

Less than Best Effort: Application Scenarios and Experimental Results^{*}

Tim Chown¹, Tiziana Ferrari², Simon Leinen³, Roberto Sabatino⁴,
Nicolas Simar⁴, and Stig Venaas⁵

¹ University of Southampton, United Kingdom, tjc@ecs.soton.ac.uk

² Istituto Nazionale di Fisica Nucleare, Italy, Tiziana.Ferrari@cnaf.infn.it

³ SWITCH, Switzerland, simon@switch.ch

⁴ DANTE, United Kingdom, {Roberto.Sabatino,Nicolas.Simar}@dante.org.uk

⁵ UNINETT, Norway, Stig.Venaas@uninett.no

Abstract. In this article we present the work done to study the potential benefits to end users and network operators and the feasibility of deploying a Less than Best Effort (LBE) service on a wide area scale. LBE is a Per-Domain Behaviour based on the Differentiated Services Quality of Service architecture. We present a brief overview of the evolution of the case for LBE, through the IETF DiffServ WG and the Internet2 QBone project, and then describe some proposed scenarios for LBE deployment in European research networks and GÉANT, the research backbone providing interconnectivity to the European National Research and Educational Networks (NRENs). The experimental results presented demonstrate the viability and importance of Quality of Service to meet a large set of network providers and users' requirements even in presence of communication infrastructures characterized by very high-speed connections.

Keywords: Quality of Service, Differentiated Services, Less than Best Effort (LBE), Scavenger

1 Introduction

In recent years there has been a growing demand by users in the research community for a high quality of service. The most common approaches to delivering the performance that the users require are either to increase the network provision in advance of demand (a technique commonly referred to as “overprovisioning”), or to deploy some kind of “Better than Best Effort” quality of service mechanism in the network (e.g. the Premium IP service[1][2][3].) However, overprovisioning can only be applied where the funds of the network operator permit. For example, many universities and research institutes are “only” connected at capacities in the order of 155 Mbps, and many further education colleges have 2Mbit/s links.

^{*} This work is supported by the IST projects IST-2000-26417 GN1 (GÉANT) and IST-2000-25182 DataGrid.

While it is expected that Differentiated Services-based (DiffServ) Quality of Service (QoS) deployment can offer a good service for many users[4], widespread deployment can be a far from trivial exercise where multiple administrative domains are involved, as dynamic bandwidth brokering is required, and aggregate reservations have to be considered.

In this article we evaluate a different approach to quality of service based on the Less than Best Effort (LBE) Per-Domain Behaviour (PDB) similar to the one defined in [5]. We illustrate the PDB, its potential application cases and we estimate its performance in a large number of traffic and configuration scenarios. Intuitively, one might think that very few users would be willing to run applications that would receive a worse service than regular Best Effort (BE) traffic. However, we argue that in providing a traffic class that can expand to utilise the available bandwidth on a link, without any significant effect on the BE (or Premium IP) traffic, a number of new network usage scenarios can be met.

We begin by giving a service description for LBE. In this description we choose to be interoperable with the Internet2 Qbone Scavenger Service (QBSS)[6] by using the same diffserv code point (DCSP) value of 001000 [8][9].

The goal is the demonstration of the feasibility of Quality of Service in the GÉANT[10] backbone in Europe to meet a number of users and providers' requirements, and possibly, its extension to a number of European research networks in a fully inter-domain scenario.

The results obtained to date suggest that an LBE service can be deployed on GÉANT and NREN networks, and that both the NRENs and their end users can benefit.

2 The Less than Best Effort Service

Between 1999 and 2002 there have been several initiatives to design and implement services capable of offering guaranteed and predictable network QoS to end-users. The Internet2 Qbone initiative started in 1999, whilst within GÉANT work for the definition of a Premium IP service started a little later, in November 2000.

The original ideas for an LBE-like service arose from work in the IETF DiffServ working group. However, it is the work of the Scavenger team that has helped raise the profile of such a service, to the extent that adoption is now being evaluated for GÉANT and by NRENs. The main idea of LBE is that this traffic class is able to make use of unutilised bandwidth in the network, but in a way such that in cases of competition for resources, the LBE traffic will be discarded before any Best Effort (BE) or higher-class traffic.

2.1 LBE Description

The definition of the LBE service follows the basis that a given differentiated services code-point (DSCP) is used to convey the meaning that packets bearing