

DPIT127

Networks and Communications

WEEK 6

LOCAL AREA NETWORKS: PART II

Spring 2019

Wireless Ethernet

Not really a specific topology

- Workstation in a wireless LAN can be anywhere as long as it is within transmitting distance to an access point
- Several versions of IEEE 802.11 standard define various forms of wireless LAN connections (we'll take a look at these versions in a little bit)

Wireless Ethernet

Two basic components necessary:

- ❑ **Client radio**

- ❑ Usually a PC card with an integrated antenna installed in a laptop or workstation

- ❑ **Access point (AP)**

- ❑ An Ethernet port plus a transceiver

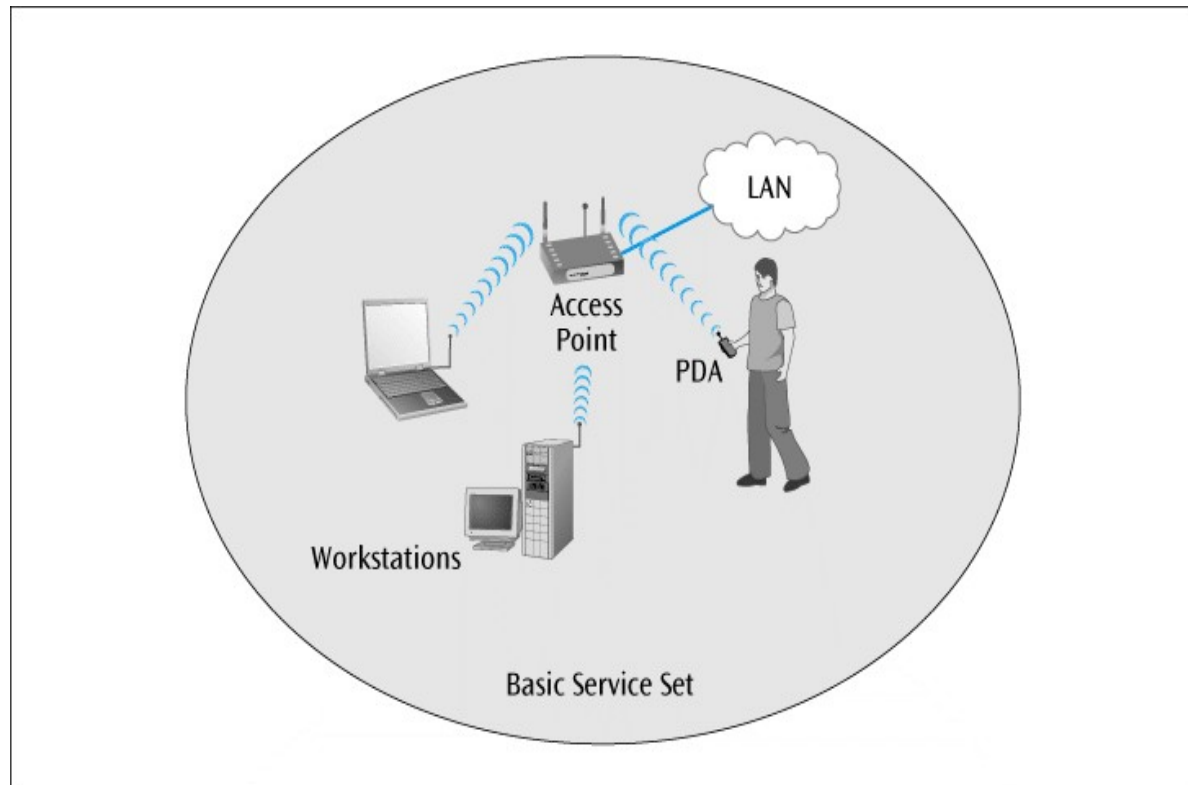
- ❑ Access point performs basic routing functions and acts as a bridge between the wired and wireless networks

- ❑ Workstations with client radio cards reside within Basic Service Set, whereas multiple basic service sets create an Extended Service Set

Wireless Ethernet

Figure 8-1

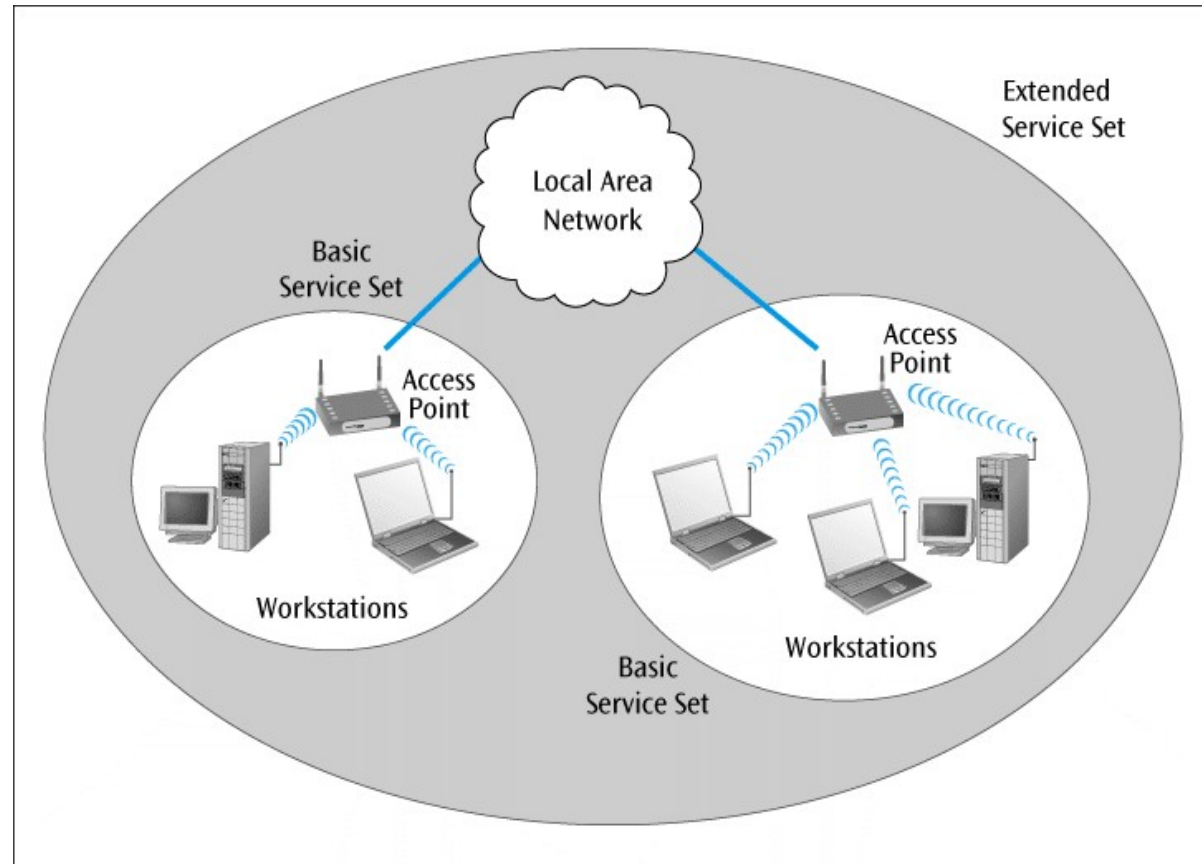
*A single-cell
wireless LAN
configuration*



Wireless Ethernet

Figure 8-2

***A multiple-cell
wireless LAN
configuration***



Wireless Ethernet

- ❑ **IEEE 802.11**

- ❑ Original wireless standard, capable of transmitting data at 2 Mbps

- ❑ **IEEE 802.11b**

- ❑ Second wireless standard, capable of transmitting data at 11 Mbps
 - ❑ In actual tests, 11 Mbps 802.11b devices managed 5.5 Mbps (from a July 2000 test by *Network Computing*)

Wireless Ethernet

- ❑ With the design of directional antennae for point-to-point transmission (rare), 802.11b can transmit up to 10 miles
- ❑ With an Omni-directional antenna on typical AP, range may drop to as little as 100 feet

Wireless Ethernet

IEEE 802.11a

- ❑ An improvement on the 802.11b standard
- ❑ Capable of transmitting data at 54 Mbps (theoretical) using the 5-GHz frequency range

IEEE 802.11g

- ❑ An additional improvement on 802.11b
- ❑ Capable of transmitting data at 54 Mbps (theoretical) but using the same frequencies as 802.11b (2.4-GHz)
- ❑ Is backwards compatible with 802.11b

Wireless Ethernet

IEEE 802.11n (100 Mbps theoretical)

- ❑ Latest standard approved
- ❑ Uses MIMO technology (multiple input multiple output)
 - ❑ Sender and receiver have multiple antennas for optimum reception

IEEE 802.11ac

- ❑ Uses advanced MIMO, wider channels in the 5 GHz band and advanced QAM techniques to achieve high data rates

Wireless Ethernet

To provide security, most systems use either:

- ❑ Wired Equivalent Privacy (WEP) – provides either 40- or 128-bit key protection (dated)
- ❑ WPA or WPA 2 (Wi-Fi Protected Access)
- ❑ WPA 2 uses the most advanced encryption techniques

Wireless LANs may also be configured without an access point

- ❑ These configurations are called “ad-hoc”

Wireless CSMA/CA

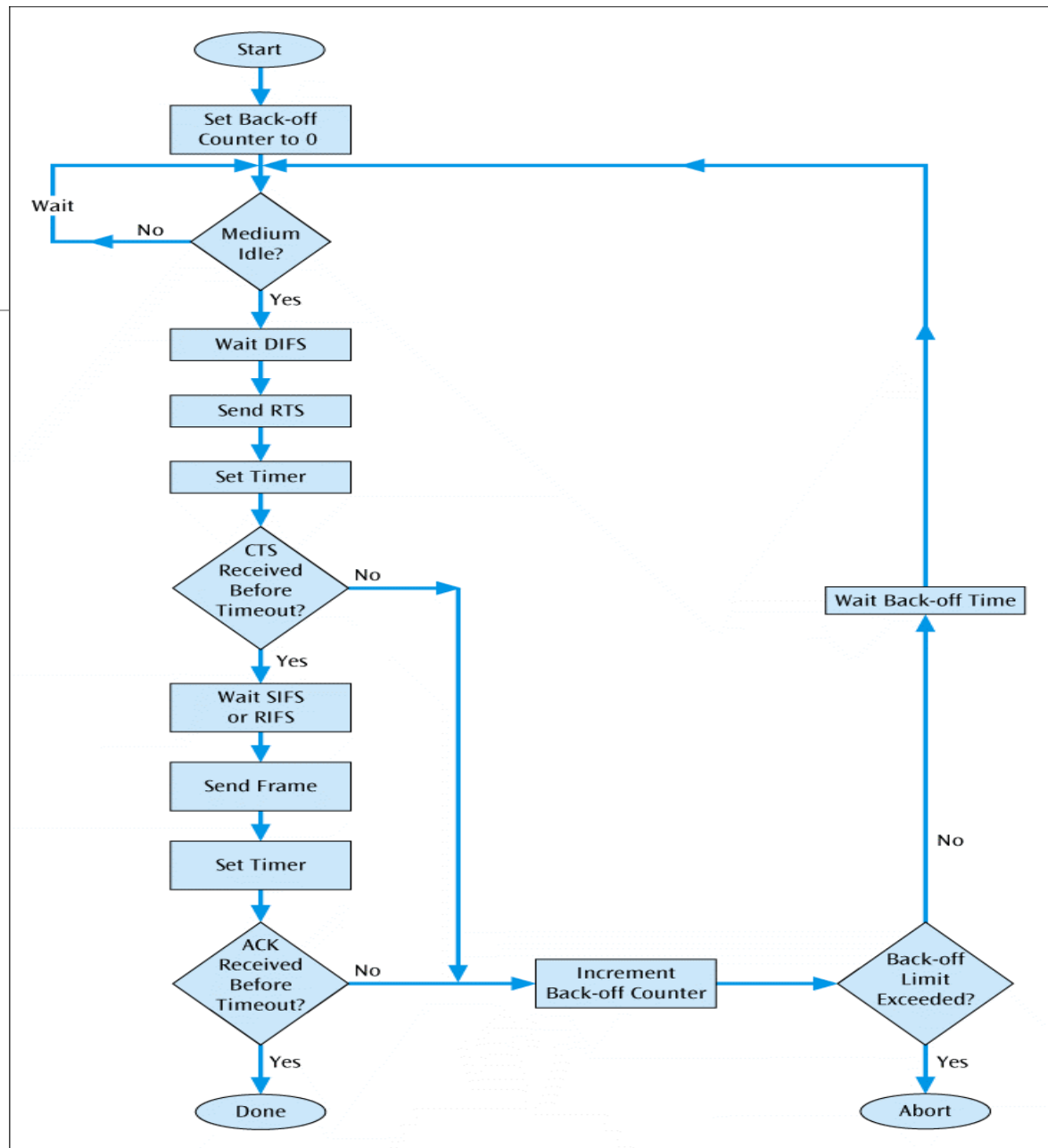
CA (Collision avoidance)

- ❑ Protocol does not listen and detect collisions like CSMA/CD
- ❑ Instead, tries to avoid collisions before they happen

How does CSMA/CA do this?

- ❑ All devices, before they transmit, must wait an amount of time called an interframe space (IFS)
- ❑ Some applications have a short IFS, while others have a long IFS
 - ❑ If two applications want to transmit at same time, the application with shorter IFS will go first

Figure 8-3
*Flowchart showing the
algorithm for CSMA/CA*

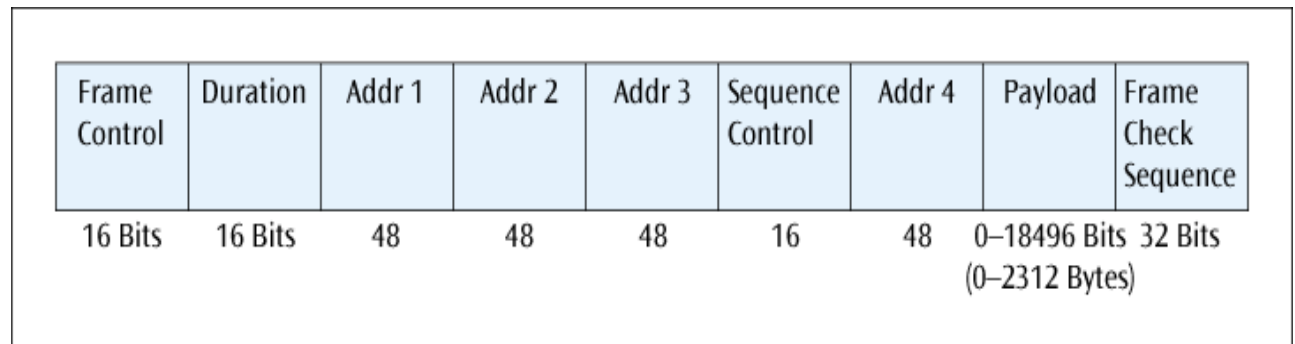


Wireless CSMA/CA

Note that the frame format for wireless Ethernet (CSMA/CA) has four address fields:

Figure 8-4

The various fields of the CSMA/CA frame



LAN Support

- ❑ Proper support of a local area network requires hardware, software, and miscellaneous support devices
- ❑ Network OS is the most important software component
- ❑ Numerous network support programs are also required to support users on a LAN
 - ❑ Support devices such as hubs, switches, routers, servers, modems, power supplies, and more are also necessary

Network Operating Systems

- ❑ An OS manages all applications and resources in a computer
- ❑ Multitasking OS supports execution of multiple processes at one time
- ❑ Network OS is large, complex program that manages the resources common on most LANs; client OS such as Windows OS can perform *some* networking functions
- ❑ Besides performing standard OS functions, a network OS is called upon for additional functions, such as (Next Page)

Network Operating Systems (continued)

Table 8-1

Summary of network operating system functions

Network Operating System Functions
Manage one or more network servers <ul style="list-style-type: none">Maintain a file system of data sets, applications, user profiles, network peripheralsCoordinate all resources and services availableProcess requests from usersPrompt users for network login, validate accounts, apply restrictions, perform accounting functions
Manage one or more network printers
Manage the interconnection between local area networks
Manage locally connected users
Manage remotely connected users
Support system security
Support client/server functions
Support Web page development and Web server operations

Current Network Operating Systems

Several popular network OSs currently exist:

- ❑ Windows Server family
- ❑ Unix
- ❑ Linux
- ❑ NetWare derivatives

Even though NetWare installations are now much fewer than any of the first three, NetWare is introduced first since it was the first to introduce the modern LAN directory structure

Novell NetWare

- ❑ At one time NetWare was the leading LAN OS
- ❑ Has since fallen way down the list on number of installations and may even pass into oblivion some day
- ❑ Nonetheless, it was NetWare that introduced a number of very powerful concepts, including the hierarchical directory structure

Novell NetWare (continued)

Version 3 – Popular but older version of Novell NetWare

- ❑ No longer supported by Novell (end of 2000)
- ❑ User logs onto a particular server
- ❑ Bindery maintains directory system

Version 4

- ❑ Unlike version 3 this version allows single network login
- ❑ Bindery replaced by powerful NDS database
- ❑ No longer supported by Novell (beginning of 2004)

Unix

- ❑ Well established and very popular multitasking OS capable of supporting network operations
- ❑ First OS written in the language C
- ❑ Very stable system capable of supporting very large operations
- ❑ Numerous versions available from different vendors

Linux

- ❑ OS based on the principles of Unix.
- ❑ Many versions available for free (Free Software Foundation's GNU toolset) or very small price
- ❑ Very stable multitasking OS
- ❑ When incorporated with other free software products, such as Apache Web server and Atipa's BlueBird network management software, this system becomes extremely cost effective and powerful

Novell Linux

Novell, seeing that its market share of NetWare was eroding, moved into the Linux market in the early 21st century

- Novell currently offers a number of versions of Linux, including high-power servers and desktop OSs

Network Servers

- ❑ In order to support a network OS, you need one or more network servers
 - ❑ Network servers are high-power workstations often with multiple processors, RAID, SCSI, and lots of memory and disk space
 - ❑ Various forms of servers include server appliances, and server blades
- ❑ Server virtualization allows you to create multiple servers in software all running on a single physical server

Network Servers (continued)

- ❑ To protect the server from catastrophic disk failure, disk drives on most network servers support one of the redundant array of independent disks (RAID) techniques
 - ❑ RAID is a collection of techniques for interfacing multiple hard disk drives to a computer

Network Servers (continued)

Some of the more common RAID techniques include:

❑ RAID-0

❑ Data is broken into pieces, and each piece is stored on different disk drives

❑ This technique is known as striping.

❑ RAID-1

❑ Data is stored on at least two disk drives, in duplicate, to provide a level of redundancy (or fault tolerance), should one disk become corrupted

❑ This technique is known also as disk mirroring

Network Servers (continued)

Some of the more common RAID techniques include (continued):

❑ RAID-3

- ❑ Data is redundantly stored across multiple disk drives (striping), and error-checking information concerning the stored data is kept on a separate disk

❑ RAID-5

- ❑ Data is broken into pieces (stripes) and stored across three or more disks
- ❑ Parity information (error-checking code) is stored along with the striped data, not on a separate disk
- ❑ RAID-5 is the most popular of the RAID techniques

Client/Server vs. Peer-to-Peer Networks

- ❑ A clear majority of LANs are **Client/server networks**
 - ❑ A client/server network has one or more network servers supporting the operations of one or more clients, or user workstations
- ❑ **Peer-to-peer networks**
 - ❑ May have servers, but the network relies less on the servers and more on the communications between workstations

Network Support Software

In order to support a network OS, may also need:

- ☐ Utilities
- ☐ Internet software

Utilities

Eight of the more common groups of network utility software include:

- ☐ Antivirus software
- ☐ Anti-spam software
- ☐ Anti-spyware software
- ☐ Backup software
- ☐ Network-monitoring software
- ☐ Crash protection software
- ☐ Security assessment software
- ☐ Remote access software
- ☐ Uninstall software

Internet Software

- ❑ Software necessary to support server side of Internet connections
- ❑ Retrieves Web pages and other documents when asked to by a client workstation
- ❑ Can interface with database program allowing users to store and retrieve data via Internet
- ❑ Necessary with commercial Internet applications

Software Licensing Agreements (SLA)

- ❑ Virtually every commercial software program comes with a specific licensing agreement
- ❑ Most licensing agreements specify the following conditions:
 - ❑ Software installation and use
 - ❑ Network installation
 - ❑ Backup copies
 - ❑ Decompilation
 - ❑ Rental statement
 - ❑ Upgrade availabilities
 - ❑ Copyright restrictions
 - ❑ Maintenance agreements

Software Licensing Agreements (continued)

Most licensing agreements come in one of the following forms:

- ☐ Single-user-single-station license
- ☐ Single-user-multiple-station license
- ☐ Interactive user license
- ☐ Network server license
- ☐ Site license
- ☐ Corporate license

LAN Support Devices

Other devices necessary for the proper support of a LAN:

- ☐ Uninterruptible power supplies (UPS)
- ☐ Tape drives
- ☐ Printers
- ☐ Media converters
- ☐ Workstations (including thin client workstations)

LAN Software In Action: A Small Company Makes a Choice

Hannah asks the following questions:

- ☐ What are the primary uses (applications) of the current system?
 - ☐ Some applications work better (or only) with a specific NOS
- ☐ How would the choice of a particular NOS affect maintenance and support?

LAN Software In Action: A Small Company Makes a Choice (continued)

Hannah asks the following questions (continued):

- ☐ Are finances an issue in the selection of a NOS?
 - ☐ Linux offers an extremely attractive cost
- ☐ Does the existing system have any unusual hardware or software that might influence the NOS choice?
- ☐ Will the network be located in a single location or in multiple locations?
 - ☐ NDS is easier to maintain from remote locations
- ☐ Are there any political pressures to select a particular NOS?

LANs In Action: A Home Office Solution

1. Sam has three computers at home and wants all three to share a printer and a connection to the Internet
2. What are some of the questions that Sam has to answer before he can start purchasing and/or installing something?

Wireless Networking In Action: Creating a Wireless LAN for Home

Many decisions to make when installing a wireless LAN

- ☐ Which IEEE 802.11 format?
 - ☐ 802.11a?
 - ☐ Fast (54 Mbps), uses higher frequencies
 - ☐ 802.11g?
 - ☐ Fast (54 Mbps), compatible with 802.11b
 - ☐ 802.11n or ac?
 - ☐ Latest standards (100+Mbps)

Wireless Networking In Action: Creating a Wireless LAN for Home (continued)

Many decisions to make when installing a wireless LAN (continued)

- ❑ What type of wireless access point do you need?
 - ❑ If you already have a wired network (with router and modem), all you need is a basic wireless access point
 - ❑ If you don't have a home network but have a high-speed Internet connection, you will need a wireless router
 - ❑ If you don't even have a high-speed Internet connection yet, you might want to consider a wireless gateway.

Readings

Chapter 8 (Textbook)