Chapter XLIII
Towards QoS-Inferred Internet

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ABSTRACT

IP networks are the federative transport networks for a large set of emerging services. These services demand hard guarantees in term of the service availability, experienced Quality of Service (QoS) and robustness. Moreover, to be able to reach customers on a large scale, most of these services should be deployed with an Inter-domain scope. In order to meet QoS requirements of these services in an inter-domain context, several issues should be solved. This chapter focuses on two issues: provider-to-provider agreements and enhancements to inter-domain routing protocol to convey QoS-related information. A concept called Meta-QoS-Class is introduced together with an enriched version of Border Gateway Protocol. This chapter provides a framework suitable for the promotion of QoS-enabled services with an inter-domain scope: the Parallel Internet. This concept is a viable way for the management of IP resources so as to deliver end-to-end QoS-enabled services.

1 INTRODUCTION

1.1 Background and Focus

Quality of Service (QoS) is one of the topics that succeeded to federate various Internet actors. Indeed, experts from both academia and industry have contributed to promote QoS-centric solutions within standardisation bodies, such as IntServ (Integrated Services) or DiffServ (Differentiated Services) Initiatives within the IETF (Internet Engineering Task Force)(IETF is the main IP standardisation body. This is the place where IP-related issues, protocols and architec-

tures are designed.). Most of that effort has been put into solving intra-domain (i.e. within the IP infrastructure owned and managed by the same IP Network Provider) specific issues. Moreover, some of the QoS proposals have been adopted by Network Providers and even have been activated in their operational networks. Before it is conceivable to have an operational deployment of end-to-end QoS services (i.e. across domains owned by plethora of IP Network Providers), a number of issues still appear to need further elaboration as identified in Huston (2000). In fact, there is a strong lack of inter-domain QoS investigation and few "big picture" solutions have been proposed. This chapter's ambition is to contribute to this area and advocate for the introduction of solutions dealing with inter-domain QoS delivery services.

For readers who are not familiar with QoS notion, we provide the ITU definition of Quality of Service as defined in E.800. Indeed, QoS is defined as "the collective effect of service performance which determines the degree of satisfaction of a user of the service".

As stated in Deleuze (1996), concepts should always be created in relation to specific problems. This section focuses exclusively on inter-domain QoS service delivery issues since intra-domain ones have benefited from a large amount of effort in both academia and standardisation bodies. This paper proposes novel means and mechanisms to ease extending intra-domain QoS capabilities beyond the boundaries of a single Network Provider. A concept denoted by Meta-QoS-Class and an extended BGP (Border Gateway Protocol) protocol to be able to convey QoS-related information (see Boucadair (2005)) are introduced. A framework is also described to promote the notion of Parallel Internet (refer to Boucadair (2006)). An implementation example based on joint exploitation of QoS-Enhanced BGP and Meta-QoS-Class is provided.

The emergence of Parallel Internet is essentially driven by the needs of end-to-end applications mainly in terms of QoS and resilience requirements. Owing to the adoption of Meta-QoS-Class concept, a coherent and consistent QoS treatment will be experienced by IP flows when crossing several Autonomous Systems managed by distinct Network Providers. QoS-Enhanced BGP ensures a global reachability within a Meta-QoS-Class routing plane, since several routing tables will be maintained, each per Meta-QoS-Class. Parallel Internet is a step forward to implement end-to-end service differentiation and facilitate the emergence of new business models suitable for the services of the future. Adhering to this approach, telecom players will clarify business roles and frontiers will be abolished between Service Providers.

Within this chapter, we introduce a QoS-Inferred Parallel Internet. Availability and robustness issues are out of scope of this paper.

1.2 Structure

This paper is structured as follows. Section 2 analyzes provider-to-provider QoS agreements suitable for a global QoS-enabled Internet and introduces the concept of Meta-QoS-Class. This concept drives and federates the way QoS inter-domain relationships are built between Network Providers. Section 3 is dedicated to QoS-Enhanced BGP proposal, an enriched version of BGP. This section describes attributes to convey QoS-related information in inter-domain routing protocol and presents also novel logics to compare and select QoS-Inferred BGP routes. Finally, Section 4 advocates for the introduction of Parallel Internet so as to offer a global infrastructure for delivering end-to-end QoS services.

2 CONSIDERATIONS OF PROVIDER-TO-PROVIDER AGREEMENTS FOR INTERNET-SCALE QOS

This section shows that for the sake of scalability, providers need not be concerned what occurs