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Wireless Access Method and Physical Layer Specification

A Mechanism for Encapsulating Ancillary LLC Information

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Abstract

This document proposes an escape mechanism which can be used by 802.11 distribution system services to perform transparent integration of non-802 LANs that convey LLC-visible information in their MAC headers (e.g. the protocol type codes in type 2 Ethernet). In the absence of a standardized mechanism for this purpose, portals to such LANs would either be impossible (in an interoperable form), or would limit their ESS to running a single higher-layer protocol stack. The proposed mechanism solves this problem in a manner where the added overhead applies exclusively to the MSDUs which convey the problem protocols.

Reference

The mechanism proposed herein is nearly identical to the one proposal by this author in clause 2 of document 95-188.

Issues Pertaining to the Integration of Non-802 LANs

For portals to function properly, all information being exchanged between peer LLC entities must be conveyed properly across both the distribution system medium (DSM) and wireless medium (WM) of the ESS, and to be handled without loss at the points where the information enters and exits the ESS, whether those points are LLC interfaces at stations within the ESS or integrated LAN interfaces at portals. For intra-ESS communication, and portals which integrate other 802 LANs, this is relatively simple to achieve. All of the 802 MAC protocols fully separate MAC framing information and LLC information, treating the LPDU as the MSDU payload. Unfortunately, certain types of non-802 LANs do not obey this strict separation of LLC-visible information from MAC-specific information. The result is potential ambiguity, which can cause insertion or removal of information from the LPDU when translating between different LAN types. Rather than precluding integration of certain non-802 LANs (which is the approach taken by FDDI), 802.11 can provide unrestricted integration of these LANs by adopting the mechanism described below. A further advantage of this mechanism is that the added overhead of integrating the "ill-behaved" LANs applies only to the MSDUs which convey LPDUs for those LANs, leaving normal MSDUs of 802.11 and other 802-type LANs unaffected.

Definition of the Problem

The principal example of the integration problem caused by ill-behaved, non-802 LANs the inclusion of a protocol type code in the MAC header. This protocol type code is used at the destination station to select the correct higher-layer protocol handler for the LPDU, and is therefore LLC layer information. In order for 802.11 distribution systems to integrate LANs with these sorts of protocols, there must be a way to indicate the presence of such information, and to encapsulate the information in a manner which is unambiguous to 802 LANs, including 802.11 station functionality. The most common instance of an ill-behaved, non-802 LAN is type 2 Ethernet, which places a protocol type code in the MAC header field which 802.3 Ethernet uses for the frame length. (Another non-802 LAN which has a protocol type code in its MAC header is ARCNET.) A portal which integrates an 802.3 LAN cannot treat the length field as part of the LPDU, because to do so would add two, non-LPDU octets to the beginning of the MSDU passed to LLC at the destination. On the other hand, a portal which integrates a type 2 Ethernet LAN cannot discard the type code, because some protocol stacks layered above type 2 Ethernet, notably TCP/IP, rely upon the contents of this field reaching the destination station. The simple solutions to preserving this information have the side effect of limiting the ESS to supporting only one type of higher layer protocol, which is not the intent of 802.11 LAN integration.

Proposed Solution

A general solution to this problem is to use the high-order bit of the subtype field of the data frame type. This bit is =0 for all eight currently defined data subtypes. Under this proposal, this bit being =1 would indicate the presence of encapsulated LLC information in the MSDU payload. The three low-order bits of the subtype field would be interpreted as currently defined, independent of the state of the high-order subtype bit. This permits MSDUs with encapsulated LLC information to be transferred in an identical manner to normal MSDUs, using either distributed or point coordination functions. When this high-order data subtype bit is =1, the MSDU payload begins with an element that encapsulates the ancillary LLC information. When present, encapsulated information element is located just before the conventional LPDU, and is considered part of the MSDU payload. Therefore, if WEP is used on a frame with ancillary LLC information, the IV field is located between the MAC header and the encapsulated information element.

The general format of the encapsulated information element, and the specific layout and values for use with type 2 Ethernet, are shown below in Figure 1. The first octet contains a type code indicating the type of encapsulated information. Currently a information type value of 0 is defined to mean a protocol type code, and all other type values are reserved. The second octet contains the number of octets in the remainder of the element, which is always an even number. If necessary, a pad octet is added at the end of the encapsulated information to maintain even octet alignment for the remainder of the MSDU payload. For information type 0, the information length is 2.

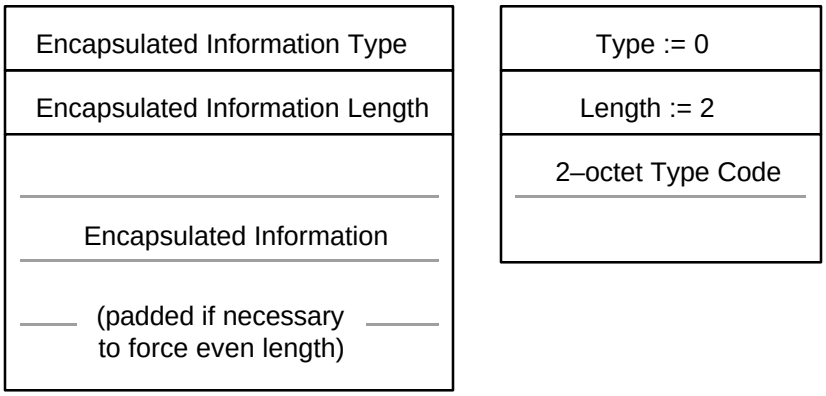

Figure 1. Encapsulated Information Element Format and Values for Type 2 Ethernet

The encapsulated information element plus the basic MSDU payload must fit within the 2304-octet maximum MSDU payload size. This is not expected to be a problem, because 1500 octets is the largest MSDU payload from any of the instances of ill-behaved, non-802 LANs identified to date.

Rules for Using Encapsulated Information Elements

1. A portal which integrates an ill-behaved, non-802 LAN (a LAN that puts LLC-visible information in its MAC header) shall generate an encapsulated information element to hold this information as a part of the MSDU payload of each frame distributed within the ESS after receipt from the integrated LAN. The resulting MSDUs shall be sent using data subtypes in the range 8-15. When such a portal receives a frame containing an encapsulated information element from within the ESS, the encapsulated information shall be used to generate the appropriate field(s) of the integrated LAN frame, as indicated by the type of the encapsulated information element.

2. A portal which integrates a conventional, 802-type LAN shall discard encapsulated information elements on MSDUs received from the within the ESS unless there is a generally-accepted method of handling the particular type of ancillary information indicated by the encapsulated information element type over the 802-type LAN integrated by this portal. In the case of the protocol type encapsulated information element, the portal can generate an LLC header as specified in 802.1H.

3. All stations of an ESS involved in the inter-station transfer of frames for distribution services (e.g. APs and stations that are part of a WDS) shall forward all MSDUs as appropriate for their addressing information, leaving any encapsulated information elements intact.

4. All other stations, upon valid reception of an MSDU containing an encapsulated information element, may discard the encapsulated information, may (in the case of an encapsulated protocol type code) generate an LPDU with LLC information as specified in 802.1H, or may report the encapsulated information to the local LLC entity as status information, rather than as part of the MSDU payload. This reporting shall use the “reception_status” parameter of the MA-UNITDATA.indication. These stations are not required to be able to generate encapsulated information elements; however, these stations may generate MSDUs with encapsulated information elements if their implementation provides a means for the LLC entity to request such generation and to provide the information to be encapsulated.