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Implementation of PI^2 Queuing Discipline for Classic TCP Traffic in ns-3

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This dissertation presents the implementation and validation of PI^2 Active Queue Management (AQM) algorithm in ns-3 simulator. AQM mechanisms have been extensively studied and deployed in the Internet to monitor and limit the growth of the queue at routers. These mechanisms *avoid* congestion by proactively informing the sender about congestion, either by dropping a packet or by marking a packet. Many algorithms such as Random Early Detection (RED) and Controlled Delay (CoDel) have been designed to control the queuing delay and retain high link utilization. The state of the art queue management algorithms include Proportional Integral controller Enhanced (PIE) and PI^2. PI^2 provides an alternate design and implementation to PIE algorithm without affecting the performance benefits it provides in tackling the problem of *bufferbloat*.

Bufferbloat is a situation arising due to the presence of large unmanaged buffers in the network. It results in increased latency and therefore, degrades the performance of delay-sensitive traffic. PIE algorithm tries to minimize the queuing delay by auto-tuning its control parameters. However, with PI^2, this auto-tuning is replaced by just squaring the packet drop probability. Squaring the drop probability helps PI^2 offer a simplified design and improved performance without risking responsiveness and stability. In this dissertation, we have implemented a model for PI^2 in ns-3 and verified its correctness by comparing the results obtained from it to those obtained from the PIE model in ns-3. The results indicate that PI^2 offers a simple design and achieves similar or at times better responsiveness and stability than PIE.