BLUE : Active Queue Management

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Congestion Control

- Earliest congestion control scheme is TCP congestion control
  - reduces transmission rates after detecting packet loss events
  - result in large number of packet drops
  - wastage of resources
- Router algorithms related to congestion control
  - Queue Management Algorithms
  - Packet Scheduling Algorithms

Need for Active Queue Management

- Tail Dropping: if the queue is full, arriving packet is dropped.
  - Lock out : allows a single flow or a few flows to monopolize the queue
  - Full Queues : can cause global synchronization which results in underutilization of the link.
- Drop Front On Full, Random Drop On Full
  - Solves Lock out problem
- Full Queues problem can be solved by dropping the packets before the queue becomes full - "Active Queue Management"

Goals of Active Queue Management

- Reduce number of packet drops at gateways
- Low end-to-end delay
- Avoiding Lock out

RED

- Maintains exponentially weighted moving average of the queue length to detect congestion
- When average queue length exceeds a maximum threshold, all packets are dropped or marked.
- When average queue length lies between minimum threshold and maximum threshold, packets are randomly dropped or marked.

Shortcomings of RED

- Using queue lengths as indicator of the severity of congestion
- In order to to be effective, RED must have a sufficient amount of buffer space and must be correctly parameterized.

BLUE

- Uses Packet loss and Link utilization history.
- Maintains a marking probability
- If the queue is continually dropping the packets, increments marking probability
- If the queue becomes empty or idle, decreases the marking probability

BLUE Algorithm

Upon Packet loss (or $Q_{len} > L$) event:

if ((now – last_update) > freeze_time)

$p_m := p_m + \delta_1$

last_update := now

Upon link idle event:

if ((now – last_update) > freeze_time)

$p_m := p_m - \delta_2$

last_update := now

taken from reference [1]

Stochastic Fair BLUE

- Maintains N × L accounting bins and are organized in L levels with N bins per level
- L independent hash functions, each associated with each one level
- Hash function maps a flow, through connection ID (Source address, destination address, Source port, Destination port, protocol) into one of the N accounting bins in that level
- Each bin keeps a marking probability p_m and is updated as in BLUE

- Arrived packet is hashed in to one of the N bins in each level
- Based on the minimum of p_m values of all the bins to which the packets of a flow are hashed, that flow will be identified either as a non-responsive or responsive

References

[1] Wu-chang Feng, Kang Shin, Dilip Kandlur, Debanjan Saha, The Blue Active Queue Management Algorithms, IEEE/ACM Transactions on Networking, Vol. 10, No. 4, August 2002.

[2] [RED] S.Floyd and V. Jacobson, Random Early Detection Gateways for Congestion Avoidance, IEEE/ACM Transactions on Networking, Vol. 1, pp 397-413, August 1993

[3] [RFC2309] B. Braden, D. Clark, J. Crowcroft, B. Davie, S. Deering, D. Estrin, S. Floyd, V. Jacobson, G. Minshall, C. Partridge, L. Peterson, K. Ramakrishnan, S. Shenker, J. Wroclawski, L. Zhang, Recommendations on Queue Management and Congestion Avoidance in the internet, April 1998.