INTRODUCTION TO AI

LECTURE 2

Agent

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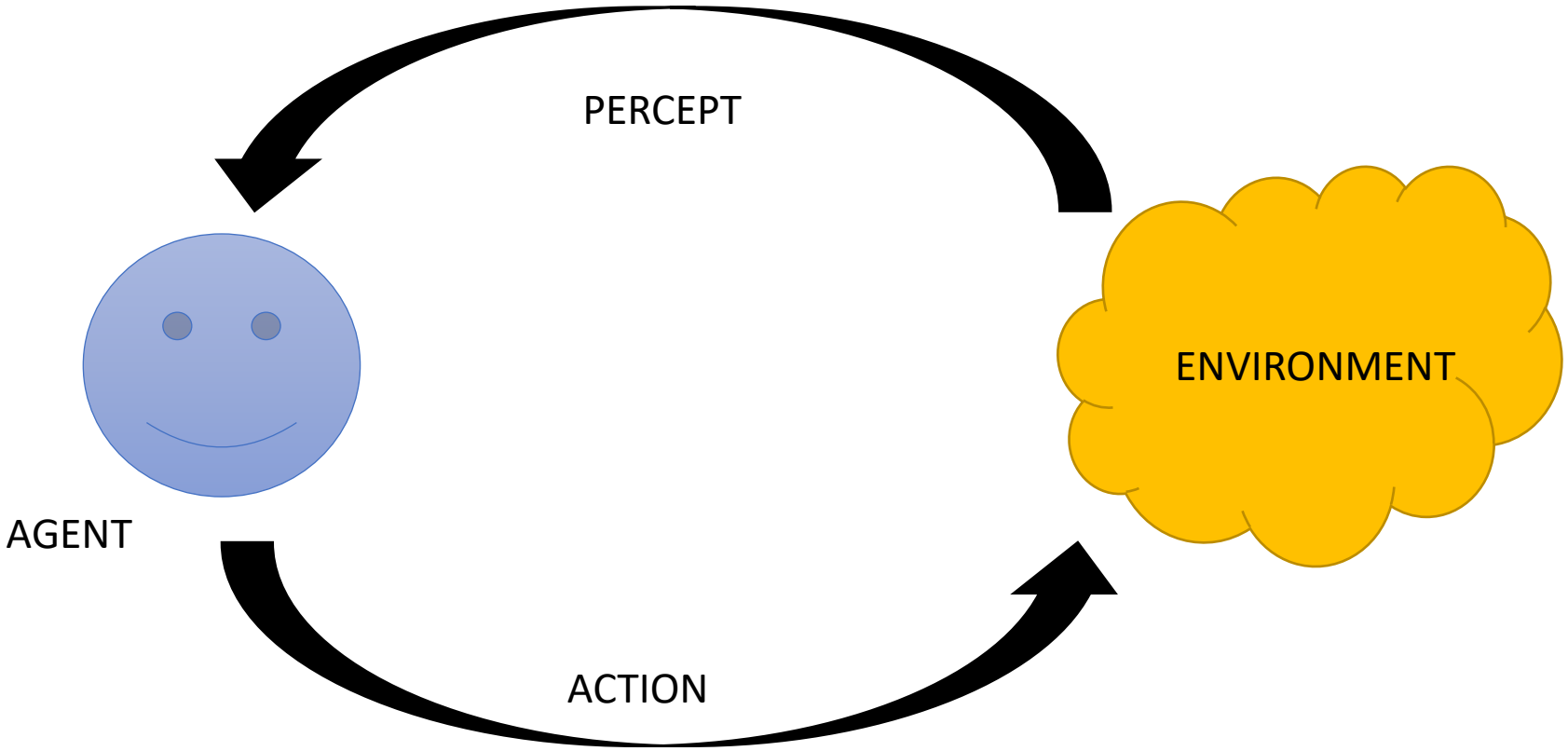
Definition of agent



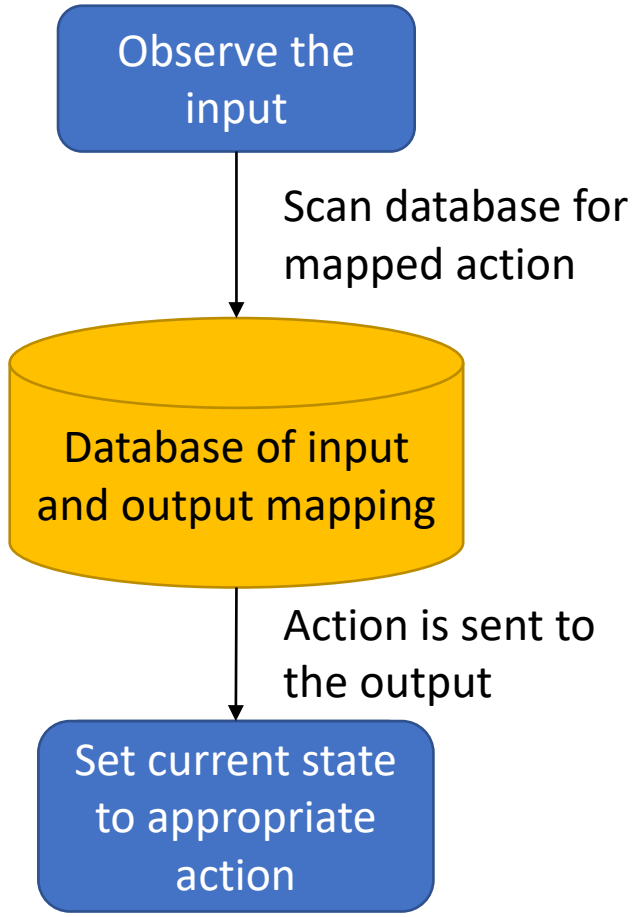
- Agents operate in an environment.
- Perceives its environment through sensors.
- Agents act using actuators or effectors.
- The agent has goals.

Key components and features of agents

- They have sensors, actuators, and a goal to meet.
- They are programmed to convert percept signals into actions to meet goals.
- Performance Measure to evaluate an agent.
- While in the current state, the agent should independently plan actions to maximize progress toward goals.

Features:

- Reactiveness: Must act within a defined timeframe.
- Proactiveness: Goal-oriented.
- Social Ability: Can interact with other agents.
- Self-Learning: Update knowledge base from experience.
- Movable: Can move
- Self-Governing: Can have full control of self-actions.



Rational agents

- A rational agent could be a human, computer, robot, or program that carries out tasks based on pre-defined rules and procedures. The idea is that the agent can be programmed to follow specific instructions independently to make decisions rather than requiring its programmer to write every decision down manually.

A rational agent has four primary characteristics:

- **Perception:** The ability to perceive the current state of the environment and gather relevant information.
- **Actuators:** The ability to take actions within the environment to achieve its goals.
- **Performance measure:** A way to evaluate the success or failure of the agent's actions.
- **Rationality:** The ability to make decisions based on logical reasoning and optimize behavior to achieve its goals, considering its perception of the environment and the performance measure.
- **Learning Curve:** It can learn quickly and rectify actions if found no-goal oriented.

P-e-a-s property of agent

P- Performance Measure

E- Environment

A- Actuator

S- Sensor

Self-Driving Car:

PM: Fuel Efficiency, Safety, Optimum Speed, Comfort

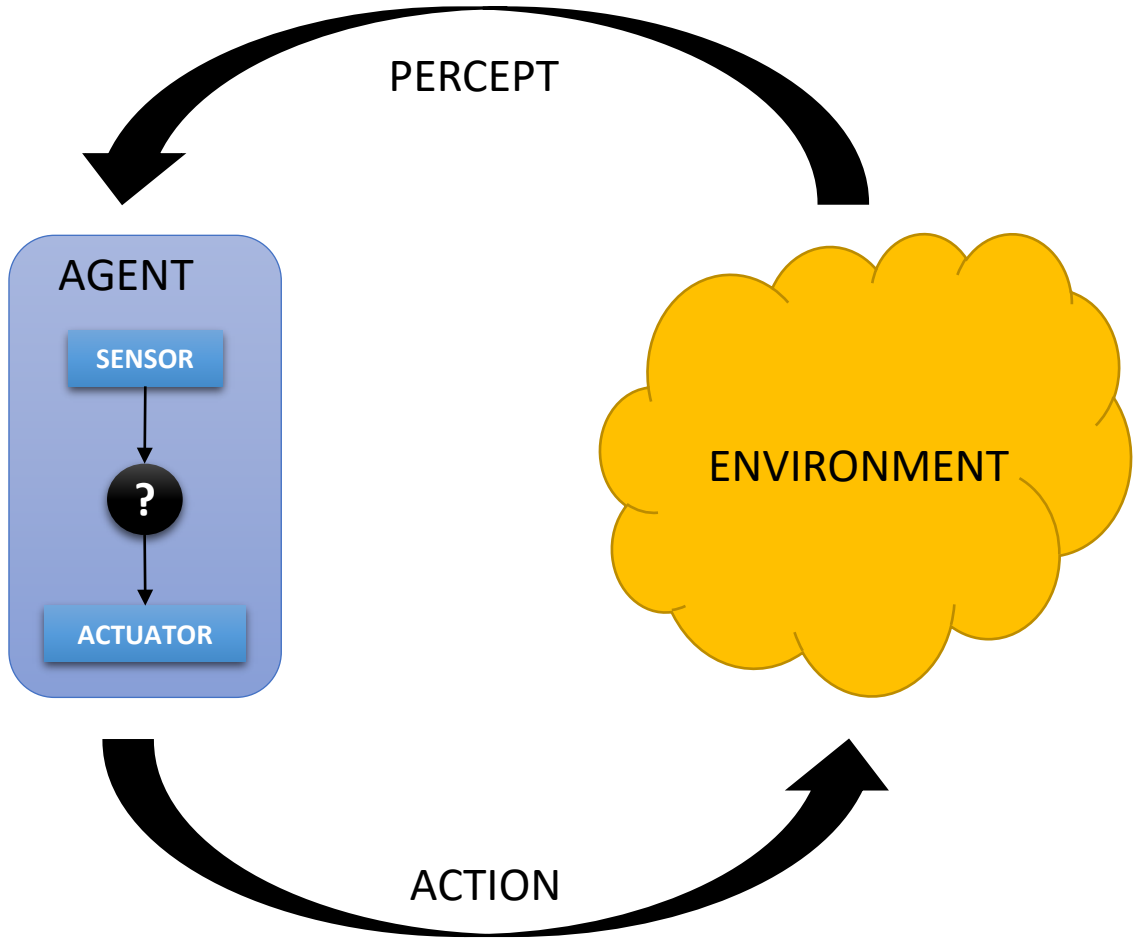
Environment: Road, Traffic, Climate

Actuators: Steering Wheel, Breaks, Accelerator, Gear, Light, Horn

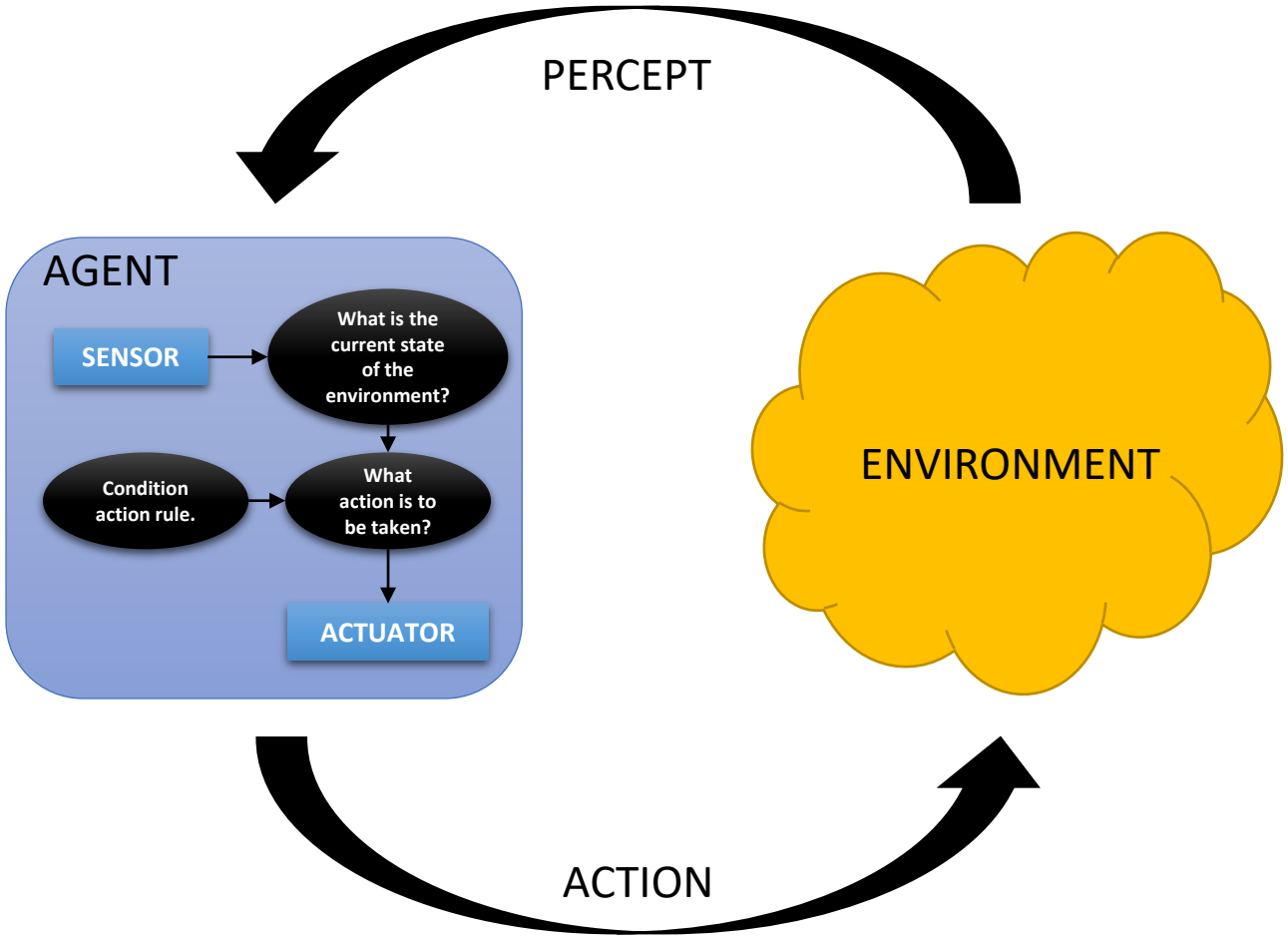
Sensors: Camera, Microphone, Sonar, IR, GPS

Types of agents

- Simple Reflex Agent
- Model-Based Reflex Agent
- Goal-Oriented Agent
- Utility-Oriented Agent
- Learning Agent



Simple reflex agent

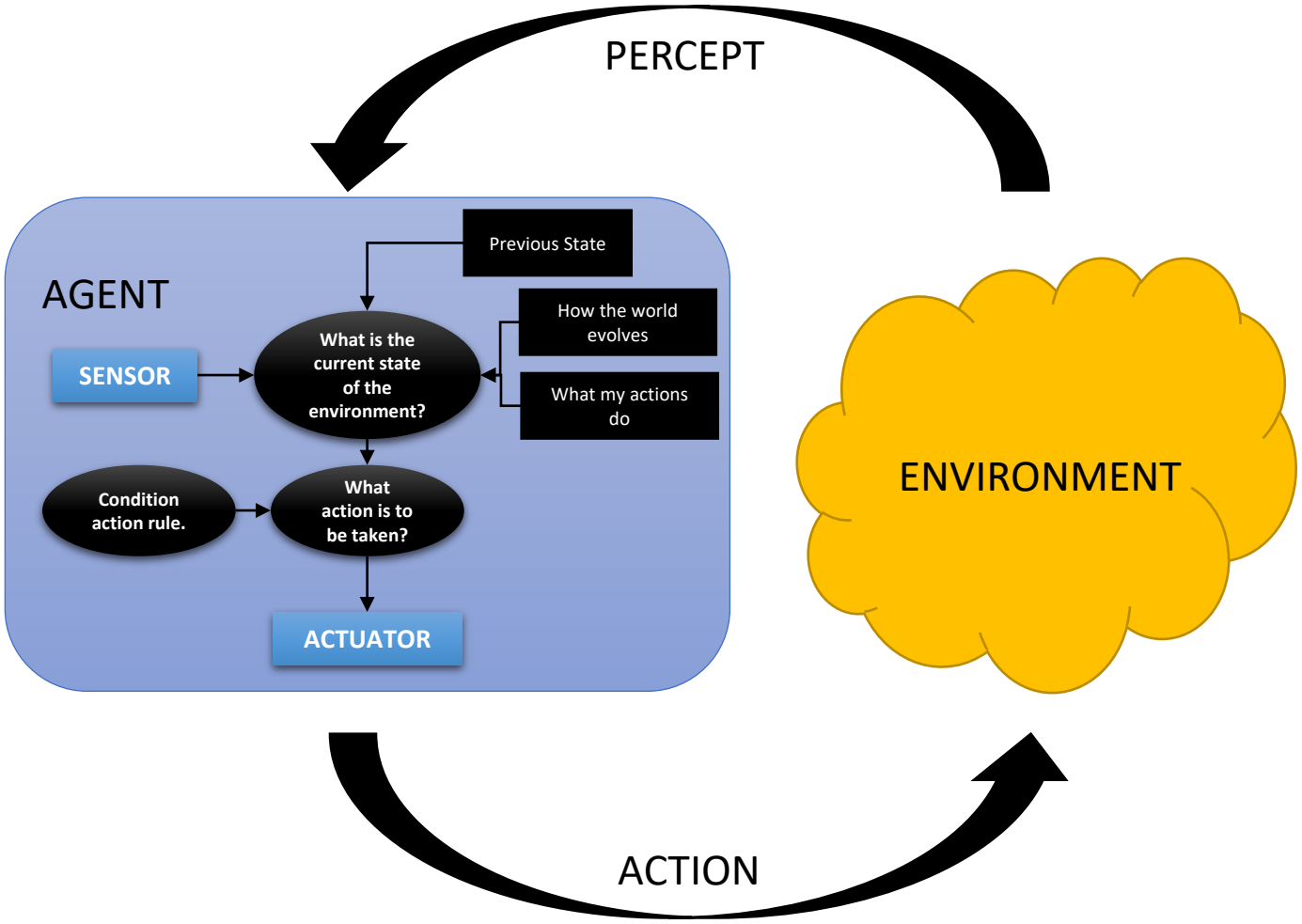


- SRA only works on the current state of the environment. It doesn't keep the previous state in memory. forgets about the situation after taking action.

Limitations:

- Rule-based/not intelligent.
- Can be stuck in a loop if it is working in the partially observable loop.
- Example: Chess

Model-based reflex agent

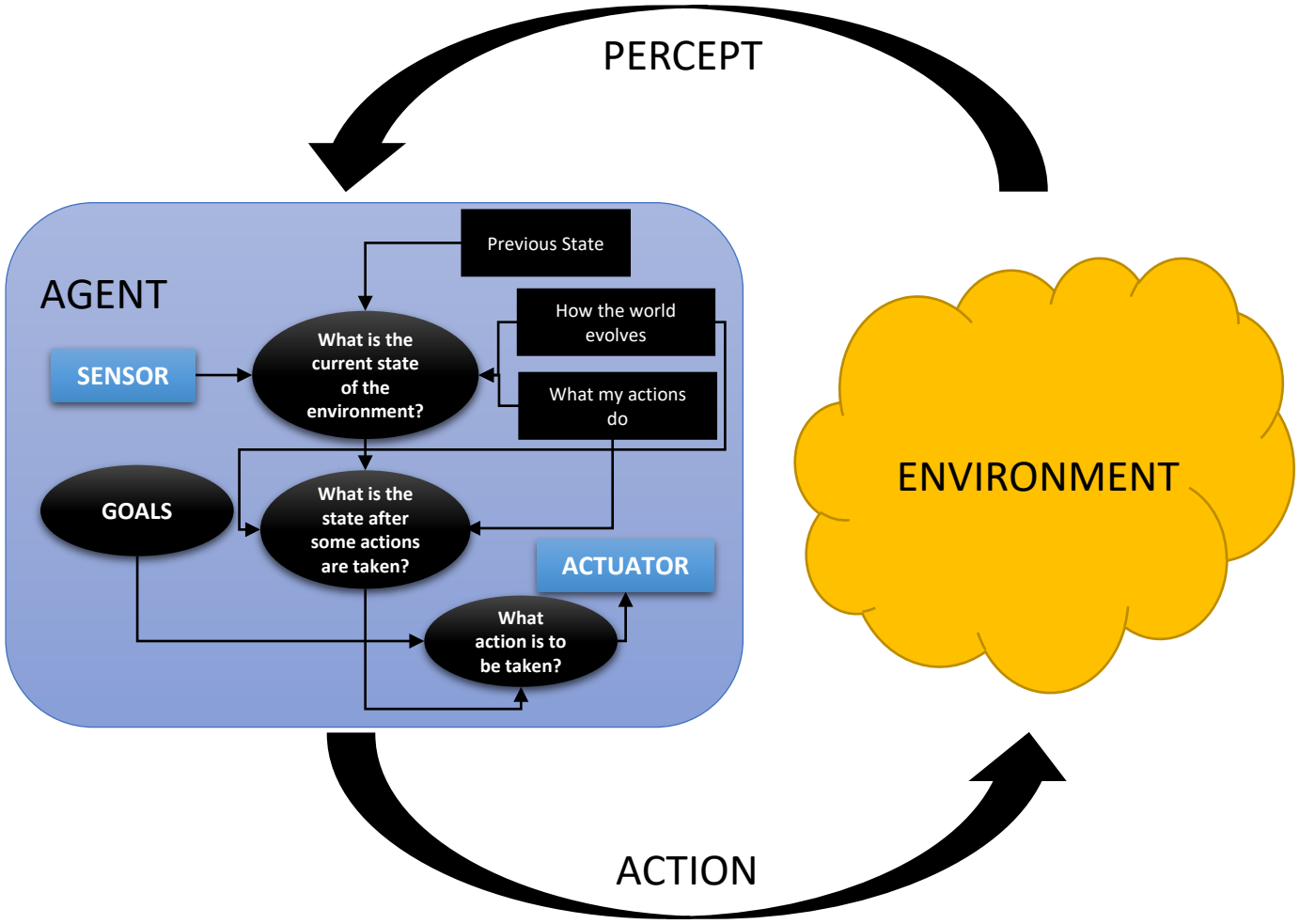


- MBRA considers Information on how the world evolves on its own and how the world is affected by the agent's actions

Advantages:

- It considers the past state.
- Can work with the partially observable loop.
- Example: Self Driving Car

Goal-oriented agent



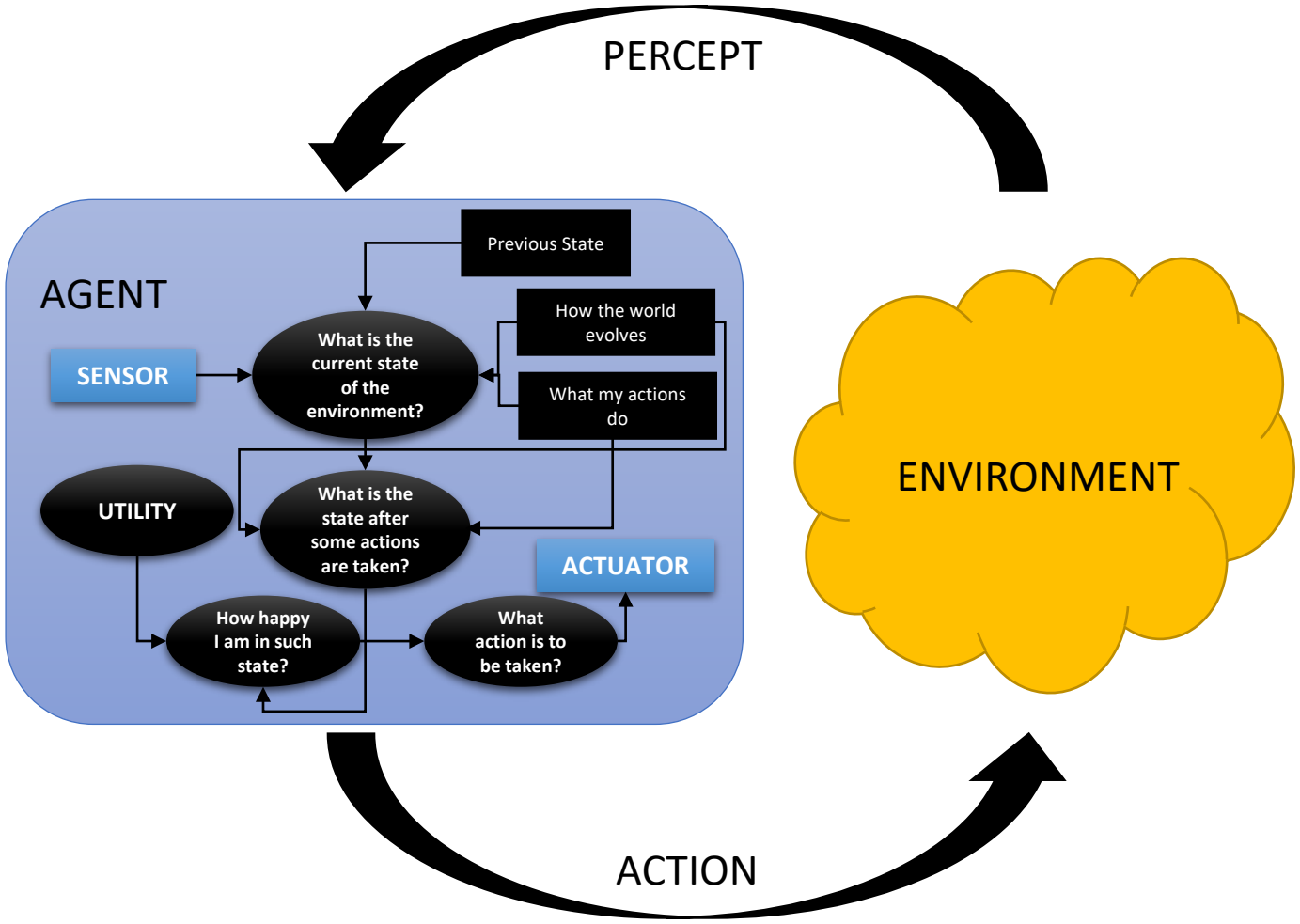
- It does everything to meet goals.

Limitations:

- Flexibility – since it only follows goals, hence once the goal is fixed it can't change the direction. So it is less flexible.

Example: Searching Robots

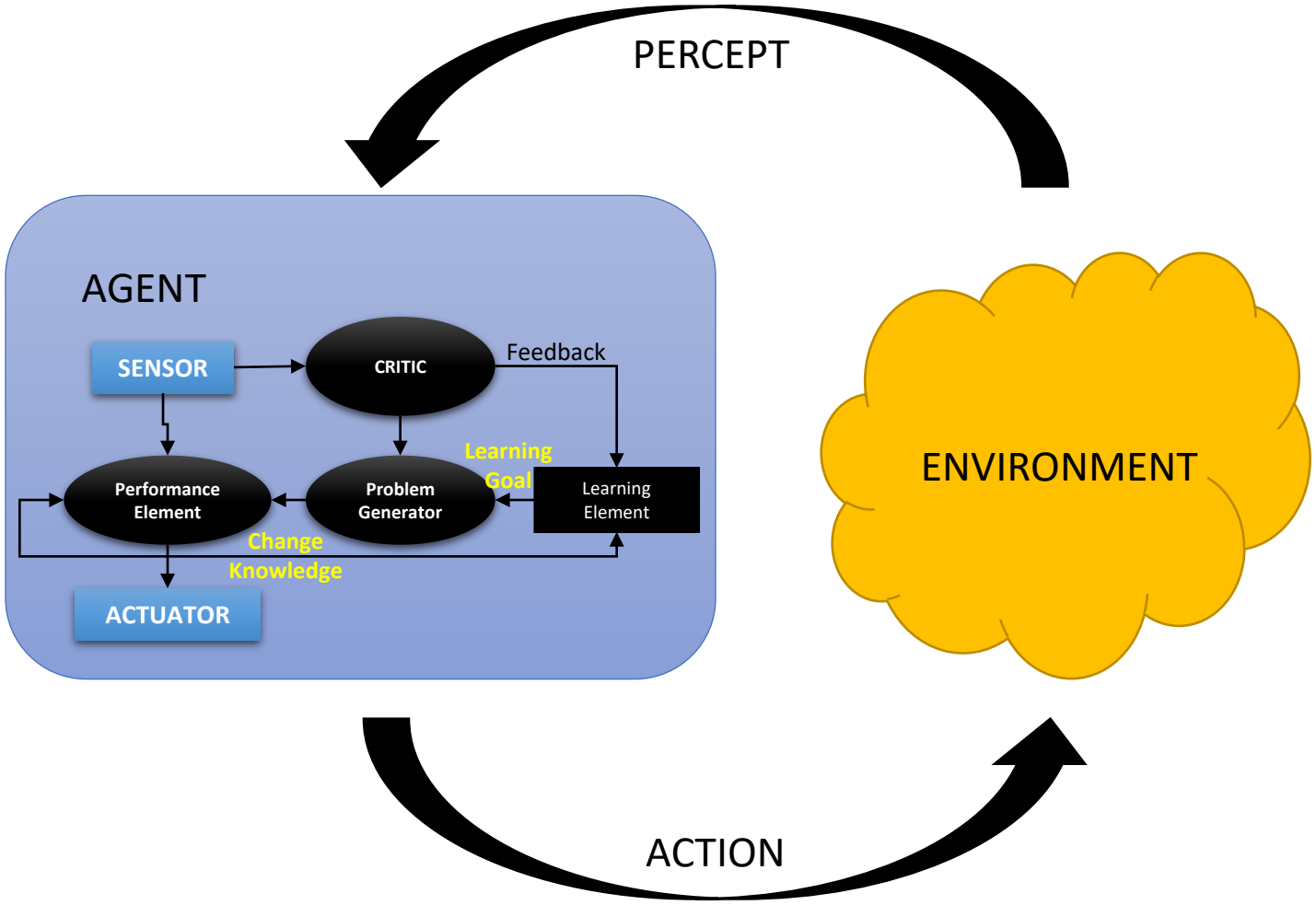
utility-oriented agent



- Utility is defined as a happy or unhappy state after taking action. It does everything to meet goals.
- It follows preferences or choices.

Example: GPS, route recommendation system

Learning agent



- Can Learn and rectify and grow
- Feedback is built on information collected by the sensor which consists of the environmental effect of its actions.
- LE helps the agent to learn new things from the environment.
- PG suggests actions to the agent based on the new information received.
- PE select actions.

Example: Any agent

In a nutshell

Simple reflex: Respond to stimuli with pre-programmed outcomes

Model-based: Rely on history and memory

Goal-based: Use memory, too, but toward a programmed goal

Utility-based: Incorporate preferences

Learning Agent: Experiential Learning