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Common Multi-Agent System Architectures

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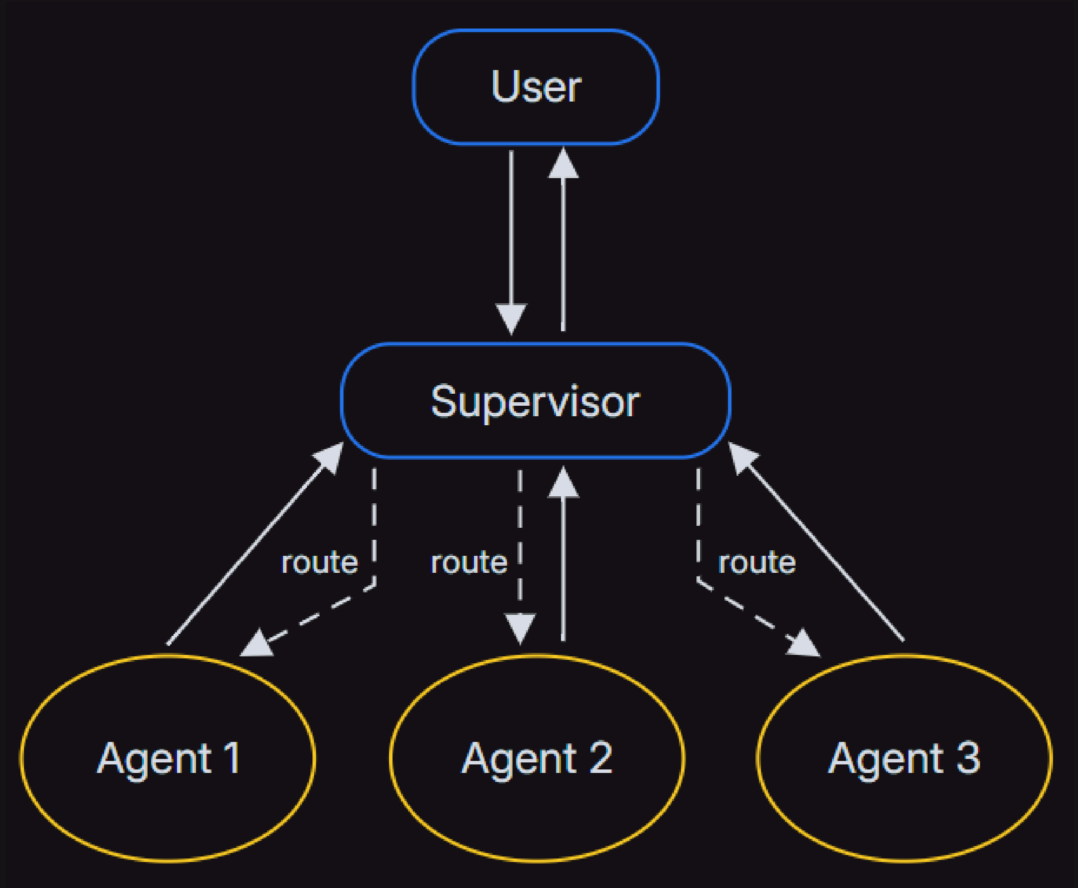
Multi-Agent System Essentials

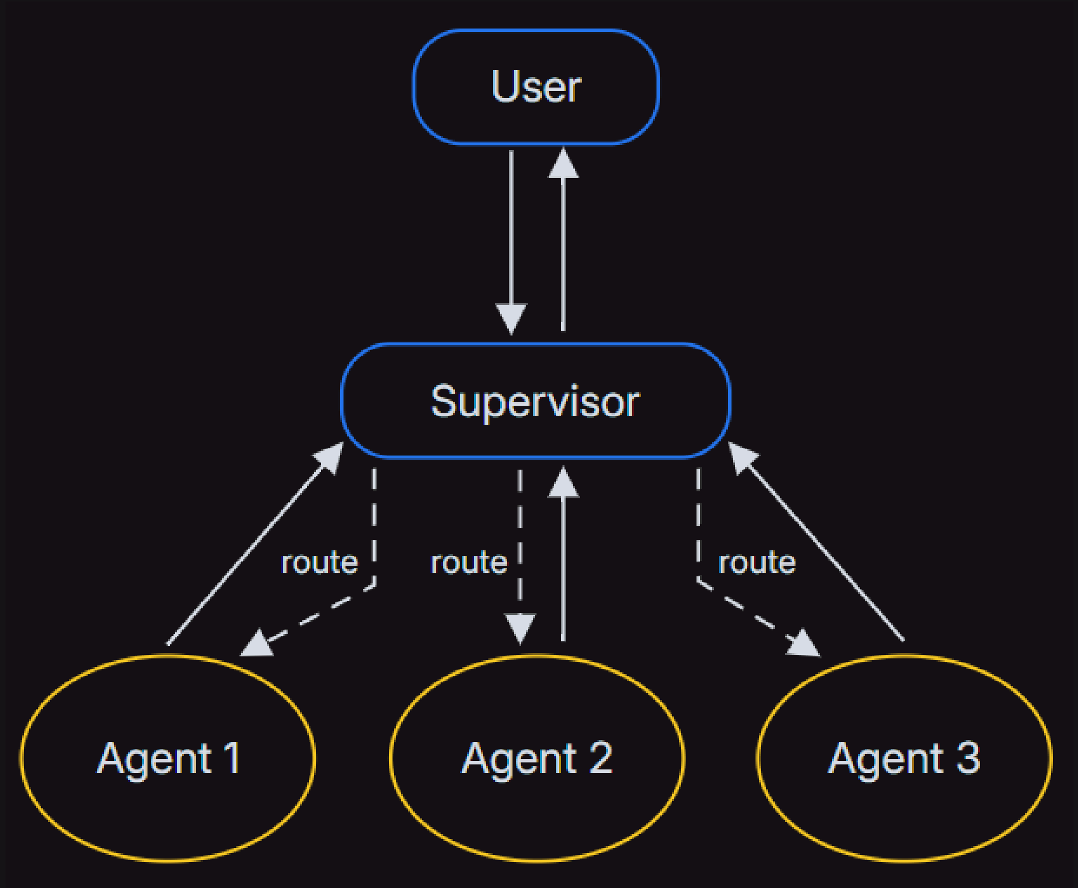
- A single agent-based Agentic AI System can face challenges where there are too many tools to handle, too many specialized tasks to handle and context states start growing too large
- A multi-agent system has several AI Agents that work together or independently to solve a larger complex problem



Multi-Agent System Essentials

The Primary benefits of using multi-agent systems are

- Modularity
  - Separate agents make it easier to develop, test, and maintain agentic systems
- Specialization
  - You can create expert agents focused on specific domains, which helps with the overall system performance
- Control
  - You can explicitly control how agents communicate



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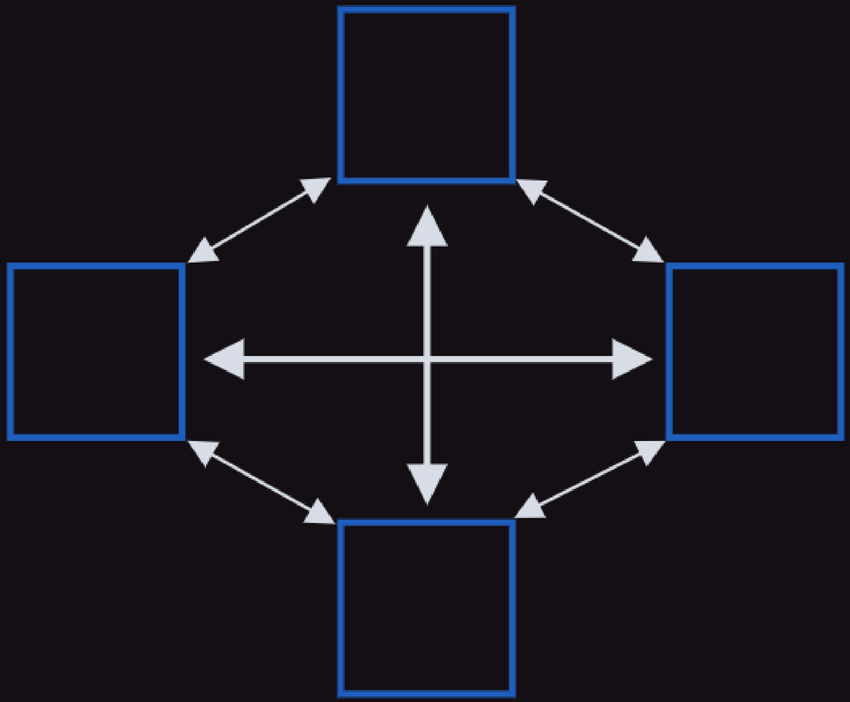
Network Architecture

- Each agent can communicate with every other agent
- Any agent can decide which other agent to call next
- Typically also known as collaborative multi-agent systems



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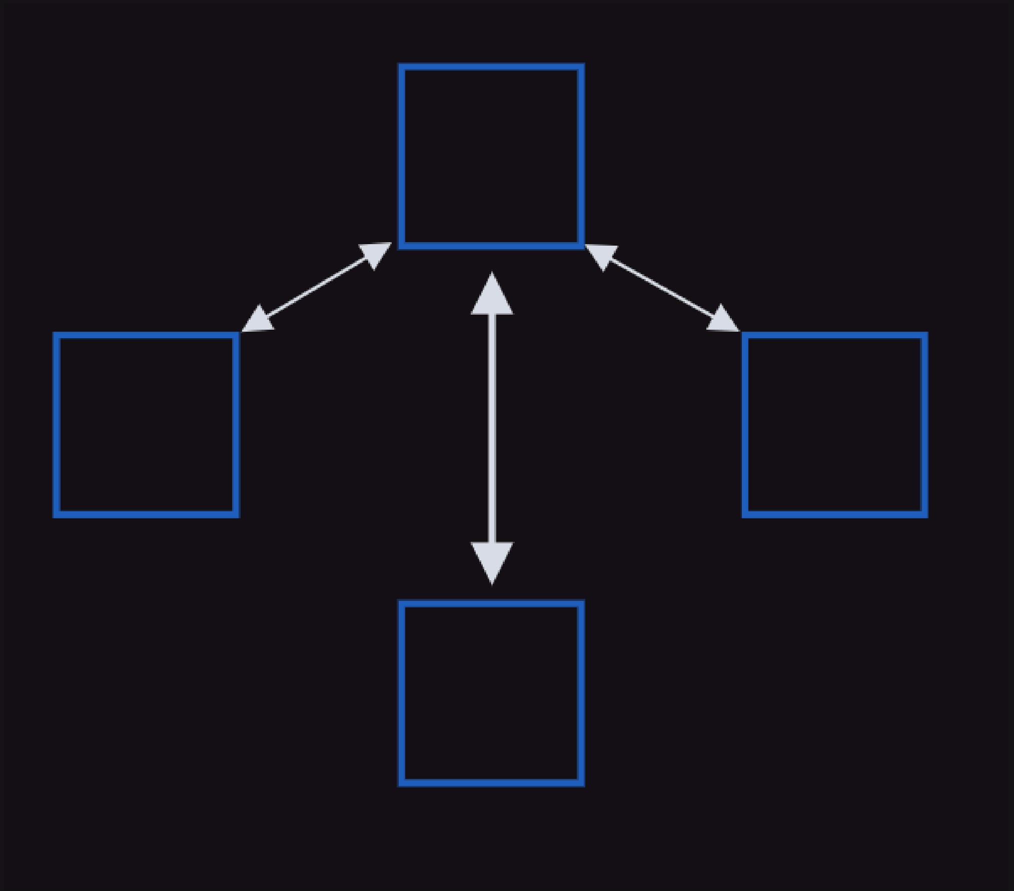
Supervisor Architecture

- We first build separate agents (known as sub-agents) to tackle a specific set of tasks
- We can then choose to use an LLM to orchestrate the different agents
- Each sub-agent communicates with a single supervisor agent
- Supervisor agent makes decisions on which agent should be called next.



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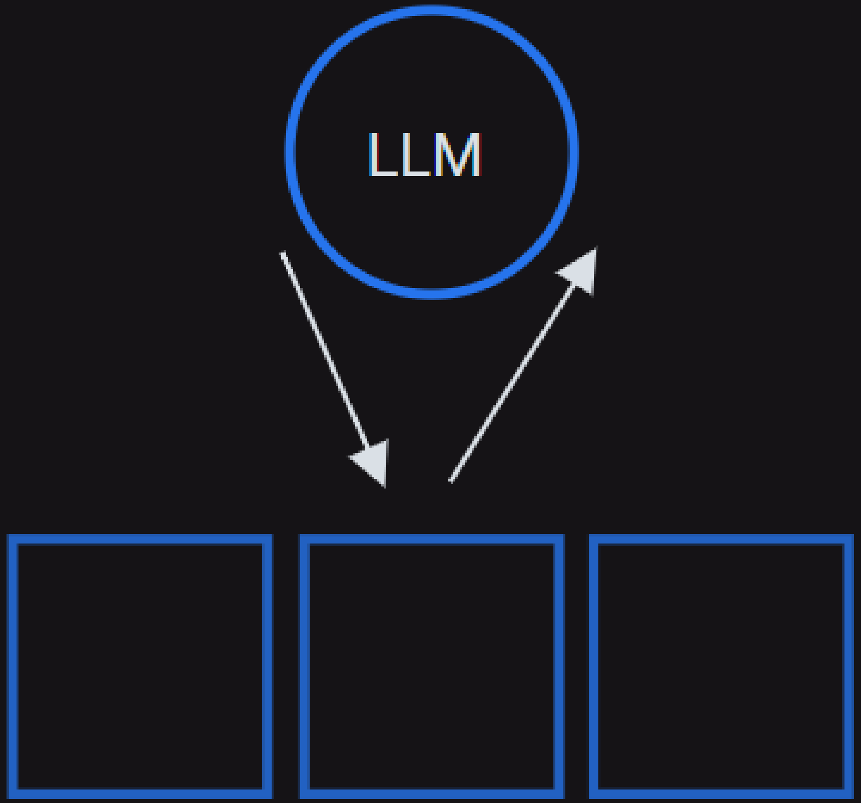
Supervisor (tool-calling) Architecture

- A special case of the supervisor architecture
- Individual agents can be represented as tools
- In this case, a supervisor agent uses a tool-calling LLM to decide which of the agent tools to call, as well as the arguments to pass to those agents.



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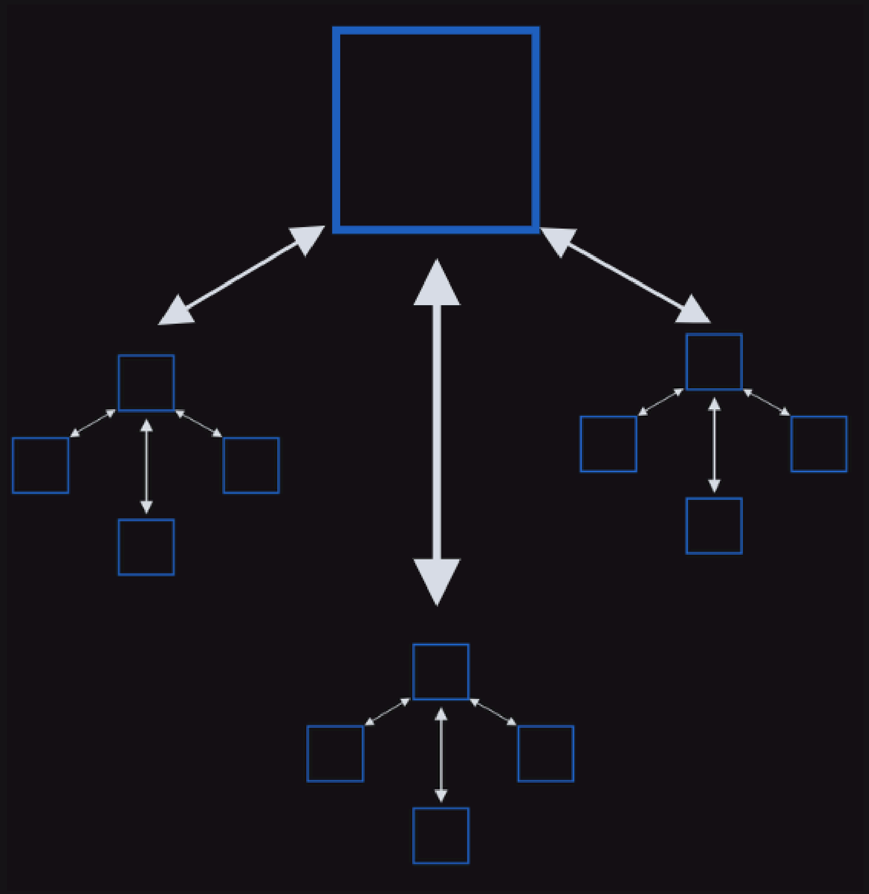
Hierarchical Architecture

- Think of it as multiple supervisory multi-agent systems with a primary supervisor overseeing them.
- Basically a supervisor of supervisor multi-agent systems
- Useful when tasks are too complex to be just routed to single sub-agents
- Specific sets of tasks are handed to specific supervisor agents
- The supervisor of supervisors controls the overall delegation and flow



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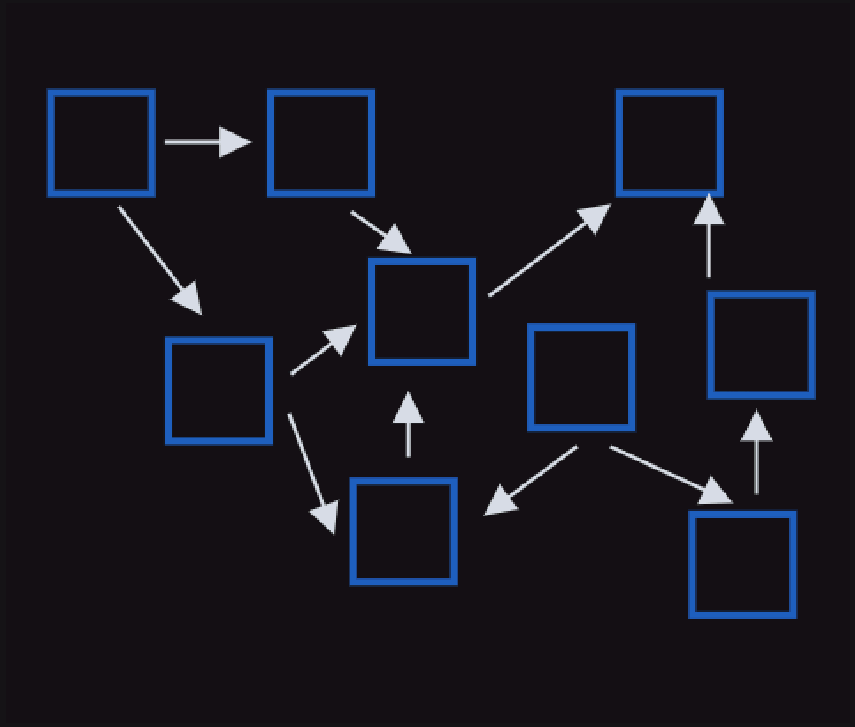
Custom Architecture

- Each agent communicates with only a subset of agents.
- You can combine different architectures and patterns based on your use-case
- Some parts could also be deterministic AI workflows



Thanks