Collaboration between services using a B2B Platform in the retail environment

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Abstract

Service collaboration is an efficient way to enable the interconnection between different business entities. General platforms are used to obtain a connection between the provision and consumption of data and this can place several actors in the same context taking advantage of the business architect figure, which is the one responsible of defining the business logic implemented in the business process. In this paper we describe a platform that manages the exchange of product information in a retail environment through business collaboration making use of a platform created for such specific task. The proposed tool uses B2B and is deployed in a cloud platform that provides support for the business logic and the collaboration between business partners. The system is validated implementing certain applications that allow partners in the food chain such as farmers, transportation companies or supermarkets, to share information between them.

Keywords: Future Internet, generic enabler, business process, business architect, capability

1 Introduction

The main objective of the retail environment has traditionally been the provision of an environment to the customers that facilitates the access to the products the supermarket is interested in selling. In order to achieve this, they make use of certain marketing techniques such as fidelity cards, specific aisles design and shelves layout, proper product replenishment, stock management, queues management and etcetera. Despite this, as new technology arises supermarkets are evolving from these traditional techniques to some more sophisticated. Users continually demand increasing information about the products they obtain and the supermarkets, in search of competitiveness [1], have to adapt to these needs. To achieve this goal is where the current paradigm of Future Internet and Service Collaboration can be employed.

The integration of Business to Business automates these processes that are still shared with traditional business partners. The main objective of these platforms is the automation of the whole commerce process involving certain business processes (and also documents), which are composed in addition to the buyer or the seller of the goods or services, also the banks and any third party logistics companies.

B2B has been used for a long time in retailers? buying and distribution systems. But nowadays, with the appearance of new technology and the maturity of the environments, an increasing number of retail firms have made use of B2B to improve both their operation efficiency and effectiveness.

A B2B platform offers many services, but with the disadvantage of working in general purpose solutions, and are not specifically adjusted for a particular case. In this paper we explain how a business architect can configure a B2B core platform with the objective to support one specific ?business logic? and is suitable for fulfilling the requirements of the retail environment.

IT CoNvergence PRActice (INPRA), volume: 3, number: 2 (June), pp. 36-45

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This B2B platform is deployed on the cloud, and can be thus configured and used from any Internet device. The platform is also optimised for its use in mobile devices what allows the user a great mobility while working with the platform.

The structure of the paper is the following. Section 2 reviews related works with B2B platforms and retail and supermarkets environments. Section 3 describes the business collaboration process making use of new features presented in the Future Internet. Section 4 shows the platform created and explains the details of how the collaboration between entities works and how an entity is able to offer its services so that other entities can consume it. Section 5 explains the technology used to develop the platform and the steps necessary to deploy it. Section 6 validates the platform showing some applications created that make use of it and their functionalities. Finally Section 7 explains the conclusions of this work and possible future works.

2 Related Work

It has been said a lot about the need for business to collaborate between them and about several approaches taken to create a platform that manages this collaboration between different entities [7] [5]. Certain languages has been used that facilitate this task such as for example XML Process Definition Language (XPDL), Business Process Execution Language (BPEL) or Web Services Choreography Description Language (WS-CDL). These languages allow the generation and later execution of workflows using some Business Process Modelling and others also allow the user to generate its own workflows with very simple tools [4].

The inclusion of capabilities in the business model facilitates the association of customers searching for specific information as it makes it easier for a business to offer their own information for others to use. Software companies have made use of capabilities in order to improve their performance [2].

Related to the retail environment, a lot of work is required to adapt the new technologies that appear in order to show more and clearer data to the user [1]. Nowadays the user is very interested in having as much information as possible in his hands so he can analyse all the possible products and get the one he considers is the best for him. Supermarkets are slowly adapting in order to satisfy their customers and are evolving making use of new technologies in their stores trying to offer a more interesting experience for the user. Different examples of these new technologies are the use of interactive displays that let the users access the information of the item they want to sell [8], the use of user authentication with the own users? smartphone, enabling the supermarket to keep an updated user profile with credit card info so he can easily make a transaction [9] or the use of Semi Attended Customer Activated terminals (SACATs) that enables the customer to checkout their own products without the need of a cashier.

3 The Future Internet with the Business Collaboration

The Future Internet (FI) main task is to expand the functionalities of the actual Internet searching for new architectures that improve the performance, reliability, scalability and security between many categories, but also to allow developers to easily reuse some modules used for specific tasks [3]. These modules are called Generic Enablers (GE) and make certain tasks found in most platforms such as user managing, data storing, generating data backups or adding a security layer in the application [6], much more easier. Private software exists that can solve some of these particular mentioned problems, but one of the main ideas in the FI is to create an open source and universal solution for these, and more to come, problems with the benefits associated in everyone working with the same modules thus avoiding the necessity to reimplement something that already exists.

This work makes use of some of these GE expanding its functionality enabling business collaboration. It also creates a platform for everybody to use to offer its own data and use others information for their own benefit, generating in this way a global B2B collaboration platform for the retail environment. With this platform we manage that anything related to the retail environment is in a standardised way and everybody can access the public information in this platform in order to use it to its own benefit generating new applications that make use of the platform and offer new information to the platform that others could use.

This platform could easily work, not only in the retail environment, but could be expanded to other areas in a very easy way, creating specialised platforms that share the information within its connected entities. Nearly all of the work necessary to generate these other platforms is already done allowing the data exchange, data storage, user management and much more functionalities, only needing some message configuration. This also allows that new functionalities added to a platform can be easily exported to others usually with minor work adapting them.

4 Service collaboration using the Future Internet

In this chapter it is explained the working of the platform, the different components it contains and the interaction between them. Firstly we define the role of the business architect and how this person is in charge of loading the business models when initially configuring the platform. These models contain certain rules that are process the data received from the entities connected to the platform and contain certain boundaries that these data should not exceed. If the data received is out of those boundaries, and advice is created to inform an Expert System which will respond with some instructions to follow in order to solve the problem arisen.

4.1 Platform configuration

The Business Architect is the main role in this platform and is the one in charge of its configuration with all the attributes necessary to define a retail environment and also to extend it with any future needs. He also is the one responsible to upload and later manage the models into the platform. These models define the message interaction between the different entities connected to it and their relations. The structure of the platform in general and all the entities that connect to it can be seen in Figure 1.

As observed in the figure 3 main components can be identified in the platform. The first one is the Management Information System (MIS), which is the one that generates the data and sends it to the platform. It has also been initially configured with some parameters such as the structure of the messages used to send this data and the way in which the communications are handled with the Core Platform. For example, one MIS could be a farm with all kind of sensors such as humidity, luminosity and temperature, and also some actuators such as a tap that controls the water pressure into the farm. From time to time these sensors recollect data and send it to the platform for a later processing.

Between the MIS and the application logic there is the Core Platform. This is the section that enables Business Collaboration using messages and interconnecting both the MIS and the application logic. It is also capable to execute some rules that are processed in the data received from the MIS and checks if they are inside the predefined boundaries, defined when the platform was initially configured by the Business architect.

The final entity is the applications that connect to the platform in order to process the information from one or more MIS. They also contain the logic used to analyse that data and the instructions necessary to solve certain problems that could arise in the MIS. Following with the previous example of the sensorised farm these logic could contain the instructions necessary to open certain taps if for example

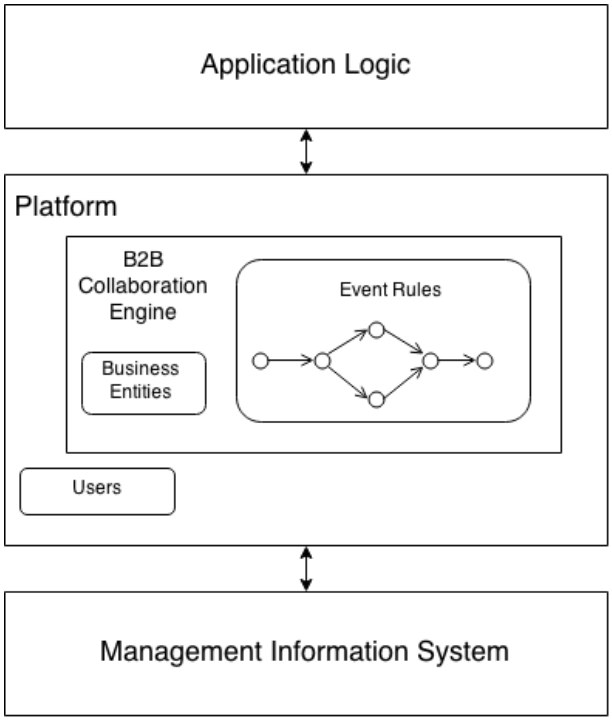

Figure 1: Platform structure

the humidity in the soil is below a critical value.

4.2 Design and data flow of the business process

The main objective of this platform is to enable the communication between different entities to be as easy as possible, and to allow an information flow between them and certain automated processes that control this information and analyse it in order to find problems applying some rules previously defined. All this communication process in the business platform and the way the information flows through the Core Platform, generating new information and interacting with different entities can be observed in figure 2.

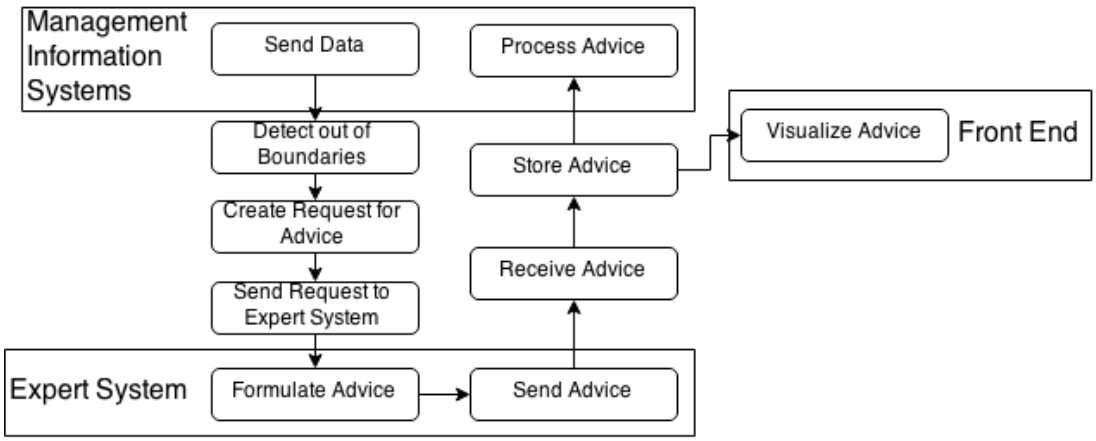

Figure 2: Data flow

The second agent is the Expert System whose task is to process requests that come from the MIS and executing some internal predefined rules it creates some instructions that will help in the solution of the requested problem.

The third agent is the Core Platform. This entity is composed mainly of a data bus that works as a bus between the MIS and the Expert System but is also responsible of storing the advices generated and checking whether the data coming from the MIS is correct or surpasses some boundaries. The final agent is the Front End. This agent enables a user to get access to the data saved in the platform in an easy way. The Front End can be accessed from anywhere in the Internet and from any device as the graphical interface works both for desktop and mobile devices.

The data flow begins with the Management Information Systems generating new information. If the data crosses some predefined boundaries something wrong is expected to be happening so the MIS generates an advice message and sends it to the Expert System. Otherwise, if the data is between the predefined boundaries nothing happens, as everything seems to be working as intended.

Four different agents can be identified in the flow. The first one is the Management Information System (MIS) that is the entity that generates the information. This data can come from a sensor for example and is then sent to the Core Platform. Once in the platform it is evaluated following certain predefined rules. If a problem is detected an advice is created and send to the Expert System to further analyze it. The message sent to the Expert System includes all the information regarding the problem and a solution is expected from it. Once the Expert System answers, the MIS is capable of following certain instructions that will help to solve the problem.

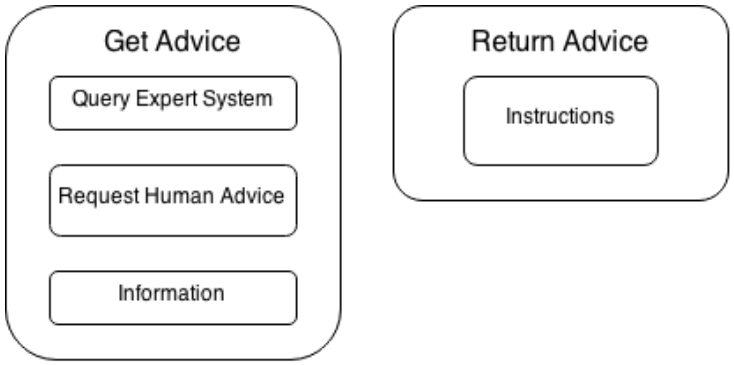

Figure 3: Services skeleton

The advice message is generated using a structure that has been previously defined and it contains the data sent by the MIS as can be seen in Figure 3. This advice can ask both for the aid of an expert system or, if necessary, for a human advice. When the Request for Advice gets to the Expert System, it processes the information and generates a new advice that will include the detailed steps to follow in order to try to solve the problem. The Expert System sends these instructions to the Core Platform that will then proceed to store it so that a user accessing the platform can later check this information using the Platform Front End. The advice is also sent to the MIS that once received will follow the instructions in the advice, and if everything works as intended, these instructions will help to solve the problem so that the next data generated by the MIS will be again inside the boundaries.

4.3 Search and offer of capabilities

With many systems working in the platform it is very difficult to know what every entity can offer. In this way new participants can?t access that information easily in order to process it and generate new one.

This is where capabilities are useful, allowing every entity to show what they are able to offer so that any participant can search for specific capabilities, process the information and offer a new one, should it be the case and offering also a new capability so that the information can be easily accessed.

One example of this whole process could be a farmer looking for seeds for their crop field. They can search in the platform for entities offering seeds. If there is one, they are matched and the process ends, otherwise the farmer keeps offering the capability of buying seeds until someone selling them appears. Something similar could happen later once the crop grows. The farmer could search for someone to buy it and if there is no one interested, wait until someone appears. This process could be much more complex adding other variables such as for example location, so that someone is only interested in the match if the other entity is located near him.

The way the platforms handles capabilities is offering a REST API with different methods that allow the search and post of these capabilities. With a predefined JSON message an entity can post its capabilities containing data related to the tasks it offers. In a similar way an entity can search for all the capabilities the platform offers or with a predefined JSON message, it can search if a specific capability is available.

5 Development and deployment of the platform

The Core Platform has been programmed with the Java programming language, making use of some collaboration tools that facilitate the development in a great way for example with code repositories that makes it easier for different people to program in the same files avoiding conflicts. These repositories also allow keeping all the versions of the code and save a history with all the changes created during the process, enabling to revert to a previous version if required. The graphical interface of the applications using the platform have been developed mainly using HTML5 and other related web technologies such as Javascript and CSS, so that they are accesible both in a desktop environment and also in a mobile one and work in any operating system used. This way, the task of developing an application is eased and the developer can concentrate in the content rather than in adapting the view to various operating systems and devices. The servers of these applications use different technologies such as Node.js and Java and its mains tasks are to provide the application to the client, communicate with other entities through the platform and apply some algorithms using the data received and sent so that the events are triggered when necessary. The messages sent through the platform are in the xml format with a predefined structure. The Business Architect is the role in charge of defining this structure when the models are uploaded to the platform.

The platform is deployed in several servers in the cloud. Due to the necessity of a high uptime some backup machines are prepared to be deployed, in case the currently deployed have any sort of difficulty. Also backups are created from time to time with all the data in the platform such as users, models, capabilities and etc. A generic enabler is responsible for managing the users registered in the platform and another one handles all the security aspects, such as malware detection or authentication. Some times maintenance of the machines is required but in this case the back up machines are turned on before the other ones are put down. Everything works with virtual machines so this task can be easily achieved in relatively no time. Should more resources be required, more virtual machines are created to prevent an overload in the servers. In the same way if there is not much load, certain machines can be turned off in order to save resources.

Figure 4 represent a general view of the overall system as explained before.

The client requires nothing but a browser to access the platform as everything is programmed with web technologies, as stated previously. Neither an application nor a plugin is necessary to install. Despite this, if it is required one can create a specific application for the mobile phone such as Android, iOS

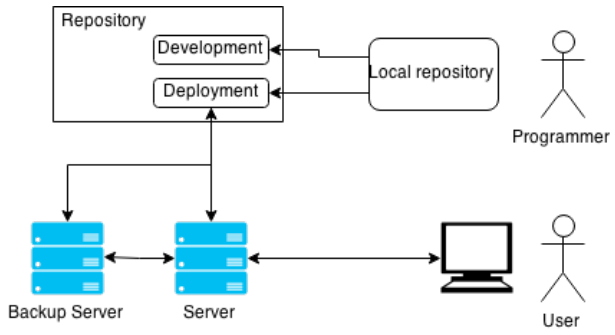

Figure 4: Development and deployment diagram

URL	Methods
/api/business-process-templates	GET/POST/PUT/DELETE
/api/business-processes	
/api/capability-types	
/api/capability-types	
/api/triggers	
/api/channels	
/api/capability-providers	

Table 1: Capabilities REST API

or Window Phone should a web application not be powerful enough for the requisites and in order to improve the user experience with the application.

As stated in section 4.3, the capability model is accessed via a REST interface that enables each component to identify its own capabilities and also enables an entity to search for others capabilities. In the following table is an example with the API used in the platform.

These urls allow to search for the different capability types and providers as well as business processes. And all the different methods are allowed in each url (GET, POST, PUT and DELETE), but some of them are restricted to the business architects.

6 Platform validation

The scenario shown in this paper has been validated with the creation of certain applications that access the platform functionalities previously described. One of the applications is the Product Information App that provides users in a retail environment the functionality to manually insert a code or scan a product barcode in order to get all the information the platform and the entities accessing it, can offer. The kind of information obtained is related to the product in its lifecycle, from the origins in the farm to the end of the chain in the supermarket as well as the rest of the supply chain such as the transportation form or the packaging. Other data is obtained related to the product composition and attributes such as for example calories, fats, sugars and also some medical information such as allergies or whether the product is considered healthy or not. In Figure 6 it can be seen a screenshot of this application with the information of a product in it. The application also enables the user to filter the product so that only the important information is shown as can be seen in figures 7 and 8.

Another example of an application is the Greenhouse Advice App that is responsible of managing

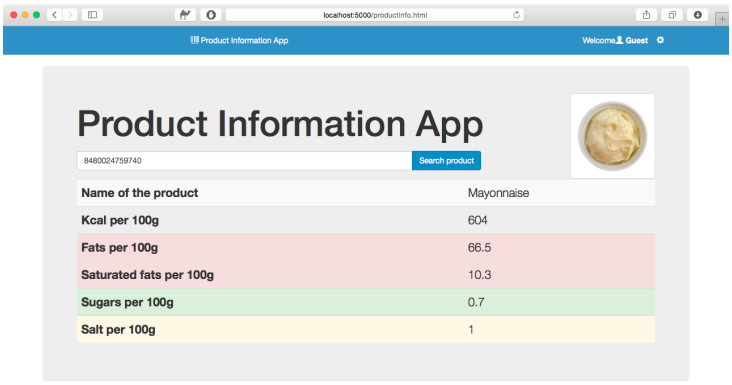

Figure 5: Product Information App

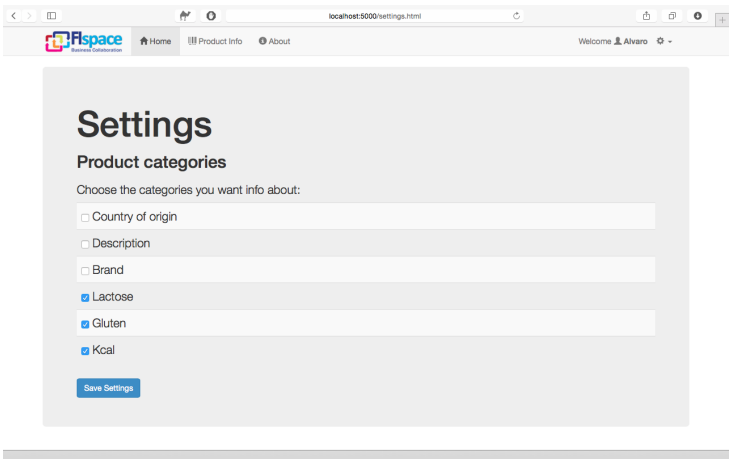

Figure 6: Product Information App filter menu

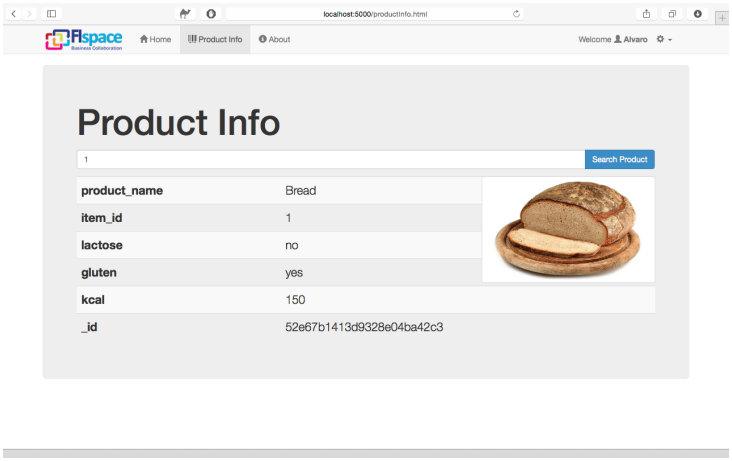

Figure 7: Product Information App filtered product

a sensorised greenhouse with all the plants in it. The application controls all the necessities the plants have such as water or fertilisation, acting accordingly. This application manages several greenhouses in

different places and gathers all the information from them using it to solve future problems.

These applications make a great use of the platform functionalities requesting information from several entities and gathering the responses so that the user can access the composed information. They can also give feedback to the other entities in the supply chain making use of the platform, because the user is able to rate the product according to his experience, and can optionally make some comments about it. This information travels through the platform to the entity responsible of processing it that once it received it can request for more information about the product or can also send messages to other entities in the supply chain. The platform also allows the search of capabilities and for an entity to offer its capabilities to other systems in the platform that might be interested. The platforms then matches the two entities, the one that offers it and the one that consumes.

7 Conclusions and future works

The future of collaboration between businesses seems to be the giving of a solution specifically created to solve the problem rather than offering a general solution to many problems. In order to achieve this, automated processes are used to monitor the data obtained and to solve many tasks, but despite this, the human is still necessary when problems without a preprogrammed solution arise so that they are informed as fast as possible, providing him all the information available and enabling him a way to easily access it. Once the problem is solved, then future similar problems can be solved by the platform intelligence without the necessity of human intervention.

The more users access the platform, the more interactions are created, what results in more beneficial to its entities because more variety of information can be found. In the future we expect to have a standardised business platform than enables access to many basic tools as well as the ease of creating new ones than can solve future problems. We also expect the platform to be easy to use so that more users can adopt it, what directly generates more information exchange. All these is what the Future Internet expects, offering global and open source tools than can be used by everyone, because they are easy to use and enable the collaboration between entities.

Acknowledgement

This work was supported by the projects FIspace (E13 0925-405) and CALISTA (TEC2012-32457).

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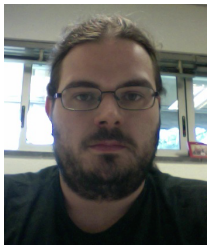
Author Biography



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