Network Layer
Part 3

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*"Way down South they had a jubilee,
Those Georgia folks they had a jamboree.
They're drinkin' home brew from a wooden cup,
The folks dancin' got all shook up."*

IP datagram format

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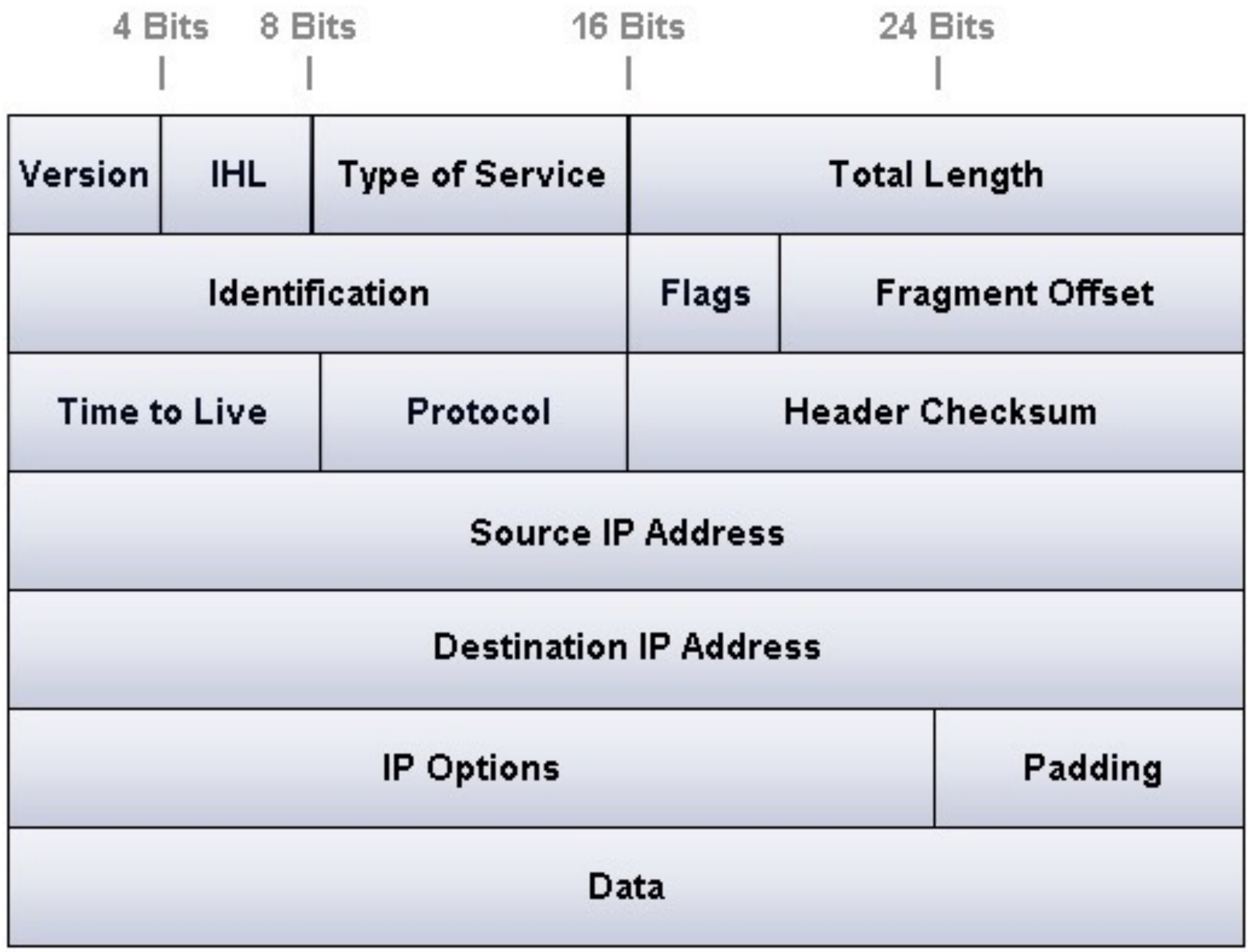

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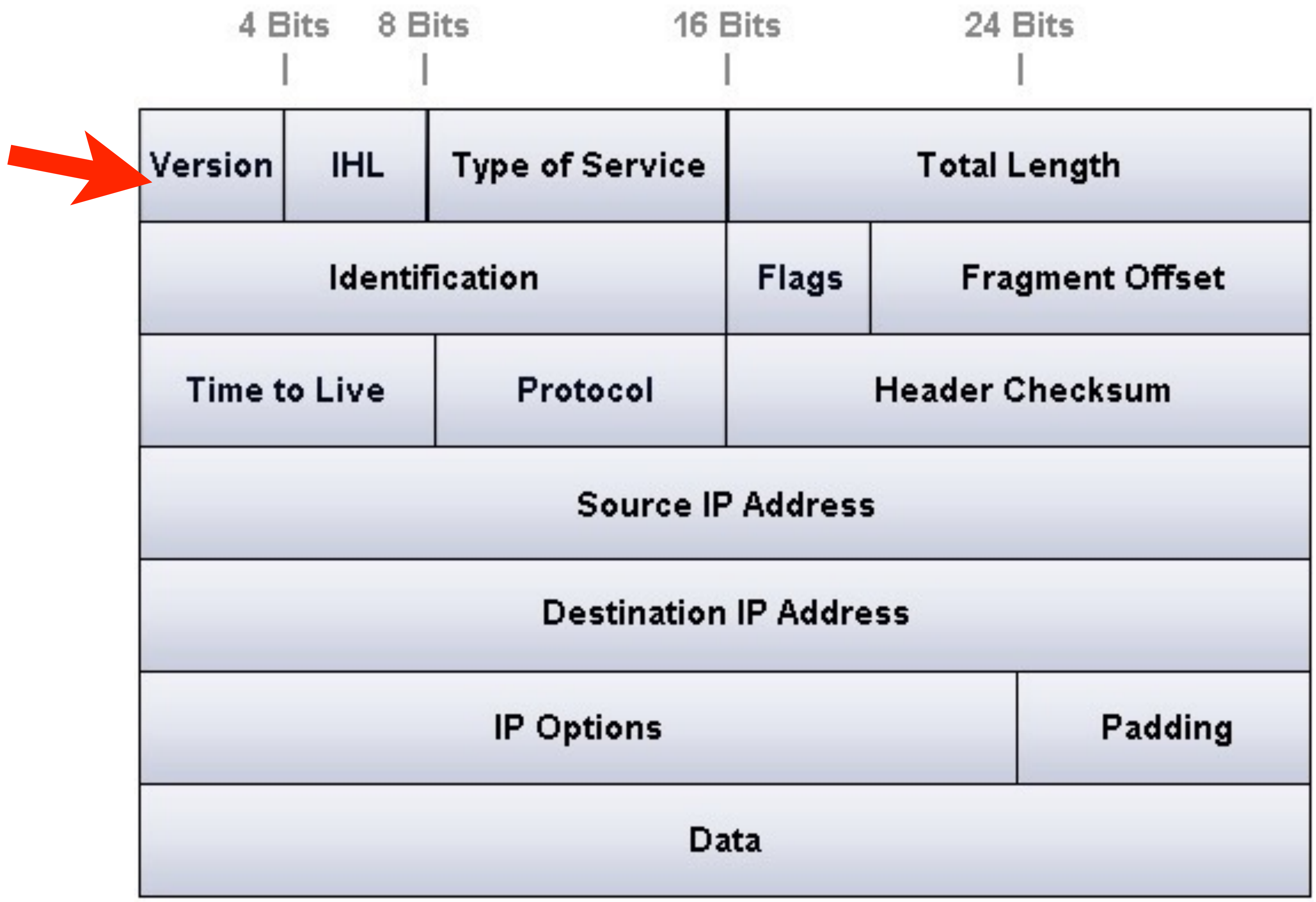

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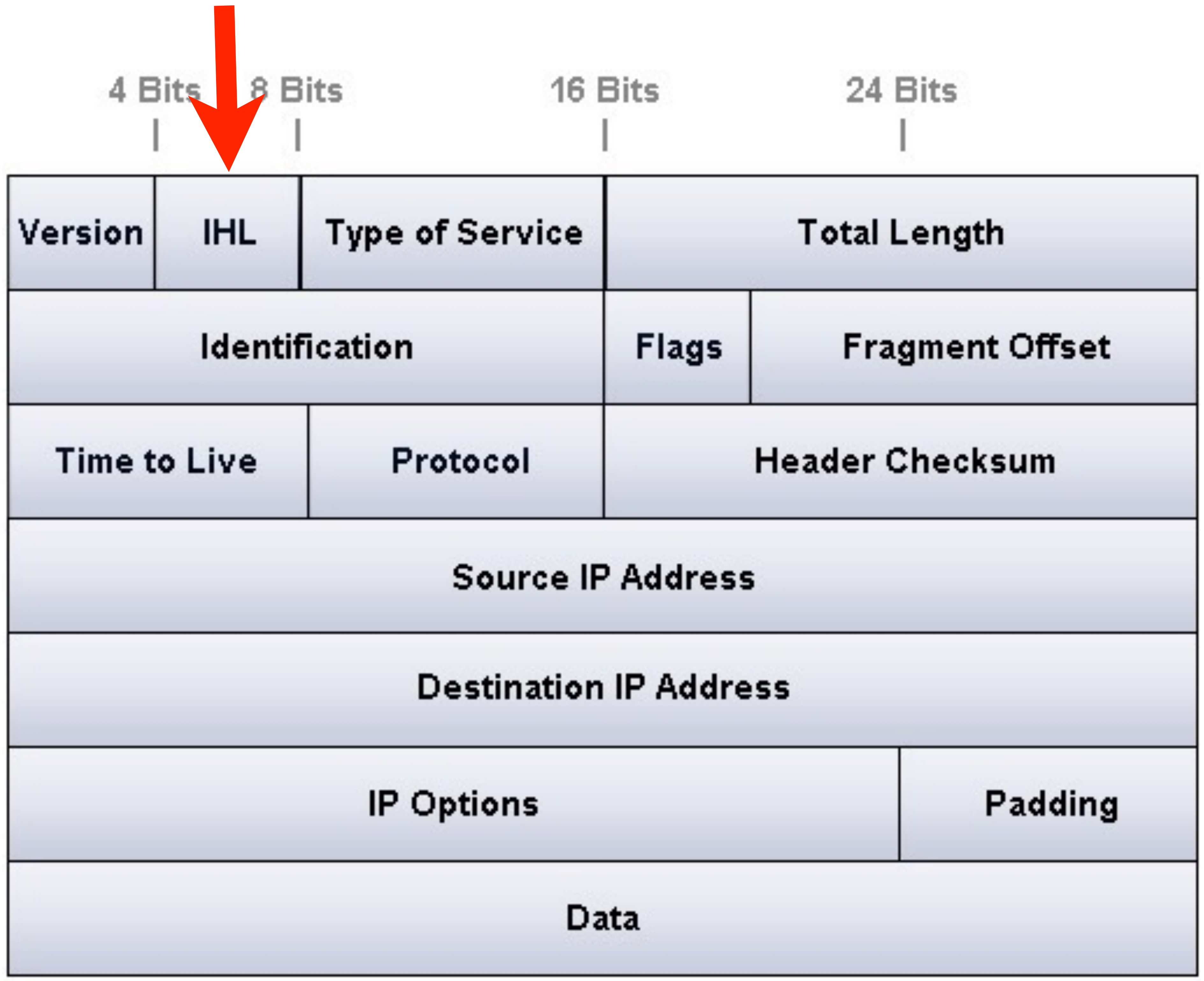

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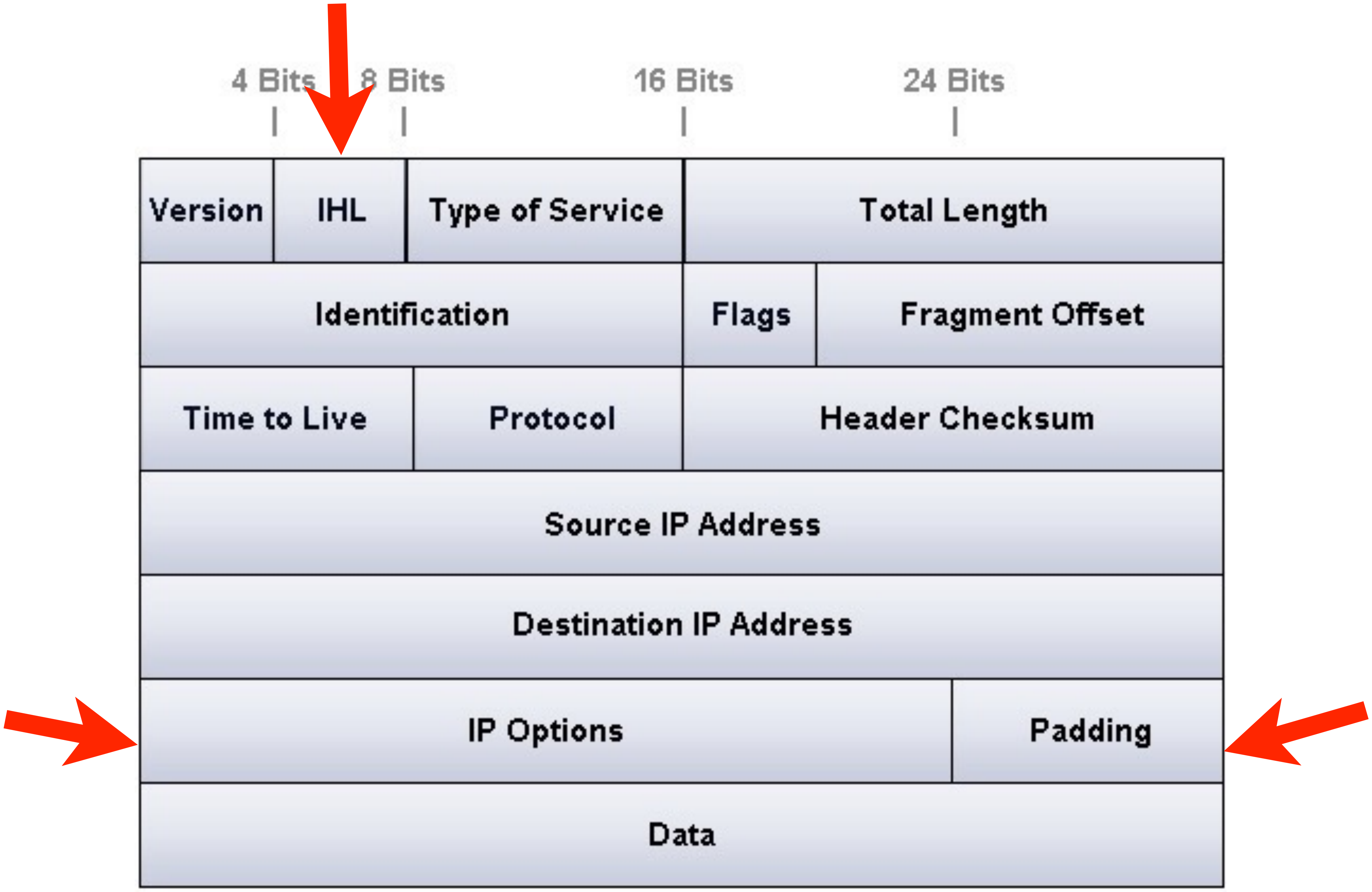

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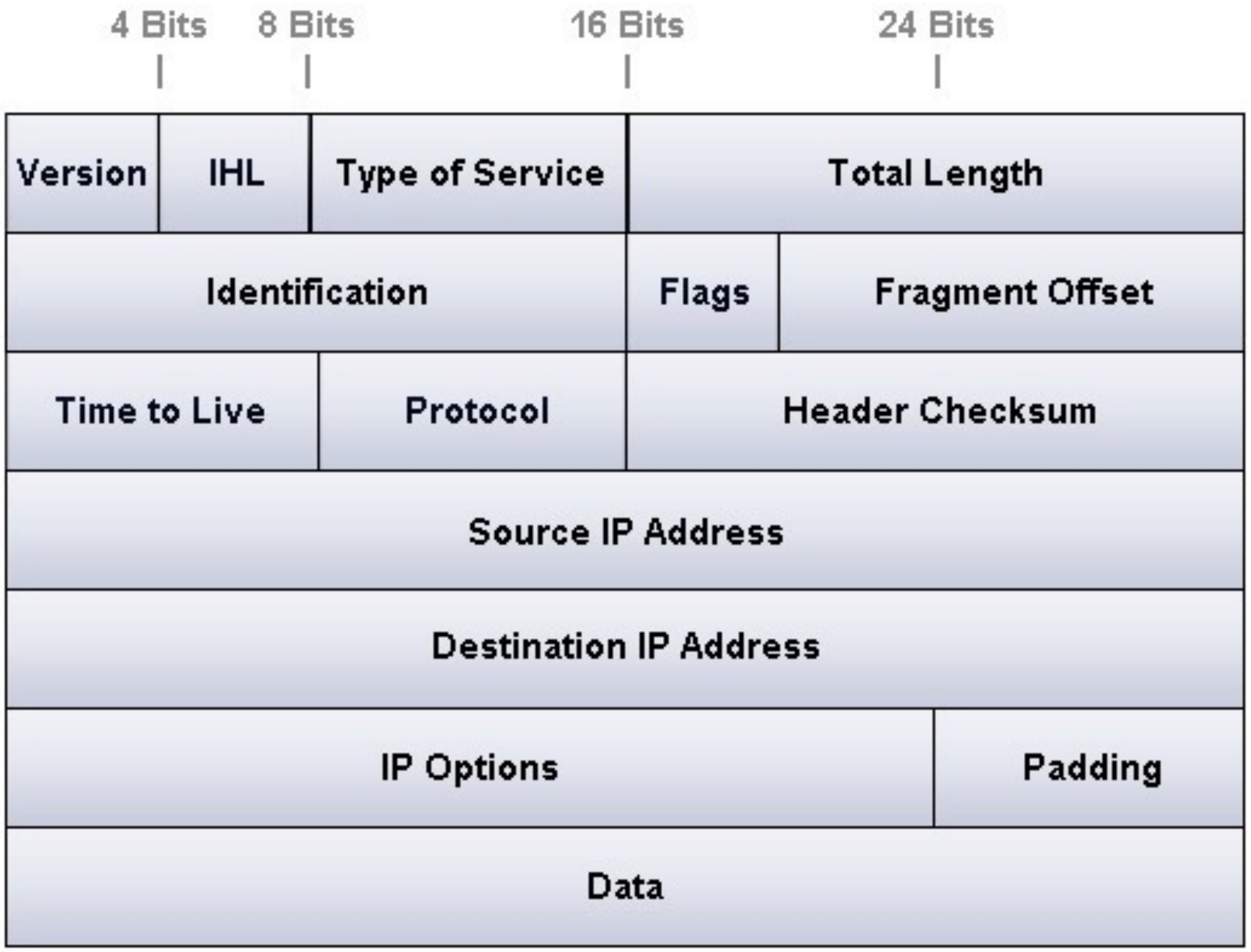

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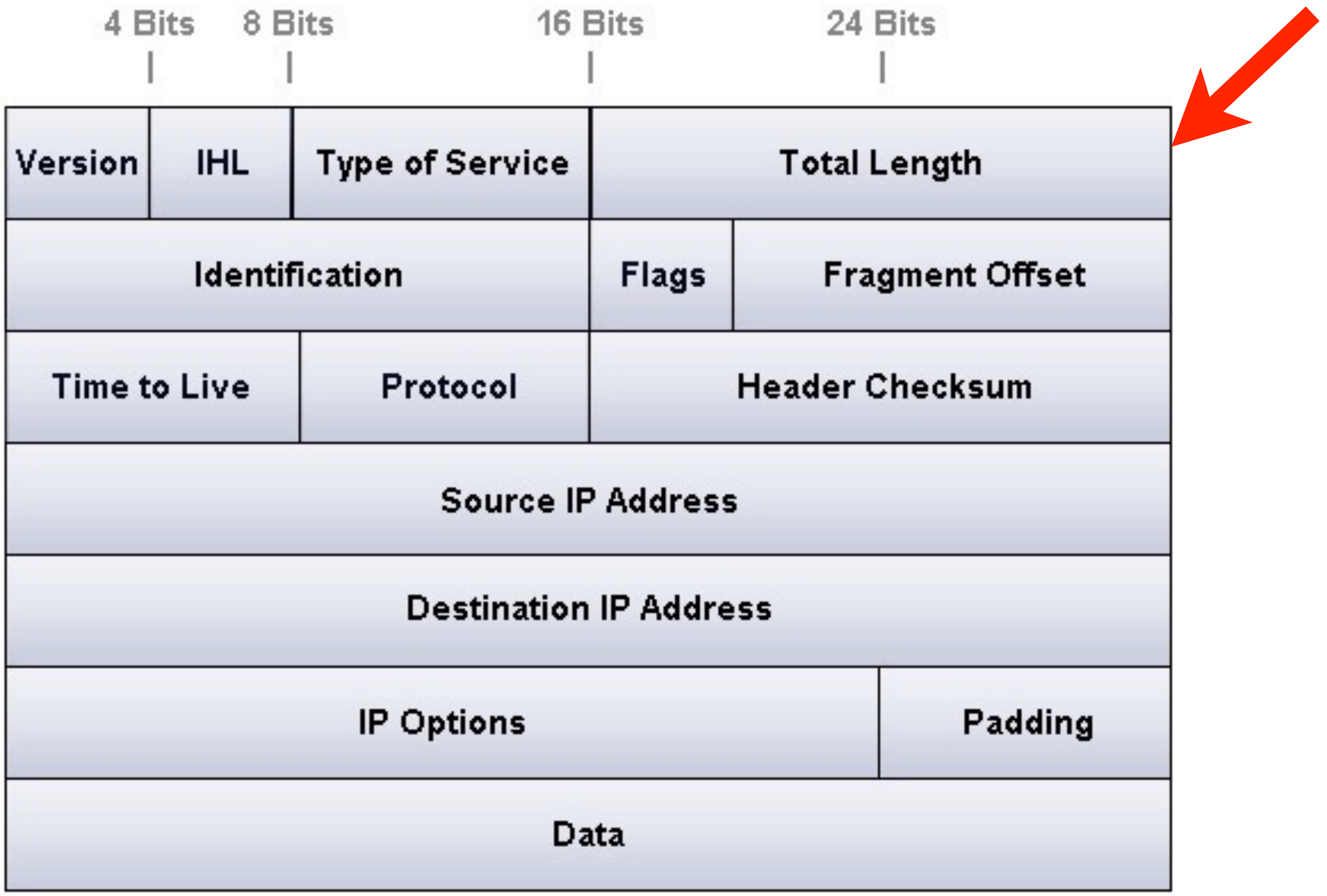

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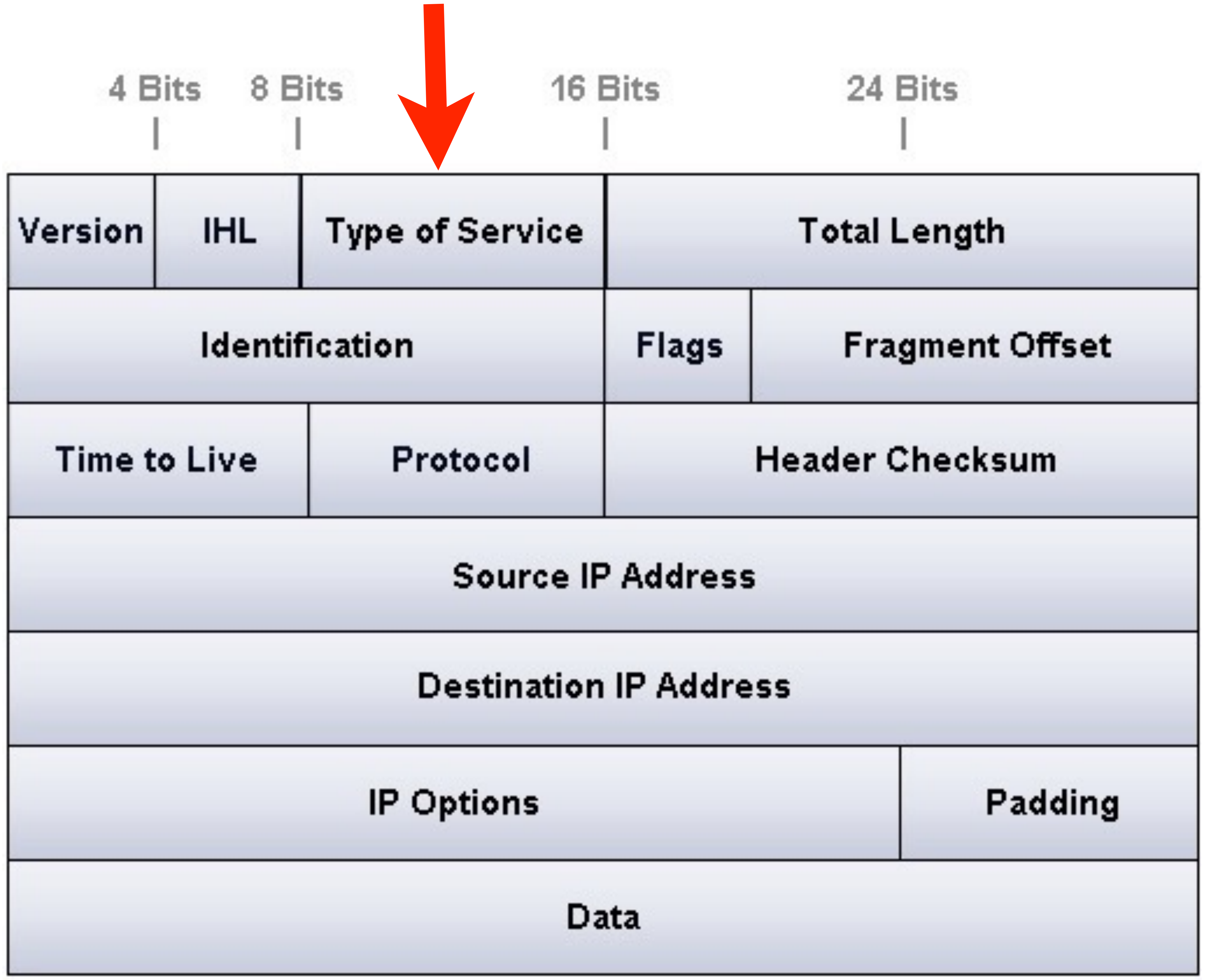

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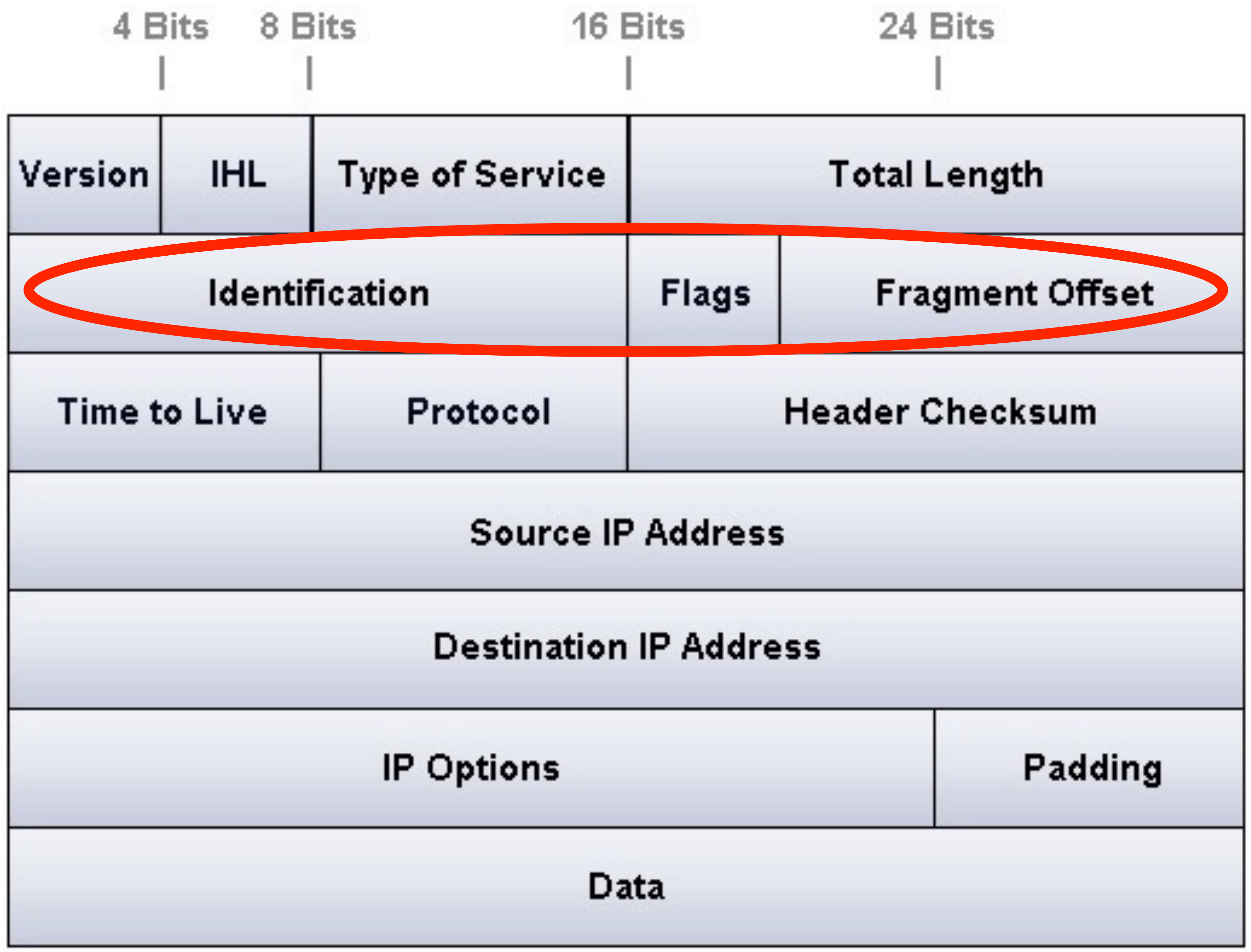

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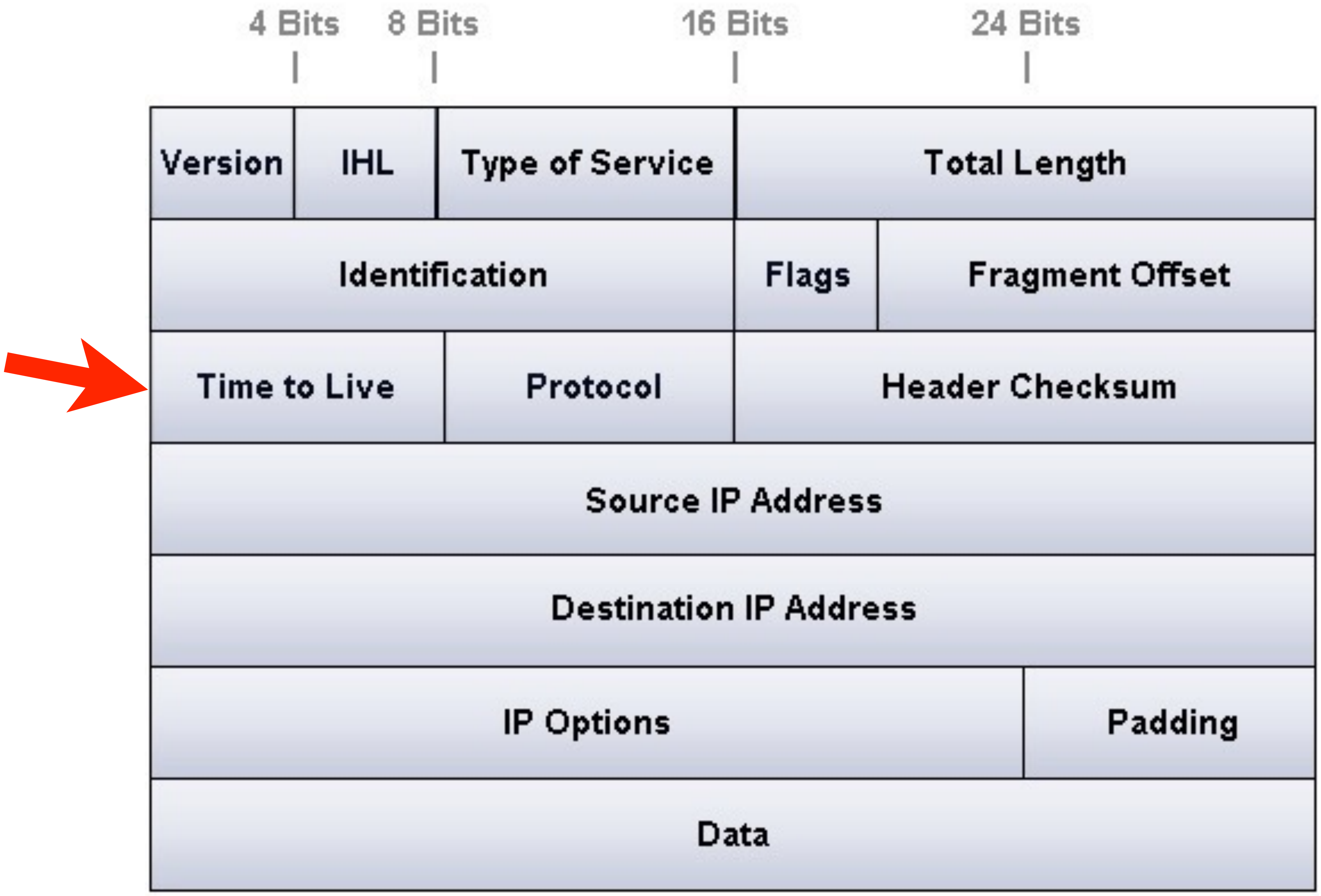

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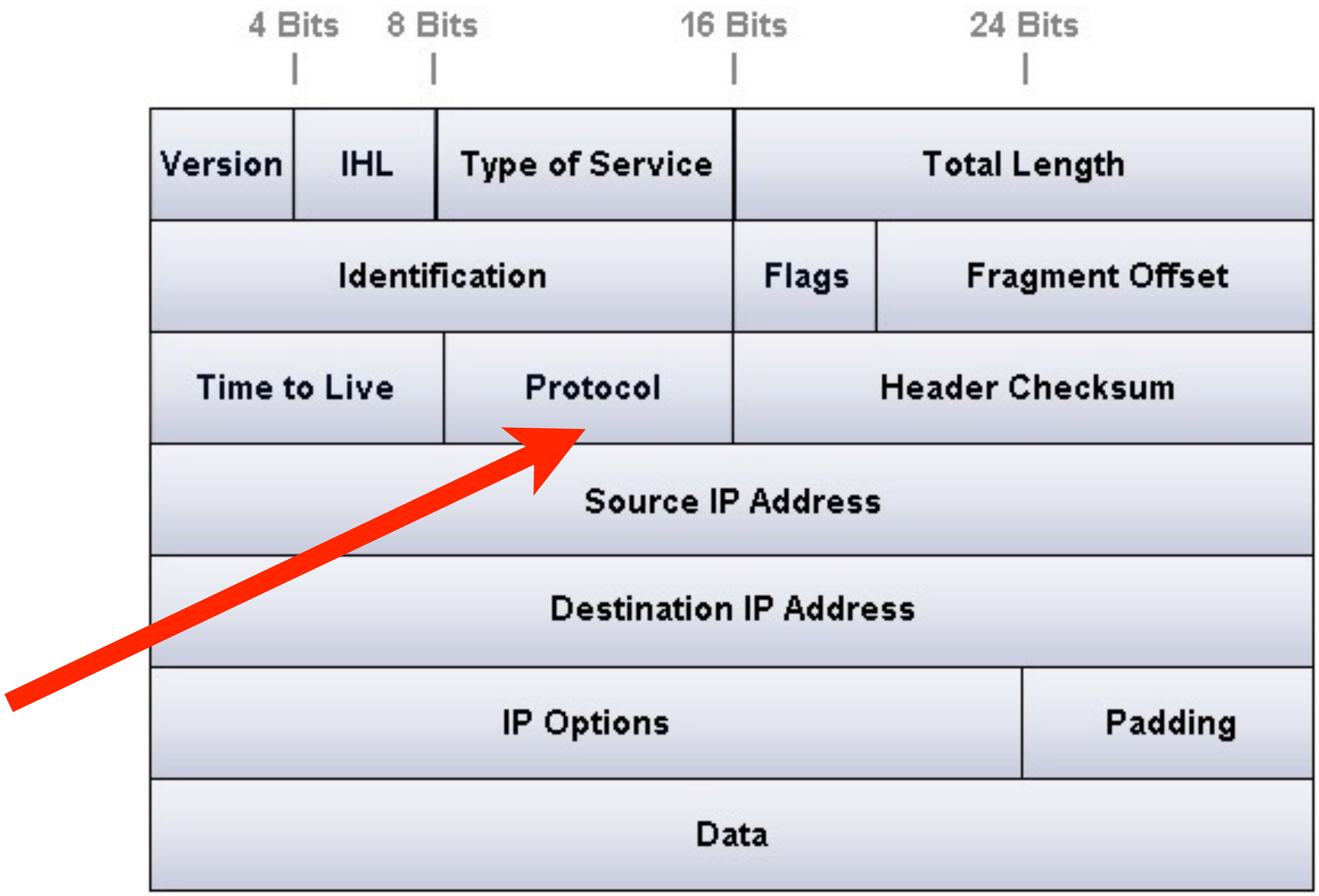

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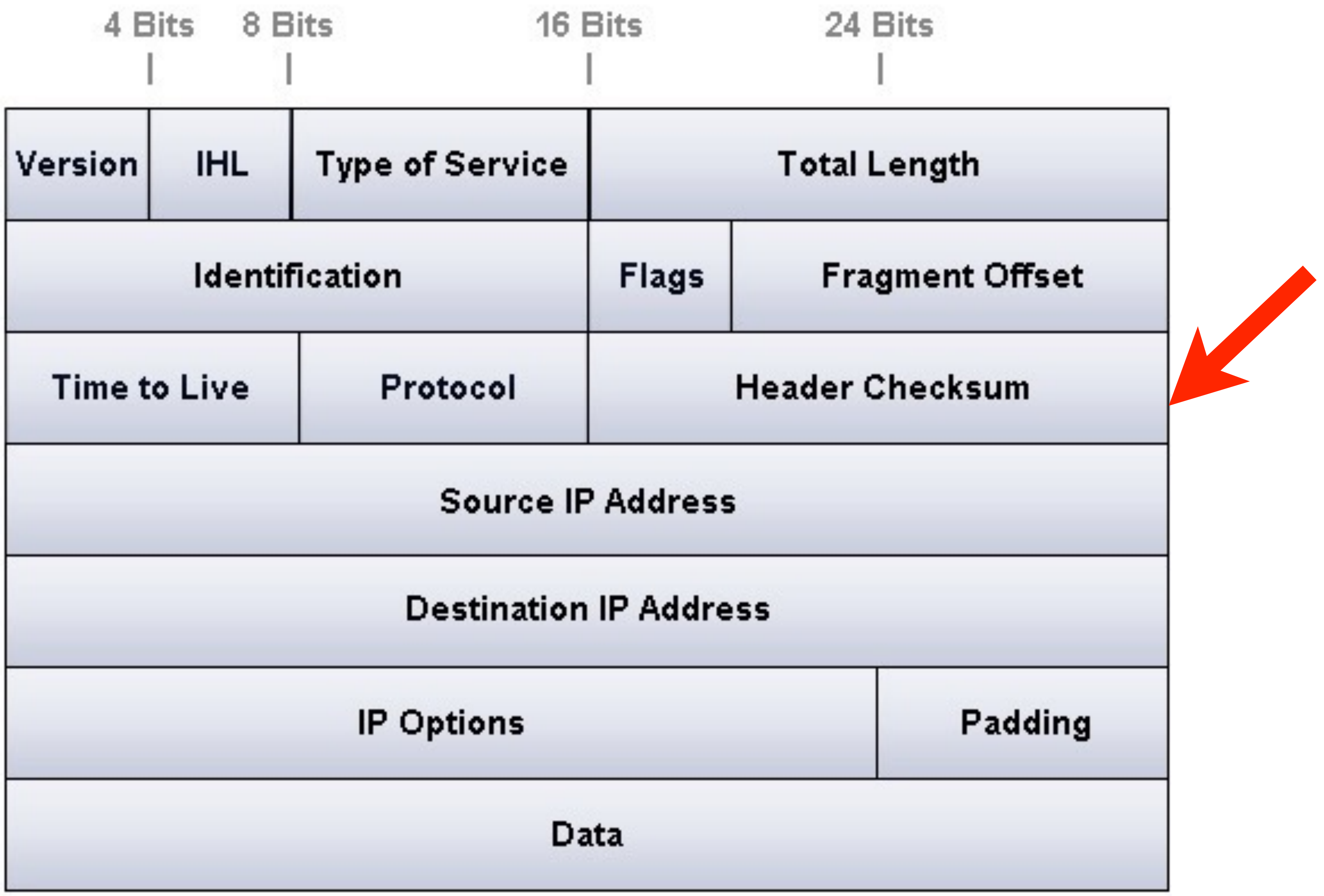

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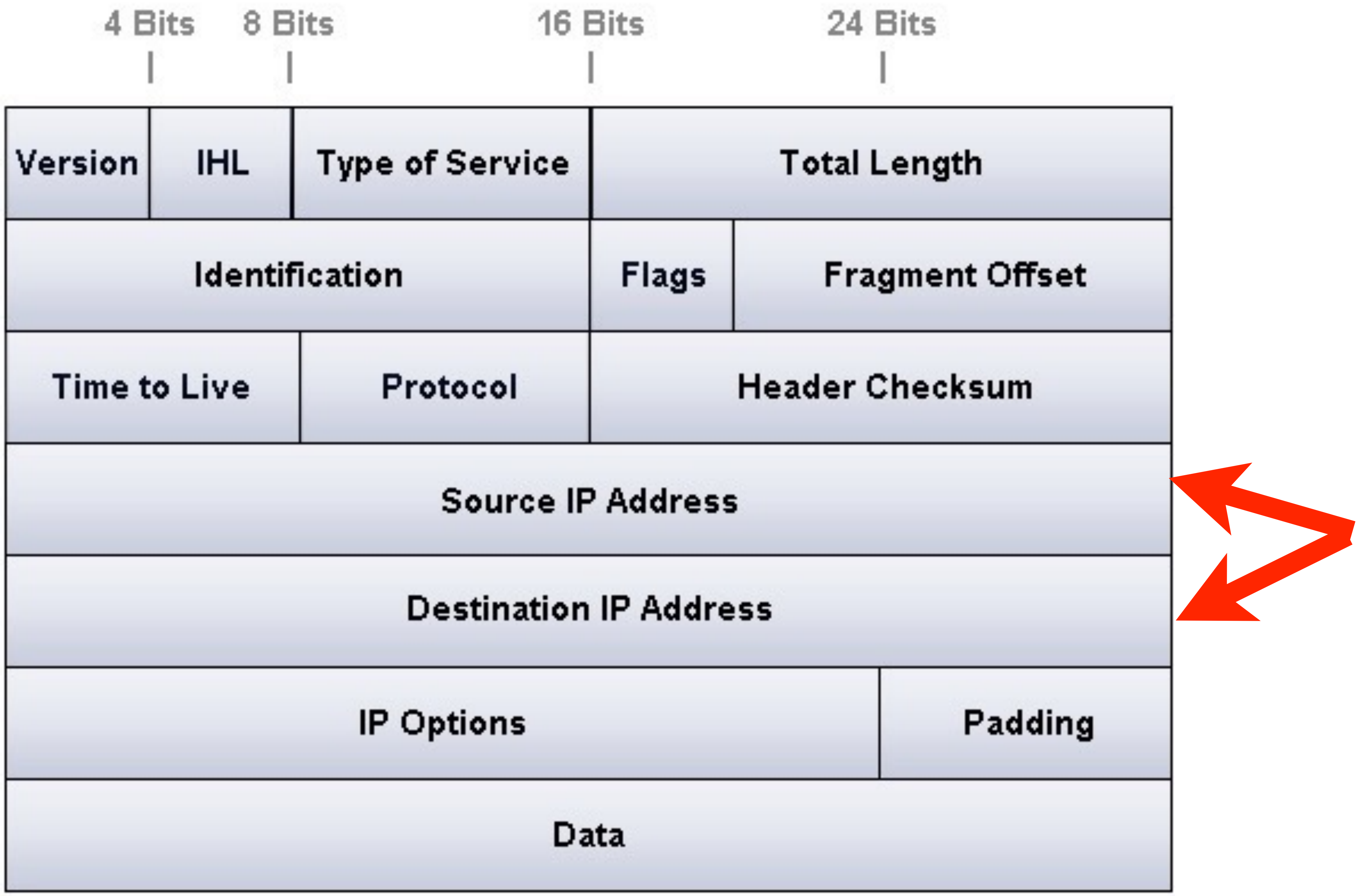

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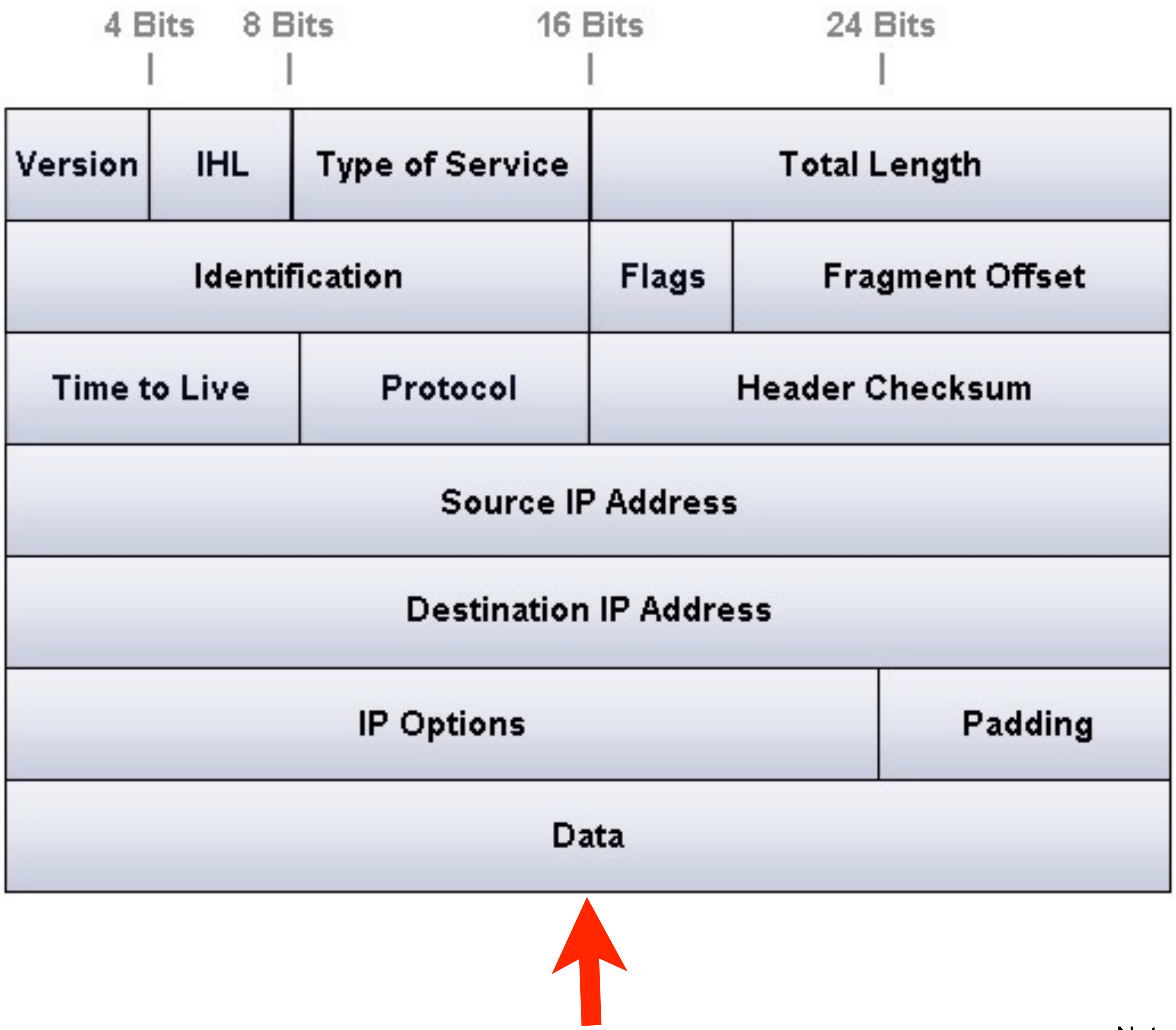

Packet Sizes

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- Is this a problem?
- Mismatch between LL and IP packet sizes … UGH!

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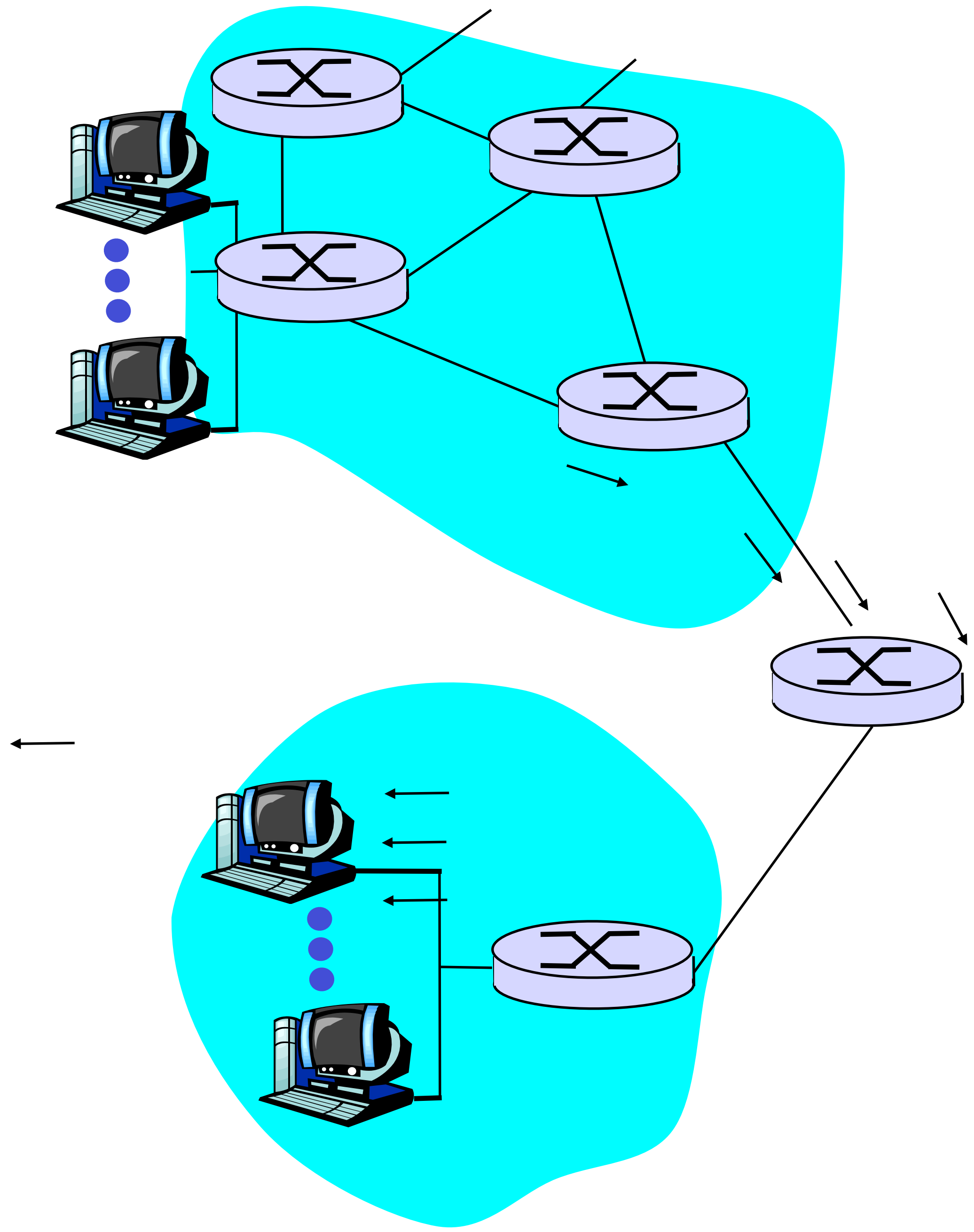

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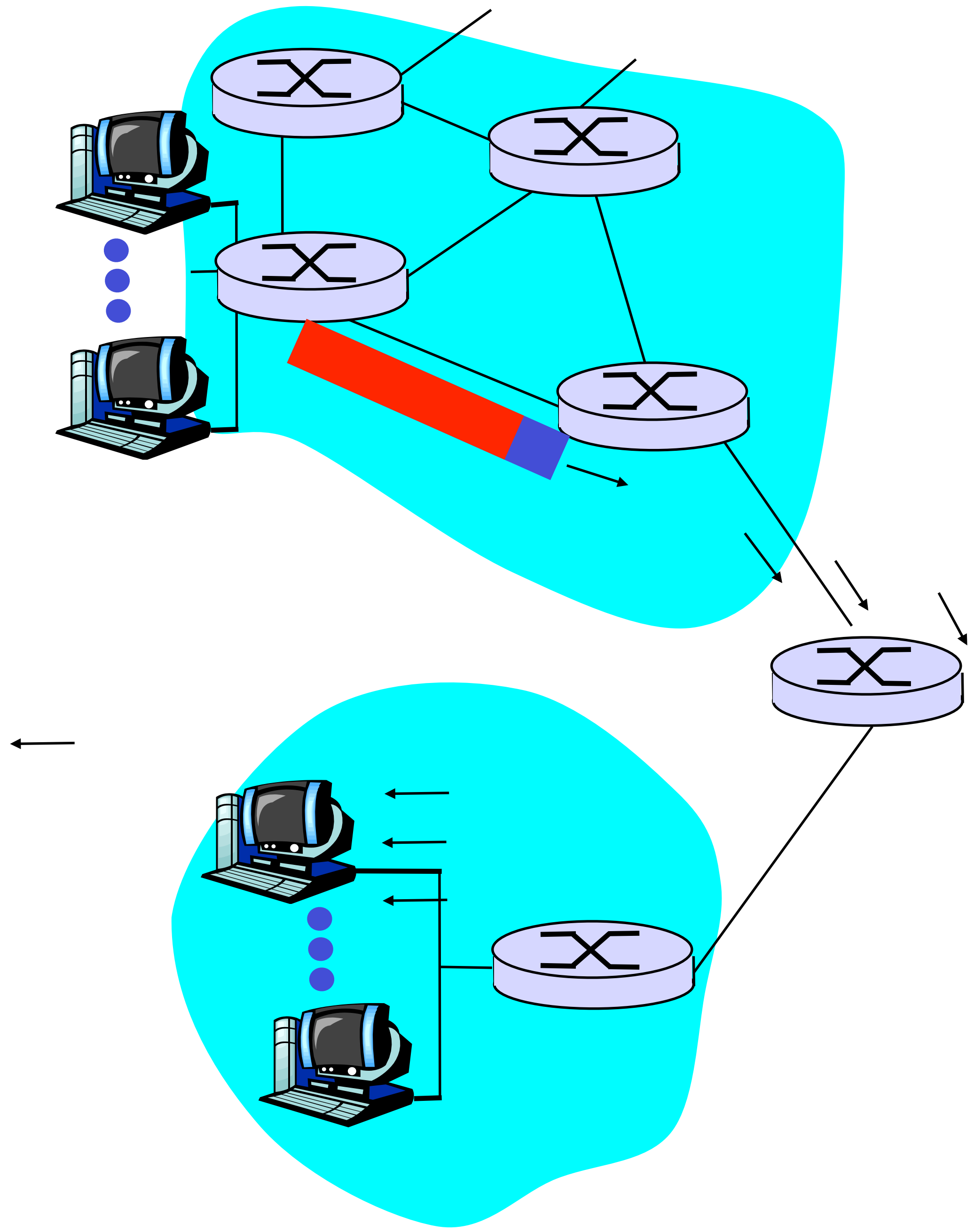

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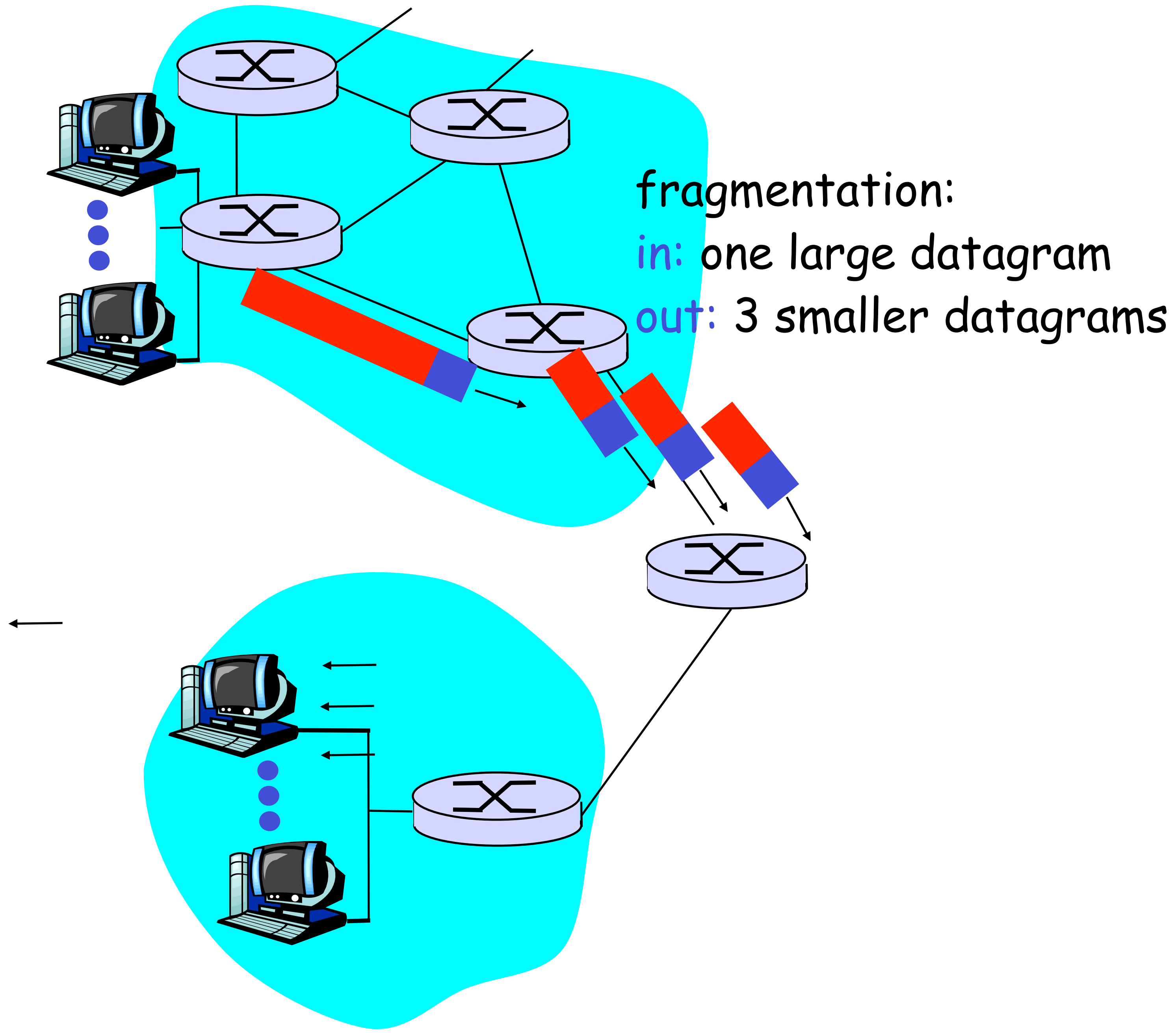

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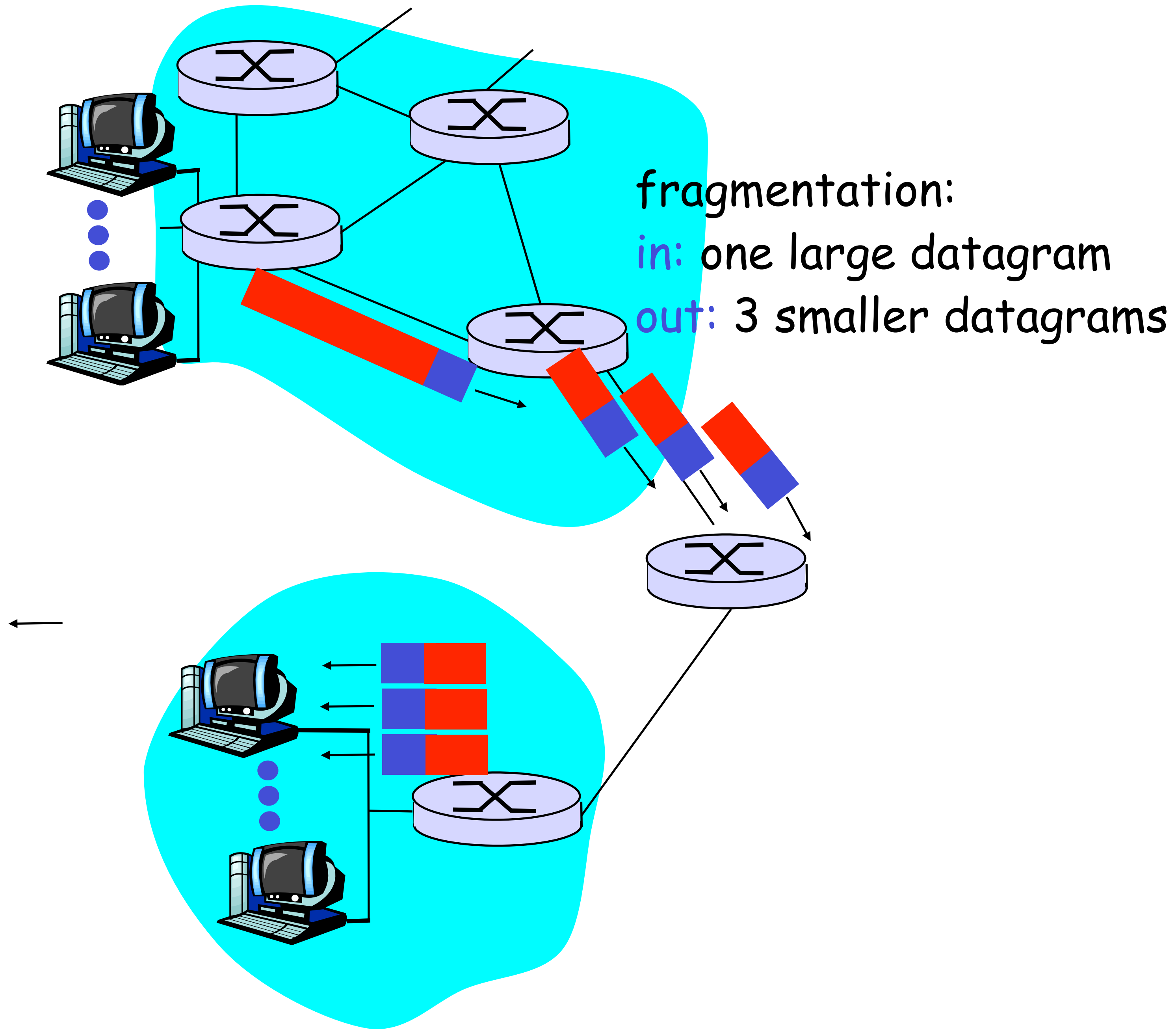

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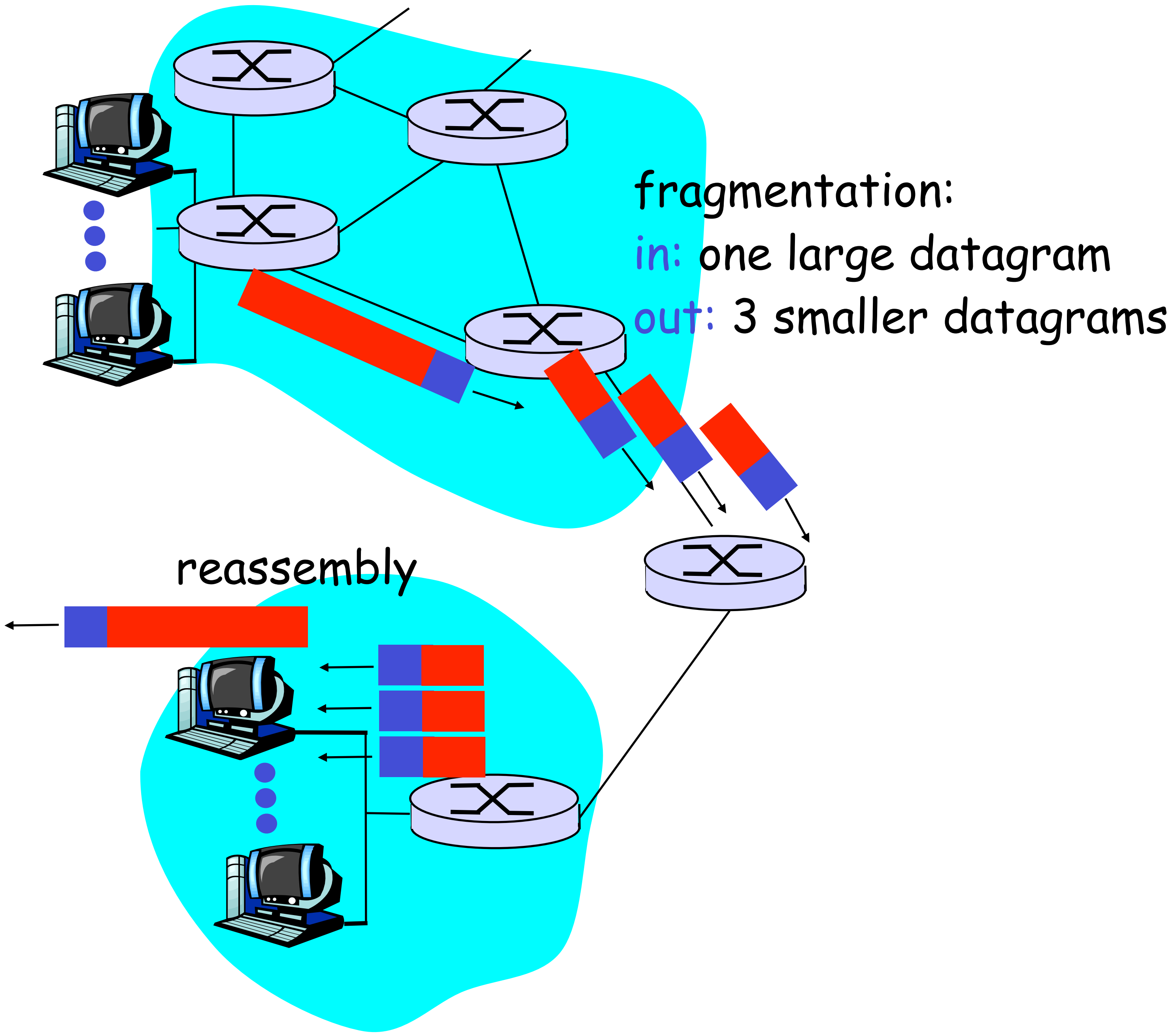

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- 4000 byte IP datagram
- MTU = 1500 bytes

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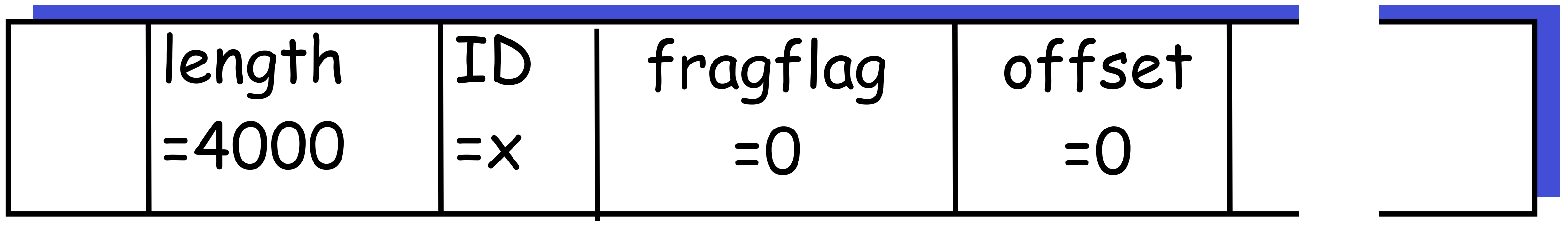

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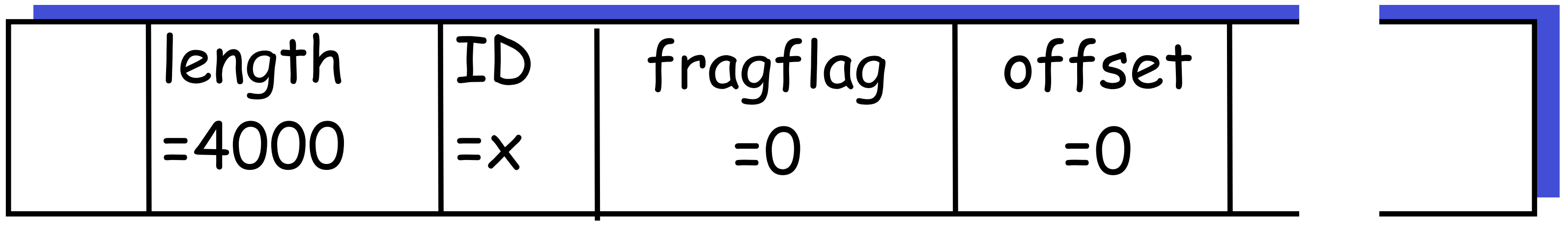

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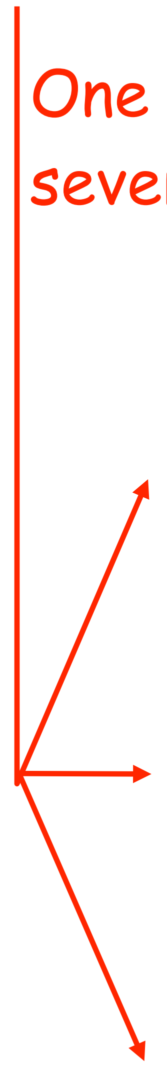

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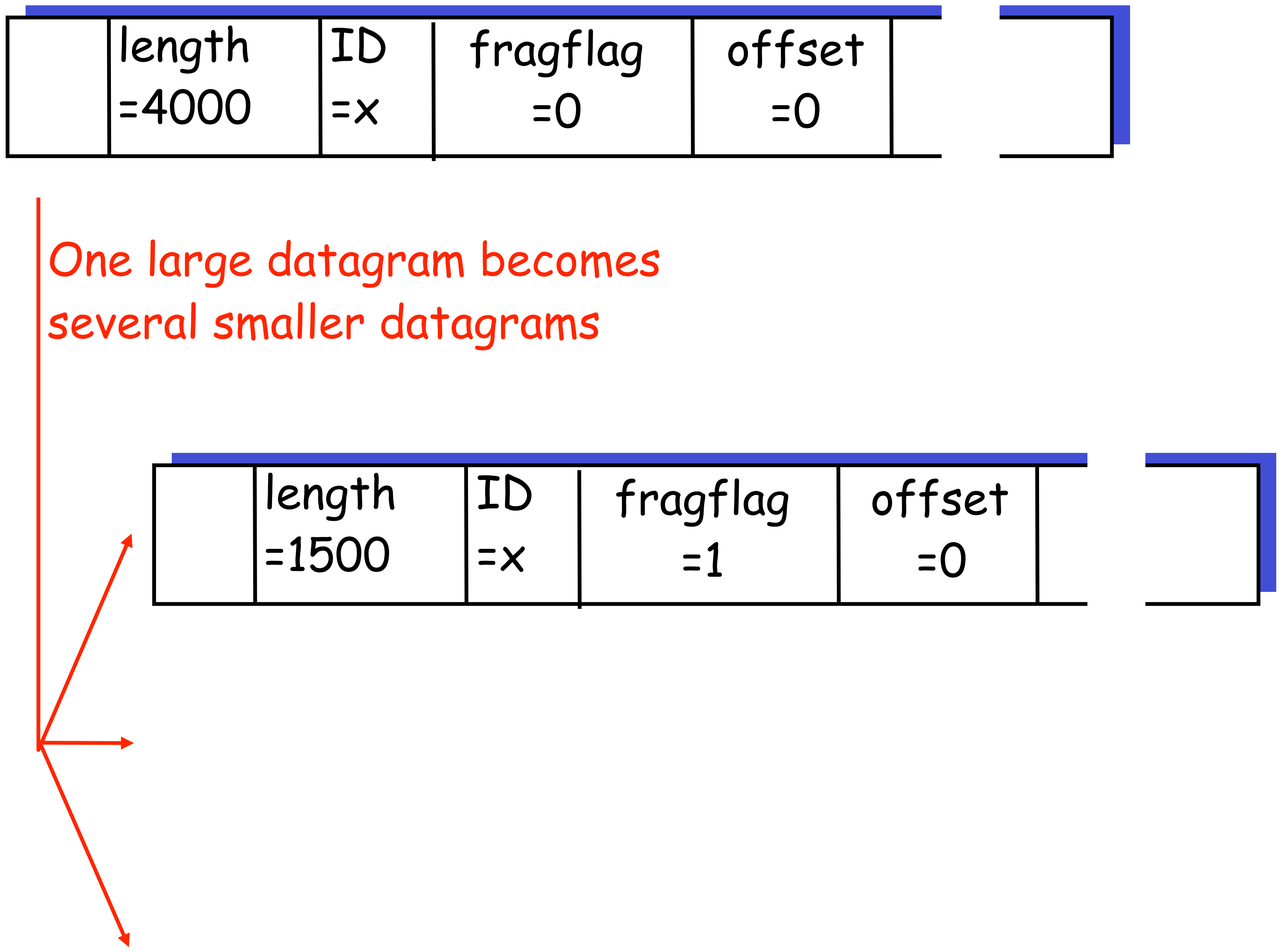

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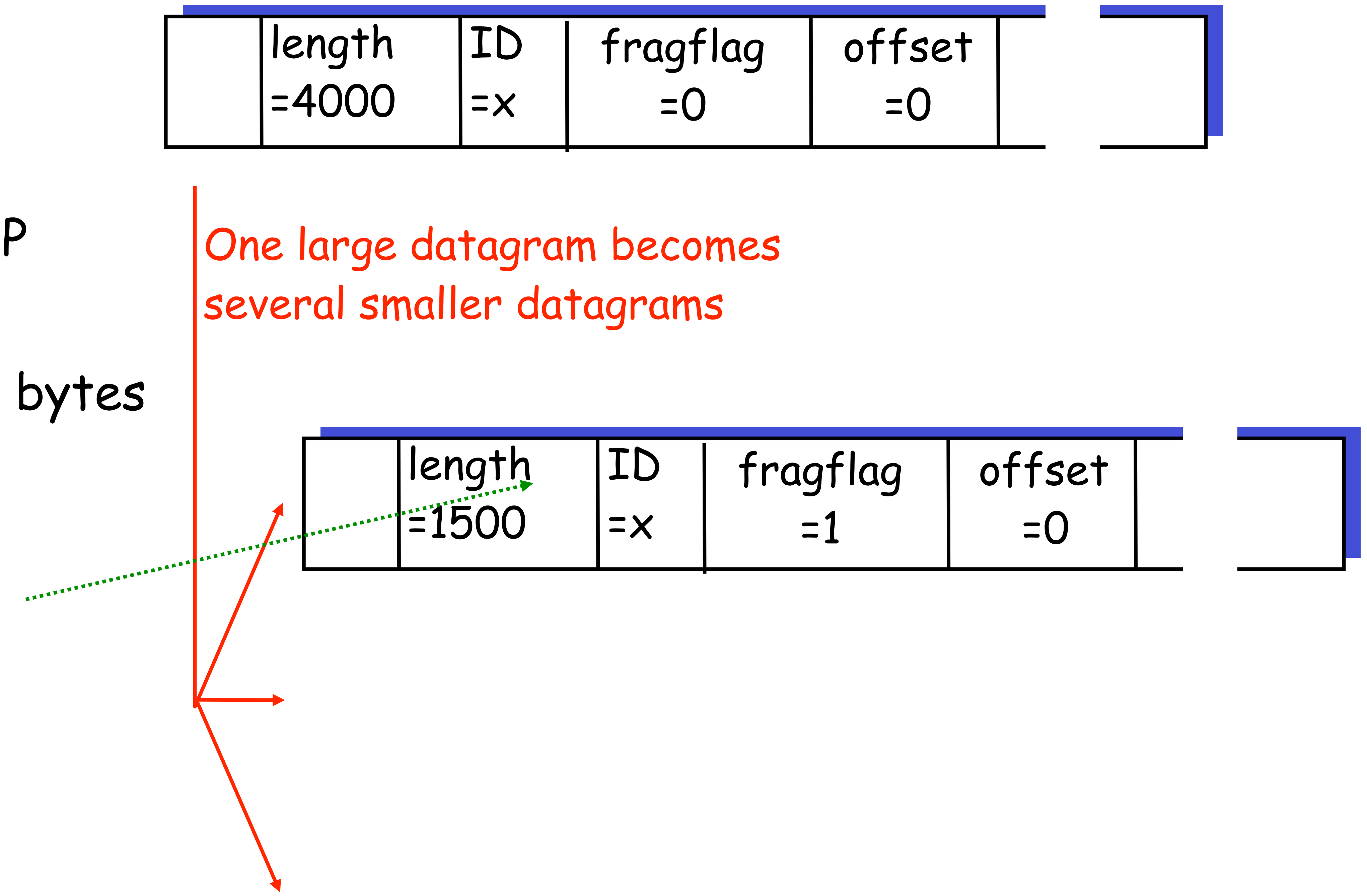

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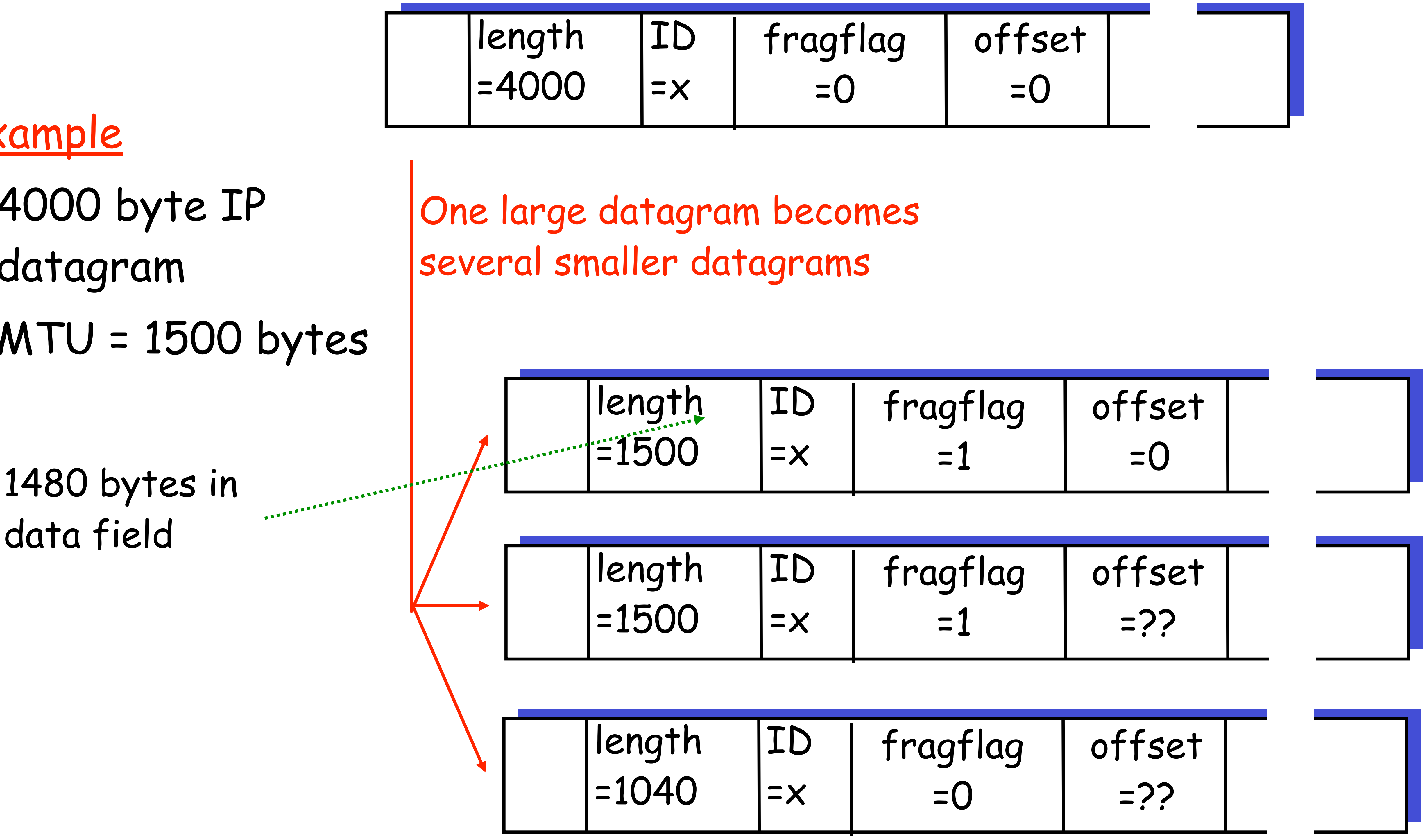

IP Packet Header Revisited

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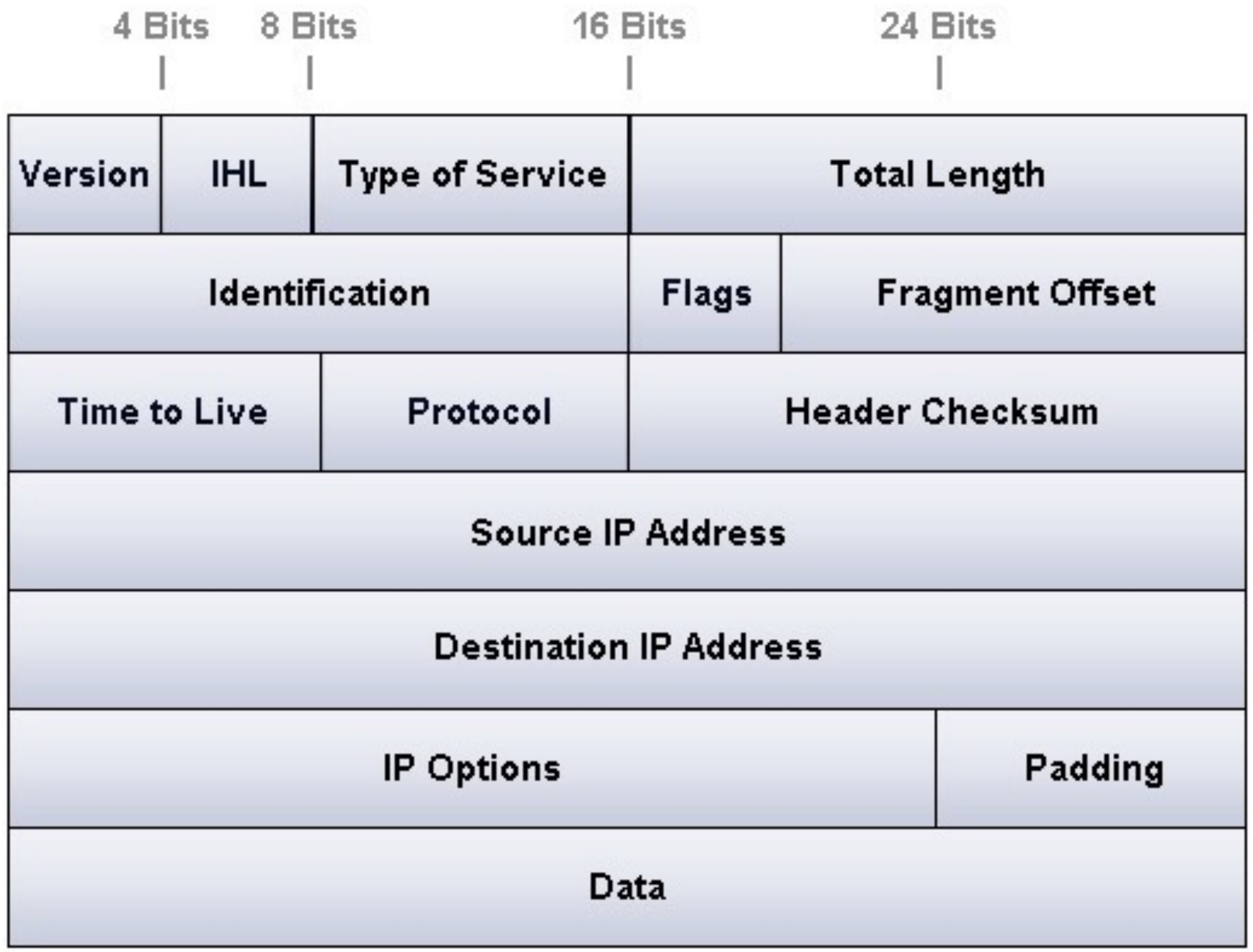

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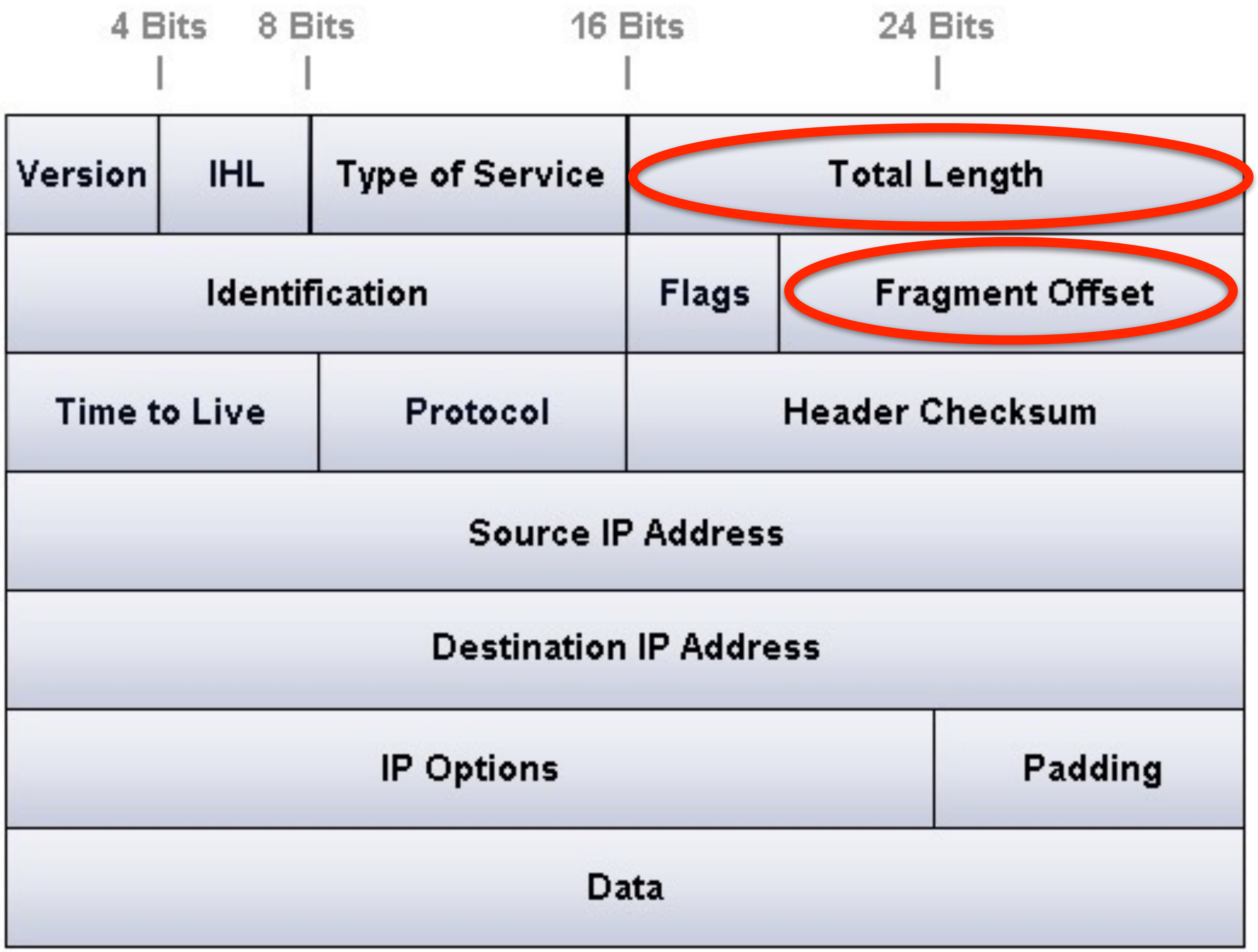

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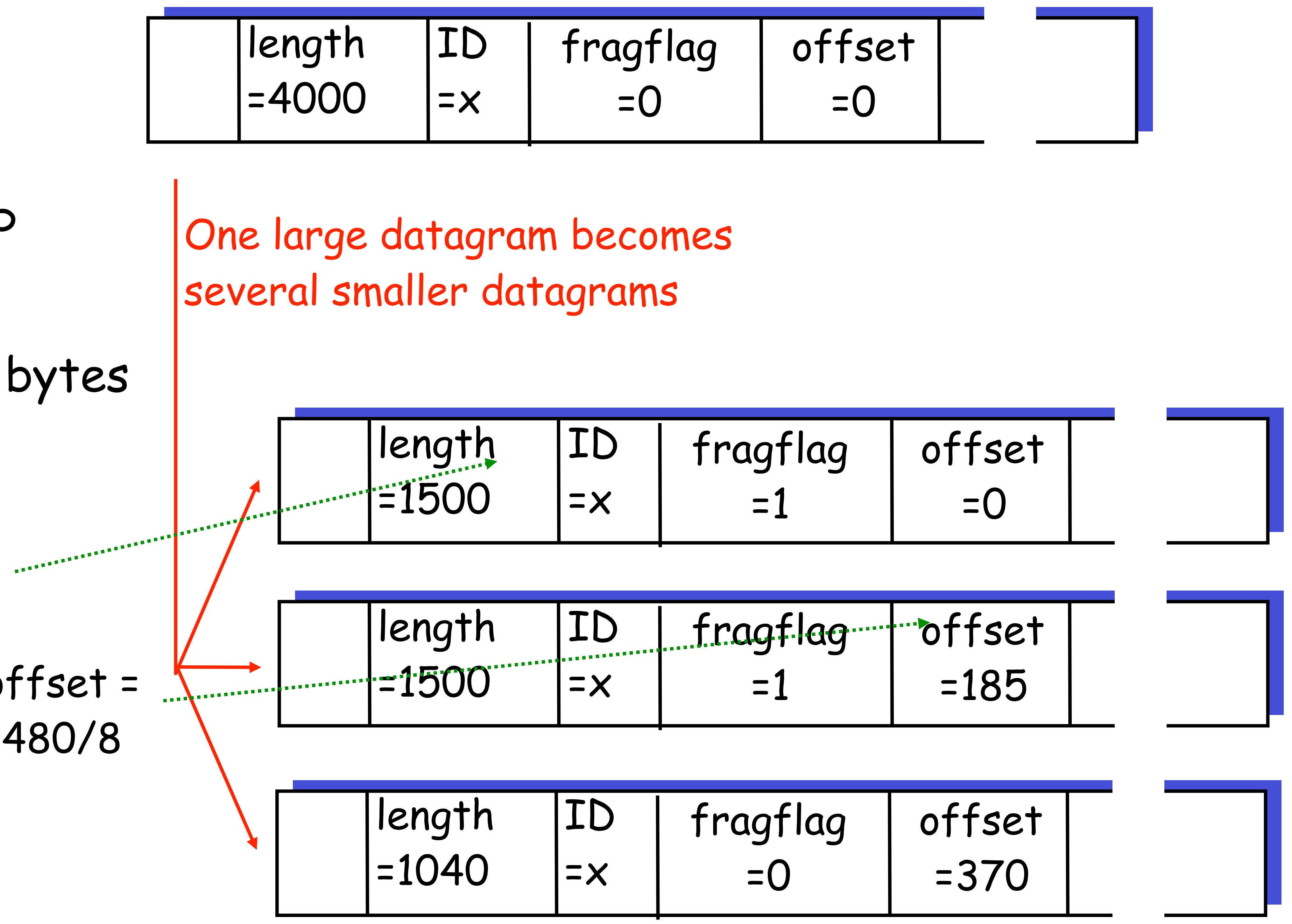

How Do We Know the MTU Size?

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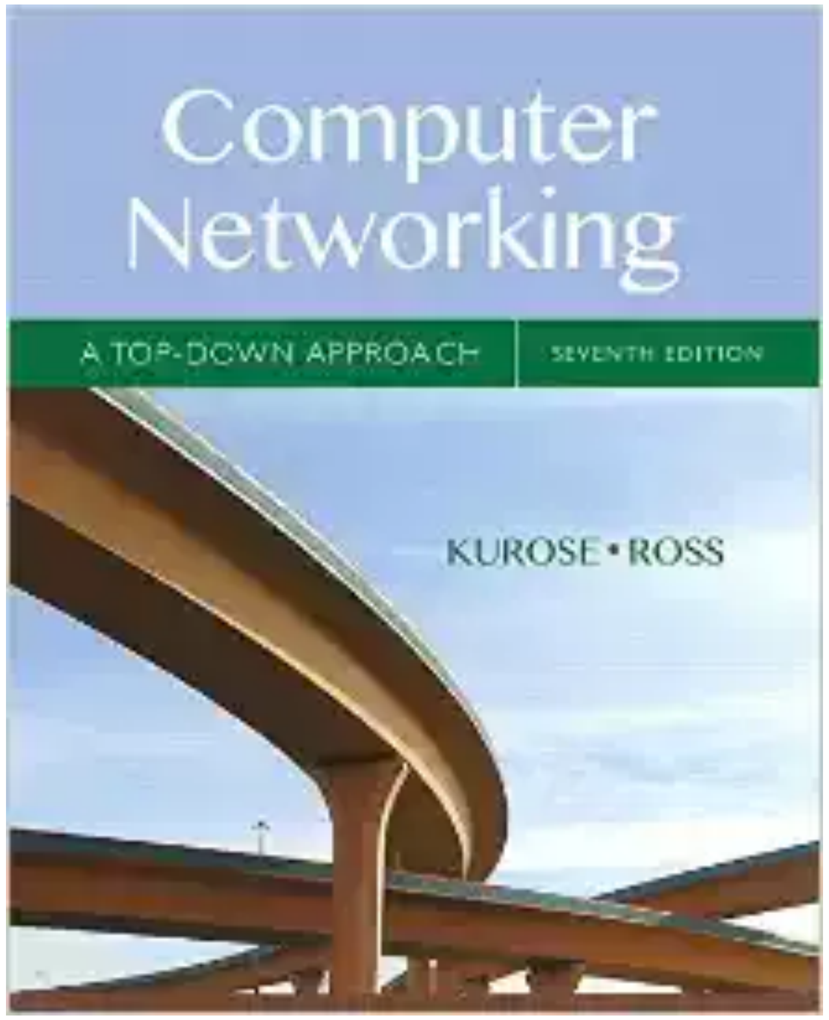
- Data link layer must "support" a packet of at least 576 bytes

Reading Along ...



- Network layer is chapters 4 & 5
  - 5.6: ICMP

ICMP: Internet Control Message Protocol

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- ICMP message: type, code plus first 8 bytes of IP datagram causing error
  - (sometimes > 8 bytes)

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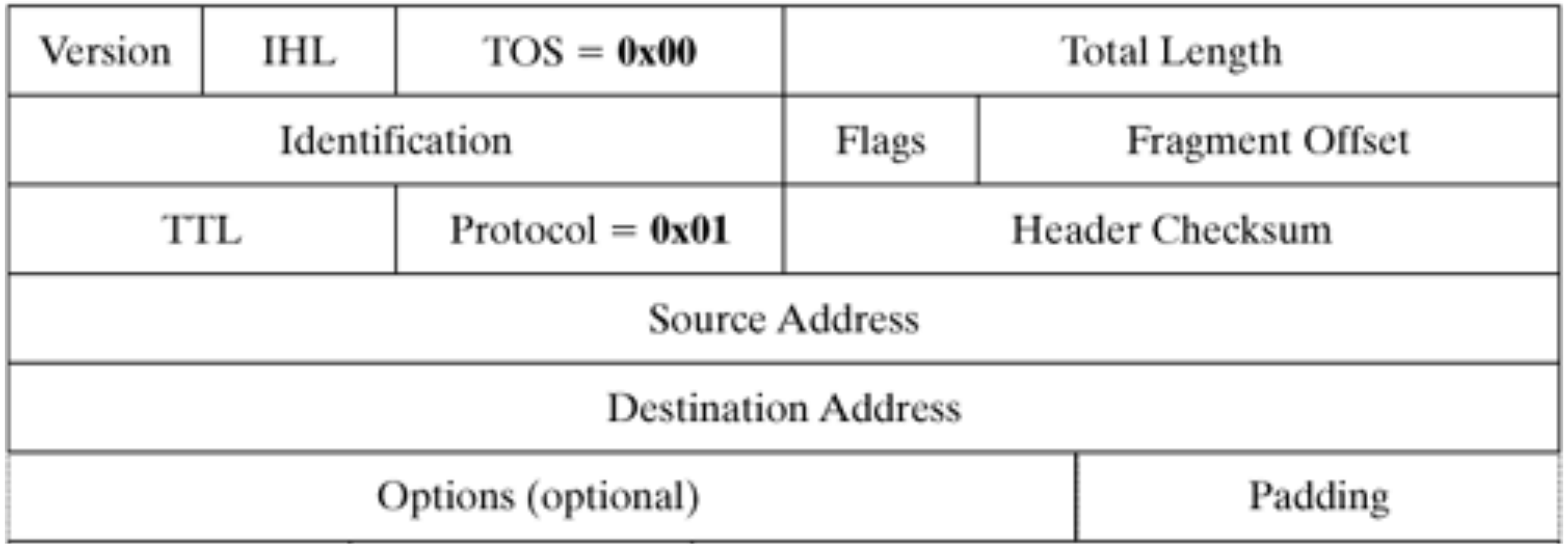

Version	IHL	TOS = **0x00**	Total Length	
Identification			Flags	Fragment Offset
TTL		Protocol = **0x01**	Header Checksum	
Source Address				
Destination Address				
Options (optional)				Padding

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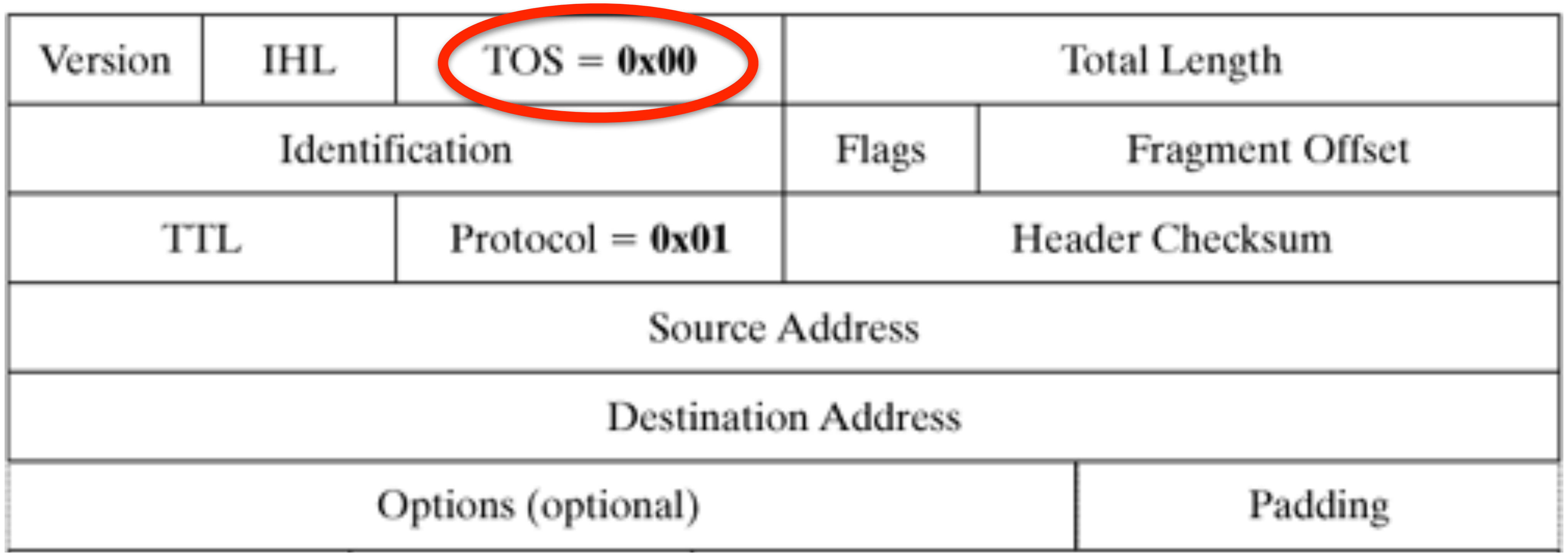

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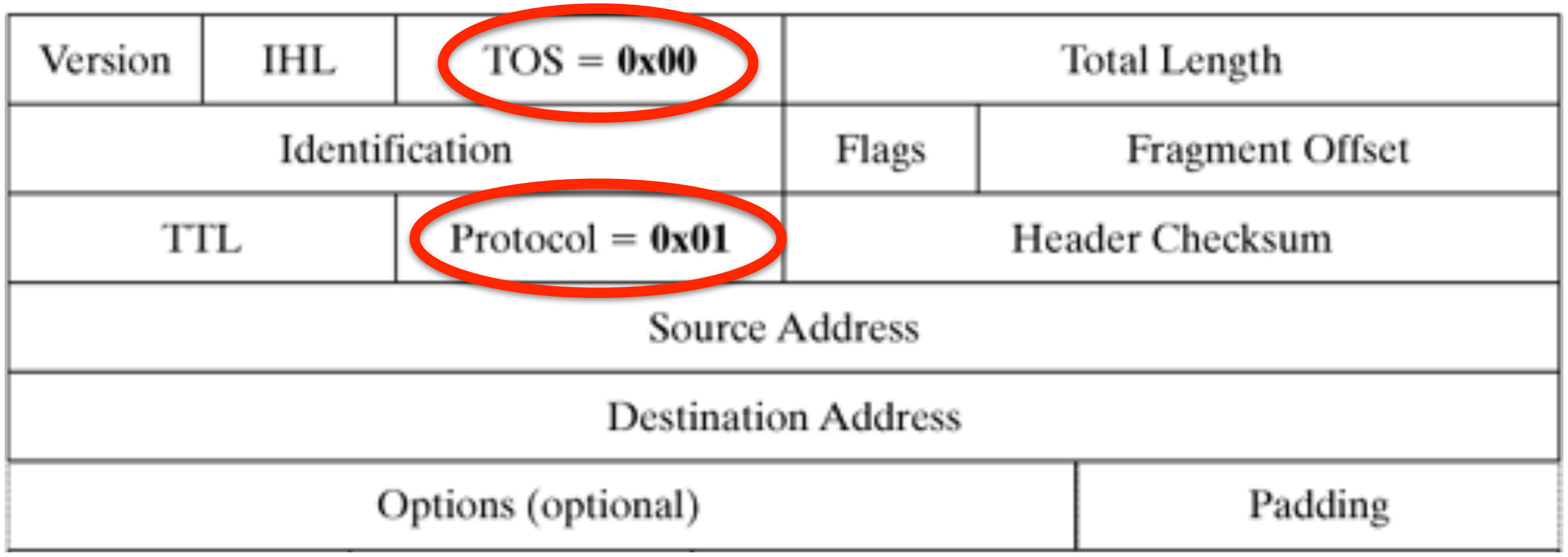

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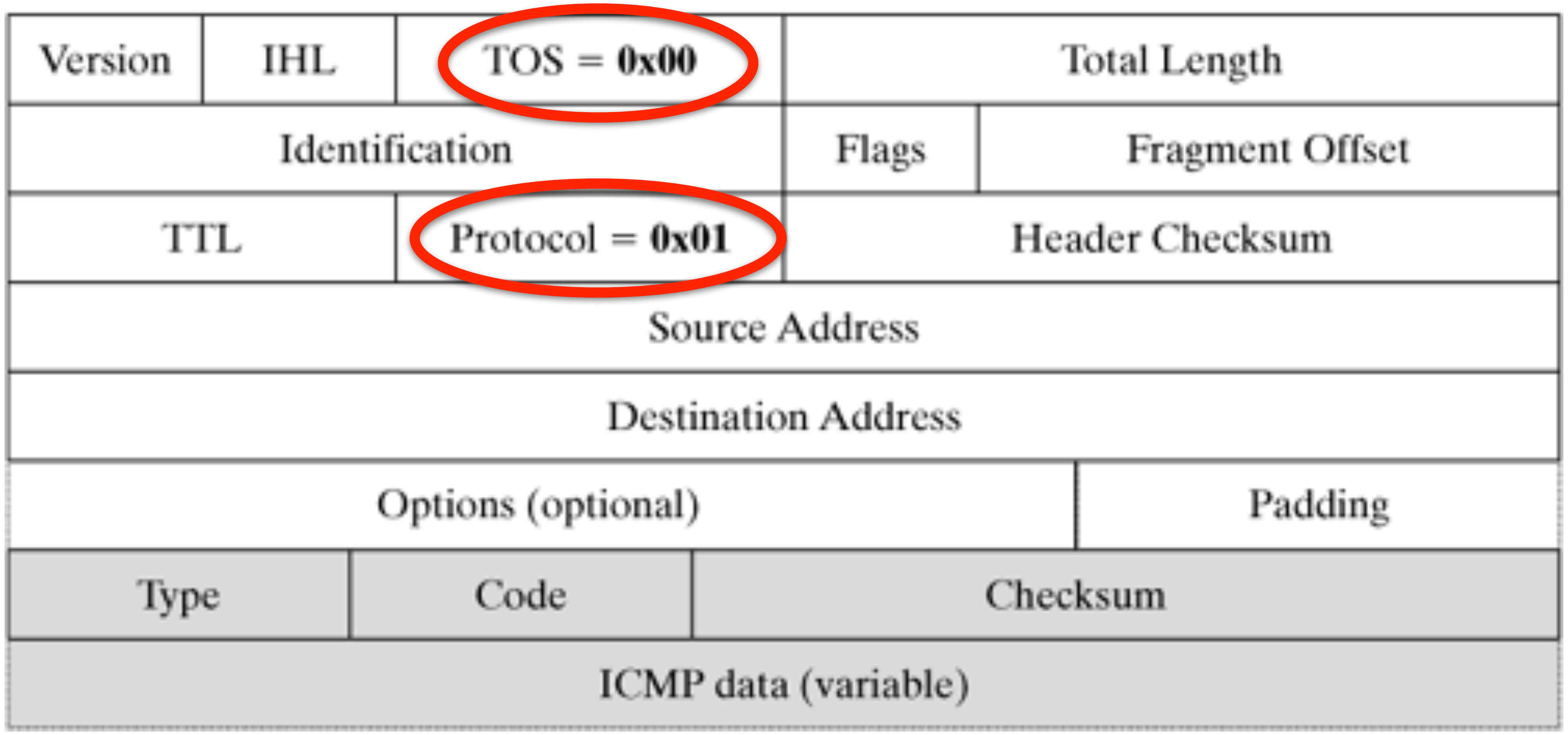

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Type	Code	Checksum	
ICMP data (variable)			

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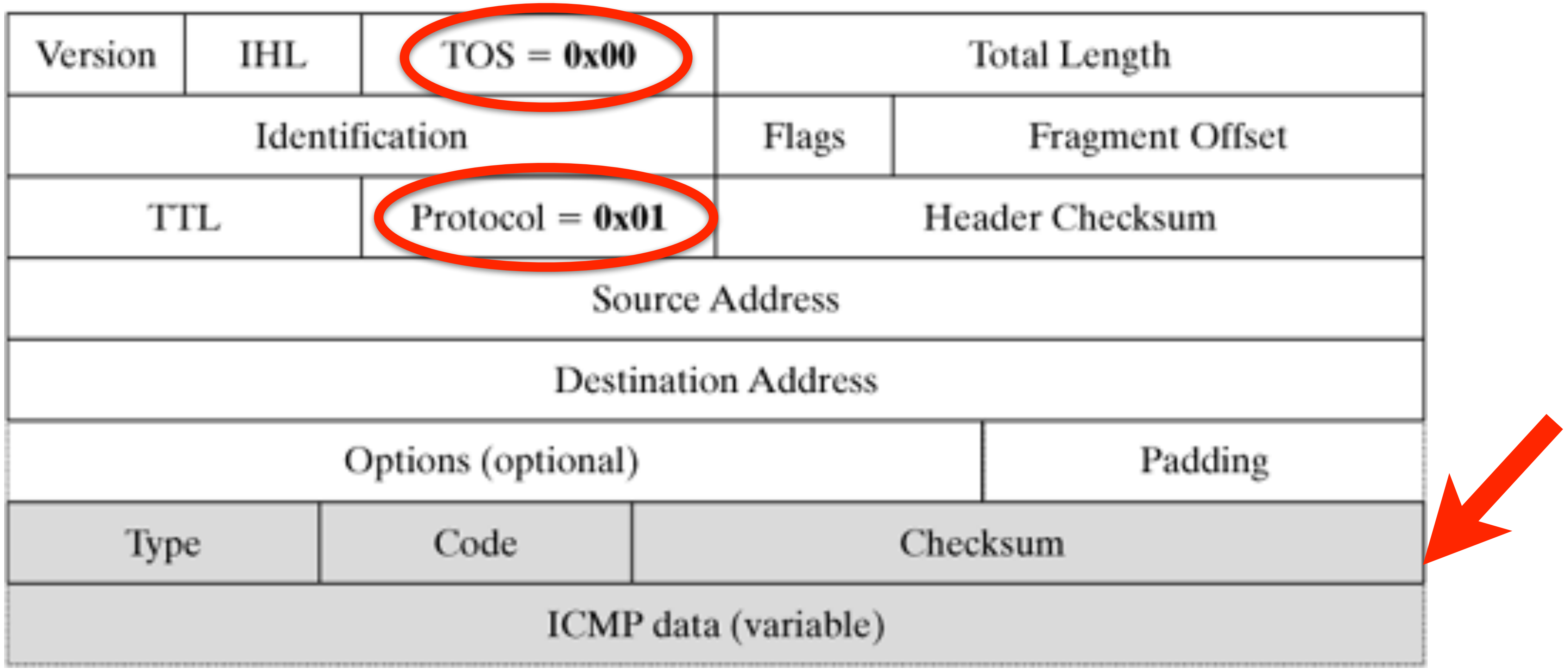

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3	4	packet too big
3	6	dest network unknown
3	7	dest host unknown
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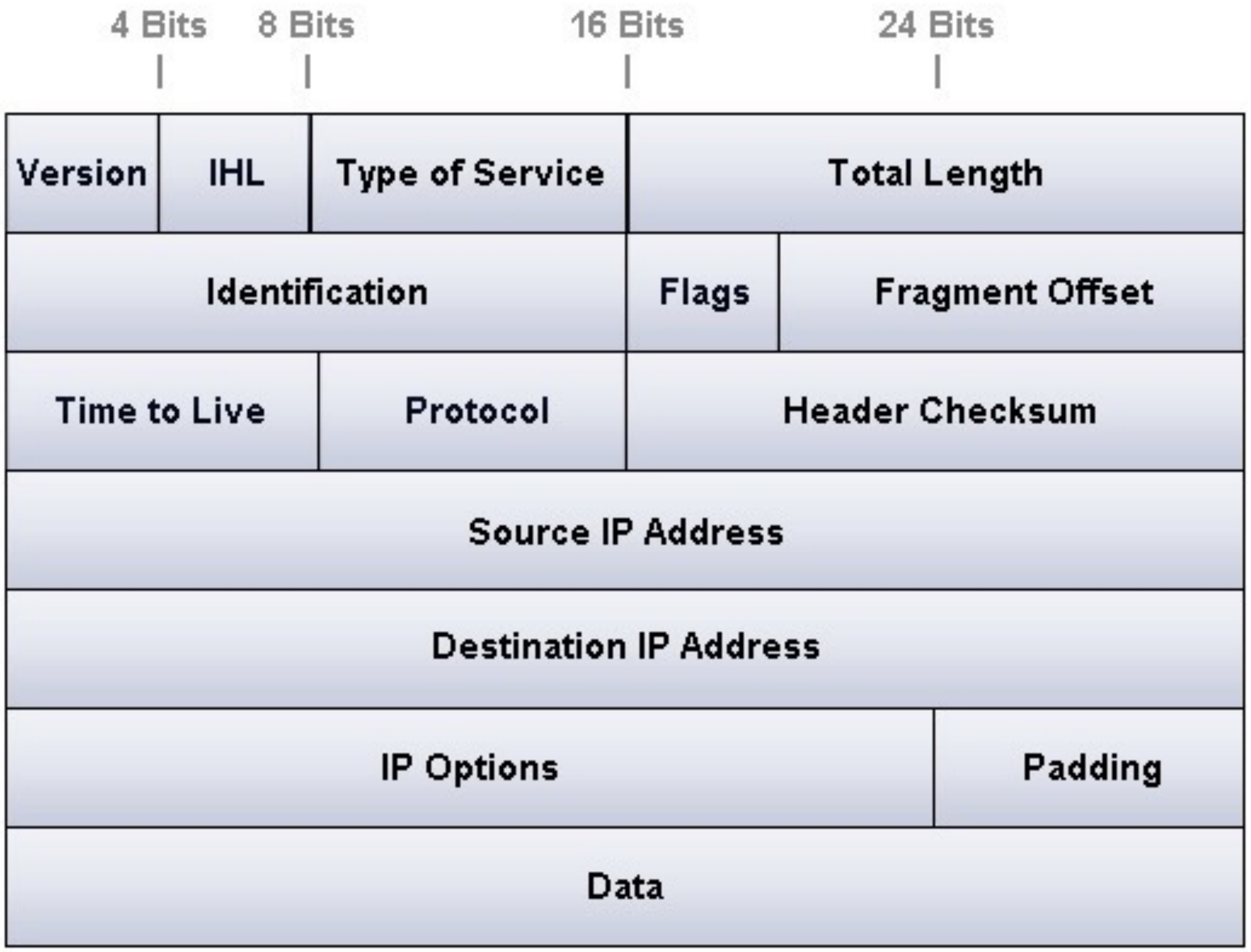

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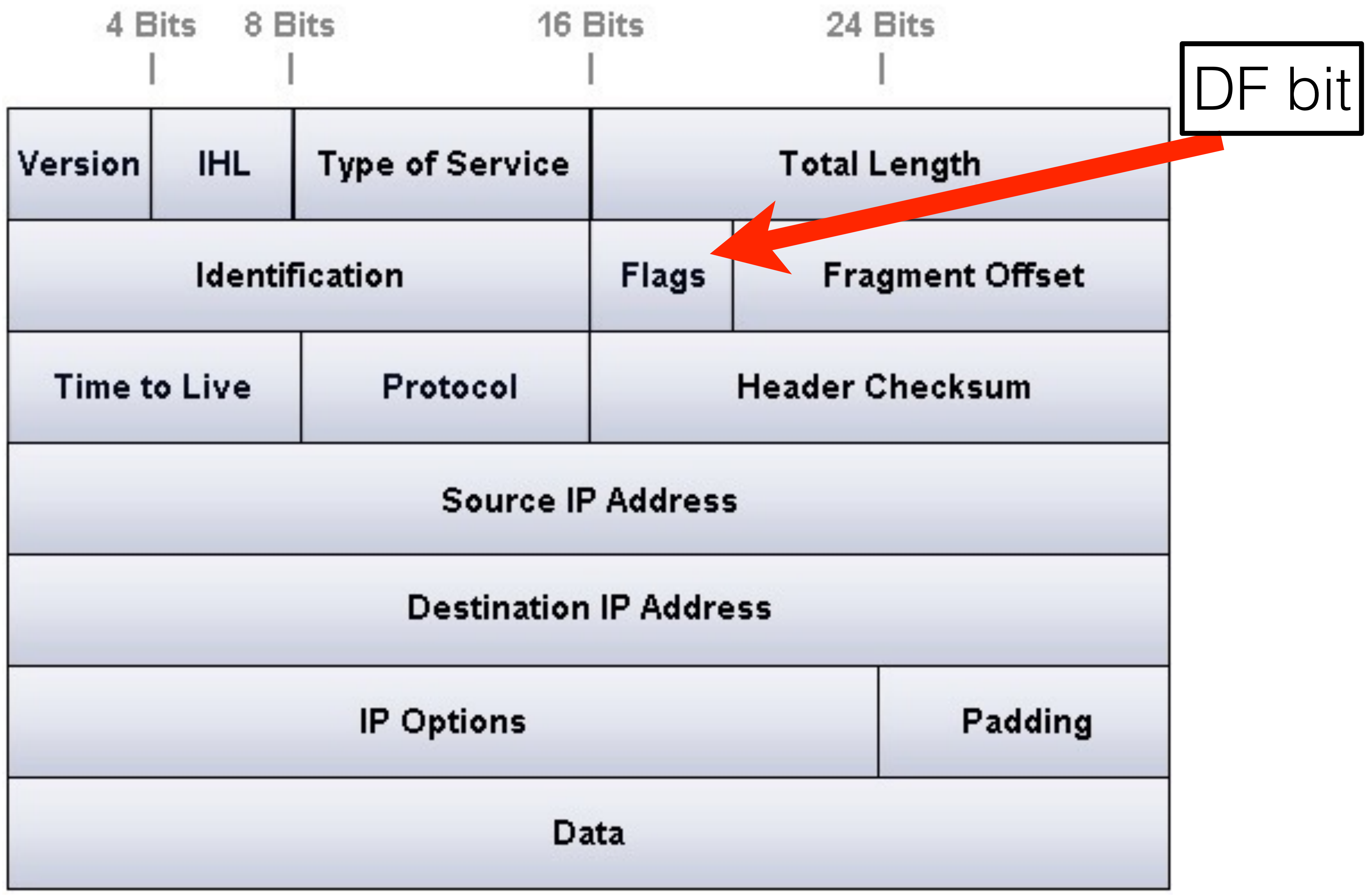

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traceroute to www.icir.org (192.150.187.12), 64 hops max, 52 byte packets
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 3  69.222.35.254  10.028 ms
 4  12.81.252.194  19.145 ms
 5  12.122.132.197  23.057 ms
 6  * * *
 7  * * *
 8  * * *
 9  4.15.122.46  164.480 ms
10  137.164.46.144  177.389 ms
11  137.164.50.31  164.832 ms
12  128.32.0.37  172.196 ms
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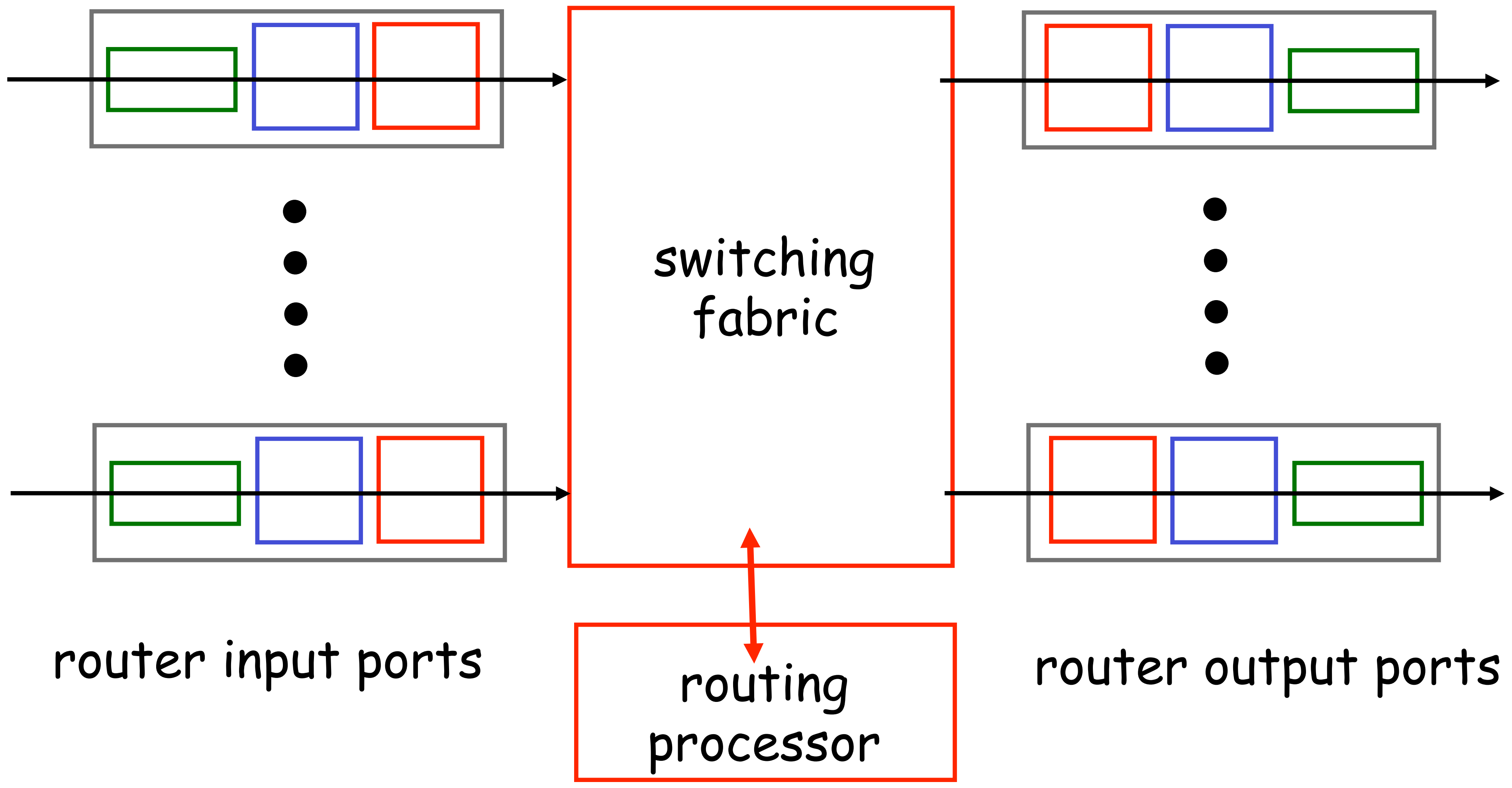
- How does this work?

Router … Revisited



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- Probe segment eventually arrives at destination host
  - destination returns ICMP "port unreachable" packet (type 3, code 3)
  - when source gets this ICMP, stops