Active Queue (Buffer) Management

Sonia Fahmy
Department of Computer Sciences
Purdue University
fahmy@cs.purdue.edu
http://www.cs.purdue.edu/homes/fahmy/

Overview

- Drop Tail
- PPD/EPD
- RED
- RED Variants
- ECN

Routers

- Drop tail: drop when buffer is full
- Problem: Partial packets
  - Partial packet discard (PPD)
  - Early packet discard (EPD): do not admit new packets beyond threshold to leave space for partial packets
- Random Early Detection (RED): between maxth and minth, drop with \( p = f(\text{avg } Q) \)
- Potential advantages: early detection (TCP), avoid synchronization, punish misbehaving flows, avoid unfairness against bursty sources

Random Early Detection (RED)

- Mark/drop with \( p = 1 \)
- From 0 to \( P_{\text{max}} \)
- No dropping or marking
- \( Q_{\text{avg}} \) to \( P_{\text{max}} \)
- \( T_{\text{min}} \) to \( T_{\text{max}} \)

RED Variants

- Gentle RED (Rosolen, Bonaventure 1998)
- Flow RED (Lin,Kung) compare \( Q_i \) to \( Q_{\text{avg}}/N \)
  - Per flow state required. Also BRED
- SRED: estimate number of active flows
- ARED: variable \( p_{\text{max}} \), BLUE: variable \( p_{\text{drop}} \)
- WRED, RIO (parameters): diffserv
- ECN (RFC 2481 (sec7), CCR 10/94): 4 bits: ECN capable and CE bit to signal congestion, ECN-echo, CWR
- In addition to timeout and 3 dupacks

Explicit Congestion Notification (ECN)

- React to ECN only once per RTT (like loss event in TFRC)
- Advantage: Packet drops avoided, no need to wait for a Timeout
- React to ECN similar to packet drop to preserve TCP-friendliness, but not drastically
Key Points

- RFC 2309
- See www.aciri.org/floyd/red.html for links to papers discussing RED, RED variants, RED modeling, simulations and measurements

Thank You!

Questions?