Services Management In Component Based Collaborative Workflow Processes

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Abstract: *Collaborative and dynamic workflow management systems in logistic companies require strong information systems and computer support. Business processes in such industries generally compose of several parts, a structured operational part and an unstructured operational part, or they could be composed of semi-structured parts with some given and some unknown details. Unpredictable situations may occur as a result of changes in decisions made by the management. The inability to deal with various changes greatly limits the applicability of workflow systems in real industrial and commercial operations. This paper deals with adaptation management of collaborative workflow changes in such consortia and proposes architecture for implementation of these changes through the process of component integration and synchronization where by existing workflow systems adapt to the changes. This paper describes conceptual framework required for prototype implementation resulting in new collaborative workflow adaptation.*

1. Introduction

In this paper we develop a prototype adaptation management for dynamic business processes of large logistic consortia, as these systems are complex, heterogonous and unpredictable due to rapid change in decision making process.
This situation raises problems in workflow design and workflow systems development. We propose workflow implementation methodology through the process of component integration techniques for development of new workflow using existing workflow components.

2. Workflow and collaborative workflow in logistics consortium

In literature review, we found that most workflow modelling and workflow design are only concentrated on the Operational aspects of the organisation or an enterprise. Although Operational aspect of workflow design is crucial to the organisation, we note that they are passive in changes and they are not dynamic[1,2,6]. They only changes when there is a management decision to changes.
The advent of the web to bind organizations together, for carrying out sales over great distances and at any time, has created new modes for marketing and enabled partnerships, previously inconceivable within a wide array of businesses, as well as other human activities[1]. A consequence of this connectivity and information richness is that one is faced with an increasingly dynamic business environment and marketplace. This environment requires major forms of collaborative workflow. A workflow is a sequence of activities that produces a result of observable value. A collaborative workflow is to focus on working together towards common goals. They can be small group of companies, project-oriented research teams, to widely dispersed industries with common interests. Effective use of collaborative workflow is now considered a vital element in the success of enterprises of all kinds. Workflow can be represented by sequence diagram, a collaboration diagram, Petri net or an activity diagram [5]. This IT support has expanded with the advent of e-commerce. However, with this advancement of B2B (Business to Business) and P2P (Partner to Partner) e-commerce [6], there has been an increasing tendency to set up consortia that represent several players in a given field. Such consortia consist of companies or organizations in a given field that get together and produce a single site, which appear to be single site in order to increase traffic through the site compared to other competitor's sites and/or extend beyond their region of operation, but a mere enumeration of all workers, activities and artefacts does not quite constitute a process. We need a way to describe meaningful sequences of activities that produce some valuable result, and to show interactions between processes.

3. E-solution for collaborative workflow

An example of Warehouse and Logistics Consortium is to provide space for customers who want to store their goods in warehouse and shift their goods from origin location to destination location, detailed logistic services for its customer to move their goods from one place to another place.
A Consortium consists of many departments. Generally there are six operational divisions: Management Department, Warehouse Department, Logistic Department, Accounts Department, Customer Service Department and Transport Department. Each department has its own responsibility; however they are connected to each other. Warehouse Department now already has its own system, so does Accounts Department. The complexity of works become bigger and bigger when the customer's orders increase, it is hard to know the progress of the orders, warehouse check. It is also difficult to schedule the trucks, manpower, etc. consortium likes to change its internal

work (flow of works among department) and its external work (flow of works with its customers and other collaborative organizations). Consortium would like to integrate various departments, and also with other logistic network companies in its consortium. Consortium also wants its customers to be able to book warehouse service, logistic service, place orders and view the status of orders, etc on the Internet. This is more like e-commerce way. Figure 1 shows a typical e-solution for collaborative workflow [3]. On the other hand Logistic Management, in its widest definition, is concerned with the strategy and management of the movement and storage of materials and products from suppliers, through the firm's distribution systems to retail outlets and customer. The scope of logistic management for the physical movement of goods starts with the sources of supply and ends at the point of consumption [2, 4]. In today's business environment, good logistics management often determines the success of a business. Retailers are well aware of how excess inventory, frequent stock-outs, poor item turnover, and excessive markdowns can cut into profits. Logistic management attempts to achieve a balance between holding minimum stock while providing the best services possible to the customer

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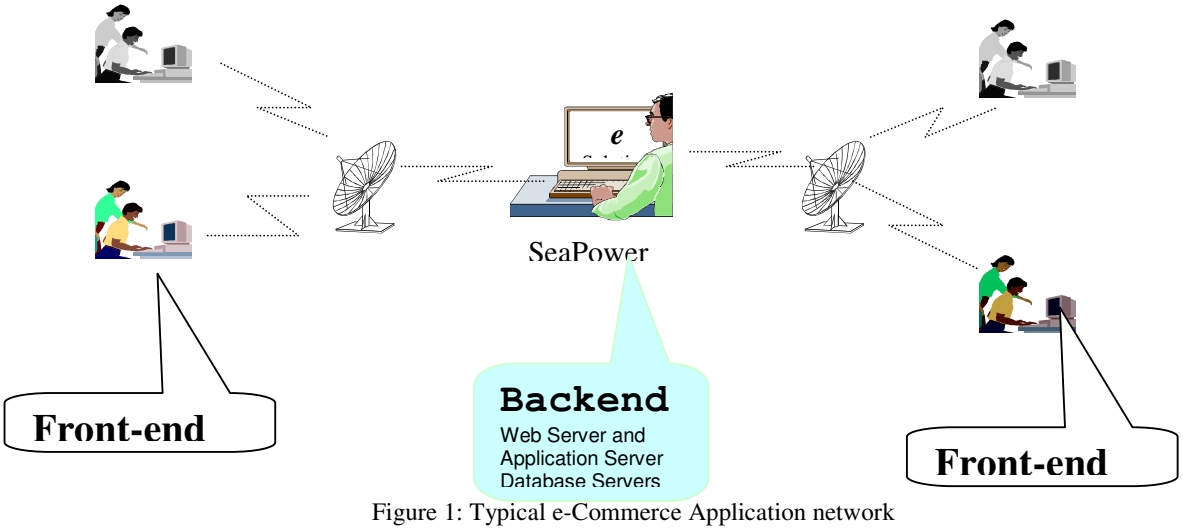

Figure 1: Typical e-Commerce Application network

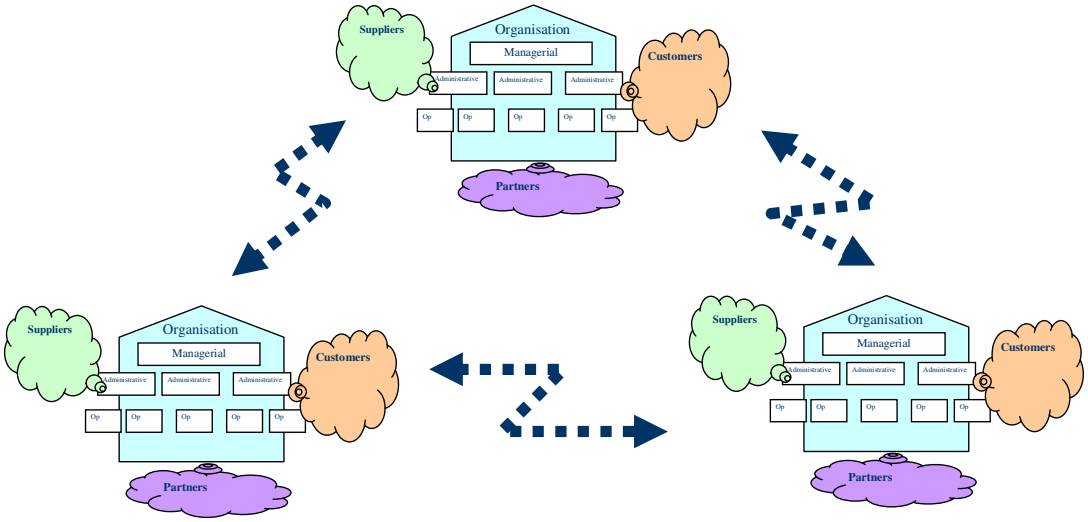

Figure 2 Collaborative Organisational Workflow in a Logistics company

4. Collaborative Workflow for an Extended Enterprise [9,10,11]

Collaborative workflow is a new type of workflow that allows an organisation or enterprise to be added to the existing workflow model and be used in the extended organisation or enterprise.The advent of the internet has provided mechanisms for binding organisations to work together as they need collaborative workflow management for carrying out sales over great distances and at any time. Collaborative workflow is important for marketing and enabled partnerships, previously inconceivable within a wide array of business, as well as other human activities.

Management of collaborative workflow helps the connectivity and information richness that one is faced with in an increasingly dynamic business environment and workflow. Collaborative workflow management helps the shift from old business paradigms to new business paradigms. New collaborative organisation workflow systems that *transcend* the *previous static, closed, competitive models* and *move* to *dynamic open re-configurable, often collaborative models* that are able to respond to the business environment dynamics inherent within the networked economy [13]. Several factors characterise collaborative workflow management for extended enterprise; namely:

(a) A strong information infrastructure that extends beyond the original closed walls of the *individual enterprise*.

(b) High connectivity and electronic handling of information, of all sorts including data and documents.

(c) An increasingly *collaborative approach* between what were more traditional *individual enterprises*.

(d) Utilisation of new forms of electronic interaction, provision of services and utilisation of services.

(e) Ability to self organise and reconfigure the business of the organisation, perhaps even the organisation as a whole.

(f) Use of multiple channels for sales and marketing.

(g) Capture and utilisation of business intelligence from data and *smart information use*.

These features are increasingly exhibited by successful modern business organisations, for instance, in collaborative supply chains, collaborative consortia for marketing, strategic partnerships, alliances and selling services, utilisation of web sales, marketing and customer service and creation of multiple modes of user interaction with the business.

A key factor in the success of such collaborative workflow management for Extended Enterprise is the creation of the underpinning *information infrastructure* to carry out the required services and development to enable and support the creation and the strengthening of small-medium enterprises (SMEs) to achieve some of the characteristics of collaboration. However current workflow techniques do not address the collaborative workflow issues and management.

5. Challenges of collaborative workflow

Activities and artefacts do not quite constitute a process. We need a way to describe meaningful sequences of activities that produce some valuable result, and to show interactions between processes. Changes in collaborative workflow have to be incorporated into the integrated enterprise system; we have proposed a prototype of its working in our previous papers [8, 9, 10, 11].

In this paper we are concentrating on,

1. Implementation aspects of integrating and adaptation of changes in the new workflow into an already existing workflow.

2. Information systems can change at run time so that new workflow can synchronize with existing workflow to adapt quickly. Other issues like

3.1 Management of data scattered over multiple origin systems/legacy systems, for example, a company will have consolidate data in one logical view with a unified architecture, thereby enabling data-source independence. Because application data continues to live and change in the origin systems, the new software layer must be able to retrieve origin data on the fly and also propagate changes back to the origin systems.

3.2 provide support for transactions/interaction across multiple back-end systems. "The hard part is getting a transaction model wrapped around those back-end systems; so if it didn't work in the third system, it was able to roll back in those first two systems," [17].

These challenges will help in having a uniform data processing environment for the whole enterprise, which would lead to changes and improvements in customer services, control of receivables and increase efficiency in communication, sales, marketing as well as minimization of warehouse stocks, streamlining inventory and logistics flows. Provide control to Consortium management to monitor the collaborative enterprise's condition, its stock, order and its general financial condition on a routine basis, this is indispensable to the management processes and enhances decision-making and changes which need to be taken on the short term and long term bases for the consortium to compete in the global market.

6. Service oriented framework to collaborative workflow

In this paper we present a service oriented framework for collaborative logistic companies. The framework has four layers, 1.Framework Layer 2.Network Layer 3.Communication Layer 4.Technical Layer, In framework layer browsers interact with HTTP servers in their normal way taking advantage of any technologies that enhance this browser-to-web server link. For example in network layer, secure socket layer communication protocols in Netscape and Microsoft browser/server products browsers communicate with HTTP servers, which communicate with the Application Server. The Framework layer generates web application at run time, Communication layer provides application's user interface, state management and provide an environment to use and create reusable components [7]. Enterprise object framework shown in figure 3, balances across one or more application server processes (also called instances) running on one or more machines. Once running, Enterprise service framework instances do not go away between user requests; they maintain themselves, their session's state for users, and their database connections. They are efficient, fast, and by definition redundant

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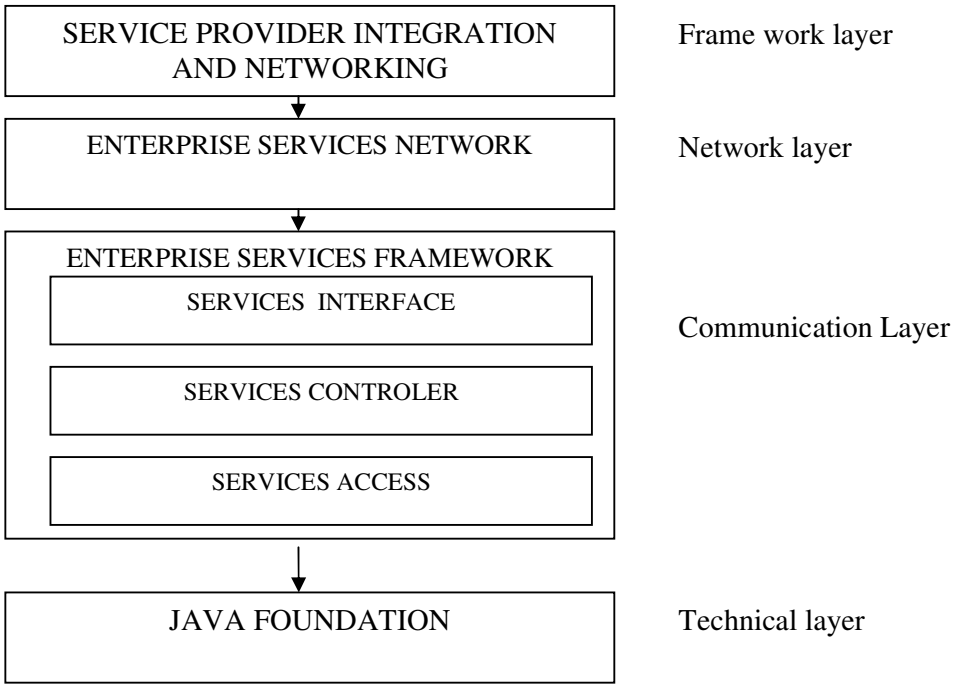

Figure 3. Enterprise model Frame work

It's the job of the HTTP server adaptor to communicate with a given HTTP server and forward requests to one or more application "instances" - an instance is a separate copy of a given application process. Enterprise services framework serving a few users may have only one instance. A large application may have tens or hundreds of instances running on one or more machines. If an application has more than one instance, the Enterprise services framework controller is essentially acting as load balancing agent. If an instance fails, it is only affects that particular instance – all other instances and/or the site's web server is unaffected. The controller will forward requests over the network as easily as it will forward requests to applications running on the same box as the HTTP server. In fact, from a load sharing perspective, it is ideal for the HTTP server and Application servers to reside on separate boxes.

Since applications are server based, database access happens behind the firewall. Browsers need never make direct connections to a database server. Services access controls database connections so that they are highly secure (only accessible via actual application API), and conserved (that is, you never have more than one connection per instance regardless of the number of users supported - unless this is specifically something the developers desire). Java Foundation contains fundamental data structure, implementations and utilities used.

7. Conceptual model of service oriented framework

Conceptual Model provides an architectural separation of business functionality from technology implementation. This separation allowed designers to use business rules defined in a UML model to drive four distinct steps in implementing such systems.

Step1. Create two platform independent models in UML. The first model is a generic domain model, used to build a common understanding and vocabulary among warehouse Logistics domain experts.

Step2. The domain model is then mapped into a second platform independent model (PMI) representing warehouse logistic business. Each of the models includes a detailed set of UML Class Diagrams, Use Cases and associated Activity Diagrams describing the system [12].

Step3. Using this business model, we can create one or more subsystems to represent the logical functions of each of the enterprise systems. This business model contains both the details of the business logic, as well as the mapping of the logic into the major subsystems. The business model forms the basis for managing all changes to the current systems.

Step4. System Integration using Conceptual Model of Platform Specific Models (PSM's), for each of individual systems to form enterprise system. These models were each derived from one or more subsystems in the business model. The relationships are

shown in Figure 4. System construction consists of customizing each of the enterprise systems, and creating the business logic. Business logic that spanned systems is constructed using components technology and deployed in the application server [12].

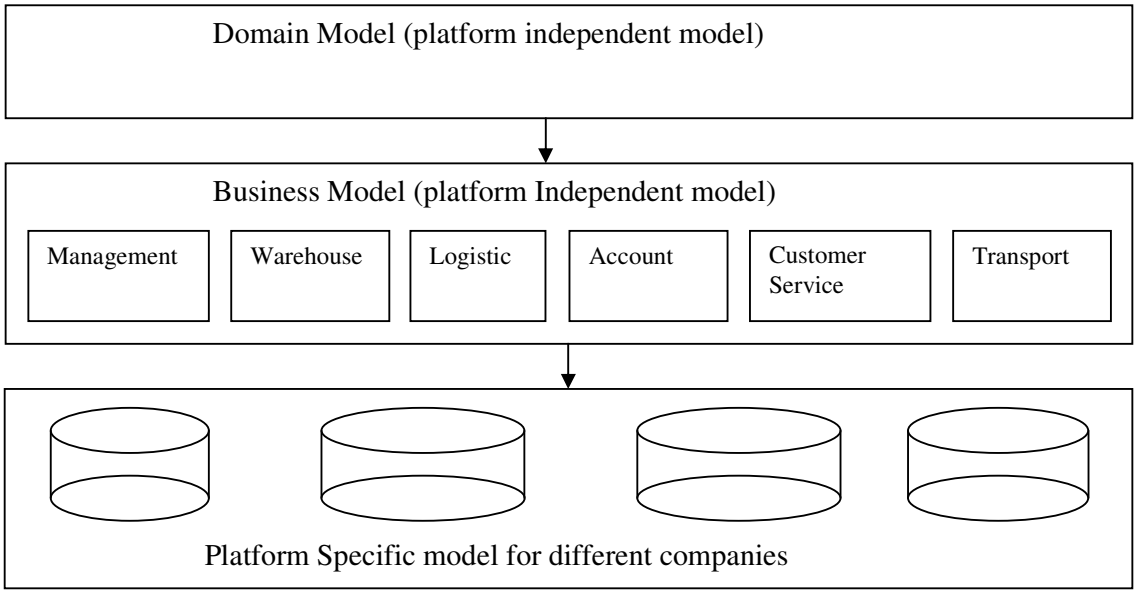

Figure 4: Service Oriented for system integration

8. Conceptual Model Of A Monitoring System

Creating workflow processes as per the requirements of management is complicated and time consuming. To support the continuous design process, we propose to introduce a workflow monitoring system which is used to create, check, edit and delete the workflow services processes. (refer to figure 5) Information collected at runtime and can be used in the diagnosis and redesign phases to derive better service model explaining the functionality of each service, and log and record all events occured. Internal factors for failure of the service are passed on for further consideration in the decision making processes by management; otherwise it is a cyclic process in creating a new workflow model from existing workflow.

This service monitor and repository acts as a generic domain model, to build a common understanding and vocabulary amongst logistics domain experts and helps in creating an architectural separation of business functionality from workflow implementation. This separation allows designers to use business rules defined in a UML model to implement such systems.

This system is used to monitor the data flow and workflow in the collaborative organization system as well. The software is broadly divided into two main applications; client side application and server side application.

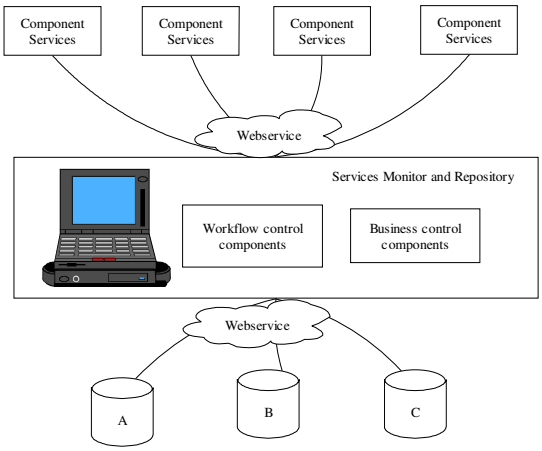

Figure 5. Enterprise monitor repository

9. Components synchronization of service oriented framework.

We propose the following method for adaptation. The proposed synchronization of similar components into one component is a step of sequential steps. For our purpose we will be using java files, for the development of such applications. As we know there can be different methods to solve a particular solution in java. Therefore when we want to concatenate two or more similar java file with only a minute amount of different behavior into one java file, the proposed plan

is to use intelligent software agents (ISA). We are using Intelligent Software Agents (ISAs) because they include problem domains that require *human-like intelligence* operating *autonomously*. Considering enterprise management department (Please refer to figure 5), where changes are to be implemented in existing workflow. Generally decisions of the management require marginal change, (assuming the ranging to be 0-50%), it only requires few changes to the already existing workflow, in such situation we want to reuse the existing components of this workflow and change only those components that are different from the existing components.

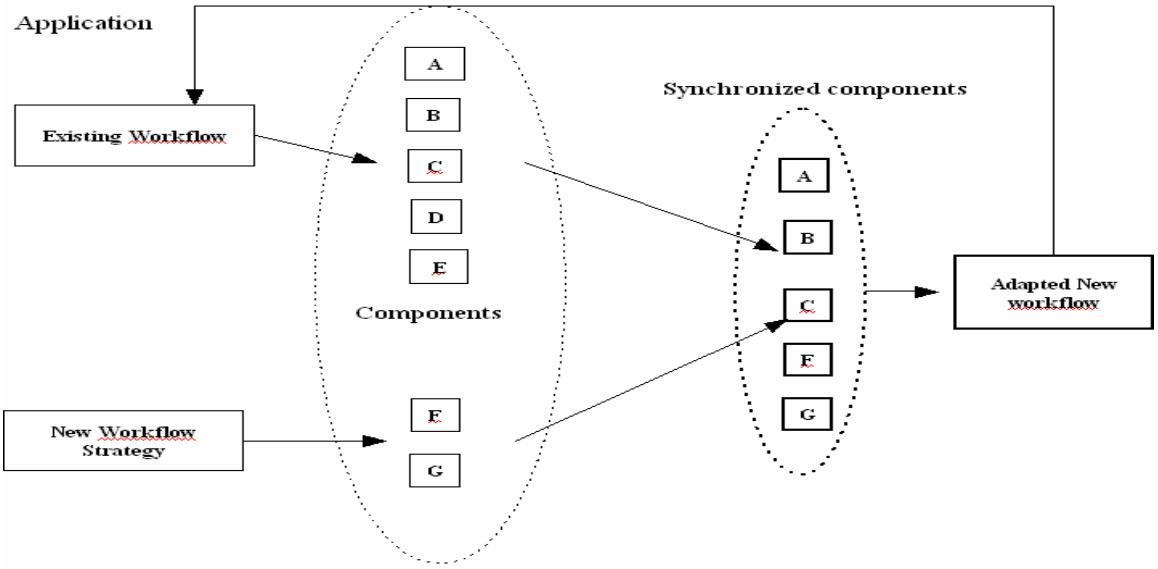

Figure 6: Company Management Department Workflow

The two-workflow processes, which have to be synchronized, should possess the same qualities, that this application be developed using an object-oriented language Java, with low coupling and high cohesion. Let's suppose we call these two java files as ***class A*** and ***class B*** (Figure 6), we will make use of ISA to find the similarities of these two files and process the information on similarities in methods of these two files. These ISA agents analyze the particular information to create the synchronized ***class C*** files by carefully copying components from class A or class B and pasting it into class C. Other ISA agents will analyze the information on the different functionalities of the classes. After retrieving different methods information these ISA agents will store them onto logs for future retrieval as and when required for the synchronization to form class C, here the combination of two java classes into one java class incorporates the same components (objects) of existing workflow and the changed components of the new workflow.

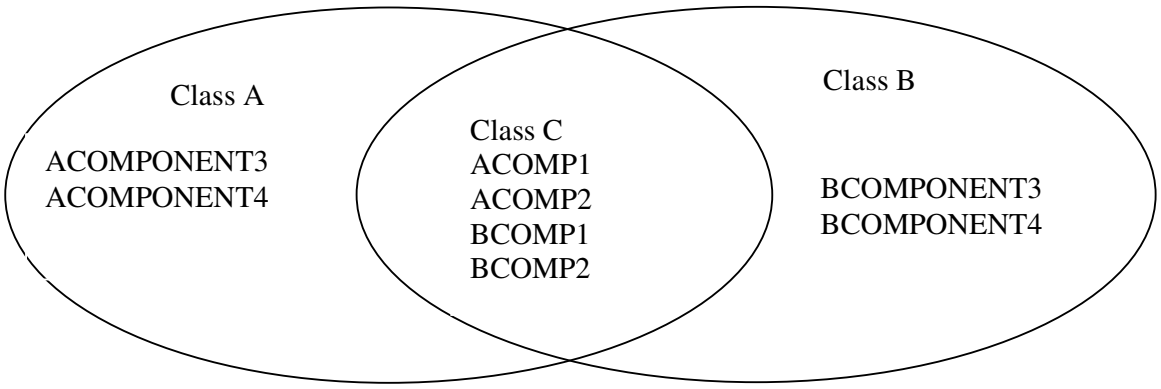

Figure 7: Classes Synchronization

10. System Implementation

An system design will both describe the various different roles of each service component that exist within the system and characterize the relationships that exist between these roles. The building process is broadly classified as 1.Workflow logistics automation Ontology 2.Logistics and General monitoring services (Enterprise services) 3.Ontology of reasoning rules (Enterprise rules), having identified the various service roles in a system, our next step is to determine how each of these roles can be best realized. Service agent architecture needs to be devised or adopted for each role, which will deliver the required functional and non-functional characteristics of the agent's role. Many agent architectures have been developed by the intelligent agent's community, with many different properties. At one extreme, there are 'strong Artificial Intelligent systems, which allow users to build agents as knowledge-based systems, or even as logic theorem proves. In order to build agents using such systems, one goes through the standard knowledge-based system process of knowledge elicitation and representation, coding an agent's behavior in terms of rules, frames, or semantic nets. At the other extreme, there are many agent frameworks that simply offer enhanced versions of (for example) the Java Applications of Intelligent Agents programming Selanguage; they include no AI techniques at all. Neither of these extremes is strictly right or wrong: they both have merits and drawbacks. In general, of course, the simplest solution that will effectively solve a problem is often the best. There is little point in using complex reasoning systems where simple Java-like agents will do. Obviously, more detailed guidelines to assist with this decision making process are desirable.

11. Conclusion:

In this paper, we have discussed logistics e-business development of adaptive workflow systems based on changes made at managerial levels. We have also discussed benefits, challenges and framework of adaptive enterprises systems and have come up with a method for dynamic adaptation of adaptive systems by the process of synchronization and monitoring of the management workflow system. our future research will be to mathematically model these processes to develop a prototype of a working adaptive system.

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