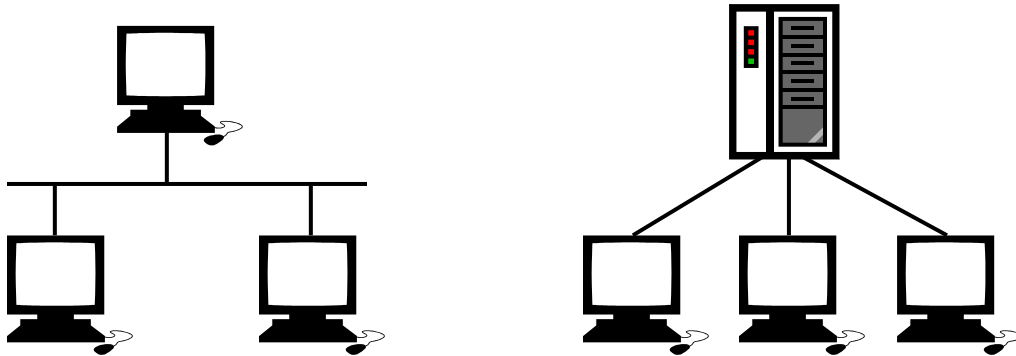


Session: Background
Topic: Networking & Internet

Daniel Chang

Computer Network

- Collection of single machines connected together
- LAN - Local Area Network (WAN: Wide, MAN: Metropolitan)



Network Topologies

- Bus - Computers can communicate with each other
- Hub - Computers communicate through central server

Internet Structure

- Organizations have own computer networks
- Interconnecting networks from different organizations results in an "InterNet"
- "Gateway" (Router) in individual network has responsibility for connecting to "outside"
- "Backbone" is the high speed connection between networks
- Typically involves telephone company networks

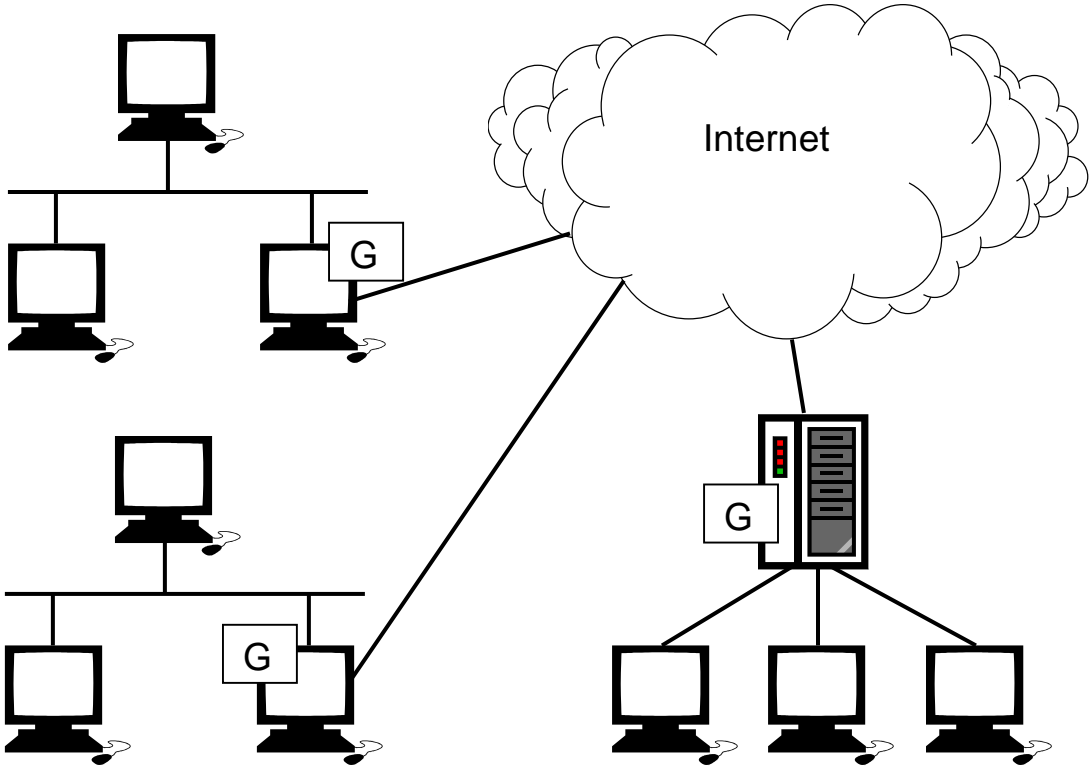
Communication

- Individual networks can use whatever methods they want to communicate within the network
- When going outside an individual network, information must be sent using the rules for connecting on the Internet
- Thus, once on the Internet everyone knows how to communicate in the same way

Protocol

- A protocol is an agreed set of rules for communication
- In a classroom the protocol might include rules like "raise your hand"
- At the movie theater the protocol might dictate "use instant message"

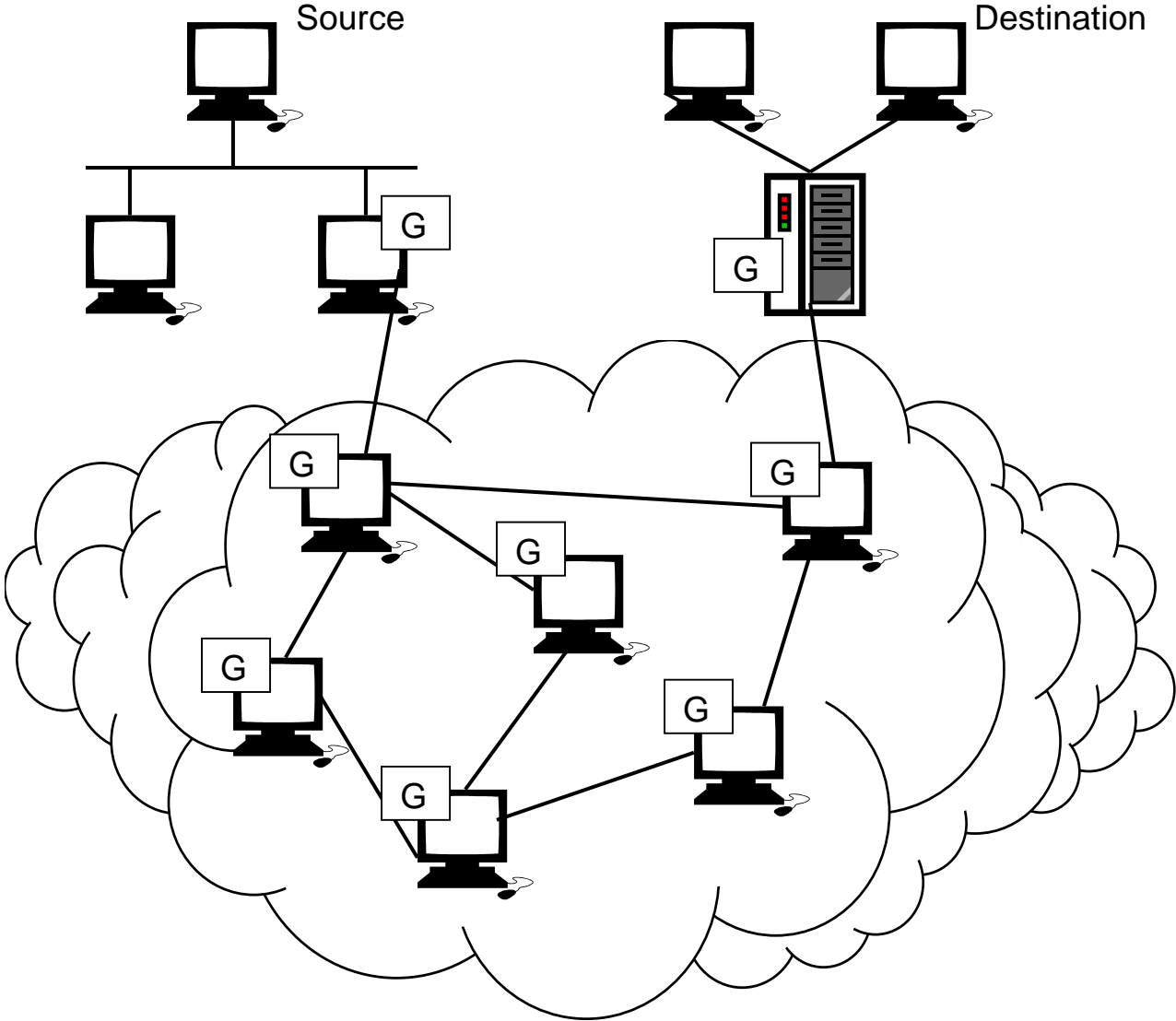
Internet Structure



Internet Protocol (IP)

- Rules governing transmission of information from one computer to another through the Internet
- Each computer has unique "IP address"
 - Dotted Quad (202.47.104.3)
- Messages broken up into "packets"
 - text, pictures, sound files
 - packets passed from network to network
- Each packet addressed with
 - Source IP address
 - Destination IP address
 - Packet number (X out of TOTAL)
- Computers on network check packet destination
 - Often "Gateway" does checking
 - Keep packet if matches computer on local network
 - Otherwise pass on toward destination network

Communication Path



Transmission Control Protocol (TCP)

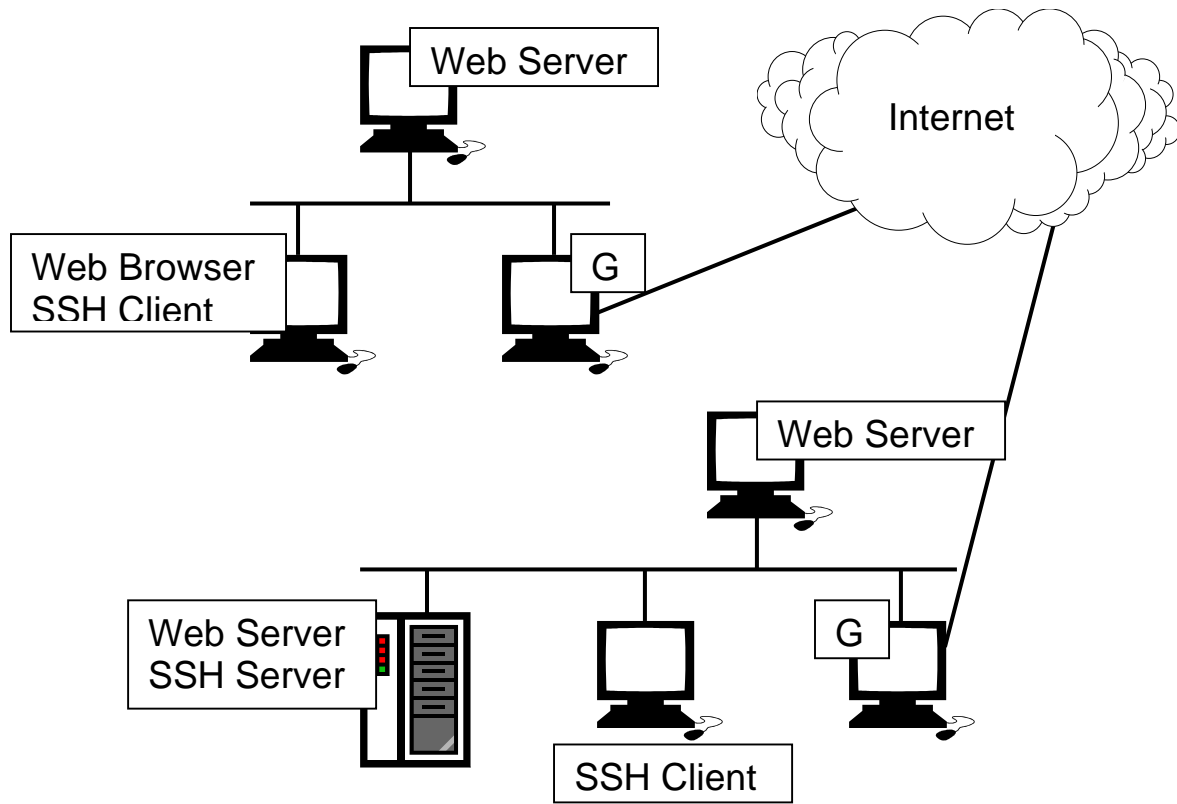
- Used when packets arrive at destination computer
- Rules used to reassemble all the packets back into a message

TCP/IP Protocol Suite

- Collection of all protocols (rules sets) used on Internet
- Includes TCP and IP **and**
- Also includes a slew of others (HTTP, FTP, UDP, SSH)

Client-Server Architecture

- Basic model for Internet Applications
 - E-Mail, NNTP, World Wide Web, SSH
- Client Program and Server Program
 - Running on same or (typically) separate machines



Web Pages

- "Web pages" are text files written in HTML (Hyper Text Markup Language)
- HTML text defines media to display (text, graphics)
- HTML also provides "distributed media" (links to other pages or media)

WWW Server Example

- Uses HTTP for communication (Hyper Text Transport Protocol)
- Web Browser (client) requests web pages from Web Site (server)
- Web Server software at site responds by delivering HTML file (script code for web pages)
- Web Browser interprets HTML and renders web page
- Incidentally, actual files sent according to HTTP are broken into packets and sent according to TCP

World Wide Web

- The collection of computers on the Internet that run Web Server software

Domain Name System (DNS)

- IP requires identifying computers by IP address
- DNS is a system of servers that provide a mapping of "domain names" to IP addresses
- Easier to not memorize dotted quads
- Sometimes a domain name may be directed to a specific place on a machine that is different than if you just specified the machine IP address
- <http://www.dnsstuff.com>

Examples

- quake.cs.fsu.edu → 128.186.120.23
- www.microsoft.com → 207.46.192.254
- www.appleseedthemovie.com → 69.20.8.216?

TCP/IP Networking

- Recall that local networks (LAN) are a collection of connected computers
- Can use the same rules as used on the Internet (TCP/IP) for local network connections
- IP requires each computer to have a unique IP address

IP Address

- A dotted quad of four numbers (each from 0 - 255)
- Technically has two parts, a subnet portion that identifies the entire local network and then individual numbers for each machine on the network

	Subnet	Machine Number
	192.168.1	101
Entire IP Address	192.168.1.101	

(for subnet mask 255.255.255.0)

- Machines within the same network must have the same subnet portion (otherwise cannot "see" each other)
- Machines within the same network must have *different* overall IP address (different machine number)

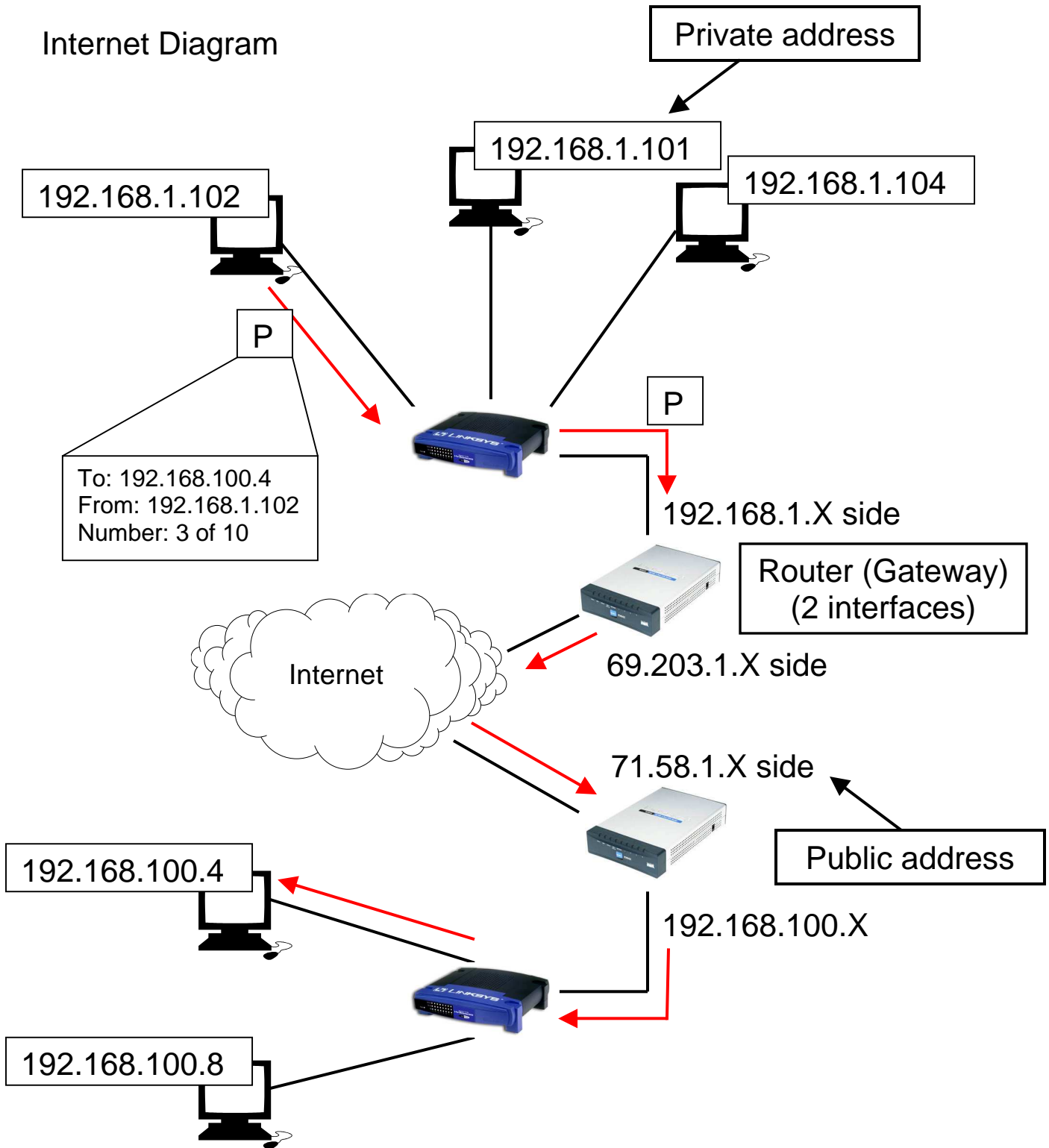
Private IP Addresses

- Special ranges of addresses are reserved as "private" addresses, not available on the public Internet
- These addresses cannot be used to connect directly to the Internet, but will work with TCP/IP for local networks
- Ex: 192.168.X.X
- Note: If you are directly connected to the Internet through an Internet Service Provider (ISP) you may be using a public IP address

Routers

- Routers have connections to different networks (subnets), and can transfer information from one to another
- Must keep information to track "where" different networks are located, then forward packets
- Has two (or more) IP addresses, one on each network directly connected to Router
- Analogous to simply having two network interfaces (cards)
- A router between a local network and the Internet is called a "Gateway"

Internet Diagram



Organization Network Structure

Private Machines

- Typically private IP addresses are used for computers on the organization intranet (internal network)
- These machines cannot directly communicate with Internet machines, but must go through a router (the Gateway)
- Private IP addresses are typically distributed dynamically using DHCP

Public Machines

- A gateway will have a public address that is reachable from the Internet
- Any machines that need to be accessible from the Internet (such as a Web Server) might also have public IP addresses
- Businesses must pay for public IP addresses which are given in Class A, Class B, and Class C sized licenses (groups of IP addresses)
- Public IP address licenses cost a lot of money

Dynamic Host Control Protocol (DHCP)

- When connecting to other networks (for example, an ISP for Internet access), they typically have their own subnets
- When connections are not permanent, can often be difficult to select an IP address that does not conflict with other machines on the network
- A DHCP server will accept requests for an IP address on a network and issue an IP address that does not conflict with others.
- The client machine must not have a "hard-coded" IP address set, but instead allow for automatic assignment of IP
- Configured in Windows under "Control Panel/Network Connections" (right-click on the desired connection and select "Properties")

