# IPv4 Addressing and IPv6

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# Outline

- IPv4 Addressing
  - network addresses
  - classless interdomain routing
  - address allocation and routing
  - longest-prefix matching

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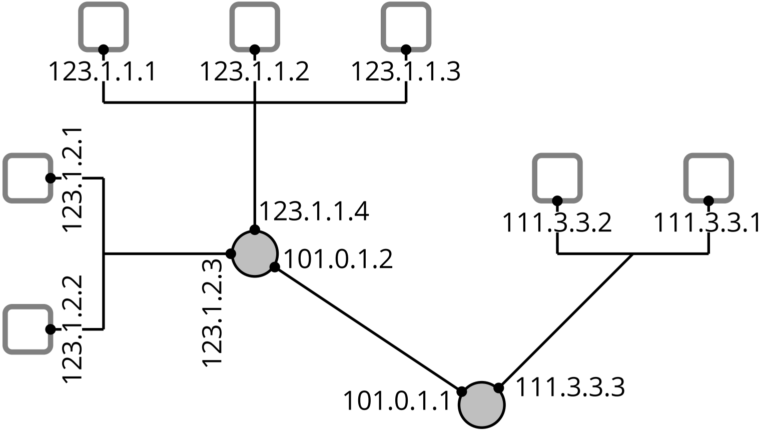
- IPv4 Addressing
    - network addresses
    - classless interdomain routing
    - address allocation and routing
    - longest-prefix matching
- IPv6
    - motivations and design goals
    - datagram format
    - comparison with IPv4
    - extensions

# *Inter*connection of *Net*works



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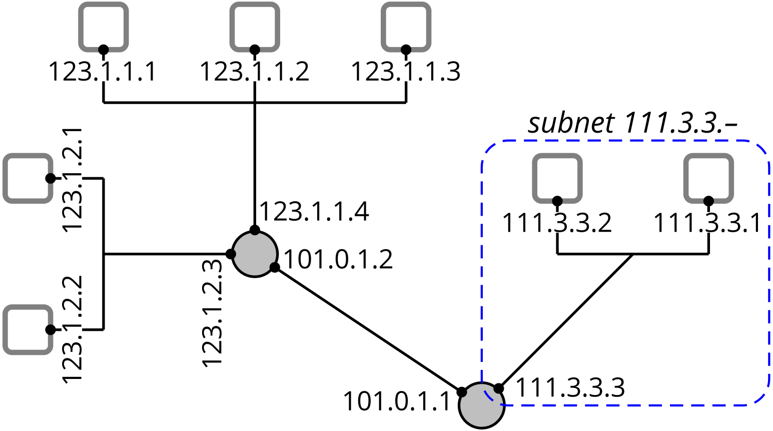

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- The key idea is to assign addresses with the ***same prefix*** to interfaces that are on the ***same subnet***

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- This addressing scheme is not limited to entire bytes. For example, a network address might be 128.138.207.160/27

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- In Java:

```
int match(int address, int network, int mask) {
    return (address & mask) == (network & mask);
}
```

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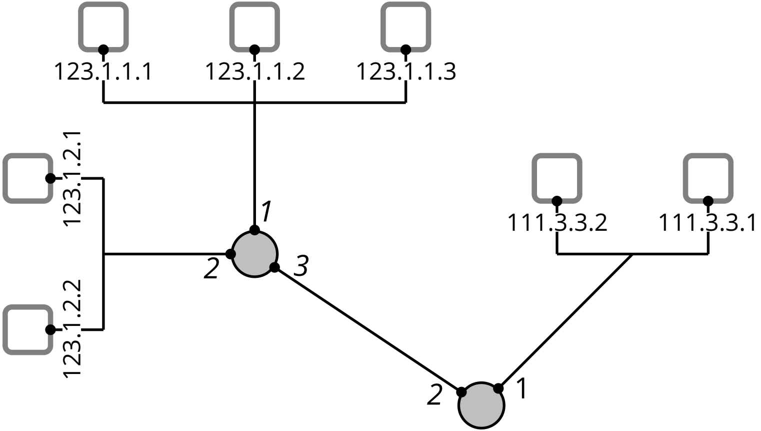
- Why is the idea of the common prefix so important?

- Routers outside a (sub)network can ignore the specifics of each address within the network
  - there might be some 64 thousands hosts in 128.138.0.0/16, but they all appear as one address from the outside

# Example: Good Address Allocation



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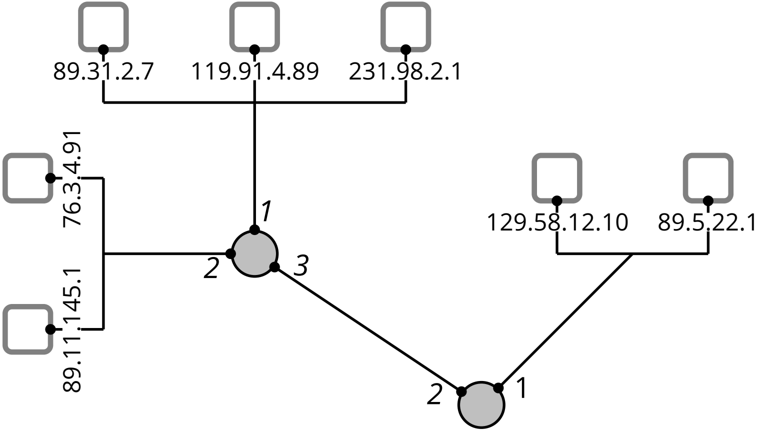

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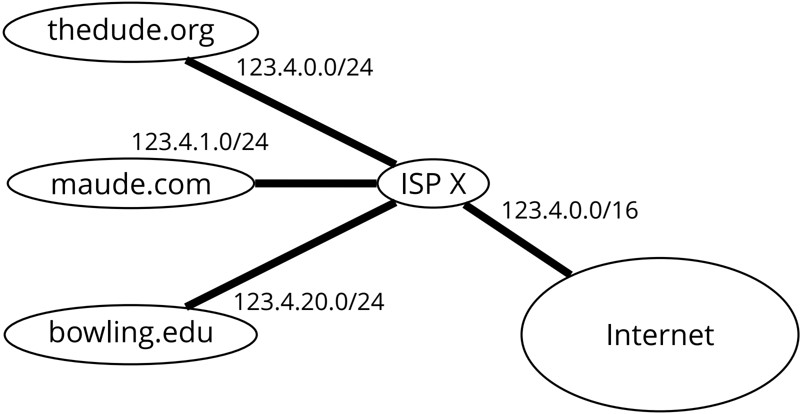

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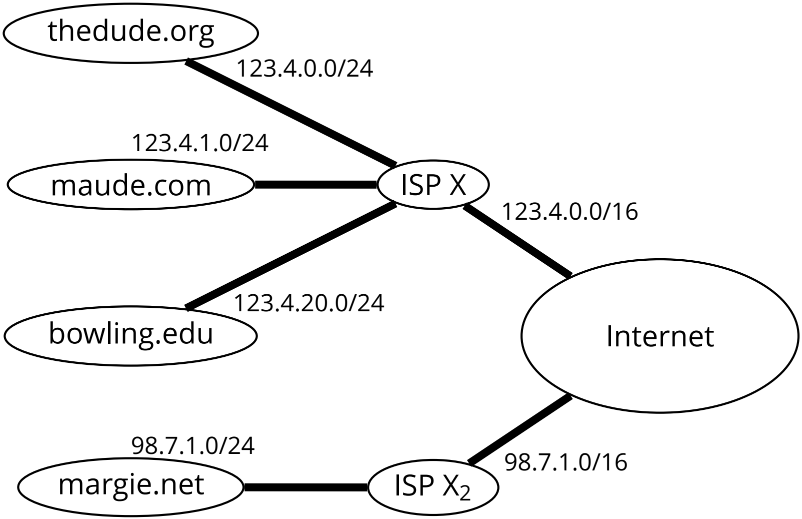

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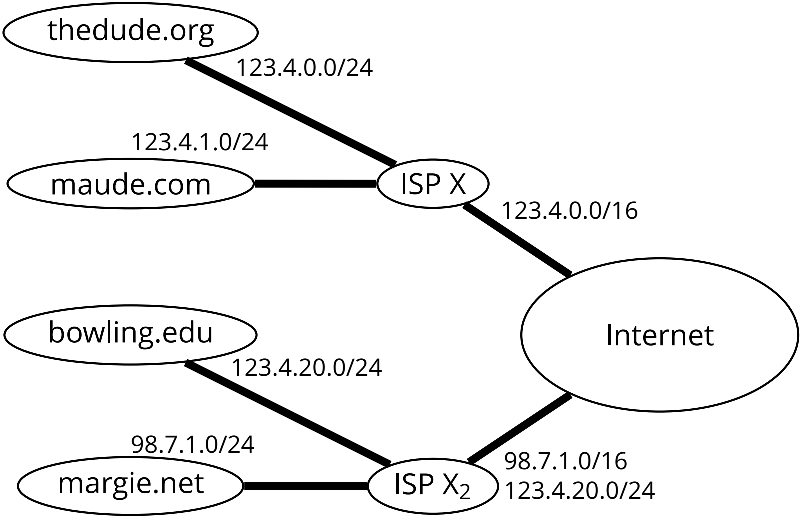

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| 123.4.20.0/24 | 2 |
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  - 200.100.2.1→3
  - 128.138.207.167→4
  - 123.4.20.11→2
  - 123.4.21.10→1

| *forwarding table* | |
|---|---|
| *network* | *port* |
| 123.4.0.0/16 | 1 |
| 98.7.1.0/16 | 2 |
| 123.4.20.0/24 | 2 |
| 128.0.0.0/1 | 3 |
| 66.249.0.0/16 | 3 |
| 0.0.0.0/1 | 4 |
| 128.138.0.0/16 | 4 |

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- Also, IPv6 improves various design aspects of IPv4

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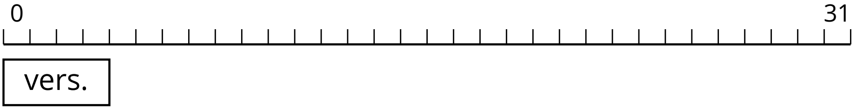

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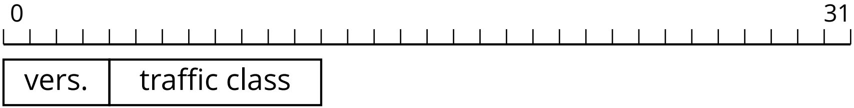

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vers.

traffic class

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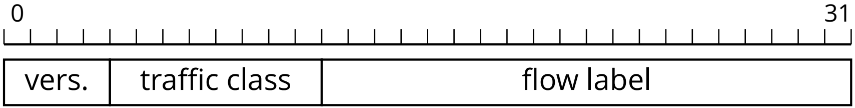

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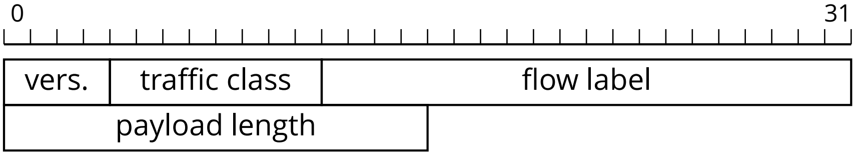

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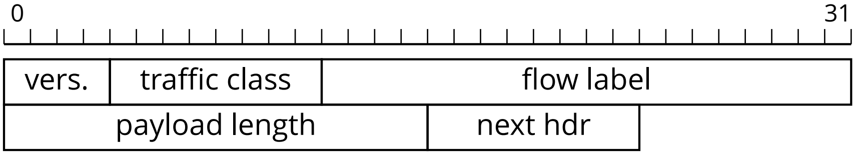

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vers. | traffic class | flow label

payload length | next hdr

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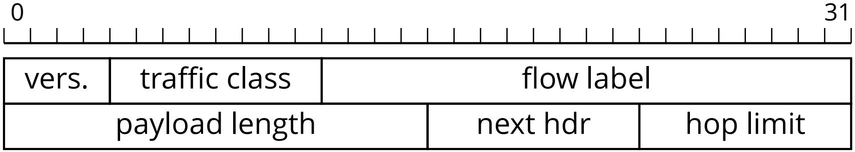

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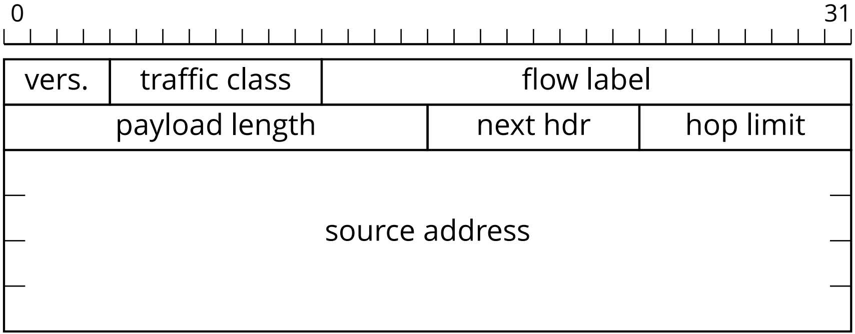

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hop limit

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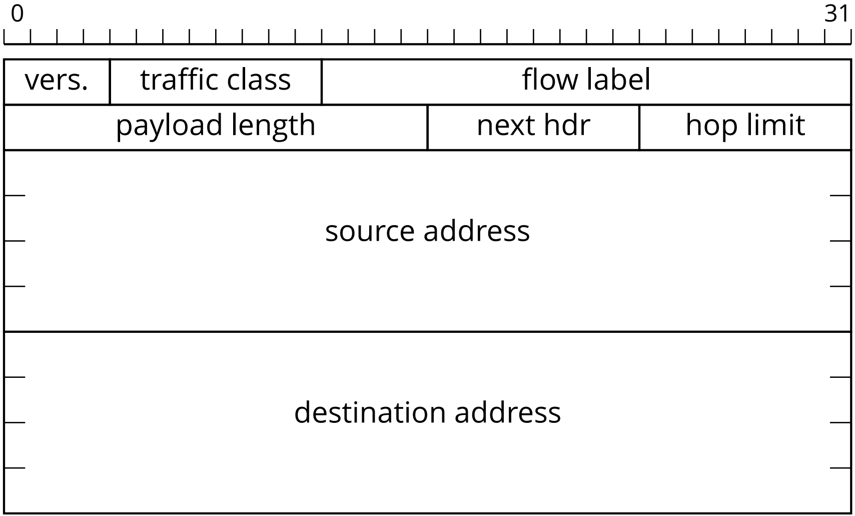

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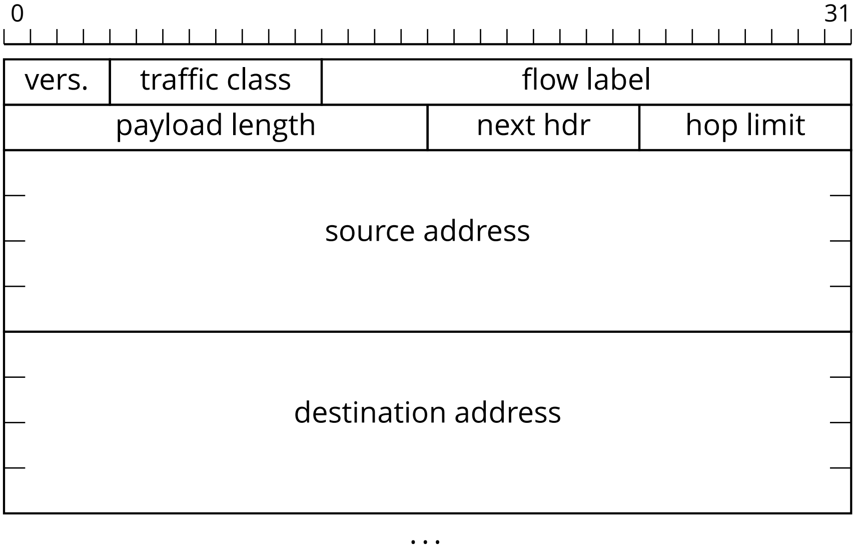

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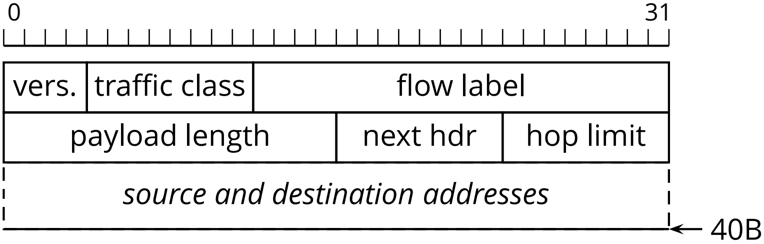

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vers. | traffic class | flow label

payload length | next hdr | hop limit

*source and destination addresses*

40B

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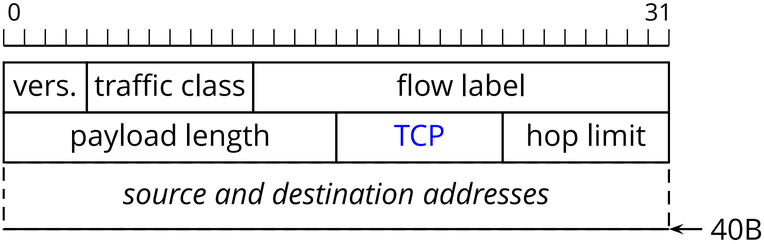

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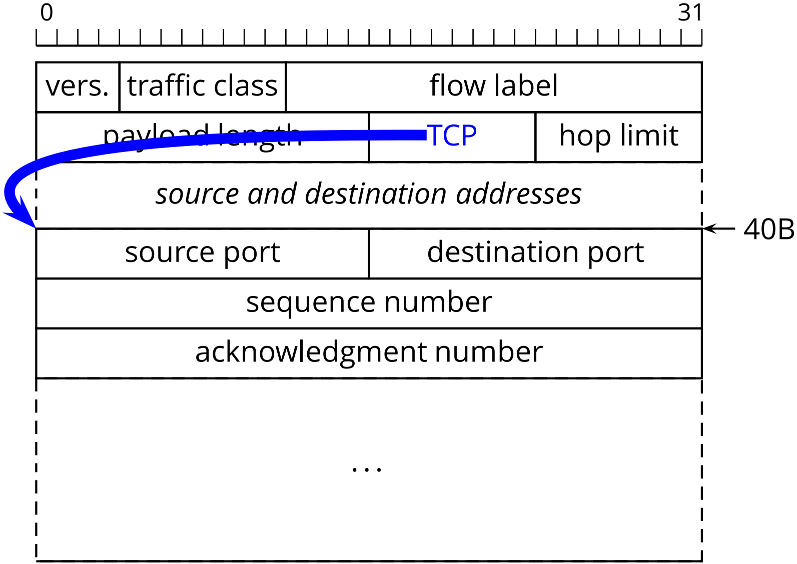

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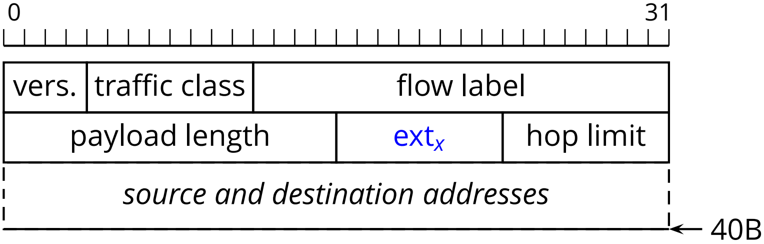

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vers.

traffic class

flow label

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$\text{ext}_x$

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40B

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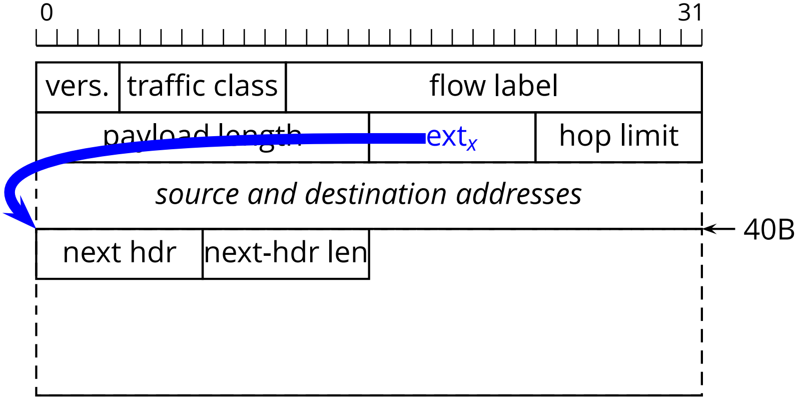

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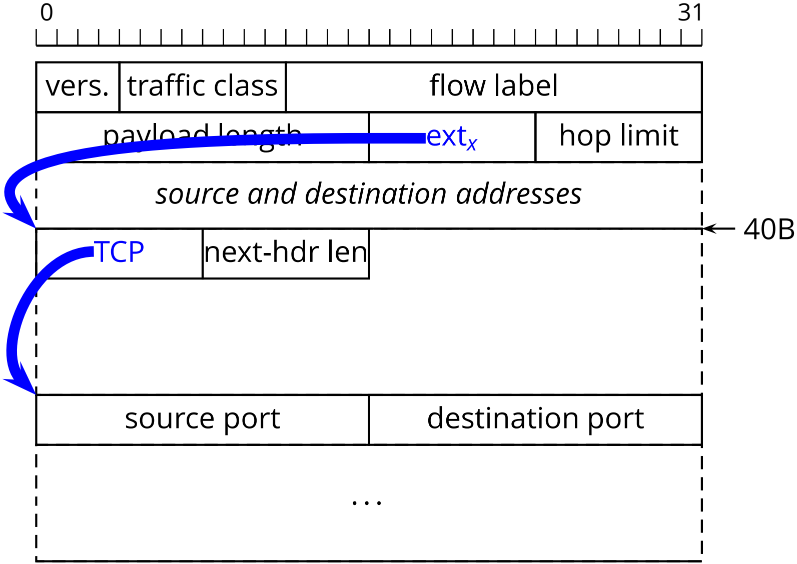
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vers.
traffic class
flow label
payload length
ext$_x$
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40B
TCP
next-hdr len
source port
destination port
. . .