RTT Measurement

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Different Meanings For RTT

- Time for control frame or data frame to be sent around an entire ring
- Time for control frame or data frame to be sent from Station X to Station Y and back
- Time for fairness feedback loop between Station X and Station Y

RTT Not Always Constant

- Relatively fixed only for control frames sent all the way around a ring

- Relative locations of source and destination stations

- Paths chosen for each direction

- Classes of service chosen for each direction

- Current congestion conditions between source and destination stations

- For fairness frames, variable lag between receipt of FCM and generation of FCM at each station

Proposals

- Do not use "RTT" without specifying which meaning is desired, e.g.
  - Ring RTT (RRTT)
  - Loop RTT (LRTT)
  - Fairness Feedback RTT (FFRTT)
- Specify how to measure and/or calculate each timing, and to what degree of accuracy

FFRTT: Most Important

- The RTT measurement that has the most benefit on the system from being accurate is the FFRTT

- The fairness feedback loop, like any feedback loop, will work best if the adjustments are made at the same timing of the loop

- Ideally, all stations in a common congestion domain would use the same, correct timing

- Avoids under damping or over damping the feedback loop by reacting too slowly or too quickly

FFRTT: Most Difficult

- Head and tail of congestion domain change dynamically

- Variable lag between receipt of FCM and generation of FCM at each station

- Dynamic amount of congestion and queuing in data path

FFRTT: Range Of Approaches

- Fixed time chosen for all rings, all times
- Time based on ring circumference or measurement of RRTT
- Time set as above, but interpolated to assumed length of current congestion domain
- Time measured between each station at topology changes resulting in addition or deletion of stations
- Time measured between head and tail of congestion domain each time either changes
- Time measured between head and tail of congestion domain constantly

FFRTT: Dynamic Measurement

- **3 parts to calculate or measure**
  1. Time for a classA frame to traverse from the congestion domain head to the congestion domain tail
     - measured dynamically or premeasured
  2. Nominal time for a data frame subject to fairness limitations to traverse from the tail to the head
     - calculated based on number of stations in congestion domain and fixed average FCM lag per station
  3. Amount of delay in the path from the tail to the head caused by fairness limitations and service class prioritization
     - measured dynamically

- **No global clock assumed, so one way timing can't be done**
- **Dynamic measurements made on the same order as advertisement interval**

FFRTT: Possible Mechanism

- Initiated whenever a station finds itself to be a head of a congestion domain, and smoothed over a small number of results as long as the head and the tail remain the same

- New type of frame - timing request - very similar to an echo, but whose destination is the MAC, not the MAC client

- MAC would send timing request as classA

- Replied to by MAC at tail of the congestion domain

- Replying MAC would send response as classC

- Timestamp included as payload, and compared on receipt of reply to determine time delay

- Fixed delay added for each station transited to account for FCM lag

- Last measured/calculated delay included in timing request to synchronize entire congestion domain to same timing

FFRTT: Illustration

- D determines it is head of a congestion domain and sends classA timing request
- Timing frame is copied and transited by C and B since neither are the tail of the domain
- A strips and responds to the timing request with a classC timing response
- D measures time difference between sending request and receiving response
- D repeats requests, with most recently measured (and smoothed) timing measurement included