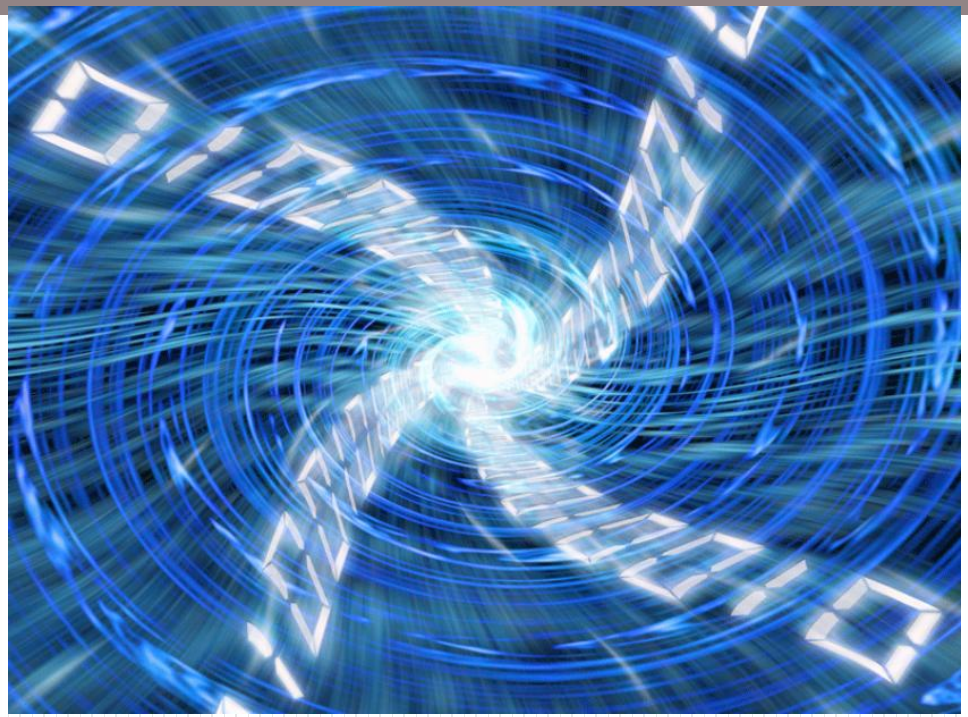
Introduction to Data Communications



Chapter One Summary

Ed Crowley

Data Communications

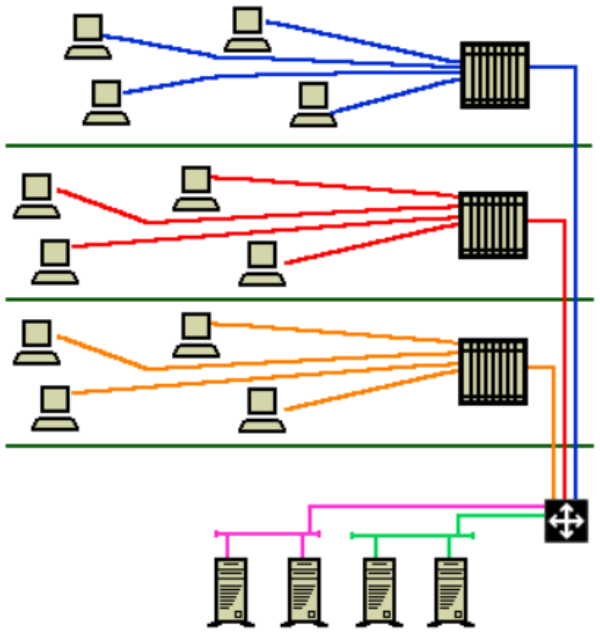
- Principal enabler of rapid information exchange
- Enterprises that are successful data communication users, such as Wal-Mart, can gain significant competitive advantage.
- Global scale of data communications continues to evolve.
  - Facebook
    - 1 billion users a day!
    - 210 terabytes of data scanned every hour!

http://techcrunch.com/2012/08/22/how-big-is-facebooks-data-2-5-billion-pieces-of-content-and-500-terabytes-ingested-every-day/

Network Definitions

- Local area network (LAN: group of computers located in the same general area.
- Backbone network (BN): central network connecting most things on a single site.
- Metropolitan area network (MAN) encompassing a city or a county area.
- Wide area network (WAN) spans city, state, or national boundaries.

- Note: In general, larger networks are created by connecting smaller networks.



Backbone

LAN

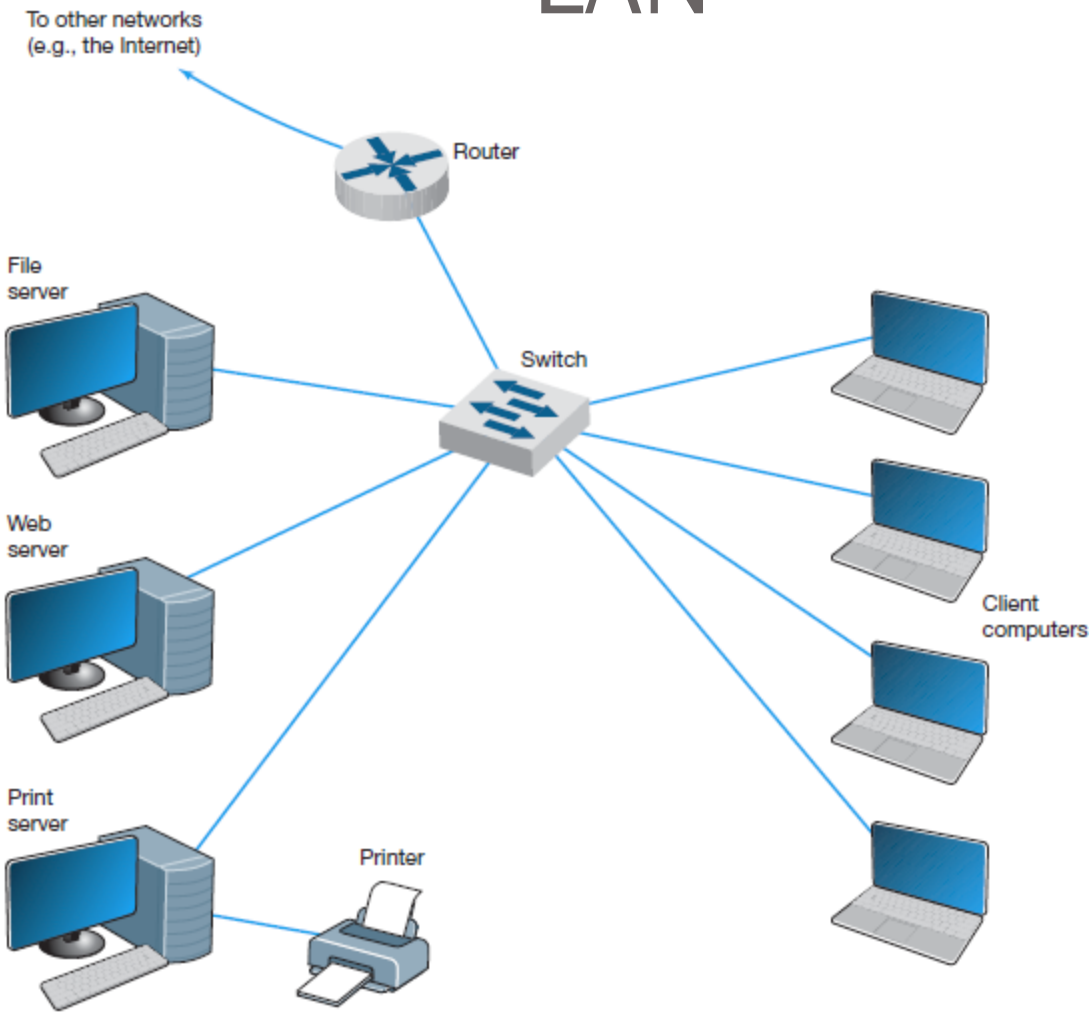
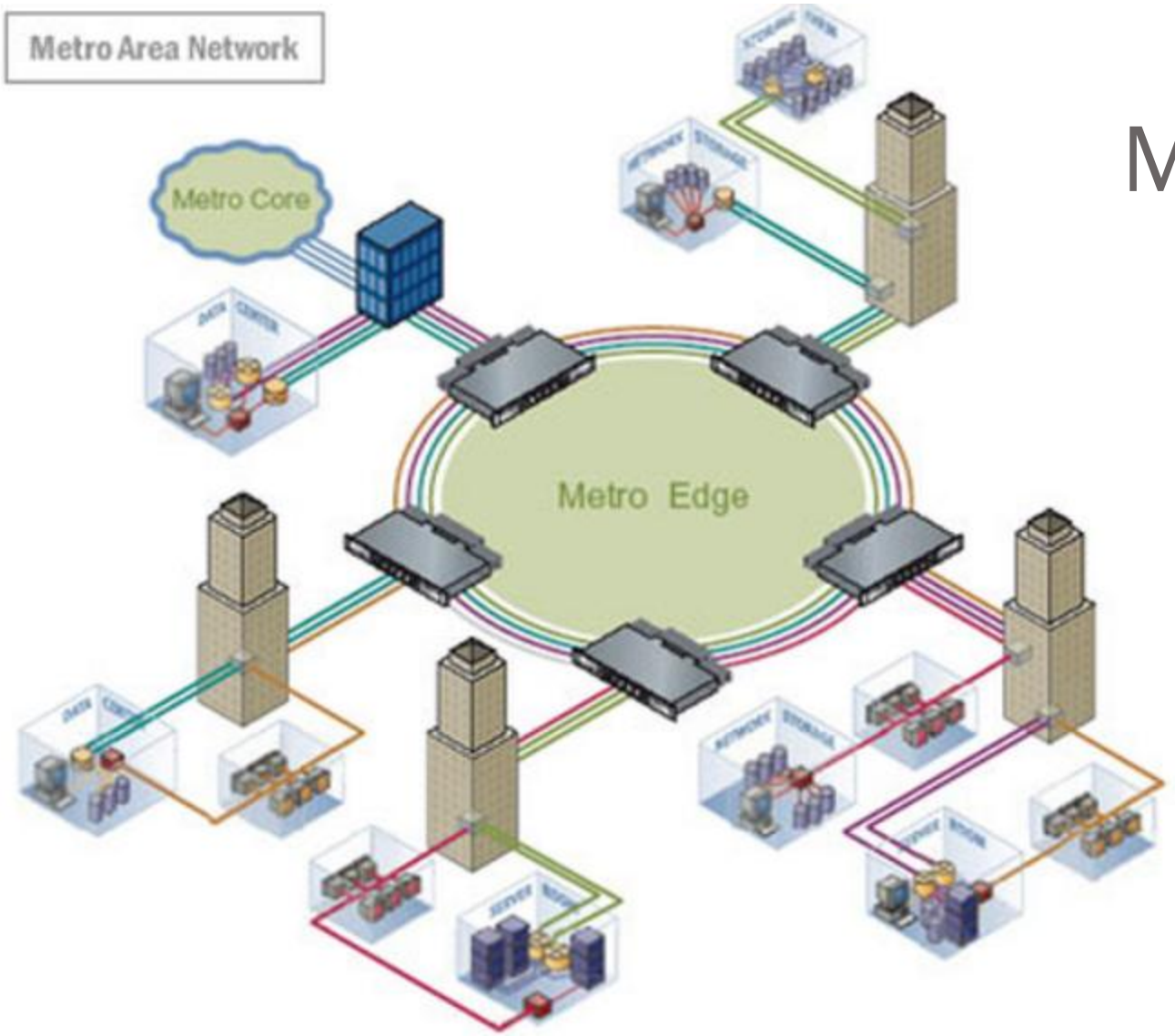


FIGURE 1.1 Example of a local area network (LAN)



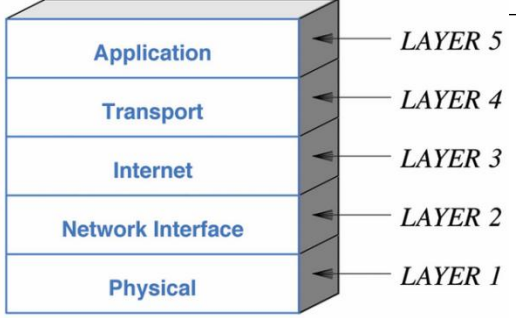
MAN

Layered Network Models

- Conceptualizes digital communications as a series of layers (*multiple smaller problems*)
  - Each layer separate and independent
  - Each border well defined
  - Produces a model where each layer's function can be treated as a black box.
  - Enables development of O/S & platform independent software/hardware.

Layered Network Models

- Well defined layer boundaries
  - Only specifically formatted information can pass through boundary
- Unique work performed at each layer
- Work process independent of standard (black box model)
- Each, sending or receiving, layer has identical information…



Text uses Five Layer TCP Model

- Application layer is the application software used by the network user.
- Transport layer takes the message generated by the application layer and breaks it into several smaller messages.
- Network layer addresses the message and determines its route through the network.
- Data link layer formats the message to indicate where it starts and ends, decides when to transmit it over the physical media, and detects and corrects any transmission errors.
- Physical layer is the physical connection between the sender and receiver, including the hardware devices (e.g., computers, terminals, and modems) and physical media (e.g., cables and satellites).

OSI and TCP Models

OSI Model	Internet Model	Groups of Layers	Examples
7. Application Layer	5. Application Layer	***Application Layer***	Internet Explorer and Web pages
6. Presentation Layer			
5. Session Layer			
4. Transport Layer	4. Transport Layer	***Internetwork Layer***	TCP/IP Software
3. Network Layer	3. Network Layer		
2. Data Link Layer	2. Data Link Layer	***Hardware Layer***	Ethernet port, Ethernet cables, and Ethernet software drivers
1. Physical Layer	1. Physical Layer		

http://www.professormesser.com/network-plus/n10-005/the-osi-model-2/

Wireshark 101: The OSI Model, Hak5 116

https://www.youtube.com/watch?v=dN8PcdOdcHs

Standards

- Ensure that hardware and software produced by different vendors can work together.
- De juro standards are developed by an official industry or government body.
- De facto standards emerge in the marketplace and are supported by several vendors but have no official standing.
- Many different standards and standards-making organizations exist.
- In general, IEEE makes hardware standards and Internet Society or W3C, or similar, make software standards

Future Trends -- IoT

- Pervasive networking will change how and where we work and with whom we do business.
- As the capacity of networks increases dramatically, new ways of doing business will emerge.
- Big Data and Big Data analysis is currently emerging…
- Convergence, the integration of voice, video, and data onto the same networks will greatly simplify networks and enable anyone to access any media at any point.
- The rise in these pervasive, integrated networks will mean a significant increase in the availability of information and new information services such as application service providers (ASPs) and information utilities.

Questions?

For further inquiry, examine Hands-on activity 1BWireshark.

HANDS-ON ACTIVITY 1B

Seeing the PDUs in Your Messages

We talked about how messages are transferred using layers and the different Protocol Data Units (PDUs) used at each layer. The objective of this Activity is for you to see the different PDUs in the messages that you send. To do this, we'll use Wireshark, which is one of the world's foremost network protocol analyzers, and is the *de facto* standard that most professional and education institutions use today. It is used for network troubleshooting, network analysis, software and communications protocol development, and general education about how networks work.

Wireshark enables you to see all messages sent by your computer, as well as some or all of the messages sent by other computers on your LAN, depending on how your LAN is designed. Most modern LANs are designed to prevent you from eavesdropping on other computer's messages, but some older ones still permit this. Normally, your computer will ignore the messages that are not addressed for your computer, but Wireshark enables you to eavesdrop and read messages sent to and from other computers.

Wireshark is free. Before you start this activity, download and install it from www.wireshark.org.

1. Start Wireshark.
2. Click on Capture and then Interfaces. Click the Start button next to the active interface (the one that is receiving and sending packets). Your network data will be captured from this moment on.
3. Open your browser and go to a Web page that you have not visited recently (a good one is www.iana.org).

This presentation is a summary.

All of the information in the text chapter as well as all the assignments should be considered testable.