Amateur Framing Protocol

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Abstract

Over the last ten years Amateur Radio packet mode operations have evolved to the point where there are approximately fifty thousand Radio Amateurs worldwide using the AX.25 Link Layer Protocol implemented in special computer interfaces called Terminal Node Controllers (TNCs). During this period many functional extensions or changes to the protocol have been suggested, but their use would not conform to the basic AX.25 protocol.

The authors have identified a common set of protocol capabilities which can be provided in a simple framing sublayer. These capabilities include framing, station identification, bit-error detection, digipeating, and application specific options. The Amateur Framing Protocol (AFP) presented in this paper defines a a format and a set of rules to support these functions, while providing an envelope for higher layer protocols such as ARRL AX.25 Link Layer, CCITT Q.921, CCITT 4.93 1, CCITT X.25, IS0 8208, IS0 IP, and US DoD TCP/IP and ARP.

Introduction

The Amateur Framing Protocol is a stable base for the evolving Amateur Radio packet protocols. Its major objective is to provide a format for proper station and protocol identification. It also provides framing, bit-error detection, digipeating, and application specific options.

In this model, the framing sublayer protocol has been defined separately from the logical link layer protocol. The separation of the framing protocol is an outgrowth of the diverse software development work done by the authors and other members of the Amateur Radio community. This framing protocol provides a common base for the development of the ARRL AX.25,[1] the CCITT X.25,[2] and the U.S. Department of Defense TCP/IP[3] and other protocols in the Amateur Radio Network.

The creation of a new framing protocol provides an ideal opportunity to incorporate the various station identification format requirements of regulatory authorities. AFP has also been structured to support local protocol extensions for cooperating systems.

Functional Overview

The Amateur Framing Protocol was developed from a "wish list" of enhancements to the AX.25 Link Layer Protocol which came from the ARRL Digital Committee, vendors, Radio Amateurs worldwide, and the authors. Functional capabilities of the framing sublayer were included in AFP and are described in this document.

. Hardware Selective Receive

In order to reduce the overhead of processing every received frame, AFP requires that the first octet received in a frame match a predefined value which is based on a hash function of the next station's identification. Only when this octet is matched, does the serial interface interrupt the processor. This leaves the processor free to handle other tasks. This is beneficial when operating on a high-speed channel because many frames can be immediately discarded by the hardware when this octet fails to match. This capability also supports the automatic detection of a "broadcast-mode" frame. This causes the hardware to receive AFP frames with the value 0FFH in the first octet.

. Version Number

This protocol features a version number which will provide a mechanism to indicate major frame format differences to other systems.

. Upper Layer Protocol Identification

This field provides an indication of the upper layer protocol type(s) in use by the system. This protocol identification has assigned values for ARRL AX.25 Link Layer, CCITT Q.921, CCITT X.25, IS0 IP, and US DoD TCP/IP and ARP. Other protocol values can be added after review.

. Variable Length Station Identifiers

AFP supports variable length station identifiers up to a maximum of 40 octets. An additional "length octet" is provided before each Station Identifier field.

. Simplified Relay (Digipeating)

Digipeater stations are primitive source-routed relay devices, this function was incorporated into AFP. A simple pointer is provided to indicate the start of the next receiver's Station Identifier in the frame header.

. Supplementary Header

This field allows individual protocol implementations to carry addlitional header information such as is required by an administration, or other information required by a specific local protocol implementation.

. Header Checksum

In many applications the overall frame may be received in a damaged condition yet the header might be usable by the system. Minor corruption of the data may be acceptable in applications such as packet voice facsimile or video.

- **Frame Data**

  This field contains the frame of data used on the communications channel. The protocol format for this field is governed by the protocol indicated in the Upper Layer Protocol Identifier field.

- **Frame Check Sequence**

  This field provides a means by which bit-errors can be detected. It contains the sixteen bit Cyclical Redundancy Check as specified by IS0 3309[4] (HDLC). This is CRC function used in AX.25 and X.25.

Conclusion

The authors have included the text of the Amateur Framing Protocol (AFP) in this paper. This protocol provides a basic tool which can be used by the Amateur Radio community to explore advanced digital communications techniques while maintaining the ability to verify the source of transmissions and providing a basic relay capability. It is hoped that this protocol will act as a catalyst for the rapid development and deployment of a wide variety of communications protocol implementations.

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