

Introduction to TCP/IP

SHARE Tampa Winter 2007 – Session 3401

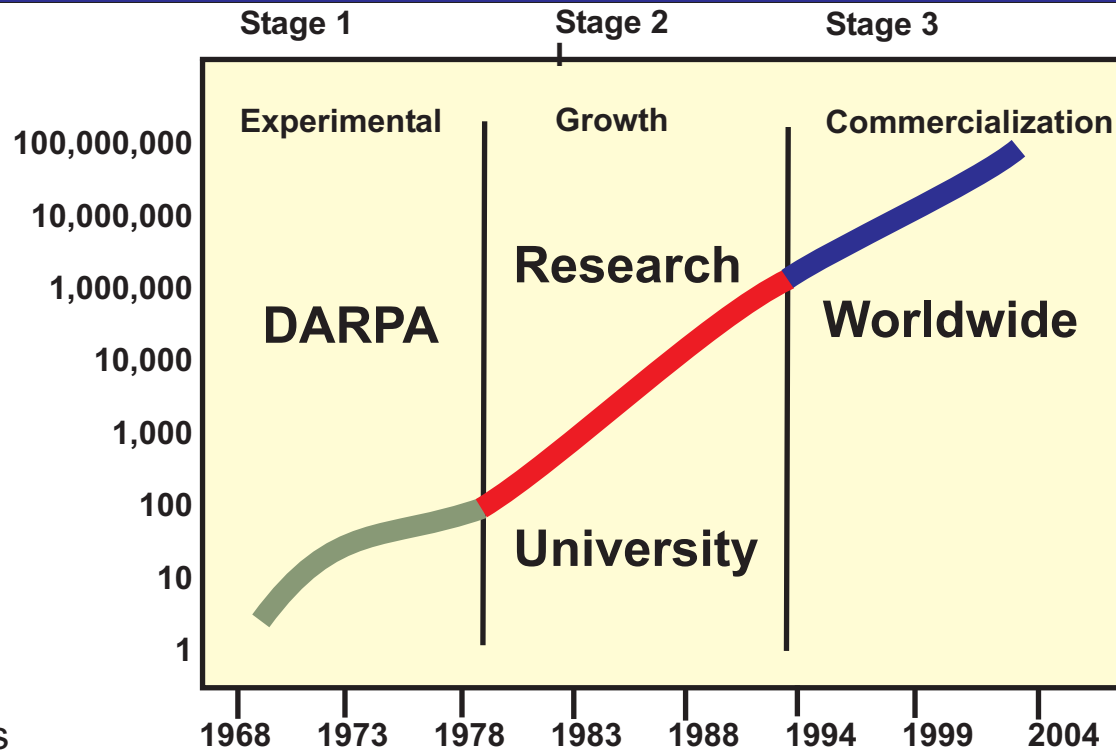


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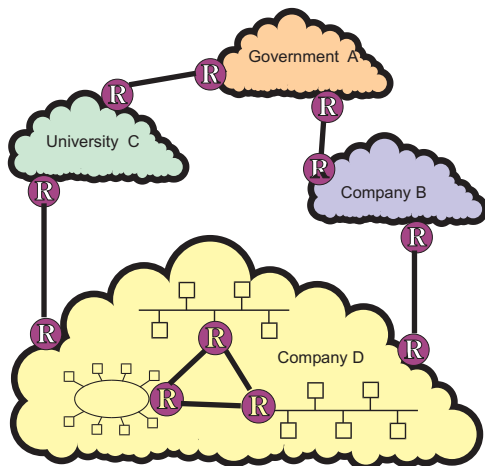
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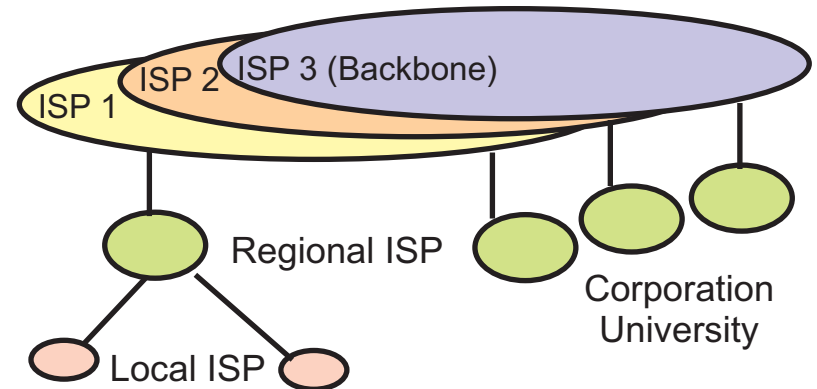
TCP/IP History



In the 1980's



Today



World Wide Web - WWW

URL

Uniform Resource Locator
The Internet address of the requested information

Home Page

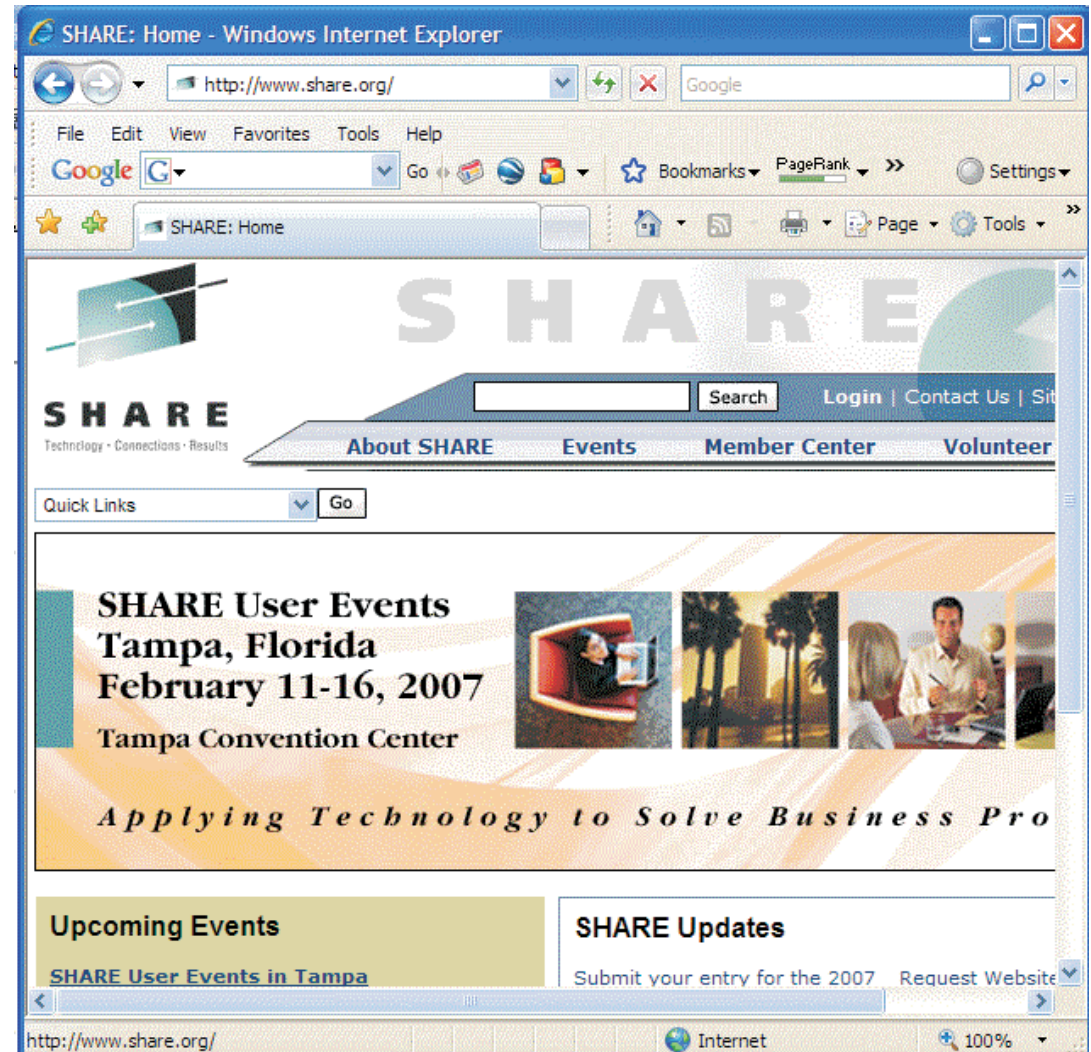
Web page of information

HTML

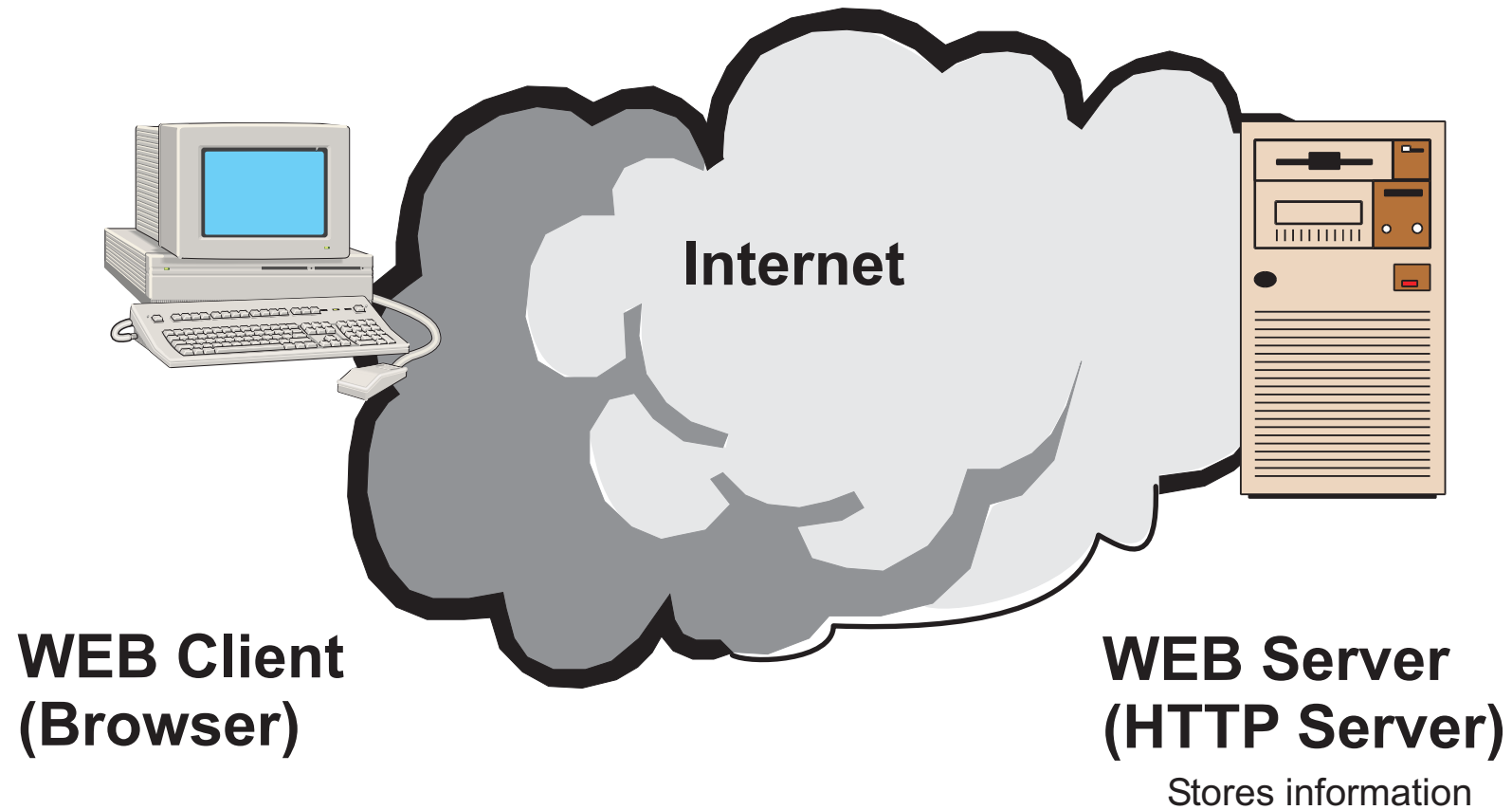
HyperText Markup Language
How WWW pages are written

HTTP

HyperText Transport Protocol
Rules used to transfer information between client and WWW server

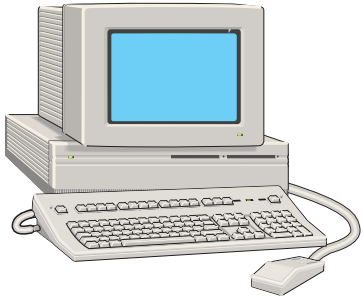


Client/Server Application

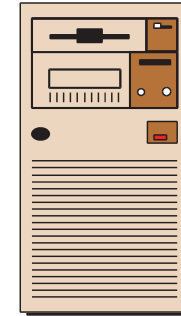


HTTP application
TCP/IP transmission mechanism

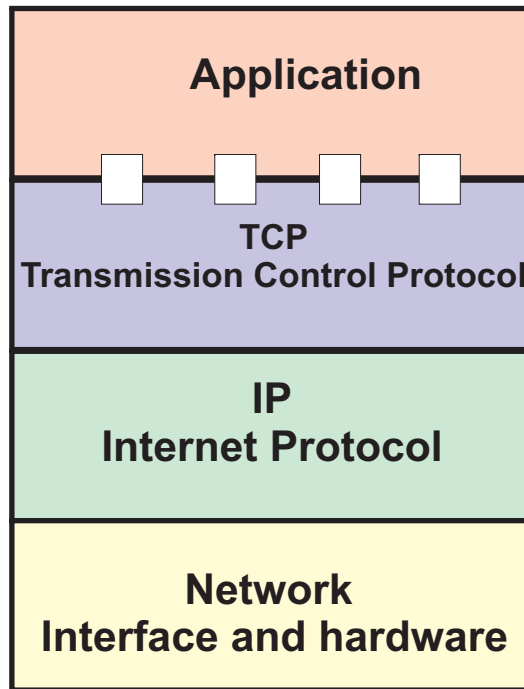
TCP/IP Layered Architecture



Browser



HTTP Server



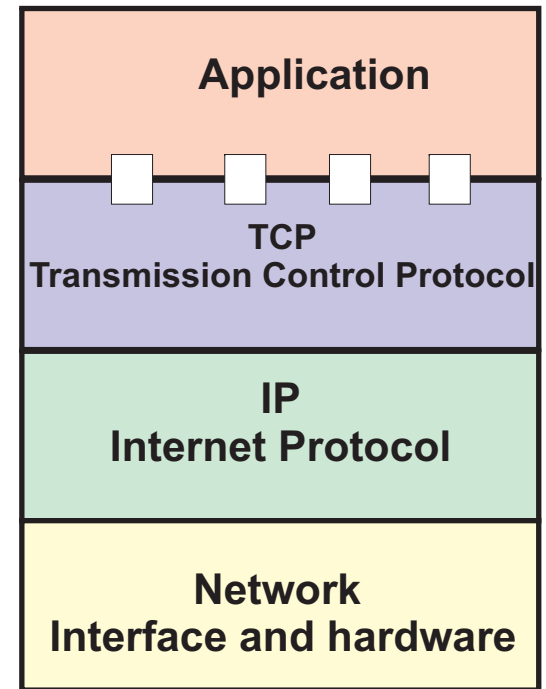
**WWW, mail, file transfer,
remote access**

Application interfaces

End-to-end delivery

Best effort delivery

Physical connection

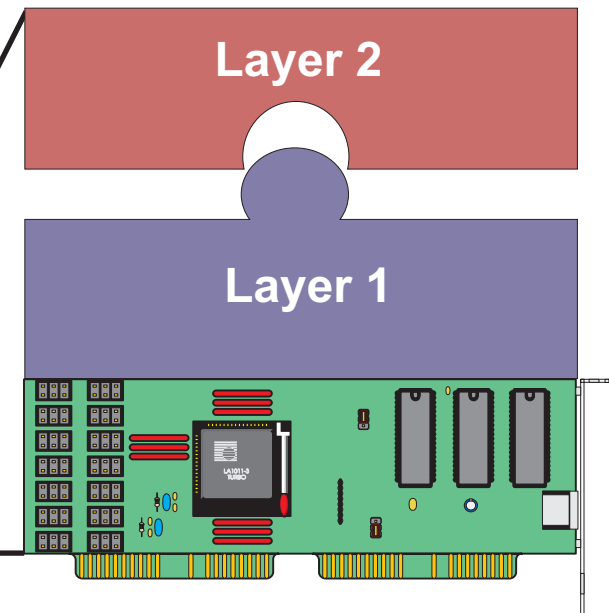
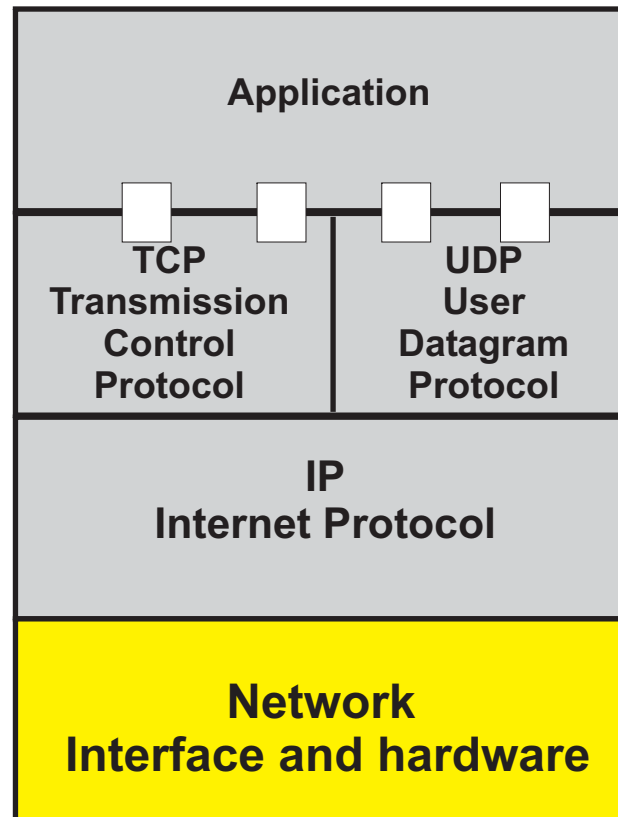


Network Interface Layer

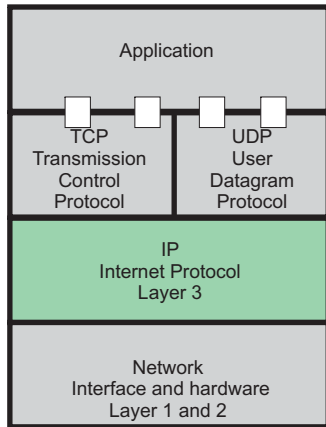
OSI Model

Layer	OSI Model
8	End User (Politics)
7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data Link
1	Physical

4 layer TCP/IP Model



IP - Internet Protocol



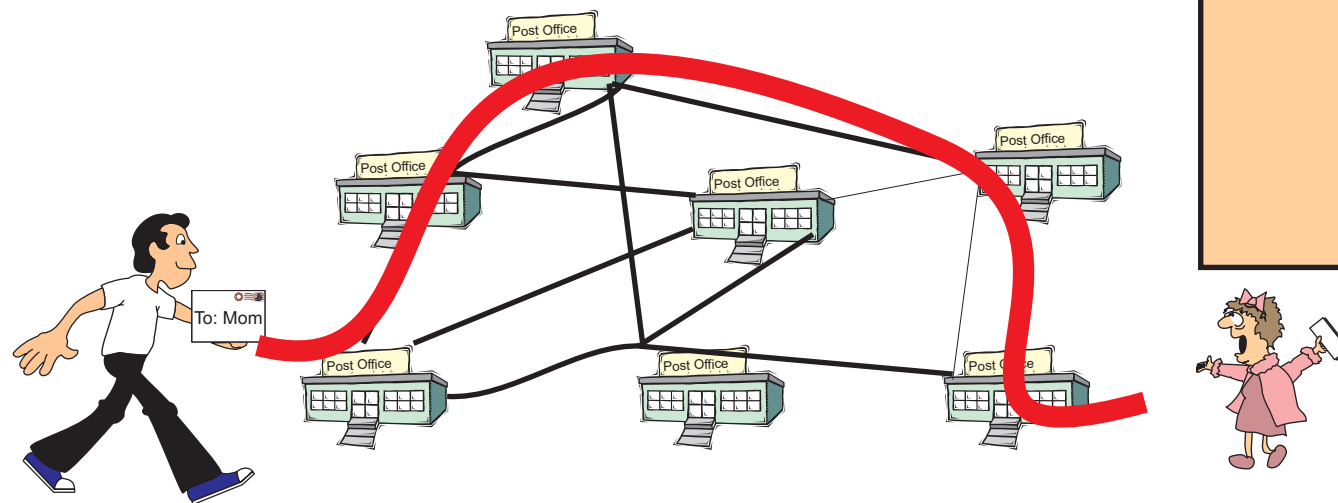
Data transferred in self contained units called datagrams

20 byte IP header

Best effort delivery -- no guarantee

Dynamic path selection for every datagram

Handles datagram fragmentation & reassembly



Datagram

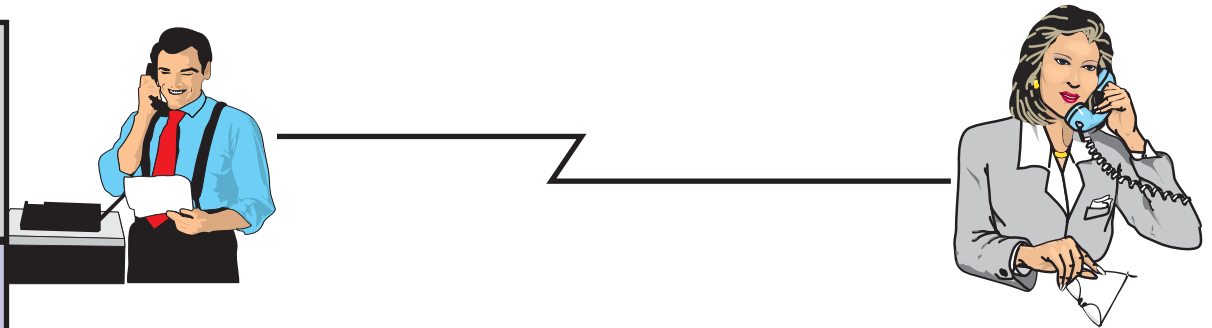
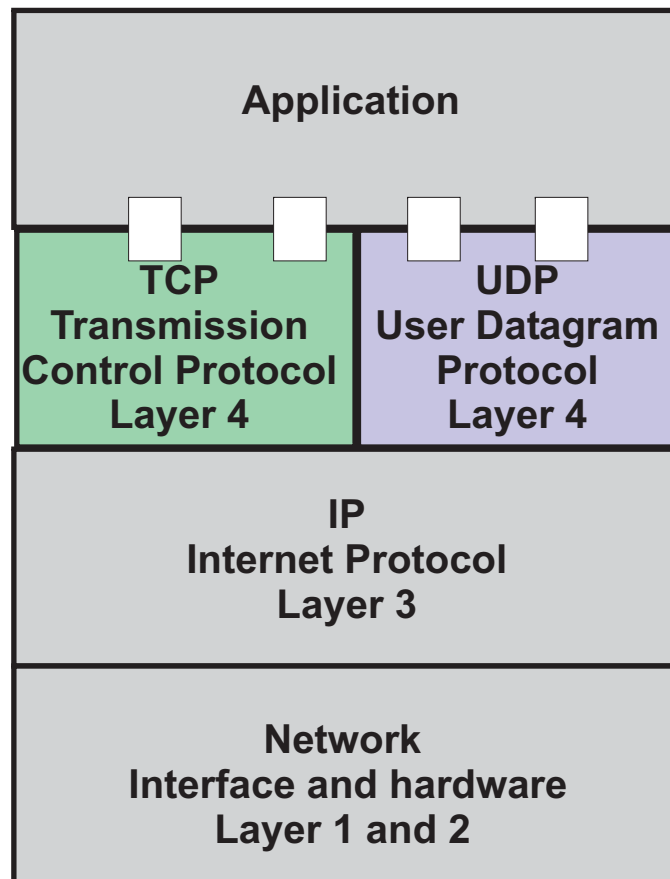
Vers: HD	TOS	Payload length
Fragment ID		Fragment Information
TTL	Protocol	Header Checksum
Source Address		
Destination Address		
Data		

Best Effort Delivery



**Postal Truck Stolen Near Wilson, Mail Destroyed
Postal Inspectors Working With Police To Solve Crime
Over 10,000 mail pieces were destroyed - January 16, 2002**

TCP - Transmission Control Protocol



Connection established

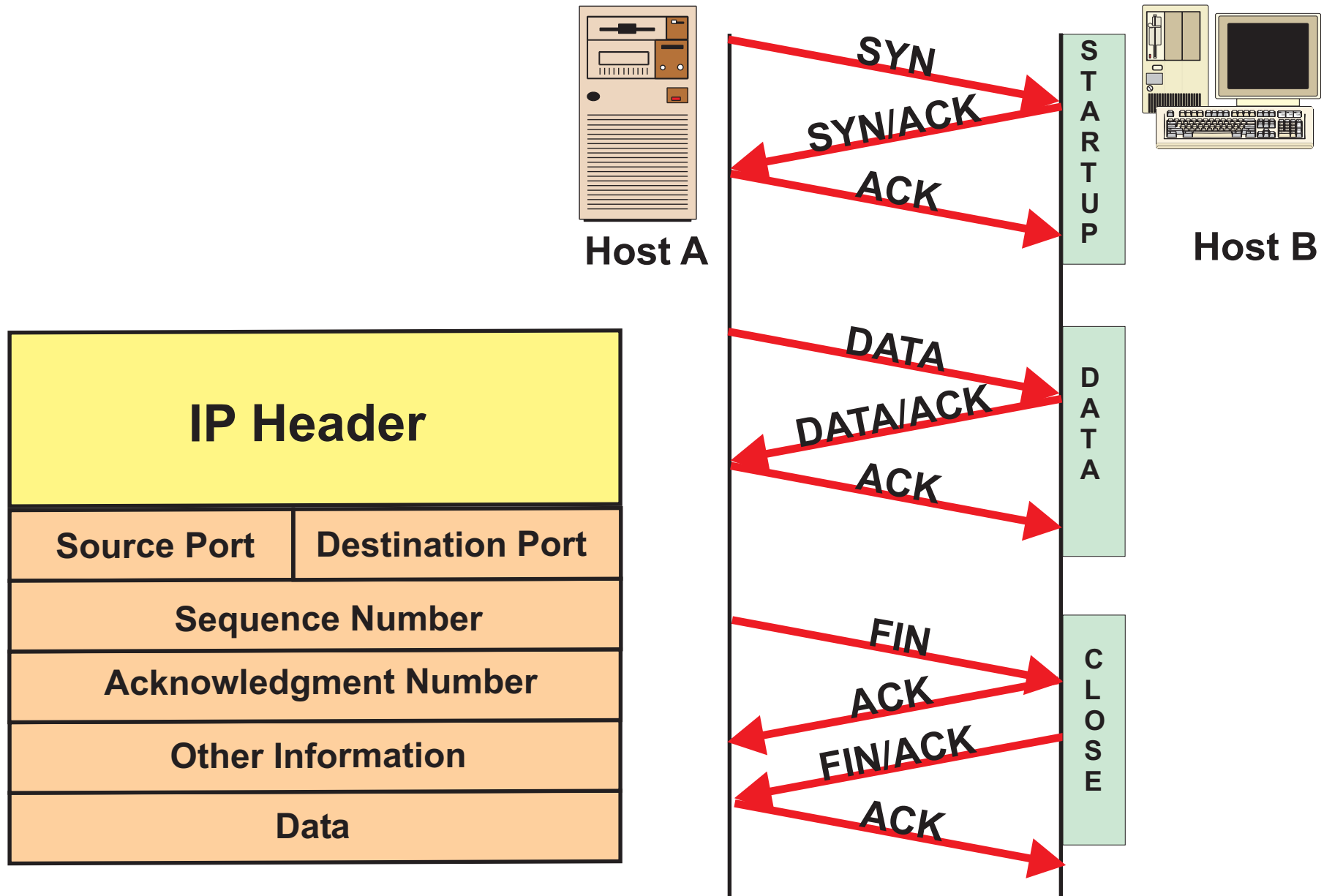
End-to-end acknowledgments

Orderly delivery of datagrams to application

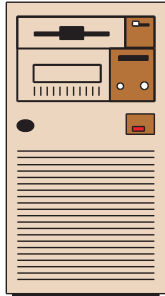
Error and flow control

Connection takedown

TCP - Connection Flow



TCP - Acknowledgments



**Sends datagram
Starts timer**

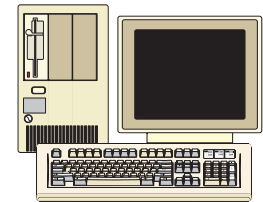
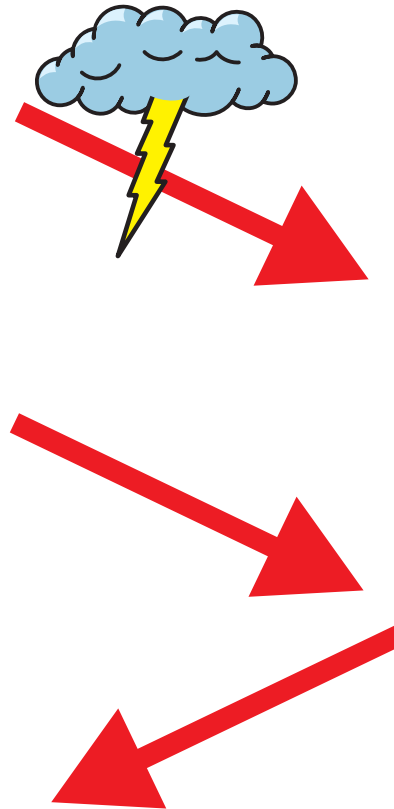
Host A

**Acknowledgment
was not received**



**Timer expires
and datagram retransmitted**

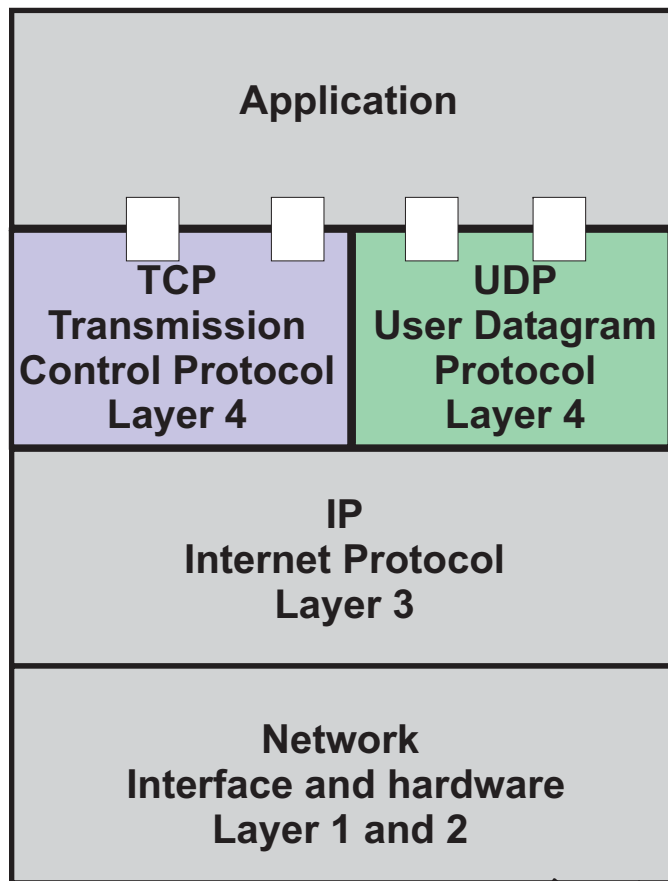
**Host A receives acknowledgment,
resets timer, and clears buffer**



Host B

**Host B receives datagram
and acknowledges receipt**

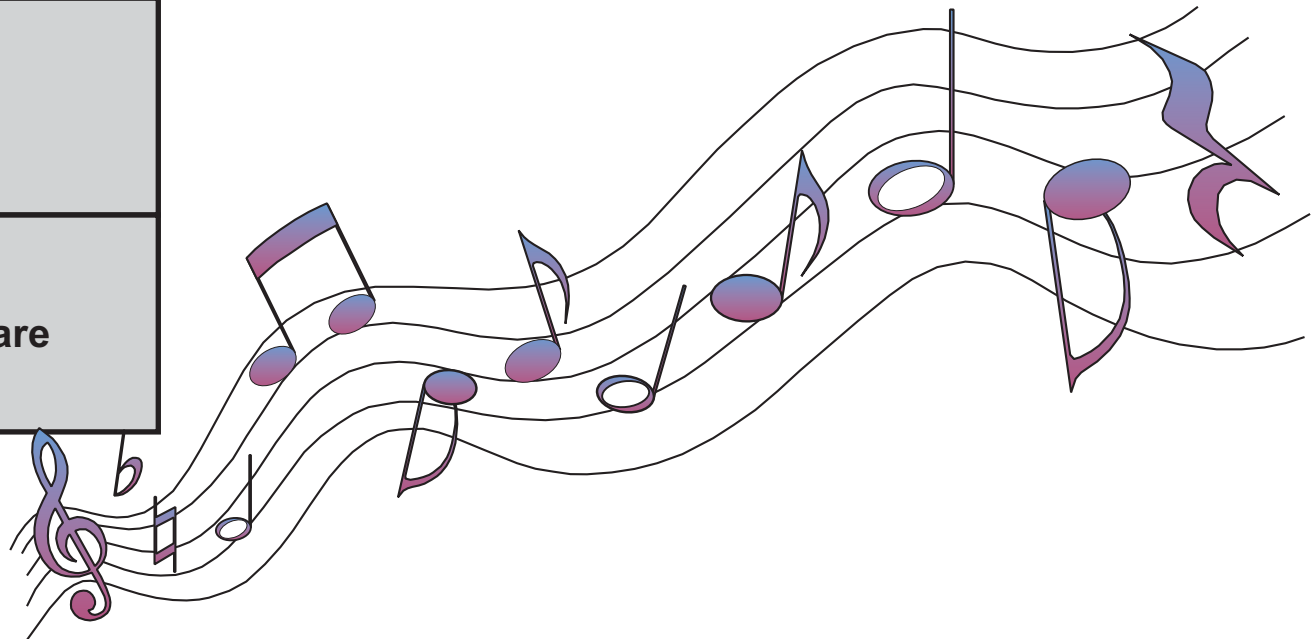
UDP - User Datagram Protocol



Program to program datagram transfer

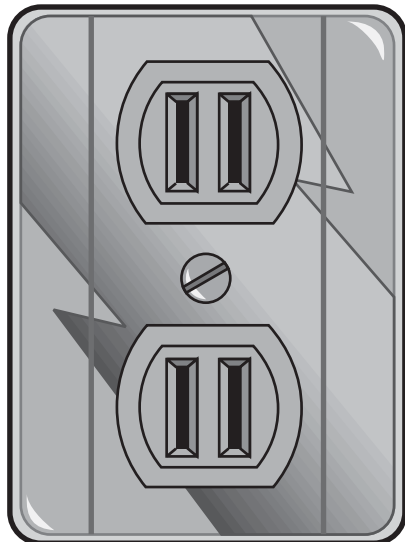
Fast mechanism

Used for management frames, streaming audio



TCP/IP Ports

Sockets



Network I/O for UNIX
Library of C routines
Berkeley UNIX (BSD) API

Also called Ports

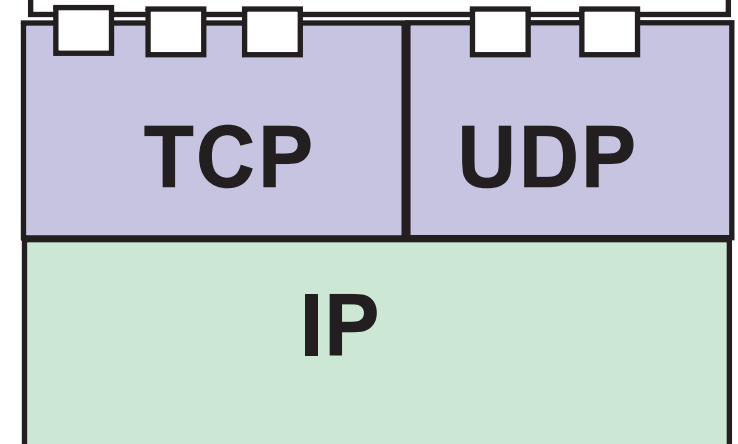
Well known 0 - 1023
Registered 1024 - 49151
Dynamic 49152 - 65535
also called Private

Application address

IP Address
Protocol (TCP or UDP)
Port Number

Application code

Port Number	Protocol	Application
20	TCP	FTP-data
21	TCP	FTP-control
23	TCP	Telnet
25	TCP	SMTP
53	TCP/UDP	DNS
70	TCP	Gopher
79	TCP	Finger
80	TCP	HTTP
110	TCP	POP3
161	UDP	SNMP
162	UDP	SNMP-trap
520	UDP	RIP
1435	TCP/UDP	IBM CICS
1525	TCP/UDP	Oracle
10007	TCP/UDP	MVS Capacity



IP Addressing

IP address is 32 bits long

Expressed as 4 decimal numbers

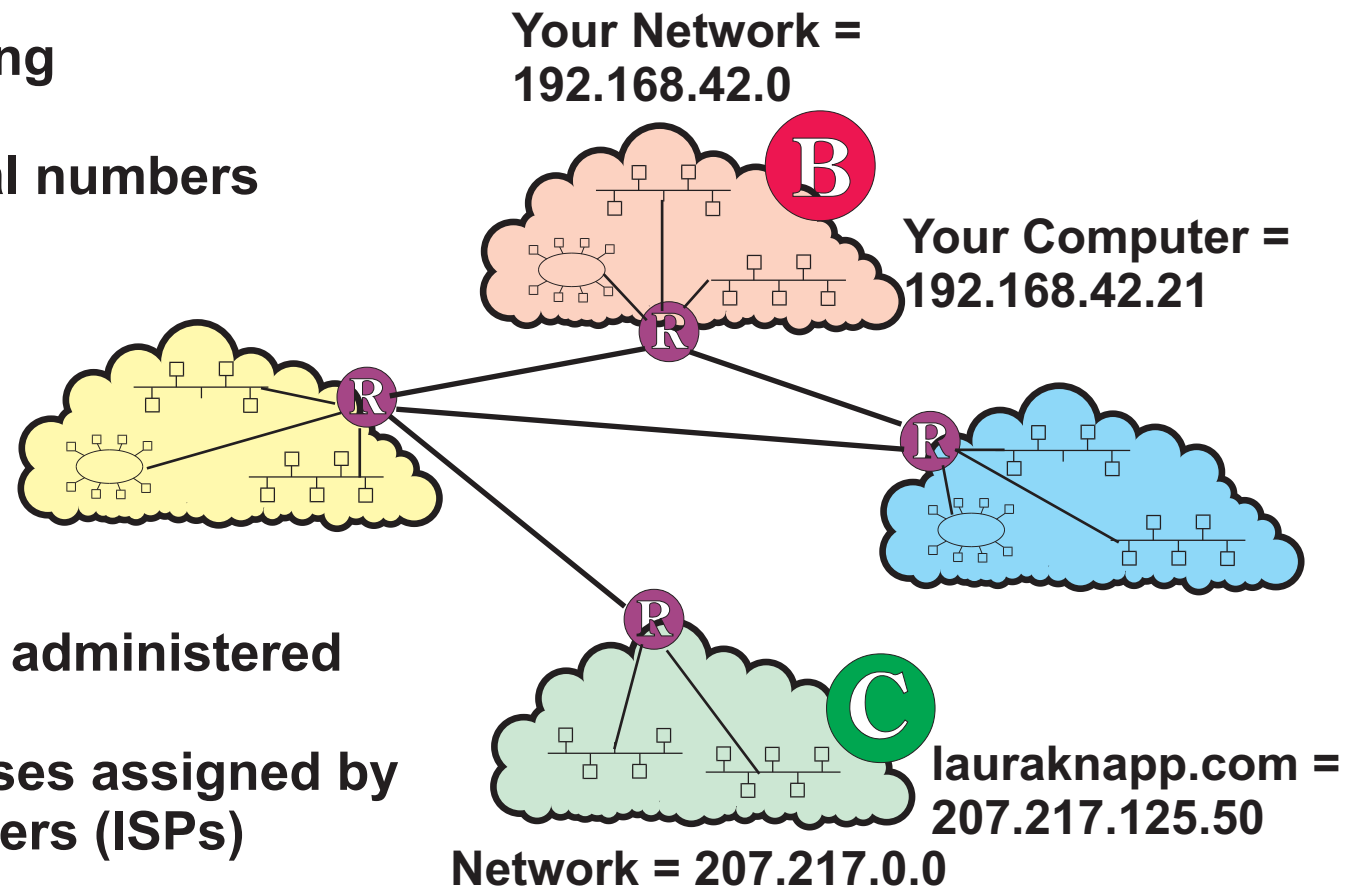
Format: 128.189.65.1

Divided into 2 parts
Network address
Host address

Host addresses locally administered

Public network addresses assigned by
Internet Service Providers (ISPs)

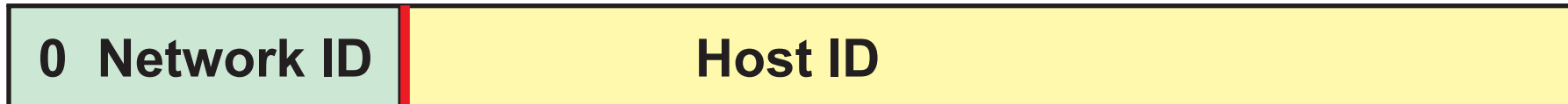
We recommend using private IP addresses inside your network



Private IP Addresses



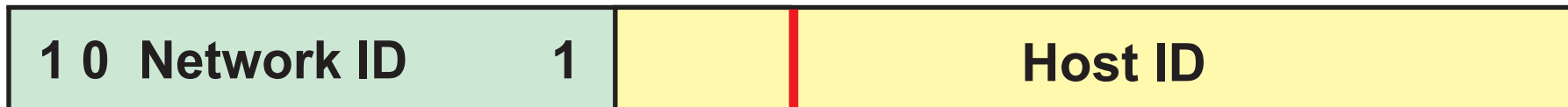
Class A



Private 10.0.0.0/8

10.0.0.0 - 10.255.255.255

Class B



Private 172.16-31.0.0/12

172.16.0.0-172.31.255.255

172.0-15.n.n and 172.32-255.n.n are Internet addresses

Class C

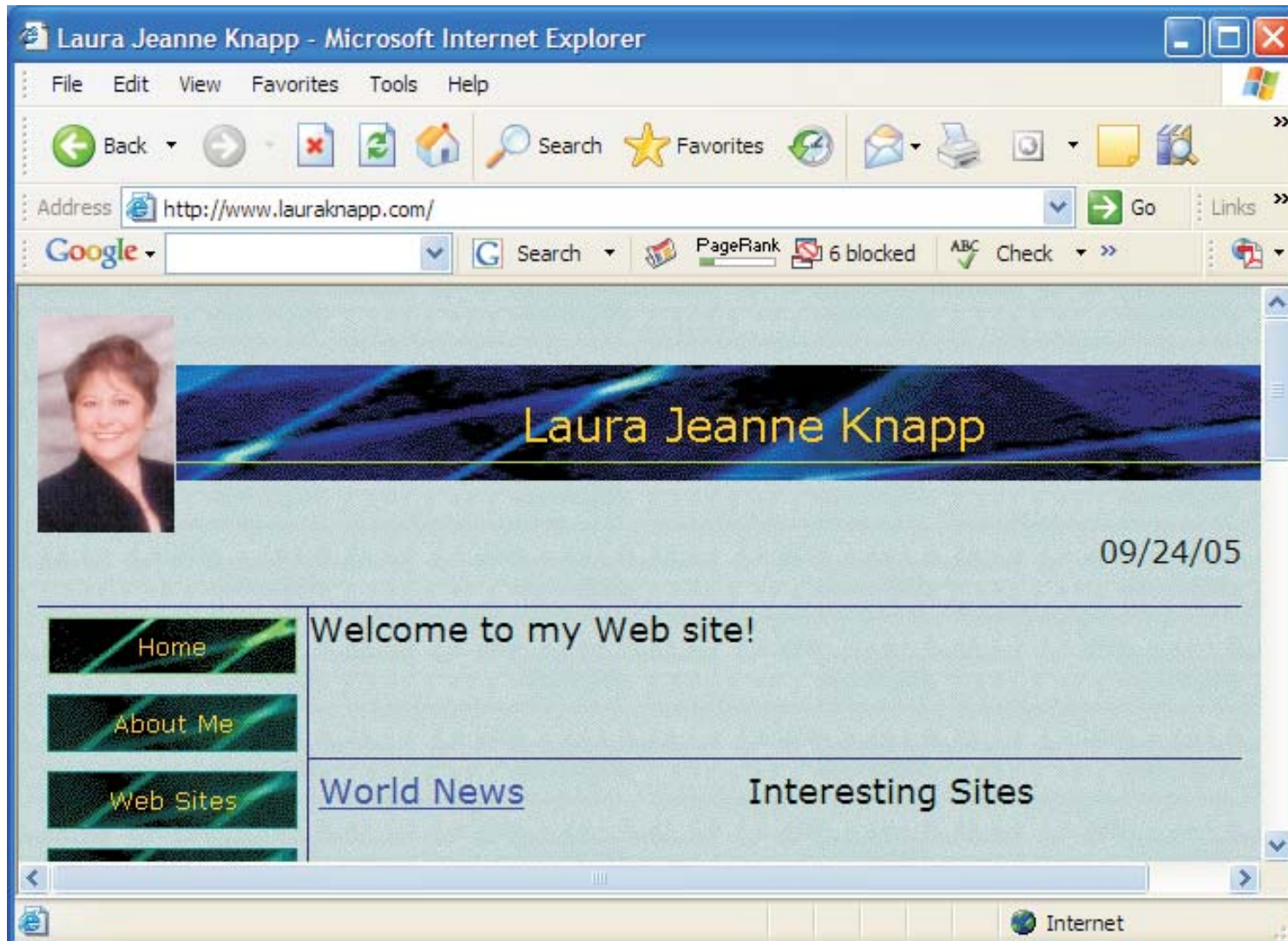


Private 192.168.0.0/16

192.168.0.0-192.168.255.255

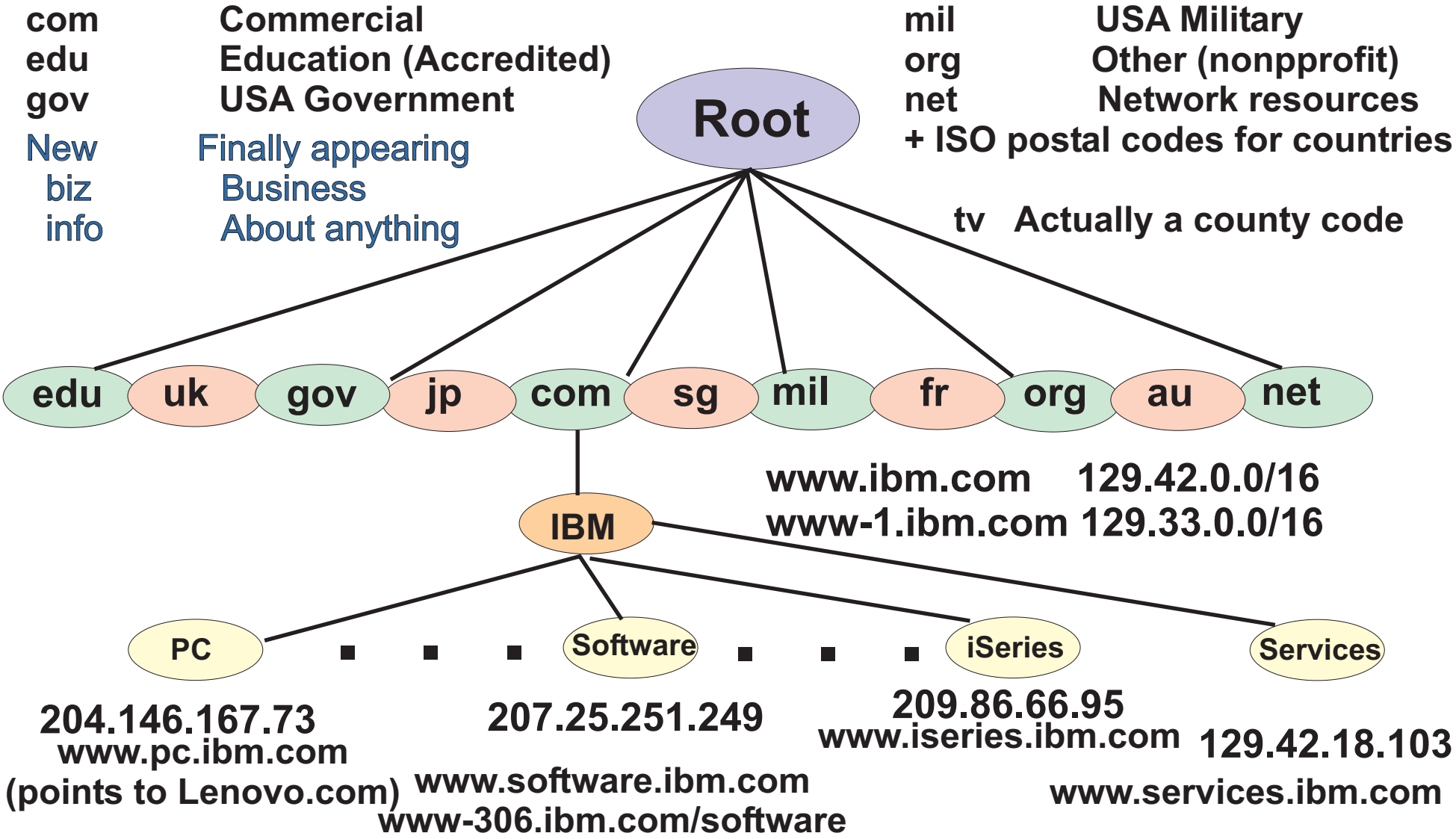
By agreement, private IP addresses are not routed in the public Internet
Public addresses usually CIDR (Classless Internet Domain Routing)

Names and Addresses

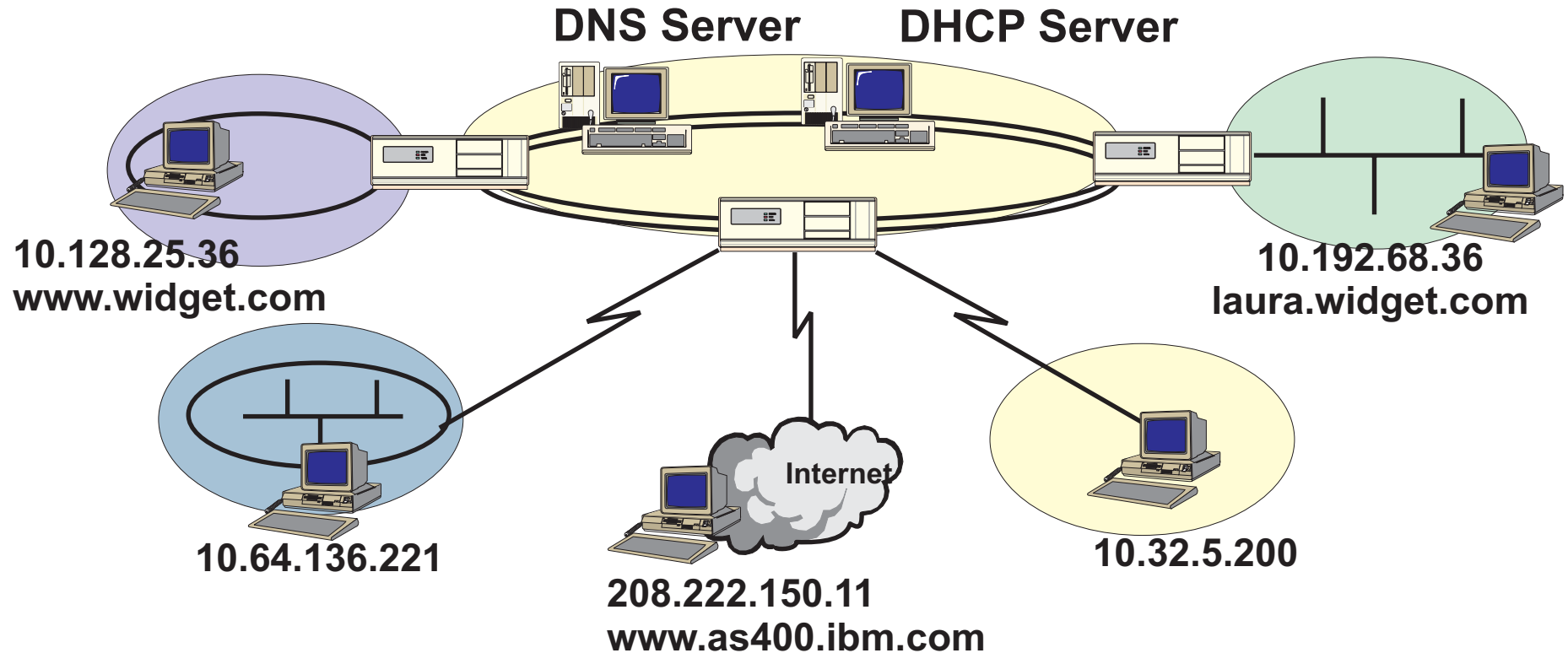


**If IP needs an address and I use a name in the URL,
how does it all work?**

DNS and TCP/IP Addresses



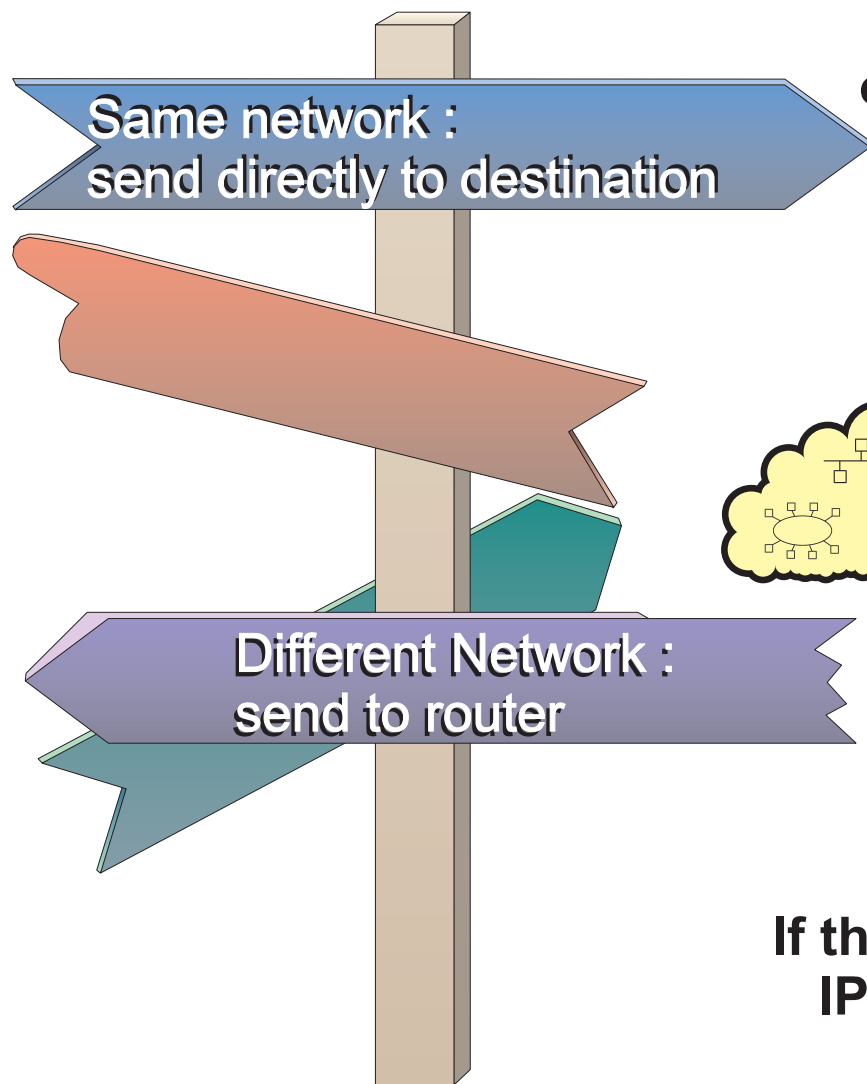
Dynamic IP



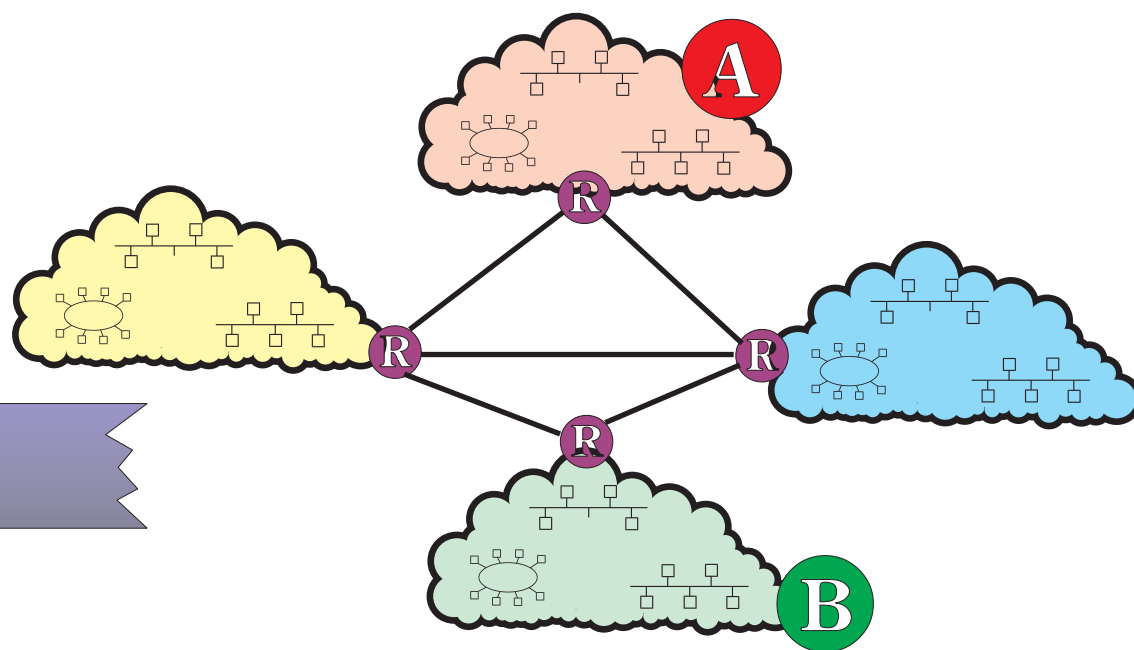
How did my browser resolve the Web server name to an IP address?
DNS server - Domain Name System Server

How can I function on an IP network if I didn't configure an IP address?
DHCP - Dynamic Host Configuration Protocol

Routing

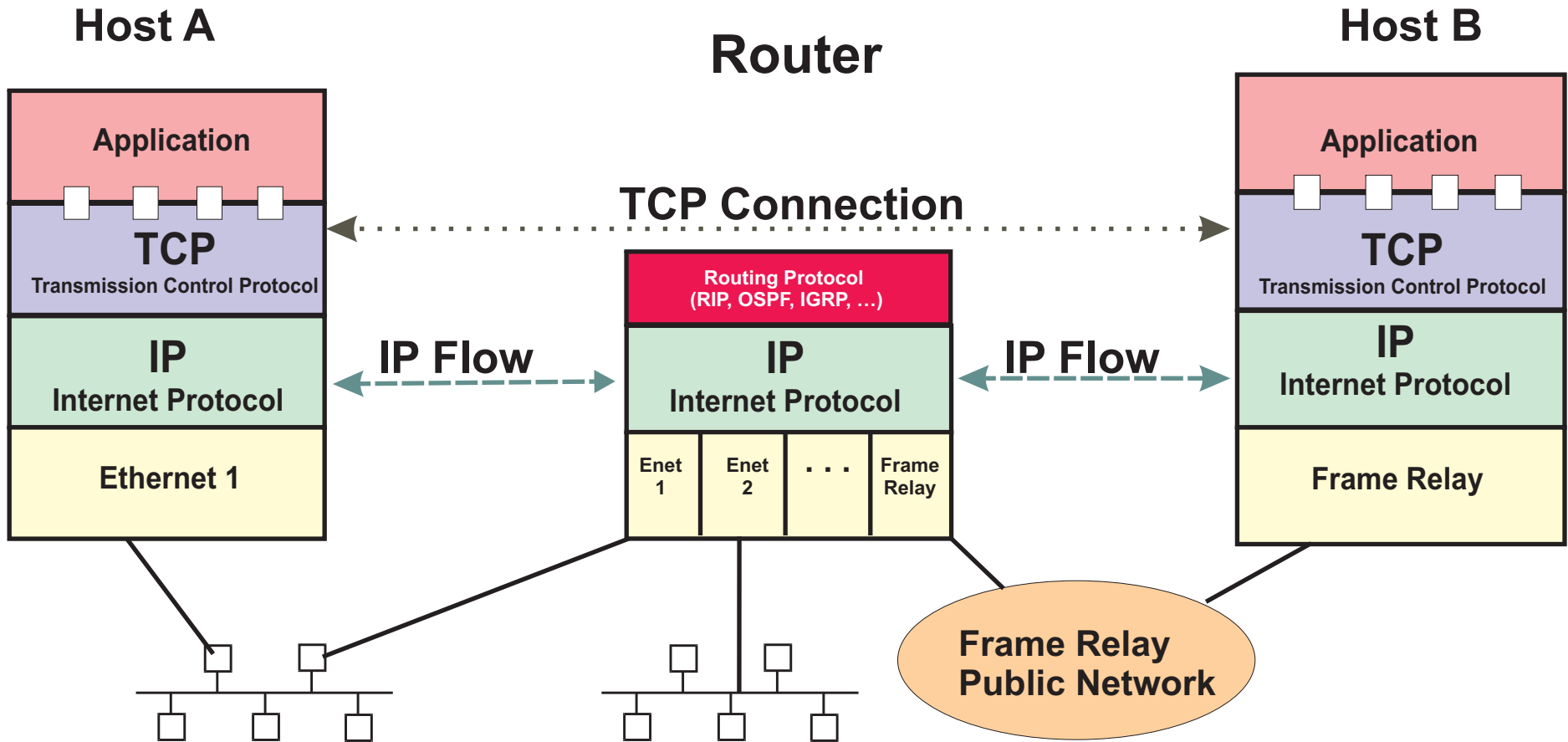


IP delivers datagrams directly from origin to destination if they are on the same network



If the destination is on a different network, IP sends the frame to a router that will forward through the network

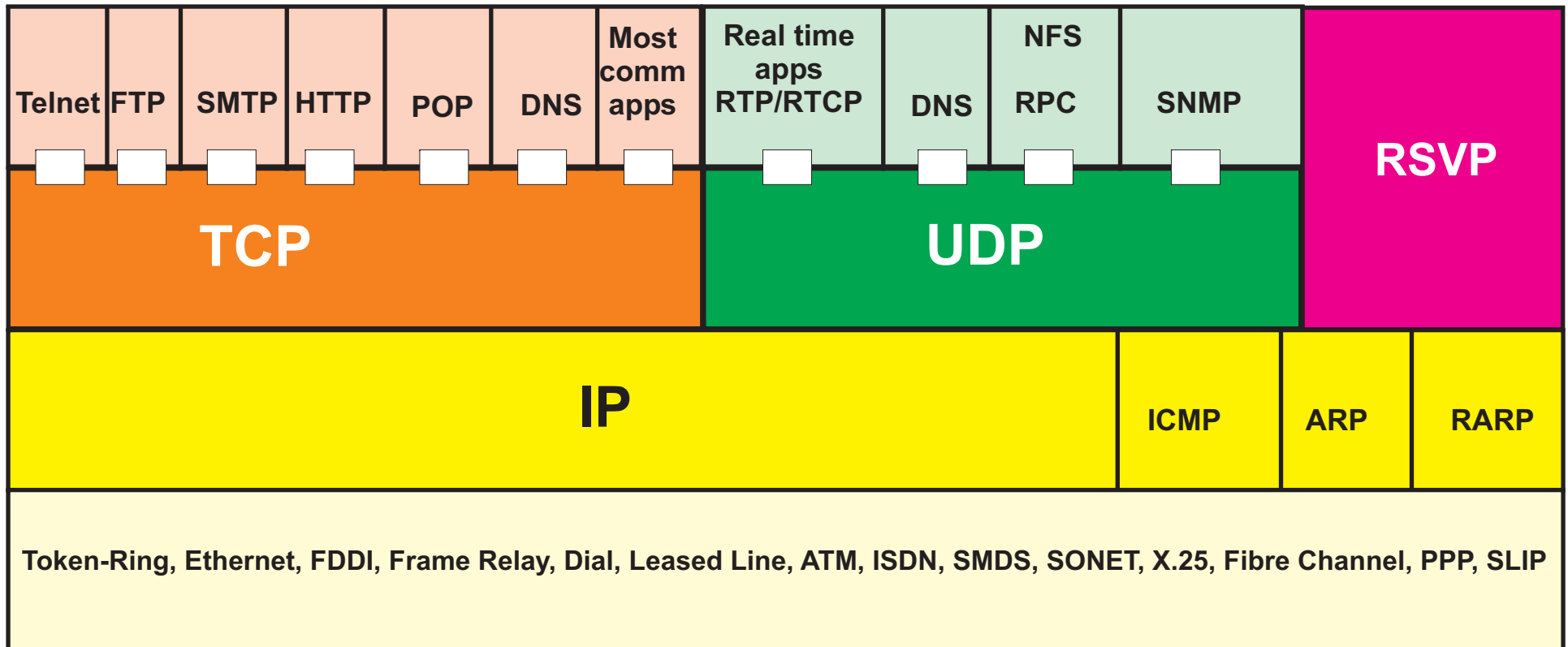
IP Routing



The routing function is performed by the IP protocol and routers

RIP - Routing Information Protocol
OSPF - Open Shortest Path First
IGRP - Interior Gateway Routing Protocol

TCP/IP Protocol Suite



IP - Internet Protocol

ICMP - Internet Control Message Protocol

ARP - Address Resolution Protocol

RARP - Reverse Address Resolution Protocol

TCP - Transmission Control Protocol

UDP - User Datagram Protocol

POP - Post Office Protocol

DNS - Domain Name System

Telnet - Teletype Network

FTP - File Transfer Protocol

SMTP - Simple Mail Transfer Protocol

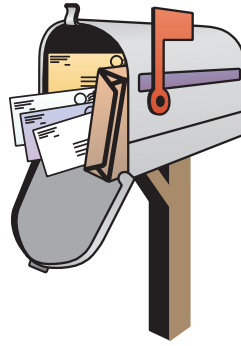
HTTP - Hypertext Transport Protocol

NFS - Network File System

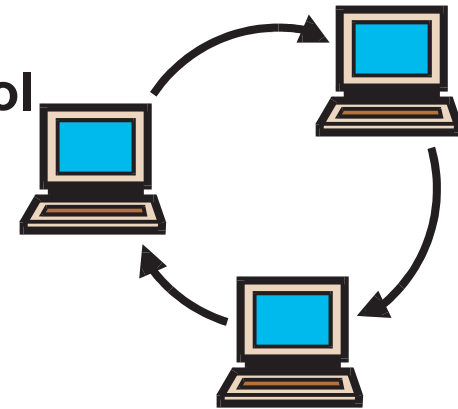
RPC - Remote Procedure Call

SNMP - Simple Network Management Protocol

Internet Capabilities (Basics)



**Internet Mail
Simple Mail Transfer Protocol
(SMTP)**



**File Transfer Protocol
(FTP)**

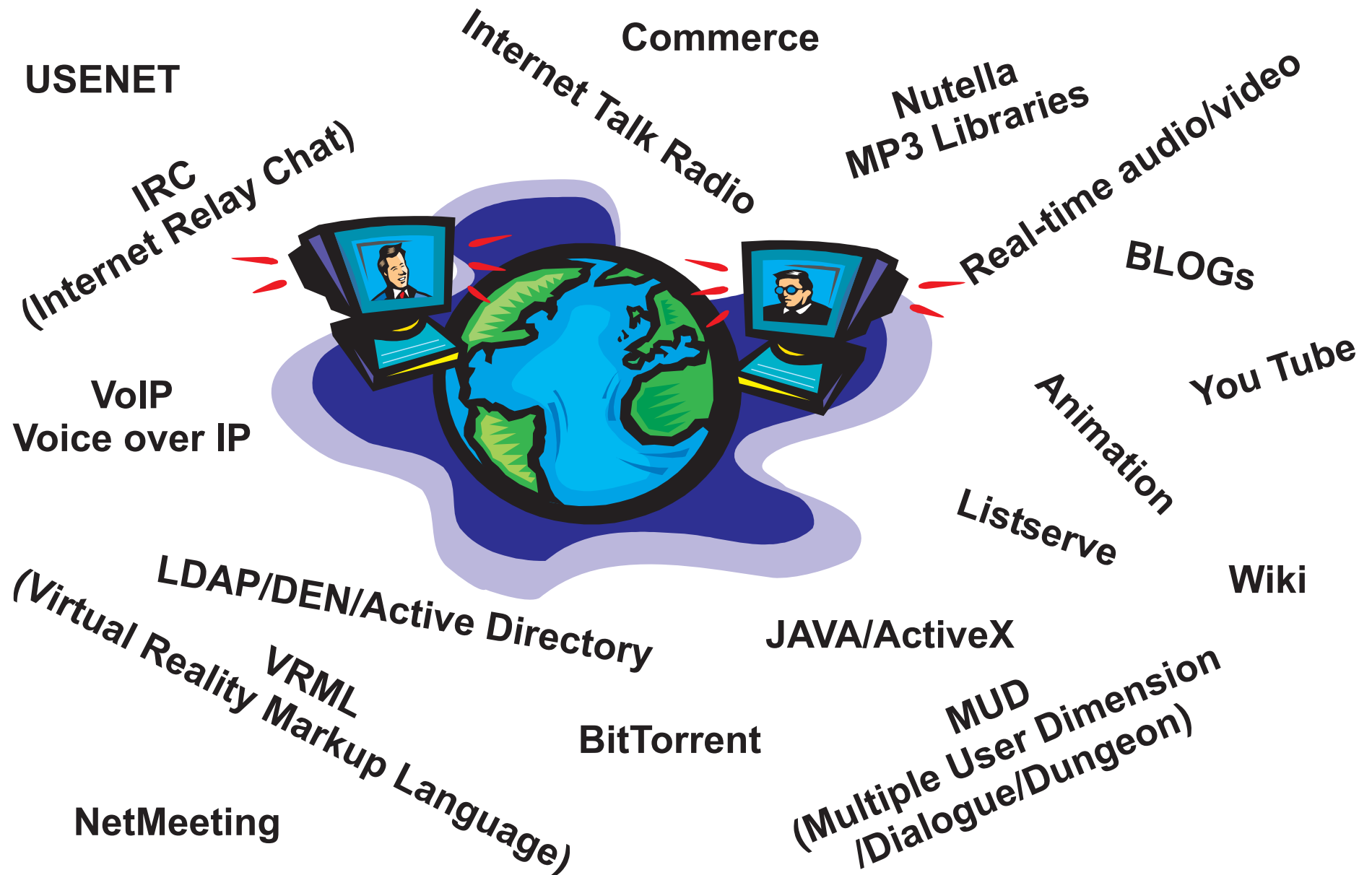


**Terminal Emulation
(TELNET)**



**Simple Network
Management Protocol
(SNMP)**

Application Advances



TCP/IP Standards

IAB - Internet Architecture Board

Sets direction

Determines standards

Guides evolution of Internet

Coordinates developments in TCP/IP

IETF - Internet Engineering Task Force

Solutions for engineering problems

Produce RFC (Request for Comments)

IRTF - Internet Research Task Force

Coordinates research activities

Longer term solutions

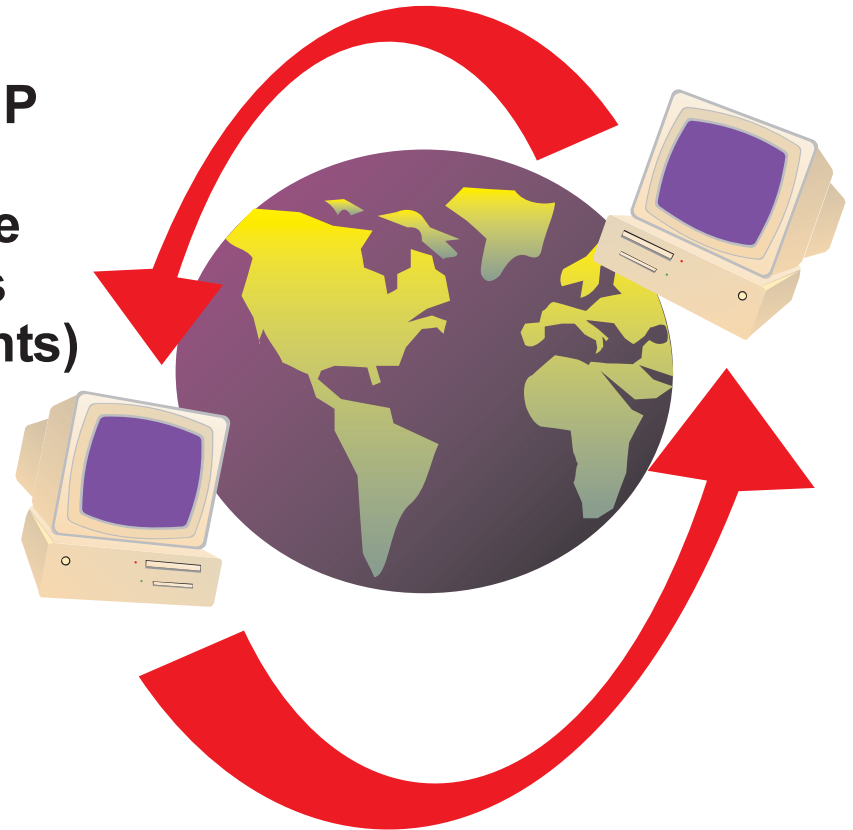
ICANN - Internet Corporation for Assigned Names and Numbers

**** (US)/RICE (Europe)/APNIC (Asia)**

Administer top-level domain names (TLDs)

**** Many domain registrars today**

One master list



TCP/IP Summary

TCP/IP has a heritage of equality ...

IP network designed to span Wide and Local Area Networks

Hosts (systems) are equal
PC or mainframe or midrange

Connection and connectionless support

Application environments supported

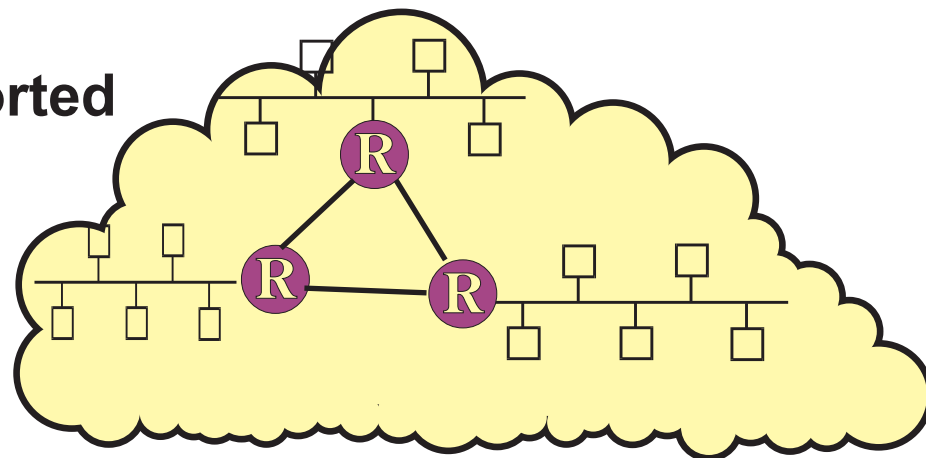
Client/server networking

Peer-peer networking

Distributed computing

Network computing

Terminal emulation



Designed for independence and interoperability