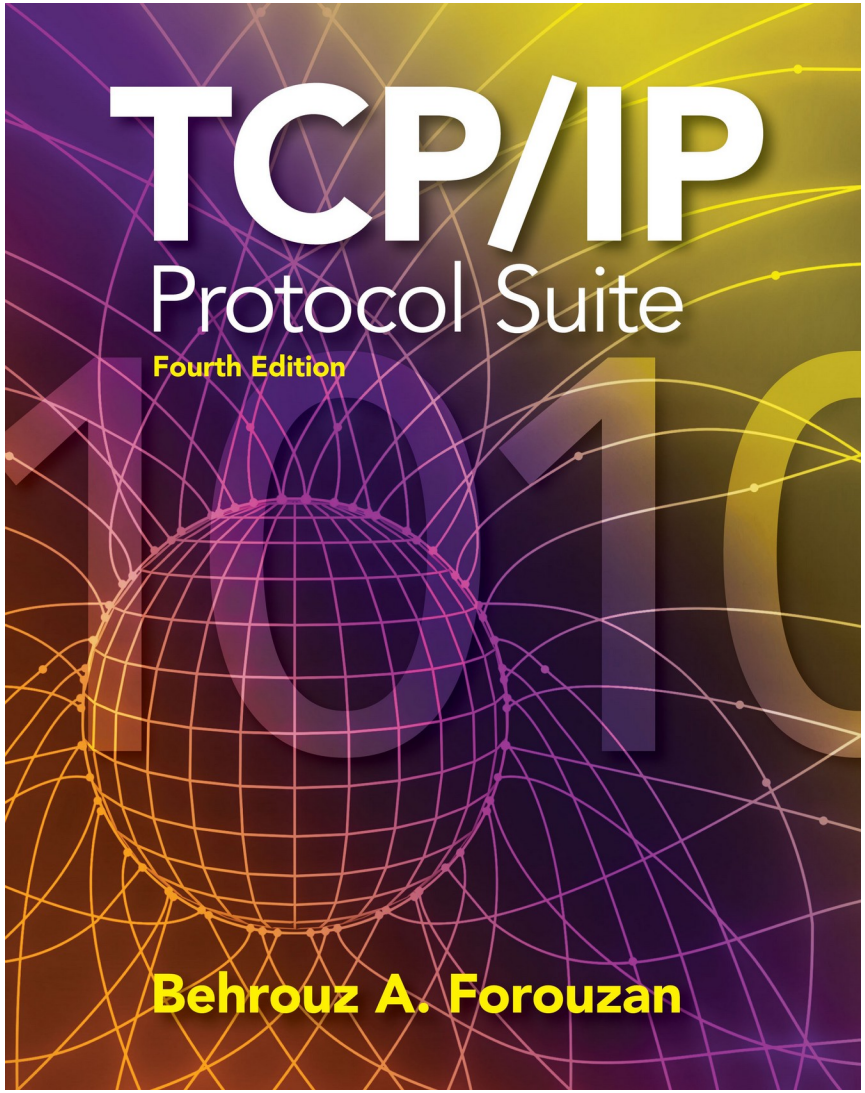
Chapter 27

IPv6 Protocol



OBJECTIVES:

- To give the format of an IPv6 datagram composed of a base header and a payload.
- To discuss different fields used in an IPv6 datagram based header and compare them with the fields in IPv4 datagram.
- To show how the options in IPv4 header are implemented using the extension header in IPv6.
- To show how security is implemented in IPv6.
- To discuss three strategies used to handle the transition from IPv4 to IPv6: dual stack, tunneling, and header translation.

Chapter Outline

27-1 INTRODUCTION

In this introductory section, we discuss two topics: rationale for a new protocol and the reasons for delayed adoption.

Topics Discussed in the Section

- ✓ **Rationale for Change**
- ✓ **Reason for Delay in Adoption**

27-2 PACKET FORMAT

The IPv6 packet is shown in Figure 27.1. Each packet is composed of a mandatory base header followed by the payload. The payload consists of two parts: optional extension headers and data from an upper layer. The base header occupies 40 bytes, whereas the extension headers and data from the upper layer contain up to 65,535 bytes of information.

Topics Discussed in the Section

- ✓ **Base Header**
- ✓ **Flow Label**
- ✓ **Comparison between IPv4 and IPv6 Headers**
- ✓ **Extension Headers**
- ✓ **Comparison between IPv4 and IPv6 Options**

Figure 27.1 *IPv6 datagram*

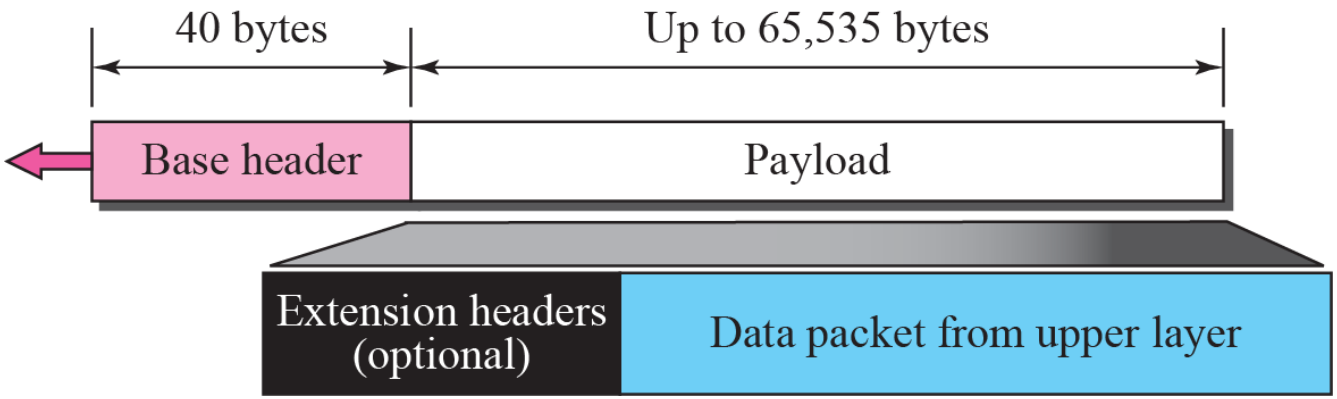


Figure 27.2 *Format of the base header*

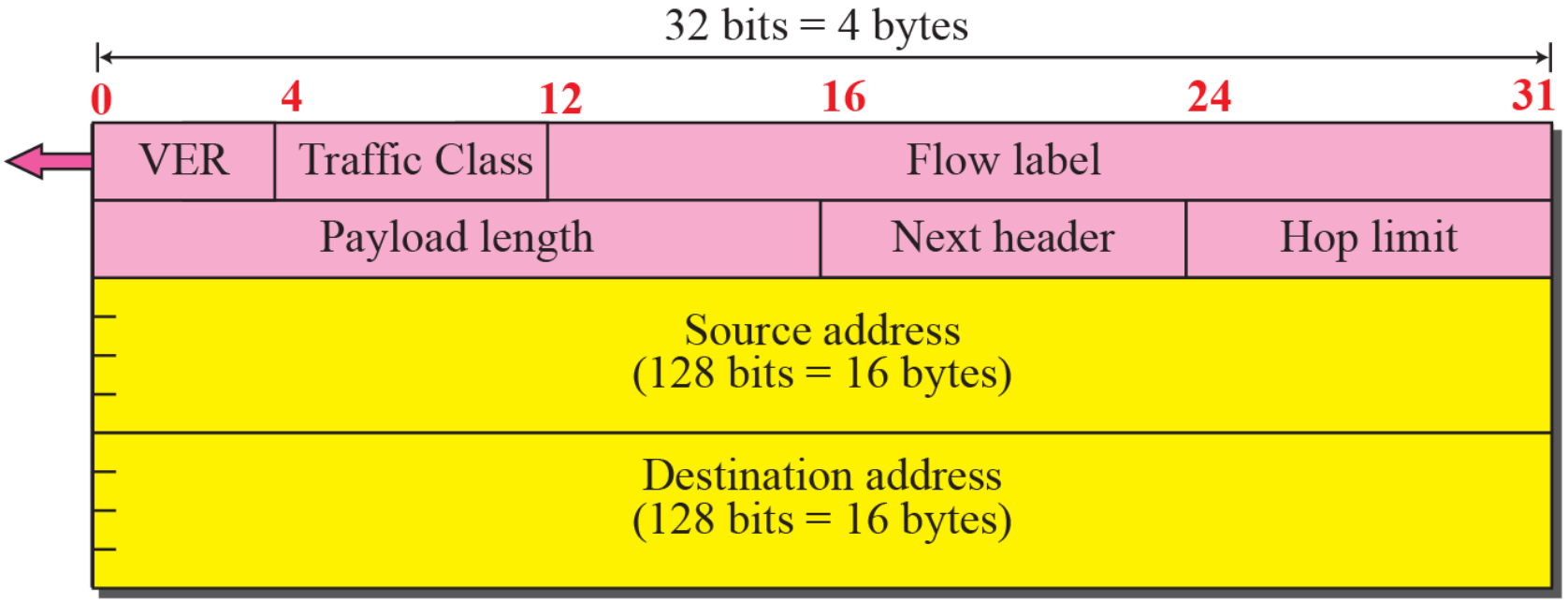


Table 27.1 *Next Header Codes*

Code	*Next Header*	*Code*	*Next Header*
0	Hop-by-hop option	44	Fragmentation
2	ICMP	50	Encrypted security payload
6	TCP	51	Authentication
17	UDP	59	Null (No next header)
43	Source routing	60	Destination option

Figure 27.3 *Extension header format*

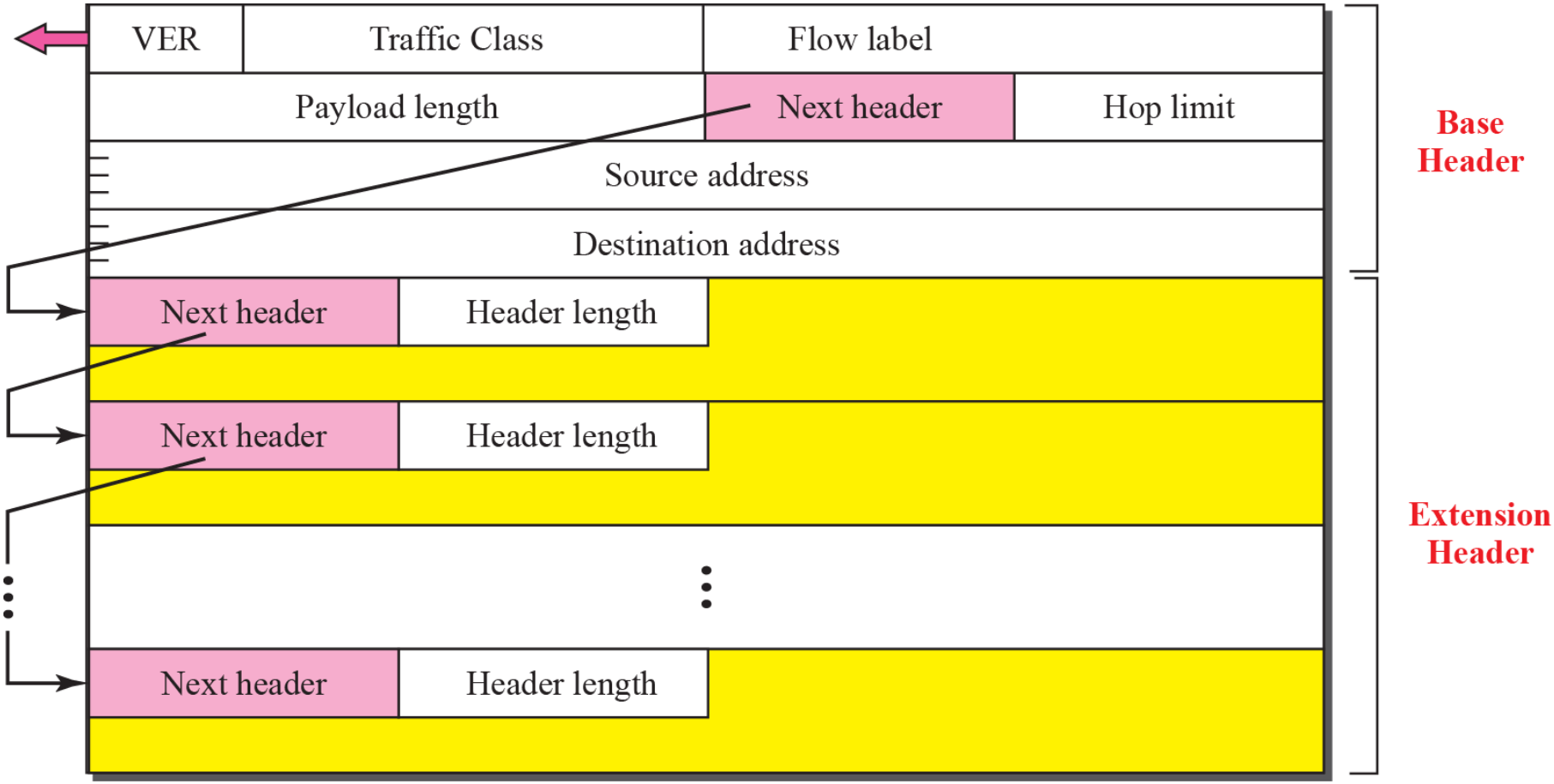


Figure 27.4 *Extension header types*

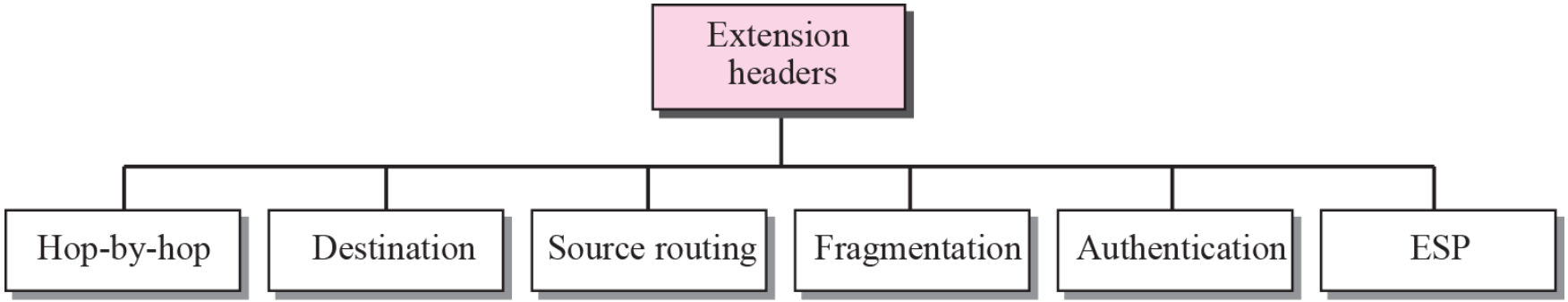


Figure 27.5 *Hop-by-hop option header format*

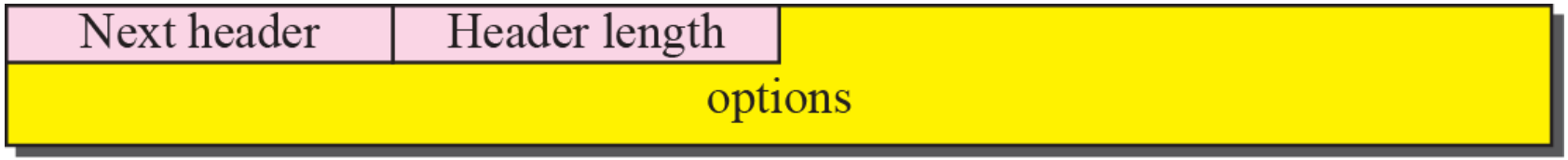


Figure 27.6 *The format of the option in a hop-by-hop option header*

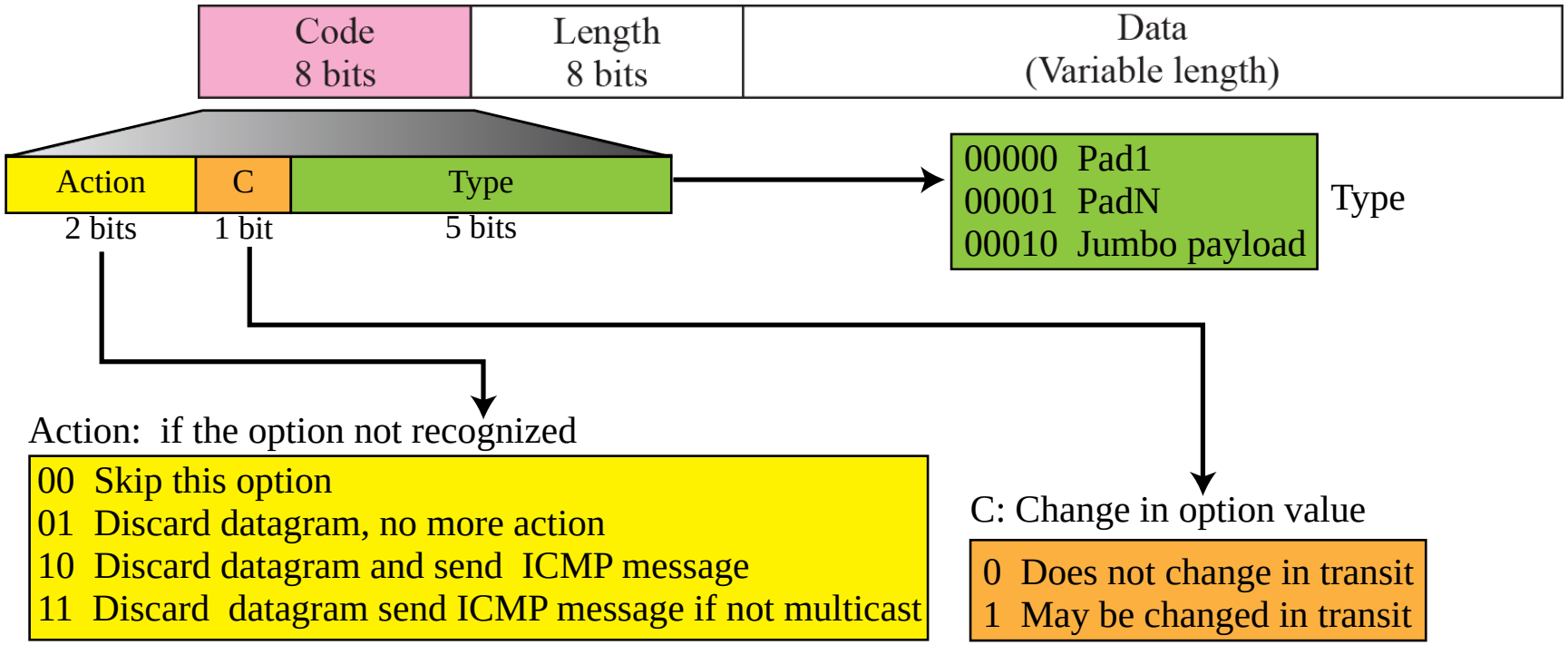


Figure 27.7 *Pad1*

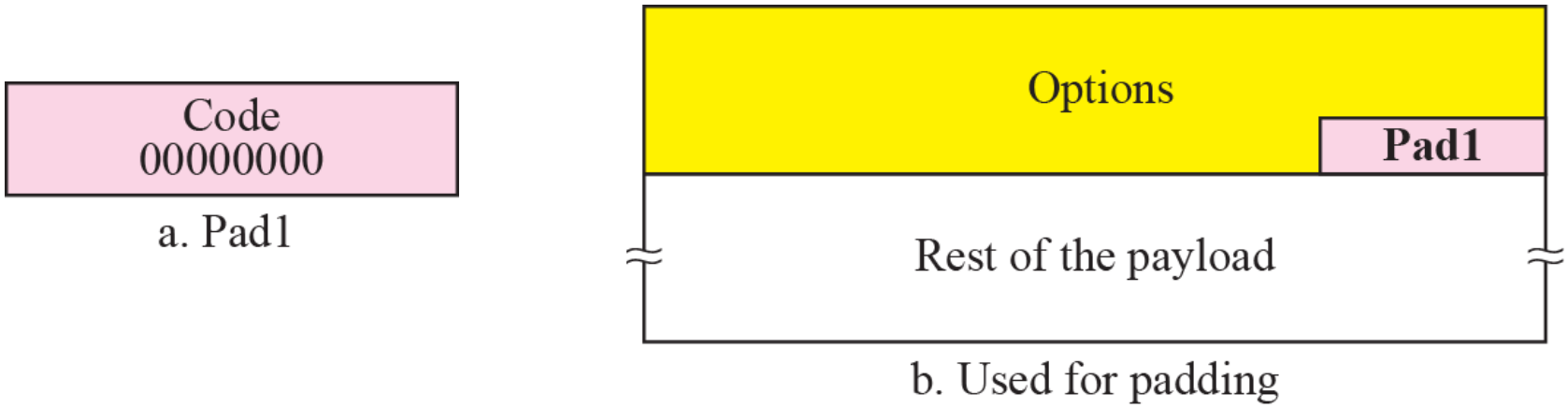


Figure 27.8 *PadN*

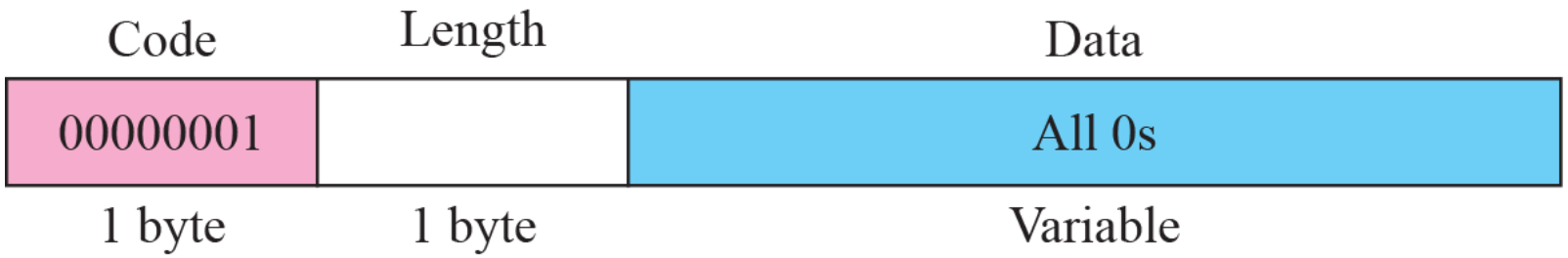


Figure 27.9 *Jumbo payload*

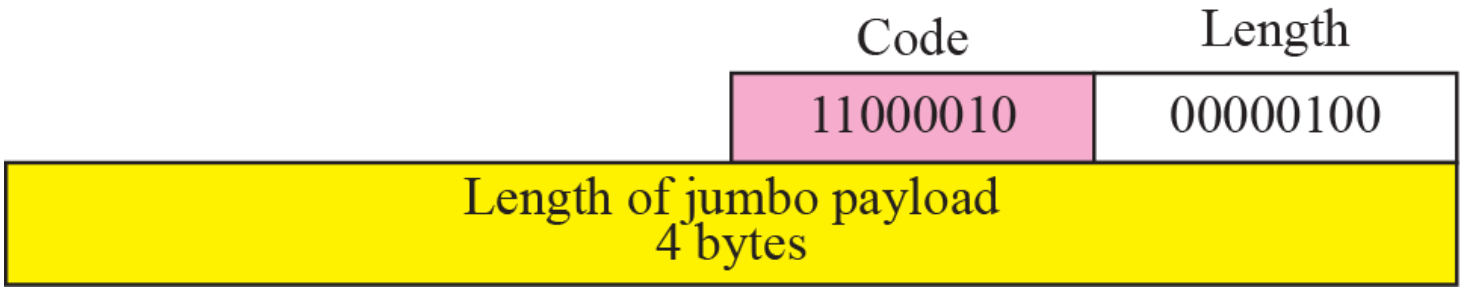


Figure 27.10 *Source routing*

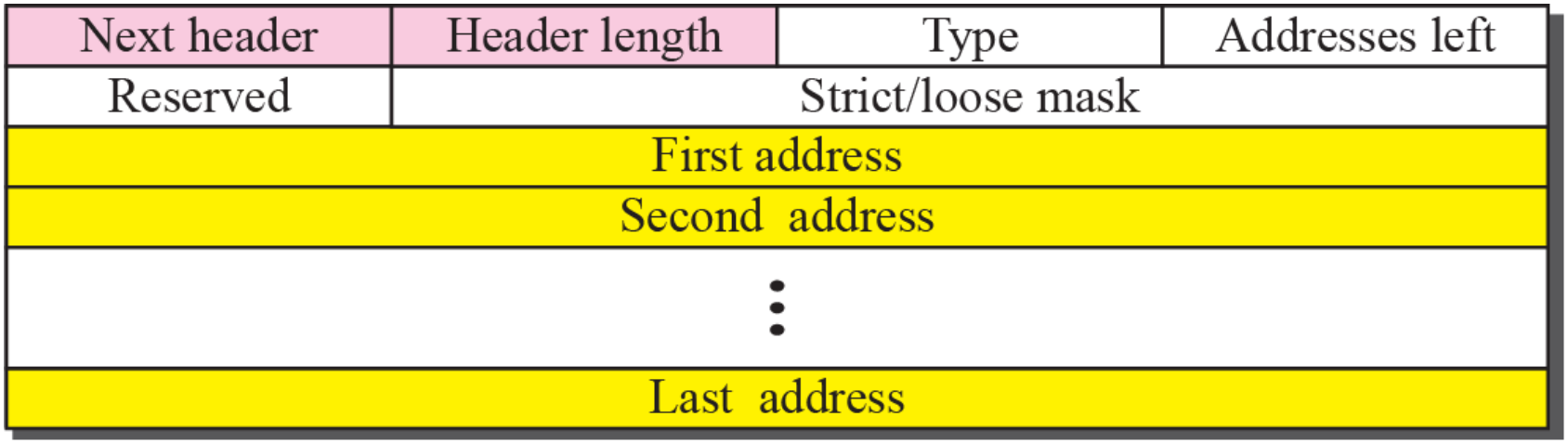


Figure 27.11 *Source routing example*

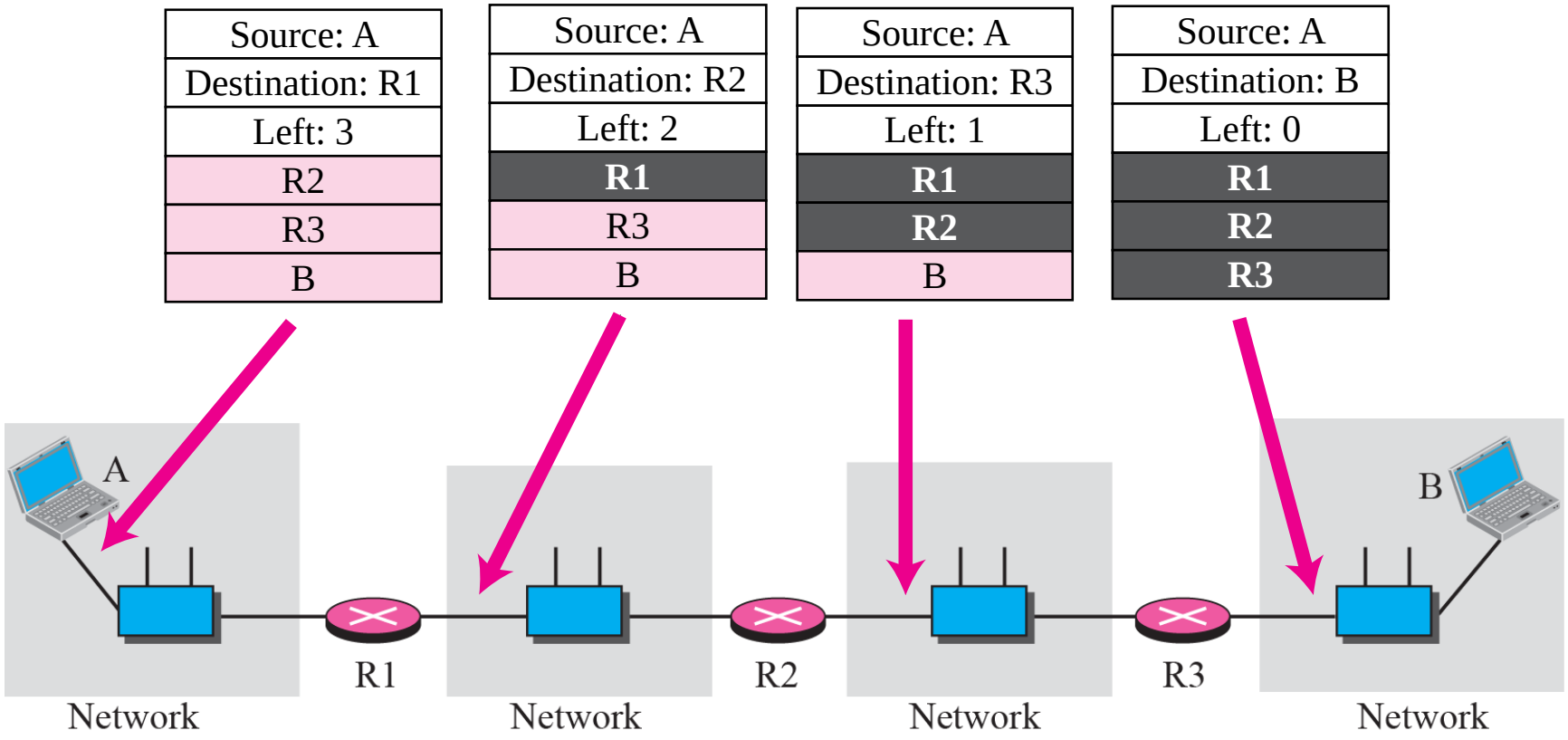


Figure 27.12 *Fragmentation*

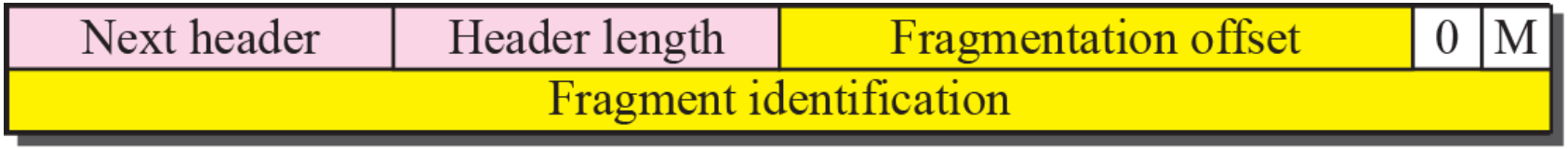


Figure 27.13 *Authentication*

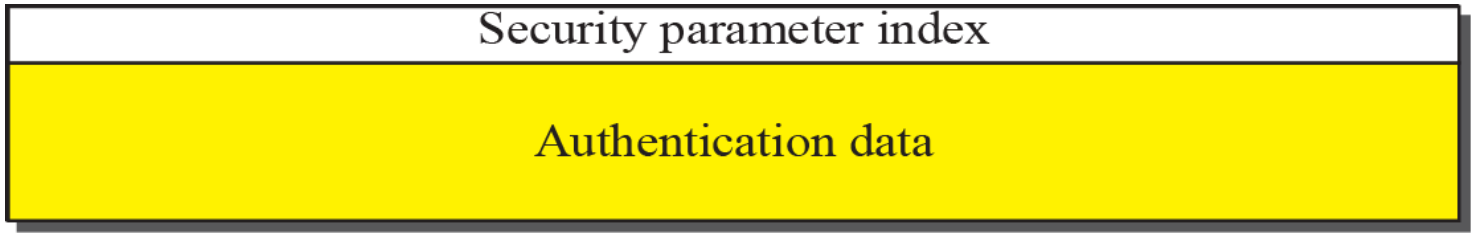
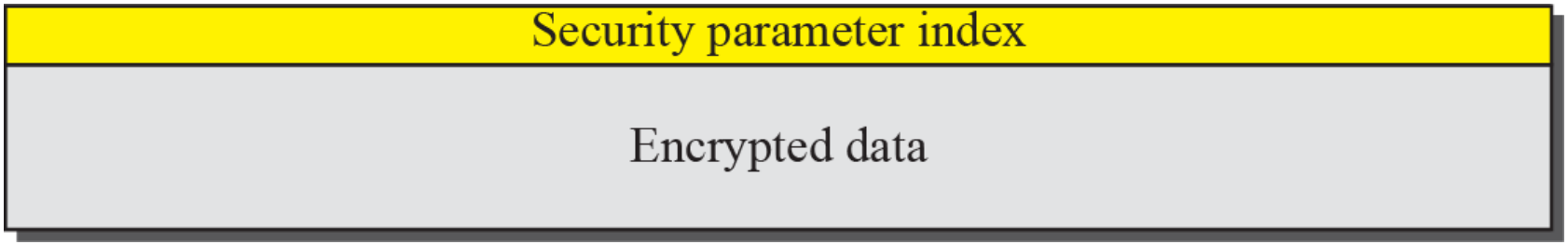


Figure 27.14 *Calculation of authentication data*

Figure 27.15 *Encrypted security payload*



27-3 TRANSITION FROM IPv4 TO IPv6

Because of the huge number of systems on the Internet, the transition from IPv4 to IPv6 cannot happen suddenly. It will take a considerable amount of time before every system in the Internet can move from IPv4 to IPv6. The transition must be smooth to prevent any problems between IPv4 and IPv6 systems. Three strategies have been devised by the IETF to help the transition (see Figure 27.16).

Topics Discussed in the Section

- ✓ **Dual Stack**
- ✓ **Tunneling**
- ✓ **Header Translation**

Figure 27.16 *Three transition strategies*

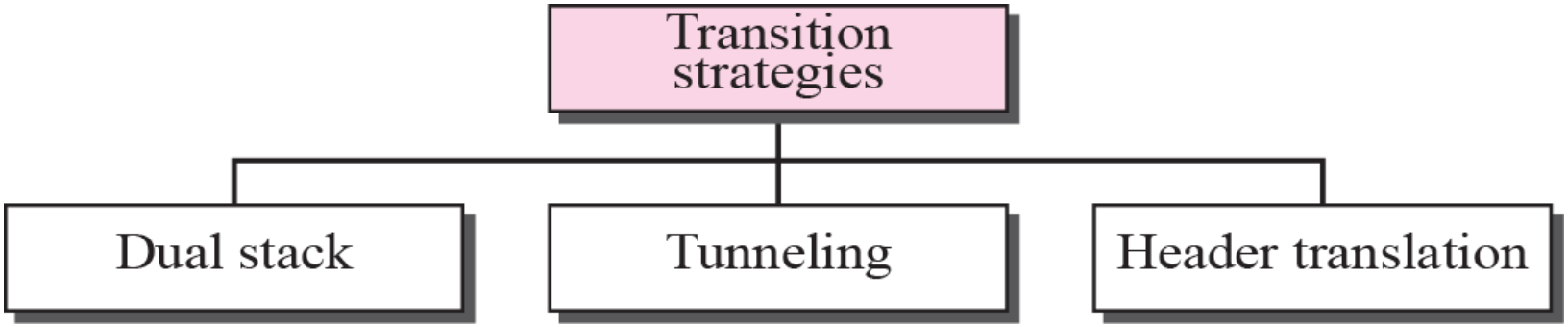


Figure 27.17 *Dual stack*

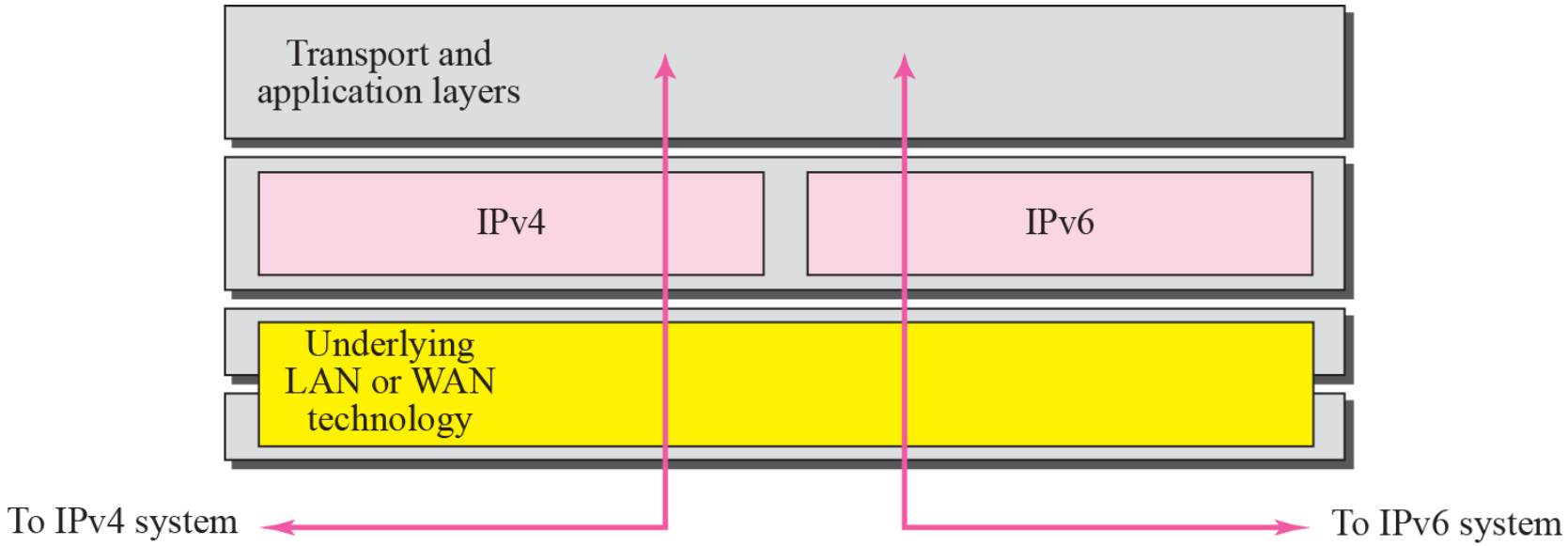


Figure 27.18 *Tunneling strategy*

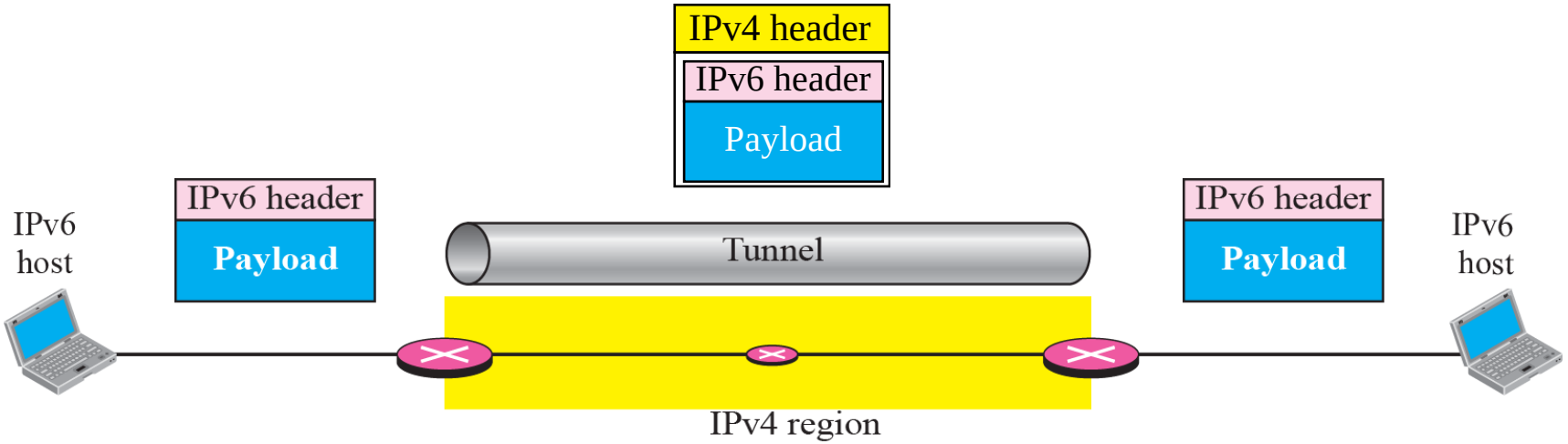


Figure 27.19 *Header translation strategy*