

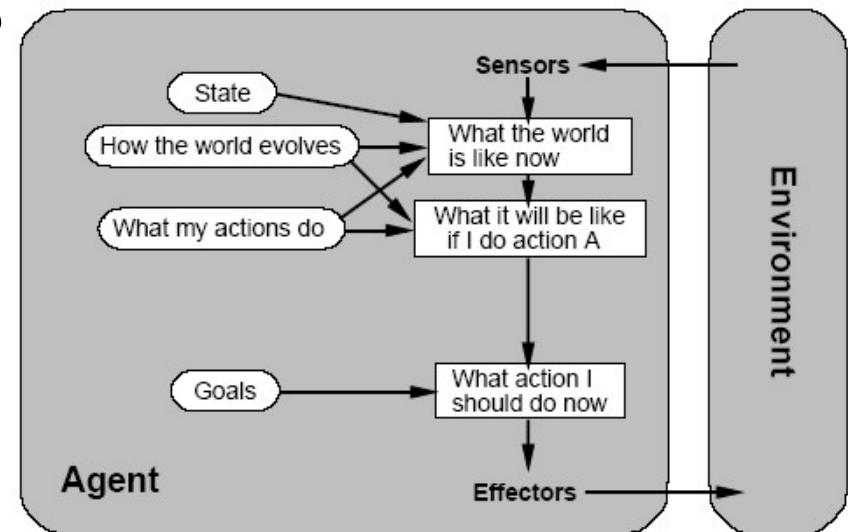
Implementing a Deliberative Agent

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**

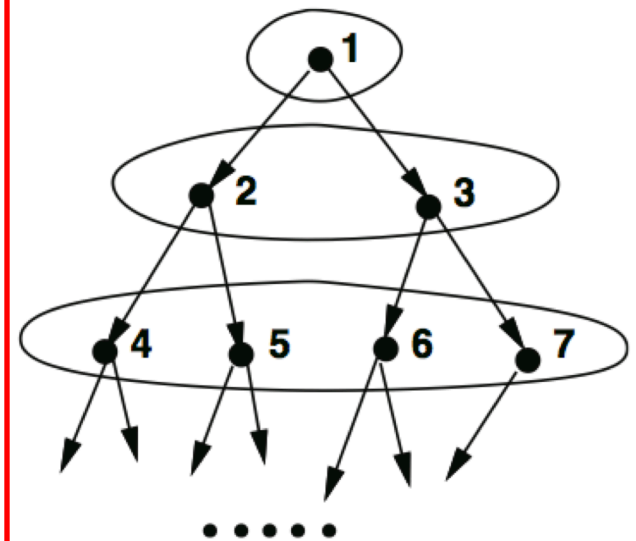
The Cost of a Plan

- 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
```

Implementing Vehicles

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

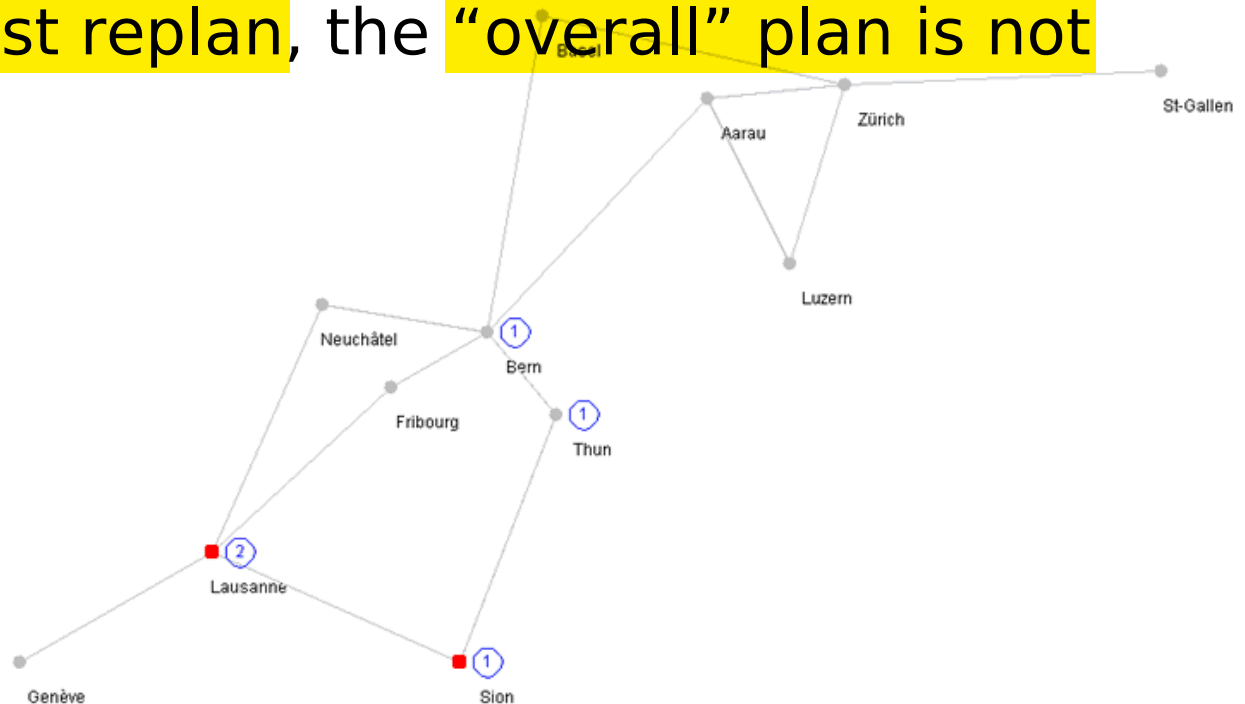
- Internal planning process:

```
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: \Rightarrow 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

