the best service it can, but there are no controls to preserve higher levels of service for some flows and not others. This inefficient traffic resource allocation causes congestion in the network which eventually leads to a drop in network performance.

Over the years, several approaches have been developed to enhance the internet in order to support the different requirements of different types of traffic and address the QoS problem. DiffServe is one of the mechanisms able to provide QoS.

In DiffServe, traffics are treated differently based on their QoS requirements. Thus, in a Best-Effort (BE) environment, what DiffServe does is attempt to provide better levels of service. However, it is still below par because traffic engineering remains a problem.

DiffServe and MPLS perform a similar set of functions that can be combined when both are implemented in a network. Support of DiffServe in MPLS that was standardized by the IETF can provide QoS guaranteed service, while keeping network resource utilization at high level [13].

GMPLS is a more general protocol that extends MPLS to provide common control and traffic engineering.

Hence, this project studies the Quality of Service (QoS) capabilities and traffic pre-emption for priority fine-tuning in Multi Protocol Label Switching (MPLS) and extended Generalized Multi Protocol Label Switching (GMPLS).

GMPLS is not just about protocols the existing MPLS protocols are reused with relatively small extensions and it is not about any particular technology. It can be applied to many, including TDM, lambda switching, and pre-existing MPLS devices. GMPLS is all about the general software architecture of a network element and network applications on top of the protocol [1].

1.2 Problem Statement

The increasing population of internet users are demanding for faster, more efficient and more reliable service network. As stated earlier, Quality of Service (Qos) is now a prerequisite for the transport of high bandwidth voice and video services, as well as critical data.

An insight into the traditional Best Effort method provides a transparency for the requirements of Quality of service (QoS) and the basis for this project.

In Best Effort (BE), traffic congestion often occurs in the path and this leads to major flaws related to the bandwidth, delay, jitter and packet loss which are the parameters for QoS in a network. These are the contributing factors to degrading network performance. Hence, the need for QoS is vital in order to control and manage the mentioned parameters.

1.3 Objectives of the Project

The main objective of this project is to investigate the QoS capabilities and traffic pre-emption for priority fine-tuning in MPLS and extended GMPLS using Differentiated Services (DiffServ) mechanism. In doing so, the following objectives are to be met:

- To study and compare the Quality of Service (QoS) under different policy based used in MPLS / GMPLS networks by modelling the traffic pre-emption.
- To simulate the performance parameter on DiffServ over MPLS / GMPLS environment using NS-2 software tool.

- To compare results with Class of Service (CoS) such as EF, AF and BE on ER-LSP and CR-LSP in QoS and Traffic Prremption.
- To generate analysis from the results and draw conclusion.

1.4 Scope of the Project

The project will first estimate and identify the provisioning of Quality of Service (QoS) capabilities on DiffServ-aware-MPLS and DiffServ-aware-GMPLS based on RFC2474, RFC2475, RFC2597, RFC2598, RFC3140, RFC3270, RFC3471, RFC3472 and RFC4594 by generating the CBR traffic into different priority levels, and then apply different event schedulings such as the following;

(a) Per Hob Behaviour (PHB);

1. Expedited Forwarding [EF] or Premium Service
2. Assured Forwarding [AF]

(b) Best-Effort [BE] – default

(c) CBQ Queuing Mechanism at the nodes.

Second, simulate the resource pre-emption defined in Constrained Routing – Label Distribution Protocol (CR-LDP) on MPLS / GMPLS by generating different CBR traffic.

Finally, compare and contrast both the variation in bandwidth studies obtained and then generate analysis before drawing a conclusion.

1.5 Thesis Structure

This report consists of 7 chapters. Chapter 1 is an introduction presenting a brief overview of QoS and the trend of the current Internet, problem statement as well as objectives and scope of this project. Chapter 2 describes the QoS and label switching that can be categorized into MPLS and GMPLS, followed by a brief explanation on DiffServ. Next, Chapter 3 explains the implementation of QoS in MPLS network.

The use of NS-2 in the simulation of MPLS/GMPLS network is discussed in Chapter 4. This is then followed by Chapter 5 which looks into project methodology and simulation studies. Chapter 6 then presents the analysis of the performance. The QoS parameters investigated for this network model is also presented and discussed here. Finally, Chapter 7 draws a conclusion based on the findings and discussions from the preceding chapters and presents several proposals to improve the performance of MPLS/GMPLS and extensions to the works of this project.

CHAPTER 1

INTRODUCTION

1.1 Overview of QoS and MPLS/GMPLS Networks

The internet industry is growing rapidly with increasing demands for the provisioning of new and more advanced services that are able to dynamically react to changes within the network. In spite of the internet's evolution from a network that provided just Best-Effort (BE) transportation to a network capable of providing a wide range of services, users are seeking for a more efficient and reliable network with guaranteed quality of service.

Quality of Service (QoS) is in itself a measurement of how much a service meets and satisfies its users' needs. Technically, it is a set of qualities related to the collective behaviour of one or more objects [1]. In a network, QoS is measured via bandwidth, delay, jitter and packet loss.

In today's internet industry, Quality of Service (QoS) plays a significant role in the implementation of multiservice and converged networks. The parameters of QoS need to be met to support distinct applications such as voice, video, and data, and multiple network services such as IP, Ethernet, and ATM.

However, bandwidth, delay, jitter and packet loss are the main problems in traditional Best Effort (BE), and as such BE doesn't support QoS requirements. With Best Effort (BE) there is no attempt to differentiate between the traffic flows that are generated by different hosts. As traffic flow varies, the network provides