A multi-agent model for provider centered trust in Service Oriented Architectures

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1 Context

In current SOAs, the selection is mainly performed by the client, who creates a workflow adapted to his needs and then selects the providers she feels the most adapted to complete her overall goal. In this approach, service providers are assumed to be passive and thus cannot decide who they collaborate with. This can cause several problems such as forced collaboration with concurrents, disparity of quality for the composite service and unwanted sharing of private data. This problem is different from automated web service composition since we assume that the client already has her workflow structure and just search for providers to fill the functions needed to achieve her service.

SOAs, as distributed systems are closely related to Multi-Agent Systems. We argue that finding suitable partners for an abstract workflow is not that different from forming a coalition of agents endowed with specific skills working together to solve a set of tasks. Furthermore, we think that the best criterion, beside the payoff, to select a potential partner is trust.

This study is based on the Language Grid project [4], an infrastructure for sharing language resources. We identified the current drawbacks in term of provider involvement and tried to design an architecture to take providers’ collaboration expectations into account.

2 Background

In an open SOA, users are often confronted to unknown partners and must base their partner choice on several parameters. In the services computing area, efforts are focused to define QoS to become able to distinguish between functionally equivalent services. Clients have to rely of these parameters to decide if a service is trustworthy or not. Hence, in SOAs, QoS and trust are closely related.

On the other hand, agents, computer systems situated in an environment, and capable of autonomous action, are very similar to web services. Being autonomous, distributed and having to cooperate to reach their goal, agents have been considered for SOAs [2]. While SOAs focus on trust empowered by security mechanisms such as the WS-Trust initiative, agent-oriented systems present a semantically rich system to evaluate the reputation of the other agents present in the system.

In our context, and since research on how providers can decide to collaborate together to meet a client’s needs is absent, answers must be found in coalition formation as it is done in multi-agent systems. [5] examines how job and team selection heuristics can be combined to form coalitions in large scale unpredictable dynamic environments of self-interested agents without enforceable contracts. An agent is randomly selected as a foreman agent to form a team to carry a task being rewarded proportionally to its length.

3 Agent model for provider-centered trust

As described above, the similarity between multi-agent systems and SOAs, what MAS can bring in
matter of trust and coalition formation can be exploited through a multi-agent layer. In this paper, we describe a multi-agent architecture in Jason [1], based on AgentSpeak, empowered by artifacts [3].

As depicted in Fig 1, we distinguished three different roles. The user, on the left is the requester of a workflow. She comes with a workflow, publishes it to the workflow repository and waits for an offer until his selected request time expires. The worker represents a provider. She is proposed jobs by the foreman and decides to accept or not according to the trustworthiness of the partners. The foreman proposes jobs to the workers.

Artifacts are not a mere source for agent perceptions but a first-class abstraction that can encapsulate some functionalities and services. [3] describes how artifacts can be used for trust and reputation. In our architecture an artifact is used to store workflows and the other to store past interactions to update the trust model.

The client posts a workflow containing abstract services to the workflow repository, the foreman, monitoring this repository selects a job that might interest him. Then he searches for other providers to bind the services to the abstract slots. This choice is made on a trust criteria based on past interactions stored in an artifact. Finally, when a suitable coalition to realize the composite service is formed, the workflow is executed and each participant, including the client enters her feedback in the reputation artifact. These values are used to update the trust providers have into each other.

4 Current work

This paper described a work in progress on how multi-agent techniques, notably coalition formation can be used to put the provider back in the loop when it comes to composition formation. We are currently implementing a test multi-agent architecture to test various parameters such the decision to trust another provider to enter a coalition based on past interactions and heuristics to simplify the coalition formation process. Finally, we want to study what an agent-oriented approach can bring in terms of service providers autonomy.

References


