

# A Multi-Agent Framework for Inter-Organizational Applications

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## Extended Abstract

The CEC GOAL Project (Esprit 6283) aims to develop generic software tools to support inter-organizational project management. Some distinguishing characteristics of inter-organizational projects are that they are collaborative, decentralised and heterogeneous. This means that generic issues in project management (such as risk and uncertainty) take on an extra dimension, and there are many new problems to be addressed, such as information access, dissemination, and security, the coordination of independent partners, and communication between partners at remote sites.

Our work focuses on the inter-organizational aspects of communication and interaction which enable participating organizations to complete shared tasks and to achieve shared goals – i.e. computer-supported cooperative work (CSCW) for inter-organizational projects. The GOAL Cooperation Services Framework (henceforth CSF) is proposed to enable the specification of project-wide standards for normalized interactions between autonomous software agents acting in a federated information system, so providing mechanisms to:

- i standardize inter-organizational terminology and information exchange between organizations;
- ii structure inter-organizational interactions wrt. contractual relationships and local working practices;
- iii enable each organization to provide/use project services required/offered by other organizations.

The aim of the CSF is to remove the barriers to meaningful interaction between independently developed applications in an open and distributed inter-organisational environment. For our purposes in the GOAL project, implementation of the phrase “meaningful interaction between independently developed applications” has been restricted to *negotiation* between *semi-autonomous agents*. Agents are both service providers and service consumers, and negotiate over the content, terms and quality of service delivery.

The CSF defines several standards to facilitate negotiation between service consumers and service providers. There are three interrelated elements:

- i the encapsulation of service consumers and providers

within standard interfaces supporting the fundamental operations necessary for structured negotiation over service delivery, e.g. *Request*, *Offer*, etc.;  
ii standards of behaviour for service consumers and providers via cooperation protocols<sup>1</sup>;  
iii conversation handling facilities which allow applications to validate the actions of other agents with respect to agreed protocols.

A prototype of the CSF has been implemented using DEC's ObjectBroker 2.5, which is compliant with the OMG CORBA 1.2 specification and architecture<sup>2</sup>. Demonstrator applications include:

- service browser: an agent which matches agent servers with agent consumers and facilitates negotiation over the terms of delivery (cf. a *trader* in the ANSA<sup>3</sup> Trading and Federation Model);
- project handbook: an agent-based solution to disseminating, accessing and altering information in a distributed, dynamic electronic document;
- project archive: agent-based ‘publish and subscribe’, in which the agents negotiate over format, frequency and quality of circulated project documentation.

In conclusion, the CSF builds on existing distributed object computing systems to address new issues in inter-organizational project management. However, the CSF need not be limited to this domain, indeed it should be applicable to any open computing environment which spans organizational boundaries<sup>4</sup>. Indeed, by establishing a framework for agent interaction where the terms and quality of service delivery are open to negotiation, we have the basic infrastructure for a market-place in electronic services.

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<sup>1</sup><ftp://medlar.doc.ic.ac.uk/pub/llar/jvp/coop95.ps.gz>

<sup>2</sup><ftp://omg.org>

<sup>3</sup><http://www.ansa.co.uk/>

<sup>4</sup>Cf. <http://www.cs.umbc.edu/kse/>