Abstract

E-learning has become widely known method for delivering the lecture. However, several drawbacks occur in the current e-learning platform. For example, the client-server architecture platform will create a problem when the numbers of work load increase. Thus, we introduce the use of grid computing to solve the current problems in e-learning. The purpose of this thesis is to study the effectiveness of using grid computing to support e-learning.

To measure the effectiveness of using grid computing for e-learning, we defined several criteria for it. The criteria are affordability, availability, security, scalability, response time, and interface. Then, we will choose the solution that applicable toward those criteria. Since, we do not do a real implementation; we pick the other people’s solution which they had already implemented grid computing to support e-learning. They use Data Grid as their education grid. Then, we compare the Data Grid to the other solution of grid computing for e-learning based on those criteria.

The output of this thesis is the applicability of those criteria to the Data Grid. In Data Grid, it is able to integrate idle computer resources to complete the task. With this technique, we are able to save the cost for investing in hardware and infrastructure. Almost all criteria are applicable to the Data Grid solution.

The implementation of grid computing could solve the current problems in e-learning. To have an obvious result of the effectiveness of using grid computing for e-learning, we need to do an actual implementation and have more resources. We also need to consider the human resource aspect in order to use grid computing for e-learning.

Keywords: E-learning, Grid Computing, Data Grid.
This thesis is written as the evidence that I have conducted an acceptable research in computer science field. This thesis is the final work during my undergraduate study. It focuses on the effectiveness of using grid computing to support electronic learning (e-learning). As we know that e-learning has become popular teaching method during recent years. With all drawbacks and advantages that e-learning have, I hope that this thesis will assist other people to develop grid computing as the effective way to do e-learning.

During the completion of my thesis, many supports have been given to me. First, I would like to thank to my entire family member: my father, my mother, my sister, and my brother. They have been so supportive throughout my thesis writing, and without their encouragement I would not found the energy or time to complete this thesis.

I would like to thank to my supervisor, Mr. Tri A. Budiono for his guidance, advice, compassion. His assistance was a significant contribution to the completion of this thesis. I would also like to thank the entire lecturer from Computer Science major at Bina Nusantara University International for their knowledge, dedication and support throughout my undergraduate study. Most of all I would like to thank God, for all his blessings and love.
TABLE OF CONTENTS

Cover Page................................................................. i
Title Page................................................................. i
Certificate of Defense Approval........................................... ii
Abstract................................................................. iii
Preface................................................................. iv
Table of Contents....................................................... v
List of Tables........................................................... ix
List of Figures.......................................................... x

CHAPTER 1 INTRODUCTION.............................................. 1

1.1. Background....................................................... 1
1.2. Scope............................................................. 4
1.3. Aim and Benefit.................................................. 5
1.4. Hypothesis....................................................... 5
1.5. Structure......................................................... 6
CHAPTER 2 THEORITICAL FOUNDATION

2.1. Theoretical Foundation

2.1.1. Electronic Learning System

2.1.2. Grid Computing

2.1.2.1. Terms and Concepts

2.1.2.1.1. Virtual Organizations

2.1.2.1.2. Type of Resources

2.1.2.1.2.1. Computation

2.1.2.1.2.2. Storage

2.1.2.1.2.3 Communications

2.1.2.1.3. Jobs And Applications

2.1.2.1.4. Scheduling, reservation, scavenging

2.1.2.2. Grid Architecture

2.1.2.2.1. Fabric Layer

2.1.2.2.2. Connectivity Layer

2.1.2.2.3. Resource Layer

2.1.2.2.4. Collective Layer

2.1.2.2.5. Application Layer

2.1.2.3. Grid Infrastructure

2.1.2.4. Type of Grids

2.1.3. Grid for E-learning

2.2. Theoretical Framework

2.2.1. Criteria
2.2.2. Evaluation Metric.............................................. 30

CHAPTER 3 PROBLEM ANALYSIS........................................... 31

3.1. Current Problems.................................................. 31
3.2. Proposed Solution.................................................. 34
    3.2.1. Existing Solution.............................................. 34
    3.2.1.1. Web Service Architecture for E-learning.............. 34
    3.2.1.2. Semantic Web for E-learning.......................... 36
    3.2.2. Our feasible solution...................................... 39

CHAPTER 4 SOLUTION DESIGN........................................ 40

4.1. Use-case diagram................................................. 40
4.2. Globus Toolkit.................................................... 43
4.3. Data Grid........................................................ 46
4.4. Grid Portal....................................................... 48

CHAPTER 5 IMPLEMENTATION........................................ 51

5.1. Hardware and Software Configuration.......................... 51
5.2. The Front End – Grid Portal..................................... 52
5.3. The Back End – Data Grid Contents............................ 53
5.4. Data Grid Implementation..................................... 54
5.5. SCO Repository.................................................. 59
List of Tables

Table 2.1 Criteria for Measuring the Effectiveness of Grid Computing............ 30

Table 5.1 Hardware Configuration of Grid Nodes........................................... 51

Table 6.1 The Acceptance of Criteria toward Different Grid Architectures........ 69
List of Figures

Figure 2.1 General View of Learning Management System.......................... 9

Figure 2.2 An application is one or more jobs that are scheduled to run on grid.. 15

Figure 2.3 The Layered Grid architecture ................................................. 18

Figure 2.4 Grid Computing Infrastructure ................................................. 24

Figure 3.1 The Architecture of LearnServe ................................................. 36

Figure 3.2 The Architecture of E-learning Portal Using Semantic Web.......... 37

Figure 3.3 Proposed Architecture of Grid Computing for E-learning............. 39

Figure 4.1 Use-case Diagram for E-learning System................................... 40

Figure 4.2 The Globus GT3 Core Architecture.......................................... 44

Figure 4.3 Data Grid Architecture............................................................ 46

Figure 4.4 OCGE Grid Portal Architecture ................................................. 50

Figure 5.1 E-learning System Framework.................................................. 53

Figure 5.2 E-learning Portal Framework.................................................... 55

Figure 5.3 SCO Data Grid Platform .......................................................... 58

Figure 6.1 SandS VO Architecture............................................................ 64

Figure 6.2 Grid Design of OntoEdu ........................................................... 67