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ISURF: RFID Enabled Collaborative Supply Chain Planning Environment

Asuman Dogac
Dept. of Computer Engineering, Middle East Technical University, asuman@metu.edu.tr

Gokce Laleci
Yildiray Kabak, Mustafa Yuksel, Fulya Tuncer, Cagdas Ocalan, Mehmet Olduz, Software Research, Development and Consultancy Ltd

John Kennedy
Julian Roche, Intel, Collinstown Industrial Park, Leixlip, Co. Kildare, john.m.kennedy@intel.com

Samia Drissi
Fraunhofer-Gesellschaft Institute Manufacturing Engineering and Automation, Samia.Drissi@ipa.fraunhofer.de

Michele Sesana
TXT e-Solutions S.p.A, michele.sesana@txt.it

See next page for additional authors

Authors
Asuman Dogac, Gokce Laleci, John Kennedy, Samia Drissi, Michele Sesana, Ricardo Jardim-Goncalves, and Alessandro Canepa

ISURF: RFID ENABLED COLLABORATIVE SUPPLY CHAIN PLANNING ENVIRONMENT

Dogac, Asuman, Dept. of Computer Engineering, Middle East Technical University, İnönü Bulvari, Ankara, 06531, Turkey, asuman@metu.edu.tr

Laleci, Gokce, Yildiray Kabak, Mustafa Yuksel, Fulya Tuncer, Cagdas Ocalan, Mehmet Olduz, Software Research, Development and Consultancy Ltd., METU-KOSGEB Tekmer, Ankara, 06531, Turkey, (gokce,yildiray,mustafa,fulya,cagdas,mehmet)@srdc.com.tr

Kennedy, John, Julian Roche, Intel, Collinstown Industrial Park, Leixlip, Co. Kildare, IRELAND, john.m.kennedy@intel.com

Drissi, Samia, Fraunhofer-Gesellschaft Institute Manufacturing Engineering and Automation, Nobelstrasse, 12, 70569, Stuttgart, Germany, Samia.Drissi@ipa.fraunhofer.de

Sesana, Michele, TXT e-Solutions S.p.A, Via Frigia 27, 20126 Milano, Italy, michele.sesana@txt.it

Jardim-Goncalves, Ricardo, Fernando Luís Ferreira, Hugo Miguel Vieira, UNINOVA, Intelligent Robotics Center, Quinta da Torre 2829-516 Monte Caparica, PORTUGAL, (rg, flf,hmv)@uninova.pt

Canepa, Alessandro, Fratelli PIACENZA S.p.A., Regione Cisi, 13814 Pollone - Italy, alessandro.canepa@PIACENZA1733.it

Abstract

To be able to cope with the requirements of today’s competitive and demanding digital world of business, companies, especially SMEs, need to be more agile, and be ready to react to the changing requirements of the sector. This requires a better view and a more comprehensive analysis of the whole marketplace which can be achieved through a knowledge oriented collaborative supply chain planning initiative. The parties also need to be capable of monitoring the supply chain visibility in a real time fashion, which can be enabled through the use of RFID devices.

RFID enabled collaborative supply chain planning has been achieved by big industry players in well defined restricted business circumstances through some selected standard message schemes. However, SMEs are still far behind in this process due to their small IT budgets. In iSURF Project we address this problem by providing a set of open source tools to enable seamless collection of supply chain visibility, synchronizing this with master data, exchanging supply chain visibility and other planning data with each other through a service oriented supply chain planning environment which also handles the interoperability of the messages exchanged.

Keywords: *RFID ,CPFR ,GDSN, UNCefact CCTS, UBL, Collaborative Supply Chain Planning*

1 INTRODUCTION

To be able to cope with the requirements of today’s competitive and demanding digital world of business, companies, especially SMEs, need to be more agile, and be ready to react to the changing requirements of the sector. This requires a better view and a more comprehensive analysis of the whole marketplace. Trading partners within a supply chain usually have different competencies based on their business strategies and varying sources of information. When this information is not shared, the decision making capability of companies is reduced since the impact of a decision on the supply chain as a whole could not be assessed correctly. What needs to be done is to create an environment facilitating the collaborative exploitation of this distributed intelligence of multiple trading partners in the order to better plan and fulfil the customer demand in the supply chain.

As a response to this need iSURF project provides a knowledge-oriented inter-enterprise collaboration environment to SMEs to share information on the supply chain visibility, individual sales and order forecast of companies, current status of the products in the manufacturing and distribution process, and the exceptional events that may affect the forecasts in a secure and controlled way.

In order to achieve such a knowledge-oriented inter-enterprise collaboration environment for European SMEs, there are a number of challenges to be addressed. These challenges and how iSURF Project addresses these are presented in the following section.

1.1 Challenges for Knowledge Oriented Supply Chain Collaboration

- The first prerequisite of such a knowledge sharing environment is having an appropriate infrastructure established to enable information exchange between partners, and a business process definition that orchestrates this knowledge sharing practice according to well defined practices. Such an environment should be easy to use, the SMEs should be capable of easily creating a new collaborative planning process definition, and the tool should not be costly. Collaborative Planning, Forecasting, and Replenishment (CPFR)® guidelines ("VICS, CPFR-An Overview", 2004) present collaborative business practices enabling the trading partners to have visibility into one another's critical demand, the order forecasts and the promotional forecasts through a systematic process of sharing planning information, exception identification and resolution. The main objective of CPFR® is to increase the accuracy of demand forecasts and replenishment plans, necessary to lower inventories across the supply chain and attain high service levels by making right products available at right locations. CPFR® proposes a nine step planning process which involves a number of transactions between partners exchanging planning documents with each other. However, 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 ("European CPFR Insights", 2002). Although CPFR® provides guidelines, there is no machine processable process templates defined. Also, CPFR® does not mandate any technology to implement the CPFR® approach, as a result the consortiums agreed to collaborate based on CPFR® guidelines need to implement their own strategy. As a response to these needs, iSURF project provides a **Service Oriented Collaborative Supply Chain Planning Process Definition and Execution Platform** based on "CPFR®" guidelines. This platform presents "template" collaborative planning process definitions, enables customization of these templates graphically and provides wizards to create executable planning process definitions that can be easily deployed in integration with the underlying enterprise planning applications.
- Within the scope of a collaborative planning process, partners are enabled to exchange supply chain planning documents such as "Sales Forecast", "Retail Event" and "Inventory Status". There are various standard initiatives addressing the standardization of communication in exchanging the supply chain planning information in different domains, such as OAGIS, CIDX, GS1 eCOM. Hence when companies involved in more than one supply chain need to exchange this planning information across multiple domains, they face an interoperability problem. iSURF project provides a Semantic **Interoperability Service Utility (ISU)** for achieving the semantic reconciliation of the planning and forecasting business documents exchanged between the companies according to different standards.
- In order to be used effectively, this inter-enterprise collaboration process should be integrated with the underlying legacy applications handling the internal planning activities such as ERPs. Rather than all-in-one integration, interoperability solutions should be accessible to SMEs: with their limited resources, they cannot afford integration costs with all of their partners. iSURF project proposes to use a Service Oriented Architecture: **Legacy Wrappers** are implemented as Web services to interact with the underlying business processes and to expose the existing legacy applications functionalities in order to solve the technical interoperability problem.

- One of the fundamental requirements for optimizing supply chain performance is availability of the right data at the right place and at the right time in the right format, i.e., visibility of appropriate information in the supply chain. Visibility of appropriate information in the product distribution network and real time information updates enable the companies to optimize their internal schedules and forecasts in a timely manner. However, most of the traditional data gathering processes are far from being in real-time. Data is gathered from various sources through different techniques which may vary from manual methods to automated ones like barcodes or tags. The data then is computerized at regular intervals. This yields to only a pseudo real-time processing and introduces visibility gaps in the system. Because of the visibility gaps in the supply chain, the internal planning and scheduling systems base their decisions on inaccurate and out-to-date data which results in sub-optimal decision-making in the whole supply chain. To address this problem, iSURF project provides an open source Smart Product Infrastructure (SPI) based on RFID technology using EPCGlobal standards. Through this infrastructure, necessary tools and processes are provided to SMEs to collect real-time product visibility events from massively distributed RFID devices; filter, correlate and aggregate them in order to put them into business context.
- RFID based systems provide real time supply chain visibility data. However to achieve maximum benefit from RFID technologies, the supply chain must be supported with Global Data Synchronization mechanisms to allow partners to share accurate master data reliably and efficiently. To facilitate this, iSURF provides **Global Data Synchronization Service Utility (GDSSU)**. GS1 provides guidelines and standards for Global Data Synchronization Networks (“GS1 GDSN,” 2008). GDSN enables partners to publish/subscribe/query master data about their companies and product catalogs through a Global Registry and several Data Pools through standard GS1 messages. iSURF GDSSU provides easy to use open source client interfaces for SMEs as graphical interfaces and also as Web Services so that they can be easily integrated to a GDSN Network.

iSURF RFID enabled collaborative supply chain planning environment will be deployed as a pilot application in the premises Fratelli Piacenza S.p.A., a manufacturer of noble fibres fabrics and pure cashmere clothing and accessories, supplier to almost all luxury apparel brands and high end multi brand retailers. Through iSURF Platform Fratelli Piacenza aims to increase supply chain visibility, and to increase efficiency and efficacy of supply chain planning with its partners and hence reducing costs.

This paper is organized as follows: In Section 2, we introduce the technical architecture of iSURF Platform by describing each component in a separate subsection. In Section 3, we describe how we aim to enhance the existing supply chain process of Fratelli Piacenza through iSURF. Finally Section 4 concludes the paper.

2 ISURF GENERAL ARCHITECTURE

iSURF RFID enabled collaborative supply chain planning environment is hosted through an Enterprise Service Bus (ESB). This ESB facilitates the communication and integration of different iSURF Components and legacy planning systems with each other. For this purpose each component implements the necessary Java Business Integration (JBI) Interfaces (JSR-000208, 2005). The following interactions take place over this ESB:

- The Legacy Wrappers are registered to a service registry, and served through this ESB, so that the Collaborative Supply Chain Planning Environment can seamlessly communicate with legacy planning applications.
- iSURF Collaborative Supply Chain Planning Environment is capable of locating the legacy wrapper services in the collaborative planning process definition phase. In this way the Collaborative Supply Chain Planning Process definition can be bound to the real interfaces of enterprise planning applications, and the executable Collaborative Supply Chain Planning Process definitions can be created.

- The iSURF Smart Product Infrastructure can communicate with legacy applications through the ESBs, so that such legacy applications can subscribe to smart product events, and also query previous smart product events.
- iSURF GDSSU can communicate with the legacy systems so that such legacy systems can register/update new product data or subscribe to item change notifications, and such notifications can be delivered to the legacy applications.
- iSURF ISU is provided as a service unit in ESB, so that the parties can communicate with each other within the scope of a supply chain planning process, although they may be using different planning document standards.

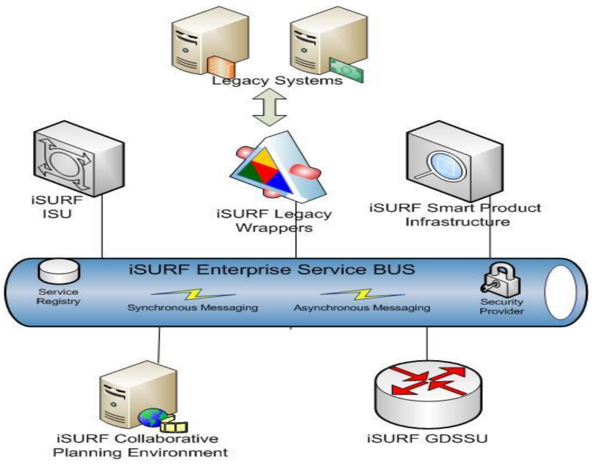

Figure 107iSURF Architecture Overview

2.1 iSURF Service Oriented Collaborative Supply Chain Planning Environment

iSURF provides a modular Service Oriented Collaborative Supply Chain Planning (CSCP) environment (Olduz, 2008; Laleci et al., 2009), that enables SMEs to build their own collaborative planning process graphically. For this purpose, the building blocks of collaborative supply chain planning process are defined as machine processable binary collaboration patterns, which then can be customized and exploited by the SMEs to create CSCP Processes according to their needs. For this purpose, the CPFR® guidelines for the planning process between the retailer and the manufacturer have been examined. By also considering the requirements of the iSURF end users, we have identified the possible building blocks, as binary collaboration definitions.

Each Binary Collaboration Definition involves exchange of a number of Planning Documents. For example, the exchange of “Point of Sales data” through a “Product Activity” Document between a retailer and a manufacturer can be one of the building blocks. These building blocks are represented through a machine processable business process specification language, namely the, OASIS ebXML Business Process Specification Schema (ebBP) (Moberg and Martin, 2006).

These binary collaboration definitions are presented to the SMEs though a graphical process definition tool. SMEs are enabled to visualize these template guidelines, customize them, by changing the direction and/or order of transactions, by adding new transactions, updating or removing already existing transactions based on their supply chain topology and requirements. As a result, the overall process definition can be exported as an ebBP process definition.

The SMEs are in need of executing this CSCP process with their supply chain partners in integration with their already existing legacy planning applications. For this purpose, iSURF CSCP provides a graphical wizard to enable SMEs to bind the interfaces of this CSCP Process with the Web Services implemented to interact with their planning applications. As a result, the iSURF CSCP Tool produces two BPEL ("OASIS WS-BPEL," 2007) definitions, one for each collaborating partner, that are ready to be executed through a BPEL engine such as Apache ODE ("Apache ODE," n.d.).

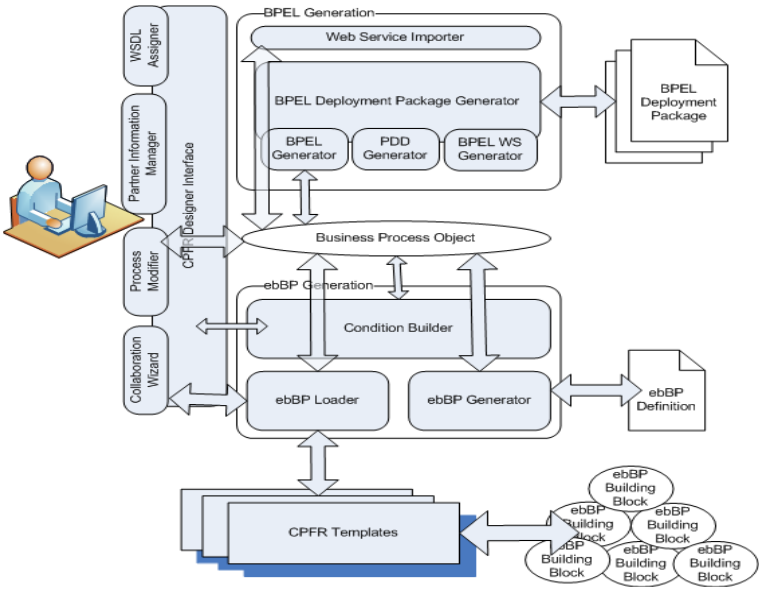

Figure 108 Architecture of iSURF CSCP Tool

2.2 iSURF Legacy Wrappers

The collaborative supply chain planning process should work fully integrated with the already existing enterprise legacy applications of the companies. This necessitates the available enterprise legacy applications to send and receive messages to/from iSURF Tools, such as CSCP Execution environment. To enable this, we have chosen a Service Oriented Wrapping Approach: Legacy Adapters are developed by wrapping the needed functionality of the legacy applications as Web Services, and also by facilitating the transmission of messages and data between those Web Services and the available iSURF components via an Enterprise Service Bus. In the iSURF architecture Apache ServiceMix is being used as an Enterprise Service Bus ("Apache ServiceMix," n.d.).

To enable such a communication architecture the following subtasks have been realized:

- For each legacy application wrapped as a Web Service, an appropriate Binding Component is implemented that enables the invocation of this interface through the Enterprise Service Bus
- For each legacy application wrapped as a Web Service, the Enterprise Service Bus disposes a service enabling the call of external legacy applications in order to achieve ingoing communication. Web Services are being implemented and exposed to outside as POJO Web Services.
- Routing Mechanism are implemented on the Enterprise Service Bus side, in order to invoke the Receive Methods of the legacy applications wrapped as Web Services
- In order to achieve outgoing communication, the Enterprise Service Bus provides a component, providing the ability to call external Web Services and appropriate methods. This component is referred as "Web Service Receive Invoker (WSRI)-Component". The legacy applications are seen as external Services, and have to expose a receive method over WSDL, in order to receive messages.
- For each legacy application wrapped as a Web Service, appropriate Receive-Method are provided, in order to enable the consumption of data delivered by iSURF components.

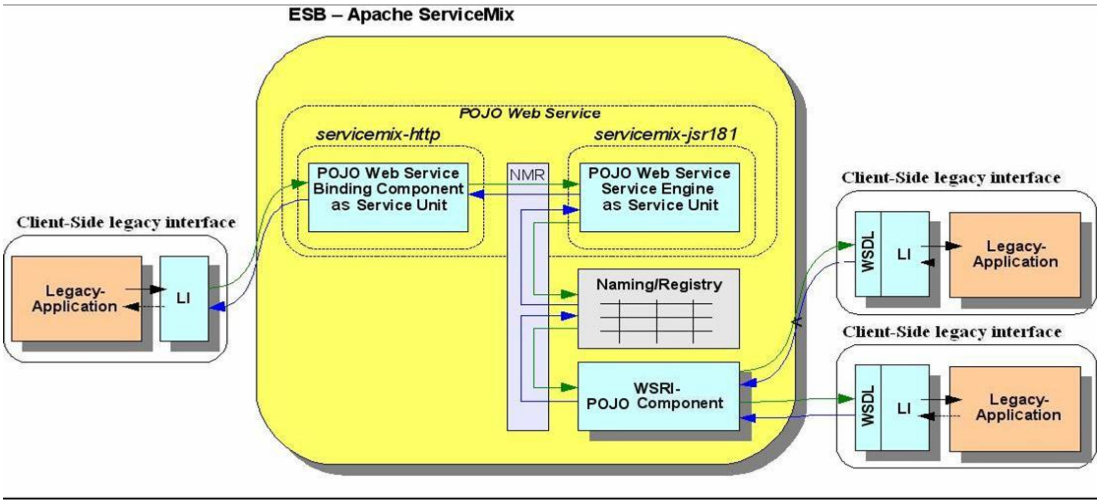

Figure 109 Legacy Adapters Overall Architecture

2.3 iSURF Smart Product Infrastructure

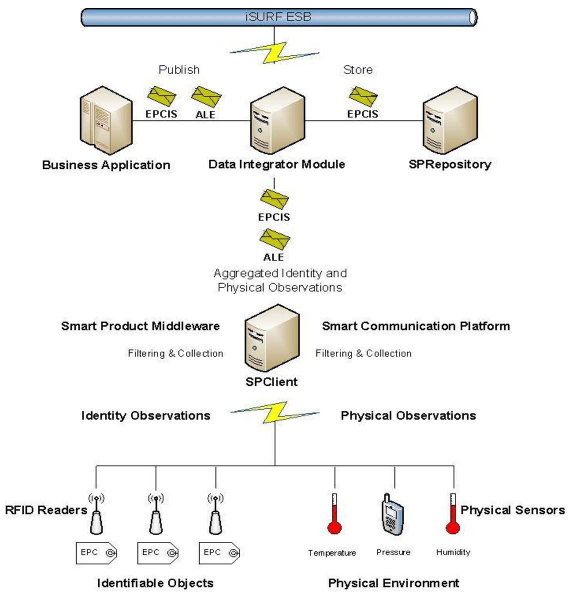

Figure 110 iSURF SPI Architecture

iSURF Smart Product Infrastructure (SPI), as shown in Figure 110, enables the tracking of items across supply chain historically in a near real-time fashion using RFID technology and delivery of RFID data to iSURF business applications and services to support their business processes seamlessly. The iSURF SPI is the lowest tier in the iSURF software stack and its primary function is the collection and delivery of data for use by higher level iSURF components.

iSURF SPI implementation is compliant with the EPCglobal standards ("EPCGlobal Architecture Framework," 2007). This ensures maximum interoperability with other EPCIS compatible software components that SMEs may have invested in. All components in the SPI have been developed as open source, service oriented components capable of flexible deployment models to match the disparate requirements of SMEs.

The main component of the SPI is the Smart Product Middleware (SPM) which has been implemented as a small footprint, client side, service oriented middleware implementing the Filtering and Collection roles of the EPCglobal architecture. The SPM captures declaratively defined RFID events (filtering, grouping etc.) and delivers it synchronously and asynchronously to subscriber applications as EPCglobal ALE (ALE, 2009) and EPCIS (EPCIS, 2007) events. The Smart Communication Platform (SCP) has extended the EPCglobal ALE and EPCIS events to allow the capture of arbitrary environmental information from physical sensors integrated with the SPM. Hence it is possible to correlate the physical environment of objects with their location and business context. The result of this is the capture of detailed contextual history of smart products and their environment in an iSURF enabled supply chain, in support of higher level business processes.

The SPM is integrated with the Smart Data Integrator Module (SDIM) which acts as a repository of historical supply chain data stored in iSURF extended EPCIS format. iSURF SDIM is an open-source software which is designed to receive and store RFID event data from a SPM and to make this data available to applications like Enterprise Resource Planning (ERP) or user interfaces connected anywhere on the iSURF-enabled supply chain. iSURF SDIM carries out the EPCIS Query Interface role of the EPCglobal standard. The SDIM has implemented a publishing layer enabling subscriptions to predefined queries of its repository. In addition to this business applications can send "SimpleEventQuery" messages specified by EPCGlobal to the SDIM Query Interface to query the EPCIS events reported by a SPM.

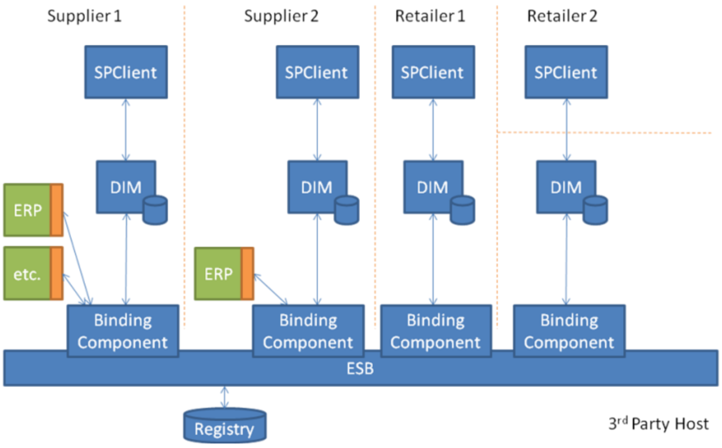

Figure 111 Deployment of SDIM across a supply chain

To be able to query distributed EPCIS event data from different production partners, suppliers and retailers, the SDIM has to be deployed at several locations. Those locations can be locally at a participant's site or at a 3rd party host system. Selection depends on the willingness of the participant to make the effort of hosting the EPCIS data at his own system. As presented in Figure 111, a supplier may choose to deploy the SPM and SDIM to its own premises, while a small retailer like Retailer 2 may exploit the SDIM served by a third party. Through the ESB, each partner becomes capable of querying each other's EPCIS event if the necessary access rights are granted.

2.4 iSURF Global Data Synchronization Architecture

Today, trading partners are suffering from high and unnecessary costs due to master data problems, such as inaccurate data in transactions. Incorrect or outdated data used in purchase orders can result in errors both in product delivery and sales. To achieve maximum benefit from RFID technology and EPCGlobal implementations, the supply chain must be supported with global data synchronization mechanisms which would allow partners to share accurate information reliably and efficiently.

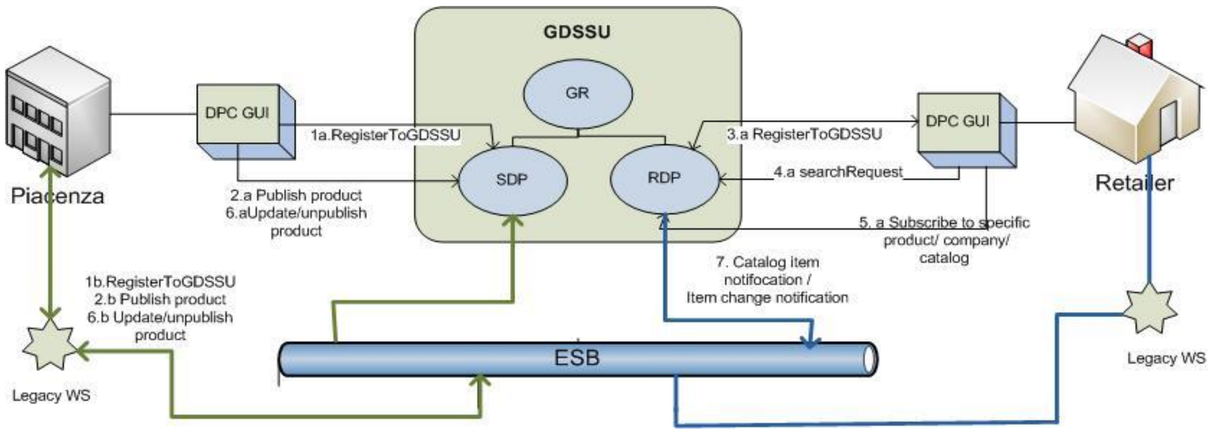

Figure 112 iSURF GDSSU Architecture Overview

iSURF Global Data Synchronization Service Utility (GDSSU) is implemented for achieving a standards based data synchronization platform which ensures the synchronization and harmonization of the master data used in supply chain transactions. GDSSU is developed as an open architecture ensuring interconnectivity.

iSURF GDSSU has been implemented based on GS1 GDSN architecture ("GS1 GDSN," 2008). The GS1 Global Registry is the unique registry containing all master products data; it does not contain all products information but only the codes that identify univocally a product in the World. It lets companies to locate source or recipient data pools so that the data is standardized and synchronized for trading partners on a near real-time basis. Data pools are the only systems authorized to communicate with global registry. They can be logically divided into two categories:

- Source data pool is the data pool exposing functionalities needed by a supplier/seller to publish its catalog on Web;
- Recipient data pool exposes functionalities needed by a retailer/buyer: subscription to suppliers' company and products information, search for products, be informed about changes happened in subscribed catalogs, etc.

GS1 global registry can be accessed only by certified data pools. Since iSURF aims to create a collaborative planning environment addressing the specific needs of SMEs, the main focus of iSURF is to create open source GDSSU Data Pool Consumer (DPC), which enables the SMEs to send and receive GS1 messages to GS1 Data Pools. For this purpose, only very basic versions of GS1 Global Registry and Data Pools are implemented (simulating the GDSN Global Registry and Pools, exposing a subset of the main methods) just to demonstrate the functionality of GDSSU Data Pool Consumer. GDSSU DPC supports several functionalities including Product Management (Create new product, Edit product, Delete product, Publish product, Unpublish products), Search products, Product Subscription and Product Synchronization. The GDSSU DPC gives end users the possibility to interact with data pool through an intuitive graphical user interface. On top of this, DPC also exposes Web Services that serve a messaging interface to the GDSN Pools to facilitate these functionalities. These Web services can be exploited by the legacy applications of the supply chain partners to integrate GDSN functionalities to their systems easily, without delving into GS1 Messaging standards.

2.5 iSURF Interoperability Service Utility Architecture

In the scope of CPFR® Process, supply chain partners exchange planning documents such as "Product Activity", "Inventory Status", "Order Forecast" and so on. There are various standard initiatives addressing the standardization of communication in exchanging the supply chain planning information in different domains, such as RosettaNet, OAGIS, CIDX, GS1 eCOM (including GS1 EANCOM EDI messages and GS1 BMS XML messages). The CPFR guidelines do not enforce any specific Business Document Standard. This creates an interoperability problem, especially when companies involved in more than one supply chain need to exchange this planning information across multiple domains.

As a response to this problem, iSURF provides an "Interoperability Service Utility" (ISU) architecture (Kabak et.al., 2009). iSURF ISU proposes to use semantic information for transforming documents from one standard to another as a step to realize Interoperability Service Utility. For this purpose, the semantic representations of UN/CEFACT CCTS ("UN/CEFACT CCTS", 2007) based Electronic Business Document Artifacts are developed. The basic idea is to explicate the semantic information that is already given both in the CCTS and the CCTS based document standards in a standard way to make this information available for automated document interoperability tool support.

This methodology enables the explication of the semantics of CCTS based business document standards by defining their semantic properties through a formal, machine processable language as an ontology. In this way, it becomes possible to compute a harmonized ontology, which gives the similarities among document schema ontology classes of different document standards through both the semantic properties they share and the semantic equivalences established through reasoning. However, as expected, the semantic properties of the CCTS based document artifacts help discovering only the similarities of structurally and semantically equivalent elements. In order to handle the structurally different but semantically similar document artifacts, heuristic rules are developed describing the possible ways of organizing simple document artifacts into compound artifacts as identified in the CCTS methodology. Finally, the equivalences discovered among document schema ontologies are used for semi-automated generation of XSLT definitions for the translation of document instances.

It should be noted that different representations and vocabularies will make it difficult (if not impossible) to harmonize the semantics of document standards. In other words, it is necessary to agree on a common way of expressing the semantics of document artifacts. For this purpose, that is, in order to standardize the semantic specifications developed for the iSURF Interoperability Service Utility, a technical committee namely "OASIS Semantic Support for Electronic Business Document Interoperability (SET)" is initiated under OASIS umbrella ("OASIS SET TC", 2008). The OASIS SET TC aims to specify semantic mechanisms based on the work done in the iSURF Project in order to achieve interoperability among document standards based of UN/CEFACT CCTS used in B2B, B2G and G2G applications.

Currently, the SET Harmonized Ontology contains about 4758 Named OWL Classes and 16122 Restriction Definitions conforming to the specification described in this document consisting of the following:

- All of the CCs/BIEs in UN/CEFACT CCL 07B
- All of the BIEs in the common library of UBL 2.0
- All of the common library of GS1 XML
- OAGIS 9.1 Common Components and Fields

The Harmonized Ontology expresses the relationships among the document artifacts of UN/CEFACT CCL, UBL 2.0, OAGIS 9.1 and GS1 XML according to SET specifications. Related with performance, an issue that needs to be addressed is whether the gain in automation justifies the resources needed to develop the ontological representation of the document schemas. In order to reduce this cost, we provide the SET XSD-OWL Converter tool to create OWL definitions of the document schemas. This component converts a CCTS based document schema into OASIS SET TC OWL Definition. It should be noted that, by conforming to a standard ontological representation and hence having all the document schema ontologies in a common pool, the users of the Harmonized Ontology only need to create a document schema ontology if it is not already in the Harmonized Ontology and benefit from all the existing connections when they do so.

In parallel with this effort, iSURF project provides a graphical environment for the customization and re-use of UN/CEFACT CCTS based document schemas (Tuncer et.al., 2009). iSURF eDoCreator tool serves as an online common UN/CEFACT CCTS based document component modeling repository which integrates the machine processable version of the paper-based UBL customization guidelines to be applied on the document components. In this way, it aims to maximize re-use of available document building blocks and minimize the duplicative efforts of document designers in customizing the document schemas.

The repository ("iSURF eDoCreator", 2009), currently contains all of the BIEs in the common library of UBL 2.0; all the BIEs of the UN/CEFACT Cross Industry Electronic Invoice (CII) and is gradually evolving to include document components from other standards. As the new document models are created or document building blocks are customized and committed to the repository, its impact on the data interoperability will increase by making it possible to share all these to a wider audience.

3 ISURF PILOT APPLICATION

The iSURF architecture will be deployed in the premises Fratelli Piacenza S.p.A., a manufacturer of noble fibres fabrics and pure cashmere clothing and accessories, supplier to almost all luxury apparel brands (including Italian ones among which Zegna, Brioni, Canali, Gucci and international ones like Louis Vuitton, Hermès, Escada, Basler, Celine, Chanel) and high end multi brand retailers.

Currently barcodes are used in Piacenza for product identification. For example when the production is completed and items have to be shipped to the retailers, before shipping, items' barcodes are read manually decreasing the stock value automatically. On the other side, when the retailer receives goods several manual operations have to be performed such as manual check of correspondences between order/goods/delivery notes. This control is done manually through barcode readers. Every item has to be re-coded at the retailer side; product codes are not shared between PIACENZA and its retailers, the retailer creates its own product codes on its own legacy system and manually takes care of the correspondence between its codes and PIACENZA product codes. Then items are brought from the warehouse and are put on a shelf, at this time the item is equipped by a physical anti-theft mechanism.

Through the deployment of iSURF GDSSU and Smart Product Infrastructure, most of the manual operations will be eliminated: an RFID based auto inventory system, non-intrusive anti-theft system, item tracking system, a system facilitating automatic match of order document with transport document will be implemented. Additionally, product coding reconciliation mechanism will be easily handled through the GDSSU system.

When it comes to current planning practices, the current production of PIACENZA is purely order based; i.e. the production phase is initiated after sample products are presented to the retailers and real orders for winter season are collected. This is not a big problem for winter season preparation phase, since the orders are collected well in advance.

However this is not the case for the "Re-order-Gift" Season which starts in October and ends in December. In the winter re-order season when warehouse stock is low, the retailer based on sales data sends a new order to PIACENZA for some of the goods that sell well in that season. The delivery of the replenishment orders should be immediate, hence the production of these possible orders should be initiated well in advance (around April) based on forecasts. Currently, without collecting any point of sales data from the retailers, this forecast is handled internally in Piacenza, that not always result in optimized production resources/inventory levels.

iSURF CPFR® based Collaborative Supply Chain Planning Process will enable the PIACENZA partners to more effectively create a joint forecast based on historical and real time data. The partners will be able to share purchase conditions, Trade Item location Profiles (Frozen Period Days, Minimum Inventory Levels, Order Quantity minimum and maximums etc.), Retail Events, Historical Point of Sales Data, and Distribution Center Withdrawals, and will be able to set common Exception criteria so that forecast exceptions can be caught and addressed in a timely fashion. The sales and order forecasts can be shared and agreed upon. After the Winter Season Delivery is started to be fulfilled in the beginning of June, the real time Point of Sales data will also be shared, which will help the parties to see the variances between statistical forecasts and actual buying patterns.

In addition to this, PIACENZA is outsourcing some of the tasks in the production phase to some sub-suppliers. The CSCP process will also enable collaborative planning between PIACENZA and its sub-suppliers. Based on the order forecast that has been agreed between PIACENZA and its Retailers, PIACENZA will be able to share this forecast with its sub-suppliers so that they can arrange their production environments, reserve the correct number of machines for the batch of tasks that are expected to be received from PIACENZA. In the production phase, continuous communication between PIACENZA and its sub-suppliers will take place over iSURF CPFR® based Collaborative Supply Chain Planning Process in order to monitor the production process and catch exceptions in a timely fashion.

4 RELATED WORK

Exploiting RFID devices for collaborative supply chain planning has been addressed by other research initiatives too. (Pramatari, 2007) discusses alternative technological approaches and the role they play in supporting collaboration in supply chains, based on three different case studies from the grocery retail sector depicting different aspects of implementing supply chain collaboration practices. In this paper the benefits of using RFID for collaborative supply chain management and planning have been highlighted. In (Pramatari et.al, 2005) an infrastructure to support RFID-enabled collaborative practices in the demand and supply side has been proposed within the scope of Smart Project. In Smart Project, a Web Service based approach is used in order to provide ubiquitous access to prediction flow supported with RFID devices along the supply chain while at the same time strengthening collaboration practices between trading partners (Michalako et.al, 2005). iSURF project complements these approaches by providing a Service Oriented Collaborative Supply Chain planning description and execution environment. These tools enable the supply chain partners to easily design and customize collaborative planning process definitions which can be automatically converted to executable business process definitions. On top of this, in these studies the requirement for interoperability solutions have been identified, iSURF complements them through Interoperability Service Utility provided.

5 CONCLUSIONS

RFID enabled collaborative supply chain planning has been achieved by big industry players in well defined restricted business circumstances through some selected standard message schemes. However, SMEs are still far behind in this process due to their small IT budgets. In iSURF Project, we provide:

- An open source tool enabling Service Oriented Collaborative Supply Chain Planning Environments, through which the SMEs can graphically customize CPFR® templates, and create the executable CSCP Process as WS-BPEL definitions. Through this tool it is also possible to integrate this collaborative planning process with the underlying enterprise planning applications, functionalities of which are wrapped as Legacy Adapters in terms of Web Services.
- An open source Smart Product Infrastructure enabling the SMEs to collect RFID and Sensor data from the field, filter/aggregate these data through a middleware; providing both a publish/subscribe and also a query mechanism for accessing smart product data.
- An open source Global Data Synchronization Service Utility that will enable SMEs to easily be a part of GDSN architecture as a single point of reference for sharing most up-to-date partner and product information among supply chain partners
- An open source Interoperability Service Utility providing the mechanisms for semantic mediation of planning documents conforming to different CCTS based standards, such as GS1 XML, UBL, OAGIS

The source codes of iSURF Components are available in ("iSURF SourceForge", 2009). Both the iSURF components, the integrated platform and the pilot application will be tested and evaluated in a systematic way. The evaluation methodology follows the standard process defined on the Evaluation reference model ISO/IEC CD 2504n of the SQuaRE series (Suryn et.al., 2003). On top of this, pilot applications scenarios will be used to test the final pilot deployment to assess the functional and nonfunctional iSURF requirements.

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