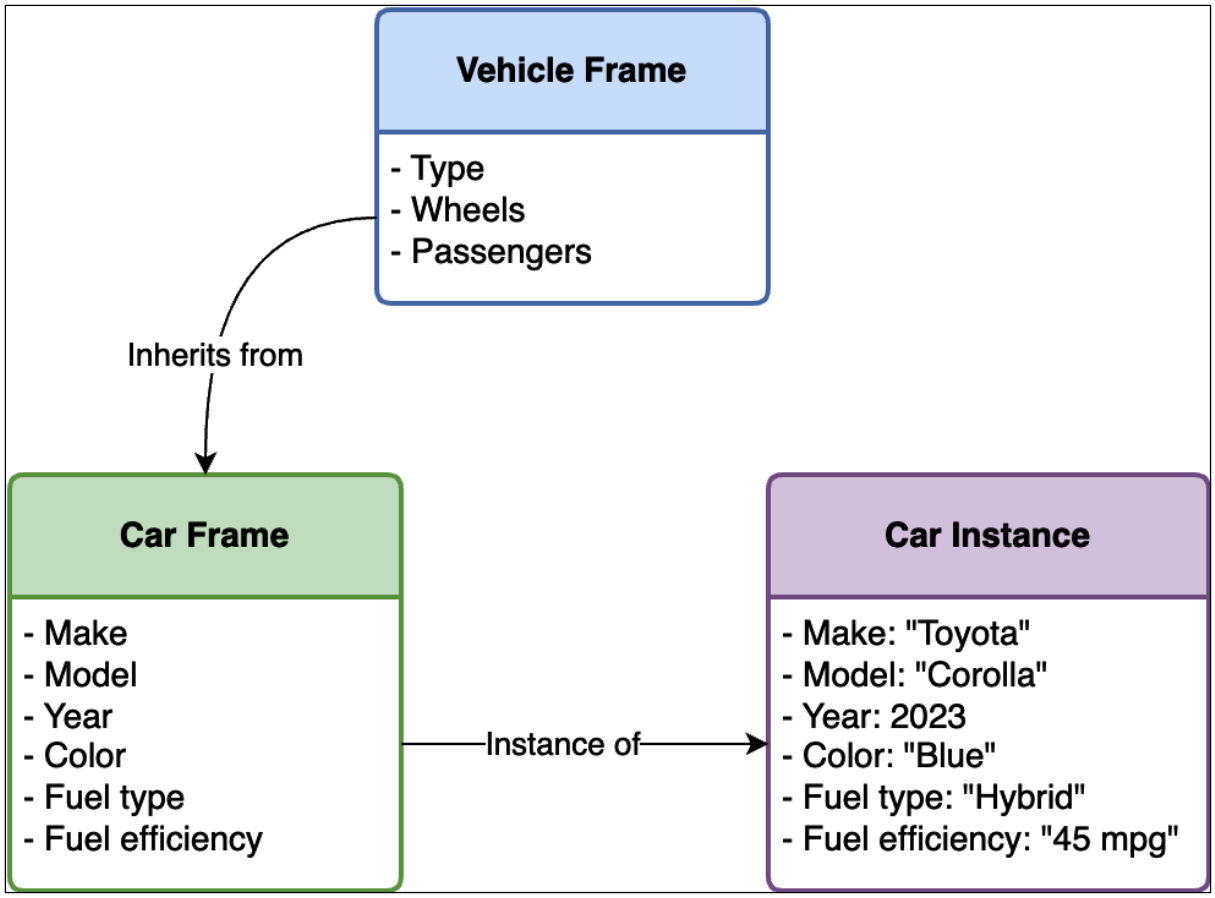


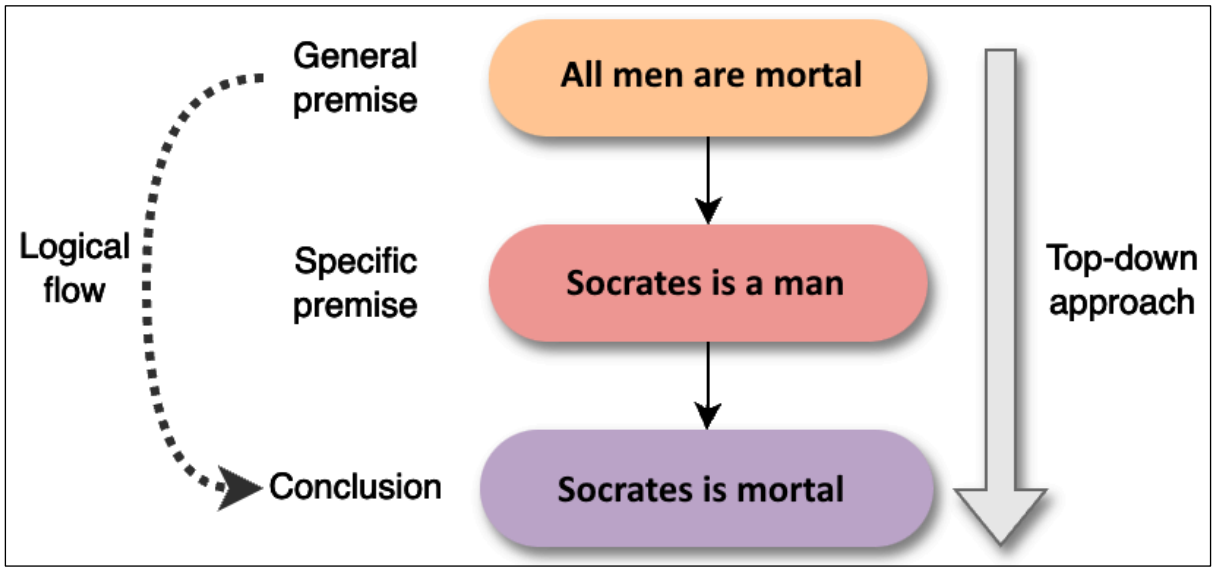


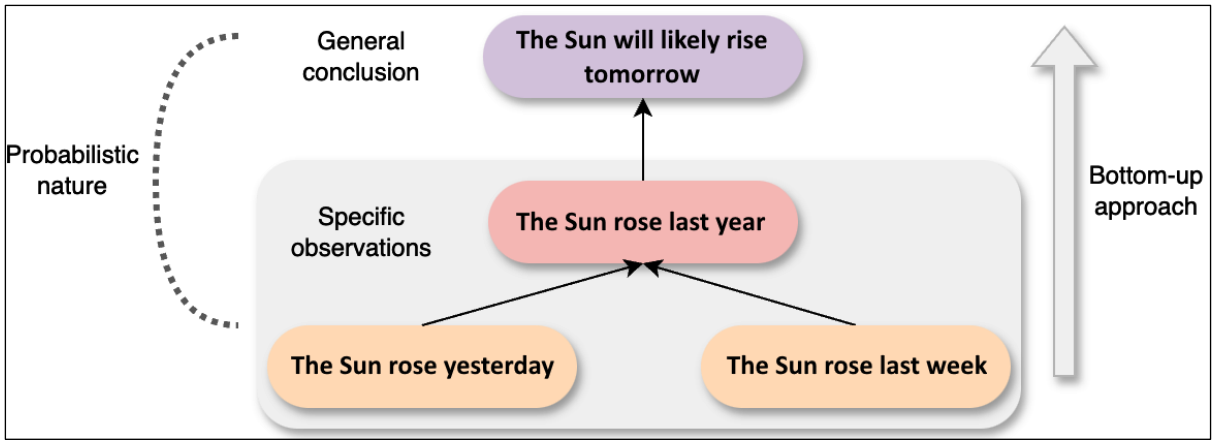
Chapter 3: Essential Components of Intelligent Agents

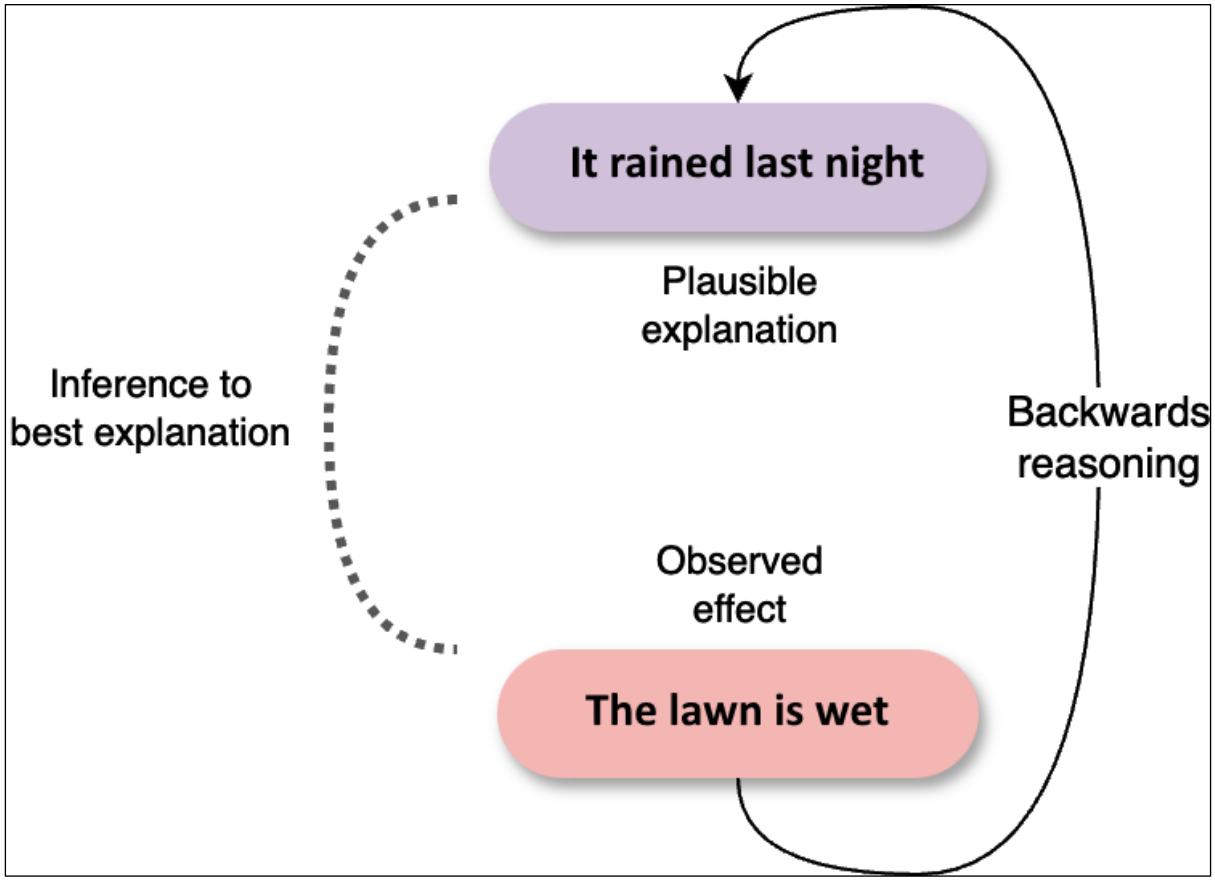





Vehicle Frame
- Type
- Wheels
- Passengers
Inherits from
Car Frame
- Make
- Model
- Year
- Color
- Fuel type
- Fuel efficiency
Instance of
Car Instance
- Make: "Toyota"
- Model: "Corolla"
- Year: 2023
- Color: "Blue"
- Fuel type: "Hybrid"
- Fuel efficiency: "45 mpg"


General premise
All men are mortal
Logical flow
Specific premise
Socrates is a man
Top-down approach
Conclusion
Socrates is mortal


General conclusion
The Sun will likely rise tomorrow
Probabilistic nature
Specific observations
The Sun rose last year
The Sun rose yesterday
The Sun rose last week
Bottom-up approach


It rained last night
Plausible explanation
Inference to best explanation
Backwards reasoning
Observed effect
The lawn is wet

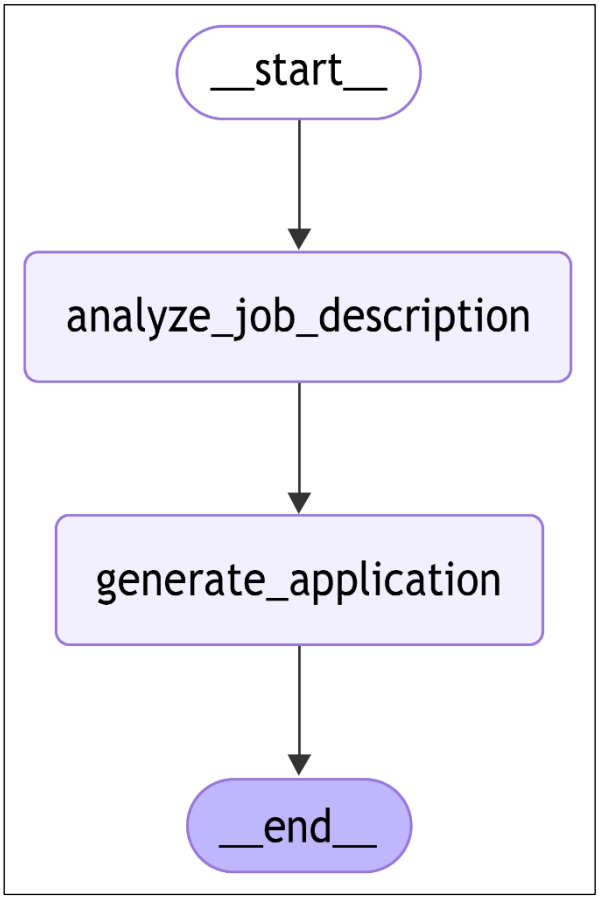
YOUR AI TRAVEL AGENT

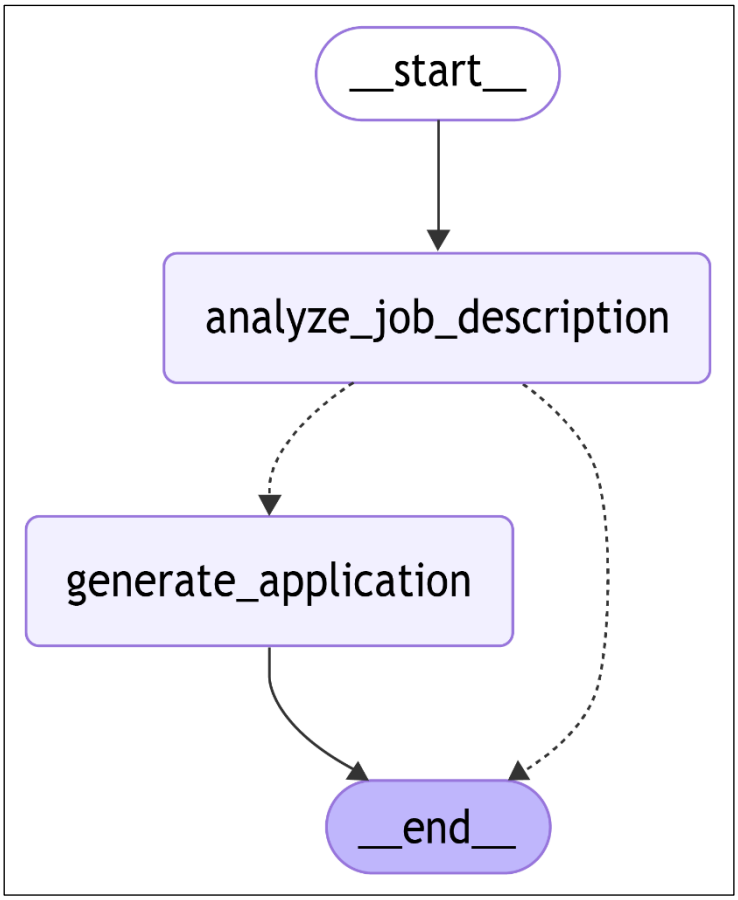
User: Hi i want to book a flight ticket

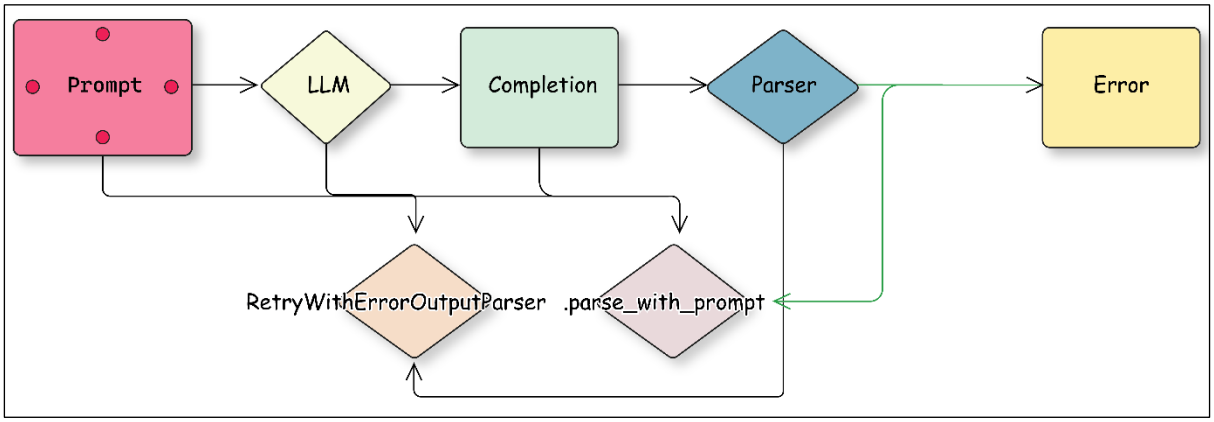
Travel agent: I can help you with that! Could you please provide me with the following details for your flight booking? 1. Departure City 2. Arrival City 3. Date of Travel 4. Your legal name as it appears on your passport or ID With these details, I'll be able to book the ticket for you.

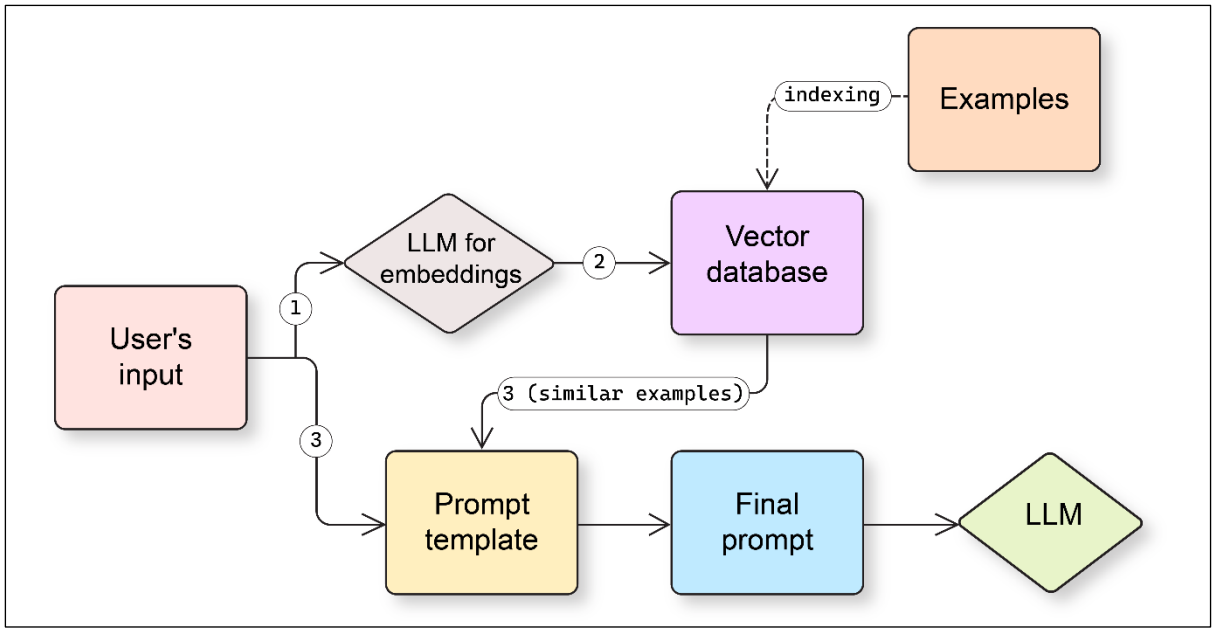
User: from LA to NY, on Oct 1 2024. Name is Johhny Doe.

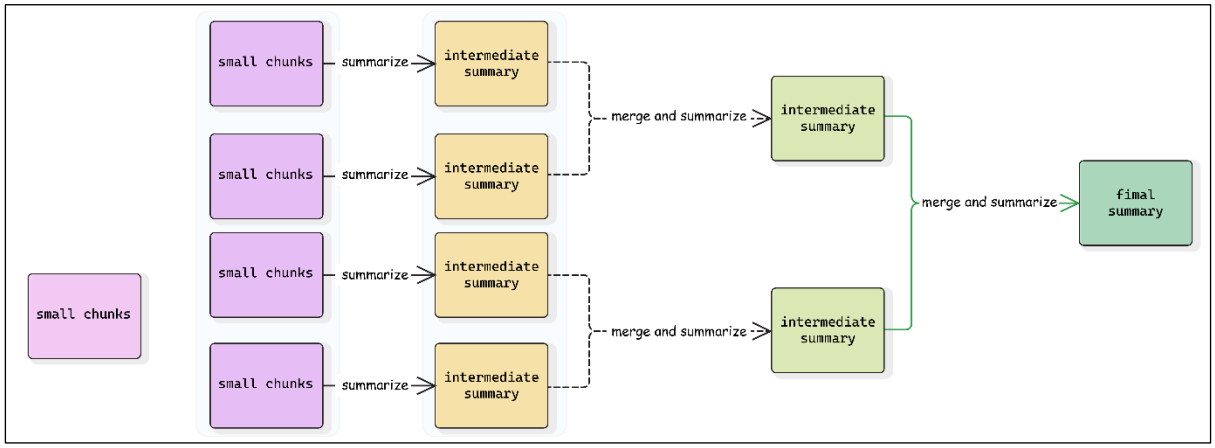
Travel agent: Your flight from Los Angeles to New York on October 1, 2024, has been successfully booked for Johnny Doe. If you need any further assistance or additional bookings, feel free to ask. Have a great trip!



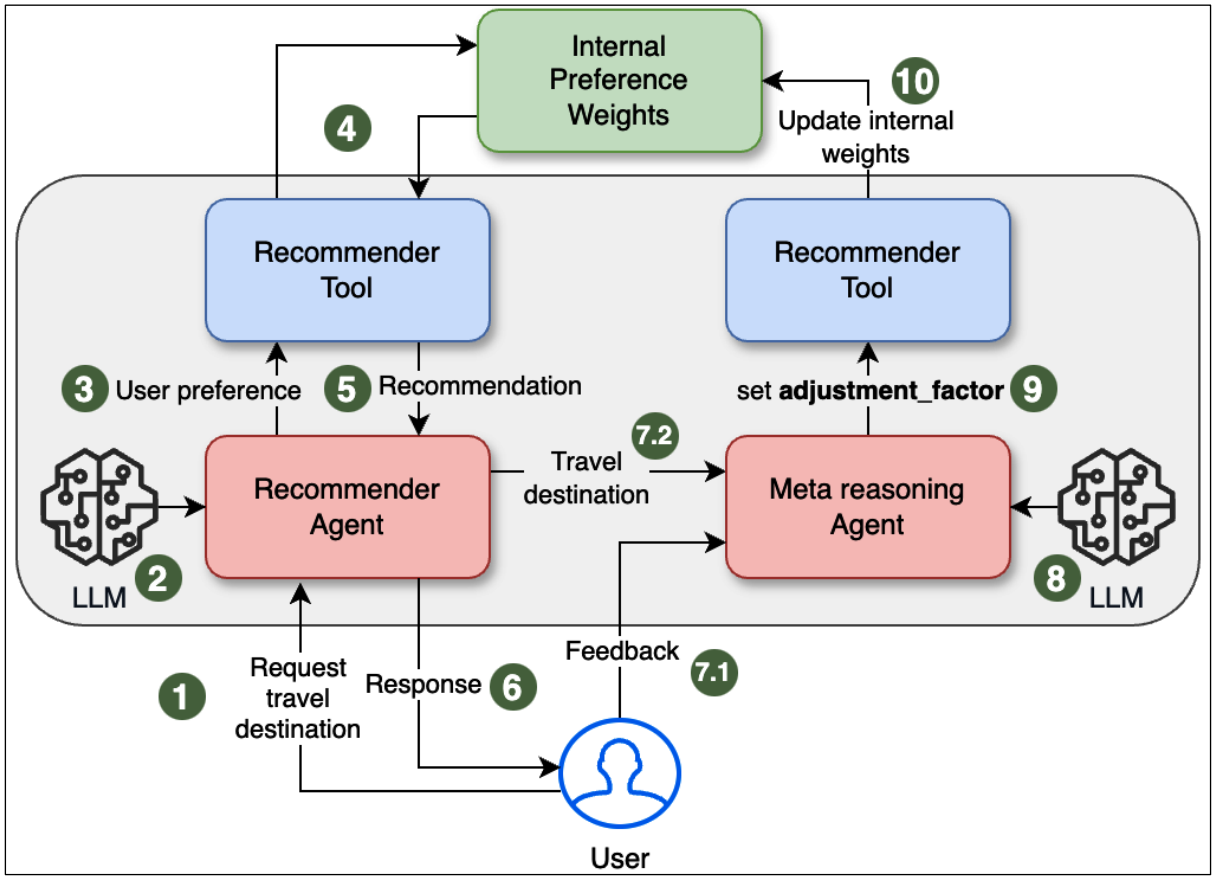

__start__
analyze_job_description
generate_application
__end__

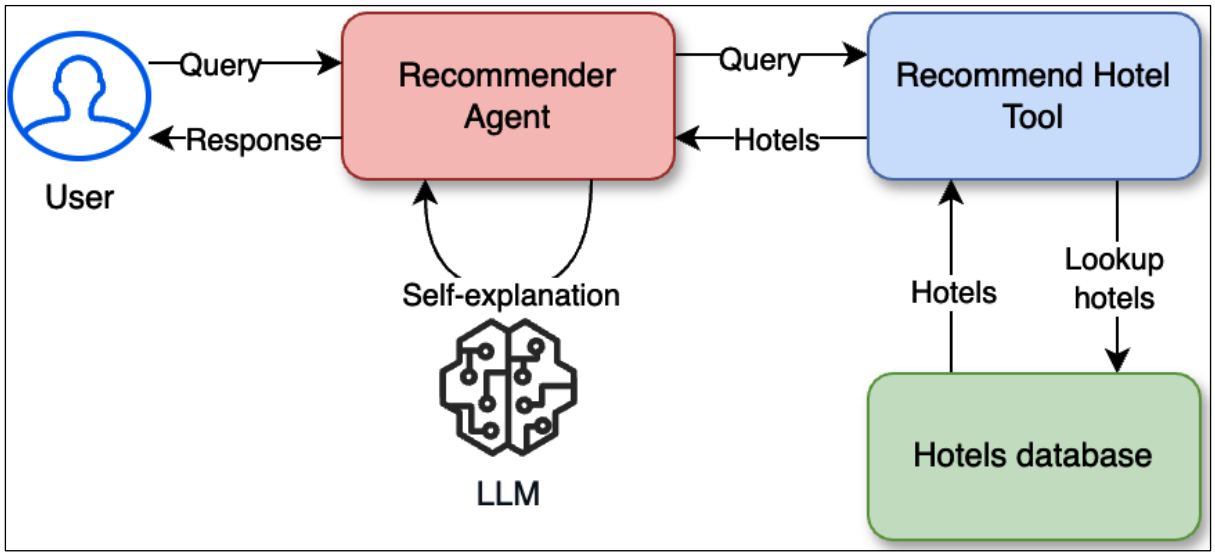

Prompt
LLM
Completion
Parser
Error
RetryWithErrorOutputParser
.parse_with_prompt

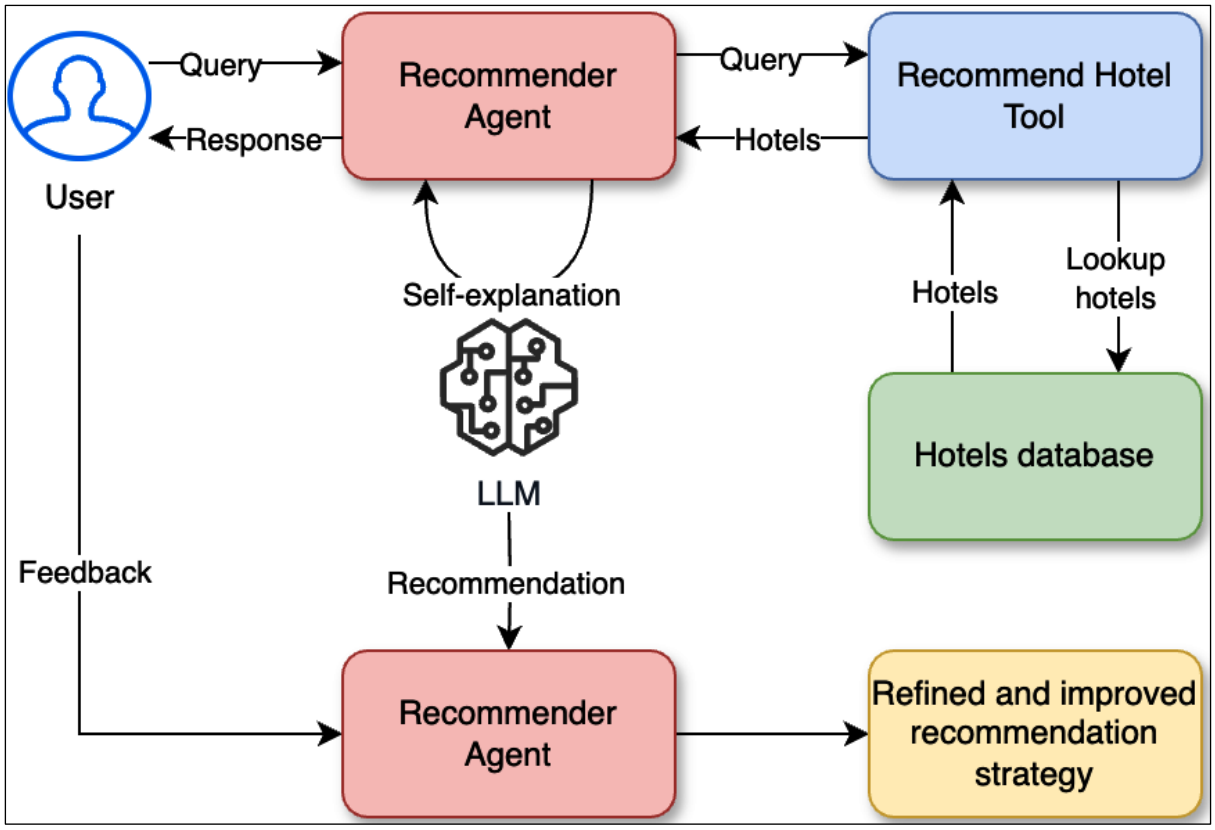

indexing
Examples
LLM for embeddings
2
Vector database
User's input
1
3 (similar examples)
3
Prompt template
Final prompt
LLM

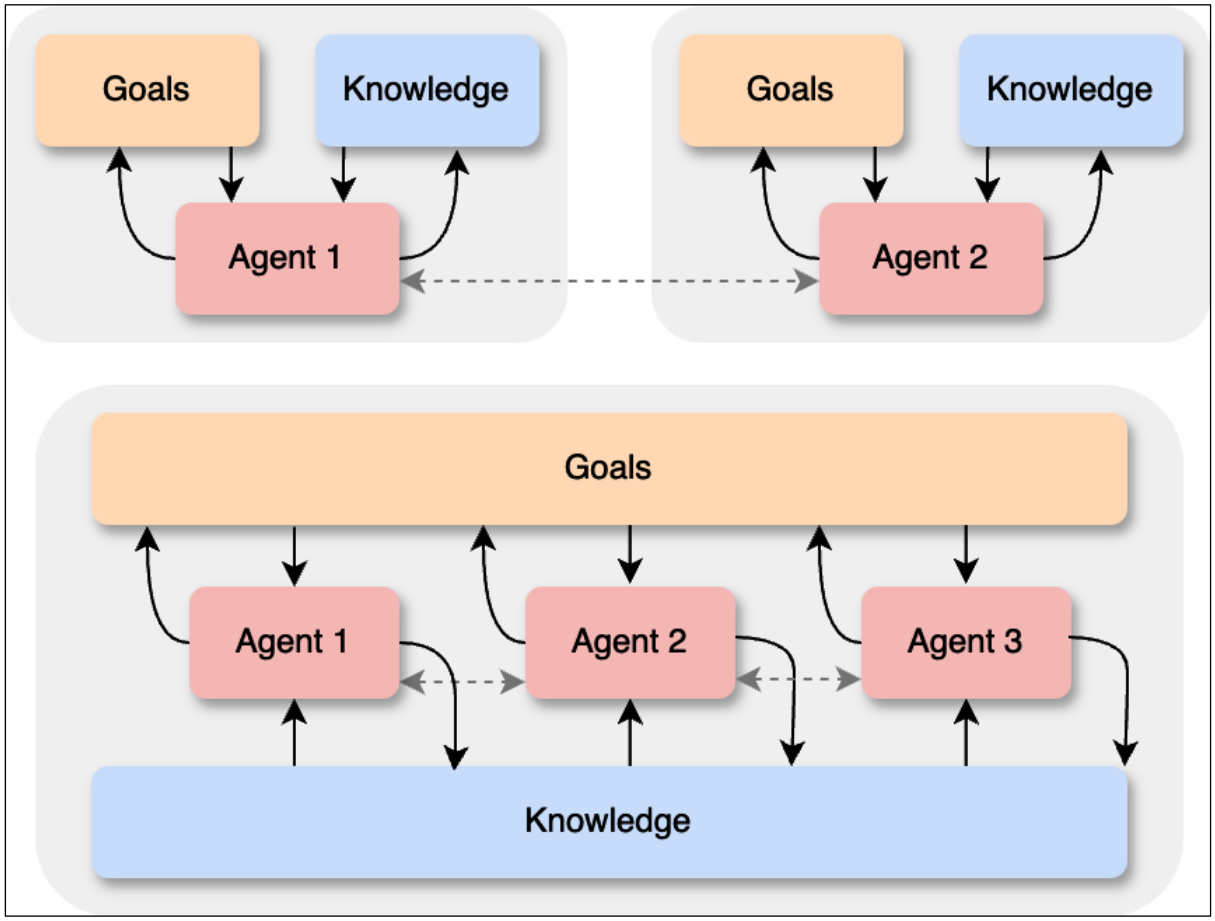

small chunks
small chunks
summarize
intermediate summary
small chunks
summarize
intermediate summary
small chunks
summarize
intermediate summary
small chunks
summarize
intermediate summary
merge and summarize
intermediate summary
merge and summarize
intermediate summary
merge and summarize
fimal summary

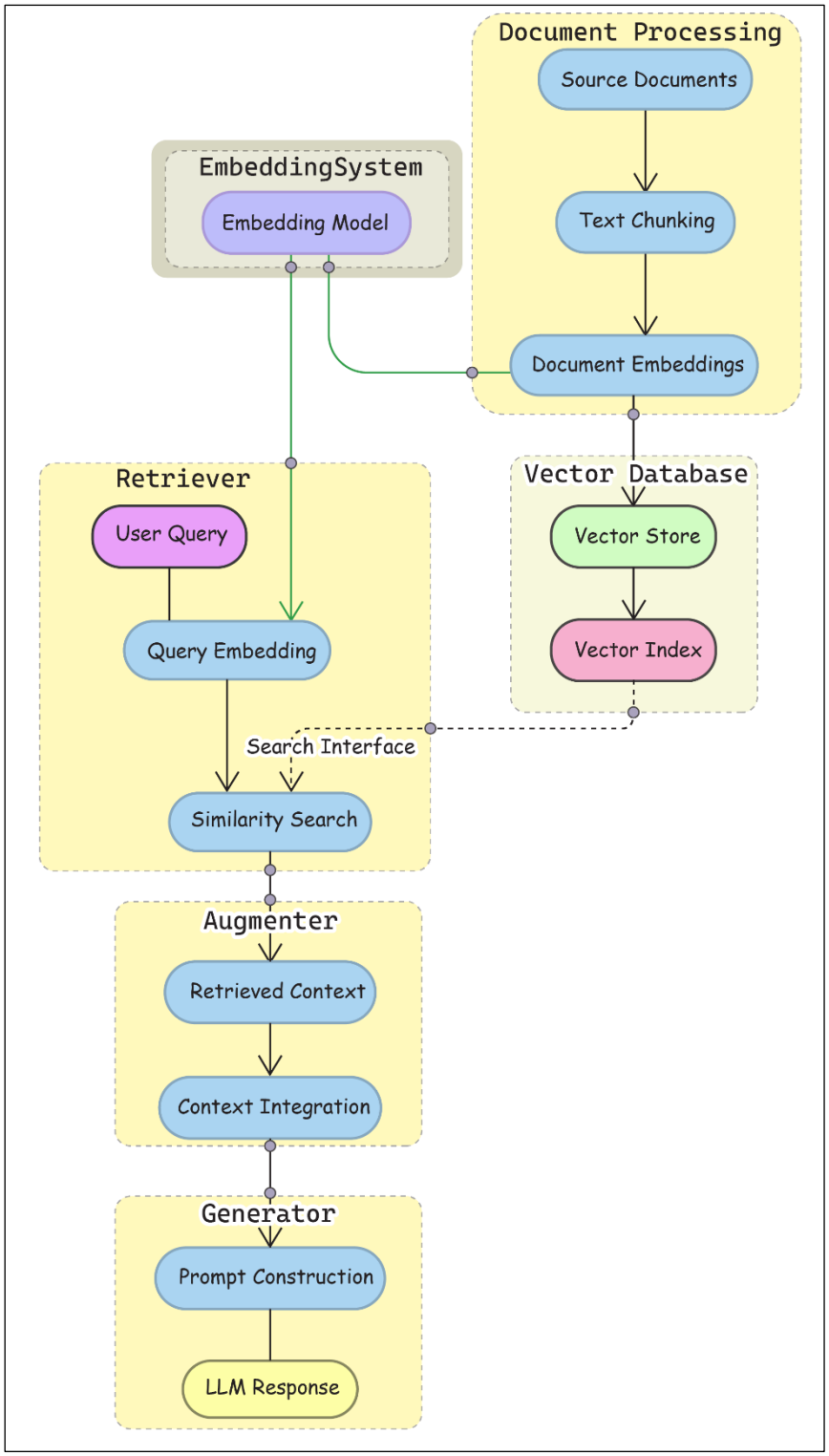
Chapter 4: Reflection and Introspection in Agents

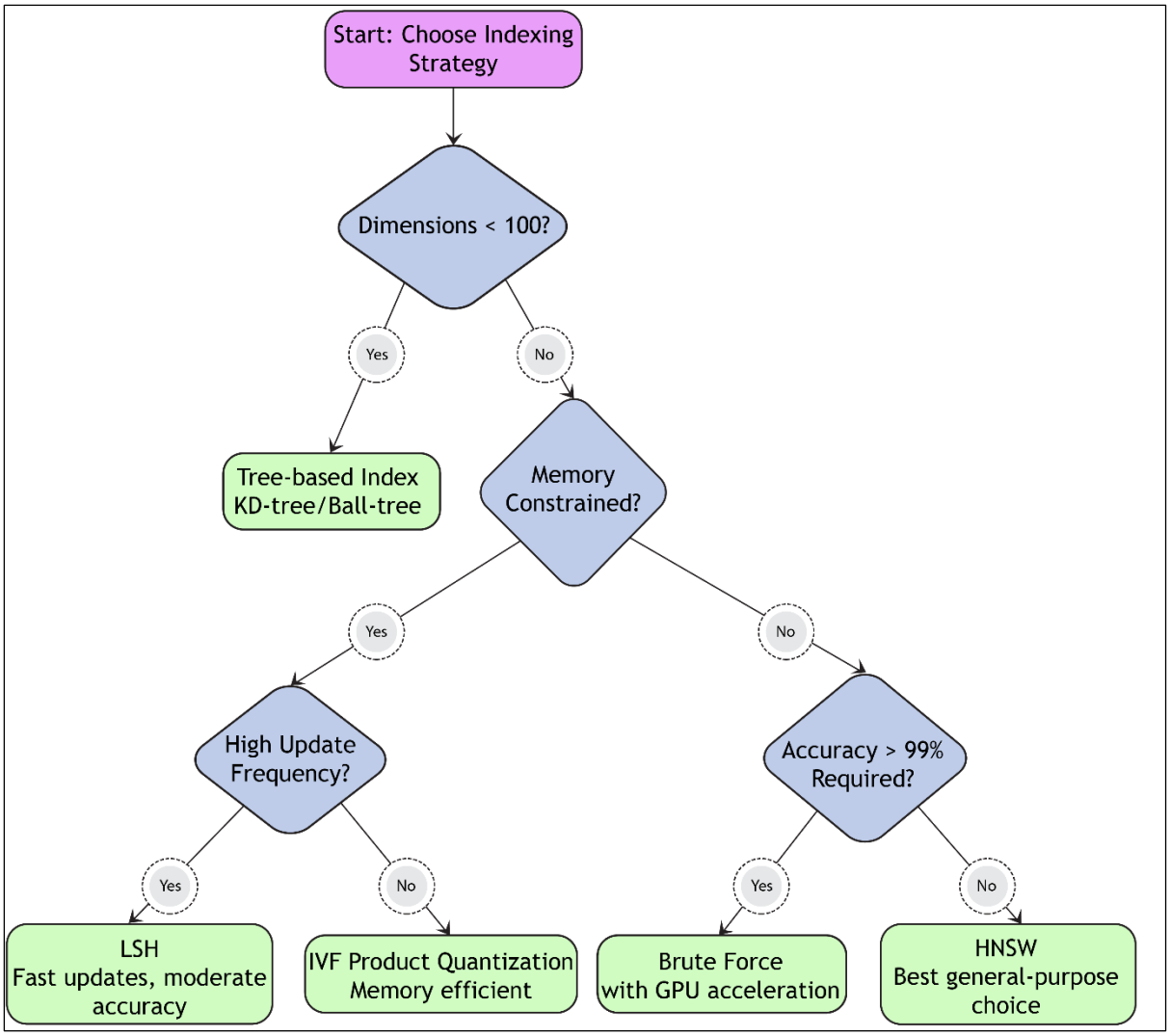


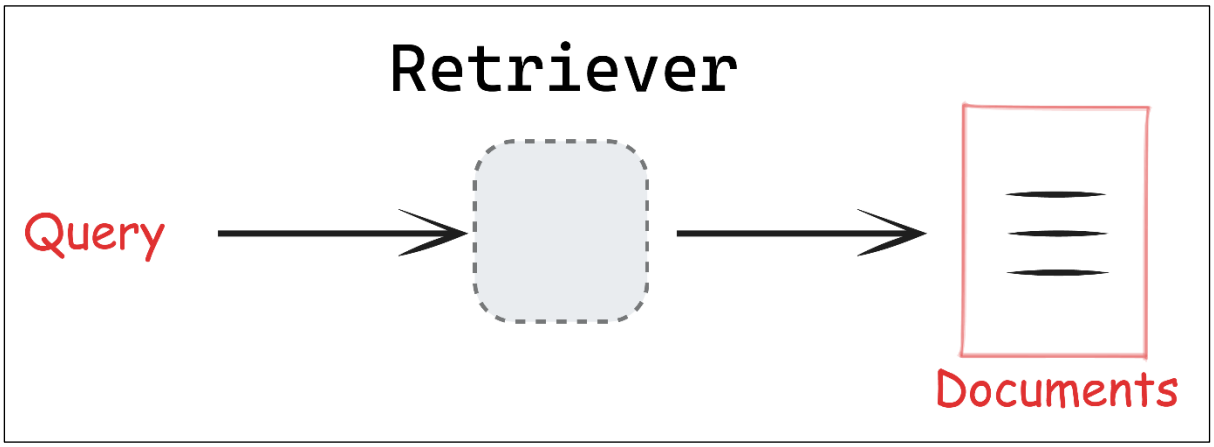


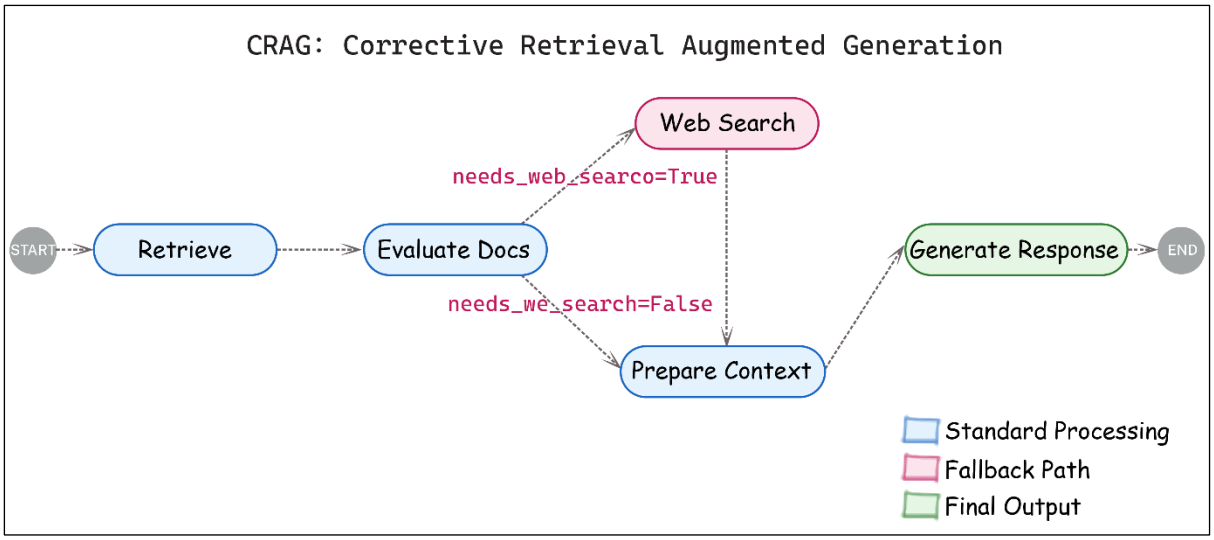

Query
Response
Recommender Agent
Query
Hotels
Recommend Hotel Tool
User
Self-explanation
Hotels
Lookup hotels
Hotels database
LLM
Feedback
Recommendation
Recommender Agent
Refined and improved recommendation strategy

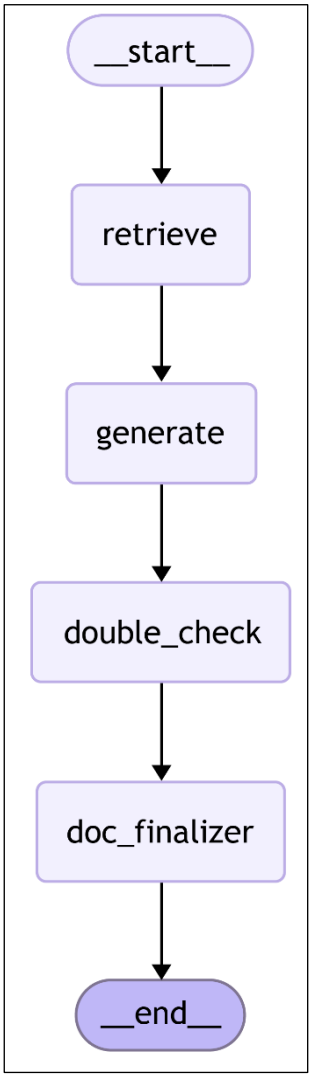

Goals
Knowledge
Agent 1
Goals
Knowledge
Agent 2
Goals
Agent 1
Agent 2
Agent 3
Knowledge


Document Processing
Source Documents
Text Chunking
Document Embeddings
EmbeddingSystem
Embedding Model
Retriever
User Query
Query Embedding
Search Interface
Similarity Search
Vector Database
Vector Store
Vector Index
Augmenter
Retrieved Context
Context Integration
Generator
Prompt Construction
LLM Response

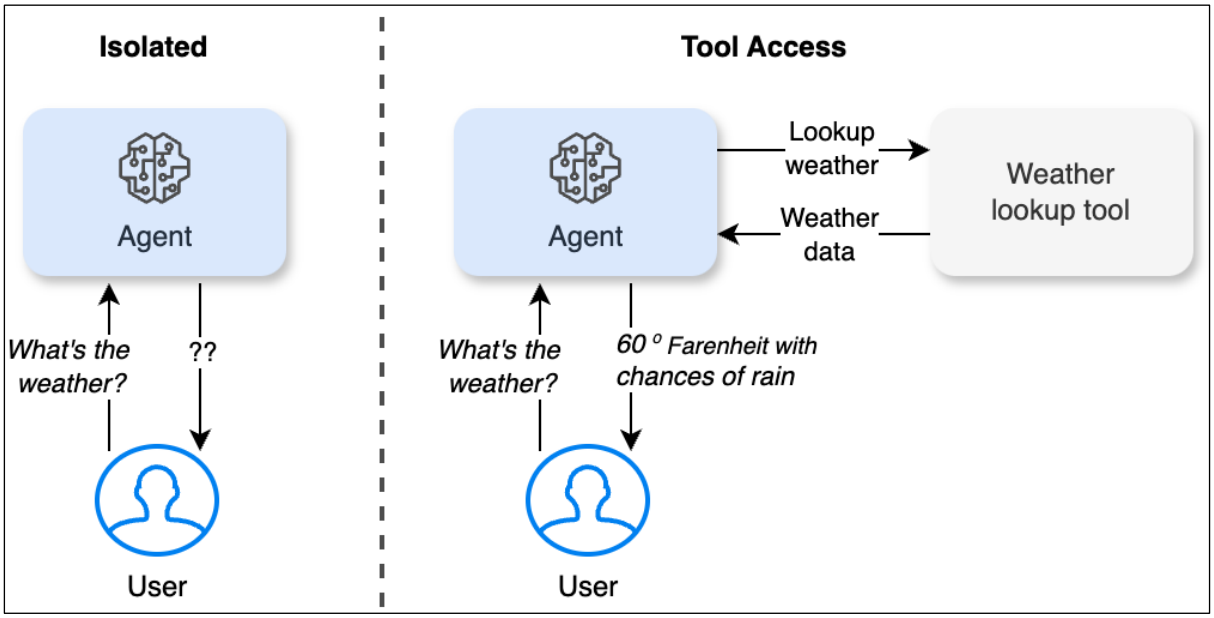

Start: Choose Indexing Strategy
Dimensions < 100?
Yes
No
Tree-based Index KD-tree/Ball-tree
Memory Constrained?
Yes
No
High Update Frequency?
Accuracy > 99% Required?
Yes
No
Yes
No
LSH Fast updates, moderate accuracy
IVF Product Quantization Memory efficient
Brute Force with GPU acceleration
HNSW Best general-purpose choice

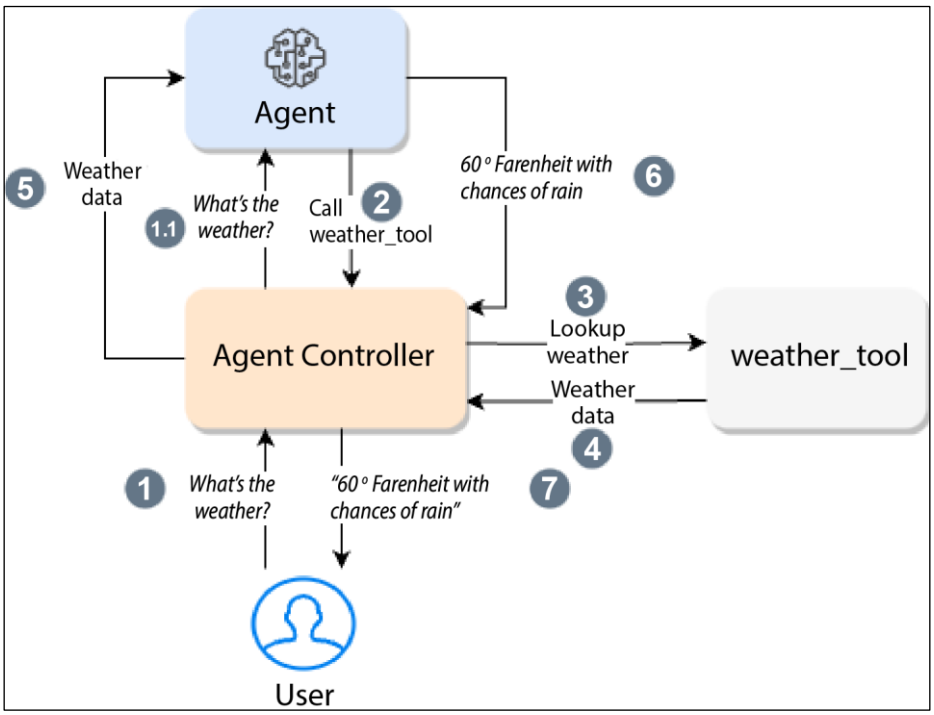

Retriever
Query
Documents

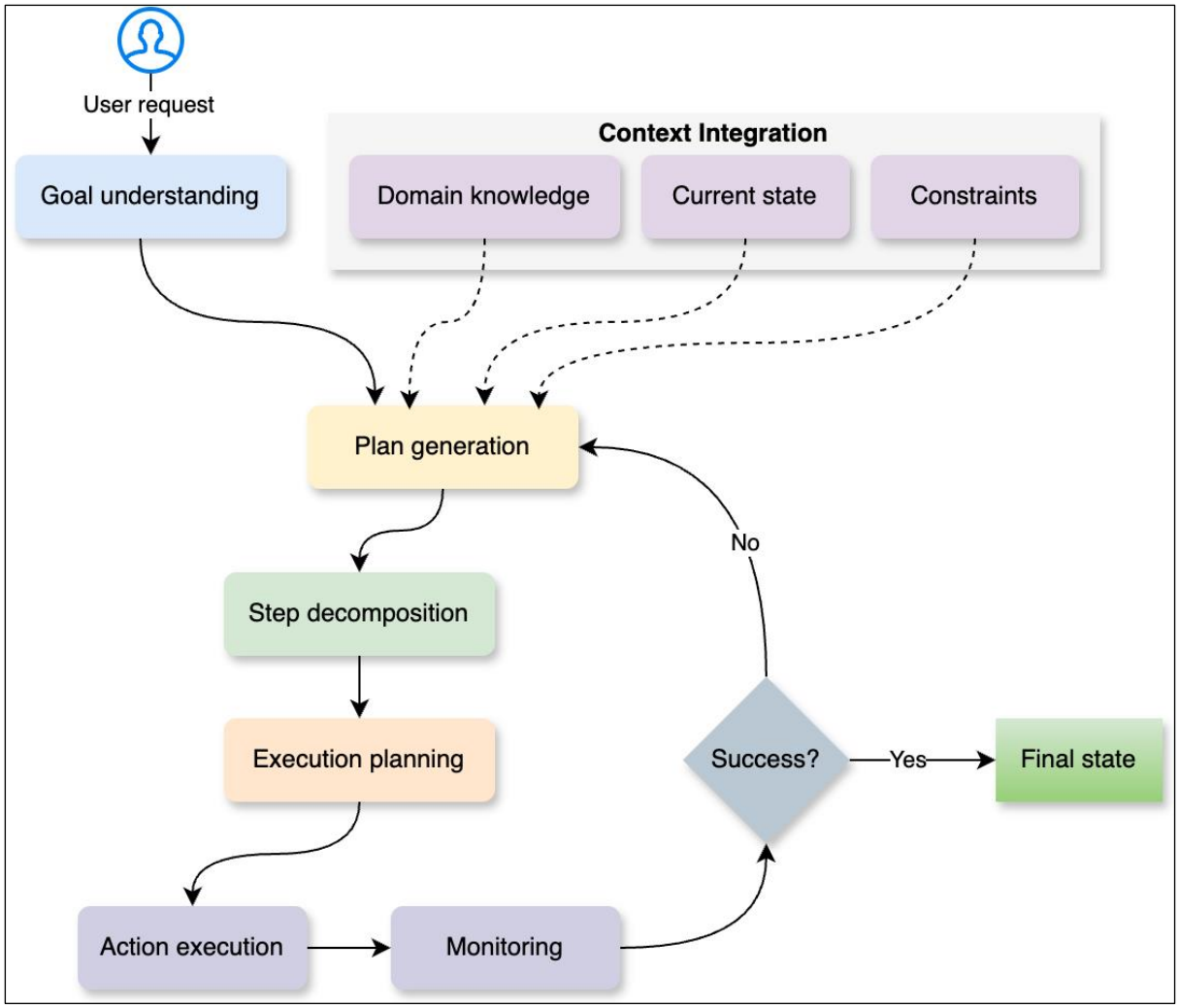

CRAG: Corrective Retrieval Augmented Generation
Web Search
needs_web_searco=True
START
Retrieve
Evaluate Docs
Generate Response
END
needs_we_search=False
Prepare Context
Standard Processing
Fallback Path
Final Output

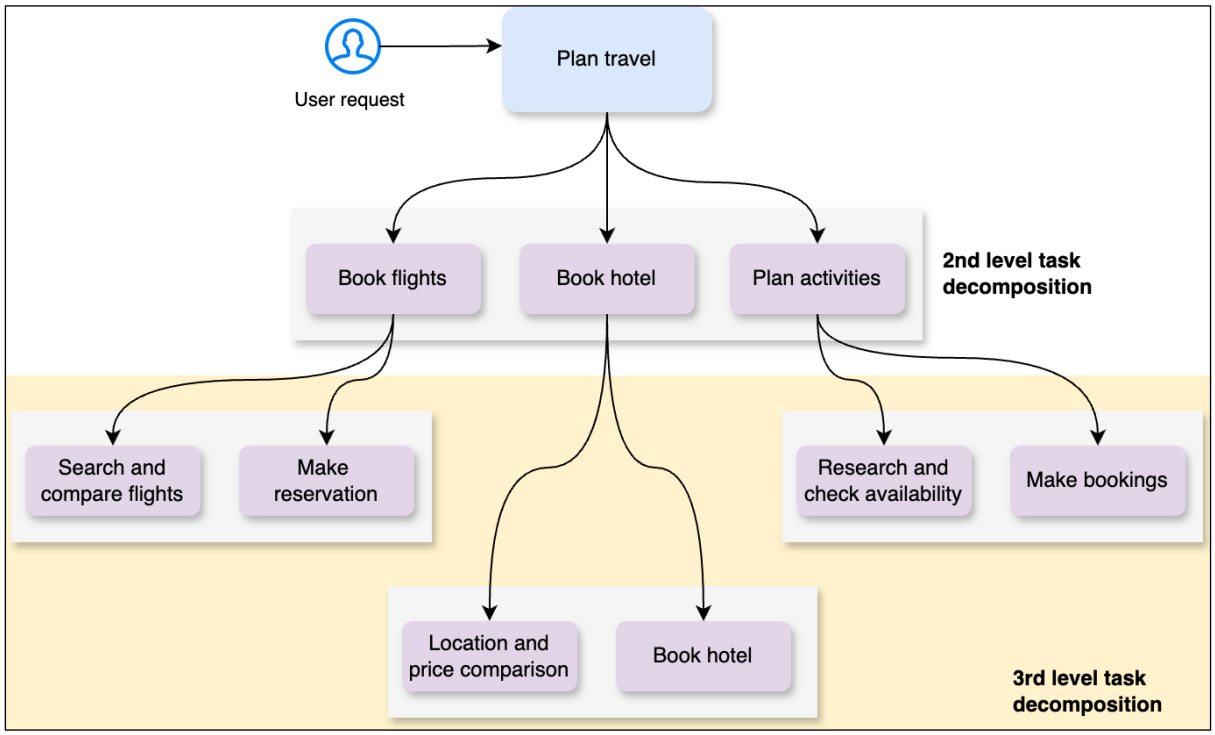

__start__
retrieve
generate
double_check
doc_finalizer
__end__

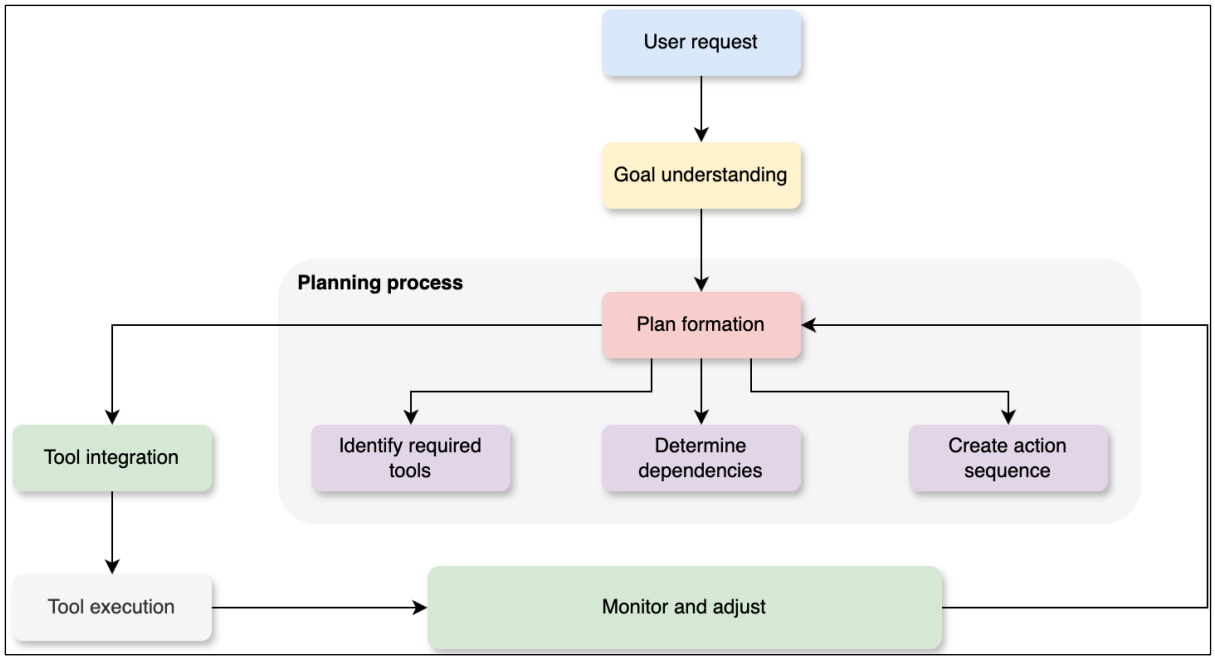
Chapter 5: Enabling Tool Use and Planning in Agents

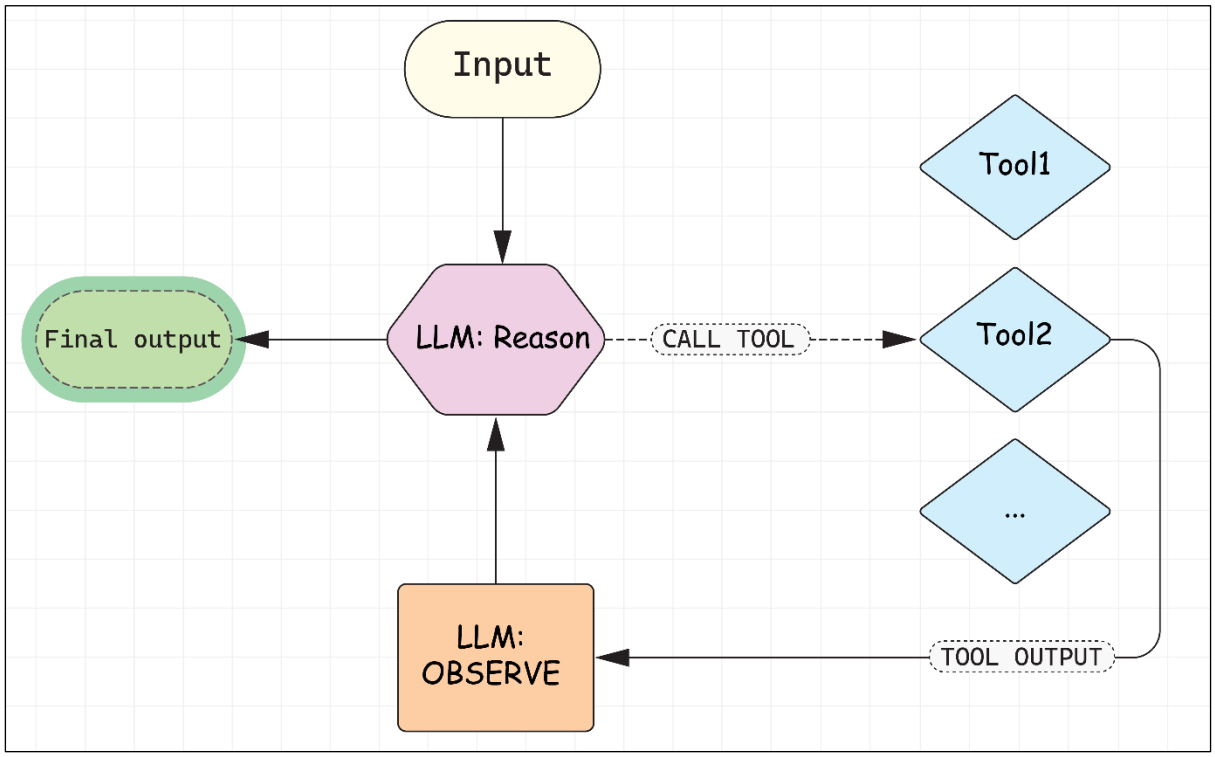


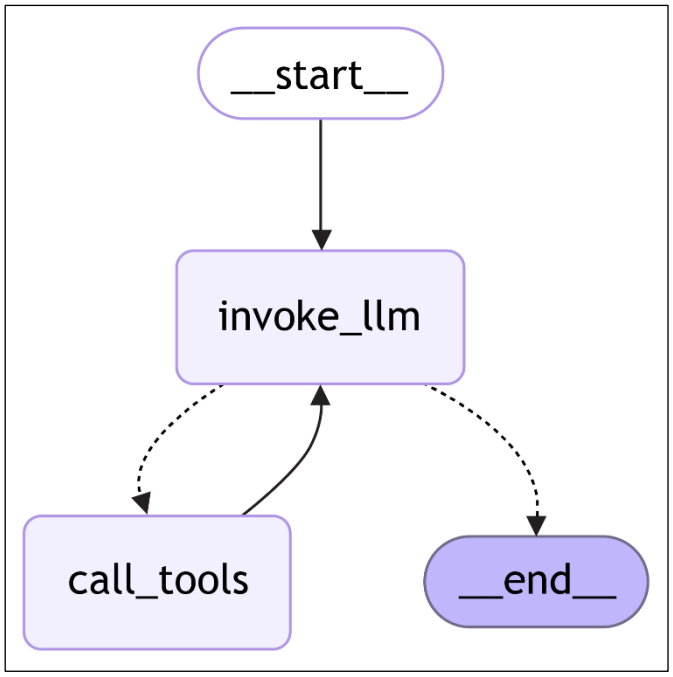


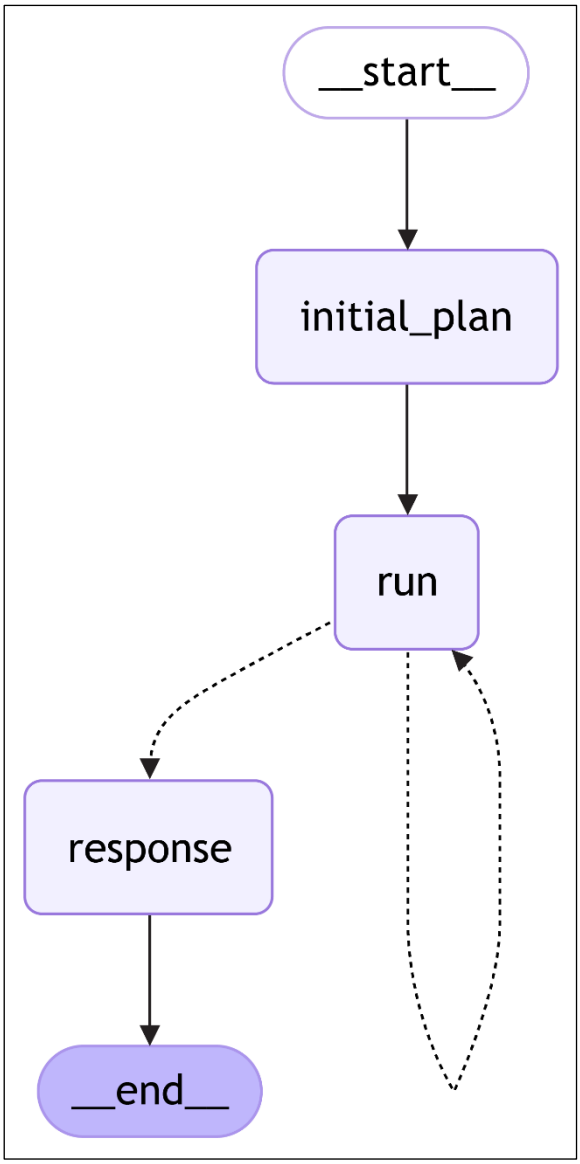

User request
Goal understanding
Context Integration
Domain knowledge
Current state
Constraints
Plan generation
No
Step decomposition
Execution planning
Success?
Yes
Final state
Action execution
Monitoring


User request
Plan travel
Book flights
Book hotel
Plan activities
2nd level task decomposition
Search and compare flights
Make reservation
Research and check availability
Make bookings
Location and price comparison
Book hotel
3rd level task decomposition

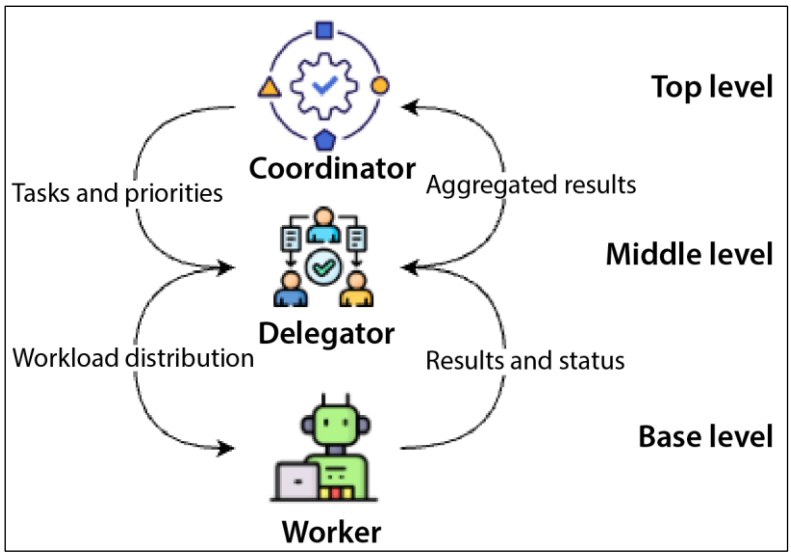

User request
Goal understanding
Planning process
Plan formation
Tool integration
Identify required tools
Determine dependencies
Create action sequence
Tool execution
Monitor and adjust

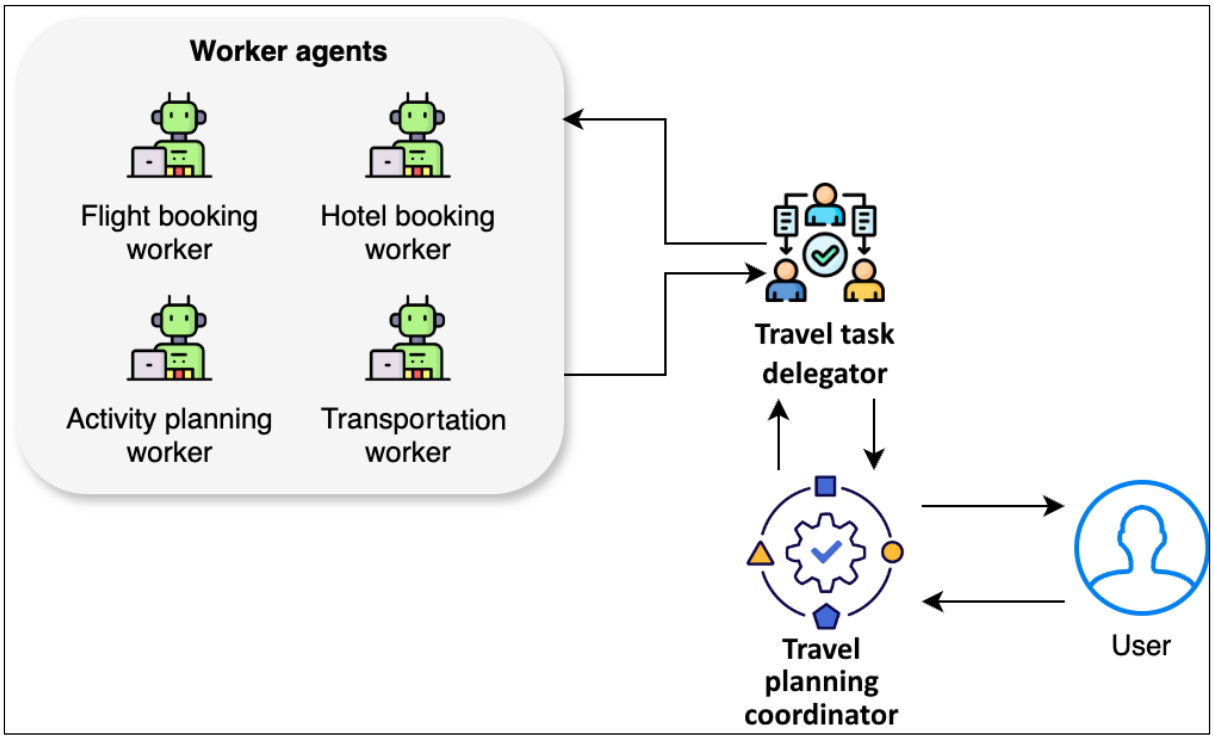

Input
Tool1
Final output
LLM: Reason
CALL TOOL
Tool2
...
LLM: OBSERVE
TOOL OUTPUT

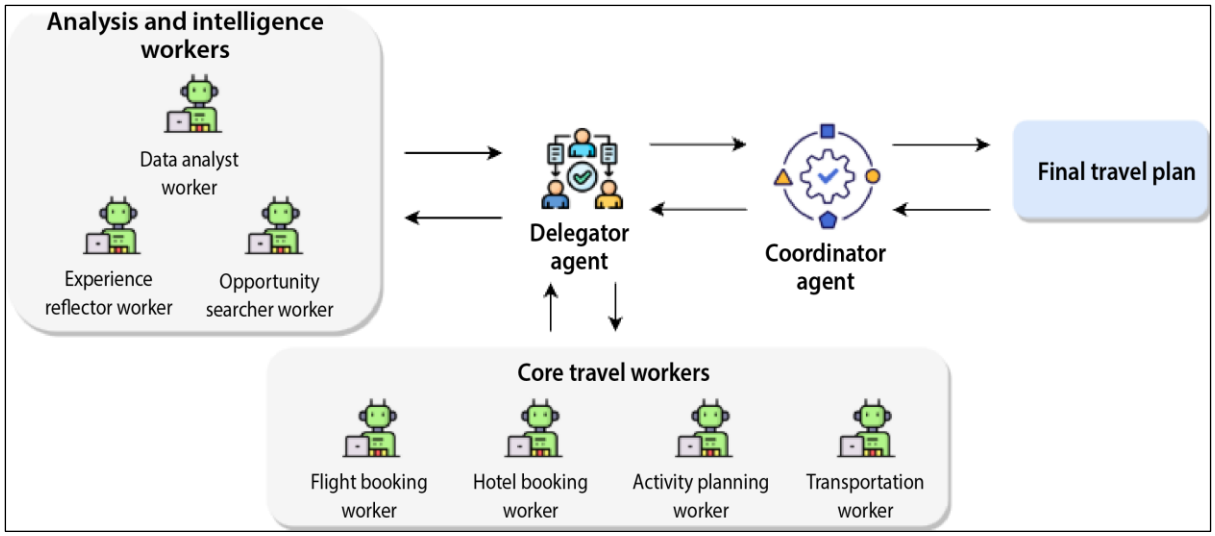

__start__
invoke_llm
call_tools
__end__

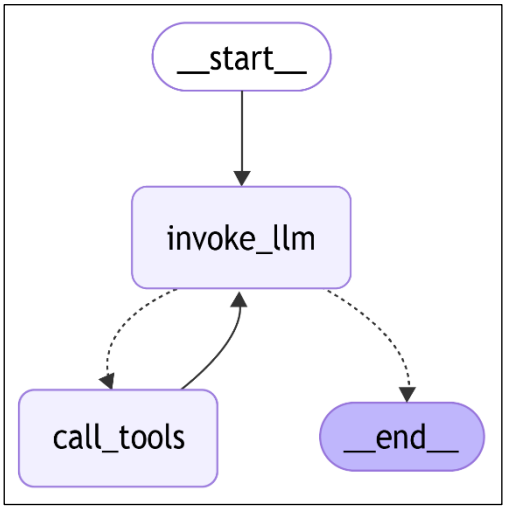

__start__
initial_plan
run
response
__end__

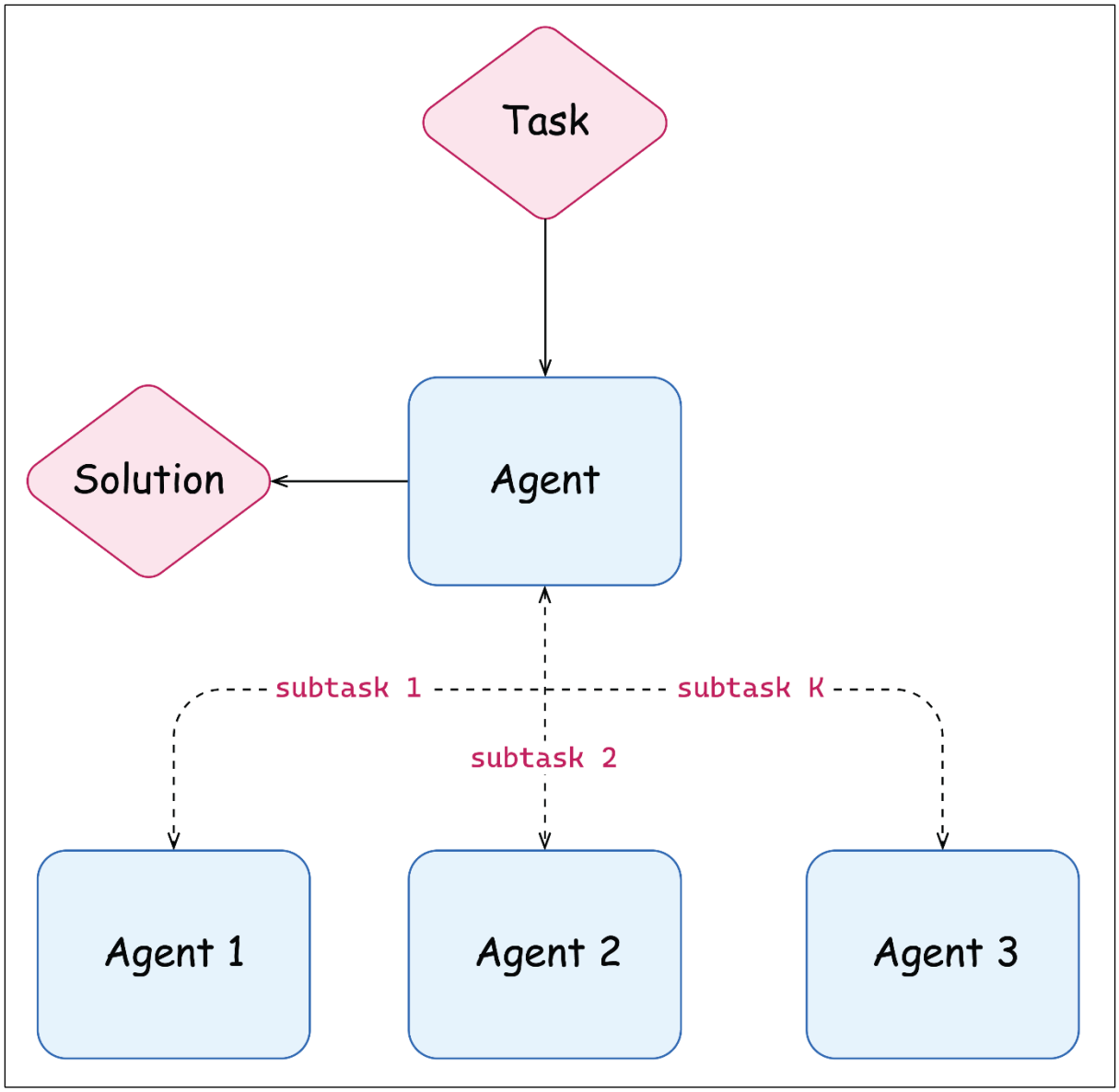
Chapter 6: Exploring the Coordinator, Worker, and Delegator Approach

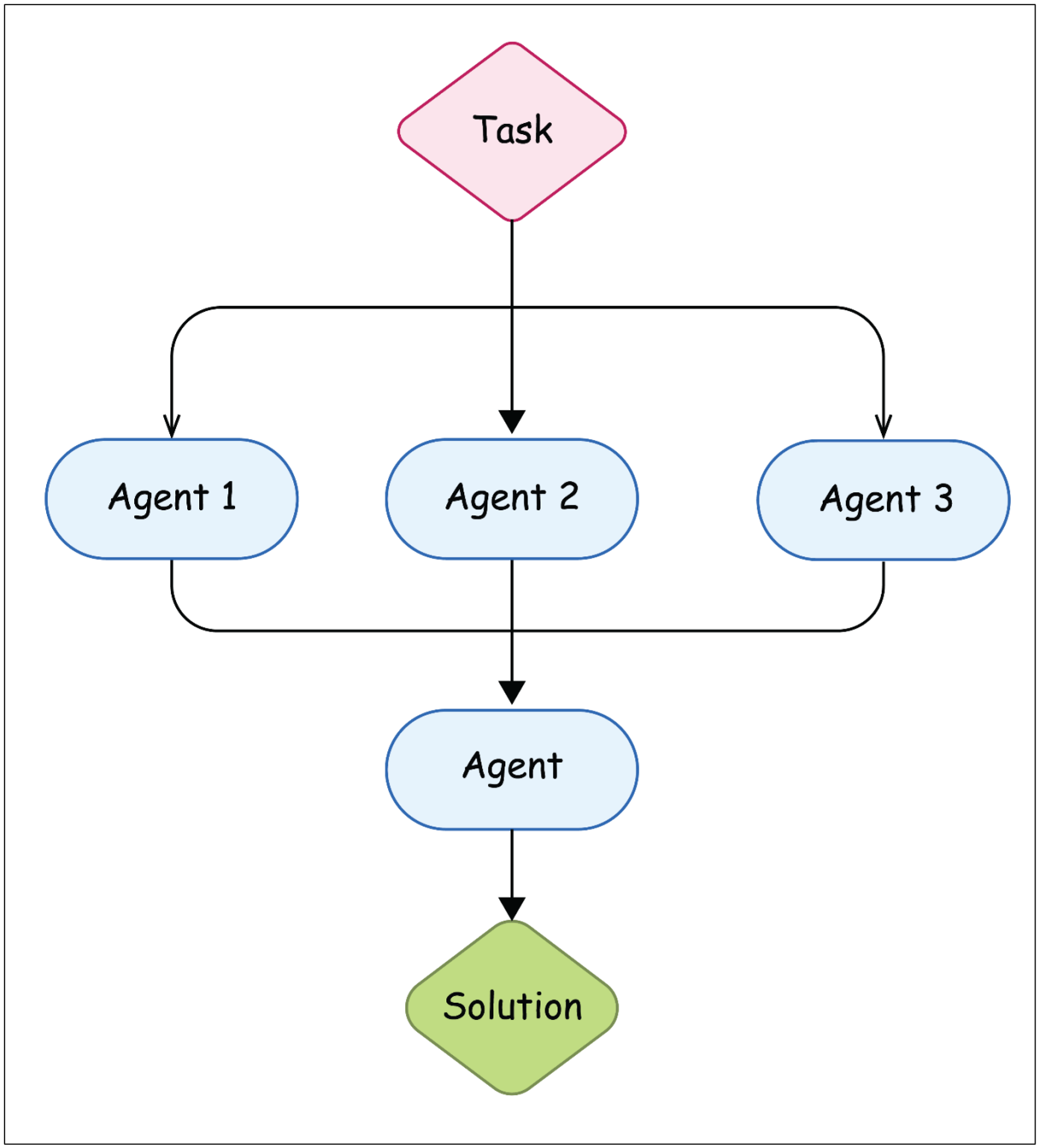


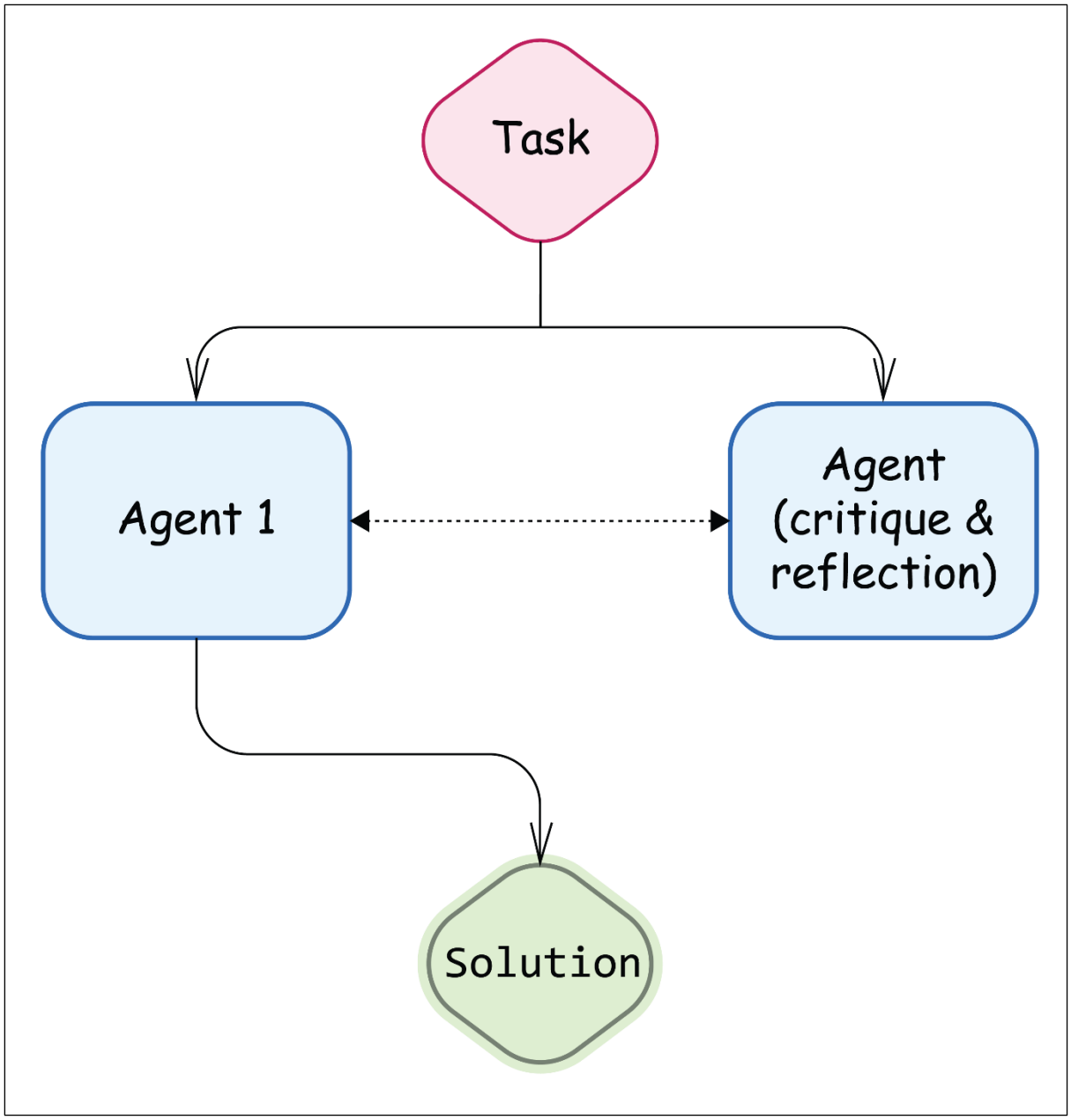


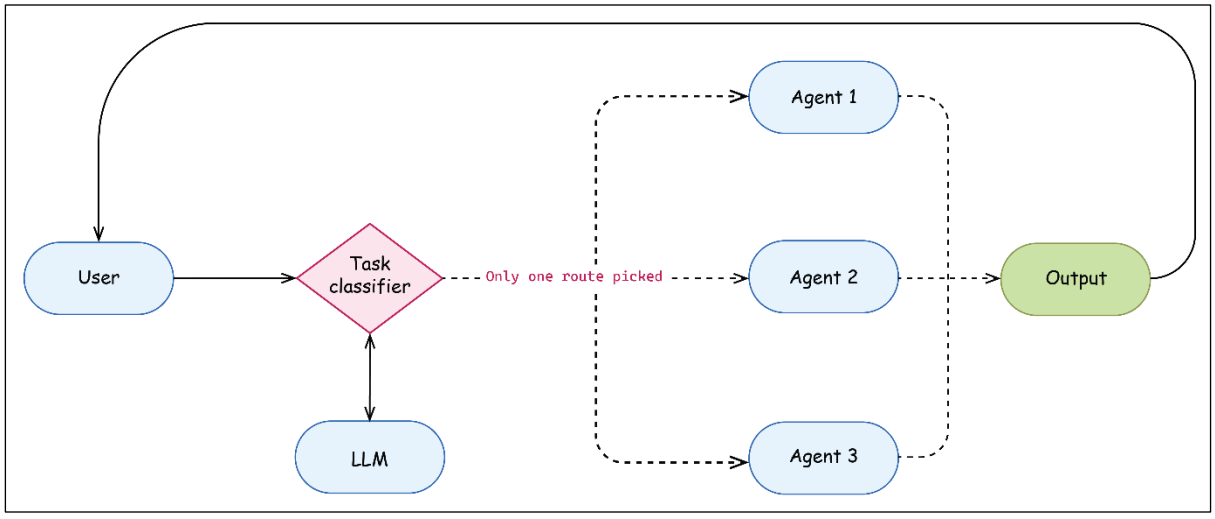

Analysis and intelligence workers
Data analyst worker
Experience reflector worker
Opportunity searcher worker
Delegator agent
Coordinator agent
Final travel plan
Core travel workers
Flight booking worker
Hotel booking worker
Activity planning worker
Transportation worker

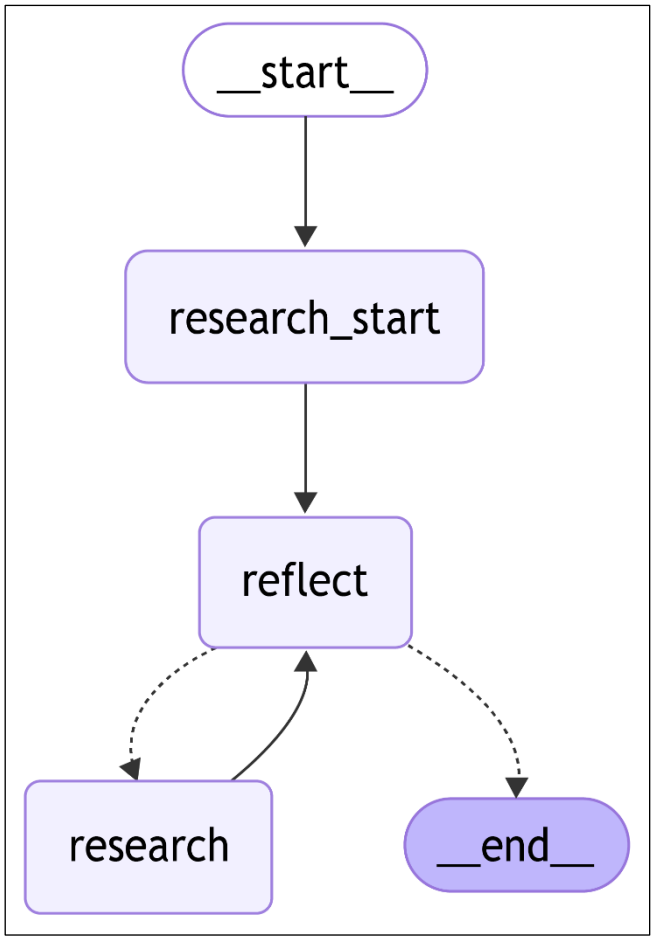

__start__
invoke_llm
call_tools
__end__

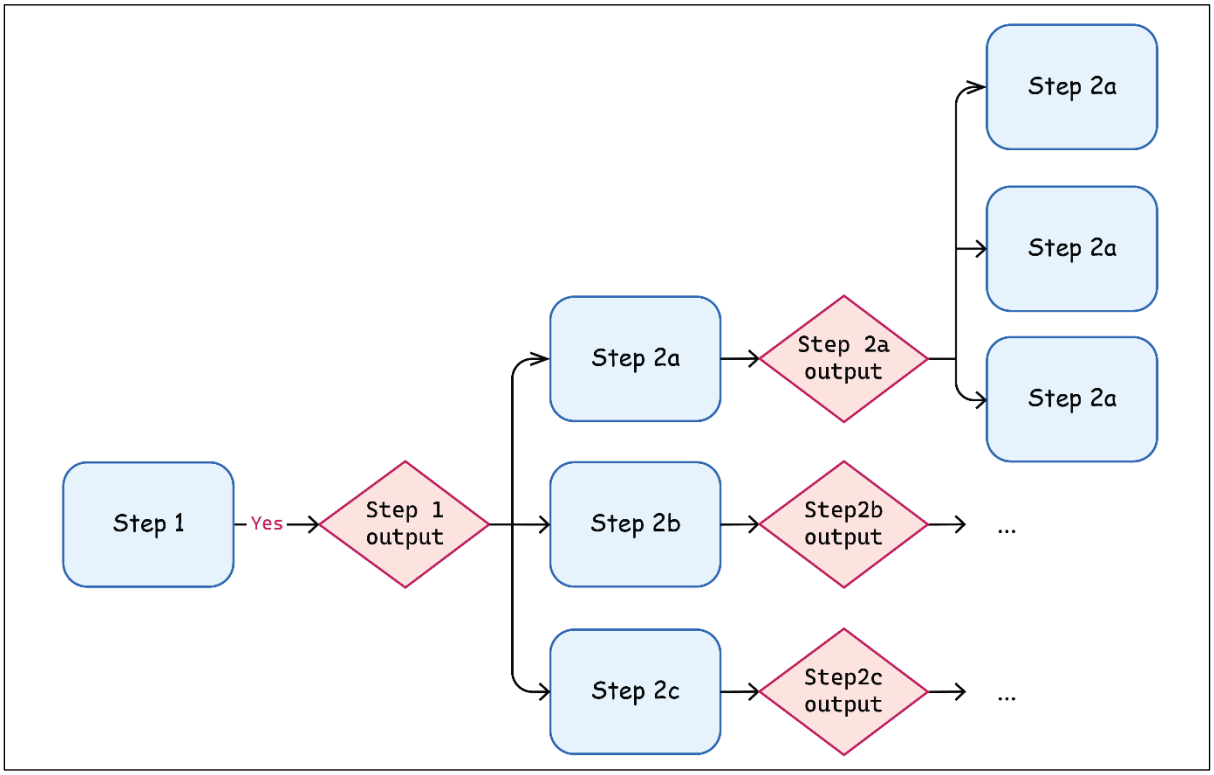

Task
Solution
Agent
subtask 1
subtask 2
subtask K
Agent 1
Agent 2
Agent 3

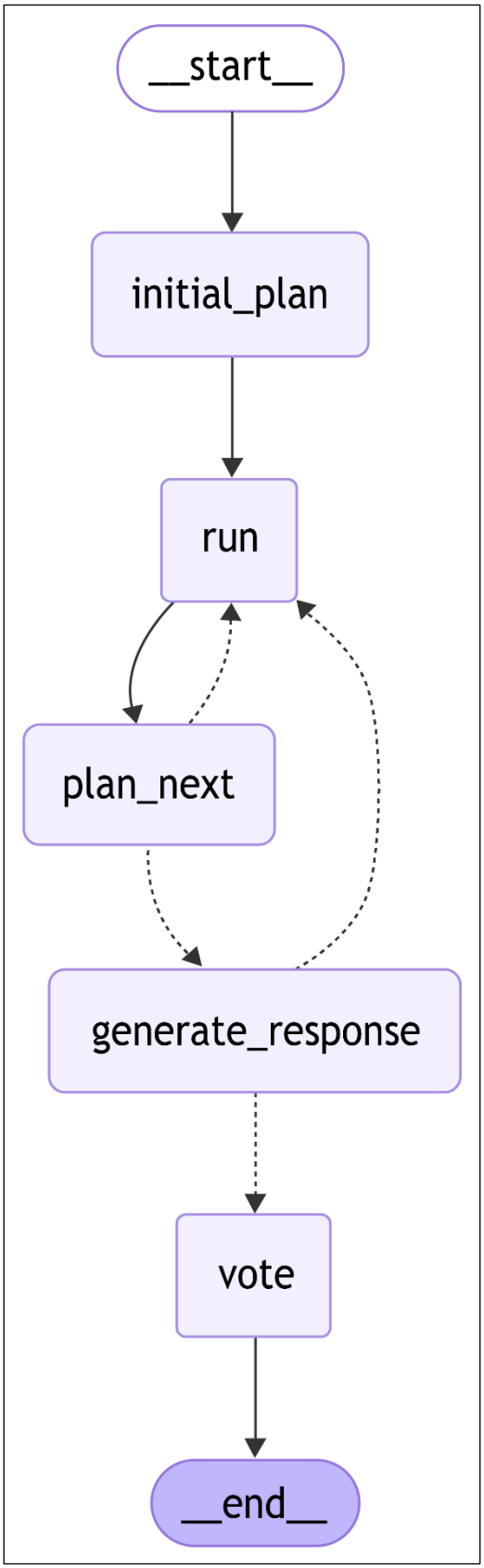

Task
Agent 1
Agent 2
Agent 3
Agent
Solution

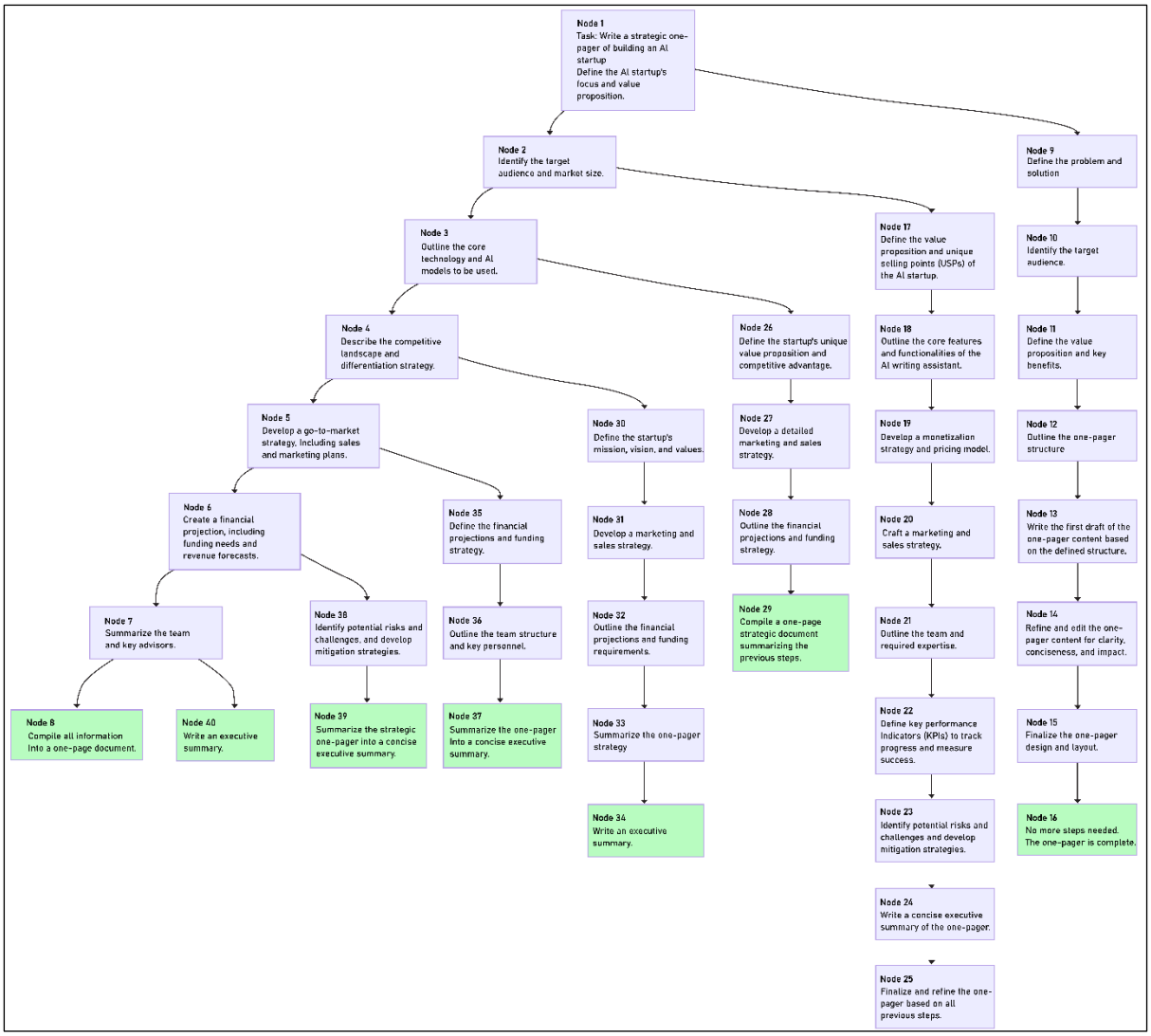

Task
Agent 1
Agent (critique & reflection)
Solution

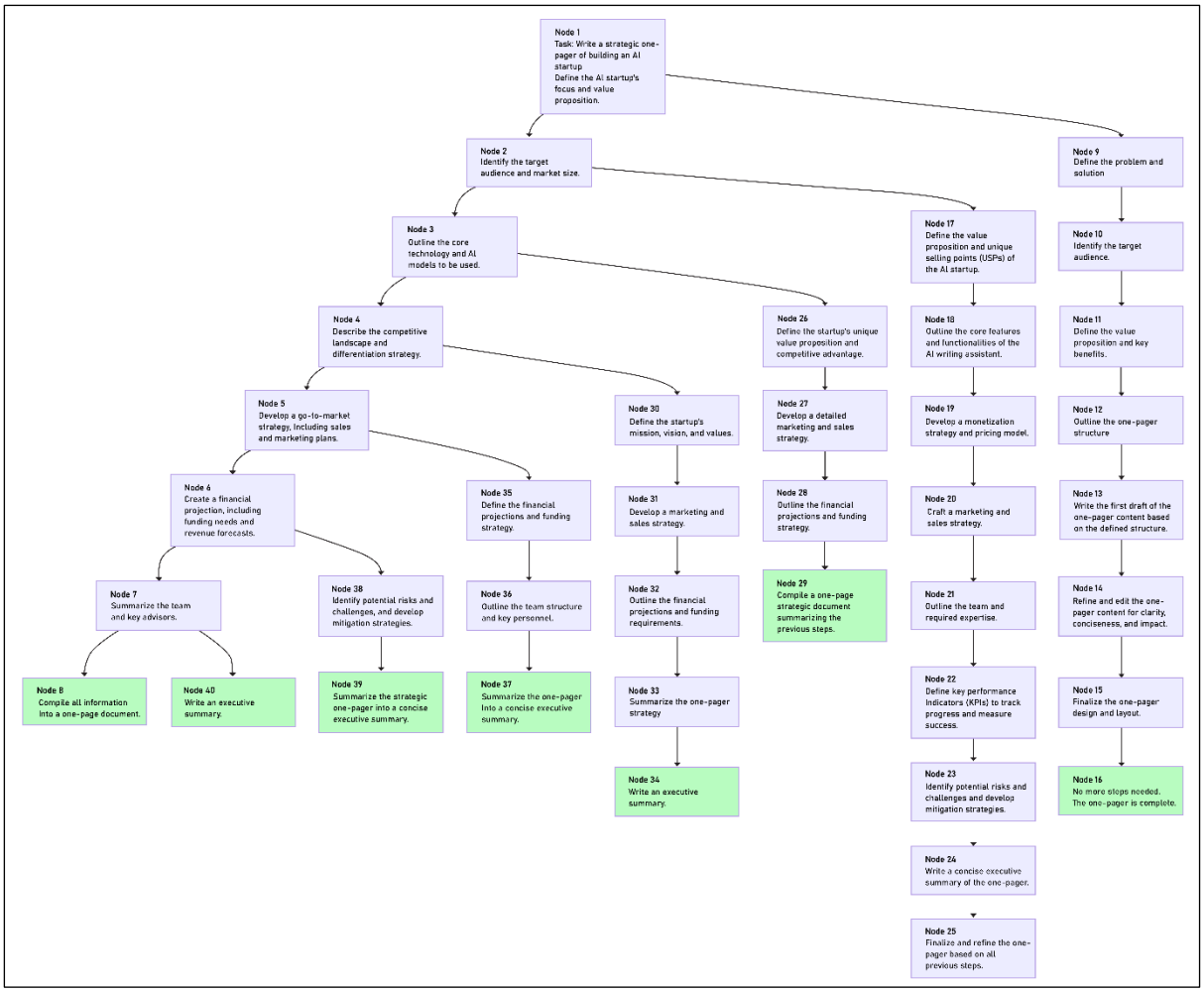

User
Task classifier
Only one route picked
Agent 1
Agent 2
Agent 3
Output
LLM


__start__
research_start
reflect
research
__end__

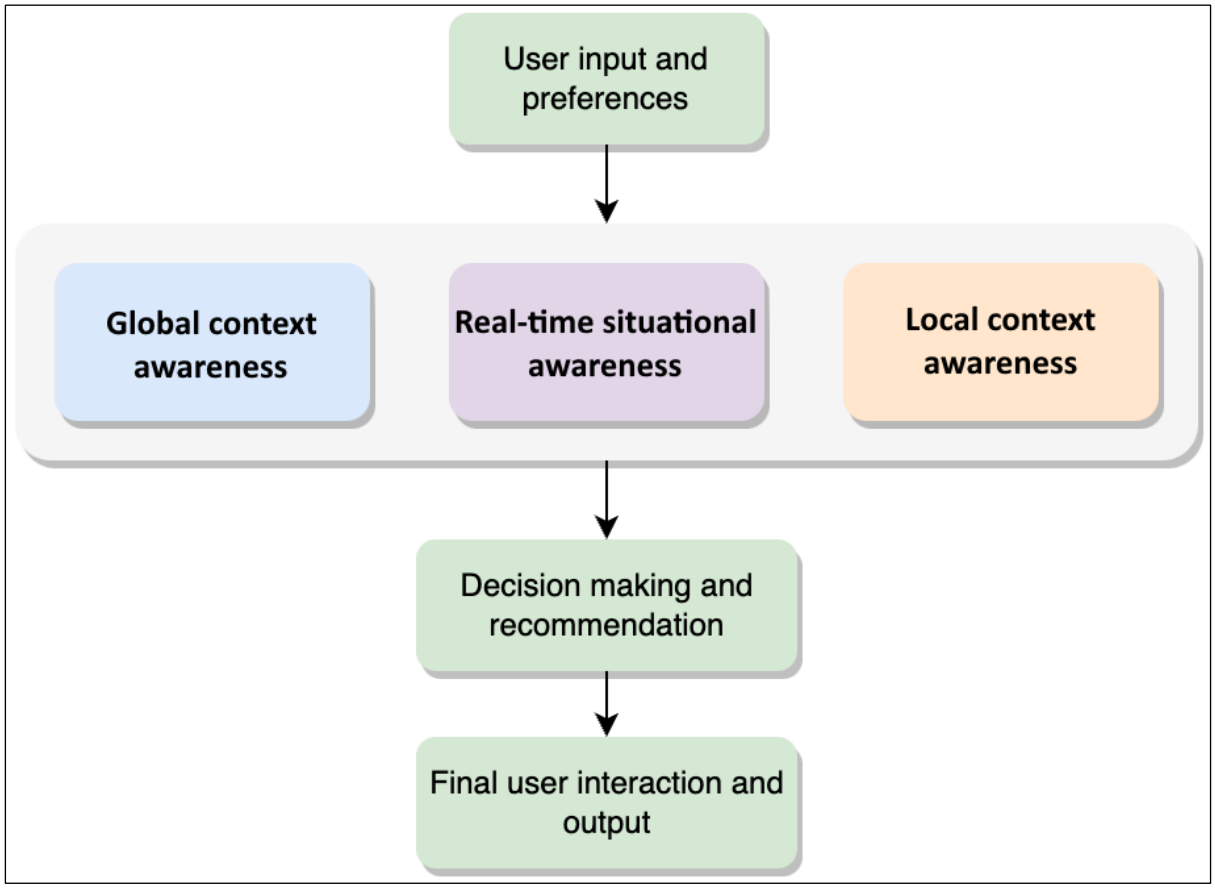

Step 1
Yes
Step 1 output
Step 2a
Step 2a output
Step 2a
Step 2a
Step 2b
Step2b output
...
Step 2c
Step2c output
...

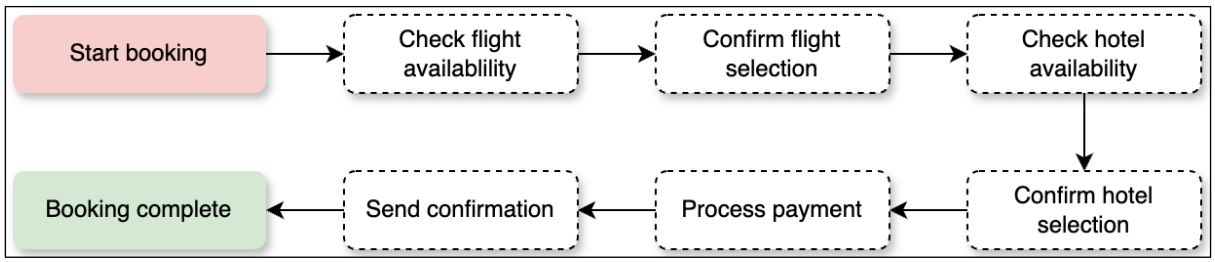

__start__
initial_plan
run
plan_next
generate_response
vote
__end__

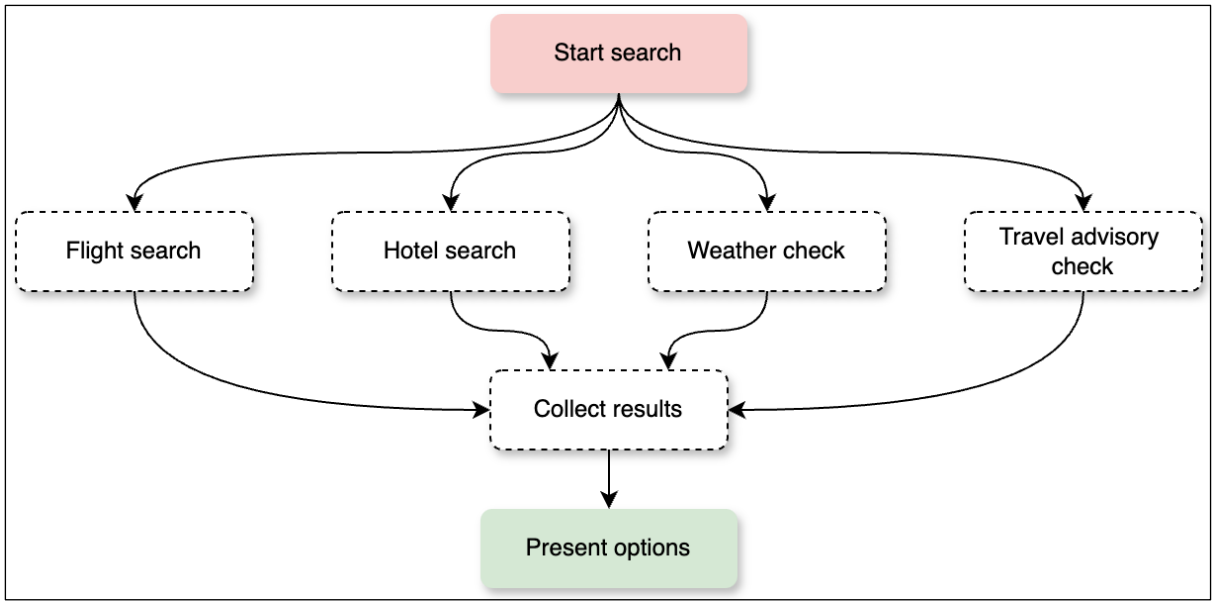

Node 1
Task: Write a strategic one-pager of building an AI startup
Define the AI startup's focus and value proposition.
Node 2
Identify the target audience and market size.
Node 3
Outline the core technology and AI models to be used.
Node 4
Describe the competitive landscape and differentiation strategy.
Node 5
Develop a go-to-market strategy, including sales and marketing plans.
Node 6
Create a financial projection, including funding needs and revenue forecasts.
Node 7
Summarize the team and key advisors.
Node 8
Compile all information into a one-page document.
Node 40
Write an executive summary.
Node 38
Identify potential risks and challenges, and develop mitigation strategies.
Node 39
Summarize the strategic one-pager into a concise executive summary.
Node 35
Define the financial projections and funding strategy.
Node 36
Outline the team structure and key personnel.
Node 37
Summarize the one-pager into a concise executive summary.
Node 30
Define the startup's mission, vision, and values.
Node 31
Develop a marketing and sales strategy.
Node 32
Outline the financial projections and funding requirements.
Node 33
Summarize the one-pager strategy
Node 34
Write an executive summary.
Node 26
Define the startup's unique value proposition and competitive advantage.
Node 27
Develop a detailed marketing and sales strategy.
Node 28
Outline the financial projections and funding strategy.
Node 29
Compile a one-page strategic document summarizing the previous steps.
Node 17
Define the value proposition and unique selling points (USPs) of the AI startup.
Node 18
Outline the core features and functionalities of the AI writing assistant.
Node 19
Develop a monetization strategy and pricing model.
Node 20
Craft a marketing and sales strategy.
Node 21
Outline the team and required expertise.
Node 22
Define key performance indicators (KPIs) to track progress and measure success.
Node 23
Identify potential risks and challenges and develop mitigation strategies.
Node 24
Write a concise executive summary of the one-pager.
Node 25
Finalize and refine the one-pager based on all previous steps.
Node 9
Define the problem and solution
Node 10
Identify the target audience.
Node 11
Define the value proposition and key benefits.
Node 12
Outline the one-pager structure
Node 13
Write the first draft of the one-pager content based on the defined structure.
Node 14
Refine and edit the one-pager content for clarity, conciseness, and impact.
Node 15
Finalize the one-pager design and layout.
Node 16
No more steps needed. The one-pager is complete.

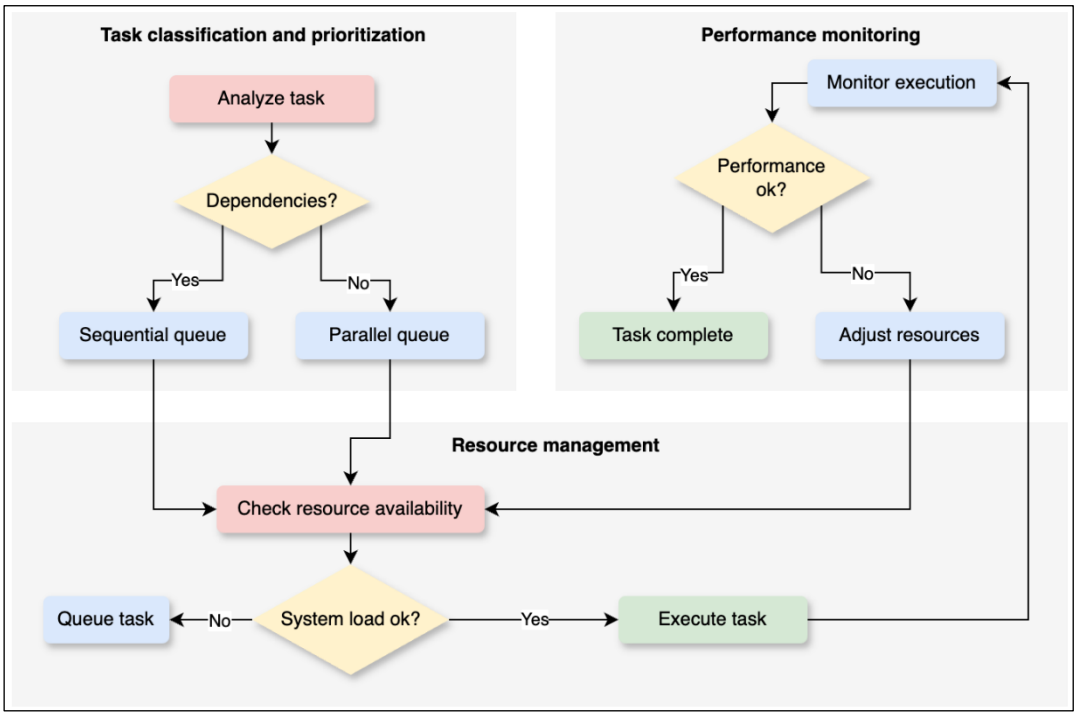

Node 1
Task: Write a strategic one-pager of building an AI startup
Define the AI startup's focus and value proposition.
Node 2
Identify the target audience and market size.
Node 3
Outline the core technology and AI models to be used.
Node 4
Describe the competitive landscape and differentiation strategy.
Node 5
Develop a go-to-market strategy, including sales and marketing plans.
Node 6
Create a financial projection, including funding needs and revenue forecasts.
Node 7
Summarize the team and key advisors.
Node 8
Compile all information into a one-page document.
Node 40
Write an executive summary.
Node 38
Identify potential risks and challenges, and develop mitigation strategies.
Node 39
Summarize the strategic one-pager into a concise executive summary.
Node 35
Define the financial projections and funding strategy.
Node 36
Outline the team structure and key personnel.
Node 37
Summarize the one-pager into a concise executive summary.
Node 30
Define the startup's mission, vision, and values.
Node 31
Develop a marketing and sales strategy.
Node 32
Outline the financial projections and funding requirements.
Node 33
Summarize the one-pager strategy
Node 34
Write an executive summary.
Node 26
Define the startup's unique value proposition and competitive advantage.
Node 27
Develop a detailed marketing and sales strategy.
Node 28
Outline the financial projections and funding strategy.
Node 29
Compile a one-page strategic document summarizing the previous steps.
Node 17
Define the value proposition and unique selling points (USPs) of the AI startup.
Node 18
Outline the core features and functionalities of the AI writing assistant.
Node 19
Develop a monetization strategy and pricing model.
Node 20
Craft a marketing and sales strategy.
Node 21
Outline the team and required expertise.
Node 22
Define key performance indicators (KPIs) to track progress and measure success.
Node 23
Identify potential risks and challenges and develop mitigation strategies.
Node 24
Write a concise executive summary of the one-pager.
Node 25
Finalize and refine the one-pager based on all previous steps.
Node 9
Define the problem and solution
Node 10
Identify the target audience.
Node 11
Define the value proposition and key benefits.
Node 12
Outline the one-pager structure
Node 13
Write the first draft of the one-pager content based on the defined structure.
Node 14
Refine and edit the one-pager content for clarity, conciseness, and impact.
Node 15
Finalize the one-pager design and layout.
Node 16
No more steps needed. The one-pager is complete.

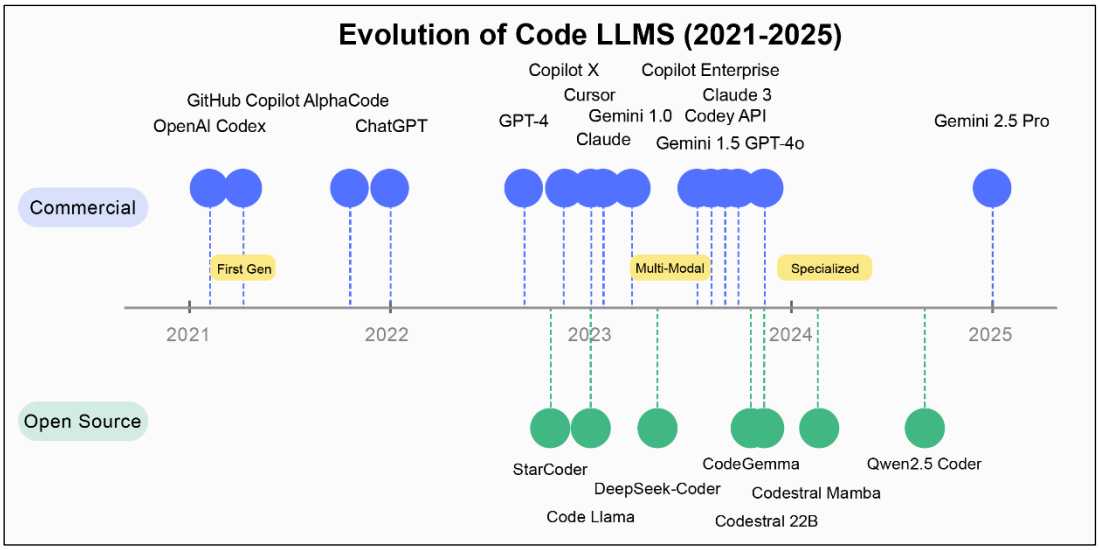
Chapter 7: Eff ective Agentic System Design Techniques

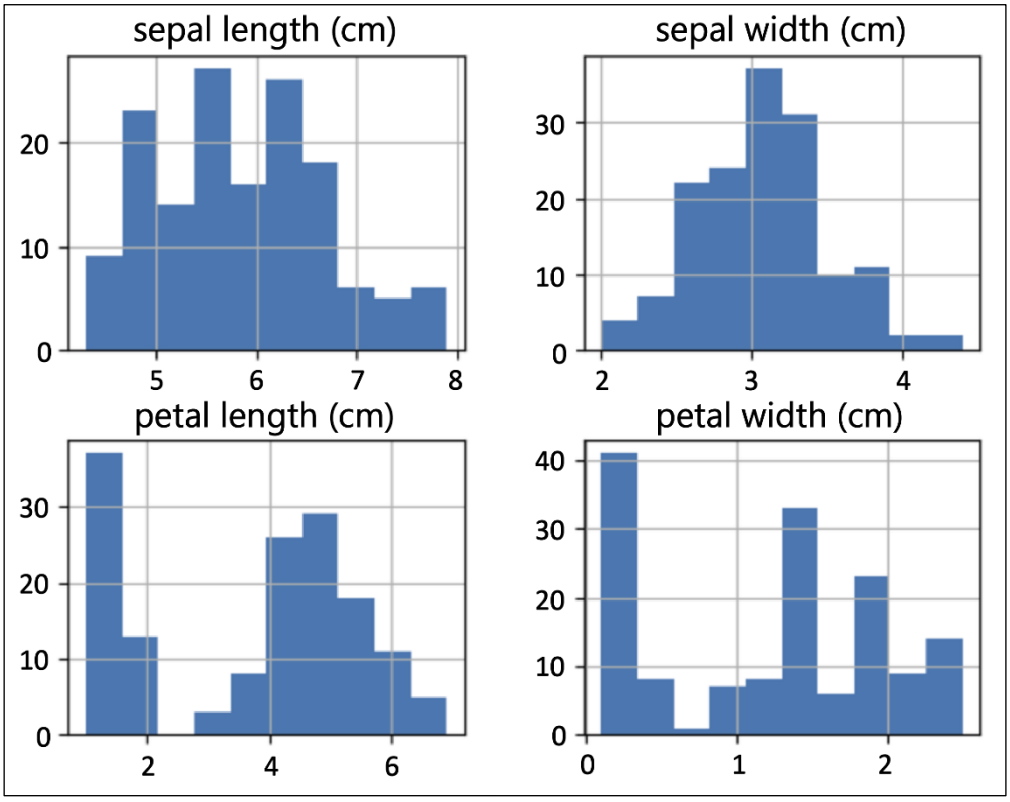


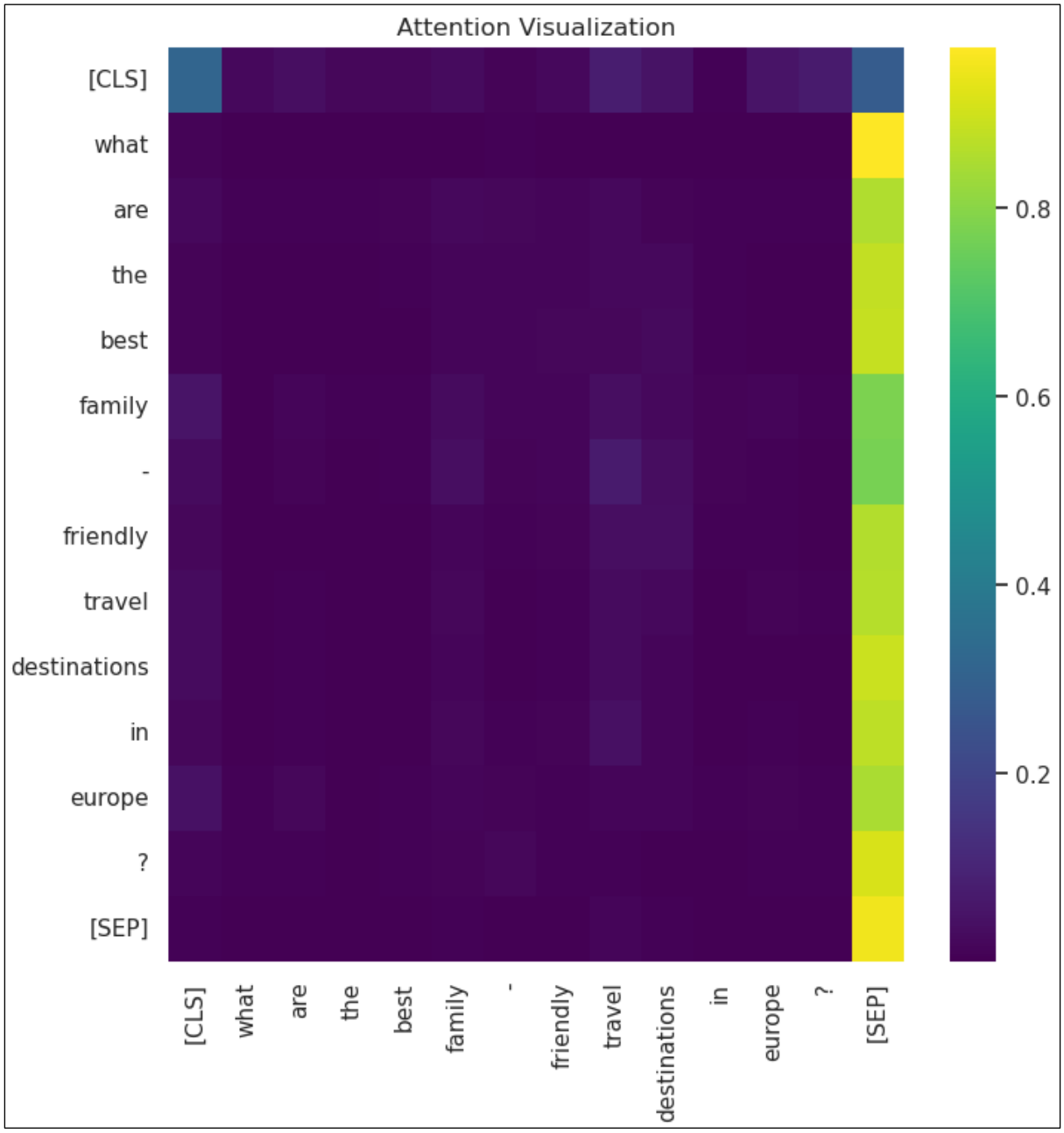


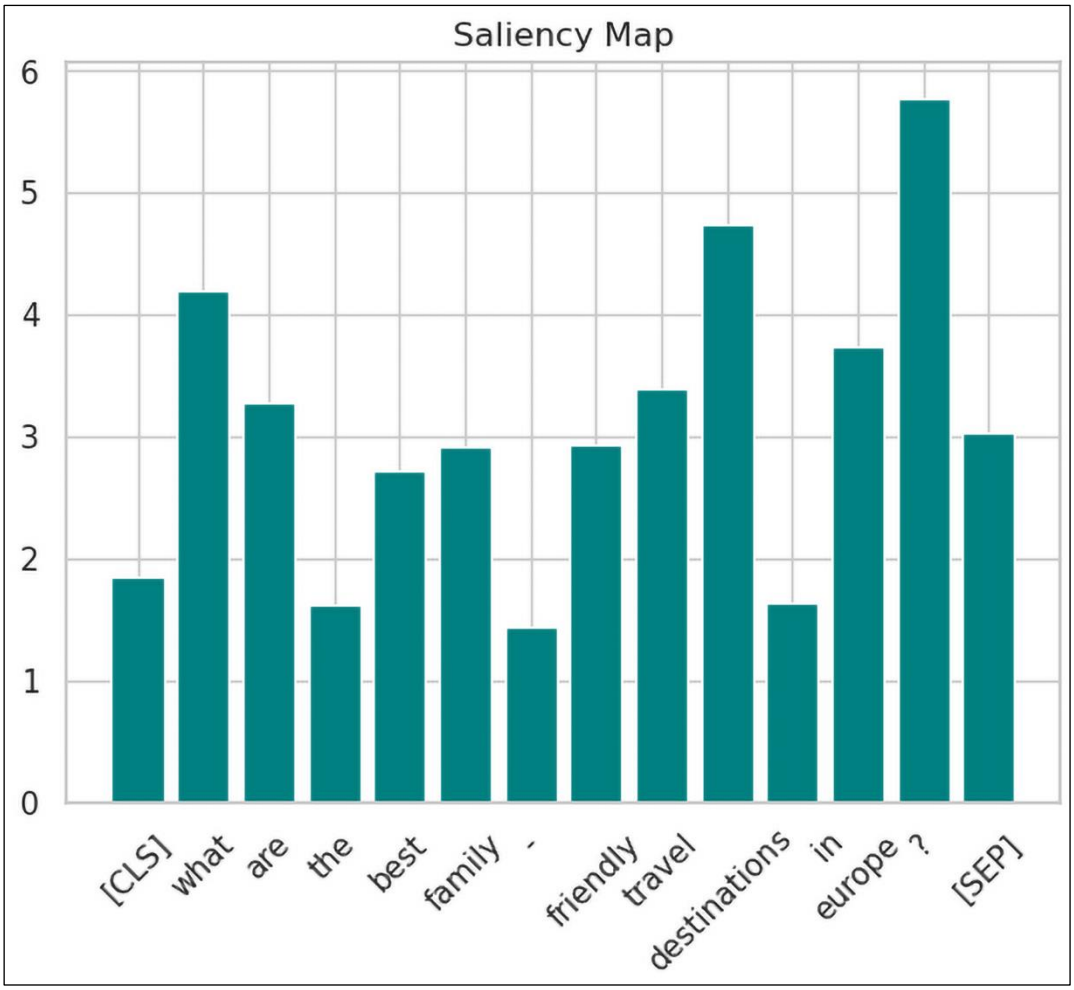

Start search
Flight search
Hotel search
Weather check
Travel advisory check
Collect results
Present options


Task classification and prioritization
Analyze task
Dependencies?
Yes
No
Sequential queue
Parallel queue
Performance monitoring
Monitor execution
Performance ok?
Yes
No
Task complete
Adjust resources
Resource management
Check resource availability
Queue task
No
System load ok?
Yes
Execute task


Evolution of Code LLMS (2021-2025)
Commercial
Open Source
First Gen
Multi-Modal
Specialized
2021
2022
2023
2024
2025
GitHub Copilot
AlphaCode
OpenAI Codex
ChatGPT
Copilot X
Cursor
GPT-4
Gemini 1.0
Claude
Copilot Enterprise
Claude 3
Codey API
Gemini 1.5
GPT-4o
Gemini 2.5 Pro
StarCoder
Code Llama
DeepSeek-Coder
CodeGemma
Codestral 22B
Codestral Mamba
Qwen2.5 Coder


sepal length (cm)
sepal width (cm)
petal length (cm)
petal width (cm)


Attention Visualization
[CLS]
what
are
the
best
family
-
friendly
travel
destinations
in
europe
?
[SEP]
0.8
0.6
0.4
0.2



Explanation:
The question 'What are the best family-friendly travel destinations in Europe?' is significant for several reasons in the context of travel:

1. **Diverse Needs of Families**: Families traveling with children have unique requirements compared to solo travelers or couples. This includes considerations for safety, availability of kid-friendly activities, and accommodations that cater to families. Identifying the best destinations helps families plan trips that meet these specific needs.

2. **Quality Time and Bonding**: Family vacations provide essential opportunities for bonding and creating lasting memories. Finding destinations that offer activities and experiences suitable for all ages can enhance family dynamics and improve relationships.

3. **Educational Opportunities**: Europe is rich in history, culture, and art. Family-friendly travel destinations often incorporate educational components, allowing children to learn while having fun. This can enrich children's understanding of the world, making travel both enjoyable and informative.

4. **Health and Safety**: Choosing the right destination can also be crucial for health and safety. Certain locations may have better healthcare facilities, less crowded tourist areas, or environments that are more suitable for children, thus easing parents' worries.

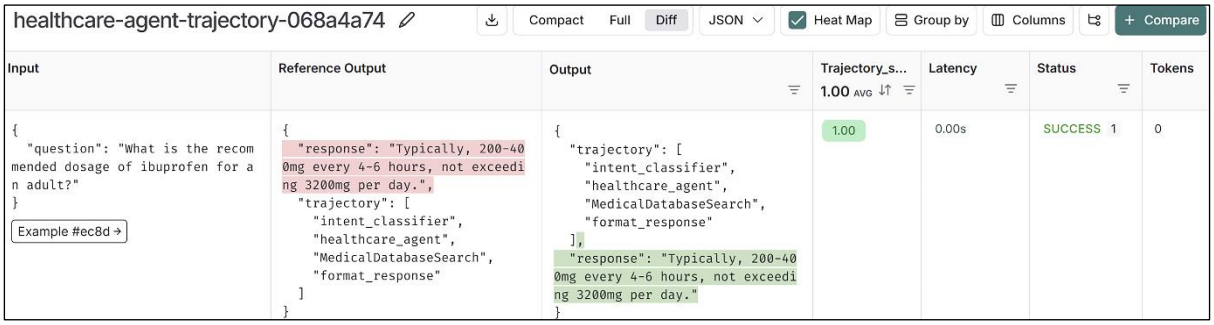
5. **Budget Considerations**: Families often travel on a budget. Knowing which destinations are family-friendly can help parents find affordable options for accommodations, meals, and activities that provide good value for money.

6. **Cultural Exposure**: Traveling to Europe can expose families to different cultures, traditions, and languages. Family-friendly destinations often facilitate these experiences in a manner that's engaging and accessible for children.

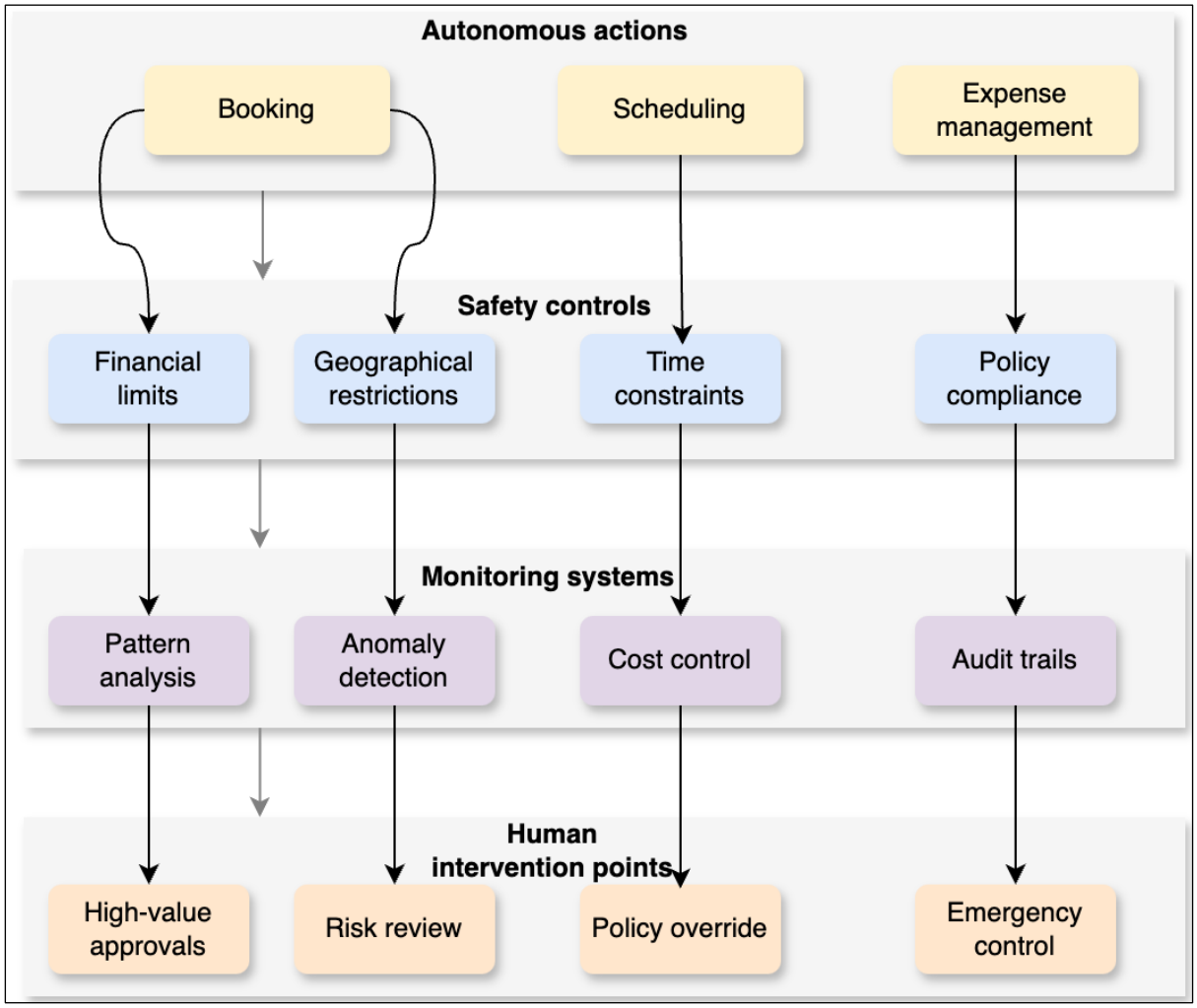
7. **Travel Logistics**: Family travel often involves more logistical planning, including transportation and accessibility. Knowing which destinations are easier to navigate with children can simplify the travel experience and reduce stress.

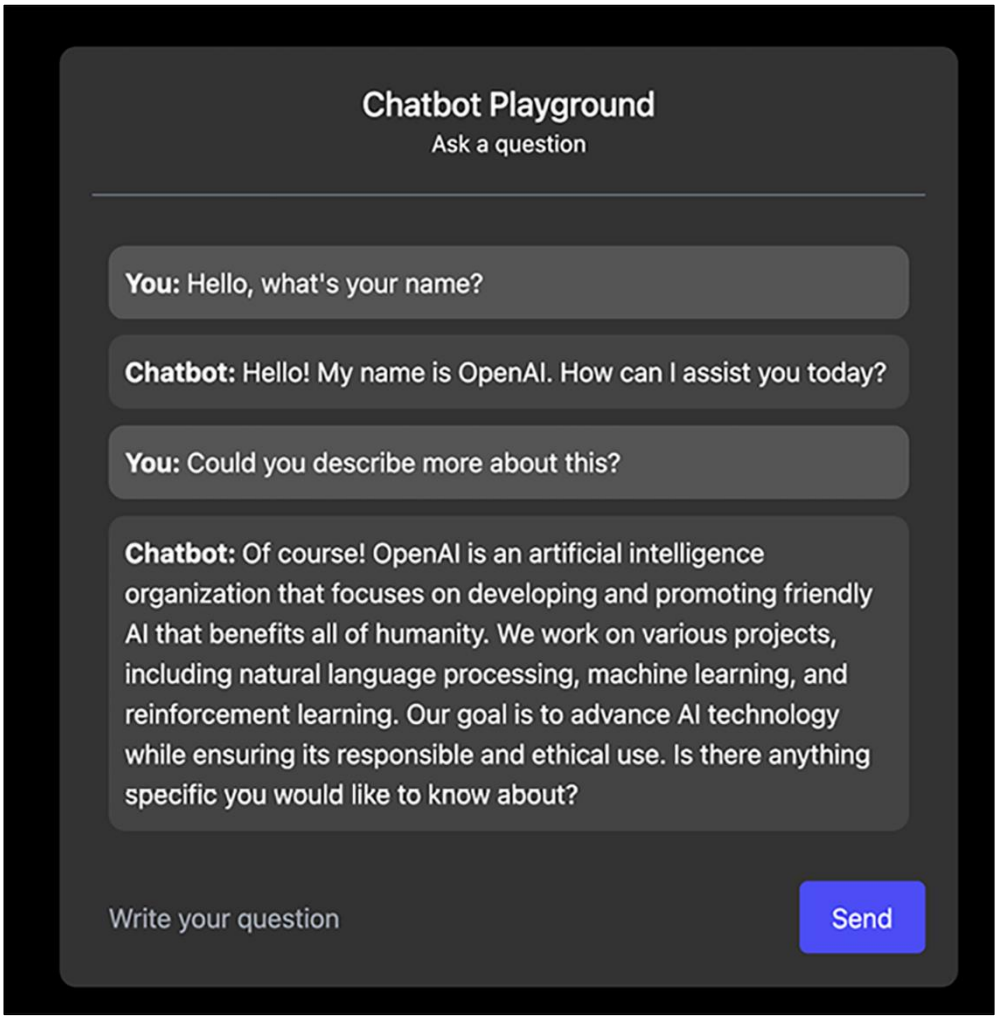
8. **Encouragement for Travel**: By highlighting family-friendly options, more families may be encouraged to travel. This can lead to increased cultural exchange and a broader appreciation for global diversity among younger generations.

Overall, understanding the best family-friendly travel destinations in Europe allows families to make informed choices that enhance their travel experiences, contributing positively to their overall well-being and enjoyment.


healthcare-agent-trajectory-068a4a74
Compact
Full
Diff
JSON
Heat Map
Group by
Columns
Compare
Input
Reference Output
Output
Trajectory_s...
1.00 AVG
Latency
Status
Tokens
{
"question": "What is the recommended dosage of ibuprofen for an adult?"
}
Example #ec8d
{
"response": "Typically, 200-400mg every 4-6 hours, not exceeding 3200mg per day.",
"trajectory": [
"intent_classifier",
"healthcare_agent",
"MedicalDatabaseSearch",
"format_response"
]
}
{
"trajectory": [
"intent_classifier",
"healthcare_agent",
"MedicalDatabaseSearch",
"format_response"
],
"response": "Typically, 200-400mg every 4-6 hours, not exceeding 3200mg per day."
}
1.00
0.00s
SUCCESS 1
0

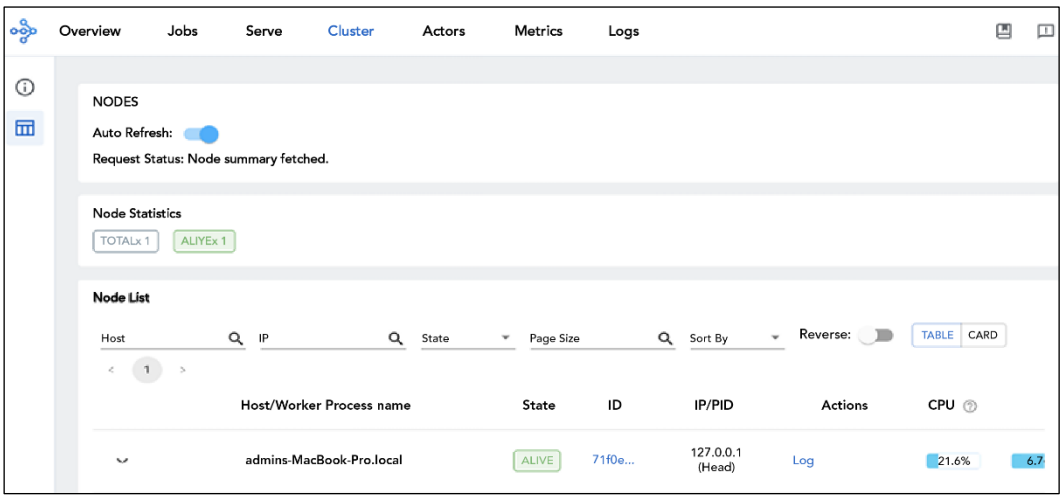
Chapter 9: Managing Safety and Ethical Considerations

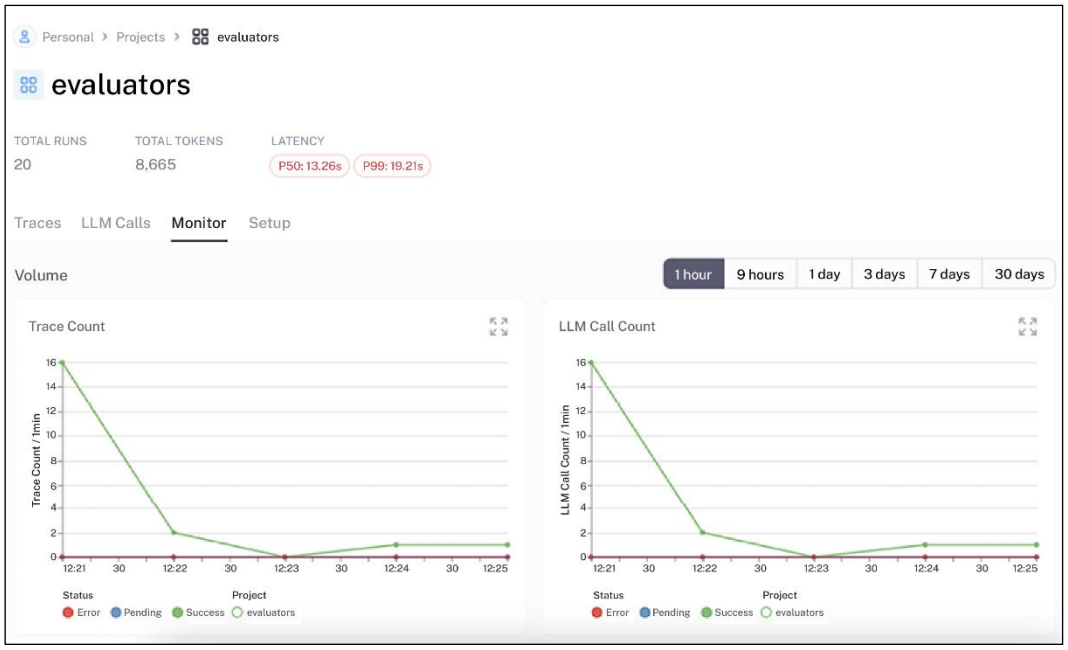


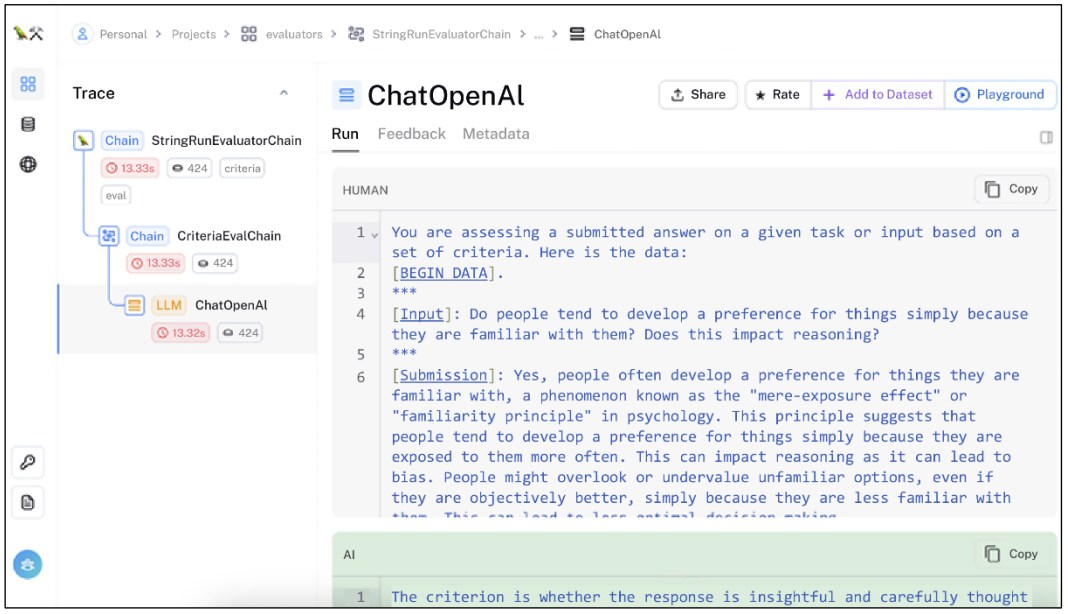



```
Your application is listening on ports: 47743 44217 40895 37393 46773 44643 36427 44581 44405 44351
                                        44065 43725 35499 43135 34739 39071 38539 46031 37519 37225
                                        45335 45157 8000

/home/ben/anaconda3/envs/langchain_ai/bin/python /home/ben/generative_ai_with_langchain/chapter9/ray/main.py
2025-02-28 16:59:35,122 INFO worker.py:1841 -- Started a local Ray instance.
```




Personal › Projects › evaluators
evaluators
TOTAL RUNS
20
TOTAL TOKENS
8,665
LATENCY
P50: 13.26s
P99: 19.21s
Traces
LLM Calls
Monitor
Setup
Volume
1 hour
9 hours
1 day
3 days
7 days
30 days
Trace Count
Trace Count / 1min
LLM Call Count
LLM Call Count / 1min
12:21
12:22
12:23
12:24
12:25
Status
Error
Pending
Success
Project
evaluators


Personal › Projects › evaluators › StringRunEvaluatorChain › ... › ChatOpenAI
Trace
Chain StringRunEvaluatorChain
13.33s
424
criteria
eval
Chain CriteriaEvalChain
13.33s
424
LLM ChatOpenAI
13.32s
424
ChatOpenAI
Share
Rate
Add to Dataset
Playground
Run
Feedback
Metadata
HUMAN
Copy
1 You are assessing a submitted answer on a given task or input based on a set of criteria. Here is the data:
2 [BEGIN DATA].
3 ***
4 [Input]: Do people tend to develop a preference for things simply because they are familiar with them? Does this impact reasoning?
5 ***
6 [Submission]: Yes, people often develop a preference for things they are familiar with, a phenomenon known as the "mere-exposure effect" or "familiarity principle" in psychology. This principle suggests that people tend to develop a preference for things simply because they are exposed to them more often. This can impact reasoning as it can lead to bias. People might overlook or undervalue unfamiliar options, even if they are objectively better, simply because they are less familiar with
AI
Copy
1 The criterion is whether the response is insightful and carefully thought

Chapter 11: Appendix

