

Agents & Environments

Chapter 2

Mausam

(Based on slides of Dan Weld, Dieter
Fox, Stuart Russell)

Outline

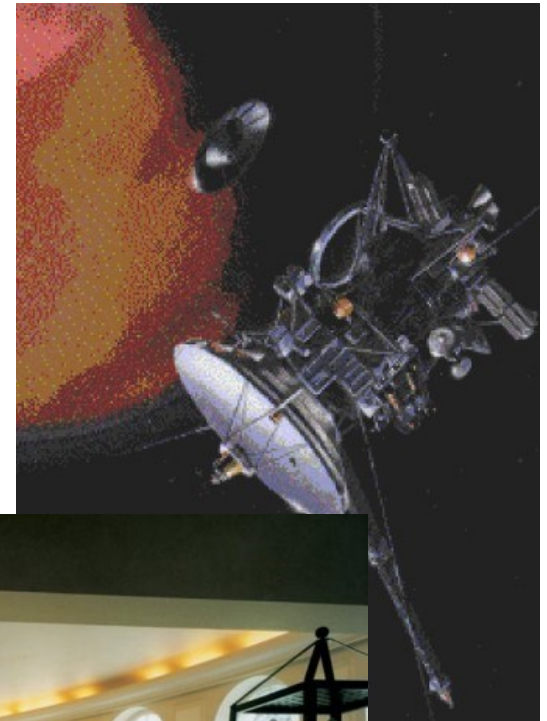
- Agents and environments
- Rationality
- PEAS specification
- Environment types
- Agent types

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 laser range finders for sensors
 - various motors for actuators

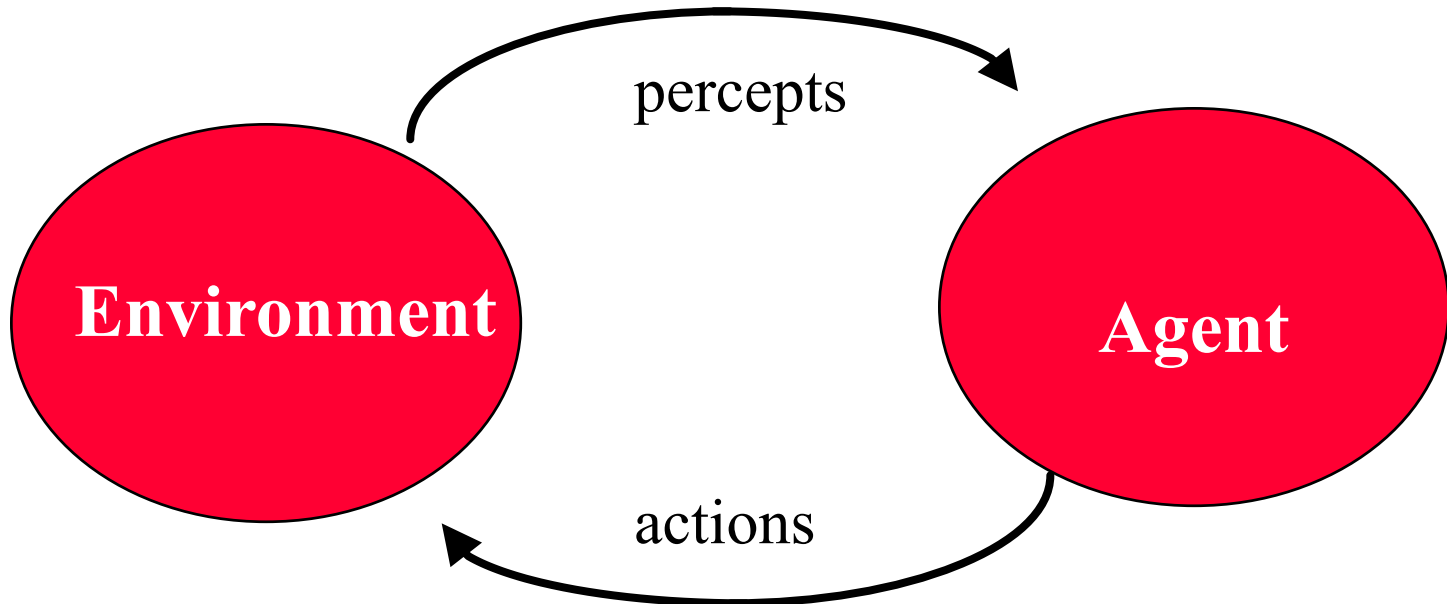
Examples of Agents

- Physically grounded agents
 - Intelligent buildings
 - Autonomous spacecraft
- Softbots
 - Expert Systems
 - IBM Watson



Intelligent Agents

- Have sensors, effectors
- Implement mapping from percept sequence to actions



- Performance Measure

Rational Agents

- An agent should strive to **do the right thing**, based on what it can perceive and the actions it can perform. The right action is the one that will cause the agent to be most successful
- **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, amount of noise generated, etc.

Ideal Rational Agent

*“For each possible percept sequence, does whatever action is expected to maximize its performance measure on the basis of evidence perceived **so far** and built-in knowledge.”*

- Rationality vs omniscience?
- Acting in order to obtain valuable information

Bounded Rationality

- We have a performance measure to optimize
- Given our state of knowledge
- Choose optimal action
- ***Given limited computational resources***

PEAS: Specifying Task Environments

- PEAS: Performance measure, Environment, Actuators, Sensors
- Must first specify the setting for intelligent agent design
- Example: the task of designing an automated taxi driver:
 - Performance measure
 - Environment
 - Actuators
 - Sensors

PEAS

- Agent: Automated taxi driver
- Performance measure:
 - Safe, fast, legal, comfortable trip, maximize profits
- Environment:
 - Roads, other traffic, pedestrians, customers
- Actuators:
 - Steering wheel, accelerator, brake, signal, horn
- Sensors:
 - Cameras, sonar, speedometer, GPS, odometer, engine sensors, keyboard

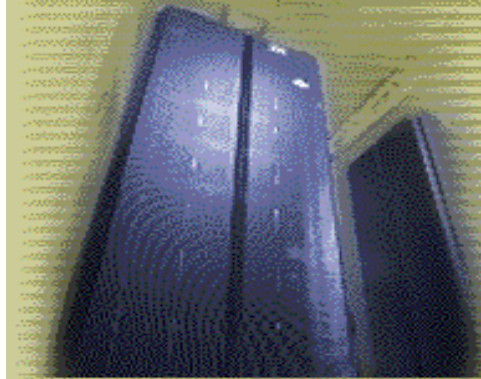
PEAS

- Agent: Medical diagnosis system
- Performance measure:
 - Healthy patient, minimize costs, lawsuits
- Environment:
 - Patient, hospital, staff
- Actuators:
 - Screen display (questions, tests, diagnoses, treatments, referrals)
- Sensors:
 - (entry of symptoms, findings, patient's answers)

Properties of Environments

- Observability: full *vs.* partial *vs.* *non*
- Deterministic *vs.* stochastic
- Episodic *vs.* sequential
- Static *vs.* *Semi-dynamic* *vs.* dynamic
- Discrete *vs.* continuous
- Single Agent *vs.* Multi Agent (Cooperative, Competitive, Self-Interested)

RoboCup vs. Chess



Deep Blue

- Static/Semi-dynamic
- Deterministic
- Observable
- Discrete
- Sequential
- Multi-Agent



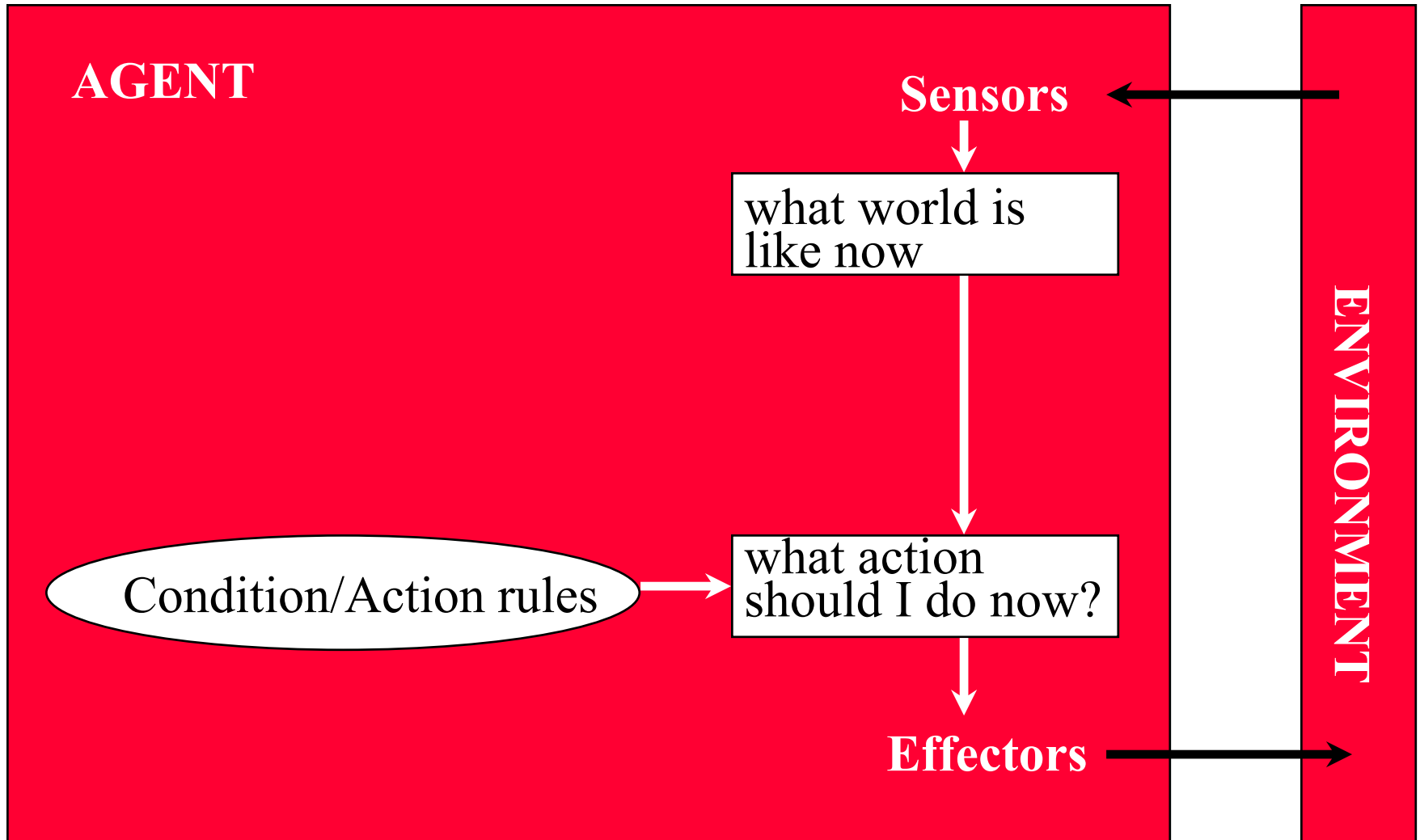
Robot

- Dynamic
- Stochastic
- Partially observable
- Continuous
- Sequential
- Multi-Agent

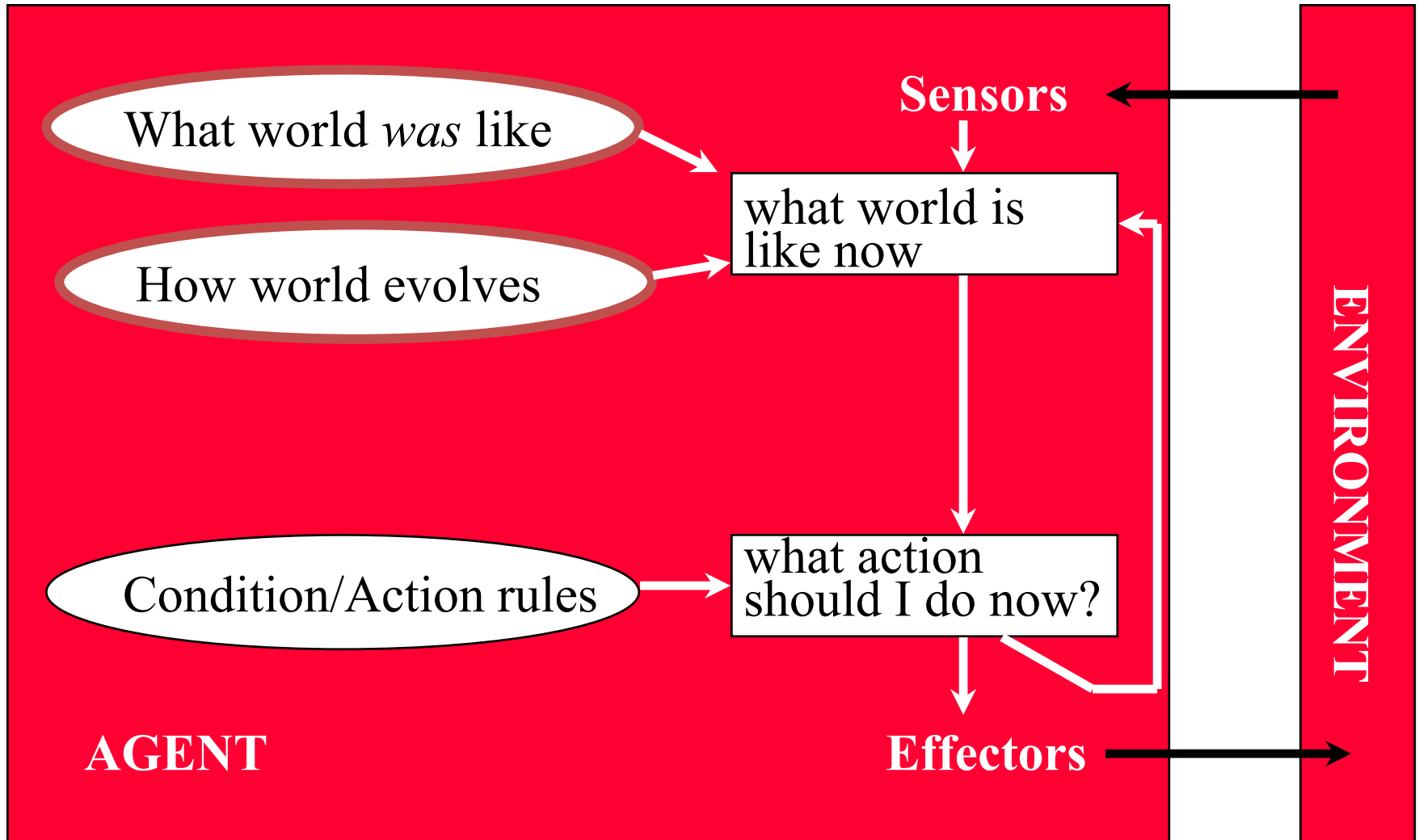
More Examples

- 15-Puzzle
 - Static – Deterministic – Fully Obs – Discrete – Seq – Single
- Poker
 - Static – Stochastic – Partially Obs – Discrete – Seq – Multi-agent
- Medical Diagnosis
 - Dynamic – Stochastic – Partially Obs – Continuous – Seq – Single
- Taxi Driving
 - Dynamic – Stochastic – Partially Obs – Continuous – Seq – Multi-agent

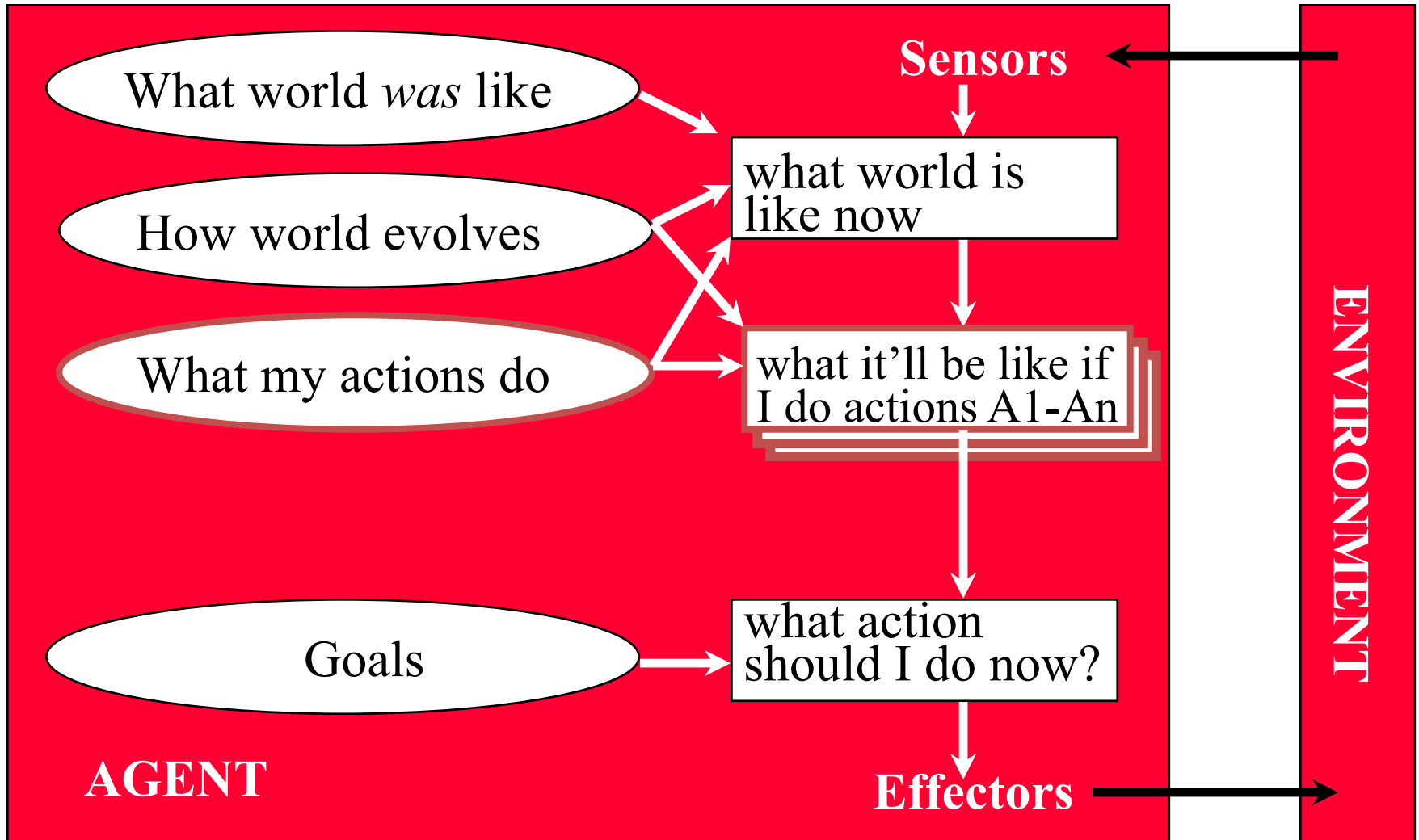
Simple reflex agents



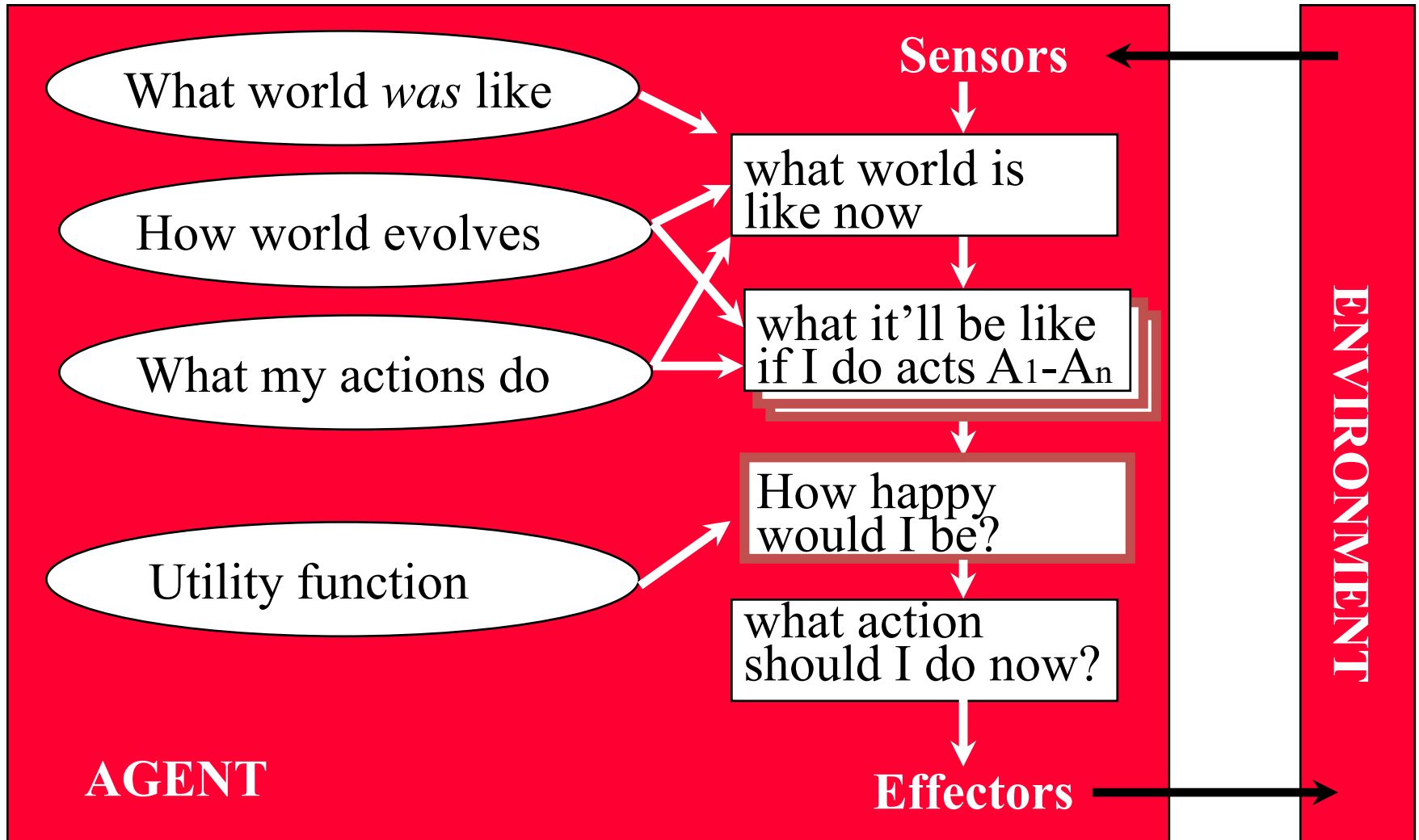
Reflex agent with internal state



Goal-based agents



Utility-based agents



Learning agents

