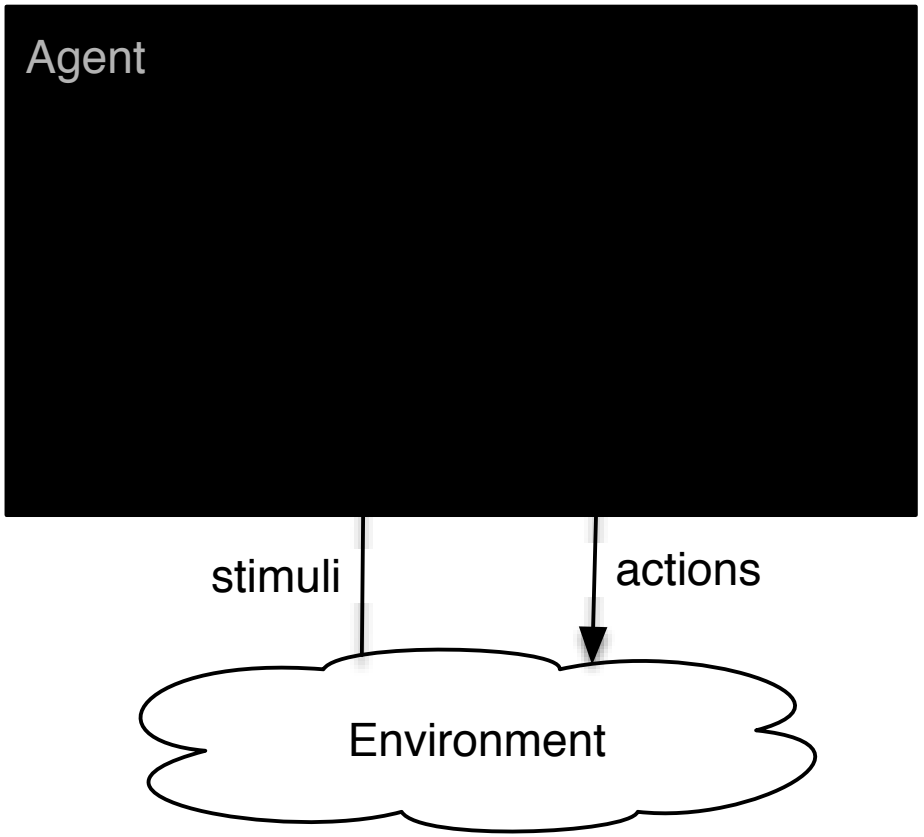
Agent architectures and hierarchical control

Overview:

- Agents and Robots
- Agent systems and architectures
- Agent controllers
- Hierarchical controllers

Agent Systems



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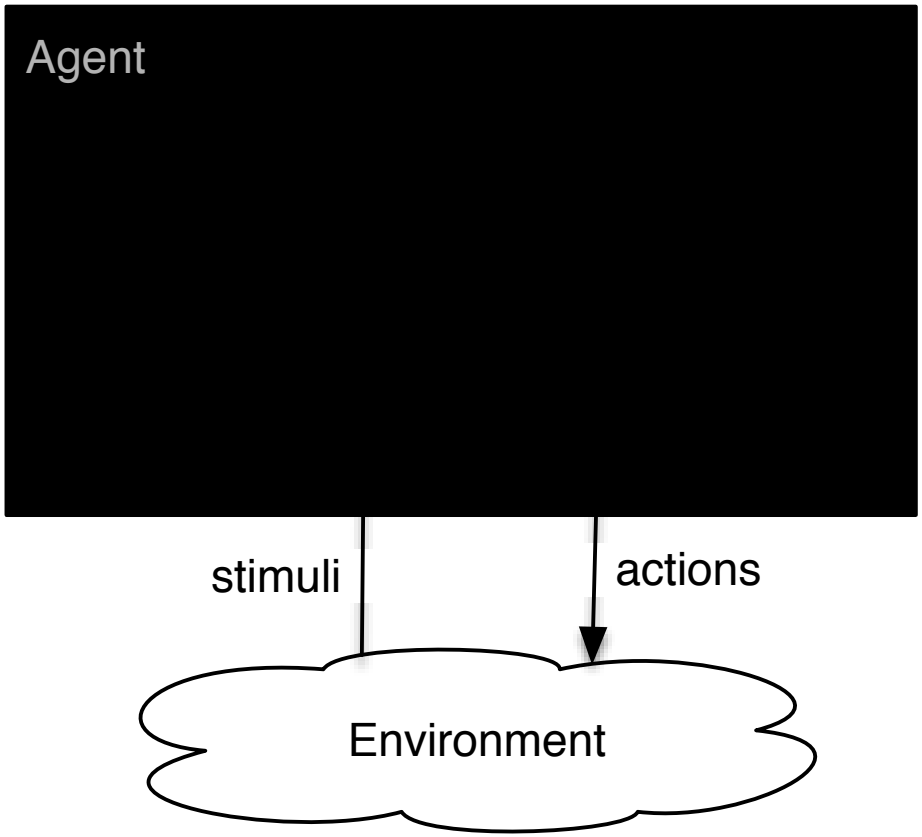
Agent Systems



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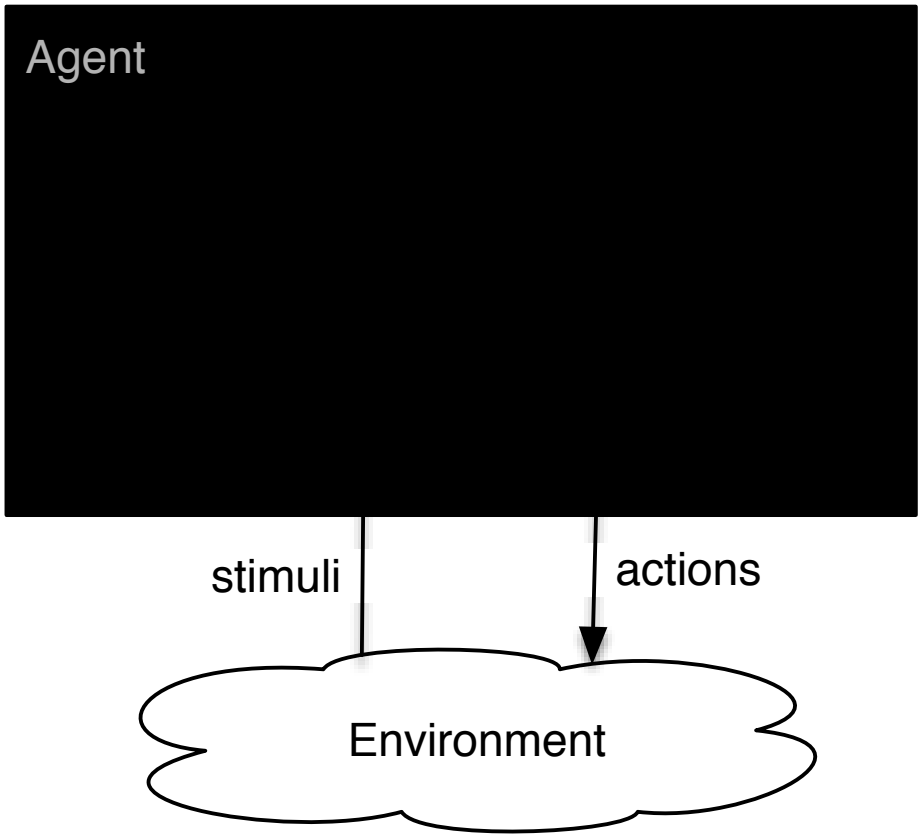

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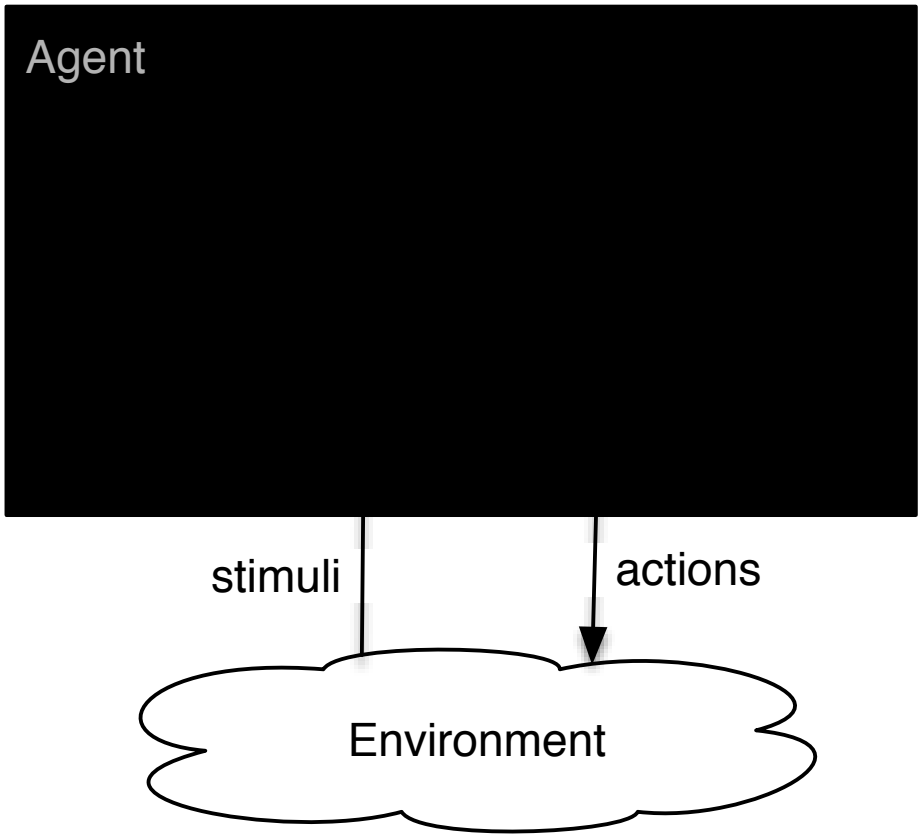

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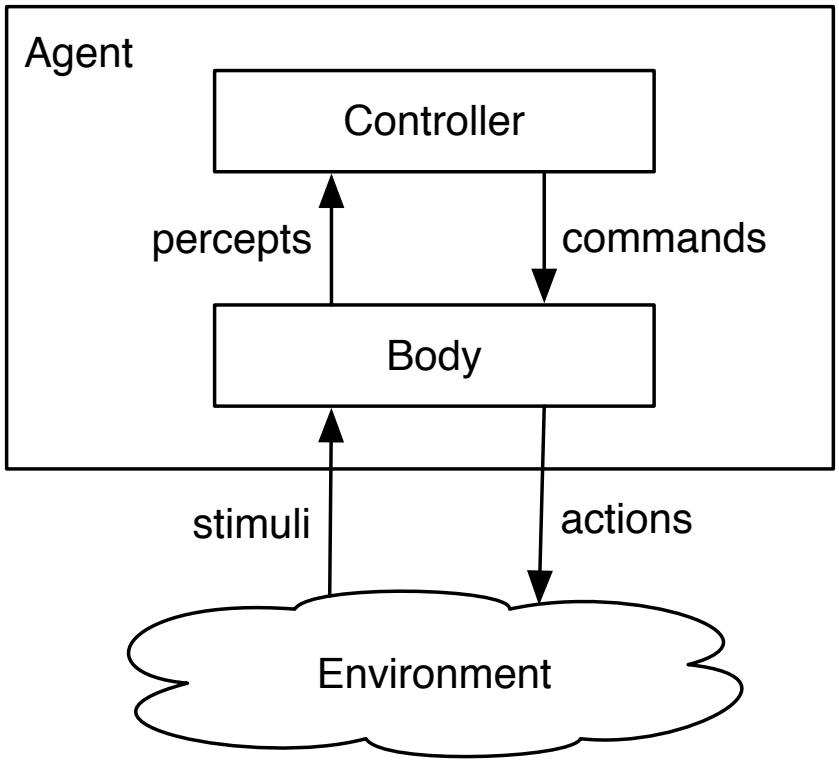
- An agent receives stimuli from the environment
- An agent carries out actions in the environment.

Agent System Architecture

An agent is made up of a body and a controller.



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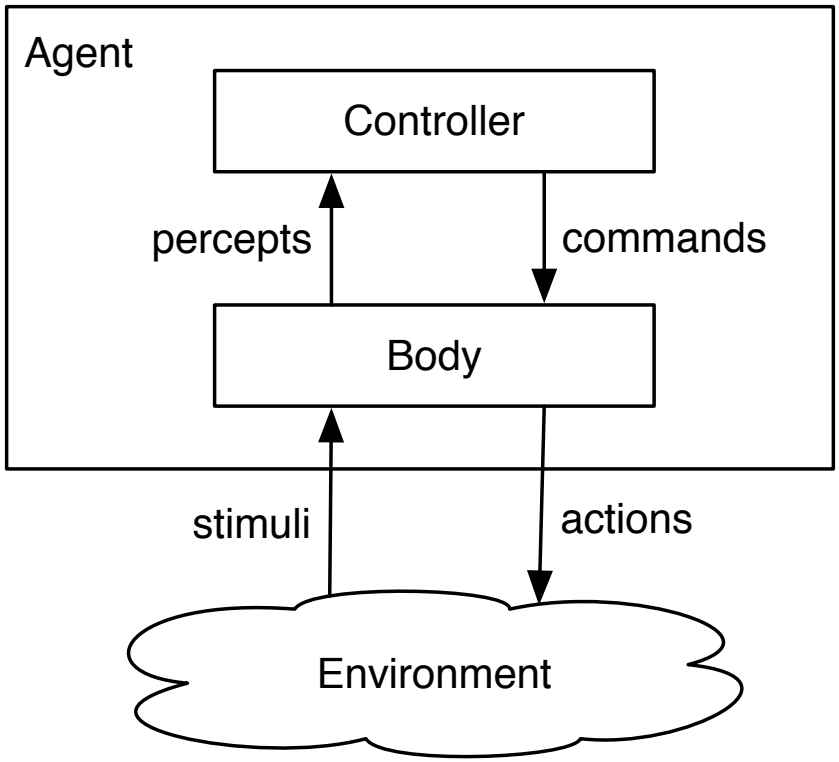

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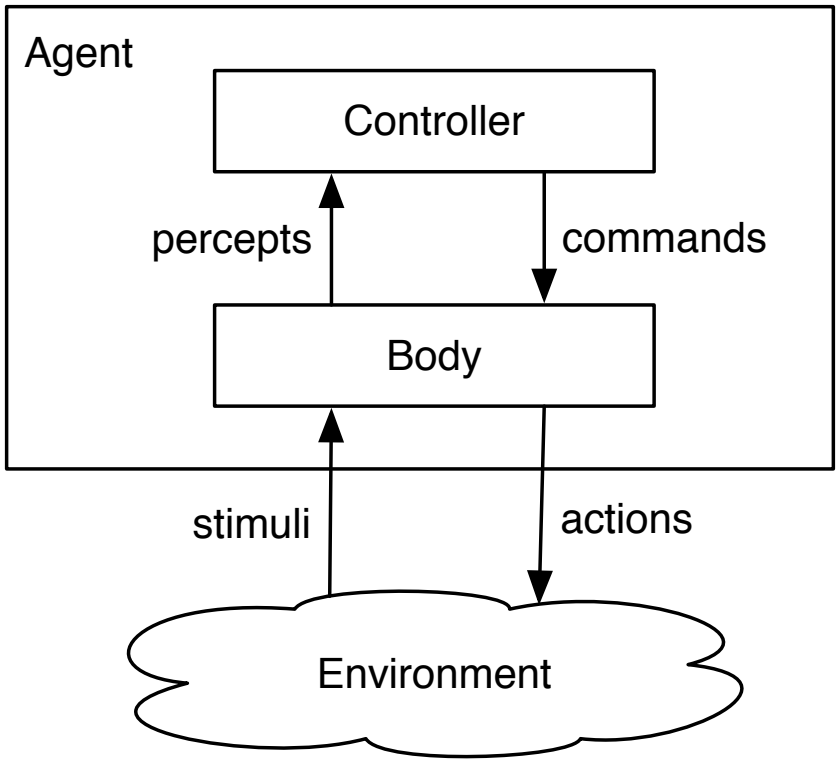

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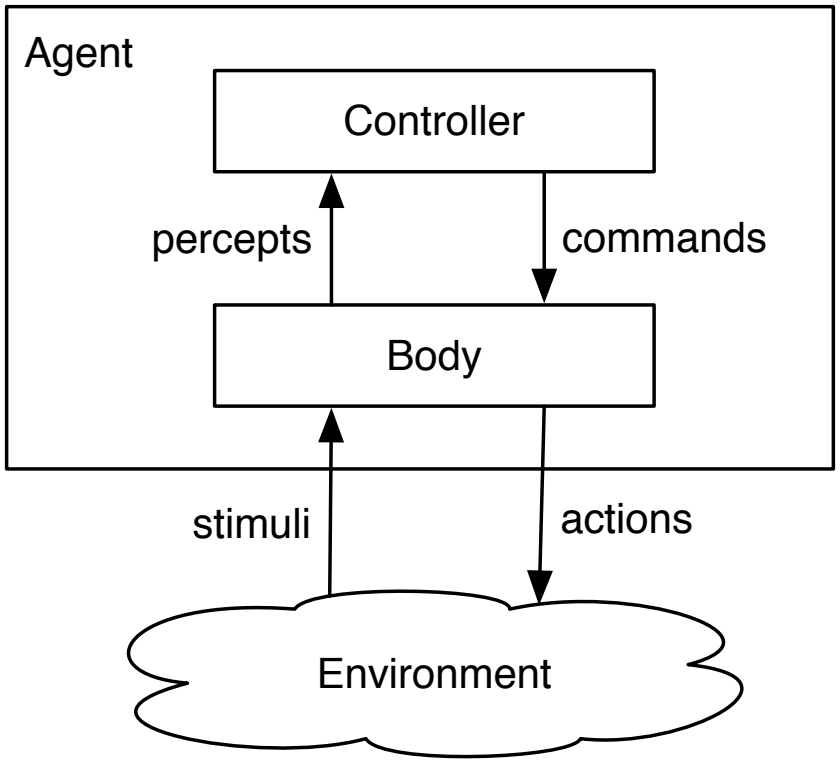

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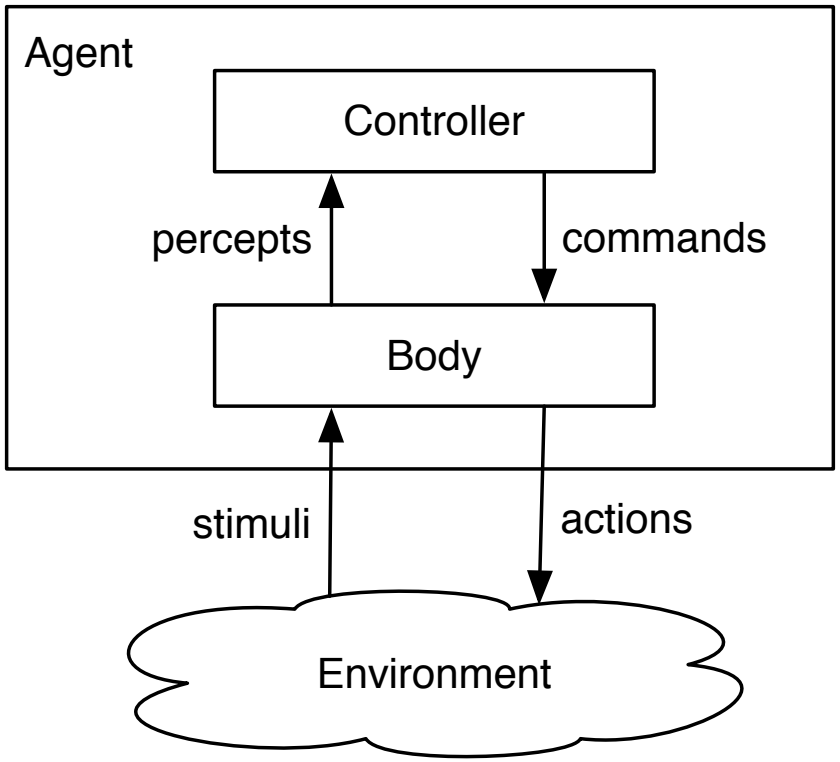

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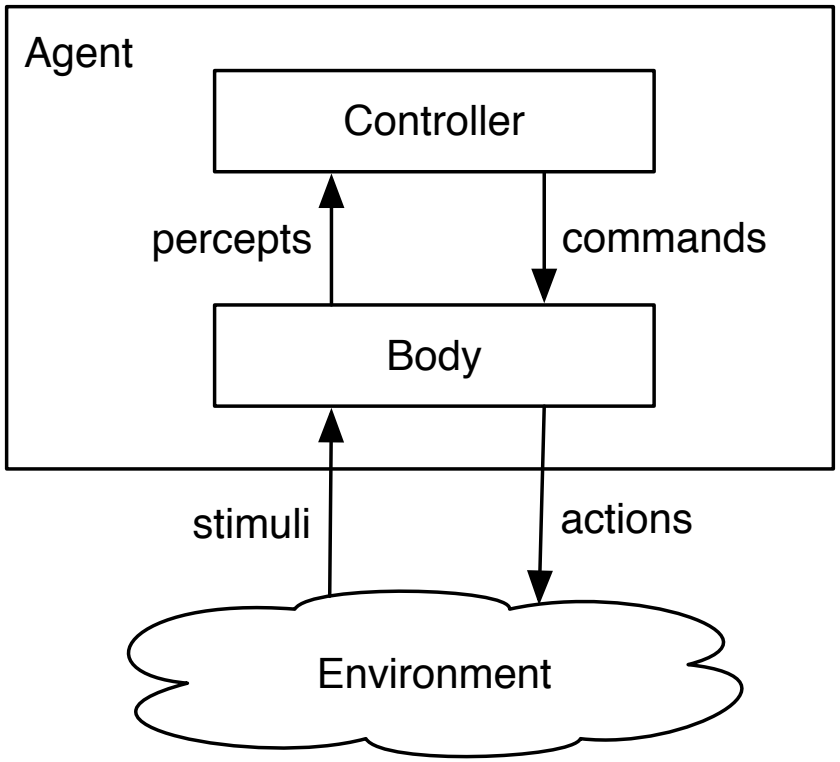

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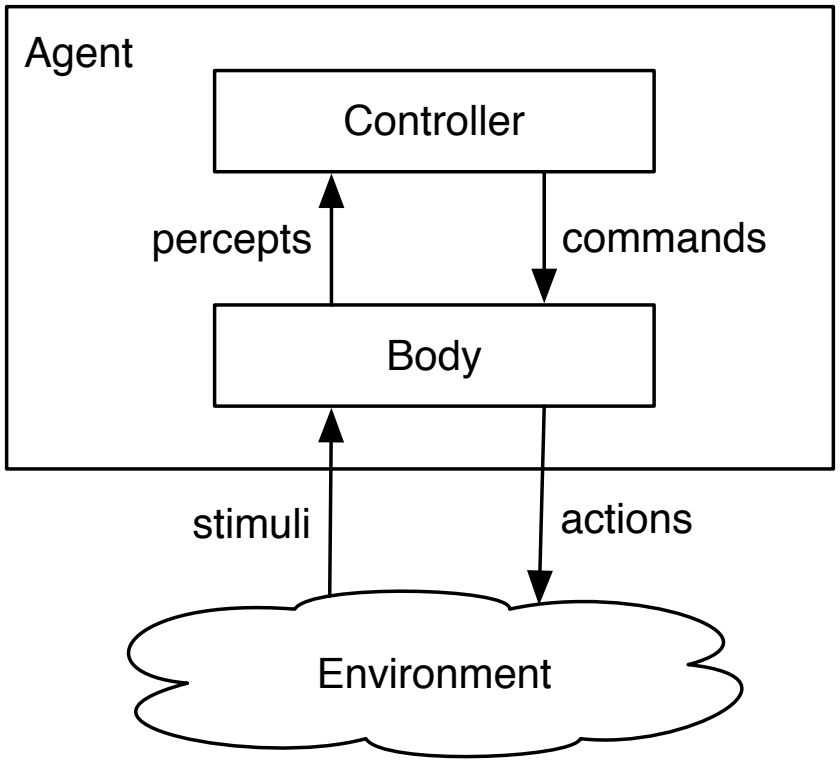

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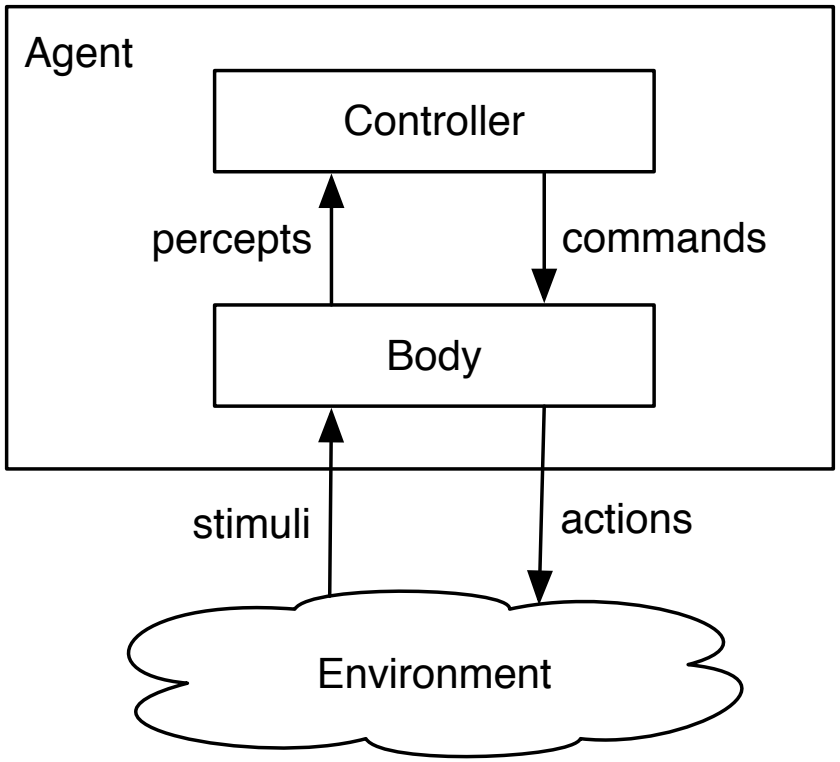

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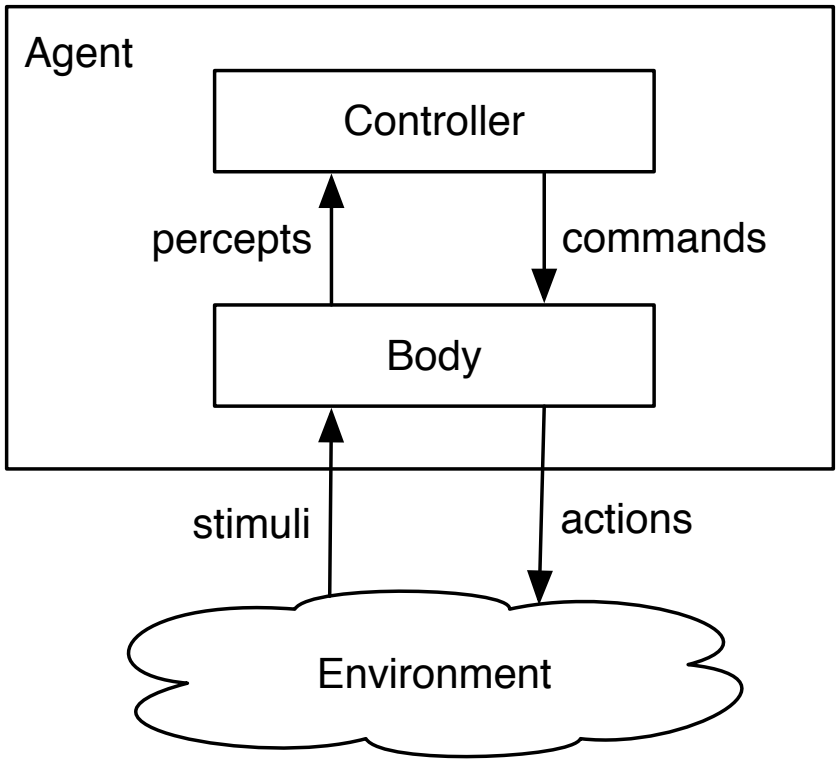

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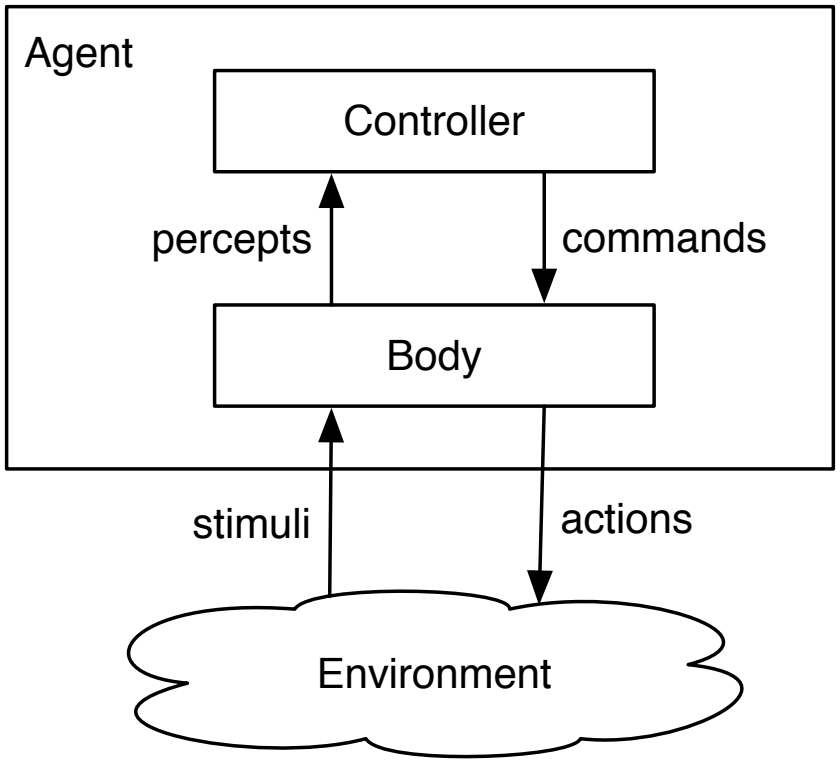

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- The body can also have reactions that are not controlled.

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- The command at any time can depend on the current and previous percepts.

Example: smart home

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  Example: snack buying agent:
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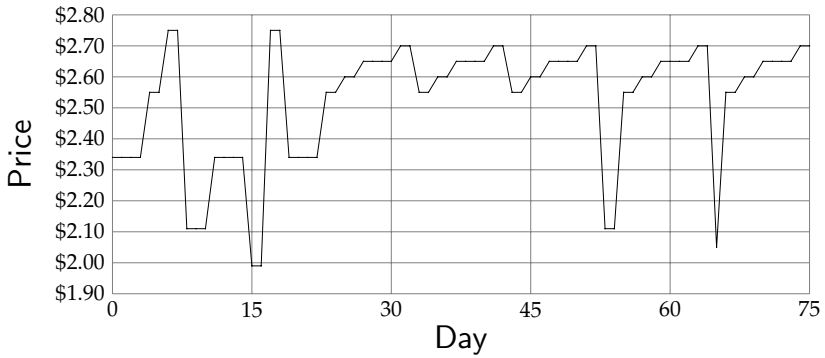

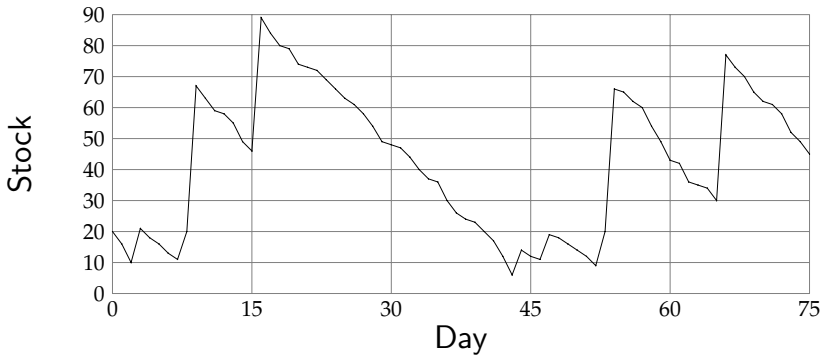

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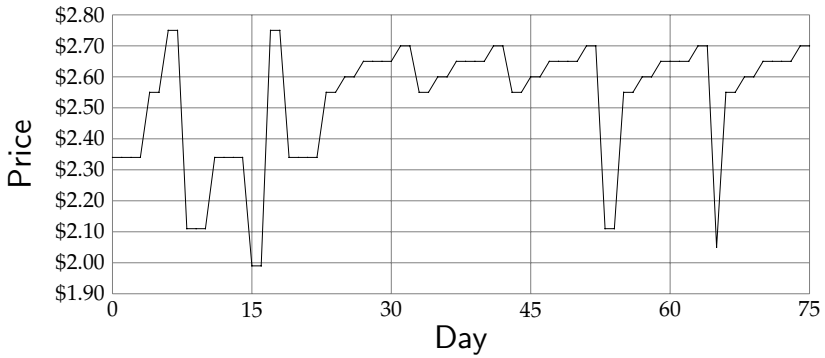

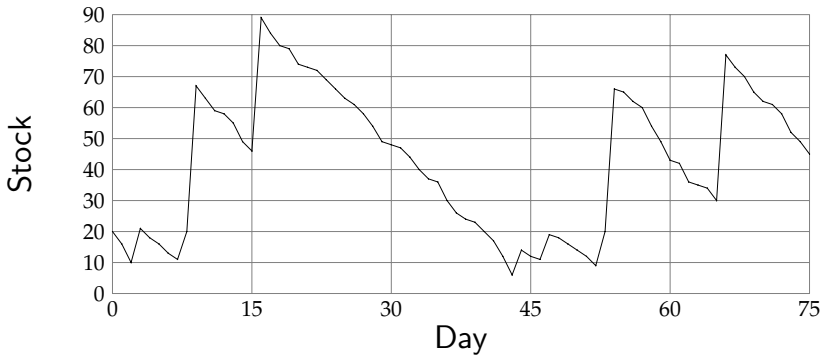

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- A controller is an implementation of a transduction.

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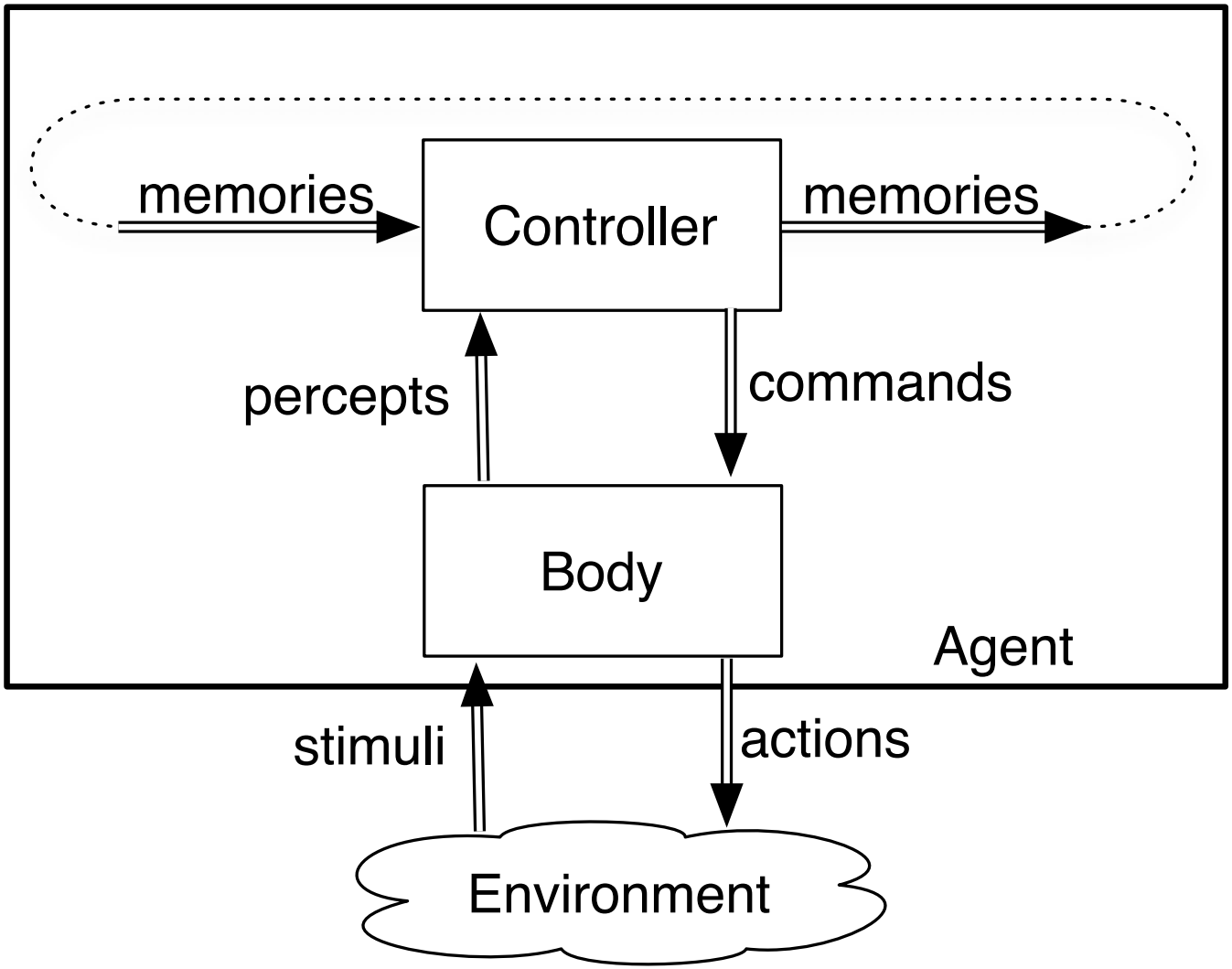
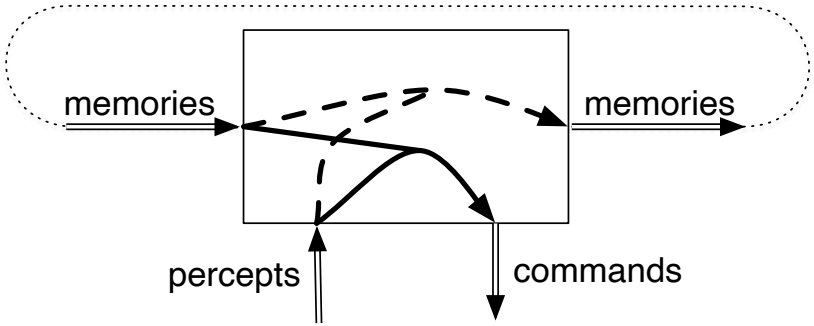
  — as a function of its percepts and its memory.

Controller


memories
Controller
memories
percepts
commands
Body
Agent
stimuli
actions
Environment

Functions implemented in a controller



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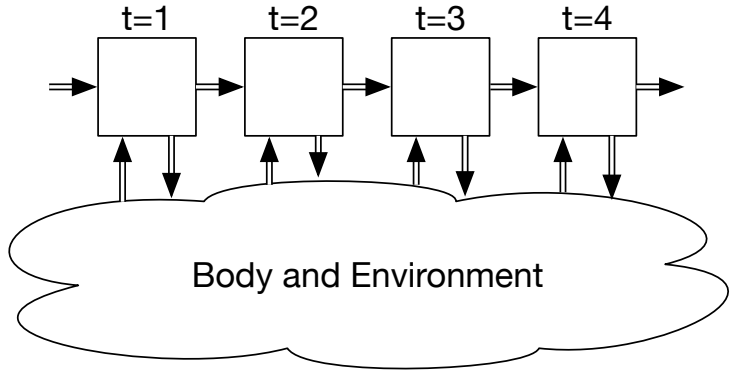

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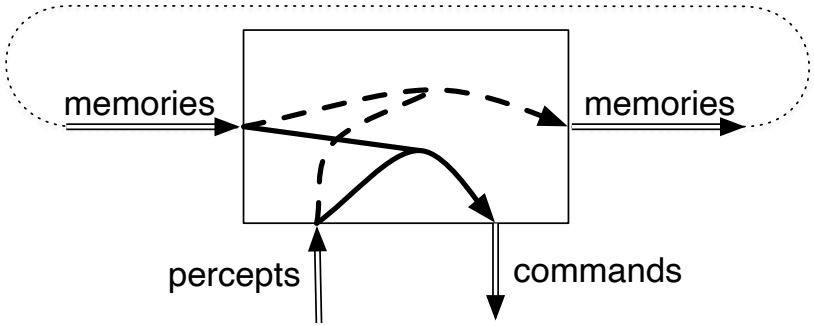

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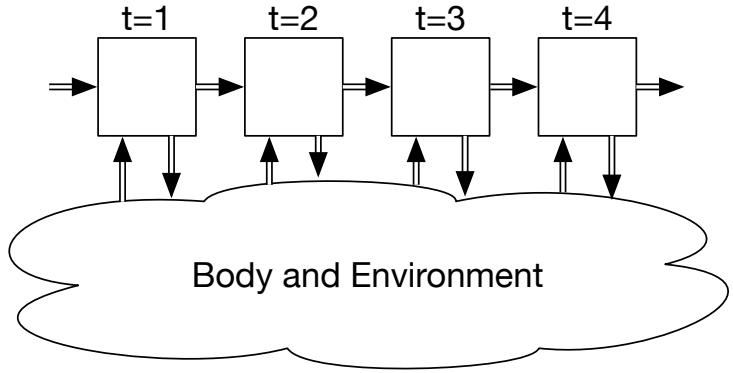

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For discrete time, a controller implements:

- belief state function *remember*(*belief_state*, *percept*), returns the next belief state.

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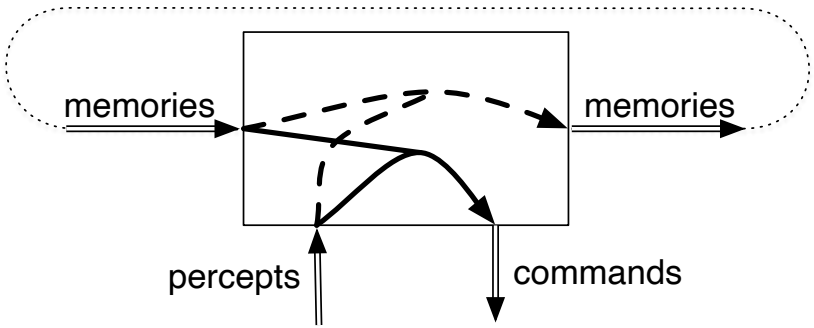

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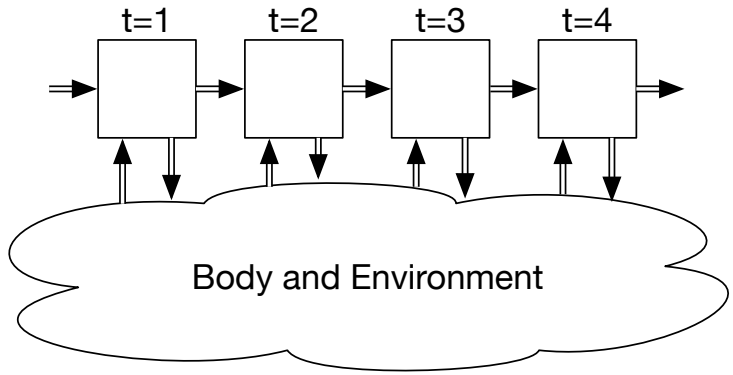

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For discrete time, a controller implements:

- belief state function *remember*(*belief_state*, *percept*), returns the next belief state.
- command function *command*(*belief_state*, *percept*) returns the command for the agent.

Chip buying controller

- Percepts:

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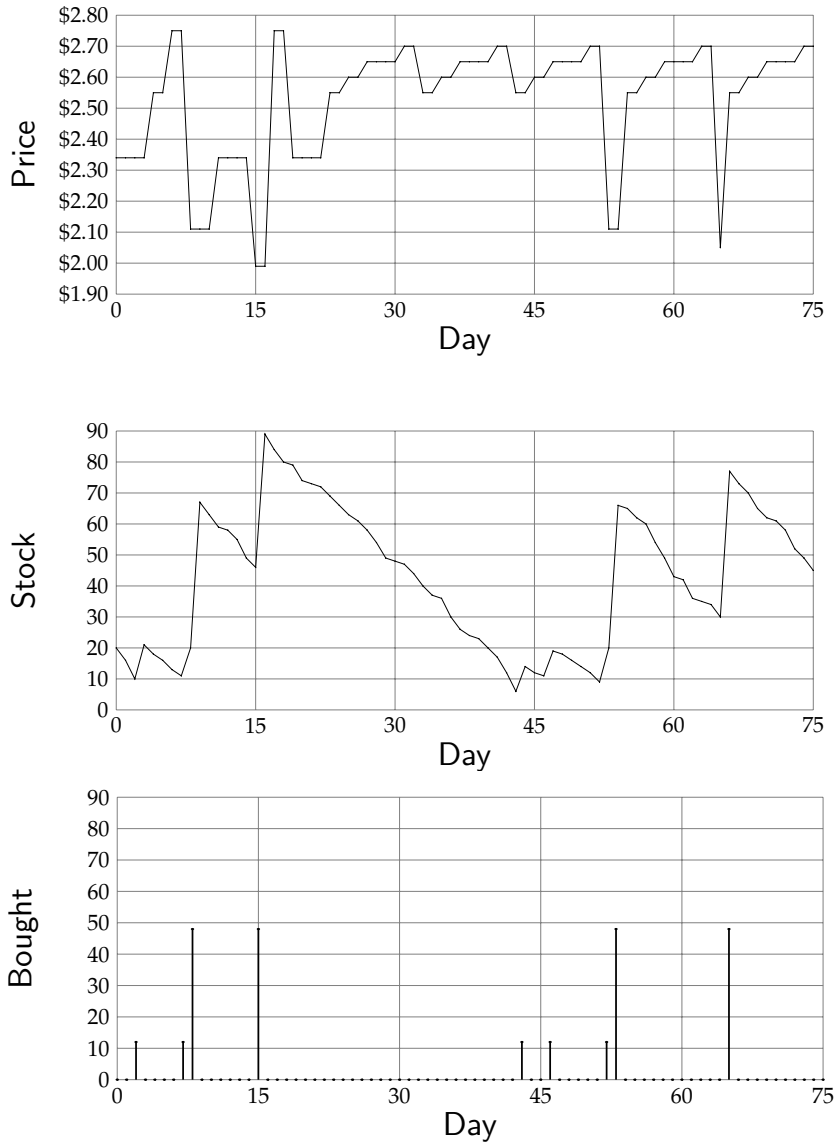
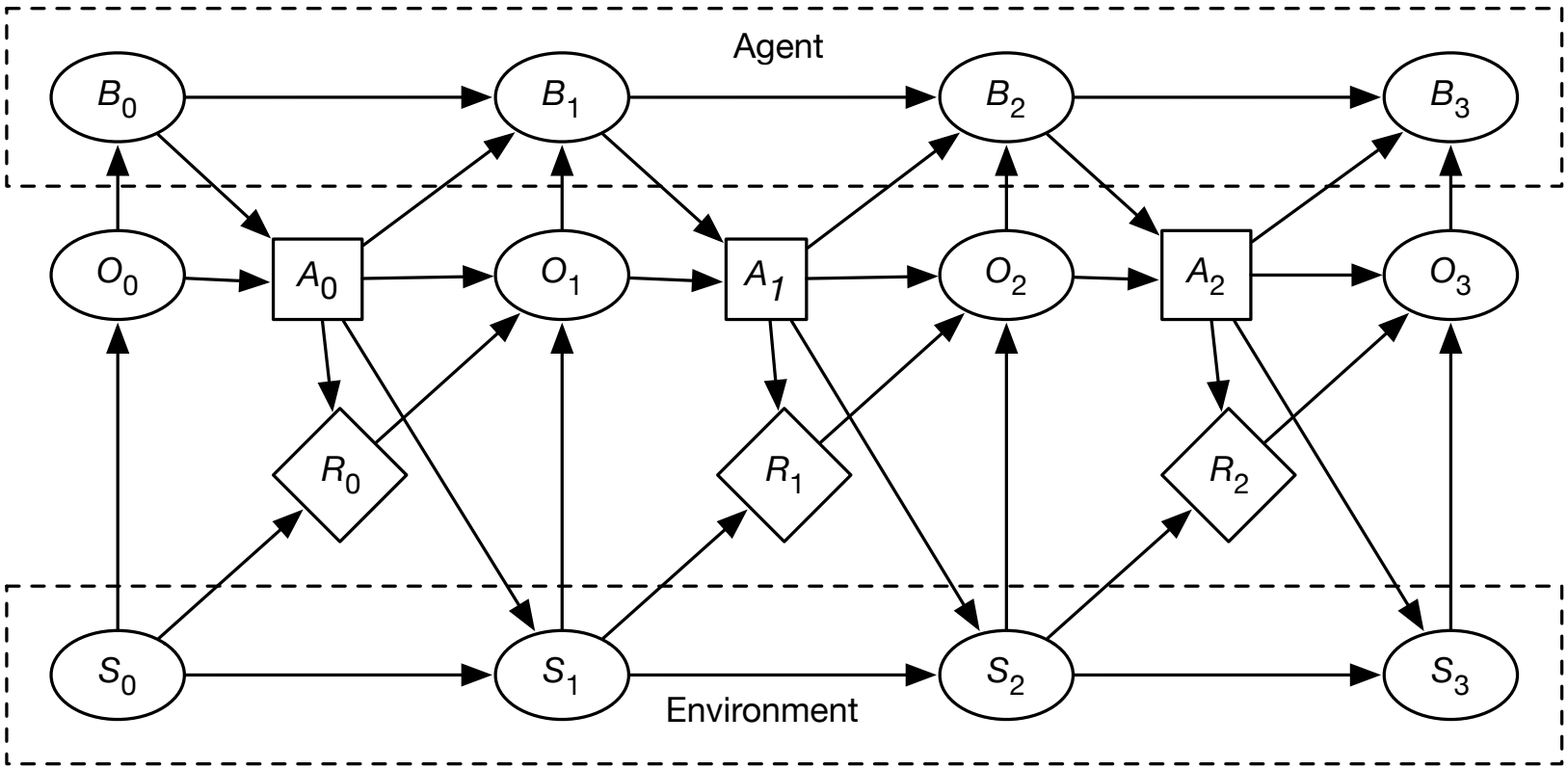
This maintains a discouning rolling avergage that (eventually) weights more recent prices more.

(see `agents.py` in AIPython distribution `http://aipython.org`)

Percept and Command Traces (POMDP)



Agents acting in time



B_i agent's belief state at time i.

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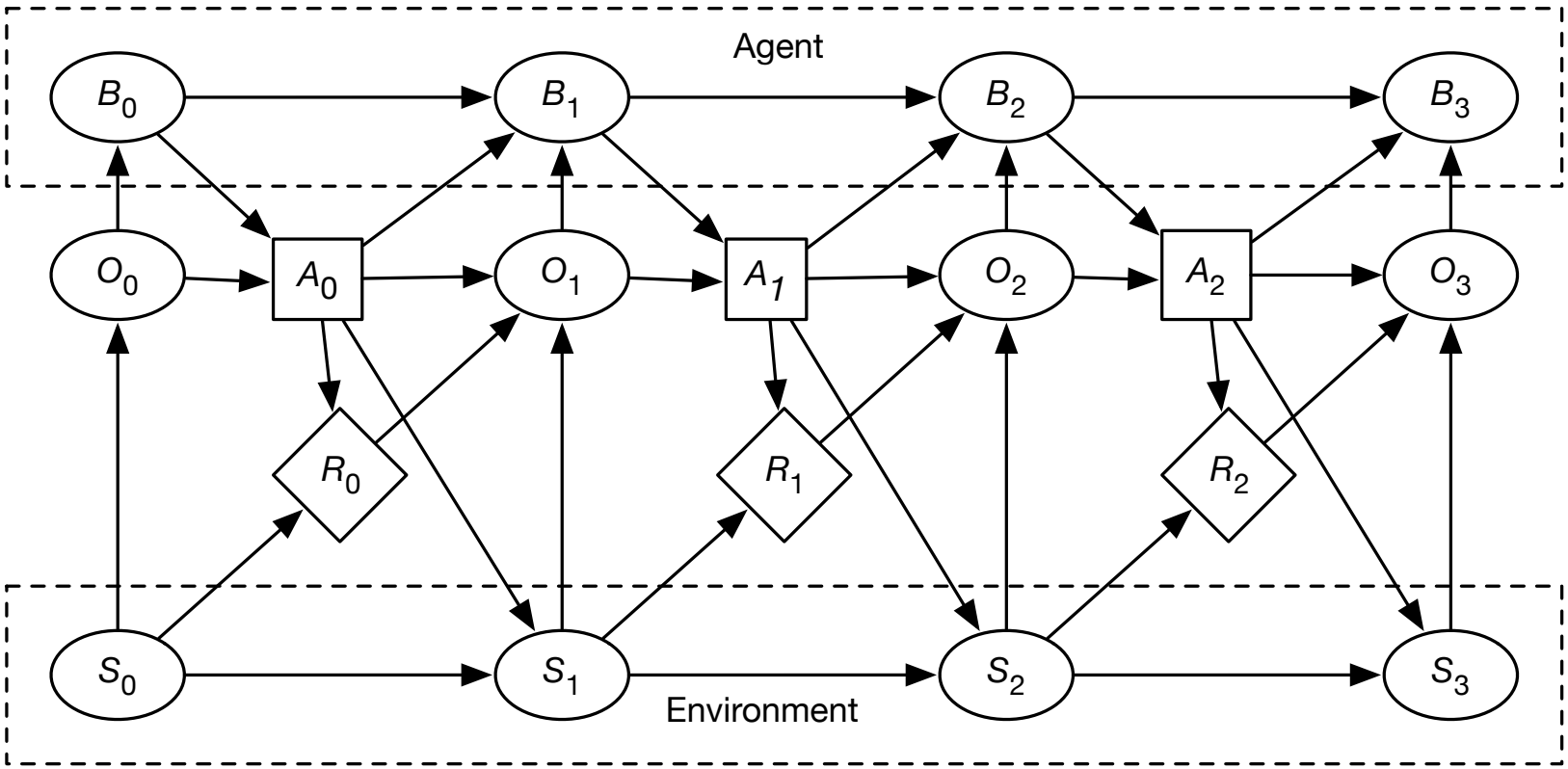

B_i agent's belief state at time i.A_i agent's action.

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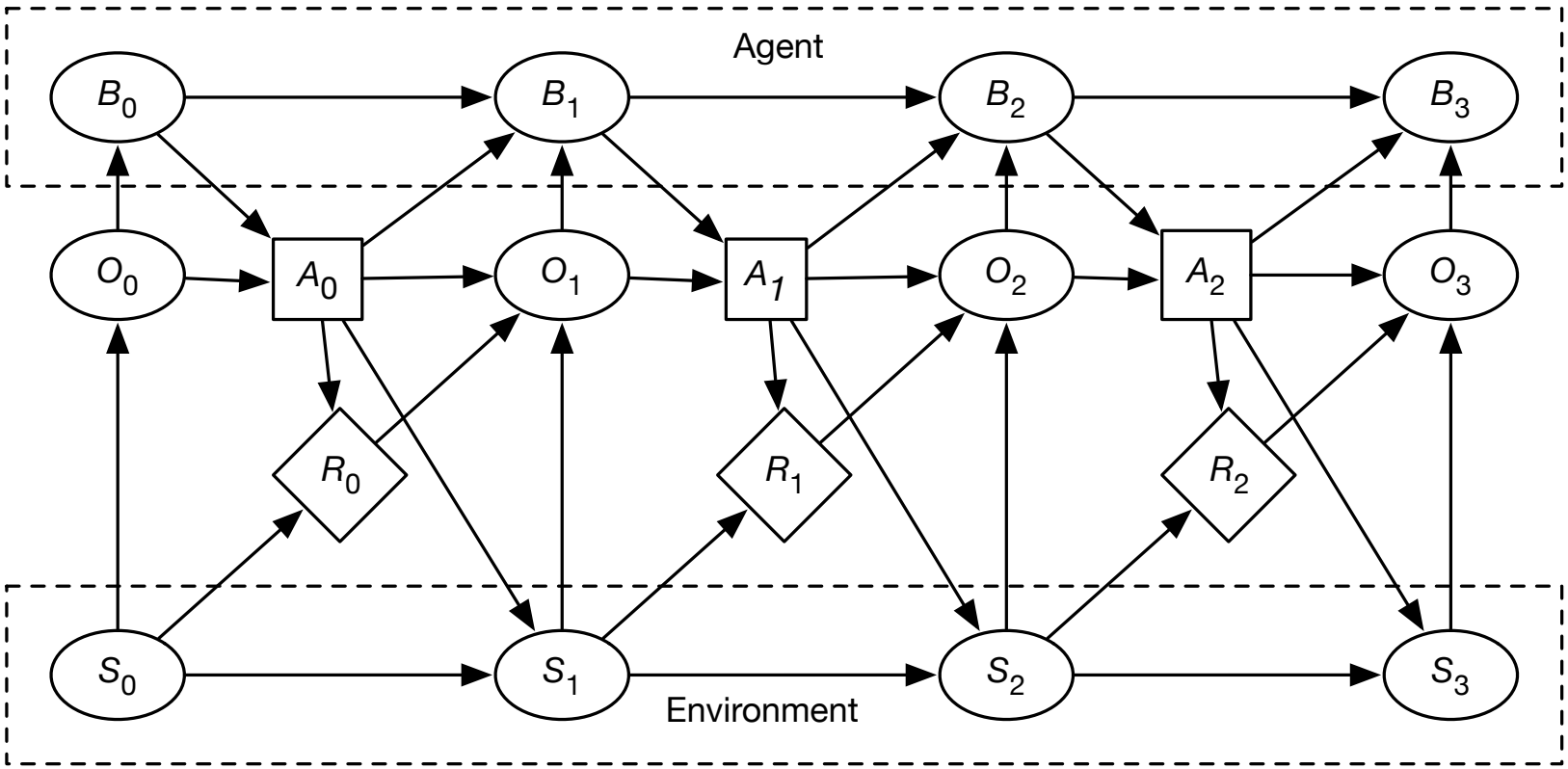

B_i agent's belief state at time i.A_i agent's action.O_i is what the agent observes.

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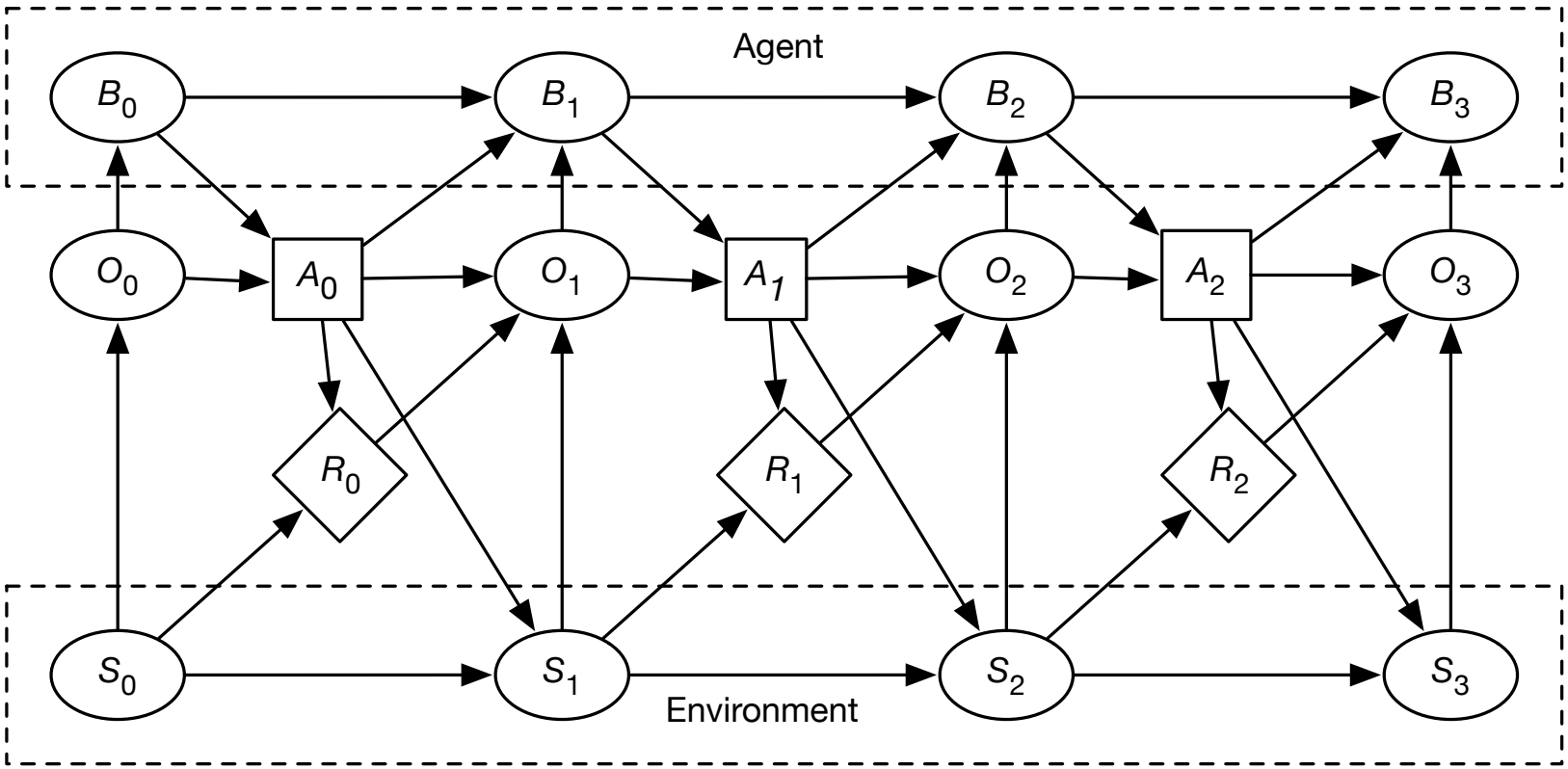

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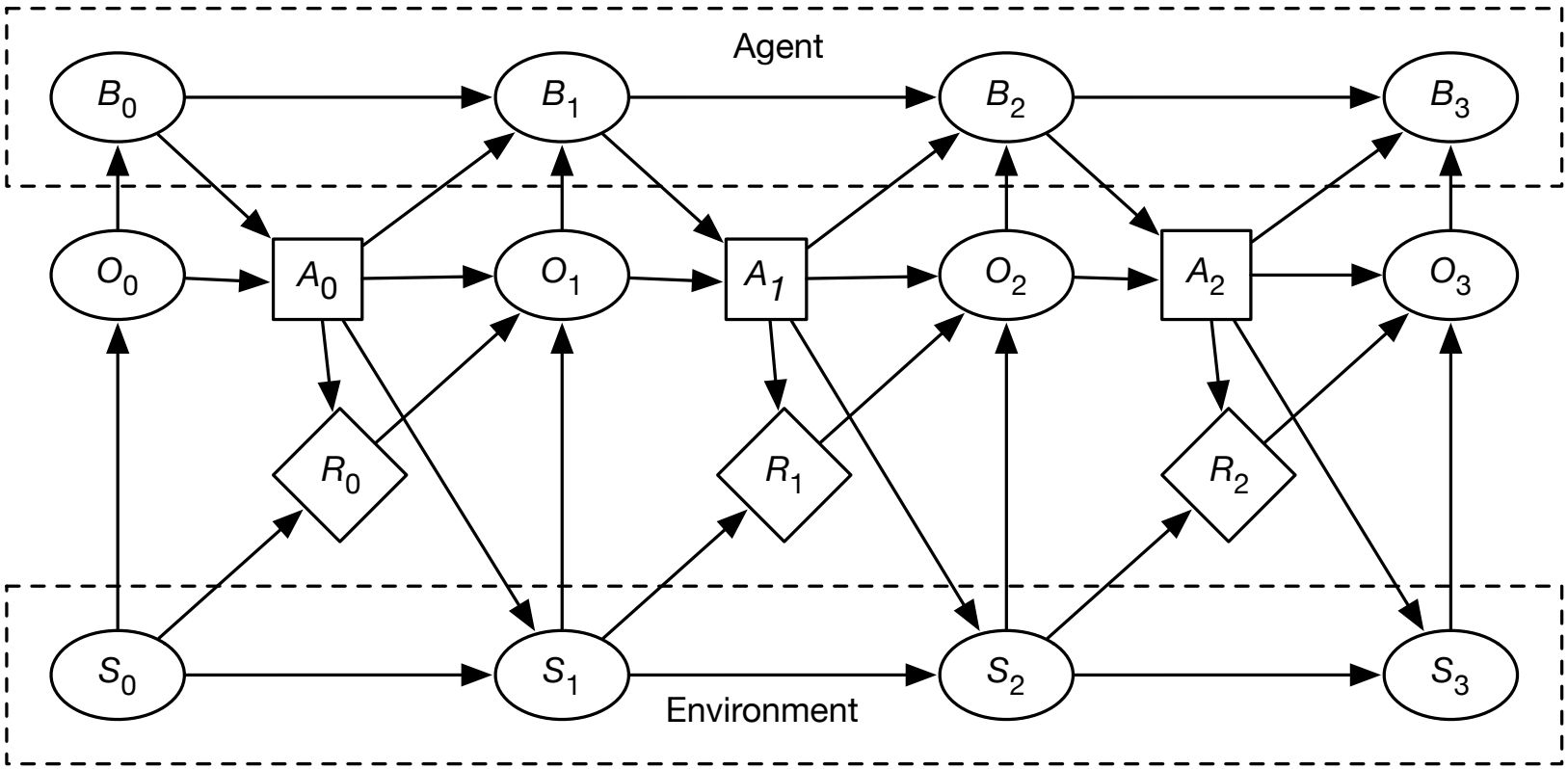

B_i agent's belief state at time i.A_i agent's action.O_i is what the agent observes.R_i is the reward.S_i is the world state.