Open Source Supply Chains: Enabling software technologies and methodologies for Information Supply Chains

1. Overall objective and description of the Open Source project

The project concerns the identification of commonalities amongst a set of operational European RTD projects in the IST Programme, that reside in the wider area of E-Commerce, aiming to harmonize efforts for the establishment of common methodological and technological building blocks in the area of smart organizations, taking into consideration relevant standardized models and methodologies developed by respective bodies and consortia.

The overall objective is to develop a reference model for promoting the establishment and lifecycle management of open, scalable, distributed Supply Chain communities and the related technical specifications, drawing on the base technologies being developed by the IST Projects ADRENALIN, CAWICOMS, LIAISE and COOPERATE. The technology reference framework is supported and validated by leading methodologies, support tools and management infrastructures as these are developed by the IST Projects INSPIRE, WHALES and MEDIAT SME.

Furthermore the development and validation of the Open Source Reference Model takes into consideration methodologies and frameworks developed by standardization bodies and industry consortia establishing this way an upper level of “marriage” between results of active IST RTD projects and Standardization.

Specifically, these are the OMG’s Model-Driven Architecture (MDA), RosettaNet’s Partner-Interface-Process (PIPs) specifications, the Open Group’s Architectural Framework (TOGAF) and FIPA standards for software Agents. Moreover the project analyses the interoperability aspects with three well-established models in the area of Supply Chains, workflow management and B2B. The first is the SCOR reference model by the Supply Chain Council and the second is the ebXML architecture co-developed by OASIS and UN/CEFACT. Standardization issues related with Workflow Management (WFRM of the WFMC) are also taken into consideration.

The Open Source project introduces the notion of Distributed Configuration in the field of “conventional” Supply Chains, regarding management of flows for complex customisable products and services, dealing simultaneously with multiple suppliers over a network, focusing on management of both tangible and intangible goods, services and competencies, aiming to create products that better match their buyers’ needs and reduce costs by more efficient sales processes.

The project focuses in particular on the aspects relating to the design and implementation of open source platforms and paradigms within the area of Supply Chain Management, made up of autonomous network nodes which by employing the notions of web-based Configurators and Intelligent / Mobile Agents are able to scale their behaviour.

Open source does not mean only open source code though it stems from the evolution of the open source information technology, but relates rather to the “openness” in enabling and / or licensing development, testing and improvement of
specific software components which may constitute components of a wider IT architecture or system, ensuring in this way higher interoperability and evolvability.

In the project, and in the context of the CEN/ISSS Electronic Commerce Workshop, we exploited synergies with the project groups on Frameworks Architectures and Models for Electronic Commerce (Architectures) and the E-Commerce Integration Meta Framework (ECIMF).

2. The approach taken

The adopted approach for establishing the Open Source Supply Chains reference model within the wider area of e-Commerce and smart/networked organizations, extends the field of “conventional” Supply Chains, enriching them with characteristics from the Open Source paradigm, considering them as unique, open, easily configurable entities:

− composed by independently operating nodes, able to interoperate with supply chain models compliant with different software standards
− which can adopt different technologies and standards (from legacy to open, to specific technologies for information systems) to be an integrated part of the supply chain ensuring this way the open future collaboration
− supported by re-usable software components for communications between autonomous supply chain network nodes, scalable according to business operations.

The Open Source Supply Chain reference model was implemented by organizing and extending the corresponding set of already existing commonalities amongst the participating projects that reside in the area of Networked/Smart organizations, in two different levels taking into consideration the nature of their provided concepts.

More specifically, the four of the seven participating projects (ADRENALIN, CAWICOMS, LIAISE, Co-OPERATE) by the provision of their relevant to Supply Chain management organizational/technological results will formulate the Open Source Supply Chain Technology Interoperability level (TIL) responsible for sustaining the development and evolution of the mechanism for supply chain establishment and lifecycle management.

For the successful achievement of the previously described integration, methodological and business interoperability concepts of the other three (INSPIRE, WHALES, MEDIAT SME) participating projects will be utilized, formatting a framework consisted of their application tools, relevant methodologies and architectural support frameworks, that are used for the support and validation of the Open Source Supply Chains reference model.
3. The main pillars

Currently we are witnessing the surge of Supply Chain models supported by the implementation of different industry standards. In addition to these models companies are implementing internal information system infrastructures based on a variety of technologies and architectures. These technical evolutions have to be integrated if we want to produce scenarios of re-usability and scalability in the area of supply chains, but also if we want to enable the business integration of supply chains that have been built based upon and embracing different frameworks and standards. In other words the challenge faced here deals with bridging the gap between the business model of a Supply Chain participant supported by a specific platform with the business model of another supply chain participant supported by a different platform.

But how one has to organise the information flows of both intra and inter-enterprise Supply Chains so that autonomous, decentralised Supply Chain participants get the information they need, in the quality, quantity and time they really require to navigate themselves autonomously and in close communication with other entities positioned in different Supply Chain environments, compliant to the same or different models and standards, in order to follow the same overall goal?

In general, for any integration exercise both are required a technology solution (to connect systems and move messages around efficiently) and a linguistic, social, and philosophical solution (to resolve semantic, schematic, communication, and knowledge differences inherent in variant systems).

Similarly, the same occurs within the field of Supply Chain management where the challenge relates with the attempt of bridging the gap between the actual business model of a Supply Chain participant supported by a specific platform with the business model of another supply chain participant supported by a different platform (different organisations with different processes, information flows, etc) which wants to be an integrated part of that supply chain.

In order to support such an integration exercise amongst (potential) participant of a Supply Chain or amongst different Supply Chains in which participate different organisations with different processes, different information flows and different way of classification of HR and competencies, a number of issues have to be addressed that
combined together will formulate the basic for the development of a Supply Chain Integration Reference Framework.

Specifically, the issues that have to be addressed relate with the:

- development of a methodology for modelling and exchange of data / information on the structure and properties of the Supply Chain participants as well as of the exchanged products (the product ontology) or services, amongst supply chain participants,
- exchange of the actual customer requirements to the supplier systems which requires the definition of a common language and protocol to be defined,
- development and establishment of a common vocabulary (ontology) for the application domain between the involved Supply Chain entities,
- the development of some intelligent (configuration) components, based on this common view on the products / services, able to receive customer requests and distribute these requirements accordingly to the suppliers involved in providing the specific solution,

As such in order to cope with the above described barriers in a theoretical/logical level both syntactic and semantic aspects have to be taken into consideration, formulating a high level conceptual reference model for the domain of supply chain management, the Open Source Supply Chains reference model, to be used for the establishment and lifecycle management of Open Supply Chains and the related technical specifications to enable reusable software components for communication between autonomous supply chain nodes building upon the technical integration of Mobile agent and Configuration technologies.

Comprising a rich set of concepts, contributed by the participating projects, the OSSC reference model is difficult to be understood if it is approached from a single viewpoint. In this regard a set of UML diagrams (class, activity, sequence) was developed, emphasising on specific logical-independent aspects of the whole model. As such, those sub-models are not totally discrete but may be regarded as different aspects of a single, complex model. This is the reason why elements of the OSSC model appear in more than one of its developed sub-models.

More specifically, within the Open Source Supply Chains reference model we define and organize the business framework for mapping all relevant information organized in the following generic models, which formulate the “big picture” of the architecture:

1. the Open Source Supply Chains Abstract Object Model which describes the objects involved in the provision of a service or product.
2. the Open Source Supply Chains Abstract Process Model, which provides process (operating sequence) templates for the operations to be executed by the Open Source Supply Chain participants and
3. the Open Source Supply Chains Abstract Interaction Model, which describes interaction mechanisms providing communication protocol templates for the communication between Open Source Supply Chain Participants.
In this case, *generic* means that all the above-mentioned schemas provide a description applicable to different particular Supply Chain domains. For this reason there are no specific domain attributes, relations, or actors presented in these schemas but rather purely generic components that can be *specialized* in order to create the specific domain models.

Adopting a bottom to top approach, the base for the conceptual architecture presented here was based upon the outcome of the comparative identification analysis of participating IST projects as well as on the resulted outcomes and business requirements as those were brought to surface by the identification and analysis of real-world business case application scenarios conducted within the previous chapter.

Then during the last phase of the project, using these generic schemas as blueprints, in a top to bottom approach the Open Source Supply Chain scenarios described in the previous Chapter will be further exploited and their specific technical specifications will be implemented.

It is important to be mentioned that the modelling work was conducted in a way that drove the incorporation of standardization concepts and activities as well as simplification/compatibility of Supply Chain Management procedures amongst its actors.