

QoS Requirements and Capacity Planning for IP Backbone Links

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Abstract

The demands for Quality of Service (QoS) to support multimedia applications has stimulated approaches for integration and differentiation of services in IP networks. We study differentiated services (DiffServ) using a model that reflects the router behavior and its effect on the delay and loss probability. Scheduling options like Deficit Round Robin (DRR) and the Random Early Detect (RED) discard policy are considered.

We analytically derive a 3-state source model for elastic traffic generated by TCP with regard to different access bandwidths for servers and subscribers and to long-range correlation. The results show how QoS in terms of a low loss probability depends on the utilization of the links. We observe that for transmissions with stronger long-range correlation even a higher utilization of backbone links may be admissible to achieve a demanded loss probability under the TCP control mechanism. The approximate analysis of the loss probability using a bufferless model makes available a very simple worst case dimensioning tool which overestimates the bandwidth demand by no more than 5 %.

When differentiated services assign the major volume of traffic to the best effort class with moderate QoS demands and a small portion of traffic is supported with higher priority and generous bandwidth assignment under high load then even strong QoS requirements are met for the preferred class due to a relative low utilization of the resources at its disposal.

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