Multi-agent architecture for distributed-in load control and overload protection

**Details of the project**

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<th>Coste total:</th>
<th>Tema(s):</th>
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<tr>
<td>No disponible</td>
<td>5 - Service engineering, security &amp; communications management</td>
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<tr>
<th>Aportación de la UE:</th>
<th>Régimen de financiación:</th>
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<td>No disponible</td>
<td>CSC - Cost-sharing contracts</td>
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<th>Coordinado en:</th>
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<td>Ireland</td>
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**Objective**

**Main Objective**

The main objective of the MARINER project is to assess the usefulness of agent technology for the enhancement of the performance and management of complex distributed telecommunications network environments. Agent technology offers the opportunity both to deliver intelligence to the end-user and to organise intelligence in the network itself, thus its successful application will greatly aid the future evolution of the telecommunications infrastructure. Recent years have seen the development of a variety of agent languages, architectures and platforms. However, efforts towards the standardisation of agent facilities have only started recently, mainly within the Foundation for Intelligent Physical Agents (FIPA) and the Object Management Group (OMG). MARINER will seek to validate the FIPA and OMG models for agent-based systems through the design, implementation and trialing of a prototype multi-agent system for Distributed Intelligent Network (IN) load control, which will need to satisfy stringent real-time performance constraints.

It is widely agreed that Intelligent Network distribution (facilitated through the introduction of CORBA into IN network elements) will shortly be required to meet the increasing demand for the rapid and cost effective introduction of telecommunications services such as multi-operator Freephone and Virtual Private Network (VPN). In this context, it will be critical to ensure that the performance of such services is not degraded due to network congestion problems. Given that reactivity and pro-activity are characteristics of agents and multi-agents systems, it would appear that the adoption of an agent-based approach may offer a timely solution to the problem of efficient load control in Distributed-IN network environments.

**Technical Approach**

The agent-based implementation of a Load Control and Overload Protection strategy, to be developed by the project, will be highly distributed in nature, requiring complex interactions between a large number of agents and will have to satisfy stringent real-time performance criteria.

The exploration of whether an agent-based application implemented in accordance with the FIPA and OMG specifications can meet real-time performance requirements will be a central part of the work to be undertaken by the project. Real-time issues such as the assignment of priorities to and scheduling of agent actions and whether network communication protocols can meet real-time needs (e.g. the ability to control the desired response to dropped or erroneous packets) will be investigated in detail. The consortium expect that this investigation will lead to the identification of the need for enhancements to the FIPA and OMG models which, once identified, will be contributed to the relevant body.

Study of the development of a multi-agent system for a Distributed-IN network environment permits the investigation of the manner in which agents can be deployed in network elements and communicate with each other utilising available communications infrastructure. Distributed-IN networks will consist of a mixture of both 'legacy' network elements (based on existing IN standards) with those utilising CORBA for the realisation of IN components and communication; the project will explore how FIPA-compliant agents can be deployed in both types of element. In elements where CORBA is used, of particular
interest will be the possible utilisation of the services of the OMG Mobile Agent System Interoperability Facility (MASIF) for the
realisation of some components of the agent platform. In addition, the project will investigate whether general aspects of the
structure and operation of Distributed-IN networks may place constraints on the realisation and operation of FIPA and OMG
MASIF compliant agent systems.

The initial phase of the project workplan will address the objectives of and requirements for load control strategies in the
context of a Distributed-IN environment. The focus will be on the specification of a multi-agent architecture incorporating a
number of different agent types, each responsible for a well defined subset of the tasks necessary for the realisation of the
overall load control strategy. Strategies based on a number of different approaches will be evaluated, though an approach
based on agents operating a trading market for the buying and selling of network resource usage appears very promising.

Subsequently, the multi-agent architecture, implementing the chosen load control strategy will be realised in terms of a
prototype multi-agent system implementation built upon a suitably real-time enhanced agent system development and
execution platform. The final phase of the project workplan involves the running of trials, of both an operational and simulation
nature, which will test that the developed system both functions as specified and is likely to deliver acceptable performance in
a real network environment.

Summary of Trial

The project will adopt a two-stranded approach to trials of the multi-agent architecture:

-simulation Trials: The first trial strand will involve the use of event-driven simulation techniques to model operation of
suggested Load Control and Overload Protection strategies and subsequently to model in detail the performance of the multi-
agent system which realises the chosen strategy. Use of simulations will allow the modelling of the multi-agent system in the
context of a multi-operator network environment supporting many services and under a wide range of traffic load conditions.

-virtual Multi-Node Network Trial: The prototype multi-agent system will be deployed on a single-node IN Service Switching
Point (SSP) / Service Control Point (SCP) test platform built upon a fully programmable switch. This process will provide
valuable practical experience of the deployment of a FIPA / OMG MASIF compliant agent system on telecommunications
network infrastructure. The platform will then be integrated with simulations developed in the other trial strand in order to
realise a virtual multi-node, multi-operator network trial environment, which will be used for full testing of multi-agent system
functionality and the assessment of its likely performance.

Expected Achievements

The MARINER consortium foresees potential for significant contributions relating to the application of agent technologies in the
telecommunications domain. The most relevant standards body in this regard is likely to be FIPA, however there may also be
potential for contribution to OMG and IN standards bodies. Contributions are likely to focus on enhancements to current agent
standards to allow their use in circumstances where real-time performance is crucial. The project will implement a prototype
multi-agent IN load control application, in conformity (where possible) to FIPA and OMG standards, which will be made publicly
available in the form of a software demonstrator which will be exhibited at relevant conferences and industry fora.

Expected Impact

MARINER will aid the development of an open telecommunications infrastructure by promoting the uptake of CORBA and
agent technologies in real-time, distributed telecommunications environments. Its work on the development of wrapping
techniques for the incorporation of legacy software in agent-based applications and development of a viable commercial
approach to Intelligent Network Load Control will also contribute significantly towards the future evolution of the
telecommunications infrastructure.

Main contributions to the programme objectives:

Main deliverables
Agent technology for distributed IN (Intelligent Network) load control and overload protection.
Contribution to the programme
Validates agent technology for the enhancement of the performance and management of complex distributed networks.
Extended current standards (FIPA, OMG) to cope with real-time requirements.

Key Issues

The key issues for MARINER are:

-identification and development of necessary enhancements to existing agent standards to allow for the development of real-
time, distributed agent based applications for deployment in multi-operator telecommunications network environments;

-investigation of the means of introducing agent-based applications into telecommunications infrastructure;

-investigation of the relationship between FIPA and OMG MASIF agent standards;

-development of an efficient and effective load control strategy for Distributed Intelligent Networks.
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Temas
Information Processing and Information Systems - Social sciences and humanities - Telecommunications

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