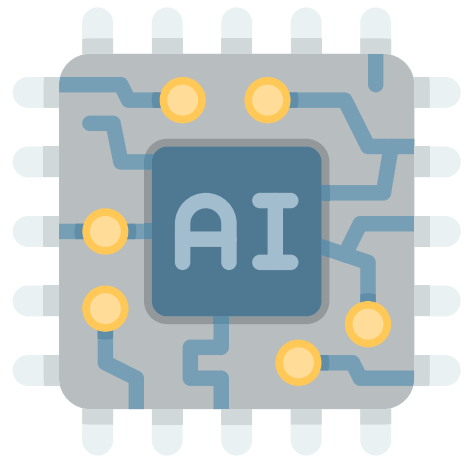# Artificial Intelligence

Unit 4

Topics to be covered...

Intelligent Agent

Intelligent Agent Architecture

Logic based agent architecture

Reactive agent architecture

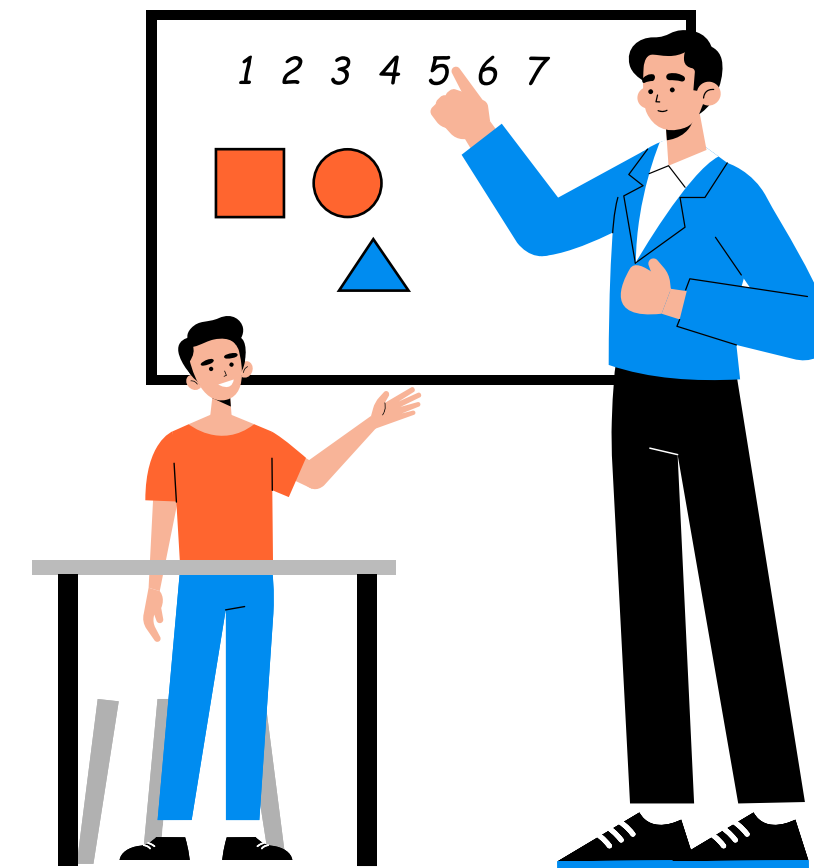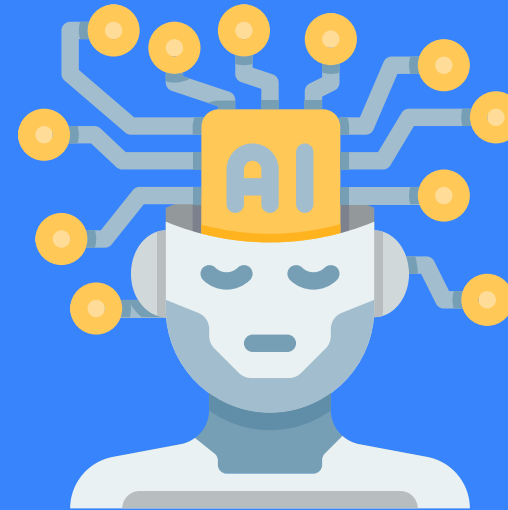Belief desire intension agent architecture

Agent communication

Multiagent system characteristics

Negotiation and Bargaining

Trust and Reputation in Multiagent system

Happy Ending!

Intelligent Agent

Intelligent Agents

- An intelligent agent is an autonomous entity which acts upon an environment using sensors and actuators for achieving goals.
- An intelligent agent may learn from the environment to achieve their goals

- **Following are the main four rules for an AI agent:**
  - Rule 1: An AI agent must have the ability to perceive the environment.
  - Rule 2: The observation must be used to make decisions.
  - Rule 3: Decision should result in an action.
  - Rule 4: The action taken by an AI agent must be a rational action.
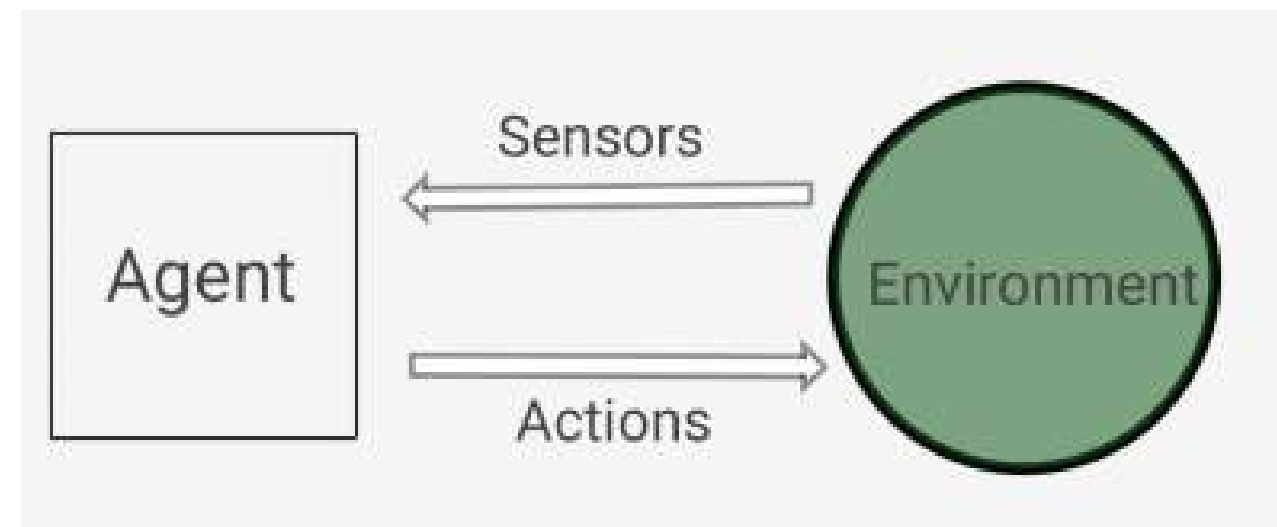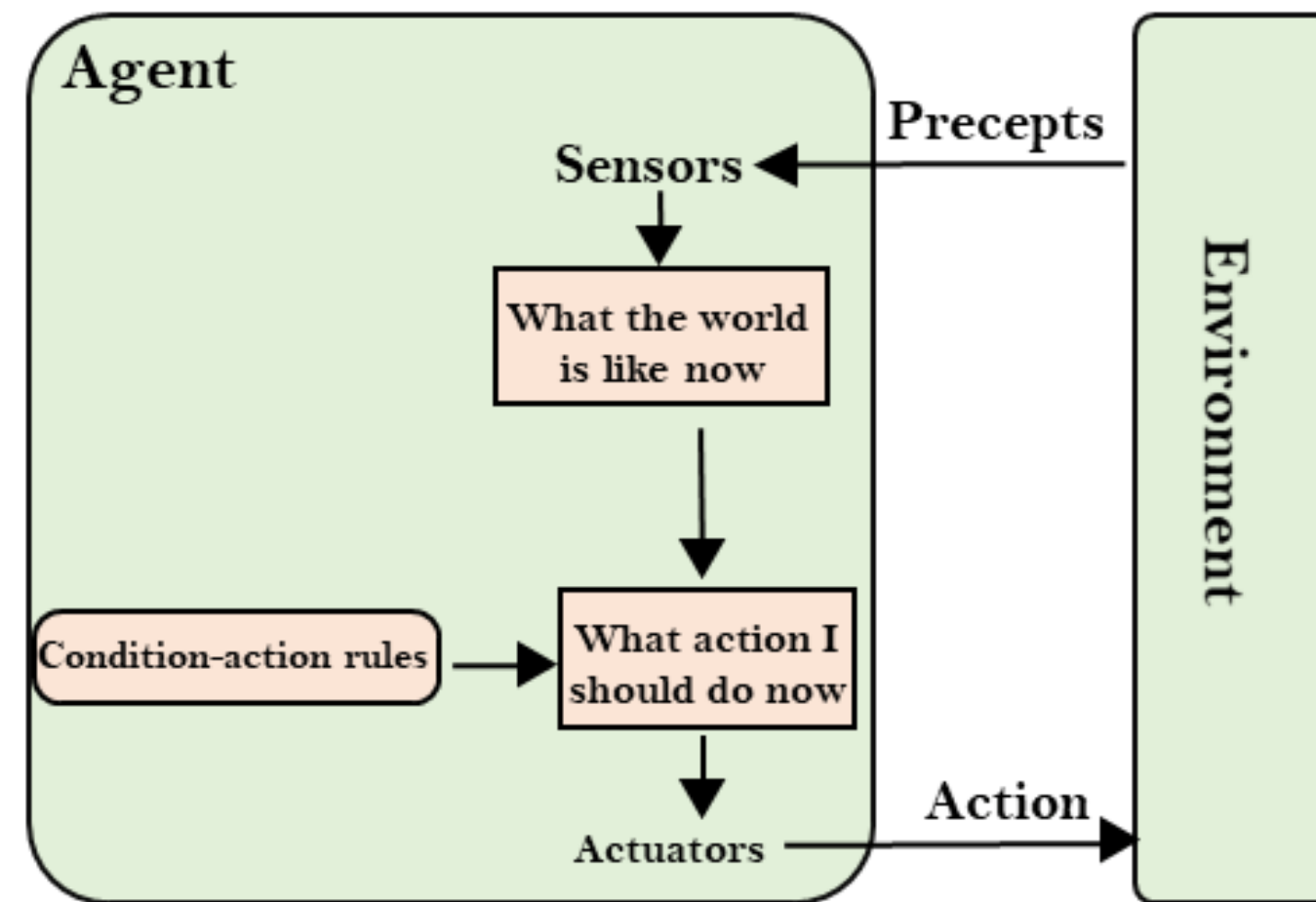
Categories of Agents

1. **Logic based agents**
2. **Reactive agents**
3. **Belief-desire-intension agents**
4. **Layered architecture**
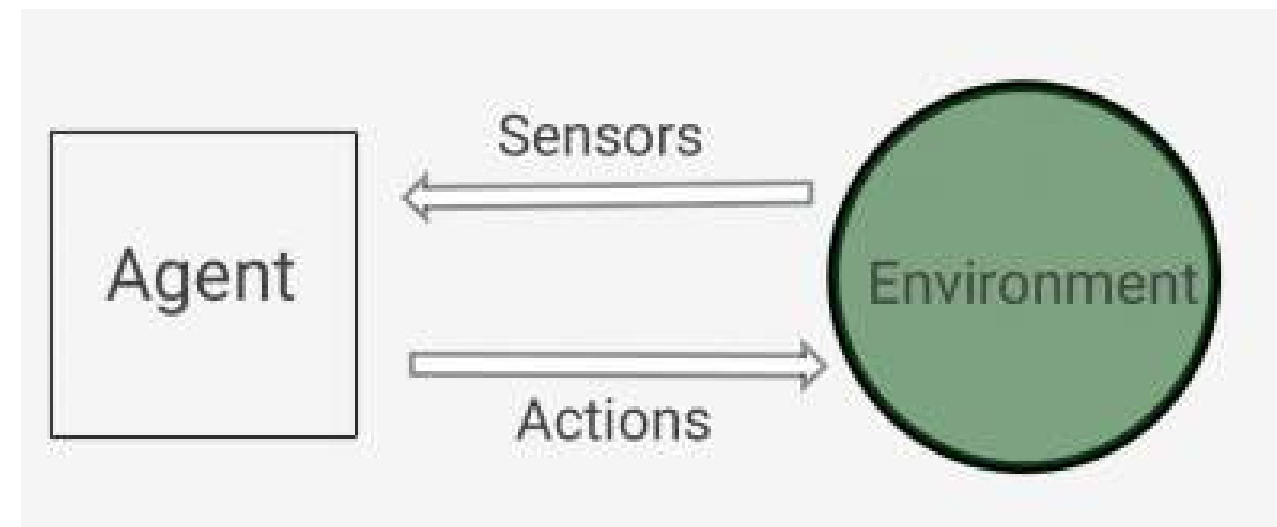
Logic based agent

1. Logic based agent

1. Logic based agent

- An agent can represents the knowledge of its world, its goals and the current situation.
- Logical agent has a collection of sentences in logic.
- What to do with the help of logical sentences.
- Knowledge and reasoning are important.

Advantage:
- It have a clean semantic due to which they can be used over long period of time.

Disadvantage:
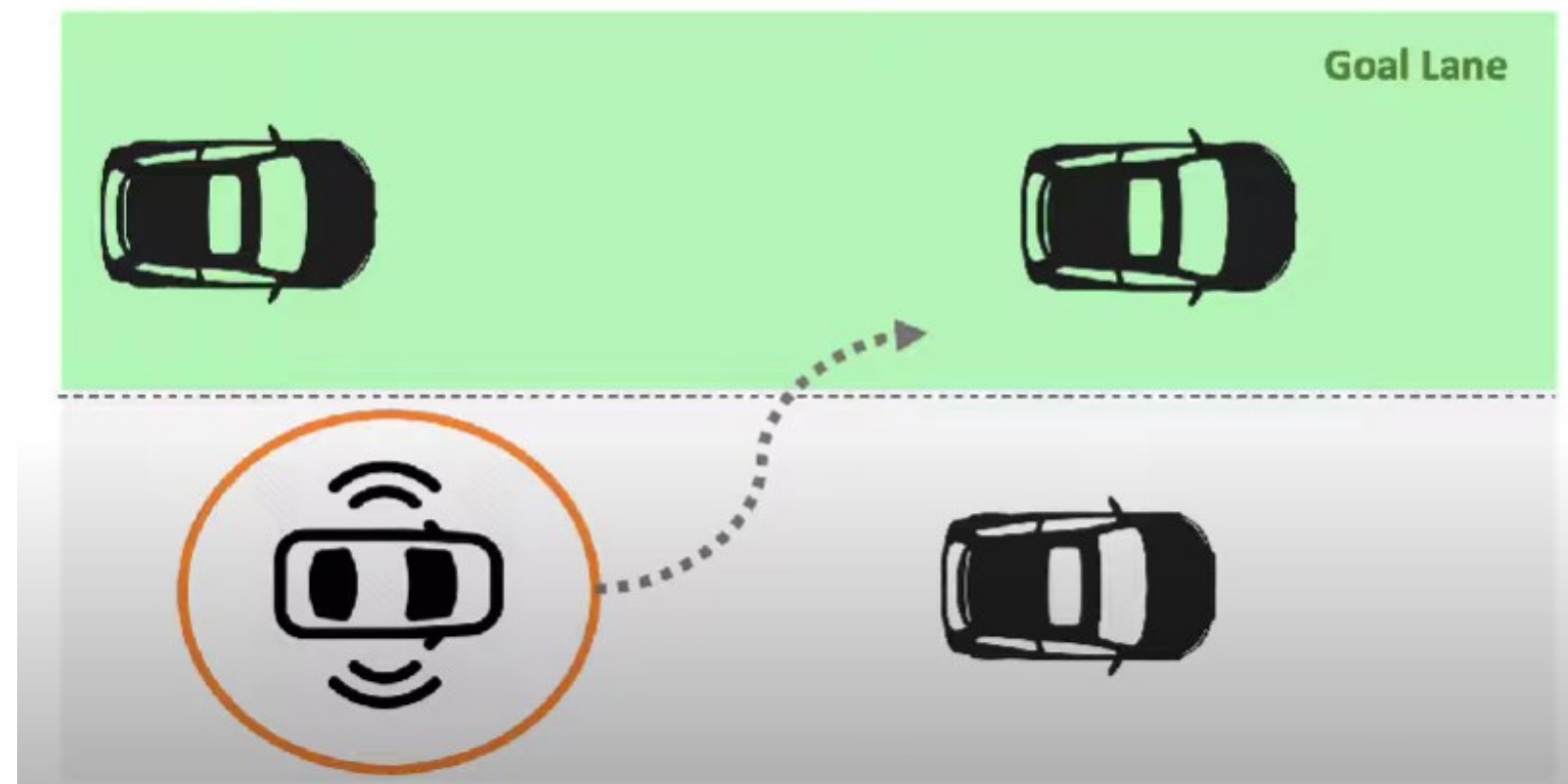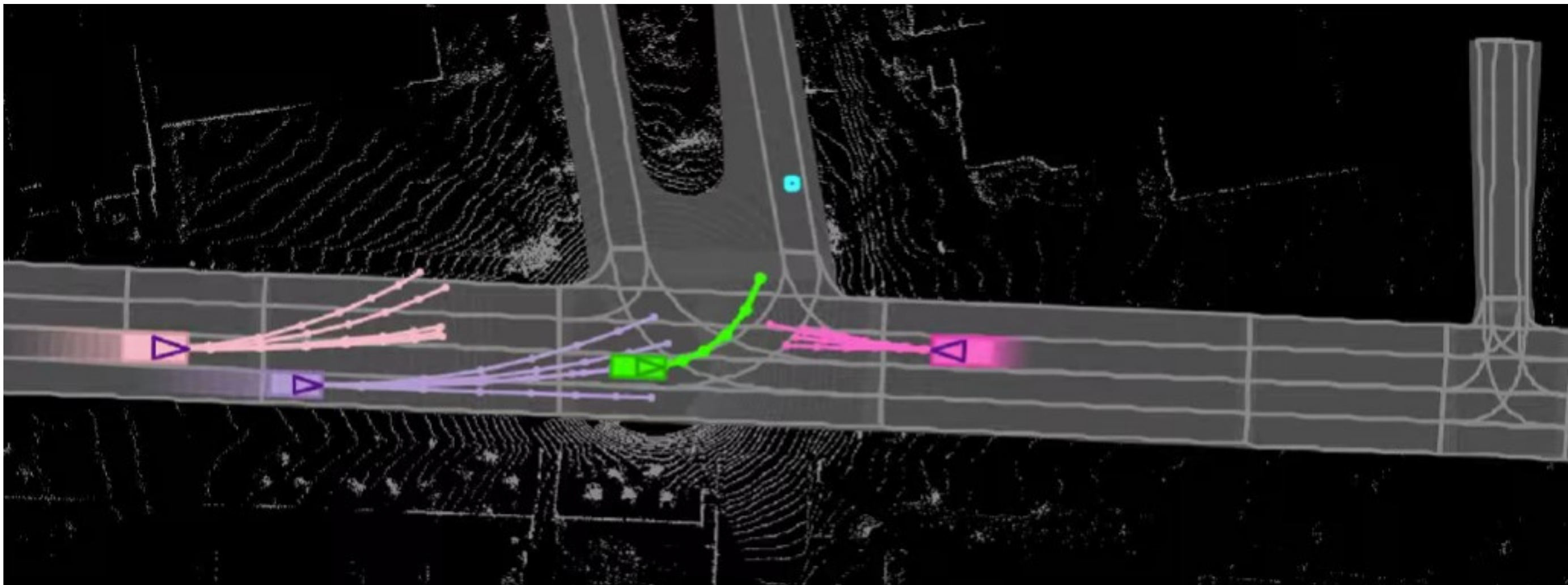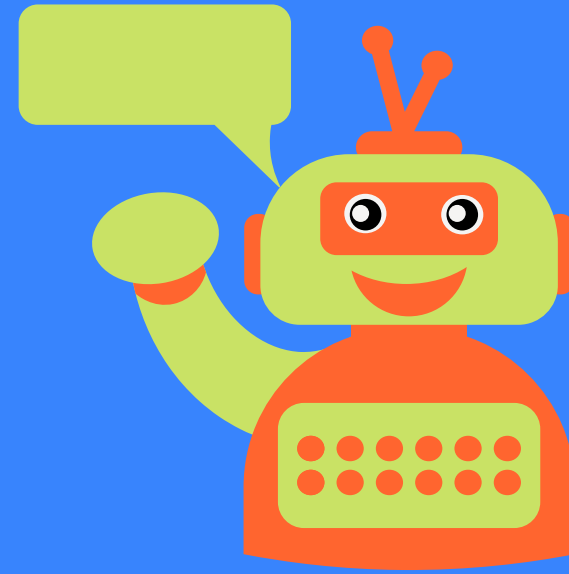- It creates issues with complex, dynamic environments.
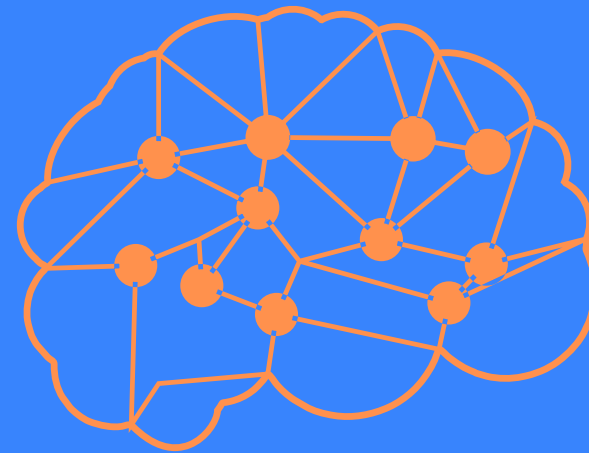
Reactive agent

2. Reactive agent

- The reactive agent architecture are sometime referred toa as behavioral, situated. and reactive.
- It is referred to as reactive because search systems are 100% understood to be just reacting to an environment without reasoning about it.

2. Reactive agent

Belief-Desire-Intension agent

3. Belief-Desire-Intension agent

- The BDI agent architecture is based on Michael Bratman's philosophical theory (Bratman 1987) that explains reasoning through the following attitudes: beliefs, desires and intentions.

Beliefs are the agent's model of the environment, basically what it believes to be true. It's not knowledge as some of its beliefs might be false.

Desires represent the ideal state of the environment for the agent. Like in the human mind, these represent things we would like to see accomplished in the future. A desire might be realistic or not, as it occurs with human thinking, and may or may not be achievable.

Intentions represent a subset of desires that the agent has taken as goals to be accomplished soon.

Belief represents the agent's model of the world, desire represents the agent's goal(s) and intention represents the action choice.

3. Belief-Desire-Intension agent

Robotic Process Automation (RPA) application—specifically, a Travel Assistant Agent.
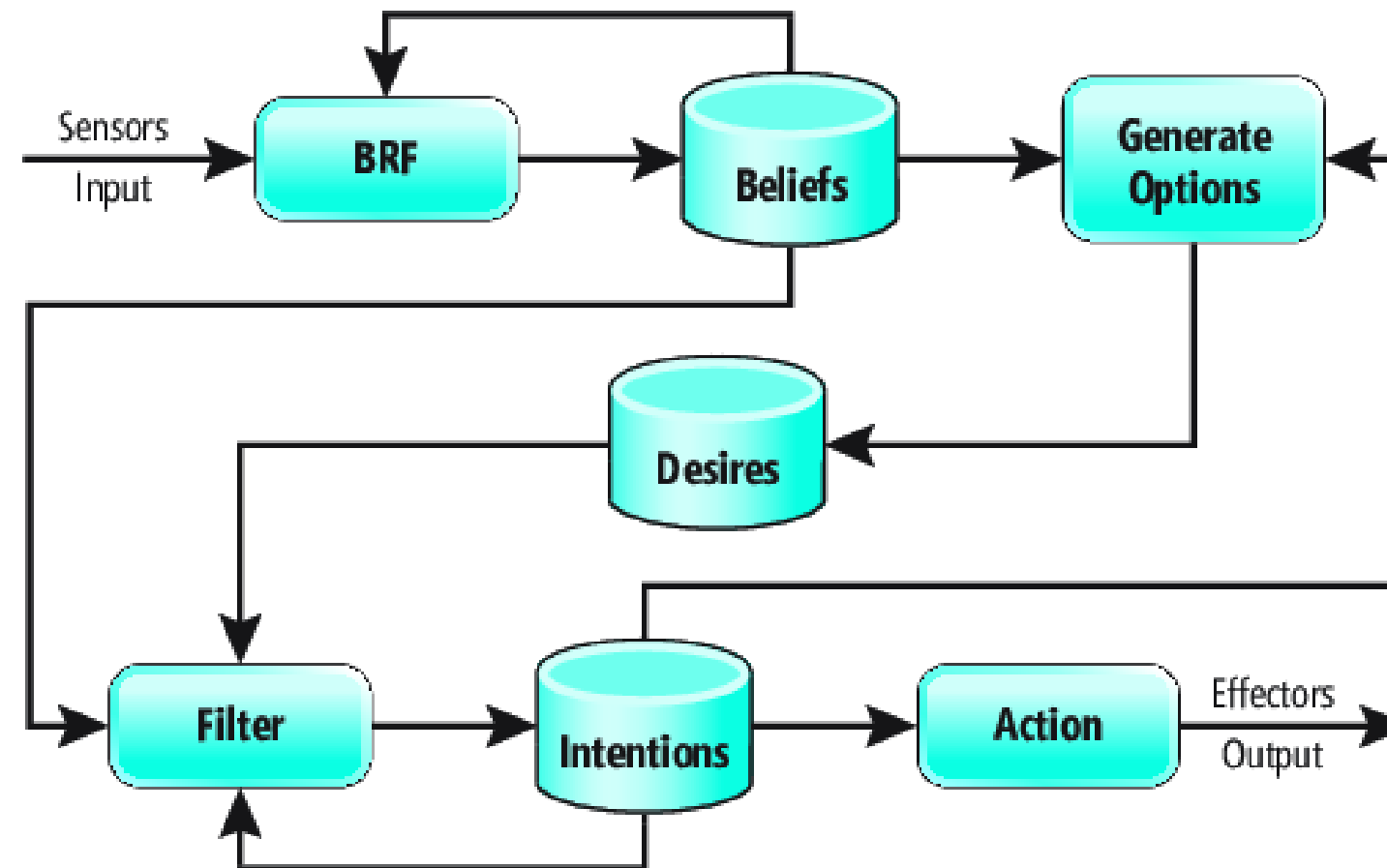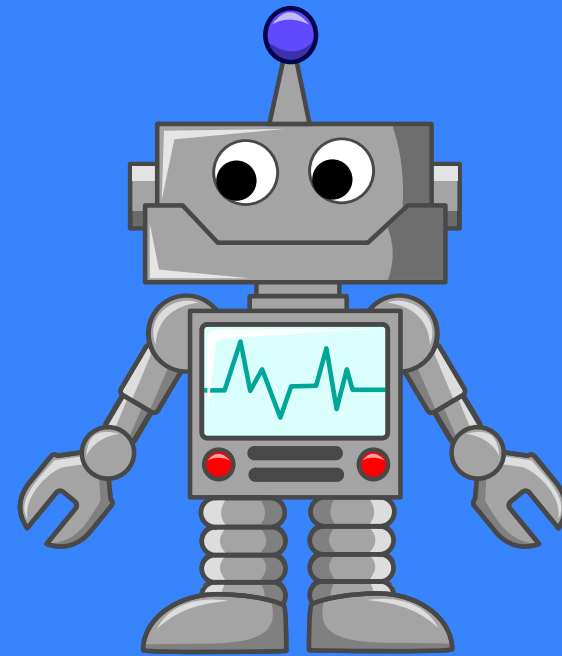
# 3. Belief-Desire-Intension agent

- **Advantages**
  - It uses a standard human reasoning process to reach to goal it is easy to understand.
  - It has clear functional decomposition.

- **Disadvantage**
  - Difficulty lies in knowing how to efficiently implement all BDI model functions.

Agent communication

Multiagent and Agent communication

- While acting in real world and agent may not be always in Singleton mode.
- It has to deal with the situation wherein other agents and related factors are affecting the agents environment.
- Such systems wherein multiple agent work together, communicate, co-operate and deal with the situation are termed as multi agent system .
- Multi agent system are essentially distributed systems which more efficient in the sense that they can be optimized and are mostly easier to understand and easier to develop especially when the problem being solved is itself distributed.
- Data and information itself is distributed is spinning at different geographical locations and needs to be handled through multiple agents.
- Data can come from various domains and multiple devices or components are involved in data generation.
- The system itself is too big and complex that needs to be separated in multiple components so as to reduce its complexity and size that can be handled easily.
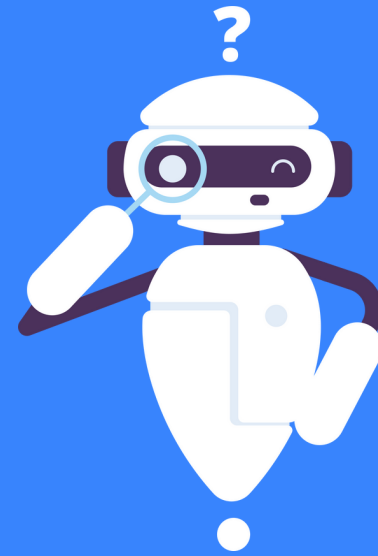
Multiagent system and characteristics

Multiagent system characteristics

- Each agent has just incomplete information and is restricted in its capabilities.

- The system control is distributed.

- Data is decentralized.

- Computation is asynchronous.

- multi agent environments are typically open and have no centralized design.

- Multi agent environments have agents that are autonomous and distributed and maybe self interested.
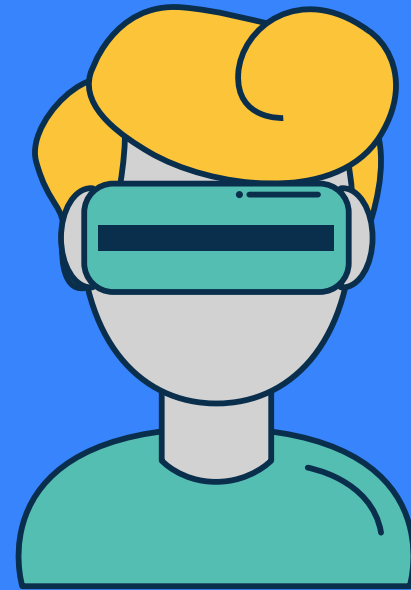
Negotiation and Bargaining

Negotiation and Bargaining

- **Negotiation:** discussions at which people try to decide or agree something.
- **Bargaining:** to discuss prices, conditions, etc. with somebody in order to reach an agreement that suits each person

- In a multi agent system negotiation is form of interaction that occurs among agents with different goals.
- Major challenges of negotiation and bargaining is to allocate is scars resources scarce resources among agents representing self interested parties the resources can be bandwidth commodities money processing power etc. The resource becomes scarce as competing claims for it can be simultaneously satisfied.
- Negotiation and bargaining is a process by which a joint decision is reached by two or more agents each trying to reach an individual goals or objective.

Negotiation and Bargaining

- Negotiation and bargaining mechanism should have the following attributes:
  - Efficiency
  - stability
  - simplicity
  - distribution
  - symmetry
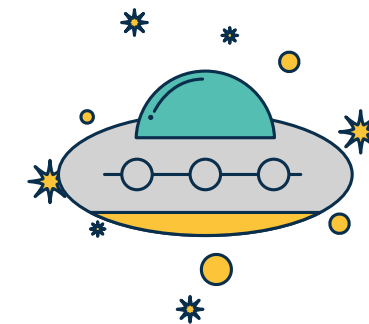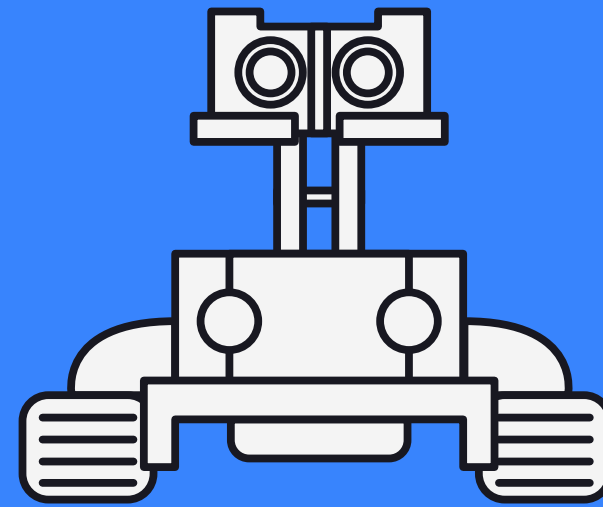
Trust and Reputation in Multiagent system

Trust and Reputation in Multiagent system

Trust

A couple of definitions that I like:

"*Trust begins where knowledge [certainty] ends: trust provides a basis dealing with **uncertain**, complex, and threatening images of the future.*" (Luhmann,1979)

"*Trust is the outcome of observations leading to the **belief** that the actions of another may be relied upon, **without explicit guarantee**, to achieve a goal in a **risky situation**.*" (Elofson, 2001)

Trust and Reputation in Multiagent system

Reputation

"After death, a tiger leaves behind
his skin, a man his reputation"

Trust and Reputation in Multiagent system

What is reputation good for?

- Reputation is one of the elements that allows us to **build trust**.

- Reputation has also a social dimension. It is not only useful for the individual but also for the society as a mechanism for **social order**.

Trust and Reputation in Multiagent system

- TMS is designed to ensure the integrity of an agent's knowledge, which should be stable, well founded and logically consistent.
- In a multi agent system, a group of agents can form a small society in which they play different kinds of role. The group defines the rules and the rules define the commitments associated with them.
- When an agent joins a group, he joins in one or more roles and acquires the commitments of the role.

Happy Ending!

Congratulations!

LIKE