
Large-Scale, Heterogeneous Teams

For CS 597

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Research Goal

- Research goal: Large-scale heterogeneous teams

- *Types of entities:* Agents, people, robots, resources, sensors,...
- *Scale:* 1000s or more
- *Domains:* Highly uncertain, real-time, dynamic
- *Activities:* Form teams, persist for long durations, coordinate, adapt...

- Some applications:

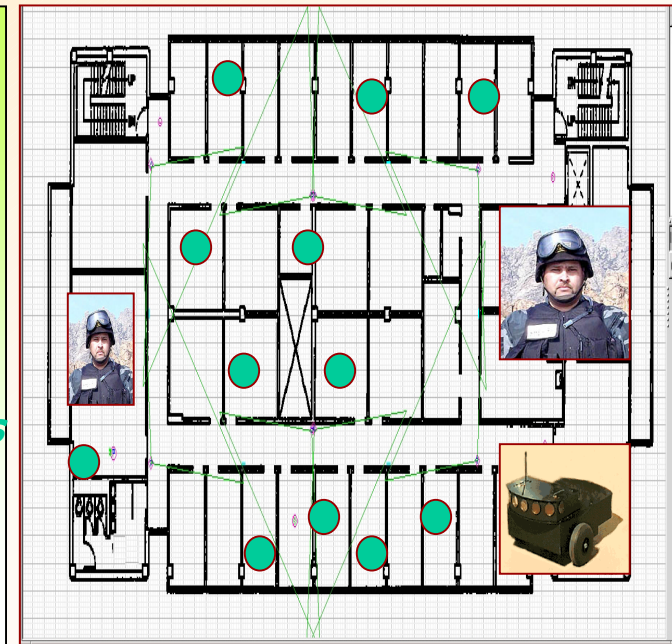
Large-scale disaster rescue



Military crisis response



Large area security



Longer-term Major Obstacles

● *Multiagent research:*

- *Known knowns:* Hard problems (NEXP-complete), solve in “real-time”
 - *Paradigm shift (e.g., BDI & POMDP hybrids)*
 - *New heuristic algorithms, abstraction & approximations*
- *Known unknowns:* Self-interested vs team goals,...
- *Unknown unknowns:* “Team spirit”

● *Human interface issues:*

- Natural dialogue with agents, emotions and personality,...
- Human culture/norms, e.g., agents may need to lie

● *Hardware:*

- Significantly faster hardware to run complex algorithms
- Handheld devices, interfaces; reliable communication, sensors,...

Known Knowns: Research Issues

Role allocation/performance

	Allocation	Performance
Agent-agent	DCOP POMDPs	Adaptation
Agent-human	<i>Adjustable autonomy, privacy....</i>	Training camps?

Communication/Monitoring

	Explicit	Implicit
Agent-agent	BDI theory POMDPs	Plan recog
Agent-human	Multi-modal	

Unified?
Theory
&
practice

Infrastructure/models to rapidly build large-scale heterogeneous teams of agents, humans, robots

Metrics

Task & domain complexity

High

Medium

Low




Small-scale homogeneous

Small-scale heterogeneous

Large-scale heterogeneous

Team Scale & Complexity

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- # What is it?
- (Cognitive Architecture for Learning and Organizes)
 - Joint project between USC Teamcore group, SRI, many others.
 - We are working on one part of a much larger system.

How to schedule a meeting while...



- Respecting participants' preferences
- Maintaining their privacy
- Discouraging selfish manipulation of the system
- Considering other real-world issues (costs, location, status, etc.)

<http://teamcore.usc.edu>

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Collaborative Multiagent Environments

In many domains, agents collaborate with other agents, humans

● Applications:

- *Agents facilitated human organizations*
- *Robot-agent-person teams for disaster rescue, monitoring*

Electric Elves



“RAP” Disaster Rescue



Monitoring Robot Teams

