802.1 Class of Service Alternatives

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Changes suggested during the presentation are in italics. Portions in Roman type are as presented at the interim meeting. The last three pages of Pros and Cons, on choices 10-12, were neither presented nor discussed to any great length, and are the opinion of one of the authors (Finn).

802.1 Class of Service Alternatives

1. **Redefine one or more of the 48 bits in the destination MAC address.**
   a. **I/G bit.**
   b. **U/L bit.**
   c. **OUI bits.**
   d. **remaining 24 bits.**
2. **2. Redefine one or more of the 48 bits in the source MAC address.**
   a. **I/G bit.**
   b. **U/L bit.**
   c. **OUI bits.**
   d. **remaining 24 bits.**

802.1 Class of Service Alternatives (cont'd)

3. **Use the source address I/G bit to signal the presence of a field inserted between the source MAC address and the length/ Ethertype field containing the CoS indication. This technique would be similar to the placement of the RIF in an 802.5 frame.**
4. **Define a set of new Ethertypes, each implying a specific class of service. One Ethertype would be added ahead of the existing Ethertype or 802.3 length field (or VLAN Ethertype field?), extending the frame length in a manner similar to the proposed 802.1q tags.**
5. **Define a single new Ethertype, followed by an explicit class of service field. One Ethertype and CoS field would be added ahead of the existing Ethertype or 802.3 length field (or VLAN Ethertype field?), extending the frame length in a manner similar to the proposed 802.1q tags.**

802.1 Class of Service Alternatives (cont'd)

6. **Sub-divide the 802.1q VLAN-ID into separate VLAN-ID and CoS indicator fields. VLAN-ID 0 means "no VLAN-ID specified".**
7. **Make the CoS indication implicit in the VLAN-ID. That is, each VLAN-ID is associated with a single CoS.**
8. **Define more than one 802.1q VLAN-ID tag, one for each CoS level, so that all 16 bits of the VLAN-ID can be preserved.**
9. **Redefine bits in the frame marker or preamble to contain CoS bits.**
10. ***Avoid the situation by using multicast for all CoS traffic.***
11. ***Define a combined 802.1p/802.1q Ethertype which is followed by two fields, one with the CoS, one with the VLAN-ID.***
12. ***Define CoS filters in terms of flows (e.g. source/destination MAC address, L3 addresses, applications protocols, etc.).***

Pros and Cons

1b. Redefine the U/L bit in the destination MAC address.

Destination MAC				Source MAC			
Indiv/Grp	Univ/Loc	OUI	ident	Indiv/Grp	Univ/Loc	OUI	ident

PRO:
1. **Compatible with existing bridges.**
2. **Does not extend the packet length.**

CON:
1. **Redefines Universal/Local bit, which is common to all 802 and FDDI media, when only 802.3 needs the solution.**
2. **Not interoperable with existing uses of the U/L bit (e.g. DECNet Phase IV)**
3. **Restricted to two classes of service.**
4. **Many existing endstation interfaces are able to recognize only one MAC address.**
5. **Receiving endstation must be CoS-aware.**

Pros and Cons

1c. Redefine an OUI bit in all MAC addresses.

Destination MAC				Source MAC			
Indiv/Grp	Univ/Loc	OUI	ident	Indiv/Grp	Univ/Loc	OUI	ident

PRO:
1. **Compatible with existing bridges.**
2. **Does not extend the packet length.**

CON:
1. **Cuts available OUI space from 4 million to 2 million.**
2. **Affects all 802 and FDDI media, when only 802.3 needs the solution.**
3. **Restricted to two classes of service.**
4. **Many existing endstation interfaces are able to recognize only one MAC address.**
5. **Receiving endstation must be CoS-aware.**

Pros and Cons

2a. Redefine the I/G bit in the source MAC address as CoS bit.

Destination MAC				Source MAC			
Indiv/Grp	Univ/Loc	OUI	ident	Indiv/Grp	Univ/Loc	OUI	ident

PRO:

1. **This bit has a fixed value in 802.3, so is available for redefinition, and affects no other 802 media or FDDI.**
2. **MAC addresses and CoS are independent, like other media.**
3. **Does not extend the packet length.**
4. **Receiving endstation uses only one MAC address.**
5. **Receiving endstation need not be CoS-aware.**

CON:

1. **Incompatible with CoS-unaware bridges; group source MAC address won't be learned - packet may be discarded.**
2. **Restricted to two classes of service.**
3. **Bridge cannot determine CoS until it sees 14th byte of frame.**
4. ***Confuses endstations that look at source MAC address.***
5. ***Bridge cannot determine CoS until first byte of source MAC.***

Pros and Cons

3. Redefine the I/G bit in the source MAC address to signal presence of a RIF-like field containing the CoS.

Destination MAC		Source MAC		CoS (+ other?)	length/Ethertype
		Indiv/Grp = 1			

PRO:
1. **Source I/G bit has a fixed value in 802.3, so is available for redefinition, and affects no other 802 media or FDDI.**
2. **MAC addresses and CoS are independent, like other media.**
3. **Endstation uses only one MAC address.**

CON:
1. **Incompatible with CoS-unaware bridges; group source MAC address won't be learned - packet may be discarded.**
2. **Packet is lengthened.**
3. **Adding zero or two bytes to the MAC header, instead of zero or four, would cause significant performance penalties in many existing implementations.**
4. **Receiving endstation must be CoS-aware.**
5. ***Bridge cannot determine CoS until it sees 14th byte of frame.***
6. ***Confuses endstations that look at source MAC address.***

Pros and Cons

4. Define a set of new Ethertypes, one for each CoS, and insert after MAC header.

Destination MAC	Source MAC	Ethertype + CoS	802.1q Ethertype	VLAN-ID	length/ Ethertype

PRO:
1. **Supports 8 classes of service.**
2. **Endstation uses only one MAC address.**

CON:
1. **Packet is lengthened.**
2. **Adding zero or two bytes to the MAC header, instead of zero or four, would cause significant performance penalties in many existing implementations.**
3. **Receiving endstation must be CoS-aware.**
4. **This tag would be in addition to 802.1q tag(s).**
5. ***Bridge cannot determine CoS until it sees 14th byte of frame.***

Pros and Cons

5. Define a single new Ethertype, followed by an explicit class of service field.

Destination MAC	Source MAC	CoS Ethertype	CoS value	802.1q Ethertype	VLAN-ID	length/ Ethertype

PRO:
1. **Supports 8 classes of service.**
2. **Endstation uses only one MAC address.**

CON:
1. **Packet is lengthened.**
2. **Receiving endstation must be CoS-aware.**
3. **This tag would be in addition to 802.1q tag(s).**
4. ***Bridge cannot determine CoS until it sees 16th byte of frame.***

Pros and Cons

6. Sub-divide the 802.1q VLAN-ID into separate VLAN-ID and CoS indicator fields. VLAN-ID 0 means "no VLAN-ID specified".

Destination MAC	Source MAC	802.1q Ethertype	Cos + VLAN-ID		length/ Ethertype
			CoS	VLAN-ID	

PRO:
1. **Supports 8 classes of service.**
2. **Endstation uses only one MAC address.**
3. **Integrated with 802.1q VLAN solution.**
4. **VLAN choice independent of CoS choice.**

CON:
1. **Packet is lengthened.**
2. **Receiving endstation must be CoS-aware.**
3. **Maximum number of VLANs is reduced.**
4. **Alters 802.1q formats tentatively agreed to.**
5. ***Bridge cannot determine CoS until it sees 15th byte of frame.***

Pros and Cons

7. Make the CoS indication implicit in the VLAN-ID. That is, each VLAN-ID is associated with a single CoS.

Destination MAC	Source MAC	802.1q Ethertype	VLAN-ID (implies CoS)	length/ Ethertype

PRO:
1. **Supports 8 classes of service.**
2. **Endstation uses only one MAC address.**
3. **Integrated with 802.1q VLAN solution.**
4. **Does not alter 802.1q formats tentatively agreed to.**

CON:
1. **Packet is lengthened.**
2. **Receiving endstation must be CoS-aware.**
3. **VLAN choice dependent on CoS choice.**
4. ***Bridge cannot determine CoS until it sees 16th byte of frame.***

Pros and Cons

8. Define more than one 802.1q VLAN-ID tag, one for each CoS level, so that all 16 bits of the VLAN-ID can be preserved.

Destination MAC	Source MAC	802.1q Ethertype + CoS		VLAN-ID	length/ Ethertype
		Ethertype high bits	Low bits == CoS		

PRO:
1. **Supports 8 classes of service.**
2. **Endstation uses only one MAC address.**
3. **Integrated with 802.1q VLAN solution.**
4. **VLAN choice independent of CoS choice.**
5. **Does not alter 802.1q formats tentatively agreed to.**

CON:
1. **Packet is lengthened.**
2. **Receiving endstation must be CoS-aware.**
3. ***Bridge cannot determine CoS until it sees 14th byte of frame.***

Other rejected alternatives

1a. Redefine the I/G bit in the destination MAC address. (incompatible with existing hardware)

Destination MAC				Source MAC			
Indiv/Grp	Univ/Loc	OUI	ident	Indiv/Grp	Univ/Loc	OUI	ident

1d. Redefine an endstation identifier bit in all MAC addresses. (incompatible with existing MAC address assignments)

Destination MAC				Source MAC			
Indiv/Grp	Univ/Loc	OUI	ident	Indiv/Grp	Univ/Loc	OUI	ident

2a, 2c, and 2d (Source MAC changes) are dependent on 1a, 1b, 1d.

9. Redefine bits in the frame marker or preamble to contain CoS bits. (incompatible with existing hardware)

flag + CoS	Destination MAC	Source MAC	802.1q Ethertype	VLAN-ID	length/ Ethertype

Pros and Cons

13. Avoid the situation by using multicast for all CoS traffic.

PRO: 1. Requires no changes to support multicast traffic above those presented in 802.1p.

CON: 1. Using this technique requires the creation of a L3 multicast address, registration of the corresponding MAC multicast address, and mapping the desired unicast hostname/L3 multicast address to the created L3 multicast address.

2. Cannot be used, practically, for high-priority datagrams, as opposed to long-lived streams.

Pros and Cons

14. Define a combined 802.1p/802.1q Ethertype which is followed by two fields, one with the CoS, one with the VLAN-ID.

Destination MAC	Source MAC	CoS/ VLAN Ethertype	CoS value	VLAN-ID	length/ Ethertype

PRO:
1. ***Supports 8 classes of service.***
2. ***Endstation uses only one MAC address.***
3. ***Integrated with 802.1q VLAN solution.***
4. ***VLAN choice independent of CoS choice.***
5. ***Does not alter 802.1q formats tentatively agreed to.***

CON:
1. ***Packet is lengthened.***
2. ***Receiving endstation must be CoS-aware.***
3. ***Adding zero or six bytes to the MAC header, instead of zero or four, would cause significant performance penalties in many existing implementations.***
4. ***Bridge cannot determine CoS until it sees 16th byte of frame.***

Pros and Cons

15. Define CoS filters in terms of flows (e.g. source/destination MAC address, L3 addresses, applications protocols, etc.).

PRO:
1. ***Requires no changes to support multicast traffic above those presented in 802.1p.***
2. ***Supports 8 classes of service.***
3. ***Endstation uses only one MAC address.***
4. ***MAC addresses and CoS are independent, like other media.***

CON:
1. ***Greatly complicates the implementation of a bridge, compared to the other methods presented.***