How real is the threat of instability events predicted by Adversarial Queueing Theory?

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ABSTRACT

Adversarial Queueing Theory (AQT) [2] analyzes inherent stability characteristics of network topologies. The common FIFO scheduling policy is shown to be susceptible to arrival patterns that lead to unbounded delay despite seemingly innocent arrival rates [3]. Such an event is called instability.

The underlying arrival patterns may arise due to misconfiguration, bad luck, or even as a stealthy denial-of-service attack. As such, instability may be deemed a threat to large computer networks as it may lead to persistently high delay and packet loss. However, until recently, little attention has been given to quantifying the threat level under realistic assumptions. In particular, most of the existing AQT literature makes two unrealistic assumptions: infinite buffers and a synchronous network model.

Recent work shows that classical AQT instability events appear harmless without these two assumptions [1]. Classical examples are shown to induce a bounded fraction of packet loss, which is small unless the network utilization is high. Unfortunately, the same work also encounters a new class of traffic patterns, which induce serious levels of packet loss even at medium-low network utilization.

The actual threat potential of AQT instability for real-world networks remains inconclusive. For instance, topologies studied in the AQT literature are not directly related to real-world topologies;; AQT effects have never been studied on real hardware; and a general bound on the packet loss, e.g., depending only on network size, remains unknown. Further understanding the practical impact of the AQT predictions thus will require the input of both theorists and practitioners.

BODY

Theoretical results suggests that innocent traffic patterns can overwhelm networks. Yet, for finite buffers these patterns appear harmless

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