

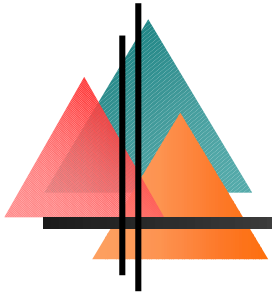


Lara Networks

Technology Solutions for a Better Internet™



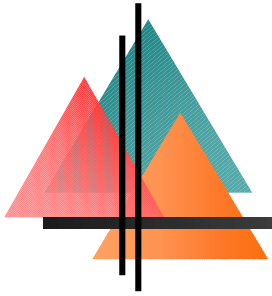
802-17-01-00011 (dvj July 2001)



802.17 presentation

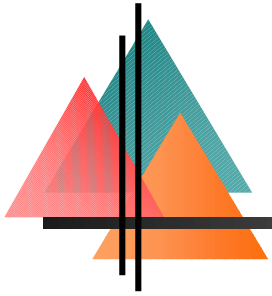
- Prepared for 802.17, July 2001
- Dr. David V. James
Chief Architect
Lara Networks
110 Nortech Parkway
San Jose, CA 95134
+1.408.942.2010
dvj@alum.mit.edu



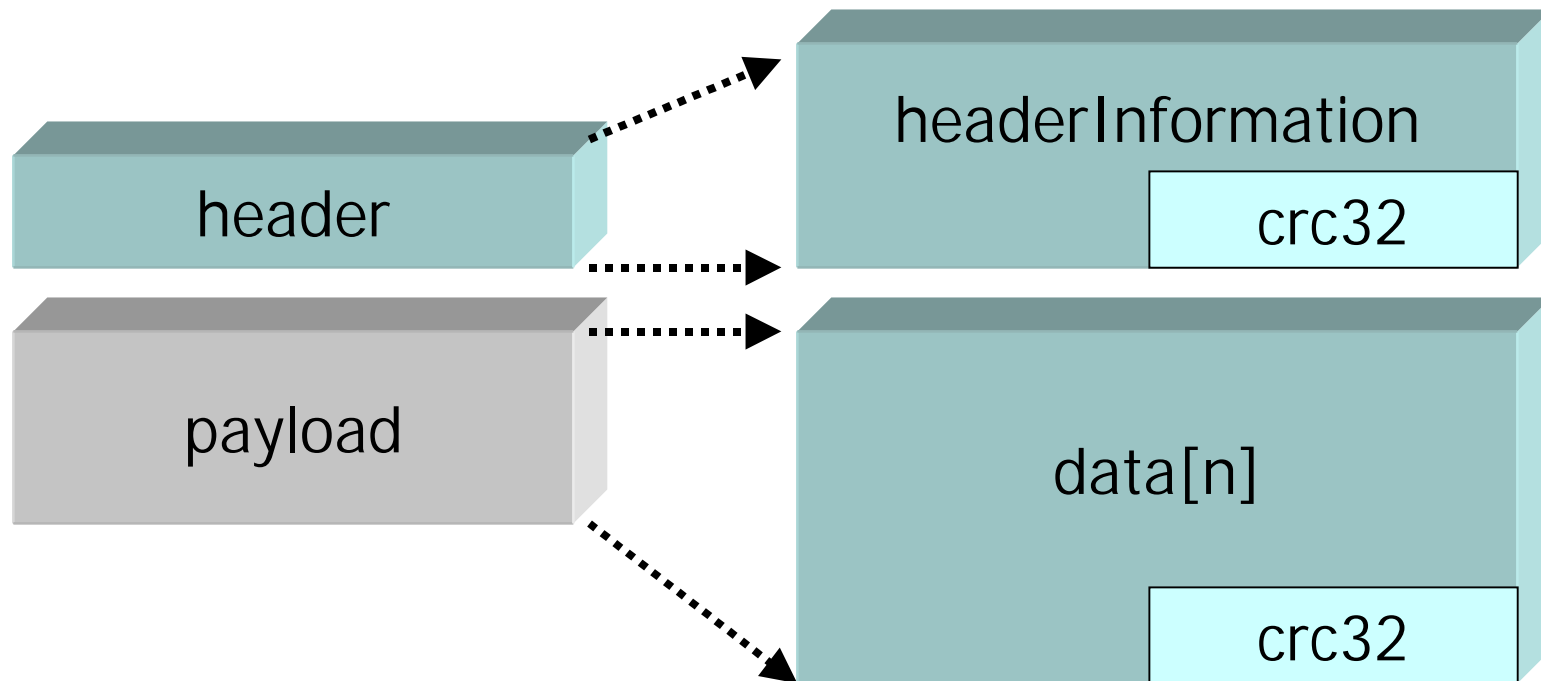


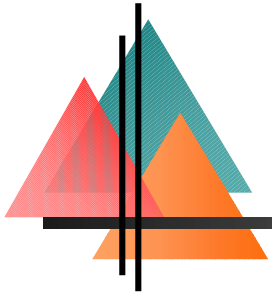
CRC processing

- Store&forward/Cut-through agnostic
- Invalid data is effectively discarded
 - store-and-forward discards
 - cut-through stomps the CRC
- Maximize error-logging accuracy
 - Separate header&data CRCs
 - "most" corruptions hit the data

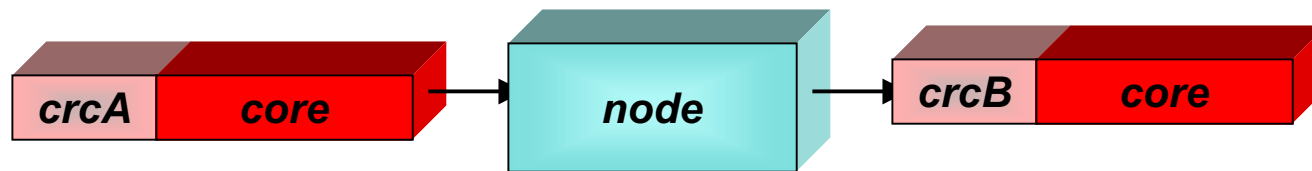


Separate header & data CRCs

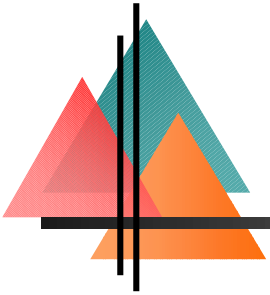




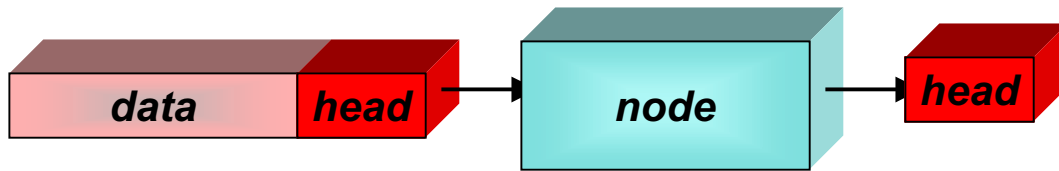
Cut-through CRCs



- Corrupted packet remains corrupted
- Error logged when first detected
- ```
if (crcA!=crc) {
 errorCount+= (crcA!=crc^STOMP);
 crcB= crc^STOMP;
}
```

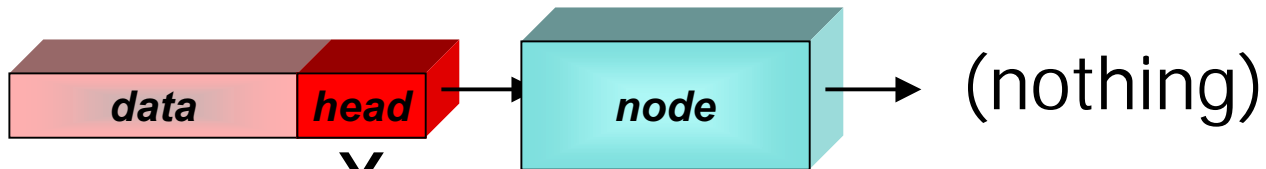


# Distinct CRCs reduces discards



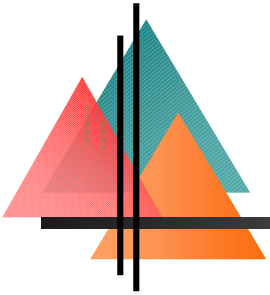
X

- Discard the corrupted data

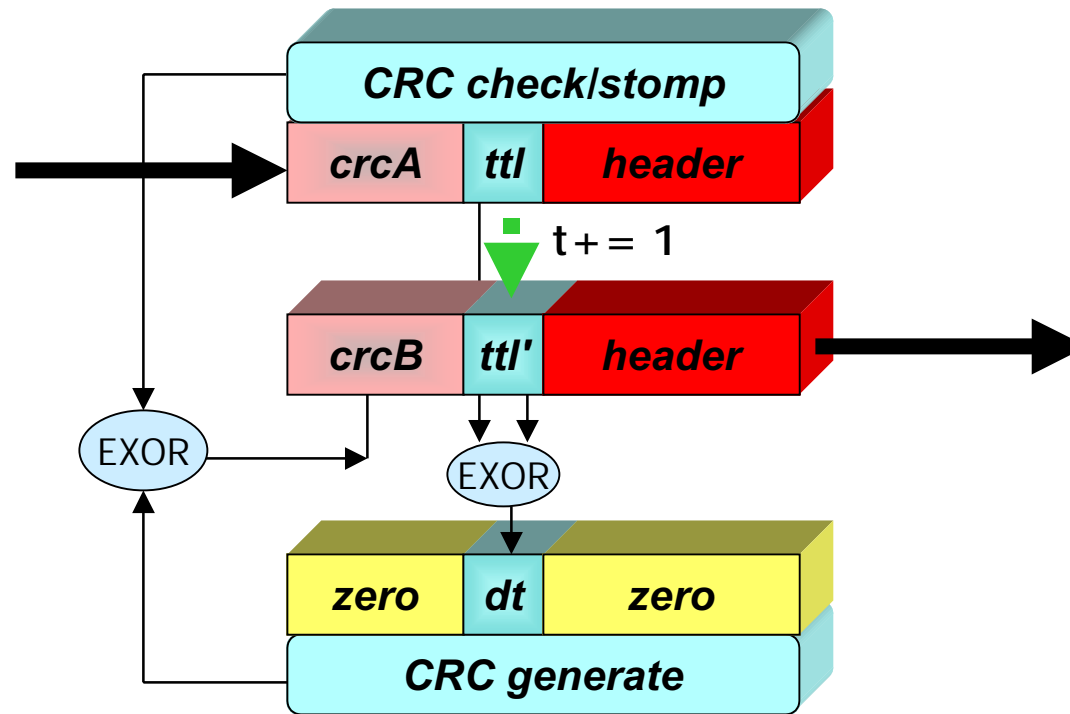


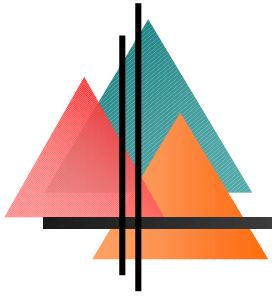
X

- Discard the corrupted packet



# End-to-end CRC protected TTL



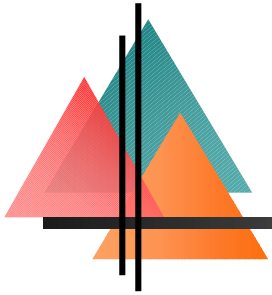


# Pre-emption

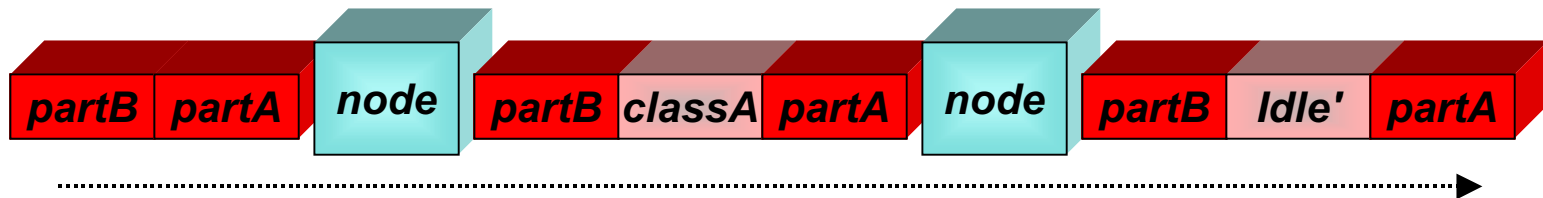
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- Suspend class-B/C for class-A packet
- Only one level is sufficient
  - class-A is the latency critical traffic
  - more levels complicate hardware
- Physical layer dependent
  - marginal for high BW & small packets
  - distinctive “suspend” symbol required

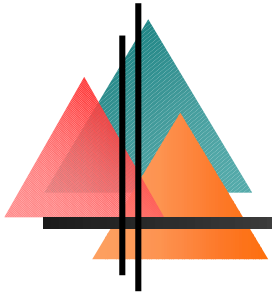




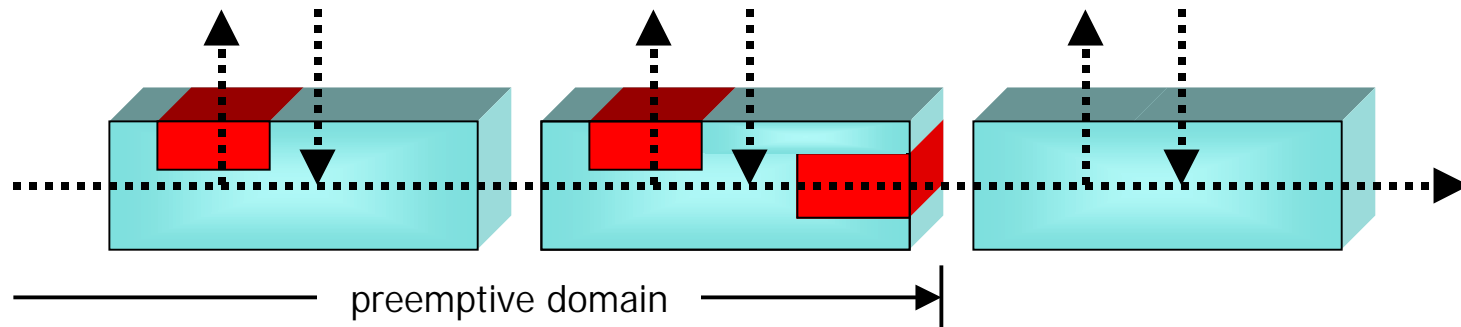
# Pre-emption fragments



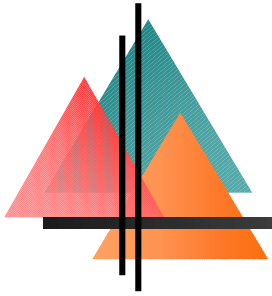
- Packets can be suspended
- The class-A packet can be stripped
  - egress queues are store&forward
  - distinctive idle markers needed



# Pre-emption compatibility



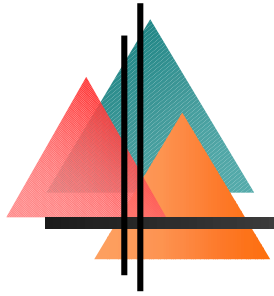
- Pre-emption mandates egress S&F
- Simplistic node has no such S&F
- Interoperability burden on elegant
  - boundary node has S&F bypass
  - cut-through in preemptive domain



# Basic issues

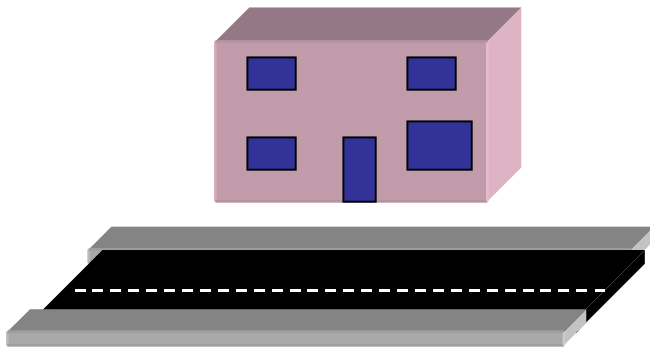
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- Limits of scalability
- Supported topologies
- Packet formats
- Transport services
- Arbitration
- Initialization (plug & play)

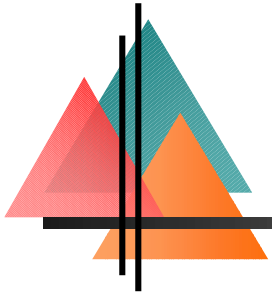


# Limits of scalability

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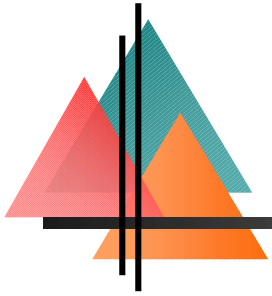
- Geosynchronous
- Terrestrial
  - The metro area
    - To the curb
      - To the home



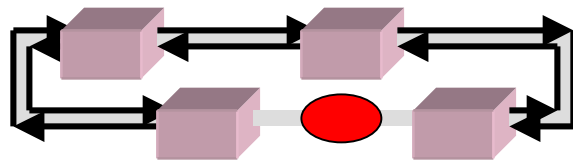
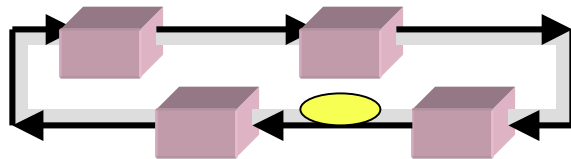
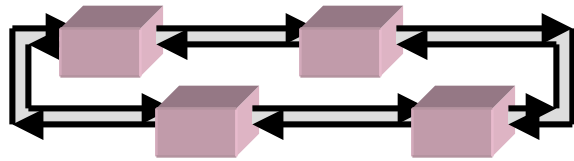
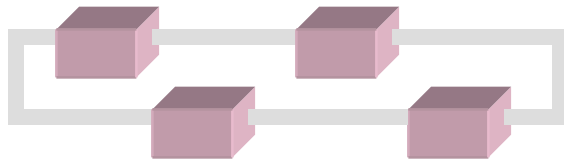
# Basic issues

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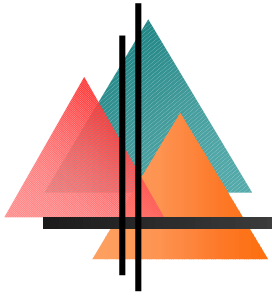
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# Supported topologies



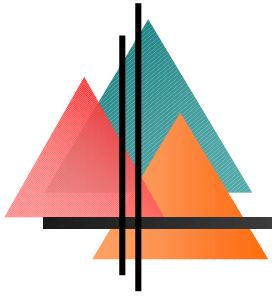
- A physical ring
- Dual ringlets
- Single ringlet
- Duplex ringlet



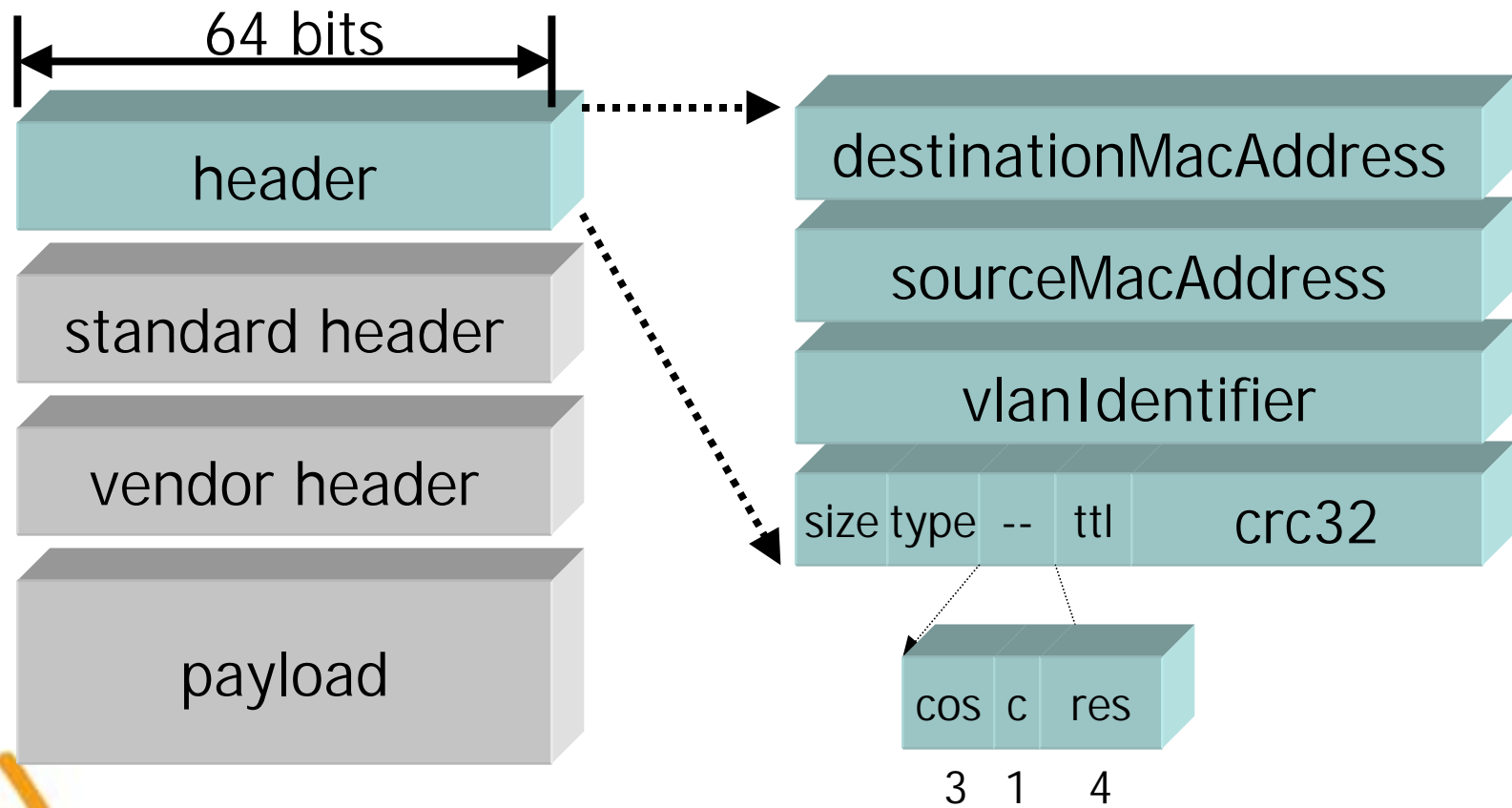
# Basic issues

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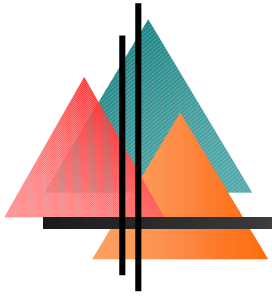
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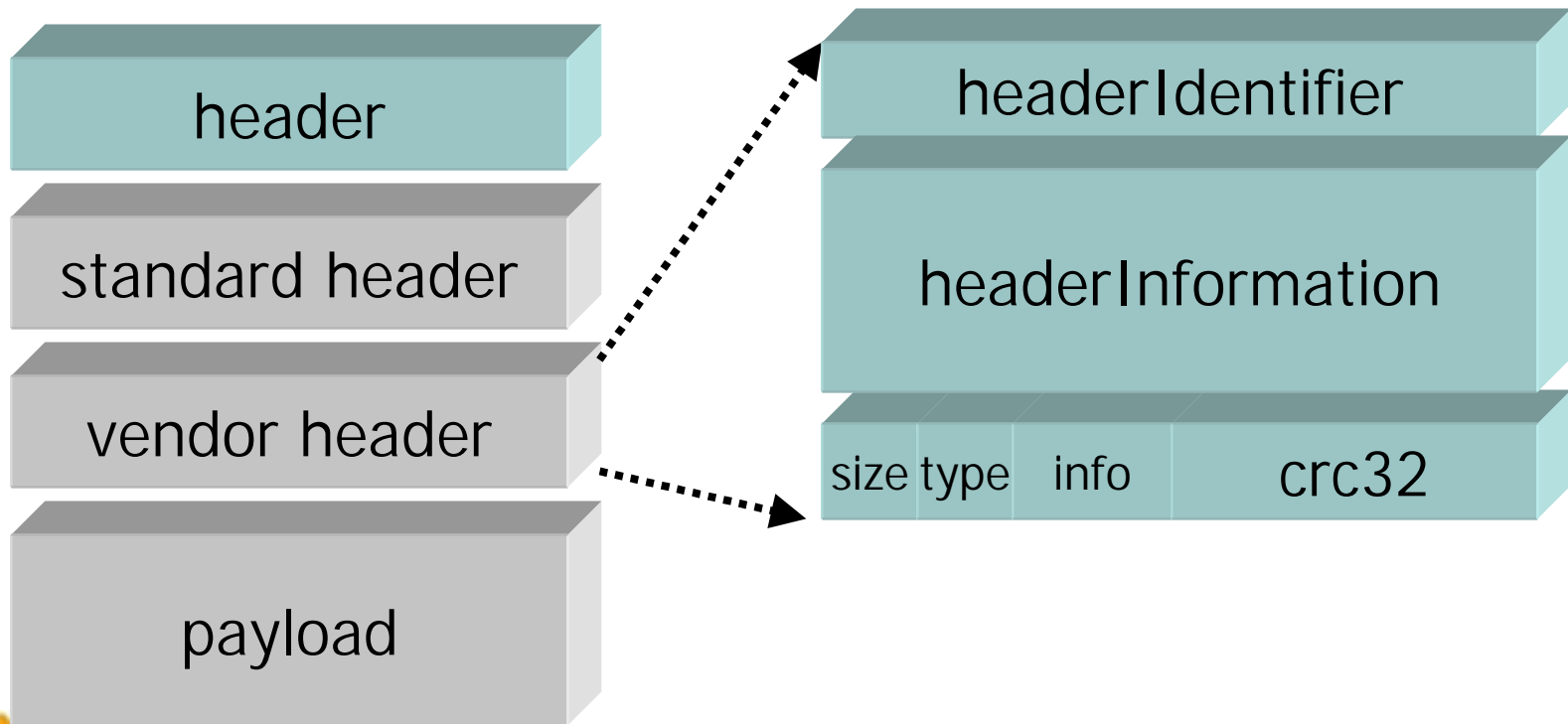
# Packet header

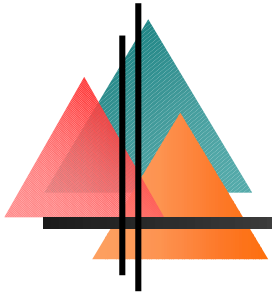




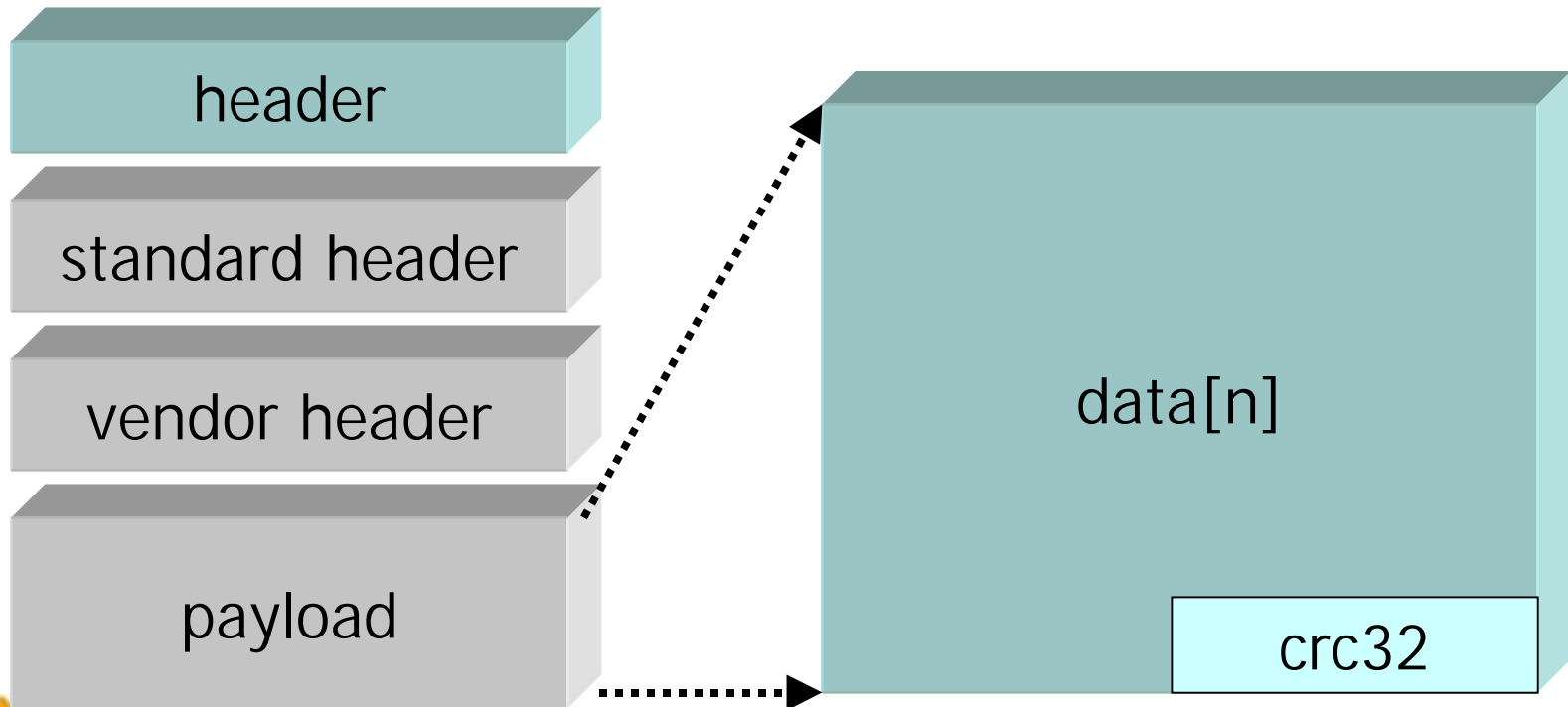


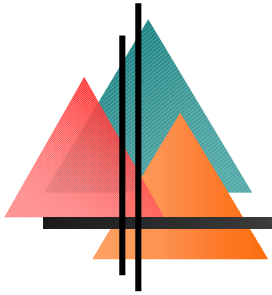
# Vendor dependent header



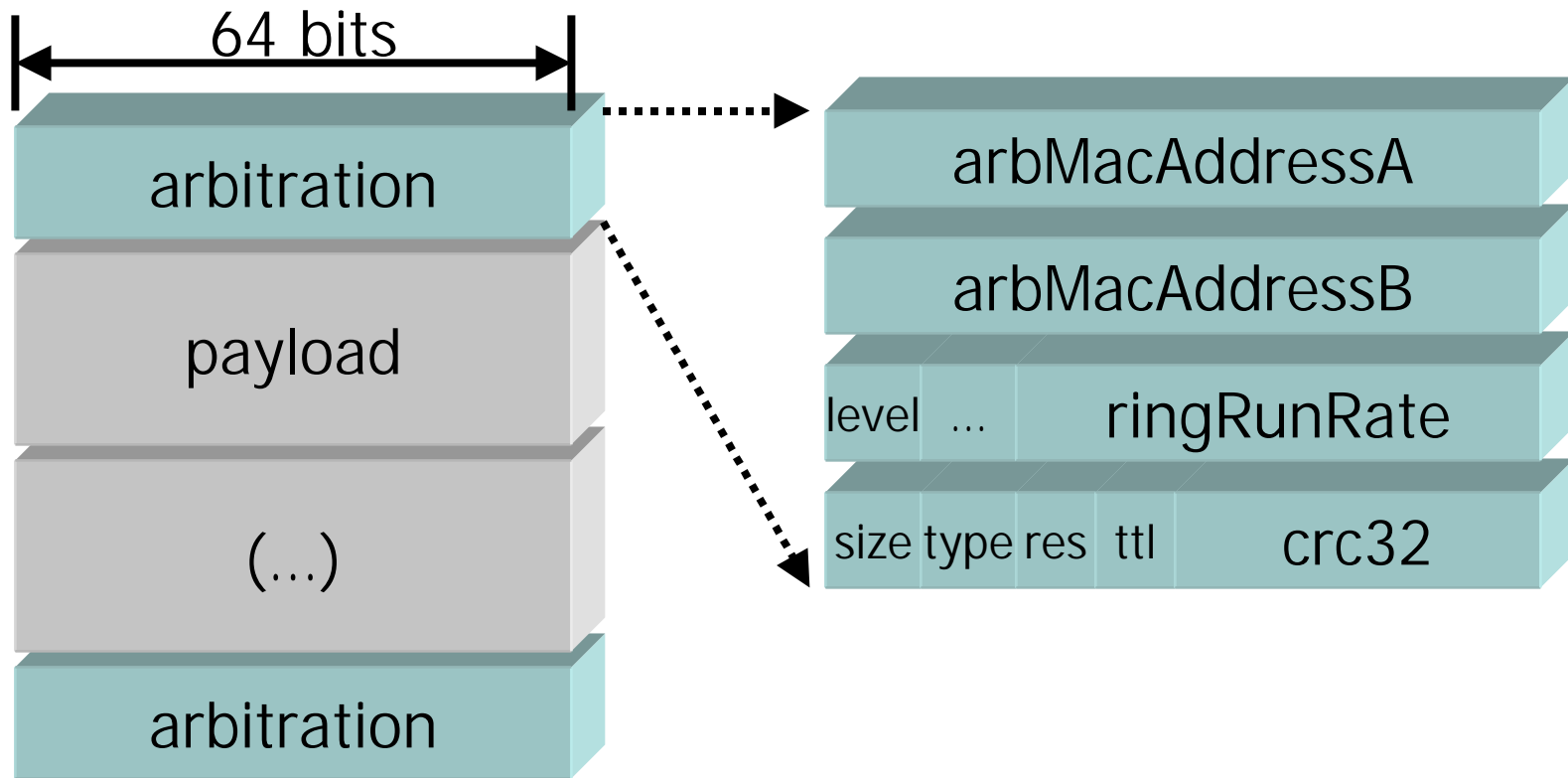


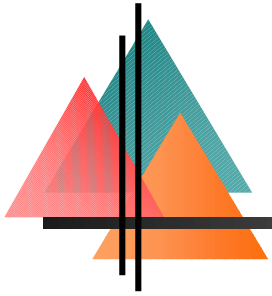
# Payload





# Arbitration packets

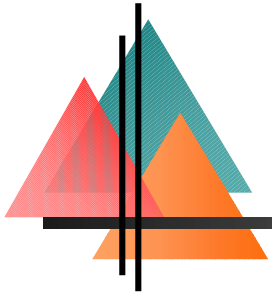




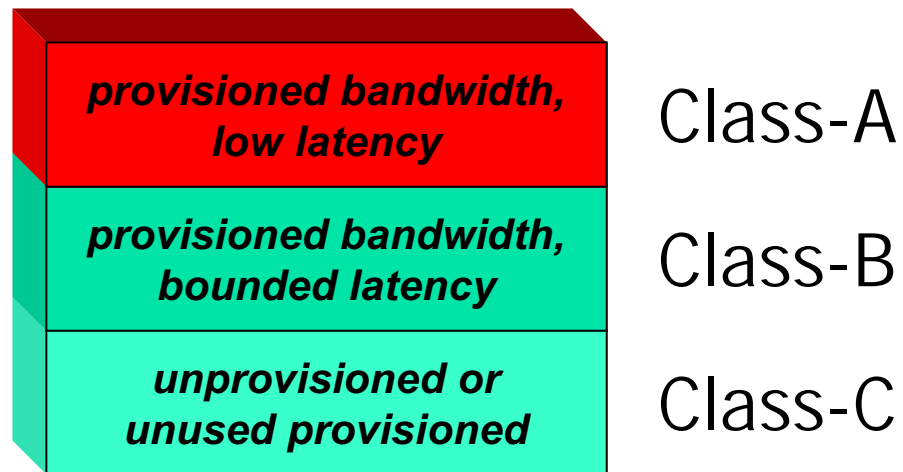
# Basic issues

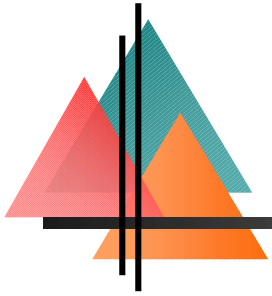
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# Arbitration classes

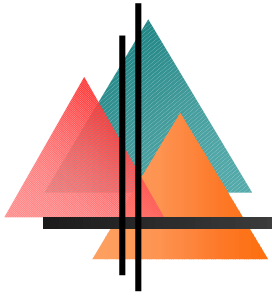




# Basic issues

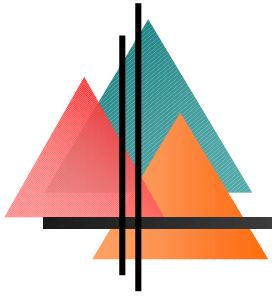
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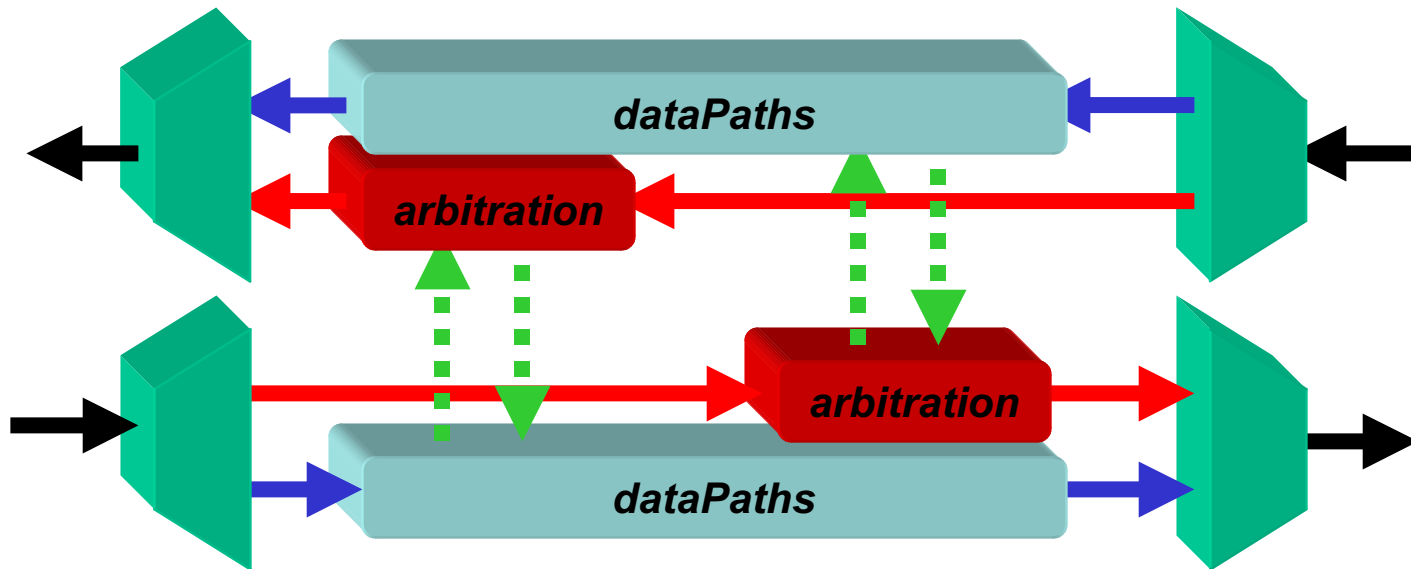


## Lessons of the past...

- Flow control mandates 2-out-of-3
  - Low latency transmissions
  - Fair bandwidth allocation
  - High bandwidth utilization
- Feedback control systems
  - Low latency signaling
  - Control can pass class-B/C packets
  - Separate class-A queue is utilized
- Other observations
  - Local control => global perversions
  - Fairness is inherently "approximate"
  - Strange beating sequences DO OCCUR

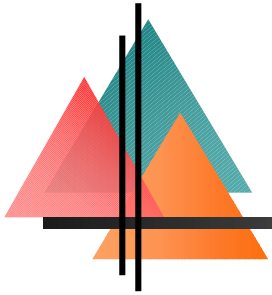


# Internal MAC arbitration signals

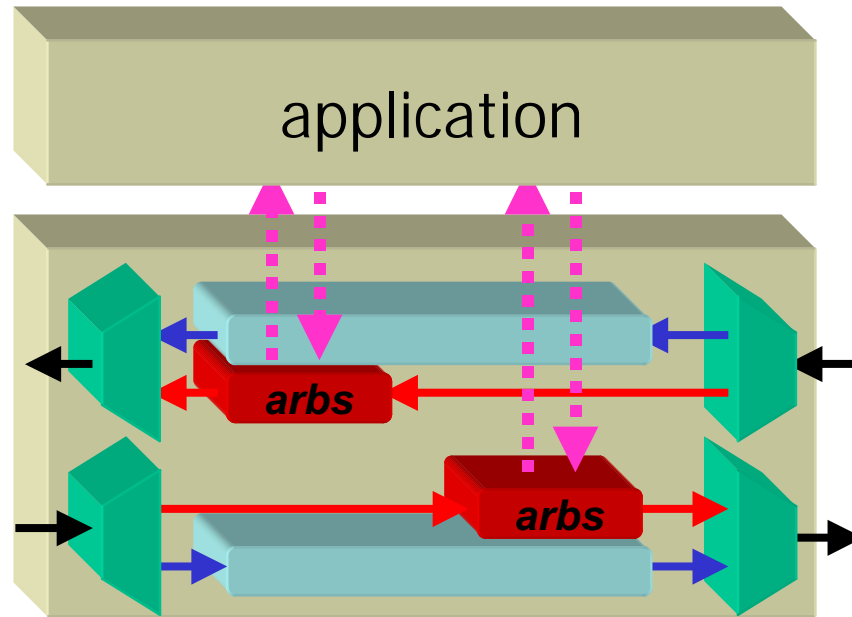


- Arbitration affects opposing run
- My congestion affects upstream node
- Downstream congestion affects me

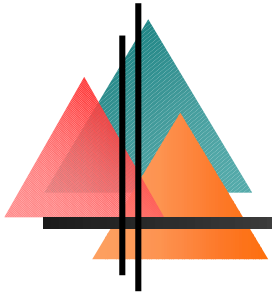




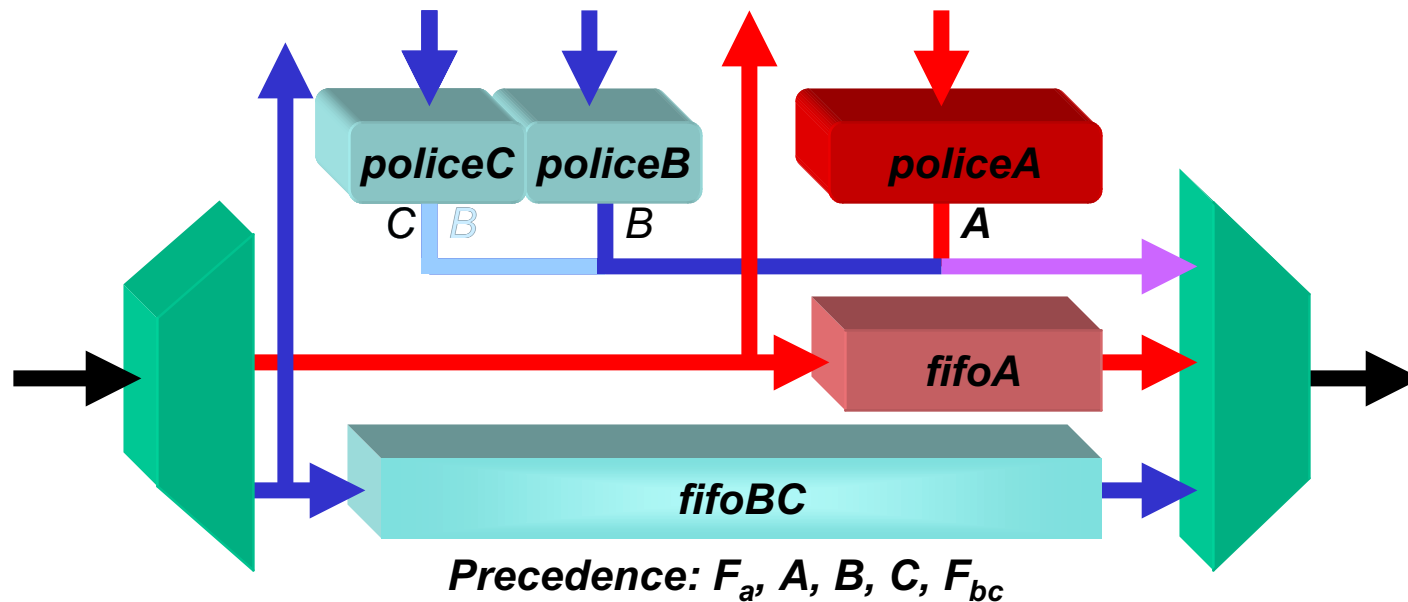
# External MAC arbitration signals



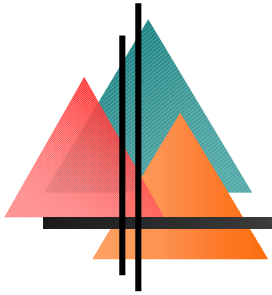
- MAC receives information
  - MAC FIFOs are \$\$, latency++, inflexible
- Application receives information
  - Allows reordering and run selection



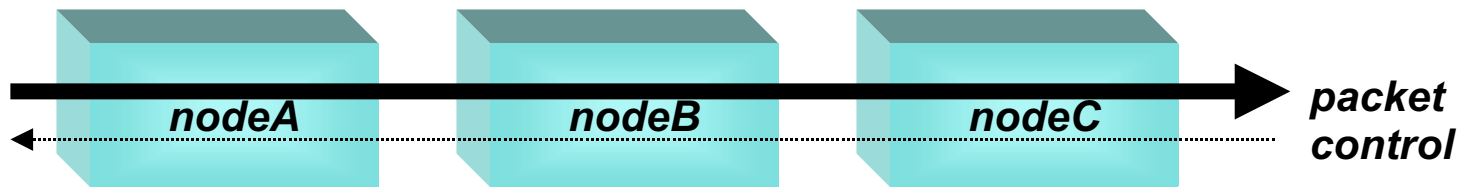
# Arbitration related components



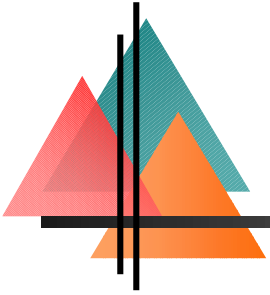
- Distinct class-A & class-B/C paths
- Load dependent policing



# Opposing arbitration

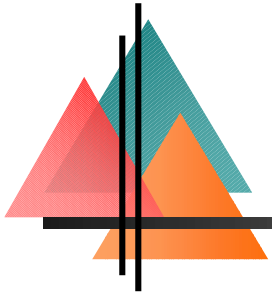


- Data packets flow in one direction
- Arbitration control flows in the other\*



# Allowed transmissions

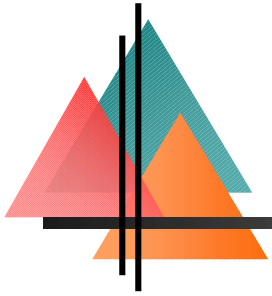
|            | warnings |      | transmissions                         |     |     |
|------------|----------|------|---------------------------------------|-----|-----|
|            | LO       | HI   | none                                  | LO  | HI  |
| $\geq 3/4$ | send     | send | A,F                                   | A,F | A,F |
| $\geq 1/2$ | send     | pass | A,F                                   | A,F | A   |
| $\geq 1/4$ | pass     | --   | A,B,C <sub>b</sub> ,F                 | A,B |     |
| $\geq 0$   | --       | --   | A,B,C <sub>b</sub> ,C <sub>c</sub> ,F |     |     |



# Arbitration summary

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- Dual levels
  - Class-A, pre-emptive low latency
  - Class-B, less latency sensitive
- Jumbo frames
  - Affect asynchronous latencies
  - NO IMPACT on synchronous latency
- Cut-through vs store-and-forward
  - Either should be allowed
  - Light-load latency DOES matter



# Basic issues

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- Transport services
- Arbitration
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