“EFFECTIVE REPRESENTATION AND INTELLIGENT EXECUTION OF WORKFLOWS”

SOHAIL SAFDAR

Supervised By

Dr. SHEHZAD KHALID

A thesis submitted in partial fulfillment of the requirements for degree of MS (Software Engineering)

Department of Computer Sciences & Engineering

Bahria Institute of Management and Computer Sciences (BIM&CS)

BAHRIA UNIVERSITY ISLAMABAD

2008

ABSTRACT

The main objective of the research is to design an effective workflow representation and defining a model for intelligent and robust execution of workflows. An effective and powerful representation of workflows is formalized by comparing and analyzing different workflow representational techniques. The aim is to identify the pros and cons associated with them and hence modify the existing techniques appropriately to rectify the associated problems to acquire the workflow representation in much more detail and expressive way. The comparison and analysis of Petri-Nets and UML activity diagram directs us to use both of them hand in hand under the concept of CIMOSA- Workflow (C-Wf) model to represent the workflow through workflow activity diagram. C-Wf model and workflow activity diagram are then appropriately modified to rectify the identified problems and to provide more expressive, effective and powerful representation of workflows. The research also aims to provide an intelligent solution and algorithm for the execution of a workflow process by ensuring the data consistency, correctness, completeness among various tasks involved. The proposed solution provides a synchronized execution of a workflow activity, free of failure among various tasks involved in a workflow process. A synchronizing agent is bound at a very low level, i.e. with the workflow activity to assure the execution of task robustly. An algorithm is also provided to show the complete execution of workflow process. The research enhances the capabilities of workflow management systems by improving the expressiveness of workflows and by providing robust execution of workflows.

TABLE OF CONTENTS

Chapters			Pages
1-	**Introduction**		**1**
	1.1-	Introduction and Motivation	1
	1.2-	Problem Definition	2
	1.3-	Objectives	2
	1.4-	Structure of the Report	3
2-	**Workflow Management Systems: A Review**		**4**
	2.1-	Introduction	4
	2.2-	Components of Workflow Management Systems	5
	2.3-	Distributed Workflows	7
	2.4-	Advantages of WFMS	9
	2.5-	Summary	10
3-	**Workflow Representation: A Review**		**11**
	3.1-	Introduction	11
	3.2-	Basic Constructs of Workflows	11
	3.3-	Petri-Nets	13
	3.4-	UML (Unified Model Language)	15
		3.4.1- Activity Diagram	16
	3.5-	Petri-Nets vs. UML Activity Diagram	18
	3.6-	C-Wf Model	20
	3.7-	Workflow Activity Diagram	21
	3.8-	Meta-Process Model	23
	3.9-	Problems with Existing Workflow Representation	26
	3.10-	Discussion	27
	3.11-	Summary	28

4- Workflow Execution: A Review **29**

4.1- Introduction 29

4.2- Factors Affecting Workflows in Execution 29

4.2.1- Distribution of Data 29

4.2.2- Accessing Distributed Data 30

4.2.3- Connection Types for Network Services 31

4.2.4- Network Speed 32

4.3- Workflow Intelligence 33

4.4- ECA Model for Workflow Execution 35

4.5- Transactional Behavior of Workflows 36

4.6- Data Synchronization and Consistency related Issues in Distributed Workflows 37

4.7- Problems with the existing solution 38

4.8- Discussion 40

4.9- Summary 40

5- Proposed Workflow Representation **41**

5.1- Introduction 41

5.2- Proposed Workflow Representation 41

5.2.1- Solving the Problem of Missing Sub-Workflow Representation in C-Wf Model 41

5.2.2- Solving the Problem for Defining the Stereotype for Sub-Workflows 43

5.2.3- Solving the Problem of Maintaining State of Parent-Child workflows 43

5.3- Discussion 44

5.4- Summary 44

6- Proposed Model for Intelligent Workflow Execution 45

6.1- Introduction 45

6.2- Proposed Solution 45

6.3- Designed Synchronizing Agent 45

6.3.1- Components and working of synchronizing agent 46

6.4- Designed Workflow Activity 48

6.5- Proposed Workflow Activity in Light of ECA Model 48

6.5.1- Components and working of Workflow Activities 49

6.6- Proposed Model and Algorithm for Intelligent Workflow Execution 50

Step1- Loading and Configuring Workflow Process 50

Step2- Execution of Workflow Process 51

Step3- Signaling Workflow Completion to Workflow Server 54

6.7- Discussion 55

6.8- Summary 55

7- Conclusion 56

7.1- Contribution towards Workflow Representation 56

7.2- Contribution towards Workflow Execution 57

7.3- Future Work 58

References 59