Network Working Group
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Juha Heinanen
Telecom Finland
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Multiprotocol Encapsulation over ATM Adaptation Layer 5

Status of this Memo

Abstract

This memo describes two encapsulations methods for carrying network interconnect traffic over ATM AAL5. The first method allows multiplexing of multiple protocols over a single ATM virtual circuit whereas the second method assumes that each protocol is carried over a separate ATM virtual circuit.

1. Introduction

Asynchronous Transfer Mode (ATM) based networks are of increasing interest for both local and wide area applications. This memo describes two different methods for carrying connectionless network interconnect traffic, routed and bridged Protocol Data Units (PDUs), over an ATM network. The first method allows multiplexing of multiple protocols over a single ATM virtual circuit. The protocol of a carried PDU is identified by prefixing the PDU by an IEEE 802.2 Logical Link Control (LLC) header. This method is in the following called "LLC Encapsulation" and a subset of it has been earlier defined for SMDS [1]. The second method does higher-layer protocol multiplexing implicitly by ATM Virtual Circuits (VCs). It is in the following called "VC Based Multiplexing".

ATM is a cell based transfer mode that requires variable length user information to be segmented and reassembled to/from short, fixed length cells. This memo doesn't specify a new Segmentation And Reassembly (SAR) method for bridged and routed PDUs. Instead, the PDUs are carried in the Payload field of Common Part Convergence Sublayer (CPCS) PDU of ATM Adaptation Layer type 5 (AAL5) [2].

Note that this memo only describes how routed and bridged PDUs are carried directly over the CPCS of AAL5, i.e., when the Service Specific Convergence Sublayer (SSCS) of AAL5 is empty. If Frame

Relay Service Specific Convergence Sublayer (FR-SSCS), as defined in I.36x.1 [3], is used over the CPCS of AAL5, then routed and bridged PDUs are carried using the NLPID multiplexing method described in RFC 1294 [4]. Appendix A (which is for information only) shows the format of the FR-SSCS-PDU as well as how IP and CLNP PDUs are encapsulated over FR-SSCS according to RFC 1294.

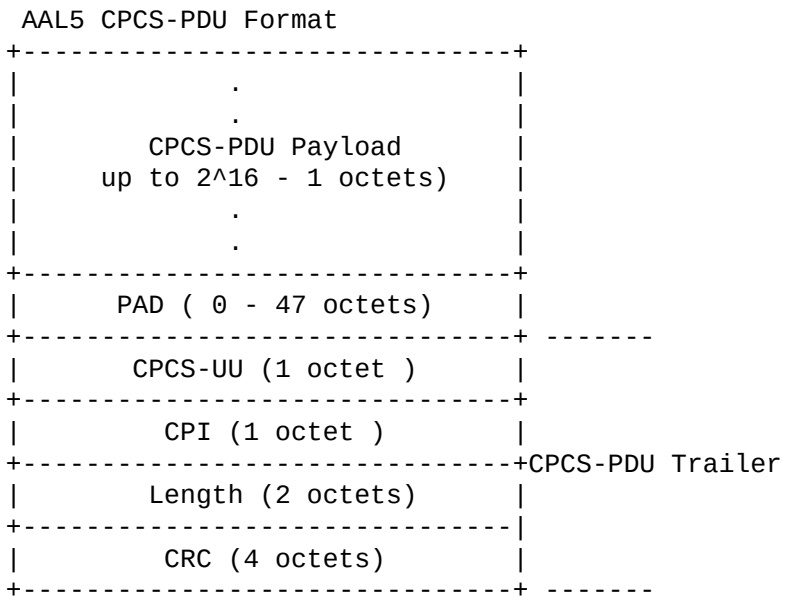
2. Selection of the Multiplexing Method

It is envisioned that VC Based Multiplexing will be dominant in environments where dynamic creation of large numbers of ATM VCs is fast and economical. These conditions are likely to first prevail in private ATM networks. LLC Encapsulation, on the other hand, may be desirable when it is not practical for one reason or another to have a separate VC for each carried protocol. This is the case, for example, if the ATM network only supports (semi) Permanent Virtual Circuits (PVCs) or if charging depends heavily on the number of simultaneous VCs.

When two ATM stations wish to exchange connectionless network interconnect traffic, selection of the multiplexing method is done either by manual configuration (in case of PVCs) or by B-ISDN signalling procedures (in case of Switched VCs). The details of B-ISDN signalling are still under study in CCITT [5]. It can, however, be assumed that B-ISDN signalling messages include a "Low layer compatibility" information element, which will allow negotiation of AAL5 and the carried (encapsulation) protocol.

3. AAL5 Frame Format

No matter which multiplexing method is selected, routed and bridged PDUs shall be encapsulated within the Payload field of AAL5 CPCS-PDU. The format of the AAL5 CPCS-PDU is given below:



The Payload field contains user information up to 2^16 - 1 octets.

The PAD field pads the CPCS-PDU to fit exactly into the ATM cells such that the last 48 octet cell payload created by the SAR sublayer will have the CPCS-PDU Trailer right justified in the cell.

The CPCS-UU (User-to-User indication) field is used to transparently transfer CPCS user to user information. The field has no function under the multiprotocol ATM encapsulation described in this memo and can be set to any value.

The CPI (Common Part Indicator) field alings the CPCS-PDU trailer to 64 bits. Possible additional functions are for further study in CCITT. When only the 64 bit alignment function is used, this field shall be codes as 0x00.

The Length field indicates the length, in octets, of the Payload field. The maximum value for the Length field is 65535 octets. A Length field coded as 0x00 is used for the abort function.

The CRC field protects the entire CPCS-PDU except the CRC field itself.

4. LLC Encapsulation

LLC Encapsulation is needed when several protocols are carried over the same VC. In order to allow the receiver to properly process the incoming AAL5 CPCS-PDU, the Payload Field must contain information

necessary to identify the protocol of the routed or bridged PDU. In LLC Encapsulation this information is encoded in an LLC header placed in front of the carried PDU.

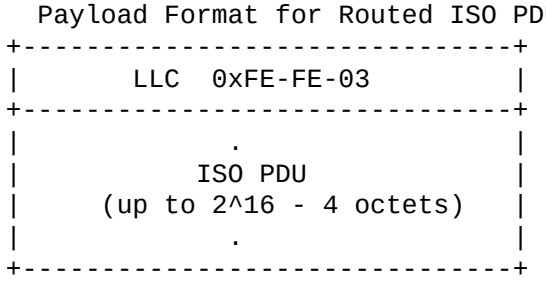
Although this memo only deals with protocols that operate over LLC Type 1 (unacknowledged connectionless mode) service, the same encapsulation principle applies also to protocols operating over LLC Type 2 (connection-mode) service. In the latter case the format and/or contents of the LLC header would differ from what is shown below.

4.1. LLC Encapsulation for Routed Protocols

In LLC Encapsulation the protocol of the routed PDU is identified by prefixing the PDU by an IEEE 802.2 LLC header, which is possibly followed by an IEEE 802.1a SubNetwork Attachment Point (SNAP) header. In LLC Type 1 operation, the LLC header consists of three one octet fields:

In LLC Encapsulation for routed protocols, the Control field has always value 0x03 specifying Unnumbered Information Command PDU.

The LLC header value 0xFE-FE-03 identifies that a routed ISO PDU (see [6] and Appendix B) follows. The Control field value 0x03 specifies Unnumbered Information Command PDU. For routed ISO PDUs the format of the AAL5 CPCS-PDU Payload field shall thus be as follows:



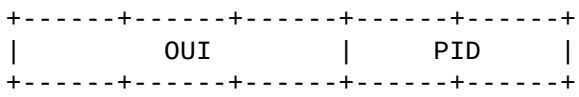
The routed ISO protocol is identified by a one octet NLPID field that is part of Protocol Data. NLPID values are administered by ISO and CCITT. They are defined in ISO/IEC TR 9577 [6] and some of the currently defined ones are listed in Appendix C.

An NLPID value of 0x00 is defined in ISO/IEC TR 9577 as the Null Network Layer or Inactive Set. Since it has no significance within

the context of this encapsulation scheme, a NLPID value of 0x00 is invalid under the ATM encapsulation.

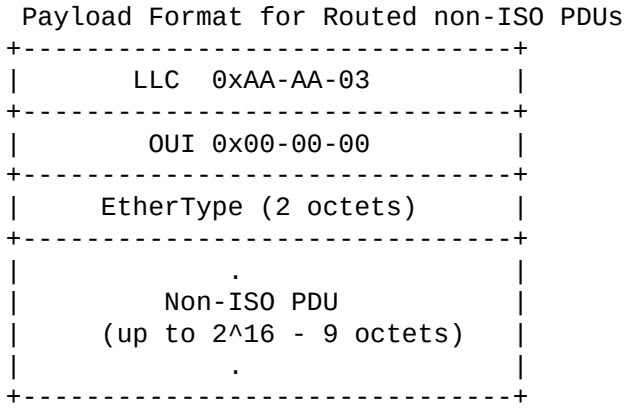
It would also be possible to use the above encapsulation for IP, since, although not an ISO protocol, IP has an NLPID value 0xCC defined for it. This format must not be used. Instead, IP is encapsulated like all other routed non-ISO protocols by identifying it in the SNAP header that immediately follows the LLC header.

The presence of a SNAP header is indicated by the LLC header value 0xAA-AA-03. A SNAP header is of the form



The three-octet Organizationally Unique Identifier (OUI) identifies an organization which administers the meaning of the following two octet Protocol Identifier (PID). Together they identify a distinct routed or bridged protocol. The OUI value 0x00-00-00 specifies that the following PID is an EtherType.

The format of the AAL5 CPCS-PDU Payload field for routed non-ISO PDUs shall thus be as follows:



In the particular case of an Internet IP PDU, the Ethertype value is 0x08-00:

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