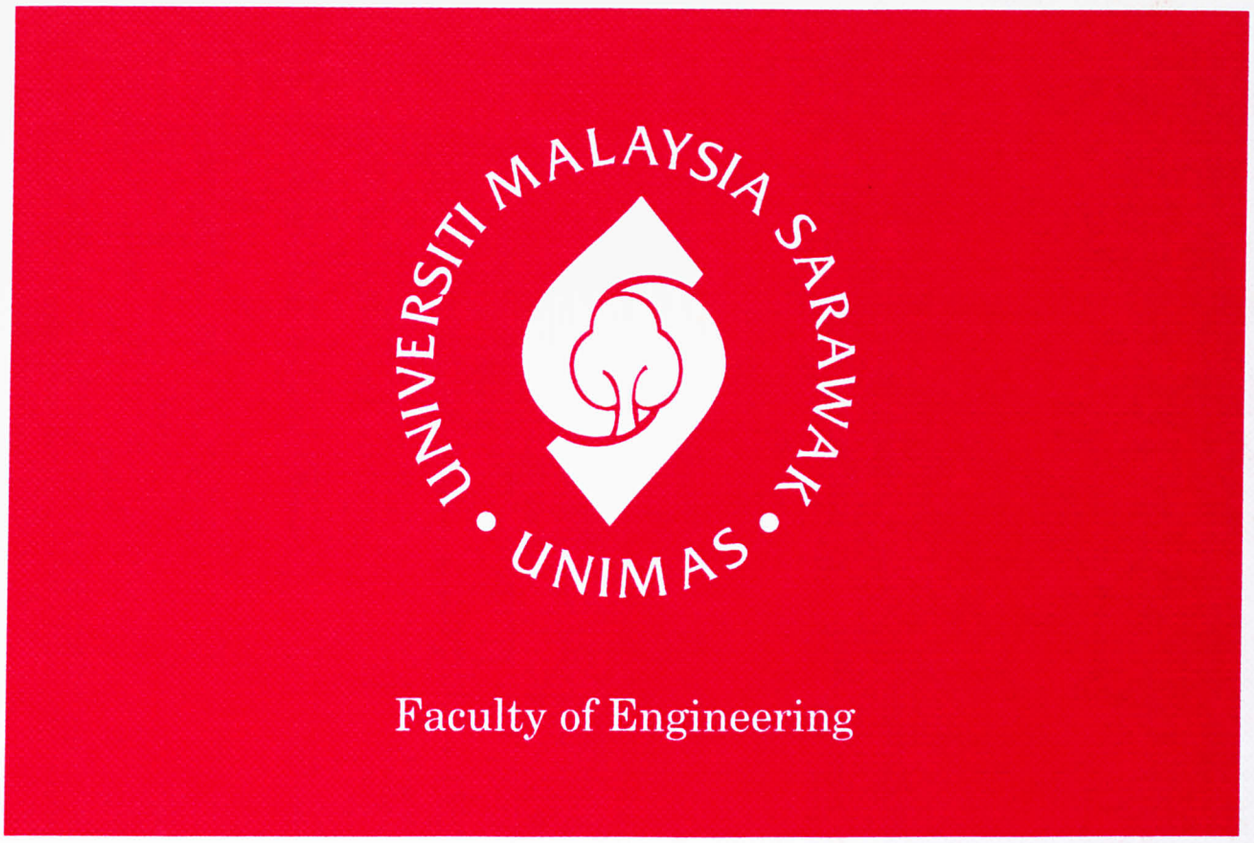

DYNAMIC CHANNEL ALLOCATION FOR MULTIMEDIA APPLICATIONS

Siti Noormaya Binti Bilmas

Bachelor of Engineering with Honours
(Electronics and Computer Engineering)
2004

UNIVERSITI MALAYSIA SARAWAK

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En. Wan Azlan Wan Zainal Abidin
Supervisor

25/3/2004

Tarikh

DYNAMIC CHANNEL ALLOCATION FOR MULTIMEDIA APPLICATIONS

SITI NOORMAYA BINTI BILMAS

This project is submitted in partial fulfilment of
the requirements for the degree of Bachelor of Engineering with Honours
(Electronic & Computer Engineering)

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ABSTRAK

Dalam projek ini, satu kaedah penentuan jalur lebar dinamik yang baru iaitu Algorithma Limpahan Trafik Minimum dicadangkan untuk menentukan jalur lebar bagi setiap kelas trafik dalam hirarki struktur kebenaran kawalan yang didapati dalam rangkaian *ATM*. Jenis trafik yang dipertimbangkan ialah teks, foto, bunyi dan siding video. Fungsi limpahan trafik, Q digunakan untuk menyesuaikan penentuan jalur lebar setiap kali apabila sambungan baru diperlukan. Dalam projek ini purata kebarangkalian kehilangan sel maya digunakan sebagai kualiti perkhidmatan untuk ukuran prestasi system. Pendekatan ini boleh meminimumkan purata kebarangkalian kehilangan sel maya dalam sistem dengan mengoptimumkan Q apabila syarat-syarat penangguhan dipenuhi dan dapat menyediakan jumlah bahan yang tinggi untuk diproses dalam pelbagai persekitaran kelas trafik.

ABSTRACT

In this project, a new dynamic channel allocation scheme called *Minimum Overflow Traffic Algorithm (MOTA)* is proposed to assign the bandwidth for each traffic class in the hierarchical admission control structure in ATM network. The traffic types considered are text, image or still photo, voice and video conferencing. An *Overflow Traffic Function Q* is used to manage the bandwidth assignment each time when a new connection is required. The *Mean Cell Loss Probability (MCLP)* is the quality of service (QoS) for the performance measurement of the system. This approach can minimize the mean virtual cell loss probability of the system by optimizing Q when the delay constraint is satisfied and provide high throughput in multi-class traffic environment.

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CHAPTER 5 RESULT AND DISCUSSION

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ABBREVIATIONS

ABR	Available Bit Rate
ATM	Asynchronous transfer mode
BS	Base station
CBR	Constant Bit Rate
CD	Code Division
CIR	Carrier to interference ratio
DCA	Dynamic channel allocation
FCA	Fixed channel allocation
FD	Frequency Division
HCA	Hybrid channel allocation
MCLP	Mean cell loss probability
MOTA	Minimum overflow traffic algorithm
MSC	Mobile switching centre
PCM	Pulse code modulation
QoS	Quality of service
TD	Time Division
UBR	Undefined (or Unspecified) Bit Rate
VBR	Variable Bit Rate
VCLP	Virtual cell loss probability

CHAPTER 1

INTRODUCTION

1.1 Project Overview

Existing channel allocation methods are usually implemented for voice oriented services where the main aim is to reduce the call blocking and call dropping rate. The issue nowadays is how to allocate channel for wireless multimedia network applications. For the multimedia applications, channel allocation is really needed to offer a good quality of service (Qos) in different environment for instance interactivity, low jitter, low error and higher bandwidth. Therefore, the challenge here is to select the channel assignment strategy that can be used as an efficient utilization of the scarce spectrum besides serving the best of quality of service through the wireless network system.

For this project, the concentration is on the voice class and video conference class. The bandwidth allocation used is the dynamic channel allocation (DCA). DCA is different from other scheme in a way; all channels are potentially available to all cells and are assigned to cells dynamically as calls arrive. If this is rightly done, it can take advantage of temporary changes in the spatial and temporal distribution of calls in order to serve more users.

The DCA strategy proposed is the Minimum Overflow Traffic Function (MOTA) that basically assigns the bandwidth to each traffic class in the hierarchical admission control structure. The Asynchronous Transfer Mode (ATM) is used as a reference network.

Using MATLAB 6.1, the MOTA is applied to show the network performance through simulation program. All these will be discussed in detail in the next chapter.

1.2 Objectives

Dynamic channel allocation for multimedia application research has several objectives to be achieved. There are four objectives listed as follows:

- To propose an algorithm of DCA that can be used to efficiently utilize the bandwidth usage.
- To analyze to the algorithm by implementing it into the traffic classes according to the suitable network.
- To develop a simulation program by manipulating the algorithm to define the network performance.
- To put the theoretical knowledge that has been gained into practice.

1.3 Methodology

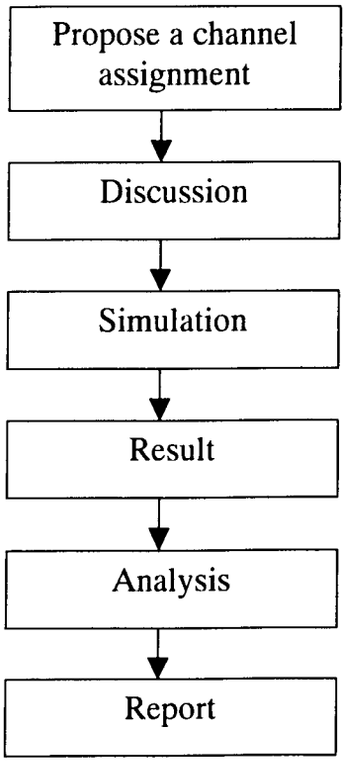

Figure 1 Flowchart for Process of Final Year Project 2

Stage 1

Propose a channel assignment: After a brainstorming process, the proposed channel assignment is the "Dynamic Channel Allocation for Multimedia Applications".

Discussion: The algorithms involved are discussed and elaborated besides showing how the algorithms are used. In addition, all the equation involved must be evaluated and understood.

Stage 2

Simulation: The equations are manipulated into the simulation program using M-file in MATLAB 6.1. All the parameters and assumption values are tested using the created simulation program to attain result according to the discussion part before.

Result: Then, after the simulation we get the result. To get the best result, the research for the algorithms and simulation design is done repeatedly until it achieves the target.

Analysis: The analysis is done according to the result obtained and followed by discussion.

Report: Finally, the report for the thesis 2 is written based on the analysis of the whole project process.

The final step for this final year project is submitting the report and presents the project results.

CHAPTER 2

MULTIMEDIA APPLICATIONS

2.1 Definition of Multimedia

Multimedia literally can be defined as more than one medium. The real multimedia word actually comes from the Latin word *multus*, mean many or multiple. Then it is combined with the word *medium* or simply known as a channel or system of communication, information or entertainment. So, multimedia is carrying combination of these words.

There are three elements that includes in multimedia. Firstly the audio element for example the speech, sounds and music. Secondly is the video element such as text, graphics, pictures, animations, movies and motion. Lastly is the interactivity via keyboard or mouse.

In this project, the multimedia information will be discussed as the data to be transmitted through the wireless network.

2. 2 Multimedia Applications

The usual media that use multimedia approaches are television, wireless mobile telephone and internet. So, there are two classifications for multimedia data. First is real-time data which is for the video and voice application. Secondly is for the graphic and data

for internet use such as email and other TCP/IP application known as the non real-time data type.

A multimedia application can be as simple as augment a real estate database with pictures, to adding an audio help function in one or two languages to a complete training simulator of a dangerous or expensive flight mission.

Then through the application of personal computer all the media can be delivered such as text still images, graphics, and audio and full motion video. More importantly, the personal computer brings to this entire media two other important functions: the ability to present this media in an integrated way and in an interactive way.

In the perspective of communication, multimedia is the new option to make the process and content more natural and powerful. For example the information can be a simple photograph with audio notation attached to a memo or a short video clip that have been captured to introduce yourself to a colleague in another site that may become a request for a meeting. It is the same concept for video conference that usually used for education.

For a conclusion, the multimedia can be applied in many ways in our daily life. Figure 2 shows the global information multimedia communication village that involves the technologies and the place. This is for the general survey on multimedia communication application. Figure 3 below shows the distribution of multimedia application for the whole world nowadays.

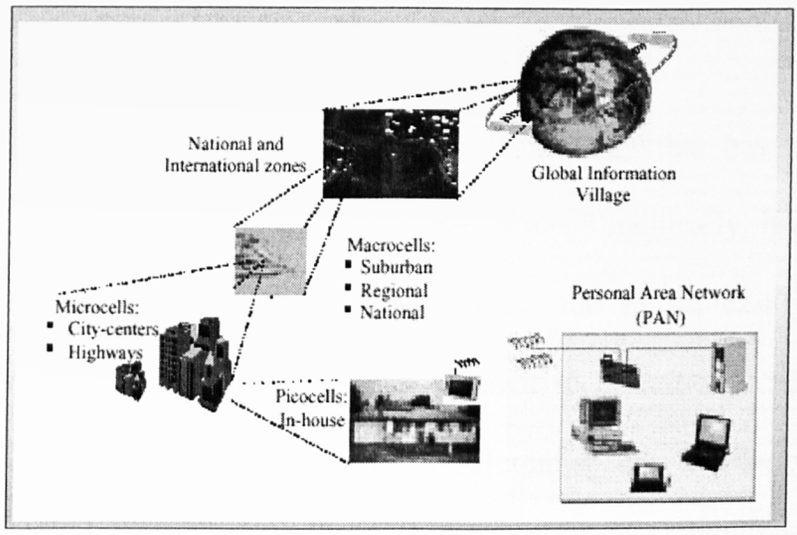

Figure 2 Global Information Multimedia Communication Village

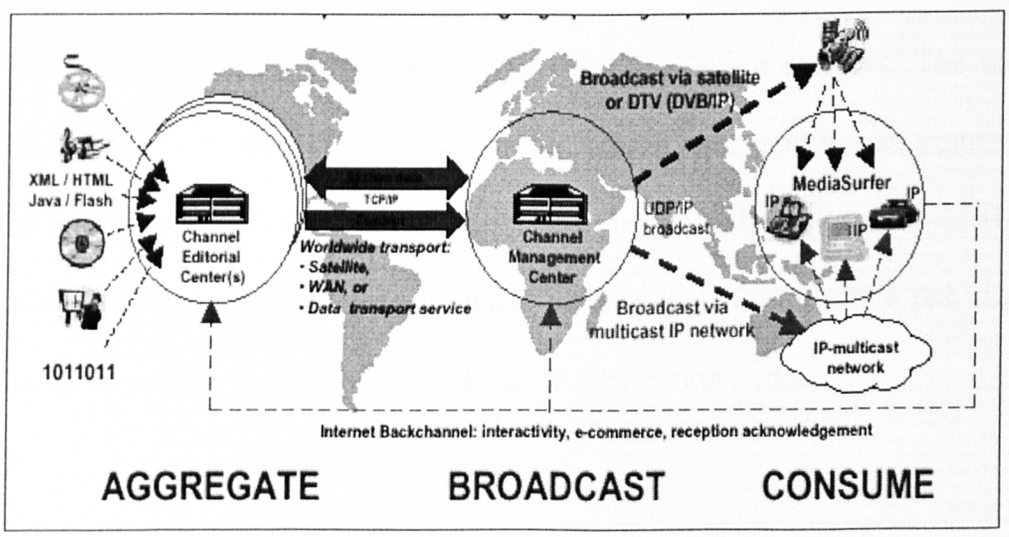

Figure 3 Multimedia Distributed

2.3 ATM Network

Asynchronous transfer mode (ATM) is a technology that has its history in the development of broadband ISDN in the 1970s and 1980s. Technically, it can be viewed as an evolution of packet switching. ATM integrates the multiplexing and switching functions, is well suited for burst traffic (in contrast to circuit switching), and allows communications between devices that operate at different speeds. Unlike packet switching, ATM is designed for high-performance multimedia networking. ATM technology has been implemented in a very broad range of networking devices such as PC, workstation, and server network interface cards.

ATM also offered an end-user service by service providers (as a basis for tariff services) or as a networking infrastructure for these and other services. The most basic service building block is the ATM virtual circuit, which is an end-to-end connection that has defined end points and routes but does not have bandwidth dedicated to it. Bandwidth is allocated on demand by the network as users have traffic to transmit. ATM also defines various classes of service to meet a broad range of application needs.

2.4 Benefit of ATM Network

The high-level benefits delivered through ATM services deployed on ATM technology using international ATM standards can be summarized as follows:

- high performance via hardware switching with terabit switches on the horizon

- dynamic bandwidth for burst traffic meeting application needs and delivering high utilization of networking resources; most applications are or can be viewed as inherently burst; data applications are LAN–based and are very burst, voice is burst, as both parties are neither speaking at once nor all the time; video is burst as the amount of motion and required resolution varies over time.
- class-of-service support for multimedia traffic allowing applications with varying throughput and latency requirements to be met on a single network
- scalability in speed and network size supporting link speeds of T1/E1 to OC–12 (622 Mbps) today and into the multi–Gbps range before the end of the decade; networks that scale to the size of the telephone network (i.e., as required for residential applications) are envisaged
- common LAN/WAN architecture allowing ATM to be used consistently from one desktop to another; traditionally, LAN and WAN technologies have been very different, with implications for performance and interoperability
- opportunities for simplification via switched VC architecture; this is particularly for LAN–based traffic that today is connectionless in nature; the simplification possible through ATM VCs could be in areas such as billing, traffic management, security, and configuration management
- international standards compliance in central-office and customer-premises environments allowing for multivendor operation

2.5 Traffic over ATM Network

Traffic in general is defined as the movement. In the context of wireless network, there are two types of traffic assumed. First is class I which is the real-time traffic and secondly is class II which is the non real-time traffic.

Class I traffic includes video and voice traffic from users that equipped with an adjustable rate codec. In the case of blocking such users can gracefully adjust the coding rate such that the quality of video or audio received at destination is still acceptable. But if the coding rate is reduced below some threshold, the quality of received video or audio becomes unacceptable.

Class II traffic includes non real time data traffic such as email and other TCP/IP traffic. In the case of blocking, it is acceptable to buffer non real time data at a network node such as base station or at a user station and transmit them at a slower rate. For this type of traffic, it is assumed that there is no minimum required bandwidth since it can tolerate relatively large delays.

2.5.1 Multimedia Traffic

Multimedia traffic is quite similar with the wireless network traffic. Traffic in the case of multimedia traffic context can be described as the movement of multimedia data transfer. The traffic can be classified into two categories, time based and non time based information. For the time based information, it is sensitive to time varying such as video and voice. The non time based is insensitive to time varying such as image and data.