

## ABSTRACT

Improving the quality of service (QoS) of Internet traffic is widely recognized as a critical issue for next-generation networks. QoS is more sensitive to delay and packet loss (PL) than other factors. The objective of this thesis is studying the effect of Random Early Detection (RED) algorithm on different queuing mechanisms. Simulation tool is “OPNET IT Guru Academic Edition 9.1”. This thesis analyses QoS through measuring the major factors that affect the QoS for video streaming according to international telecommunication union (ITU) standards. A congestion avoidance scheme allows a network to operate in the region of low delay and high throughput. Such scheme prevents a network from entering into congested state. RED is one such congestion avoidance mechanism used for effectively control of congestion.

This thesis presents RED gateways for congestion avoidance in packet-switched networks. The gateway detects incipient congestion by computing the average queue size. The gateway could notify connections of congestion either by dropping packets arriving at the gateway or by setting a bit in packet headers. When the average queue size exceeds a preset threshold, the gateway drops or marks each arriving packet with a certain probability. RED gateways keep the average queue size low while allowing occasional bursts of packets in the queue. During congestion, the probability that the gateway notifies a particular connection to reduce its window is roughly proportional to that connection's share of the bandwidth through the gateway. RED gateways are designed to accompany a transport-layer congestion control protocol such as Transmission Control Protocol (TCP). The RED gateway has no bias against bursty traffic and avoids the global synchronization of many connections decreasing their window at the same time.

This thesis discusses the effect of RED algorithm on different queuing profile like First-in First-out queuing (FIFO), priority queuing (PQ), Custom Queuing (CQ), and weighted-fair queuing (WFQ).

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## LIST OF ABBREVIATIONS

<b>ACLs:</b>	Access Control Lists.
<b>AF:</b>	Assured Forwarding.
<b>AutoQoS:</b>	Automatic Quality of Service.
<b>CoS:</b>	Class of Service.
<b>CQ:</b>	Custom Queuing.
<b>DES:</b>	Discrete Event Simulation.
<b>DiffServ:</b>	Differentiated Services.
<b>DSCP:</b>	Differentiated Service Code Point
<b>DT:</b>	Drop Tail.
<b>DWRR:</b>	Deficit Weighted Round Robin.
<b>ECN:</b>	Explicit Congestion Notification.
<b>EF:</b>	Expedited Forwarding.
<b>EPD:</b>	Early Packet Discard.
<b>ERD:</b>	Early Random Drop.
<b>FCFS:</b>	First-come, First-Served.
<b>FIFO:</b>	First-in, First-out.
<b>FQ:</b>	Fair Queuing.
<b>FTP:</b>	File Transfer Protocol.
<b>HoL:</b>	head of line.
<b>HTTP:</b>	Hypertext Transfer Protocol.
<b>ICMP:</b>	Internet Control Message Protocol.
<b>IETF:</b>	Internet Engineer Task Force.
<b>IMAP:</b>	Internet Message Access Protocol.
<b>IntServ:</b>	Integrated Services.
<b>IOS:</b>	Internetwork Operating System.
<b>IP:</b>	Internet Protocol.
<b>ISL:</b>	Inter-Switch Link.
<b>MAC:</b>	Media Access Control Address.
<b>MPD:</b>	Mark Probability Denominator.
<b>MPEG:</b>	Moving Picture Experts Group.
<b>MQC:</b>	Modular QoS Command Line Interface.
<b>MWRR:</b>	Modified Weighted Round Robin
<b>PHBs:</b>	Per-Hop Behaviors.
<b>POP3:</b>	Post Office Protocol.
<b>PPD:</b>	Partial Packet Discard.
<b>PQ:</b>	Priority Queuing.
<b>QoS:</b>	Quality of Service.
<b>RD:</b>	Random Drop.
<b>RED:</b>	Random Early Detection.
<b>RFC:</b>	Request for Comments.
<b>RSVP:</b>	Resource Reservation Protocol.
<b>RTP:</b>	Real Time Protocol.
<b>SMTP:</b>	Simple Mail Transfer Protocol.
<b>TCP:</b>	Transmission Control Protocol.
<b>ToS:</b>	Type of Service.
<b>UDP:</b>	User Datagram Protocol.
<b>VoIP:</b>	Voice over Internet Protocol.
<b>WFQ:</b>	Weighted Fair Queuing.

**WRED:** Weighted Random Early Detection.  
**WRR:** Weighted Round Robin.

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