# PIC 40A

## Lecture 1: The Internet

# What is the Internet?

For this class we use the following definition:

*The Internet is a network of networks.*

Ok. What is a network?

# Networks

- *A network* is two or more computers connected together to share resources, or to communicate with each other.

- Computers on a network may be connected via direct cable, telephone lines, satellites etc.

- There are two main types of networks: LAN and WAN

# LAN (Local Area Network)

LANs are usually a small collection of computers sharing resources.

Typically a LAN is confined to a small geographic area. School, home etc.

One computer is the file server.  It stores the software that controls the network.

Other computers (called workstations) connect to the server.

# WAN (Wide Area Network)

Wide Area Networks (WANs) connect larger geographic areas like California, the United States, or the world.

Dedicated transoceanic cables or satellites are used to connect a WAN.

To users WAN appears to function much like a LAN.

# The Internet

- Started by U.S. Department of Defense

- Originally called ARPAnet(Advanced Research Projects Agency)

- First node at UCLA (1969) (Connection between UCLA and Stanford)

# Caution!

Do not confuse the Internet with the web!

Web is part of the Internet.

Web is the resource of particular kinds of documents on the Internet.

The Internet is the vast collection of computer networks and resources.  Much of the data exchanged on the Internet has nothing to do with the web.

# How does the internet work?

There is a great article on the web explaining all the details in a fairly understandable manner.

[http://www.theshulers.com/whitepapers/internet_whitepaper/index.html](http://www.theshulers.com/whitepapers/internet_whitepaper/index.html)

I will put the link on our useful links page.

# Structure of the internet

The internet is built around large robust fast networks called the backbones or Network Service Providers.

Examples of NSP are companies like: IBM, Cisco, UUNet, Cerfnet, Sprintnet etc.

Each NSP connects to at least three Network Access Points (NAPs).

At the NAPs the data may pass from one major backbone to another.

# Structure of the internet

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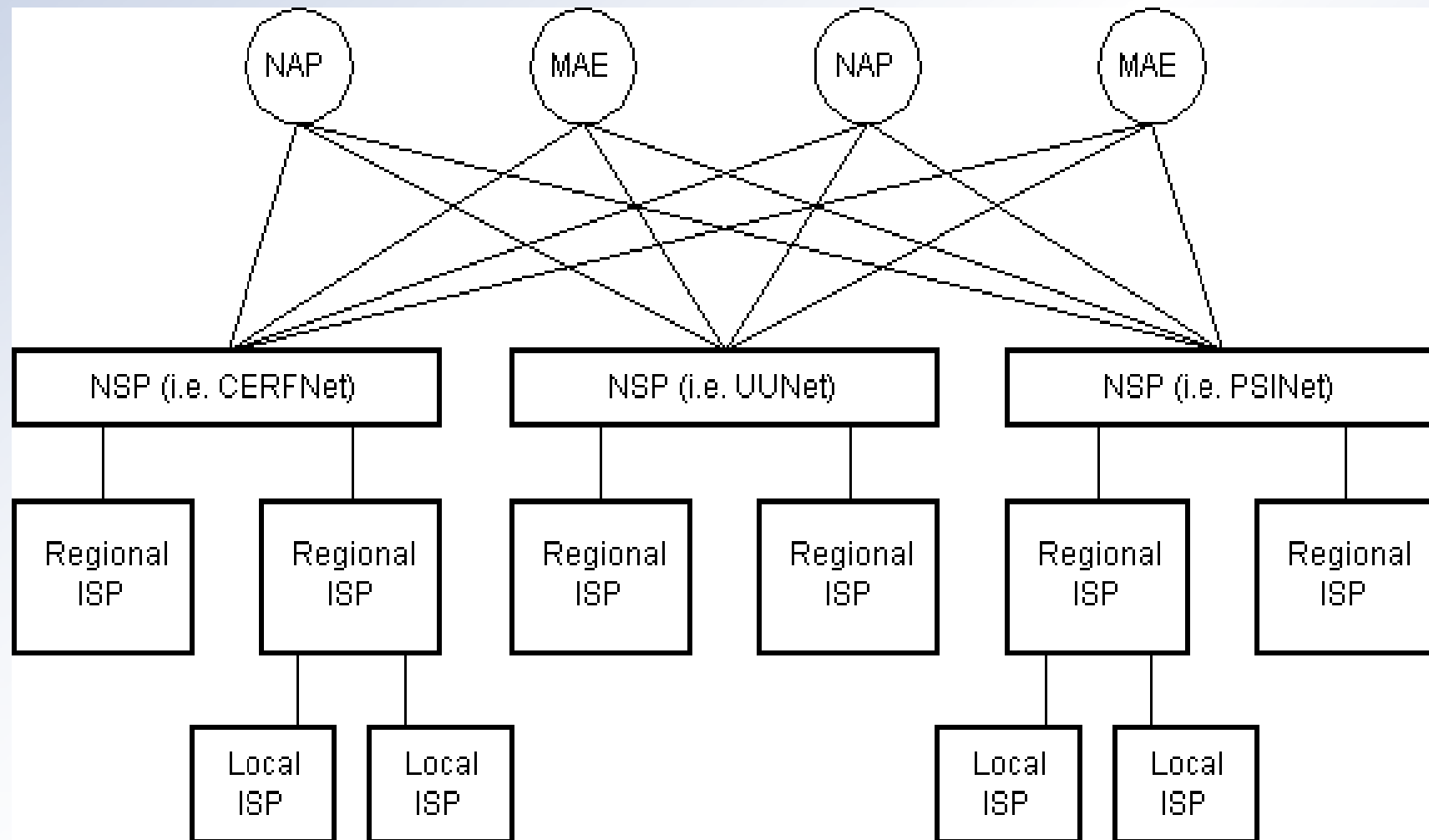
# How does the Internet work?

Let's assume that you want to access a webpage on the web.  What happens after you type in the web address?

Web pages are text documents that your web browser interprets and displays with nice formatting, graphics etc.

Web pages must be stored somewhere.  They don't just "float" on the internet.  They are on some server's hard drive.

So to get a particular webpage your computer has to find this server on the Internet and ask for the webpage!

# How does my computer find another computer on the net?

Does every computer know where every other computer is online?

No!

The key ideas are IP addresses and routers.

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# IP Addresses

IP stands for Internet Protocol

Every computer on the Internet has a unique IP address.

You can think of IP address as a address of a house.

IP address is of form nnn.nnn.nnn.nnn where nnn is a number 0-255.

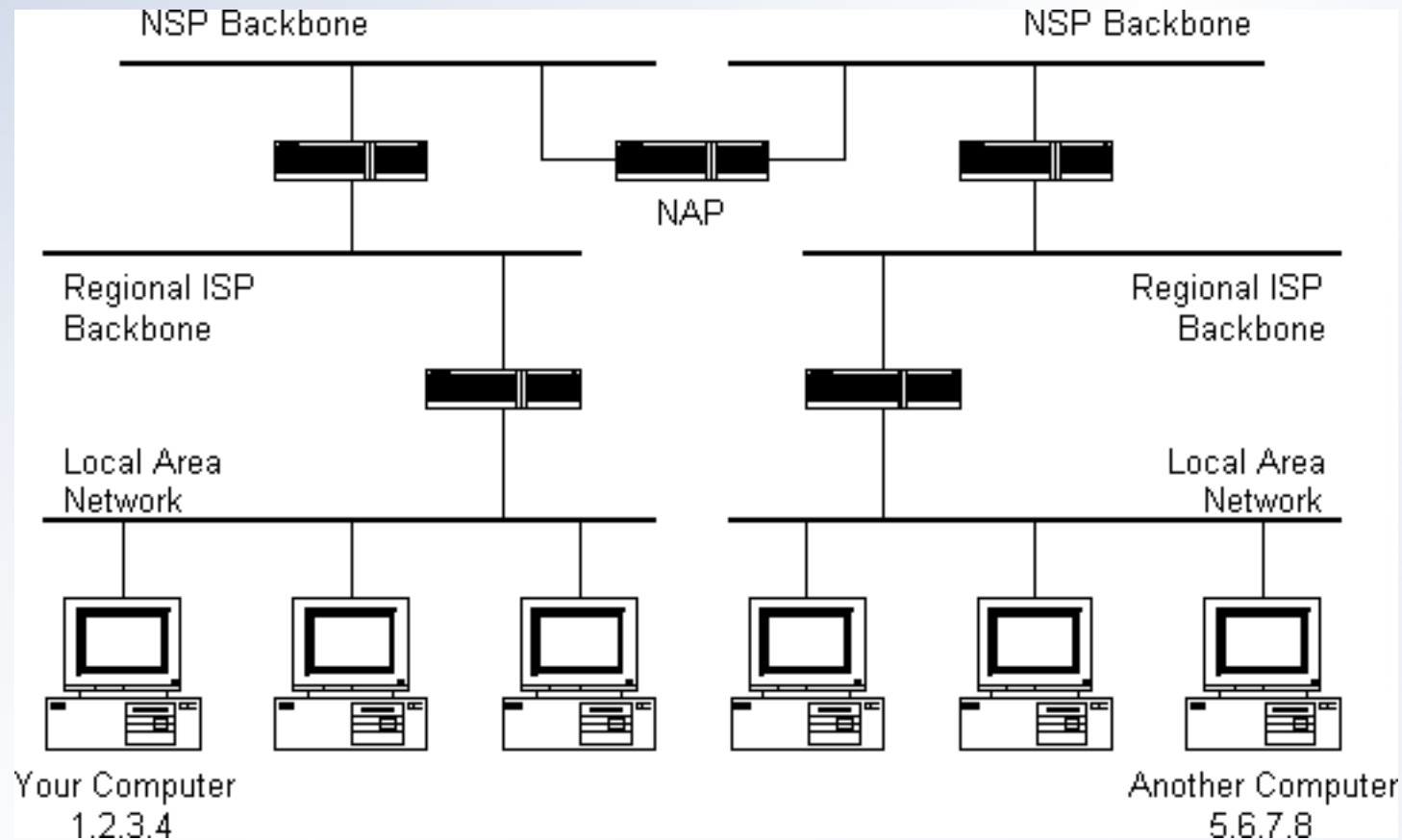e.g. 192.234.12.000

# Router

Router is like a mail sorting station.

Router contains a table of addresses.

One router typically forwards data to the next router.

Only knows about sub-net works.

# How data gets routed

# Domain names

What is this junk with IP numbers.  I have never written a number into my browser!

Well you could.  [www.cnn.com](www.cnn.com) corresponds to a number 157.166.255.18.

Routers need IP addresses to direct traffic but people want to type in domain names.

Lets first talk about what domain names are.

# Domain names

Every domain name (the internet address of a host you type into browser e.g [www.pic.ucla.edu](www.pic.ucla.edu)) corresponds to an IP number.

There are databases that record what domain names corresponds to what IP addresses.

This is called Domain Name Service (DNS)..

The DNS is structured as a hierarchy similar to the IP routing hierarchy.

# Fully-qualified domain name

- Fully-qualified domain name specifies the exact location of a host in the tree hierarchy of the Domain Name System.

- A **domain** is a collection of hosts.

- Domains can contain other domains.

Example of a fully-qualified domain name: laguna.pic.ucla.edu

**Host name**: laguna
**Enclosing domain** of laguna: pic
**Enclosing domain** of pic: ucla
**Top-level domain**: edu

Top level domain id's type of organization in which host resides.

# Examples of top level domains

Some top level domains
- com Commercial
- net Network (a second com)
- org Organization
- edu Education
- gov Government
- mil Military

Some Country Codes
- au Australia
- ca Canada
- cn China
- de Germany
- es Spain
- fr France
- it Italy
- jp Japan
- mx Mexico
- ru Russia
- uk United Kingdom

# Internet Protocols

Devices on the Internet communicate via Internet protocols.

Protocol is a set of rules governing the format of data exchange.

## TCP / IP

Stands for Transmission Control Protocol / Internet  Protocol.

Two different protocols working together.

To be part of the Internet, devices must communicate with each other using the protocol TCP/IP.

# TCP

When sending data TCP protocol takes the data you want to send and chops it up into "packets"

When receiving data TCP protocol takes the packets and reassembles them.

TCP is also responsible for:

- Directing data to the correct application.
- Error correcting.
- Sending confirmation messages for each packet received.

# IP

IP protocol takes each packet and adds to it the receivers address and sends the packets on to your hardware to be sent to the internet.

# URI

URI stands for uniform resource identifier

URIs can be classified as URLs (locators) or as URNs (names), or as both

URL stands for Uniform Resource Locator

URN stands for Uniform Resource Name

Think of URL as an address of a person
Think of URN as a name of a person

# What is a URL?

URL specifies a resource and its location on the web.

common form a of URL is

http://www.math.ucla.edu/~virtanen/40a.12f/index.html

www.math.ucla.edu is a fully-qualified domain name.

/~virtanen/40a.112 specifies a directory on the server

index.html is a file on the server

http specifies the transfer method for the file being requested.

Other possible transfer schemes are: https:, gopher:,  ftp, mailto.

URLs are case inSensiTiVe.

# What is a URN?

URNs allows us to talk about resources by name but gives no indication on how to locate it.

URNs are often used to specify namespaces.

# What is hypertext?

**Hypertext** is a document or documents containing hyperlinks to other documents

Hypertext with sound, images, video, or other media is **hypermedia**.

# What is the *World Wide Web*?

The vast collection of resources, hypertext, and hypermedia stored on Internet hosts
–accessed by **Web clients**

eg Microsoft IE, Mozilla Firefox, Safari
–provided by **Web servers**

eg Apache, Microsoft Internet Information Server (IIS)

To be "on the Web", hosts must communicate with each other using the protocol HTTP

# Tim Berners-Lee

Invented HTML in 1989

Wrote HTTP

Developed the first Web client and server in 1990

Founded the **W3C** (World Wide Web Consortium), a standardization organization whose standardized technologies are called **recommendations**.