

LATEST HEADER FORMATS

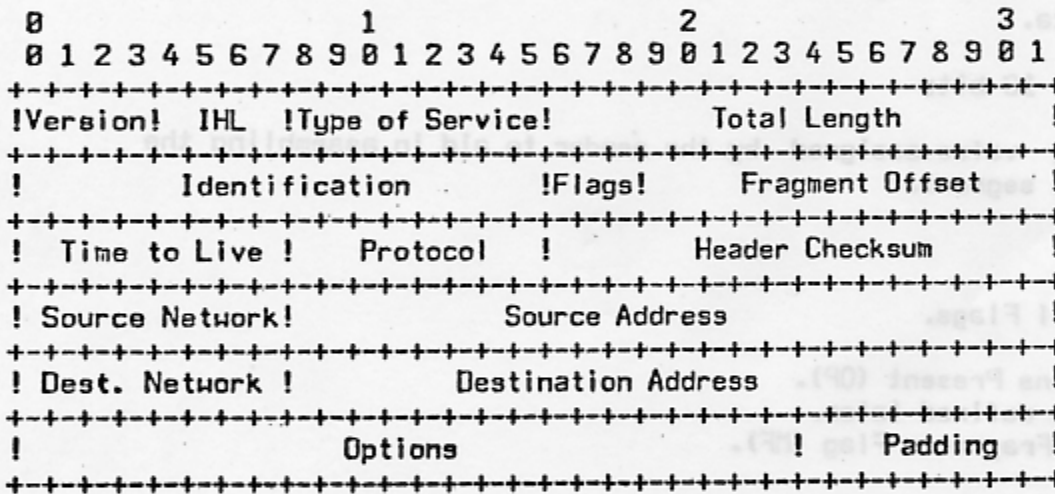
INTRODUCTION

The recent TCP meeting (15&16 June at MIT-LCS) discussed the format of the internet header and converged on the following header descriptions.

INTERNETWORK HEADER

A summary of the contents of the internetwork header follows:

Internetwork Header Format



Example Internet Packet Header

Figure 1.

Note that each tick mark represents one bit position.

Version: 4 bits

There is a Version field which indicates the "shape", or format, of the internet portion. This is version 4.

IHL: 4 bits

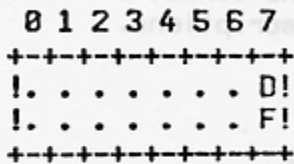
Internet Header Length is the length of the internet header in 32 bit words, and thus points to the beginning of the data.

Latest Protocol Formats  
Internetwork Header

Type of Service: 8 bits

Type of service.

- Bits 0-6: To be defined later.
- Bit 7: Don't Fragment This Segment (DF).



Total Length: 16 bits

Total Length is the length of the packet in octets including internet header and data.

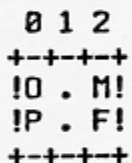
Identification: 16 bits

An identifying value assigned by the sender to aid in assembling the fragments of a segment.

Flags: 3 bits

Various Control Flags.

- Bit 0: Options Present (OP).
- Bit 1: To be defined later.
- Bit 3: More Fragments Flag (MF).



Fragment Offset: 13 bits

This field indicates where in the segment this fragment belongs. The fragment offset is measured in units of 8 octets (64 bits).

**Time to Live: 8 bits**

This field indicates the maximum time the segment is allowed to remain in the internetwork system. If this field contains the value zero then the segment should be destroyed. This field is modified in internet header processing. The time is measured in units of seconds.

**Protocol: 8 bits**

Identifies the protocol used at the next level.

**Header Checksum: 16 bits**

A checksum on the header only. Since some header fields may change this is recomputed and verified at each point the internet header is processed.

**Source Network: 8 bits**

The number of the source network.

**Destination Network: 8 bits**

The number of the destination network.

**Source Address: 24**

The source host address.

**Destination Address: 24**

The destination host address.

Latest Protocol Formats  
Internetwork Header

Options: variable

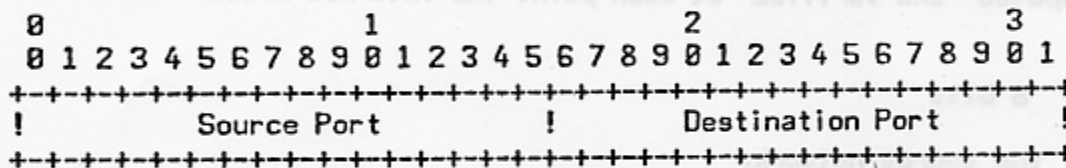
The option field is variable in length. The format is an option-type octet, a length octet, and the actual option octets.

Padding: variable

The Padding field is used to ensure that the data begins on 32 bit boundary. The padding is zero.

PORT ADDRESSES

Port Header Format



Example TCP Header

Note that one tick mark represents one bit position.

Figure 2.

Source Port: 16

The source port address.

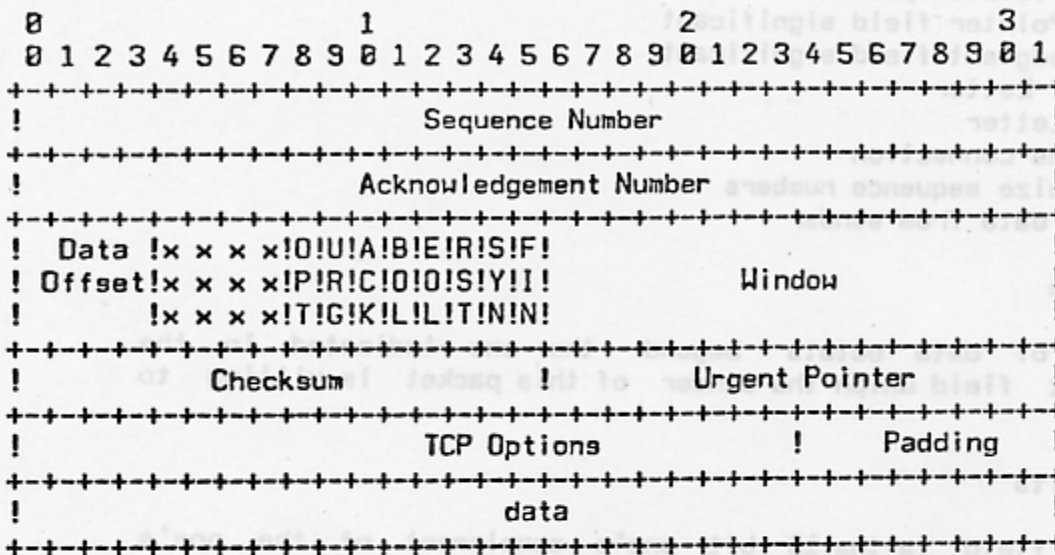
Destination Address Port: 16

The destination port address.

TCP HEADER

All internetwork packets (TCP and otherwise) have a basic internet header consisting of source and destination addresses, and header and total length fields, among others. A TCP header follows the internet header, supplying information specific to the TCP protocol. This division allows for the existence of internet protocols other than TCP, and for experimentation with TCP variations.

TCP Header Format



Example TCP Header

Note that one tick mark represents one bit position.

Figure 3.

**Sequence Number: 32 bits**

The sequence number of the first data octet in this packet.

**Acknowledgement Number: 32 bits**

If the ACK control bit is set this field contains the value of the next sequence number the sender of the packet is expecting to receive.

**Data Offset: 4 bits**

The number of 32 bit words in the TCP Header. This indicates where the data begins.

**Reserved: 4 bits**

Reserved for future use.

## Latest Protocol Formats

### TCP Header

**Control Bits: 8 bits (from left to right):**

OPT: Option Field(s) present  
 URG: Urgent Pointer field significant  
 ACK: Acknowledgment field significant  
 BOL: Begin of Letter  
 EOL: End of Letter  
 RST: Reset the connection  
 SYN: Synchronize sequence numbers  
 FIN: No more data from sender

**Window: 16 bits**

The number of data octets beyond the one indicated in the acknowledgment field which the sender of this packet is willing to accept.

**Checksum: 16 bits**

The checksum field is the 16 bit one's complement of the one's complement sum of all 16 bit words in the header and text, except that unchecksummed option fields are replaced with zeros in the computation. If a packet contains an odd number of header and text octets to be checksummed, the last octet is padded with zeros to form a 16 bit word for checksum purposes. The pad is not transmitted as part of the packet.

**Urgent Pointer: 16 bits**

This field communicates the current value of the urgent pointer as a positive offset from the sequence number in this packet. This field should only be interpreted in packets with the URG control bit set.

**TCP Options: variable**

Options may occupy space at the end of the TCP header, and are a multiple of 8 bits in length. All options have the same basic format: a length octet, a type octet, and (if necessary) option value octet(s).

**Padding:**

Padding fields are used to ensure that the protocol specific (e.g. TCP) header and the data begin on 32 bit word boundaries.