IEEE 802.1 DRAFT PAR and 5C for pre-emption and fragmentation enhancement to 802.1Q

Version 6,

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2.1 Project Title

IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks: <n> Amendment: Support for Frame Preemption in Bridged LAN.

Other PAR Fields (1)

4.1 Type of Ballot: Individual

4.2 Expected Date of submission of draft to the IEEE-SA for Initial Sponsor Ballot: ? 11/2014 ?

4.3 Projected Completion Date for Submittal to RevCom: ? 11/2015 ?

5.1 Approximate number of people expected to be actively involved in the development of this project: ? 20 ?

5.3 Is the completion of this standard dependent upon the completion of another standard:
No.

5.6 Stakeholders for the Standard: Developers, providers, and users of networking services and equipment for Industrial Automation, In-vehicle networking, and other systems requiring low latency virtual LAN bridges, including networking IC developers, bridge and NIC vendors, and users.

5.2 Scope

This amendment specifies protocols, procedures, and managed objects that:

- Defines class of service for low-latency frames and the transmitter in a bridged LAN to selectively suspend frame-in-transmit and allow for the low-latency frame to be transmitted ("Preemption"), then the suspended frame to resume. This suspend-and-resume may occur multiple times for a given non-low-latency frame.
- Provide for discovery, configuration, and control of preemption service for a bridge port and end station.

5.4 Purpose

- The purpose of this amendment is to provide reduced latency transmission for scheduled time-sensitive frames in a bridged network.

5.5 Need for the Standard

- A large, lower-priority frame may be ahead of low-latency frame on a given egress port. This condition, “head-of-line blocking”, leads to excessive bridge relay latency for the low-latency frame (?).
  For many control applications in industrial control and automotive, lower latency than this condition is required to support applications such as control loops onto bridged LAN.
- In automotive, lower link speed (100 Mb/s and above), lower latency over smaller number of bridge hop requires support of low-latency bridging.
- In industrial control, higher link speed (1 Gb/s and above) with a significantly greater than 7 bridge hop requires support of low-latency bridging.
  - Multiple additional uses of this standard extends to medical (e.g. MRI controllers) and Energy sub-station real-time power control systems.(? Double check w/ IEEE policy ??)

Other PAR Fields (2)

6.1 Intellectual Property

- 6.1.a. Is the Sponsor aware of any copyright permissions needed for this project?: No
- 6.1.b. Is the Sponsor aware of possible registration activity related to this project?: No

7.1 Are there other standards or projects with a similar scope?: No

7.2 International Activities

- a. Adoption
- Is there potential for this standard (in part or in whole) to be adopted by another national, regional or international organization?: No
- b. Joint Development
- Is it the intent to develop this document jointly with another organization?: No
- c. Harmonization
- Are you aware of another organization that may be interested in portions of this document in their standardization development efforts?: No

8.1 Additional Explanatory Notes (Item Number and Explanation):

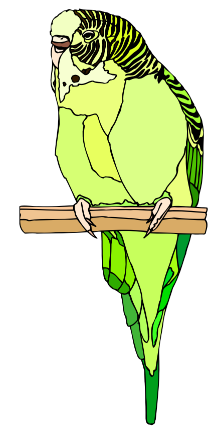
The 5 Critters

Broad Market Potential

Compatibility

Distinct Identity

Technical Feasibility



Economic Feasibility

Broad Market Potential

a) **Broad sets of applicability**
b) **Multiple vendors and numerous users**
c) **Balanced costs (LAN versus attached stations)***

a) Specific to automotive in-vehicle environment.
Streaming, Data, Control, over single wire that supports, infotainment, driver assist and diagnostics within various functional LAN segments within a vehicular network. Control system requires lower-latency bridged network for this convergence.

Specific to Industrial network environment.
Low Latency Sampling Data, (Closed Loop) Control, Data Streaming (e.g. image processing) and supervision data traffic. Sampling Data and Closed Loop Control traffic have very demanding latency requirements,
Data streaming (e.g. image processing) is less demanding than control, but higher than best effort. Supervision Data traffic is not time-critical, but provides a constant source for interference traffic.

b) 60 million in 2010 (56~70 million per annum from 1960's till now) cars and light-trucks/SUVs sold per year. In-vehicle networking is expected to reach >15% in 2011 and grow. With a assumption of @ 5 Ethernet nodes/vehicle, Assuming 60 million vehicles/year, potential vehicle market served at 15% adoption would yield 45+ million nodes (plus 45+ million Switch ports). The number of Ethernet Switch ports is ~400 million/yr, split 35%:60%:5% FE/GE/10+GE in 2011.
Thus potential for 15% Ethernet market expansion as adoption occurs in automotive.

Industrial Automation – The number of industrial Ethernet ports sold worldwide is 24 million per year in 2010. This is expected to grow to 40 million per year in 2014.] Additional market served with this standards are medial control systems (e.g. MRI), and Energy (e.g. Power substation power controllers), and Avionics.

c) This project does not materially alter the existing cost structure of bridged networks.

(Add bits about AVB + this does not materially alter??)

Compatibility

> **a) IEEE 802 defines a family of standards. All standards shall be in conformance with the IEEE 802.1 Architecture, Management and Inter-working documents as follows: 802-Overview and Architecture, 802.1D, 802.1Q and parts of 802.1f. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with 802.Conformance with 802.1D, 802.1Q, 802.1f**
>
> **b) Each standard in the IEEE 802 family of standards shall include a definition of managed objects that are compatible with systems management standards.**

a) The standard will conform to the above architectures, and specifically 802.1Q bridge framework for forwarding and receiving compatibility at the ISS . This guarantees that 802.1Q bridges can be added to a network of bridge and an end stations that implements this standard to increment the network functionality. (?? Feedback to refer to other existing Q implementations – i.e. does not break existing Q)

b) Such a definition will be included.

Distinct Identity

a) Substantially different from other IEEE 802 standards
b) One unique solution per problem (not two solutions to a problem)
c) Easy for the document reader to select the relevant specification

a) There is no existing 802 standard or approved project that provides lower-latency through the use of preemption.

b) There is no IEEE 802 based solution that improves latency to be better than transmit of urgent frame after of a large sized frame (e.g. “Head of Line Blocking”).

c) This standard enhances QoS relevant sections of 802.1Q.

Technical Feasibility

a) Demonstrated system feasibility
b) Proven technology, reasonable testing
c) Confidence in reliability
d) Coexistence of 802 wireless standards specifying devices for unlicensed operation.

a) General fragmentation and on-demand fragmentation has been used in other networking and dedicated links in the past and today in both software and hardware based systems.

b) This standard is based on mature virtual LAN bridging and transmit selection and scheduling.

c) The technology re-use, and other augmented methods are deemed proven for their reliability.

d) Not Applicable

Economic Feasibility

a) Known cost factors, reliable data
b) Reasonable cost for performance
c) Consideration of installation costs

a) The standard would add small and contained incremental cost to bridge and end station implementations.

b) Reasonable cost for performance, widely accepted today in IT segment, will be consistent in this standard. In addition, this standard would help convergence of low-latency control application over time sensitive networking supported by AV Bridging and virtual LAN bridging that exist today, thereby helping to replace a) overlay LANs, b) multiple dedicated point-to-point wires.

c) Installation cost is expected to be not different than installation cost of existing VLAN bridges and end station.