iSURF -An Interoperability Service Utility for Collaborative Supply Chain Planning across Multiple Domains: Textile Supply Chain Pilot[1]

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Abstract: One of the key challenges in supply chain collaboration is to improve the efficiency and effectiveness of the suplly chain planning process to handle rapidly changing customer demands. Trading partners usually have different competencies based on their business strategies and investments. They have varying sources of information and also dissimilar views of the marketplace. The distributed intelligence of multiple trading partners needs to be collaboratively exploited in the planning and fulfilment of customer demand in the supply chain so as to enhance supply chain responsiveness.

This paper discusses the technical issues to be addressed for achieving an intelligent collaborative supply chain planning network in which distributed intelligence of multiple trading partners are exploited in the planning and fulfilment of customer demand in the supply chain. This work is supported by the European Commission through ICT- 213031-iSURF project.

1. Introduction

In order to guarantee the survival in today's competitive and demanding digital world of business, the European companies, especially SMEs, should be more agile, self-sustainable and responsive to the changes in the supply chain. Obtaining and maintaining a competitive edge in supply chain is not only the concern of individual SMEs, but should also be addressed by the entire chain jointly. The supply chain partners should collaborate effectively to better align supply and demand forecasts to have a joint strategy for handling exceptions in the way of realizing "the network is the business" vision.

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In order to achieve collaborative inter-enterprise planning there is a need for a joint planning process, defining when and how this information should be collected, and which application is responsible for assessing this information in order to create joint supply chain forecasts, replenishment and exception management strategies.

The industry realized this need and has produced "Collaborative Planning, Forecasting, and Replenishment (CPFR)" guidelines. CPFR formalizes the processes between two trading partners used to agree upon a joint plan and forecast, monitor success through replenishment, and recognize and respond to any exceptions [1]. The main idea behind sharing forecast data in the planning phase comes from the fact that trading partners have different competencies based on their strategies and investments. Also, the trading partners have different sources of information and different views of the market. The objective of CPFR is to increase the accuracy of demand forecasts and replenishment plans, which is necessary to lower inventories across the supply chain and attain high service levels of the right products in right locations [2].

CPFR envisions providing significant effects on the supply chain; however the effects will be dramatic only when it is completely integrated with the demand plan of an enterprise, in which the production cycle is synchronized with CPFR order cycle. There are two important challenges in order to facilitate the smooth implementation of CPFR: technical interoperability of the planning and forecasting business documents, costly and labour intensive deployment of CPFR processes within a supply chain consortium.

The key requirement for successful collaboration between partners in a supply chain is the existence of technical infrastructure in accordance with the goals of the collaboration [3]. In order to facilitate CPFR, the trading partners should have the necessary infrastructure to build, share and adjust online forecasts and plans. However, since CPFR does not mandate any messaging standard to be used in the collaboration process, the semantic interoperability of the planning and forecasting business documents exchanged between the companies must be addressed.

In successful CPFR pilot applications, it has been reported that the definition and deployment of CPFR processes within a supply chain consortium is too costly and labour intensive. Although CPFR provides guidelines, no machine processable process templates have been defined. It is necessary to support companies by providing tools in order to build the joint inter-enterprise collaboration process and automate legacy application integration.

In iSURF project it is aimed to create an open collaborative supply chain planning environment for European SMEs to address these problems.

2. Objectives

The iSURF project aims to develop a collaborative supply chain planning environment based on CPFR guidelines addressing the interoperability challenges of deploying a CPFR process within a supply chain consortium.

The iSURF architecture will be deployed in the premises Fratelli PIACENZA, a manufacturer of fine woollen fabrics and supplier to many world-leading apparel brand manufacturers, including Boss and INCO/Zegna. In the following sections we introduce the as-is business model of PIACENZA's textile supply chain and describe how we aim to enhance this process through iSURF components enabling collaborative planning.

2.1 – AS-IS Business Model of PIACENZA Textile Supply Chain

The PIACENZA textile supply chain is dramatically stressed to optimize highly complex production cycle in a very fragmented sector, where companies with different dimensions, structures, locations and languages must collaborate to manufacture products in a very short production life cycle.

PIACENZA is composed of two different business units: “Fabric division” and “Finished products (knitwear division)”. The fabric division receives raw material from the supplier and, after the production phase, sells its products directly to the retailers or to its knitwear division. The latter unit at the end of its production phase sells the finished products to the retailers. In this way each division acts as a customer/supplier of the others and both have highly customized tools for specific production, developed at different times and in different ways and no direct information exchange is possible between them. In this paper we concentrate on the supply chain between PIACENZA Knitwear division and its retailers.

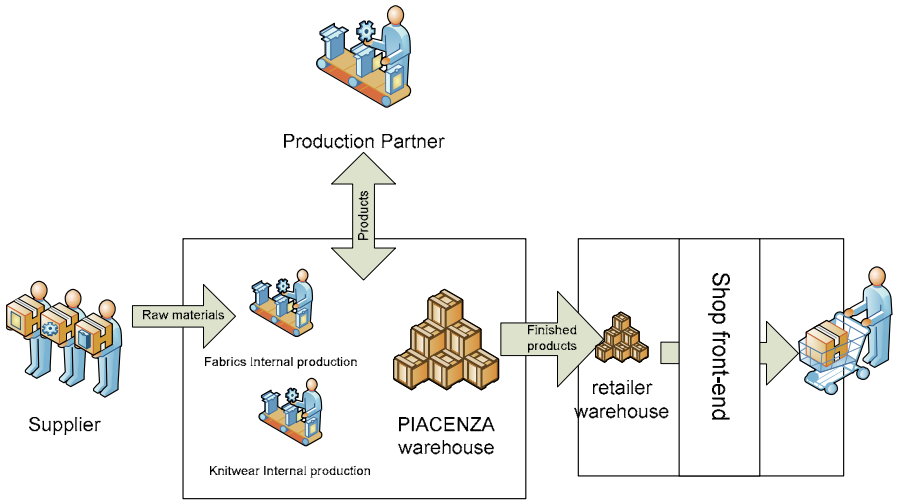

Figure 1 PIACENZA supply chain

The activities performed in this part of the supply chain can be summarized as follows:

- PIACENZA shows a first version of its product to all the retailers
- The retailer sends its order related to the preferred products
- PIACENZA starts its production only when it receives an order
- Finished products are shipped to the customer
- Meanwhile the retailer sells the products
- PIACENZA acts as retailer’s warehouse producing the product that can be reordered by customer
- When a new order comes from the retailer, PIACENZA sends the goods available in the warehouse adding a new production activity related to products that are not available in its warehouse
- When the order is accomplished (all the products are available in the PIACENZA warehouse), the goods are shipped

In the current business model, the business documents exchanged between PIACENZA and Retailers are Order, Order confirmation and Transfer documents. Unfortunately, the document formats used by all of the retailers and PIACENZA are not uniform.

Currently one of the biggest problems of this as-is business model for PIACENZA is to forecast the amount of retail sold goods in order to increase the efficiency and efficacy of the item production for the stock service and minimize its final warehouse stock. Retailers today do not share their Point-of-Sale data with PIACENZA; for this reason PIACENZA has to prepare its replenishment plan without any information about the number of sold goods.

This situation generates a lot of problems such as:

- Slow response time to replenishment orders or even infeasibility to respond to the replenishment orders in the stock phase,
- Decreased efficiency of production phase,

- No information about market direction (which products have been sold in-time and which ones are sold only at discount time).

Another important problem in the as-is business model is the different codes used by PIACENZA and the retailers to identify product items. Each kind of product is associated with a product code composed of six fields by PIACENZA. This code is translated into a unique serial number used for internal activities in PIACENZA. The code is applied to the item by a barcode. It is also possible to reconstruct the original coding structure from serial number. Retailers mainly do not use this code; usually they recode it in their proprietary format. For example in the PIACENZA retail point, the product code is composed of three fields that are different from the producer ones and translated into a different serial number. This means that each time a product arrives in the retail point, it has to be recoded manually. The same problem occurs when the retailer is a multibrand retailer. Even in the stock-house owned by PIACENZA there is the recoding problem: the software used in the stock-house has been produced by different companies, and produces different product codes with different purposes and fields.

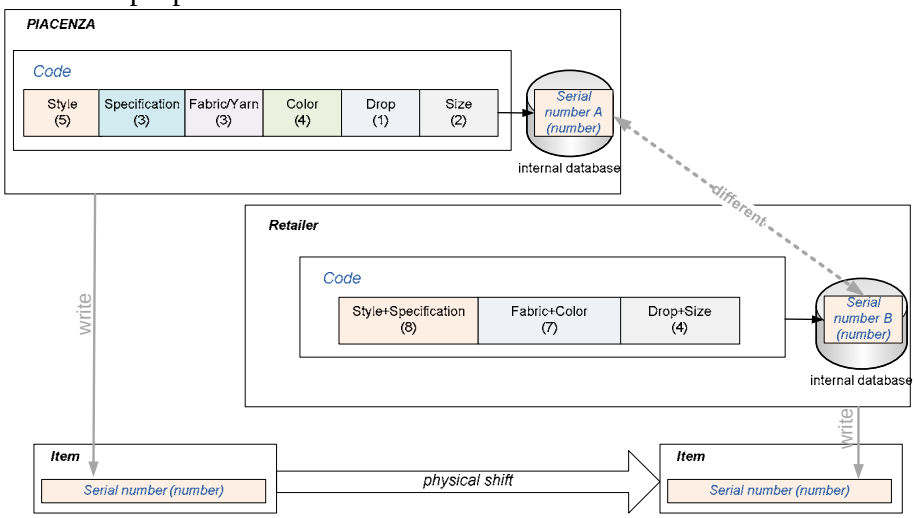

Figure 2: recoding problem between PIACENZA knitwear division and PIACENZA retail

2.2 – TO-BE Business Model of PIACENZA Textile Supply Chain

The problems of the as-is business model of PIACENZA can be summarized as follows:

- Product recoding between retailers and PIACENZA
- Inefficient information management through the value chain: Lack of information exchange between PIACENZA and the retailers resulting in unrealistic replenishment plans and entirely order-based production plans
- Document exchanged in Supply chain are in different formats
- Barcodes are slow and do not contains detailed information about product; Manual data entry; No item traceability; No historical data available for items
- Significant time spent in warehouses to calculate inventory levels
- No real planning synchronization between partners; Inaccurate transactions and Long lead times

The available business process of the textile supply chain of PIACENZA is re-engineered based on the functionalities provided by iSURF platform. The enhancements can be summarized as follows:

- The current supply chain visibility gathering architecture based on barcodes and manual information reading will be replaced by an RFID infrastructure: The actual system based on barcodes is not satisfactory: it is slow, requires significant human effort that

generates high cost and low precision and does not provide any additional features to the system. The “to be” goal is to set up an RFID based system where each item will be identified by a single identifier in the whole supply-chain. The system will introduce a non-intrusive anti theft system, an auto-shelf utility and an auto inventory/inventory check mechanism. Other benefits can be summarized as:

  - Item traceability will be achieved through the RFID based supply chain visibility system. For PIACENZA, it is important to monitor its products: know where they are (warehouse to be shipped, shipped, shop, sold), to know exactly the physical item position (first shelf, on the left part at the middle of the warehouse).
  - Item counterfeit control will be achieved by the RFID based supply chain visibility system.
  - Item quality control will be handled to identify quality defects and trace these items along the supply chain.
- Master Data Synchronization will be achieved. In order to maintain updated and synchronized information about products, a common reference model will be used based on the available standards. In this way product IDs and master data will be accessible to all partners. PIACENZA will be able to insert/update/delete data into this system, and on the other hand, retailers will be informed about product creation/changes maintaining automatically synchronized data. The usage of common product data will avoid recoding activities between partners, out-of-date information and data mismatches.
- The replenishment efficiency will be increased through a collaborative planning environment that enables the definition and execution of a well defined collaboration process. This collaborative planning environment will make use of the synchronized master data, the real time supply chain visibility data gathered from each member of the supply chain, enable sharing and comparing replenishment plans and forecasts and provide a set of instruments to handle exceptions.
- Document Reconciliation will be achieved in order to address the interoperability problem of the planning documents conforming to different standards that are exchanged in the collaborative planning process.

3. Methodology and Technology Description

In this section, we present how to address the problems of PIACENZA as-is business model through iSURF components to enable the to-be business model. iSURF general architecture is presented in Figure 3. In order to increase the adoption of a collaborative supply chain planning environment, the architecture includes a service oriented supply chain planning process definition and execution architecture. In the iSURF architecture, the interaction with legacy planning applications are achieved through semantically enriched Web services implemented as legacy adapters. The interoperability of business documents exchanged within the scope of this planning process is addressed by iSURF Interoperability Service Utility. Finally, the supply chain visibility data is collected through a smart product architecture implemented based on EPCGlobal [4] guidelines, and master data synchronization is achieved through Global Data Synchronization Service Utility.

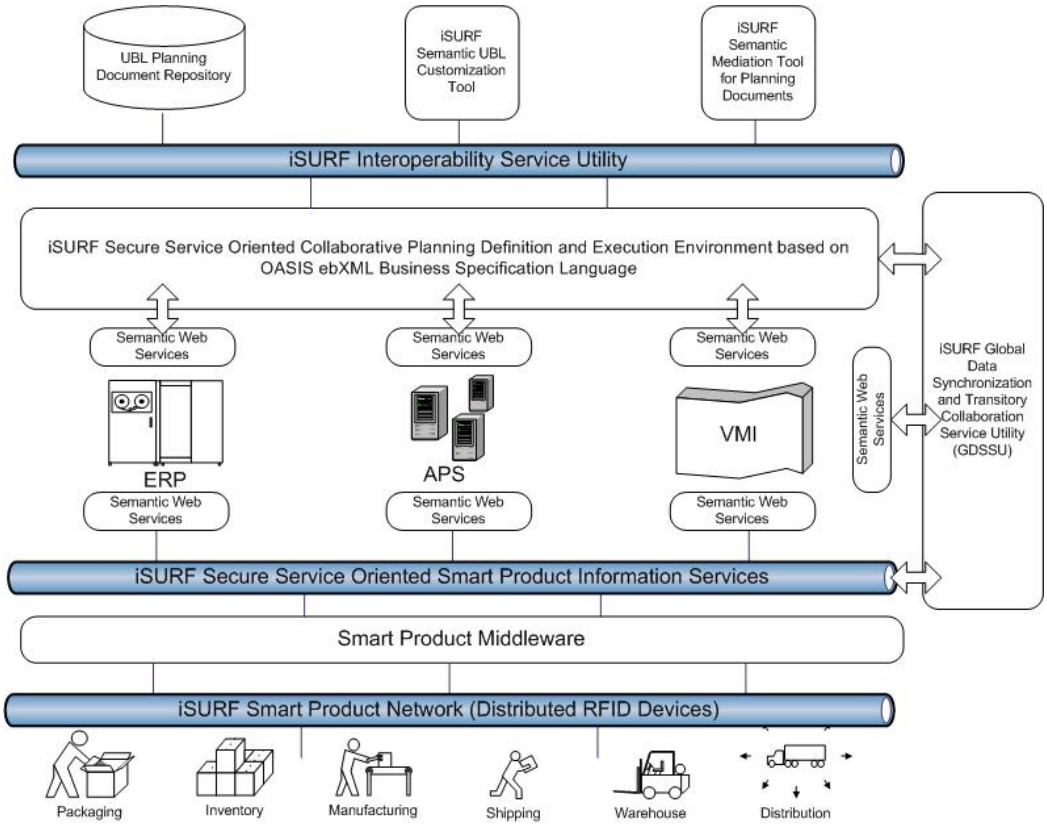

Figure 3 iSURF General Architecture

The functionalities of these components can be summarized as follows:

- The semantic interoperability of the planning and forecasting business documents exchanged between the companies are achieved through the iSURF Interoperability Service Utility provided. In iSURF Interoperability Service Utility OASIS Universal Business language (UBL) [5] is used as a common denominator. UBL is an OASIS initiative to develop a common vocabulary in exchanging business documents using XML syntax. For this purpose first of all, UBL Planning messages are created using the UN/CEFACT Core Components [6] methodology. The architecture also allows customization of these UBL planning messages to the needs of different industries through a semantic customization process. As a result of this customization process, semantic mediation of planning document instances will be enabled.
- In order to support trading partners to deploy CPFR processes and integrate their internal enterprise planning applications to the joint planning process, the joint collaborative planning process are defined via a graphical interface through predefined CPFR building blocks. These CPFR building blocks are defined in a standard, machine processable business process specification language, namely, OASIS ebXML Business Specification Language, (ebBP) [7]. The companies are enabled to build the joint inter-enterprise collaboration process by grouping these building blocks. Through this platform, it is possible to define the following planning process parameters:
    - What data is needed from the supply chain partners? What data is collaborated on?
    - Which systems provide the data? How the interaction with the underlying legacy systems is achieved?
    - How is the exchanged data translated if they are not directly compatible?
    - Who owns the process for sharing the data and which application will process the data?
    - Is the data publicly shared or is it secured, through which protocols?

- What frequency is the data communicated?

The platform produces a service oriented, executable collaborative planning process to be enacted among different supply chain partners.

- iSURF Global Data Synchronization Service Utility ensures the accuracy and reliability of master data used in the supply chain by developing standard based open platform for SMEs. While developing the system the GS1 Global Data Synchronization Network (GDSN) [8] standards are used. GDSN is a network that connects data pools, which are regional sources of manufacturer and retailer data, to the GS1 Global Registry. The GS1 Global Registry lets companies locate the source (manufacturer) or the recipient (retailer) data pools so that data is standardized and synchronized for trading partners on a near real-time basis. The organizations using the GDSN pays fee based on their annual turnover. Since iSURF aims to create a business network addressing the specific needs of SMEs, iSURF project will develop a Global Data Synchronization and Transitory Collaboration Service Utility (GDSSU) targeting SMEs to share synchronized data on a near real-time basis as presented in Figure 4.

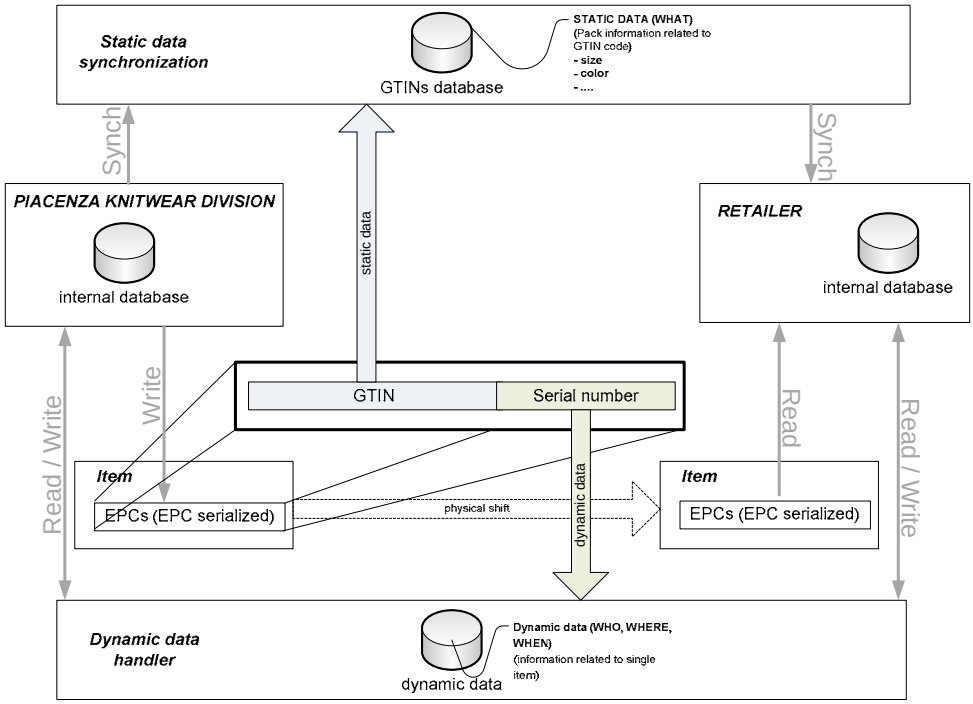

Figure 4 iSURF Global Data synchronization Service Utility and EPCGlobal Architecture

- The iSURF Open Smart Product Infrastructure is capable of filtering and aggregating the acquired smart product data through RFIDs and also correlating them with other business parameters. It is developed based on EPCGlobal Standards. Not all of the data from all of the RFID tags may be interest to the enterprise application. In this respect, the infrastructure eliminates redundant information coming from RFID tags attached to smart products and will provide the filtered data to business applications. When dealing with the processed data, enterprise applications may require dynamic information about the product such as the production or the expiry date. In such a case, iSURF Smart Product Infrastructure will provide required interfaces for gathering necessary data from subscribed party where the product is manufactured.

4. Business Benefits

Voluntary Interindustry Commerce Solutions (VICS) reported that since the publication of CPFR guidelines in 1998, over 300 companies have implemented the process. Numerous case studies of CPFR projects report in-stock percentage improvements of from 2-8% for products in stores, accompanied by inventory reductions of 10-40% across the supply chain [9]. Syncra Systems and Industry Directions also conducted a survey of manufacturers, retailers, distributors and logistics providers [2]. According to this survey respondents report:

- An 80% increase in business opportunities for a CPFR partner
- $9M increase in sales
- Simultaneous sales growth and inventory reductions of at least 10%
- Improved availability rates with less inventory

In parallel with these results, in the textile supply chain planning pilot application of iSURF project we aim to achieve the following business benefits:

- Increase replenishment efficiency and efficacy through collaboration activities
- Improve interoperability among supply chain partners
- Increased product data synchronization
- Reduce human interaction during data gathering
- Quick and synchronized transfer of information between supply chain partners
- Increase the amount of information that can be traced related to product items
- Reduce costs
- Achieve shorter production time during the stock phase
- Allow item traceability

5. Conclusions

iSURF project develops an intelligent collaborative supply chain planning network that realizes a knowledge-oriented inter-enterprise collaboration environment in which distributed intelligence of multiple trading partners are exploited in the planning and fulfilment of customer demand in the supply chain. The project provides interoperability solutions for achieving the semantic reconciliation of the planning and forecasting business documents exchanged between the companies according to different standards. The developed system will be deployed in textile supply chain to increase efficiency and efficacy of supply chain planning and hence reducing costs. In this paper, we describe how the end user of the iSURF Project, namely PIACENZA, will benefit from the infrastructure.

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