Multilevel Coordination Agent (MCA)

Edmund Durfee, Jeffrey Cox, and Thomas Bartold
University of Michigan

Deconfliction:
- Collects together abstract descriptions of coalition agents’ plans.
- Identifies potential unintended conflicts.
- Formulates possible resolutions at current level of plan detail:
  - Synchronization to avoid demands on same assets at same time.
  - Selection to strictly assign assets.
- Collects together more details about plan steps involved in conflicts.
- Iteratively identifies and resolves conflicts at the deeper levels.
- Presents options as they are found.
- Commander can choose to act on an option that has been found, or to wait for possibly better choices.

Finding and Exploiting Synergies:
- Deconfliction is based on finding actions of agents that achieve contradictory effects.
- Synergies are based on finding actions that achieve similar effects.
- Simple case:
  - Discover that agents are planning actions with redundant effects.
  - Determine which of the agents can drop unnecessary actions.
  - Insert synchronization constraints between agents to assure that agent takes action when others need it to.
  - Top-down search finds big merges faster.
  - Deeper solutions partition assignments.
  - Sort by estimates of execution efficiency and present options to commander as they are found.

Least Duration & Lowest Cost after adding Evac Agents

Avoiding Disruption:
- As more coalition partners formulate plans, coordinating them could involve changing coordination commitments already agreed to by partners that began sooner.
- Revoking commitments and implementing new ones can incur downstream costs.
- All else being equal, should prefer coordination solutions that minimally disrupt commitments already in place.
- MCA capabilities support:
  - Providing estimates on the amount of disruption associated with a solution.
  - Sorting solutions based on disruption.
  - Biasing the top-down search to find less disruptive solutions sooner.