

## Criticality-Sensitive Coordination (CSC)

The goal of CSC is to help fielded human units (e.g., soldiers, tactical teams) adapt their mission plans online in response to change. Coordination support will enable fielded units to respond more rapidly and more accurately to the dynamics of the situation. Research problems include distributed coordination over large interconnected mission structures that change dynamically, supporting coordination of large-scale operations where units may have roles in multiple missions, learning to support the units better by automating decision making when data is potentially sparse, responding in (fast enough) “real time” to change, and reasoning about decision-making policies and procedures during coordination.

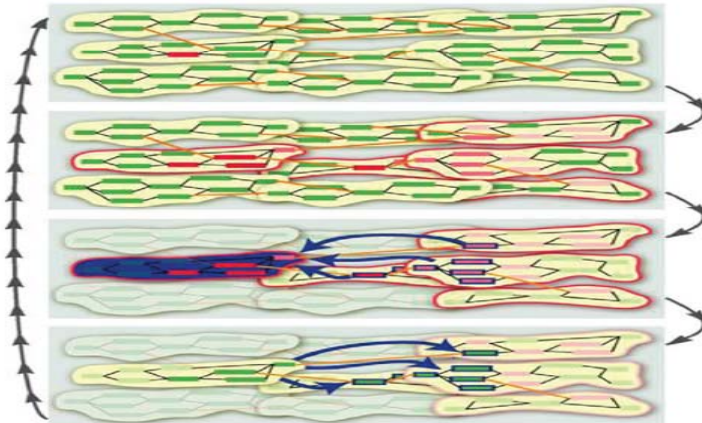
The CSC approach to coordination is "dynamic partial centralization". When a unit detects a problem (task delay, inability to perform a task), it will dynamically form a cluster of the critically affected units (a subset of all potentially affected units). The cluster will elect a leader, who will retrieve all task and contingency plan information from the cluster members and compute a solution depending on the situation. If the cluster is independent from other clusters, it will compute adjustments to the plans of all cluster members using centralized solver techniques and distribute the solution to all members. If small clusters interact, they will be merged and a new leader selected. It is expected that in the majority of cases cluster sizes can be kept small enabling the use of fast, centralized solutions techniques that enable leaders to quickly compute high quality solutions before the world changes in a significant way. As a last resort, if merging of clusters would result in large clusters, leaders will negotiate using slower, less optimal distributed constraint satisfaction techniques.



# Criticality-Sensitive Coordination



## Dynamic Partial Centralization



## Impact

### Order of magnitude improvement in:

- Speed and precision of command
- Elimination of unproductive human-to-human coordination discussions
- Flexibility and adaptability
- Decision superiority

## New Ideas

### Criticality-Sensitive Coordination

- Good-enough/soon-enough coordination on critical problems: *temporally, spatially, hierarchically*

### Proactive Coordination

- Anticipate and monitor for events that presage impacts to the plan, pre-coordinate options to address them

### Integration of Multiple Coordination Techniques

- Dynamically select and integrate *constraint propagation, adaptive clustering* and *negotiation*

### Cooperative Learning Techniques

- Accumulate & share subsets of training data, combine using voting

## Schedule

