

Overview of 802.11 Networks

802.11



Outline

- ❑ IEEE 802.11 Network Family Tree
- ❑ 802.11 Nomenclature and Design
- ❑ Types of Networks
- ❑ 802.11 Network Operations
- ❑ Mobility Support

IEEE 802 Family Tree

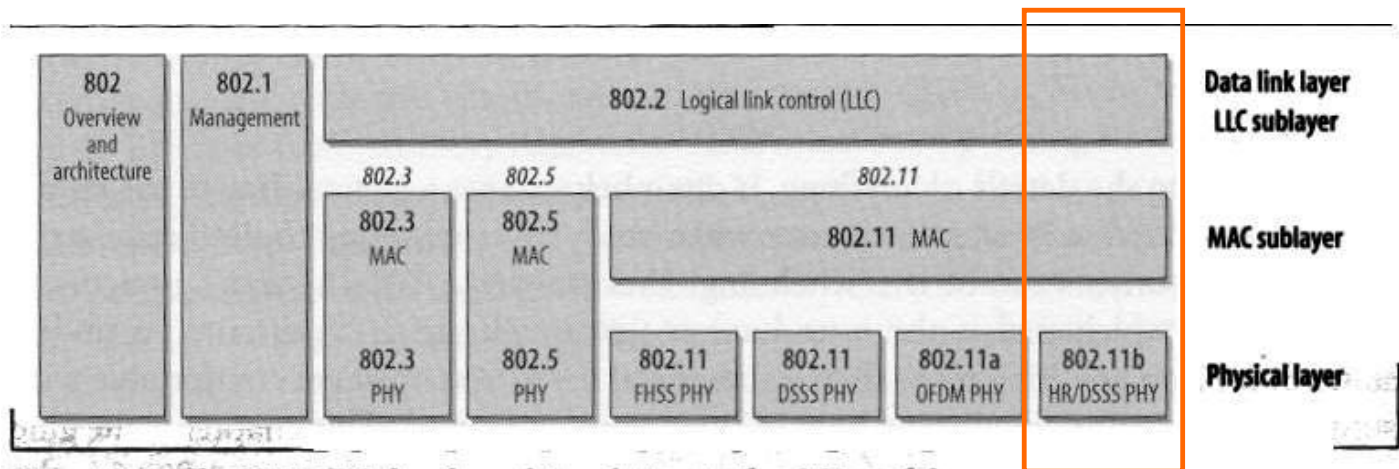


Figure 2-1. The IEEE 802 family and its relation to the OSI model

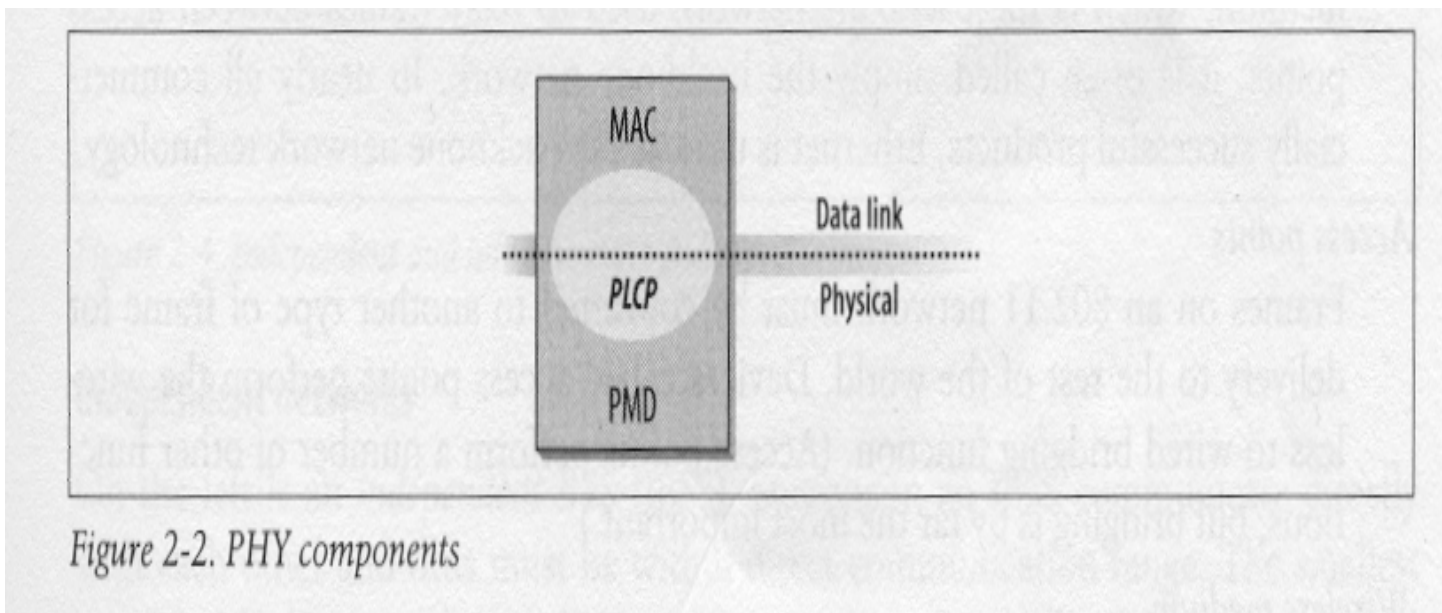
IEEE 802.11 Standards

Table 1-2. Comparison of 802.11 standards

IEEE standard	Speed	Frequency band	Notes
802.11	1 Mbps 2 Mbps	2.4 GHz	First standard (1997). Featured both frequency-hopping and direct-sequence modulation techniques.
802.11a	up to 54 Mbps	5 GHz	Second standard (1999), but products not released until late 2000.
802.11b	5.5 Mbps 11 Mbps	2.4 GHz	Third standard, but second wave of products. The most common 802.11 equipment as this book was written.
802.11g	up to 54 Mbps	2.4 GHz	Not yet standardized.

發布年份	Wi-Fi	無線網路標準	頻段	最高傳輸速率
1997 年	第一代	IEEE 802.11	2.4GHz	2Mbit/s
1999 年	第二代	IEEE 802.11a IEEE 802.11b	5GHz 2.4GHz	54Mbit/s 11Mbit/s
2003 年	第三代	IEEE 802.11g	2.4GHz	54Mbit/s
2009 年	第四代	IEEE 802.11n (Wi-Fi 4)	2.4GHz 或 5GHz	600Mbit/s
2013 年	第五代	IEEE 802.11ac (Wi-Fi 5)	5GHz	6,933Mbit/s
2019 年	第六代	IEEE 802.11ax (Wi-Fi 6)	2.4GHz 或 5GHz	9,607.8MBit/s

IEEE 802.11 PHY components



Nomenclature

- ❑ Distribution System: a logical component of 802.11 used to forward frames to their destinations
- ❑ Access Points: perform the wireless-to-wired bridging function
- ❑ Wireless Medium, Stations

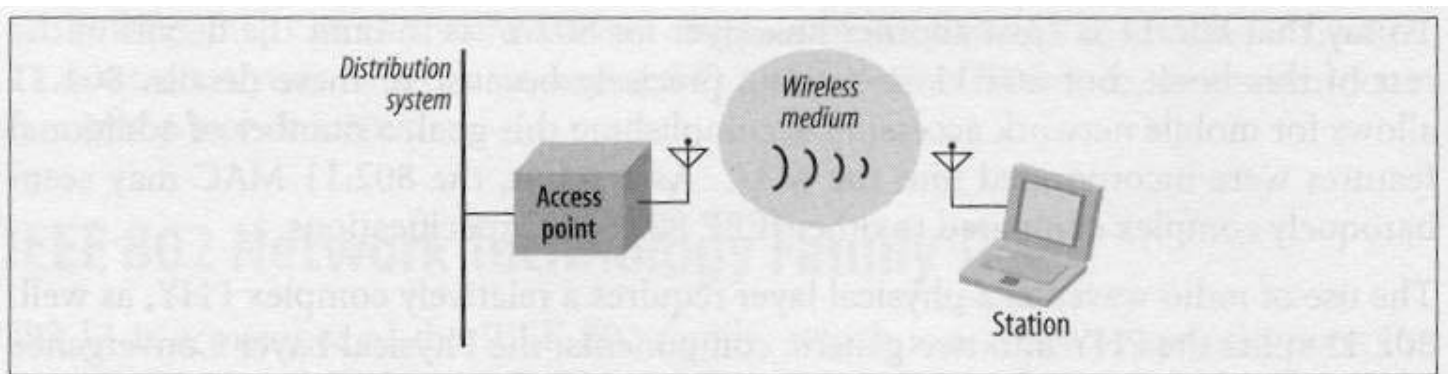


Figure 2-3. Components of 802.11 LANs

Types of Networks

- ❑ Independent networks (indep. basic service set, IBSS), also known as ad hoc networks.
- ❑ Infrastructure networks

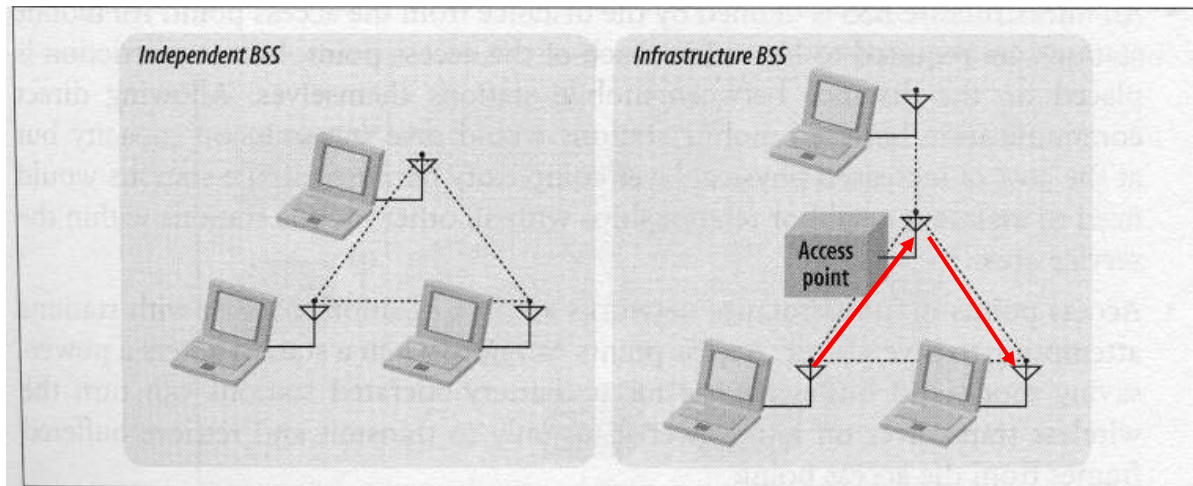
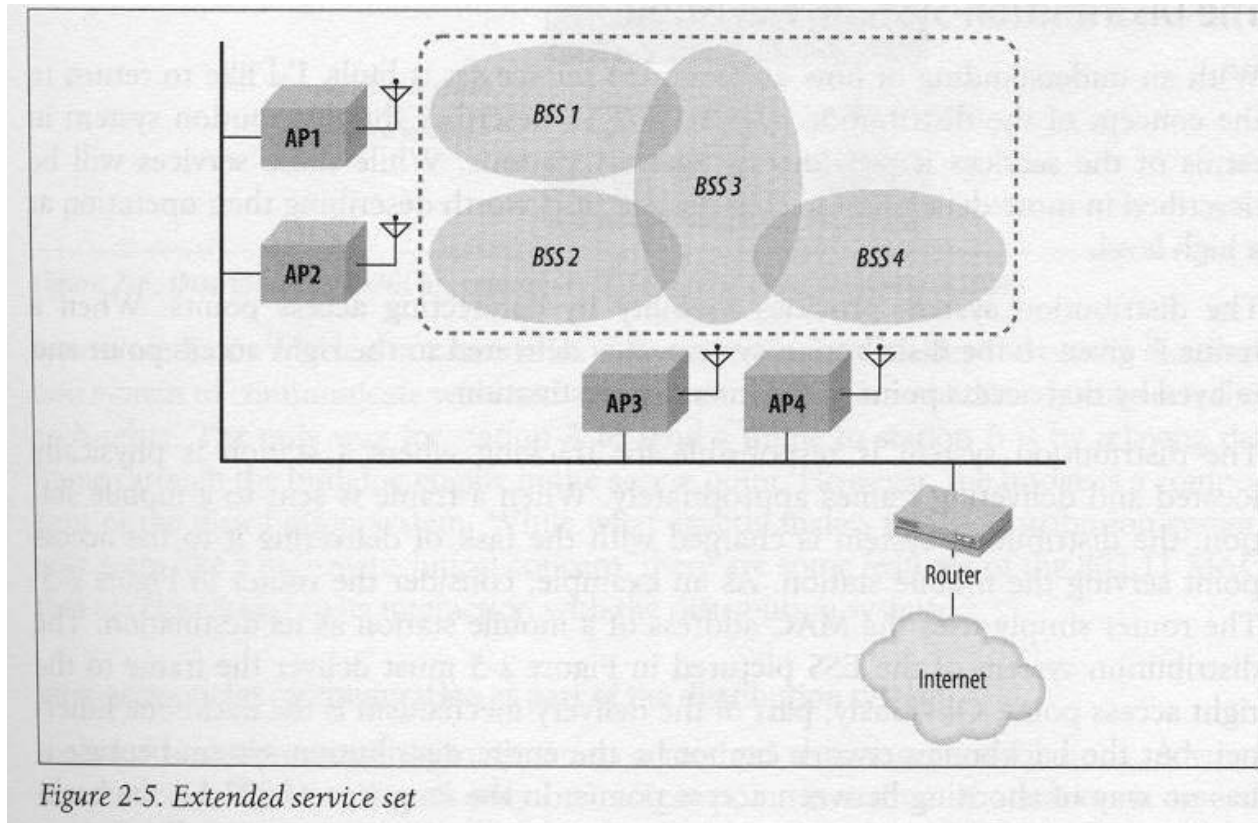


Figure 2-4. Independent and infrastructure BSSs

Infrastructure BSS

- ❑ Two advantages for infrastructure networks
 - The mobile stations need not to maintain neighbor relationships.
 - Access points assist with stations attempting to save power.
- ❑ In an infrastructure network, stations must *associate* with an AP to obtain network services. (equivalent to plug in the network cable)
- ❑ An extended service set (ESS) is created by chaining BSSs together with a backbone network.

Extended Service Set (ESS)



Access Point

- ❑ Access points act as bridges.
- ❑ The router uses a single MAC address to deliver frames to a mobile station; the AP with which that mobile station is associated delivers the frame.

Distribution System

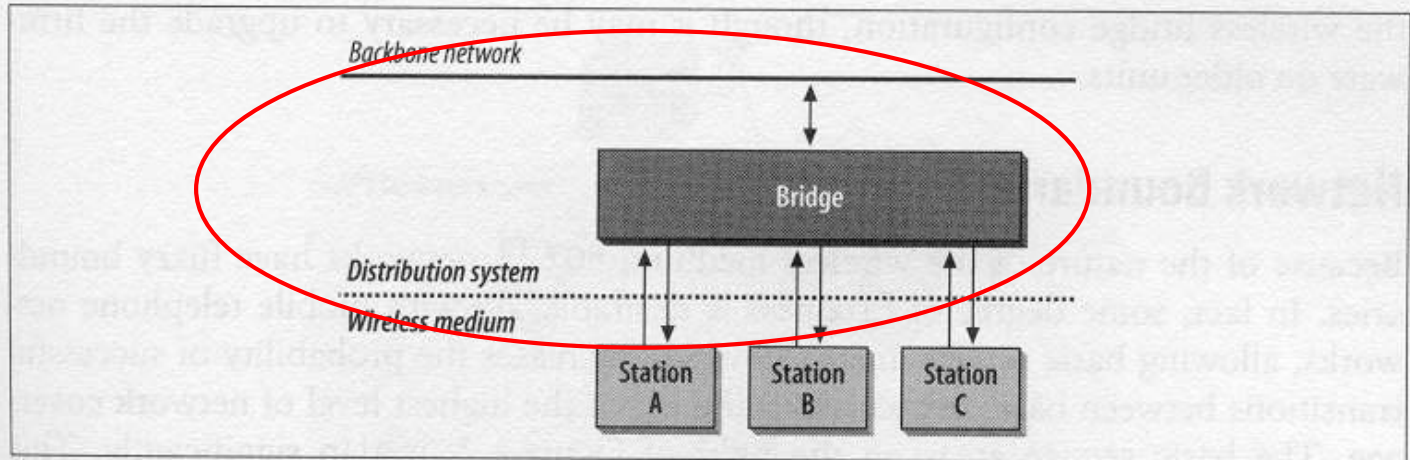
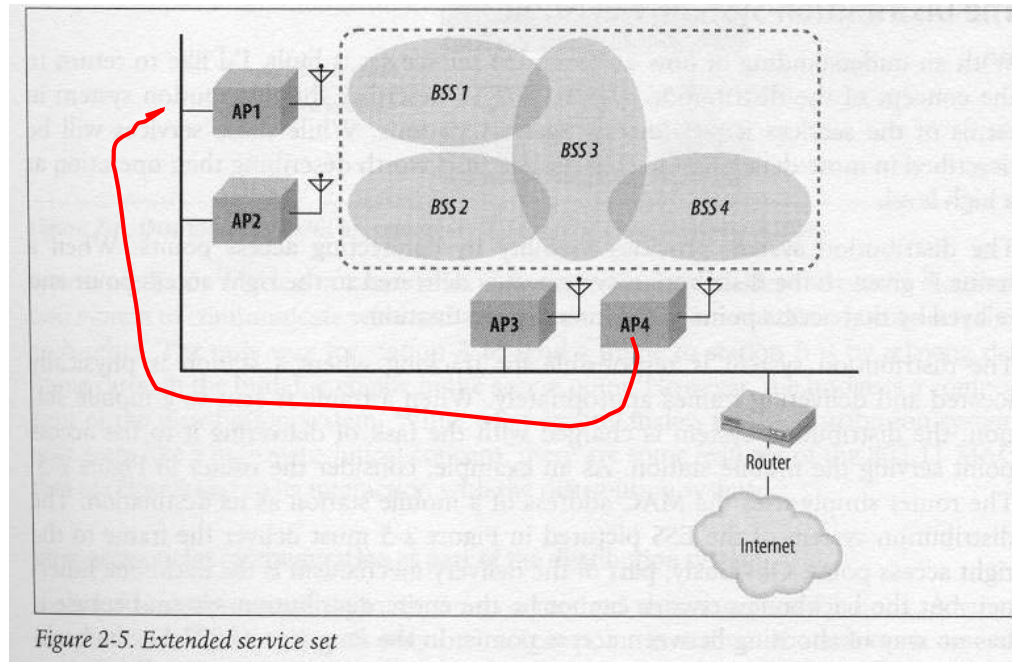


Figure 2-6. Distribution system in common 802.11 access point implementations

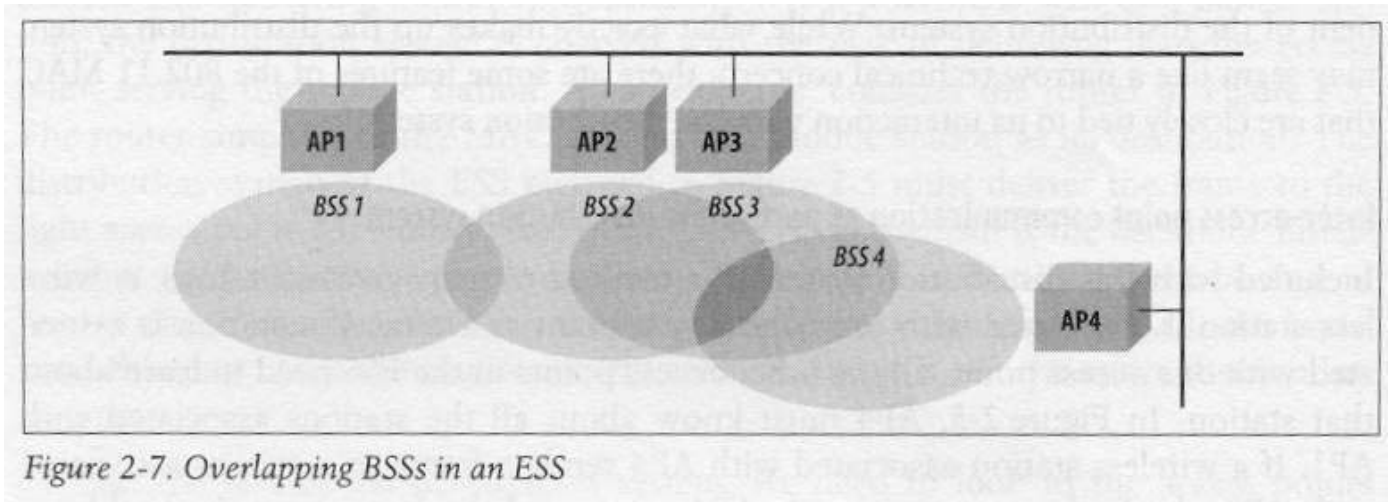
- ❑ The distribution system is responsible for tracking where a station is physically located and delivering frames appropriately.
- ❑ The backbone Ethernet is the *distribution system medium*, but it is not the entire distribution system.

Inter-AP Protocol (IAPP)



AP4 and AP1 exchange associated stations information for frame forwarding.

Network Boundaries



❑ 802.11 networks have fuzzy boundaries

AP3 fails → without compromising the network too badly

AP2 fails → two disjoint parts

Overlapping Network Types

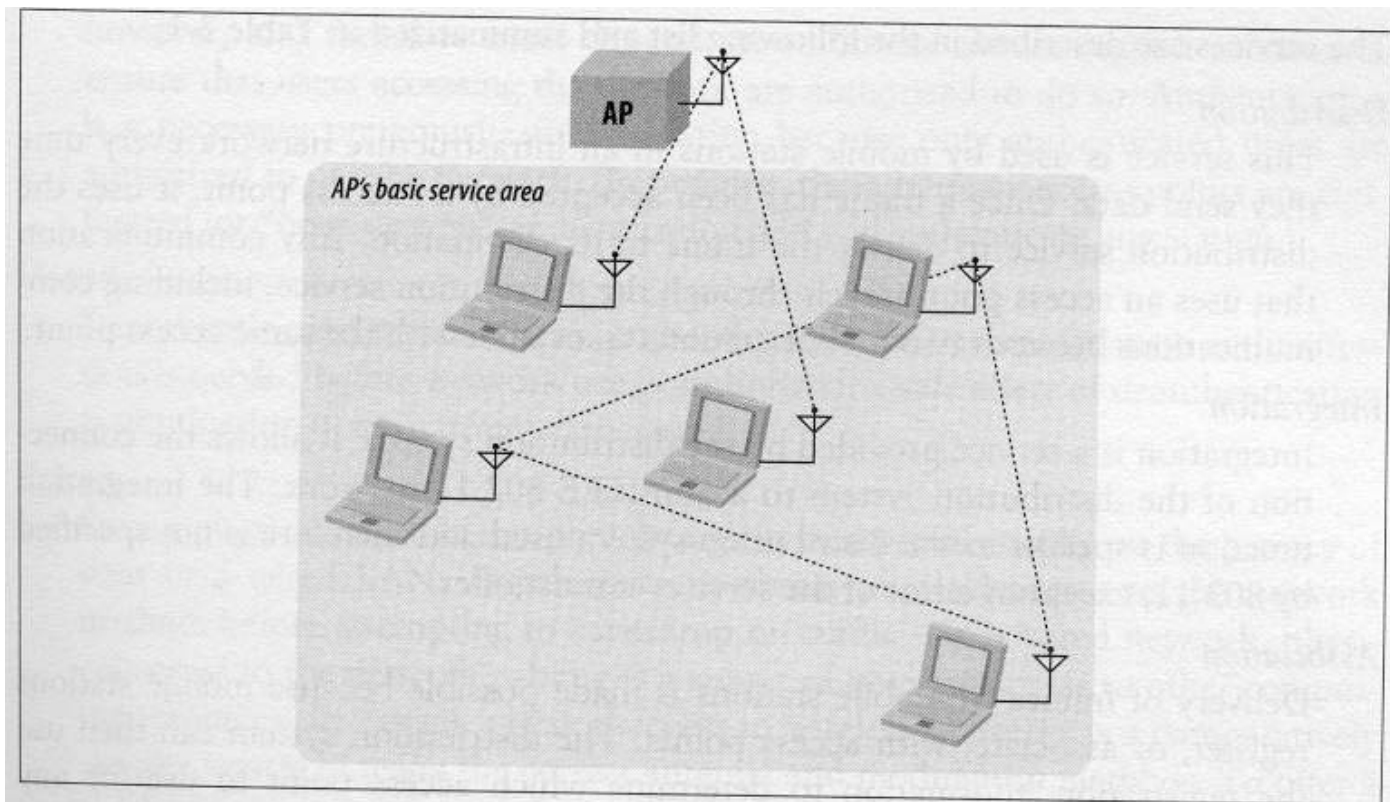


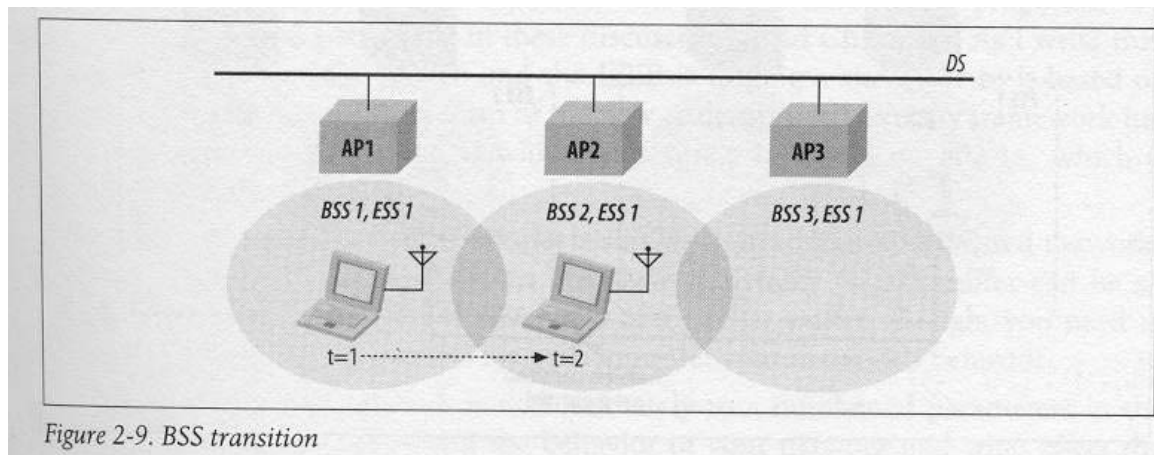
Figure 2-8. Overlapping network types

Network Services

- ☐ Distribution: Send function; Deliver the frame
- ☐ Integration: Allow the connection to a non-IEEE 802 networks.
- ☐ Association
- ☐ Re-association
- ☐ Dis-association
- ☐ Authentication
- ☐ De-authentication
- ☐ Privacy (Wired Equivalent Privacy, WEP)
- ☐ MAC Service Data Unit (MSDU) delivery: Getting data to the recipient.

Mobility Support

- Mobility can cause one of three types of transition
 - No Transition (In the same AP)
 - BSS transition (IAPP)
 - ESS transition (Mobile IP)



ESS transition (Mobile IP)

- In case of TCP/IP, Mobile IP is required to seamlessly support an ESS transition.

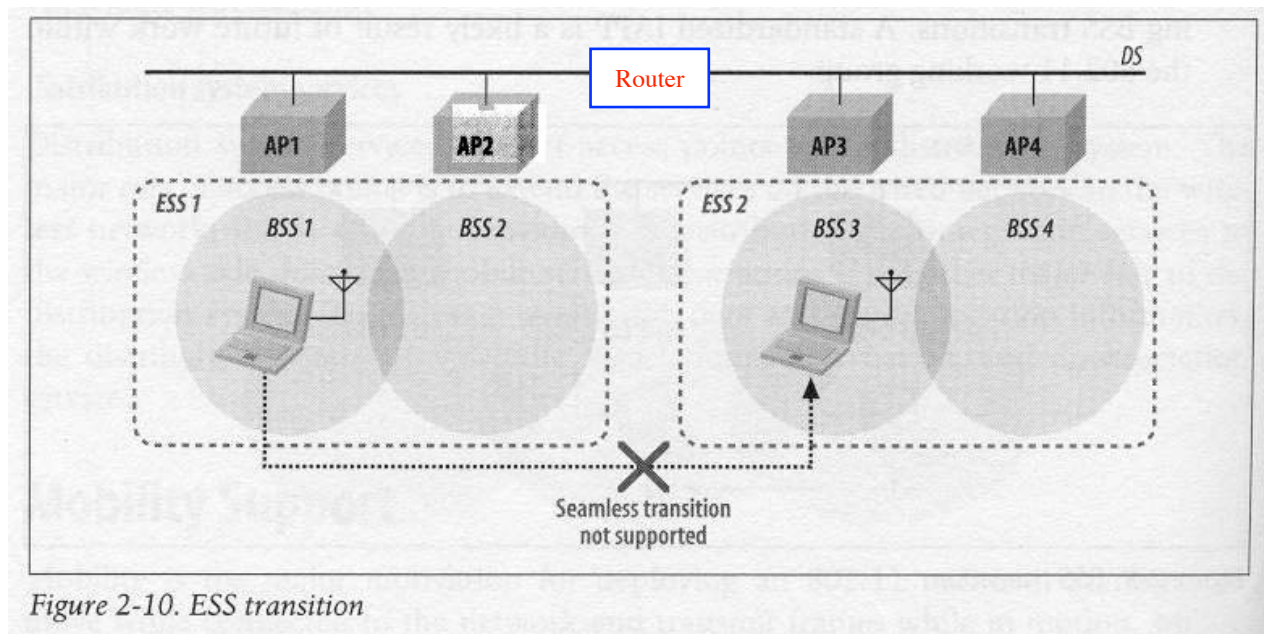


Figure 2-10. ESS transition