RED - Details

- **Average queue size**
  - use exponentially weighted average
  - RED uses low weights (0.002)

- **Determining packets to discard:**
  - discards should be regular (so burst are not targeted)
  - … but not too regular (because strict regularity is also undesirable)
Quality of Service in IP

- **Type of Service (TOS) field in IPv4, Traffic Class in IPv6**
  - 8 bits
  - priority (3 bits)
  - bits to request high throughput, low latency, low loss, and low monetary cost
  - set by traffic generating applications

- For most parts, this attempt has *failed*:
  - no *cost* for requesting higher category of service
  - no broad *agreement* on how to handle the different categories
Differentiated Services

- Domain-based solution
- Relative guarantees
- Few classes of service
- Framework rather than a complete and prescriptive solution
- Reuses TOS field (called DSCP - Differentiated Services Code Point)
Differentiated Services

- **Src**
- **Src**
- **R**
- **R**
- **R**
- **R**
- **R**
- **Dst**

**DS Domain**

- Classifier
- Meter
- Marker
- Shaper
- Dropper

**Queuing policy**

- Route selection
- L2 control

**Regular router**

**Border router**

**Interior router**

**Differentiated Services Code Point (DSCP)**

**TOS (Type of Service)**
Real-Time Traffic

- **Elastic vs inelastic traffic**

- **Real-time transport**
  - timing is critical (low latency and jitter)
  - perishable data
  - (often) constant rate of delivery
  - (rate adaptation)

- Hard vs soft real time…
RTP

- Real-time Transport Protocol (RTP)
  - data transfer protocol
- Real-time Control Protocol (RTCP)
  - control protocol (QoS and synchronization)
- Typically run over UDP on unprivileged ports
- One pair per multimedia stream
- Sessions initiated using signaling protocols (e.g., SIP, RTSP)