6. Support of the MAC Service ~~in VLANs~~

<<The proposed changes in this draft use a preliminary version of P802.1Q Consolidated, incorporating P802.1ad, as the base text. P802.1ag, P802.1ah, P802.1aj, and P802.1ak are not expected to amend any of the subclauses affected by this amendment.>>

Delete the last paragraph of the introductory text following the clause 6 heading as follows:

~~The provisions of IEEE Std 802.1D, Clause 6, apply to this standard, with the additions and modification defined in this clause.~~

Add the following text following the introductory text to clause 6, immediately prior to clause 6.1.

This clause:

a) Summarizes basic architectural concepts and terms used throughout this standard, introduces the primitives and parameters of the MAC Service, and defines VLANs in terms of the connectivity provided to service users (,)
b) Describes how Bridges preserve and maintain the quality of the MAC Service ()
c) Specifies the MAC Internal Sublayer Service (ISS) and MAC status parameters, and their support of by specific media access methods (,)
d) Specifies the Enhanced Internal Sublayer Service (EISS) used by VLAN-aware stations, the encoding of VLAN identifier and priority parameters in transmitted frames , and the classification of received frames that do not explicitly convery those parameters. ()

<<Some modest additions to this list will be required to include additions to clause 6 by P802.1ah>>

Add the following clause 6.1, renumbering subsequent clauses.

6.1 Basic architectural concepts and terms

The architectural concepts used in this and other IEEE 802.1 standards are based on the layered protocol model introduced by the OSI Reference Model (ISO/IEC 7498-1) and used in the MAC Service Definition (ISO/IEC 15802-1), in IEEE Std 802, in other IEEE 802 standards, and (with varying degrees of fidelity) in networking in general. IEEE 802.1 standards in particular have developed terms and distinctions useful in describing the MAC Service and its support by protocol entities within the MAC Sublayer[8].

6.1.1 Protocol entities, peers, layers, services, and clients

The fundamental notion of the model is that each protocol entity within a system is instantiated at one of a number of strictly ordered layers, and communicates with peer entities (operating the same or an interoperable protocol within the same layer) in other systems by using the service provided by interoperable protocol entities within the layer immediately below, and thus provides service to protocol entities in the layer above. The implied repetitive stacking of protocol entities is bounded at the lowest level by the protocols inherent in the laws of physics, expressing the interaction of electrons or photons[9], and at the highest level by an application supported by peer systems. In descriptions of the model, the relative layer positions of protocol entities and services is conventionally referred to by N, designating a numeric level. The N-service is provided by an N-entity that uses the (N-1) service provided by the (N-1) entity, while the

[8]Drawing on prior network layer standards, including ... (see Bibiography) wherever possible.
[9]Or another physical phenomenon, such as quantum state.

N-service user is an (N+1) entity. Figure 6-1 illustrates these concepts with reference to the MAC Sublayer, which contains MAC entities that provide the MAC Service, to MAC Service users.

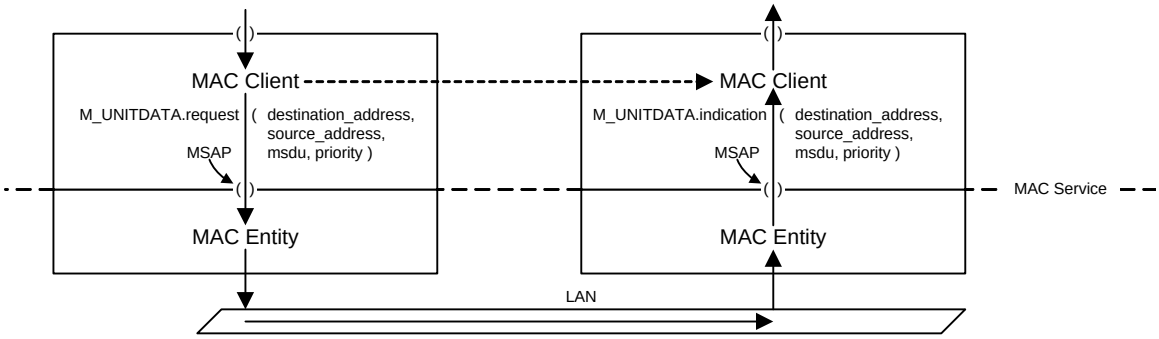

Figure 6-1—MAC entities, the MAC Service, and MAC Service users (clients)

6.1.2 Service interface primitives, parameters, and frames

Each N-service is described in terms of service primitives and their parameters, each primitive corresponding to an atomic interaction between the N-service user and the N-service provider, with each invocation of a primitive by a service user resulting in the service issuing corresponding primitives to peer service users. The purpose of the model is to provide a framework and requirements for the design of protocols while not unnecessarily constraining the internal design of systems : primitives and their parameters are limited to, but include all of the information elements conveyed to corresponding peer protocol entities or required by other systems (and not supplied by protocols in lower layers) to identify (address) those entities and deliver the information. The parameters of service primitives do not include information that is used only locally, i.e. within the same system, to identify entities or organize resources for example[10].

The primitives of the MAC Service comprise a data request and a corresponding data indication; each with MAC destination address, MAC source address, a MAC service data unit comprising one or more octets of data, and priority parameters. Taken together these parameters are conveniently referred to as a frame, although this does not imply that they are physically encoded by a continuous signal on a communication medium, that no other fields are added or inserted by other protocol entities prior to transmission, or that the priority is always encoded with the other parameters transmitted.

6.1.3 Layer management interfaces

A given N-entity can have many associated management controls, counters, and status parameters that are not communicated to its user's peers, and whose values are either not determined by its user or not required to change synchronously with the occurence of individual N-service primitives to ensure successful (N+1)-protocol operation. Communication of the values of these parameters to and from local entities, i.e. within the same system, is modeled as occuring not through service primitives[11] but through a layer management interface (LMI). One protocol entity, for example an SNMP entity, can be used to establish the operational

[10]These points are frequently misunderstood by those unfamiliar with the reference model, who take it as simply restating common sense principles of modular engineering. Early variants of the MAC Service, for example, omitted the source MAC address parameter on the grounds that it was a fixed property of the transmitting station and should be supplied by the MAC entity itself, despite the fact that communicating peer service users (and the protocols they operate) required that information. The introduction of MAC Bridges necessitated the development of a MAC Internal Sublayer Service with the required parameter, and has led to a restatement of the service definition included in a number of standards. However the source address parameter would still have been required even if MAC Bridges did not exist. Similarly versions of the MAC Service have included local acknowledgment primitives or status return codes for primitives issued. These play no part in defining the peer to peer communication and do not conform to the reference model. The scope of some IEEE 802 standards does include the definition of interfaces, particularly electrical interfaces, within systems. These play a valuable role in defining components used to build those systems, but should not be confused with OSI service interfaces.

[11]Which would require considerable enlargement and continuous modification of service interfaces, obscuring their original purpose, not to mention the creation of many additional interfaces and the addition of "pass through" functions to others.

parameters of another. Communication of the results of authentication protocol exchanges to entities responsible for controlling and securing access is one of the uses of LMIs in this standard.

6.1.4 Service access points, interface stacks, and ports

Each service is provided to a single protocol entity at a service access point (SAP) within a system. A given N-entity can support a number of N-SAPs and use one or more (N-1)-SAPs. The service access point serves to delineate the boundary between protocol specifications and to specify the externally observal relationship between entities operating those protocols. A service access point is an abstraction, and does not necessarily correspond to any concrete realization within a system, but an N-entity often associates management counters with the SAP and provides status parameters that can be used by the (N+1)-entity using the SAP. Examples include the MAC_Operational and operPointToPointMAC status parameters (6.6.2, 6.6.3).

The network and link layers[12] of the reference model accomodate many different real networks, subnetworks, and links with the requirements for bandwidth, multiplexing, security, and other aspects of communication differing from network to network. A given service, e.g. the MAC Service, is often provided by a number of protocols, layered to achieve the desired result. Together the entities that support a particular service access point compose an interface stack. Figure 6-2 provides an example, showing the use of Link Aggregation (IEEE Std 802.3 Clause 43).

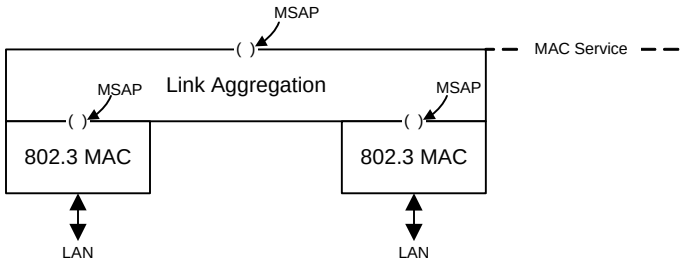

Figure 6-2—An interface stack

The term port is used to refer to the interface stack for a given service access point. Often the interface stack comprises a single protocol entity attached to a single LAN, and port can be conveniently used to refer to several aspects of the interface stack, including the physical interface connector for example. In more complex situations — such as that in Figure 6-2, where the parts of the interface stack provided by the 802.3 MAC entities effectively compose two ports that are then used by link aggregation to provide a single port to its user — the port has to be clearly specified in terms of the particular service access point supported.

6.1.5 Media independent protocols and shims

Protocols specified in IEEE Stds 802.3, 802.11, and other IEEE 802 standards, are specific to their LAN media or to the way access to that media is controlled. Other protocols and functions within the MAC sublayer, such as link aggregation and bridging, are media independent — thus providing consistent management and interoperability across a range of media.

[12]The data link layer, as originally envisaged by the OSI reference model, contained no addressing and caused some involved in its development to reject the idea of LANs at the link layer. There is a sound argument for regarding LANs as simply subnetworks within the network layer, and in practice this is how they are treated. However this would have been unpalatable to many more people at a time when correspondence between LLC (IEEE Std 802.2) and HDLC was sought, together with the adoption of a unique network layer protocol (X.25). Continuing to regard the MAC Sublayer as part of the OSI Data Link Layer does relatively little harm, except when duplication of network layer functionality is proposed, and is convenient given the mass of historic documentation.

Definition of a media independent service facilitates the specification of shims, i.e. protocol entities that use the same service as they provide. Protocol shims can be inserted into an interface stack to provide aggregation (e.g. IEEE Std 802.3 Clause 43), security (e.g. IEEE Std 802.1AE), or multiplexing.

6.1.6 MAC Service clients

The protocol entity that uses the service provided at an MSAP is commonly referred to as client of the MAC Service, or of the entity providing the service. Clients of the MAC Service (or ISS) include the MAC Relay Entity , and the LLC Entity specified in IEEE Std 802.2. The latter provides provides protocol identification, multiplexing and demultiplexing to and from a number of clients that use a common MSAP. The clients of LLC are also often referred to as clients of the MAC.

NOTE—For the purposes of this standard, the terms "LLC" and "LLC Entity" include the service provided by the operation of entities that support protocol discrimination using an LLDP Ethertype, i.e. protocol discrimination based on the Type interpretation of the Ethertype field as specified in IEEE Std 802a-2003.

6.1.7 Stations and systems

A LAN station comprises a single media access method specific entity, operating the MAC procedures specified in the applicable 802 standard, together with other protocol entities mandated by those standards (e.g. an LLC Entity) or commonly used in conjunction with that entity.

A system is a collection of hardware and software components whose intercommunication is not directly externally observable and outside the scope of the IEEE 802 standards that specify the system behavior as a whole. Management of a system, when supported, is typically provided through a single management entity. A system (such as a bridge) can contain many media access method specific entities, of the same or a variety of types, attached to different LANs. A system can therefore be said to comprise one or more LAN stations.

6.1.8 Connectionless connectivity

The MAC Service supported by an 802 LAN provides connectionless connectivity, i.e. communication between attached stations occurs without explicit a priori agreement between service users. The potential connectivity offered by a connectionless service composes a connectivity association that is established prior to the exchange of service primitives between service users. The way in which such a connectivity association is establised depends on the particular protocols and resources that support it, and can be as simple as making a physical attachment to a wire. However simple or complex, the establishment of a connectivity association for connectionless data transfer involves only a two-party interaction between the service user and the service provider (though it can result in exchanges between service providing entities in several systems) and not a three-party user-service-user interaction as is the case for connection-oriented communication. With the continual increase in the number of ways that 802 LAN connectivity can be supported it is no longer useful to regard a LAN as definite set of physical equipment, instead the connectivity association that exists between a set of MAC Service access points defines a LAN[13].

6.2 Provision of the MAC service

The MAC Service provided in end stations attached to a Bridge Local Area Networks and Virtual Bridged Local Area Network is the (unconfirmed) connectionless mode MAC Service defined in ISO/IEC 15802-1. The MAC Service is defined as an abstraction of the features common to a number of specific MAC Services; it describes the transfer of user data between source and destination end stations, via MA-UNITDATA request primitives and corresponding MA-UNITDATA indication primitives issued at MAC

[13]A LAN is thus defined in terms of its external observable behavior, not by an abstraction of its internal operation.

Service access points. Each MA-UNITDATA request and indication primitive has four parameters: Destination Address, Source Address, MAC Service data unit (MSDU), and Priority.

NOTE—The primitives of the MAC Service are closely aligned with those of the ISS (6.6).

In a Bridged Local Area Network, MAC Bridges (IEEE Std 802.1D) provide a single instance of the MAC Service for the network as a whole — a single LAN, as defined above (6.1.8) — by forwarding between the individual LANs that compose the network, though frames with specified group destination addresses are confined to individual LANs.

NOTE 2—MAC Bridges can be configured to completely partition a bridged network, though that is rarely intended.

In a Virtual Bridged Local Area Network, Virtual LANs are defined in terms of the connectivity associations (6.1.8) supported by the network: if service requests made at two different MSAPs both result in service indications at any third MSAP then the two MSAPs are transmitting on the same VLAN; and if the service requests made at any given MSAP can result in service indications at either (or both) of two MSAPs, then those two MSAPs are receiving on the same VLAN. When only two MSAPs are in bi-directional communication, they are using the same VLAN for both transmit and receive if a third station could be added in such a way that it would receive transmissions from both.

NOTE 3—This definition of a VLAN accommodates an unavoidable and sometimes useful consequence of configuration possibilities : use of a single MSAP can result in transmission on one VLAN and reception on another.

NOTE 4—Protocol VLAN classification can be used to classify frames transmitted from a single MSAP into separate VLANs. Where protocol classification is used the above rules apply to frames of a single classification.

6.3 Support of the MAC service

Delete the initial paragraph of clause 6.3 (formerly 6.1) as follows.

~~The MAC Service (MS) provided to end stations attached to a Virtual Bridged Local Area Network is the (unconfirmed) connectionless mode MAC Service defined in ISO/IEC 15802-1. The MAC Service is defined as an abstraction of the features common to a number of specific MAC Services; it describes the transfer of user data between source and destination end stations, via MA_UNITDATA request primitives and corresponding MA_UNITDATA indication primitives issued at MAC Service access points. Each MA_UNITDATA request and indication primitive has four parameters: Destination Address, Source Address, MAC Service data unit (MSDU), and Priority.~~

Delete the last paragraph of clause 6.3 and the accompanying note as follows:

~~The operation of Bridges supports the provision of the MAC Service only to devices that are authenticated and authorized for such use. Unauthorized devices may be denied access to the network, other than as necessary to support the protocol exchanges that are required by any authentication process that is supported.~~

~~NOTE—Authentication and authorization to access a LAN may be achieved by administrative or management mechanisms, or by means of an active authorization mechanism, such as is defined in IEEE Std 802.1X-2001.~~

<<Some text that is more accurate than that immediately above might be added to the new 6.2>>

Insert the following text at the beginning of clause 6.3: