```
3.1.  Internet Header Format

  A summary of the contents of the internet header follows:


    0                   1                   2                   3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |Version|  IHL  |Type of Service|          Total Length         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |         Identification        |Flags|      Fragment Offset    |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |  Time to Live |    Protocol   |         Header Checksum       |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                       Source Address                          |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                    Destination Address                        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                    Options                    |    Padding    |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

                    Example Internet Datagram Header

                               Figure 4.

  Note that each tick mark represents one bit position.

  Version:  4 bits

    The Version field indicates the format of the internet header.  This
    document describes 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.  Note that
    the minimum value for a correct header is 5.


  Type of Service:  8 bits

    The Type of Service provides an indication of the abstract
    parameters of the quality of service desired.  These parameters are
    to be used to guide the selection of the actual service parameters
    when transmitting a datagram through a particular network.  Several
    networks offer service precedence, which somehow treats high
    precedence traffic as more important than other traffic (generally
    by accepting only traffic above a certain precedence at time of high
    load).  The major choice is a three way tradeoff between low-delay,
    high-reliability, and high-throughput.

      Bits 0-2:  Precedence.
      Bit    3:  0 = Normal Delay,      1 = Low Delay.
      Bits   4:  0 = Normal Throughput, 1 = High Throughput.
      Bits   5:  0 = Normal Relibility, 1 = High Relibility.
      Bit  6-7:  Reserved for Future Use.

         0     1     2     3     4     5     6     7
      +-----+-----+-----+-----+-----+-----+-----+-----+
      |                 |     |     |     |     |     |
      |   PRECEDENCE    |  D  |  T  |  R  |  0  |  0  |
      |                 |     |     |     |     |     |
      +-----+-----+-----+-----+-----+-----+-----+-----+

        Precedence

          111 - Network Control
          110 - Internetwork Control
          101 - CRITIC/ECP
          100 - Flash Override
          011 - Flash
          010 - Immediate
          001 - Priority
          000 - Routine

    The use of the Delay, Throughput, and Reliability indications may
    increase the cost (in some sense) of the service.  In many networks
    better performance for one of these parameters is coupled with worse
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performance on another. Except for very unusual cases at most two of these three indications should be set.

The type of service is used to specify the treatment of the datagram during its transmission through the internet system. Example mappings of the internet type of service to the actual service provided on networks such as AUTODIN II, ARPANET, SATNET, and PRNET is given in "Service Mappings" [8].

The Network Control precedence designation is intended to be used within a network only. The actual use and control of that designation is up to each network. The Internetwork Control designation is intended for use by gateway control originators only. If the actual use of these precedence designations is of concern to a particular network, it is the responsibility of that network to control the access to, and use of, those precedence designations.

Total Length: 16 bits

Total Length is the length of the datagram, measured in octets, including internet header and data. This field allows the length of a datagram to be up to 65,535 octets. Such long datagrams are impractical for most hosts and networks. All hosts must be prepared to accept datagrams of up to 576 octets (whether they arrive whole or in fragments). It is recommended that hosts only send datagrams larger than 576 octets if they have assurance that the destination is prepared to accept the larger datagrams.

The number 576 is selected to allow a reasonable sized data block to be transmitted in addition to the required header information. For example, this size allows a data block of 512 octets plus 64 header octets to fit in a datagram. The maximal internet header is 60 octets, and a typical internet header is 20 octets, allowing a margin for headers of higher level protocols.

Identification: 16 bits

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

Flags: 3 bits

Various Control Flags.

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Bit 0: reserved, must be zero
Bit 1: (DF) 0 = May Fragment,  1 = Don't Fragment.
Bit 2: (MF) 0 = Last Fragment, 1 = More Fragments.

    0   1   2
  +---+---+---+
  |   | D | M |
  | 0 | F | F |
  +---+---+---+
```

Fragment Offset: 13 bits

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

Time to Live: 8 bits

This field indicates the maximum time the datagram is allowed to remain in the internet system. If this field contains the value zero, then the datagram must be destroyed. This field is modified in internet header processing. The time is measured in units of seconds, but since every module that processes a datagram must decrease the TTL by at least one even if it process the datagram in less than a second, the TTL must be thought of only as an upper bound on the time a datagram may exist. The intention is to cause undeliverable datagrams to be discarded, and to bound the maximum datagram lifetime.

Protocol: 8 bits

This field indicates the next level protocol used in the data portion of the internet datagram. The values for various protocols are specified in "Assigned Numbers" [9].

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Header Checksum:  16 bits

  A checksum on the header only.  Since some header fields change
  (e.g., time to live), this is recomputed and verified at each point
  that the internet header is processed.

  The checksum algorithm is:

    The checksum field is the 16 bit one's complement of the one's
    complement sum of all 16 bit words in the header.  For purposes of
    computing the checksum, the value of the checksum field is zero.

  This is a simple to compute checksum and experimental evidence
  indicates it is adequate, but it is provisional and may be replaced
  by a CRC procedure, depending on further experience.

Source Address:  32 bits

  The source address.  See section 3.2.

Destination Address:  32 bits

  The destination address.  See section 3.2.

Options:  variable
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