Amateur Framing Protocol Specification

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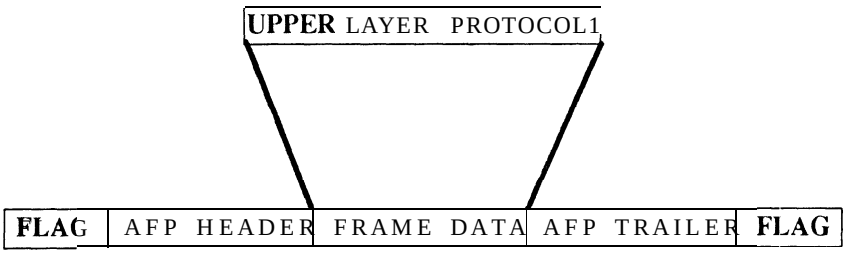
1. Introduction

The Amateur Framing Protocol (AFP) is a general purpose data format protocol for Amateur Radio packet mode communications systems. AFP provides the framework on which other protocols may be implemented.

An AFP frame provides an envelope to support any form of Logical Link Control protocol which two (or more) stations wish to use during packet mode operations. The relationship of AFP to other protocols is shown below.



1.1 Relationship of AFP to Other Protocols

The upper layer protocols currently supported by AFP are listed in section 3.3. These protocols will generally be of the link layer, but may also be network layer protocols or other protocol stacks.

1.2 Document Scope

This document presents the frame format, the field encodings, and other guidelines for users of the protocol.

2. *Frame Structure*

2.1 Frame Format

The basic AFP frame format is shown in the table below.

AFP Frame Format	
Octet	Field
	Flag
0	Next Station ID Checksum
1	Version
2	Upper Layer Protocol ID
3	Frame Data Offset
4	Next Station ID Offset
5 toX	Station IDs
x+1 to y	Supplementary Header
y+1	Header Checksum
y+2 to z	Frame Data
z+1	Frame Check Sequence
z+2	Frame Check Sequence
	Flag

2.2 Frame Boundaries

The Flag Field occurs before and after each AFP frame. Two frames may share one flag, which would denote the end of the first frame and the beginning of the next. The Flag is will contain the value 7EH.

2.3 Frame Length

2.3.1 Maximum

The maximum length of AFP frames is 2560 octets. This value includes an AFP Header length of 254 octets(max.), a Frame Data length of 2304(max.), and a Frame Check Sequence of 2 octets. This does not include the Flag field which bound the frame.

Specific upper layer protocols or local implementations may limit the frame length to a lower number of octets by setting limits on the AFP Header or Frame Data fields.

2.3.2 Minimum

The minimum length of an AFP frame is 14 octets. This includes the Next Callsign Checksum(1), Version(1), Upper Layer Protocol ID(1), Frame Data Offset(1), Next Station Identification Offset(1), Station Identification(6 - if one, four character callsign), Header Checksum(1), and a Frame Check Sequence(2) fields.

2.4 Bit Order

With the exception of the Frame Check Sequence field, all fields of an AFP frame are sent with each octet's least-significant bit first. The Frame Check Sequence is sent most-significant bit first.

25 Octet Order

The octets are transmitted in the order in which their fields occur in the figure in section 2.1.

3. Field Encodings

3.1 Next Station Identification Checksum

The Next Station Identification (Station ID) Checksum octet contains an eight bit value which is the one's complement sum of each octet of the Station Identification field of the next receiver. If the result is 127 (0FFH) for a non-broadcast frame, then the value 0 (00H) should be used. The algorithm used to calculate the Next Station Identification Checksum is:

$$[\ SUM(n) = \tilde{}SUM(n\text{-}1) + OCTET(n)\ ]$$

3.2 Version

The Version octet presents the AFP Version. The value 1 (0000001B) represents the current value.

AFP Version Octet Encoding		
Version	Binary Value	Hexadecimal Value
1	00000001B	01H

3.3 Upper Layer Protocol ID

The Upper Layer Protocol ID is indicated, by this octet. The values OFEH and 0FFH are reserved for future extensions.

Specific encodings are shown in the table below.

Upper Layer Protocol ID	
Protocol(s)	Hexadecimal Value
CCITT x.25	00H
IS0 8208	10H
CCITI' Q.921	20H
CCITI' 4.93 1	30H
IS0 IP	40H
DoD IP	OCOH
DoD ARP	0C2H
ARRL AX.25	0F0H
Extension	OFEH
x-ension	OFFH

3.4 Frame Data Offset

The Frame Data Offset octet contains a seven bit index from the beginning of the frame (the Next Station ID Checksum is position 0) to the start of the Frame Data field. The maximum AFP header length is 254 octets. The maximum value is 254.

35 Next Station Identification Offset

The Next Station Identification Offset octet contains a seven bit index from the beginning of the frame (the Next Callsign Checksum is position 0) to the length octet of the Station ID field of the next receiver. The next receiver is either the destination, digipeater or other relay device.

3.4 Station Identification Fields

3.6.1 Amateur Station Identification

Station Identification (Station ID) octets contain the legal Amateur Radio Station Callsign. The legal Amateur Radio Station Callsign must be encoded into the first octets of the field. The Callsign may contain any uppercase alphabetic character (A-Z), and numeral (0-9), or the "slash" (/) character.

Any additional station assigned identification may be appended to the callsign. This additional identification may be used to provide uniqueness of a particular transmitter or to indicate a special capability to other systems. The ASCII character "-" or "Dash" (2DH) is used as a separator between the legal Amateur Radio Callsign and any station assigned identification.

3.6.2 Station Identification Field Order

Station Identifiers occur in sequence in an AFP frame.

The first and only required Station ID is the Source Station ID. Subsequent Station ID fields contain either the Destination Station ID, a digipeater Station ID or the Station ID of another type of relay device.

The last Station ID on a direct or digipeated path is that of the Destination.

If a digipeater (or digipeaters) is in the path between the Source and Destination stations, the Station ID field (or fields) is placed in order of communications in the frame.

The table below presents the layout of the Source, Digipeater and Destination Station Identification fields.

Station Identifier Fields						
Station ID 1		Station ID 2		Station ID 3		End
Length	Source	Length	Digipeater	Length	Destination	End
9	N2DSY-3B 1	9	W2VY-DIGI	8	KA9Q-SUN	*0*

No Station ID sequence restrictions are placed on other types of operations other than that the first Station ID field must always contain the Station ID of the Source station.

3.6.3 Station ID Field Encoding

Each Station ID field contains length octet and a sequence of Station ID octets. The octet following the last Station ID field is encoded with the value 0.

3.7 Supplementary Header

The Supplementary Header field provides a mechanism to include information needed to meet various national, local implementation or Upper Layer Protocol-dependent requirements.

3.7.1 Supplementary Header Field Encoding

The first octet contains the length octet for the remainder of the field. Subsequent octets contain the data of the Supplementary Header field.

The table below shows the encoding of the basic Supplementary Header field.

Supplementary Header Field
Supplementary Header Length Octet
Supplementary Header Data

3.7.2 Supplementary Header Options Encoding

The Supplementary Header contains subfields which contain Supplementary Header Options. Each Option has an encoded in a type, length and value sequence. The values in the range O-127 and 255 are reserved for standard values available to all AFP users. The values 128- 19 1 are reserved for use by specific upper layer protocols. The values 192-254 are available for local protocol implementations.

3.8 Supplementary Header Options

There are two standard Supplementary Header options which are available for all AFP users. These deal with the identification requirements of some telecommunications administrations. The first option provides a means to communicate the legal Amateur Station Callsign of the originating station. The second provides a means to communicate the legal Amateur Station Callsign of the terminating station.

3.8.1 Originating Station Identification Option

This option the callsign of the originating station. The first octet of the field will be encoded with the value 0. The second will contain the binary value of the length of the callsign character string. The characters of the callsign are encoded into a string of ASCII octets.

3.8.2 Terminating Station Identification Option

This option the callsign of the terminating station. The first octet of the field will be encoded with the value 0. The second will contain the binary value of the length of the callsign character string. The characters of the callsign are encoded into a string of ASCII octets.

3.8.3 Supplementary Header Option Encoding

Below is an example of the Supplementary Header Field with both the Originator and Terminator Station ID Options.

Supplementary Header Field with Originator/Terminator Callsigns
Supplementary Header Length
Originating Station ID Option
Originating Length
Originating Callsign
Terminating Station ID Option
Terminating Length
Terminating Callsign

3.9 *Header Checksum*

The Header Checksum octet contains an eight bit value which is the one's complement sum of each octet of the AFP Header octets(Cktets 0 through y, see figure 2.1). The algorithm used to calculate the Header Checksum is:

$$[\ SUM(n) = \tilde{}SUM(n\text{-}1) + OCTET(n)\ ]$$

If the result is 0 (00H) then the value 127 (0FFH) should be used. The value 0 indicates that the checksum was not calculated by the sender.

3.10 Frame Data

This field contains an octet sequence not to exceed 2304 octets in length, which conforms to the protocol requirements of the protocol indicated by the Upper Layer Protocol ID field

3.11 Frame Check Sequence

The Frame Check Sequence is a 16 bit number, encoded into two octets and calculated by both the sender and receiver of a frame. It is used to insure that the frame was not corrupted by the medium used to get the frame from the sender to the receiver. It is calculated in accordance with IS0 3309 (HDLC).

REFERENCES

1. T. Fox, WB4JFI, "AX.25 Amateur Packet-Radio Link-layer Protocol Version 2.0", The American Radio Relay League, Inc. (1984).
2. CCITT, "CCITT Recommendation X.25", CCITT (1984)
3. J. Postel et al., "DDN Protocol Handbook", USC-ISI (1986).
4. ISO, "ISO 3309", International Organization for Standardization (1981)