ARGUGRID

Scope

Business processes are costly, lengthy and error-prone. Computing tools can decrease the Business-to-Business complexity by the automation of such processes. Obviously, simple routines such as the order fulfilment have been already automated. Our goal is not a fully automated system but supporting:

- The selection of the best supplier;
- The purchase of complex services;
- The creation of tailored products with high added value.

Since the human and computing environments of services industry are global, complex, interconnected, and dynamic, the characteristics of our software applications are:

- Interoperability, Reusability, Flexibility, Adaptation.
- Efficiency, Autonomy, Intelligence, Scalability.
- Reliability, Robustness, Security, Trust.

Advances

Argugrid has developed new models, new architectures, and a new platform for building software applications for B2B through the use of Multi-Agent technologies, Argumentation logic, Peer-to-Peer techniques, and Grid.

The key advantages of Argumentation techniques are:

- Supporting the interactions between service providers and service consumers in a Service-Oriented setting.
- Supporting rational decision-making, as well as negotiation, for the agreement and orchestration of services and contracts that regulate the provision and acceptance of services.
- Helping to justify decisions and agreements and thus contributing to a user-friendly environment for service composition.
- Adding flexibility to the orchestration of services, rendering this cooperation while at the same time maintaining the competitive nature of service composition in a distributed and open environment.
- Supporting the creation, management and dynamic evolution of virtual organisations, understood as societies of Agents, to compose individual services into more complex ones.

Thanks to this approach, we envisaged that the Argugrid platform could easily manage complex problems, as selecting the best supplier in a distributed eProcurement scenario, or creating tailored products derived from different Earth Observation sources.

Positioning in global context

Argugrid aims at providing a new model for programming the Grid at a semantic, knowledge-based level of abstraction, through the use of Argumentative Agent technology. Agents are associated with service/resource requestors and service/resource providers on the Grid.

Argugrid aims at making an impact upon the Grid research area via the new model, as well as a corresponding system architecture - which supports Agents, their interactions, Virtual Organisations and Web Service standards - and a platform supporting the implementation of the models over the Grid via Peer-to-Peer techniques. It also aims at impacting business and business practices, by empowering Grid-enabled e-business applications where multiple service providers and requesters exist. Although it focuses on e-business scenarios, we envisage that its results will be outreaching to all kind of applications empowered by the Grid.

Contribution to standardization and interoperability issues

In order to support the matching of service descriptions and concrete services, the automated searches, and composition of services, the Argugrid platform uses the conceptual framework WSMO, which is built upon the ontology language WSML, for semantically describing all relevant aspects of services. WSMO allows modelling the requirements of service requestors at the semantic level, as well as the competencies of service providers.

Argugrid, as a leader project on Argumentation logic, contributes to the specification of an Argument Interchange Format (AIF). This XML-based language intends to represent and exchange data between several Argumentation tools and Agent-based applications. It represents a consensus abstract model established by researchers across fields of Argumentation, Artificial Intelligence and Multi-Agent systems.

Target users / sectors in business and society

The direct targets for Argugrid project are:

- Software and application developers with the aim of providing new value-added Semantic Web Services.
- Industrial service providers who want to simplify access and interoperability of their services.
- End users that will benefit from Agents with improved reasoning capabilities.

Overall benefits for business and society

The Argugrid approach simplifies the process of providing, using and managing Web/Grid services in distributed applications, improving business opportunities for both service providers and service requestors.

Examples of use

Three different scenarios are being used to test and validate the innovative Argugrid capabilities:

- **Earth Observation:** Information about Earth Observation services is currently accessible only in a very scattered way through different mission operators, scientific institutes, service companies, data catalogues, etc.
  Easier and timely access to large quantities of primary data, together with a deep knowledge of the sensors and its characteristics, is needed for delivering effective services.
  A system with that knowledge, able to select the best options and combine them to quickly create a tailored product, would be very appreciated in crises.

- **E-Procurement:** The Argugrid e-Procurement scenarios refer to two complex cases where Argumentation techniques will prove their effectiveness:
  - Selecting and deciding upon the best deal when procuring complex systems, projects or services from a supplier, or from a consortium of suppliers, and,
  - Selecting the best type of e-Auction, and its optimum setup parameter values, given specific assumptions and inputs.

- **Business Planning & Outsourcing:** a business consultant scenario on investing and operating a business case presents a vision on how Grid technologies could be applied as a communication network, describing business processes by using Workflows, and managing negotiation between parties by using Intelligent Agents.
  This case provides guidelines for developing a conceptual framework for decision-making and negotiation components therein.

Achievements

During the first two years of the project, four new software components have been developed and integrated within Argugrid platform:

- **CaSAPI** is a general-purpose Argumentation tool for Abstract and Assumption-Based Argumentation.
- **GOLEM** is an Agent environment middleware that can be used to create Multi-Agent system applications. Applications in GOLEM can be specified declaratively, thus making the deployment of cognitive Agents of the kinds envisaged by Argugrid easier in that perceiving the environment amounts to importing parts of a logical theory.
- **MARGO** implements an Argumentation-based mechanism for multi-criteria decision making about services selection and composition. MARGO evaluates the possible actions, suggests some solutions, and provides an interactive and intelligible explanation of the choice made.
- **PLATON**: Peer-to-Peer platform supporting multi-attribute and range queries. Load balancing of resources guarantees logarithmic querying time using any distributed tree-based multi-attribute Peer-to-Peer platform.

Additionally, over 30 papers have been published in conferences and journals.

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