



# RPR Bandwidth Management

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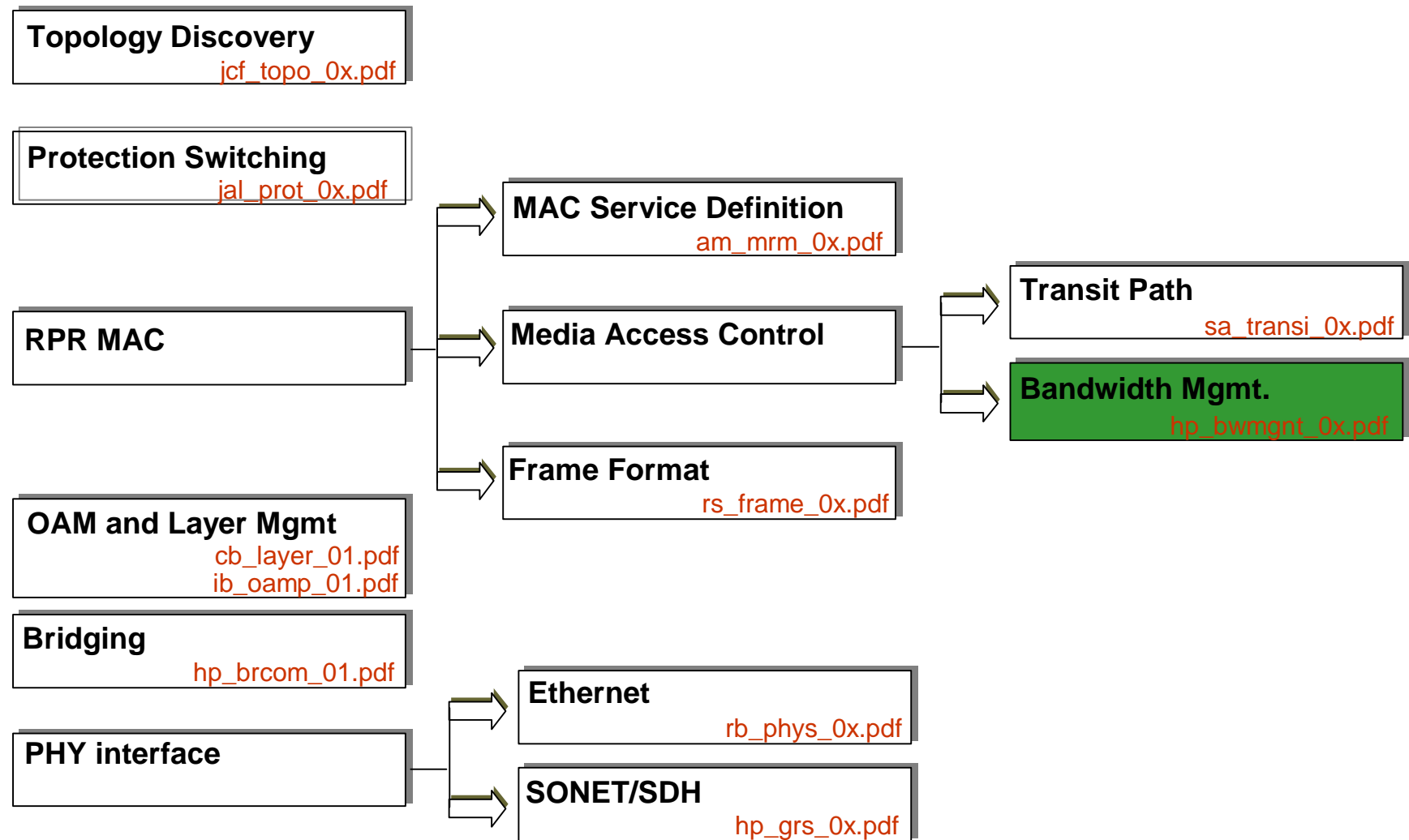
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# Components of a complete RPR proposal





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# RPR Attributes

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- Shared Medium
- Contention domain
- Source packet is temporal and spatial unaware of contention
- Parking lot problem
- Downstream disadvantage
- Spatial reuse

An 802.17 Objective: “Dynamic weighted BW distribution”



# Service Definitions

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- Local Area and Metropolitan Area Networks
- Customers: Carriers and Service providers
- Applications: VPN, Internet Access
- Support Service Level Agreements attribute in terms of Media Access
  - Delay, jitter, BW, and loss
  - Guaranteed Class
    - No BW reclamation
  - Committed Class
    - Excess BW are reclaimed
    - Committed BW may be reclaimed
  - Opportunistic Class
    - Best Effort



# RPR BW management

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- Fairness
- Trigger Points
  - Access Delay
  - Change in BW “demand”
  - Link Utilization
- Close Loop control message to source to control utilization
  - Active BW management for Media Access
  - Predicable Steady state with high utilization
  - Optimal Transient response
  - Support for VoQ
- Support for N+1 ringlets
- Support for weight fairness (unfairness)

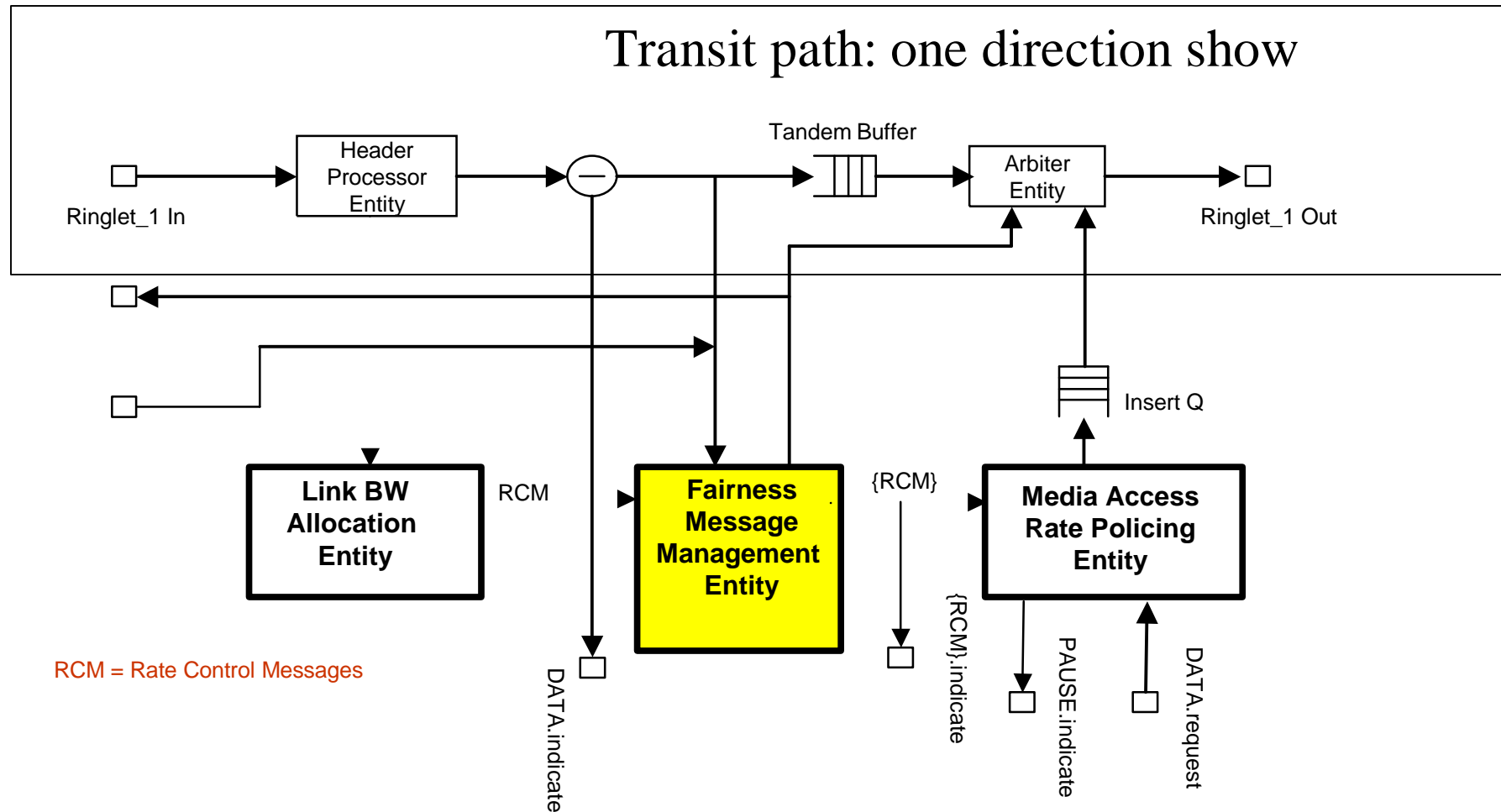


# BW Management protocol

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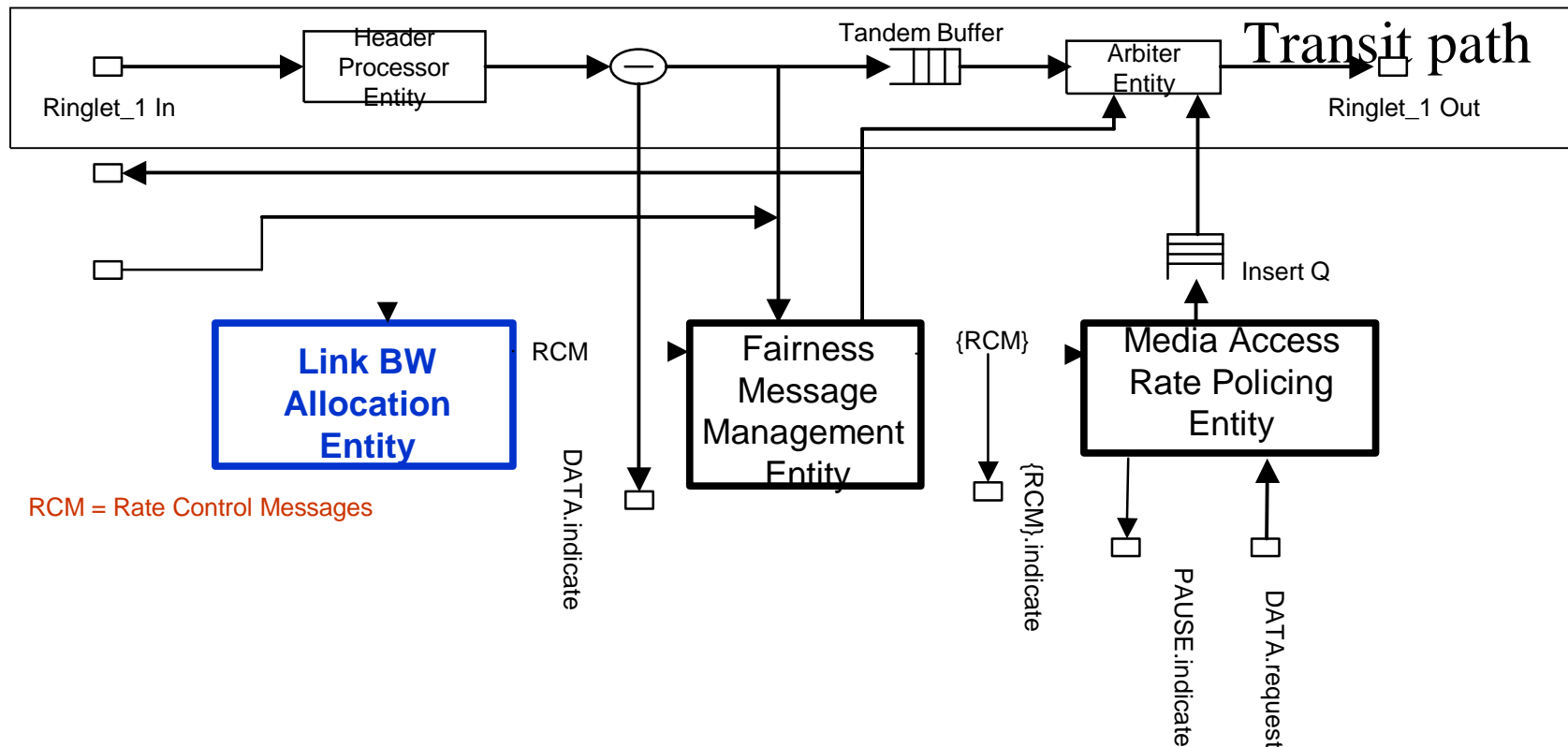
- Monitors station output link BW usage
  - = (Passthru + transmit)
    - Monitor number of active sources
- Calculates advertised rate: Rate Control Factor (RCF)
- Advertises RCF to upstream stations using Rate Control Messages (RCM)
- Source station polices based on received RCF
- Supports performance monitoring: RCF operation compliance
- Support for BW reclamation and none BW reclamation class

# BW Management entities in MAC





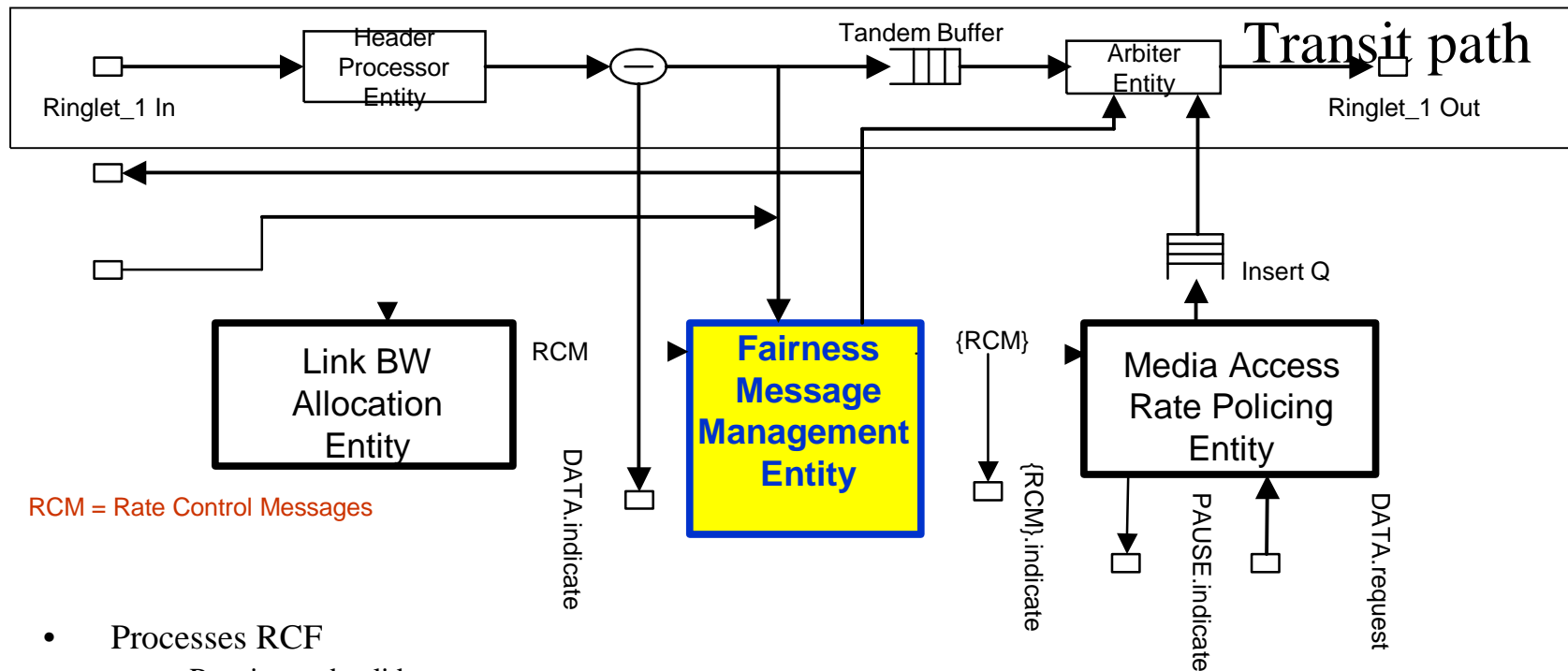
# BW Management Entities: Link BW Allocation Entity



1. Measure output link utilization:
2. Monitors active sources and passthru utilization

# BW Management Entities:

## Fairness Message Management Entity



- Processes RCF
  - Receive and validate message
  - Calculates local RCF, weighted scheme
- Generates advertised RCF:
  - triggers
  - Soft state: Periodic transmit RCF



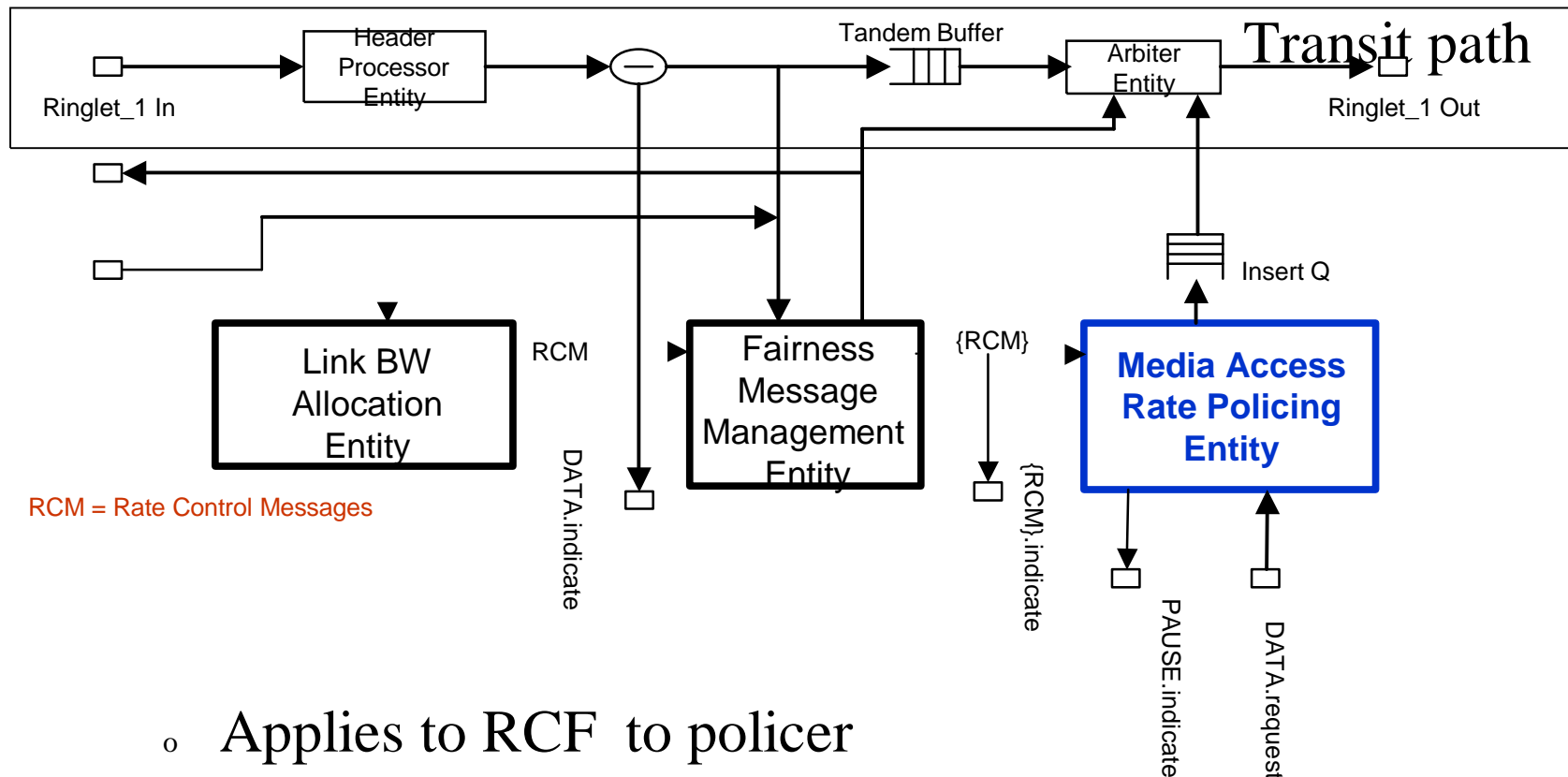
# Rate Control Factor

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- Rate estimator on output link per source
- $RCF_{sample}$ : usage per sample window
- Filtering:

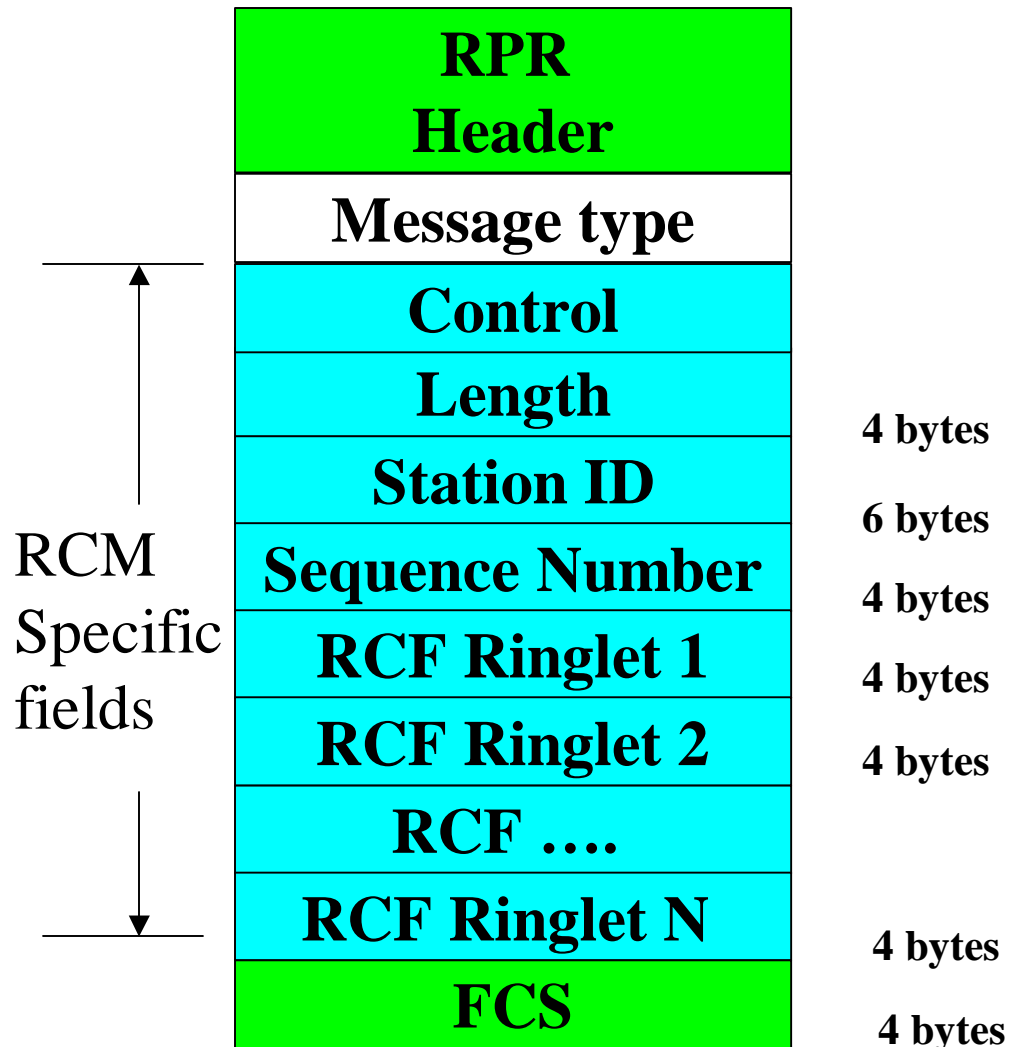
$$RCF_{(t)} ? weight_1 RCF_{(t-1)} ? weight_2 RCF_{sample}$$

# BW Management Entities: Media Access Rate Policing Entity



- Applies to RCF to policer
- Generates PAUSE.indicates when over transmit

# Rate Control Message Format



- **Common control frame and message type=RCM:**
  - Control: specific control bits-version etc.
  - Length: length of RCM packet
  - Station ID: packet source station address
  - Sequence number: message synchronization
  - RCF: rate control factors. One for each ringlet
  - FCS: error detection for RCM



# Conclusions

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- Started with a clean sheet
  - designed for carrier, service provider, and enterprise requirements.
- Complete functional BW management protocol that is simple, scalable and logical
  - Interworks with higher layer protocols
  - No HoL blocking
  - Stable, robust, predicable performance
  - Satisfies customer requirements