Introduction to AI

Lecture 3: Types of Environment & Agents

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How is an Agent different from other software?

- Agents are **autonomous**, that is, they act on behalf of the user

- Agents contain some level of **intelligence**, from fixed rules to learning engines that allow them to adapt to changes in the environment

How is an Agent different from other software?

- Agents have **social ability**, that is, they communicate with the user, the system, and other agents as required

- Agents may also **cooperate** with other agents to carry out more complex tasks than they themselves can handle

Environment Types

- Characteristics
  - Accessible vs. inaccessible
  - Deterministic vs. nondeterministic
  - Episodic vs. nonepisodic
  - Static vs. dynamic
  - Discrete vs. continuous

Environment Types

- Characteristics
  - Accessible vs. inaccessible
    - Sensors give access to **complete** state of the environment.
  - Deterministic vs. nondeterministic
    - The next state can be determined based on the current state and the action.
  - Episodic vs. nonepisodic (Sequential)
    - Episode: the agent receives a percept and then performs a single action
    - The quality of action does not depend on the previous episode.

Environment Types

- Characteristics
  - Static vs. dynamic
    - Dynamic if the environment changes during deliberation
  - Discrete vs. continuous
    - Chess vs. driving

Environment types

Environment	Accessible	Deterministic	Episodic	Static	Discrete
Operating System					
Virtual Reality					
Office Environment					
Mars					

Environment types

Environment	Accessible	Deterministic	Episodic	Static	Discrete
Operating System	Yes	Yes	No	No	Yes
Virtual Reality					
Office Environment					
Mars					

Environment types

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Office Environment					
Mars					

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Office Environment	No	No	No	No	No
Mars	No	Semi	No	Semi	No

The environment types largely determine the agent design.

Agent types

- Reflex agents
- Reflex agents with internal states (Model-based)
- Goal-based agents
- Utility-based agents

Agent types

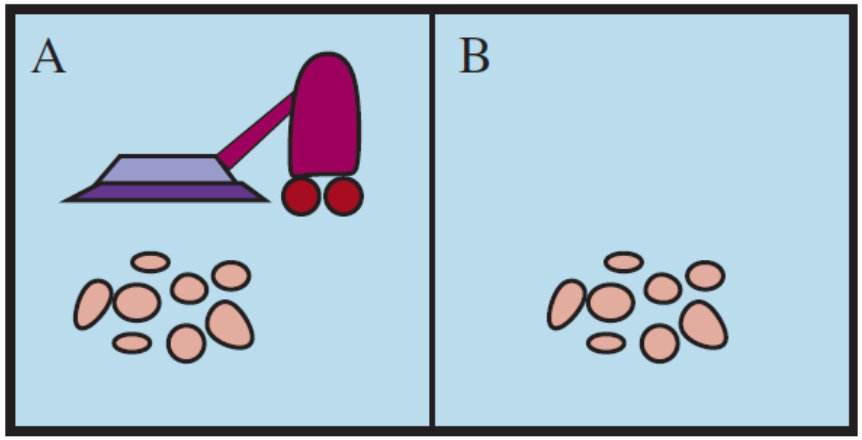
- Reflex agents
  - Reactive: No memory
- Reflex agents with internal states (Model-based)
  - With previous state, handle partial observability.
- Goal-based agents
  - Goal information needed to make decision

Agent types

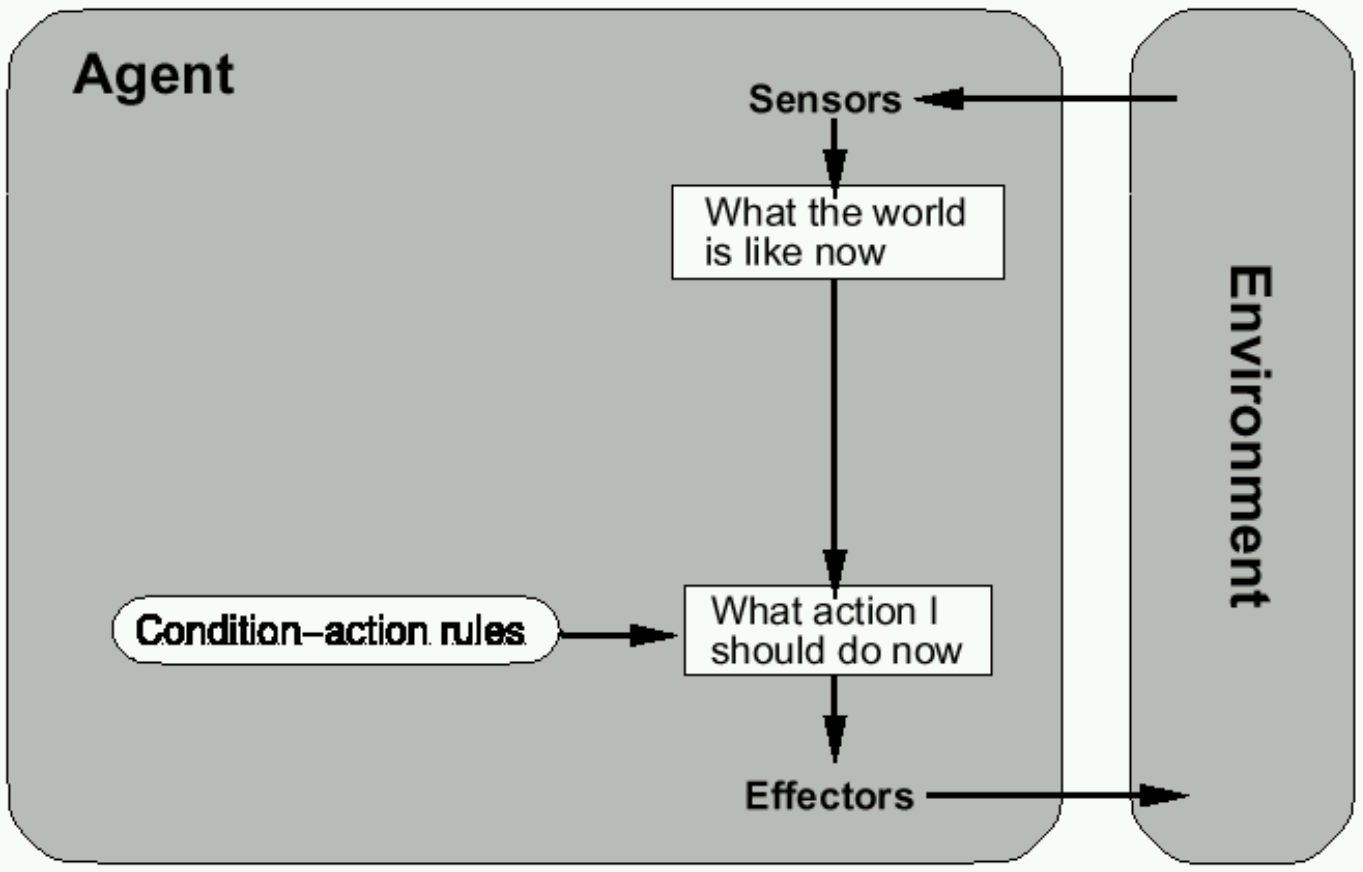
- Utility-based agents
  - How well can the goal be achieved (degree of happiness)
  - What to do if there are conflicting goals?
    - Speed and safety
  - Which goal should be selected if several can be achieved?

Robot vacuum

- The vacuum agent is a simple reflex agent, because its decision is based only on the current location and on whether that location contains dirt.



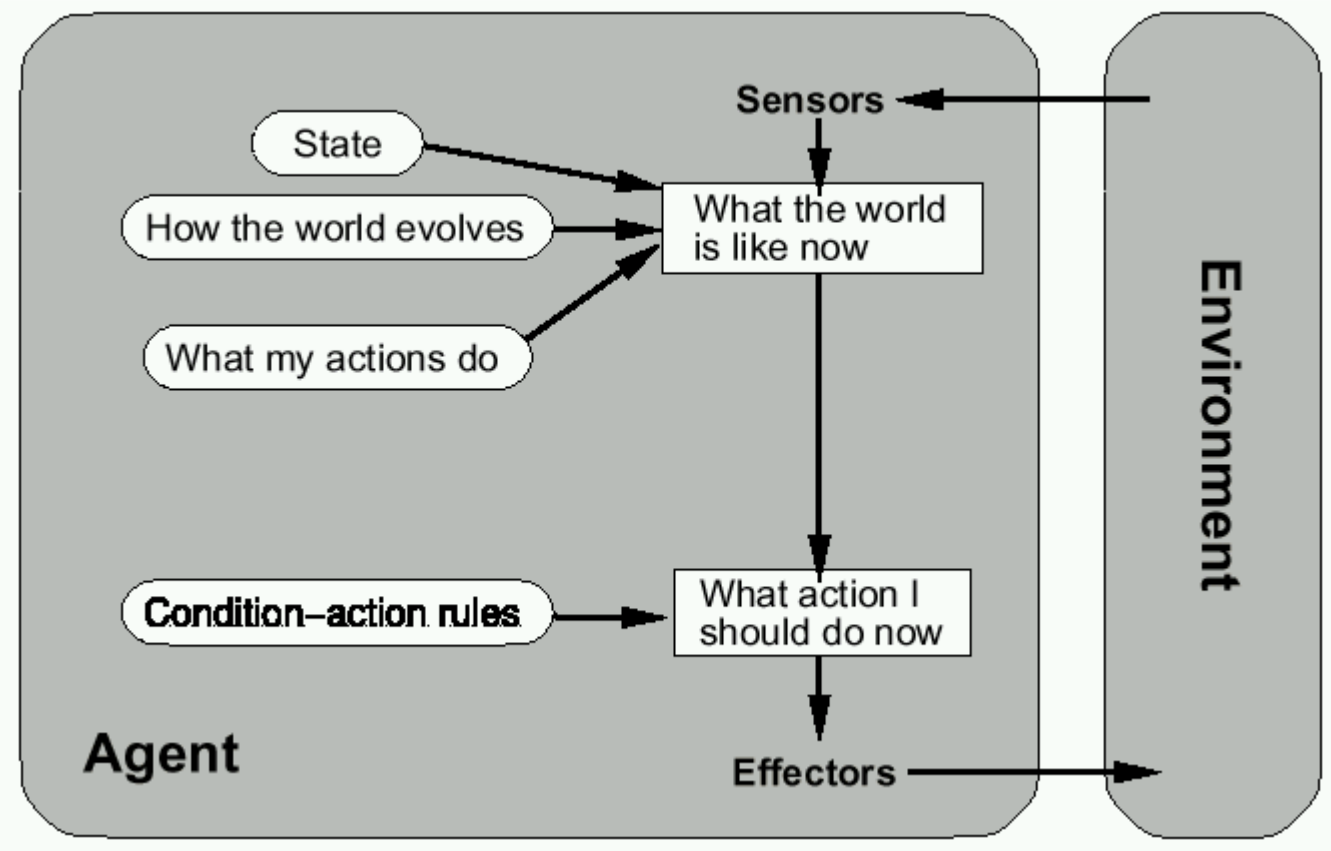
Reflex agents



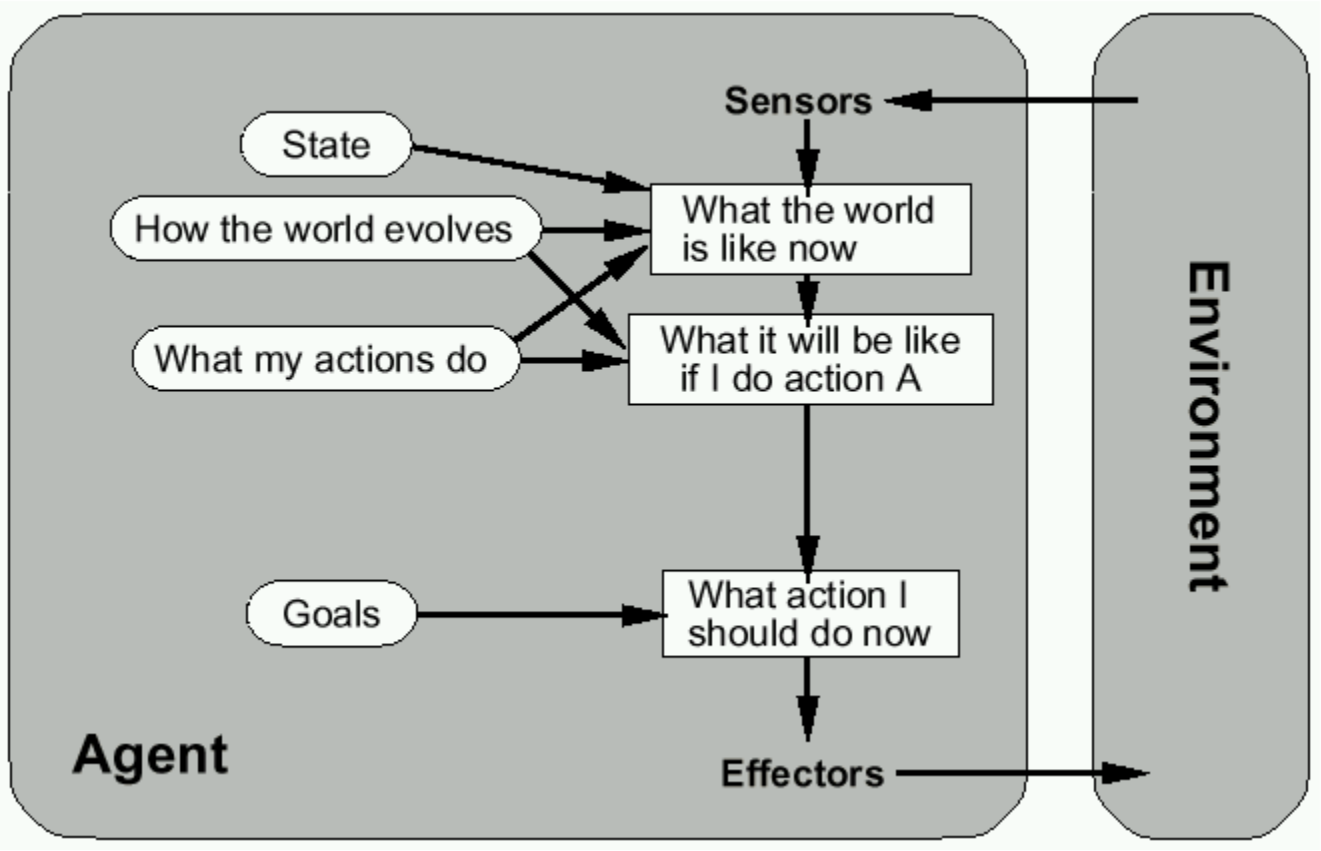
The agent program for a simple reflex agent in the two-location vacuum environment:

```
function REFLEX-VACUUM-AGENT([location,status]) returns an action
    if status = Dirty then return Suck
    else if location = A then return Right
    else if location = B then return Left
```

Reflex agents with state



Goal-based agents



Utility-based agents