

SICS AgentBase – A Toolbox for Developing MarketSpace Agents

(Extended Abstract)

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Introduction

The Internet has evolved from an information space to a market space with thousands, potentially millions, of electronic storefronts, auctions, and other commercial services. This offers great opportunities, but is not without problems. One major problem is the difficulty of finding relevant offers. Another problem is coping with the multitude of different styles of interfaces to different market-places. Yet another problem is how to automate routine tasks in such an environment.

We present one possible solution to these problems. An agent-based market infrastructure helps customers and commercial sites find matching interests, and, if desired, negotiate and close deals. Each participant has an agent that acts in the interest of its owner. The infrastructure is entirely open and decentralized, just like the web itself, allowing anyone to enter the market. Interaction is entirely symmetrical. Any participant can play any role in a market. The benefits of automation, lowered transaction costs, are made available to all.

The *SICS MarketSpace* agent-based market infrastructure [1] is intended to complement the web, email, and other human-oriented forms of communication. At its core is an *information model*, for describing user interests, items, contracts, etc, and an *interaction model*, defining a basic vocabulary for searching, negotiating and settling deals. These are for the agent infrastructure what HTML and HTTP are for the web. A brief summary is provided here.

The information model is based on structured documents representing *contracts* and representations of sets of contracts called *interests*. The building blocks of contracts are *concepts* (frames) with global identifiers (URLs that refer to their definitions). The language for interests offers an ability to give alternatives for any component, generalize concepts in an inheritance hierarchy, and give ranges for values, thus specifying a set of possible matching con-

tracts. Currently, a custom designed language, the Market Information Format (MIF) is used to encode interests. It is possible that W3C RDF/XML (Resource Description Framework mapped onto XML) [2] could become general enough to serve the purpose of representation language.

The interaction model is asynchronous message communication in a speech act based language, the Market Interaction Language (MIL). MIL belongs to the KQML [3] and FIPA ACL [4] family of agent communication languages, and shares with these its Lisp based serial syntax. Compared to these, its set of message types is small and focused: ASK, TELL, NEGOTIATE, OFFER, ACCEPT, and DECLINE, which all take a single interest as an argument. Sending messages of types OFFER, ACCEPT, and DECLINE means making legally binding commitments, and hence requires support by digital signatures or other authentication mechanisms.

The SICS AgentBase Toolbox

We have developed a toolbox, *SICS AgentBase*, that supports agent development based on the MarketSpace information and interaction models. The toolbox consists of libraries implementing basic agent facilities, several standard Internet formats and protocols (HTTP, HTML, ...), and the agent communication languages KQML/KIF and MIL/MIF. (KQML/KIF is used in sibling projects.) The current version of the toolbox is for Java. (An older version exists for SICStus Prolog [5].)

Figure 1 illustrates the use of AgentBase in a MarketSpace scenario. There are three agents. The agent below the user screen is the user agent (or personal assistant). To the upper right is a store agent, and to the lower right a directory agent. Agents communicate with other agents by sending and receiving MIL/MIF messages via SMTP, HTTP, or MAP (the Market Agent Protocol), and with users by serving generated HTML pages in response to HTTP requests, as in the interaction between the user and

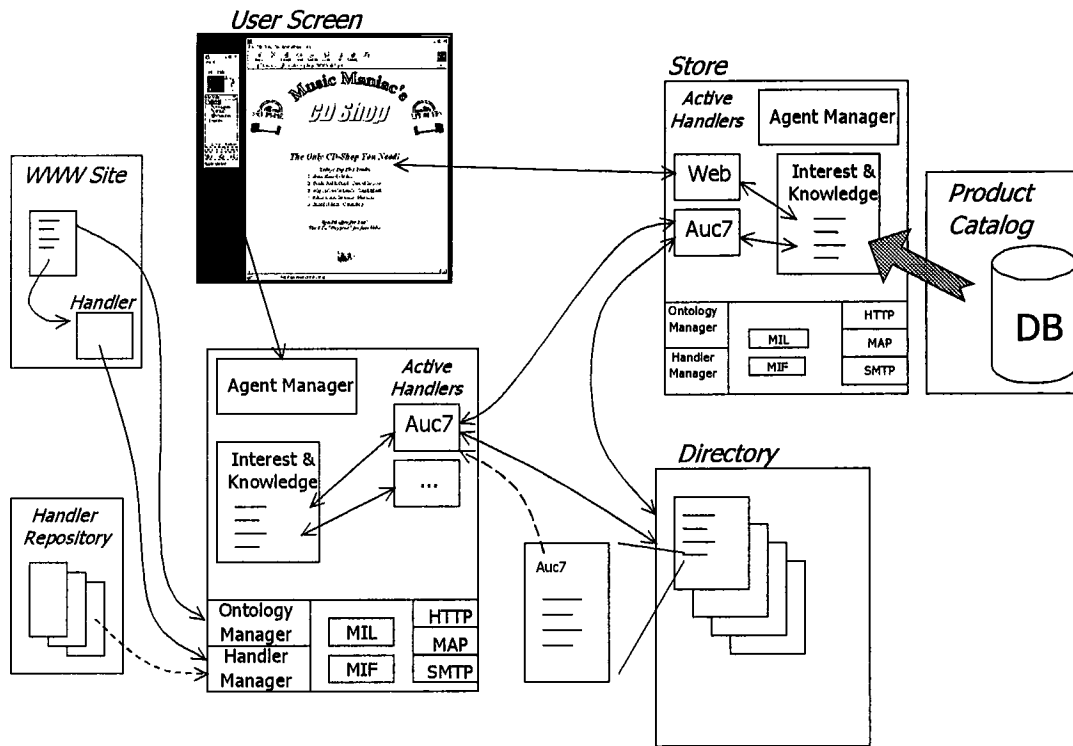


Figure 1: A MarketSpace scenario illustrating the use of AgentBase in a user agent, in an agent supported store, and in a directory service.

the store. (See [6] for more information about interaction between agents and users in MarketSpace.)

All agent addresses are URLs, in the case of MAP addresses of the form `map://domain:port/name`. AgentBase provides no agent name server. In MarketSpace, agents publish their addresses as a part of advertised interests, using the standard message types.

Figure 1 illustrates the use of a directory agent for this purpose. Agents publish their interests in the directory and query it to find other agents with matching interests. Agents also need to know how they are expected to interact about the interest (i.e., by haggling, auctioning, etc.). This information is published as a part of the pertaining interest together with the address. Here, the `auc7` interaction type is to be used. The agents use this information to start sub-agents that handle that particular interaction.

SICS AgentBase is used in four projects at SICS: an agent-based market service (with Telia Research), an agent-based workflow management system (with Telia Research), the SICS Digital Library project, and a conference call system.

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