Objectives (Draft for Review)
IEEE 802 Exec Study Group on QoS and Flow Control

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Objective Statement

The primary objective is to study the potential to develop an IEEE 802 standard to facilitate the addition of new kinds of traffic over Ethernet networks, including real-time voice and video, while maintaining classic datagram service.

Problem Statement

The key problem is loss and unacceptable delay or delay jitter of frames due to congestion caused by speed mismatches, oversubscribing, and interaction with high bandwidth fast start data streams (for example: UDP streams that do not follow the TCP slow start mechanism, and are being used in many multimedia and video conferencing applications.)

Basic Approach

The most effective method of meeting this objective is expected to be: provisioning the LAN with ample bandwidth and providing enhanced Layer 2 flow control, including means of differentiating service for various classes of traffic.

Scope of Work

The proposed scope of work is to study the feasibility and value of enhancing existing flow control mechanisms to provide more flexible flow control, offering means of differentiated services to various classes of traffic. Appropriate simulations are to be utilized in order to optimize the resulting gains in QoS while minimizing the complexity of implementation of the enhanced flow control.

The proposed scope is to be limited to link-by-link flow control, since it is anticipated that end-to-end flow control mechanisms would be inappropriate for IEEE 802 to define.

The proposed scope is to be further limited to packet-by-packet flow control, since control of specification of 'Flows' or 'Virtual Connections' or 'Sessions' would be outside the scope of IEEE 802's Layer 2 activities.

Finally, it is proposed that efforts for Layer 3 QoS (such as the IETF's efforts) should be reviewed for possible interactions with this Study Group. It is recognized as a distinct possibility that Layer 3 QoS efforts might benefit from Layer 2 QoS services and interface. In that case, coordinated efforts for such services and interface may be warranted. However, for the current version of this Objectives document, we assume that Layer 2 and Layer 3 QoS efforts proceed largely independently while maintaining mutual awareness.

Current Flow Control Not Designed for These Needs

- 802.3x flow control provides XOFF only
    - Not optimized for bandwidth reservation
    - Not optimized for minimum packet loss
- 802.3x controls all traffic on a link
    - Causes blocking in some cases
    - No selectivity by priority class
    - No selectivity by destination of traffic
    - No selectivity by source of traffic
- Half-Duplex flow control becoming obsolescent

Alternatives Not Attractive

- Move to all Layer 3 switching, including emerging IP QoS tools.
    - QoS tools not ready now, and schedule uncertain
    - Previous effort, RSVP, not fully satisfactory
    - Total forklift conversion for existing Layer 2 LANs
        - Very expensive
    - Much more management required – more routers
    - Much less attractive than ample bandwidth + flow control
    - But could be seamless with router-based WAN
- Extreme overprovisioning
    - Total forklift conversion from existing ample LANs
        - Surprisingly expensive
        - Difficult to justify, since no visible improvement
    - Reduces speed mismatches
        - No more 10 Mb clients, for example
        - But still 100/1Gb mismatches
    - Often increases oversubscribing
        - Many more high-speed pipes contending for backbone
        - May just move the problem
    - Intrinsically less efficient than enhanced flow control
        - Bandwidth must exceed peak aggregate requests
            - Potential to occur simultaneously
    - Less reliable QoS than enhanced flow control
        - Still suffers from Head of Line blocking

Simulation Results Support the Need for Enhanced Flow Control

- Tobagi et al tutorial at 7-98 plenary
  - Priority Class enhancement reduces loss and delay
  - Destination Address enhancement reduces loss and delay
- Further simulation needed
  - To support optimum design of Enhanced Flow Control
  - Effective simulation tools now available

Enhanced Flow Control is Achievable

- Could utilize 802.3x mechanism as basis
  - Already provides flow control frames
  - Widely implemented in switches
  - Could readily be extended
- Could utilize 802.1p/Q priority classes
  - Already provides well-defined priority tags
  - Expected to be widely implemented in switches
  - Could readily be utilized for flow control

Time is Right for Enhanced Flow Control
- 802.3x flow control standardized and implemented
- 802.1p/Q priority class tags clearly defined
- New traffic types ready to migrate to Ethernet LANs
- Switches rapidly replacing shared segments
    - Eliminate collisions
    - Potential to facilitate delay-sensitive traffic
- Simulation demonstrates value of Enhanced Flow Control
- Simulation tools now mature, efficient, flexible and powerful

Conclusion

There may be an excellent opportunity for IEEE 802 to provide new Layer 2 capabilities for a new generation of LAN applications.

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