TASK ALLOCATION

Video segment: extinguishing fires

- From the Bernadine Dias's and Anthony Stentz's group at CMU, USA
- http://www.youtube.com/watch?v=7b6LYQRAmbU

- How can tasks be assigned to agents?

The problem of task allocation

- Given a set of tasks and a set of agents, the goal is to find the optimal set of (agent, task) pairs
- Optimality often refers to a utility function *u(a,t)*
- Centralized or distributed
  - Centralized task allocation algorithms resort to traditional optimization techniques
  - Distributed task allocation algorithms are based on markets (suboptimal allocations)
  - *Contract net* (= a very simple auction), from the 1980s
    - A manager proposes a task
    - Agents bid for that task
    - The manager assigns the task to the best bidding agent

Taxonomies

- Classical taxonomy by Gerkey and Mataric
  - Given a robot, how many tasks it can perform
  - Given a task, how may robots are needed to perform it
  - Istantaneous assignment vs. time extended assignment
- New taxonomy by Korsah, Dias, and Stentz

Sequential single-item auctions

- Tasks (items) are allocated incrementally, one at a time
- Basic idea of sequential single-item auctions and of their variants
  [presented by Riccardo Maderna]

ND [ST-SR-IA] approaches

- ND: no dependencies
- [ST-SR-IA] one-to-one assignment of independent single-agent tasks to independent single-task agents
- Linear problem, Hungarian method
- Distributed implementation: MURDOCH
  [presented by Andrea Lamparelli]

ID [ST-SR-TA] approaches

- ID: in-schedule dependencies between tasks of the same agent
- [ST-SR-TA] time-extended assignment of single-agent tasks to single-task agents
- Specific setting: multirobot routing
- Performance analysis of auction-based approaches for multirobot routing
  [presented by Luca Bonali]
- Multirobot routing with time windows
- …

XD [ST-SR-IA] approaches

- XD: cross-schedule dependencies between schedules of different pairs (agent, task), which affect utilities
- [ST-SR-IA] one-to-one assignment of independent single-agent tasks to independent single-task agents
- Multirobot setting
- Collaborative tasking
- …