Data Communications and Networking Fourth Edition

Forouzan

Chapter 14

Wireless LANs

14-1 IEEE 802.11

IEEE has defined the specifications for a wireless LAN, called IEEE 802.11, which covers the physical and data link layers.

Topics discussed in this section:

Architecture
MAC Sublayer
Physical Layer

Note

A BSS without an AP is called an ad hoc network;
a BSS with an AP is called an infrastructure network.

Figure 14.1 *Basic service sets (BSSs)*

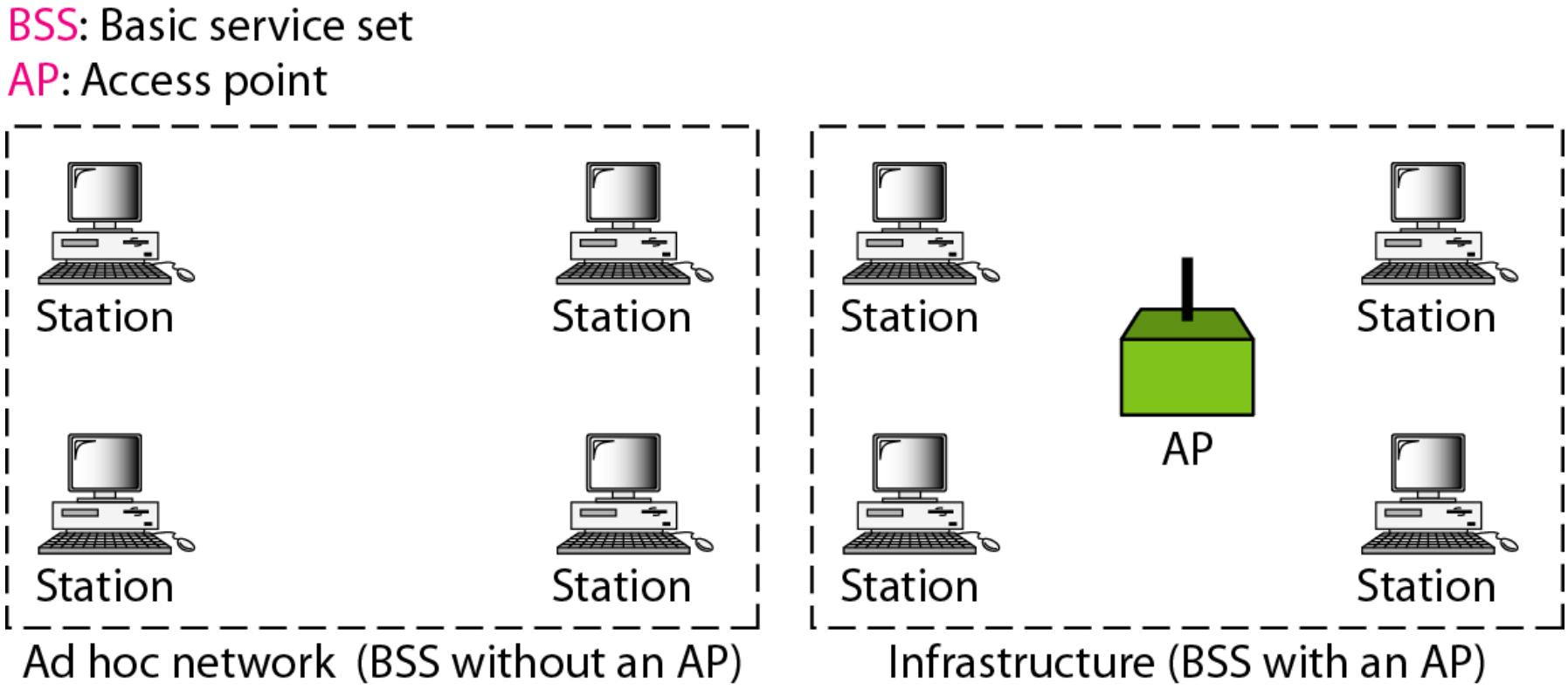


Figure 14.2 *Extended service sets (ESSs)*

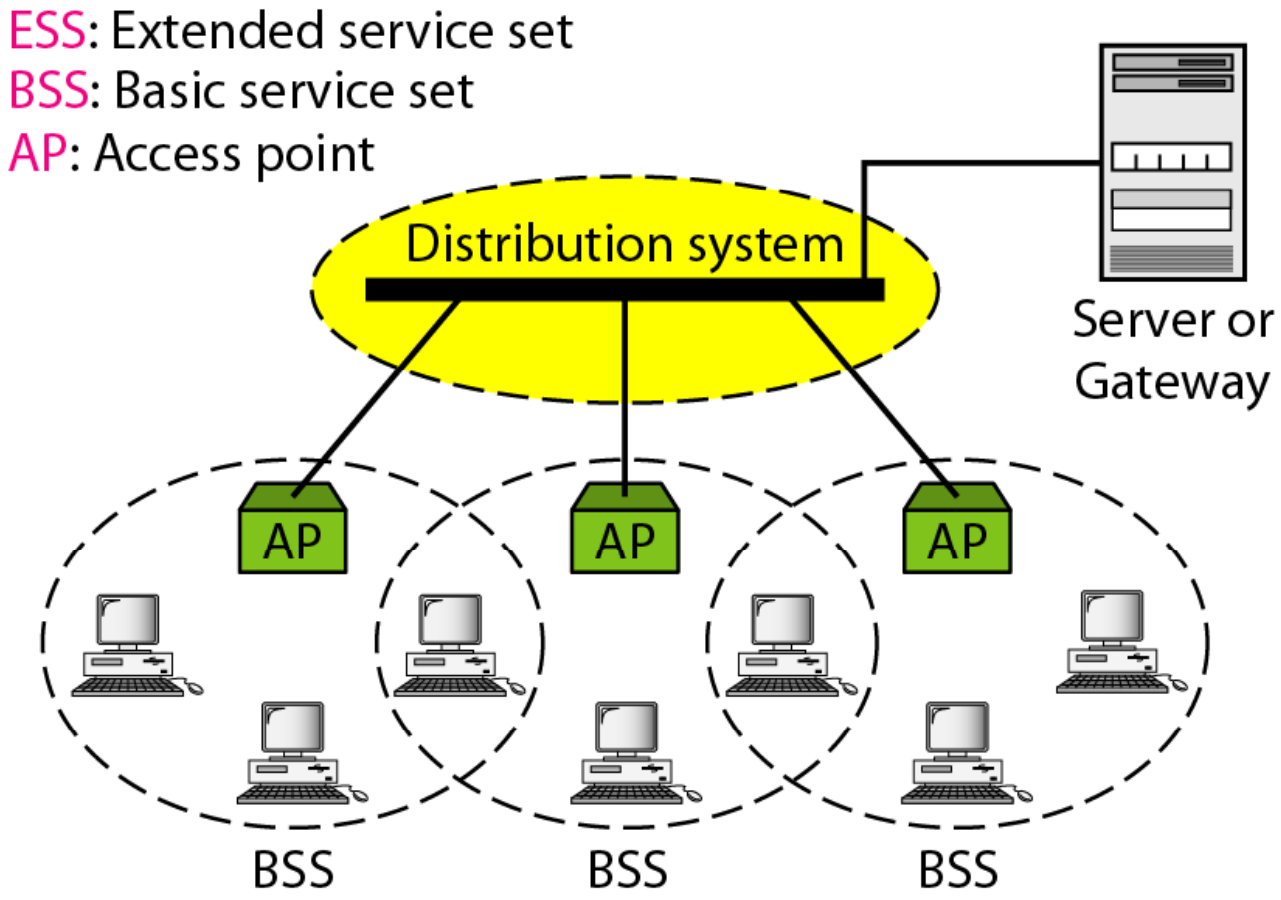


Figure 14.3 *MAC layers in IEEE 802.11 standard*

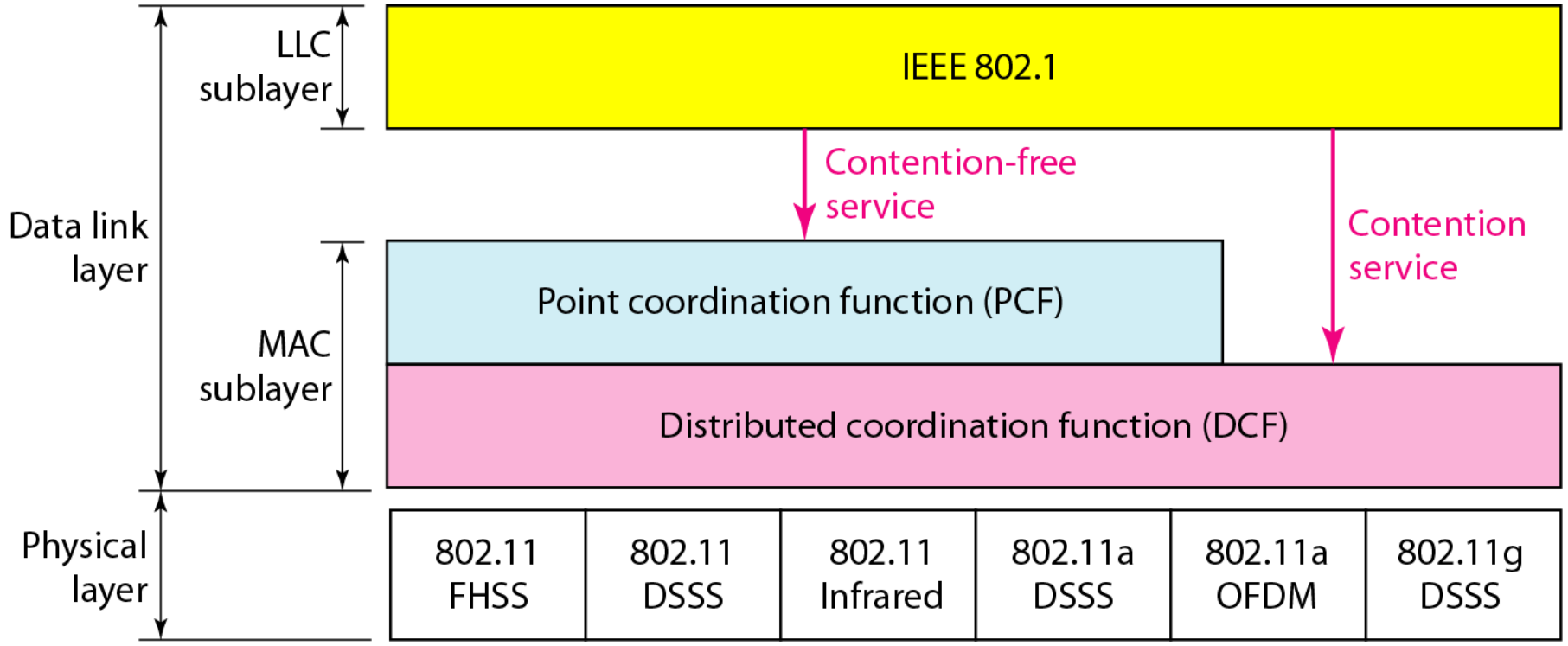


Figure 14.4 *CSMA/CA flowchart*

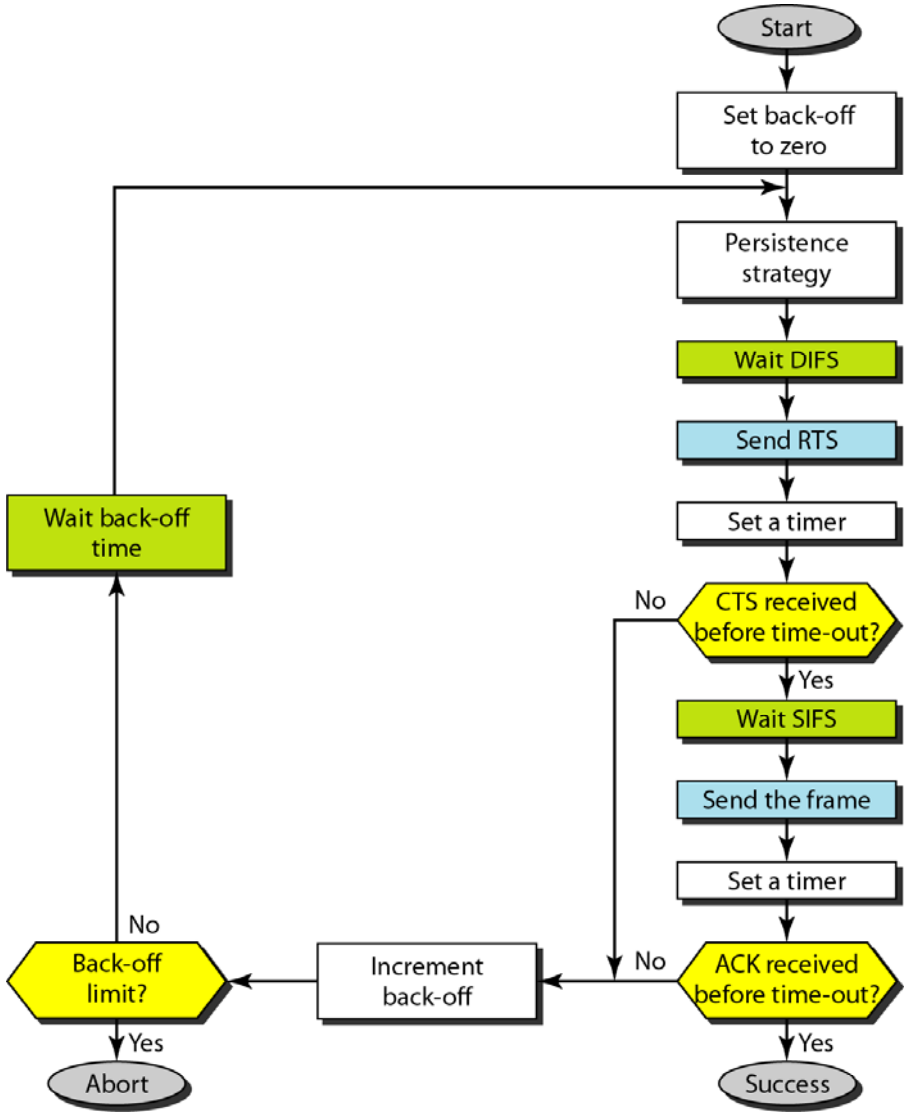


Figure 14.5 *CSMA/CA and NAV*

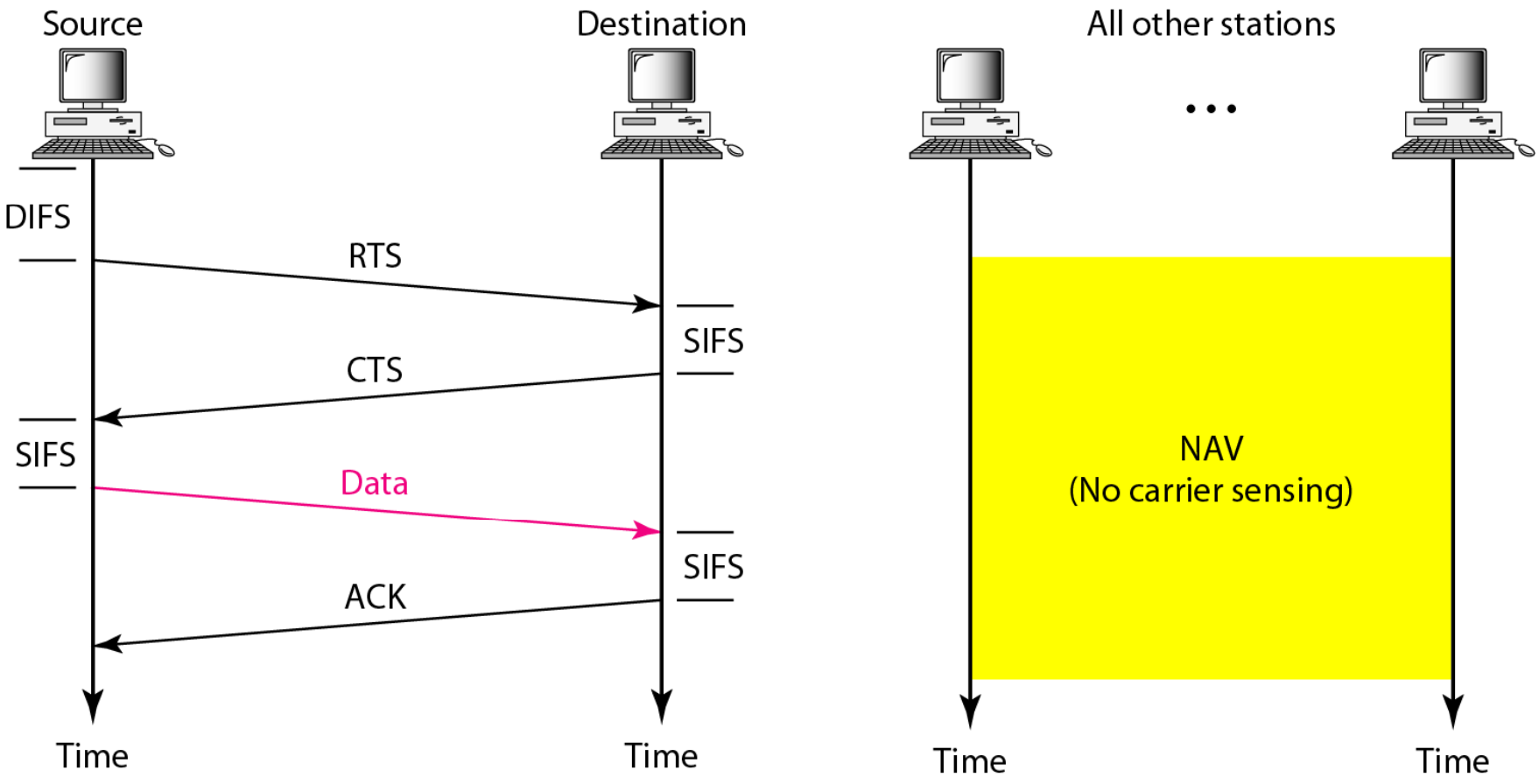


Figure 14.6 *Example of repetition interval*

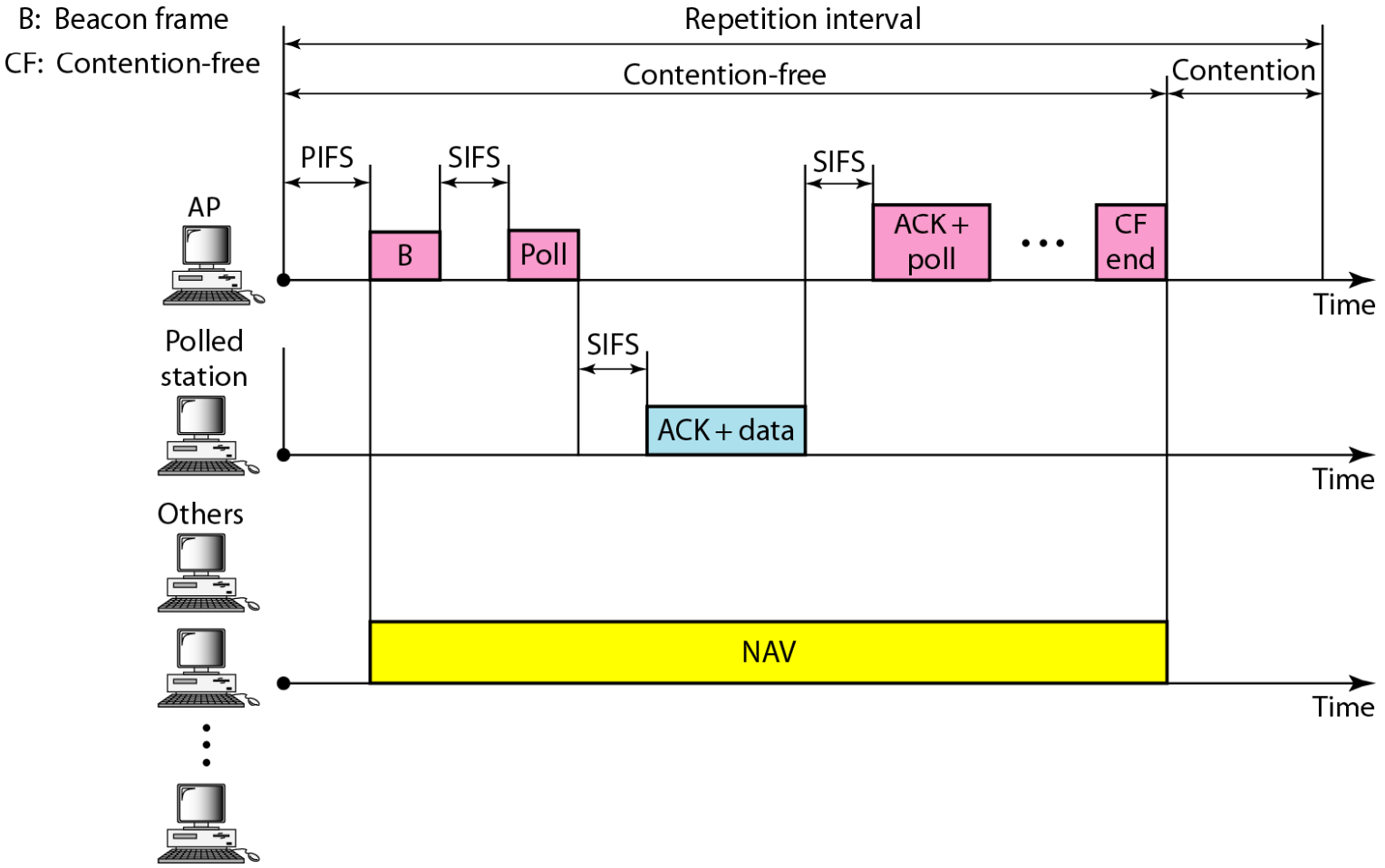


Figure 14.7 *Frame format*

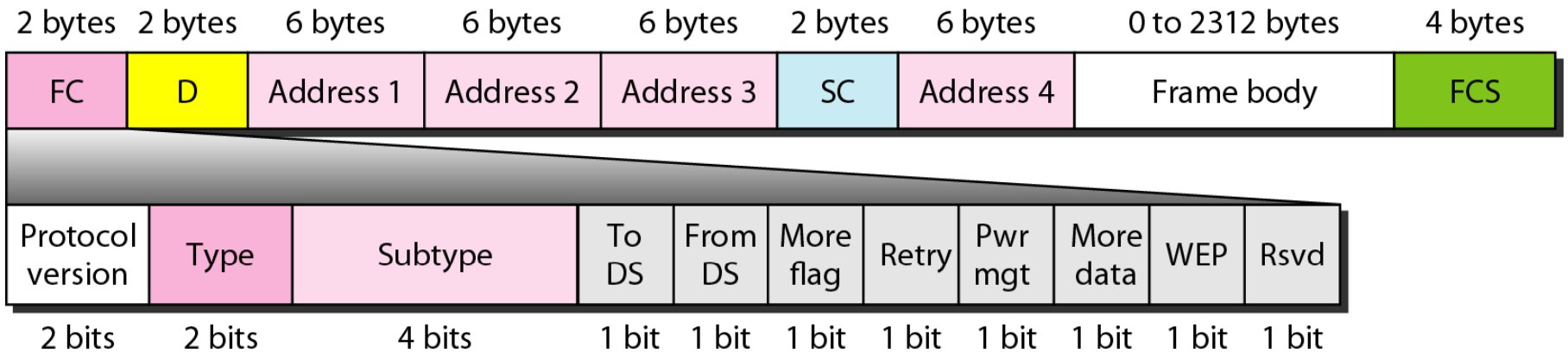


Table 14.1 *Subfields in FC field*

Field	*Explanation*
Version	Current version is 0
Type	Type of information: management (00), control (01), or data (10)
Subtype	Subtype of each type (see Table 14.2)
To DS	Defined later
From DS	Defined later
More flag	When set to 1, means more fragments
Retry	When set to 1, means retransmitted frame
Pwr mgt	When set to 1, means station is in power management mode
More data	When set to 1, means station has more data to send
WEP	Wired equivalent privacy (encryption implemented)
Rsvd	Reserved

Figure 14.8 *Control frames*

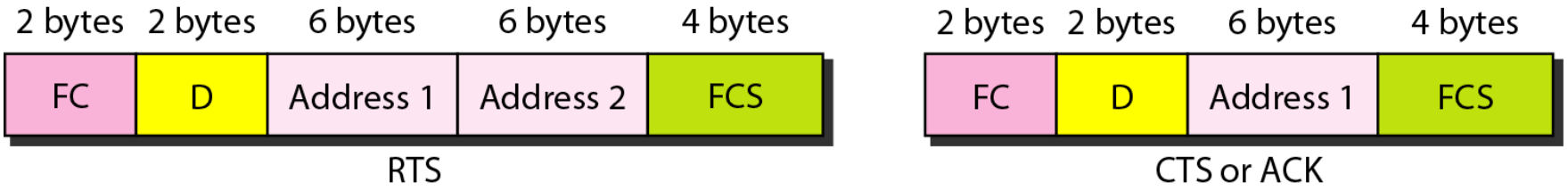


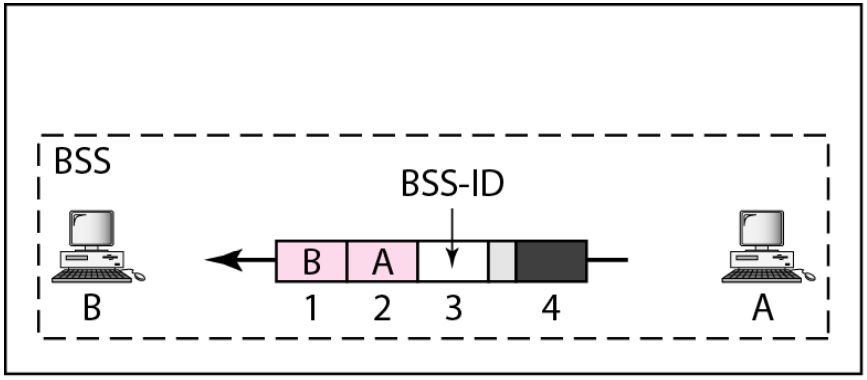
Table 14.2 *Values of subfields in control frames*

Subtype	*Meaning*
1011	Request to send (RTS)
1100	Clear to send (CTS)
1101	Acknowledgment (ACK)

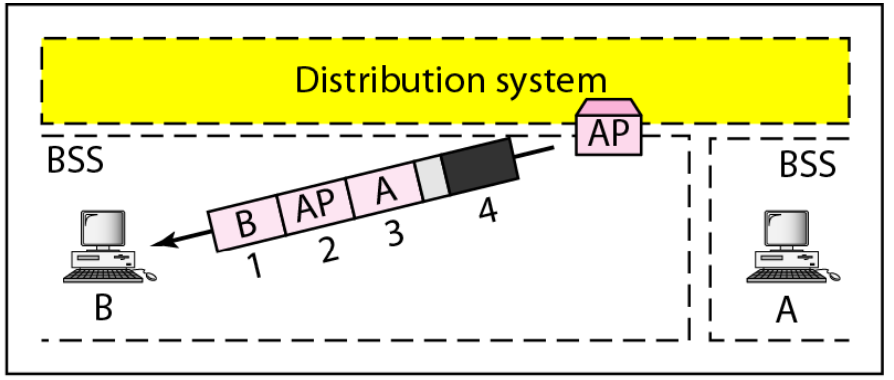
Table 14.3 *Addresses*

To DS	*From DS*	*Address 1*	*Address 2*	*Address 3*	*Address 4*
0	0	Destination	Source	BSS ID	N/A
0	1	Destination	Sending AP	Source	N/A
1	0	Receiving AP	Source	Destination	N/A
1	1	Receiving AP	Sending AP	Destination	Source

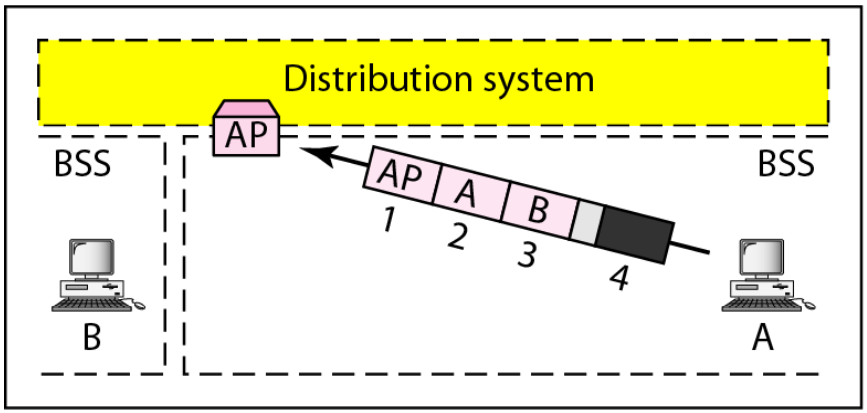
Figure 14.9 *Addressing mechanisms*



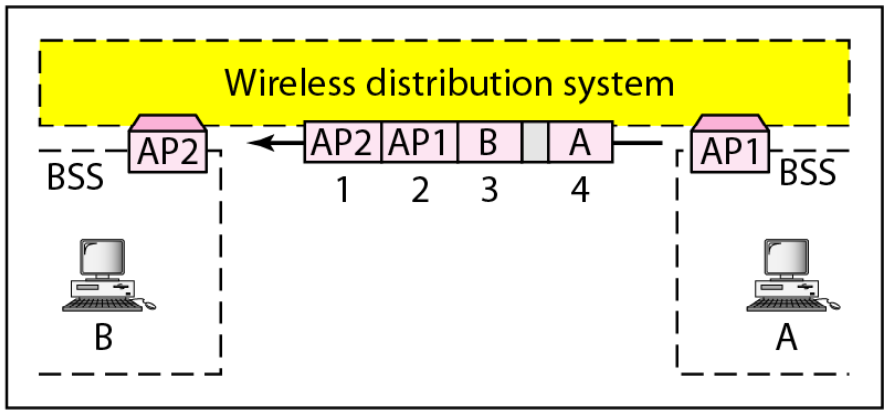
a. Case 1



b. Case 2

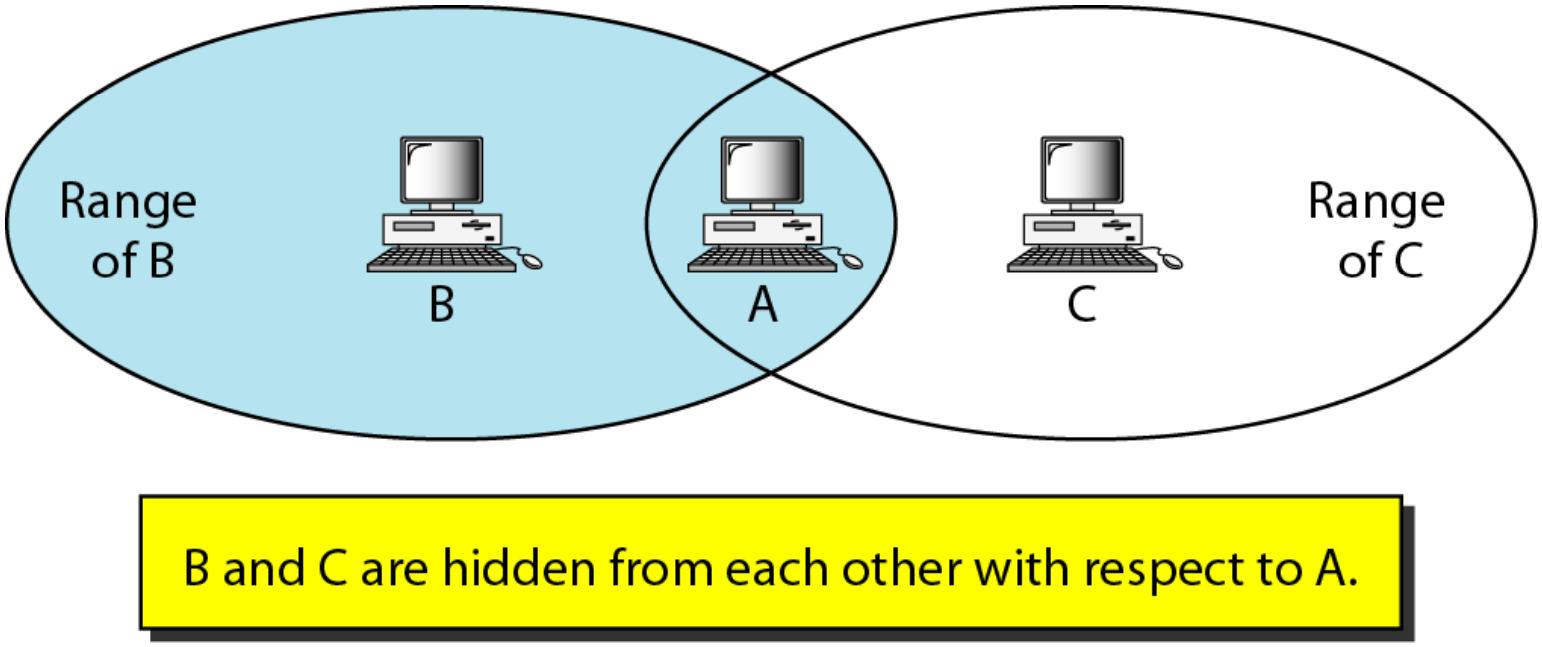


c. Case 3



d. Case 4

Figure 14.10 *Hidden station problem*



Note

The CTS frame in CSMA/CA handshake can prevent collision from a hidden station.

Figure 14.11 *Use of handshaking to prevent hidden station problem*

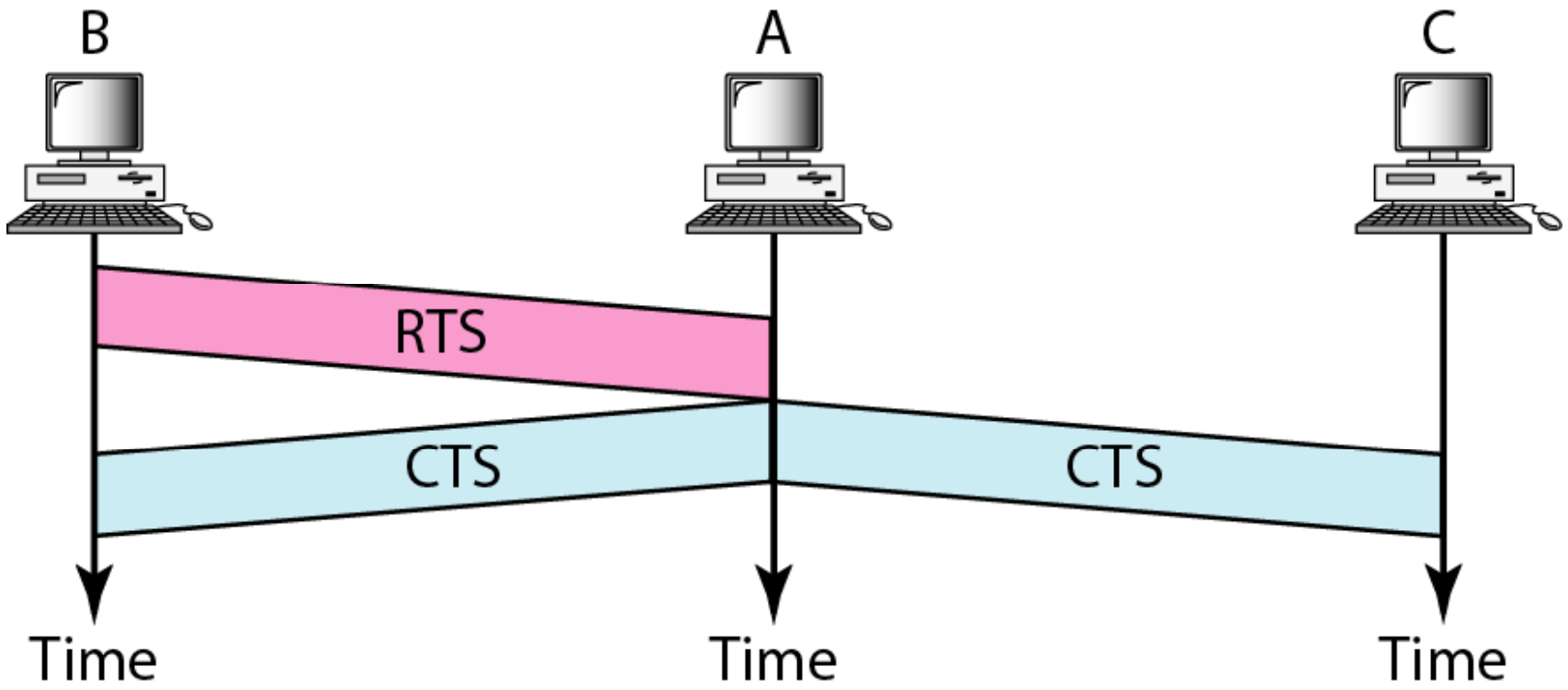


Figure 14.12 *Exposed station problem*

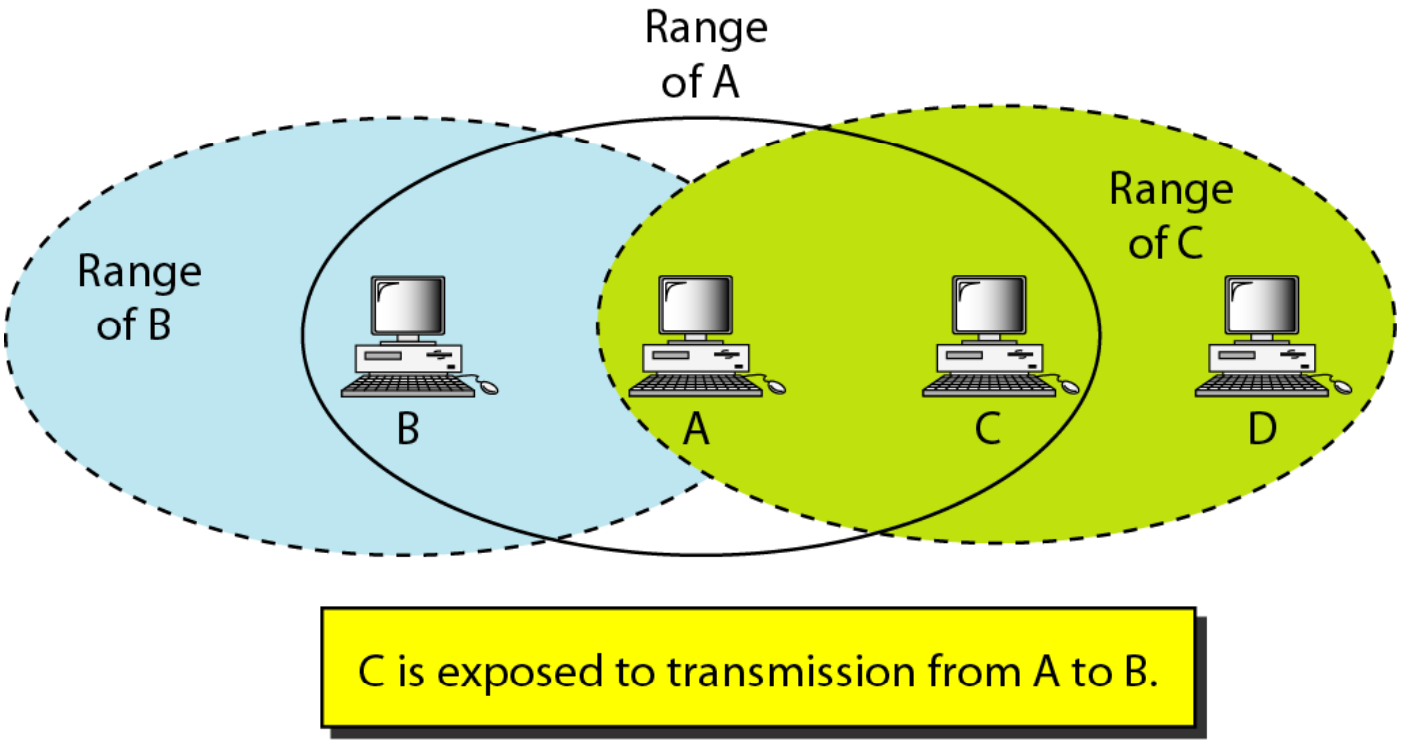


Figure 14.13 *Use of handshaking in exposed station problem*

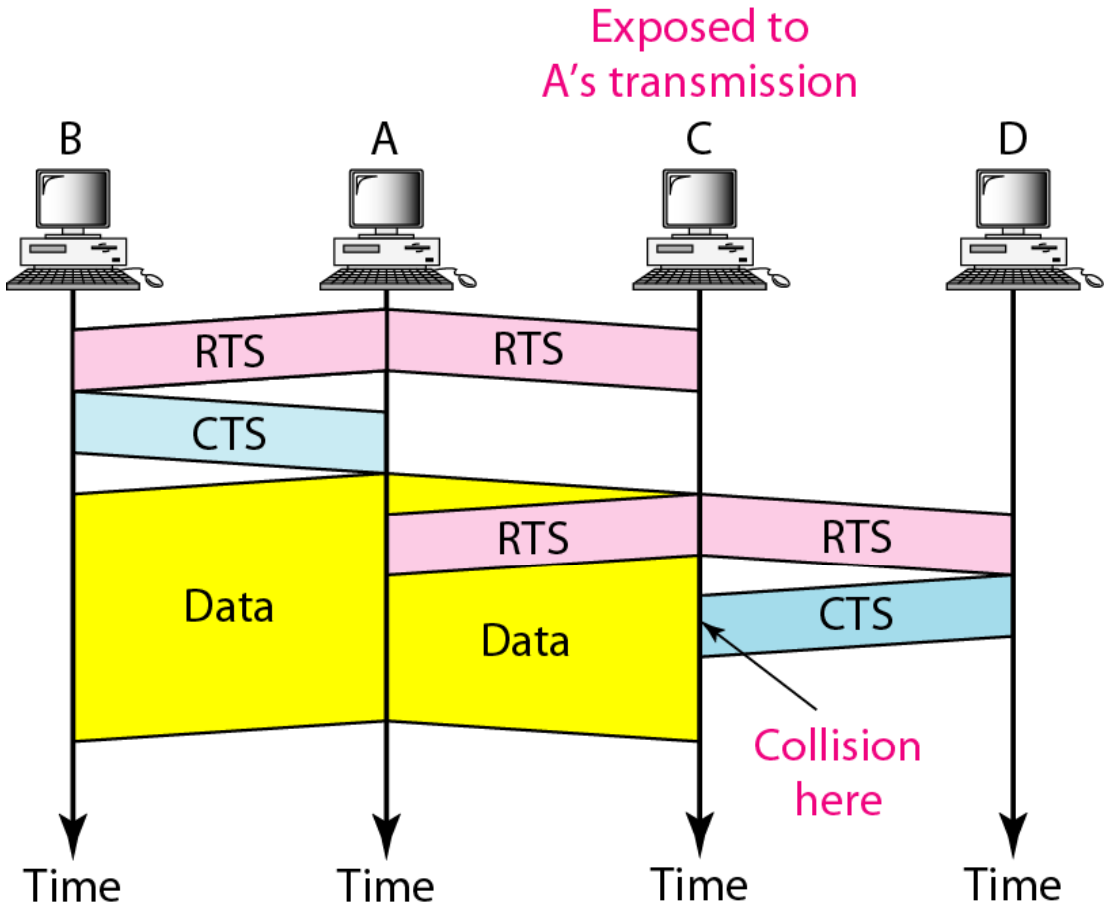


Table 14.4 *Physical layers*

IEEE	*Technique*	*Band*	*Modulation*	*Rate (Mbps)*
802.11	FHSS	2.4 GHz	FSK	1 and 2
	DSSS	2.4 GHz	PSK	1 and 2
		Infrared	PPM	1 and 2
802.11a	OFDM	5.725 GHz	PSK or QAM	6 to 54
802.11b	DSSS	2.4 GHz	PSK	5.5 and 11
802.11g	OFDM	2.4 GHz	Different	22 and 54

Figure 14.14 *Industrial, scientific, and medical (ISM) band*

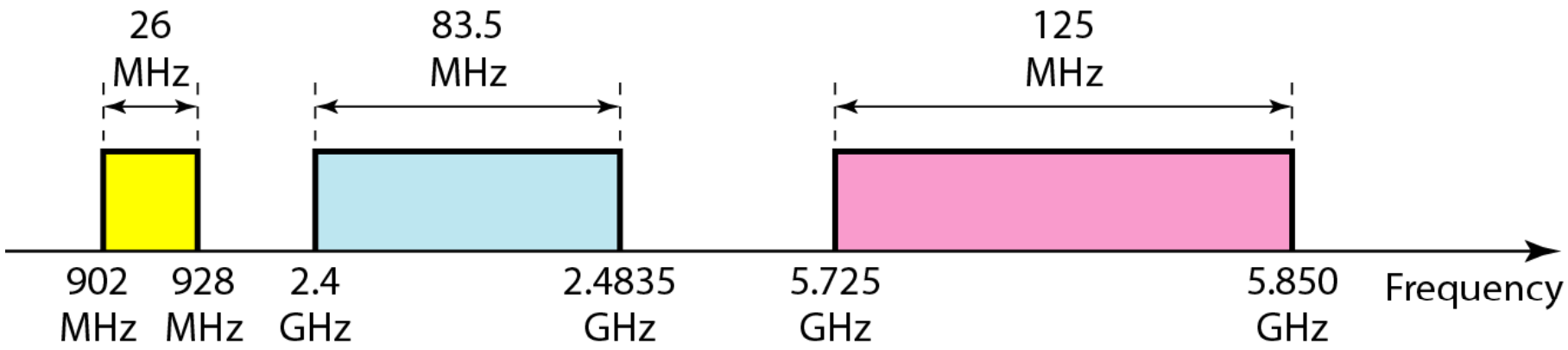


Figure 14.15 *Physical layer of IEEE 802.11 FHSS*

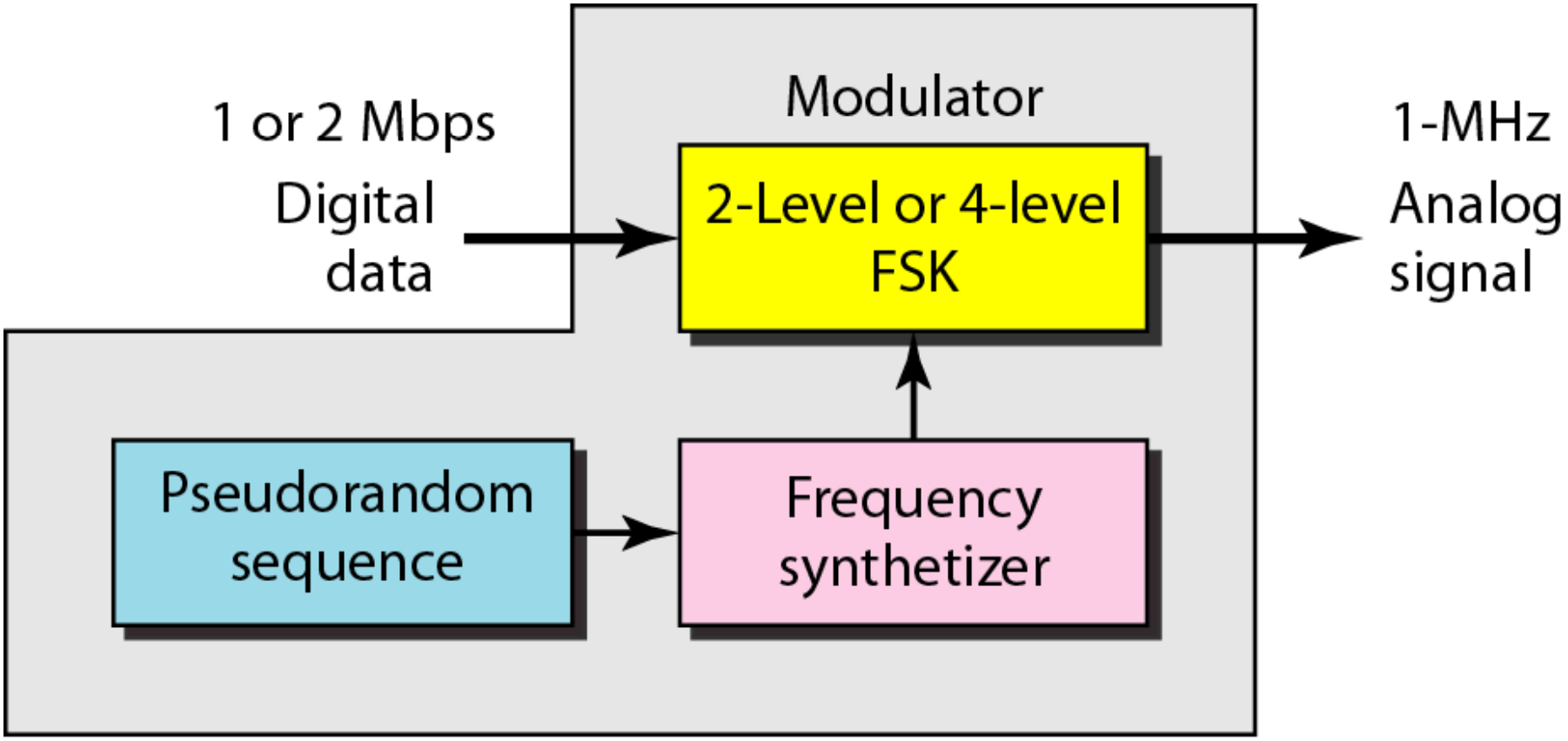


Figure 14.16 *Physical layer of IEEE 802.11 DSSS*

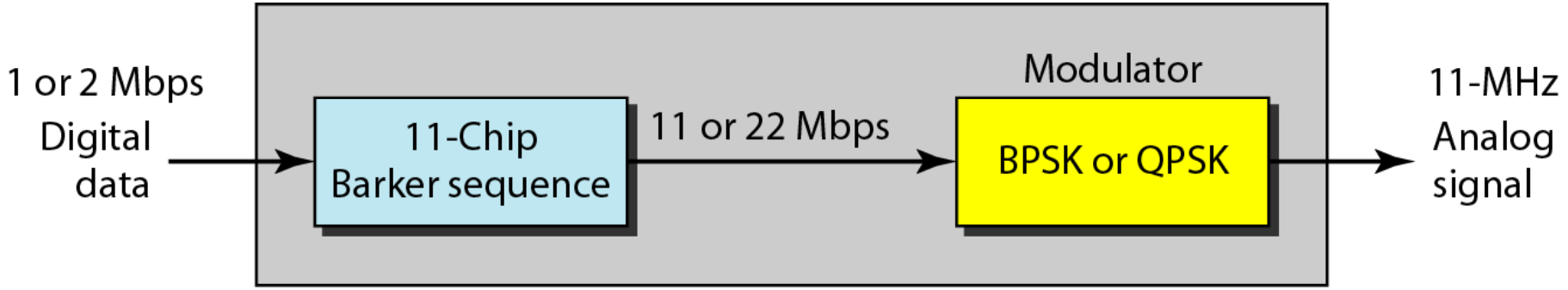


Figure 14.17 *Physical layer of IEEE 802.11 infrared*

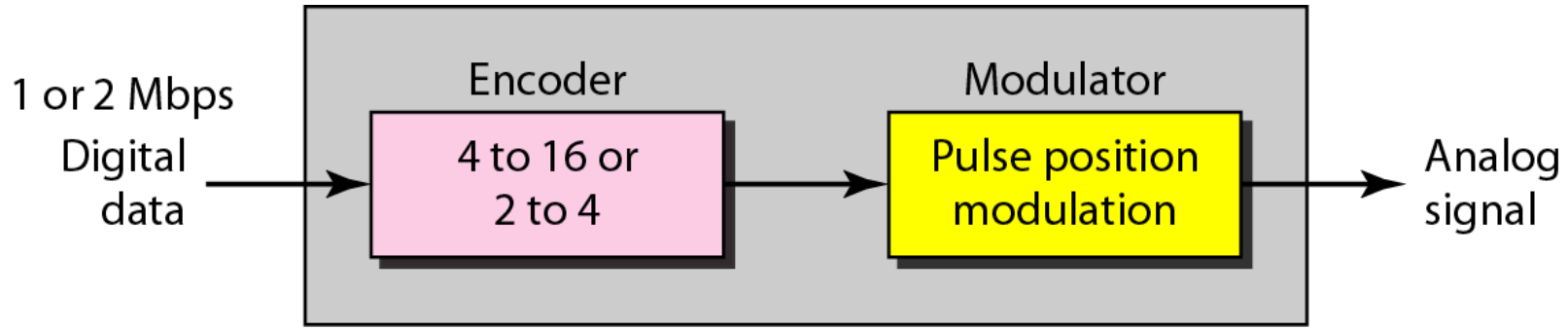
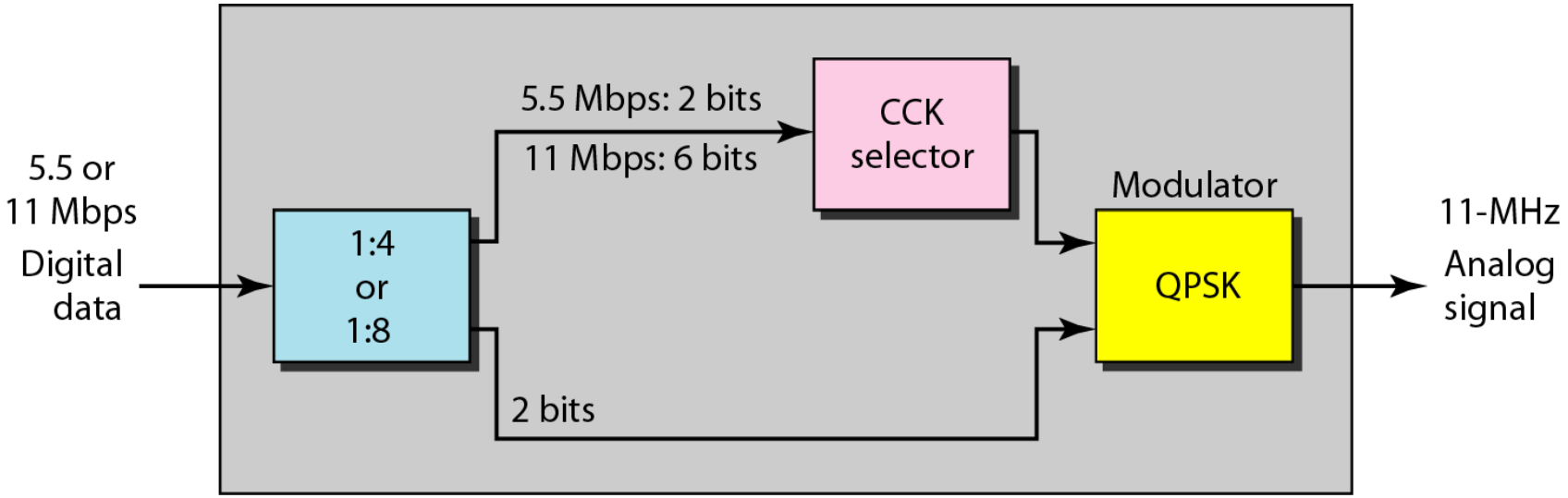


Figure 14.18 *Physical layer of IEEE 802.11b*



14-2 BLUETOOTH

***Bluetooth** is a wireless LAN technology designed to connect devices of different functions such as telephones, notebooks, computers, cameras, printers, coffee makers, and so on. A Bluetooth LAN is an ad hoc network, which means that the network is formed spontaneously.*

Topics discussed in this section:

Architecture
Bluetooth Layers
Baseband Layer
L2CAP

Figure 14.19 *Piconet*

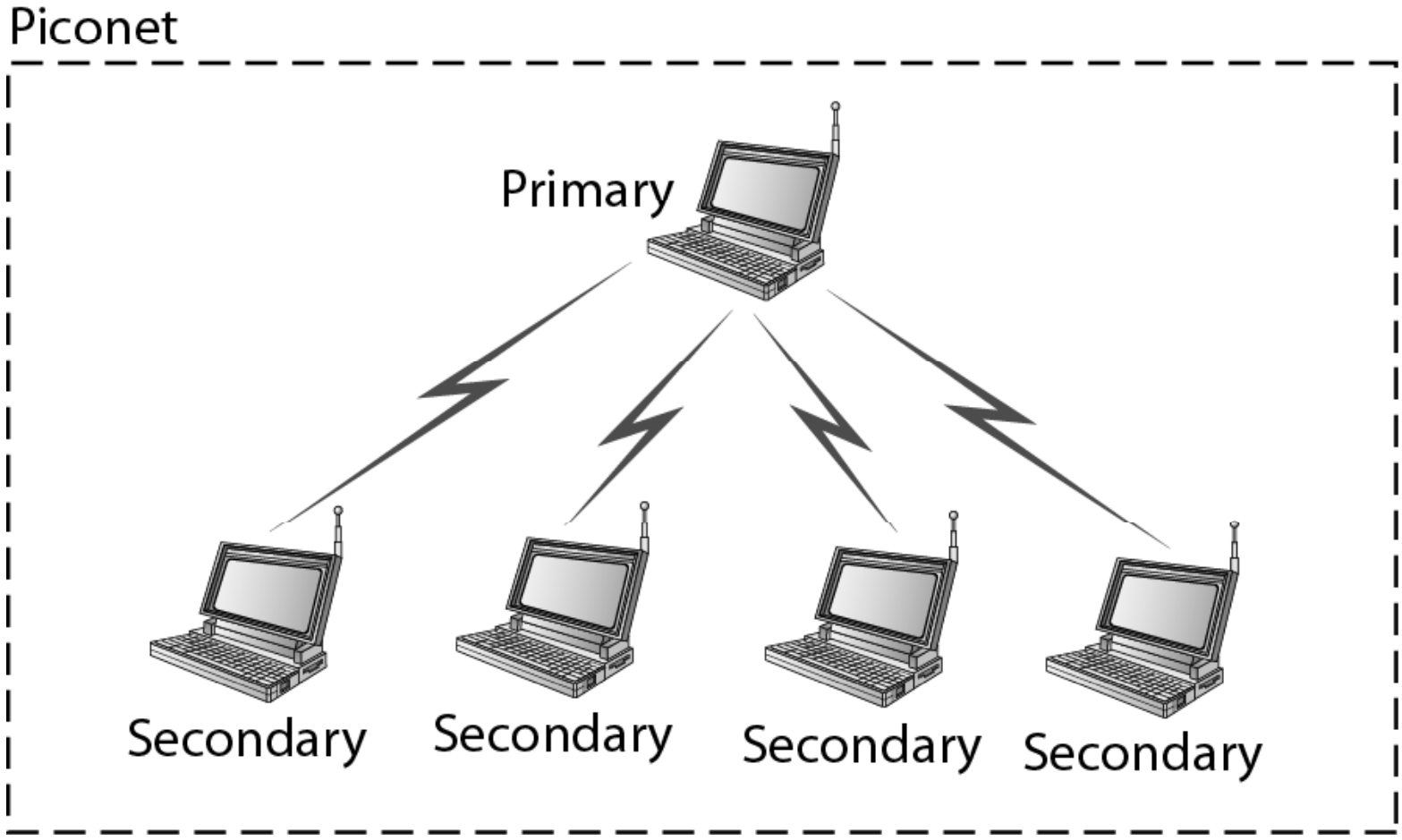


Figure 14.20 *Scatternet*

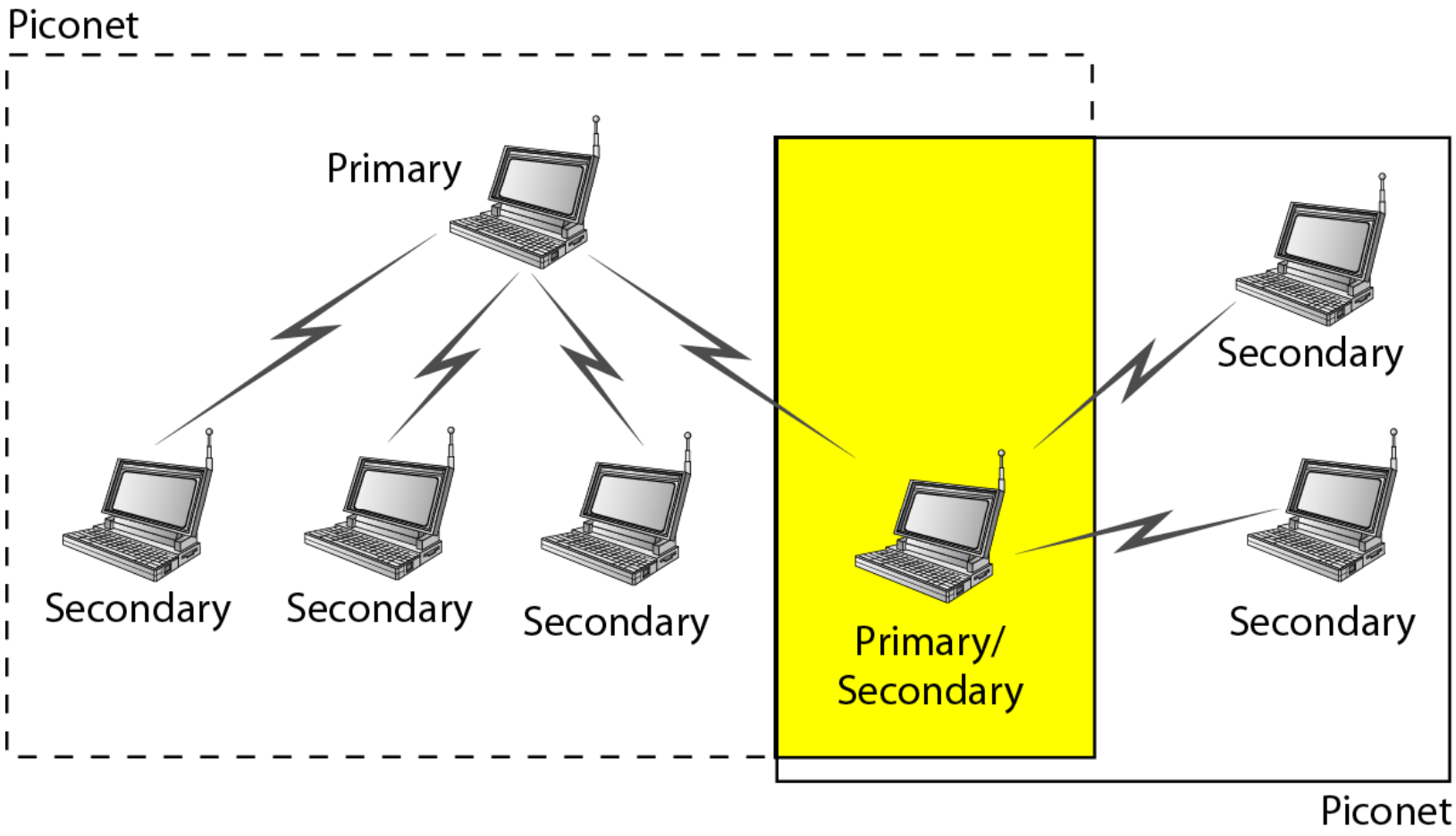


Figure 14.21 *Bluetooth layers*

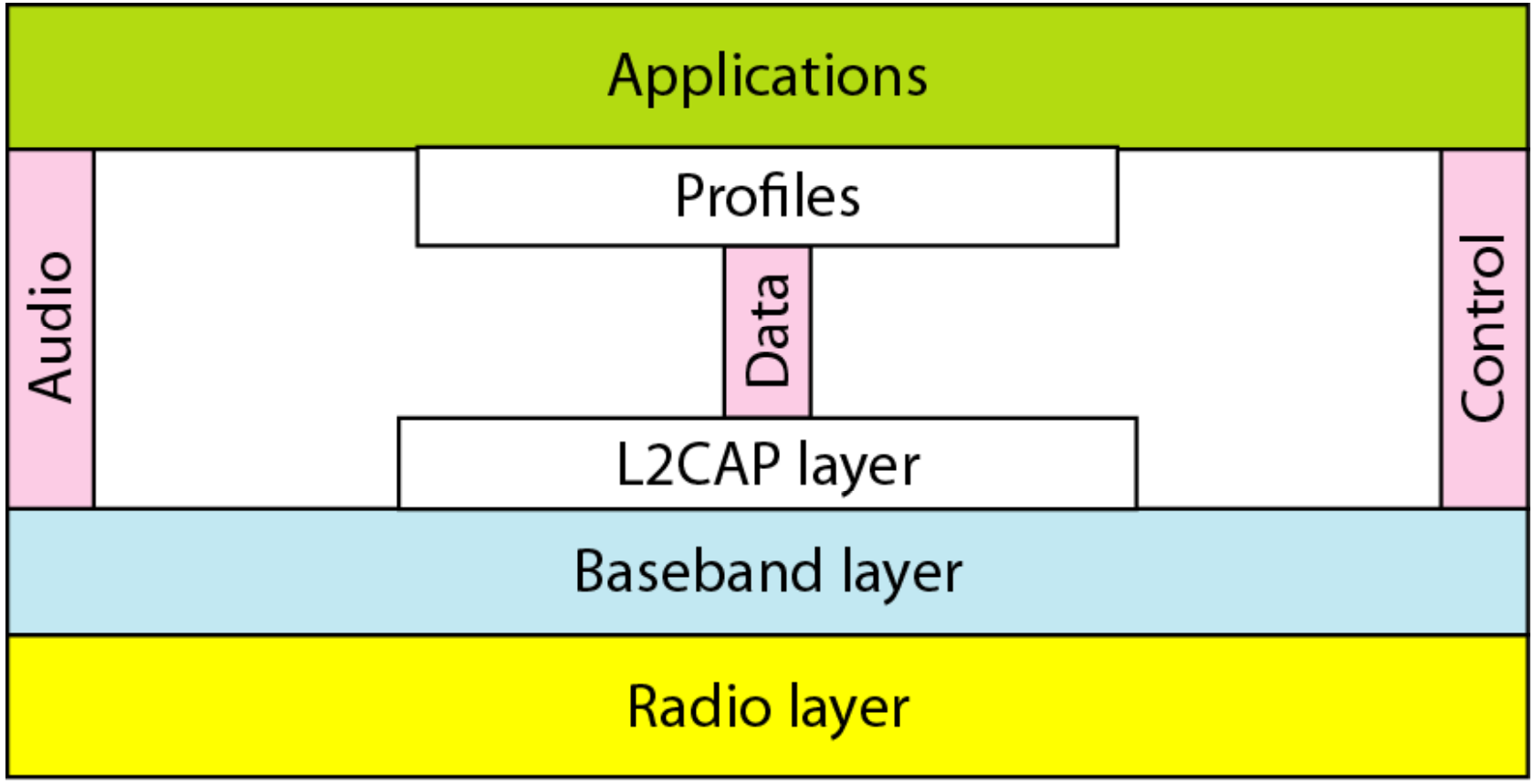


Figure 14.22 *Single-secondary communication*

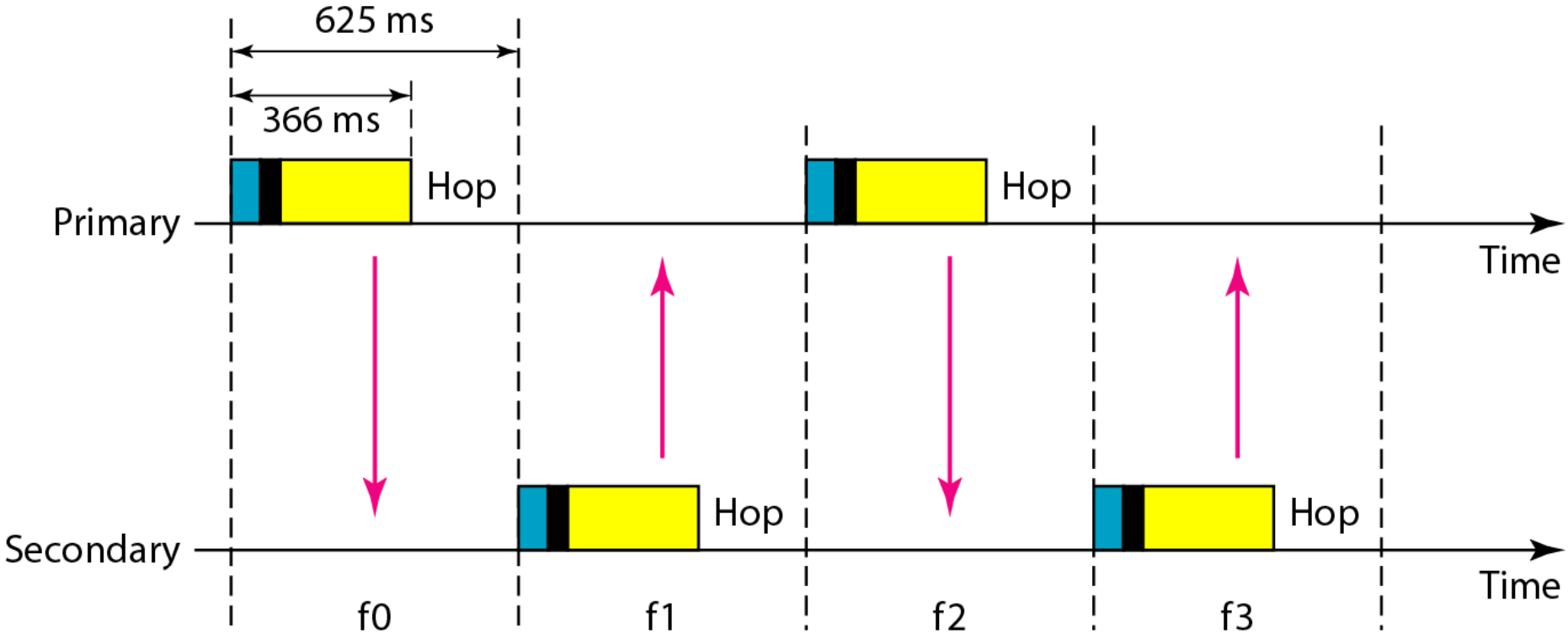


Figure 14.23 *Multiple-secondary communication*

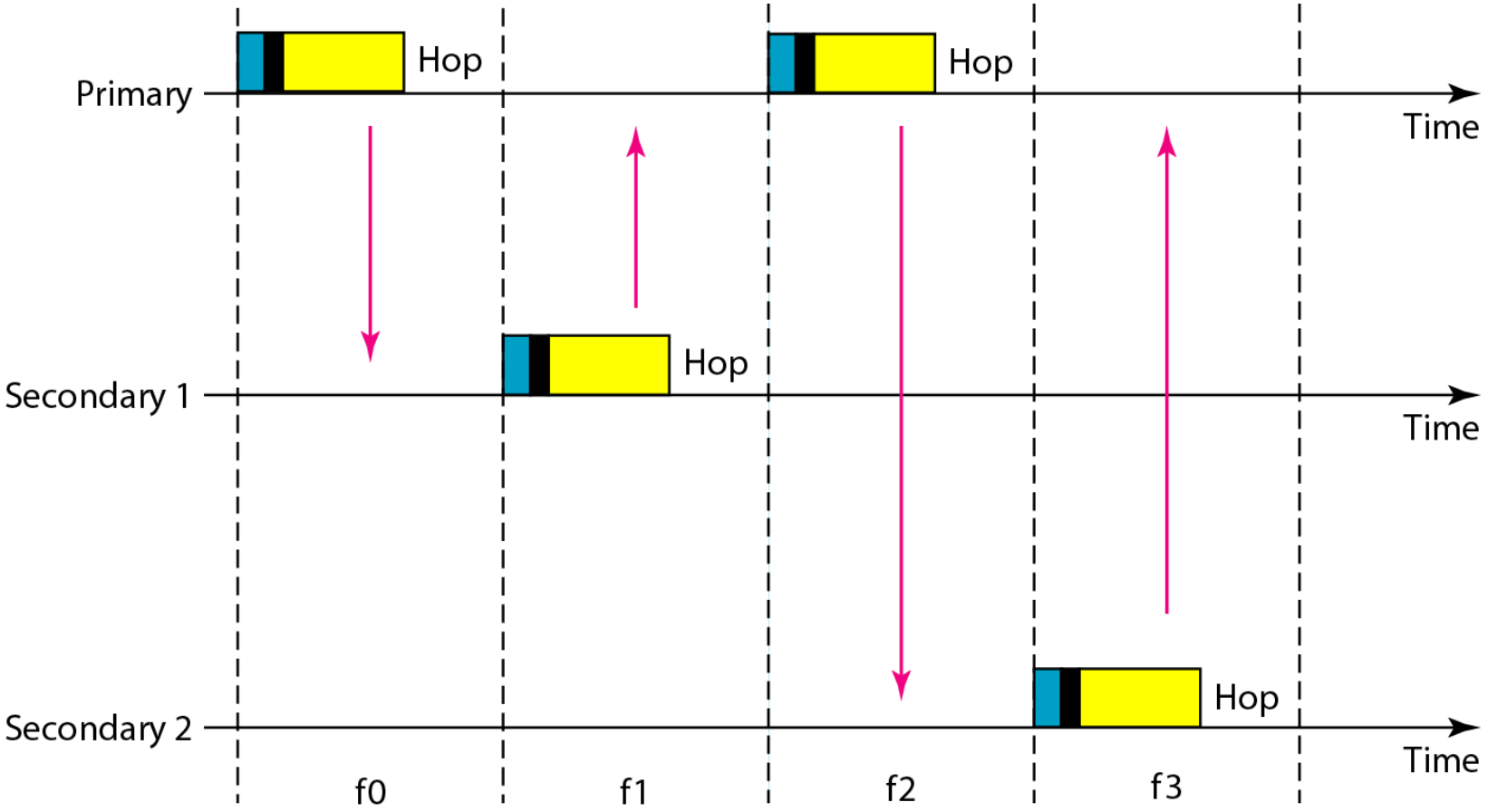


Figure 14.24 *Frame format types*

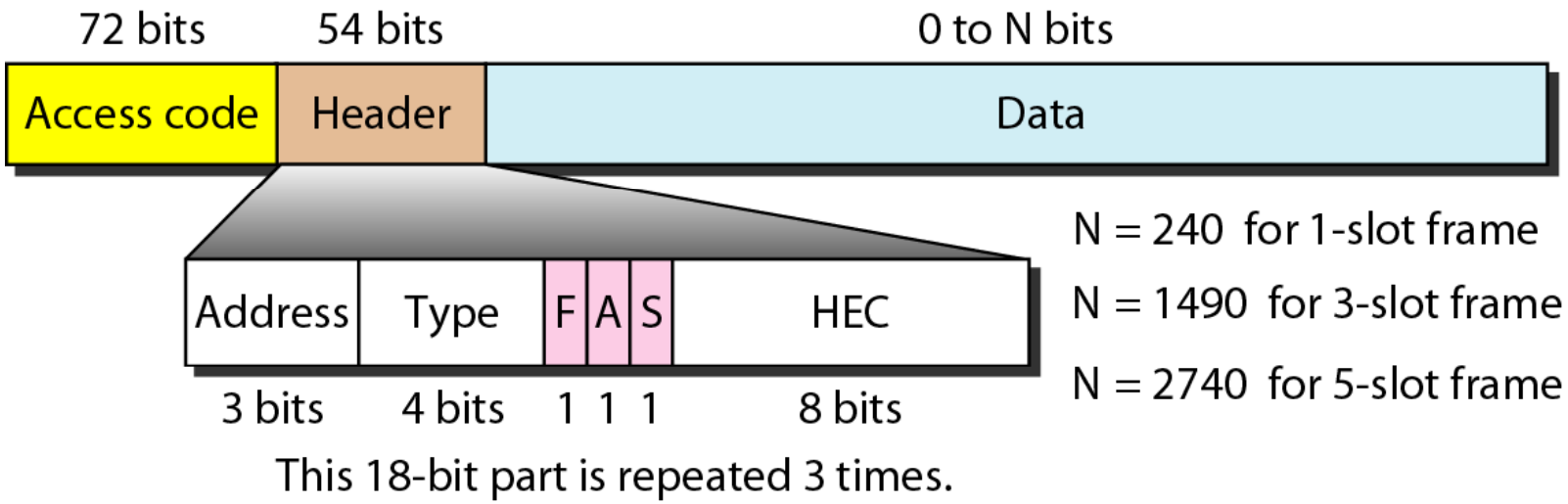


Figure 14.25 *L2CAP data packet format*