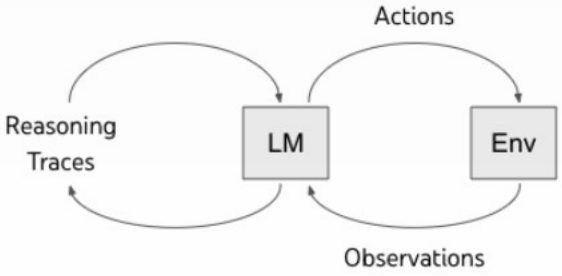
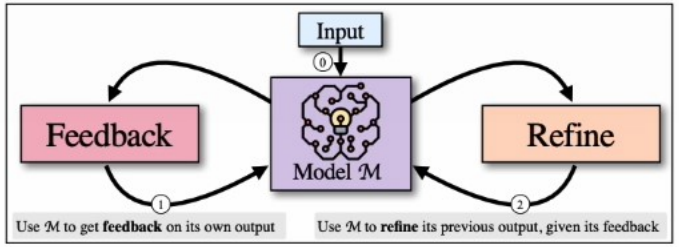
LangGraph supports Cyclic Graphs



ReAct (Reason + Act)

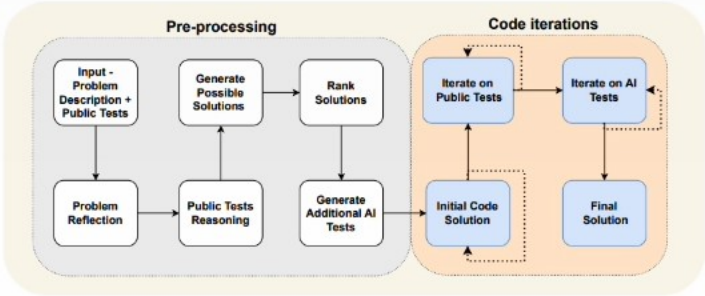
REACT: SYNERGIZING REASONING AND ACTING IN LANGUAGE MODELS

https://arxiv.org/pdf/2210.03629.pdf



SELF-REFINE:
Iterative Refinement with Self-Feedback

https://arxiv.org/pdf/2303.17651.pdf

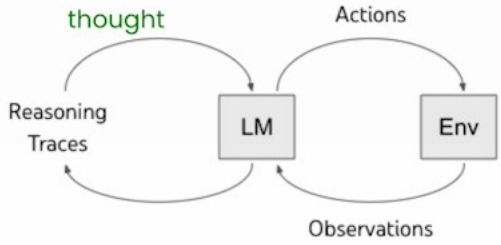


(a) The proposed AlphaCodium flow.

Code Generation with AlphaCodium: From Prompt Engineering to Flow Engineering

https://arxiv.org/pdf/2401.08500.pdf

Let's build an agent from scratch

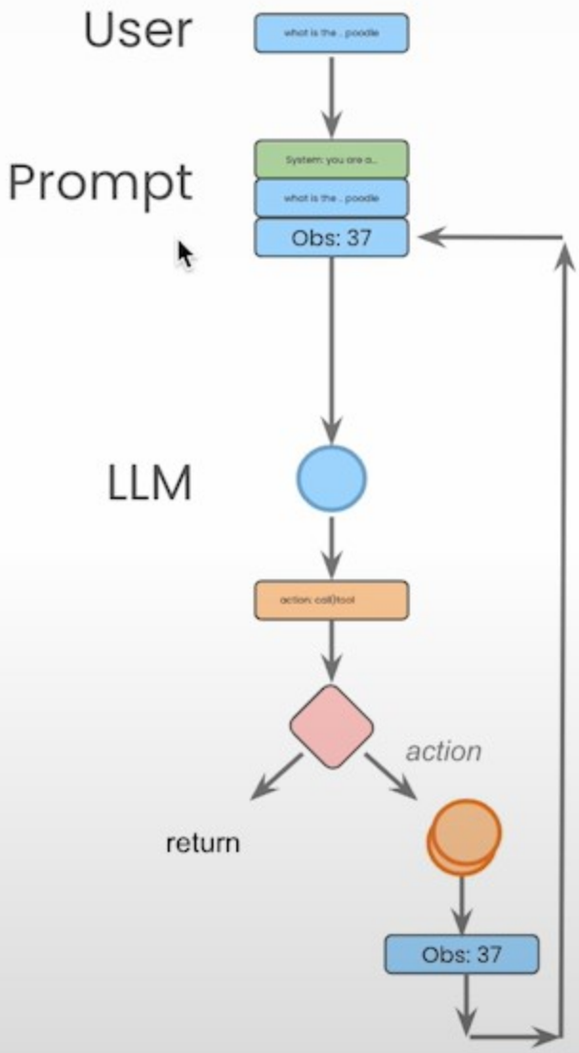


ReAct (Reason + Act)

Published as a conference paper at ICLR 2023

REACT: SYNERGIZING REASONING AND ACTING IN LANGUAGE MODELS

Break Down



"""
System:
You run in a loop of Thought, Action, PAUSE, Observation.
…
Your available actions are:

calculate:
e.g. calculate: 4 * 7 / 3
…
Example session:
…
User:
… weight of collie…

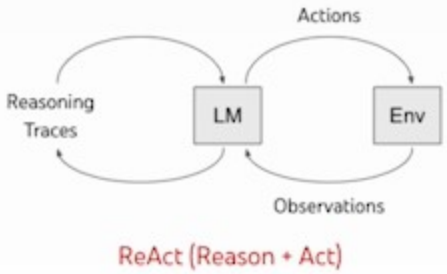
'Thought: To find the combined weight of a Border Collie and a Scottish Terrier, I need to first find the average weight of each breed and then add those weights together.
Action: average_dog_weight: Border Collie\n PAUSE'

Observation: a Border Collies average weight is 37 lbs

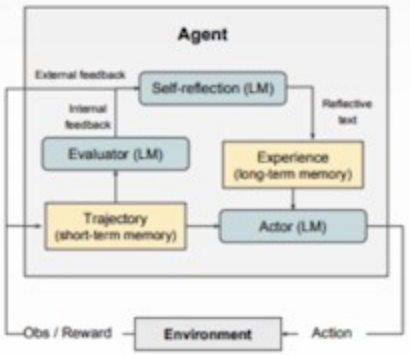
```
def query(question, max_turns=5):
 i = 0
 bot = Agent(prompt)
 next_prompt = question
 while i < max_turns:
    i += 1
    result = bot(next_prompt)
    print(result)
    actions = [action_re.match(a) for a in result.split('\n') if action_re.match(a)]
    if actions:
        # There is an action to run
        action, action_input = actions[0].groups()
        if action not in known_actions:
            raise Exception("Unknown action: {}: {}".format(action, action_input))
        print(" -- running {} {}".format(action, action_input))
        observation = known_actions[action](action_input)
        print("Observation:", observation)
        next_prompt = "Observation: {}".format(observation)
    else:
        return
```

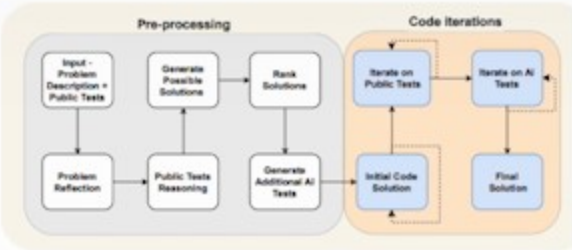
```
def calculate(what):
  return eval(what)

def average_dog_weight(name):
  if name in "Scottish Terrier":
      return("Scottish Terriers average 20 lbs")
  elif name in "Border Collie":
      return("a Border Collies average weight is 37
lbs")
  elif name in "Toy Poodle":
      return("a toy poodles average weight is 7 lbs")
  else:
      return("An average dog weights 50 lbs")
```

Graphs



ReAct (Reason + Act)





(a) The proposed AlphaCodium flow.

- LangGraph is an extension of LangChain that supports graphs.
- Single and Multi-agent flows are described and represented as graphs.
- Allows for extremely controlled “flows”
- Built-in persistence allows for human-in-the-loop workflows

Graphs

Nodes: Agents or functions

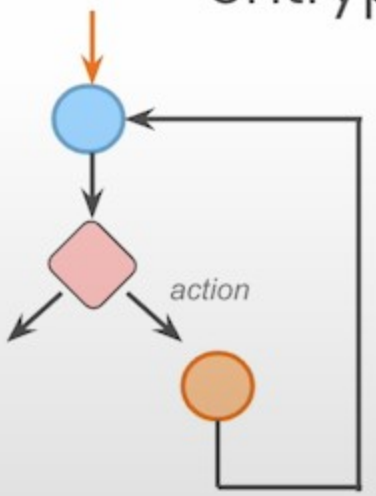
Edges: connect nodes

Conditional edges: decisions

entrypoint : starting node

agent node

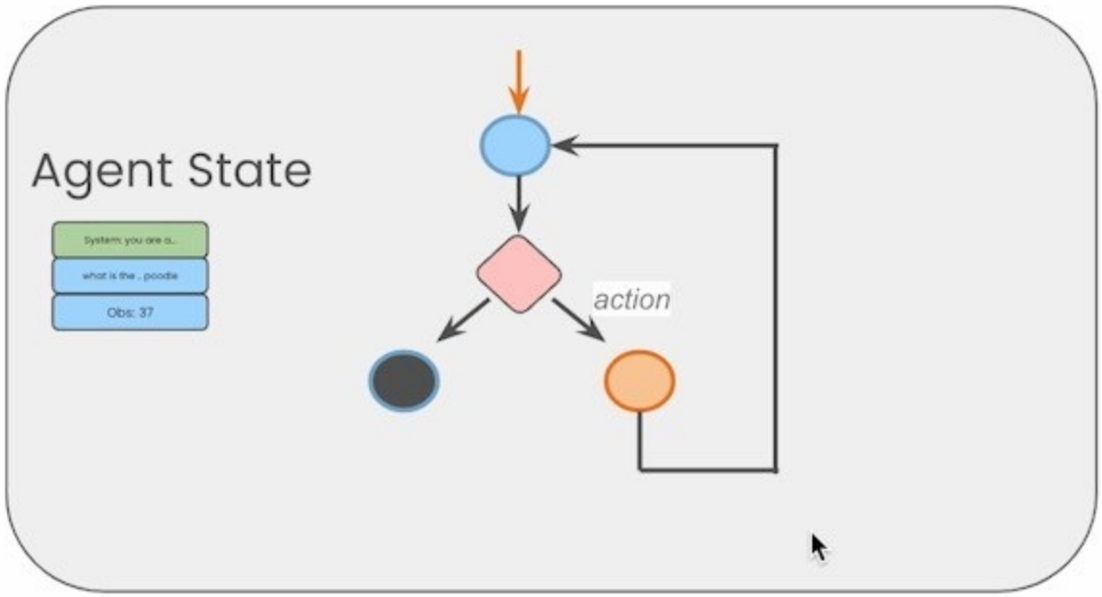
conditional edge



edge

function node

Data/State



- Agent State is accessible to all parts of the graph
- It is local to the graph
- Can be stored in a persistence layer

Simple

1. BaseMessage is a langchain type. It's annotated with operatore.add.
2. Whenever there are new messages it would instead of overwriting.
3. Intermediate steps are tracked

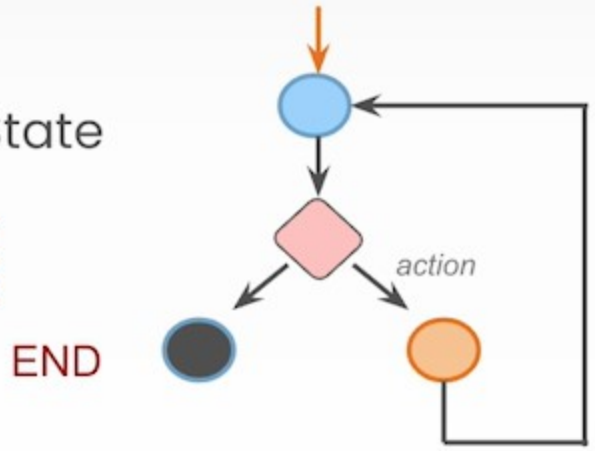
```
class AgentState(TypedDict):
    messages: Annotated[Sequence[BaseMessage], operator.add]
```

Complex

```
class AgentState(TypedDict):
    input: str
    chat_history: list[BaseMessage]
    agent_outcome: Union[AgentAction, AgentFinish, None]
    intermediate_steps: Annotated[list[tuple[AgentAction, str]], operator.add]
```

CODE

Agent State



llm: call_openai

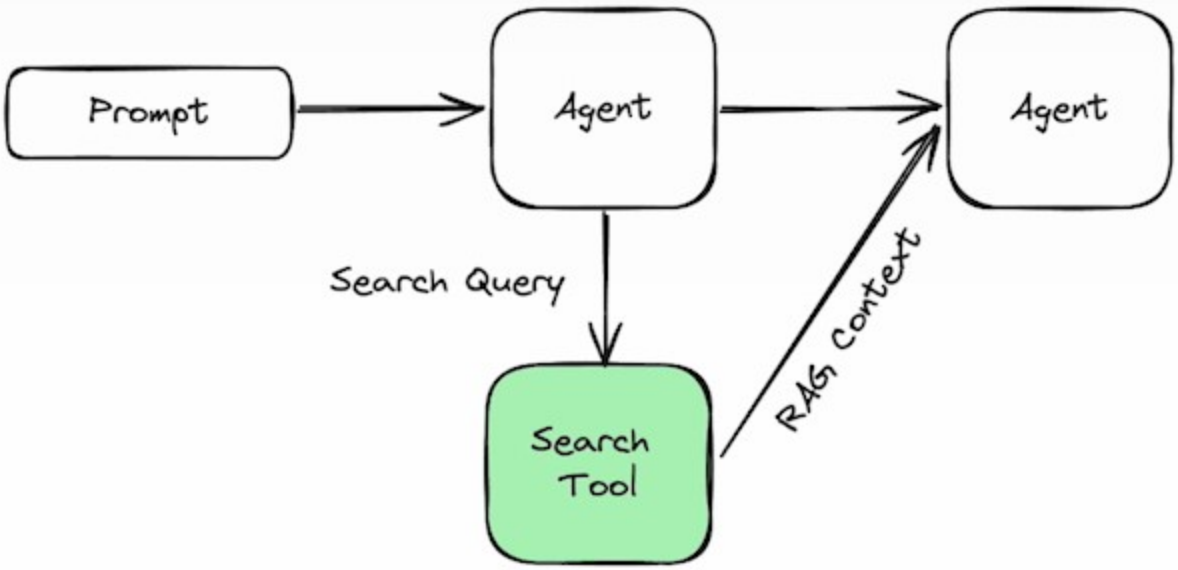
c_edge: exists_action

action:take_action

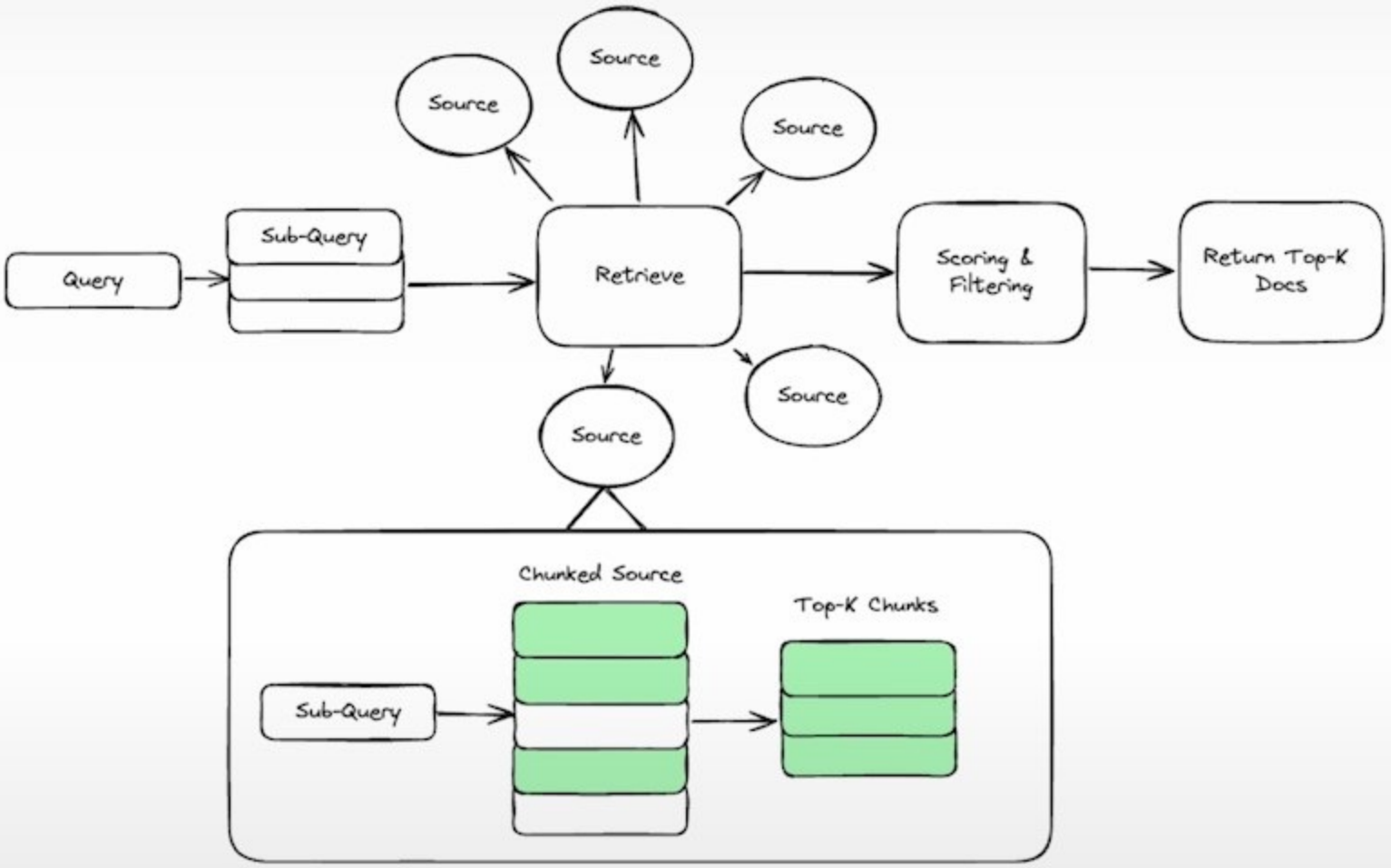
State

```
class AgentState(TypedDict):
    messages: Annotated[list[AnyMessage], operator.add]
```

Why Search Tool

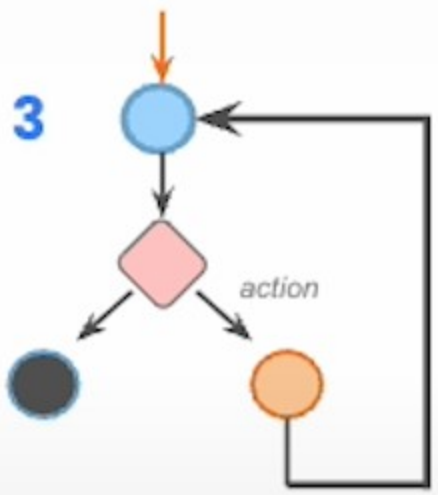


Inside a Search Tool



1. It would understand the questions and divide into sub questions.
2. Find the best source choosing from multiple integrations.
3. Should extract the relevant information from the search tool.
    a. Chunking the search results
    b. Vector search -> retrieve top k
    c. Score the results from various sources.
    d. Filter out less relevant

State Memory



Memory

state 3

state 2

state 1

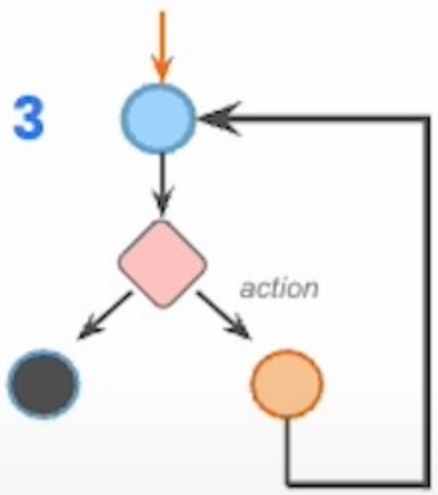
state 0

StateSnapshot: { AgentState, useful_things}

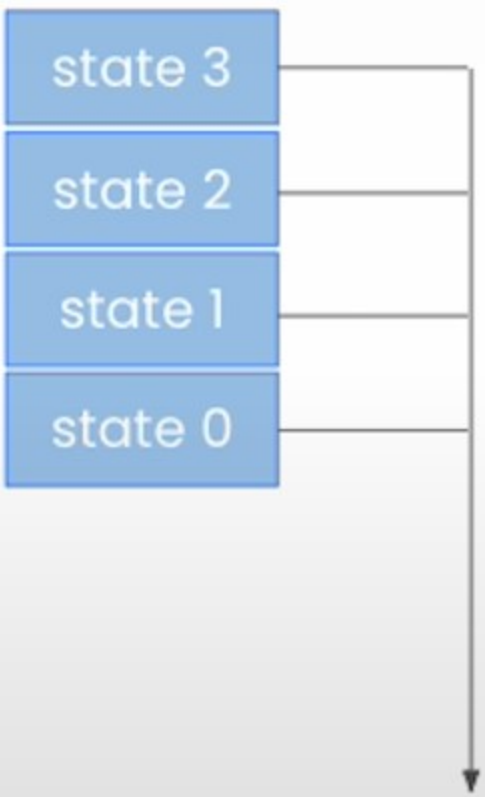
{ .., thread, thread_ts..}

config={'configurable': {'thread_id': '1',
'thread_ts': '1ef17b36-ed06-6185-8001-15cf75dea535'}}

State Memory



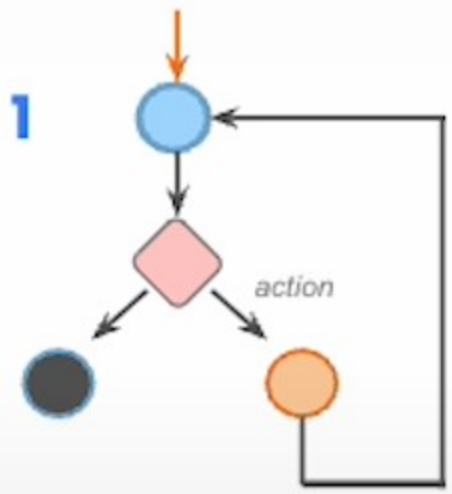
Memory



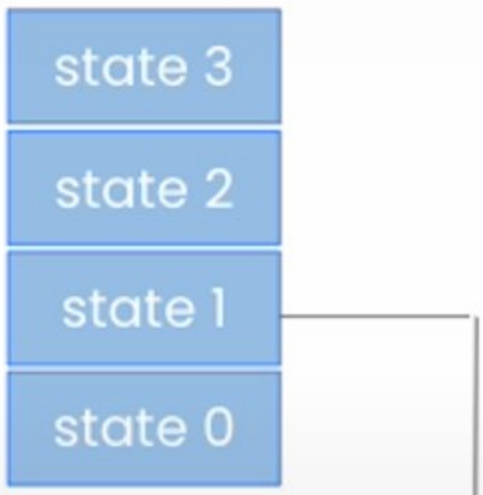
g.get_state_history(thread)

Returns iterator over all StateSnapshots

State Memory



Memory

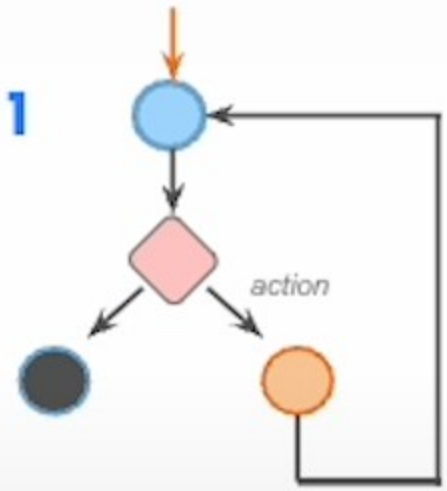


g.invoke(None,{ .., thread, thread_ts..})
g.stream(None,{ .., thread, thread_ts..})

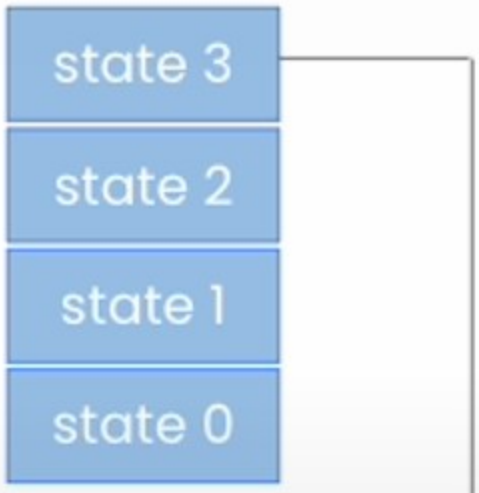
state 1

runs with state 1 as starting point
Time Travel

State Memory



Memory

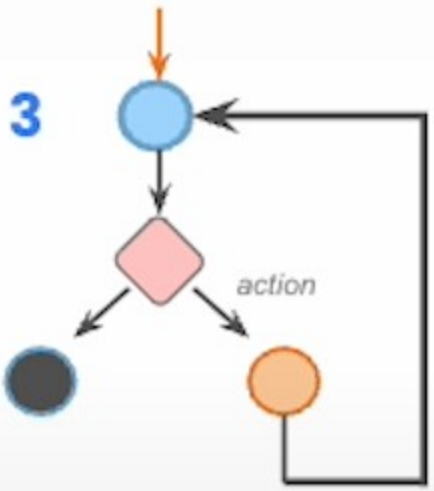


without thread_ts

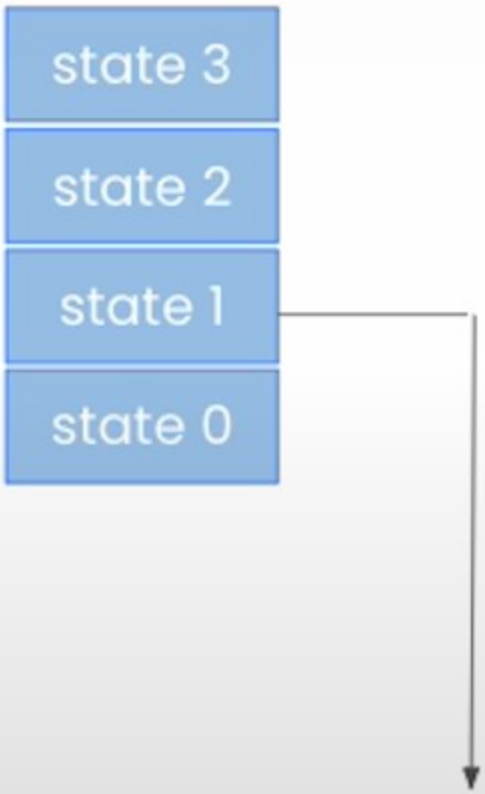
```
g.invoke(None,{ .., thread})
g.stream(None,{ .., thread})
```

Uses current state as starting point

State Memory



Memory

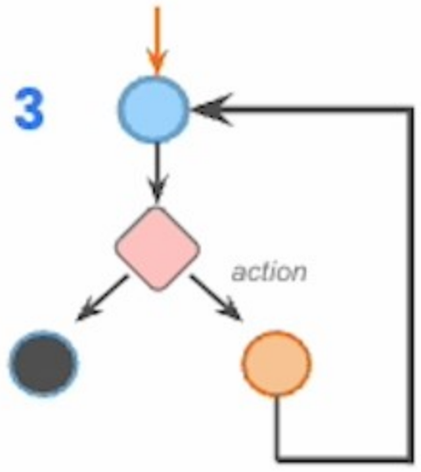


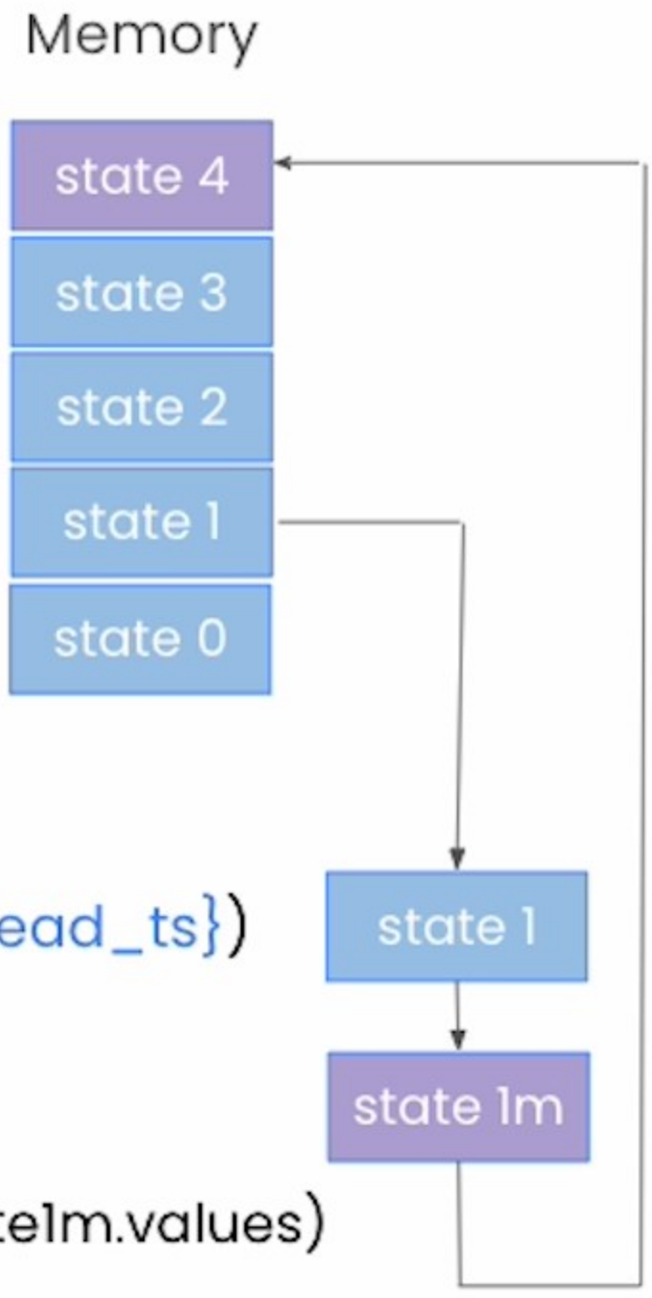
g.get_state({thread, thread_ts})

state 1

Returns 'thread_ts state-snapshot'

State Memory





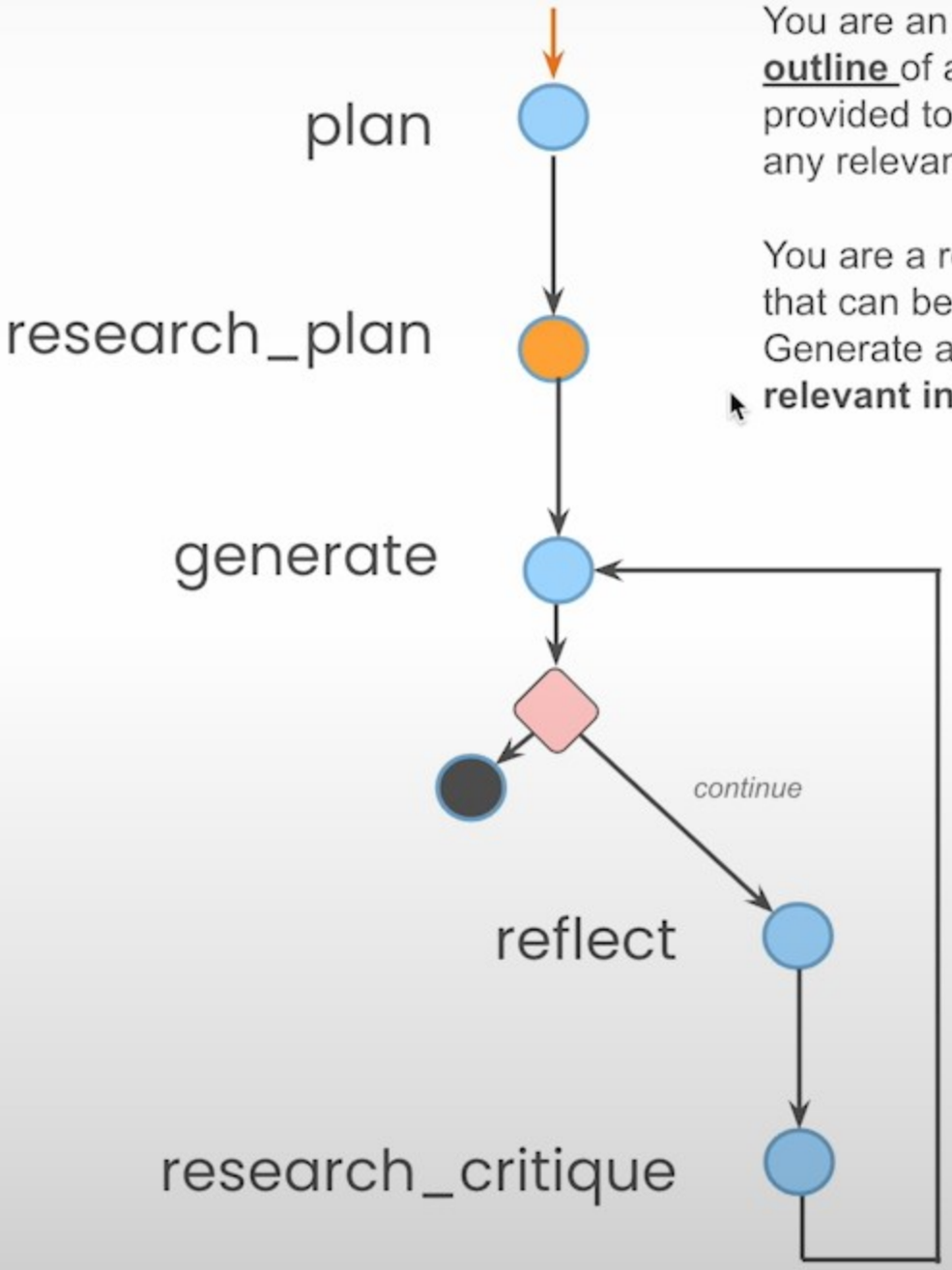
g.get_state({thread, thread_ts})

modify it

g.update_state(thread, state1m.values)

run it g.stream(None, thread)

Essay Writer

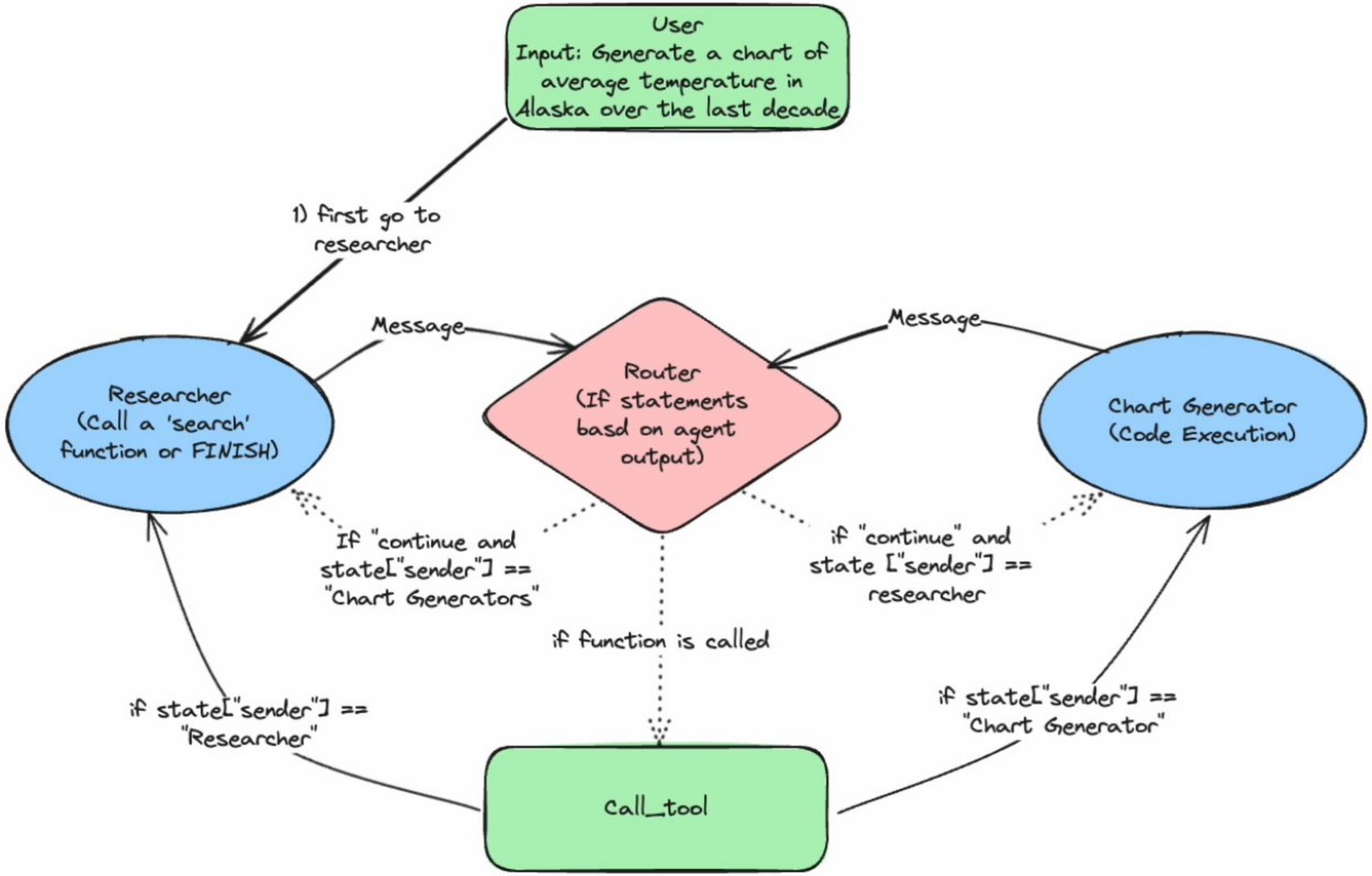


You are an expert writer tasked with writing a **high level outline** of an essay. Write such an outline for the user provided topic. Give an outline of the essay along with any relevant notes or instructions for the sections.

You are a researcher charged with providing information that can be used when writing the following essay. Generate a list of **search queries that will gather any relevant information.** Only generate 3 queries max.

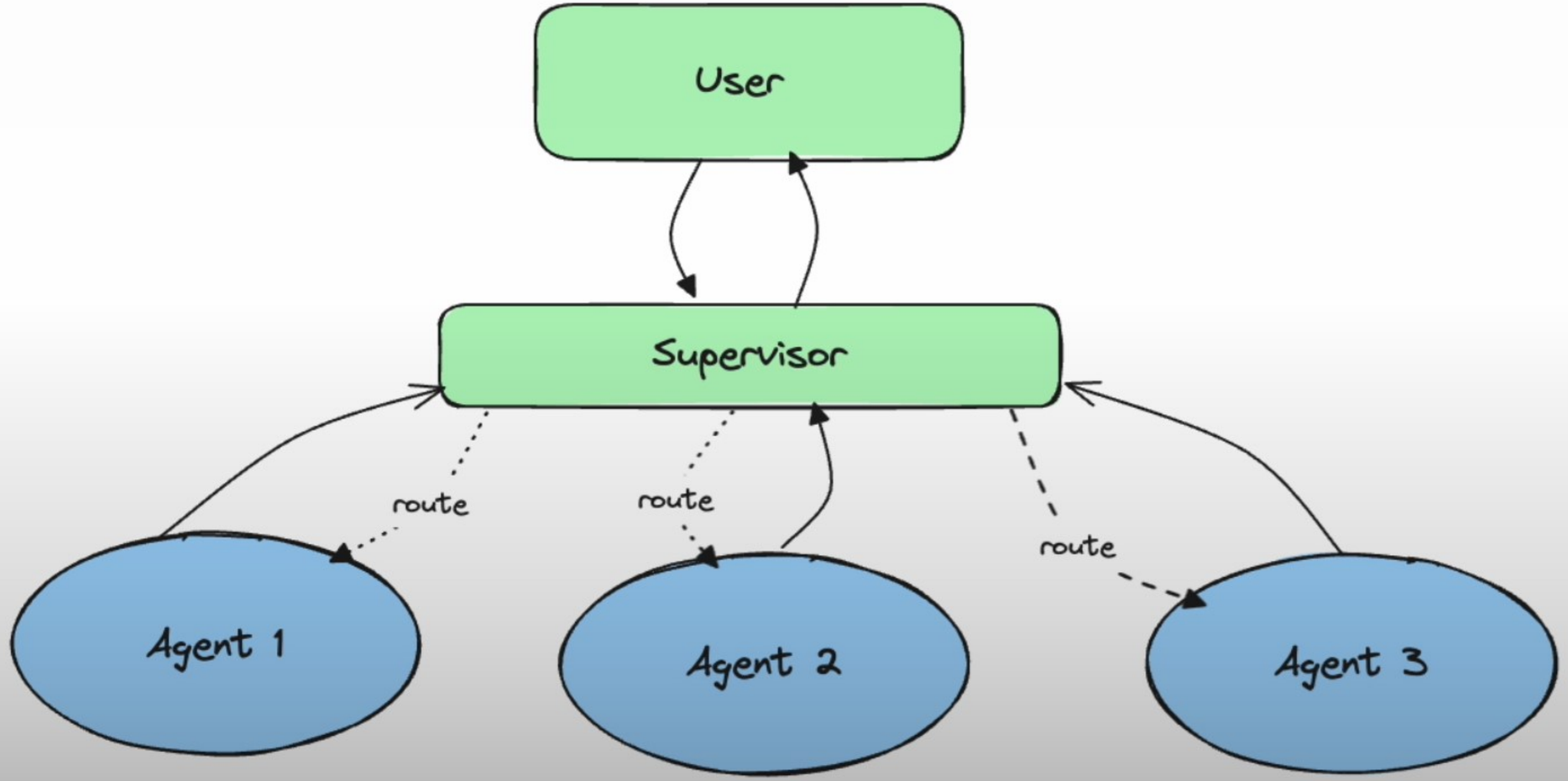
You are an essay assistant tasked with **writing excellent 5-paragraph essays.**Generate … If the **user provides critique, respond with a revised version** of your previous attempts. Utilize information:

Multi-Agent

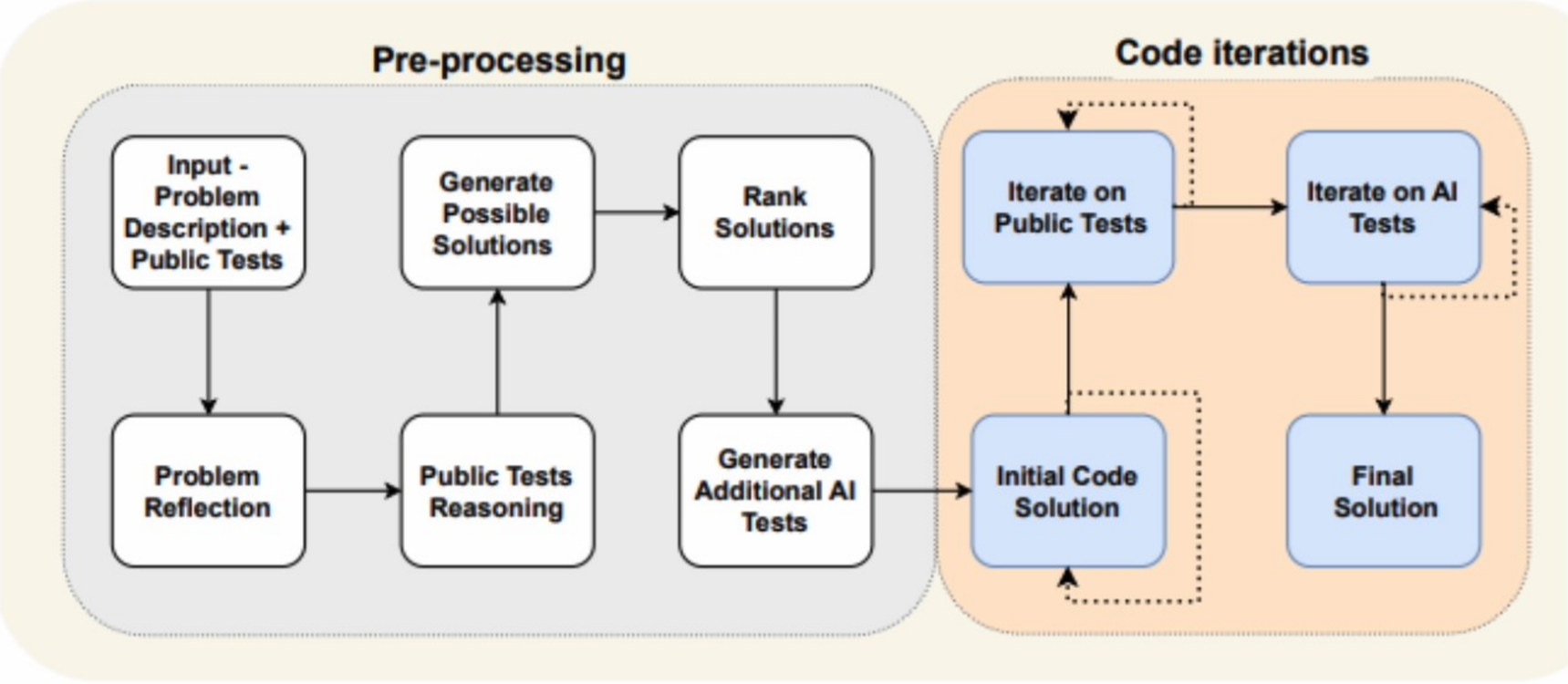


https://github.com/langchain-ai/langgraph/tree/main/examples/multi_agent

Supervisor

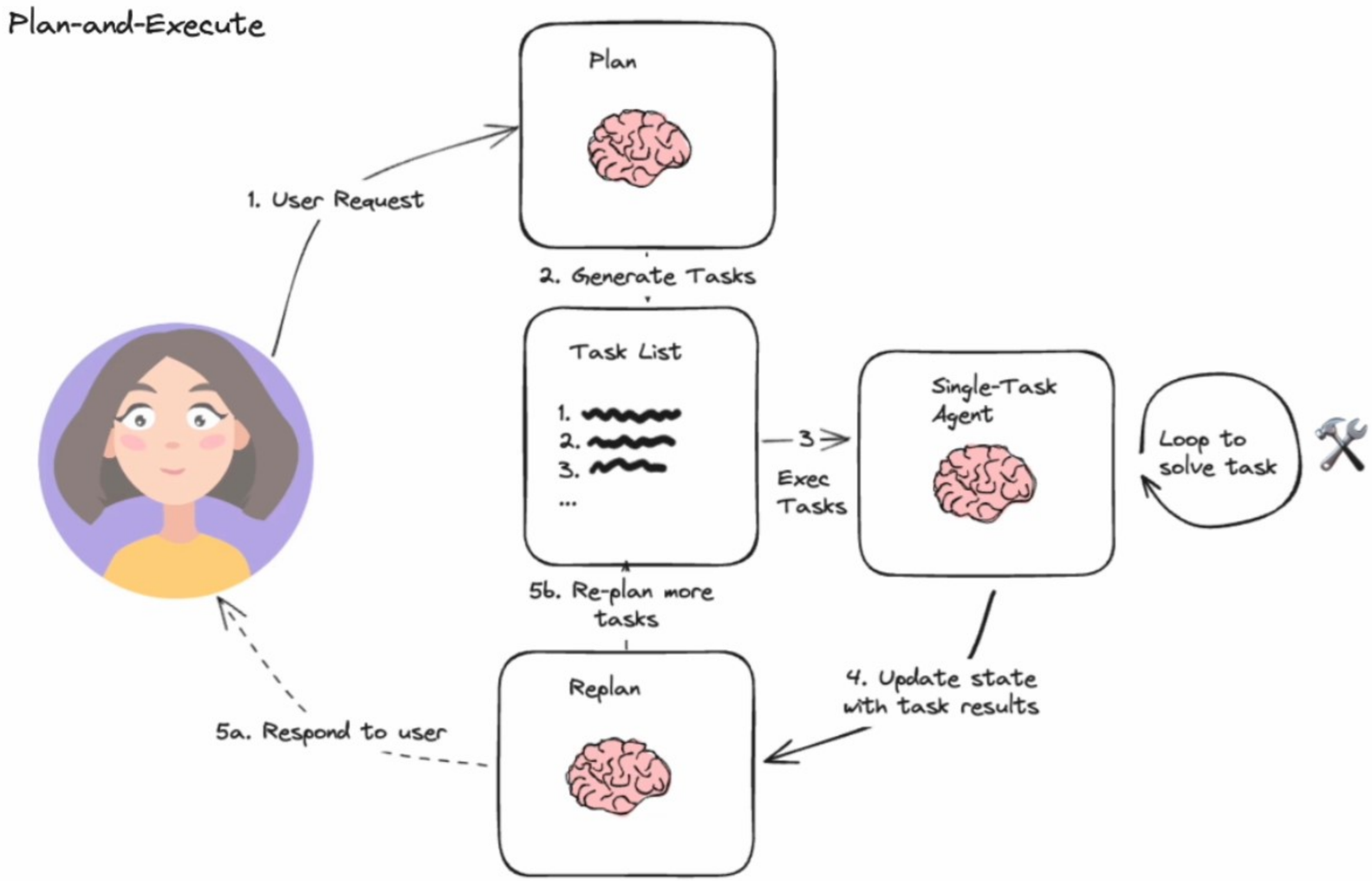


Flow Engineering



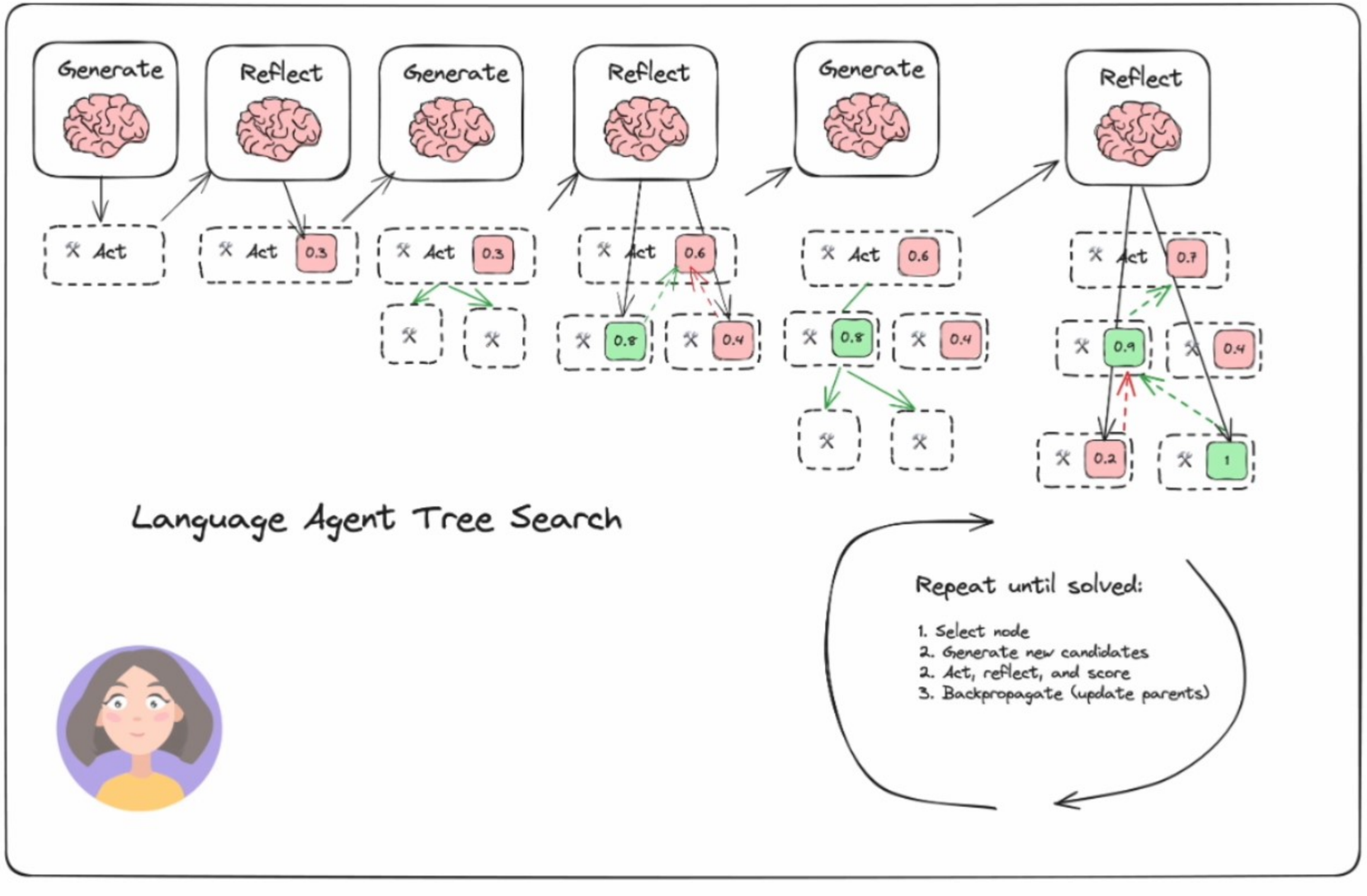
(a) The proposed AlphaCodium flow.

Plan and Execute



https://github.com/langchain-ai/langgraph/blob/main/examples/plan-and-execute/plan-and-execute.ipynb?ref=blog.langchain.dev

Language Agent Tree Search



https://github.com/langchain-ai/langgraph/blob/main/examples/lats/lats.ipynb