

# Agents & Environments

## Chapter 2

**Mausam**

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

# Outline

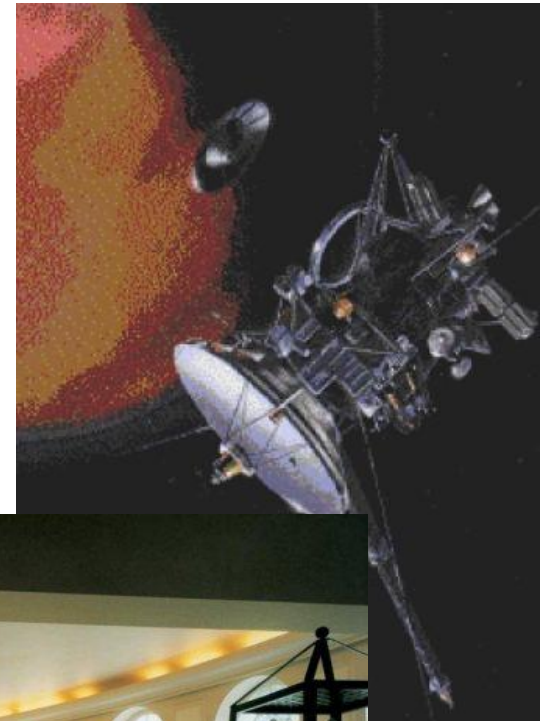
- Agents and environments
- Rationality
- PEAS specification
- Environment types
- Agent types

# 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

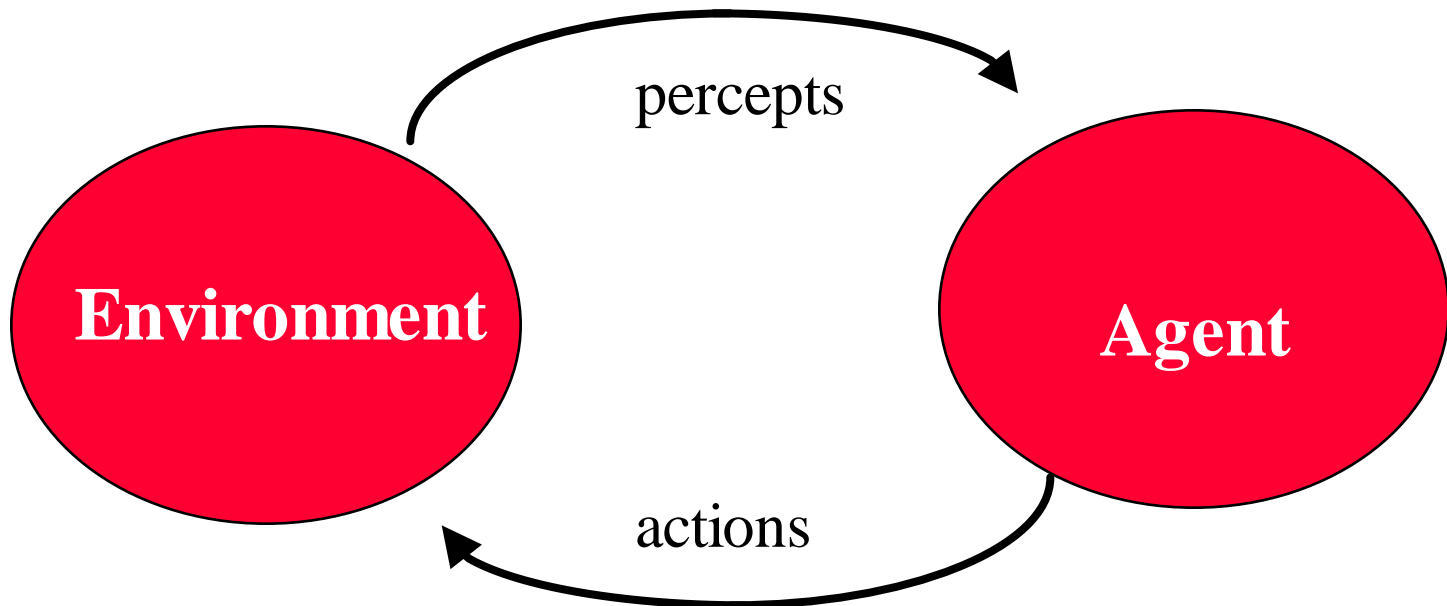
# Examples of Agents

- Intelligent buildings
  - Autonomous spacecraft
- 
- Softbots
    - Askjeeves.com
    - Expert Systems



# 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

# 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)

# Robocup

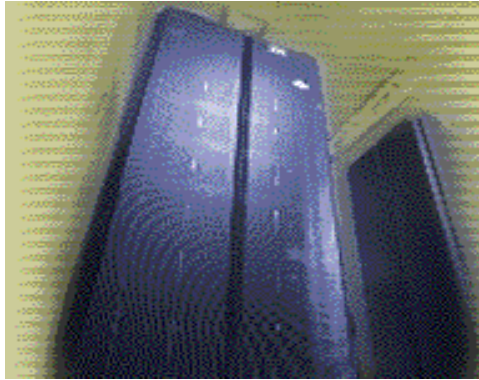
[http://www.youtube.com/watch?v=-Y4H3Sox\\_4I](http://www.youtube.com/watch?v=-Y4H3Sox_4I)

[http://www.youtube.com/watch?v=iMM\\_XQXJUUC](http://www.youtube.com/watch?v=iMM_XQXJUUC)

# 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



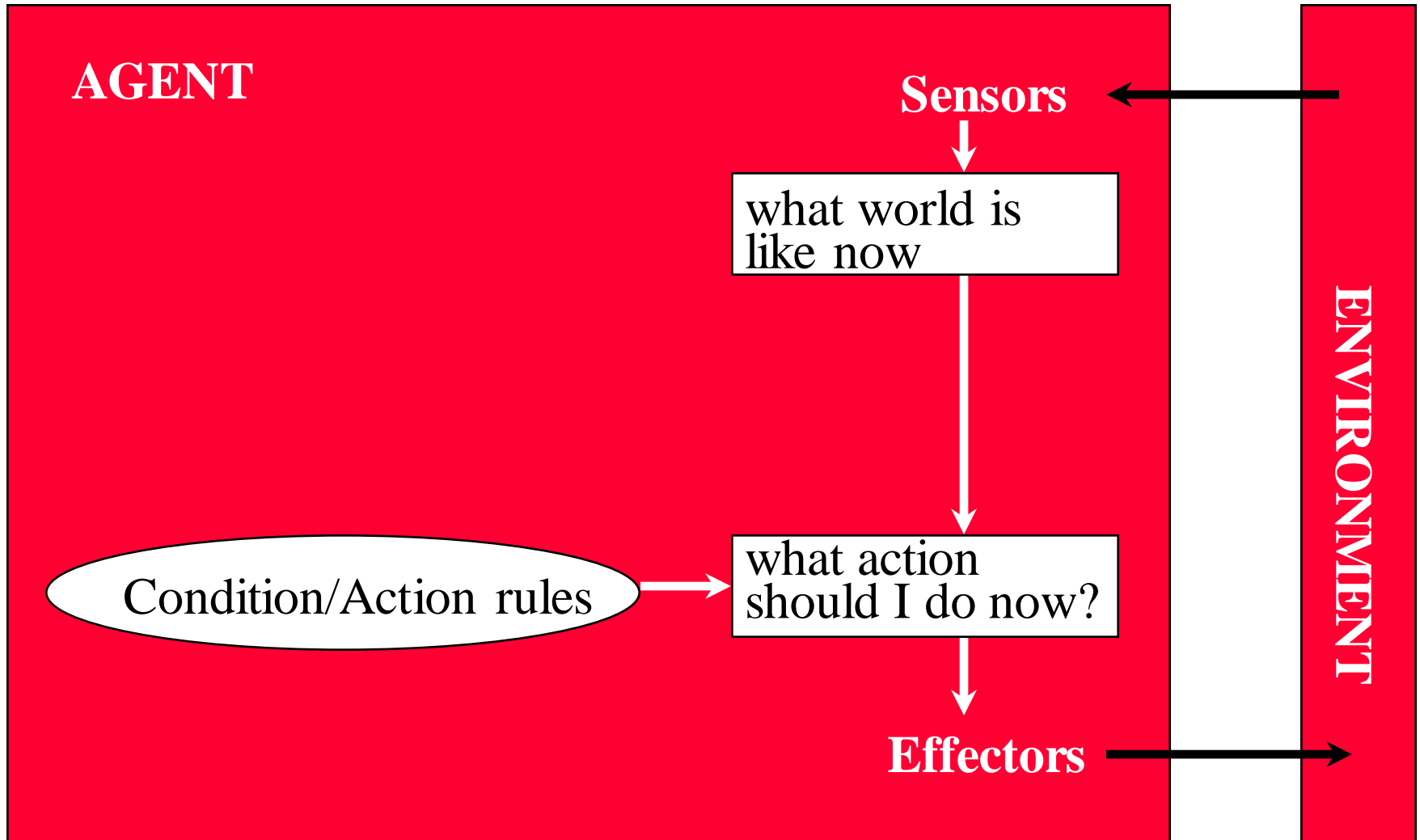
**Robot**

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

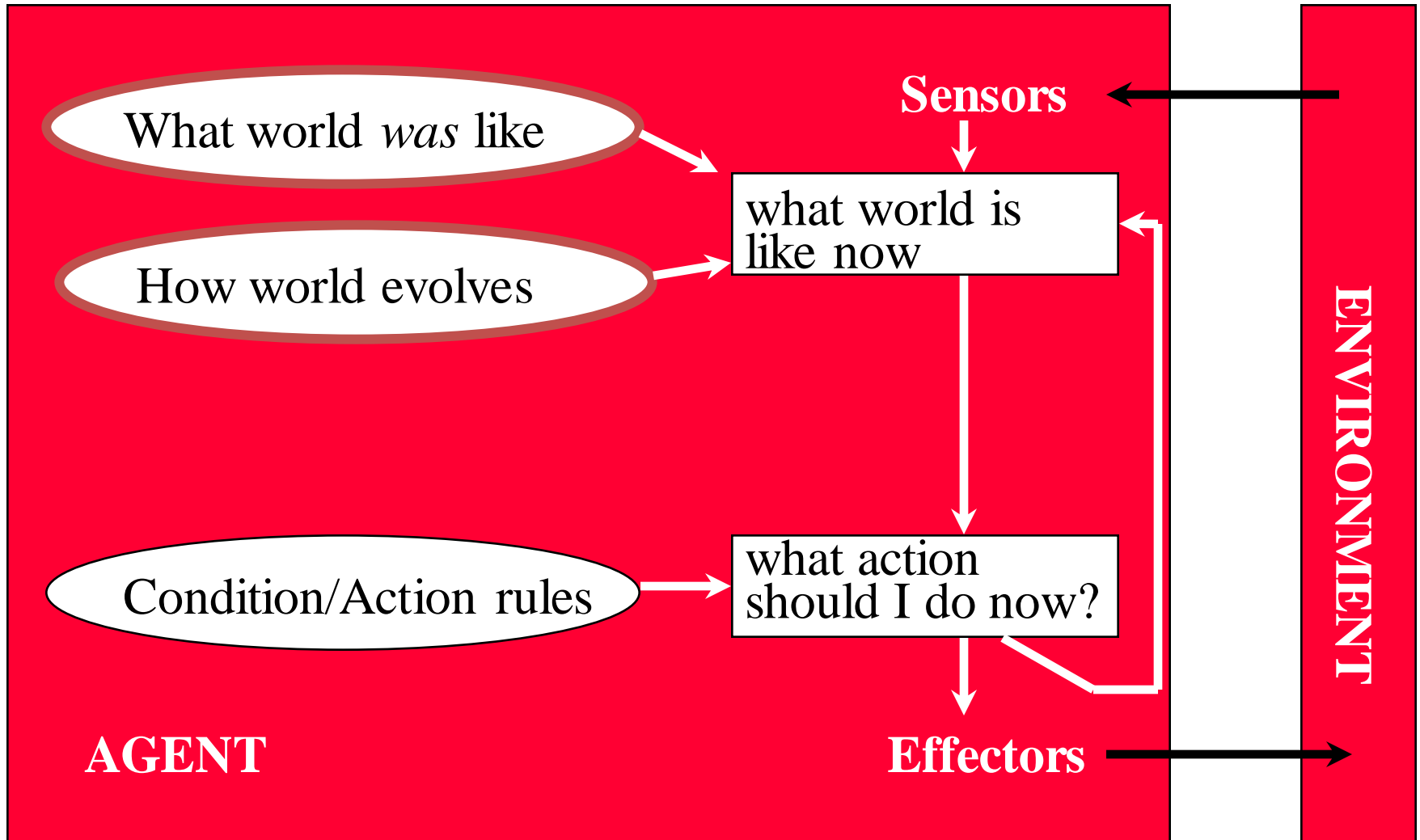
# More Examples

- Classical Planning
  - 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

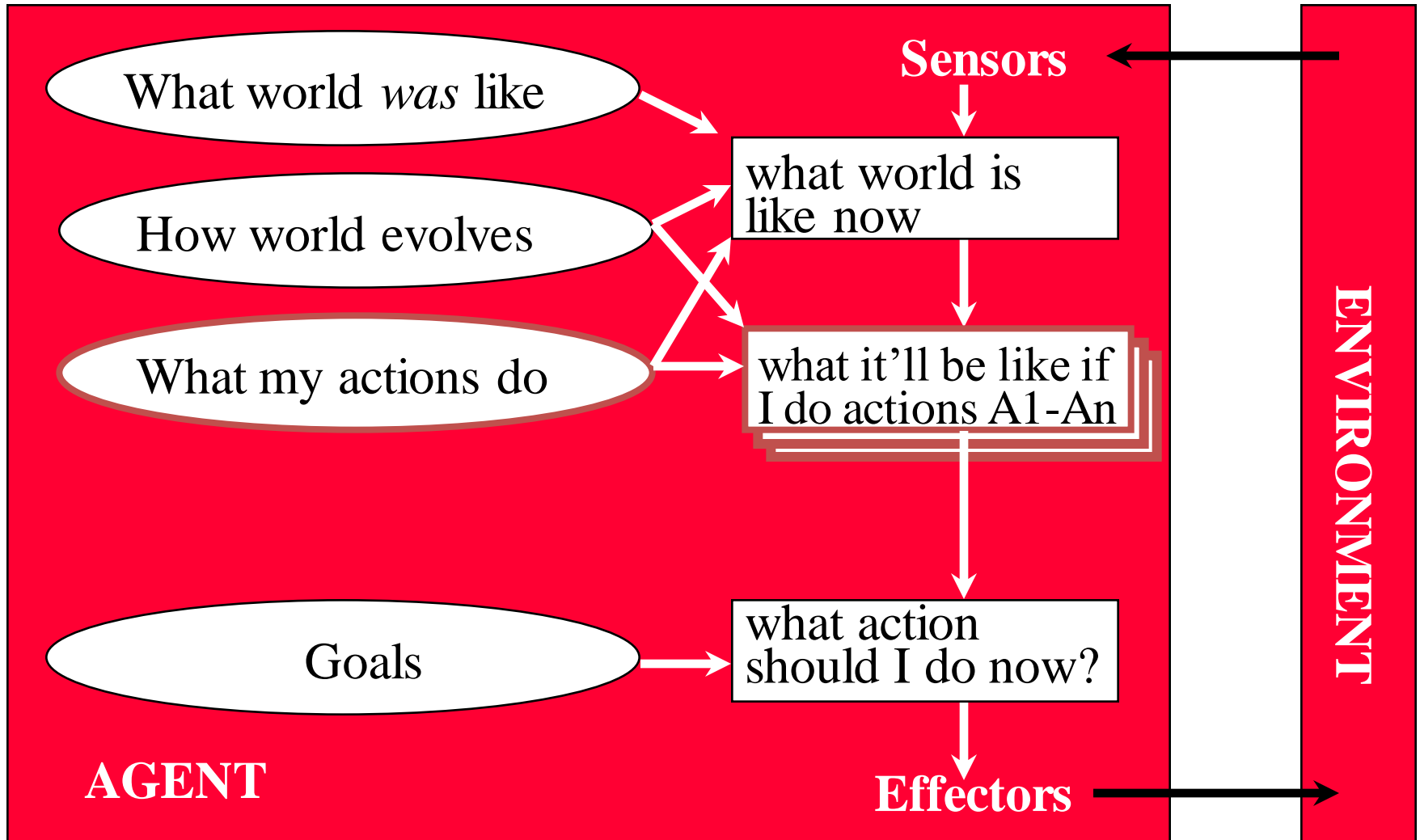


# Reflex agent with internal state

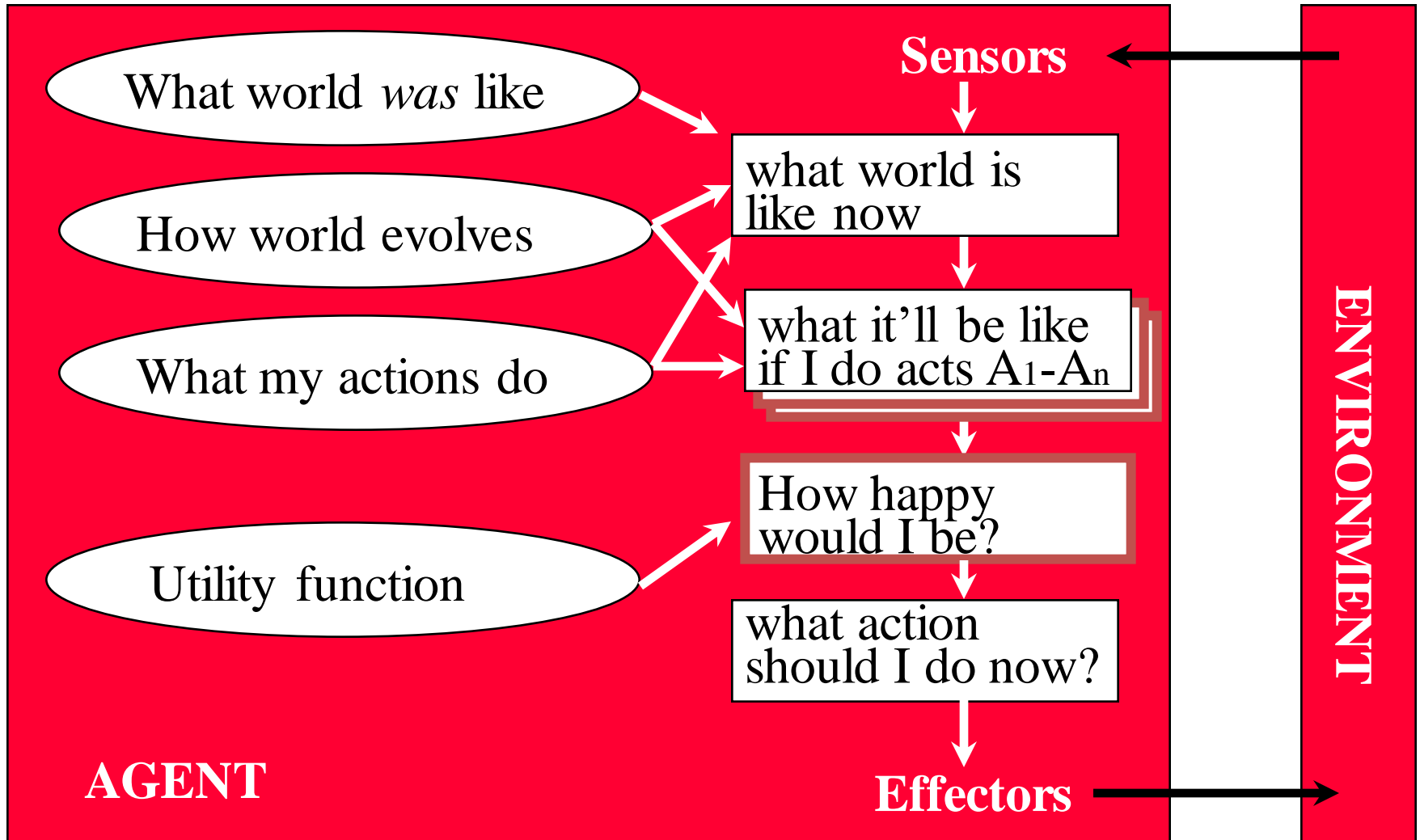




# Goal-based agents



# Utility-based agents



# Learning agents

