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Capacity Planning for Voice over IP Applications with Bandwidth-delay Constrained Routing

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Abstract. Voice Over IP (VoIP) has been one of the fastest-growing application in the Internet today. High-quality IP telephony services require stringent bounds on several quality-of -service (QoS) requirements, especially on bandwidth and end-to-end delay. In order to provide such services, network engineers need tools for capacity planning, which often involves QoS routing for each communication request stemmed from the services. However, it has been proven that the allocation of each single demand with multiple QoS criteria is NP-complete. This paper approaches the problem by extending the *Blocking Island* heuristic [7], which has been proven very efficient for solving the bandwidth allocation problem, to provision for both bandwidth and delay requirements in the context of VoIP.

Keywords. QoS routing, Bandwidth-delay constrained routing, Blocking island.

1 Introduction

Internet telephony (or Voice over IP, VoIP) has emerged as one of the fastest-growing areas in communications. It grew by almost 900% from 1999 to 2001, reaching 9.7 billion minutes of communication time, and is projected to grow by another 5000% by 2004 [3]. This has placed a burden on resources on the core networks of service providers and alike, as satisfactory experiences with such applications impose stringent bounds on certain quality-of-service (QoS) requirements. In order to ensure such requirements be met, capacity planning, resource allocation and traffic engineering techniques and tools become important, if not essential, for service providers and network architects to properly manage the network resources

1.1 QoS Routing for Capacity Planning

QoS routing mechanisms is one such tool for network capacity planning. It ensures that each of the IP telephony calls will be allocated a route from the source to destination nodes which are given the proper resources and, equally importantly, network resources are optimally utilized. Congestion or under-utilization of links should be avoided as much as possible, while demands that are admitted should be ensured that their requirements are met end-to-end.