REPUBLIC POLYTECHNIC

Flowise Fusion: Building AI Crews

Build Smart Teams, Flow by Flow

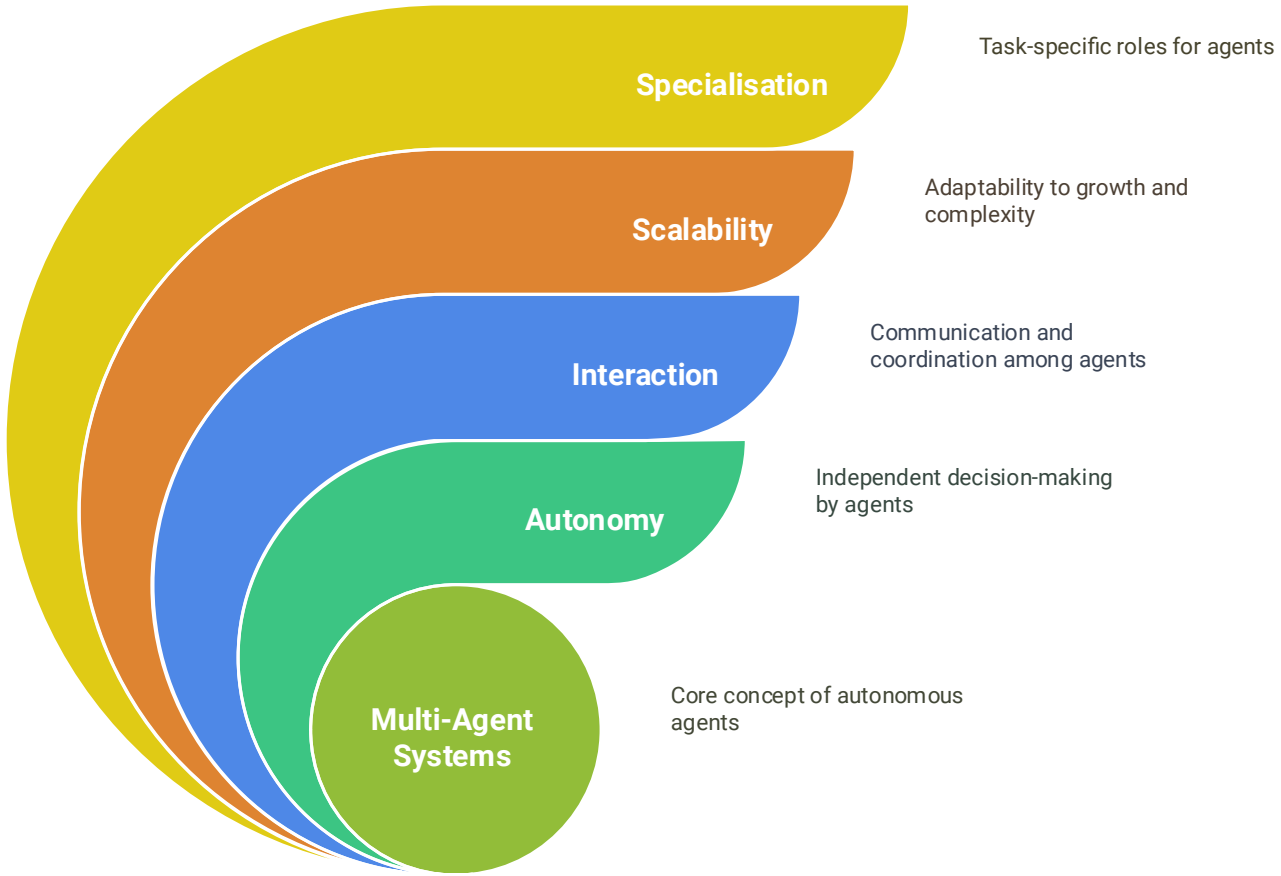
Multiple AI Agents

What's better than one agent?
Multiple agents!

What are Multi-Agent Systems?

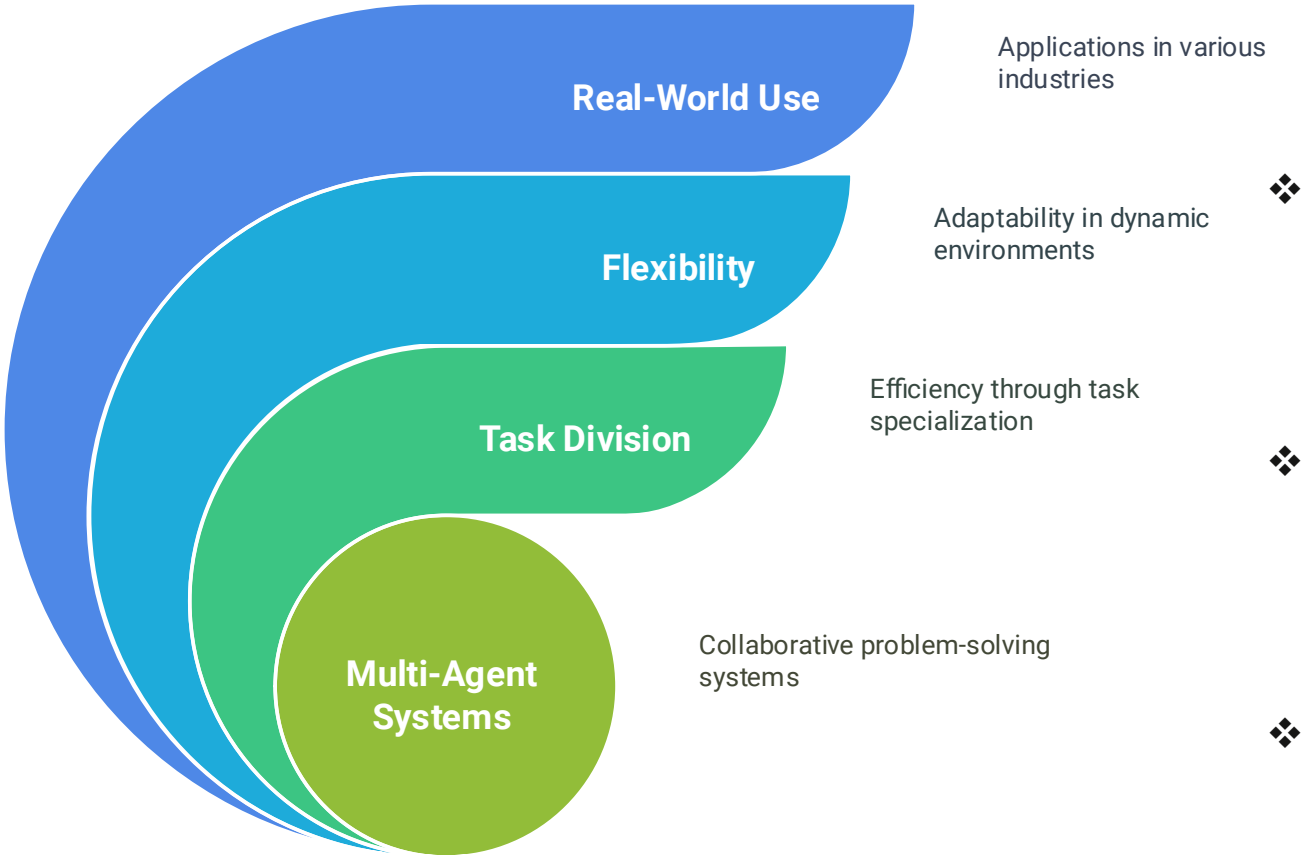
- **Collection of AI Agents Working Together**
  Multi-agent systems consist of autonomous AI agents interacting within a **shared environment**.
- **Solve Complex Problems via Collaboration**
  Agents communicate, share tasks, and combine insights to address challenges that may often **exceed the capability of any single agent**.
- **Each Agent Has a Specialised Role**
  Roles may include sensing, planning, decision-making and execution, each tailored to the agent's strengths.
- **Example: Teams of Drones Coordinating Flight**
  One drone maps terrain, another identifies obstacles, while others manage delivery route together forming a cohesive, intelligent swarm.

Features of Multi-Agent Systems



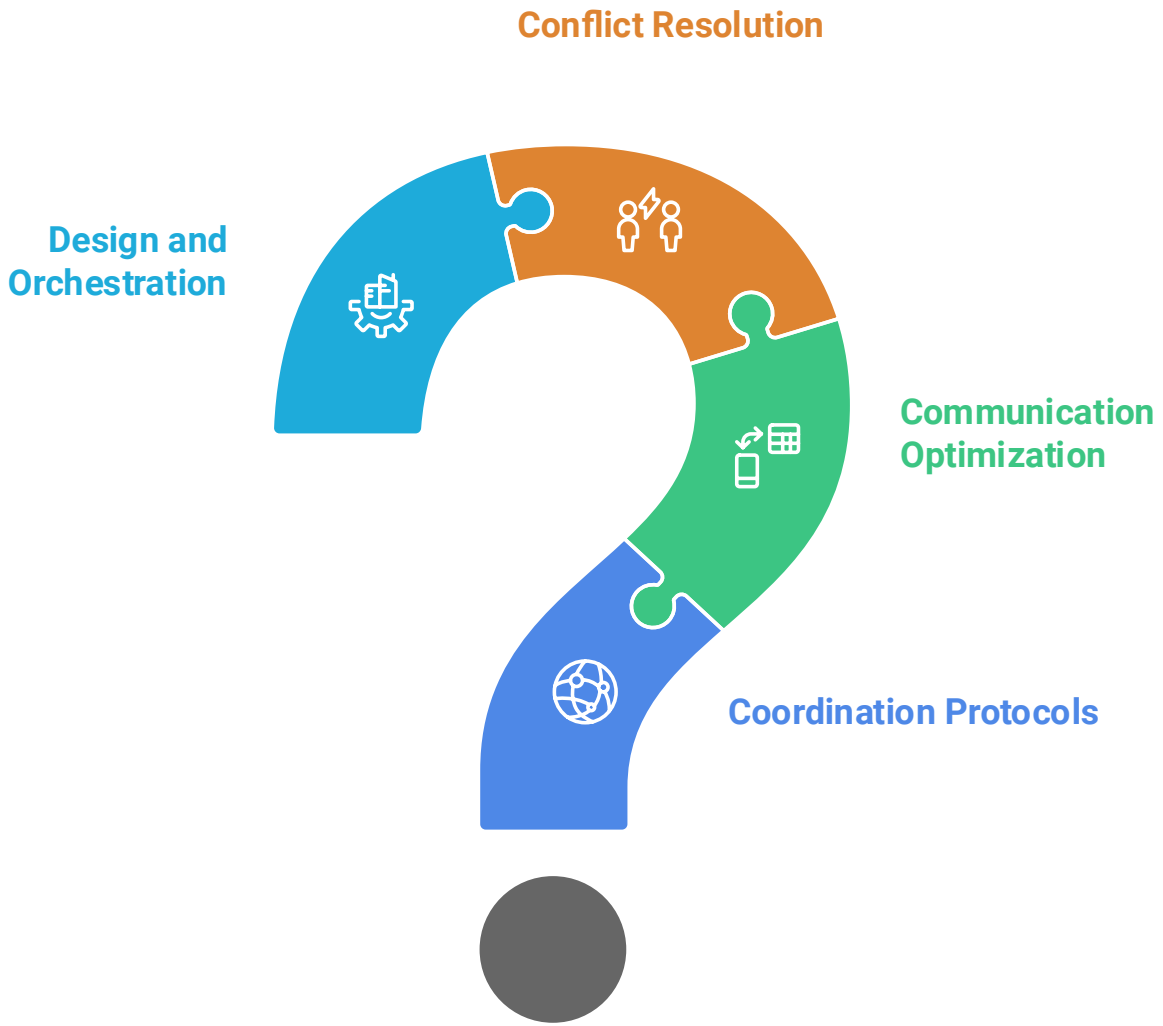
- **Specialisation**: Agents are designed for specific roles (e.g., data filtering, routing, monitoring), enabling efficient task distribution and parallel processing.
- **Scalability**: Systems can grow to include more agents, adapting to increased tasks or environments without central bottlenecks.
- **Interaction**: Agents exchange information, negotiate, and synchronise actions to achieve shared or individual objectives.
- **Autonomy**: Each agent operates without direct human control, making its own decisions based on goals and inputs.

Benefits of Multi-Agent Systems



- **Real-World Use**: Applied in robotics (e.g., swarm drones), gaming (NPC coordination), finance (market simulations), and energy grids (load balancing and optimisation).
- **Flexibility in Dynamic Environments**: Agents can adapt to changes, recover from failures, or reassign roles in real-time, making the system robust and resilient.
- **Improved Efficiency Through Task Division**: Specialised agents handle different parts of a workflow simultaneously, speeding up processing and reducing redundancy.
- **Tackle Problems Too Big for Single Agents**: Complex, large-scale tasks—such as disaster response or traffic management—can be broken down and solved collaboratively.

Challenges of Multi-Agent Systems



- **Coordination Can Be Chaotic**
  Without clear protocols, agents may duplicate efforts, miss dependencies, or act at cross-purposes.
- **Communication Overhead**
  Constant data exchange can strain bandwidth, slow down decisions, or introduce latency in fast-moving environments.
- **Potential for Conflicts Between Agents**
  Agents may pursue conflicting goals or compete for limited resources, leading to inefficiencies or deadlocks.
- **Requires Careful Design and Orchestration**
  Successful systems need well-defined roles, interaction rules, and fallback strategies to ensure stability and scalability.

Flowise AgentFlow V2

- **Modular Workflow Design:** AgentFlow V2 uses standalone, specialised nodes connected visually to define logic, data flow, and execution paths.
- **Advanced Orchestration:** Supports complex patterns like loops, branching, and human-in-the-loop interactions through a node-dependency and execution queue system.
- **Agent Collaboration:** Enables agent-to-agent task delegation and communication, with shared access to full conversation history for better context and coordination.
- **Human-in-the-Loop + Checkpoints:** Execution can pause for human input and resume later, supporting long-running, stateful workflows.
- **Shared State & Streaming:** Agents may exchange data across steps via Flow State and support real-time streaming of responses using Server-Sent Events (SSE).

Flowise AgentFlow V2 Patterns

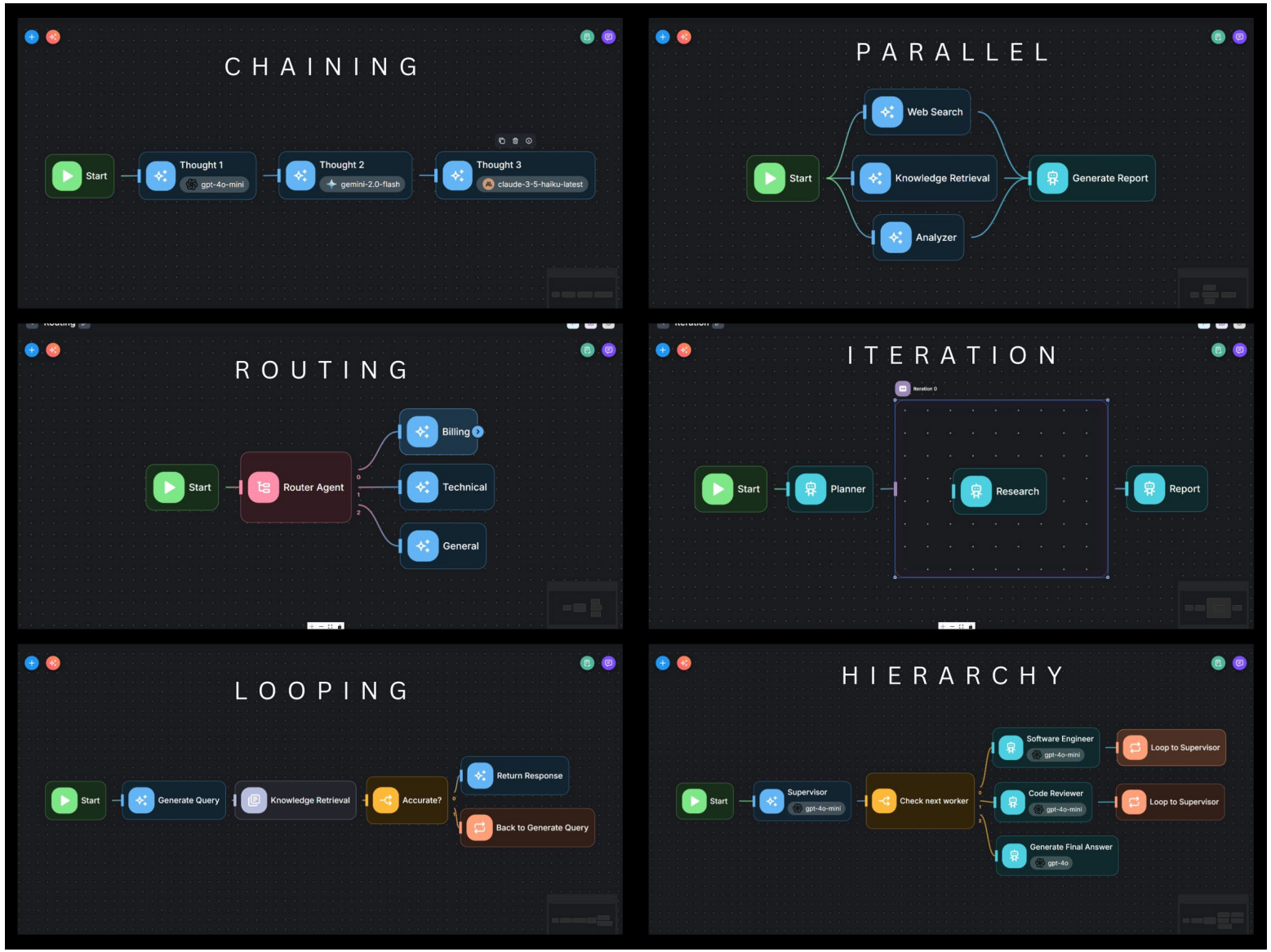


Image from https://docs.flowiseai.com/using-flowise/agentflowv2

Flowise AgentFlow V2 Nodes

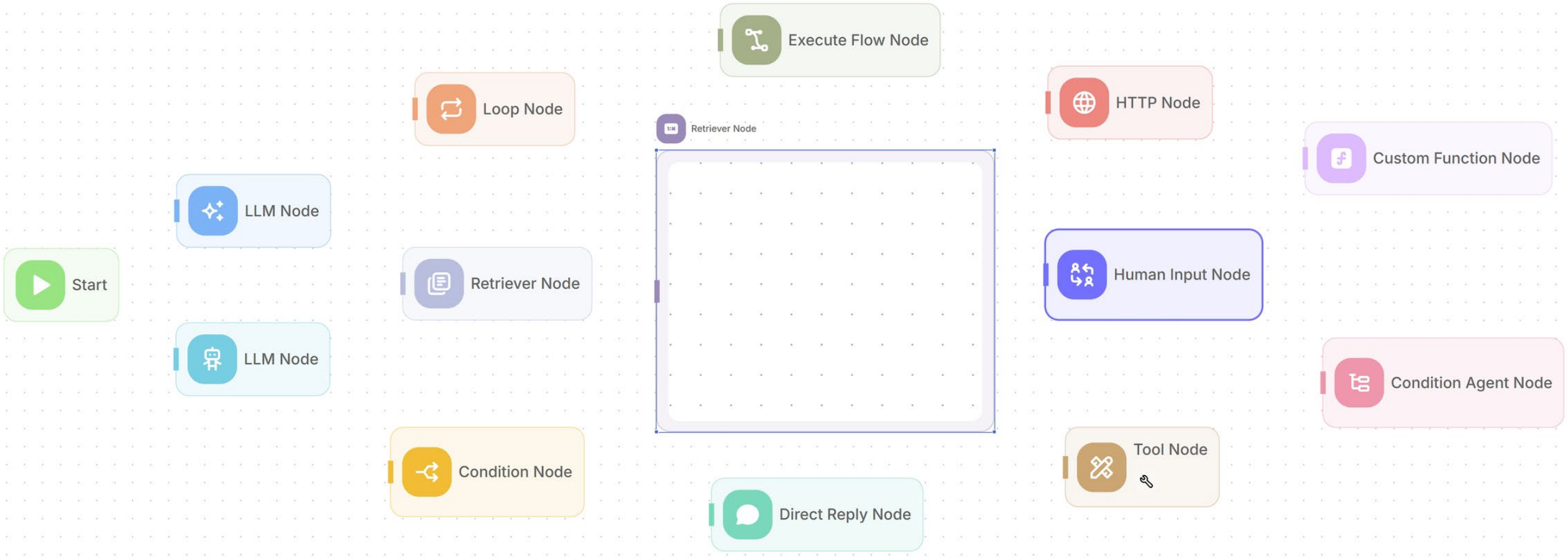


Image from https://docs.flowiseai.com/using-flowise/agentflowv2

Reference: https://docs.flowiseai.com/using-flowise/agentflowv2

Flowise

Activity

Activity: Flowise

- Two different methods to build a RAG system in Flowise covered today:
  - Custom Assistant (20 mins): Follow the detailed instructions included in the activity document entitled:

    Flowise Assistant on Hugging Face. (Activity 1).docx

  - Multi-Agent Flow: Follow the detailed instructions included in the activity document entitled:

    Flowise Multi-Agent on Hugging Face. (Activity 2).docx

- Don't forget to post to MST. Posting details are given in the activity documents.

Lesson 11

Summary of Material Covered

Lesson 11 Review

- **Multi-Agent Systems**: AI agents collaborate in shared environments to solve complex problems more effectively than individual agents, using specialisation, autonomy, and interaction.
- **Benefits & Challenges**: Multi-agent systems offer scalability, efficiency, and adaptability, but require careful coordination to avoid conflicts, communication overhead, and design complexity.
- **Flowise AgentFlow V2**: A modular architecture that enables visual design of sophisticated AI workflows, supporting agent collaboration, human input checkpoints, and real-time data exchange.
- **Workflow Patterns & Nodes**: Flowise supports patterns like chaining, parallelism, and loops, using specialised nodes (e.g., LLM Node, Human Input Node, Retriever Node) for flexible orchestration.
- **Practical Application**: Learners apply these concepts by building RAG systems in Flowise using either a Custom Assistant or Multi-Agent Flow, with structured activity guides provided.

Thank you

School of Infocomm

C240 AI Essentials and Innovations