Combining Ontology and Rules as Service Constraint Policy for P2P Systems

[Position Statements]

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ABSTRACT

We are going to address several important challenges and issues on Semantic Web Service Constraint Satisfaction Problem (SWSCSP) for P2P systems. The marriage of semantic web and web services has been considered as one of the most important research areas to lift off semantic web vision on the WWW. The (semantic) web services will be a runaway train if we do not have any constraint and control mechanisms for the entire service process. Unfortunately people did not pay attention on this issue until recently so the results are very scare and primitive [20]. The service constraints are defined as policies that can be specified by combination of ontology and rules. Therefore the OWL Rule Language (ORL) will be the best candidate to declare semantic web service constraints. Furthermore, our SWSCSP research will focus on P2P systems and this infrastructure is more complex and dynamic than the WWW on policy management and enforcement.

Keywords

Semantic Web Services, Peer-to-Peer (P2P), Ontology Language, Rules Language, Policy Specification, Semantic Overlay

1. INTRODUCTION

The Peer-to-Peer(P2P) systems allow tremendous amount of online peers to provide services for resources sharing and information exchange [13]. Unfortunately, generic P2P systems do not have a rich metadata and schema to represent services resource and policy's context on information search, analysis and integration [11]. Therefore several studies were proposed to enhance P2P routing and clustering strategies based on RDF(S) [1][12]. These results are very primitive and premature because they did not really fulfill semantic web vision.

It has become one of the most interesting research topics to combine ontology (language) and rules (language) as metadata and schema to represent information context on P2P network to resolve the above problem [2][3][17]. The semantic web services is considered as one of the most promising areas to lift off semantic web vision on the WWW so several important research results were proposed [15][18].

Are there any incentives to introduce P2P network as web services platform instead of WWW environment? Firstly, any online peer nodes are eligible for services providers so service momentums are much bigger than a small number of Web servers can provide. These momentums include hardware and software capacity to deliver and execute web services. Secondly, semantic overlay P2P systems allow us flexibly group web services into a clustering domain so services management and enforcement are more efficient and dynamic.

This ongoing research aim at solving service constraints satisfaction problem (CSP) for both service provider and consumer using semantic-based policy specifications and management on P2P network. Comparing with existing web services environment, our web services will be built and executed on semantic overlay P2P network so service ontology and policy management issues, such as naming, matching, exchange, merging, inferencing, and enforcement, etc, are completely different from existing semantic web approach.

It has been a big challenge to combine ontology language with rules language for having an integral semantic web language to specify ontologies and policies for consistent reasoning. From description logic programs (DLPs) theoretical result to OWL Rules Language (ORL) and Semantic Web Rule Language (SWRL) concrete development, semantic web service vision is getting closer to reality [4][5][6][7].

In the following section, we address several important challenges and issues for research on the web service constraint satisfaction problem on P2P network while using ontology and rules as policy specification components:

2. THE CHALLENGES AND ISSUES

The challenges and issues we address will be the following:

1. **Generic P2P system construction**

   The construction of generic P2P system testbed so that simulation on real P2P system operations with-

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out having scalability and robustness problems. The PlanetLab (`https://www.planet-lab.org/`) was chosen as generic platform but scalable and robust issues for the PlanetLab environment still need further study.

2. **Service constraints representation as policy**

   The service constraints as policy can be interpreted script language or compiled structure programming language. We prefer using ontology and rules language, such as ORL or SWRL, to represent our declarative policy. This allows us flexibly and dynamically to represent all kinds of service constraints, such as security, privacy, QoS, digital rights management (DRM) and service incentives selection criteria, etc. It will be a challenge to define and translate above abstract web service constraints to SWRL-based executable policy.

3. **Services grouping and aggregation**

   There are all kinds of services on the semantic overlay P2P network. It will be a challenge to group and aggregate a variety of services so that the complete web service processes, including declaration, discovery, matching, execution, and monitoring, can be speed-up and more efficient. In case of composite services, we might have to cross services grouping domains to enforce the compound service processes.

4. **Embedded service constraints policy to semantic web services framework**

   There do not exist any service constraints and capabilities in the existing (semantic) web services framework [20]. Therefore we must define what are these service constraints and find out where are the appropriate entry points that we can add these service constraints to enforce possible control mechanisms for P2P systems.

5. **Naming and addressing of resources and service constraints for policy management**

   One of the challenges for service constraints satisfaction problem is naming and addressing issues for having integral service constraints policy management on the semantic overlay P2P network.

   The services on WWW are based on heavyweight ontology and rules using URI as naming and addressing indicator. But services on P2P network are based on lightweight ontology with associated rules located at each peer node. The naming and addressing of resources and constraint polices for P2P network are overlay the Internet so we have to design a translation and mapping mechanism to locate resources and policies. Otherwise, we can not use ontological engineering techniques to match, query, exchange, and merge ontologies and policies distributed at each peer node [16].

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