G-Net 2000

A Network Management System for UNIMAS Virtual Campus

by

Gokula Krishnan Subramaniam

A report submitted

In partial fulfillment of the requirements for the degree

Of Bachelor of Information Technology

Faculty of Information Technology

UNIVERSITY MALAYSIA SARAWAK

March 2001

Acknowledgement

This thesis would not have been successful if not for the contribution of many individuals that have helped in one way or another. Hence I would like to take this opportunity to thank the following people.

First and foremost, I would like to thank my supervisor, Asoc. Prof. Narayanan Kulathuramaiyer for his constant support, guidance and abundant ideas that had one way another influenced the development of this thesis into a full fledge Network Management System.

My sincere thanks to Mr. Ahmad Akhzan of UNIMAS, Mr.Haniff Khoo of Motorola Multimedia Sdn. Bhd. and the network operations center (NOC) of UNIMAS for having tested and evaluated G-Net 2000 within their Local Area Network. Their testing and evaluation had helped rectify many software bugs that existed within the prior version of G-Net 2000.

I would also like to thank my friends, especially my housemates, Iskandar and Sugatha for the support and encouragement given. A word of thanks is also conveyed to the staff of The Center for Applied Learning and Multimedia (CALM) for accommodating me in their premises throughout the development period of G-Net 2000.

Last but not least, I would like to thank my dearest family, my parents Mr. and Mrs. Subramaniam, brother Siva Kumar Subramaniam and sister Gowri Subramaniam for all their love, care and support that have kept me constantly motivated towards success.

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ABSTRACT

With the introduction of Information, Communication and Technology (ICT) in education, a new paradigm in learning called E-learning has replaced the conventional method of education. E-Learning, which is the key entity of the UNIMAS Virtual Campus, relies on a networked computer environment to facilitate communication between knowledge providers and knowledge seekers. Hence there is great pressure on network service providers to provide their customers with the best possible quality of service when it comes to network availability and reliability. A professional and systematic approach to Network Management is needed, in order to minimize network outage. G-Net 2000 Network Management System is developed to help network administrators of UNIMAS Virtual Campus to manage their networks efficiently. The approach to network management in this thesis is based on the Open System Interconnections (OSI) network functional model. The components of G-Net 2000 address all five functional areas of this model, namely configuration management, fault management, security management, accounting management and performance management. The successful real time implementation of G-Net 2000 also opens a new world of possibilities for future research work to be done in the field of Network Management in UNIMAS.

ABSTRAK

Perkembangan sector ICT telah membawa kepada suatu paradigma baru yang kenali sebagai E–pendidikan yang mula mengantikan system pendidikan konvensional yang sedia ada. Kampus maya UNIMAS adalah berasakan kepada konsep ini. Asas kepada E-Pendidikan adalah rangkaian perkomputeran yang di hubungkan terus kepada Jaringan Web Sedunia (WWW). Ini telah menyebabkan tekanan kepada pembekal khidmat Internet "ISP" untuk memberikan perkhidmatan rangkaian yang berkualiti dan bermutu. Untuk mengelakkan kegagalan pada system rangkaian komputer , suatu pendekatan yang lebih professional dan sistematik haruslah diambil dalam pengurusan rangakain. G-Net 2000 telah di bangunkan untuk membantu dalam pentadbiran rangkaian komputer kampus maya UNIMAS. Pendekatan kepada pengurusan rangkaian yang diambil didalam tesis ini adalah berasaskan kepada model perfungsian pengurusan rangkaian "Open System Interconnections" (OSI). Komponen – komponen yang dibangunkan di dalam G-Net 2000 merangkumi kesemua 5 bahagian berfungsi model ini yakni pengurusan konfigurasi, pengurusan kegagalan fungsi, pengurusan keselamatan, pengurusan perakaunan dan pengurusan kecekapan. Dengan berjayanya implementasi G-Net 2000, terbukalah suatu lembaran baru dalam bidang pengurusan rangkaian. Selain daripada tu, kajian selanjutnya juga boleh dilakukan dalam bidang ini di UNIMAS.

Chapter 1

An Overview

1.1 Background

In the next decade an impressive growth is to be expected in the use of communication networks. To initialize and optimize the operations of these networks, good management facilities must be developed. The importance of research in this area is confirmed by a number of studies that show the state of current networks.

A study in the UK for example showed that LANs go down an average of twenty times a year and subsequently stay out of service for more than four hours [DATA COMMUNICATIONS, 1991]. A study in the US showed that every hour of LAN interoperability, 'Fortune 1000' companies loose more than $30,000 [SAAL.H.,1991]. The nine hours breakdown of AT&T's long-distance telephone network in January 1990 resulted in a $60 million to $75 million loss in AT&T's revenues [DEWITT.P.E,1990].

It might be impossible to run a network without failures but it is definitely possible to run a network with minimum failures. Many big organizations around the world are adopting new policies and strategies, which minimizes

network downtime by utilizing various network management techniques and recovery procedures.

One notable policy is the 5 9's policy or 99.999% system availability policy practiced by Motorola Inc. International. In the case of Motorola, they strive to provide at least 99.999% system availability at all times [RAJ.T.,2000]. With these policies well in place, companies can now concentrate on their primary business needs and avoid thinking of network failures. However just by formulating policies alone, failures will not be minimized, but good network management systems are needed to achieve these goals.

As more and more companies get wired, the task of managing these networks becomes more complex and challenging. With the Internet growing at an immeasurable speed, users worldwide are worried about many issues and threats brought about by this new phenomena called the World Wide Web (WWW). Corporate users especially are getting worried about issues such as hacking, intrusion, virus and other computer security related matters, which may cripple million dollar companies overnight.

Hence to avoid such things from occurring, good and effective network management policies and effective tool usage must be employed. It is an undeniable fact that good network management tools packed with strong

management policies are the key to minimizing networks failures and thus saving organizations millions of dollars caused by network failures.

This Introduction chapter will focus on the basic definition of Network Management with specific interest on network management needs for Universiti Malaysia Sarawak's (UNIMAS) Virtual Campus network. It will also specify the problem statements, objectives, project scope and also project significance to UNIMAS.

1.2 What is Network management

In literature several definitions of network management exist [CCITT,1992],[CFSA150,1991],[ISO7498-4,1989]. Most of these definitions are produced by standardization organizations, which use specific terminology and aim their definitions at specific fields of application. But however for the scope of this thesis, it is necessary to parameterize the definition of Network management to cater for the needs of UNIMAS Virtual Campus.

Definition : Network Management is a constant act of initializing, monitoring and modifying the operation of a network to provide the users with the highest possible quality of service at all times.

This implies that the act of network management has many different phases starting from initializing the various network systems. Upon the success of initialization, the network comes into service and the operational phase starts. During this phase, management monitors the various network systems to check if no errors occur. In case of failures, malfunctioning systems will be identified, isolated and repaired. If systems cannot be repaired, they will be replaced by new systems, which must be initialized too.

Prior to the beginning of this thesis, ample time had been spent researching into the field of Network Management. This is necessary to truly understand the fundamental elements of Network Management that need to be addressed in this thesis. Details on the research done are included in the coming chapter (Chapter 2 : Introduction To Network Management).

1.3 Problem Statement

1.3.1 Goal Of Network Management

The ultimate goal of network management is to reduce if not completely, network failures while providing the end user with the best possible quality of service. This same goal applies to UNIMAS and it's virtual campus project. At present, UNIMAS does not have a well structured policy and Network Management System to manage it's networks. This has led to the following problems.

1.3.2 Security threats

Administrators of common networks in the corporate world usually have only once concern, external intruders trying to intrude into their internal network, to steal data. But in the case of a University or UNIMAS in specific, trouble comes from both inside the intranet and also from the outside world of the Internet.

In the past, UNIMAS System Administrator's have had to deal with many hacking attempts from within the University campus itself. Being inside and within the boundaries of University Firewalls makes entry to prudent servers

by these hackers much easier. Hence security is among the main network management issues that need to be addressed here. Currently, UNIMAS network administrators employ various different security solutions to perform various different security tasks. However there isn't' a single low cost solution to do all these tasks.

1.3.3 Network Discovery

Looking at the physical network itself, having to manage over 1000 computers isn't an easy task. At any given time, it's impossible for the administrators to know exactly which computer is in which segment of the network and running which IP. Currently, there isn't any form of mechanism employed by UNIMAS for IP management and also network discovery to log all the users that are online. Some networks can be real messy and it will take days if not weeks to understand the flow of data within a network. Without the aid of good network diagnostic and discovery tools, it is almost impossible to physically understand your network.

Good network diagnostic tools such as Ping, Trace routes, Finger, Ns lookup, OS identifiers, port scanner's and domain scanners will help Network Administrators perform network discovery and gather data on available network resources.

1.3.4 Not Knowing the Occurrence of Failures

Another problem faced by many network administrators are the insufficient knowledge on the occurrence of failures. When a system goes down, it notifies no one about the failure (fault management). So how will the network administrator know about the occurrence of a failure? Though most of today's expensive UPS (Uninterrupted Power supply) have the ability to send an automated email or voice email to the Network Administrator, this usually happens only in the event of a power failure. There's no way the network administrator may be informed automatically when a system malfunction's or stop responding.

1.3.5 Student Activity monitoring

In the case of UNIMAS Virtual Campus, amongst it's attributes are the Virtual Classroom concept where students and lecturers are in different geographical locations. The possibility for education to still go on is achieved with the aid of new technologies such as Video Conferencing and other distributed computer technologies.

In such an environment, it is hard to monitor student activities. How will the lecturer know what exactly a student is doing when a class is supposed to go on? Since the lecturer can't physically see the student, there must be some way to monitor his or her existence. These are among the problems faced by UNIMAS in its implementation part of the UNIMAS Virtual Campus.

1.4 Objectives

With the above-mentioned problems, the following are the initial objectives set to be achieved in this thesis.

1.) To research into the field of Network Management and truly understand the requirements and elements that it is made up of. Next, to match the requirements of the generic network management model with the requirements of the UNIMAS Virtual Campus.

2.) To review existing technologies and applications that provide network management functionalities. To identify their limitations, which could be enhanced in this thesis.

3.) To formulate a project methodology to guide the successful completion of this thesis within the given two semester time frame. This thesis methodology will closely follow the industry standard system development life cycle (SDLC) process.

4.) To design and implement a network management system (NMS), called G-Net 2000 that is capable of managing UNIMAS Virtual Campus Local Area Networks. G-Net 2000 will be developed for use on the Microsoft Windows platform. It will comprise of the following 6 main components;

i. Network Discovery components
ii. Network Diagnostic components
iii. System/IP Management components
iv. Domain Management components
v. Network Security components
vi. Remote Monitoring components

5.) To perform testing and evaluation on G-Net 2000. This includes the distribution of the G-Net 2000 to internal and external beta testers.

6.) To write up a complete report comprising of the thesis findings. This report will also discuss comprehensively the research done on network