Control of Agent Based Systems (CoABS) & DARPA Agent Markup Language (DAML)

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CoABS PROGRAM GOALS

• To develop and demonstrate techniques to safely control, coordinate and manage large systems of autonomous software agents.
CoABS VISION

• To increase military user’s productivity, "Software Agents" are being developed to
  – automatically accept abstract tasking, get needed information
  – decide how to solve simple problems
  – help the user solve difficult problems, and
  – take action on the user’s behalf.

• This would allow automation of relevant command and control functions such as information gathering and filtering, mission planning and execution monitoring, and information system protection
PROBLEM STATEMENT

• *R&D is needed in control of agent-based systems*
  – to mitigate dangerous and chaotic behaviors such as resource consumption, faulty communication, poor performance, system shutdowns, and security vulnerabilities.
EXAMPLE PROBLEMS

- Agents or agent systems produced by different developers cannot cooperate in any meaningful way.
- No sufficient algorithms, policies, or mechanisms that prevent a large heterogeneous set of agents from exhibiting dangerous or chaotic behavior on a network.
  - can lead to clogged networks, wasted resources, poor performance, system shutdowns, and security vulnerabilities
CoABS PROGRAM THRUSTS

- Cooperative Control Strategies
- Reliability Assurance Methods
- Computer Systems Architectures
- Related Technologies
Cooperative Control Strategies

- Models of collaborative behavior
- Role of competition, policy and mechanisms for competition and cooperation
- Semantic representation and translation methods
- Agent facilitation, brokering, and mediation
Reliability Assurance Methods

• Resource allocation and control
• Security mechanisms
• Methods of agent creation and deletion
• Distribution of agents on the network
• Trade-offs between control mechanisms and collaboration
Computer Systems Architectures

- Communication protocols
- Standards for agent interoperability
- System integration
- Application programmer interfaces
Related Technologies

• Agent development languages
• Tools and environments
• Test & demo environments, evaluation methods
• Component capabilities
  - AI-based techniques such as planning, scheduling, execution monitoring, machine learning, user interfaces, knowledge-sharing, and acting
DAML PROGRAM GOALS

- Create technologies that will enable software agents to dynamically identify and understand information sources, and to provide interoperability between agents in a semantic manner.
DAML TASKS – 1/6

- Create an Agent Mark-Up Language built upon XML that allows users to provide machine-readable semantic annotations for specific communities of interest.
DAML TASKS – 2/6

• Create tools that embed DAML markup on to web pages and other information sources in a manner that is transparent and beneficial to the users.
DAML TASKS – 3/6

• Use these tools to build up, instantiate, operate, and test sets of agent-based programs that markup and use DAML.
DAML TASKS – 4/6

• Measure, via empirical experimentation, the productivity improvements provided by these tools.
DAML TASKS – 5/6

- Apply these tools to third party agent development, military-specific problems, and support for the intelligence community so as to evolve DAML technologies towards large-scale use.
DAML TASKS – 6/6

- Transition DAML to the commercial and military markets via partnerships with industrial and defense-related (C2 - Command & Control - and intelligence) organizations.