EtherTalk 2.0: Networking Packet Formats and Protocols

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TOPIC ----------

1) With AppleTalk Phase 2, how does the SNAP (SubNetwork Address Protocol) work?

   If this works with the condition: DSAP=SSAP in LLC (Logical Link Control), the first 5 bytes of the LLC Information (LLC data) is the PID (Protocol Identifier). In this case, what are the DSAP and SSAP used?

2) Also, if the above is correct, what is the Apple OUI (Organizational Unique Identifier) in the PID header?

   Notes

   IEEE 802.3 Frame

   Preamble
   Dest-Addr (6 bytes)
   Source-Addr (6 bytes)
   Length (2 bytes)
   LLC-DSAP (1 byte)
   LLC-SSAP (1 byte)
   LLC-control (1 byte)
   LLC-data (43-1497 bytes)

DISCUSSION ----------

1) With EtherTalk 2.0, Apple is adopting standard networking packet formats as defined by the Institute of Electrical and Electronics Engineers (IEEE) 802 committee. The 802 committee defines standards for local area networking.

   The IEEE divides the OSI data link layer into the Logical Link Control (LLC) layer and the Medium Access Control (MAC) layer. The IEEE LLC layer

provides error checking and reliable transfer of data. The LLC layer was defined to provide a uniform interface to the network layer, independent of the MAC and physical layers used. The LLC provides connectionless-oriented (Type 1) or connection-oriented (Type 2) services.

The MAC layer provides some of the lower-level functions of the OSI data link layer and some functions that fit into the OSI physical layer. These functions include channel (media) access, channel contention arbitration, and data formatting. The MAC layer has three variants:

- Carrier Sense Multiple Access/Collision Detect (CSMA/CD), which is similar to the Ethernet standard and is used in engineering and office automation applications.

- Token Bus, used in factory automation applications.

- Token Ring, which has been widely adopted by IBM and other companies for office automation applications.

Ethernet and 802.3 CSMA/CD are often incorrectly considered identical. Ethernet is a de facto local area network standard developed by Digital Equipment Corporation, Xerox, and Intel. It forms the basis for 802.3, but the 802.3 packet format is slightly different. Unlike the Ethernet packet, the 802.3 packet has no protocol-type field and has a data length field. Workstations using Ethernet packets do not recognize workstations using 802.3 packets, and vice versa.

The Ethernet protocol-type field is used to distinguish higher-level protocols. The protocol-type field allows for 64 different protocol identifiers. However, with the maturation of local area network technology, 64 different protocol identifiers are too few. To accommodate the large number of protocols, the IEEE developed the SubNetwork Address Protocol (SNAP) standard.

SNAP allows multiple protocols to be used with one data link. It defines a 5-byte field to identify the protocol using the data link. It ensures that protocol identifiers from different vendors do not conflict. The IEEE has assigned Apple a SNAP identifier for AppleTalk and AARP (Apple Address Resolution Protocol).

With EtherTalk 1.0, AppleTalk data was transmitted in the data field of an Ethernet packet. With EtherTalk 2.0, AppleTalk data is encapsulated in a SNAP packet, which is encapsulated in an LLC packet, and transmitted in a CSMA/CD 802.3 packet. The result is that EtherTalk 1.0 packets are not seen by EtherTalk 2.0 nodes, and EtherTalk 2.0 packets are not seen by EtherTalk 1.0 nodes.

Though EtherTalk 2.0 uses the SNAP interface, higher-level protocols can go directly to the LLC layer, and not use SNAP. SNAP allows connectionless communication services only. Software developers that need to use connection-oriented services must bypass SNAP and use the 802.2 LLC interface directly. Such developers would use Apple's Ethernet driver for our EtherTalk card, but would not use our higher-level EtherTalk 2.0

software.

EtherTalk 2.x (802.3) Frame

802.3 Destination	6 bytes
802.3 Source	6 bytes
802.2 LLC Length	2 bytes
802.2 LLC Header	
802.2 LLC DSAP	1 bytes (always $AA (SNAP SAP) for EtherTalk 2.x)
802.2 LLC SSAP	1 bytes (always $AA (SNAP SAP) for EtherTalk 2.x)
802.2 LLC Control	1 bytes (always $03)
SNAP Header	5 bytes (always $080007809B for EtherTalk 2.x)
DDP Header	13 bytes
AppleTalk Data	?? bytes (586 bytes maximum)
Padding (if needed)	?? bytes
	60 to 621 bytes

DSAP - Destination Service Access Point
SSAP - Source Service Access Point
The SNAP SAP is defined as $AA.

If the 802.3 packet is less than 60 bytes padding is added to make the packet 60 bytes long.

In 802.2, DSAP and SSAP are almost always the same except in frames that are establishing an initial SNA connection.

2) The SNAP (SubNetwork Address Protocol) unique identifier assigned to Apple by the IEEE is $0800070000. The first 3 bytes of the unique identifier is the vendor address. The last 2 bytes are the local administered (by Apple) identifiers. We (Apple) have defined $809B as EtherTalk. The unique identifier for EtherTalk 2.0 is $080007809B. This is considered to be a locally administered SNAP address.

   A global SNAP address has been defined by the IEEE for AARP packets. The SNAP number is $00000080F3.

   These values are the same for TokenTalk 2.0.

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