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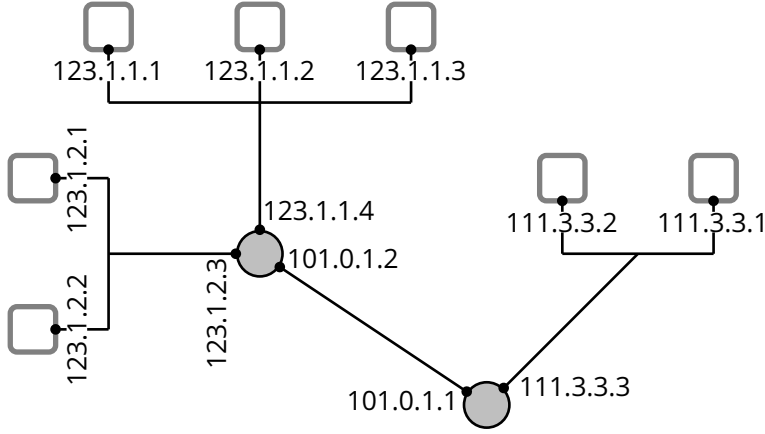
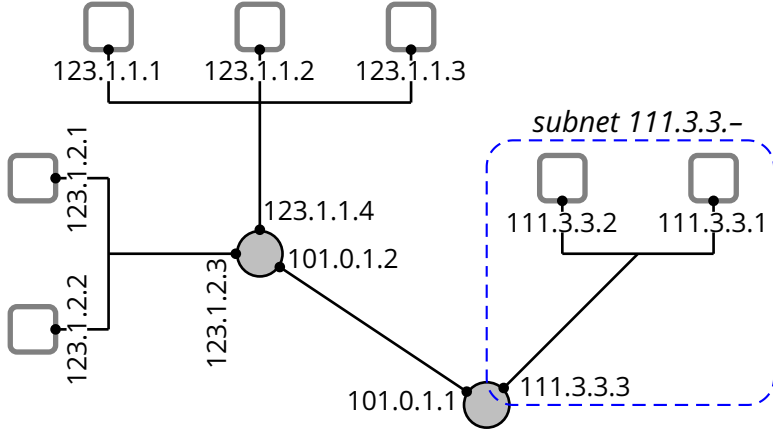
- IPv4 Addressing
  - network addresses
  - classless interdomain routing
  - address allocation and routing
  - longest-prefix matching
- IPv6
  - motivations and design goals
  - datagram format
  - comparison with IPv4
  - extensions


123.1.1.1
123.1.1.2
123.1.1.3
123.1.2.1
123.1.1.4
111.3.3.2
111.3.3.1
101.0.1.2
123.1.2.3
123.1.2.2
111.3.3.3
101.0.1.1


123.1.1.1
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123.1.1.3
subnet 111.3.3.–
123.1.2.1
123.1.1.4
111.3.3.2
111.3.3.1
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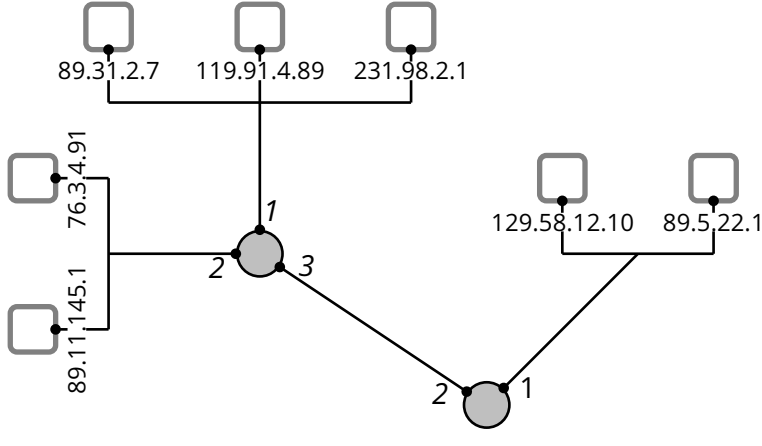
- The key idea is to assign addresses with the ***same prefix*** to interfaces that are on the ***same subnet***
- Why is the idea of the common prefix so important?

  Because it compresses the forwarding tables by an exponential factor!
  - there might be some 64 thousands hosts in 128.138.–.–
    but they all appear as ***one table entry*** from the outside

Example: Bad Address Allocation



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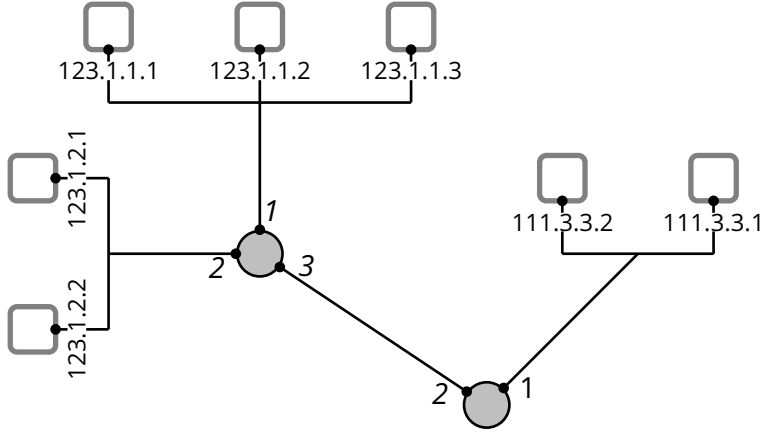

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  - 123.1.1.0/24 means that all the addresses share the same leftmost 24 bits with address 123.1.1.0
- This addressing scheme is not limited to entire bytes. For example, a network address might be 128.138.207.160/27
  - as opposed to the original scheme which divided the address space in “classes”

address class	*prefix length*
A	8
B	16
C	24

Examples

- Network address 128.138.207.160/27

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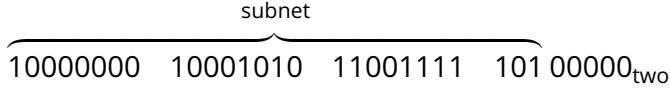

- Network address 128.138.207.160/27

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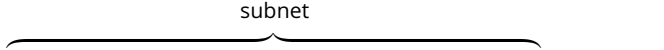

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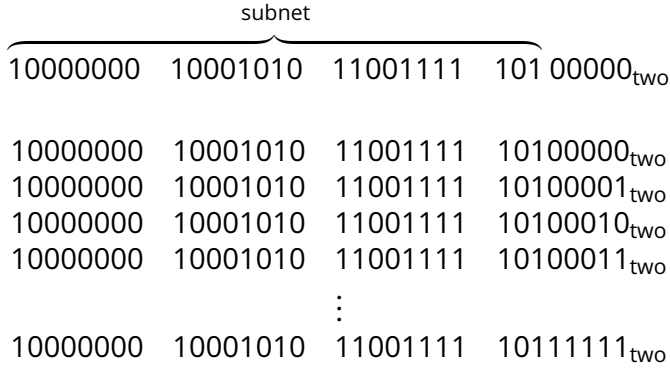

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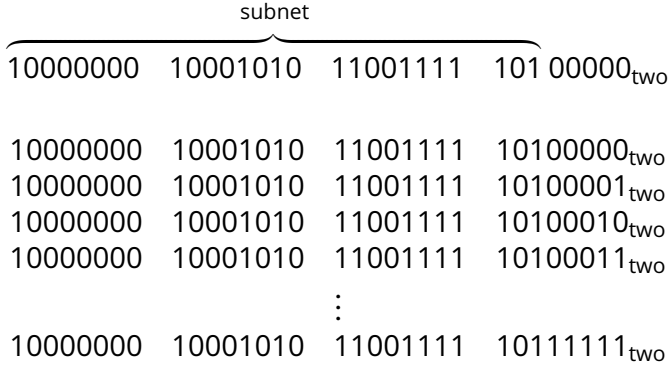

128.138.207.160–128.138.207.191

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  - 192.168.0.3/24=?

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- In Java:

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

Allocation of Address Blocks

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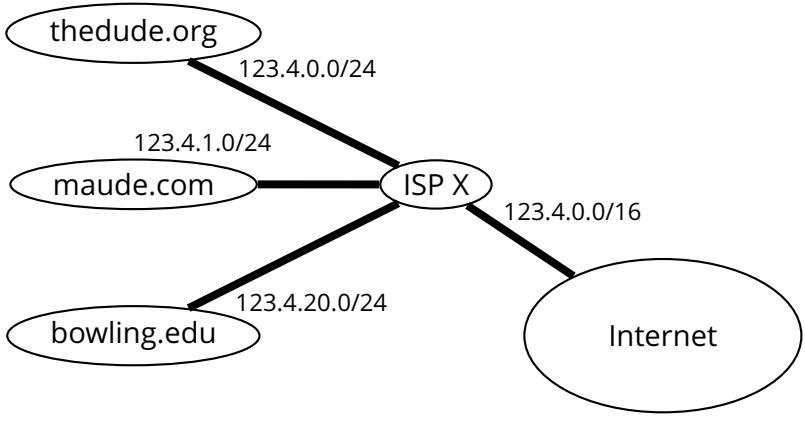

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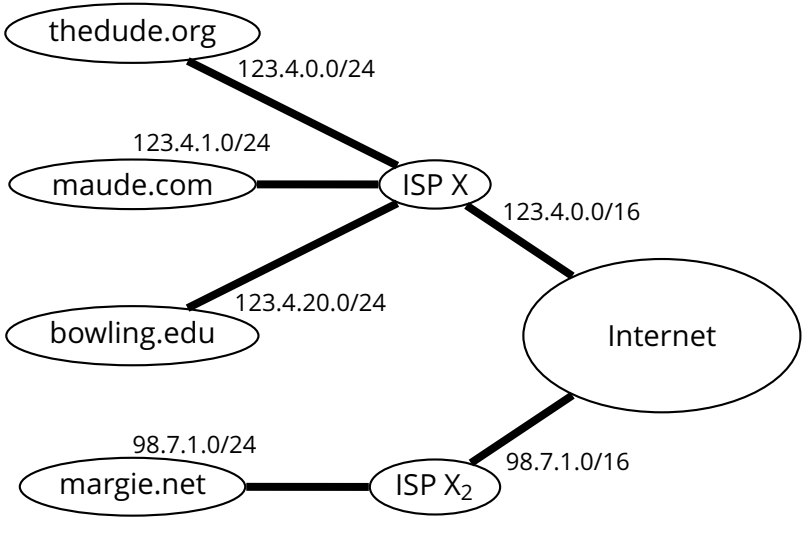

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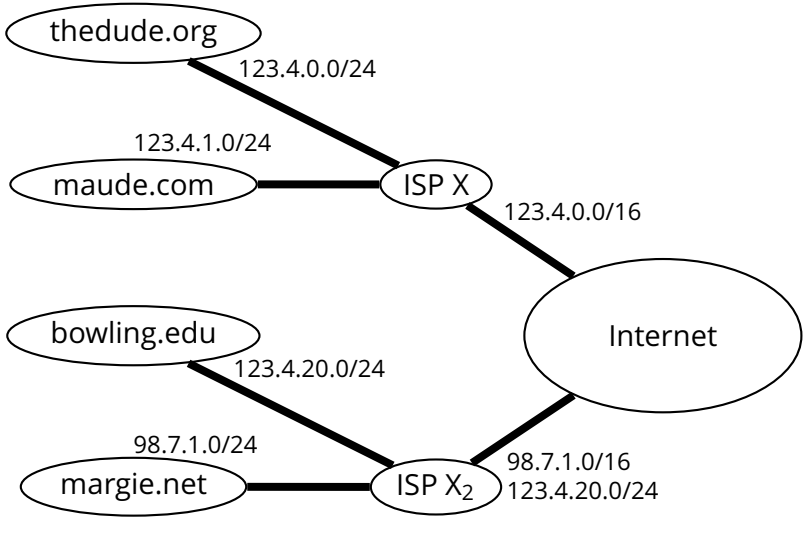

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  E.g.,

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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  - 123.4.1.69→?

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  - 68.142.226.44→?

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  - 128.138.207.167→?

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  - 123.4.21.10→?

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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

IPv6 Datagram Format

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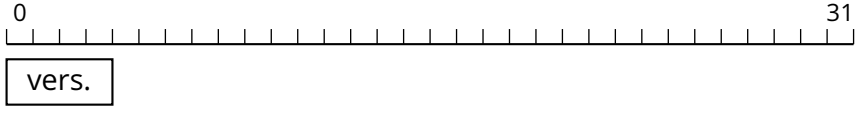

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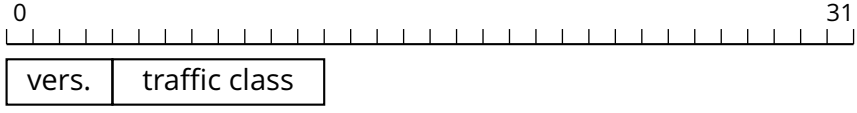

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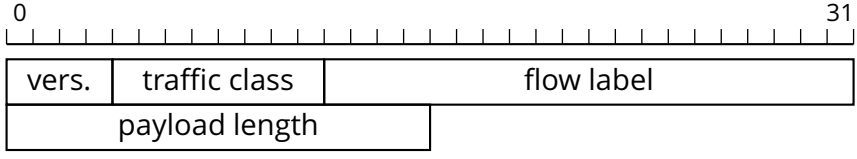

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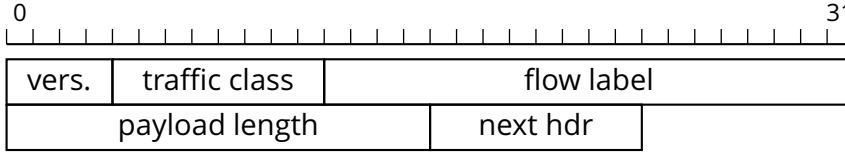

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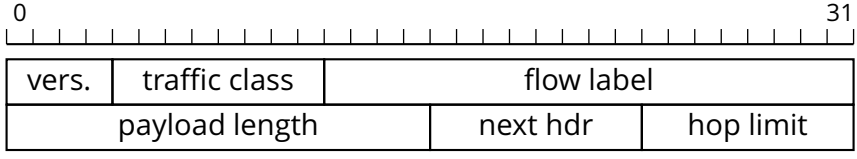

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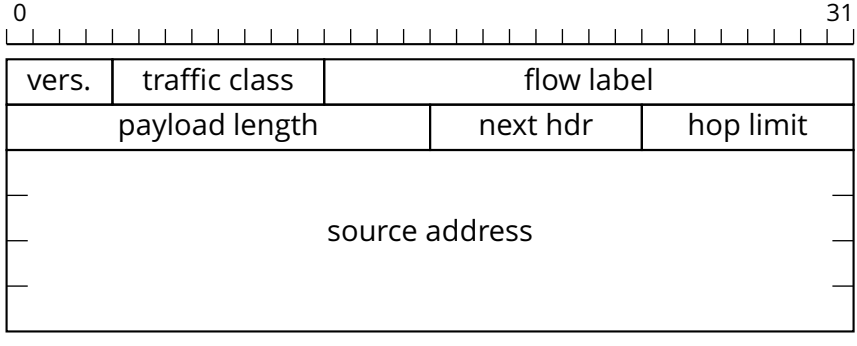

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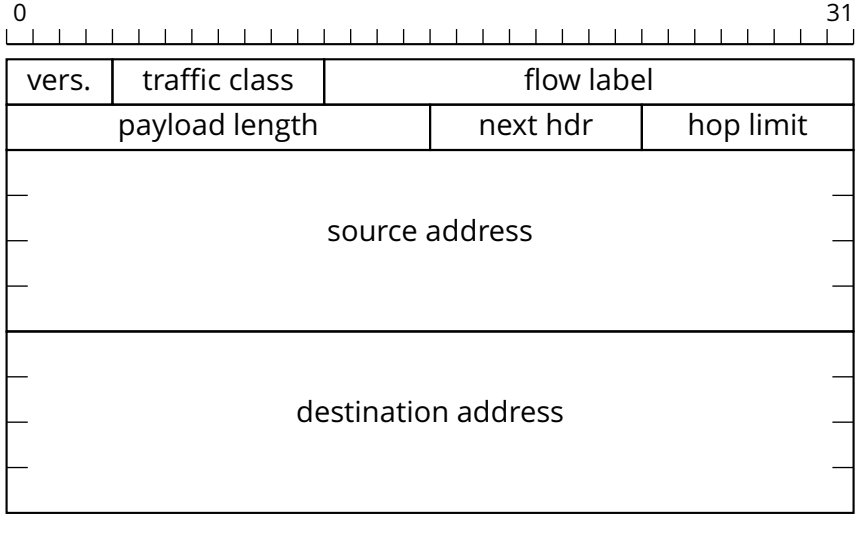

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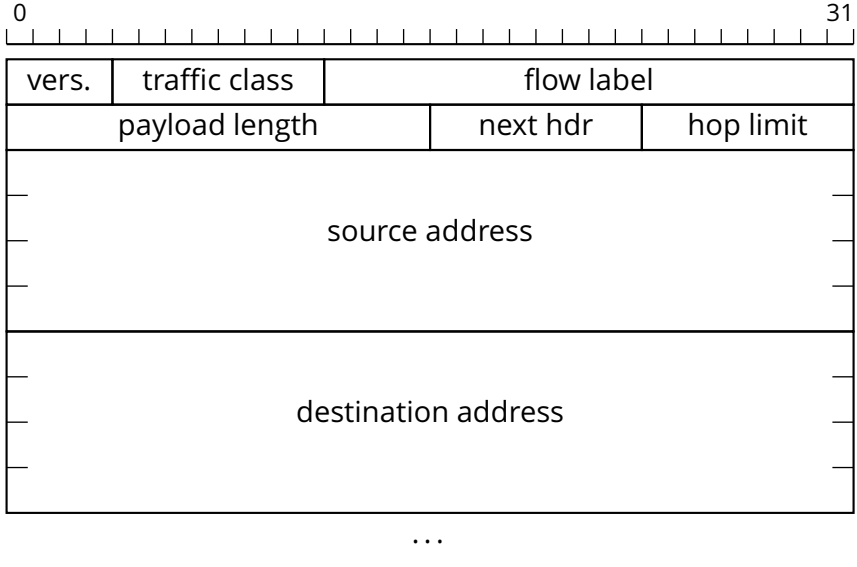

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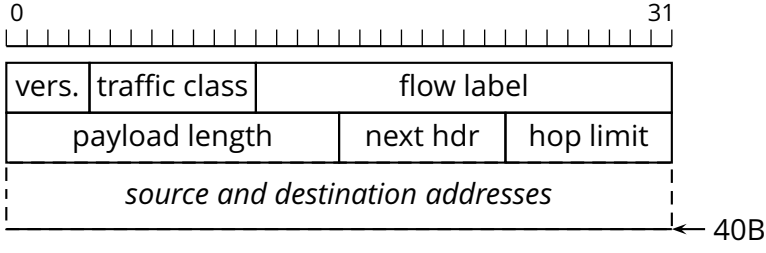

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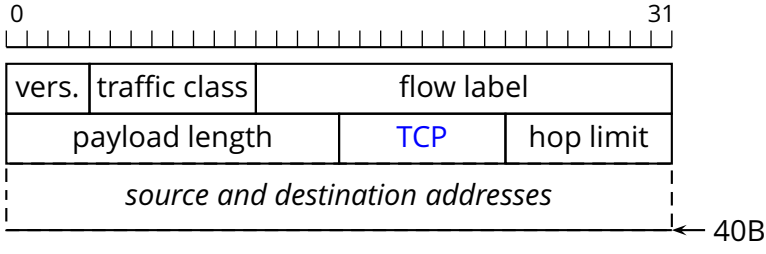

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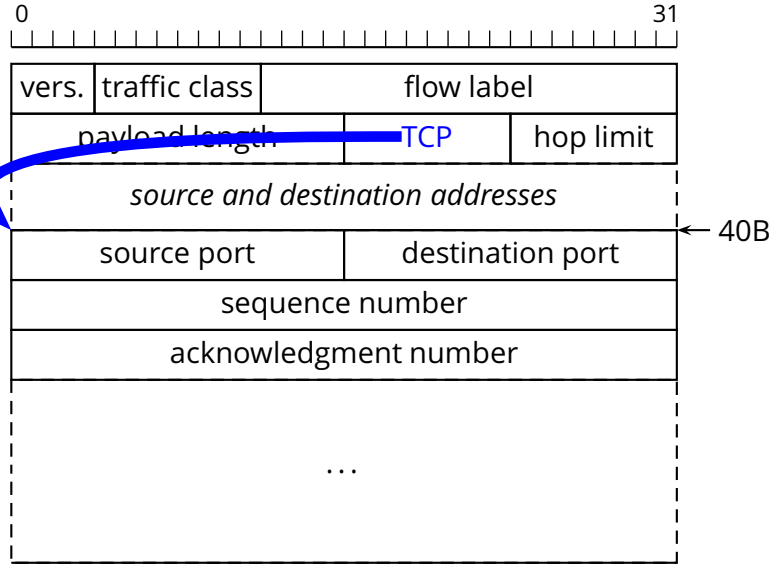

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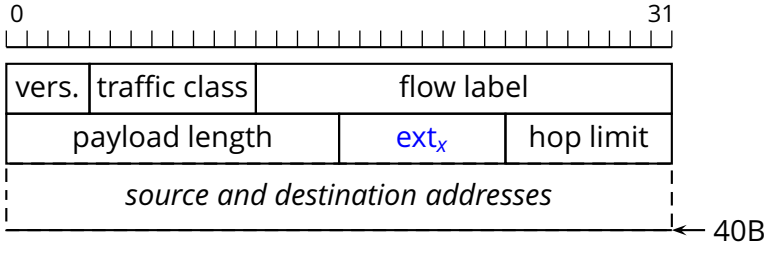

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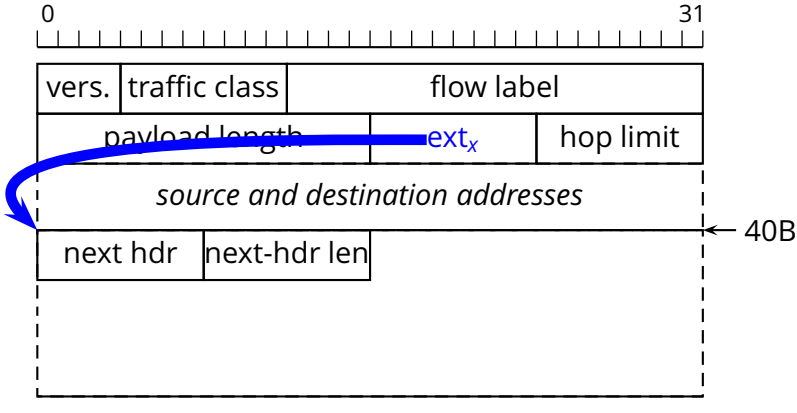

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