Seamless Integration of E-Commerce and Business Process Management

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Abstract— Business process management (BPM) includes the capability to discover, design, deploy, execute, interact with, operate, optimize, and analyze business processes. It is critical for businesses in the current intensive and competitive market. Traditional BPM has problems in interoperability, agility, and flexibility. This research investigates the role of Web services in process management. Web services are loosely coupled reusable software components that semantically encapsulate discrete functionality. They provide a distributed computing technology for publishing, discovering, and consuming business services on the Internet or intranet using standard XML protocols and formats. Web services provide a way to empower business users to specify complex business functionality in a clear, building-block fashion that can be quickly modified. The paper presents the importance and benefits of using Web services for process management in e-Business. It also provides insights into various technical issues through the introduction to a Web services-oriented architecture for process management, which is exemplified using a prototype e-Procurement system.

Keywords— Web services, E-Business, Process management, Interoperability.

I. INTRODUCTION

The dynamic development of Information Technology during the last years resulted in major reforms of the traditional business environment and the way business is performed. Spearhead of this transformation is the continuous spread of the Internet whose users over the world will probably reach 1 billion in the next ten years.

This wide spread is already offering to enterprises the ability of direct contact and electronic transactions with clients throughout the world, often resulting to dramatic cost decreases and impacting severely the way enterprises seek for competitive advantage. As a consequence Internet's role has been enlarged from a global communication vehicle to a key platform for global business development.

Although E-Commerce provides new useful ways for promotion and transactions, there are many relevant activities performed in the back office especially in the case of business to business transactions. For example when the client is ready

To buy a product from a company's web site the company should check the availability of the product, and then inform sales department to produce an invoice, arrange shipment details, etc. This means that a company has to combine successfully the new Internet based activities with traditional activities performed internally. In this context the integration of both intranet and internet based activities in an automated information system would create important competitive advantage for the company enabling quick response to the client's wishes and better process management.

Towards this direction a company's technology infrastructure could build on Web Based Workflow Management Systems (WfMS). Web based WfMS are the evolution of traditional WfMS that support the automation of Processes within a company.

II. RELATED WORK

In the Seamless Integration of E-Commerce and Business Process Management literature there is confusion as to the meaning and purpose of the term 'Business Process Model'. There are wide ranging perceptions of the term causing many to wonder just what a Business Process Model is. Definitions vary as do the designated attributes of Business Process Models thereby creating problems for academics and professionals relying on the literature for guidance in understanding Business Process Models. This project presents and analyses the definitions of 'Business Process Model'

presented in the electronic commerce literature along with the designated Business Process Model attributes.

The term 'Business Process Model' is used in many contexts and it is difficult to understand exactly what a Business Process Model is (Timmers, 1999; Mahadevan, 2000; Hawkins, 2002). Some authors do not try to define the term but do refer to Business Process Models and/or taxonomies of Business Process Models (Bambury, 1998; Saloner and Spence, 2002; Chen, 1 2001). Others such as Kalakota and Robinson (1999) and Whiteley (2000) do not use the term 'Business Process Model' at all but use terms such as business designs and strategies. Many authors use the terms 'Business Process Model', 'e-commerce model' or 'Internet Business Process Model' interchangeably. For the purposes of this paper it is not important to distinguish between traditional and web based businesses as the term 'Business Process Model' applies equally to both. The aim of this paper is to explore the literature for the meaning of the term 'Business Process Model' and to determine the attributes afforded Business Process Models. Furthermore, this project reveals the shortcomings of Business Process Model taxonomies and other classification methods presented in the literature.

Ecommerce:

"Electronic commerce, commonly known as e-commerce, consists of the buying and selling of products or services over electronic systems such as the Internet and other computer networks."

The E-commerce – International approach Defines the term **"e-commerce"** in various ways, in which two of them are as follows:

➢ **World Trade Organization:** The World Trade Organization defines e-commerce as, "e-commerce is the production, distribution, marketing, sales or delivery of goods and services by electronic means."

➢ **Organization for Economic Co-operation and Development (OECD) :** It defines e-commerce as "commercial transactions, involving both organizations and individuals, that are based upon the processing and transmission of digitized data, including text, sound and visuals images and that are carried out over open networks (like, the internet) or closed networks (like, AOL or Mintel) that have gateway onto an open network."

Business Process Management (BPM):

According to the Workflow Management Coalition (WfMC), **business processes** are "a set of one or more linked procedures or activities that collectively realize a business objective or policy goal, normally within the context of an organizational structure defining functional roles and relationships [2]". A business process can be a routine process pre-defined as a procedure, a planned process defined at its beginning and changed, if necessary, during its execution, an evolutionary process, or a composition of the above ones [1].

Business process management includes the ability to discover, design, deploy, execute, interact with, operate, optimize and analyze processes, and more importantly, to do it at the level of business design, not technical implementation [1]. *Interaction* means allowing humans to interact with automated and manual processes. A BPM system should allow flexible and dynamic interactions among processes and/or activities. BPM is top-down and model driven – process models can be composed or decomposed, and process design is independent of technical implementation. This approach is often used in conjunction with bottom-up integration and aggregation of Web services [1].

Workflow Management:

The workflow concept has evolved from the notion of the process in manufacturing and the office. Such processes have existed since industrialization and are the result of seeking to increase efficiency routine work activities. According to the workflow approach work activities are separated into well-defined tasks, roles (task performers) and rules, which all together create a process. ***Workflow stands for the automation of a business process in whole or part, during which documents, information or tasks are passed from one participant to another according to a set of procedural rules.***

Basic Types of Workflow Systems:

There are many different ways of viewing workflow products, their capabilities, and their applicability to improving different types of business activities. A widely accepted taxonomy distinguishes between *administrative*, *ad hoc*, *collaborative* and *production* workflow. The basic parameters of this classification are the similarities among the business processes involved and their value to the associated enterprises. However, it is also possible to organize them according to the task complexity and the task structure. Figure 1 summarizes both approaches.
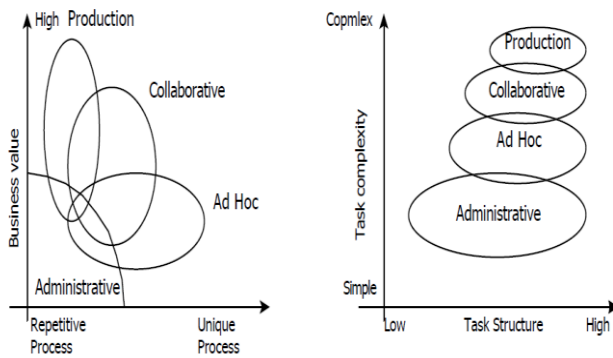
Figure 1: Types of WfMs

In general, *administrative* WfMS refer to bureaucratic processes where the steps to follow are well established and are based on rules known by all participants.

Ad hoc workflows address exceptions and unique situations. It may also be the case that the situation is not exceptional but each particular instance is unique.

Web Based Workflow Architecture:

Web based WfMS are the evolution of traditional workflow systems. They provide the ability to automate processes, parts of which are initiated or performed by users via a web browser.

Overcoming the traditional intranet's client-server architecture web based WfMS combine the abilities of Internet with workflow technology by introducing 4 layer architecture (Browser/client, Web Server, Workflow Server and Relational Databases). Figure 2 shows the Web components integrated into a full-blown workflow system. In this schematic, we see three Browsers that are on different disparate platforms, such as a Macintosh, PC, and UNIX workstation, connected to a Web server over the Internet As shown in Figure 2, the connection between the Web server and a set of relational databases is made via an application server that ties into a SQL server containing the workflow data. The Process Manager is the heart of the system and uses the information in the stored databases to affect the desired process activity on behalf of the organization the document database will contain all of the documents required to perform the activities defined in the processes. Figure 2 does not show the tools required to define and build the process definitions for the system. Workflow implementations are seldom an "off the shelf" fit with any organization, simply because of the unique and individual characteristics of each organization. Those tools are usually part of a WfMS and include a number of templates

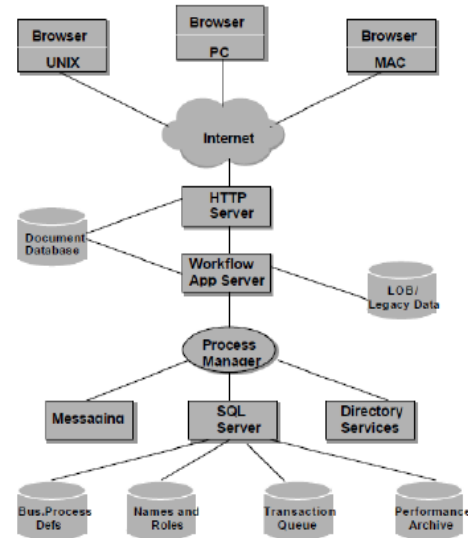and process models, which however can be considerably easily modified.

Figure 2: Web based Workflow Architecture

something they wish to buy advertised on a Web page, or filling in, for example, an insurance claim form. Once the user has entered the required information, a workflow procedure will be initiated and handled by others. The initiator will have no further part in the process – except at the end where some information, goods or payment is sent to the originator. This is identical to sending a request or information via normal mail.

2. Full participation – where a known user can take part in the full business process. The user can select procedures to start (depending on access rights), will have work sent to them via the procedure which they have to action and complete and they can access the audit trails and management information.

3. The third scenario - is essentially a combination of 1&2 above. It involves those instances where a casual user initiates a procedure, but, as a result of their action, becomes part of the full business process.

The system begins when a Web browser initiates a workflow application. First, each user logs into the work management environment by accessing a specific URL. Using a logon form, the user is prompted to enter his name and password. Following the completed form is sent back to the Web server. The Web server receives the HTTP message earmarked for that specific URL launches the work management environment and passes input data items as name-

value pairs. Accepted transactions go to the next step, while rejected logons are given an error message.

Workflow on the Web and Customer Orientation:

Web based WfMS can be applied in order to automate customer-oriented business processes over the Web. Depending on the organization, customers could be internal staff of the organization, consumers (business-to-consumer transactions) or a business entity (business-to business transactions). For business to business transactions, web based WfMS provides many advantages. Extranets, which consist of networks among trading partners using the Internet as the network infrastructure, are going to pave the way for extended Web-based workflow applications between organizations with dissimilar computing system environments. Using the Internet's infrastructure, the extranet will connect the business processes of both the customer and the supplier. One of the first implementations of network-based workflow between trading partners was Electronic Document Interchange or EDI. EDI is a technology that allows trading partners to send data from one computer system to another.

This concept has proven beneficial to many companies. Orders can be sent directly from a customer's purchase order system to the completely different order entry system of the vendor with no human intervention (see Figure 3). This form of business communication is also a form of workflow. As much as there are upsides to traditional EDI solutions, there are also downsides. Traditional EDI implementations are costly. The Internet-enabled supply chain between business partners is expected to change this.
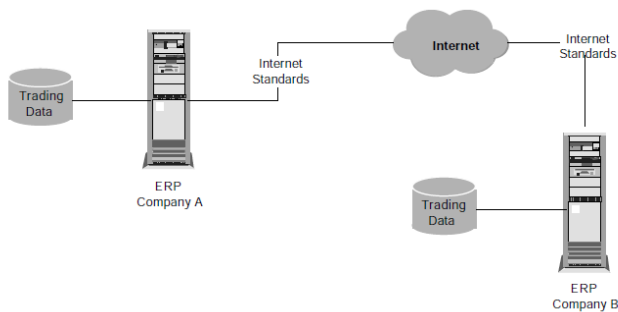

Figure 3: Electronic Business to business transactions

Workflow technologies allow companies to extend their organizational boundaries to seamlessly include their customers and suppliers. Consequently a work item can move through multiple organizations linked over the Internet to achieve the required goal. In addition, authorized users can track workflow activity through the various heterogeneous organizations from their desktop.

Web-Based Workflow Management Products:

The most common, commercially available web based workflow products. It should be noted that we concentrated on studying indicative workflow products that operate over the Web and not every WfMS available on the market. This section describes the following workflow management systems:

➢ Ultimus's Ultimus
➢ Action Technologies' ActionWorks Metro
➢ Lotus's Lotus Notes
➢ Open Text Corp.'s Open Text Livelink Intranet Suite 7
➢ InConcert Inc.'s InConcert Workflow
➢ FileNet Corp.'s Panagon Visual WorkFlow
➢ Keyfile Corp.'s Keyflow
➢ Optika's PowerFlow
➢ JetForm's InTempo
➢ Staffware's Staffware Global
➢ TeamWARE's TeamWARE Flow

Ultimus:

Ultimus is an Intranet/Internet (Web) based, client-server application targeted at business workflow automation. It provides a means of developing and deploying sophisticated workflow applications on the Web without any programming, scripting or macros. Because Ultimus relies on an Intranet as the primary transport, the application is scalable in terms of the number of users and the geographical location of the users.

Action Works Metro:

It is a product that integrates the Web with a messaging system. Its goals are to manage the commitments people make and to provide an easy way to separate work from information items. The Metro suite offers a Web-based environment for delivering collaborative workflow process management to the enterprise. It includes:

➢ Process Builder for designing workflows and incorporate them into the system for structured processes.
➢ Action Manager who interfaces with SQL Server to provide database support for version control, reporting, tracking and archiving of workflows

Lotus Notes:

Lotus Notes combines Web server technology with messaging, workflow application development and document handling. It provides an open Web application server (Domino Server), Domino Enterprise Connection Services (DECS) for easy integration with backend systems, and support for

Microsoft's IIS Web Server. Domino server bridges the open networking environment of Internet standards and protocols with powerful application development facilities and delivers messaging and collaboration services. Domino is scalable and provides failover protection. Lotus Domino provides a set of integrated services such as, Messaging, Directory, Security, and Replication.

Open Text Live link Intranet:

Open Text Live link Intranet is a Web-based integrated application suite for the collection, organization and deployment of enterprise wide information, workflow management and workgroup communication. A collection of tools including shared libraries, document. Management tools, search utilities, project management tools and workflows combine to provide a comprehensive collaborative product. Live link is a Web-exclusive product, that is, the only one not aligned with a messaging product.

In Concert Workflow:

In Concert features three-tier client/server architecture with multiple client components. Clients are used for building the process, defining the user interface to the workflow tasks, and managing the workflow. Multiple In Concert servers can run on a single machine. A workflow process is restricted to a single server. And, in order to access different processes on different servers, users must explicitly log off one server and onto another. In Concert servers can run on Windows NT or on a variety of UNIX platforms, including SunOS, Solaris, AIX, and HP-UX. The product supports Windows and UNIX (Motif) clients. Supported RDBMSs include Sybase, Oracle and Informix.

Panagon Visual WorkFlow:

Using a browser, e-mail system, or HTML form(s) tied to a workflow application FileNet's Panagon creates a large number of scenarios in business where a process can be initiated by an office user, disconnected employee or partner, or a customer from their home. Examples include credit card applications, expense report approval, insurance claims, travel's authorizations, home banking, home shopping etc.

Visual Workflow allows a standard desktop browser to create work, find a piece of work, check its status, and request updated information on that work. Visual Workflow Web Services is based on Java technology and supports applications running on a variety of supported platforms. The use of Java affords a high level of flexibility and scalability in choice of Web servers. Legacy software applications running on any Java-compliant platform can participate in the workflow.

Keyflow for Microsoft Exchange Server:

Keyflow is a collaborative workflow authoring solution based upon Microsoft Exchange Server. It expands the Exchange routing features by leveraging the messaging environment. Keyflow takes advantage of Outlook's or Microsoft Exchange's client user interface, standard active messaging, user addressing, and public folder and replication facilities. Any user can initiate a workflow and respond to workflow task messages over the Internet using Outlook's Web access. Because all work is done on the IIS server, clients do not need any extra software installed beyond a Web browser.

PowerFlow:

An object-oriented solution for the problem of how to better route, manage, monitor and coordinate the information and processes. Procedures are mapped into the system using simple graphical tools without any programming required. Business rules and procedures can be enforced while also granting ad-hoc privileges to authorized users. Parallel processing is supported, allowing multiple workers to perform tasks on the same work item simultaneously. Management control is facilitated through tracking and reporting.

InTempo:

InTempo uses an open architecture of HTML, Active Server pages and Java, along with traditional clients such as JetForm Filler, InTempo achieving broad applicability across any LAN or intranet IT infrastructure. InTempo uses any e-mail system for transport. Workflow tasks are in the mailbox. For users who want additional work management functionality, it offers a customizable, personal Web Work list, which allows users to sort, view and processes their workflow tasks.

InTempo is optimized for processes that involve structured information - from expense accounts and purchasing, through complex tasks such as project costing, to collaborative enterprise-wide exercises such as human resources surveys. It can also handle unstructured information, such as document review, budget approvals, policy distribution, etc.

Staffware Global:

Staffware Global allows users to participate fully in automated processes by accessing the Staffware Workflow server using a Web browser or Network Computing device across the Web. It offers a good compromise between production and administrative workflow requirements while delivering production workflow throughput.

TeamWARE Flow:

It is a part of the TeamWARE groupware product suite that enables users to organize, find and share information within teams, between teams and between organizations. TeamWARE Flow provides an open development environment with published API, TCL scripting language and standard API which can be utilized in Windows and Web environments. It does not depend on any e-mail product and, for example, TeamWARE Mail, Exchange Mail or Lotus Notes can be launched from TeamWARE Flow. It supports the Workflow Management Coalition's Workflow API (Interface 2) between the workflow server and client.

III. CONCLUSIONS

Web based WfMS provide the missing link to integrate Internet's capability to boost global business presence and handle customer and sales related applications with back office business activities and administrative tasks. This paper presented the business advantages that companies operating in the E-commerce era may have by integrating their customer oriented business processes with Web based WfMS

The automation of processes achieved, results on minimizing their implementation time as well as on eliminating dead times between the different tasks of each process. Up to 90% of the total time could save by installing a workflow system, managing for example the delivery of an order received electronically. This means that companies will be able to enhance their reactivity to client's demands and therefore gain a competitive advantage.

Companies could also benefit as the introduction of a workflow system eliminates most supervisory tasks. The system takes over most of the daily activity planning and assignment and sends to users a list of tasks to be performed. As a consequence a large amount of resources is deliberated and the productivity of the company would rise.

Supplementary, workflow systems provide clear detailed progress reports presenting the tasks in progress, their status and the person responsible, as well as the tasks remaining in order to complete the process. In this way Managers obtain an on time, accurate view of business performance and clients can have exact information about the stage of elaboration of their request.

In addition workflow systems contribute essentially in the areas of Quality and Cost Control. Since a workflow system maintain a detailed log, including task name, starting and finishing date and time, performer, it is possible to monitor cost evolution, spotting quality problems of customer service and managing bottlenecks.

Last but not least, the use of workflow systems increases the security of the whole system as users access ability is predefined and continuously controlled by the system. All documents to be approved are routed by the workflow engine only to authorized persons and are further processed only after been approved.

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