

# **Cisco – Ethernet Encapsulation Cheat Sheet**

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# Ethernet Encapsulation Cheat Sheet

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## **Introduction**

### **Before You Begin**

Conventions

Prerequisites

Components Used

Background Information

### **Ethernet II Encapsulation**

#### **802.3–Only Encapsulation**

#### **802.3 with 802.2 Encapsulation**

#### **802.3 with 802.2 SNAP**

#### **IP with Ethernet II (Advanced Research Projects Agency (ARPA)**

#### **Address Resolution Protocol (ARP) with Ethernet II**

#### **Internet Control Message Protocol (ICMP)/IP with Ethernet II**

#### **Intermediate System–to–Intermediate System (IS–IS) with 802.3 and 802.2**

#### **Related Information**

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## **Introduction**

This Tech Note provides information on different types of Ethernet encapsulations and is meant to be a reference document.

## **Before You Begin**

### **Conventions**

For more information on document conventions, see the Cisco Technical Tips Conventions.

### **Prerequisites**

There are no specific prerequisites for this document.

### **Components Used**

This document is not restricted to specific software and hardware versions.

## **Background Information**

The Institute of Electrical and Electronics Engineers (IEEE) 802 committees that deal with various standards for different LAN media are as follows:

- 802.2 – Committee that defines the Logical Link Control (LLC) common to many 802 networks
- 802.3 – Committee that deals with the carrier sense multiple access with collision detection (CSMA/CD) LAN
- 802.4 – Committee that deals with the token bus LAN
- 802.5 – Committee that deals with the 4–Mb and 16–Mb Token Ring LAN

The four types of Ethernet encapsulations are as follows:

- Ethernet II
- 802.3
- 802.3 with 802.2
- 802.3 with 802.2 Subnetwork Access Protocol (SNAP)

IP only uses Ethernet II and 802.3 SNAP.

RFC 1042 , A Standard for the Transmission of IP Datagrams over IEEE 802 Networks, states the following:

"IEEE 802.3 networks have a minimum packet size that depends on the transmission rate. For type 10Base5 802.3 networks the minimum packet size is 64 octets. IEEE 802.3 networks have a maximum packet size which depends on the transmission rate. For type 10Base5 802.3 networks the maximum packet size is 1518 octets including all octets between the destination address and the FCS inclusive. This allows 1518 – 18 (MAC header + trailer) – 8 (LLC + SNAP header) = 1492 for the IP datagram (including the IP header). Note that 1492 is not equal to 1500 which is the MTU for Ethernet networks."

Hence, the minimum Ethernet Frame size is 64 bytes. Conceptually, the Layer 3 (L3) part of the Ethernet frame could be as short as 0 bytes. This means that if the Ethernet data portion is less than 46 bytes, the Ethernet frame will be padded with 0x00 characters to bring it up to full size. The L3 portion (of the Ethernet data) must have a mechanism (length or end marker) to tell the difference between the L3 header, data, and Ethernet padding.

## Ethernet II Encapsulation

DST MAC	SRC MAC	Frame Type	DATA	CRC
6 Bytes	6 Bytes	2	46 - 1500 Bytes	4 Bytes

```
Ethernet Header = 18 Bytes [Dst Mac(6) + Src Mac(6) + Frame Type (2) +CRC(4)]
Minimum Data Portion = 46 Bytes
Minimum Ethernet Frame Size = 64 Bytes
```

**Note:** Ethernet II type field values are greater than 0x5FF (1535) while 802.3 length field values are less than 0x5EE (1518). This is how Ethernet II and 802.3 frames are differentiated.

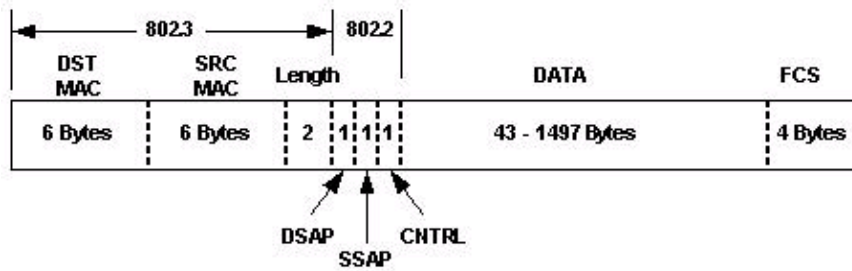
## 802.3–Only Encapsulation

DST MAC	SRC MAC	Length	DATA	CRC
6 Bytes	6 Bytes	2	46 - 1500 Bytes	4 Bytes

```
Ethernet Header = 18 Bytes [Dst Mac(6) + Src Mac(6) + Length (2) +CRC(4)]
Minimum Data Portion = 46 Bytes
Minimum Ethernet Frame Size = 64 Bytes
```

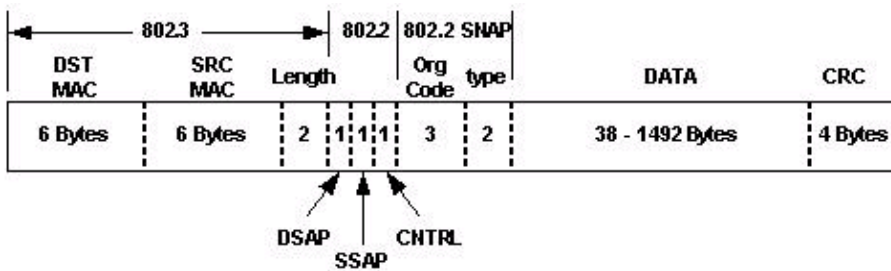
**Note:** There can only be one L3 protocol that uses 802.3–only encapsulation on a host because there isn't anything in the 802.3 header to differentiate between different L3 packets.

## 802.3 with 802.2 Encapsulation



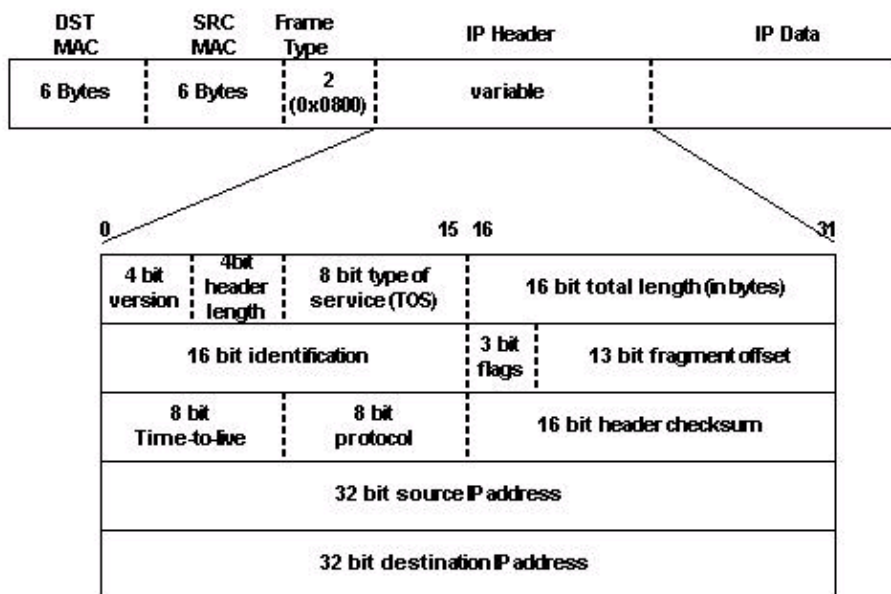
Ethernet Header = 21 Bytes [Dst Mac(6) + Src Mac(6) + Length (2) + DSAP(1) + SSAP(1) + CNTRL(1)]  
 Minimum Data Portion = 43 Bytes  
 Minimum Ethernet Frame Size = 64 Bytes

## 802.3 with 802.2 SNAP

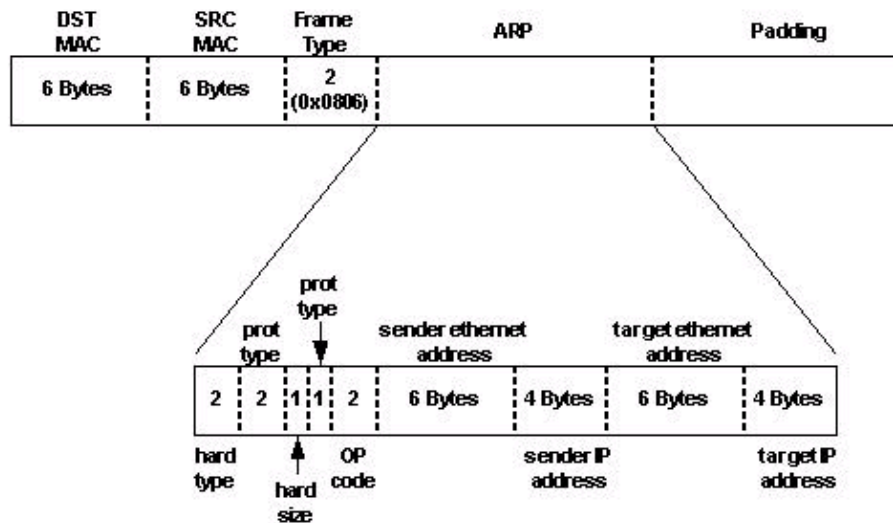


Ethernet Header = 26 Bytes [Dst Mac(6) + Src Mac(6) + Length (2) + DSAP(1) + SSAP(1) + CNTRL(1) + Org Code(3) + type(2)]  
 Minimum Data Portion = 38 Bytes  
 Minimum Ethernet Frame Size = 64 Bytes

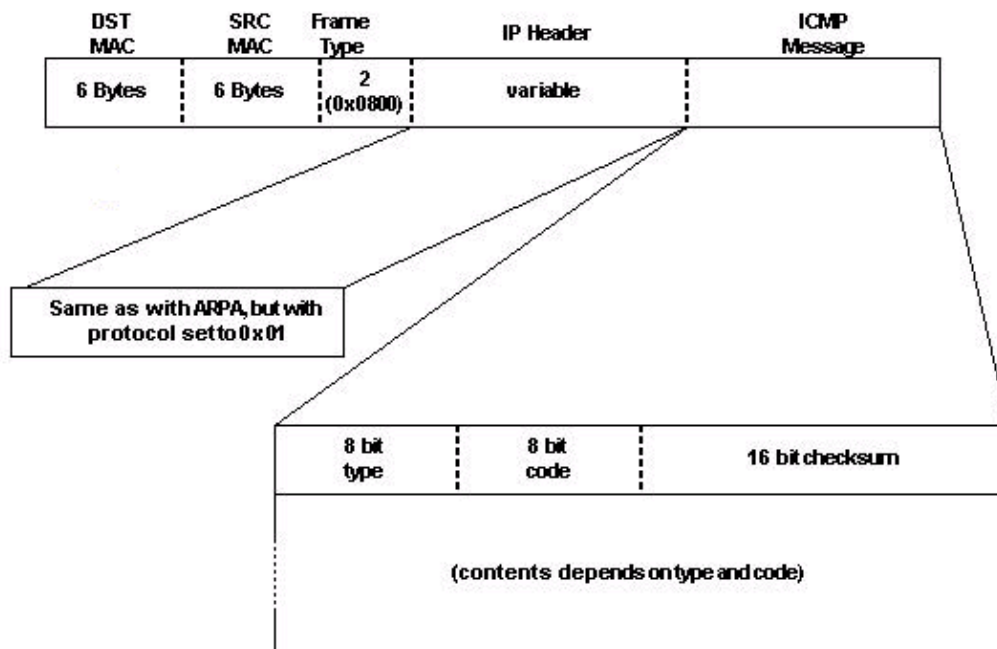
## IP with Ethernet II (Advanced Research Projects Agency (ARPA))



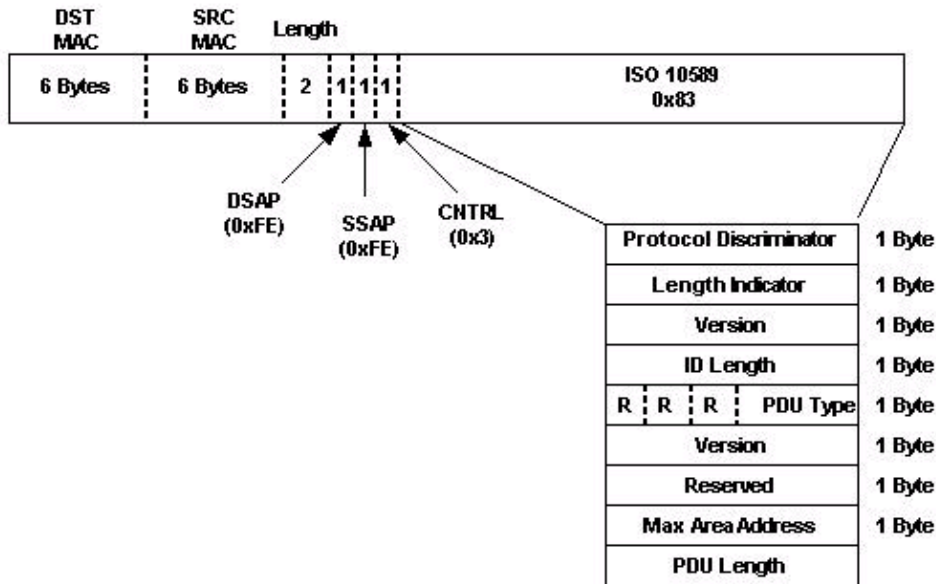
## Address Resolution Protocol (ARP) with Ethernet II



## Internet Control Message Protocol (ICMP)/IP with Ethernet II



## Intermediate System-to-Intermediate System (IS-IS) with 802.3 and 802.2



The ISO 10589 expanded fields above refer only to fields that are common among the different type of IS-IS packet types. For example: A L1-Hello on a LAN segment may have additional fields which are different from a L1-LSP packet.

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## Related Information

- [IP Routing Protocols Support Pages](#)
  - [Product Support](#)
  - [Technology Support](#)
  - [Tools and Utilities](#)
  - [Technical Support – Cisco Systems](#)
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