

HOW DOES LONG-TAIL TRAFFIC AFFECT NETWORK PERFORMANCE?*

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Network performance is affected by the Hurst Parameter. An increase in the Hurst parameter can lead to a reduction in network performance. The extent to which heavy-tailedness degrades network performance is determined by how well congestion¹ control is able to shape source traffic into an on-average constant output stream while conserving information (Wikipedia).

In today's network environment with multimedia and other QoS² sensitive traffic streams comprising a growing fraction of network traffic, second order performance measures in the form of "jitter"³ such as delay variation and packet loss variation are important to provisioning user specified QoS. Self-similar burstiness is expected to exert a negative influence on second order performance measures (Wikipedia).

Packet switching based services, such as the Internet are best-effort services, so degraded performance, although undesirable, can be tolerated. However, since the connection is contracted, ATM networks need to keep delays and jitter within negotiated limits (Wikipedia).

Self-similar traffic exhibits the persistence of clustering which has a negative impact on network performance.

With Poisson traffic (found in conventional telephony⁴ networks), clustering occurs in the short term but smooths out over the long term.

With long-tail traffic, the bursty behaviour may itself be bursty, which exacerbates the clustering phenomena, and degrades network performance (Wikipedia).

Many aspects of network quality of service depend on coping with traffic peaks that might cause network failures, such as

- Cell/packet loss and queue overflow
- Violation of delay bounds e.g. In video
- Worst cases in statistical multiplexing

Poisson processes are well-behaved because they are stateless⁵, and peak loading is not sustained, so queues do not fill. With long-range order, peaks last longer and have greater impact: the equilibrium shifts for a while (Wikipedia).

References:

Wikipedia. "Long-tail traffic", Wikimedia Foundation Inc, http://en.wikipedia.org/wiki/Long-tail_traffic, Last accessed 13th February 2006.

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*Version 1.1: Feb 15, 2006 10:29 am +0000

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¹http://cnx.rice.edu/GroupWorkspaces/wg412/module.2006-02-15.2334079630/module_text/

²http://cnx.rice.edu/GroupWorkspaces/wg412/module.2006-02-15.0906224171/module_text/

³http://cnx.rice.edu/GroupWorkspaces/wg412/module.2006-02-15.0771139961/module_text/

⁴http://cnx.rice.edu/GroupWorkspaces/wg412/module.2006-02-15.1626031171/module_text/

⁵http://cnx.rice.edu/GroupWorkspaces/wg412/module.2006-02-15.7857143883/module_text/