Wireless LANs

14-1 IEEE 802.11

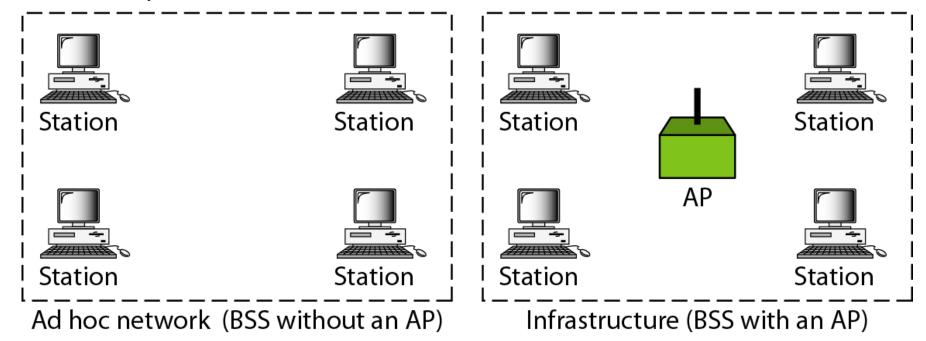
IEEE has defined the specifications for a wireless LAN, called IEEE 802.11, which covers the physical and data link layers.

Architecture MAC Sublayer Physical Layer

Figure 14.1 Basic service sets (BSSs)

BSS: Basic service set

AP: Access point





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

Figure 14.2 Extended service sets (ESSs)

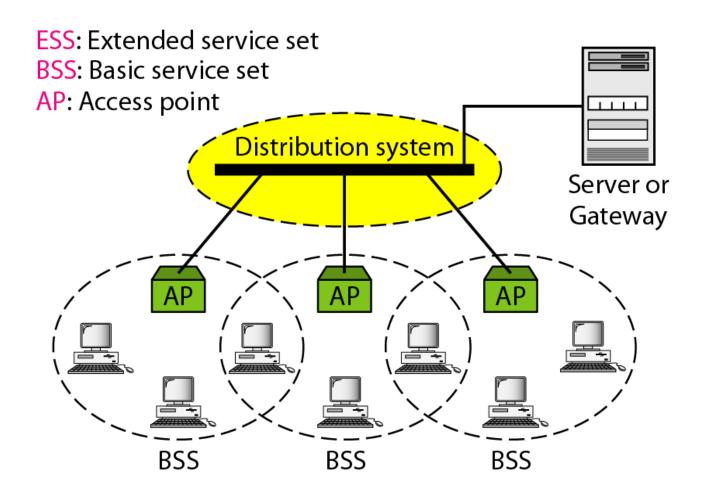


Figure 14.3 MAC layers in IEEE 802.11 standard

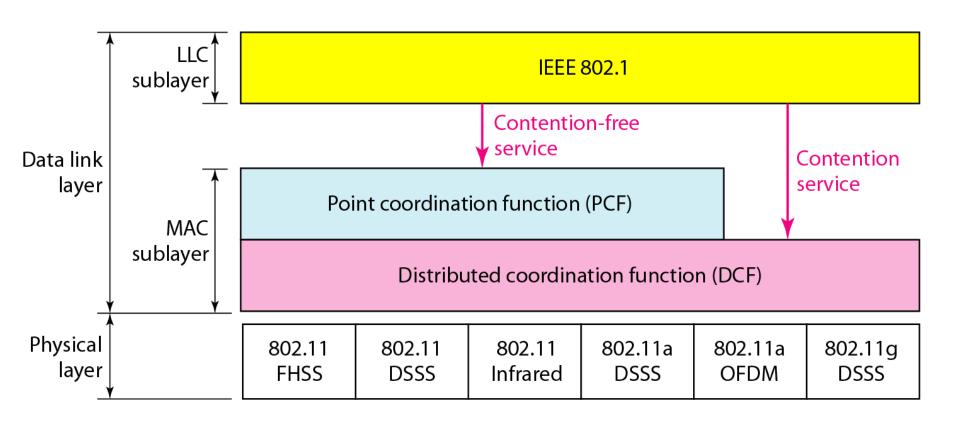


Figure 14.4 CSMA/CA flowchart

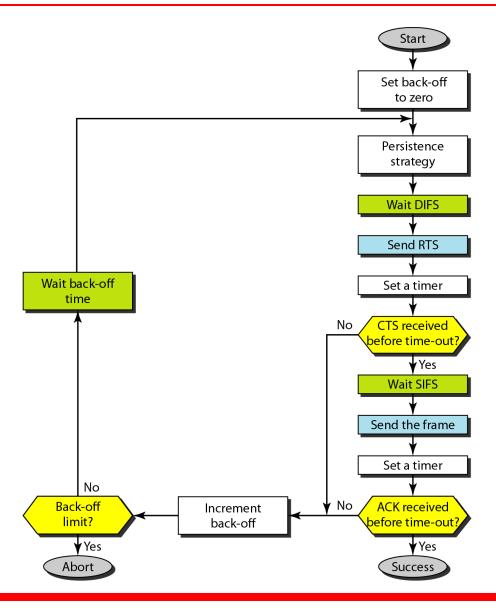


Figure 14.5 CSMA/CA and NAV

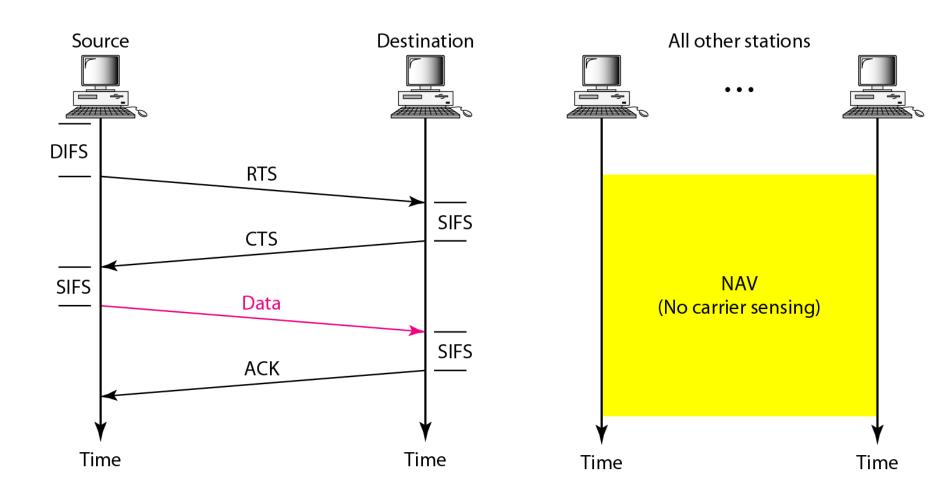


Figure 14.7 Frame format

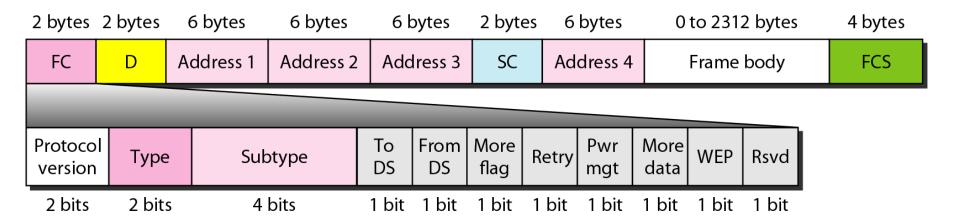
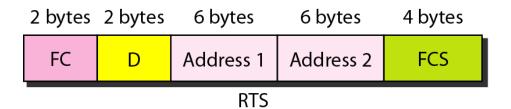


Table 14.1 Subfields in FC field

Field	Explanation		
Version	Current version is 0		
Туре	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



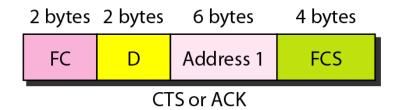


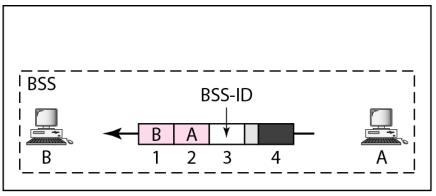
Table 14.2 Values of subfields in control frames

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

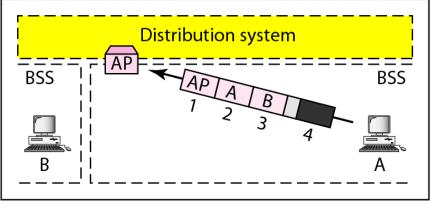
Table 14.3 Addresses

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

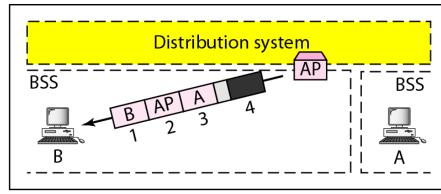
Figure 14.9 Addressing mechanisms



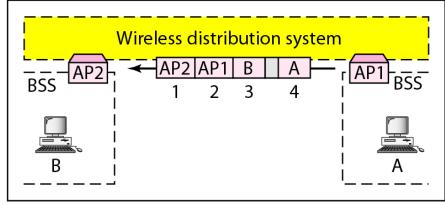
a. Case 1



c. Case 3

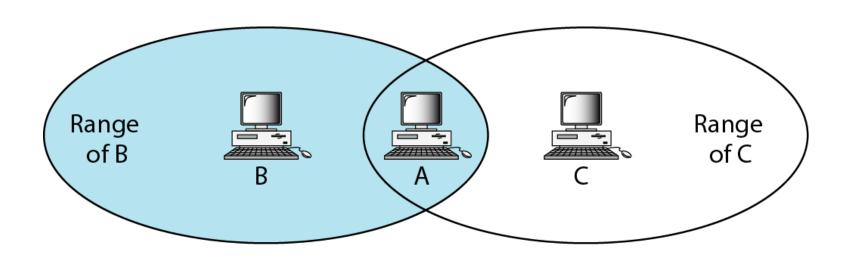


b. Case 2



d. Case 4

Figure 14.10 Hidden station problem



B and C are hidden from each other with respect to A.

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

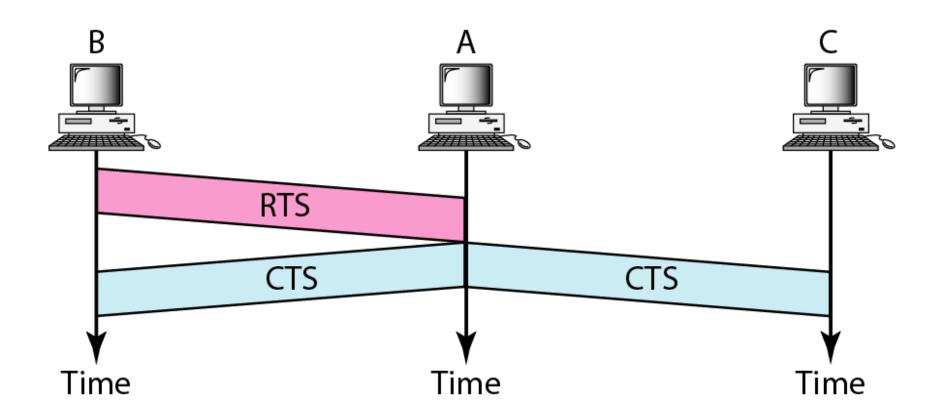
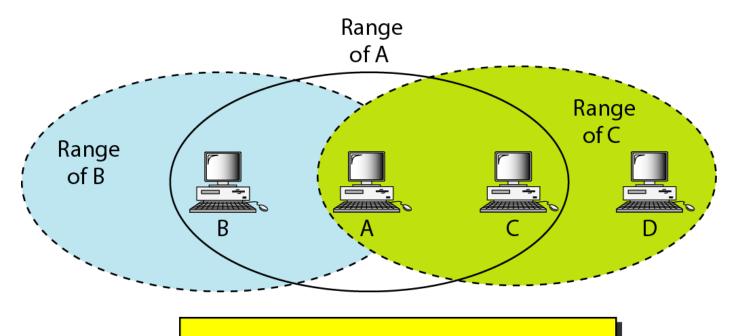


Figure 14.12 Exposed station problem



C is exposed to transmission from A to B.

Figure 14.13 Use of handshaking in exposed station problem

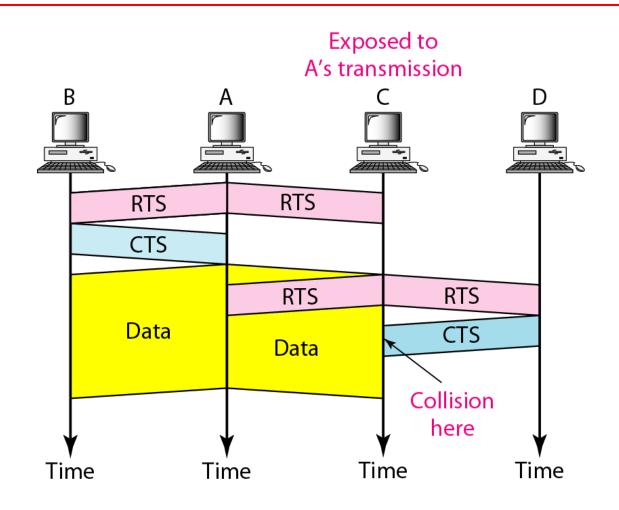


Table 14.4 Physical layers

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

802.11n (2009) 2.4/5 GHz - 288 and 600

802.11ac (2013) 5 GHz - 346 and 6466

14-2 BLUETOOTH

Bluetooth (802.15) 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.

Architecture
Bluetooth Layers
Baseband Layer
L2CAP

Figure 14.19 Piconet

Piconet

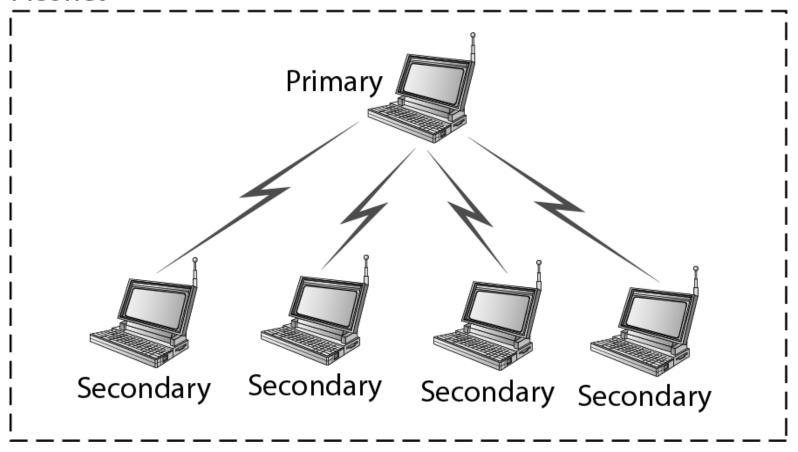
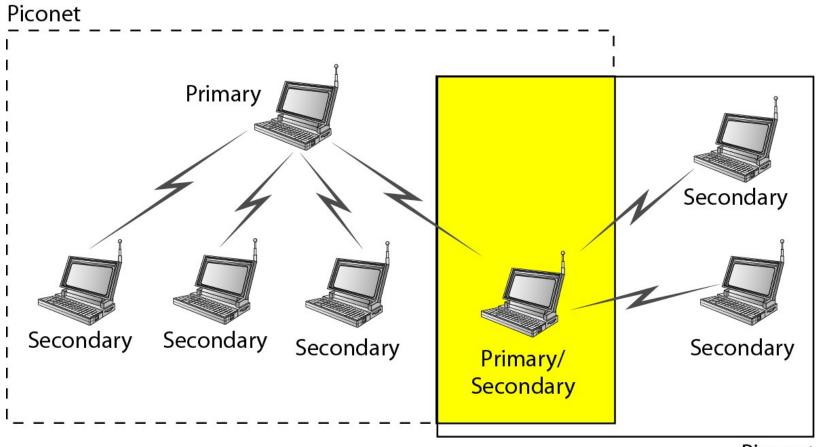


Figure 14.20 Scatternet



Piconet

Figure 14.21 Bluetooth layers

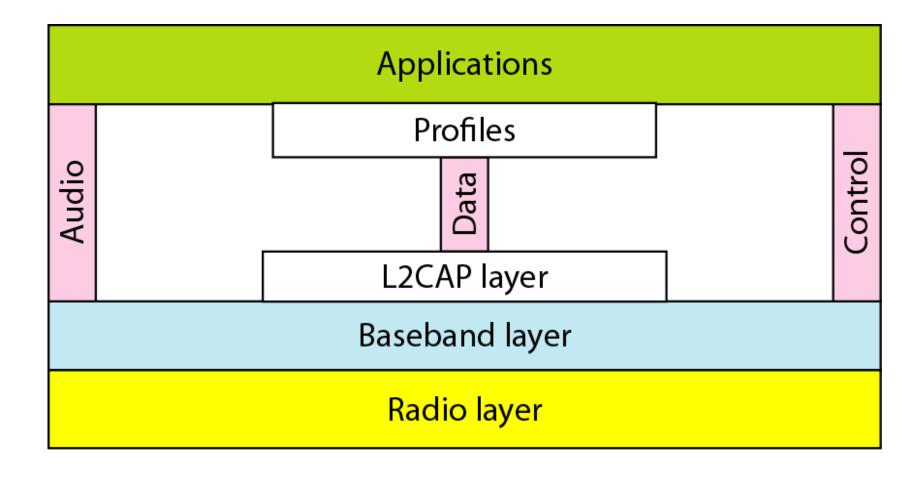


Figure 14.22 Single-secondary communication

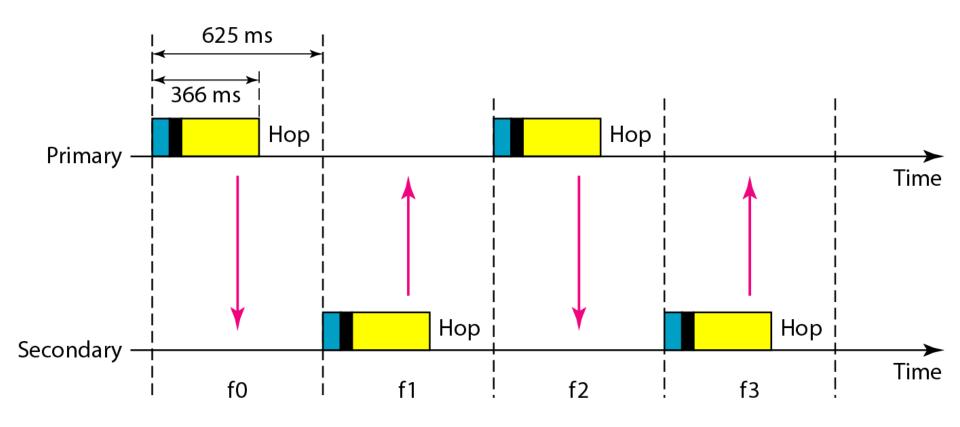


Figure 14.23 Multiple-secondary communication

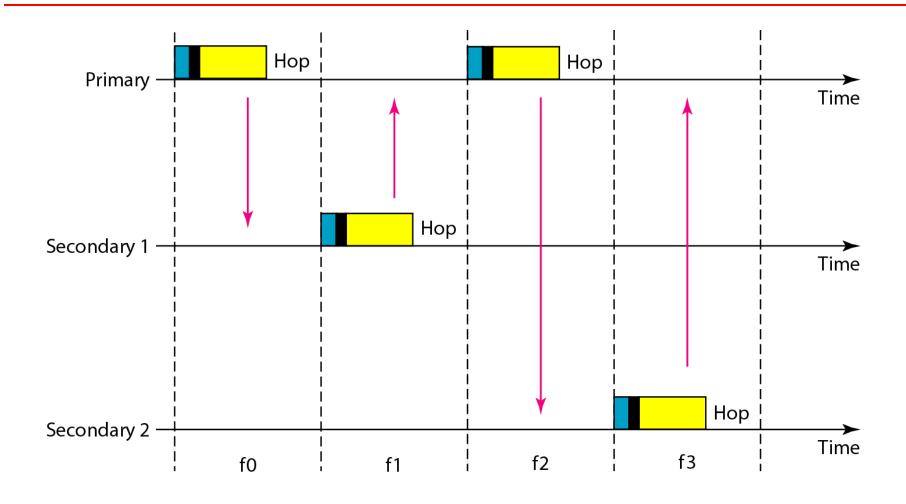


Figure 14.25 L2CAP data packet format

2 bytes	2 bytes	0 to 65,535 bytes
Length	Channel ID	Data and control