

Network Layer : Logical Addressing (IPv6)

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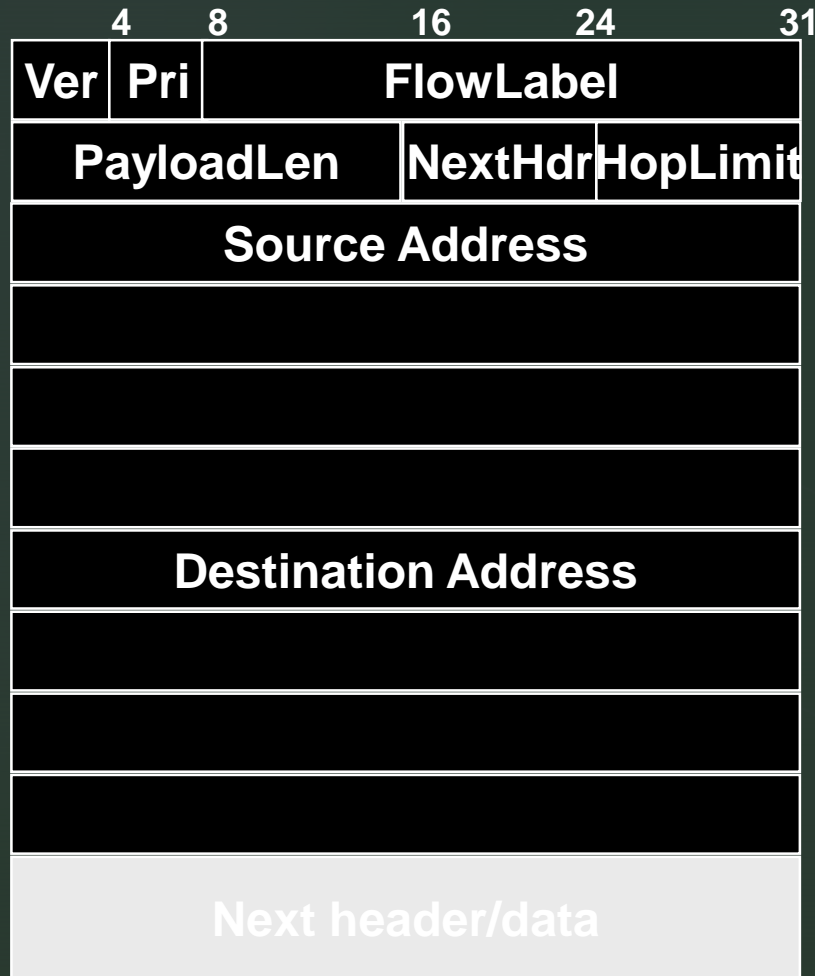
IPv6

- Also called Next Generation IP and IPng
- Extends address space from 32 bits to 128 bits
- Hierarchical address space:



- neat feature
 - embedded InterfaceID allows host to assign itself an IP address!

IPv6 packet format

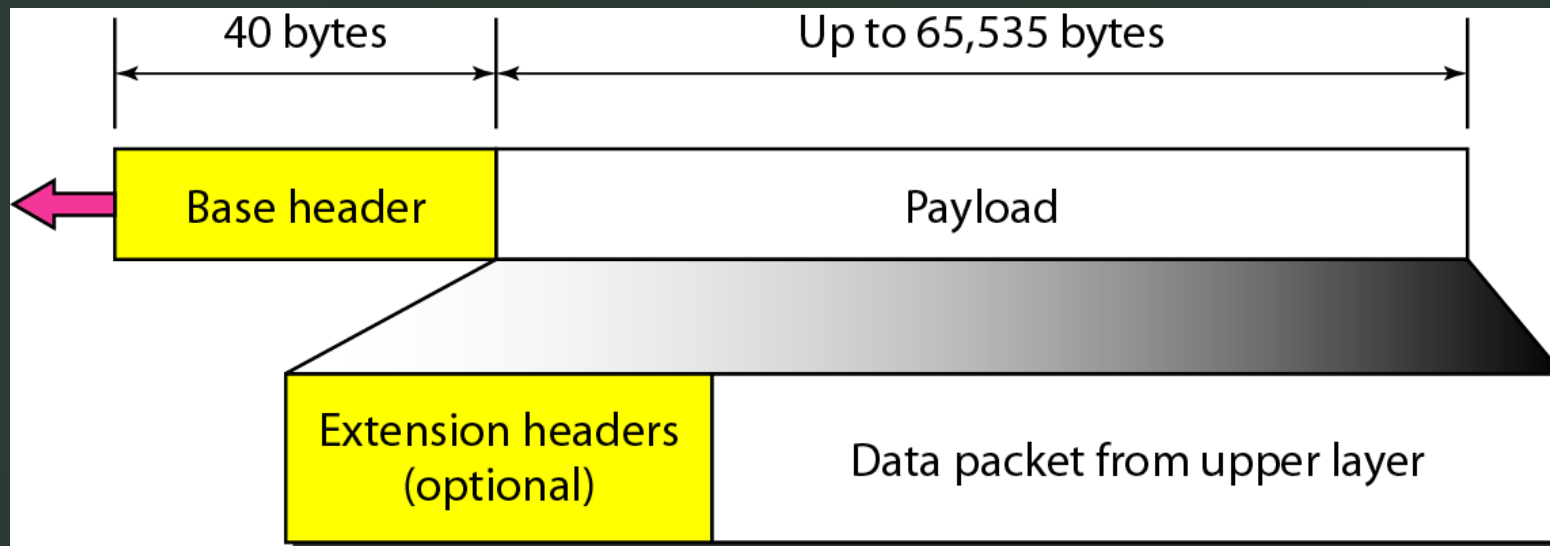


Ver IP version (6)
Pri/Flowlabel Quality of Service
PayloadLen packet len (max 64KB)
NextHdr optional/encapsulated header type
HopLimit same as TTL in IPv4
Source Address 128-bit source addr
Dest Address 128-bit dest addr

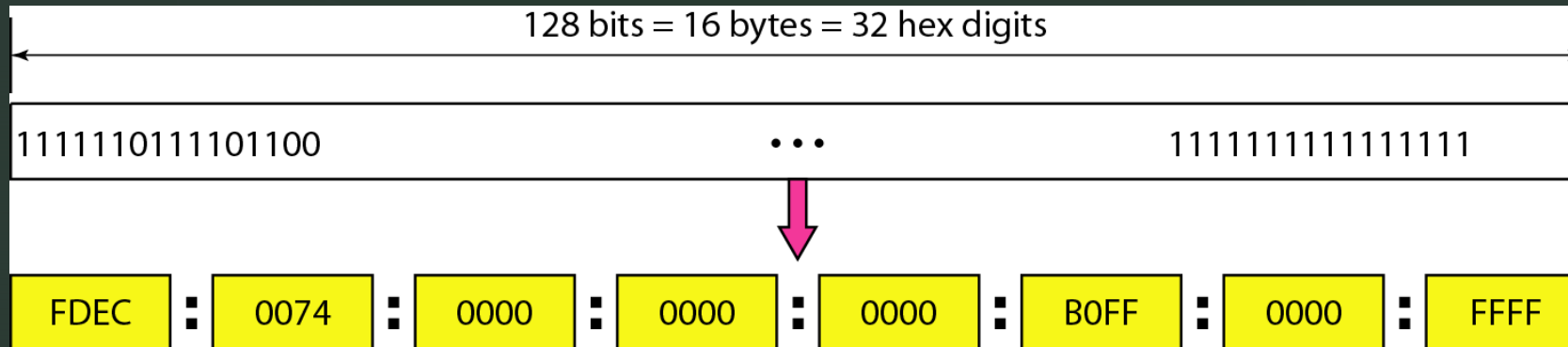
Optional header examples:

fragmentation (44)
 authentication (51)
 TCP (6)

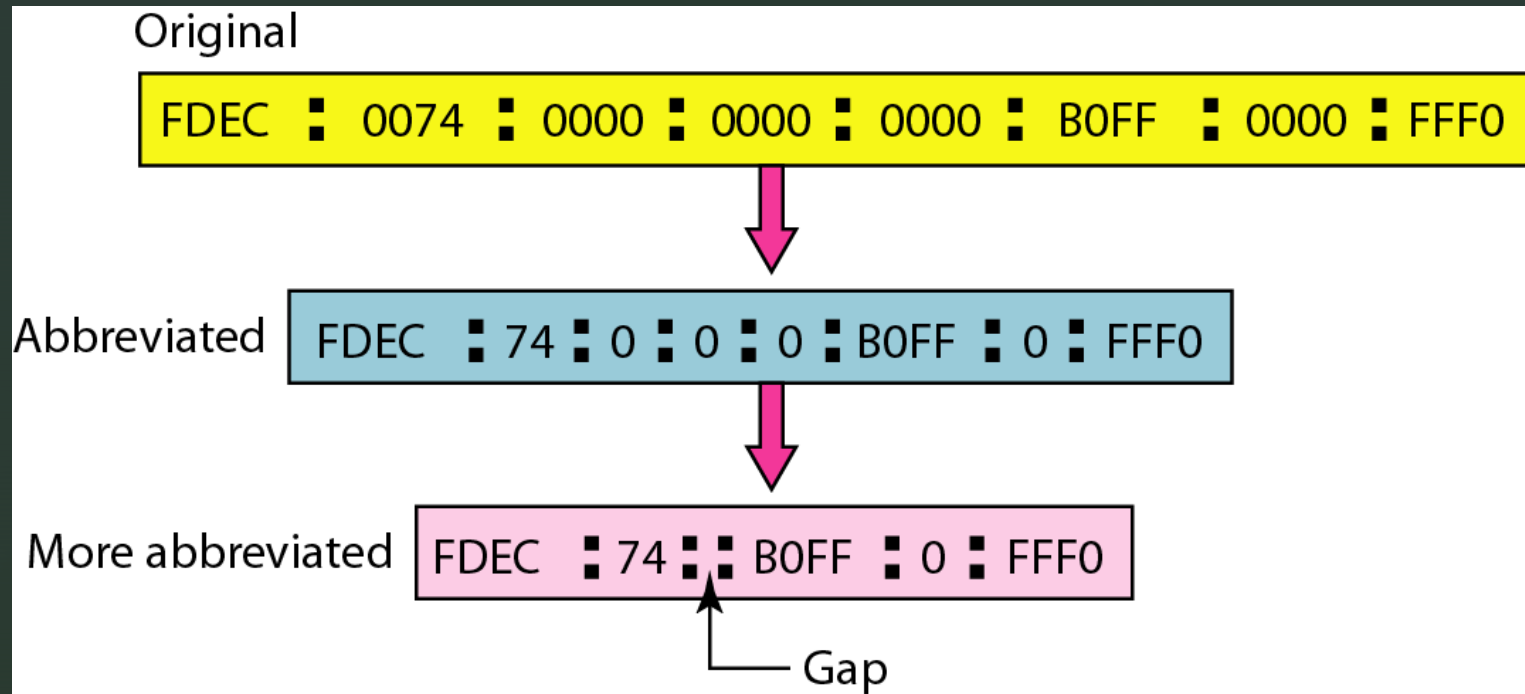
IPv6 datagram header and payload



IPv6 address in binary and hexadecimal colon notation



Abbreviated IPv6 addresses



Example

Expand the address $0:15::1:12:1213$ to its original.

Solution

We first need to align the left side of the double colon to the left of the original pattern and the right side of the double colon to the right of the original pattern to find how many 0s we need to replace the double colon

```
XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX
0: 15:           : 1: 12:1213
```

This means that the original address is.

```
0000:0015:0000:0000:0000:0001:0012:1213
```

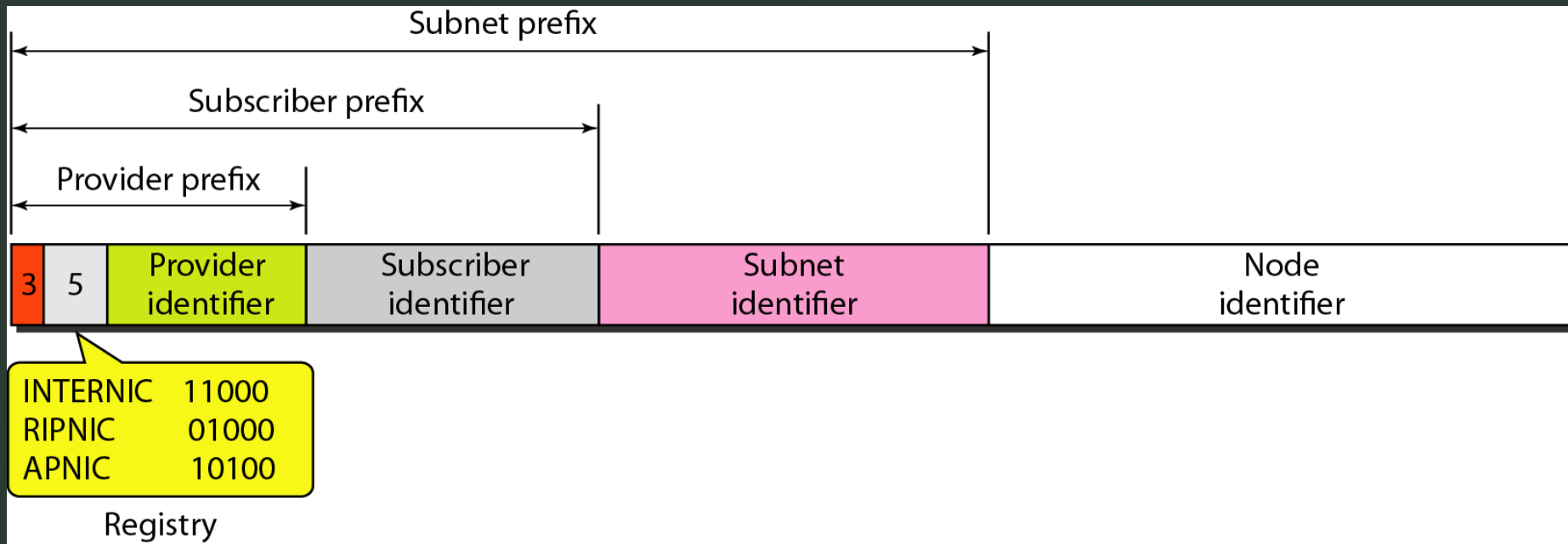
Type prefixes for IPv6 addresses

Type Prefix	Type	Fraction
0000 0000	Reserved	1/256
0000 0001	Unassigned	1/256
0000 001	ISO network addresses	1/128
0000 010	IPX (Novell) network addresses	1/128
0000 011	Unassigned	1/128
0000 1	Unassigned	1/32
0001	Reserved	1/16
001	Reserved	1/8
010	Provider-based unicast addresses	1/8

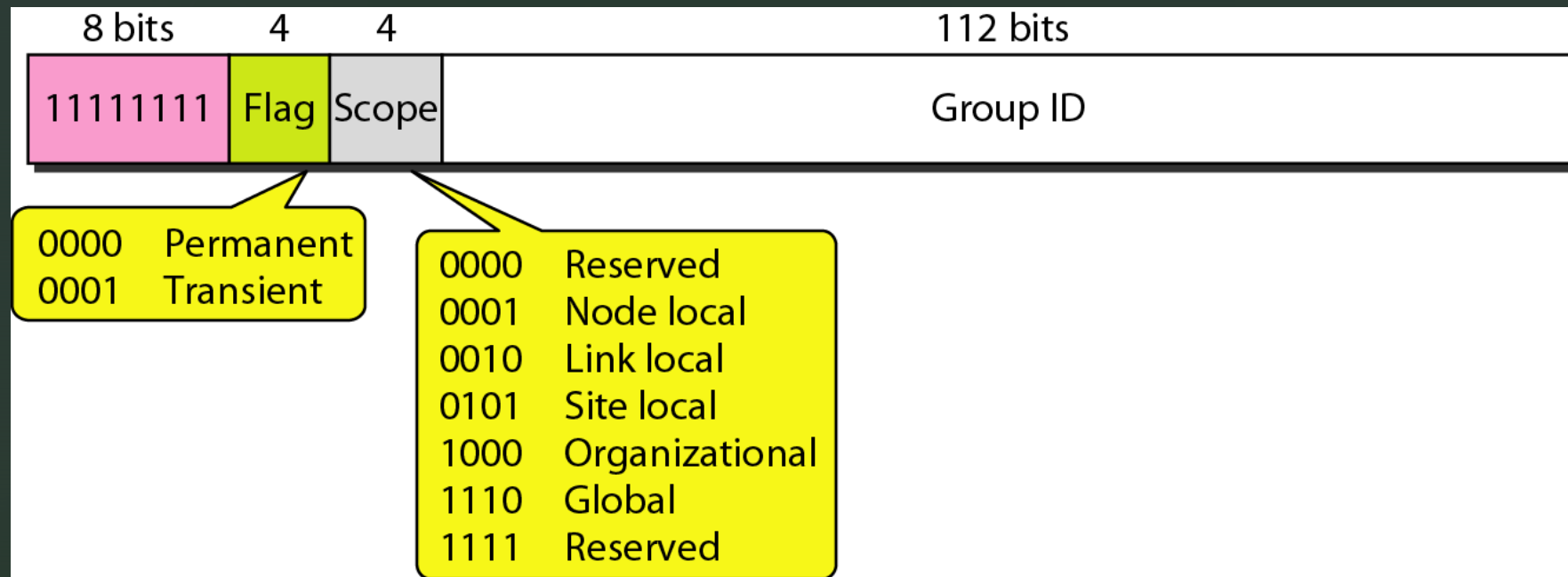
Type prefixes for IPv6 addresses (continued)

<i>Type Prefix</i>	<i>Type</i>	<i>Fraction</i>
011	Unassigned	1/8
100	Geographic-based unicast addresses	1/8
101	Unassigned	1/8
110	Unassigned	1/8
1110	Unassigned	1/16
1111 0	Unassigned	1/32
1111 10	Unassigned	1/64
1111 110	Unassigned	1/128
1111 1110 0	Unassigned	1/512
1111 1110 10	Link local addresses	1/1024
1111 1110 11	Site local addresses	1/1024
1111 1111	Multicast addresses	1/256

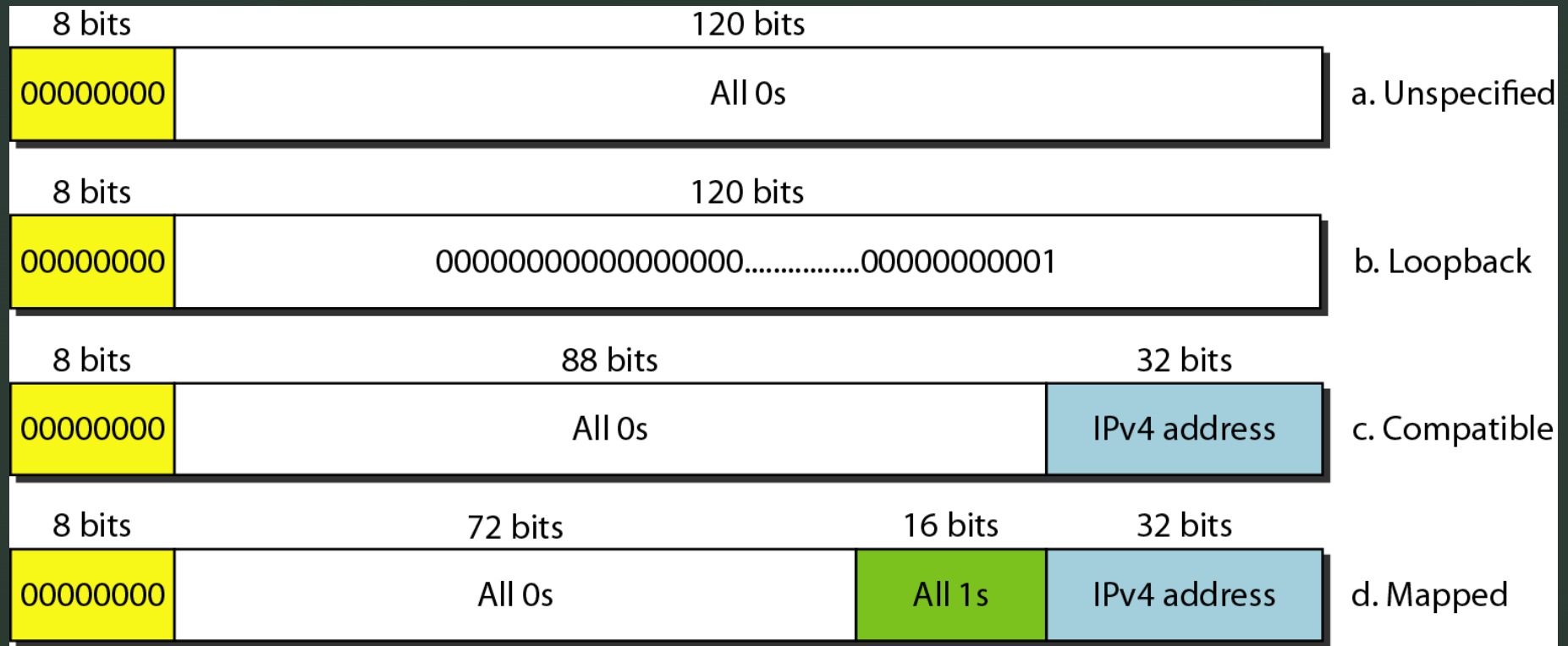
Prefixes for provider-based unicast address



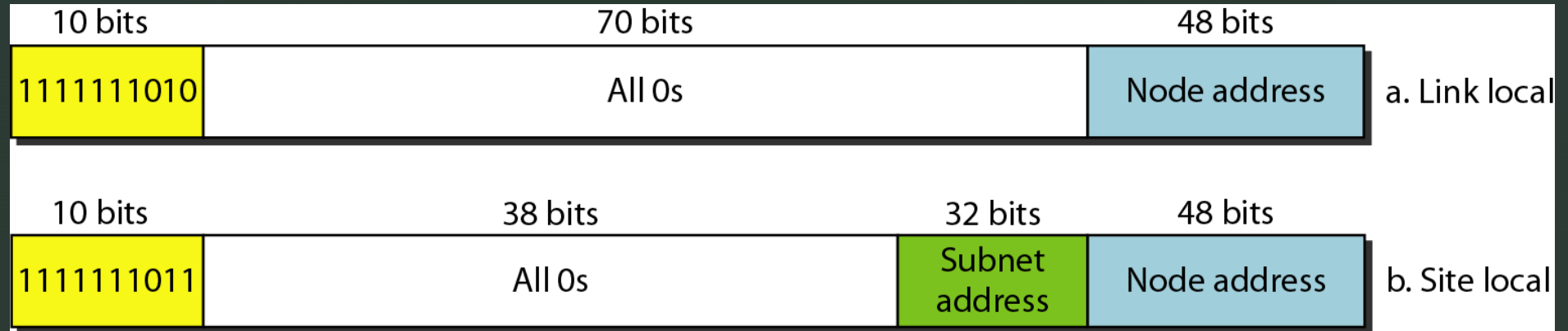
Multicast address in IPv6



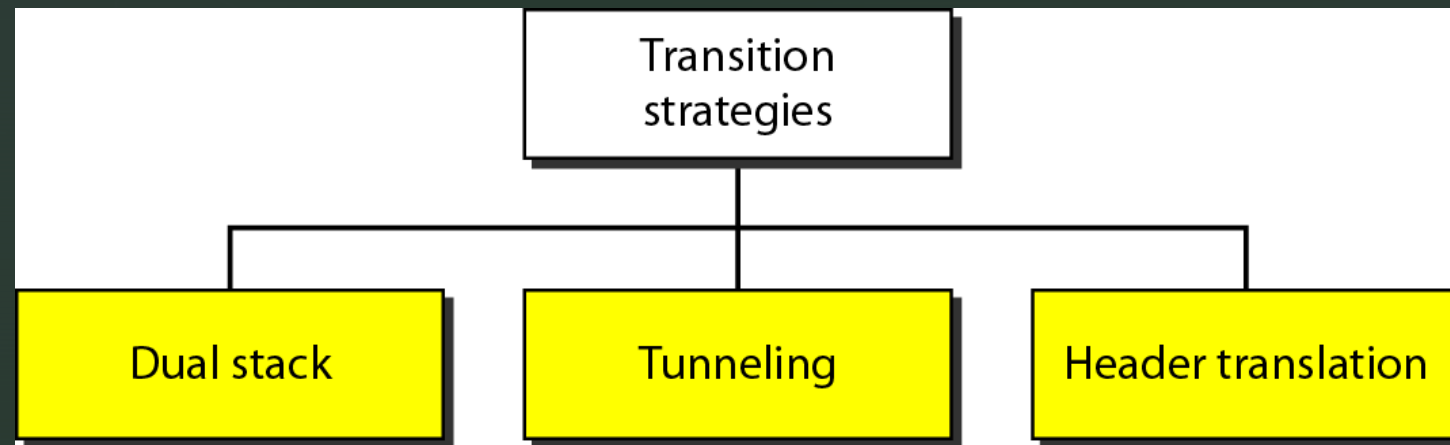
Reserved addresses in IPv6



Local addresses in IPv6



Three transition strategies

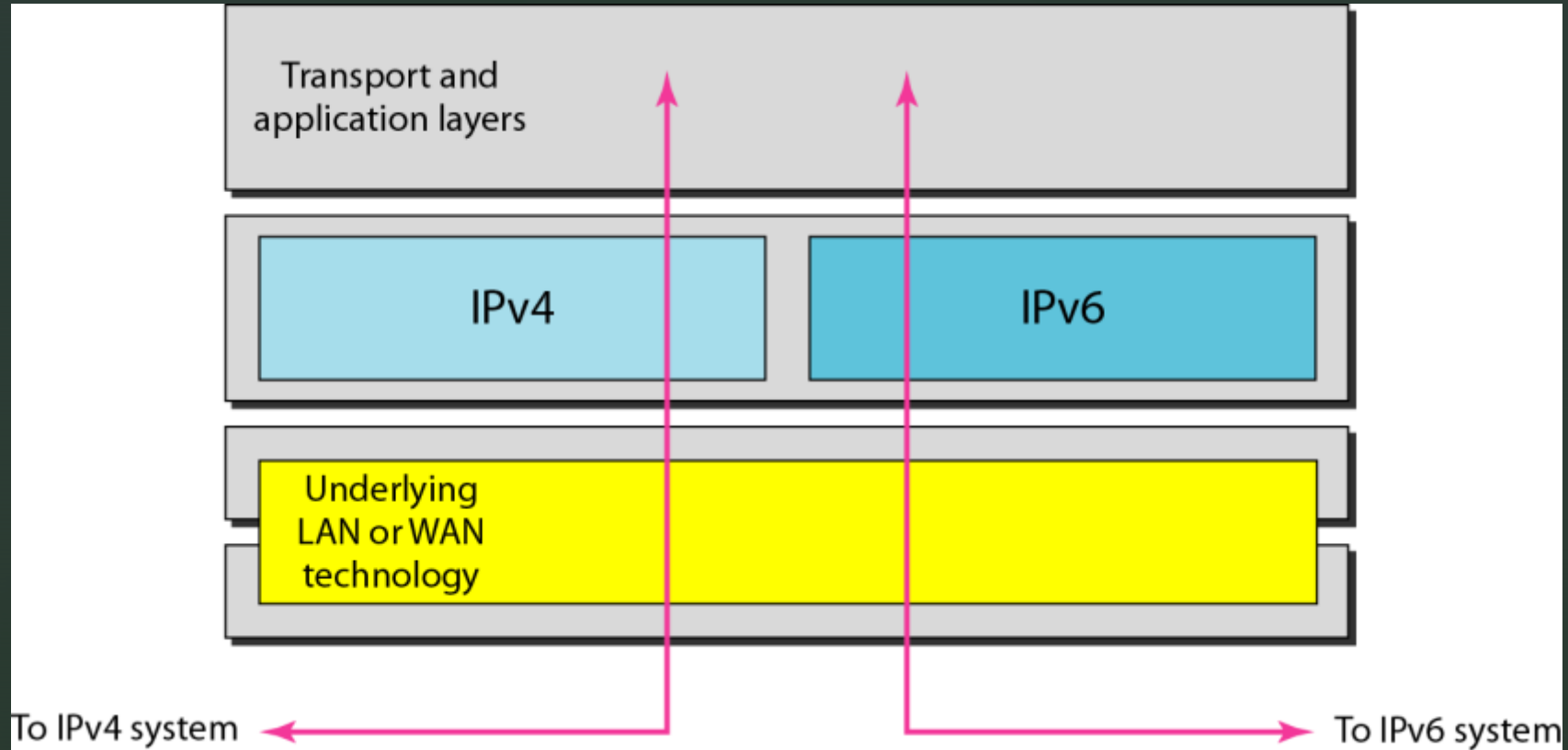


Converting from IPv4 to IPv6

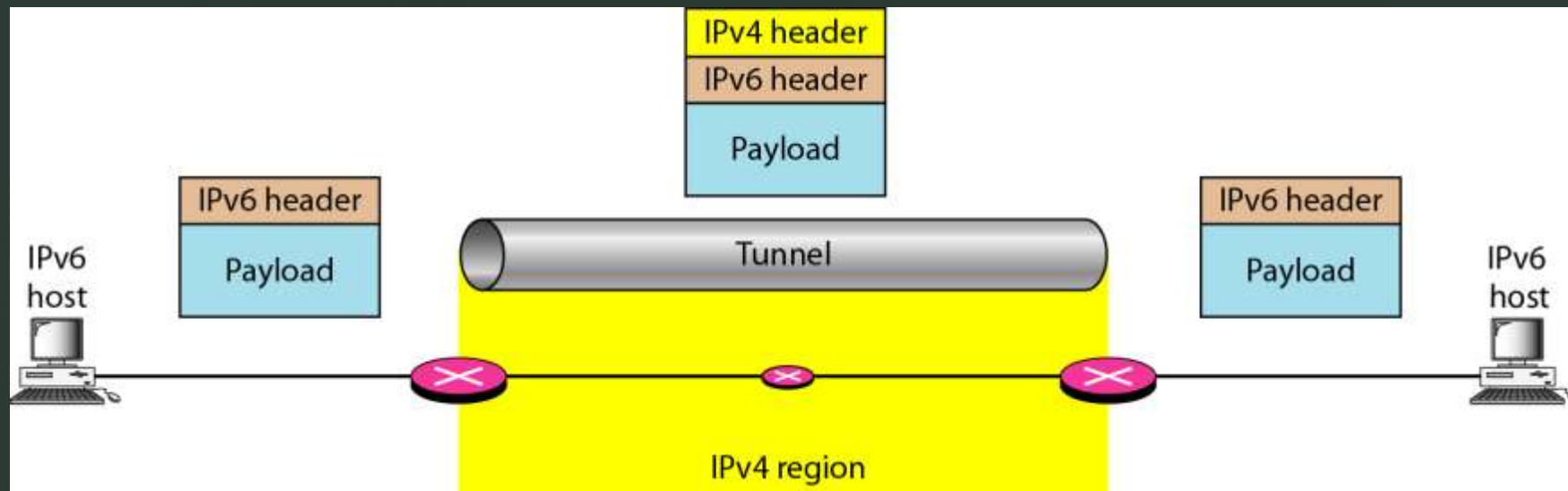
- Not possible to have a “flag day”
- Must upgrade incrementally
 - dual stack operation
 - IPv6 nodes run both IPv4 and IPv6 protocol stacks
 - IP tunneling
 - IP packet sent as payload of another IP packet
 - networking community’s version of indirection!



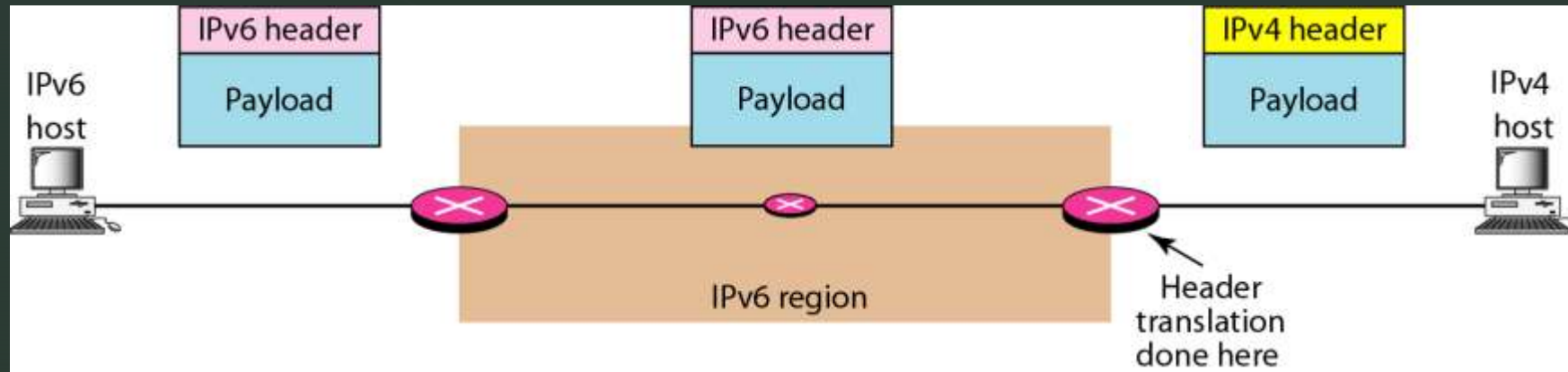
Dual stack



Tunneling strategy



Header translation strategy



Header translation

Header Translation Procedure

1. The IPv6 mapped address is changed to an IPv4 address by extracting the rightmost 32 bits.
2. The value of the IPv6 priority field is discarded.
3. The type of service field in IPv4 is set to zero.
4. The checksum for IPv4 is calculated and inserted in the corresponding field.
5. The IPv6 flow label is ignored.
6. Compatible extension headers are converted to options and inserted in the IPv4 header.
Some may have to be dropped.
7. The length of IPv4 header is calculated and inserted into the corresponding field.
8. The total length of the IPv4 packet is calculated and inserted in the corresponding field.