

# Collaborative workflow management using service oriented approach

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*Abstract: Collaborative workflow systems in large logistics companies require a well integrated information systems infrastructure and a strong communication network to meet major new challenges and opportunities. Agile infrastructure, enabled by integration, can have substantial impact on the overall success of a business, these IT integration requirements are expanding considerably with the advent of e-business; utilizing B2B (Business to Business) web services and P2P (Partner to Partner) e-commerce. This paper deals with change management of collaborative workflow in such consortia and proposes integration architecture for synchronization of these changes through the process of service modules integration where by existing workflow systems are adapted to the changes. This paper will describe conceptual framework and implementation strategy resulting in new collaborative workflow adaptation.*

**Keywords: Workflow, Collaborative, Logistics, Adaptation, integration, workflow monitor.**

## 1.0 Introduction

In this paper we discuss implementation and integration strategy for adaptation of changes made by the management and monitoring of these changes for dynamic business processes of large logistic consortia, The most typical types of business initiatives driving integration requirements today include reducing business cycle times to increase efficiency and competitiveness, improving customer satisfaction, mergers and acquisitions, and regulatory requirements. Some of these initiatives are strategic and some tactical. Different business requirements call for different types of integration technologies [15]. Often we see that the business processes are composed of several parts, a structured operational part and an unstructured operational part, we call them workflow control components and business control components, 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 situation raises problems in workflow design and workflow systems development. We propose workflow adaptation methodology through the process of services modular component integration techniques for development of new workflow using existing workflow components.

## 2.0 Collaborative Workflow In Logistics Consortium

The advent of the web is 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 form 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( Figure 1), 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 [3, 4].

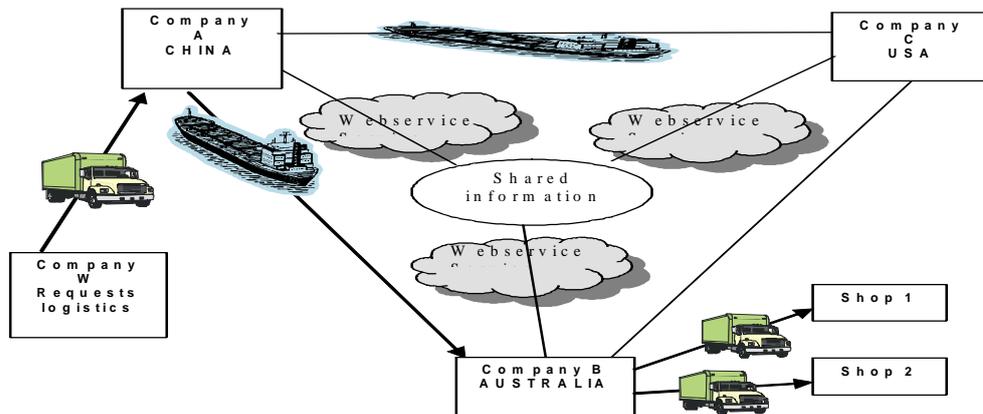


Figure1. Global collaborative logistic companies' network

A Consortium individual company 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 as it is hard to know the progress of the orders, warehouse check and 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 2 shows a typical e-solution for collaborative workflow [2]. 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.

## 2.1 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 [6, 7, 8, 9]. 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 hence a new workflow should be able to synchronize with existing workflow to adapt quickly.

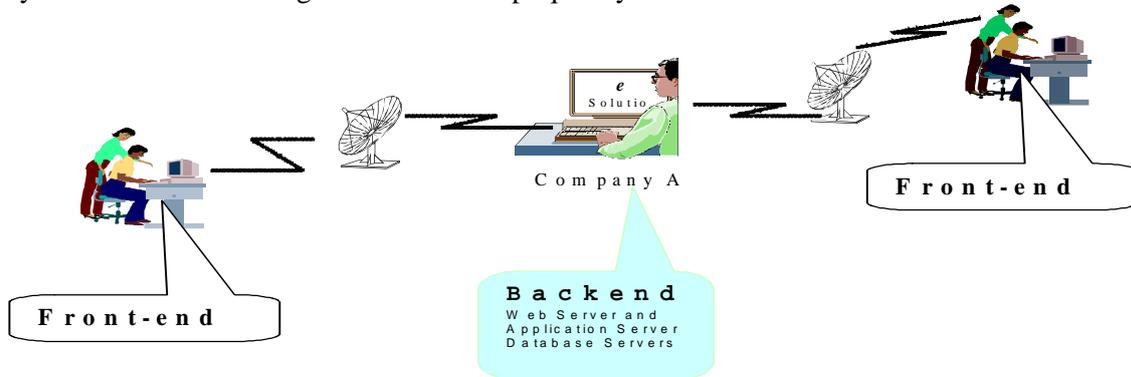


Figure 2: Typical e-Commerce Application network

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 [10].*

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. It will also 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.

### 3.0 Service Oriented Framework To Collaborative Workflow

We proposed a conceptual model of service oriented framework for collaborative logistic companies [11]. 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 [5]. Enterprise monitor repository helps by monitoring the front end as well as the back end of the system as shown in figure 3, this frame work helps to balance across one or more application server processes (also called instances) running on one or more machines. Once running, Enterprise component service 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.

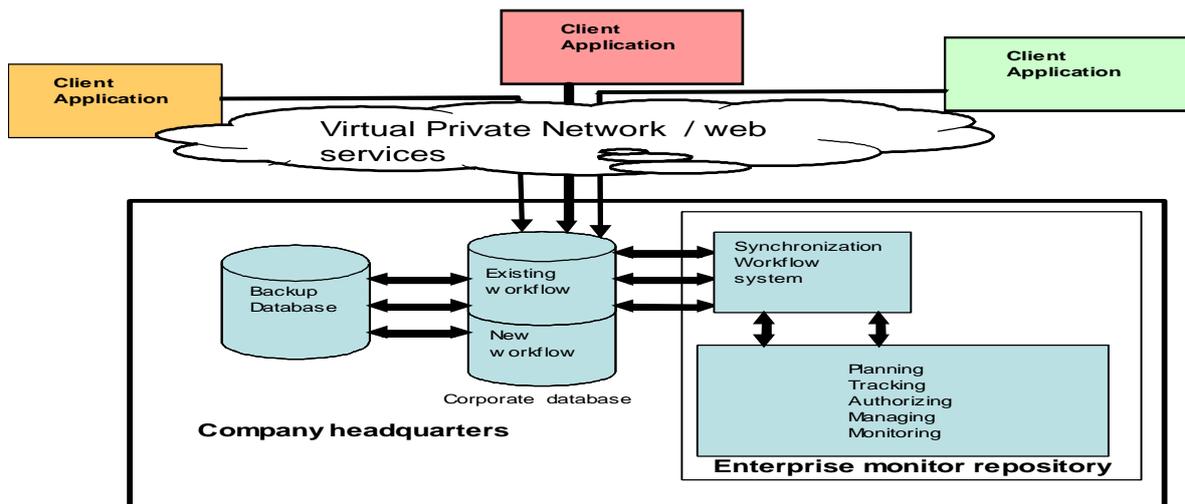


Figure 3. Enterprise monitor repository

It is 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 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.

#### 4.0 Conceptual Three Tier Architecture for Workflow Mining

The decisions taken by the consortium board, which is represented as unstructured data is passed on to the collaborative consortium management. this data which is unstructured is converted into structured data through a process of unstructured data management (udm), a process of mining, organizing and analysis to extract actionable information.

Here, UDM is used as a text mining tool to convert the unstructured information into structured data by considering precision, thoroughness and relevance of the unstructured information provided (please refer to figure 4).

Creating workflow processes is complicated and time consuming as per the requirements of management. To support the continuous design process, we propose using a workflow log which contains information about the workflow processes, information collected at runtime and can be used in the diagnosis and redesign phases to derive a model explaining the events recorded in workflow mining. Internal factors are passed on for further consideration in the decision making processes by the management; otherwise it is a cyclic process in creating a new workflow model from existing workflow. This model acts as a generic domain model; to build a common understanding and vocabulary among warehouse Logistics domain experts. Conceptual Model

provides an architectural separation of business functionality from workflow implementation. This separation allowed designers to use business rules defined in a UML model to implement such systems.

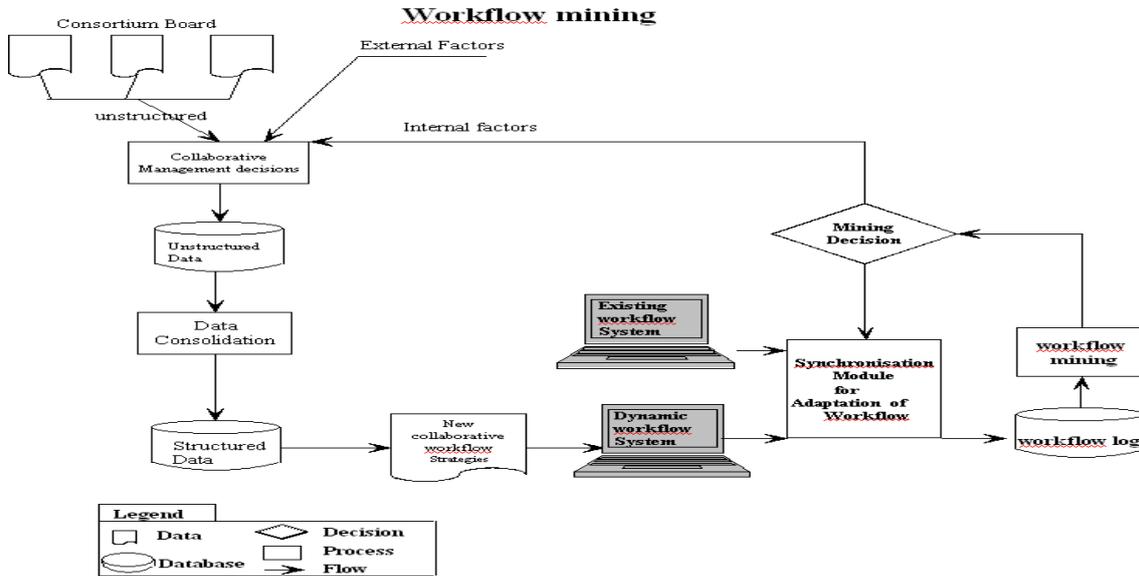


Figure 4. Workflow Mining Strategy and three tier adaptation architecture for Logistics Consortium

This model shows three distinct tiers, technical and communication layer forms the data store i.e. existing workflow and new workflow for an enterprise, the middleware consisting of synchronisation engine and monitor and on top of these layers supersedes the framework and networking layer which provides services to individual companies within the consortium through web services, this flexibility is useful in collaborative environment as the business models may also undergo change from time to time as some companies no longer want to be part of the consortium and new companies may want to join the consortium.

## 5.0 Service Oriented Implementation Architecture

The workflow strategy that has been proposed by the consortium management is to run parallel with the existing workflow. This is done for example by selecting batches of customer's orders and processing them using the proposed workflow strategy. At the same time, other customer's orders will be processed using the existing workflow system through the workflow monitoring system the progress of the two workflows can be monitored.

This testing phase is very important to reduce the risk of failure to the overall system by not allowing any changes to be made until the parallel system has been thoroughly tested. If a problem arises with the proposed strategy, the customer's orders can be processed by switching back to the existing workflows. A workflow log is needed to keep a record of all testing and proposed workflows which can be audited at regular intervals to assist in the formulation of new strategies.

Once the proposed changes to the workflow have proven to be reliable and advantageous to the organization (e.g. no interruptions to the workflow or a faster processing time for customer orders) then it will be implemented. This is performed during the evaluation stage where the decision to either reject or implement the changes is made. If the proposed strategy does not meet with expectations, management is informed through feedback. This is a continuous process as new workflow strategies are provided by management for implementation/redevelopment.

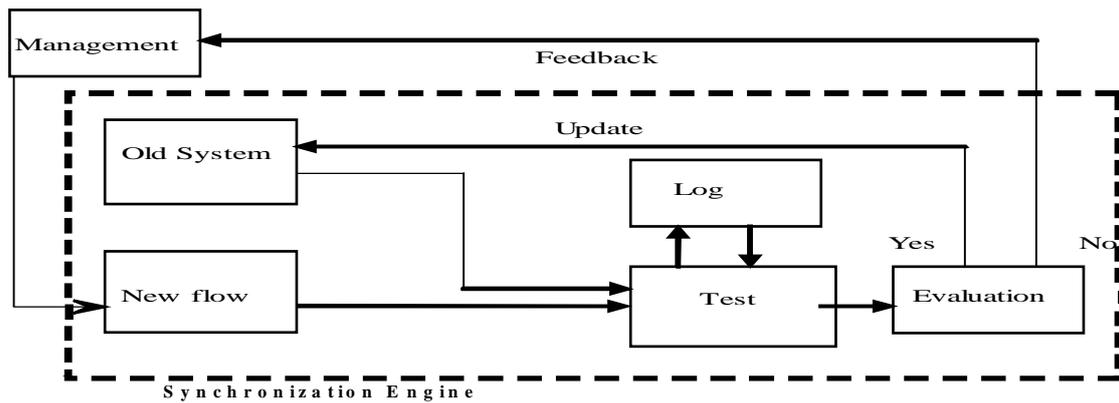


Figure 5: Workflow Synchronization Model

which are closely linked to the workflows of the organization. These services are small modules which contain well-defined business functions (workflows) that operate independently of the state of any other service in the system [12]. These services are encapsulated as a whole unit which is best represented by a workflow, which may be made up of a small group of objects that combine to become one service. A service could be simply *getCustomerDeliveryAddress* or *checkInventory*.

Customer and business needs are always changing and the organizations workflows will change with these needs. The modular service structure will allow the synchronization to be implemented much easier. This is because the services can be changed; deleted and also new services can be added to the existing workflows without having to make large changes to the existing workflow service structure.

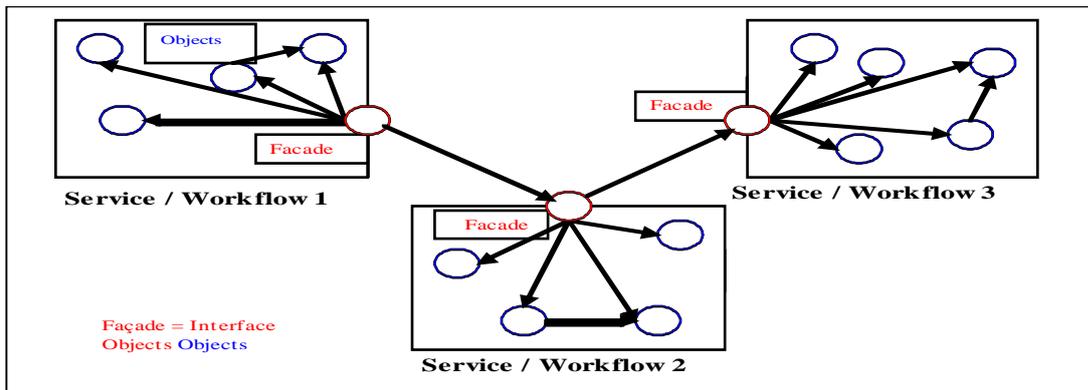


Figure 6: Example of communication between services

Some of the inherent problems with Legacy systems can also be overcome with the use of SOA [13]. This is especially useful when large investments have already been made into existing systems and it is unfeasible to replace the whole system or make costly changes. New services can be added to the legacy system allowing for expansion and new functions or workflows. The new services are able to communicate to the legacy system through a façade interface. In computer programming, “A façade is an object that provides a simplified interface to a larger body of code, such as a service” [14]. A façade structure allows for the interface of two services by reducing the coupling between them. Figure 6 shows how the façade is used to communicate between the two services. The two services may talk to the façade without the need to know about their internal structures. It acts “as single point of contact that hides the business object model and the technical implementation of the provided service” For our purpose we will be using java programming language as java standard library contains dozens of classes for façade classes programming to

enable us to develop such applications. As we know there can be different methods to solve a particular solution in java. One of the classes within the service plays the role of the façade to communicate outside of the service. This façade acts as a wrapper for the service and encapsulates the functionality inside.

Because of the service oriented architecture used, a service library should be created to store all classes. This should be expanded to include services modules, which will be a group of classes enabling the reuse of code so that these classes are not built more than once. Any service required that has previously been used elsewhere can be reused to save rebuilding for workflow integration

## 6.0 Conclusion:

In this paper, we have presented an adaptation methodology, in our further research we hope to develop a prototype of management system based on the detailed implementation strategy discussed. We have also discussed benefits, challenges and framework of adaptation mechanism for these enterprises systems and have come up with a approach for dynamic adaptation of the management workflow system. This system will be useful in providing the needed flexibility that would allow web services and integration to the consortium companies.

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