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A test-bed for the Correlation Center of Digital Services

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ABSTRACT

For an e-business to be successful, companies need to formulate a business strategy, have informative strategic alliances, develop an international system, build a proactive infrastructure, internationalize their model, capture the residual value, exploit the international telecommunications liberalization, homogenize the data structure and globalize human resources [6]. To achieve their objective, businesses need a more integrated automation system to speed up the process of establishing and conducting Internet-based services. In this paper, a component-based prototyping approach is used in developing a generic model and framework for a Correlation Center (CC) that provides entrepreneurs with a tool to quickly build and automate e-commerce linkages, thus enabling companies to establish their businesses over the Internet using a proven methodology.

1. INTRODUCTION

This paper is primarily based on the master's thesis of R. S. Sadasivam [1] in which the design of a CC was developed. It also builds on the master's thesis of U. Tanik in which a framework for Internet Enterprise Engineering (IEE) was developed, published, and presented at the IEEE southeast conference 2001[4, 5]. The explosive growth of technology is driving the next wave of economic growth. To take advantage of that growth, it is imperative to not only apply new technology, but also apply new thinking [6]. The current software systems used in enterprises lack many of the desirable qualities such as support for ease of integration, automation, and modification. Over the last two decades, enterprises are undergoing major transformations in the way they perform their operations using software systems. Traditionally, enterprises are organized into units that perform different functionalities such as accounting, sales, marketing, manufacturing, research, and development. Software systems used within enterprises have evolved to support each functional unit. As the operations became increasingly dependent on software systems, these systems became very elaborate, intertwined, and often customized to suit specific needs. As a result, these systems have become very complex and present a great deal of difficulty in their integration. Software systems should be more easily integrated and automated, while not inhibiting evolutionary changes or processes necessitated by changing business needs.

1.1 Acronyms and notations

CC: Correlation Center
CMP: Container Managed Persistent
HTML: Hypertext Markup Language
HTTP: Hypertext Transfer Protocol
HTTPS: Hypertext Transfer Protocol Secure
IEEE: Institute of Electrical & Electronics Engineers
JSP: Java Server Pages
JDBC: Java Database Connectivity
SQL: Structured Query Language
TCPIP: Transmission Control Protocol Internet Protocol
UDDI: Universal Data Directory Interface
WML: Wireless Markup Language
XHTML: Extensible Hypertext Markup Language
XML: Extensible Markup Language
XSL: Extensible Style sheet Language

2. CORRELATION CENTER

For an Internet enterprise to be successful, it must (1) rapidly deliver core business processes on the Web, (2) increase responsiveness to changing market requirements, and (3) differentiate to win in the marketplace. To leverage Internet economics, it is imperative not only to project enterprise systems into various client channels, but also to do so repeatedly and in a timely manner, with frequent updates to both information and services. In this environment, timeliness is critical in gaining and maintaining a competitive edge. As software developers continue to harness the power of the Internet for supporting business activities of enterprises, we are still far from achieving our objective. IEE principles coupled with an effective backend process implementation, such as a correlation center, would enable rapid, systematic, and reliable construction of successful online business enterprises [4]. The CC can be defined as a software system that will help entrepreneurs build any e-business from inception to completion quickly by intelligently matching suppliers with buyers.

The design of the CC identifies three different blocks or tiers [1, 2, 3]:

- Request for Service,
- Correlation Engine, and
- Digital service providers.

These digital requests can come over the Internet through various transport protocols like HTTP, HTTPS, and TCPIP etc. using Internet technologies like XML, HTML, WML, and XHTML etc [10]. The Correlation Engine, theoretically a finite state automaton based partial order system, consists of a "finite

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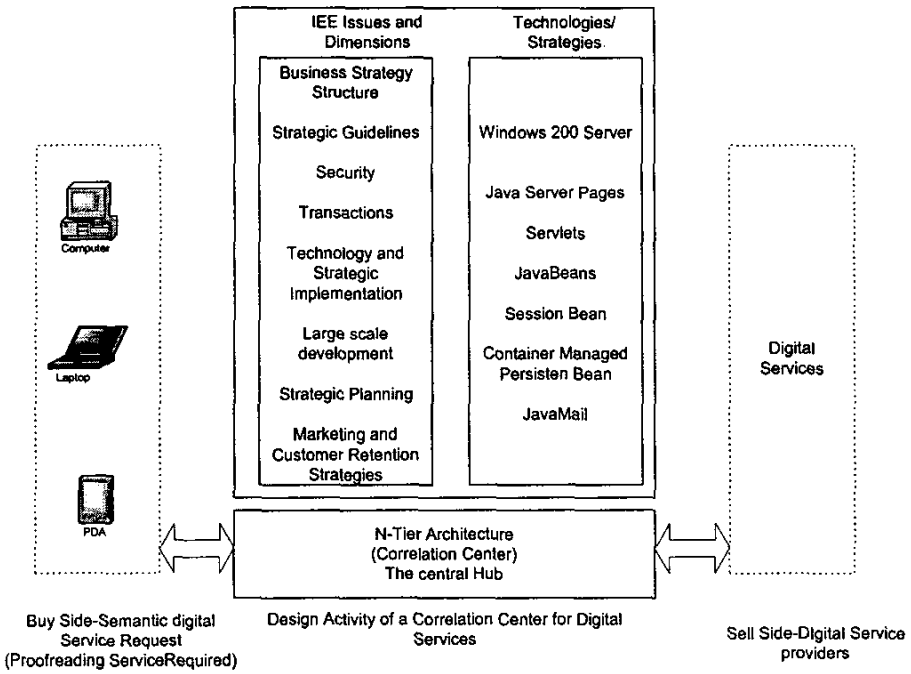

Figure 1 Design of a Correlation Center

state machine-like" engine that can deploy and monitor the status of the processes duringth eir execution lifetime. The digital services can be found through Web registries like the Universal Data Directory Interface (UDDI) [9,11]. The CC will enable companies to combine their diverse business process into one unit that will integrate, automate, and seamlessly operate within and across enterprises.

3. TEST-BED ETD

The test-bed, English Text Doctor (ETD), is a working prototype of an e-business designed to help individuals, universities, and corporations on a global scale in providing online editing services. The ETD was developed with a process model that forms the core competency for an Internet business. The test-bed was built utilizing the component-based development model of the J2EE platform using the Oracle 8i as the database. From the test-bed, it can be inferred that a key process model that orchestrates the functions in ETD can be generalized by using a CC. The test-bed is essentially an e-business designed to help individuals, schools, universities, and corporations on a global scale with the English language usage. The Internet has made possible fast, easy, and cheap communications between parties separated by continents, as new developments in digital technology begin to play a significant role in the future of global communications infrastructure. Increased interactions will mean proficiency on business, social, and technology language. The volume of correspondence is expected to rise in the future, as globalization trends are bringing the world together under one multicultural umbrella – the Internet. Due to the profusion of e-commerce transactions through millions of mobile and stationary online portals, business opportunities now exist for domestic businessmen to begin servicing international clients and customers in the area of English proofreading. Already, people from many countries are finding themselves in positions where they will need all sorts of peripheral language support, and the Web is becoming populated with companies that are ready to offer the language support today and into the future. Thus, the test-bed Englishtextdoctor.com is an ideal model of a working prototype for generalized "business-to-business" operations [4, 1, 2, 3].

The design of the ETD has three main building blocks [1, 2, 3]:

- Buy Side,
- Central Hub, and
- Sell Side.

3.1. Buy Side (Request for Service-The Author's end)

Each author uploads his or her document for proofreading service. Currently for demonstration purposes, the system is

designed to serve four types of documents: Business, Technical, Essay, and Resume. Also the type of proofreading services provided are standard proofreading, standard editing, and premium editing. Essentially, the front-end is the website that faces the author. Each of the authors will be able to interact with these Web pages as they wish at anytime and from anywhere an Internet connection exists. The documents submitted to the ETD are sorted at the Central Hub according to their (document) type and the type of service requested. The author is not required to understand the backend workflow process at the ETD hub, allowing for easy replication and flexibility for future client interfaces.

3.2. The Central Hub (Correlation Engine)

The Central hub consists of three parts:

- Author's Hub,
- Reviewer's Hub, and
- Administrator's Hub.

3.2.1. Author's Hub

Once the author uploads his or her document, the document is sorted and processed at the author's hub. A proofreader, who specializes in that particular document and that type of service, is matched to that document. A unique paper ID is then generated for that document. The price for the proofreading service is calculated based on the document type, the number of pages of the document, and the type of proofreading service requested. The ETD then sends emails with attached documents to the author for confirmation, the proofreader for review, and the ETD's mail server for storage and reference. A dynamically generated unique ID is also sent with the email. The records of the transaction are then stored in the database for future references.

3.2.2. Reviewer's Hub

The reviewer, after proofreading, uploads the proofread documents. The ETD, using the unique ID provided, tracks the author, sends email messages with attached documents back to the author, to the proofreader for confirmation, and to the ETD's mail server for storage and reference.

3.2.3. Administrator's Hub

The administrator's hub has a built-in mechanism, which helps the administrator control the overall central administration and monitoring of ETD. These mechanisms include adding, checking, updating, and deleting of proofreaders. A reminder email mechanism has been set up to help the administrator send reminder emails to reviewers who have not submitted their reviews by the allotted time (the maximum time assigned to a reviewer per proofreading job). The ETD also allows the administrator to check the author's information and the document status. A promotional email mechanism has been setup to allow administrators to send promotional packages and documents from the ETD to the author. The administrator can also set the contents of the email messages sent. The ETD also allows the administrator to set the price for the proofreading service.

The ETD has a built-in custom form based authentication login mechanism, and also logout mechanism for the authors, reviewers, and administrators. As the number of proofreaders and customers increases, the benefits of the ETD will become apparent, since the system would be dispatching and retrieving documents across all disciplines. As the system further develops, the internal mechanisms of the ETD can be refined and further modified according to the special needs of the customer and requirements of the system. The overall efficiency of the system would increase over time as improved technology, business strategy, and control algorithms are incorporated into the orchestration process at the ETD.

3.3. Sell Side (Digital Service Providers-Reviewers end)

The proofreader receives his or her assigned document and unique ID by email. After the proofreading is finished, the proofreader uploads the documents using the Website. This Website is essentially the interactive-end used by the reviewers for official business correspondence and transactions. Like the author, the reviewer never needs to understand the correlation center workflow system. This allows for easy replication and flexibility for future additions. The reviewer also has additional features for changing and finding customer passwords.

By comparing the author'sen d to the buy side, the central hub to the Correlation Engine and the reviewer's end to the sell side, it is possible to generalize the ETD model to a very specific instance of the CC. In this case, service is provided for each author's request for a proofreading of his or her documents. The central hub acts as the Correlation Engine by intelligently matching the proofreading request with the best proofreader for that document, and then monitoring the status of the document until the completion of the process. The reviewer providing the proofreading service for that document then represents the sell side.

4. ENABLING TECHNOLOGIES

4.1. Java 2 Enterprise Edition (J2EE)

J2EE defines a set of standards for building N-Tier enterprise applications. For building enterprises in real-time, J2EE provides standardized modular components. These components have a complete set of services that define and handle many details of an application automatically. The J2EE platform provides an N-Tier distributed application model, the ability to reuse components, flexible transaction control, and a unified security model needed to build enterprises. The J2EE helps in encapsulating functionality in specific types of components. Enterprise JavaBeans (EJB) encapsulates business logic components [7].

4.2. N-Tier Architecture

Client-server applications are generally easy to deploy at first, but have an architectural disadvantage. The inability to reuse or share any important business logic or function in the client-server model leads to difficulty in upgrading or enhancing the system. Any changes in the business logic require changes in the presentation logic. Client-server models do not prove very scalable and are therefore not suited to the Internet [8].

The N-Tier architecture provides an excellent alternative to two-tier architectures. N-Tier architecture involves separating

the various layers into multi-tier applications. In addition to the advantages of distributing programming and data throughout a network, n-tier applications have the advantages that any one tier can run on an appropriate processor or operating system platform and can be updated independently of the other tiers [8]. The test-bed ETD has the following Tiers:

- Presentation: This layer provides the interface to the user. HTML and JSP technologies are used in the ETD's presentation tier.
- Dynamically generated presentation: Dynamically generated presentation is handled on the Web server. Technologies that are used include JSP's, Java Bean (with JSP) and Servlets.
- Business logic and data access: The ETD uses the CMP entity bean to handle the business logic. CMP's EJB container handles the database access required by the entity bean. This results in the bean having no SQL calls, ensuring high flexibility. The ETD can be redeployed using any database with any modification or changes to the code.
- Backend System: The backend system used in the ETD is the Oracle Database and is connected using the JDBC oracle driver.

The ETD N-Tier architecture supplies a business model that is easily scalable, reusable, and maintainable. It allows for each tier to maintain a specific function [8], reducing the overall complexity of the system.

5. SUMMARY

The rise in information technologies has opened new doors for companies. Enterprises need to respond to these changes to thrive in this new economy. In order to meet the growing requirements of future organizations, it is necessary to develop an integrated automation system. In this paper, we introduced the idea of building a Correlation Center (CC) and a prototyping approach that is used to demonstrate the power of the CC. The ETD model offers a framework and compelling methodology for building the Correlation Center. A key process model that orchestrates the functions in ETD can be generalized by using a CC. The CC replaces the ad hoc method of enterprise formation and offers companies an engineering approach that will allow them to focus their efforts on the development of their main business process as their chief core competency. Many Internet enterprises can follow the ETD model and CC implementation when structuring their overall business efforts.

6. FUTURE WORK

The future work on this paper will concentrate on the implementation of the Correlation Engine in three steps. The first step is in developing a technology,w hich allows the use of distributed components and services by employing late, binding techniques. The second step is to compose new components and services from existing ones. The third step is a finite state machine, the Correlation Engine that will deploy and monitor the status of the processes during their execution lifetime.

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BIOGRAPHIES

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Rajani Sadasivam is a graduate student in the Department of Electrical and Computer Engineering at the University of Alabama at Birmingham, where he is a part of the Component Based Software Engineering group. Rajani holds a BS in Electronics and Communication Engineering Science from the University of Madras. He is currently in the process of completing his Master Thesis on the design of the Correlation Center. He is about to begin his PhD in Computer Engineering. Rajani works as a Programmer/Analyst in the office of Academic Computing at UAB.

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John Tanik received his B.S.E.E. from the University of Texas at Austin in 1997. After taking additional classes in e-commerce while working for an IT international consulting company, he became interested in the world of business strategy, entrepreneurship, and Internet business. Soon after moving to Birmingham, he began his master's studies at UAB and independent consulting work for IC2 Institute on entrepreneurship and university-based technology transfer. His main focus at UAB was high-tech entrepreneurship and the systematic study and creation of Internet-based businesses rapidly, reliably, and cost-effectively, culminating in his thesis entitled "Internet Enterprise Engineering based on T-Strategy under Zero-Time Operations." Recently, after securing a position as a Kauffman Entrepreneurship Intern at the local technology incubator, he has begun his PhD work, while working as an engineering lab instructor.

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Murat Tanik joined the UAB School of Engineering in 1998 as a professor. Prior to joining the UAB faculty, he was an associate professor and the director of Electronic Enterprise Engineering at NJIT and the director of Software Systems Engineering Institute (SSEI) at The University of Texas at Austin. He is also the director and chief scientist of Process Sciences Laboratory, a think-tank of process-centered knowledge integration. Dr. Tanik has worked on related projects for NASA, Arthur A. Collins (developer of Apollo moon missions' tracking and communications systems), and ISSI. He was an associate professor and the director of the Software Systems Engineering Technology (SEK) research group at SMU. Dr. Tanik is co-founder of the interdisciplinary and international society, Society for Design and Process Science. His publications include co-authoring six books, co-editing eight collected works, and more than 100 journal papers, conference papers, book chapters, and reports funded by various government agencies and corporations. Under his direction, 15 Ph.D. dissertations and 20 M.S. theses have been completed.

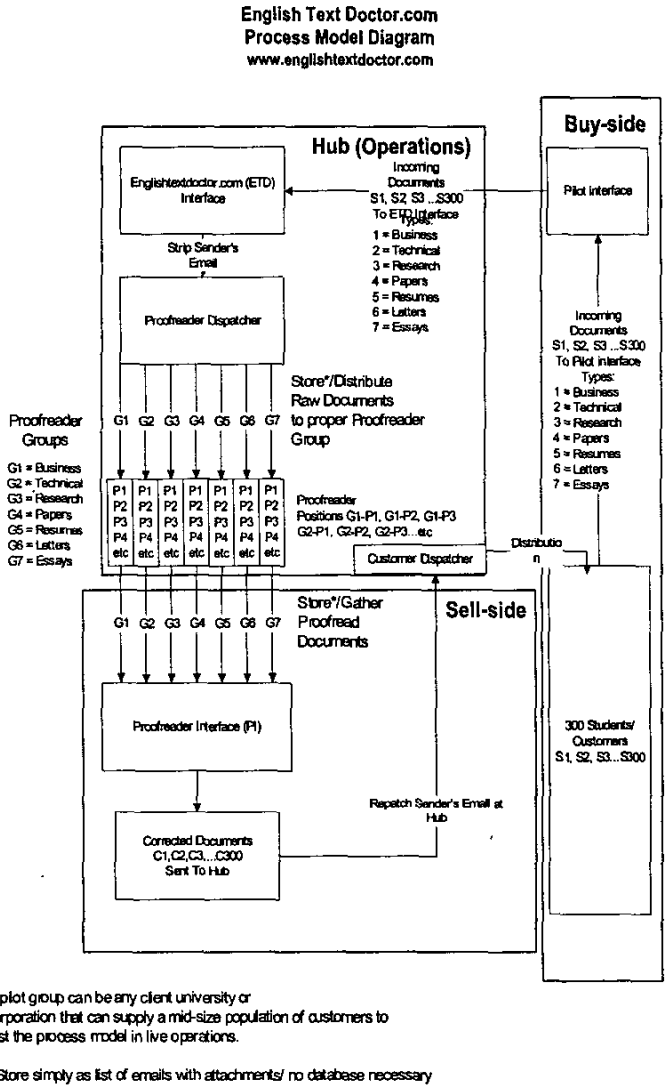

Figure 2 English Text Doctor Process Model