June 1978 IEN: 44 . Section: 2.3.2.1

### 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.

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INTERNETWORK HEADER

A summary of the contents of the internetwork header follows:

Internetwork Header Format

3 Ø 1 2 01234567890123456789012345678901 !Version! IHL !Type of Service! Total Length ! **↓** -Identification !Flags! Fragment Offset ! ! Time to Live ! Protocol ! Header Checksum ! ! Source Network! Source Address ! Dest. Network ! Destination Address ! ! Padding ! Options 

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.

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# Latest Protocol Formats Internetwork Header

Type of Service: 8 bits

Tupe of service.

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

81234567 +-+-+-+-+-+-+-+ I. . . . . . . D! . . . . . . F! 1. +-+-+-+-+-+-+-+

Total Length: 16 bits

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

pursues of the contents of the internetwork header fol

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).

012 +-+-+-+ 10 . M! 1P . FI +-+-+-+

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).

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Latest Protocol Formats Internetwork Header

Time to Live: 8 bits

This field indicates the maximum time the segment is allowed to remain 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.

> baseter constating of exarcy and destigation addresses, and handler and Stated length fields, among others. A 102 header failous the internet breather, scoolwing internation specific to the TCP protocol. This siviation allous for the seleteres of internet protocols other than TCP.

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.

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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. June 1978

# Latest Protocol Formats TCP Header

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TCP Header Format

2 3 01234567890123456789012345678901 1 Sequence Number Acknowledgement Number +-+ ! Data !x x x x!O!U!A!B!E!R!S!F! Window ! Offset!x x x x!P!R!C!0!0!S!Y!!! Fig II motell Ix x x xITIGIKILILITININI **┼**╾<del>╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╺╋╸╋╸╋╸╋╸╋╸╋╸╋╸╋╸╋╸╋╸╋╸╋╸╋╸╋</del> Checksum ! Urgent Pointer ! TCP Options ! Padding ! data 

# Example TCP Header

Note that one tick mark represents one bit position.

a 10 bit sord for credition torquists, its 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.

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Data Offset: 4 bits

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

Reserved: 4 bits

Fandding fields, any used to ensure that the protocol space Reserved for future use.

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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.

the ACK control bid is set this field contains

sequence number the second of the packet (a subsect)

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.