

S-38.180 Palvelunlaatu Internetissä
S-38.180 Quality of Service in Internet
Harjoitus 1: Rate Control
Exercise 1: Rate Control

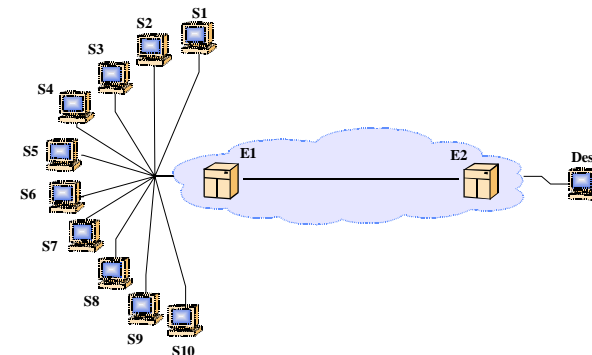
Exercise

- Comparison of different rate control methods in Internet.
- Methods which are used are:
 - Token bucket
 - Time sliding window
 - Single rate two color marker.

Reporting

- Due date: 31.10.2001 at 1200 hours.
- Reports: delivered to course locker in G-wing 2nd floor.

Topology





Task

- Investigate the operation of different metering and marking algorithms
- Source population (traffic mix):
 - Pure TCP (greedy FTP)
 - Pure UDP (CBR)
 - Mixed (2–4 UDP clients and 6–8 TCP clients)
- Contracts:
 - All clients equal contract
 - Some clients substantially higher contract
 - Some clients zero contract
- Sending rates
 - Controllable sources (UDP)
 - Below
 - At
 - Over the contracted capacity
- See what is the outcome of the service expressed as recovered capacities.



Policers

- TSW2CM:
 - Time Sliding Window Meter with Two Color Marker
 - `Queue addPolicyEntry [Destination id] [Source id] TSW2CM Initial Codepoint CIR`
 - Packets are marked to lower precedence probabilistically when CIR is exceeded
- TSW3CM:
 - Time Sliding Window Meter with Three Color Marker
 - `Queue addPolicyEntry [Destination id] [Source id] TSW3CM Initial Codepoint CIR PIR`
 - Packets are marked to medium precedence probabilistically when CIR is exceeded
 - Packets are marked to low precedence probabilistically when PIR is exceeded



Rate control

- Implemented as policies:
 - `$QE2E1 addPolicyEntry ($dest id) [$s1 id] TSW2CM 20 ($cir)`
-



Policers

- Token Bucket:
 - `Queue addPolicyEntry [Destination id] [Source id] tokenBucket Initial Codepoint CIR CBS`
 - Packets are marked to lower precedence when bucket is empty
 - $CIR = \text{Token rate} * \text{Token size}$
 - $CBS = \text{Size of the token bucket}$

Policers

- srTCM:
 - Single Rate Meter with Three Color Marker
 - `Queue addPolicyEntry [Destination id] [Source id] srTCM Initial Codepoint CIR CBS EBS`
 - Two token buckets in cascade
 - Packets are marked to medium precedence when first bucket is empty but second is not
 - Packets are marked to low precedence when both buckets are empty

Policers

- trTCM:
 - Two Rate Meter with Three Color Marker
 - `Queue addPolicyEntry [Destination id] [Source id] trTCM Initial Codepoint CIR CBS PIR PBS`
 - Two token buckets in cascade
 - Packets are marked to medium precedence when first bucket is empty but second is not
 - Packets are marked to low precedence when both buckets are empty

Policers

- Action of policers is defined

• `$qE1E2 addPolicerEntry TSW2CM 1011`

Queue to manipulate

Policer type

Initial codepoint

Degraded codepoint

Forwarding

- Each packet with assigned codepoint need some forwarding action to be associated
- This is done by selecting queue and precedence based on the codepoint

– `$qE1E2 addPHBEntry 1001`

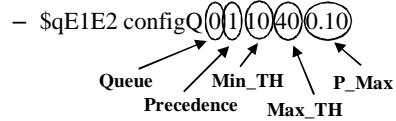
Codepoint

Queue

Precedence (virtual queue)

Forwarding

- Each virtual queue (precedence) is associated a RED algorithm with own parameters:



Sources

- UDP source is defined by
 - Protocol source
 - Packet size
 - Protocol destination
 - Null
 - Application
 - Packet size
 - Sending rate

```
set udp1 [new Agent/UDP]
$ns attach-agent $s1 $udp1
set cbr1 [new Application/Traffic/CBR]
$cbr1 attach-agent $udp1
$cbr1 set packet_size_ $packetSize
$udp1 set packetSize_ $packetSize
$cbr1 set rate_ $rate1
set null1 [new Agent/Null]
$ns attach-agent $dest $null1
$ns connect $udp1 $null1
```

Sources

- TCP source is defined by
 - Protocol source
 - Packet size
 - Protocol destination
 - Sink
 - Application

```
set tcp10 [new Agent/TCP]
$ns attach-agent $s10 $tcp10
set ftp10 [new Application/FTP]
$ftp10 attach-agent $tcp10
$tcp10 set packetSize_ $packetSize
set sink10 [new Agent/TCPSink]
$ns attach-agent $dest $sink10
$ns connect $tcp10 $sink10
```

Simulator output

- Event file where all
 - Enqueue (+)
 - Dequeue (–)
 - Drop (d)
 - Receive (r)

```
r 6.6938 4 5 tcp 1000 ----- 1 0.0 2.0 657 1301
+ 6.6938 5 2 tcp 1000 ----- 1 0.0 2.0 657 1301
- 6.6938 5 2 tcp 1000 ----- 1 0.0 2.0 657 1301
r 6.694155 1 4 tcp 1000 ----- 2 1.0 3.0 10 1356
+ 6.694155 4 5 tcp 1000 ----- 2 1.0 3.0 10 1356
d 6.694155 4 5 tcp 1000 ----- 2 1.0 3.0 10 1356
r 6.6946 0 4 tcp 1000 ----- 1 0.0 2.0 684 1357
```

are presented in tabulated fashion