Analytics Vidhya

The Command construct in LangGraph - Dynamic Navigation

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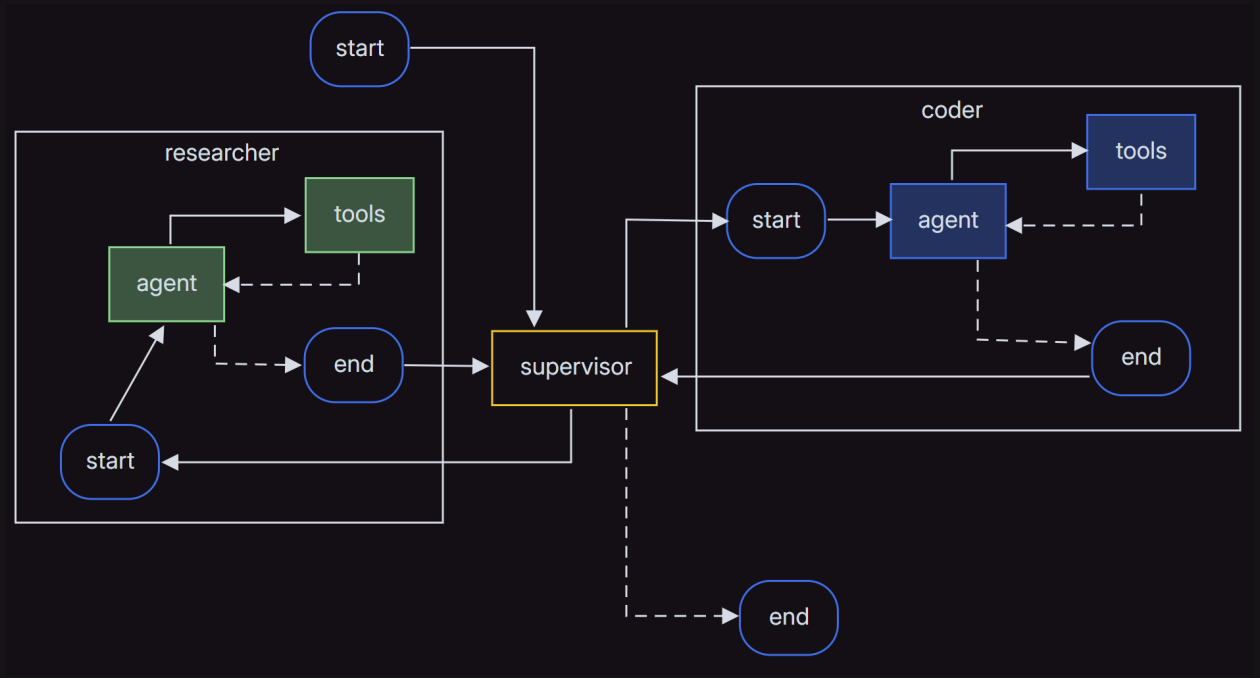
Dynamic Agent Navigation with Command

In LangGraph, the Command object is pivotal for orchestrating complex workflows involving multi-agent systems. It facilitates dynamic state updates and directs the flow of execution among agents with definite ‘commands’.

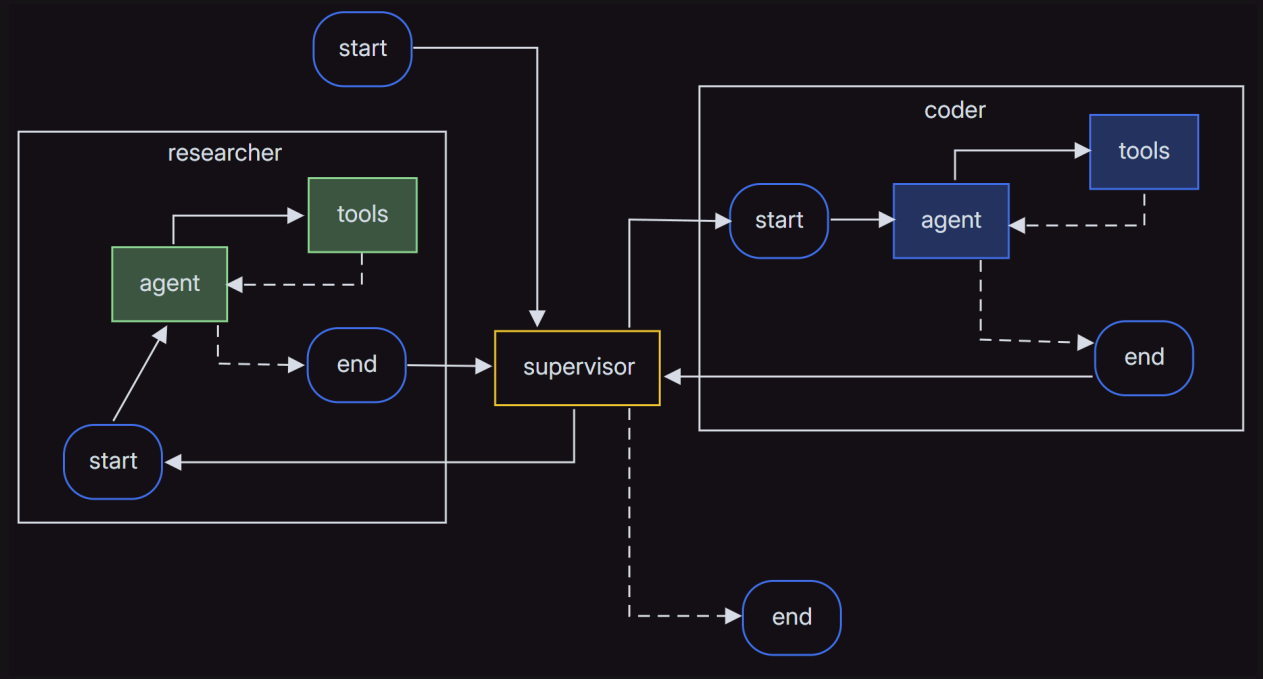


Dynamic Agent Navigation with Command

Key Points

Dynamic Workflow Control

Sub-agents or even single nodes can return a Command object to specify the next agent or node to goto after doing the necessary computations and state updates, enabling flexible and dynamic routing within the graph.



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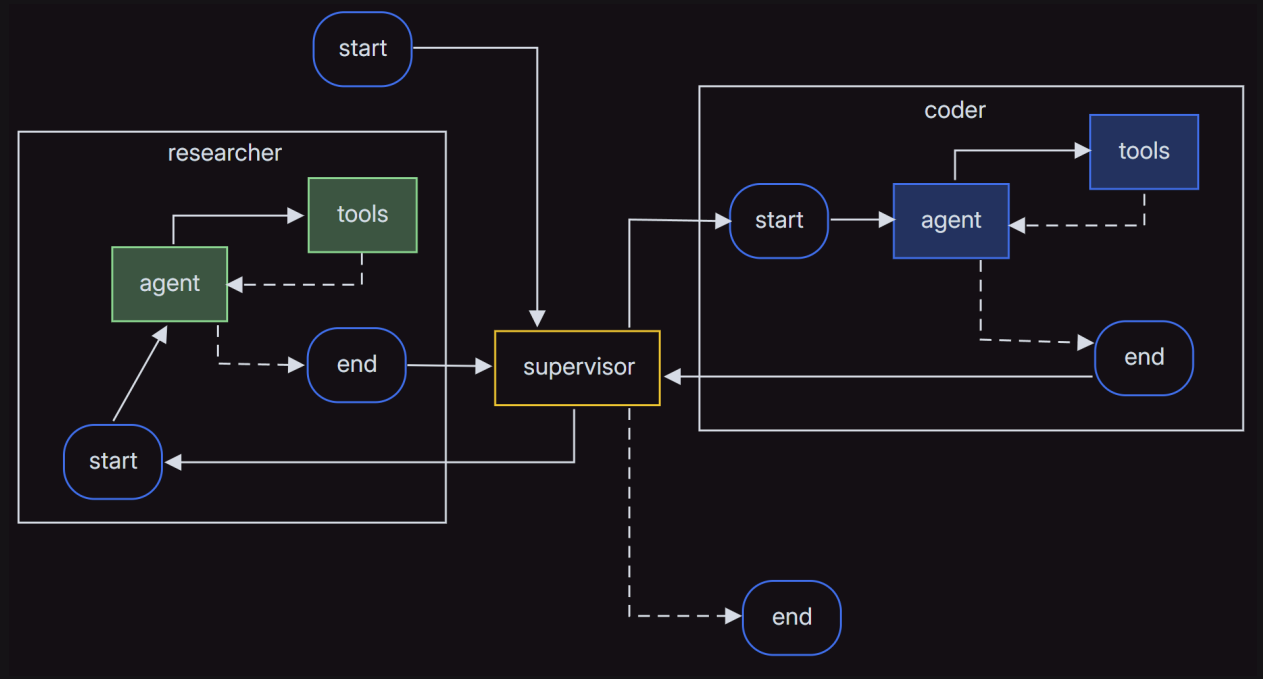
State Management

The Command object allows sub-agents to update the shared state schema, ensuring that all agents have access to the latest information necessary for task execution.



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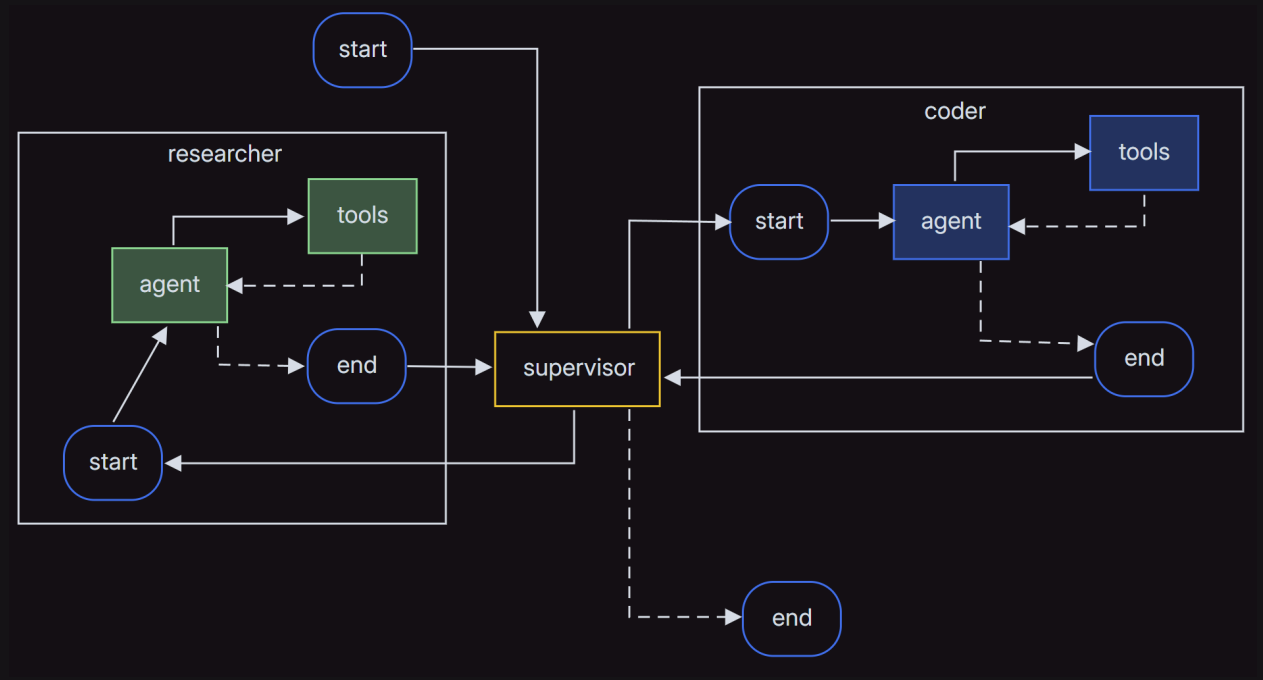
Supervisor Agent Coordination

A supervisor agent can use the Command **pattern** to delegate tasks to sub-agents based on requirements. Sub-agents, upon completion, can redirect the workflow back to the supervisor using the same pattern, enabling efficient task distribution and streamlined supervision.



Dynamic Agent Navigation with Command

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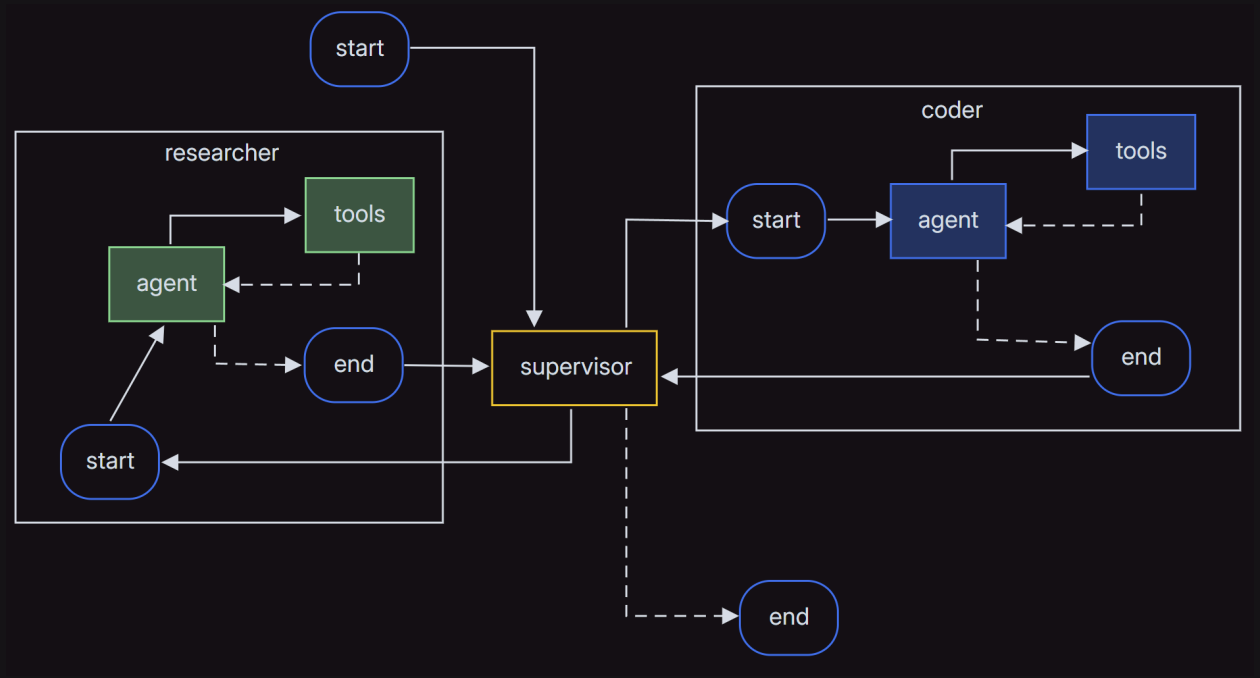
Implementation Example

In a multi-agent system, a supervisor agent can delegate tasks to a researcher agent for web searches and a coder agent for plotting or computational analysis. Using the Command construct, sub-agents execute tasks independently and report back to the supervisor seamlessly.



Dynamic Agent Navigation with Command

The Command object allows agents to dynamically delegate tasks and manage workflow transitions in a multi-agent system.

Supervisor Node

- Acts as the central decision-maker.
- Evaluates the task context and routes it to the appropriate sub-agent (e.g., researcher or coder) using the goto property in the Command construct, ensuring precise task allocation and execution.

```python
# uses Command to delegate tasks to researcher or coder
def supervisor_node(state: State) -> Command[Literal["researcher", "coder", "__end__"]]:
    messages = [{"role": "system",
                 "content": SUPERVISOR_AGENT_PROMPT,}]+state["messages"]
    response = llm.with_structured_output(Router).invoke(messages)
    goto = response["next"]
    if goto == "FINISH":
        goto = END

    return Command(goto=goto, update={"next": goto})

# searches the web, gets information and uses Command to report back to supervisor
def research_node(state: State) -> Command[Literal["supervisor"]]:
    result = research_agent.invoke(state)
    return Command(
        update={
            "messages": [
                HumanMessage(content=result["messages"][-1].content, name="researcher")
            ]
        },
        goto="supervisor",
    )

# creates and runs code and uses Command to report back to supervisor
def code_node(state: State) -> Command[Literal["supervisor"]]:
    result = code_agent.invoke(state)
    return Command(
        update={
            "messages": [
                HumanMessage(content=result["messages"][-1].content, name="coder")
            ]
        },
        goto="supervisor",
    )
```

Dynamic Agent Navigation with Command

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Researcher Node

- Handles information gathering (e.g., web search or querying data sources).
- Uses Command to send task results back to the supervisor by updating the state with the gathered content (messages) and directing the flow to the supervisor.

```python
# uses Command to delegate tasks to researcher or coder
def supervisor_node(state: State) -> Command[Literal["researcher", "coder", "__end__"]]:
    messages = [{"role": "system",
                 "content": SUPERVISOR_AGENT_PROMPT,}]+state["messages"]
    response = llm.with_structured_output(Router).invoke(messages)
    goto = response["next"]
    if goto == "FINISH":
        goto = END

    return Command(goto=goto, update={"next": goto})

# searches the web, gets information and uses Command to report back to supervisor
def research_node(state: State) -> Command[Literal["supervisor"]]:
    result = research_agent.invoke(state)
    return Command(
        update={
            "messages": [
                HumanMessage(content=result["messages"][-1].content, name="researcher")
            ]
        },
        goto="supervisor",
    )

# creates and runs code and uses Command to report back to supervisor
def code_node(state: State) -> Command[Literal["supervisor"]]:
    result = code_agent.invoke(state)
    return Command(
        update={
            "messages": [
                HumanMessage(content=result["messages"][-1].content, name="coder")
            ]
        },
        goto="supervisor",
    )
```

Dynamic Agent Navigation with Command

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Coder Node

- Executes programming or code-based tasks.
- Similar to the researcher, it updates the shared state with the output (messages) and routes the control back to the supervisor.

```python
# uses Command to delegate tasks to researcher or coder
def supervisor_node(state: State) -> Command[Literal["researcher", "coder", "__end__"]]:
    messages = [{"role": "system",
                 "content": SUPERVISOR_AGENT_PROMPT,}]+state["messages"]
    response = llm.with_structured_output(Router).invoke(messages)
    goto = response["next"]
    if goto == "FINISH":
        goto = END

    return Command(goto=goto, update={"next": goto})

# searches the web, gets information and uses Command to report back to supervisor
def research_node(state: State) -> Command[Literal["supervisor"]]:
    result = research_agent.invoke(state)
    return Command(
        update={
            "messages": [
                HumanMessage(content=result["messages"][-1].content, name="researcher")
            ]
        },
        goto="supervisor",
    )

# creates and runs code and uses Command to report back to supervisor
def code_node(state: State) -> Command[Literal["supervisor"]]:
    result = code_agent.invoke(state)
    return Command(
        update={
            "messages": [
                HumanMessage(content=result["messages"][-1].content, name="coder")
            ]
        },
        goto="supervisor",
    )
```

Thanks