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FACULTY OF MATHEMATICS AND
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Distributed Planning and Task Allocation



Task Allocation

➤ Objectives

- break down the problem into sub-problems
- allocate tasks according to agents' skills
- reorganize if necessary

➤ Method

- **static**: each agent knows who can do what
- **dynamic**: implementation of interaction between agents (e.g., contract net)
- **mixed**: periodic updating of knowledge about others



Task Allocation

➤ Centralized Allocation

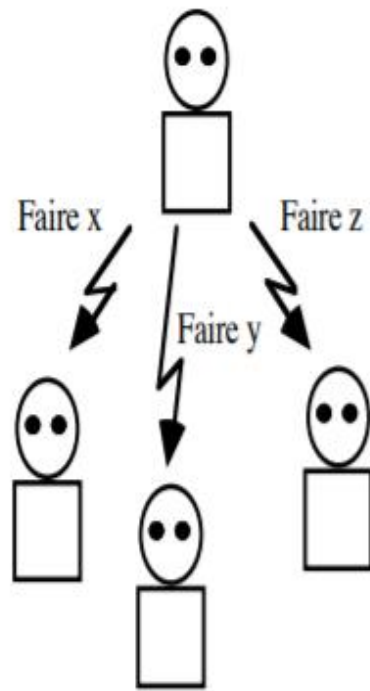
- a single agent breaks down a problem into sub-problems and distributes tasks among other agents
- greater coherence, but issues with reliability and scalability

➤ Distributed Allocation

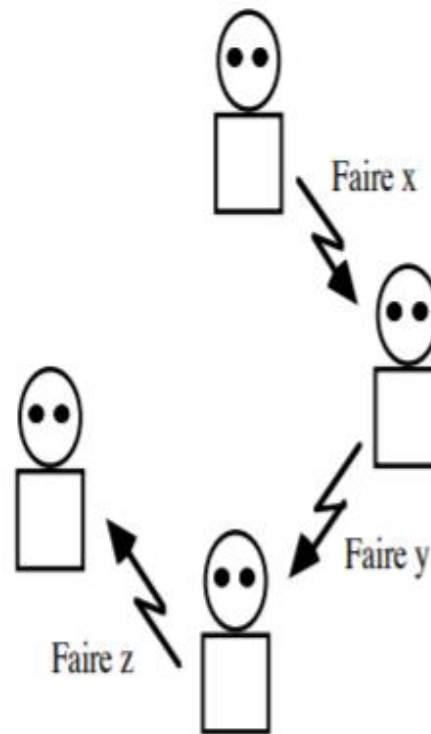
- each agent can break down its problem into sub-problems and distribute the associated tasks
- better reliability and scalability, but coherence issues

Task Allocation

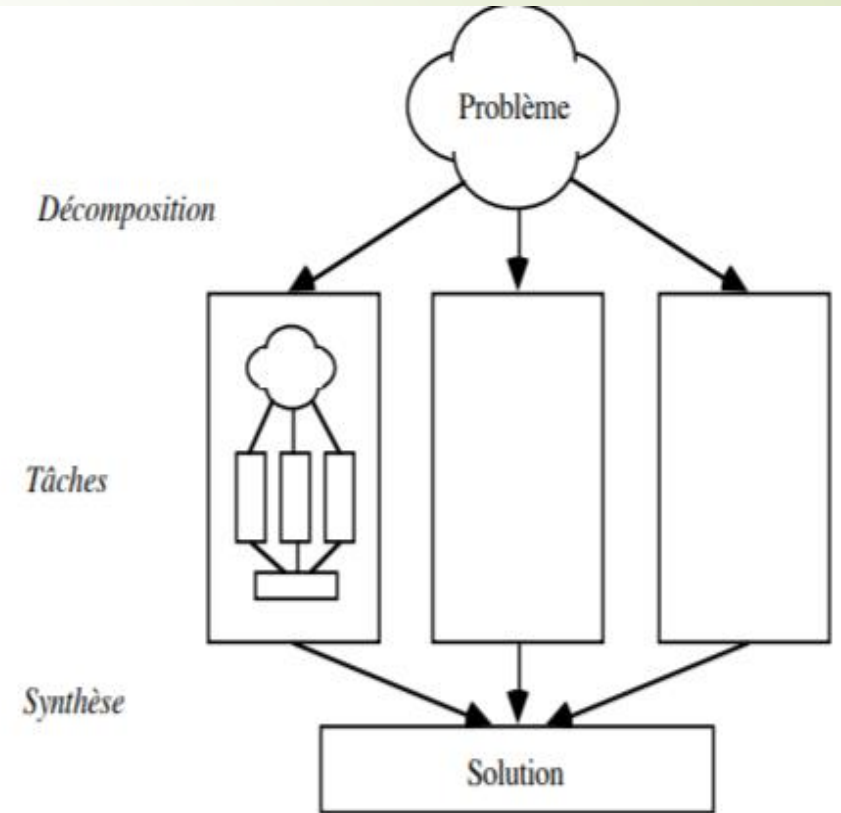
➤ Examples



Allocation centralisée



Allocation distribuée



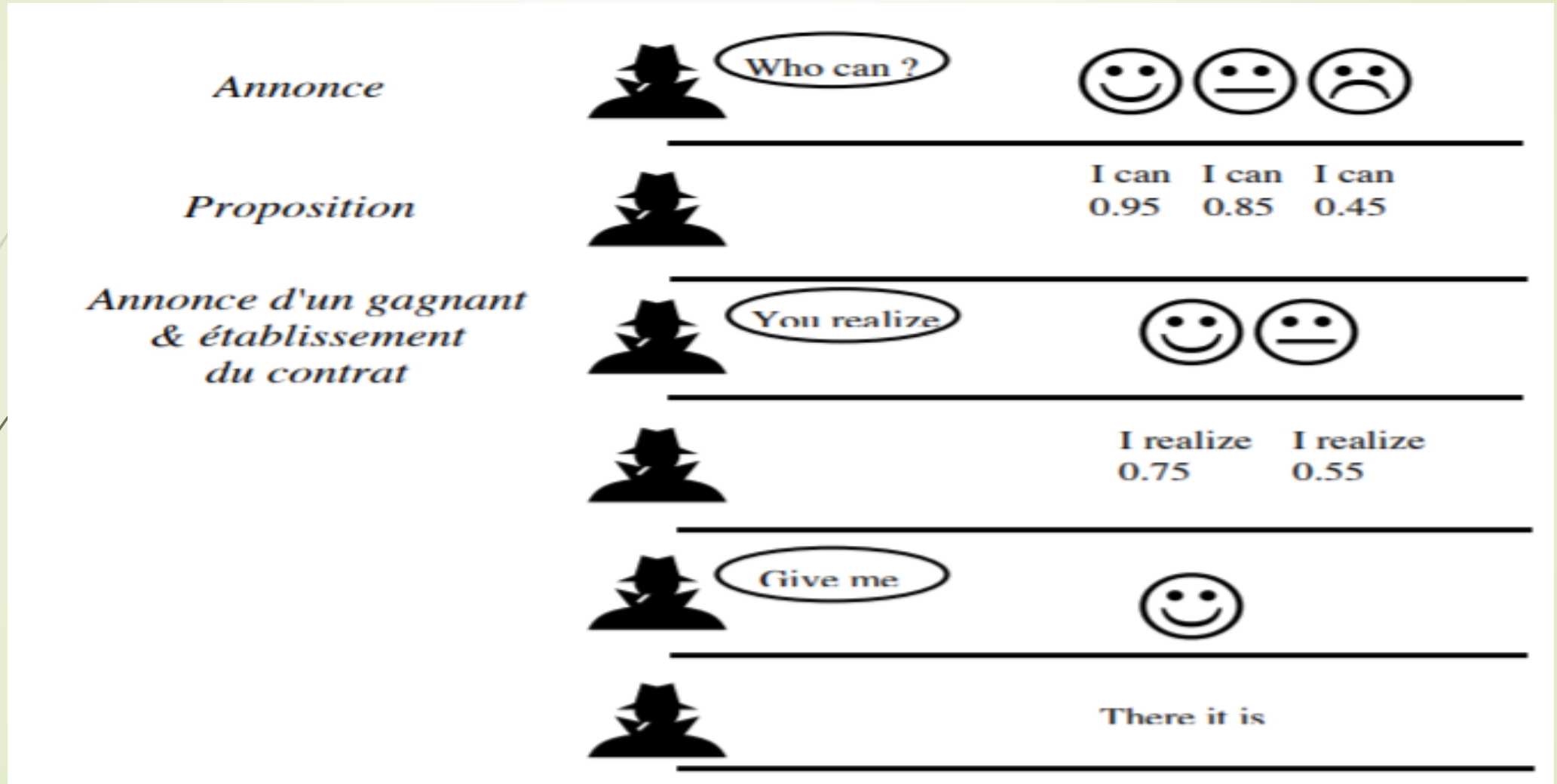
The Contract Net

➤ Distributed and Dynamic Task Allocation by Call for Proposals

It works in four steps:

- announcement by the offerer
- proposal by the bidders
- winner announcement
- contract establishment

The Contract Net





Coordination

- **Definition of coordination [Malone 1987]:**
- Additional information processing
- when connected agents pursue goals that a single agent pursuing the same goals would not need.

Coordination & conflicts

➤ Conflict resolution

Cooperative agents need to avoid conflictual situations as much as possible to solve a problem. To do this, they may need to coordinate their solutions.

➤ Coordination

Agents work on problems whose solutions are useful to other agents. Their work must therefore be coordinated over time. Coordination enables agents to consider all tasks and avoid duplicating work. The coordination of actions is linked to planning and conflict resolution, as it is at this level that the actions (plans) of other agents are taken into account.

Two types of coordination can be distinguished:

1. **coordination due to hindrance:** (navigation problem: agents must coordinate their navigation plans to avoid each other).
2. **coordination due to assistance:** (handling: in a multi-robot environment, agents must synchronize their actions to be able to act efficiently and transport an object).