A Policy-Based Team Collaboration

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ABSTRACT

This paper presents a policy-based coordination model for team collaboration. Team collaboration requires an agreement that utilizes a negotiation protocol to find candidate teams and to decide on a collaboration partner. The decision relies on policies that are rules governing team situations in an organization. Contexts and rules allow reasoning about team situations. The authors describe a policy-based negotiation protocol. It introduces an ontology-based whiteboard component that uses the Semantic Web technologies such as Web Ontology Language (OWL), Semantic Web Rule Language (SWRL), and Semantic Query-enhanced Web Rule Language (SQWRL). The negotiation protocol facilitates whiteboards as a computational foundation for awareness of situations and policies, and it assists with the final decision using a measure based on the combination of rule-based queries and functions.

Keywords: Coordination Model, Distributed Context, Ontologies, Team Collaboration, Web Technologies

INTRODUCTION

A dynamic team-based collaboration allows teams short of resources to complete tasks. Any collaboration requires an agreement reached through a negotiation protocol. With such protocol, a team selects a collaboration partner from potential candidates. Teams, depending upon organizational policies and team situations, make the decision on collaboration.

We present a policy-based coordination model for team collaboration. It discusses a negotiation protocol that may adaptively cope with organizational policies and assist with decisions. The model uses an ontology-based whiteboard as a computational foundation to manage contexts and rules. A whiteboard is a service-oriented information repository that is implemented with Semantic Web technologies such as Web Ontology Language (OWL) (Bechhofer, Van Harmelen, Hendler, Horrocks, McGuiness, Patel-Schneider, & Stein, 2004; McGuiness & Van Harmelen, 2004) and Semantic Web Rule Language (SWRL) (Horrocks, Patel-Schneider, Boley, Tabet, Grosos, & Dean, 2004; RuleML, 2010), and Semantic Query-enhanced Web Rule Language (SQWRL) (Rubin, Noy, & Musen, 2007). The negotiation protocol assists with a decision by utilizing the combination of a rule-based queries and functions to compute a measure.

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For the rest of this paper, the second section reviews the related works. The third describes the ontology-based data representation for the whiteboard component. The fourth section shows an example scenario that triggers a negotiation protocol for collaboration. The fifth section discusses the details of a policy-based negotiation protocol. The sixth sections deals with the implemented system and section seven concludes the paper.

**RELATED WORK**

**Context**

Dey (2001) says, “Context is any information that can be used to characterize the situation of entity” where an entity is a person, place, or object that is considered relevant to interactions. In a survey on context modeling approaches, Strang and Linnhoff-Popien (2004) report ontologies as a promising technology for modeling contexts. Wang, Zhang, Gu, and Pung (2004) and Chen, Perich, Finin, and Joshi (2004) propose CONON and SOUPA ontologies, respectively, for modeling contexts in a pervasive and distributed computing environment that contain concepts such as person, location, activity, or action. We define simple ontologies for our purposes modeling a team coordination environment that requires core concepts such as teams, logs, events, and tasks.

**Semantic Web**

Weitzner, Hendler, Berners-Lee, and Connolly (2006) discuss a rule-based policy management system that may support a policy-aware infrastructure in an open environment such as the World Wide Web. It describes the use of rich representational framework offered by the Semantic Web technologies (Berners-Lee, Hendler, & Lassila, 2001; Shadbolt, Berners-Lee, & Hall, 2006; W3C, 2001), where it may allow both people and machines to “play by the rules” for social and online interactions.

The paper primarily focuses on a rule-based access mechanism based on the Semantic Web technologies such as Notation 3 (N3) (Berners-Lee, 2000) and CWM (Berners-Lee, 2000). Our work is on a similar computational foundation using the Semantic Web technologies to express contexts and rules. We focus on a policy-based negotiation protocol for collaboration that is based on recent technologies such as OWL and SWRL.

**Negotiation**

Zulkernine, Martin, Craddock, and Wilson (2008) propose a Negotiation Broker (NB) middleware that supports automated negotiations of Service Level Agreement (SLA) for Web Services (Curbera et al., 2002). Negotiating parties express the high-level policy specifications containing different parameters such as goals, contexts, constraints, issues, and values. The policy specification is WS-Policy (Bajaj et al., 2006) and the protocol uses the FIPA Contract Net Interaction Protocol (FIPA, 2002). The trusted broker maps the policy specifications to negotiation strategies and parameters, and it performs the negotiations. Hung, Li, and Jeng (2004) propose an independent declarative XML language, WS-Negotiation, for Web Services providers and requesters. The paper describes WS-policy is for a broad range of service requirement, preferences, and capabilities that lacks a negotiation solution for Web Services. It discusses negotiations in terms of Message, Protocol, and Decision-Making as well as a SLA template model supporting business negotiations for different domains. Both of those prior works on the NB middleware and WS-Negotiation primarily deal with Quality of Services (QoS) containing service-level issues such as availability, response time, security, and prices. We focus on negotiations based on a rich representational framework using the Semantic Web technologies. The protocol in our work copes with awareness of contexts and rules representing team situations and policies.

Su et al. (2001) describe an Internet-based negotiation server conducting bargaining-type negotiations for e-commerce. A negotiation server registers with requirements, constraints,
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