

# AF Testing

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# AF Testing Goals (review)

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- To understand AF capabilities
  - assurance of minimum BW  
can AF effectively guarantee a minimum BW to flows independently of their behavior, aggregation at the core and remarking at edges?
  - "fairness" of BW distribution  
how resources are shared among flows depending on network state
  - user-controlled loss distribution  
can the user effectively specify which data is to be assured?
  - delay and jitter?

# AF Testing Goals (review)

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- To propose AF-based services
  - "Assured Bandwidth"

the service guarantees that target flows observe a transfer rate of "at least" X bps; more if extra resources are available.  
*(relationship to "Premium Service"?)*
  - "Assured Data"

the source/application can specify which data is not to be lost due to network congestion.  
*Suitable for audio/video streaming*
  - ...

# AF Activities

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## ★ WRED Understanding/Calibration

- find out the right configuration parameters that work for AF:

In the presence of congestion, all red packets shall be dropped before any yellow. If congestion persists, all yellow packets shall be dropped before any green.

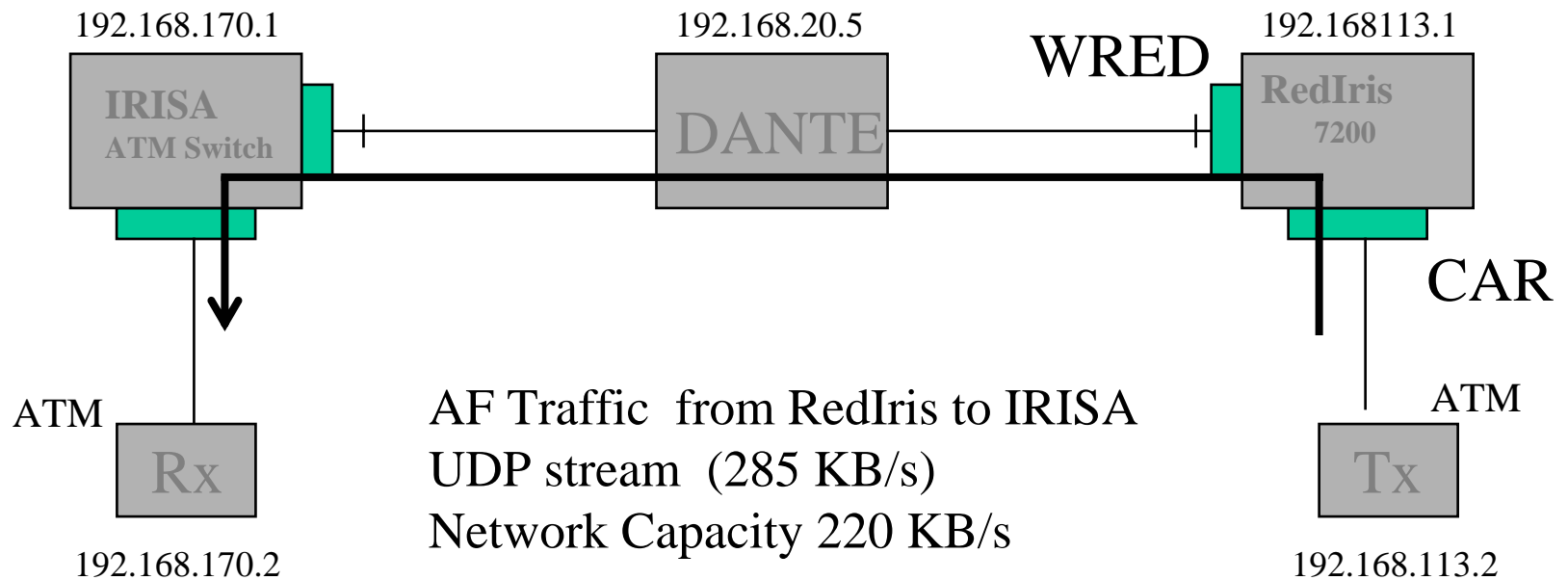
 Found the right parameters for UDP streams on Cisco implementation  
might need to be different for TCP aggregates

- Compare WRED vs RIO  
to be done (no RIO from Cisco!)

# WRED Test

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- Network Layout



# WRED Test

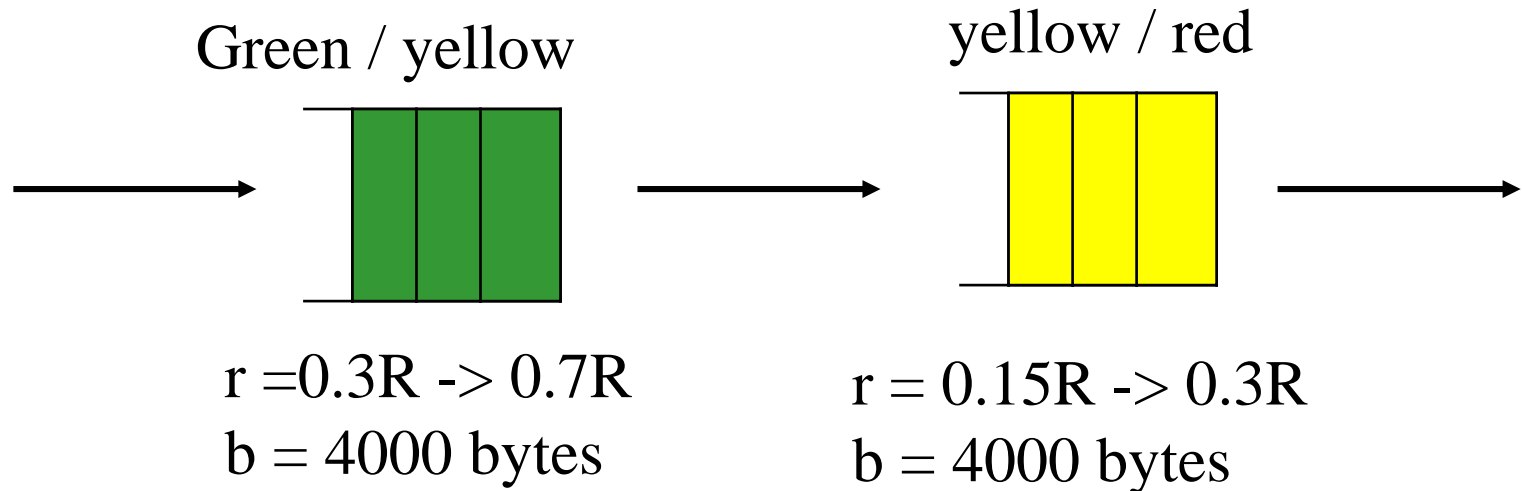
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- Marker

Sending Rate:  $R$  (285 KB/s)

Link Capacity:  $0.75R$  (~215 KB/s)

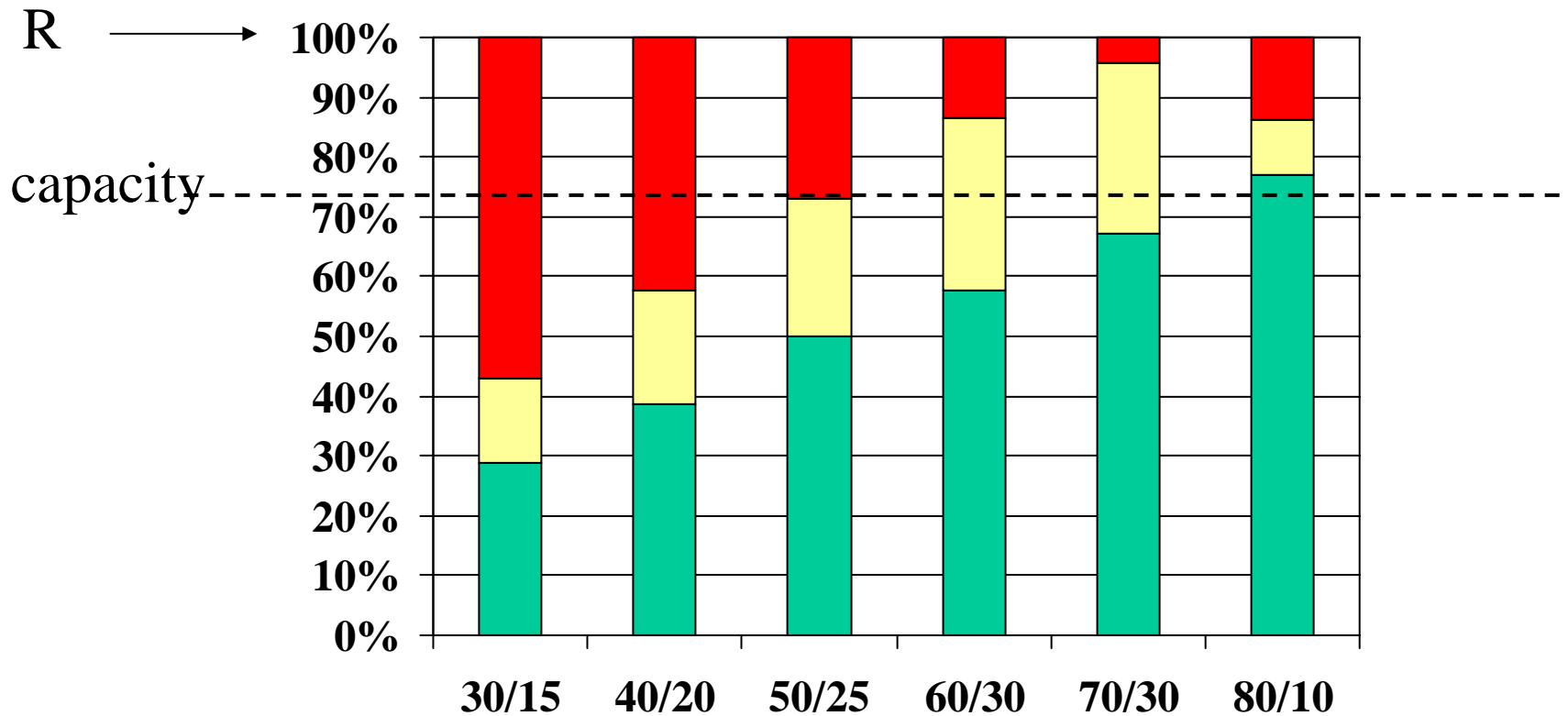
% loss:  $0.25R$



# WRED Test

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- Marking Results



# WRED Test

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- WRED parameters (before)

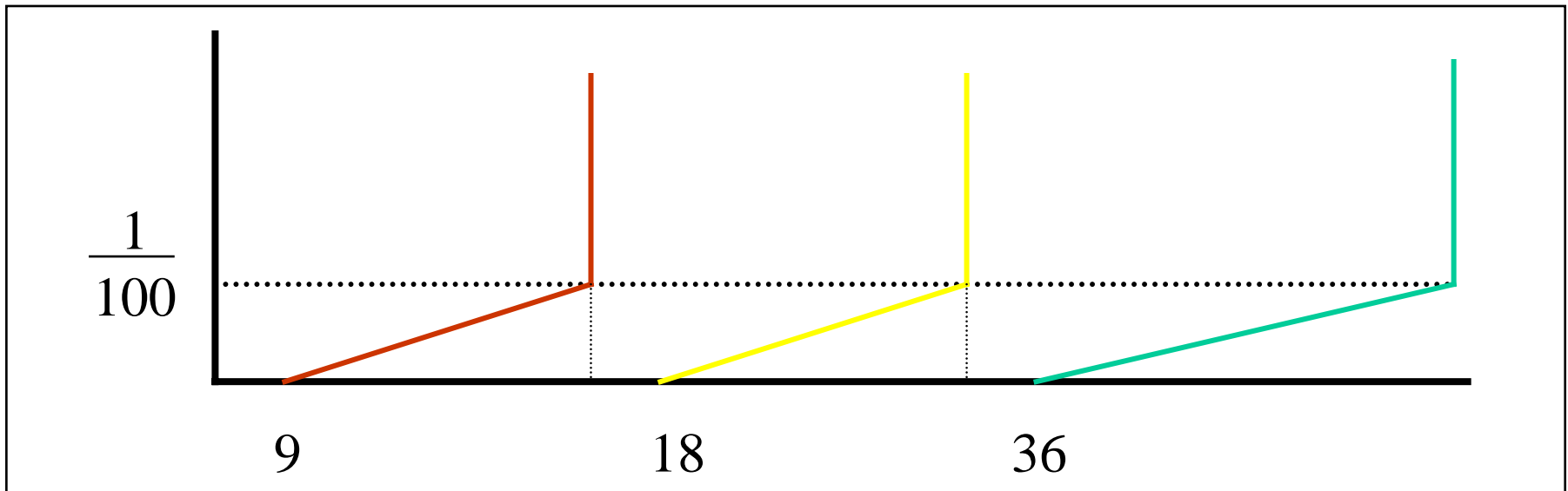
random-detect

random-detect exp **9**

random-detect precedence 2 **36 64 10**

random-detect precedence 4 **18 36 10**

random-detect precedence 6 **9 18 10**



# WRED Test

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- WRED parameters (now!)

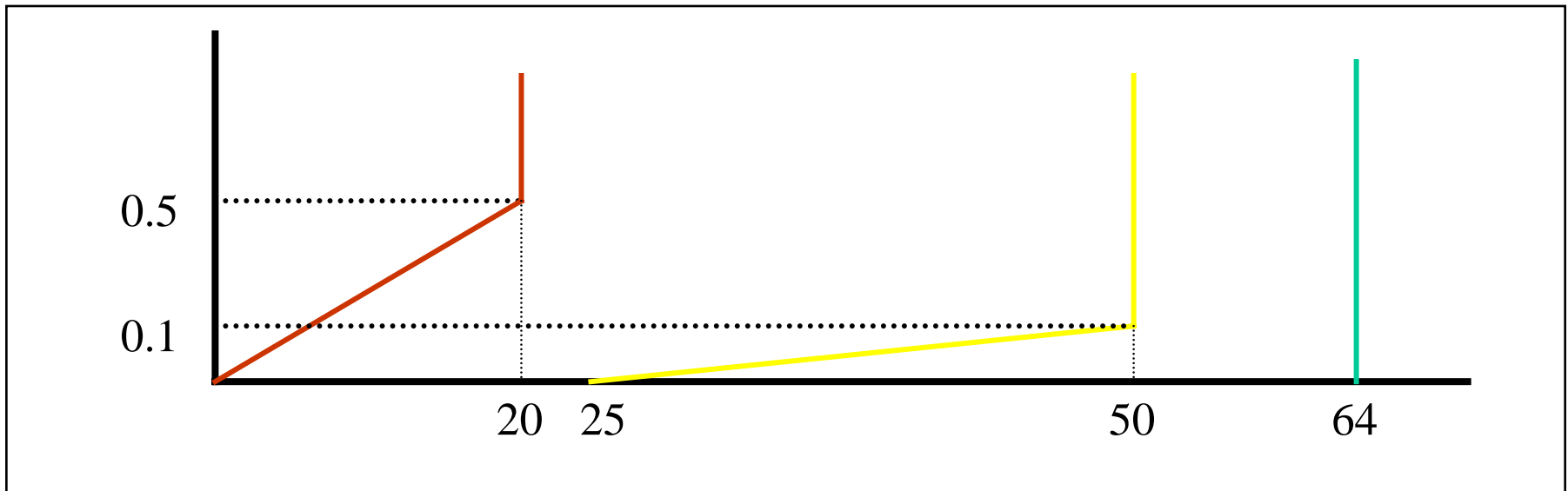
random-detect

random-detect exp3

random-detect precedence 2 **1 20 2**

random-detect precedence 4 **25 50 10**

random-detect precedence 6 **63 64 100**



# WRED Test

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- Results

| <b>%green</b> | <b>%yellow</b> | <b>Loss G</b> | <b>Loss Y</b> | <b>Loss R</b> |
|---------------|----------------|---------------|---------------|---------------|
| 30            | 15             | 0%            | 0%            | 43%           |
| 40            | 20             | 0%            | 0%            | 58%           |
| 50            | 25             | 0%            | 0%            | 86%           |
| 60            | 30             | 0%            | 37%           | 98%           |
| 70            | 30             | 0%            | 69%           | 99%           |
| 80            | 10             | 2%            | 94%           | 99%           |

 Green packets are effectively protected

# AF Activities

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## ★ AF Fairness

- How can AF differentially distribute BW among flows based on marking

Different marking parameters may result in weighted BW distribution.

- Tested for UDP streams
  - 3 colors (green, yellow, red)
  - 2 colors (in, out)
- Simulated for TCP aggregates
  - ready for testing
  - which tools?

# AF Fairness Test : 3 colors

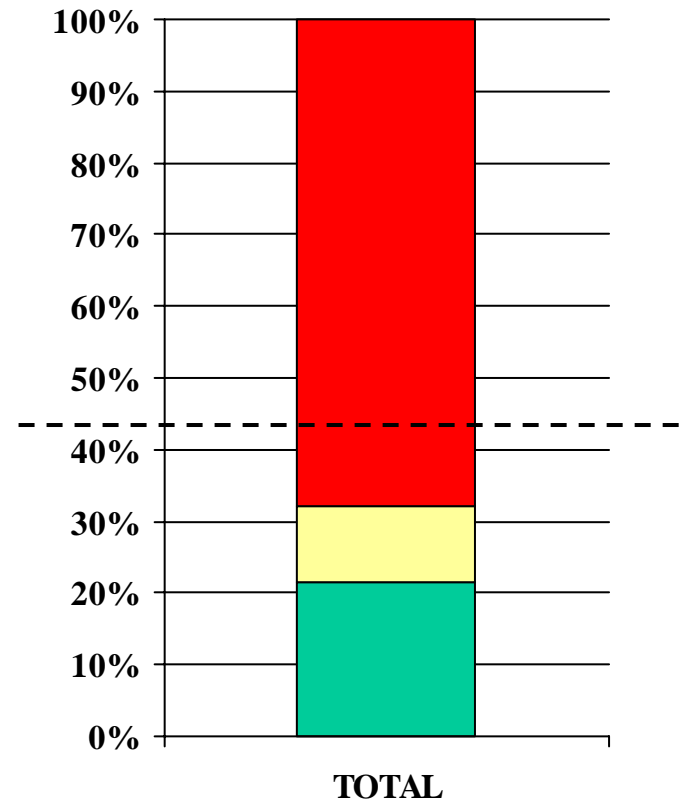
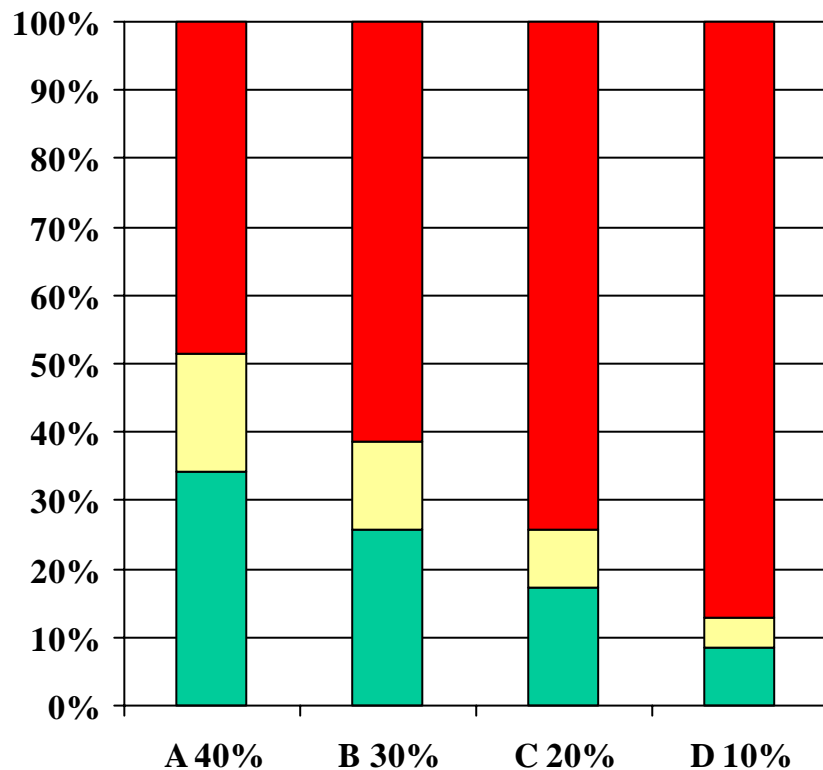
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- Sources:
  - 4 CBR sources @ 125 KB/s
  - Assured (green) bit-rate for the sources is set to 40, 30, 20 and 10% respectively.
- Markers:
  - Individual marker for each source
  - Green traffic accounts for 25, 50, 75 & 100% of total
  - Yellow traffic is fixed to  $0.5R_G$
- WRED
  - Kept the same parameters as in previous test

# AF Fairness Test: 3 colors

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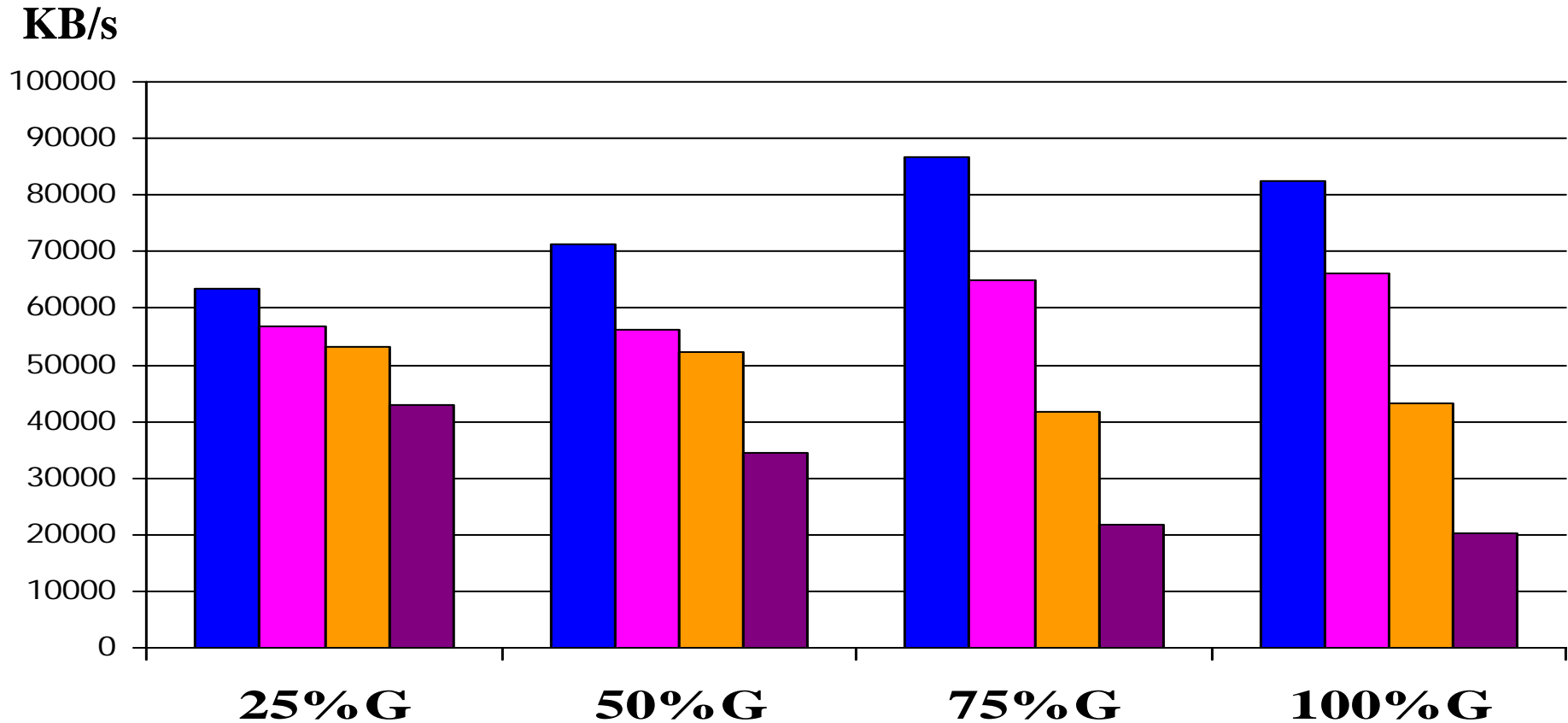
- Example: green traffic accounts for 50%



# AF Fairness Test: 3 colors

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- Results



# AF Fairness Test : 3 colors

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- Results: is this fair?
- Fairness 1: *excess fairness*
  - Sources obtain their assured BW
  - Excess resources are shared equally among sources

☒ observed on cases 25%, 50%
- Fairness 2: *weighted fairness*
  - Sources obtain their assured BW
  - Excess resources are shared differentially based on the weights specified by the assured rates.

☒ observed on cases 75%, 100%

# AF Fairness Test : 2 colors

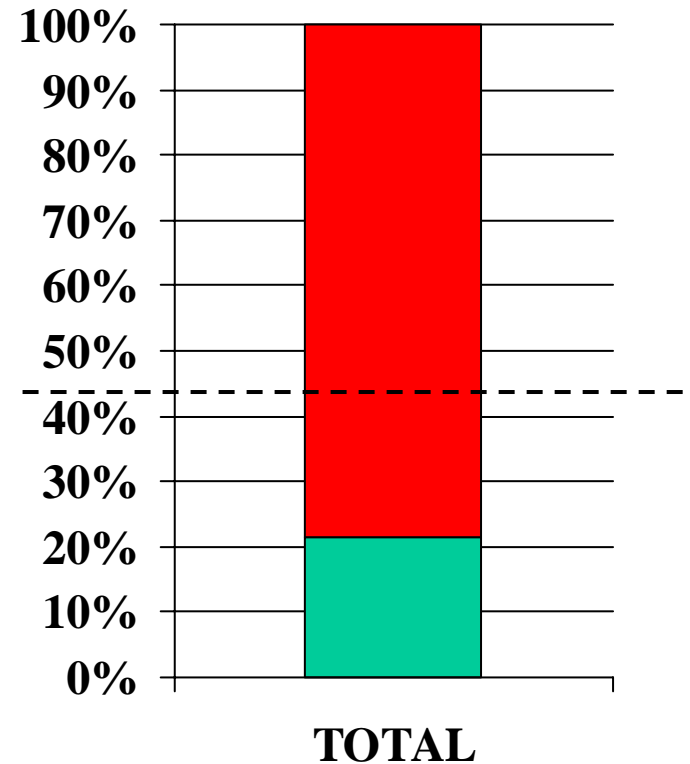
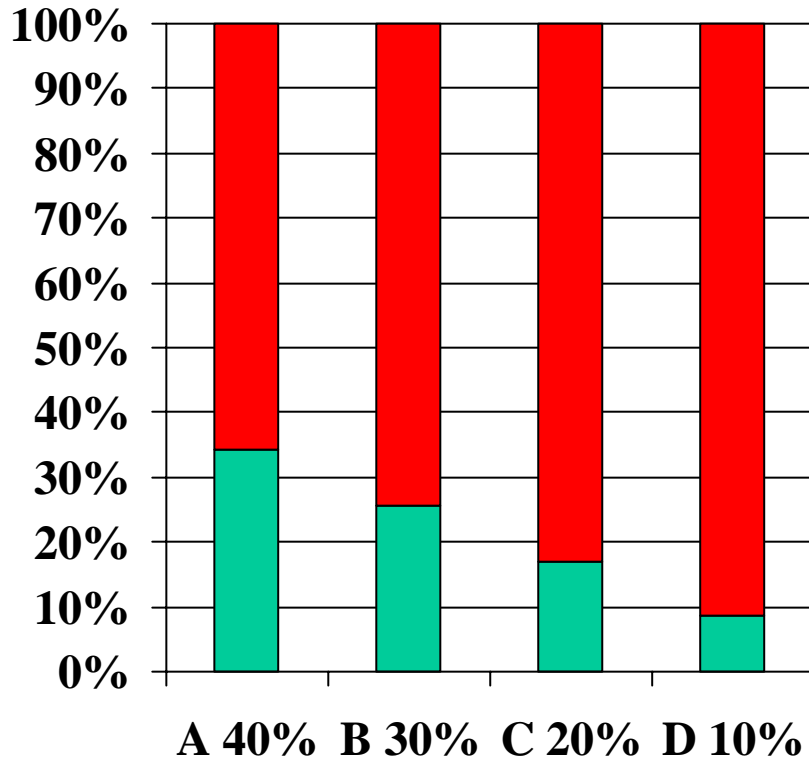
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- Same as before:
  - 4 CBR sources @ 125 KB/s, same relationship
  - Only one TB is used (IN/OUT)
  - Green traffic accounts for 25, 50, 75 & 100% of total
  
- WRED
  - New Configuration:
    - random-detect
    - random-detect exp3
    - random-detect precedence 2 **20 40 20**
    - random-detect precedence 6 **63 64 100**

# AF Fairness Test: 2 colors

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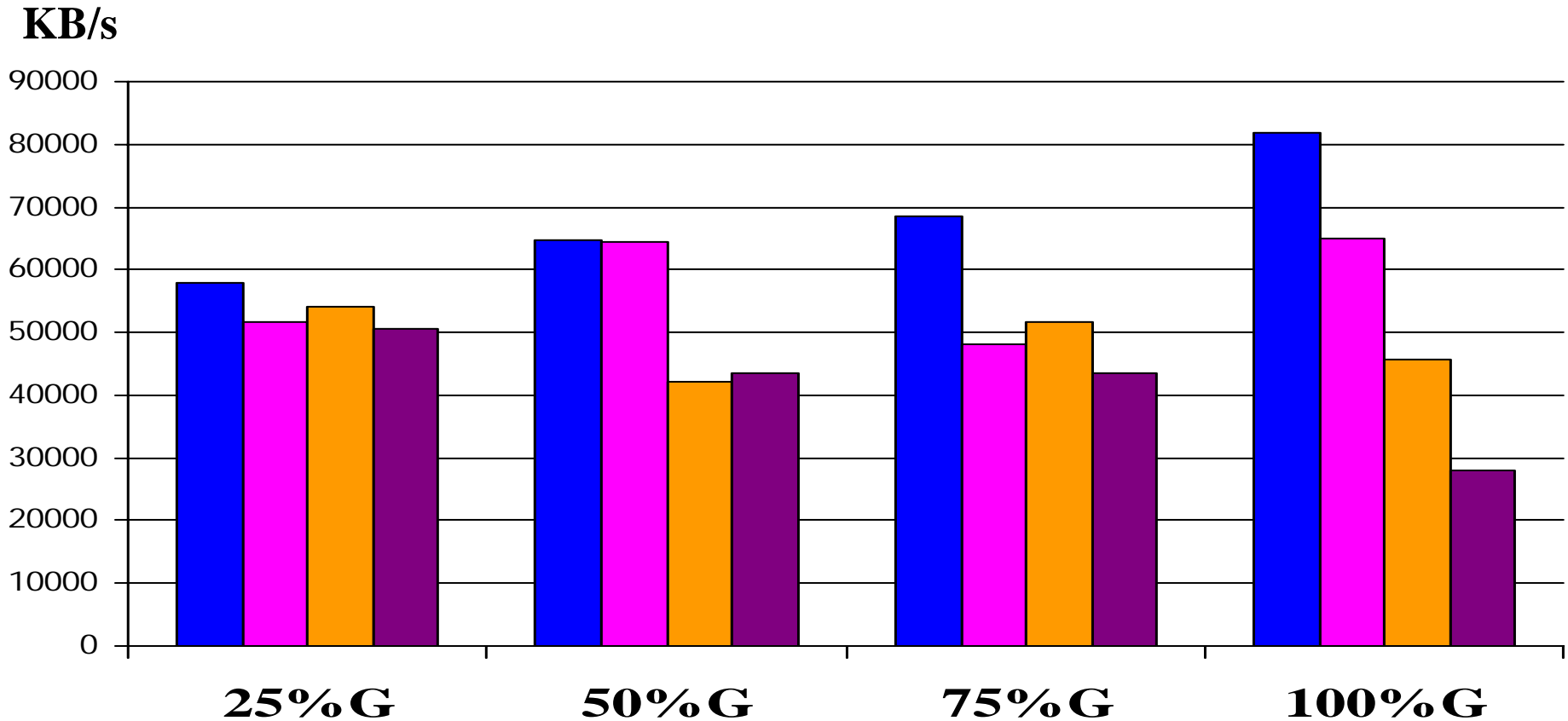
- Example: green traffic accounts for 50%



# AF Fairness Test: 2 colors

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- Results



# AF Fairness Test : 2 colors

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- Results: is something wrong?
  - ✉ Very variable results
    - important differences between 2 runs.
  - ✉ low-profile sources obtain far more than their fair (*excess or weighted*) share.
  - ✉ Only when % green ~ 100%, weighted distribution is observed.
  - ✂ May need other WRED parameters.

# AF Testing: more to come

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- Test with TCP
  - aggregates (tools?)
  - individual flows (can AF offer something?)
- Verify if resource sharing features hold under aggregation at the core
  - need more sites
- Do we care about fairness?
  - Should we worry about assurance of minimum BW?