

Contract Negotiation, a Tale of Five Themes

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ABSTRACT

Contract negotiation is an area of increasing interest to grid and web service developers. However, the implementation of systems capable of both creating and negotiating them requires considerable attention to dependability issue. In this paper the PhD projects design and implementation are laid out, prior to an examination of the area from the angle of the five DIRC themes.

KEYWORDS

Structure, Responsibility, Timeliness, Risk, Diversity, Contracts, Negotiation.

1. INTRODUCTION

The ongoing adoption and commercialisation of grid technologies has increased the pressure to develop new SOA (service oriented architectures) for both grid and web-service communities. This has led to new efforts in standardisation including the Open Grid Service Architecture (OGSA). Work under this banner has included the Open Grid Service Infrastructure (OGSI) and more recently the Web Service Resource Framework (WSRF)¹.

The PhDs emphasis is on negotiation, and the subsequent deployment of secure contracts which address the ongoing issues relating to authorisation that exist in the leading open source grid development toolkit, Globus v3². The area of automated negotiation has largely been overlooked by the wider research community, primarily because a sufficient base of equivalent services does not, as yet, exist.

This paper builds upon the PhD research completed to date, examining the area from the specific perspective of the five DIRC themes.

The structure of the paper is as follows. Firstly, a brief overview of the research completed to date. Secondly, a discussion of the areas most applicable to the themes with regard to automated negotiation. Finally, a conclusion drawing upon the observations made, complete with directions for future work.

2. RESEARCH BACKGROUND

As introduced in the previous section the aim of the PhD is to examine the possibilities for, and creation of, a workable automated contract negotiation system for both clients and service providers. The research encompassed areas of contract design, security, negotiation tactics & GUI development. To this end an

integrated environment for the discovery, preliminary investigation and negotiation of contracts was established for between 1-4 different services simultaneously with a single requesting client. In addition to this, the contract format itself could be secured using X.509 encryption for storage of secure contracts to allow non-repudiation.

The project recognised the existing construction of contracts from contract clauses, and aimed to recreate these in a format capable of simpler analysis and computation. The contracts themselves were created to allow extensible contract clauses to be added / removed around a core of compulsory fields, covering essential contract requirements including party names, date of initiation / expiry etc. The contract structure was logically split into two sections, one handling administrative details, and a second covering service operation details. An example of a service operation field could be the fault tolerance capabilities of the service in question, whether checkpointing would be used etc.

The second aim of the integrated tool was to examine the ways in which automated negotiation could occur between parties with only limited knowledge of both motives and strategies. The input mechanisms used for the negotiation support numeric, alphanumeric and formula based rules for negotiation. For example the following could be represented:

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Checkpointing "yes"  
Availability 0.999  
If TimeToComplete > 50ms then Cost < £40
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The actual specification of field names and values is only of limited use when considering negotiation. Additional information is required to allow the negotiator to compare the weighting (which could also be considered as the importance) of a given field within a specific negotiation. i.e., is it more important to satisfy some requirements than others?

The negotiation itself consists of a number of offer / reply cycles, as part of an iterative improvement cycle between client and service attempting to find a mutually acceptable compromise between their differing requirements. The area of contract negotiation is filled with risks, some of which are more manageable than others. These, amongst other issues, are explored in the following section.

3. THOUGHTS ON DIRC THEMES

Timeliness

The operation of service monitoring, negotiation and agreement mechanisms require time synchronisation and accuracy throughout, without which it would be impossible to enforce agreements. Therefore common time representations / translations

need to be established. This may lead to the development of temporal Ontologies similar to those identified in PA9³ as areas of possible future development.

Risk

The risks associated with negotiation are considerable in situations where the client in question must trust a number of potentially malicious bodies in order to do business. These include, but are not limited to Discovery services, Monitoring services, PKI bodies, as well as the services themselves.

The VO (Virtual Organisation) vision for the future is of dynamic discovery & binding between services and clients. However, services cannot be assumed atomic, and the assumption that composite services may make use of sub-services, not necessarily within the same geographic or organisational boundary, entails a number of problems and issues. For example, there are legal issues with the export computational resources in some countries, including the USA. Therefore many general services, which could potentially be put to multiple objectives, could be hampered or open up their companies to risks of service abuse, unless the clients were carefully vetted. The vetting of potential clients for the negotiation of potentially valuable service operation requires a number of infrastructure components to be in place. These include 3rd party monitoring, required to ensure that a given service performs to the standard it has agreed to.

Structure

In order for an automated negotiation tool to be successfully utilised, a number of criteria need to be addressed. Firstly, that the structure of the contracts is both extensible and standardised. An automated tool is only of use in a situation where the majority adhere to a given format and security model. This PhD has addressed these particular issues through the development of a format based on XML, to which different contract clauses can be added and subtracted as necessary. Secondly, that different organisations adhere to standardised interpretations of given contractual phrases. For example, can everyone agree on an understanding of the phrase TimeToComplete. Some may argue this constraint takes into account the time with which a service has to complete the computation on a given request. Others may argue that it must also take into account the network time taken to deliver the results. Even the format of such a phrase may give contractual pause for thought, in a domain that abhors ambiguity. The development of standardised agreements on the understanding of words and phrases, often through the implementation of ontologies, is a slow process, and will likely become more of an issue as dynamic binding to services becomes more common.

Diversity

The model for the project has depends upon the assumption that a suitable number of compatible services will exist for a given set of requirements. This diversity of services is essential, as automated negotiation only becomes desirable once the complexity / customisability of agreements between clients and providers, reaches the point where assistance is required to make a meaningful decision within a given timeframe. Without sufficient service diversity research into many forms of fault tolerance and service negotiation techniques would prove redundant. Diversity is therefore at the heart of the SOA metaphor.

Responsibility

The concept of a contract embodies many responsibility issues, most pertinently the trust of both parties to both understand the process they are agreeing to and to abide by the legalities of agreements signed. Contracting is of little use without adequate monitoring mechanisms. The monitoring mechanisms themselves have to be trusted to responsibly gather statistics and to analyse and present information to those that require it in an unbiased and above all, responsible manner.

4. CONCLUSIONS

In conclusion it is clear that the research completed in the progression of this project contains much that is of interest to those considering the five themes of Risk, Responsibility, Timeliness, Structure and Diversity, and that in order for automated negotiation to succeed; these considerations need to be taken into account in order for the area to progress.

Future work in this area with relation to the themes could include examination of third party monitoring, examining the risks and responsibilities placed upon an unbiased party with regard to the gathering and publishing of potentially damaging information.

5. ACKNOWLEDGMENTS

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