ESTABLISHING EFFECTIVE WORKFLOW INTEROPERABILITY FRAMEWORK IN THE CASE OF DOMINO WORKFLOW AND MICROSOFT EXCHANGE 2000 SERVER

A Thesis submitted to the Graduate School in full fulfilment of the requirements for the degree Master of Science (Information Technology), Universiti Utara Malaysia

by
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ABSTRAK

Kewujudan produk Pengurusan Aliran Kerja (*WFMS*) yang banyak di dalam pasaran membolehkan pengguna menggunapakai produk tertentu untuk memenuhi keperluan aplikasi yang khusus. Walaubagaimanapun, ciri-ciri sedia ada *WFMS* tidak dapat menyokong kebolehoperasian antara produk *WFMS*. Kegagalan untuk kebolehoperasian ini boleh menyebabkan berlakunya pulau-pulau otomasi proses yang tidak serasi di dalam organisasi atau pun di antara organisasi.

Penyelidikan ini memperkenalkan kaedah bagi merealisasikan kebolehoperasian aliran kerja antara *Domino® Workflow* dari *Lotus® Corporation* dan *Microsoft® Exchange 2000 Server* dari *Microsoft Corporation*. Pada peringkat akhir penyelidikan ini, kaedah yang digunakan telah dapat mengurangkan masalah di dalam strategi, peringkat dan model kebolehoperasian antara produk *WFMS* berbeza yang wujud di antara organisasi dan jabatan.

Bagi merealisasikan kebolehoperasian aliran kerja, penyelidikan ini mengadaptasikan pendekatan Pembangunan Sistem yang terdiri daripada lima peringkat. Peringkat pertama adalah membentuk rangka kerja kebolehoperasian aliran kerja antara dua produk secara konsep. Peringkat kedua pula membangunkan senibina sistem. Pada peringkat ini peralatan-peralatan untuk kebolehoperasian dianalisis. Kemudiannya hanya dua peralatan sahaja dipilih iaitu *Microsoft Exchange Connector for Lotus Notes* dan *Extensible Markup Language (XML)* bagi piawaian *Document Object Model (DOM)*. Peralatan ini kemudian dimodelkan bersama *Domino Workflow* dan *Microsoft Exchange 2000 Server* di dalam senibina sistem. Peringkat ketiga adalah analisis dan merekabentuk sistem. Pada peringkat ini proses bisnes yang khusus iaitu permohonan cuti dipilih untuk direkabentuk sebagai prototaip. Peringkat keempat pula ialah membangunkan sistem (prototaip) untuk menunjukkan peralatan kebolehoperasian berfungsi secara praktikal. Pada peringkat akhir pula, sistem tersebut dinilai bagi mengesahkan kecekapan peralatan kebolehoperasian yang digunakan.

Berdasarkan kepada prototaip yang dibangunkan, dapat disimpulkan bahawa penggunaan *Microsoft Exchange Connector for Lotus Notes* dan *XML* bagi piawaian *DOM* dapat merealisasikan kebolehoperasian aliran kerja antara *Domino Workflow* dan *Microsoft Exchange 2000 Server*, di mana model *Nested Sub-process* dan *Parallel Synchronised* telah dapat dicapai. Dokumen-dokumen (tugas-tugas) antara kedua-dua persekitaran dapat ditukar antara satu sama lain menggunakan *XML* bagi piawaian *DOM* yang menepati peringkat *Limited Common Application Programming Interface (API) Subset* dan kemudiannya dihantar antara satu sama lain menggunakan *Microsoft Exchange Connector for Lotus Notes* yang bersesuaian dengan strategi *Message Passing*.

ABSTRACT

The availability of a wide range of workflow management system (WFMS) products within the market has allowed users to adopt particular products to meet specific application needs. However, states of the art WFMSs do not have adequate features of interoperability among WFMSs. Failure of interoperability between WFMS products can cause incompatible "islands" of process automation within an organization or between organizations.

The research introduces method of realizing workflow interoperability between Domino® Workflow from Lotus® Corporation and Microsoft® Exchange 2000 Server from Microsoft Corporation. Towards the end of this research, the method used has alleviated the strategy, level and model of interoperability between different products that exist between organizations and departments.

To realize the workflow interoperability, this research adopted a System Development approach that consists of five stages. The first was to construct a conceptual framework of workflow interoperability between both products. The second was to develop a system architecture. In this stage, the tools of interoperability were analysed. Only two tools were chosen, i.e. Microsoft Exchange Connector for Lotus Notes and Extensible Markup Language (XML) of Document Object Model (DOM) standard. These tools then were modelled together with Domino Workflow and Microsoft Exchange 2000 Server in the system architecture. The third was to analyse and design the system. In this stage, a specific business process, i.e. leave application was selected to be developed as the prototype. The fourth was to build the prototype to demonstrate the practicality of the method used. Finally, the system was observed and evaluated to validate the effectiveness of the tools used.

From the developed prototype, it was concluded that the use of Microsoft Exchange Connector for Lotus Notes and XML of DOM standard realized the workflow interoperability between Domino Workflow and Microsoft Exchange 2000 Server. Two models of workflow interoperability were realised from the developed prototype, i.e. Nested Sub-process model and Parallel Synchronised model. Documents (tasks) from both environments were exchanged by the XML of DOM standard that complied with the *Limited Common Application Programming Interface (API) Subset* level. The documents were then transferred to each other by the Microsoft Exchange Connector for Lotus Notes that corresponded with the *Message Passing* strategy.

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LIST OF ABBREVIATIONS

ACL	Access Control List
AD	Active Directory
API	Application Programming Interface
BASIC	Beginner's All Purpose Symbolic Instruction Code
CDO	Collaboration Data Object
CEC	Digital's Applied Research Center
CORBA	Common Object Request Broker Agent
DLLs	Dynamic Link Libraries
DMA	Document Management Alliance
DOM	Document Object Model
DSS	Decision Support System
E-Business	Electronic Business
E-Commerce	Electronic Commerce
EAI	Enterprise Application Integration
ENC	European Networking Center
FSO	File System Object
GUI	Graphical User Interface
ID	Identification Data
IE	Information Engineering
IPSD	Interactive, Process-Oriented System Development
IPSI	Integrated Publication and Information Systems Institute
ISST	Institute for Software Engineering and Systems Engineering
IT	Information Technology
Mentor	Middleware for Enterprise-Wide Workflow Management
MIS	Management Information System
MoU	Memorandum of Understanding
OpenGL	Open Graphic Library
PDF	Portable Data Format
R5	Release 5
RDBMS	Relational Database Management Systems
RTF	Rich Text File
SAX	Simple API XML
SD	System Development
SMTP	Simple Mail Transfer Protocol
SQL	Structured Query Languauge
TP	Transaction Processing
URLs	Unified Resource Locators
UUM	Universiti Utara Malaysia
VBScript	Microsoft Visual Basic Scripts Edition
WfMC	Workflow Management Coalition
WFMS	Workflow Management System
XML	Extensible Markup Language

CHAPTER 1 INTRODUCTION

1.1 Background

Recent years have seen the focus of a number of issues for workflow. These include support for ensuring correctness of execution of workflows (Kamath and Ramamritham, 1996), ability to work with heterogeneous systems and at the same time provides high availability (Kamath et al., 1996), and integrating simulation modeling and analysis capabilities in workflow (Miller et al., 1995). These studies have addressed some of the limitations of workflow management system (WFMS) described by Georgakopoulos et al. (1995) and Alonso and Schek (1996) such as lack of interoperability among workflow management systems, lack of support for correctness and reliability, and weak tool support for analysis, modeling, testing and debugging workflows.

Apart from the efforts by individual or groups of individuals, an organization, known as the Workflow Management Coalition (WfMC), was established to address some of the issues in workflow. As stated in Workflow Management Coalition (1998a), the WfMC was founded in August 1993. It is a non-profit, international organization of workflow vendors, users and analysts. Some of the objectives of this organization are to develop workflow standard terminology and to enable interoperability between different workflow systems.

The WfMC has released several standards such as *Process Definition Tools Interface* (Workflow Management Coalition, 1999a), *Workflow Client Application Interface* (Workflow Management Coalition, 1997 and 1998c), *Invoked Application Interface* (Workflow Management Coalition, 1998c), and *Workflow Interoperability Interface* (Workflow Management Coalition, 1996 and 2000c). As stated in

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