

INTERNET QUOTA MANAGEMENT SYSTEM

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ABSTRACT

This project is developed mainly as a requirement of the degree that is being pursued. The project is titled Internet Quota Management System (IQMS) serving the purpose of managing Internet access quota for students of the Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak. The expected outcome of this project is to optimize the Internet speed in campus especially during peak hours which suffer major traffic bottleneck. Upon implementation of this system, it is hoped that the issues concerning slow Internet access in campus at least reduced to allow a better and feasible environment for students and staffs to access the Internet in campus. This system is a combination of open source web-based development, network administration and software development all in one in order to provide an efficient and user-friendly system

ABSTRAK

Projek ini dibina bagi memenuhi syarat untuk program ijazah yang sedang diikuti. Projek ini bertajuk “Sistem Pengurusan Kuota Internet” bertujuan mengurus jumlah kuota bagi akses Internet para siswa/wi di Fakulti Sains Komputer dan Teknologi Maklumat, UNIMAS. Harapan atau jangkaan sistem ini adalah untuk mengoptimiskan kelajuan penggunaan Internet di kampus terutamanya pada waktu puncak penggunaannya yang pada kebiasaannya mengalami kesesakan yang melambatkan akses Internet. Apabila sistem ini dilaksanakan, masalah-masalah berkenaan akses yang lambat sedikit-sebanyak dapat dikurangkan bagi menambah kesempurnaan dan keselesaan para siswa/wi dan staf-staf di kampus mengakses Internet. Pembangunan sistem ini adalah melibatkan gabungan pembangunan sistem web yang berorientasikan teknologi “Open Source”, pentadbiran sistem rangkaian dan pembangunan perisian bertujuan menghasilkan sistem yang interaktif dan efisien.

TABLE OF CONTENTS

ACKNOWLEDGEMENT	ii
ABSTRACT	iii
ABSTRAK	iv
TABLE OF CONTENTS	v-viii
LIST OF FIGURES	ix-xi
LIST OF TABLES	xii
CHAPTER 1: INTRODUCTION	
1.1 Project Description	1
1.1.1 Project Overview	1
1.2 Problem Statement	3
1.3 Objectives	4
1.4 Scope	
1.4.1 General Implementation Scope	5
1.4.2 System Scope	5
1.5 Significant Of Research	7
1.6 Project Report Outline	7
CHAPTER 2: SYSTEM REVIEW	
2.1 Objective Review	10
2.2 Reviews On Similar Existing System	

2.2.1	Monash University: <i>Internet Billing and Quota Management System</i>	11
2.2.2	University of Wollongong, Australia: <i>Internet Quota Management System</i>	13
2.3	Reviews On Tools And Technology Used	
2.3.1	L.A.M.P Model	15
2.3.1.1	Linux Operating Systems	16
2.3.1.2	Apache Web Server	16
2.3.1.3	MySQL	17
2.3.1.4	PHP	18
2.3.2	SQUID Web Proxy Server	18
2.3.3	Webmin-1.170 Linux system interface	20
2.3.4	SquidFire 1.30	20
2.4	Conclusion	21

CHAPTER 3: METHODOLOGY

3.1	Introduction	22
3.2	Software Development Life Cycle (SDLC)	22
3.2.1	Phase 1: Planning	24
3.2.2	Phase 2: Requirement Analysis	24
3.2.3	Phase 3: System Design	26
3.2.4	Phase 4: Coding / Implementation	27
3.2.5	Phase 5: Testing / Evaluation	27

3.3	Requirement Specification	
3.3.1	Hardware & Software Requirements	28
3.4	Conclusion	29

CHAPTER 4: SYSTEM DESIGN

4.1	Introduction	30
4.2	UML Use Case Diagrams	30
4.3	Entity Relationship Diagram	32
4.4	Data Flow Diagram (DFD)	35
4.4.1	Context level data flow diagram	35
4.4.2	DFD diagram 0	37
4.4.3	Child diagram DFD	39

CHAPTER 5: SYSTEM IMPLEMENTATION

5.1	Introduction	43
5.2	Development of tools & system platform	43
5.2.1	Mandrake linux 10.1 installation	44
5.2.2	Webmin 1.170 installation	55
5.2.3	Squid server installation	56
5.2.4	Squidfire 1.30 setup	63
5.3	Development of system	69

CHAPTER 6: TESTING AND EVALUATION

6.1	Introduction	72
6.2	Usability Testing	72
6.3	Evaluation	74
6.3.1	Heuristic Evaluation	74
6.3.2	Result of the Heuristic Evaluation on the System	77
6.3.3	Summary of the Usability Testing	78
6.4	Conclusion	79

CHAPTER 7: CONCLUSION AND RECOMMENDATION

7.1	Accomplishment	80
7.2	Problems encountered	80
7.3	Summary of internet quota management system	81
7.4	Future Enhancement	82
7.5	Conclusion	83
	REFERENCE	85
	APPENDIX A	87
	APPENDIX B	90

LIST OF FIGURES

Figure 1.1: An overview of Internet Quota Management System	2
Figure 3.1: The Software Development Life Cycle of IQMS	23
Figure 4.1: Use Case for Internet Quota Management System	31
Figure 4.2: Entity Relationship Diagram of Internet Quota Management System	34
Figure 4.3: Context Diagram	36
Figure 4.4: Diagram 0 of Internet Quota Management System	38
Figure 4.5: Child Diagram for Process 1	39
Figure 4.6: Child Diagram for Process 2	39
Figure 4.7: Child Diagram for Process 3	40
Figure 4.8: Child Diagram for Process 4	40
Figure 4.9: Child Diagram for Process 5	41
Figure 4.10: Child Diagram for Process 6	41
Figure 4.11: Child Diagram for Process 7	41
Figure 4.12: Child Diagram for Process 8	42
Figure 4.13: Child Diagram for Process 9	42
Figure 5.1: First installation Welcome screen	45
Figure 5.2: Choosing the default screen	45
Figure 5.3: License terms of the distribution	46
Figure 5.4: Configuring the peripherals	46
Figure 5.5: Security level setting	47
Figure 5.6: Selecting the mount points	48

Figure 5.7: Choosing the partitions to be formatted	48
Figure 5.8: Choosing package groups to be installed	49
Figure 5.9: Choosing individual packages to be installed	50
Figure 5.10: Setting the root password	50
Figure 5.11: Setting the Linux user	51
Figure 5.12: Installing the bootloader	52
Figure 5.13: Checking the miscellaneous parameters	53
Figure 5.14: Setting the local time zone	53
Figure 5.15: Configuring the X Graphical Server	54
Figure 5.16: Setup is completed	55
Figure 5.17: Webmin Interface	56
Figure 5.18: Set the http_port	57
Figure 5.19: Setting the access and cache log	58
Figure 5.20: Setting the visible_hostname	58
Figure 5.21: Creating the squid_passwd htpasswd list	59
Figure 5.22: Changing the access mode to write on the squid_passwd	60
Figure 5.23: Using Webmin to register users for the Squid-proxy	60
Figure 5.24: Setting the Squid to read the authentication from squid_passwd	61
Figure 5.25: Setting the ncsa basic authentication method	62
Figure 5.26: Applying the proxy settings on the browser	63
Figure 5.27: Set the logpath in config.inc.php	64
Figure 5.28: Changing the read/write access to access.log in Squid	65
Figure 5.29: Running the setup.php from the browser	66

Figure 5.30: Setting the database permission once the IQMS database is created	67
Figure 5.31: The list of tables in IQMS database	68
Figure 5.32: Admin login page	69
Figure 5.33: Admin mainpage	70
Figure 5.34: Students having to authenticate themselves before accessing the Internet	70
Figure 5.35: Student login page into the IQMS system	71
Figure 5.36: Student main page	71

LIST OF TABLES

Table 3.1: Specific Requirements for IQMS	26
Table 4.1: Relationship among entities	33
Table 5.1: Tool and software requirements	44
Table 6.1: Evaluation Methods	77
Table 6.2: Result of the Heuristic Evaluation	77

CHAPTER 1: INTRODUCTION

1.1 PROJECT DESCRIPTION

The Internet Quota Management System (IQMS) is designed to provide credit hours to students for the usage of Internet in the main campus. The purpose of IQMS is to control the usage of Internet by students to be limited for academic purposes and manage the traffic flow of the network to reduce the congestion due to point-to-point protocols such as download portals, chat, streaming media and other misuse of the Internet. The quota system ensures that students wisely use the Internet with a given amount of credit hours per semester or otherwise they are required to pay for additional quota request.

Students are provided with username and password by the system administrator by using their default matric number as username ID. Students are required to input their particulars on an online form to be stored in a centralized database. To access the Internet, the web proxy server is prompted for authentication. Once valid through the authentication process, students can access the Internet with their quota deducted according to the size of web pages accessed. When the student logs out from the system, at the end of the day the system calculates the amount of credit used. The credit value for the user is then updated into the database.

1.1.1 PROJECT OVERVIEW

IQMS is a web-based network administration for students' access to Internet. With the availability of a web proxy server, students are required to go through the proxy server and all web pages accessed under their respective accounts are stored in a SQUID access

log. This access log will be retrieved by the system and the size of web pages and applications accessed will be calculated and converted to credit units of usage. These credit units are then deducted from the available quota of each student account. The diagram below shows the conceptual design of the IQMS structure.

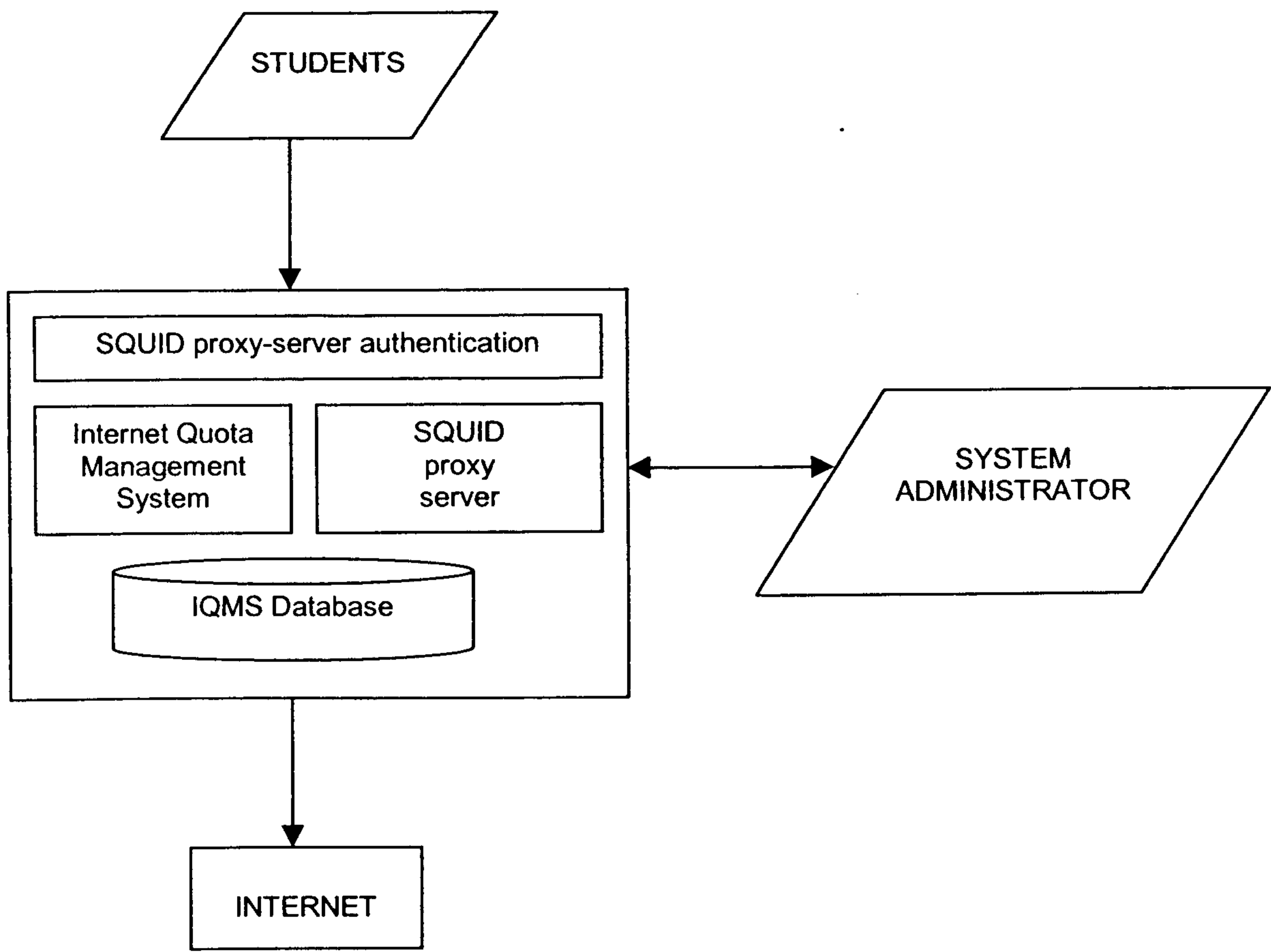


Figure 1.1: An overview of Internet Quota Management System

1.2 PROBLEM STATEMENT

- The main campus backbone infrastructure supports a bandwidth of 10Gbps and Internet speed of 2 Mbps. Due to increasing users every year, addition of more PCs with network connection will only congest the network.
- Besides that, many users are unethical in using the Internet. Apart from the observation done, after a user has finished using the WWW, he or she is not responsible enough to log out of the Internet which is just wasting the resources and restricting other users from opportunity of optimizing the Internet access.
- Many users still misuse the Internet for downloading purposes through point-to-point protocols which really consume a lot of bandwidth and resources. An irresponsible act like this prohibits lots of other users from using the Internet effectively. As a result, they have to face slow access at peak hours.
- Most of the new hostels are equipped with network access points which allow students to access the Internet. But how far is this access controlled and all the stated problems solved? A suggestion would be to provide quota for these students in order to ensure a better and deserving Internet access by the students. A user authentication to access the Internet anywhere on UNIMAS ground is developed and therefore the credit hours given reduces relative to the duration of Internet usage. The Internet Quota Management System would be the likely answer to all the stated problems.

1.3 OBJECTIVES

- **To develop a system that can limit and control the usage of Internet through quota management system**

The primary objective of this system is to utilize the Internet as a learning and reference medium, not encouraging garbage surfing. Such approach provides equal opportunity for every student to utilize the Internet. Besides that, download activities can be reduced because a higher credit weight is deducted according to the bandwidth size.

- **To reduce network congestion and increase speed of Internet services as the result of controlled usage of the Internet**

Our main campus is facing a major network congestion problem even when the infrastructure of the network is notified to be able to withstand thousands of users. From observation, it is learned that many misuse of the Internet such as download portals, chat and unethical use of the Internet has caused this problem. As a result from the implementation of this system, it is expected to reduce the network traffic at least by half once the system is fully implemented at campus level.

- **To encourage the users of the proper way of Internet usage through an effective and resource-saving method**

Most users are not educated on the proper way of using the Internet especially in campus. Many users fail to see that as long as they are logged on to the browser,

they are utilizing the Internet bandwidth. The effect of this results in the resources of the Internet bandwidth being wasted. Some users once logged on to their PC, there is a direct connection to the Internet for some fancy screen saver and desktop applications that bring no benefits but only wasting the resource of the Internet.

1.4 SCOPE

1.4.1 General Implementation Scope

- Originally, this system is first implemented at faculty level, preferably FCSIT to test and evaluate the effectiveness and how successful is the system to be implemented at a larger scale. All students in the faculty have to register as a faculty member through the system whereby only students of this faculty are permitted to use the Internet in the faculty labs.
- Once this prototype has shown a significance of success, this system is suitable to be implemented for all level of students in UNIMAS at the main gateway. All details of the users are stored in a centralized database and managed by a system administrator.
- Another additional scope would be to implement this system at upcoming hostels with existing access points. This is another ideal way of controlling and managing the usage of Internet by the students.

1.4.2 System Scope

- Based on the survey conducted among FCSIT students (*refer to Appendix A*), the students access the lab at an average of 2 to 3 hours a day. The average web pages accessed are roughly around 150 kBs if heavy usage such as downloading and video or audio streaming are not taken into consideration. Considering the students accessing the Internet 6 days a week with a rough estimation of 30 web pages accessed a day, that will sum up to a total of 370MBs of web page sizes accessed in a semester with 14 weeks. Assuming 1MB = 1 credit, a fair amount of 500MBs is suggested as the optimal amount granted for students to utilize the Internet for each semester. Therefore, IQMS will provide a default quota of 500 credits to all newly registered users on the system.
- Quota will be deducted based on the size of web pages accessed on the Internet and NOT time factor.
- Students will need to authenticate themselves through a web proxy server which is Squid in order to gain Internet access.
- Students can request for additional quota using an online request form when quota has exhausted with a charged rate.
- Admin will register users into the system providing their matric number as their user ID and unique password for each of the students.
- Admin can provide additional quota to students when requested.
- Once the quota has exhausted, the student's account is blocked by the admin.

- Once the quota has reached 10% of the original value, students will be notified with a warning message.

1.5 SIGNIFICANCE OF RESEARCH

Firstly, the research is significant because of the usage of open source tools and medium to develop the system. Open source as we are aware of are free licensed software and coding available freely on the Internet under the GPL and GNU standards. Open source PHP scripting is used to design the web page application and the back end system. All user authentication and user information will be linked to the open source MySQL as the centralized database. Much research has to be done on how to reuse open source coding and how to integrate the existing codes rather than start from nothing like the conventional C programming. This approach can be time saving and cost free.

Secondly, we are running this system and managing the network at the OSI seventh layer or known as the application layer. Web pages accessing port 80 (HTTP port) can be monitored via an access log file generated by the Squid proxy server. Utilizing this log file we can track down the details of web pages such as the date or time accessed, request by client order, the URL of the web pages, the remote host ID and the size of web pages in bytes. All these useful information are used in calculating the credits used by students.

1.6 PROJECT REPORT OUTLINE

Chapter 1 illustrates the introduction of this project. This includes the project description, project overview, the problem statements, objectives, scope and significance of research.

Project description and overview gives a picture of how IQMS functions in a brief description. The problem statement states the reason why IQMS is worth implementing after reviewing the problems at hand. The objectives clearly state the target that needs to be reached in order to serve the purpose of this system. The scope dwells on the functions IQMS and users on the IQMS are allowed to do and also the scope of implementation.

Chapter 2 is on system review which consists of survey and research done to associate with the problem context. It presents the background to the area of investigation and establishing the context of the problem. Review of the problem area comprises referencing to journals, conference papers, available systems and appropriate textbooks to identify the area of analysis. Also explained are the techniques and approaches to develop the survey and analyzing the systems. Review on the existing systems, development and implementation tools and other related software are done in this chapter.

Chapter 3 is on detailed requirements and methods of investigation, which are concerned with establishing the detailed requirement specification of work. It indicates the ways in which the requirements have been obtained and how the requirements should be expressed, prioritized and detailed in an appropriate method. This chapter mainly concentrates on the methodology used to develop the system. Included as the model of reference in this project, is the Software Development Life Cycle (SDLC). Besides that, other requirement specifications like hardware and software are also stated.

Chapter 4 mainly concentrates on the system design. The logical and physical designs of the system are explained in detail here. The design is clearly explained using a use-case diagram, Entity-Relationship-Diagram (ERD) and Data Flow Diagram (DFD).

Chapter 5 describes the system implementation details. Here, the documentation of the system installation and implementation is distinctly provided. Documentation in this case is the report and user manual.

Chapter 6 is on system evaluation and testing. Testing and evaluation is explained as to why it is required as part of the phase in the system. Also explained, is the usability testing and the Heuristic evaluation done to ensure the effectiveness of the system

Chapter 7 finally concludes the project and provides recommendation for future enhancement. It represents the summary of the project and outlines the further work that need to be done. Ideas and feedback are collected and further analyzed to consider adding in this project. It also re-outlines what has been done in the investigation and the lessons learned from the overall project to be overcome in the future.

CHAPTER 2: SYSTEM REVIEW

2.1 OBJECTIVE REVIEW

The reason for Internet Quota Management System (IQMS) to be implemented is supported by the objectives of this system which are listed as below:

- 1) To develop a system that can limit the usage of Internet through quota management system.
- 2) To reduce network congestion and increase speed of Internet services as a result of controlled usage of the Internet
- 3) To educate the users of the proper way of Internet usage through an effective and resource-saving method

A research paper presented in November 1998 by Canada's Memorial Internet Service Provider pointed out the requirement of charging for Internet access in universities is important for certain reasons. These reasons are clearly defined by the conclusions of their research and the report that they produced as below: [1]

- The study on Internet usage patterns indicated that many WWW sites browsed by users are related to non-university or non-academic activities. This refers to the first objective of IQMS and the valid reason to limit the usage of Internet in campus ground.
- From analysis, Memorial's report showed that for the current procurement of 4Mbps of Internet bandwidth to universities, 6Mbps will be required by April 2000. The issue of inadequate bandwidth was a problem to Memorial which might require universities resolving to Internet access chargeback. As depicted in

the second goal of IQMS, there is an urgent need to reduce the wastage of Internet resources that carry higher bandwidth in order to optimize and increase the speed of Internet in UNIMAS.

- As for the third objective, it is a direct impact from the implementation of IQMS. Due, to chargeback Internet access as defined by Memorial, there is a need for consideration by users to wisely utilize their Internet privilege in a cost effective and resource saving method.

2.2 REVIEWS ON SIMILAR EXISTING SYSTEM

2.2.1 Monash University: *Internet Billing and Quota Management System*

Monash University of Australia implements a similar system as proposed in IQMS. However the approaches in implementing their system vary according to university and government policies and also the Internet service schemes in this country. The objectives of IQMS are very much relevant to most existing Internet quota systems implemented in universities and institutions worldwide.

The Internet Billing & Quota Management System applied in Monash is subdivided into three levels of project: [2]

- **Phase 1: *Implementation of Internet Billing & Quota Management System***

In the first phase, faculties are allowed to introduce quotas on the volume of Internet usage by students by first free amount of credit hours. If their quota has exceeded they can purchase additional quota. Monash developed a new functionality for the introduction of quotas using available telephone billing system to process Internet billing.

- Phase 2: *Providing authentication through OSI Layer 7 gateway/proxy service*

Students cannot attain direct access to the Internet. The Internet traffic is blocked at the gateway router and therefore students needed to be authenticated through a web proxy through process called Mandatory Proxy Authentication. The reason for this is to limit students' Internet access to only web surfing (using HTTP) and file transfer services (FTP) and simultaneously prohibiting point-to-point protocols and streaming media.

- Phase 3: *Web proxy farm replacement*

The current web proxy server had to be replaced because of worn out caching capabilities and old hardware. From the survey done, it resulted that only 6 to 10% of the Internet traffic is cached where by other commercial web caching systems provide higher capabilities.

The Internet quota charges passed by AARNet which is the Internet Service Provider there are based on the inbound traffic and not the outbound traffic. Duration of usage is not a factor however, but the cost is generated based on the bandwidth of the Internet usage and the purpose of the usage. A cost for Internet quota is incurred whenever: [2]

- An external non-Monash web page is accessed. Cost depends on the location of the web page retrieved from.
- The size or bandwidth of the web page. The more images and multimedia applications involved, the higher the cost is.