Lecture 3b

Mobile IPv6

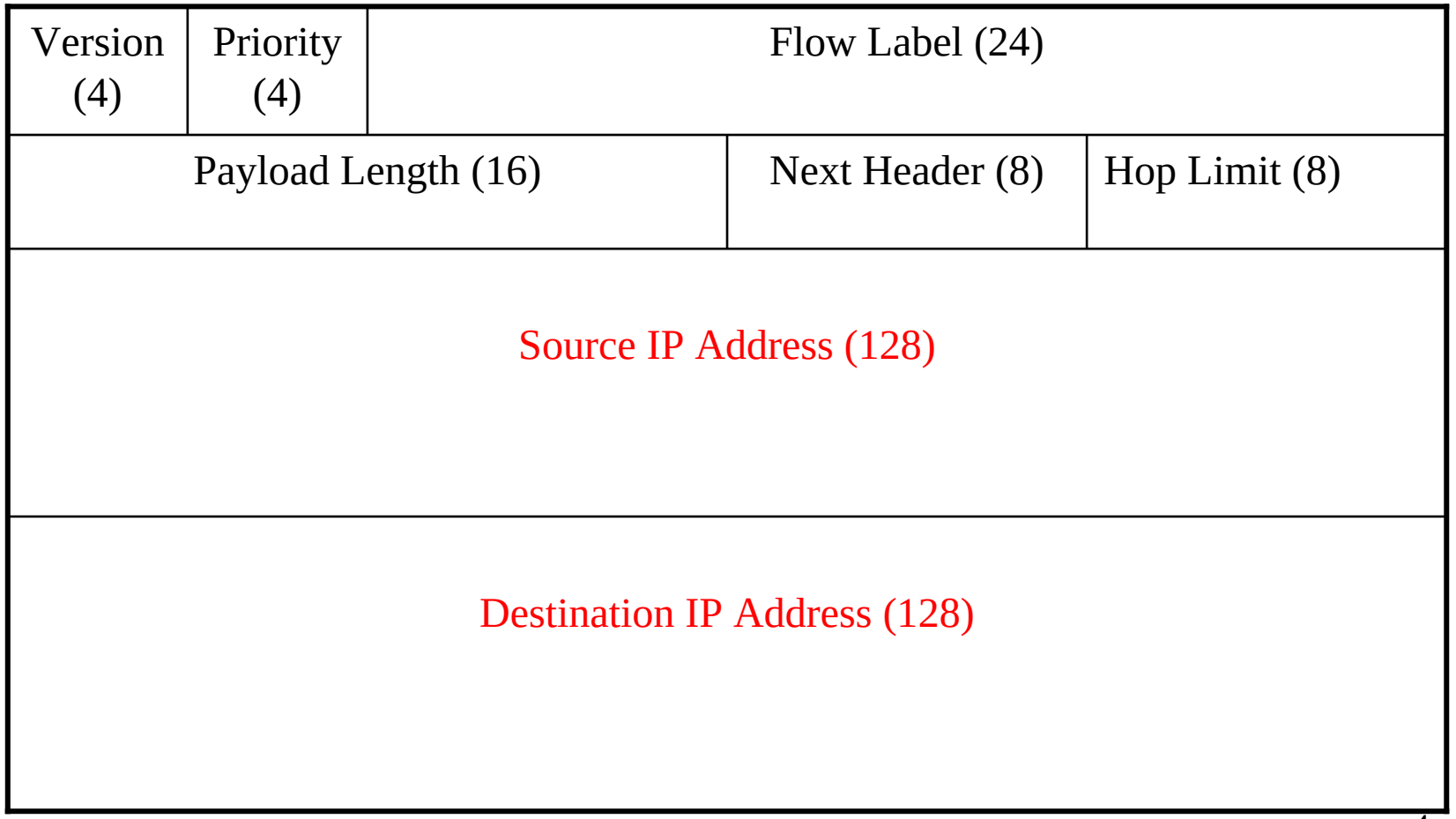
What you will learn in this lecture:

- An introduction to IPv6
- Differences between Mobile IPv4 and v6.

IPv4 Header (>=20 bytes)

<table>
<tr><td>Version (4)</td><td>Header Len. (4)</td><td>Type of Service (8)</td><td colspan="2">Datagram Length (16)</td></tr>
<tr><td colspan="3">Identifier (16)</td><td>Flags (3)</td><td>Fragmentation Offset (13)</td></tr>
<tr><td colspan="2">Time-to-Live (8)</td><td>Upper-layer Protocol (8)</td><td colspan="2">Header Checksum (16)</td></tr>
<tr><td colspan="5">Source IP Address (32)</td></tr>
<tr><td colspan="5">Destination IP Address (32)</td></tr>
<tr><td colspan="5">Options (if any)</td></tr>
</table>

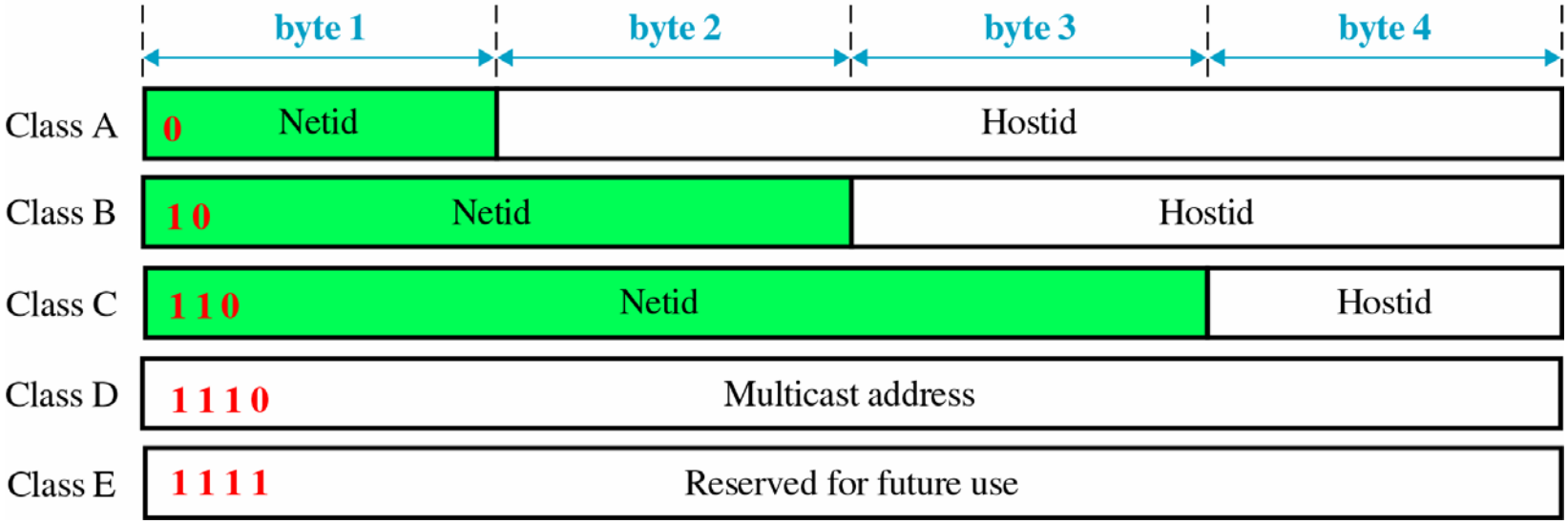
IPv6 Header (40 bytes)



Number of IP Addresses

- In IPv4, there are $2^{32} - 1$, or over 4 billion, addresses.

- *Q: Is this address space enough?*
- There is a waste of address space in the traditional two-level addressing scheme.



A class C network has only 256 addresses.

If a network has 500 hosts, then a Class B network address (which has 65536 addresses) is needed.

A lot of addresses are wasted.

Expanded Addressing Capabilities

- Address size increases from 32 to 128 bits.
  - i.e. from 4 bytes to 16 bytes.
- Three types of addresses
  - Unicast
    - A packet is sent to a single destination node.
  - Multicast
    - A packet is sent to multiple nodes in a multicast group.
  - Anycast
    - A packet is sent to any one of the nodes assigned that address.
    - e.g. an HTTP GET message is sent to any one of the mirror sites that contain a given document.

Version (4)	Header Len. (4)	Type of Service (8)	Datagram Length (16)	
Identifier (16)			Flags (3)	Fragmentation Offset (13)
Time to Live (8)		Upper-layer Protocol (8)	Header Checksum (16)	
Source IP Address (32)				
Destination IP Address (32)				
Options (if any)				

Version (4)	Priority (4)	Flow Label (24)	
Payload Length (16)		Next Header (8)	Hop Limit (8)
Source IP Address (128)			
Destination IP Address (128)			

Header Format Simplification

- IPv6 header has a fixed length of 40 bytes.
  - IPv4 header is at least 20 bytes.
  - Header Length field no longer needed.
- Fragmentation is not allowed at intermediate routers.
  - Identifier, Flags and Fragmentation offset no longer needed.
  - Error will be reported to the source if packet is too large.
- Header Checksum is removed for fast processing
  - Header checksum needed to recompute at every router, since TTL decreases after every hop.

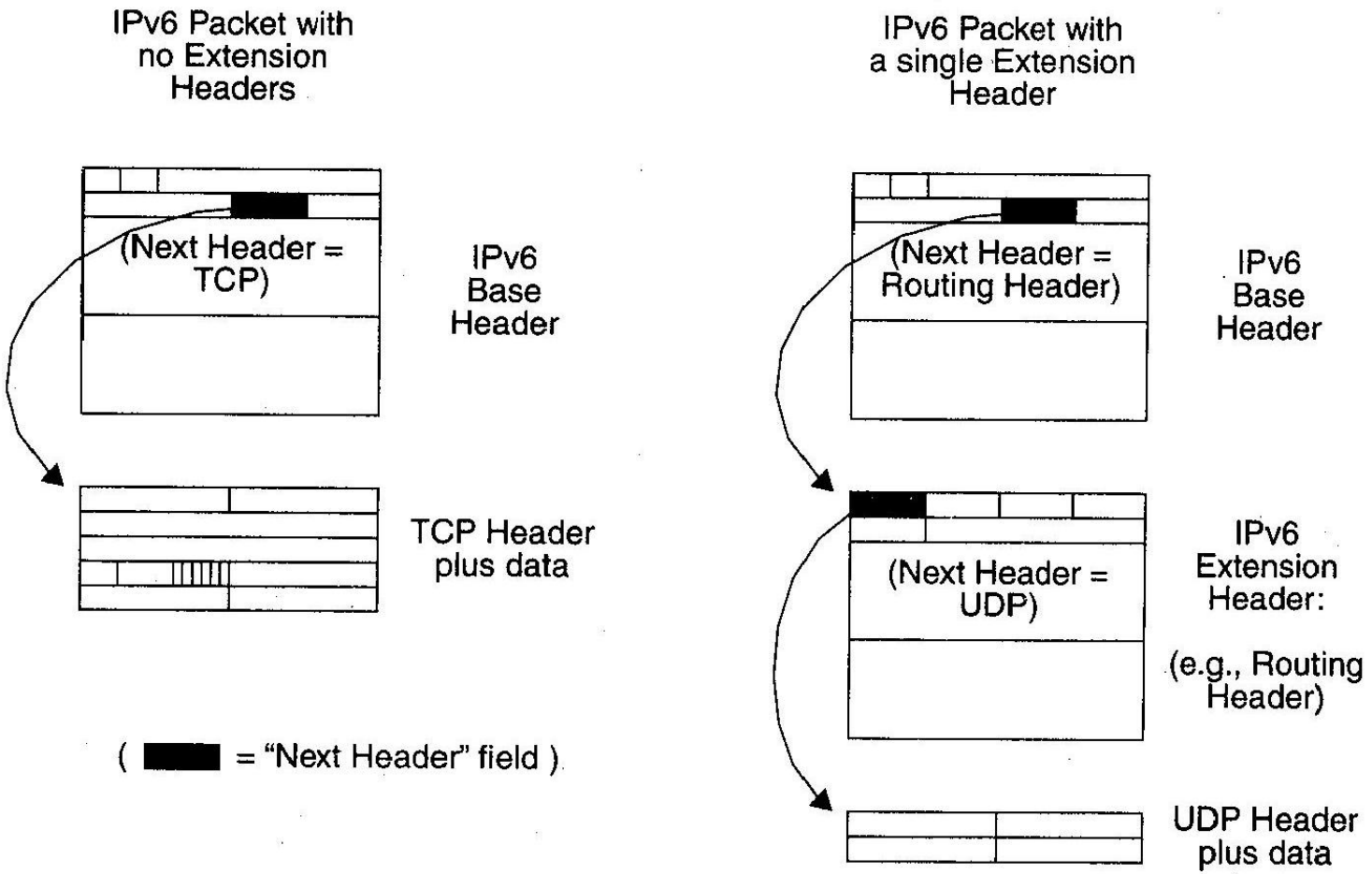
Quality-of-Service Capabilities

- Flow Label
  - can be used to label packets belonging to a particular traffic flows that needs special handling.

Improved Support for Options

- In IPv4,
  - Options field is included in the header
  - Upper Layer Protocol field points to a higher-layer protocol (e.g. TCP, UDP).
- In IPv6
  - Options are carried in “extension headers”.
  - Next Header field may point to extension headers.

IPv6 Extension Headers



Examples of Extension Headers

- Routing Header
  - Supports source routing
- Authentication Header
  - Can be used to support route optimization once a key management infrastructure becomes widely available on the Internet.

Differences between Mobile IPv4 and v6

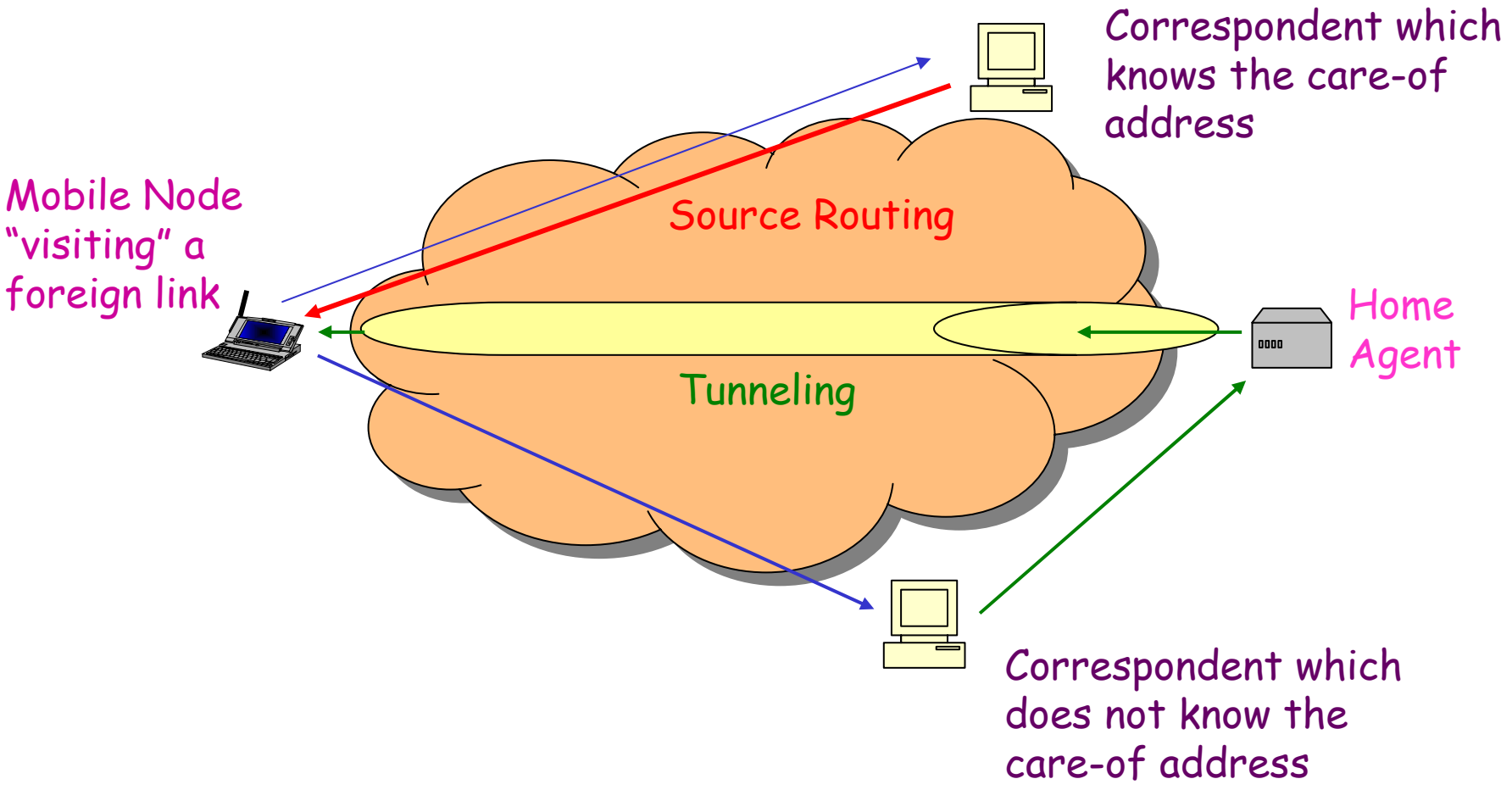
Mobile IPv6

- No Foreign Agent
- Route Optimization
  - Use both tunneling and source routing to deliver packets to mobile nodes.

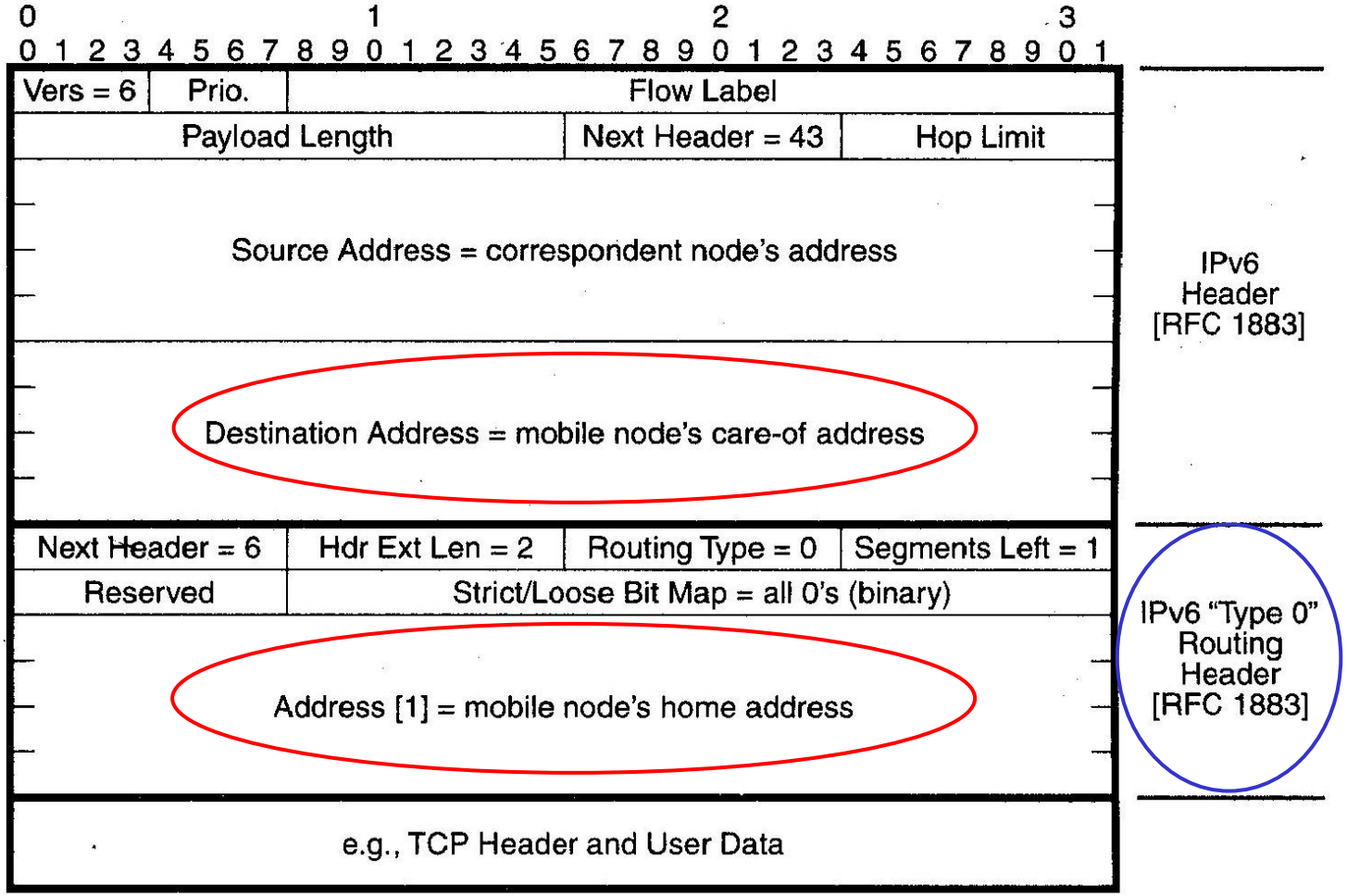
No Foreign Agent

- The enormous address space allows very simple address autoconfiguration
  - a mobile can acquire a collocated care-of address quickly and easily
  - foreign agent no longer needed.
- Stateless Address Configuration (SAC)
  - The idea is to combine the prefix of the network on which it is located with a device identifier, such as its MAC address.

Routing in Mobile IPv6



Source-Routed Packet



References

- J. F. Kurose and K. W. Ross, *Computer networking: a top-down approach featuring the Internet*, Addison Wesley, 2001.
- J. D. Solomon, *Mobile IP: the Internet unplugged*, Prentice Hall, 1998.
- C. E. Perkins, “Mobile networking through mobile IP,” *IEEE Internet Computing*, pp. 58-69, Jan/Feb, 1998.