PIE: A lightweight latency control to address the bufferbloat problem

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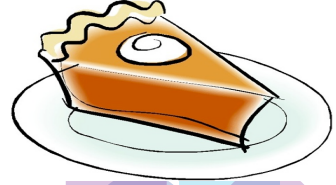
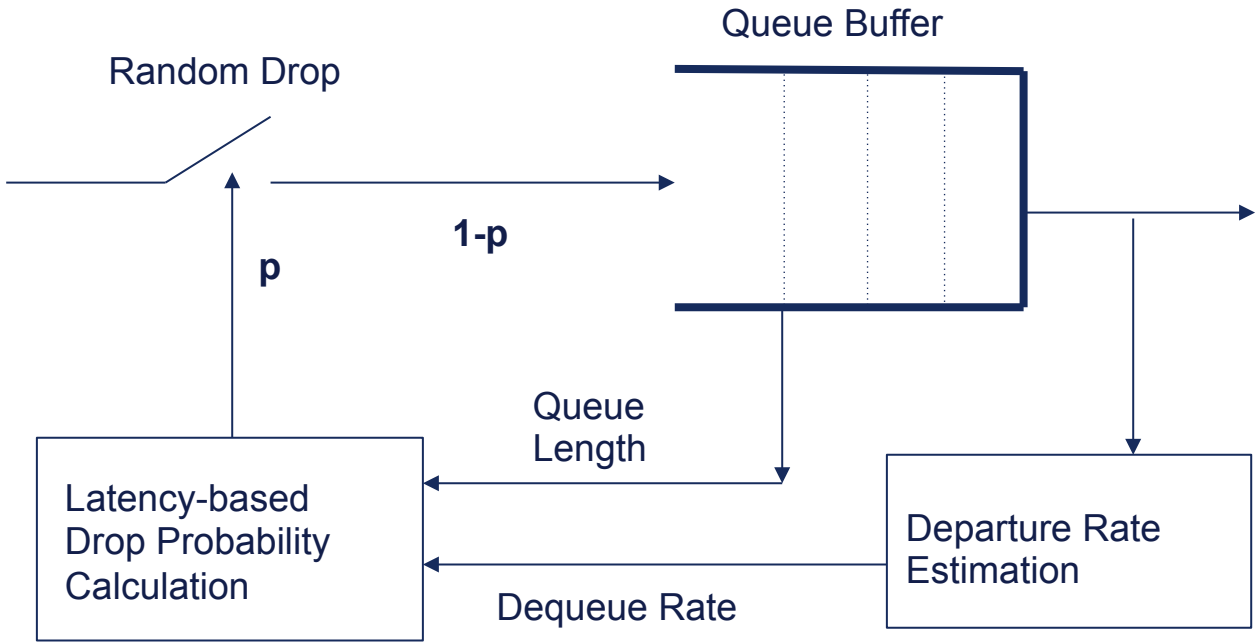
The block diagram of PIE





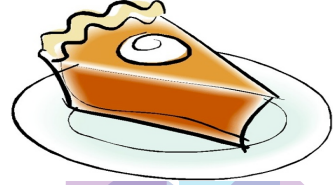
The design of PIE

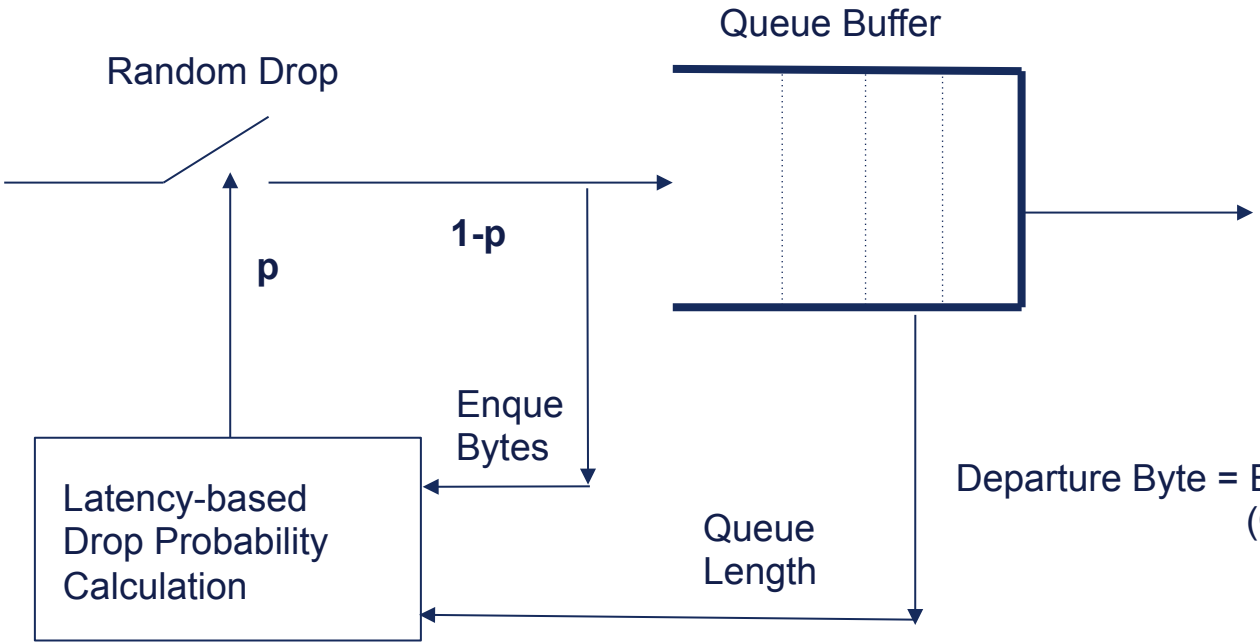
- Upon every packet arrival
  - randomly drop a packet based on drop_prob calculated below
- Every T_{update} interval
  - estimated_delay, est_del = queue_length/depart_rate
  - drop_prob += a*(est_del – target_delay) + b* (est_del – est_del_old)
  - est_del_old = est_del;
  - depart_count = 0;
- In a measurement cycle
  - Upon a packet's departure: depart_count += deque_packet_size;
  - if dq_count > deq_threshold then
  - depart_rate = deqart_count/(now-start);
  - dq_count = 0; start = now;

PIE Work Update

- Turning PIE on/off automatically
  - Spurious uptick in queueing delay would cause packet drops
- Extending auto-tuning range of PIE
  - Extend the auto-tuning region all the way up to 0.001% drop probability
- Enhanced Burst Tolerance
  - Related to the first bullet, burst tolerance is only triggered when PIE is active
  - Spurious spike will not be counted towards burst tolerance
- De-randomization
  - Random tosses could cause drops too close to each other or too far from each other
  - Add a mechanism to mitigate the outliers
- FQ_PIE
  - First pass of Linux implementation, the test results are promising

The block diagram of enque-based PIE





Departure Byte = Enque Bytes –
(Qlen – Qlen_old)

extra bytes stored in the queue

Thank you.