Location Aware Business Process Deployment

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Abstract. Every action a business process performs must be explicitly anticipated, designed for and implemented by business professionals. Most of the current techniques specify business processes (BP) without incorporating all four Ws; **W**ho, **W**hen, **W**hat and **W**here. These processes when used especially in logistics or supply chain applications will result in a BP becoming even more complicated and harder to customize. The business process is dependent upon business rules (BR), its resources to achieve its objectives. To overcome some of these issues we propose a location aware business process deployment framework. Using this framework we can integrate location awareness into the existing business processes. In this paper our focus would be on how the companies can adopt for their traditional business processes to be mobile. We have developed a case study using location aware methodologies into existing process for development of a more efficient and effective enterprise application.

1 Introduction

Business process is defined as a set of linked procedures or activities, which collectively realize a business objective or policy goal. This is normally within the context of an organizational structure defining functional roles and relationships [1]. The software process usually specifies the actors executing the activities, their roles and the artifacts produced [2]. Businesses realize that the cost of automating transactions with trading partners is very high. Standards and technologies for modeling business process that use web services could drive the costs down by achieving automated business process [2], [3]. Traditional applications cannot support the flexibility of location dependency in business process.

As the technology is changing very fast and the companies operate in complex environments that consist of thousand of processes, the business profit depends on efficient delivery of goods and services controlled by business process [4], [5]. So there is a need for the companies to make use of the technologies to make their product more profitable and their services more efficient.

Now many companies are earning profits by using mobile technology in their business applications. By this these companies tend to make their traditional business processes into mobile business processes. "*Mobile Business Process*" is a business process, when the place of execution of an activity can be different in different instances of the business process or the places can change during the execution of an activity [6], [7].

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The use of the Mobile Technology in business application has helped the companies to reduce costs and provide new revenues by improving business processes, creating competitive advantages, improving the efficiency of the mobile workforce, and by guiding stakeholders to maximize their efficiency thus reducing field costs [8], [6].

There is a need to make business process more location aware. Business processes also needs to be customizable and reusable so that the companies can be able to work more efficiently and be able to provide better service to the customers. In this paper we propose a location aware business process framework which would be used to make a mobile business process more location aware. This would result in a more complete, accurate, and flexible use of the Business Process.

2 Proposed Location Aware Business Process Framework

A location-aware application makes use of a user's location. A Location aware application is a middleware that lets company's business application take advantage of location based services from multiple vendors, while providing application developers with an easy-to-use, yet powerful Application Programming Interface (API) [7]. In this section we propose a location aware business process framework. We divide the proposed framework into different environments. We simply grouped similar functionalities into an environment, for example mobile and non mobile services in separate environments. Each environment has its own associated behavior and characteristics. Figure 1 shows that mobile and non-mobile environments perform their business processes through server environment, which is also the communication layer between business process environment.

We use software agents [9], [10], [11] to synchronize, integrate and execute all the business processes which are defined in business process environment for both mobile

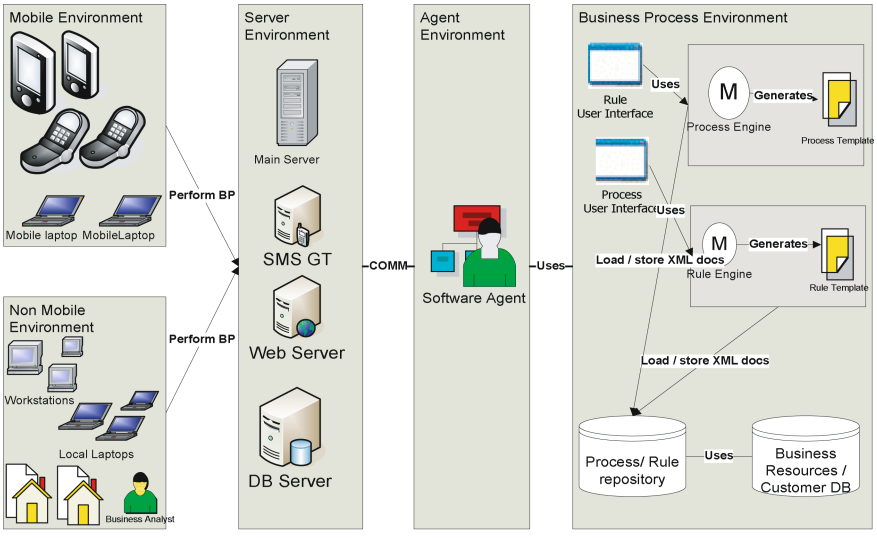

Fig. 1. General overview of mobile business process framework

and non mobile devices. We have identified business process environment as a core component of this framework and have separated from the other components. Our framework uses agent oriented rule-based approach [12]. We separate agent environment from main business process environment, the agent's behavior and their actions controlled and customized through this environment. In business process environment business logics and process are defined. Using the framework it is easy for a business to introduce and integrate new process in this environment.

In following sub-sections we present an overview about different environments used in our framework.

2.1 Mobile and Non-mobile Environment

Mobile and non-mobile devices helps to determine the location of a process. All mobile and non-mobile devices are assessed through server environment. All static entities are come under non-mobile environment and an entity whose location is not static is come under mobile environment. Both environments accessed through server environment. Non-mobile environment is used to provide a flexibility of executing business processes through web pages. For example a customer can put a pickup request through company's web pages. Whereas mobile environment is use to provide a link between business processes and non-mobile devices. Business analysts also use these environments to define its business process or process conditions. Latest technologies like GPRS (General Packet Radio Service) are used to detect the location of mobile devices.

2.2 Server Environment:

Figure 2 shows different sub servers that are connected with main server for connectivity with external entities like mobile or non mobile devices. The sub servers may

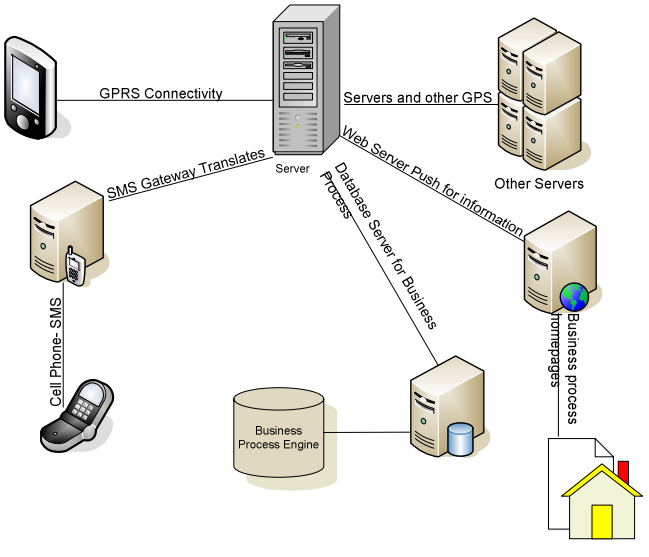

Fig. 2. Communication layout of business process

include web servers, SMS gateway translators, database servers etc. The main server is also used for GPRS (General Packet Radio Service) connectivity.

This environment is used to control all the communication connections used in location aware approach. There are different ways or methods are used to access any business process depended upon different locations including use of web services. Every server entity is linked with main server, which is responsible for accessing authority.

2.3 Agent Environment

Agent environment is a middle-ware between mobile and non mobile devices. Agent is responsible for synchronizing business processes, their integration with rules and deployment or execution of business processes within its environment shell depending upon business resources. The agent performs all its actions with its own defined ADDED properties [12], [13]. We are using software agents to handle all the business process's synchronization, integration and executions.

The agent is situated in a business environment with set goals, abilities to perform actions and having understanding of environmental characteristics [10]. An agent is capable for automating new processes at different locations depending upon roles, rules and companies resources. This agent has the objective (set goals) of calculating (performing actions) all the new processes with new process conditions (business rules) within business process environment.

2.4 Business Process Environment

This is a main environment where business processes are defined. In this environment business process and rule engines are defined where user can define business processes as well as process's rules and conditions. For simplicity rule and process

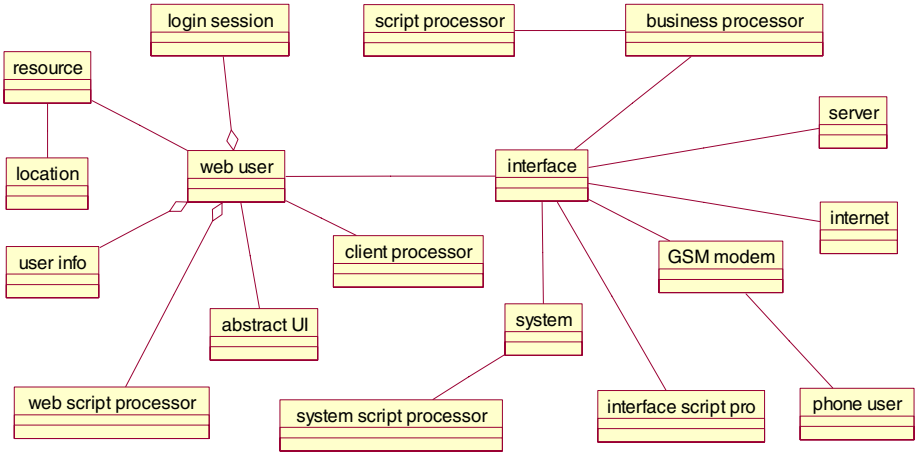

Fig. 3. Classes of location aware business process

engines are not discussed in this paper, we adopt agent oriented rule based business process approach [12], [14], [15]. Business resources and processes repository is used to define or customize business processes. Business analyst can use mobile or non mobile devices to customize existing processes through process engines or alternatively customize conditions for any particular process.

Figure 3 (class Diagram) shows the different classes and their relationships used in the location aware business process approach. This class diagram presents the overall representation of the application in the context of the location aware approach. Classes are defined in such a way that user can interact with system either from mobile technology or through web based applications.

Following are brief overview of some of the classes used in our approach:

Web user is the class for the user who will use the system through the website. This will be in regard to our system where the user will do its activities through the website.

Loginsession class is defined to record all the session details for the specific webuser. Userinfo class is used to record user information (such as address, phone etc.). Abstract UI class is being used to store the user interface customization layer, where each user will be able to customize his/her view. Every user would have specific profiles within the company.

Script processors
Script processors include WebuserScriptProcessor, SystemScriptProcessor, and InterfaceScriptProcessor classes. These classes are used to store all the functionalities and commands as scripts in the database. These script processor classes process the scripts from the database that are going to be used in the system.

Interface class
Interface class connects the mobile user to the rest of the system. A mobile user may not be able to connect to the system directly, as there are issues in mobile systems such as the device compatibility, and service integration, etc. All these issues are taken into consideration by interface class. Script class is also connected to the interface class that processes the scripts from the database class.

Business processor class
Business processor class stores different process or activities which are stored as scripts in the database. To run these scripts from the database we need the script processor that is also connected to the database.

Resource and location class
The resource class is used to have all the information associated with company's resources. And location class is part of resource class, which is responsible for having all the information about which resources are needed at what location by whom and when.

3 Case Study

This case study presents a scenario for a company that uses the location aware technologies and information intensive business processes to enrich its existing enterprise applications such as service dispatch or fleet management. The company has different processes like order pickups, order delivery and invoicing. All these processes are being processed at different locations. Each location may have different set of processes and activities. Each particular process (**What**) is done by particular actor (**Who**), at particular time (**When**) and at particular location (**Where**).

The company has fleets that are being used to pickup order from one location and deliver to another. The movement of the fleet is limited to the confined limits of the city or a state. The Application starts when a customer uses his/her mobile or web based interface to login and request for a package to be dispatched by entering its pickup and destination addresses and other related information. Then the dispatcher server would track the position of its fleet as well as their status (**idle**, **busy** or **off-duty**) and would determine the travel time between customer's pickup location and the current location of the fleet show with status as idle. If the distance of the idle fleet and the customer require a long delay before pickup, then the dispatch server would automatically allocate the pickup to a busy fleet. Based on conditions and the parameters the best suitable fleet is chosen in regard to the proximity of the location. A company can use its business processes in a more efficient manner. This could also lead to the greater increase in the company's revenue and a reduction in the losses.

We have implemented Independent Logistic System (ILS) using latest JAVA technologies. We adopt one scenario of independent logistics business process case study where customer request for delivery of plastic sheets (product) at particular location.

Fig. 4. (a) defining delivery process (b) defining an activity

First we define a delivery process for this particular system. In figure 4(a), business analyst define a process through an emulator by entering relevant information like process id, name, description, its type, start date and so on. Every process may or may not have sub activity. In delivery process sub activity is to find suitable driver for pickup and delivery whose status is available. Figure 4 (b), shows the activity of delivery process.

In figure 5, customer interacts with different options such as making a request for pickup, delivery or invoicing. After selection, customer enters all relevant details including pickup, drop-off location, product type, weight and contact details in the system. The system will automatically dispatch his/her request through his/her mobile device.

Fig. 5. Initial customer request

Once the request is placed, the system will locate a suitable driver by fulfilling process conditions. The system uses global positioning system to locate all the available drivers within that particular range whose status are idle or available. The driver's information is stored within the system database. Once the system locates a driver then it sends a message to driver for his acceptance of a particular job. It might be possible that the available driver is not willing to accept this job; system will provide basic information about delivery job on his mobile device. Driver will only see pickup and drop off location (suburb only) and he is given two options either to accept or decline a job. Once the driver accepts this job, the system will provide all the detail information for him to perform a task. Figure 6 (a) and (b) shows the emulator's screen displayed to the driver before and after accepting the job.

Fig. 6. (a) Job initial dispatch (b) Job details

4 Conclusion and Future Work

In this paper we have discussed a framework that is used to implement and integrate the business processes into location aware environment. In our approach, we have divided the framework into different environments. Each environment has its own associated behavior and characteristics. All the similar functionalities are grouped into environments like mobile and non-mobile devices in one environment. Mobile and non-Mobile environments perform their business processes through server environment, which provides a communication layer between business process environments. We have introduced software agents to synchronize, integrate and execute all business processes that are defined in business process environment used for both mobile and non-mobile devices. We have proposed and implemented a case study on independent logistic company (ILS), in which we presented a practical application to support our theoretical research findings. By using our framework, businesses are able to handle business processes more efficiently into complex business process automation where business is dependent upon location information.

For Future work, we will be extending our location aware business processes into context aware. In the current mobile technology, context-aware applications are only restricted to location aware concept for mobile applications (Location Based Services). Our future work also involves deployment of a business process to a mobile application according to the indicators of the context-awareness such as identity, schedules, agenda settings, activity (talking, walking and running), and availability of resources.

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