

Rational Multiagent Organization and Reorganization

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This research agenda has as its goal to apply principles from decision theory and organization theory to the problem of multiagent organization and reorganization. The result is a rational, dynamic multiagent architecture designed to address the following issues:

- Choosing the appropriate organizational structure (design from scratch);
- Choosing the appropriate reorganization (redesign);
- Adding, losing and moving agents within an organization; and
- Handling node and link failures that lead to agents becoming unavailable to the rest of the organization.

The architecture will be experimentally validated with different organization sizes ranging from four to fifty agents. These experiments will determine how well a dynamic organization fares versus a static one with respect to solution quality and response time.

The unique aspect of this approach to multiagent organization is the multi-stage, multi-tier representation of reorganization. Like the TAEMS approach (Decker and Lesser 1993), this architecture is designed to organize itself based on attributes of the task-environment. However the model of tasks, resources and environmental constraints includes more factors that predict the best organization. Like (So and Durfee 1994), this solution also considers multiple possible organizations before choosing the best for a given situation. This architecture will choose the best organization based on the maximum expected utility. Like the self-designing architecture of (Gasser and Ishida 1991), this design localizes reorganizations when appropriate based on constraints of resource allocations. However this approach will utilize more complex models of the resources and tasks at varying levels of granularity. Thus reorganization becomes an iterative problem in which high-level, approximate decisions are made concerning initial, coarse allocations of tasks and resources and each subset then organizes itself as an independent problem.

At this stage of the investigation, we have identified four core components of the architecture:

1. **Organization Planner:** A decision network used as a causal model whose input includes descriptions of the task and the resources and produces a list of organizational designs ranked based on how each maximizes expected utility.
2. **Reorganization Assessment:** A decision network designed to perform cost/benefit analysis of the proposed list of organizations. The marginal benefit of reorganizing is calculated as the maximum expected utility (MEU) of the target organization minus the sum of the MEU of the existing organization and the reorganization cost. Thus this component determines whether or not any of the reorganizations is worth pursuing given the current state of the organization.
3. **Reorganization Decomposition:** For relatively large organizations, reorganization across the entire community can be prohibitive with respect to cost of deliberation. This component chooses the appropriate level of detail to address allocation of resources and tasks. Therefore the system must have sufficient information to iteratively partition the task.
4. **Organization Event Handler:** This component must be able to handle the following events as variations of a reorganization problem: addition, loss or movement of an agent and reallocation of tasks and resources by higher levels in the organization.

References

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