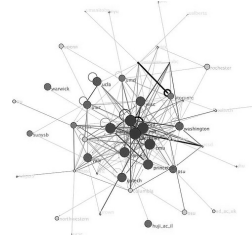


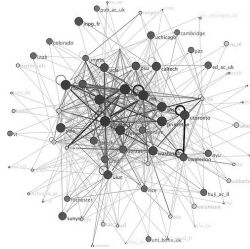
CSIS 4222
Computer Networking

Spring 2010
Dr. Mike Olan

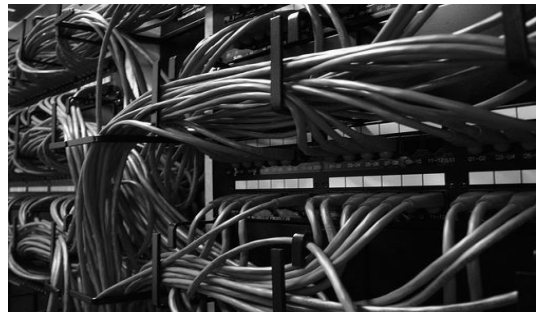
We live in a networked world where the Internet provides connections between people and devices.



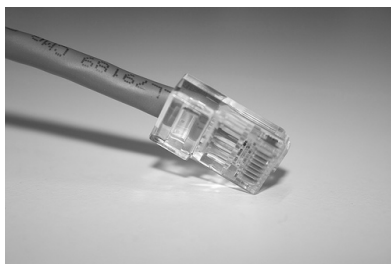
Computing professionals need to be knowledgeable in this important field.



Networking is a complex topic with lots of intricate details.



Learning the fundamentals will give you a solid foundation for future work and more advanced study.



Networks provide a means for improved access and sharing of resources

- The Web
- Social networking
- Multimedia
- Communications
- Email
- File transfer
- Remote login/execution

What is a computer network?

An *interconnected* collection of *autonomous* computers*

Interconnected: capable of exchanging messages

Autonomous: do not control one another

* Many other devices can also connect to networks

What are the basic components of a computer network?

Hardware: Physically connects machines to one another

Protocols: Specify the services provided by a network (makes the hardware usable by programmers and application software)

Basic computer network components

Special-purpose hardware devices to

- interconnect transmission media
- control transmission
- run protocol software

Protocol software

- encodes and formats data
- detects and corrects problems



What does a computer network do?

Provides communication between applications that is

- Reliable
- Efficient
- Fair

What does a computer network do?

Automatically finds optimal path from source to destination

Automatically detects and corrects problems like

- Data corruption
- Data loss
- Duplication
- Out-of-order delivery

Just a little history

(see: www.zakon.org/robert/internet/timeline)

The *Advanced Research Projects Agency* (ARPA) initiated a project in the 1960s to connect researchers with computers

Resulted in a system for remote access to expensive resources

Adopted new technologies

- Packet switching
- Internetworking

ARPAnet - late 1960s
 TCP/IP - late 1970s
 ARPAnet switched to TCP/IP in early 80s
 Start of the Internet

- Few hundred computers
- Few tens of networks

SRI, UCLA, UCSB and the University of Utah were the original four members of the ARPANET, which later grew into the Internet. The ARPANET's first transmission, in 1969, was between UCLA and SRI. From the collection of The Computer Museum History Center.

Packet Switching

Data transmitted in small, independent pieces

- Source divides outgoing messages into *packets*
- Destination recovers original data

Each packet travels independently

- Includes enough information for delivery
- May follow different paths
- Can be retransmitted if lost

Internetworking

Many (mutually incompatible) network technologies

No one technology appropriate for every situation

Internetworking glues together networks of dissimilar technologies with *routers*

Result is a *virtual network* whose details are invisible

Networking Today

Powerful devices are cheap
 Networks are everywhere

- Only need a modem and phone line, cable, or wireless connection and software to join a network

Blurred lines between data processing and data communications equipment

Fewer differences between data, voice, and video communications

Basic Network Communication Paradigm

- Establish contact
- Exchange data (bi-directional)
- Terminate contact

The subject material in this course is complex!

- Has no single underlying theory
- Uses multiple technologies
- Changes rapidly

We will concentrate on *concepts* and *practical applications*

The Big Picture

The material covered in this course involves:

- How data is encoded
- How data is transmitted
- How protocols transfer data reliably
- How applications operate over the resulting infrastructure

Five Key Aspects of Networking

To master the complexity, it is important to gain a broad background that includes:

1. Network Applications
2. Data Communications
3. Packet Switching and Networking Technologies
4. Internetworking with TCP/IP
5. Additional Networking Concepts and Technologies

Networks, Interoperability, Standards

Communication always involves at least two entities

- one sends information and another receives it

All entities must agree on how information will be represented and communicated

An important issue is *interoperability*

- the ability of two entities to communicate

All communicating parties agree on details and follow the same set of rules (protocols)

Protocol Suites and Layering Models

Each protocol should handle a part of communication not handled by other protocols

Protocols are designed in complete, cooperative sets called suites so that they will work well together

Each protocol in a suite handles one aspect of networking

Protocol Suites and Layering Models

The fundamental abstraction used to collect protocols into a unified whole is known as a layering model

Layers help protocol designers and implementers manage complexity

- Concentrate on one aspect of communication at a given time

The TCP/IP Protocol Suite

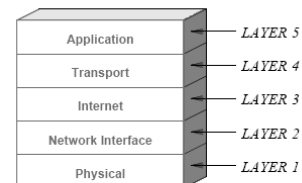
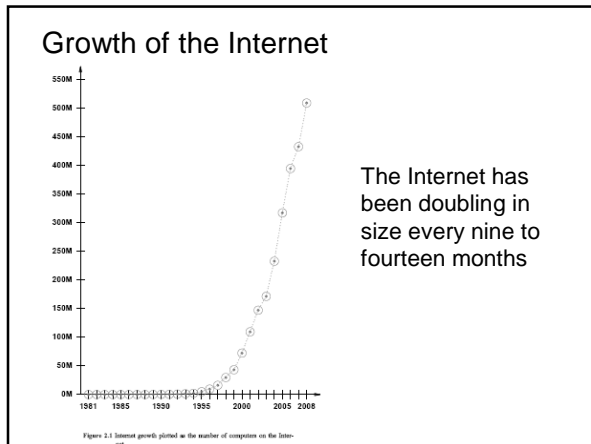


Figure 1.1 The layering model used with the Internet protocols (TCP/IP).



Recent Trends

Topic	Transition
Telephone system	Switch from analog to Voice over IP (VoIP)
Cable television	Switch from analog delivery to Internet Protocol (IP)
Cellular	Switch from analog to digital cellular services (3G)
Internet access	Switch from wired to wireless access (Wi-Fi)
Data access	Switch from centralized to distributed services (P2P)

Figure 2.5 Examples of transitions in networking and the Internet.

Application	Significant For
High-quality teleconferencing	Business-to-business communication
Navigation systems	Military, shipping industry, consumers
Sensor networks	Environment, security, fleet tracking
Social networking	Consumers, volunteer organizations

Figure 2.6 Examples of popular applications.

Topics and Scope of CSIS 4222

Computer networks and internets
 Broad overview of concepts, terminology (lots of it!), and technologies that form the basis for digital communication
 Hands-on experience configuring and administering a Linux network

Summary

Studying networks is important because

- The world is interconnected
- Applications now operate in a distributed environment

This course

- Covers networking and internetworking concepts
- Explains how some of it works