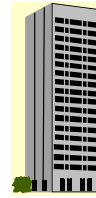## Computer Networking

- ❖ Process enabling two or many computers to transfer data and instructions via transmission medium
- ❖ Medium can be wires, fiber optics, or radio waves
- ❖ WAN (Wide Area Network), LAN (Local Area Network)

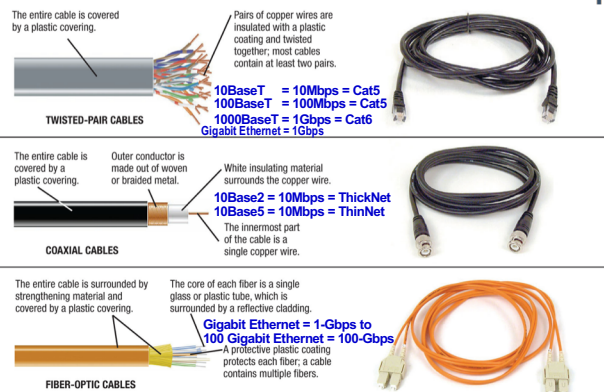Copyright © 2019 R.M. Laurie   1

Local Area Networks

- ❖ Networks in the same room or building are called LANs (local area networks)
- ❖ LANs allow sharing of resources such as printers, hardware, secondary storage, software, and data
- ❖ Ethernet is the common protocol used for LANs
  - ◆ One data-talker at a time many listeners
  - ◆ Data collisions limits connections to <= 100 computers
- ❖ Client/server configuration
  - ◆ Host Server computer controls access to data, and hardware
  - ◆ Clients rely on Host for services
- ❖ Peer-to-peer configuration
  - ◆ Each computer, or peer, has equal capabilities
  - ◆ Enables users to connect to other devices and exchange files directly

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Networking Media

The entire cable is covered by a plastic covering.

Pairs of copper wires are insulated with a plastic coating and twisted together; most cables contain at least two pairs.

10BaseT   = 10Mbps = Cat5
100BaseT   = 100Mbps = Cat5
1000BaseT = 1Gbps = Cat6
Gigabit Ethernet = 1Gbps

TWISTED-PAIR CABLES

The entire cable is covered by a plastic covering.

Outer conductor is made out of woven or braided metal.

White insulating material surrounds the copper wire.

10Base2 = 10Mbps = ThickNet
10Base5 = 10Mbps = ThinNet

The innermost part of the cable is a single copper wire.

COAXIAL CABLES

The entire cable is surrounded by strengthening material and covered by a plastic covering.

The core of each fiber is a single glass or plastic tube, which is surrounded by a reflective cladding.

Gigabit Ethernet = 1-Gbps to
100 Gigabit Ethernet = 100-Gbps

A protective plastic coating protects each fiber; a cable contains multiple fibers.

FIBER-OPTIC CABLES

Wireless Internet Access Points

- ❖ Allows wireless connection to Internet in a public location
  - ◆ Wi-Fi
  - ◆ 3G, 4G, and 5G network
  - ◆ WiMAX
  - ◆ Satellite
- ❖ Wifi LANS
  - ◆ 802.11 b, g, n, ac (Wi-Fi)
- ❖ Bluetooth
  - ◆ Short-range radio waves transmit data between eight Bluetooth devices
  - ◆ Usually peripherals

CELLULAR PHONES
Can be used wherever cellular phone coverage is available.

SATELLITE PHONES
Can be used virtually anywhere.

Standard	Maximum Speed	Frequency
802.11 (legacy)	1.2 Mbps	2.4 GHz
802.11a	54 Mbps	5.8 GHz
802.11b	11 Mbps	2.4 GHz
802.11g	54 Mbps	2.4 GHz
802.11n	150 Mbps	2.4 & 5 GHz
802.11ac	800 Mbps	5 GHz

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Internetworking using ARPANET

- ❖ **Department of Defense sponsors research**
  - ◆ ARPA=Advanced Research Projects Agency
  - ◆ Systems Survivability utilizing Redundancy
  - ◆ Connect all computers on military bases
  - ◆ Interconnect LANs using WAN Technology
  - ◆ ARPANET operational 1985
- ❖ **Specification made Available to Public**
  - ◆ Open System=Anyone can build compatible system
  - ◆ ARPANET Internetworking Protocol = TCP/IP
- ❖ **ARPANET has now become The Internet**
  - ◆ Internet has become infrastructure that society depends
  - ◆ Internet is general purpose and efficient
  - ◆ TCP/IP provides communication facilities
  - ◆ HTTP, HTTPS, and FTP provide application facilities
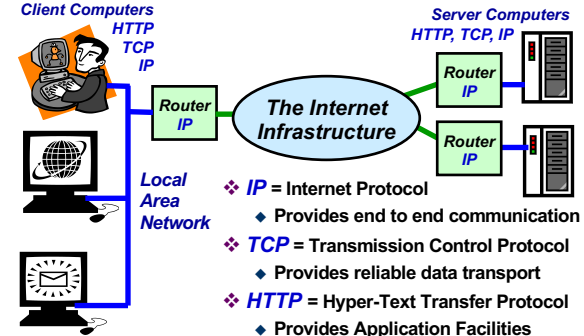 - ◆ http://www.warriorsofthe.net/

Application	HTTP, FTP, SMTP
Presentation	JPEG, GIF, MPEG
Session	AppleTalk, WinSock
Transport	TCP, UDP, SPX
Network	IP, ICMP, IPX router
Data Link	Ethernet, ATM switch, bridge
Physical	Ethernet, Token Ring hub, repeater

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TCP/IP Internetworking Protocols

Client contacts server specified by *URL =Uniform Resource Locator*

Client Computers
HTTP
TCP
IP

Server Computers
HTTP, TCP, IP

Router IP — *The Internet Infrastructure* — Router IP / Router IP

Local Area Network

- ❖ *IP* = Internet Protocol
  - ◆ Provides end to end communication
- ❖ *TCP* = Transmission Control Protocol
  - ◆ Provides reliable data transport
- ❖ *HTTP* = Hyper-Text Transfer Protocol
  - ◆ Provides Application Facilities

How the Internet Works = http://youtu.be/7_LPdttKXPc   Copyright © 2019 R.M. Laurie   6

Accessing a Web Site

- ❖**HTTP (Hyper Text Transfer Protocol) accesses web sites files located on the web server**
- ❖**Each web site has URL (Uniform Resource Locator)**
  - ◆ http://www.islandman.org
  - ◆ http://www.umuc.edu
  - ◆ http://mail.yahoo.com
  - ◆ http://maps.google.com
  - ◆ ftp://ftp.islandman.org
  - ◆ .edu (education)
  - ◆ .com (commercial)
  - ◆ .gov (government)
  - ◆ .mil (military)
  - ◆ .net (network admin.)
  - ◆ .org (non-profit)

  http://www.umuc.edu/cs/courses/index.html
  Protocol   Server Domain   TLD   Folder Path   File
- ❖**Domain Name Server matches URL with *IP address***
  - ◆ www.nmcnet.edu → **12.178.198.111** (Octet <= 255)
  - ◆ www.whois.ws → **69.25.212.161**

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The World Wide Web

- ❖ **The World Wide Web, or Web, consists of a worldwide collection of Web Pages documents**
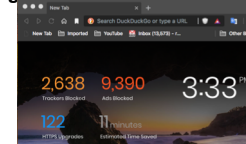- ❖ **Website is a collection of related Web pages**
- ❖ **Homepage is the first page of a Website**
- ❖ **Web server delivers web pages via Internet**
- ❖ **WWW top layer protocol is HTTP or HTTPS**
- ❖ **E-Commerce exchange of goods/services using WWW**
  - ◆ Secure transactions required using encryption
  - ◆ Privacy and Security concerns
  - ◆ https = secure http protocol 🔒
  - ◆ Spybot Search and Destroy
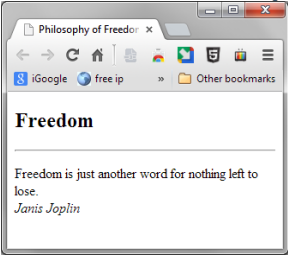 - ◆ Spybot Anti-beacon for Win10
  - ◆ Brave web browser
  - ◆ https://youtu.be/gFsRXfifcYg

2,638 9,390   3:33 PM
122 11 minutes

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HTML Markup: Document Example

❖ **HTML** is standard for web pages
  ◆ **HTML and CSS are taught in CMST385**
  ◆ **JavaScript in CMST386 and CMIS102**
❖ *HTML Tag* nesting order: **Last Open is First Closed**

```
<html>
 <head>
  <title> Philosophy of Freedom </title>
 </head>
 <body>
  <h2>Freedom</h2>
  <hr>
  <p> Freedom is just another word
      for nothing left to lose. <br>
   <em> Janis Joplin </em>
  </p>
 </body>
</html>
```

Philosophy of Freedom ×

🔍 iGoogle 🔗 free ip » 📁 Other bookmarks

Freedom

Freedom is just another word for nothing left to lose.
Janis Joplin

Markdown: Human readable code

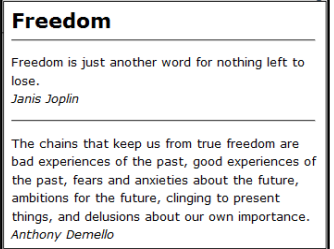❖ **A compact minimalist document format code**

```
#Freedom

---

Freedom is just another word
       for nothing left to lose.
*Janis Joplin*

---

The chains that keep us from true freedom are bad experiences of the past, good
       experiences of the past, fears and anxieties about the future, ambitions for the
       future, clinging to present things, and delusions about our own importance.
*Anthony Demello*
```

Freedom

Freedom is just another word for nothing left to lose.
Janis Joplin

The chains that keep us from true freedom are bad experiences of the past, good experiences of the past, fears and anxieties about the future, ambitions for the future, clinging to present things, and delusions about our own importance.
Anthony Demello

Markdown: Block Level Codes

To get this...	Type this...
A paragraph of text	*End with blank line or 2 spaces*
———————————	*--- is called Horizontal Rule*
# Largest Heading	*# at beginning of Line*
## X-Large Heading	*## at beginning of line*
Large Heading	*### at beginning of line*
Normal Heading	*#### at beginning of line*
Small Heading	*##### at beginning of line*
Smallest Heading	*###### at beginning of line*
Block quote indented text	*> at beginning of Line*

• **Hierarchical Bullet List**
  ○ **Second Level bullet item**
	+ Bullet List item
	    + Second level bullet item

1. **Number List Item** 2. **Number List Item**	*1. Number List Item* *1. Number List Item*

Markdown: Inline Coding

To get this...	Type this...
New line of text without ⏎ blank line above	*End preceding line with ⏎*
emphasized text shows *italics*	**emphasized* text shows *italics**
Strong text shows as **bold**	***Strong** text shows as **bold***
Emphasized Strong text	****Emphasized Strong*** text*
Some ~~Strike through~~ text	*Some ~~Strike through~~ text*
Display Image	*![Alt text](URLpath2image.jpg)*
Display Image with title	*![Alt text](URLpath2image.jpg "title")*
Link to webpage	*<URLofWebpage2Link>*
Link Text to webpage	*[Link text](URLofWebpage2Link)*
Link Text to webpage with title	*[Freedom](freedom.html "title")*
Link Image to webpage	*[![Alt text](URLpath2image.jpg)](URL)*
Fenced code block	*``` This is some code ```*

3