



LP4: Networks

Discussion Questions

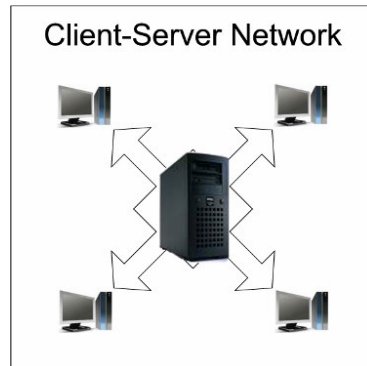
- What is a “network?” What is a “node?” What is a “link?”
- What do networks do, and why is that important for us?
- What are “protocols,” and what role do they play in networks?
- What are some examples that prove or disprove Metcalfe’s Law?

High Performance Campus Index

- In-class activity. Many thanks to Dr. Delore Zimmerman.

Computer Network Models

- Centralized (mainframe, server, client/server, thin client)
 - “Novell Approach”
- Decentralized or Distributed (peer-to-peer)
 - “Microsoft Approach”
- Hierarchical (Internet model)
 - “Unix Approach”
- LAN Evolution
 - Novell Approach → Microsoft Approach → Unix Approach

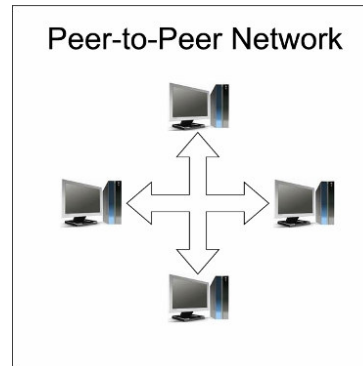


Used in:

- Mainframe systems
- Novell operating systems
- Solaris operating systems
- Microsoft Terminal Server
- Citrix Server
- Windows NT 4.0 + servers

Good for:

- centralized management.

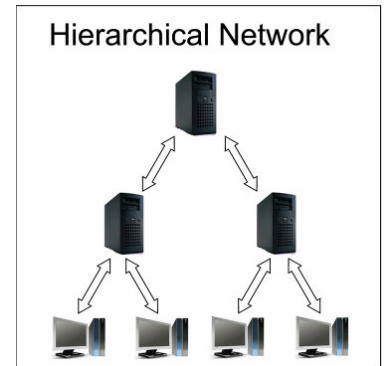


Used in:

- Windows for Workgroups
- Windows XP Home

Good for:

- less than 10 computers, with low security concerns.



Used in:

- Unix systems like the Internet
- Windows domains

Read names right-to-left

“.” is the root (implied)

“com.” is the top-level

“denhi.com.” is the second-level domain name

“www.denhi.com.” is the name of a host on the domain



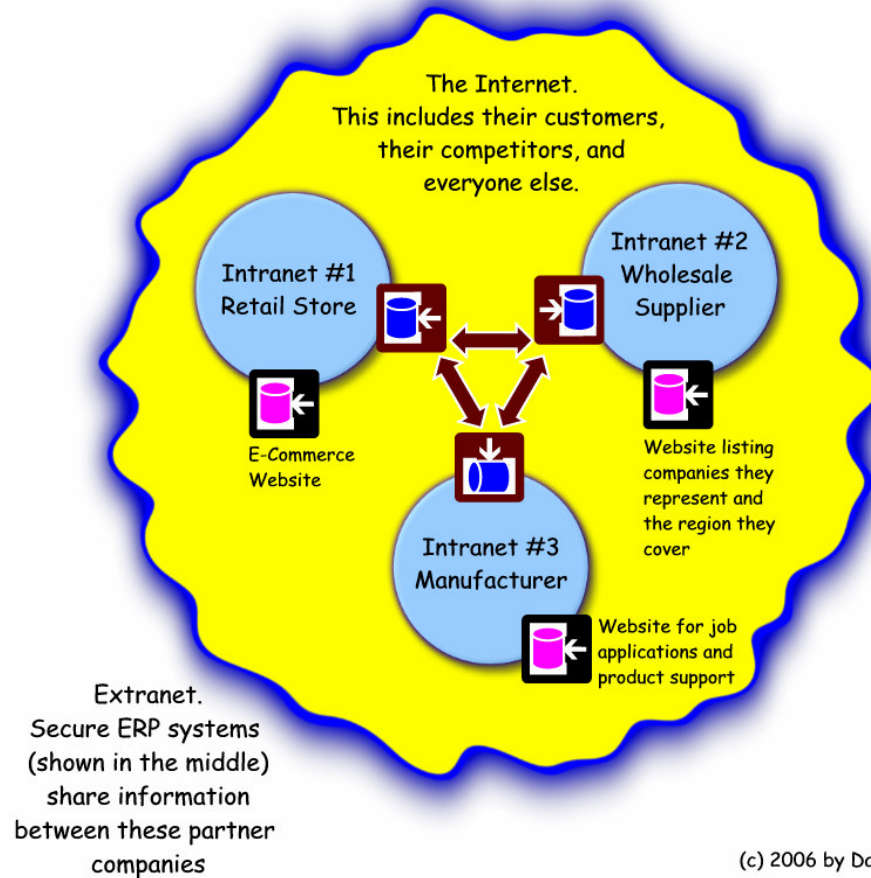
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Computer Network Scopes

- **Intranet.** Small “i” internets. These include Local Area Networks and Wide Area Networks. These days they are usually called “LANs” or “Intranets.”
- **Extranet.** Part of your network that can be accessed by people and systems outside of your organization.
- **Internet.** Big “T” Internet is a hierarchical grouping of networks that spans the globe.

How the Internet, Intranets, and Extranets work together.
Let's look at a retail store, their wholesale supplier, and a product manufacturer...



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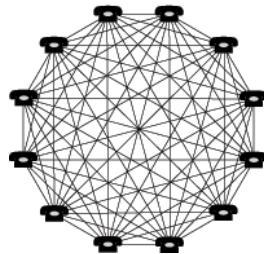
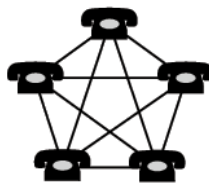
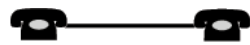
Metcalfe's Law

Once upon a time there was an electrical engineer named Robert Metcalfe. He worked at PARC, where he invented the Ethernet protocol. Then he founded 3-Com, which dominated the PC network card industry. Today, we all use Ethernet and network cards, and our networks are very valuable. Thank you Mr. Metcalfe. The end.

$$\frac{n(n-1)}{2}$$

Many people believe that this simple formula explains why the Internet is changing the world. It's like compound interest for access to information.

Nodes (n)	Links (Value)
2	1
3	3
4	6
5	10
6	15
7	21
8	28
9	36
10	45
11	55
12	66
13	78
14	91
15	105
16	120
17	136
18	153
19	171
20	190
21	210
22	231
23	253
24	276
25	300
100	4,950
1,000	499,500
10,000	49,995,000
100,000	4,999,950,000
1,000,000	499,999,500,000





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Fundamental Concepts and Vocabulary for Computer Networks

- Network Objects. Anything that you can modify, monitor, or control is an “object.” Some common object types are: users, groups, clients, and resources.



Users
(aka “accounts”)



Groups



Clients
(aka “hosts”)



Resources
(printers, shared folders)

- Network Hardware. Network hardware provides the infrastructure over which information is exchanged.
 - Cabling
 - Wireless
 - Infrared
 - Hubs
 - Routers
 - Switches
 - Access points
 - Modems
 - Satellites
 - Fiber optics
 - Perimeter network (aka “DMZ”)

"Imagine a school with children that can read or write, but with teachers who cannot, and you have a metaphor of the Information Age in which we live."
Peter Cochrane.



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SaWCaP

- This is a model that I developed to make it easier to build a physical inventory, and at the same time develop a basic understanding of how a particular network is actually configured. There are many other approaches, but this model is the simplest, and easiest to scale, of those that I have seen.

Servers

- File Servers
- Print Servers
- Web Servers
- Database Servers
- Application Servers
- Email Servers

Workstations

- Desktops
- Notebooks
- Tablets
- PDAs

Communications

- Routers
- Switches
- Hubs
- Modems
- Cabling
- Wireless Access Points and Devices

Peripherals

- Printers
- Scanners
- Projectors





Computer Network Communication Protocols

- Ethernet vs. Token Ring
- TCP/IP Model vs. OSI Model (Images taken from Wikipedia)
- Protocols (TCP/IP, IPX/SPX (NWLink), NetBIOS, Appletalk)
- Dialup vs. Broadband vs. UTP vs. Wireless
- Virtual Private Networks (VPNs) and encrypted “tunnels”

