Position Summary: Mansion, A Distributed Multi-Agent System

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In this position summary we present work in progress on a worldwide, scalable multi-agent system, based on a paradigm of hyperlinked rooms. The framework offers facilities for managing distribution, security and mobility aspects for both active elements (agents) and passive elements (objects) in the system. Our framework offers separation of logical concepts from physical representation, distribution support, mobility support, and a security architecture.

The Mansion Paradigm Our framework consists of a world (or possibly multiple disjoint worlds), each containing a set of hyperlinked rooms. Each room contains agents and objects. At any instant, an agent is in one room, but agents can move from room to room and they can take objects with them.

In essence, a room forms a shared data-space for agents with regard to visibility. Agents can interact only with objects in the same room, but can send messages to agents anywhere in the world. However, normally an agent will do most of its business with other agents in the same room.

Entities in a room can be agents, objects, or hyperlinks. Each agent is a (possibly multithreaded) process running on one host. No part of the internal process state of an agent can be accessed from the outside by other agents. Objects are strictly passive: they consist of data and code hidden by an interface. Hyperlinks determine how rooms are connected.

Every world also has an *attic*. The attic contains global services and is directly accessible to agents in any room. Through the attic, an agent can obtain world-scoped information, for example, the topology (hyperlink layout) of a world.

An agent enters a world by entering a room. Once in an entry room, an agent may move to any other room to which that room is hyperlinked. Directly moving to internal rooms (behind an entry room) is not allowed; agents can only follow hyperlinks. Except for following hyperlinks, a mobile agent may also move to a different host. However, our framework also allows for remote access to rooms: immobile (stationary) agents may also use the system.

Example As an example of the Mansion paradigm, consider a world designed for buying and selling raw materials for industry. An entry room is set up where interested parties can obtain information about the products for sale. Hyperlinks from this room lead to rooms for specific products, such as ore, water, and electricity.

Agents for users that want to buy or sell certain products can be launched into the system and go to an appropriate room where they can meet other agents that offer or want products.

An offer may be negotiated, after which an agent can either return to its owner with the current offer, or communicate with other agents to try to negotiate a package deal (e.g., optimize for the cheapest combination of ore, water, and electricity.) Some global information such as up-to-datecurrency exchange rates, freight rates, etc. may be available to agents through the attic.

In short, the Mansion paradigm replaces the World Wide Web paradigm of a collection of hyperlinked documents that users can inspect with that of a collection of hyperlinked rooms in which agents can meet to do business.

Middleware All mechansims that are needed for interacting with the system, such as support for physical mobility, following hyperlinks, binding to objects, and inter-agent communication are hidden inside a middleware system we are designing to support our framework. The middleware supports distribution and security policies, and provides location transparency for all logical entities.