Traditional Queue management v/s Active Queue management for controlling congestion in wireless network

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Abstract – *This paper studies congestion control in wireless networks supporting transmission control protocol (TCP) traditional queue management (QM) and active queue management technique(AQM) .Here we also compare the performance of a tail drop(QM) and RED(AQM) protocols.*

Key Words: Active Queue Management, tail drop, RED

1. INTRODUCTION

Queue management algorithms manage the length of packet queues by dropping packets when necessary or appropriate.

1.1 Traditional queue management technique:

Maximum router queue length (in terms of packets) is set for each queue. Only if this maximum length is not exceeded, the packets are accepted for the, otherwise subsequent incoming packets are rejected until the packet from the queue has been transmitted and the queue decreases. This technique is known as "tail drop" or "drop tail", since the packet that arrived most recently (i.e., the one on the tail of the queue) is dropped when the queue is full.

Drawbacks of traditional queue management technique:

1. Lock-Out

Drop tail allows a single connection or a few flows to capture the queue space, preventing other connections from getting room in the queue. This "lock-out" phenomenon is often the result of synchronization or other timing effects.

2. Full Queues

Drop tail discipline allows queues to maintain a full (or, almost full) status for long periods of time, since tail drop signals congestion (via a packet drop) only when the queue has become full. If the queue is full or almost full, an arriving burst will cause multiple packets to be dropped. This can result in a global synchronization of flows throttling back, followed by a sustained period of lowered link utilization, reducing overall throughput.

1.2 Active queue management technique:

In order to overcome the full queues problem of the traditional queue management technique , packets need to be dropped before a queue becomes full, so that end nodes can respond to congestion before buffers overflow. Such an approach, since it is proactive is called as "active queue management". By dropping packets before buffers overflow, active queue management allows routers to control when and how many packets to drop. Random early detection (RED) is an Active Queue management algorithms used for controlling congestion on wireless networks.

Random Early Drop **(RED)**: Monitors the average queue size and drops packets based on statistical probabilities. If the buffer is almost empty, all incoming packets are accepted. As the queue grows, the probability for dropping an incoming packet grows too. When the buffer is full, the probability has reached 1 and all incoming packets are dropped.

Advantages of Active queue management technique:

1. Less no. of packets are dropped in routers. If the entire queue space in a router is already in a "steady state" traffic or if the buffer space is inadequate, then the router cannot buffer bursts. By keeping the average queue size small, active queue management will provide greater capacity to absorb naturally-occurring bursts without dropping packets. Furthermore, without active queue management, more packets will be dropped when a queue does overflow. This leads to lowered average link utilization, lowered network throughput and waste of bandwidth

We note that while RED can manage queue lengths and reduce end-to-end latency even in the absence of end-to-end congestion control, RED will be able to reduce packet dropping only in an environment that continues to be dominated by end-to-end congestion control.

2. Lower-delay interactive service

By keeping the average queue size small, queue management will reduce the delays seen by flows. This is particularly important for interactive applications such as short Web transfers, Telnet traffic, or interactive audio-video sessions, whose subjective (and objective) performance is better when the end-to-end delay is low.

3. Avoids lock-out behavior

Active queue management can prevent lock-out behavior by ensuring that there will almost always be a buffer available for an incoming packet. For the same reason, active queue management can prevent a router bias against low bandwidth but highly bursty flows.

It is clear that lock-out is undesirable because it constitutes a gross unfairness among groups of flows. However, we stop short of calling this benefit "increased fairness", because general fairness among flows requires per-flow state, which is not provided by queue management. For example, in a router using queue management but only FIFO scheduling, two TCP flows may receive very different bandwidths simply because they have different round-trip times], and a flow that does not use congestion control may receive more bandwidth than a flow that does. Per-flow state to achieve general fairness might be maintained by a per-flow scheduling algorithm such as Fair Queuing (FQ) or a class-based scheduling algorithm such as CBQ for example.

On the other hand, active queue management is needed even for routers that use per-flow scheduling algorithms such as FQ or class-based scheduling algorithms such as CBQ. This is because per-flow scheduling algorithms by themselves do nothing to control the overall queue size or the size of individual queues.

Active queue management is needed to control the overall average queue sizes, so that arriving bursts can be accommodated without dropping packets. In addition, active queue management should be used to control the queue size for each individual flow or class, so that they do not experience unnecessarily high delays.

Therefore, active queue management should be applied across the classes or flows as well as within each class or flow.

2. Analysis of RED and Drop tail

We simulated a simple wireless network with 3 nodes. We used both RED and drop tail protocols for analyzing the performance.

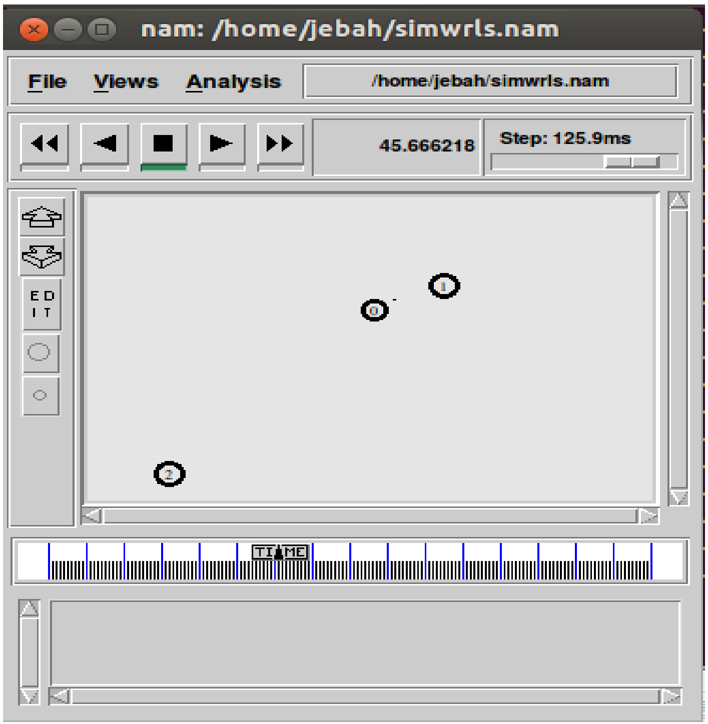

Fig1. Simulation Topology

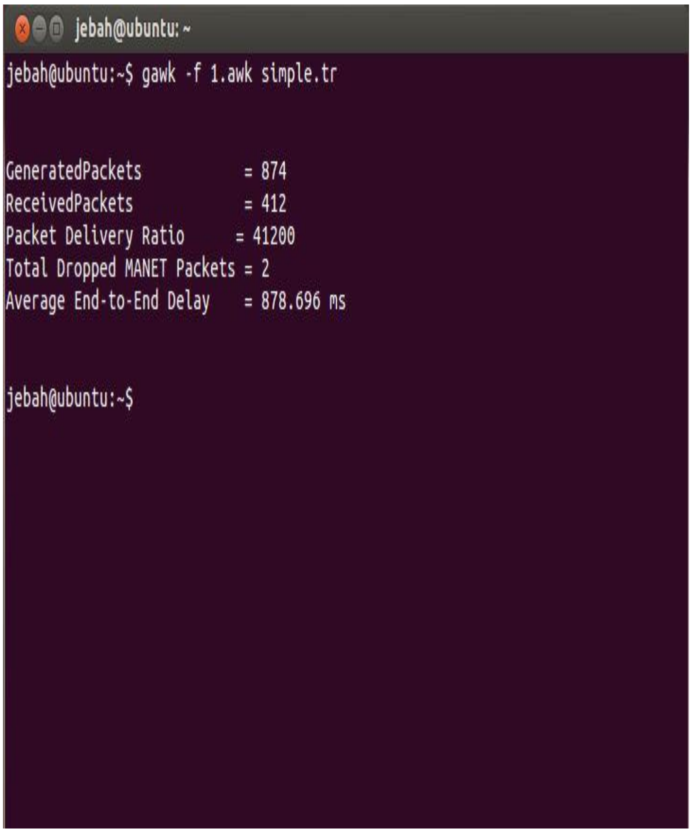

Fig2. Performance of drop tail

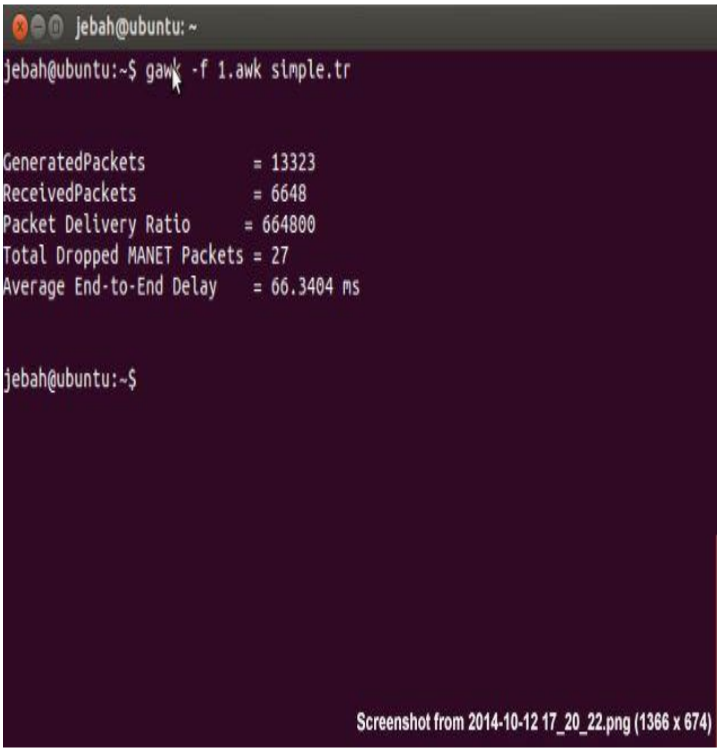

Fig3 Performance of RED

3. CONCLUSIONS

Thus we have made use of tradition and active queue management techniques - FIFO and RED to control congestion on Wireless Networks and analyzed their performance.

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