Intelligent Agents

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Instructional Objectives

- Define an agent.

- Agents Classification.

- Define an Intelligent agent.

- Define a Rational agent.

- Explain classes or Types of intelligent agents

- Applications of Intelligent agent

Agents

- An **agent** is anything that can be viewed as **perceiving** its environment through **sensors** and **acting** upon that environment through **effectors**.

- A human agent has eyes, ears, and other organs for sensors, and hands, legs, mouth, and other body parts for effectors/actuators.

- A robotic agent substitutes cameras and infrared range finders for the sensors and various motors for the effectors.

Agents

☐ Operate in an environment.

☐ Perceives and acts upon it's environment through actuators/sensors and have its goals.
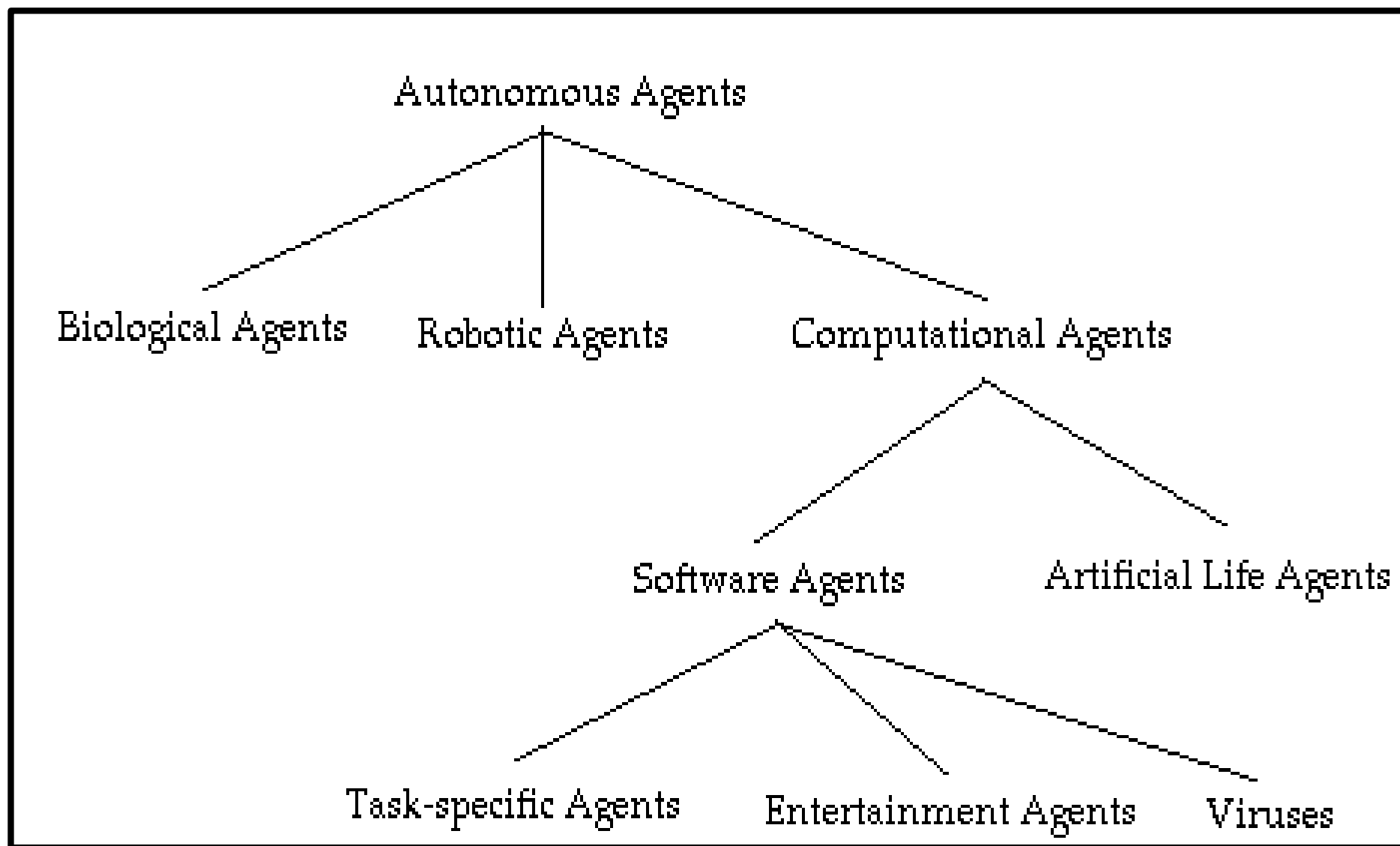

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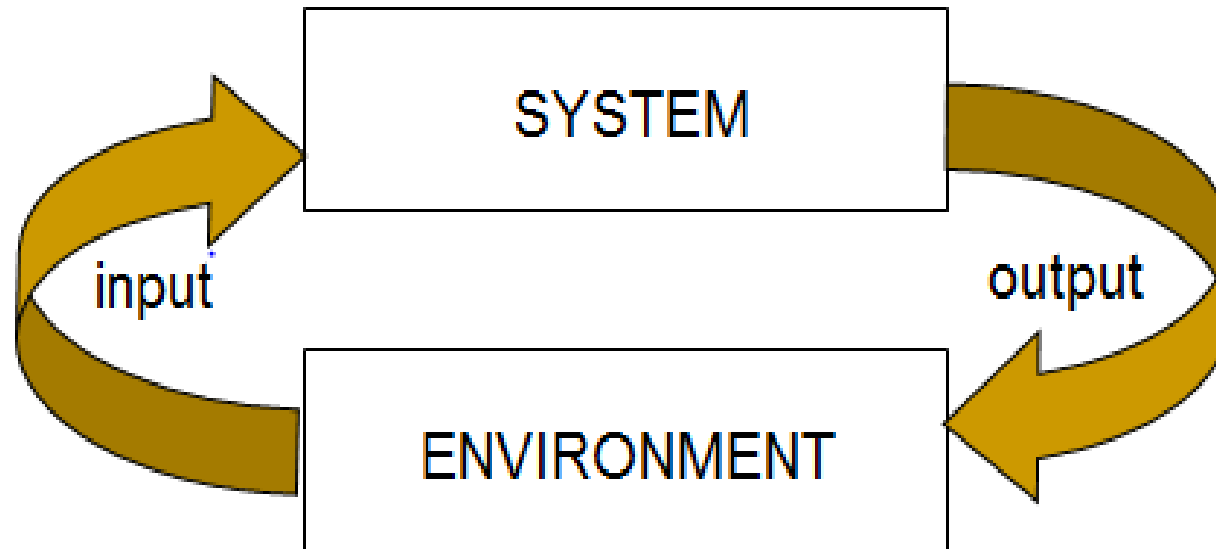
Agent and Environment
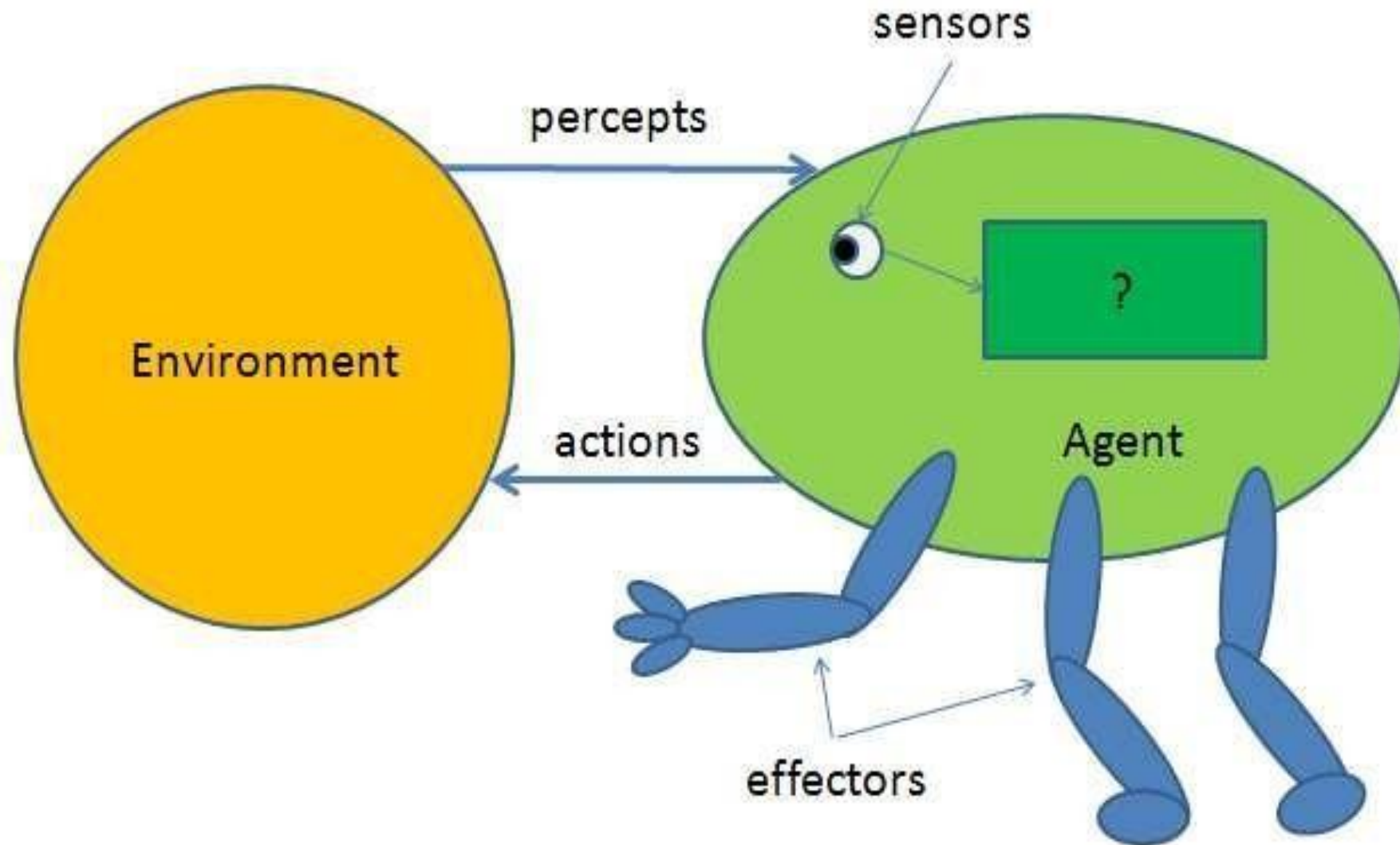
Sensors & Effectors

- An agent Perceives its environment through sensors.

- The complete set of inputs at a given time is called percept.

- The current percept, or a sequence of percepts can influence the actions of an agent.

- It can change the environment through effectors.

- An operation involving an actuator is called an action ,which can be grouped in to action sequences.

Autonomous Agents

Biological Agents   Robotic Agents   Computational Agents

Software Agents   Artificial Life Agents

Task-specific Agents   Entertainment Agents   Viruses

Examples of agents

☐ **<u>Humans</u>**

> **eyes, ears, skin, taste buds, etc. for Sensors.**
> **hands, fingers, legs, mouth for effectors.**

☐ **<u>Robots</u>**

> **camera, infrared, bumper, etc. for sensors.**
> **grippers, wheels, lights, speakers, effectors.**

Structure of agents

☐ A simple agent program can be defined mathematically as an agent function which <u>maps every possible precepts sequence to a possible action the agent can perform.</u>

$$F: p* -> A$$

☐ the term percept is use to the agent's perceptional inputs at any given instant.

Intelligent agents

<u>Fundamental functionalities of intelligence Acting are:</u>

Sensing

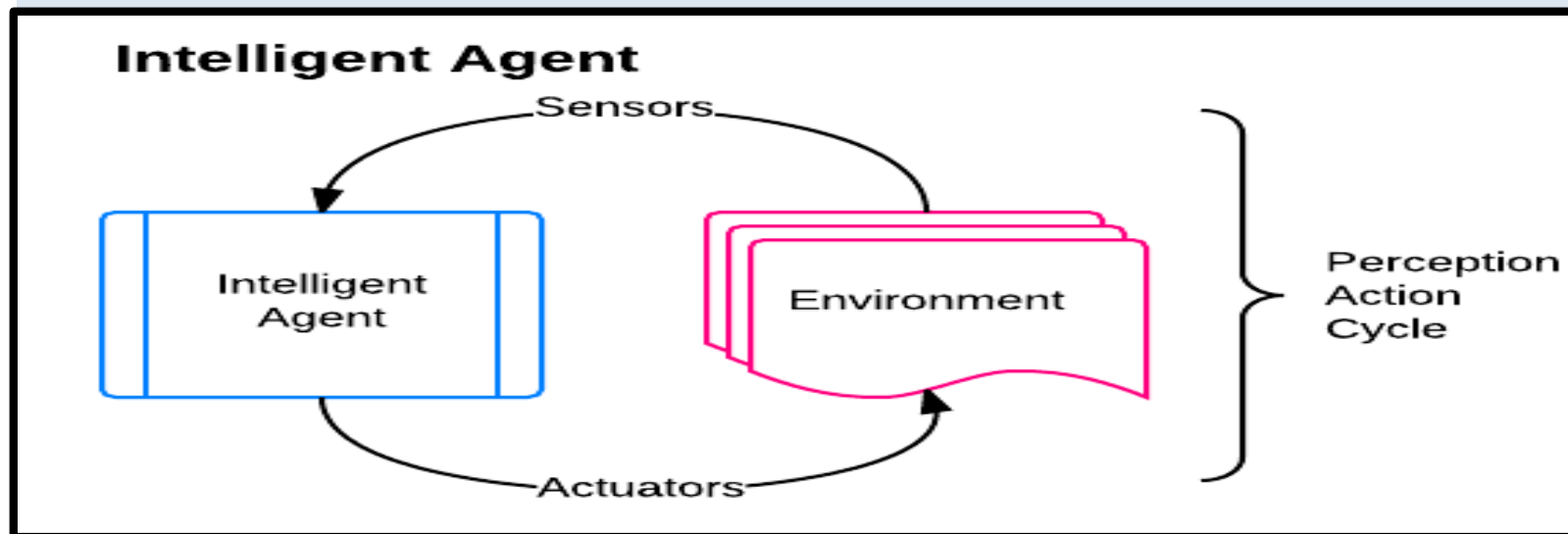Understanding, Reasoning, learning

In order to act you must sense. Blind actions is not a characterization of intelligence.

<u>Robotics:</u> sensing and acting. Understanding not necessary.

Sensing needs understanding to be useful.

Intelligent Agents

IntelligentAgent:

- must sense,
- must act,
- must be rational,

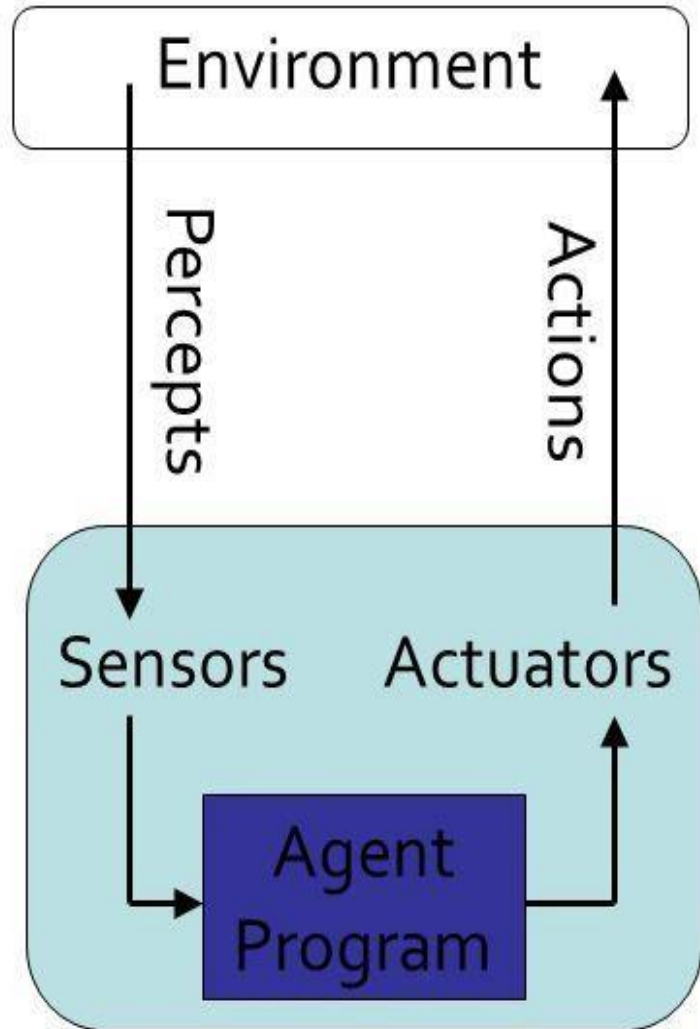 and autonomous.

Intelligent Agent

Rational Agent

- **AI is about building rational agents.**
- An agent is something that perceives and acts.
- A rational agent always does the right thing as-

What are the Functionalities

?(Goals) What are the

components?

How do we build them?

Rational Agents
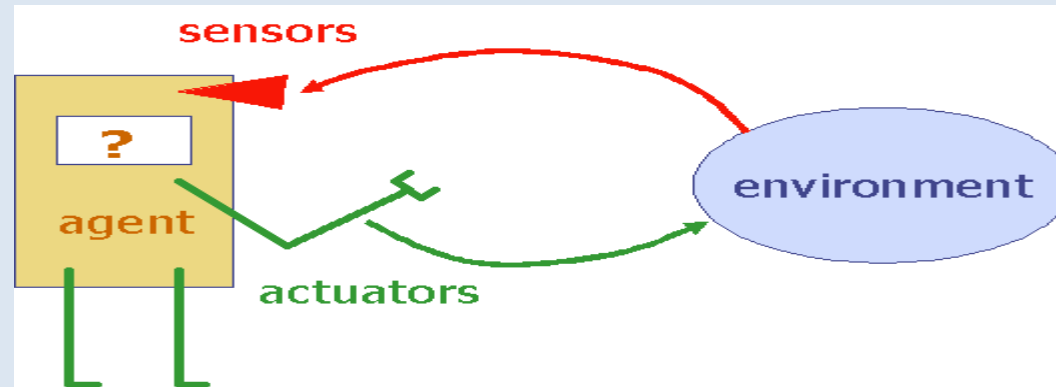
Rationality

- **<u>Perfect Rationality:</u>**

  Assumes that the rational agent knows all and will take the action that maximize the utility.

  Human beings do not satisfy this definition of rationality.

Agent Environment

- Environments in which agents operate can be defined in different ways.

- It is helpful to view the following definitions as referring to the way the environment appears from the point of view of the agent itself.

Classes of Intelligent Agents

☐ Intelligent agents are grouped in to **five** classes based on their degree of perceived intelligence and capability.

❑ Simple reflex agents
❑ Model based reflex agents
❑ Goal based agents
❑ Utility based agents
❑ Learning agents

1.Simple reflex agents

- Simple reflex agents <u>act only on the basis of the current percept</u>, ignoring the rest of the percept history. The agent function is based on the *condition-action rule*: if condition then action.

- Succeeds when the environment is fully observable.

- Some reflex agents can also contain information on their current state which allows them to disregard conditions.
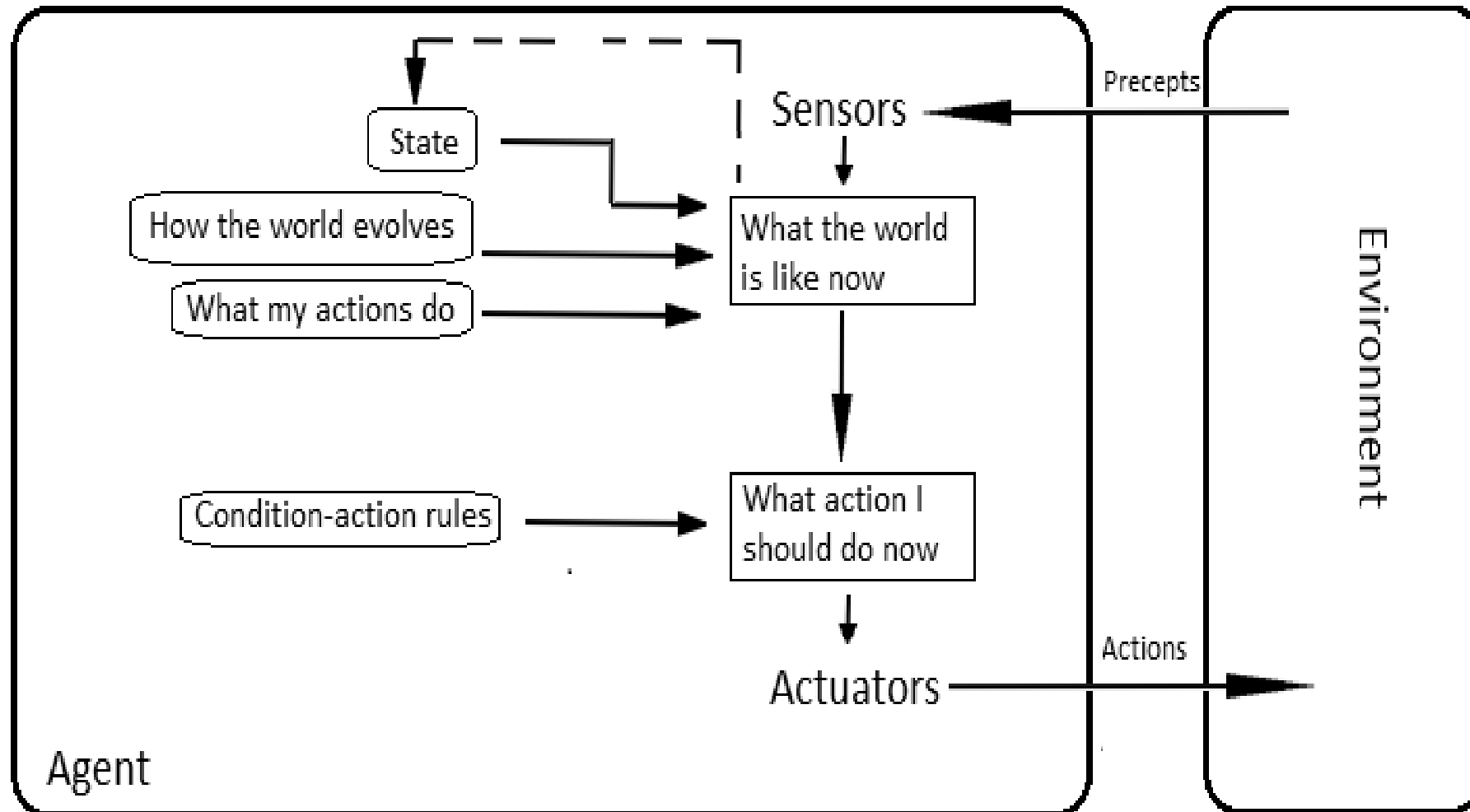
Simple reflex agents
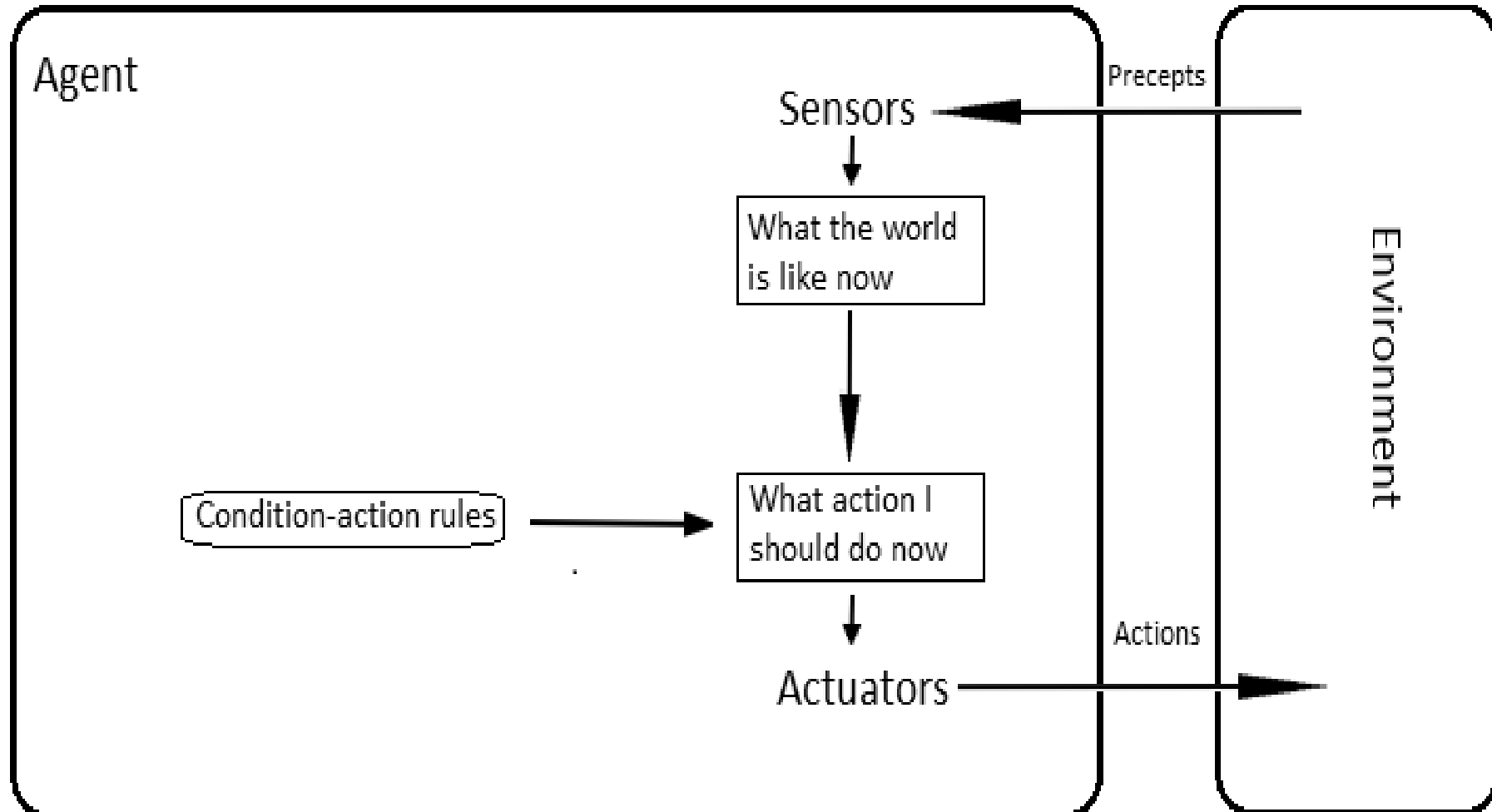
2. Model based reflex

- A model-based agent can handle a <u>partially observable</u> <u>environment</u>.

- This knowledge about "<u>how the world evolves</u>" is called a model of the world, hence the name "model-based agent".

Model based reflex

3.Goal based agents

- Goal-based agents further expand on the capabilities of the model-based agents, by using "goal" information.

- Goal information describes situations that are desirable. This allows the agent a way to choose among multiple possibilities, selecting the one which reaches a goal state.

- Search and planning are the subfields of artificial intelligence devoted to finding action sequences that achieve the agent's goals.

Goal based agents
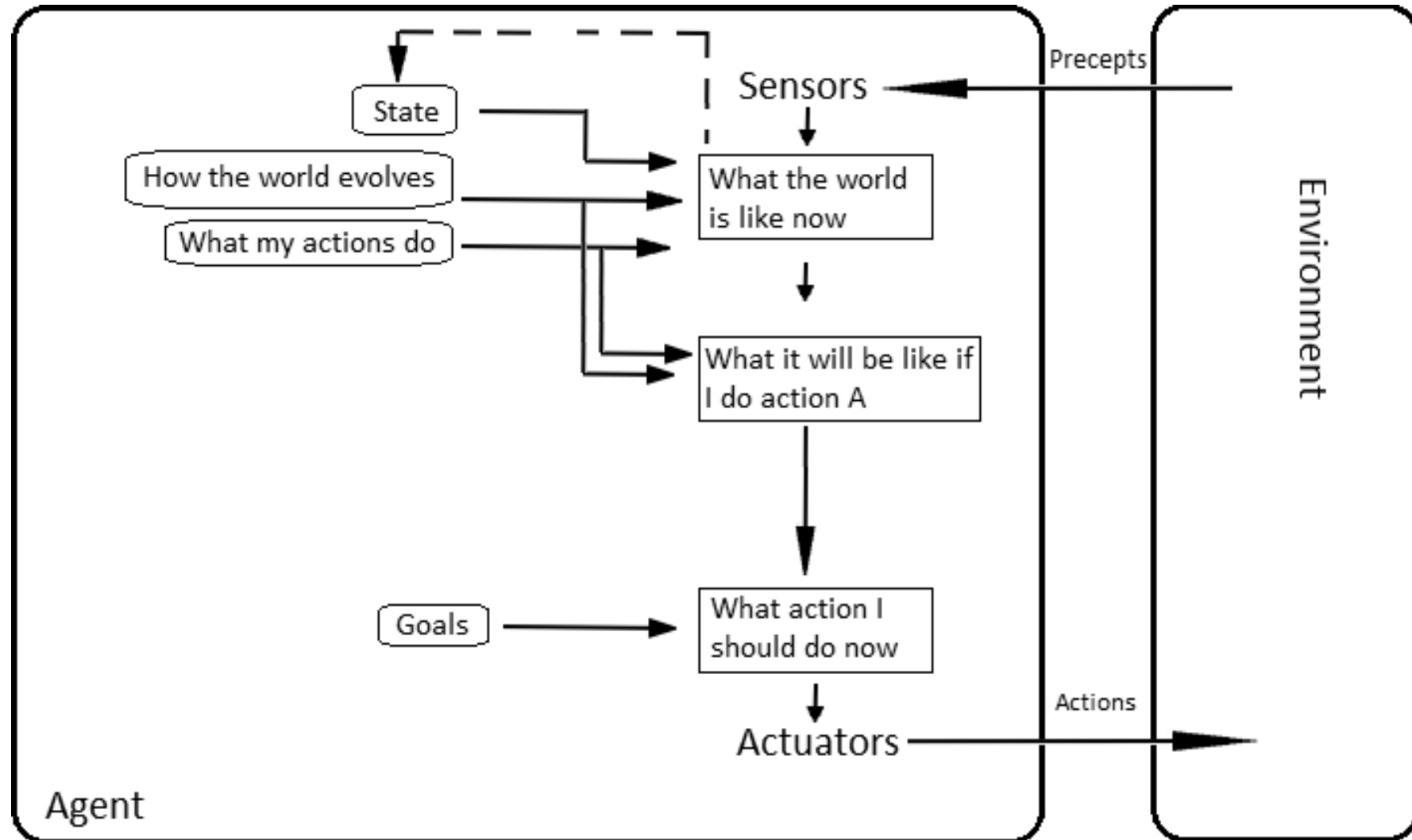
4. Utility based agents

- Goal-based agents only distinguish between goal states and non-goal states.

- It is possible to define a measure of how desirable a particular state is. This measure can be obtained through the use of a *utility function* which <u>maps a state to a measure of the utility of the state.</u>

- A more general performance measure should allow a comparison of different world states according to exactly how happy they would make the agent. The term utility, can be used to <u>describe how "happy" the agent is.</u>

Utility based agents
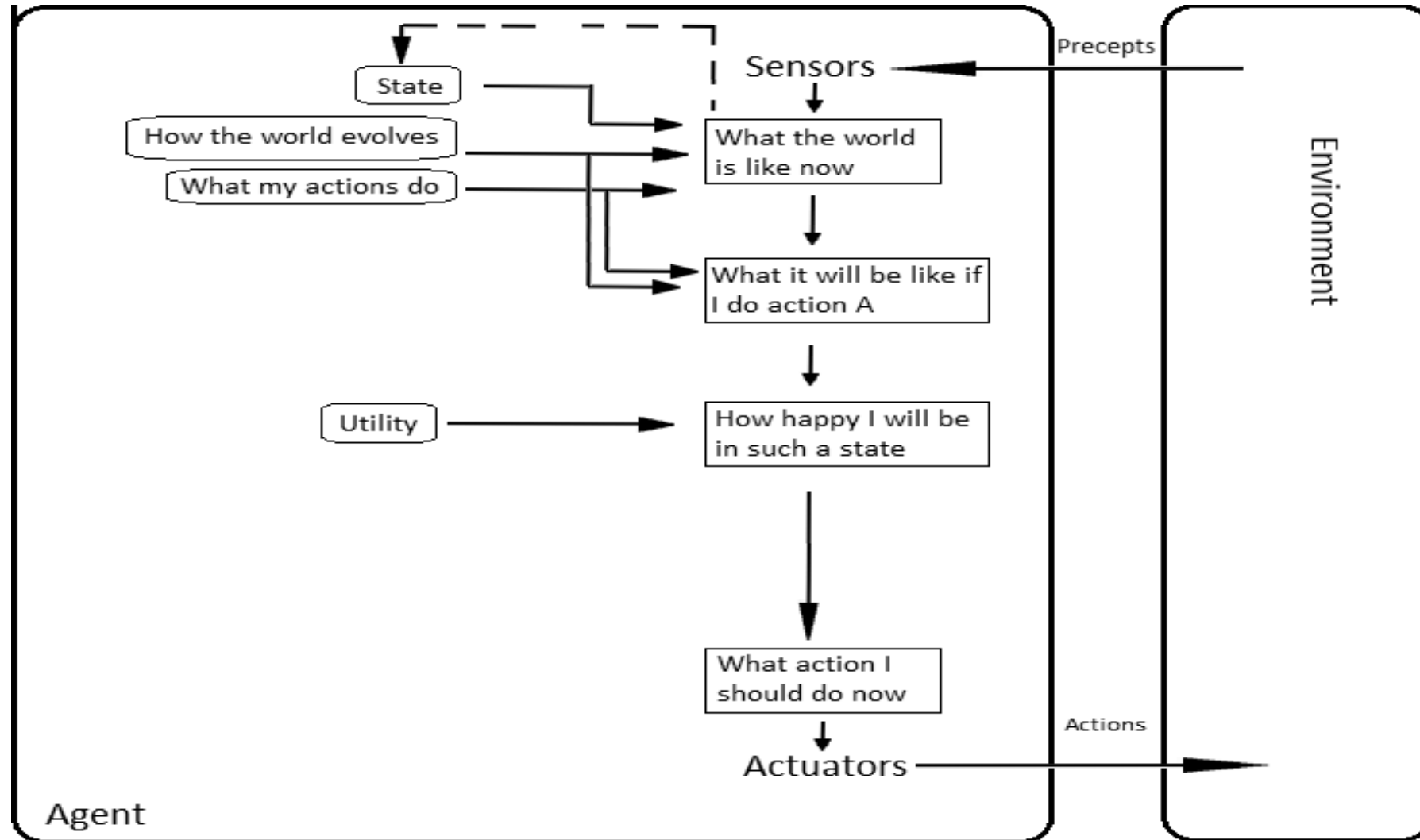
5. Learning agents

☐ Learning has an advantage that it allows the agents to initially operate in unknown environments and to become more competent than its initial knowledge alone might allow.

☐ The most important distinction is between the "learning element", which is responsible for making improvements, and the "performance element", which is responsible for selecting external actions.

☐ The learning element uses feedback from the "critic" on how the agent is doing and determines how the performance element should be modified to do better in the future.

Learning agents

☐ The last component of the learning agent is the "__problem generator__". It is responsible for suggesting actions that will lead to new and informative experiences.
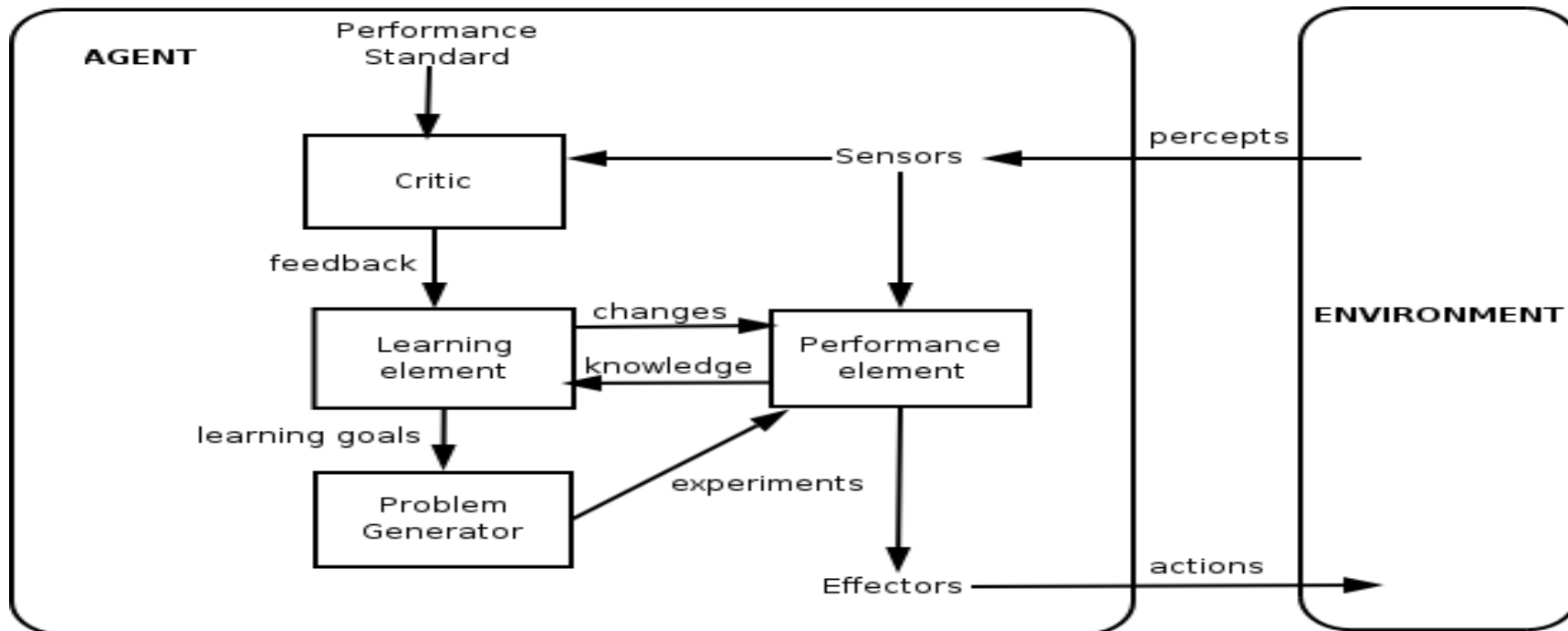
Applications of Intelligent Agents

- Where they function to perceive the needs of Customers in order to perform individualized customer service.

☐ Intelligent agents are applied as automated online assistants, as

☐ Use in smart phones in future.