# CLOUD COMPUTING IN HIGHER INSTITUTION: A TOOL TO CALCULATE TOTAL COST OF OWNERSHIP COMPARISON BETWEEN TRADITIONAL COMPUTING AND CLOUD COMPUTING

NUR LIYANA CHE OMAR

UNIVERSITI UTARA MALAYSIA

2012

**KOLEJ SASTERA DAN SAINS**
**(College of Arts and Sciences)**
**Universiti Utara Malaysia**

**PERAKUAN KERJA KERTAS PROJEK**
***(Certificate of Project Paper)***

Saya, yang bertandatangan, memperakukan bahawa
*(I, the undersigned, certifies that)*

**NUR LIYANA CHE OMAR**
**(806291)**

calon untuk Ijazah
*(candidate for the degree of)* **MSc. (Information Technology)**

telah mengemukakan kertas projek yang bertajuk
*(has presented his/her project of the following title)*

**CLOUD COMPUTING IN HIGHER INSTITUTION:**
**A TOOL TO CALCULATE TOTAL COST OF OWNERSHIP COMPARISON BETWEEN TRADITIONAL COMPUTING AND CLOUD COMPUTING**

seperti yang tercatat di muka surat tajuk dan kulit kertas projek
*(as it appears on the title page and front cover of project)*

bahawa kertas projek tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan.
*(that this project is in acceptable form and content, and that a satisfactory knowledge of the field is covered by the project).*

Nama Penyelia
*(Name of Supervisor)* : **ASSOC. PROF. NAZIB NORDIN**

Tandatangan
*(Signature)* : _____ Tarikh (Date) : 1/2/2012

Nama Penilai
*(Name of Evaluator)* : **MISS. JUHAIDA ABU BAKAR**

Tandatangan
*(Signature)* : _____ Tarikh (Date) : 1/2/2012

## PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirements for a postgraduate degree from the Universiti Utara Malaysia, I agree that the University Library may make it freely available for inspection. I further agree that permission for copying of this thesis in any manner in whole or in part, for scholarly purposes may be granted by my supervisor(s) or in their absence by the Dean of Awang Had Salleh Graduate School of Arts and Sciences. It is understood that any copying or publication or use of this thesis or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to Universiti Utara Malaysia for any scholarly use which may be made of any material from my thesis.

Requests for permission to copy or to make other use of materials in this thesis, in whole or in part, should be addressed to

Dean of Awang Had Salleh Graduate School

of Arts and Sciences Universiti Utara Malaysia

06010 UUM Sintok

Kedah Darul Aman

Malaysia

## ABSTRACT

The aim of this study is to do the comparison of Total Cost of Ownership (TCO) between Traditional Computing and Cloud Computing in higher institution. The higher instution that are choosen is University Malaysia Perlis (UniMAP). The problem addressed by this study is currently UniMAP Data Center use the Traditional Computing which are difficult to maintain, requires more data center space, large storage and server. This study help to compare and determine which computing technology is more cost effective. This study proposes solution using Cloud Computing as a lower cost option. There are five steps for creating a Total Cost of Ownership analysiswhich are project initiation, cost modelling, cost collection, evaluating and final report and ongoing refinement of the TCO Model. To calculate the TCO comparison, a tool to calculate the total cost of ownership (TCO) for both Traditional Computing and Cloud Computing will be done by using Microsoft Excel. This study compares the Traditional Computing and Cloud Computing over a period of 5 years.

# ABSTRAK

Tujuan kajian ini adalah untuk membuat perbandingan Kos Jumlah Pemilikan (TCO) antara Pengkomputeran Tradisional dan Pengkomputeran Awan di institusi tinggi. Institusi yang dipilih adalah Universiti Malaysia Perlis (UniMAP). Masalah yang ditangani oleh kajian ini adalah pada masa ini ialah Pusat Data UniMAP menggunakan teknologi Pengkomputeran Tradisional yang sukar untuk diselenggara, memerlukan lebih banyak ruang di pusat data, storan besar dan lebih banyak pelayan. Kajian ini membantu untuk membandingkan dan menentukan teknologi pengkomputeran yang lebih kos efektif. Kajian ini mencadangkan penyelesaian menggunakan Pengkomputeran Awan sebagai pilihan kos rendah. Terdapat lima langkah untuk mewujudkan Total Kos analisis Pemilikan, iaitupermulaan projek, pemodelan kos, pengumpulan kos, menilai dan laporan muktamad dan perbaikan berterusan bagi model Total Kos analisis Pemilikan (TCO. Untuk mengira perbandingan TCO, alat untuk mengira jumlah kos pemilikan (TCO) bagi kedua-dua Pengkomputeran Tradisional dan Pengkomputeran Awan akan dilakukan dengan menggunakan Microsoft Excel. Kajian ini membandingkan Pengkomputeran Tradisional dan Pengkomputeran Awan sepanjang tempoh 5 tahun.

## ACKNOWLEDGEMENT

In the name of Allah , the Most Gracious and the Most Merciful

Alhamdullilah, praise to Allah SWT for guiding, blessing me and for the strength in completing this thesis. Special appreciation goes to my supervisor Prof. Madya Nazib B. Nordin for his supervision, patience, motivation and constant support. His guidance helped me in all the time of this master project. Not forgotten my evaluator Pn. Juhaida Bt. Abu Bakar for her support regarding this project.

Sincere thanks to all my friends especially Nabilah, Tahirah, Asna, Zaihasrina, Noraini, Afifa and Khalidah and others for their kindness and moral support during my study. Thanks for the friendship and memories.

Last but not the least, my depest gratitude goes to my beloved mother; Pn. Hasnah Bt. A. Halim, my parents in law; Pn. Norzainah Bt. Abd. Hamid and En. Sukri B. Johari and also to my sister and brother in law for their prayers and encouragment. Also not forgetting my beloved husband, Norfarhan B. Sukri for his love and care. To those who indirectly contributed in this project, your kindness means a lot to me. Thank you very much.

**TABLE OF CONTENT**

APPENDICES

**LIST OF TABLE**

**LIST OF FIGURE**

## LIST OF ABBREVIATIONS

| | |
|---|---|
| TCO | Total Cost of Ownership |
| ICT | Information and Communication Technology |
| UniMAP | Univerisiti Malaysia Perlis |
| SaaS | Software as a Service |
| PaaS | Platform as a Service |
| IaaS | Infrastructure as a Service |
| HaaS | Hardware as a Service |
| OS | Operating System |
| kW | Kilo Watt |
| UPS | Uninterruptible Power Supply |
| GB | Gigabyte |
| MB | Megabyte |
| KB | Kilobyte |

# CHAPTER ONE

# INTRODUCTION

## 1.1 Introduction

Cloud Computing is the fifth generation of Computing after Mainframe, Personal Computer, Client-Server Computing and web. The term Cloud itself is refers as the internet and the term Cloud Computing refers as the computation which are done through the internet. Cloud Computing can be describe as an Internet-Based computing in which users can access all shared resource, software and information through the Internet from anywhere.

Nowadays most of the organization, business application and as well as higher institution are moving to the Cloud Computing because of the cost savings that its offered. For this study the higher instituition which isUniversity Malaysia Perlis (UniMAP) is selected. UniMAP data center house all ICT services that currently running on Traditional Computing. With the development of the campus, the increasing number of staffs and students, ICT services are on demand. The increasing number of system applications lead to the difficulties of maintaining IT infrastructures or application software individually.

The Traditional Computing which are currently running at UniMAP Data Center are become complicated and expensive. The increasing number of system application requires more space in the data center, higher network bandwidth, server

The contents of the thesis is for internal user only

## REFERENCES


Abdullah, J. (2010). Investigating Interactive Visualisation in a Cloud Computing Environment.

Aggarwal, S.&McCabe, L.(2005). The Compelling TCO Case for Cloud Computing in SMB and Mid-Market Enterprise.

Amazon.com (2009). Amazon EC2 Cost Comparison Calculator. Retrived from World Wide Web on October 10, 2011 at http://media.amazonwebservices.com/User_Guide_Amazon_EC2_Cost_Comparison_Calculator.pdf

American Power Conversion. (2003). Determining Total Cost of Ownership for Data Center and Network Room Infrastructure.

Andreescu, M. M. a. A. L. (2011). "Using Cloud Computing in Higher Education : A Strategy to Improve Agility in the Current Financial Crisis." 15.

Caintic, V.I.(2010). Cloud Computing for Network Libraries and Information Centers.

Cheng J. (2007). Google and IBM team on Cloud Computing initiatives for universities. Retrieved from World Wide Web on August, 2011 at http://arstechnica.com/hardware/news/2007/10/google-and-ibm-team-on-cloud-computing-initiative-for-universitiesgoogle-and-ibm-team-on-cloud-computing-initiative-for-universities.ars

CloudOne (2010). Component of Total Cost of Ownership. Retrived from World Wide Web on September 10,2011, at http://www.spectrum-systems.com/white_papers/wp_components_of_TCO.pdf

Coupa (2011). Total Cost of Ownership, compare the TCO for an on-premise vs. On-demand solution. Retrieved from World Wide Web on November, 2011 at http://www.coupa.com/resources/calculators/total-cost-of-ownership/

Dave P. (2009). Introduction to Cloud Computing. Retrieved from World Wide Web on October, 2011 at http://dotnetslackers.com/articles/sql/Introduction-to-Cloud-Computing.aspx

DeCusatis, C. (2010). Cloud Computing Pilots for Enterprise Data Center Applications.

Dell, Inc. (2004). Printer Total Cost of Ownership Assessment White Paper.

Educause. (2009). 7 Things You Should Know About Cloud Computing.

Erkoc, M. F. &Kert, S.B. (2010). Cloud Computing for Distributed University Campus : A Prototype Suggestion.

Federal Electronics Challenge (2007). Answer to Frequent Questions: Total Cost of Ownership. Retrieved from World Wide Web on October, 2011 at http://www.federalelectronicschallenge.net/resources/docs/costofown.pdf

Frank (2011). Cloud Computing for Business. Retrived from World Wide Web on October 09, 2011 at http://officeonlineinthecloud.com/439/cloud-computing-for-businesses/

Golden B. (2010). Five tips for evaluating the TCO of a cloud application. Retrived from World Wide Web on September, 2011 at http://searchcloudcomputing.techtarget.com/Five-tips-for-evaluating-the-TCO-of-a-cloud-application

Golden B. (2011). The case against Cloud Computing, Part One. Retrived from World Wide Web on September, 2011at http://www.cio.com/article/477473/The_Case_Against_Cloud_Computing_Part_One

Google, Inc. (2009). Cloud Computing – Latest Buzzword or a Glimpse of the Future?

Hurwitz J., Bloor R., Kaufman M. &Halper F. (2010). Cloud Computing for Dummies. Wiley Publishing , Inc.

HyperOffice. (2008). Total Cost of Ownership Analysis HyperOffice vs. MS Exchange.

i-Newswire (2011). Cumulux Release Free Cloud Computing TCO Calculator. Retrived from World Wide Web on November 18,2011 at http://www.i-newswire.com/cumulux-releases-free-cloud-computing/8009.

Ivailo, P. (2009). Cloud Computing : Overview, Concepts and Business Deployment Scenarios.

Jakobsen K, & Staavi S.U. (2009). Proposal of Global Total of Cost of Ownership Model for FMC Technologies Supplier.

Katz, R., Goldstein, P., & Yanosky, R. (2009). Cloud Computing in Higher Education.

Knorr E. &Gruman G. (2010). What Cloud Computing really means. Retrieved from World Wide Web on October, 2011 at http://www.infoworld.com/d/cloud-computing/what-cloud-computing-really-means-031?page=0,1

Konschak C. &Felt P.(2000). Understanding the Total Cost of Ownership (TCO) analysis for IS in the health, Retrived from World Wide Web on October, 2011 athttp://www.divurgent.com/images/TotalCostofOwnership.pdf

Koomey, J (2008). A Simple Model for Determining True Total Cost of Ownership for Data Centers.

Lam M. (2010). Lower Total Cost of Ownership of One-Net by Using Thin-Client Desktop Deployment and Virtualization-Based Server Technology.

Lamba, H. S. S., G. (2011). "Cloud Computing-Future Framework for e-management of NGO's." **2**.

Mathur, V. (2010). Education for a Smarter Planet:Cloud Computing in Education .

McCabe L. (2010). What is TCO and why you should care? Retrived from World Wide Web on August, 2011 at http://www.smallbusinesscomputing.com/testdrive/article.php/3861646/What-is-TCO-and-Why-Should-You-Care.htm

Menasce, D. A.& Ngo, P. (2009). Understanding Cloud Computing : Experimentation and Capacity Planning.

Neto, P. (2011). Demystifying Cloud Computing.

QuinStreet, Inc. (2011). TCO. Retrived from from World Wide Web on October 19, 2011 at http://www.webopedia.com/TERM/T/TCO.html

RackSpace (2011). Managed Private Cloud. Retrived from World Wide Web on November 10,2011 at http://www.rackspacehosting.com.my/hosting-solution/private-cloud.php?CMP=PPC_MY_Google_T1-PrivateCloud_Broad&gclid=CNfZ0LDH660CFccc6wodWX916w

Rajan, S. & Jairath A. (2011). Cloud Computing : The Fifth Generation of Computing.

Rashid, O. &Weigelt, J. (2011). Cloud Computing in Government.

Real Time Data Services, LLC.(2011). Cloud Computing TCO Benefits. Retrived from World Wide Web on October 13, 2011 at http:// http://www.myrealdata.com/cloud-computing-tco-benefits.html

RealVPS (2011). Cloud Servers: A Lower Total Cost of Ownership (TCO). Retrived from World Wide Web on September 02,2011 at http://www.realvps.com/blog/cloud-servers-a-lower-total-cost-of-ownership-tco/

RightScale Cloud Management Platform (2011).Cloud Computing Calculator.Retrievedfrom World Wide Web on October 20,2011 at http://www.rightscale.com/tco-calculator/

Roussev, V., Richard, G. & Bilar, D. (2009). Security Assessment of Cloud Computing Vendor Offerings.

SilverStr (2008). The TCO of Cloud Computing vs In House IT. Retrived from World Wide Web on August 19, 2011 athttp://silverstr.ufies.org/blog/archives/001062.html

SKALICloud (2011). Pricing. Retrieved from World Wide Web on September, 2011 athttp://www.skalicloud.com/cloud-pricing/

Socomec (2011). A Quotation To Design and Build for UniMAP Data Center.

Stevens, M.R. (2008). The Saas vs. On Premise TCO Calculator.

Strickland J. (2011). How Cloud Computing works. Retrived from World Wide Web on August, 2011 at http://computer.howstuffworks.com/cloud-computing/cloud-computing.htm

VMware, Inc. (2011). Reducing Server Total Cost of Ownership with VMware Virtualization Software. Retrived from World Wide Web on September 22,2011 at http://www.wmware.com

VMware, Inc. (2011). VMware TCO/ROI Methodology. Retrived from World Wide Web on September 22,2011 at http://www.wmware.com

Woodford C. (2011). Cloud Computing. Retrieved from World Wide Web on October, 2011 at http://www.explainthatstuff.com/cloud-computing-introduction.html