Agent Communication for the OOI CI

Statement of Work

Objective
The goal of this effort is to define the concepts and implementation technologies for agents and commitments, so that we can build up a network of contracted agents that make up the domains of authority within the OOI distributed system.

Tasks
We will focus on two use cases:

• Use case 1 – negotiations between facility agents. A facility negotiates with another facility and establishes contracts between them.

• Use case 2 – negotiations between execution agents and the execution environment. We will refine the notion of agent at the level of a virtual machine being activated as part of an execution environment and negotiating its role within the execution environment (for example, who is allowed to do what on that machine).

We will scope the effort in two phases: in the first phase, we will tackle the basic concepts and assess the technologies; and in the second phase, we will establish the contract network. The tasks below are to be performed jointly by the teams at UCSD (Calit2) and at NCSU. The order of the group names annotating each task indicates the primary and secondary responsibilities, respectively.

Phase 1 will consist of a short-term project of 5 weeks (with an additional one week to finalize the plans for Phase 2). This phase will focus on the use case of negotiations between facilities. The artifacts (models and software) developed in this phase are throwaway prototypes, not intended to be complete nor robust.

Tasks:
1. [Calit2, NCSU] Create a domain model for simple contracts between facilities pertaining to the interaction protocols by which the facilities interact, such as to establish suitable rights and privileges on one another

2. [NCSU, Calit2] Express the contract types of the above domain model via commitments

3. [NCSU, Calit2] Define the language by which the commitments needed for the contract types of the above domain model will be expressed along with a mapping to a database schema, and a serialization in XML

4. [Calit2, NCSU] Provide two or more alternative message sequence diagrams describing specific exchanges of messages corresponding to the negotiation and enactment of contracts between facilities

5. [NCSU, Calit2] Formalize a specific interaction protocol (describing message names, meanings, and constraints on their order and occurrence) for negotiation between facilities, leading to two or more of the contract types of the above domain model
6. [Calit2, NCSU] Evaluate the benefits of FIPA Agent Communication Language (ACL) and Interaction Protocols for OOI along with an assessment of the essential and inessential features
7. [NCSU, Calit2] Determine how to include commitments in FIPA ACL
8. [Calit2, NCSU] Evaluate Jade as an implementation toolkit
9. [Calit2, NCSU] Prototype two facilities agents that are capable of communicating using FIPA ACL to realize the above message sequence diagrams, and incorporate potentially hard-coded queries against their commitment stores. The prototype doesn’t need to be distributed.
10. [Calit2, NCSU] Develop a detailed plan regarding Phase 2

Phase 2 will run from March 15 to September 30, 2009. It will refine the results from Phase 1 and implement facility and execution agents that are more general than the agents of Phase 1. The software and models developed in this phase will build on the outputs of Phase 1.

Tasks:
1. [Calit2, NCSU] Revise the domain model for contracts among agents; express domain model using commitments
2. [NCSU, Calit2] Refine the language by which the commitments needed for the contract types of the above domain model will be expressed along with a mapping to a database schema, and a serialization in XML
3. [Calit2, NCSU] Provide (up to five each) alternative message sequence diagrams describing specific exchanges of messages corresponding to the negotiation and enactment of contracts (a) between facilities and (b) between machine agents and an execution environment
4. [Calit2, NCSU] Develop middleware that supports commitments, enabling their use by agents who communicate using FIPA ACL, especially as layered on top of AMQP
5. [NCSU, Calit2] Enhance a general middleware service, which an agent developer may use to incorporate support for commitments into agents, and which supports limited customization through queries for the agents’ commitment stores

**Deliverables**
For each phase, the deliverables will be:
1. Domain models; relational and XML schemas for commitments
2. Prototype
3. Report documenting the architecture, technology choices, and experience from the prototype.