What is an Agent?
Restricting the definition of an **agent**: an ideal agent

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- **Pro-Activity**: The ability to exhibit goal-directed behavior by taking the initiative instead of just acting in response.
### Agents vs. Objects

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Agents vs. Objects

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- Agents have the quality of volition.
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- Objects are abstractions of things like invoices. Agents are abstractions of intelligent beings – they are essentially anthropomorphic.
  Note that this does not mean that agents are intelligent in the human sense, only that they are modeled after an anthropomorphic architecture, with beliefs, desires, etc.
Agents vs. Objects

- Design an object-oriented solution and an agent-oriented solution for a car wash task.
- Identify why it is an object-oriented or an agent-oriented solution.
- List agents and objects for both solutions.
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Other attributes:

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- **Mobility**: The ability to move around an electronic network.
- **Veracity**: The assumption of not communicating false information knowingly.
- **Benevolence**: The assumption of not having conflicting goals.
- **Rationality**: The assumption of acting with a view to achieve its goals, instead of preventing them.
A rational agent chooses whichever action maximizes the expected value of the performance measure given the percept sequence to date.

A system is rational if it does the “right thing”, given what it knows.
Getting to an ideal agent

Agent types in order of increasing generality:

- simple reflex agents
- reflex agents with state
- goal-based agents
- utility-based agents
- learning agents
Simple Reflex Agent

Agent

Sensors

What the world is like now

Actuators

What action I should do now

Condition–action rules

Environment
Simple Reflex Agent - An Example

```
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 Agent with State

Agent

- State
- How the world evolves
- What my actions do
- Condition–action rules
- What the world is like now
- What action I should do now

Environment

Sensors

Actuators
function REFLEX-VACUUM-AGENT([location, status]) returns an action
static: last_A, last_B, numbers, initially ∞
   if status = Dirty then …
Goal-based Agent

Agent

Environment

Sensors

State

How the world evolves

What the world is like now

What it will be like if I do action A

What my actions do

Goals

What action I should do now

Actuators
Utility-based Agent

- **Agent**
  - State
  - How the world evolves
  - What my actions do
  - Utility

- **Environment**
  - Sensors
  - Actuators

- **Utility**
  - What the world is like now
  - What it will be like if I do action A
  - How happy I will be in such a state
  - What action I should do now
All the previous agents can be turned into learning agents
Agent Summary

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- **PEAS** descriptions define task environments.
- Environments are categorized along several dimensions: observable? deterministic? episodic? static? discrete? single-agent?
- Several basic agent architectures exist: reflex, reflex with state, goal-based, utility-based, learning.