

Deliberate Cooperation In Service-Oriented Environments:
Dynamic Transactional Workflows For Web Services

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(Computer Science)

by

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Statement of Originality

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.

(David John Paul)

Dedicated to my mother. You showed me the path but let me make my own way.

Acknowledgements

No man is an island entire of itself; every man is a piece of the continent, a part of the main.

John Donne

The city of Newcastle has a lot to offer. Large enough to have most modern conveniences available, but small enough not to have completely lost its village feel, the city combines the coastal lifestyle (including some of the most beautiful beaches in the world) with the industrial contrast that its mining history ensures. It has been my home; I can offer it no greater compliment or thanks. Of course, a location on its own, no matter how beautiful, cannot provide the support necessary for a long-term project such as this dissertation. For that, people are needed, and I've been fortunate enough to have had the guidance, support, and presence of some truly wonderful people, all of whom deserve my acknowledgement and my thanks.

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Abstract

The only thing that will redeem mankind is cooperation.

Bertrand Russell

Modern society is complex and, in order to achieve desired goals, individuals must work together. Cooperation between parties can either be accidental, forced, or deliberate. Deliberate cooperation occurs when individuals realise that a successful outcome is more likely when they team up with others to achieve common goals. This thesis presents a method to support deliberate cooperation in service-oriented architectures. In such an environment, deliberate cooperation can be provided through improved transaction support.

Service-oriented architectures are based on the concept of services. Providers advertise the services that they offer and clients send requests for the services to be performed without needing to understand the intricate details of how the outcomes are achieved. Clients often require services from multiple unrelated providers in order to achieve their goals, but current systems make it difficult to combine these services in such a way that the client is guaranteed an acceptable outcome. Further, the existing standards are not always flexible enough to allow service providers to always offer their desired level of transaction support.

This thesis presents a method that allows service providers to dynamically alter the level of transaction support they offer for their services. This approach is more flexible than current approaches for Web Services transactions, and ensures that providers are always able to offer a level of support for cooperation with which they are comfortable. A formal system is also presented that allows clients to use the transactional guarantees offered by providers to reason about service compositions and ensure that client workflows always end in an acceptable state.

To augment these theoretical results, a Web Services transactions simulator has been developed. By simulating transaction flow rather than service flow, this allows the dynamic transaction scheme described in this thesis to be compared with more traditional Web Services transactions. Results indicate that support for dynamic transactional workflows can provide an overall benefit for both clients and service providers, and the simulator allows detailed study of how changes to the transactional behaviour of participants affects the outcome of particular scenarios.