

# Effect of Number of Drop Precedences in Assured Forwarding

## draft-goyal-diffserv-dpstdy-01.txt

Mukul Goyal, Padmini Misra, Raj Jain  
The Ohio State University  
Columbus, OH 43210-1277  
Jain@cis.ohio-state.edu

These slides, ID, and a paper are available on-line at  
<http://www.cis.ohio-state.edu/~jain/ietf/dpstdy.htm>

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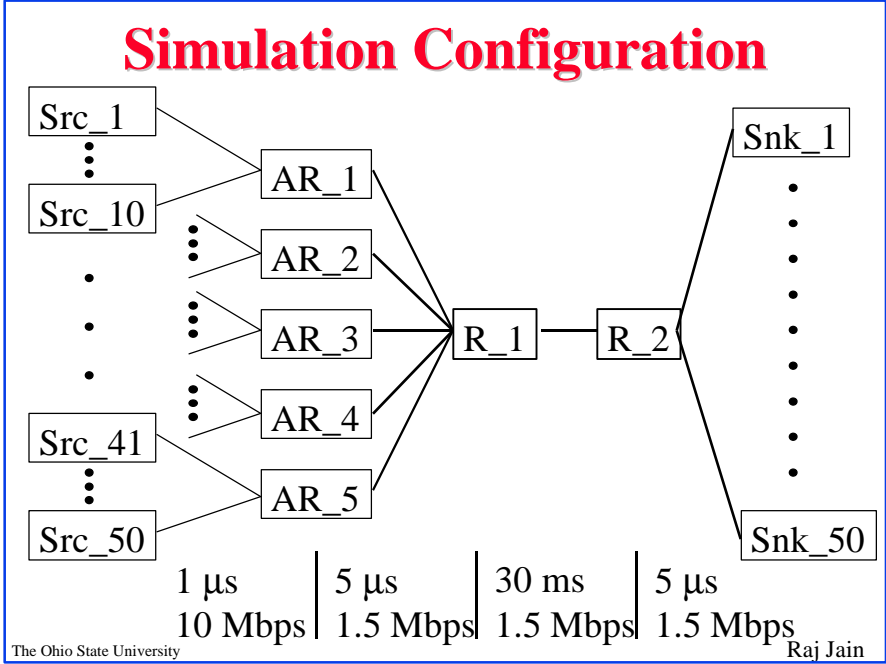


- Simulation Configuration
- Single Rate and Two Rate Marking Methods
- Results

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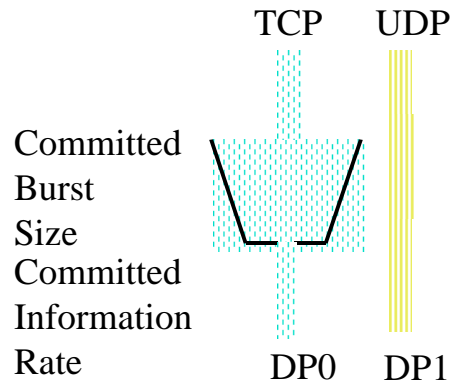


## Link Parameters

|                      | Link B/W | Link Delay | Drop Policy       |
|----------------------|----------|------------|-------------------|
| Between Src_i & AR_i | 10 Mbps  | 1 $\mu$ s  | DropTail          |
| From AR_i to R_1     | 1.5 Mbps | 5 $\mu$ s  | DropTail w marker |
| From R_1 to AR_i     | 1.5 Mbps | 5 $\mu$ s  | DropTail          |
| From R_1 to R_2      | 1.5 Mbps | 30 ms      | RED_n             |
| From R_2 to R_1      | 1.5 Mbps | 30 ms      | DropTail          |
| Between R_2 & Snk_i  | 1.5 Mbps | 5 $\mu$ s  | DropTail          |

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## Two Drop Precedences



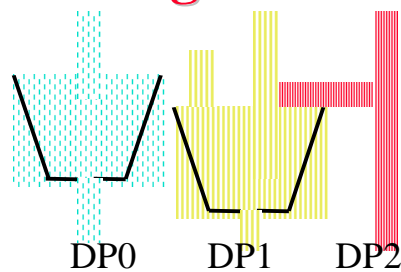
- ❑ All UDP packets are marked DP1
- ❑ TCP packets up to CIR are marked DP0
- ❑ Overflowed TCP packets are marked DP1

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## 3 DPs: Single-Rate Marking



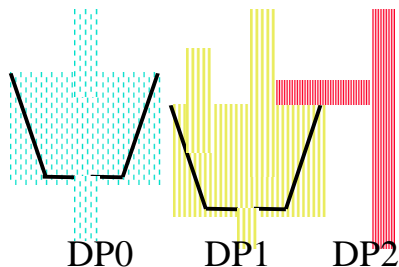
- ❑ Tokens generated at “Token Generation Rate” (TGR)  
Tokens go to DP0 bucket, if DP0 full go to DP1 bucket
- ❑ Parameters: TGR, DP0 Bucket Size, DP1 Bucket size
- ❑ Color Aware  $\Rightarrow$  Excess packets overflow to next DP  
We analyzed color-aware only.

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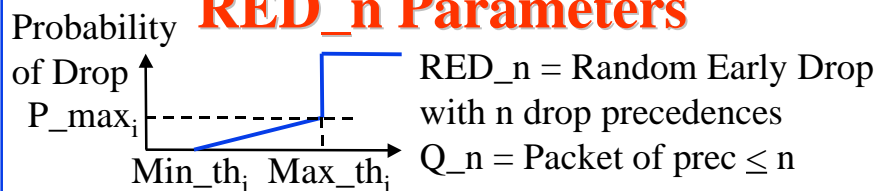
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## 3 DPs: Two-Rate Marking



- ❑ Tokens in DP0, DP1 buckets generated independently.
- ❑ Parameters: TGR0, TGR1, DP0 Bucket Size, DP1 Bucket Size
- ❑ Color Aware  $\Rightarrow$  Excess packets overflow to next DP  
We analyzed colore aware only.

## RED<sub>n</sub> Parameters



|                  | No D.P. | 2 D.P. | 3 D.P. |
|------------------|---------|--------|--------|
| Min Thresh(dp0)  | 20      | 20     | 20     |
| Max Thresh(dp0)  | 40      | 40     | 40     |
| Min Thresh(dp1)  | N/A     | 20     | 20     |
| Max Thresh(dp1)  | N/A     | 40     | 40     |
| Min Thresh(dp2)  | N/A     | N/A    | 20     |
| Max Thresh(dp2)  | N/A     | N/A    | 40     |
| Drop Prob. (dp0) | 1/30    | 1/30   | 1/30   |
| Drop Prob. (dp1) | N/A     | 1/20   | 1/20   |
| Drop Prob. (dp2) | N/A     | N/A    | 1/10   |

## Single-Rate Marker Parameters

|                 | No D.P. | 2 D.P.   | D.P.     |
|-----------------|---------|----------|----------|
| 1: TGR          | N/A     | 192 kbps | 192 kbps |
| 2: TGR          | N/A     | 256 kbps | 256 kbps |
| DP0 Bucket Size | N/A     | 8 kB     | 4 kB     |
| DP1 Bucket Size | N/A     | N/A      | 4 kB     |

## Two-Rate Marker Parameters

|                     | No DP | 2 DP | 3 DP    |
|---------------------|-------|------|---------|
| 1:TGR0+TGR1 in kbps | N/A   | 192  | 64+128  |
| 2:TGR0+TGR1 in kbps | N/A   | 256  | 128+128 |
| DP0 Bucket Size     | N/A   | 8 kB | 4 kB    |
| DP1 Bucket Size     | N/A   | N/A  | 4 kB    |

## Results: Single-Rate Marker

| UDP Rate Mbps | # of DP's | CIR kbps | Max TCP | Min TCP | Avg TCP | Max UDP | Min UDP | Fairness |
|---------------|-----------|----------|---------|---------|---------|---------|---------|----------|
| 1.28          | No        | N/A      | 0.64    | 0.05    | 0.21    | 299     | 297     | .10      |
| 1.28          | 2         | 192      | 26      | 14      | 20      | 124     | 119     | .49      |
| 1.28          | 3         | 192      | 25      | 12      | 20      | 123     | 116     | .51      |
| 1.28          | 2         | 256      | 27      | 16      | 23      | 98      | 92      | .66      |
| 1.28          | 3         | 256      | 26      | 20      | 23      | 99      | 89      | .66      |

1. W/O DPs, TCP is punished for good behavior
2. Fairness is also poor.
3. Three DPs give the same perf for TCP as two DPs

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## Results: Single-Rate Marker

| UDP Rate kbps | # of DP's | CIR kbps | Max TCP | Min TCP | Avg TCP | Max UDP | Min UDP | Fairness |
|---------------|-----------|----------|---------|---------|---------|---------|---------|----------|
| 128           | No        | N/A      | 28      | 10      | 21      | 109     | 106     | .57      |
| 128           | 2         | 192      | 32      | 7       | 25      | 75      | 73      | .80      |
| 128           | 3         | 192      | 31      | 14      | 25      | 76      | 74      | .79      |
| 128           | 2         | 256      | 32      | 17      | 28      | 49      | 47      | .95      |
| 128           | 3         | 256      | 33      | 22      | 28      | 49      | 47      | .96      |

1. TCP rate is controlled by UDP rates
2. Three DPs give the same perf for TCP as two DPs

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## Results: Two-Rate Marker

| UDP Rate Mbps | # of DP's | CIR kbps | Max TCP | Min TCP | Avg TCP | Max UDP | Min UDP | Fairness |
|---------------|-----------|----------|---------|---------|---------|---------|---------|----------|
| 1.28          | No        | N/A      | 0.64    | 0.05    | 0.21    | 299     | 297     | .10      |
| 1.28          | 2         | 192      | 25      | 11      | 20      | 127     | 118     | .49      |
| 1.28          | 3         | 192      | 24      | 11      | 19      | 135     | 130     | .43      |
| 1.28          | 2         | 256      | 26      | 19      | 23      | 98      | 93      | .66      |
| 1.28          | 3         | 256      | 26      | 13      | 23      | 95      | 89      | .68      |

1. W/O DPs, TCP is punished for good behavior
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## Results: Two-Rate Marker

| UDP Rate kbps | # of DP's | CIR kbps | Max TCP | Min TCP | Avg TCP | Max UDP | Min UDP | Fairness |
|---------------|-----------|----------|---------|---------|---------|---------|---------|----------|
| 128           | No        | N/A      | 28      | 10      | 21      | 109     | 106     | .57      |
| 128           | 2         | 192      | 34      | 19      | 25      | 75      | 74      | .80      |
| 128           | 3         | 192      | 30      | 20      | 25      | 77      | 74      | .79      |
| 128           | 2         | 256      | 34      | 20      | 28      | 48      | 46      | .96      |
| 128           | 3         | 256      | 35      | 22      | 28      | 46      | 45      | .96      |

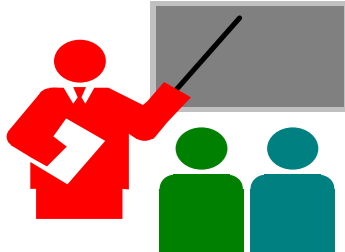
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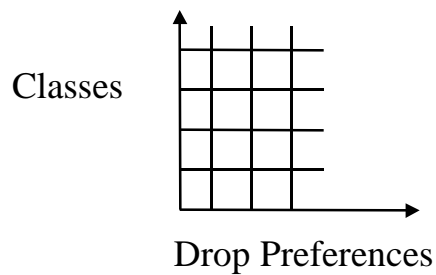
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## Summary



1. W/O DPs, TCP is punished for good behaviour
  2. Fairness is also poor.
  3. Three DPs give the same perf for TCP as two DPs
- Reason: TCP does not distinguish between loss of packets of different drop precedences

## Conclusion



- We have two dimensions of control
  - Classes = Queues
  - Drop Preferences = Right to enter the queue
- Classes  $\Rightarrow$  Directly controls bandwidth allocation

## Conclusion (Cont)

- DPs  $\Rightarrow$  Controls buffer allocation
  - $\Rightarrow$  Indirectly affects bandwidth allocation
    - Depends upon the arrival pattern
      - $\Rightarrow$  Random  $\Rightarrow$  Not Reliable
- Given a limited number of PHB's, it is better to have more classes than more DPs