Network Layer
Part 2

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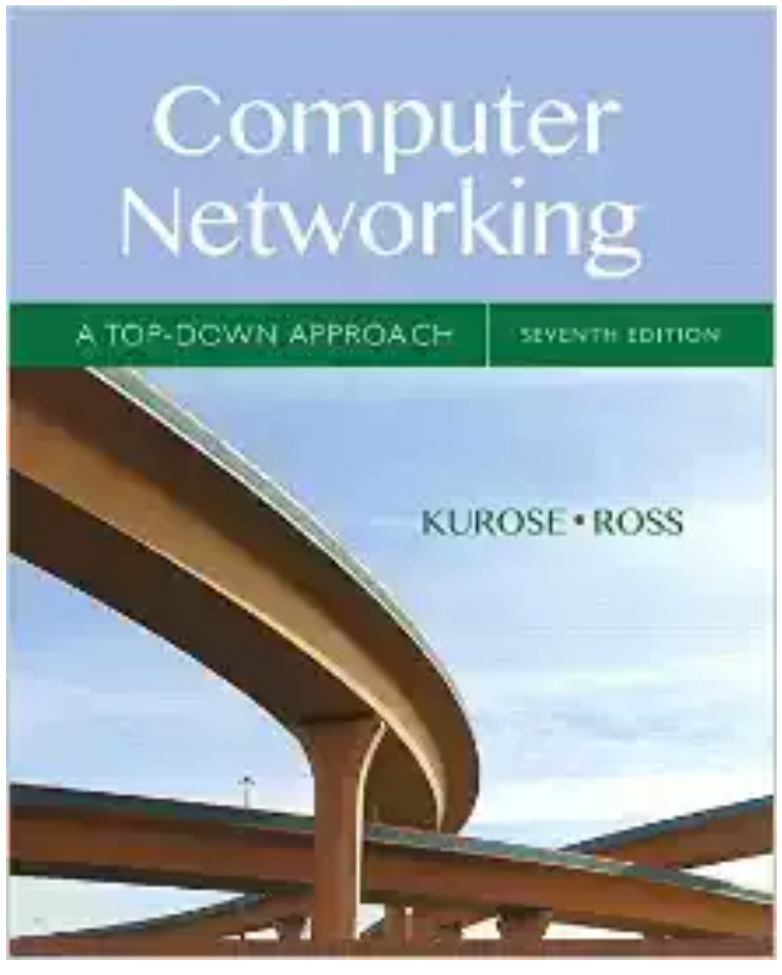
#Rally

These slides are more-or-less directly from the slide set developed by Jim Kurose and Keith Ross for their book "Computer Networking: A Top Down Approach, 5th edition".

The slides have been lightly adapted for Mark Allman's EECS 325/425 Computer Networks class at Case Western Reserve University.

Reading Along ...



- Network layer is chapters 4
- 4,2: what's inside a router?

Router Architecture Overview

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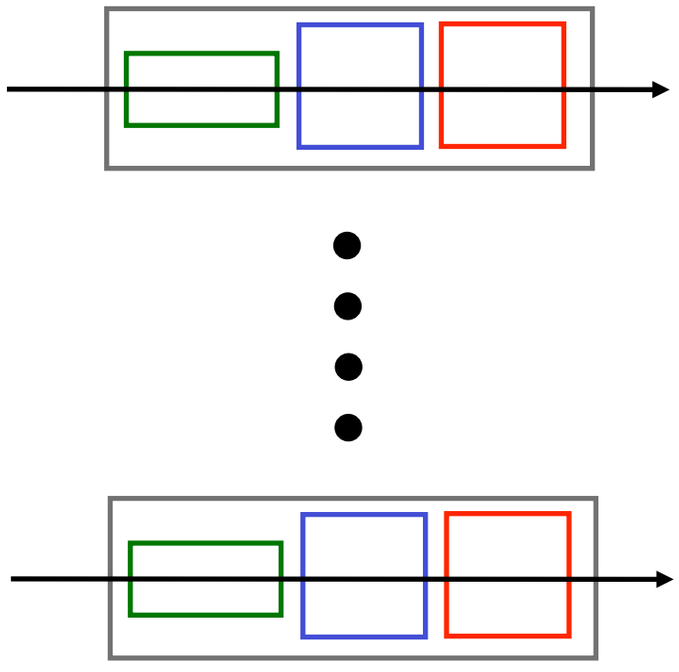

router input ports

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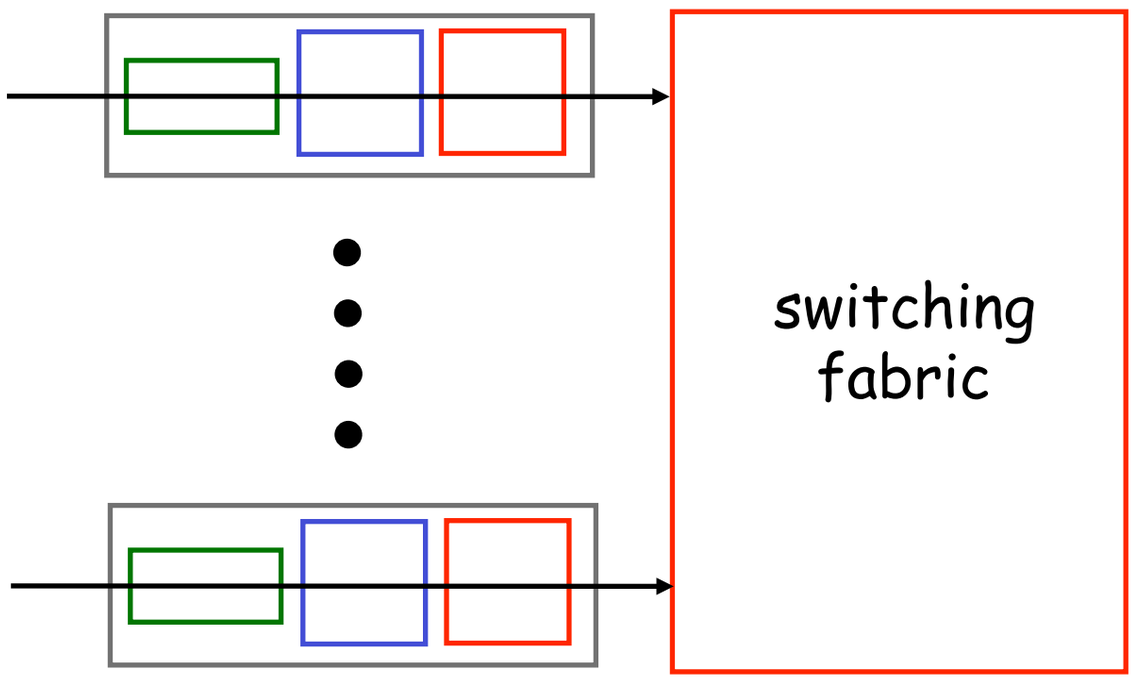

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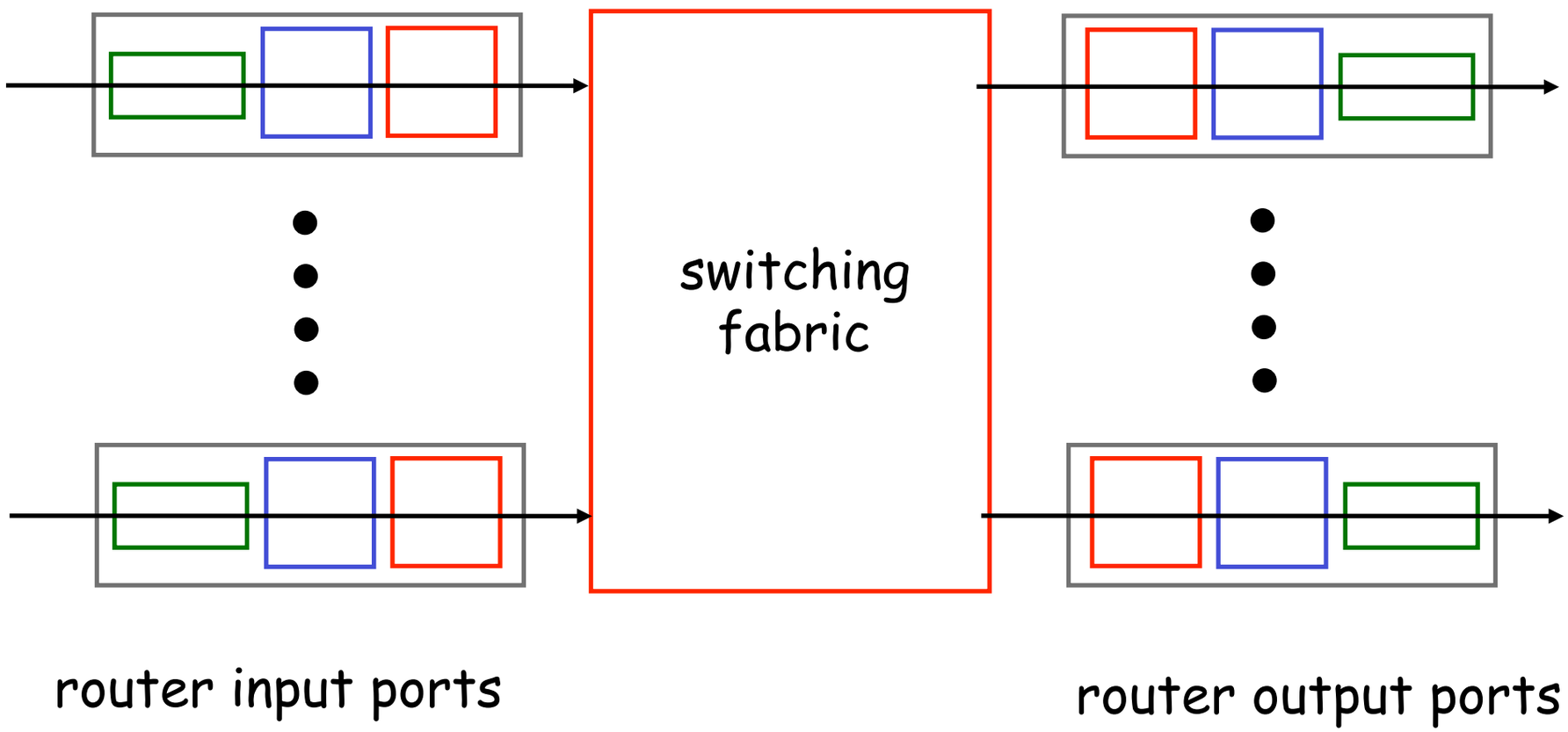

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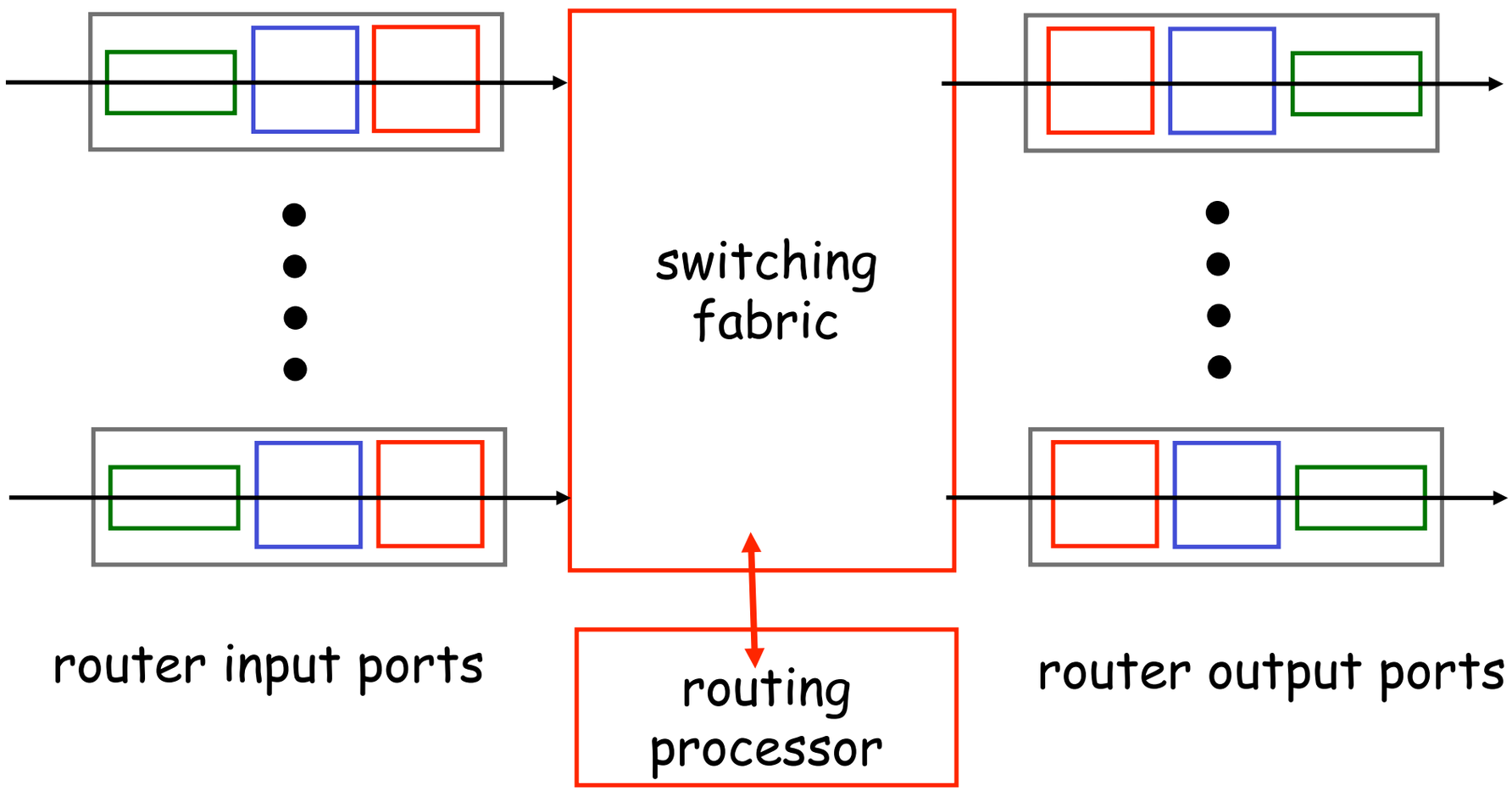
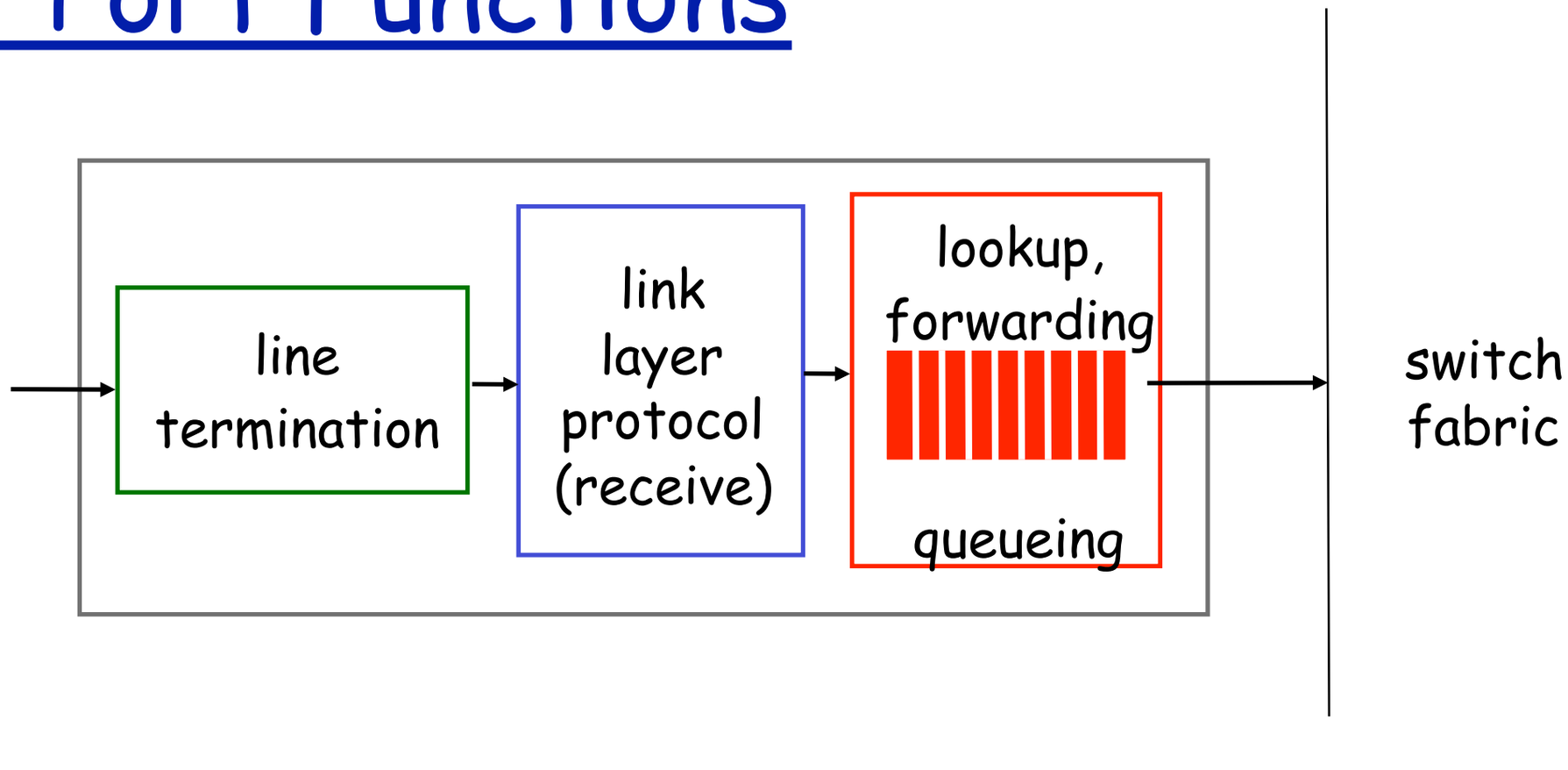


Input Port Functions



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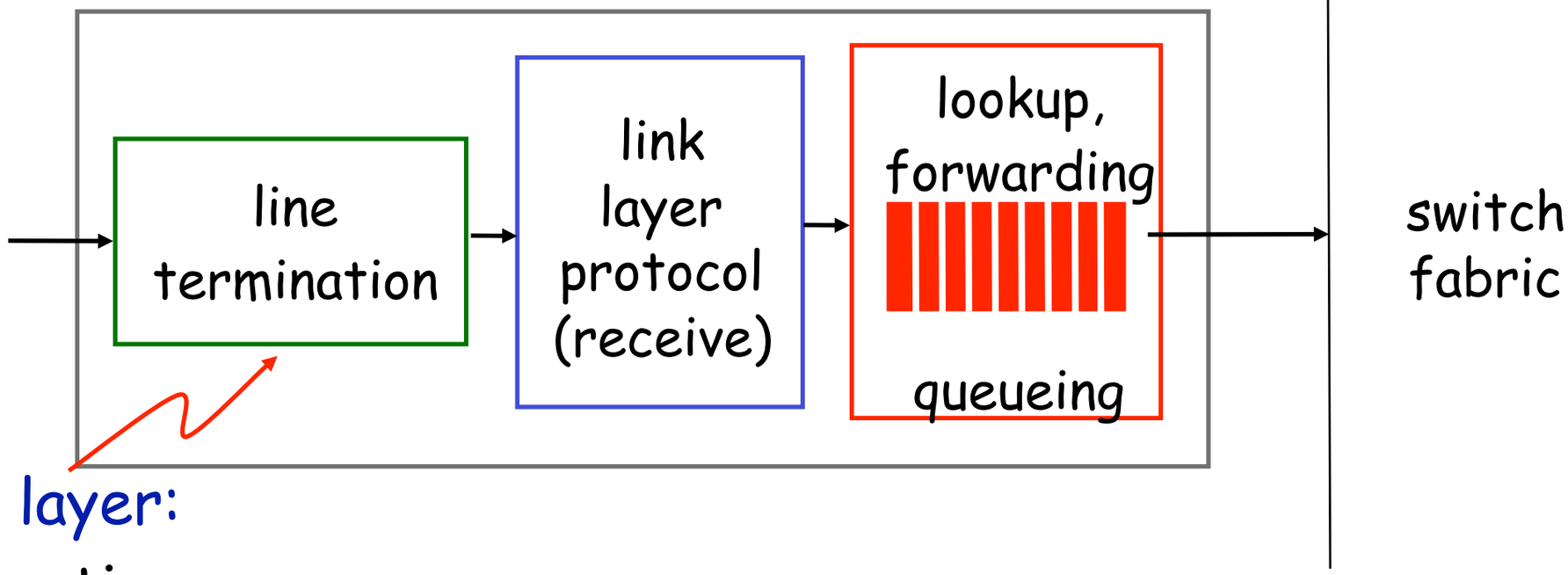

Physical layer:
bit-level reception

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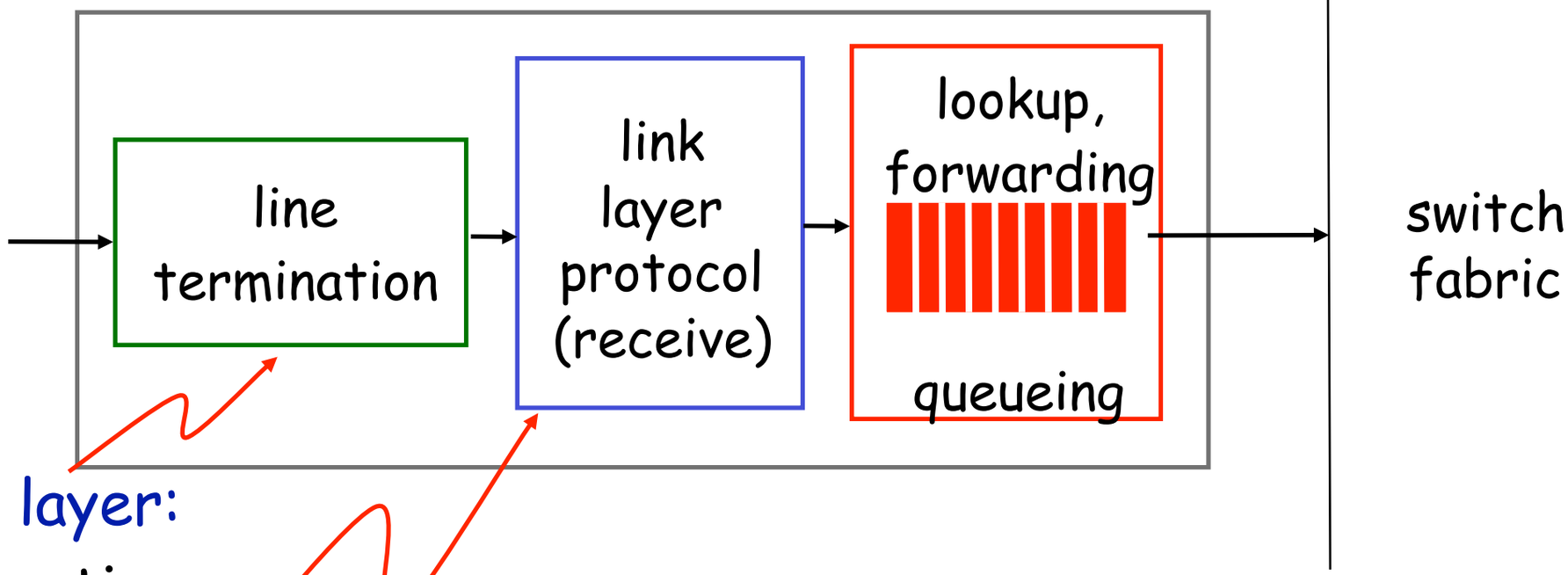

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Data link layer:
e.g., Ethernet

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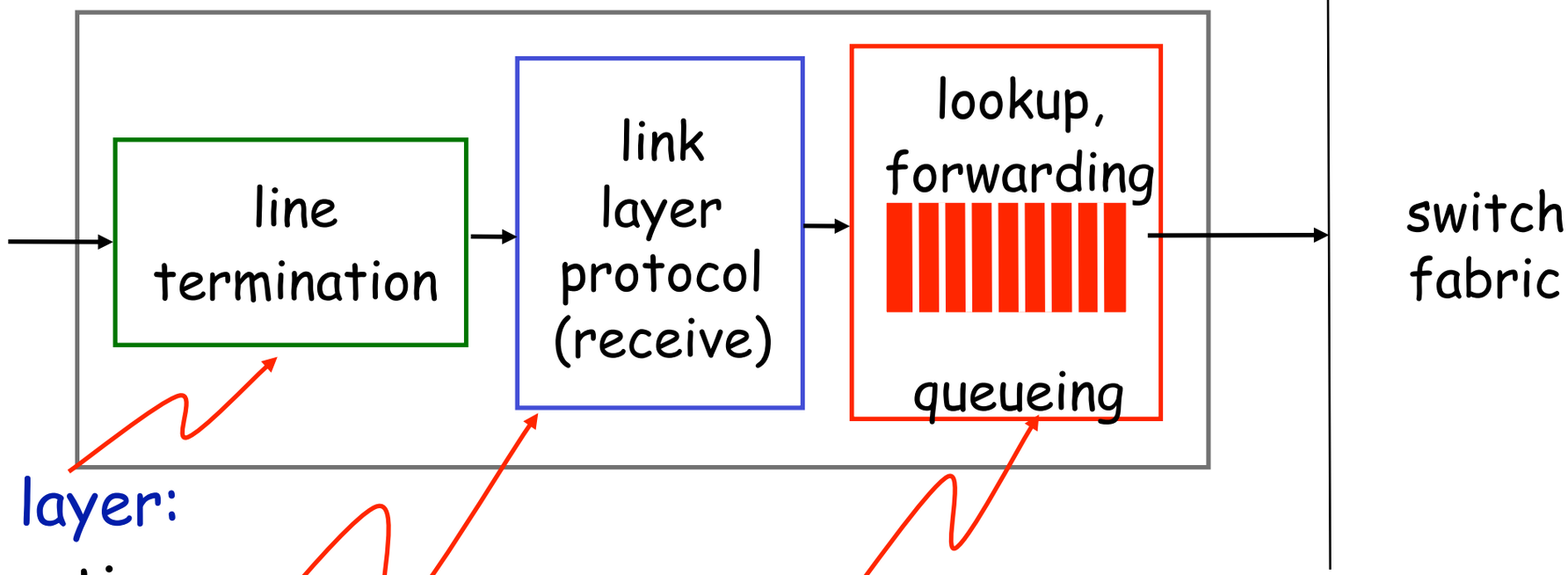

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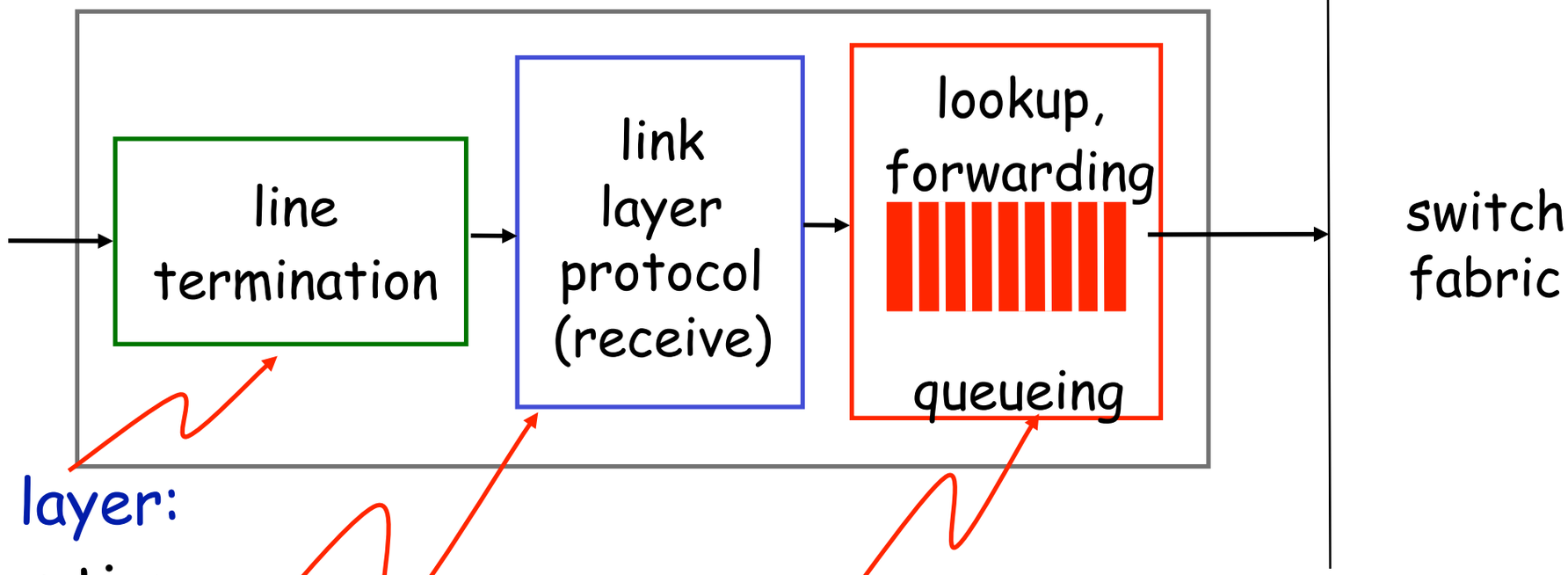
Decentralized switching:

Input Port Functions



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- given datagram dest., lookup output port using forwarding table in input port memory

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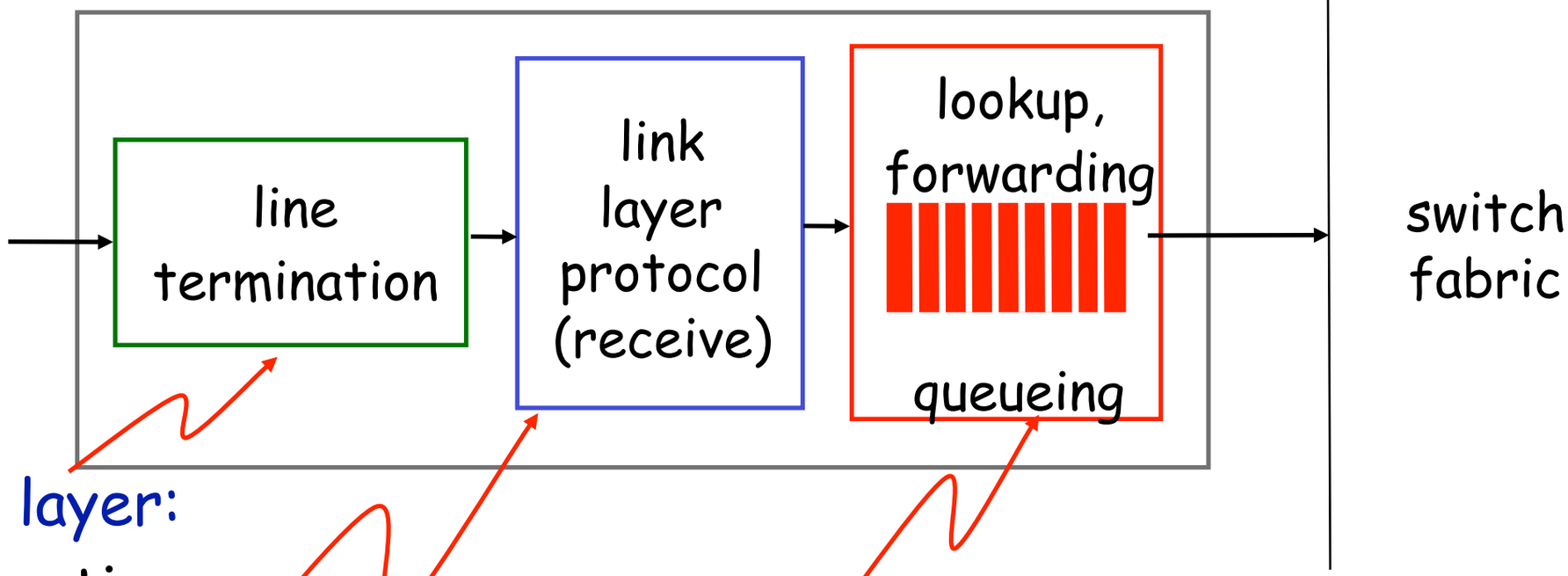

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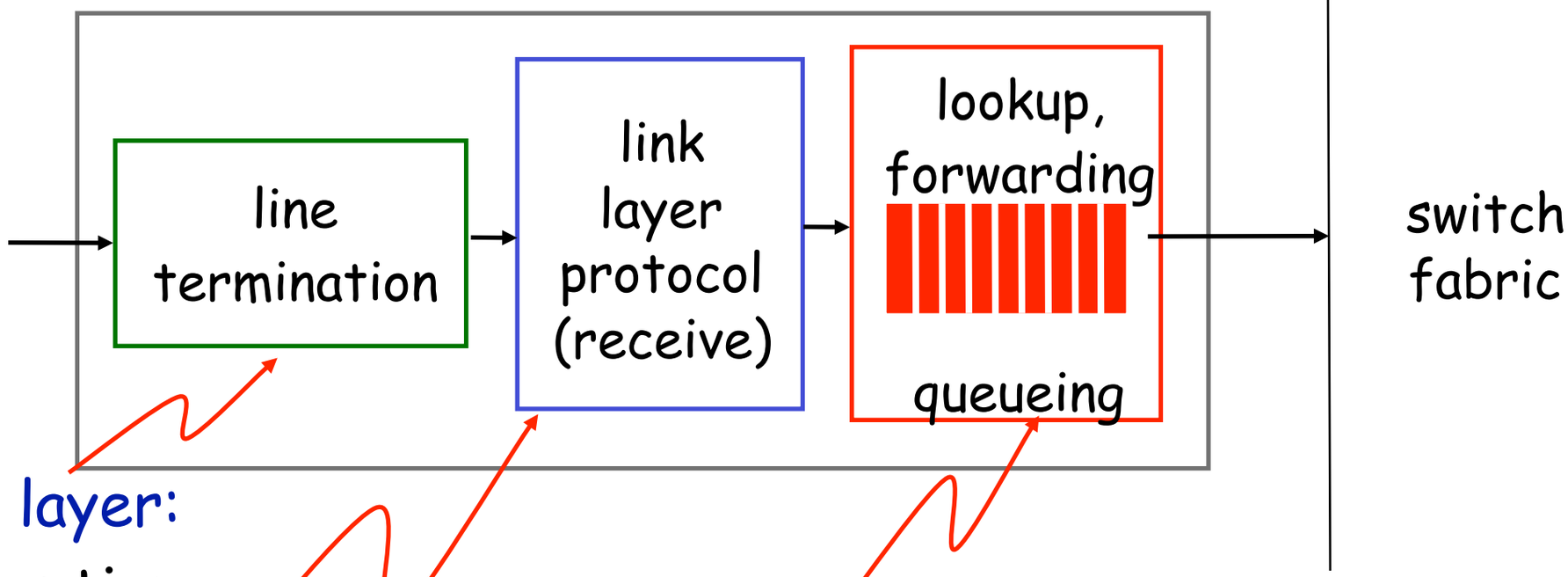

Physical layer:
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Data link layer:
e.g., Ethernet

Decentralized switching:

- given datagram dest., lookup output port using forwarding table in input port memory
- goal: complete input port processing at 'line speed'
- queuing: if datagrams arrive faster than forwarding rate into switch fabric

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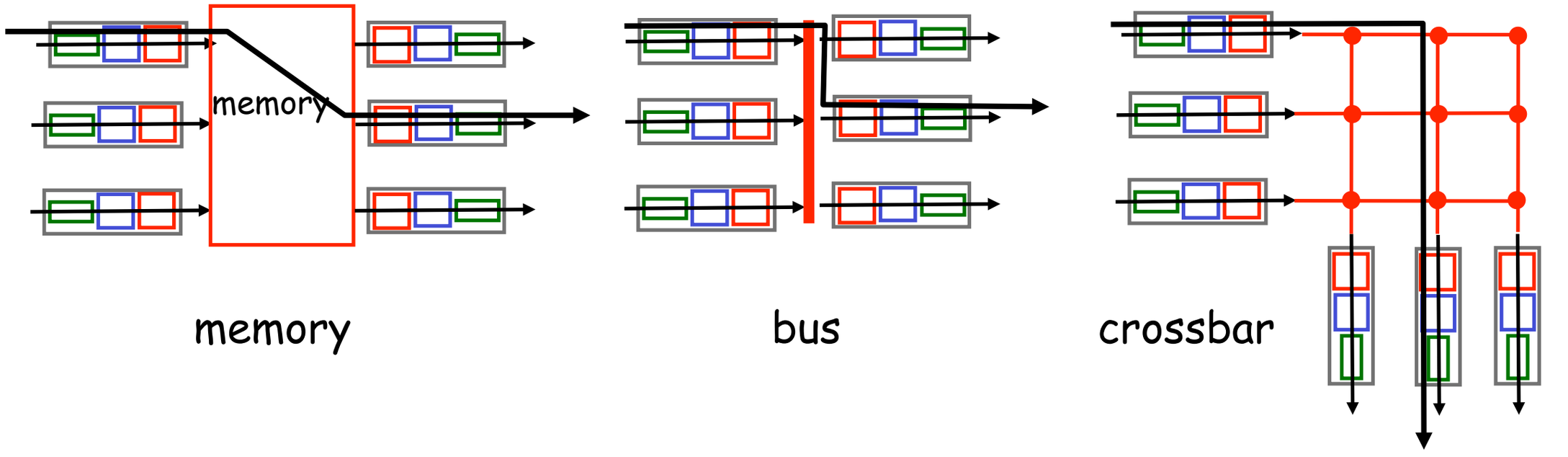
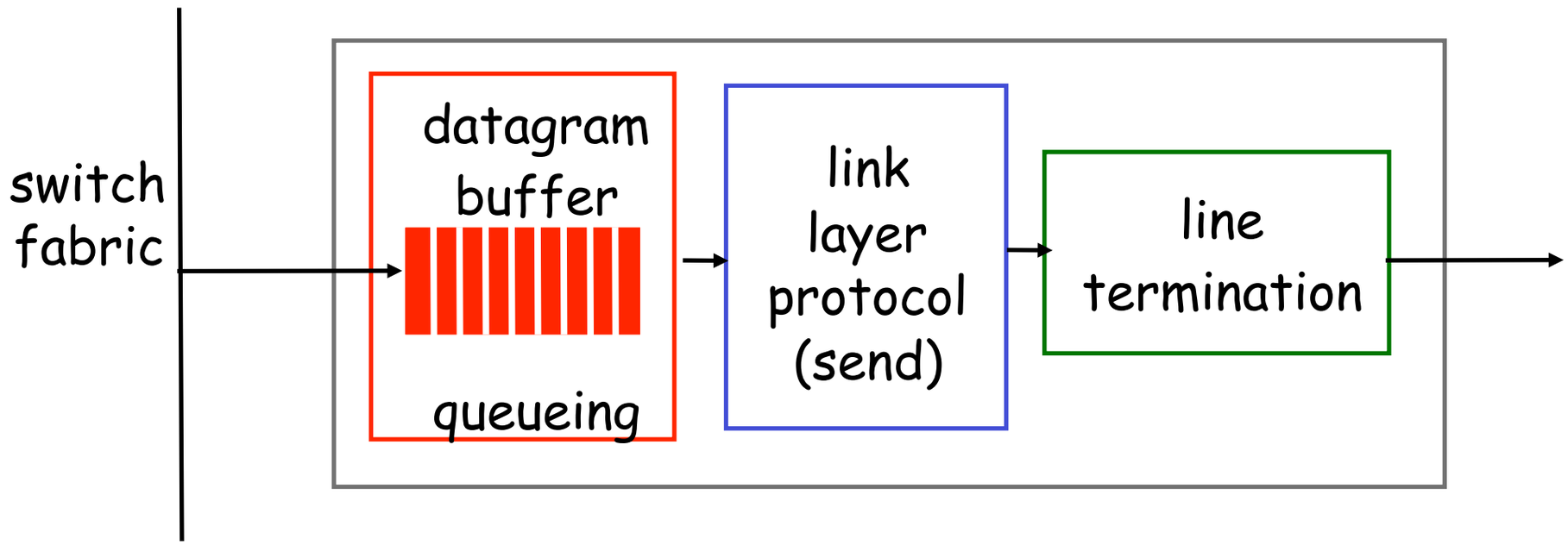
- three types of switching fabrics

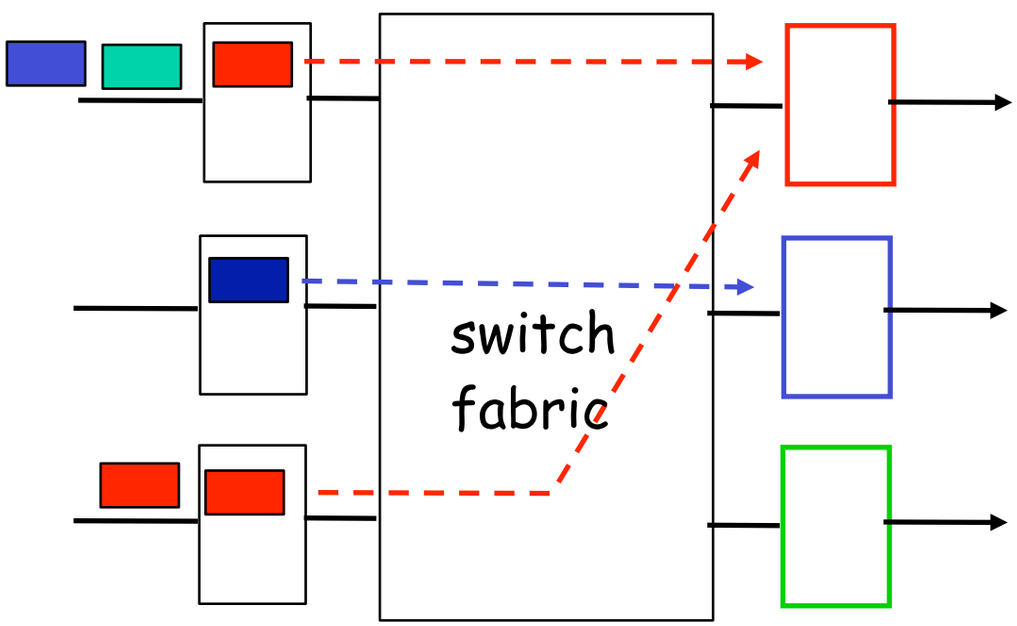


Output Ports

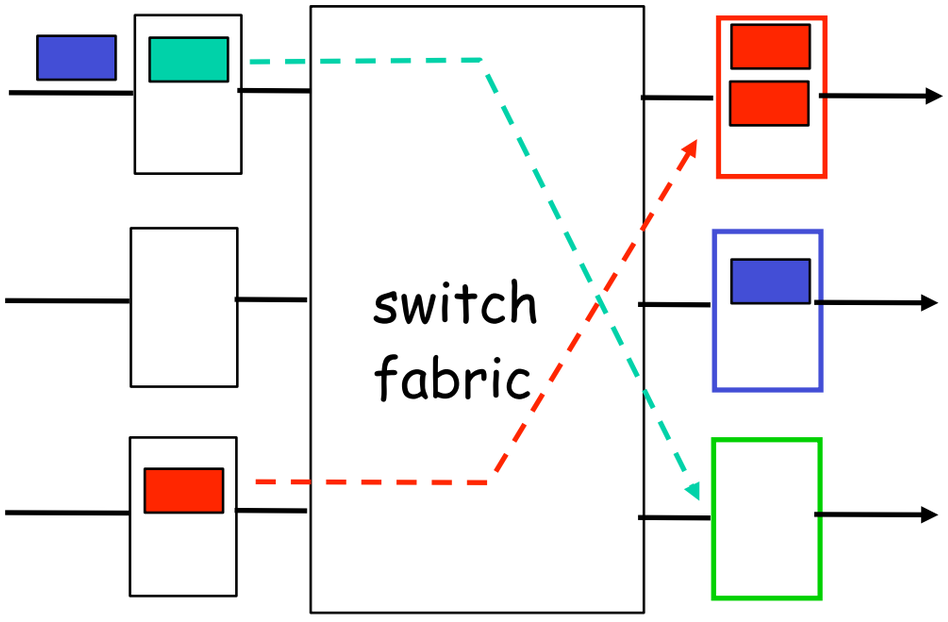


- buffering required when datagrams arrive from fabric faster than the transmission rate
- scheduling discipline chooses among queued datagrams for transmission

Output port queueing



at t, packets move
from input to output



one packet time later

- buffering when arrival rate via switch exceeds output line speed
- queueing (delay) and loss due to output port buffer overflow!

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- RFC 3439 rule of thumb: average buffering equal to "typical" RTT (say 100 msec) times link capacity *C*
  - e.g., *C* = 10 Gpbs link: 1 Gbit buffer
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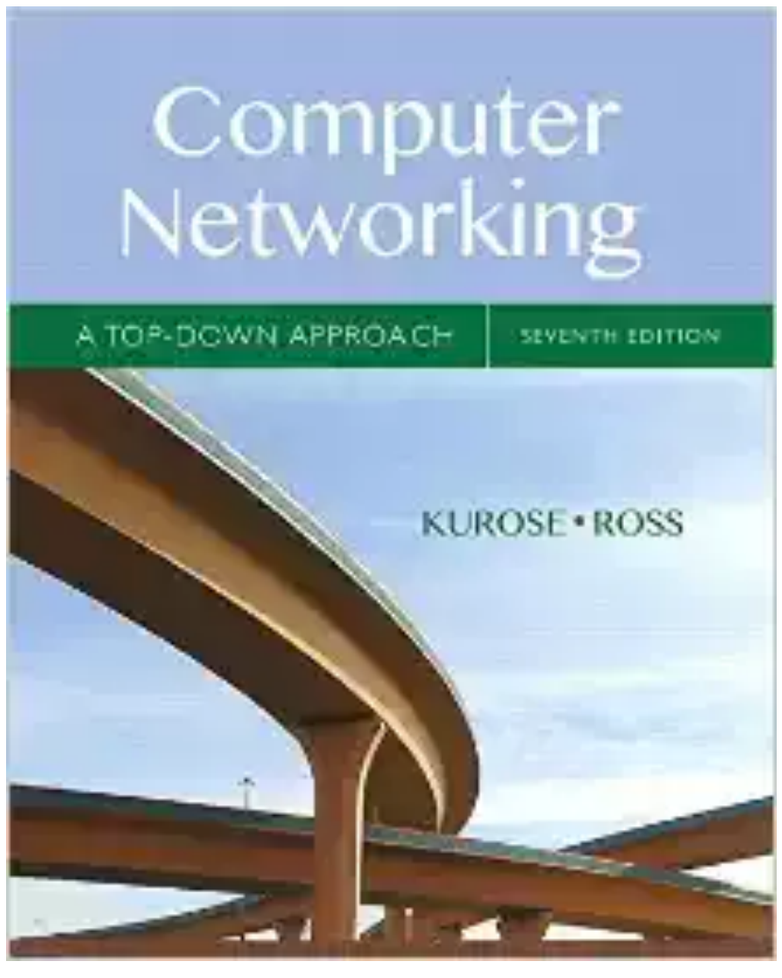
- recent recommendation: with N flows, buffering equal to $\frac{RTT \cdot C}{\sqrt{N}}$

Reading Along ...



- Network layer is chapters 4
- 4.3: Internet Protocol
  - datagram format

IP datagram format

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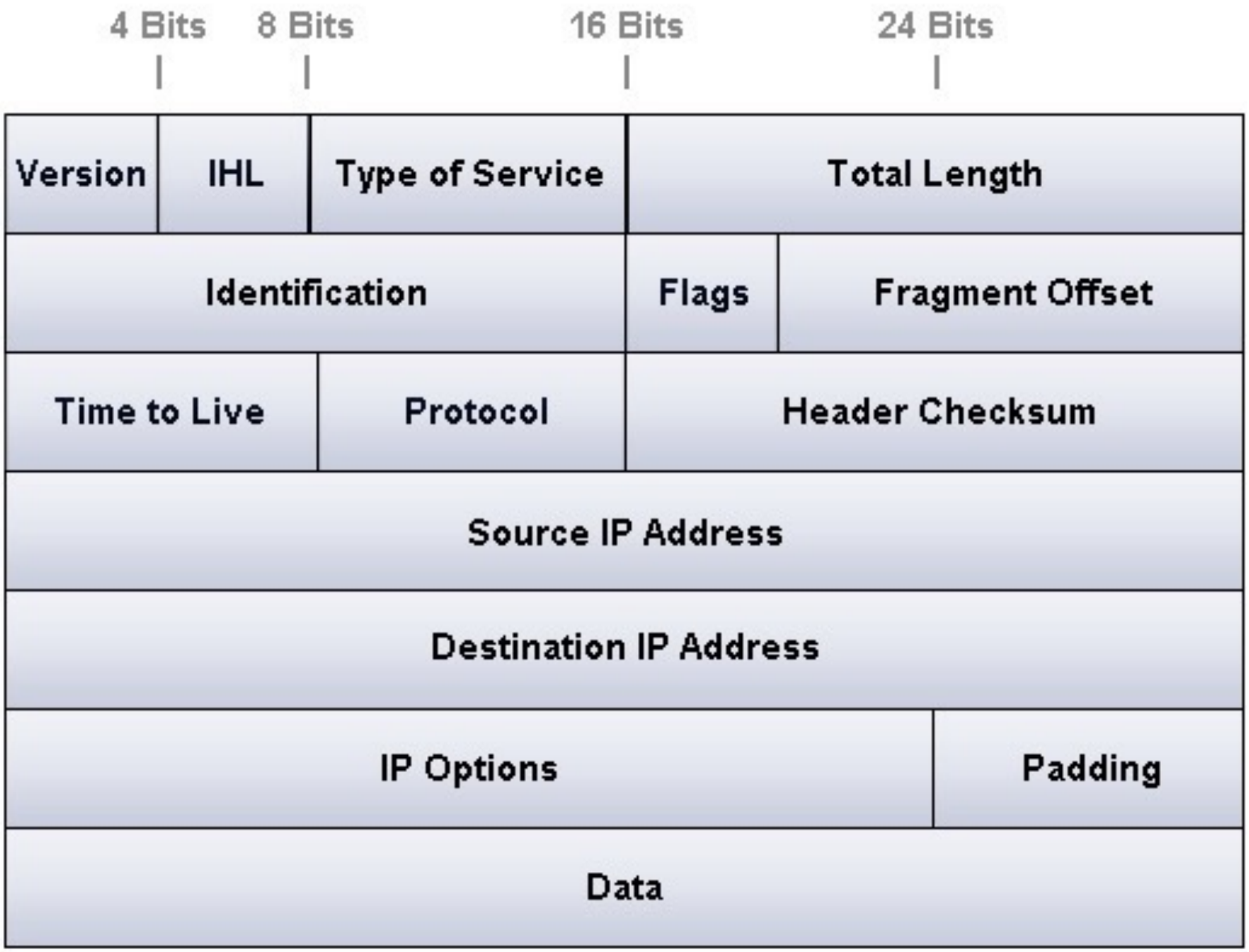

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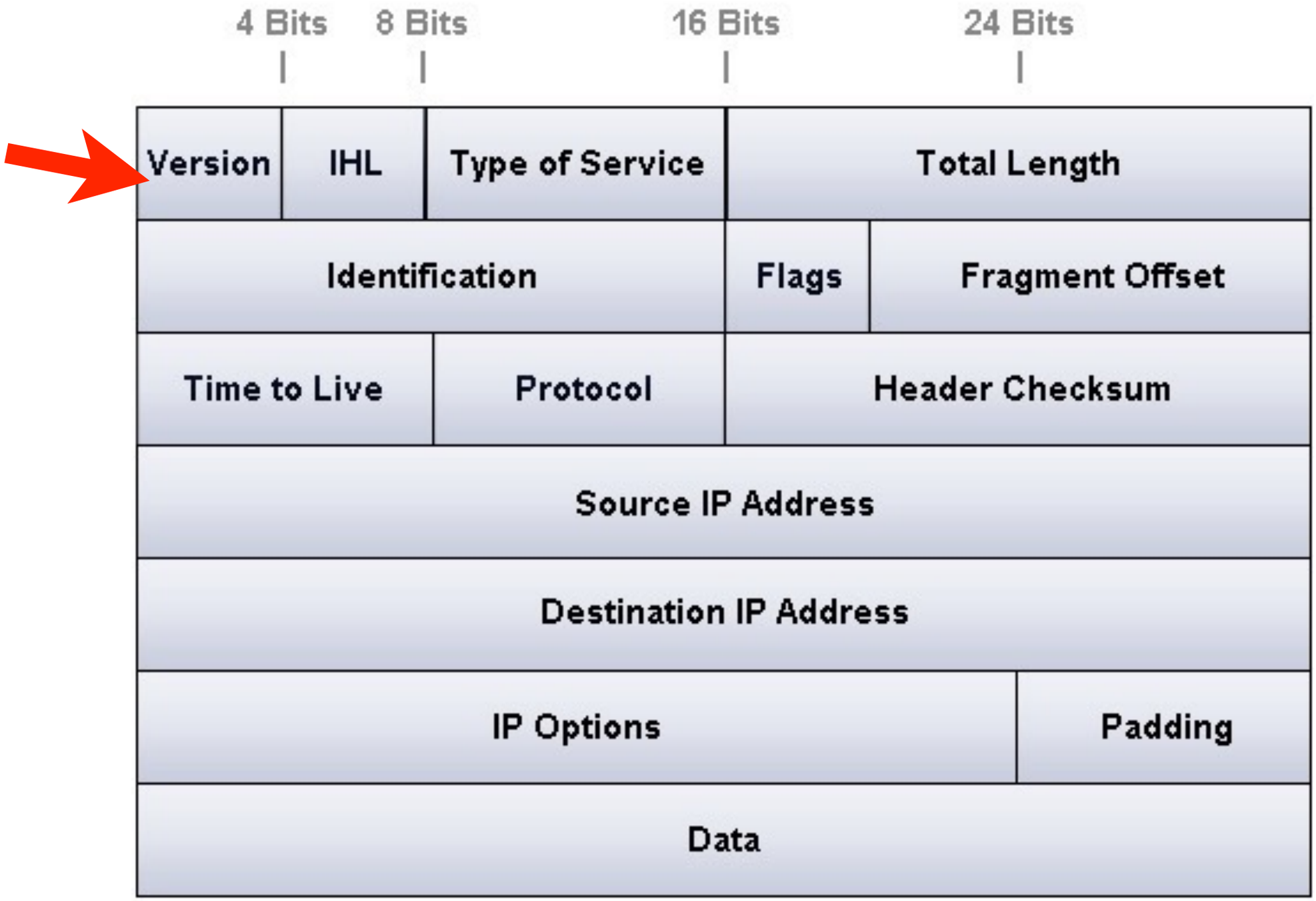

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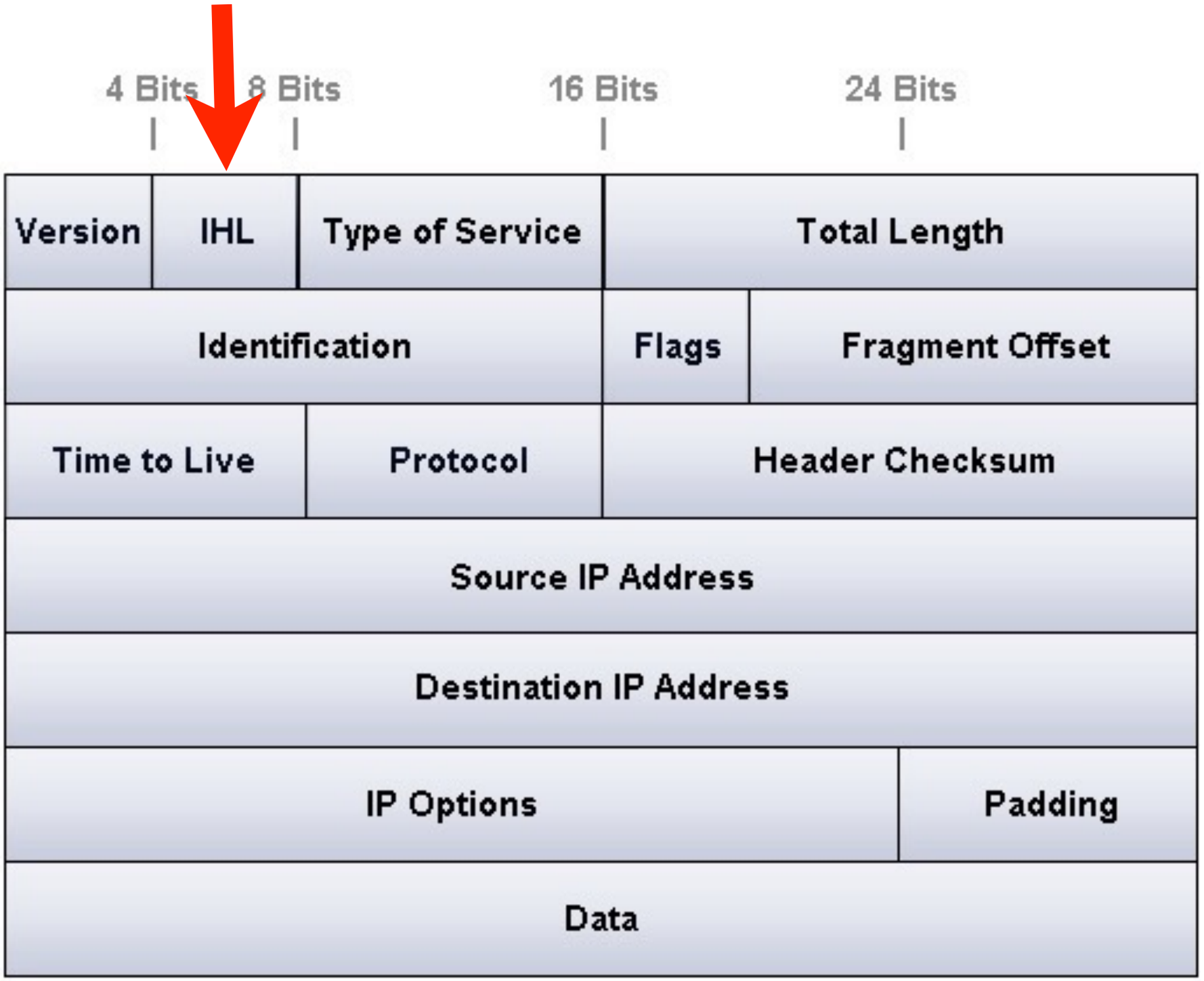

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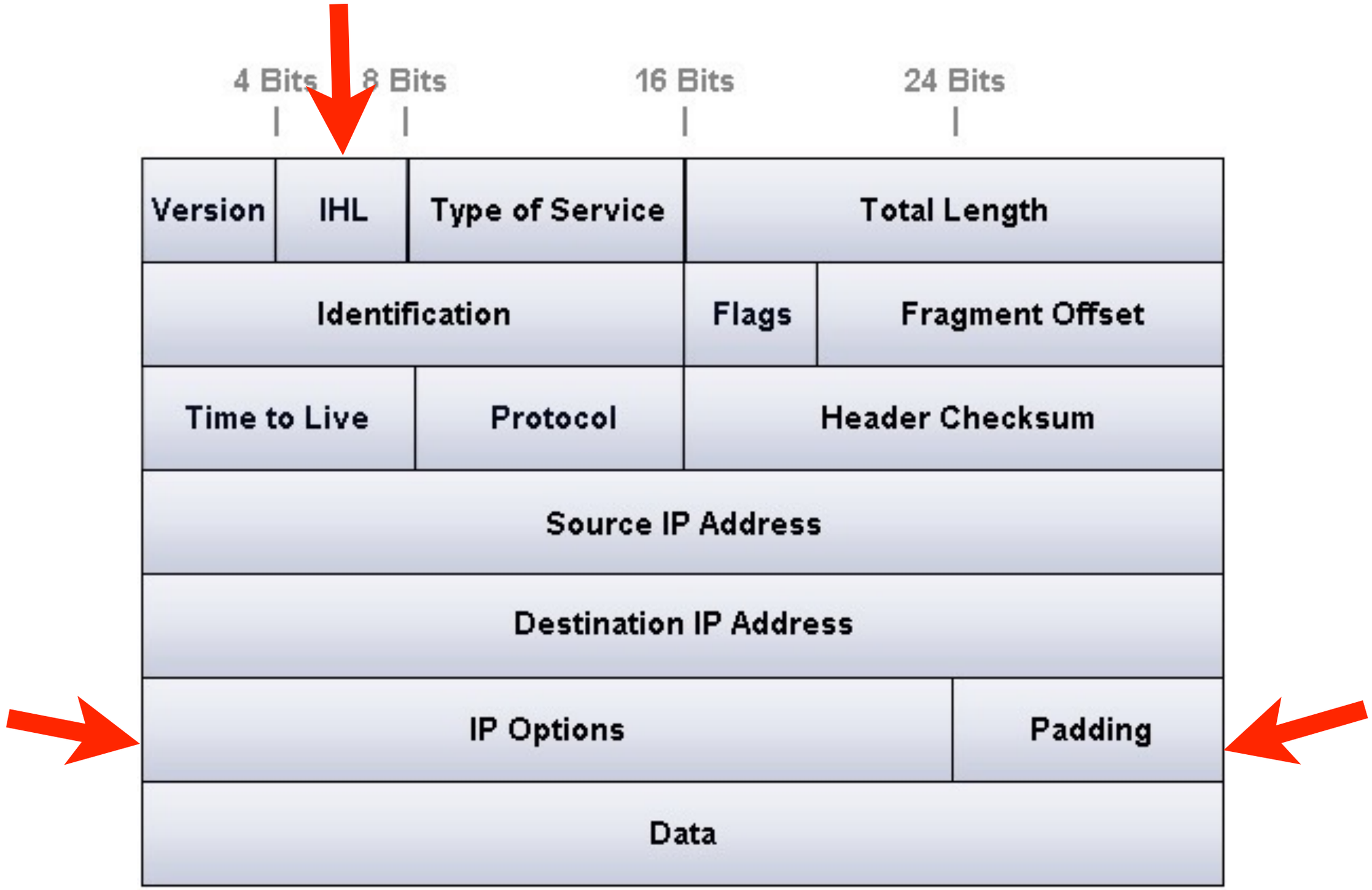
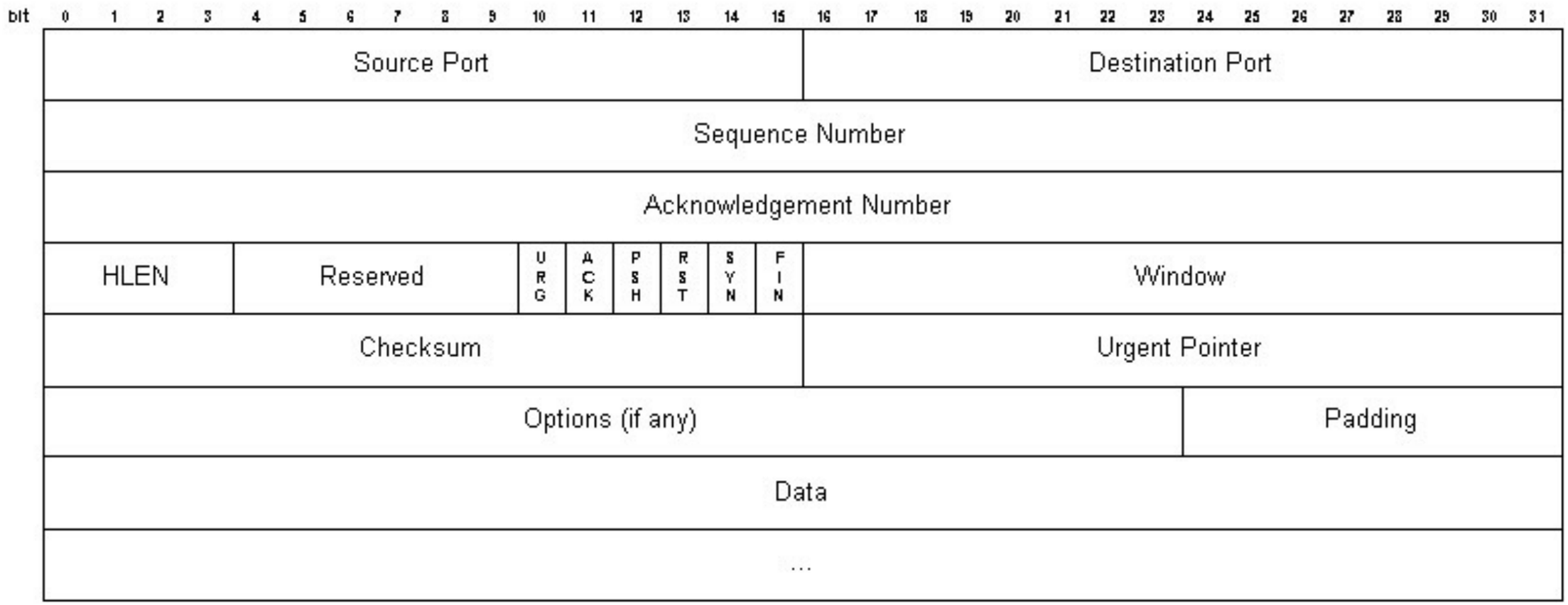


TCP Packet Length Issue …



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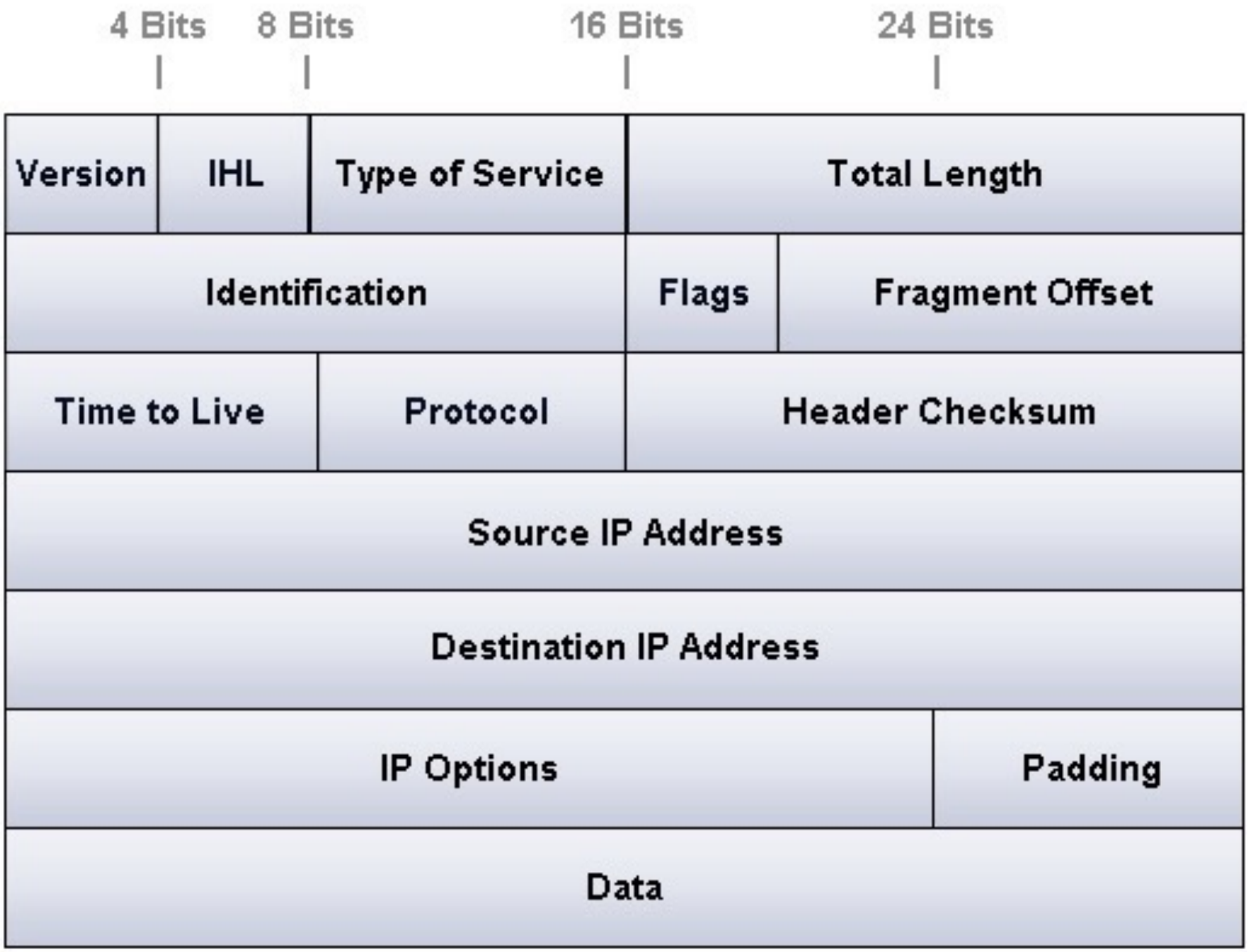

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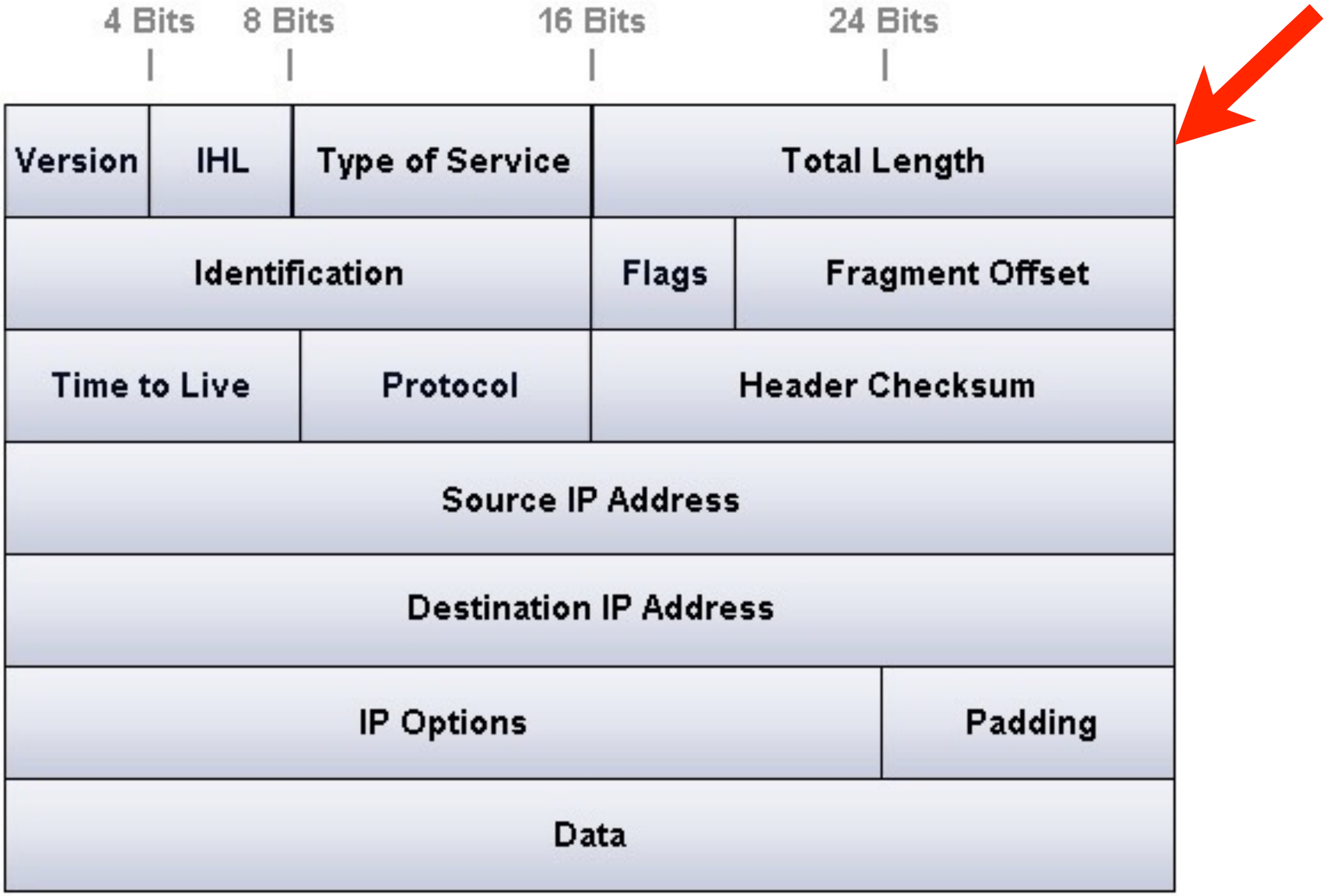

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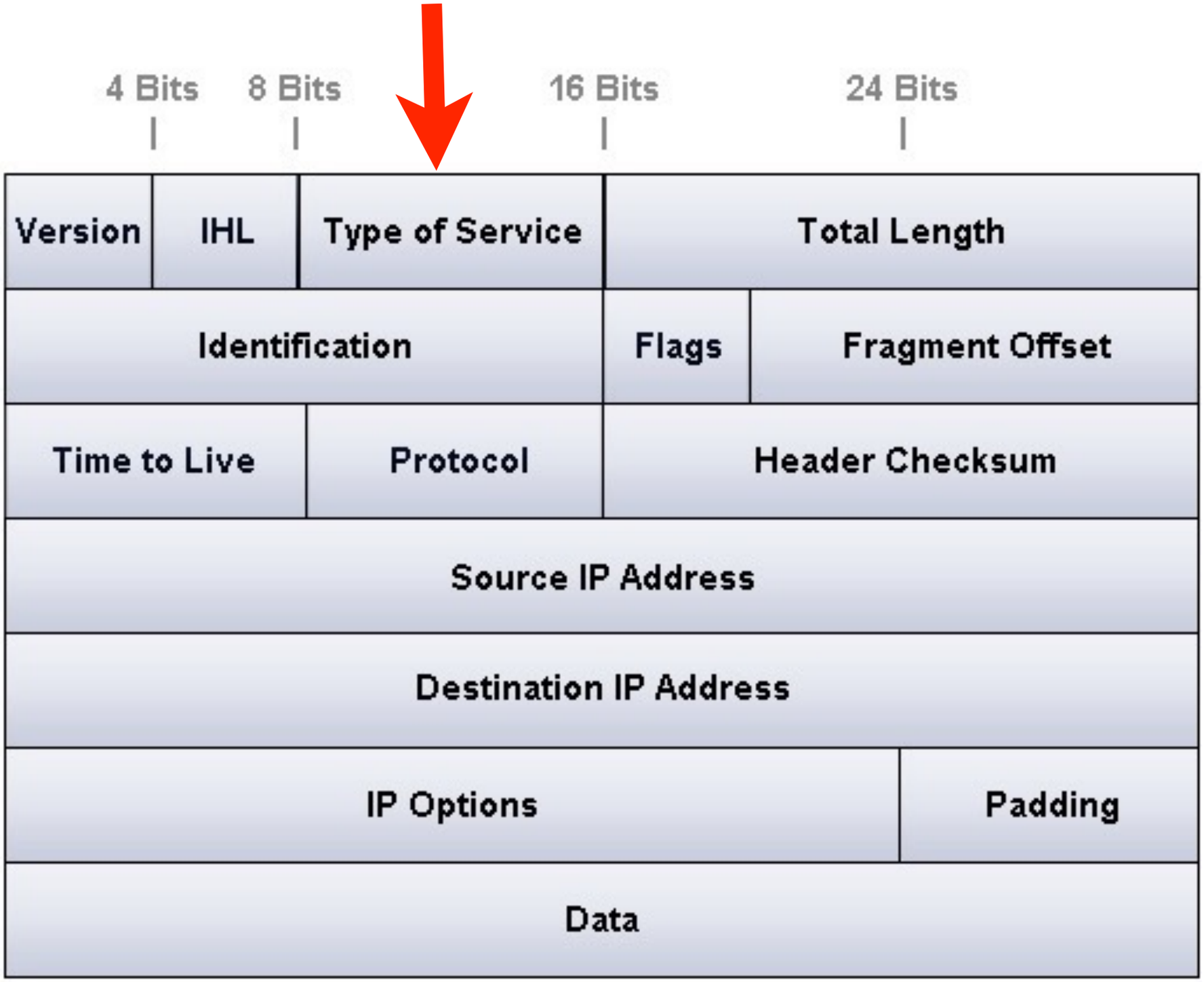

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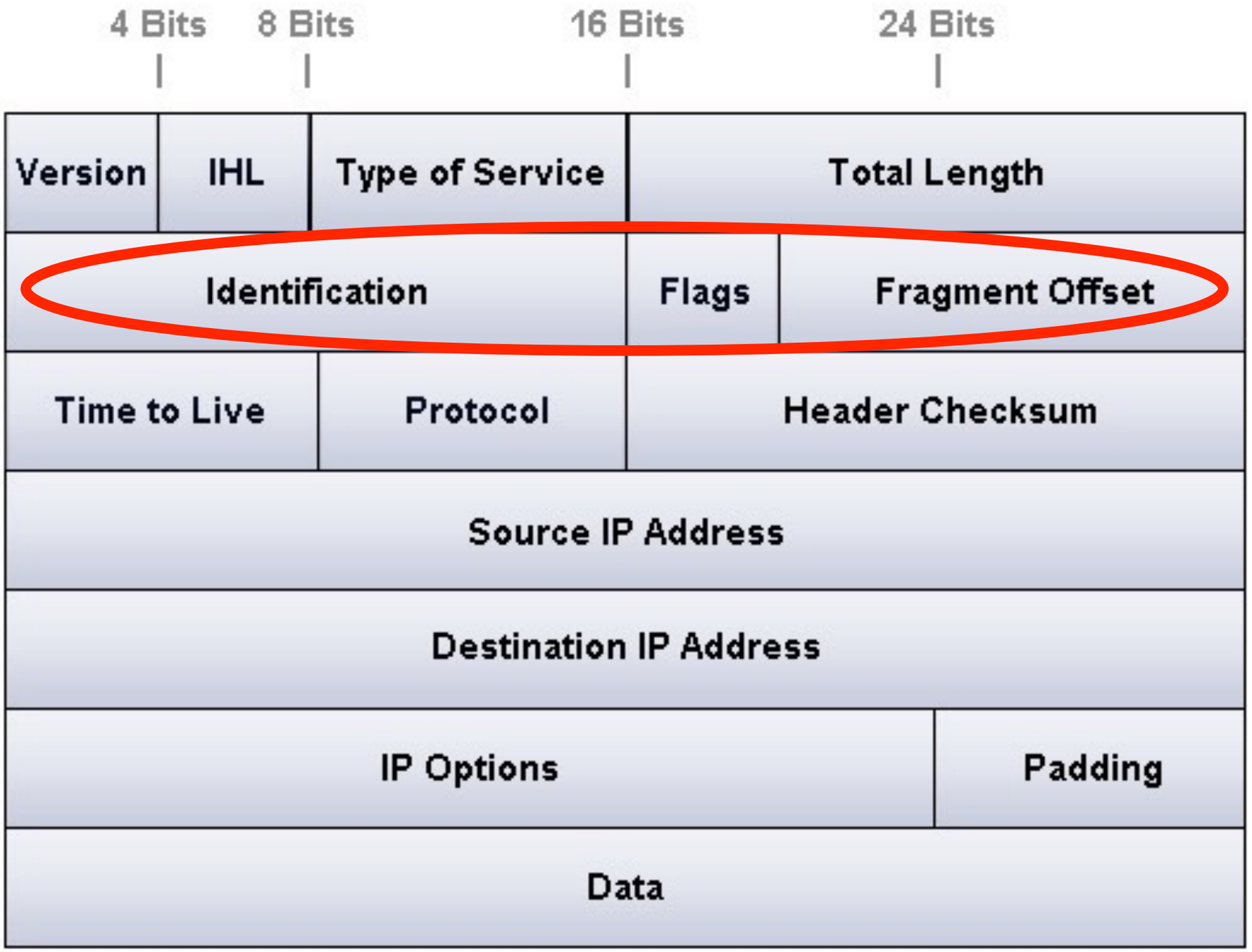

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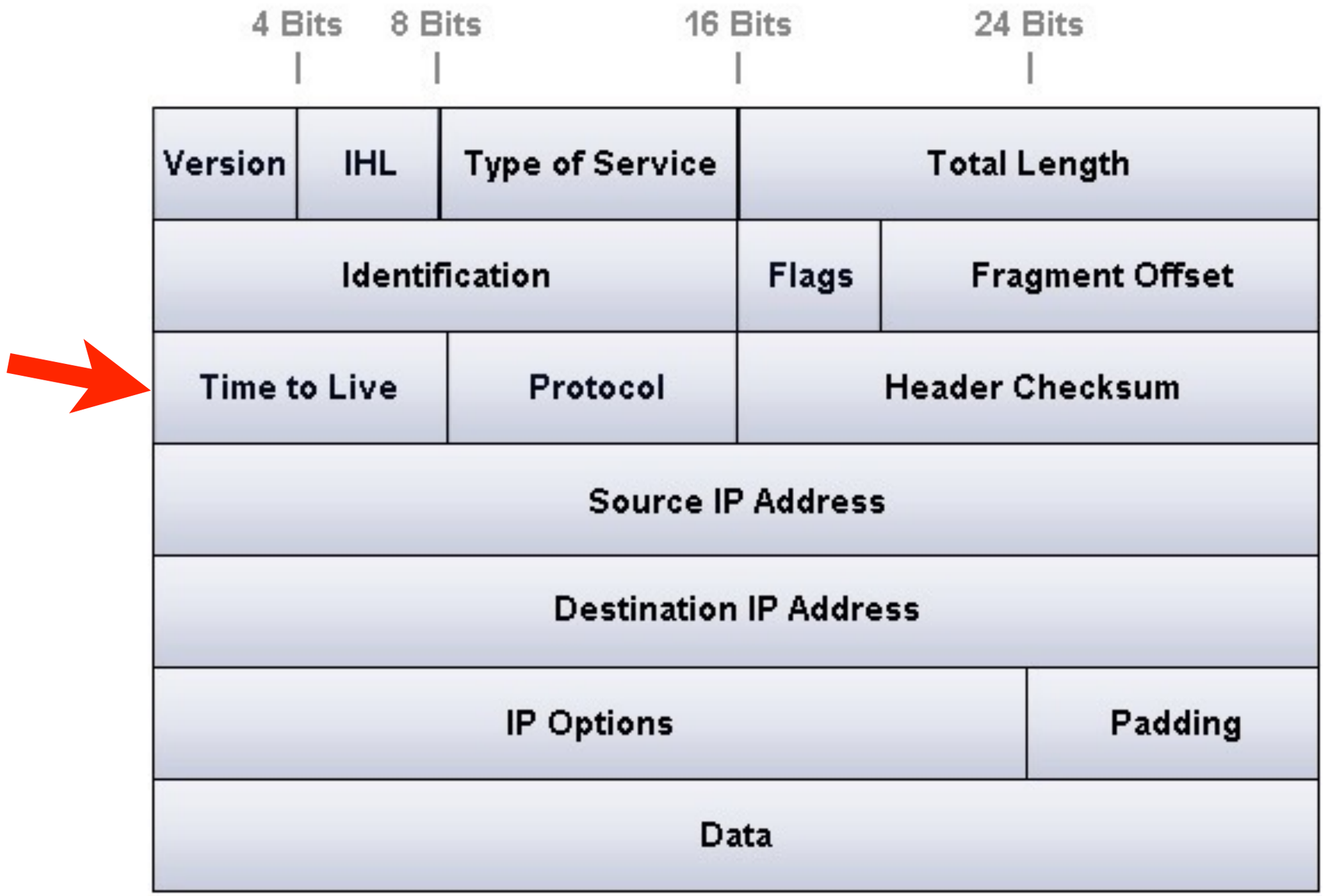

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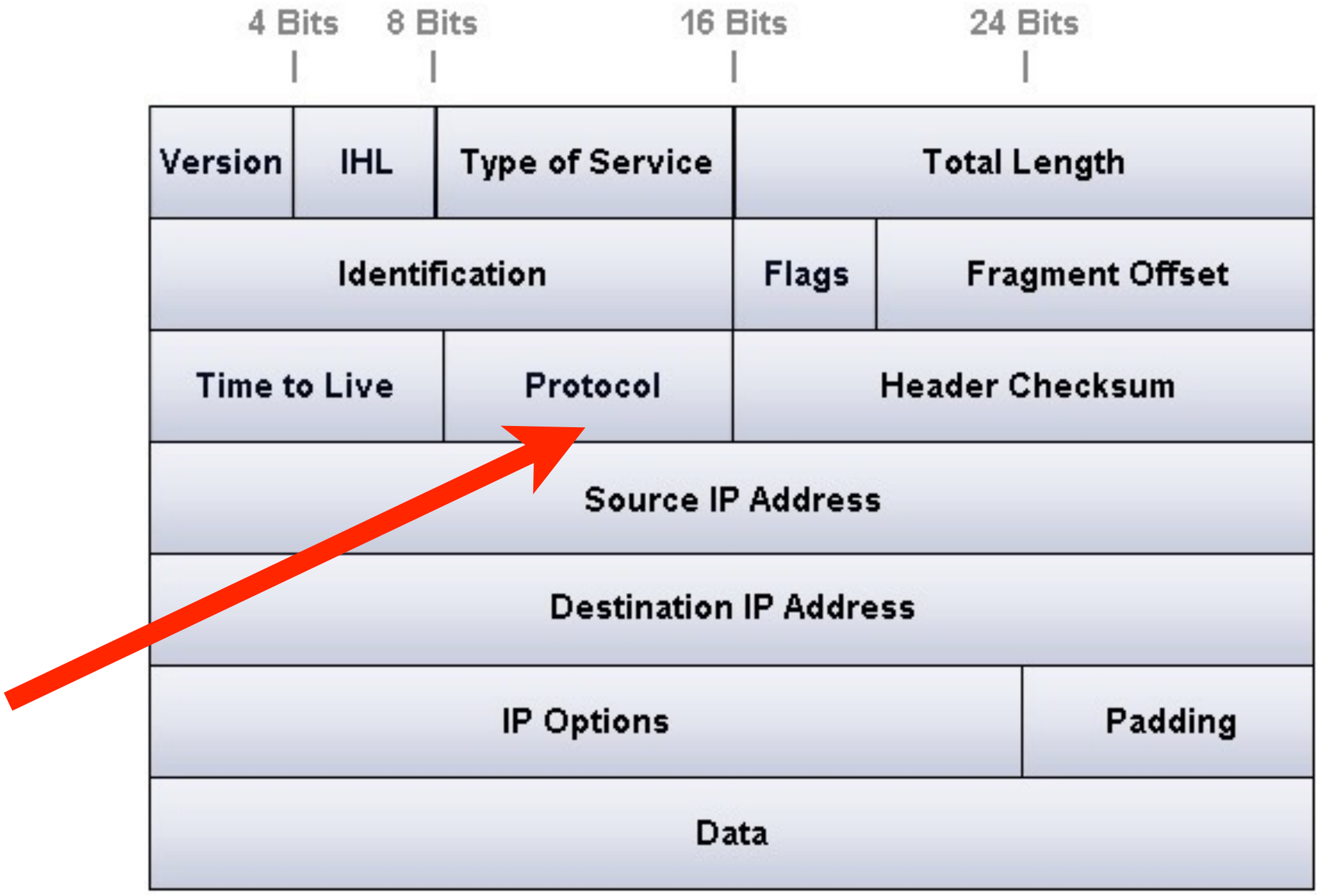

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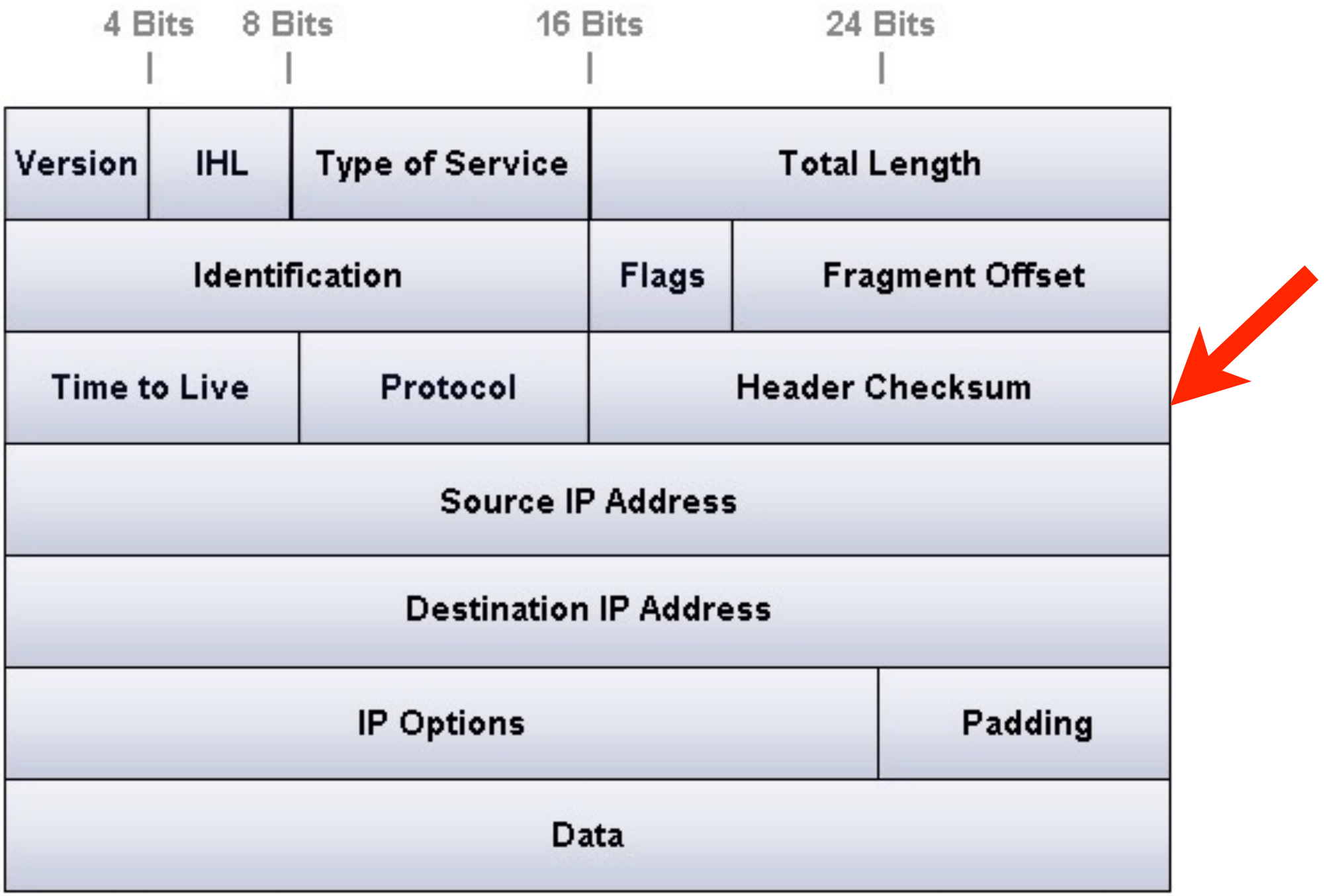

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