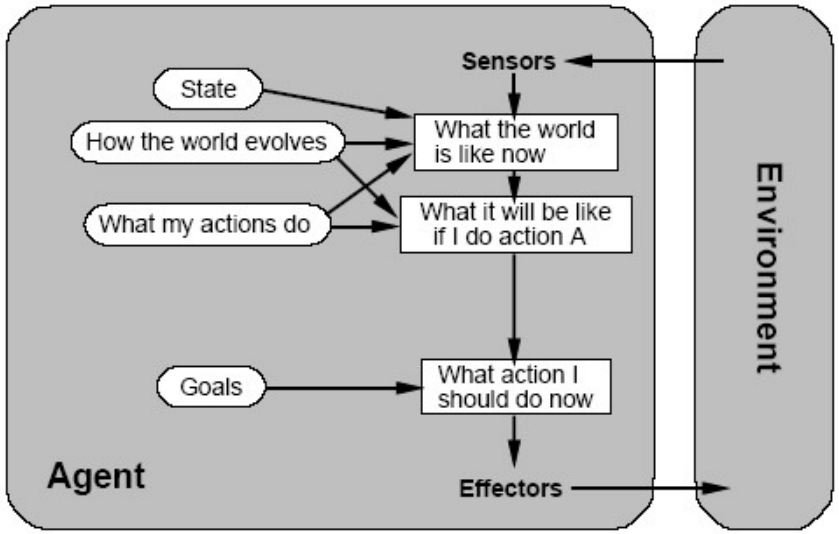
Implementing a Deliberative Agent

Intelligent Agents Course

(Credits to Radu Jurca
Michael Schumacher)

Deliberative Agents

- Also named ***mental*** or ***rational*** Agents
- The agent has an **explicit model of the world** in which it lives.
- Seeks to perform **goals**
- A **planner reasons** on the world model and decides which actions to realize by producing a plan, in order to achieve its goals.



Vehicles - Deliberative Agents

-> The vehicle computes an **optimal plan** using a state-based search algorithm

-> Rewards on goal states: an optimal plan to **minimize the cost**

- States of the world are known with certainty
- State transitions are deterministic

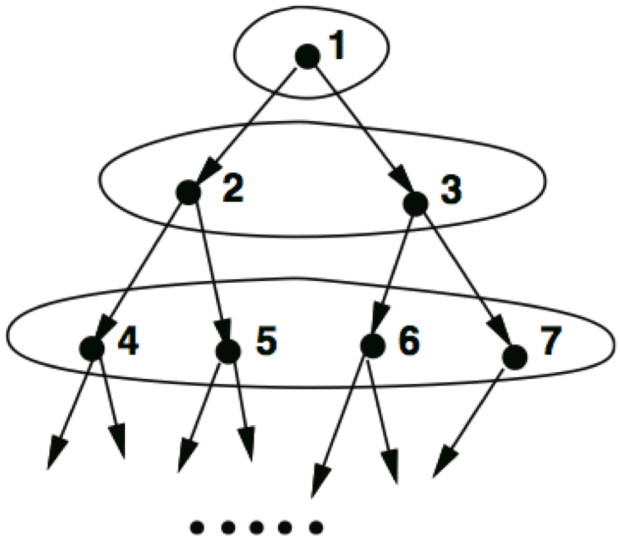
The Cost of a Plan

- Plan
  - Sequence of actions such that all tasks are delivered
  - Vehicle can carry multiple tasks
  - E.g. (T1,T2) ->
    - (move to pickup T1, pickup T1, move to delivery T1, deliver T1, move to pickup T2, pickup T2, move to deliver T2, deliver T2)
- Simplest cost form: distance x cost/km

Breadth-First Search Algorithm

Search with cycle detection

```
1.Q ← initial node
2.C ← empty
3.repeat
4.      if Q is empty, return failure
5.      n ← first element of Q , Q ← rest(Q)
6.      si n is a final node, return n
7.      si n is not a member of C then
8.           add n to C
9.           S ← succ(n)
10.         Q ← append(S, Q)
11.          endif
12.end
```



A* Search Algorithm

Algorithm A* (best-first)

```
1.Q ← initial node
2.C ← empty
3.repeat
4.    if Q is empty, return failure
5.    n ← first element of Q, Q ← rest(Q)
6.    if n is a final node, return n
7.    if n ∉ C, or has lower cost than its copy in C then
8.        add n to C
9.        S ← succ(n)
10.       S ← sort(S,f)
11.       Q ← merge(Q,S,f)
      (Q is ordered in increasing order of f(n) = g(n) + h(n))
12.   endif
13.end
```

in c : store f !!!!

Implementing Vehicles

- As soon as a delivery city is reached: task is delivered

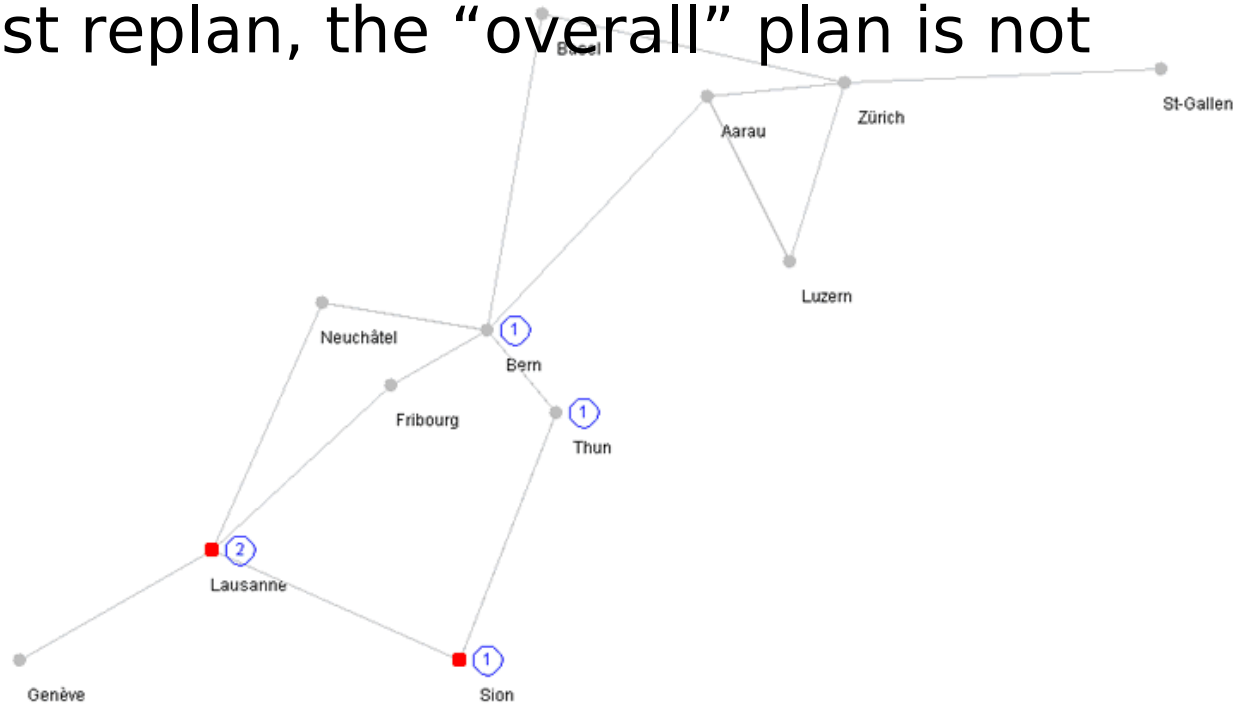
- Internal planning process:

```
if (current plan is not applicable anymore) {
  then recompute plan
}
execute the plan's next action
```

-> recomputing a plan may be necessary ...

Delivery Example

- 1 vehicle is able to carry out the intended plan
- 2 vehicles: => interference
  - they must replan, the “overall” plan is not optimal



TO DO

- **Representation for the states**, transitions and goals (or final states)
- Implement breadth-first search and a **state-based A* search algorithm**
- Implement the **deliberative agent**
- Simulate **1, 2, 3** deliberative agents

Deliverable

- Check Moodle for deadlines
- 100 points