

Negotiation Protocol for Agile and Reliable E-Science Collaboration

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In e-Science collaboration, e-Scientists from different institutions collaborate to carry out experiments to explore their research, with the computing resources provided by third-party institutions. Currently, the dominant way of organizing a resource sharing for e-Science collaboration is Virtual Organization, which bonds e-Scientists, e-Science research group management and resource provider together, and do not allow dynamic collaborations to be formed, managed, and dissolved as part of a complete resource sharing lifecycle. In this way, e-Scientists have limited control of their programs' execution, and cannot have customized demands satisfied, as surveyed by social scientists on LHC Grid [1]. The advent of Cloud eases the tension by agile service supply in a pay-as-you-go consumption manner. However, it does not support expenditure control for research group, neither sufficiently accommodate users' needs with provider-oriented SLAs [2].

Based on this, we believe that negotiation, which separates resource requesting organization (e-Science research group), and resource provider, but also considers access control between resource requester (e-Scientists) and research group manager, can be a solution to enable the resolution of the different demands in an agile and lightweight manner. Without a centralized management layer, law-based negotiation is a must demand for reliable QoS resource provisioning.

So far, the protocol design and formal verification is complete. The proposed protocol focuses on messaging sequence, rather than the contents of messages. It demonstrates that the negotiation amongst three participants is consistent, and can reach the same final state. We also argue that to verify the designed protocol formally is necessary to adhere to the legislate principles, while it also can avoid possible issues and make it efficient to deploy upon existing infrastructures, especially for large-scale distributed systems. It can also give us a view of the perspective performance for implementation, by exhausted state space exploration of the designed protocol.

I am developing testbed to test the feasibility and performance of designed protocol in real environment, which will include Grid and Cloud as providers. The testbed will enable user-interactive computational steering [3] upon existing e-Science infrastructures, via dynamically negotiating resources using ontology. It considers different requirements according to roles:

E-Scientists: people who probably have limited technical knowledge of computer science and have customized requirements for application execution, such as resource reservation to enable application to start at a particular time or condition.

E-Science research group manager: is an administrative role concerned with resource allocation and management in a research group, and possibly also expenditure control for the whole group when pay-as-you-go resource usage mechanism is applied.

E-Science infrastructure provider: executes experiment programs by providing remote access to local computing resources. It seeks limited changes upon existing infrastructures, and easy management on research group's resources.

Overall, my work will present an innovative way to re-think about e-Science collaboration lifecycle, and to form and dissolve agile, reliable, and QoS-based resource sharing for e-Science collaboration.

I intend to present a poster, accompanying with a short paper in the conference. It will be a great opportunity to communicate this protocol with experts from different fields, including e-Science infrastructure users, computing resource providers, and research management experts, who are all considered in my work. Attending this conference will offer me a great chance to discuss the feasibility of designed testbed with technical experts. Furthermore, users of e-Science tools there can give me advice about testbed user interface design, which should be taken seriously for software development, while talking with experienced e-Science group management experts can help me to evaluate this work. To attain such valuable information will definitely equip me with a picture for overall experiment perspectives, which will be enormously helpful.

Furthermore, this conference features 'live' demonstrations of recent research, providing a quick glance of work done at the frontiers of the e-Science community. It

will give me a bird's eye view of the current hot topics and innovative forthcoming ideas, and the opportunity to evaluate our work to date. It will also be a good chance to improve my presentation and communication skills.

I am excited to present my work in the conference. It is believed to benefit my graduate research ahead as well. It will help in establishing myself in field of e-Science and establish contact with other researchers, which is valuable for my academic career development.

Reference:

- [1]: Venters, Will, Eivor Oborn, and Michael Barrett. "A Trichordal Temporal Approach to Digital Coordination: The Sociomaterial Mangling of the CERN Grid." MIS Quarterly (2014).
- [2]: Hon, W. Kuan, Christopher Millard, and Ian Walden. "Negotiating cloud contracts: Looking at clouds from both sides now." Stan. Tech. L. Rev. 16 (2012): 81-833.
- [3]: Brooke, J. M., et al. "Computational steering in RealityGrid." Proceedings of the UK e-Science All Hands Meeting. Vol. 16. 2003.