

CSE 604

Artificial Intelligence

Chapter 2: Intelligent Agents

Adapted from slides available in Russell & Norvig's textbook webpage

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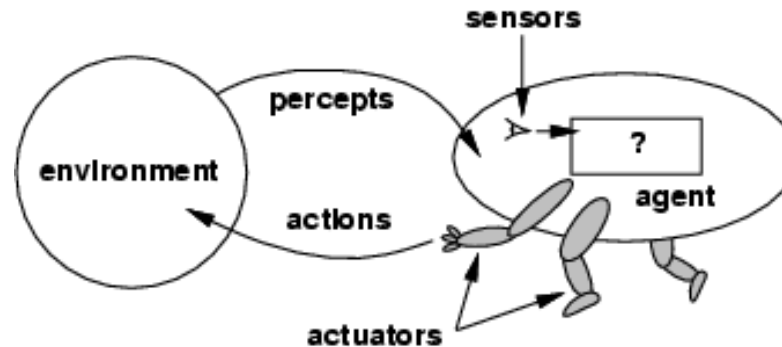
Outline

- Agents and environments
- Rationality
- PEAS (Performance measure, Environment, Actuators, Sensors)
- Environment types
- Agent types

Agents

- An **agent** is anything that can be viewed as **perceiving** its environment through sensors and **acting** upon that environment through actuators
- **Human agent:** eyes, ears, and other organs for sensors; hands, legs, mouth, and other body parts for actuators
- **Robotic agent:** cameras and infrared range finders for sensors; various motors for actuators
- **Software agent:** receives keystrokes, file contents, network packets as sensory inputs; acts by displaying on screen, writing files etc.

Agents and environments

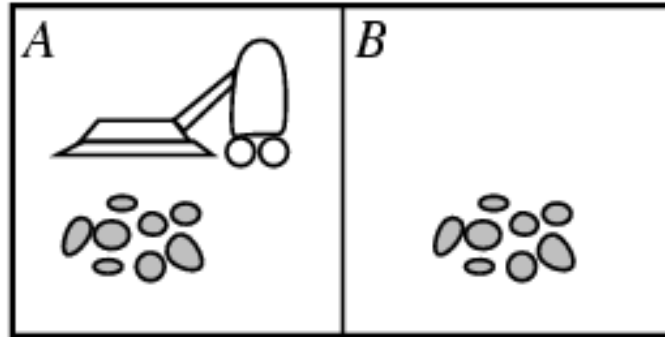


- The **agent function** maps from percept histories to actions:

$$[f: \mathcal{P}^* \rightarrow \mathcal{A}]$$

- The **agent program** runs on the physical **architecture** to produce f
- $\text{agent} = \text{architecture} + \text{program}$

Vacuum-cleaner world



- **Percepts:** location and contents, e.g., [A, Dirty]
- **Actions:** *Left*, *Right*, *Suck*, *NoOp*

Rational Agent

- A rational agent chooses whichever action maximizes the expected value of the performance measure given the percept sequence to date
- Rational \neq omniscient
 - percepts may not supply all relevant information
- Rational \neq clairvoyant
 - action outcomes may not be as expected
- Hence, rational \neq successful
- Rational \Rightarrow exploration, learning, autonomy

Rational agents

- An agent should strive to "**do the right thing**", based on what it can perceive and the actions it can perform.
- **Performance measure**: An objective criterion for success of an agent's behavior
- E.g., performance measure of a vacuum-cleaner agent could be :
 - amount of dirt cleaned up
 - amount of time taken
 - amount of electricity consumed

PEAS

- Specifying the task environment:
 - **P**erformance measure
 - **E**nvironment
 - **A**ctuators
 - **S**ensors

PEAS

- Agent: **Part-picking robot**
 - **Performance measure:** % of parts in correct bins
 - **Environment:** Conveyor belt, parts, bins
 - **Actuators:** Jointed arm and hand
 - **Sensors:** Camera, joint angle sensors



PEAS

- Agent: **Automated car**
 - **Performance measure:** Safe, fast, legal, comfortable trip
 - **Environment:** Roads, other traffic, pedestrians
 - **Actuators:** Steering wheel, accelerator, brake
 - **Sensors:** Camera, GPS, Speedometer, engine sensor

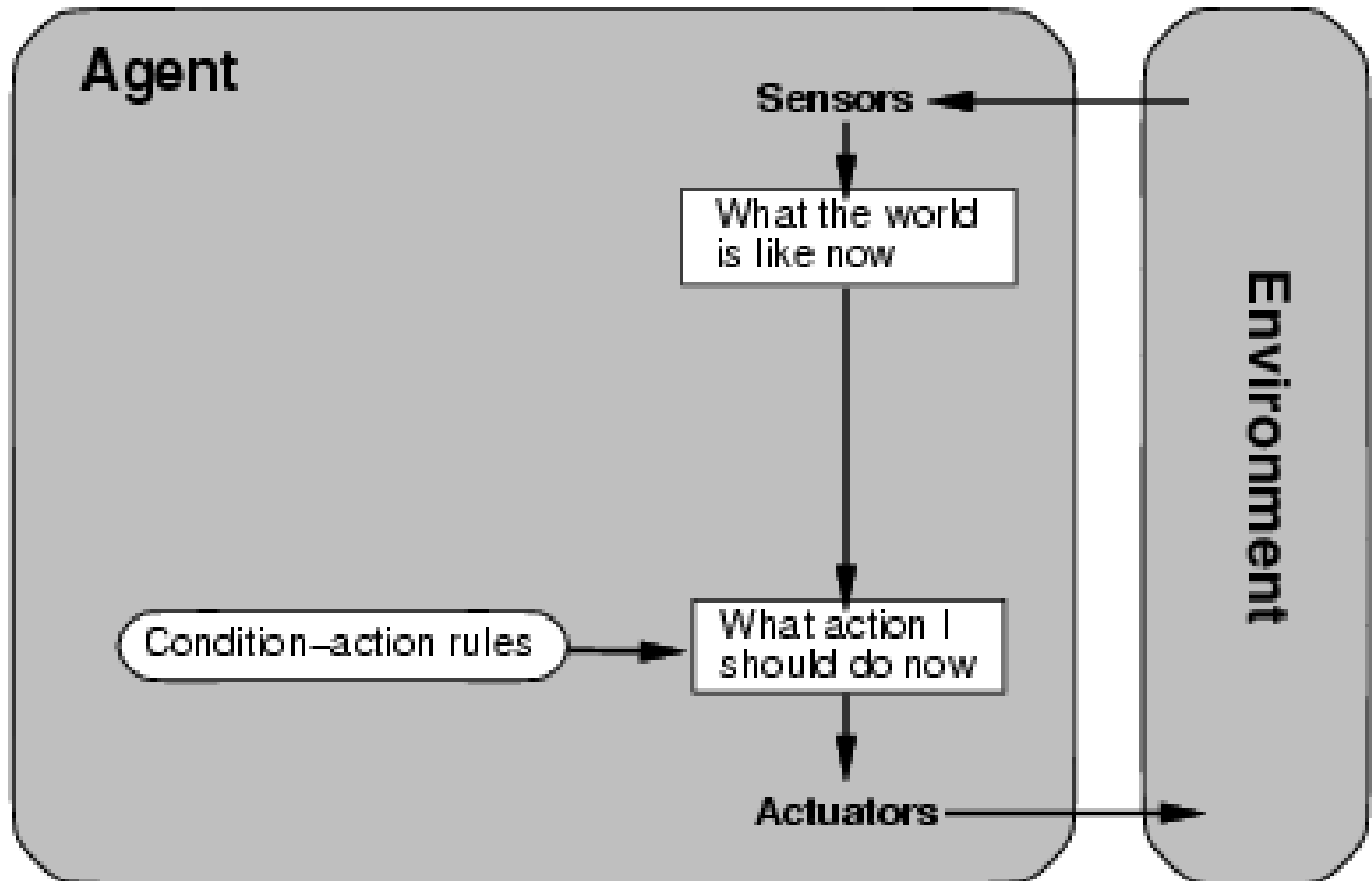
Environment types

- Fully observable vs. partially observable
- Single agent vs. multiagent
- Deterministic vs. stochastic
- Episodic vs. sequential
- Static vs dynamic
- Discrete vs continuous

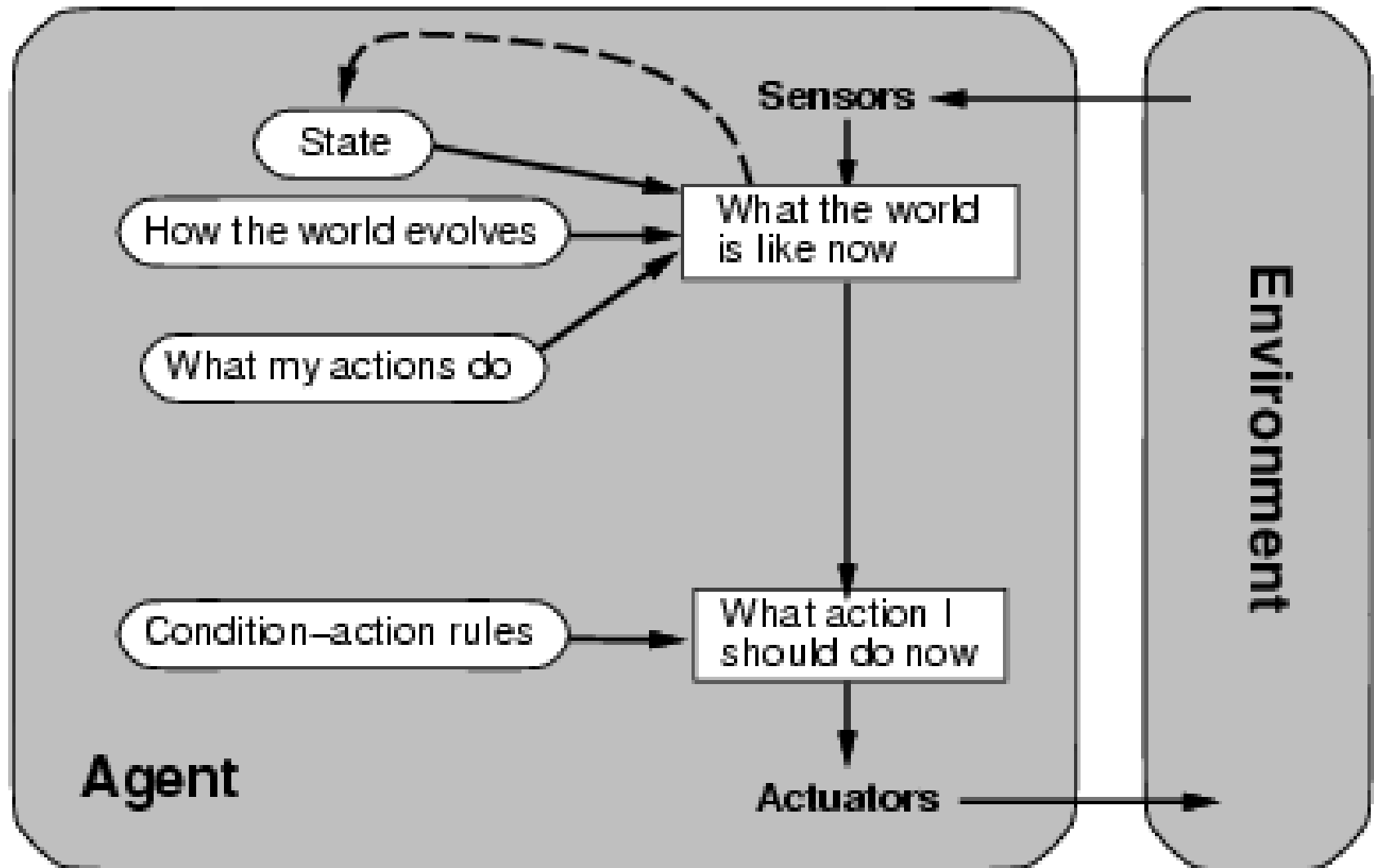
Agent types

- Four basic types in order of increasing generality:
 - Simple reflex agents
 - Model-based reflex agents
 - Goal-based agents
 - Utility-based agents

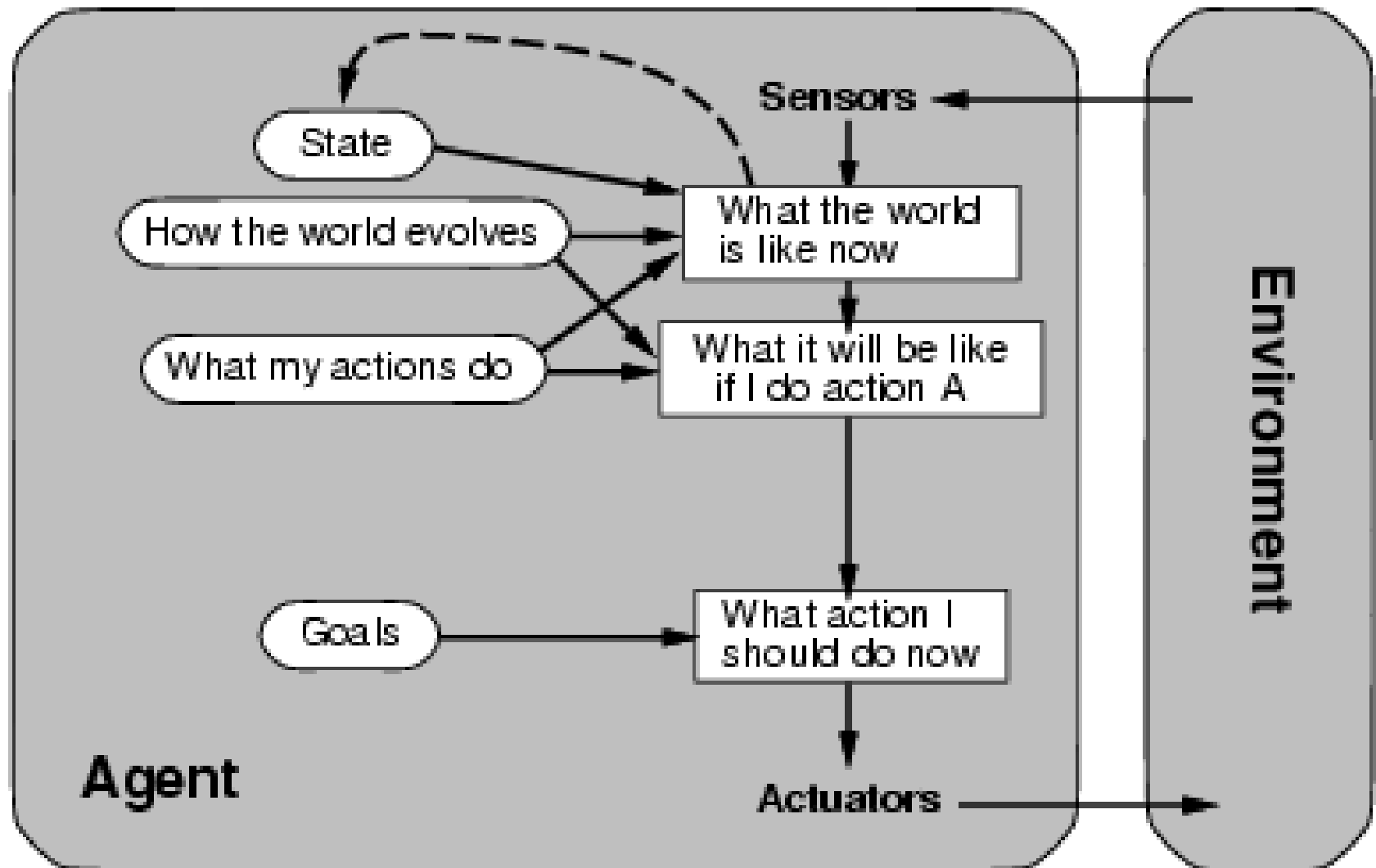
Simple reflex agents



Model-based reflex agents



Goal-based agents



Utility-based agents

