ARP Message Format

Address resolution using ARP is accomplished through the exchange of messages between the source device seeking to perform the resolution, and the destination device that responds to it. As with other protocols, a special *message format* is used containing the information required for each step of the resolution process.

ARP messages use a relatively simple format. It includes a field describing the type of message (its *operational code* or *opcode*) and information on both layer two and layer three addresses. In order to support addresses that may be of varying length, the format specifies the type of protocol used at both layer two and layer three and the length of addresses used at each of these layers. It then includes space for all four of the address combinations we saw in the previous topic.

The format used for ARP messages is described fully in Table 42, and illustrated in Figure 49.

Table 42: Address Resolution Protocol (ARP) Message Format		
Field Name	**Size (bytes)**	**Description**
HRD	2	*Hardware Type:* This field specifies the type of hardware used for the local network transmitting the ARP message; thus, it also identifies the type of addressing used. Some of the most common values for this field: <table><tr><td>**HRD Value**</td><td>**Hardware Type**</td></tr><tr><td>1</td><td>Ethernet (10 Mb)</td></tr><tr><td>6</td><td>IEEE 802 Networks</td></tr><tr><td>7</td><td>ARCNET</td></tr><tr><td>15</td><td>Frame Relay</td></tr><tr><td>16</td><td>Asynchronous Transfer Mode (ATM)</td></tr><tr><td>17</td><td>HDLC</td></tr><tr><td>18</td><td>Fibre Channel</td></tr><tr><td>19</td><td>Asynchronous Transfer Mode (ATM)</td></tr><tr><td>20</td><td>Serial Line</td></tr></table>

PRO	2	**Protocol Type:** This field is the complement of the *Hardware Type* field, specifying the type of layer three addresses used in the message. For IPv4 addresses, this value is 2048 (0800 hex), which corresponds to the EtherType code for the Internet Protocol.
HLN	1	**Hardware Address Length:** Specifies how long hardware addresses are in this message. For Ethernet or other networks using IEEE 802 MAC addresses, the value is 6.
PLN	1	**Protocol Address Length:** Again, the complement of the preceding field; specifies how long protocol (layer three) addresses are in this message. For IP(v4) addresses this value is of course 4.
OP	2	*Opcode:* This field specifies the nature of the ARP message being sent. The first two values (1 and 2) are used for regular ARP. Numerous other values are also defined to support other protocols that use the ARP frame format, such as RARP, some of which are more widely used than others:

Opcode	ARP Message Type
1	ARP Request
2	ARP Reply
3	RARP Request
4	RARP Reply
5	DRARP Request
6	DRARP Reply
7	DRARP Error
8	InARP Request
9	InARP Reply

SHA	(Variable, equals value in *HLN* field)	**Sender Hardware Address:** The hardware (layer two) address of the device sending this message (which is the IP datagram source device on a request, and the IP datagram destination on a reply, as discussed in the topic on ARP operation).
SPA	(Variable, equals value in *PLN* field)	**Sender Protocol Address:** The IP address of the device sending this message.
THA	(Variable, equals value in *HLN* field)	**Target Hardware Address:** The hardware (layer two) address of the device this message is being sent to. This is the IP datagram destination device on a request, and the IP datagram source on a reply)

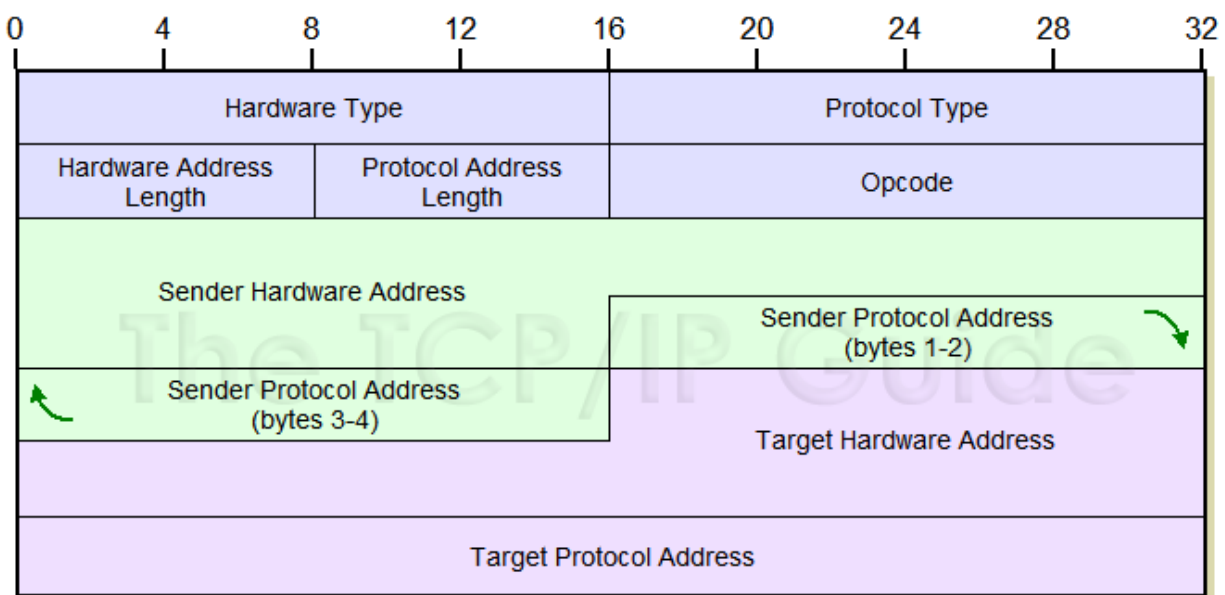|		
TPA	(Variable, equals value in *PLN* field)	**Target Protocol Address:** The IP address of the device this message is being sent to.

Figure 49: Address Resolution Protocol (ARP) Message Format

The ARP message format is designed to accommodate layer two and layer three addresses of various sizes. This diagram shows the most common implementation, which uses 32 bits for the layer three ("Protocol") addresses, and 48 bits for the layer two hardware addresses. These numbers of course correspond to the address sizes of the Internet Protocol version 4 and IEEE 802 MAC addresses, used by Ethernet.

After the ARP message has been composed it is passed down to the data link layer for transmission. The entire contents of the message becomes the payload for the message actually sent on the network, such as an Ethernet frame. Note that the total size of the ARP message is variable, since the address fields are of variable length. Normally, though, these messages are quite small: for example, they are only 28 bytes for a network carrying IPv4 datagrams in IEEE 802 MAC addresses.