Web Systems& Applications

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Network Applications

Client-Server Interaction

Introduction

-Application-level protocols provide high-level services

- -DNS
- -Electronic mail
- -Remote login ***Telnet***
- -FTP
- -World Wide Web

-All of these applications use ***client-server*** architecture

Internet protocols and network applications

-Internet protocols provide

-General-purpose facility for reliable data transfer

-Mechanism for contacting hosts

-Application programs

-Use internet protocols to contact other applications

-Provide user-level services

Establishing contact through internet protocols

-Application must interact with protocol software before contact is made

-Listening application informs local protocol software that it is ready to accept incoming messages

-Connecting application uses internet protocol to contact listener

-Applications exchange messages through resulting connection

Client-server paradigm

-**Server** application is "**listener**"

-Waits for incoming message

-Performs service

-Returns results

-**Client** application establishes connection

-Sends message to server

-Waits for return message

Characteristics of client

-Arbitrary application program

-Becomes client when network service is needed

-Also performs other computations

-Invoked directly by user

-Runs locally on user's computer

-Initiates contact with server

-Can access multiple services (one at a time)

-Does not require special hardware or sophisticated operating system

Characteristics of server

-Special purpose application dedicated to providing network service

-Starts at system initialization time

-Runs on a remote computer (usually centralized, shared computer)

-Waits for service requests from clients; loops to wait for next request (***listening***)

-Will accept requests from arbitrary clients; provides one service to each client

-Requires powerful hardware and sophisticated operating system

“Server-class” computers

-Shared, centralized computers that run many server applications are sometimes called “***servers***”

-More precisely, the applications are the “**servers**” and the computer is a **“server-class computer”**

-Servers can run on very simple computers...

Message exchanges

-Typically, client and server exchange messages:

-Client sends ***request***, perhaps with data

-Server send ***response***, perhaps with data

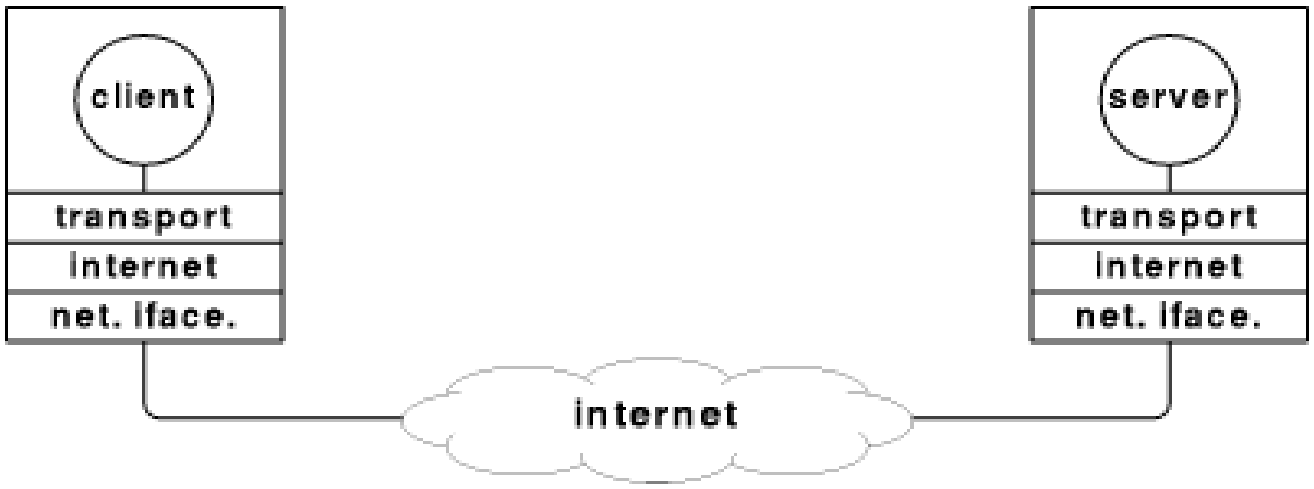
-Client may send multiple requests; server sends multiple responses

-Server may send multiple response - imagine video feed

Transport protocols and client-server paradigm

-Clients and servers exchange messages through transport protocols; e.g., **TCP** or **UDP**

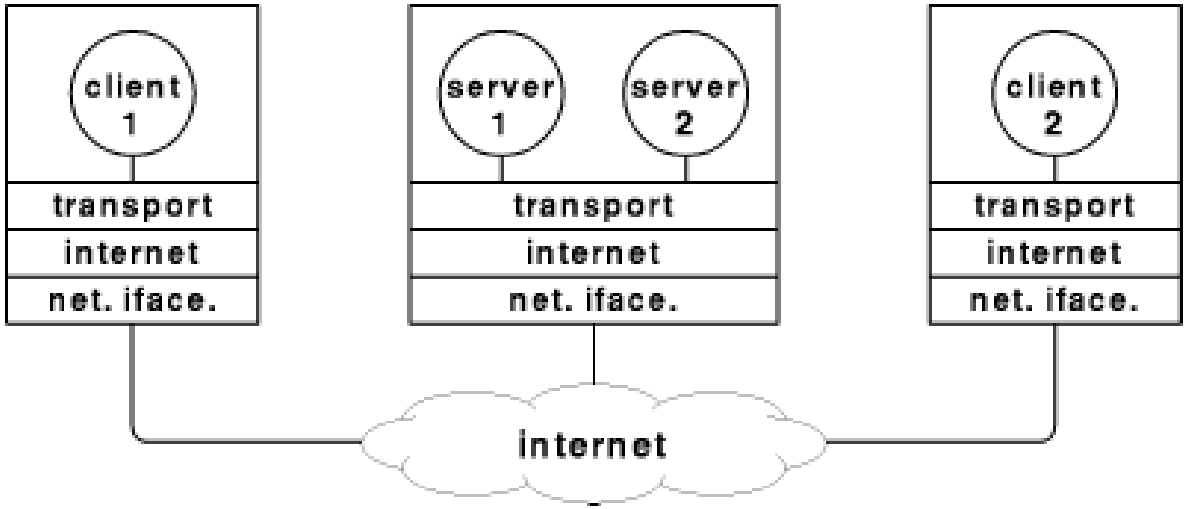
-Both client and server must have same protocol stack and both interact with transport layer



Multiple services on one computer

-Sufficiently powerful computer - fast enough processor, multi-tasking OS - may run multiple servers

-Servers run as independent processes and can manage clients simultaneously



Multiple services on one computer

-Can reduce costs by sharing resources among multiple services

-Reduces management overhead - only one server-class computer to maintain

-One server can affect others by exhausting server-class computer resources

-Failure of single server-class computer can bring down multiple servers

Basic Internet Concepts

What is the Internet?

- WWW
- Video conferencing
- ftp
- telnet
- Email
- Instant messaging
- …

A communication infrastructure

Usefulness is in exchanging information

Abbreviated History

1943	First electronic digital computer Harvard Mark I
1966	Design of ARPAnet
1970	ARPAnet spans country, has 5 nodes
1971	ARPAnet has 15 nodes
1972	First email programs, FTP spec
1973	Ethernet operation at Xerox PARC
1974	Intel launches 8080; TCP design
1975	Gates/Allen write Basic for Altair 8800
1976	Apple Computer formed by Jobs/Wozniak
1977	111 hosts on ARPAnet
1979	Visicalc

… Abbreviated History

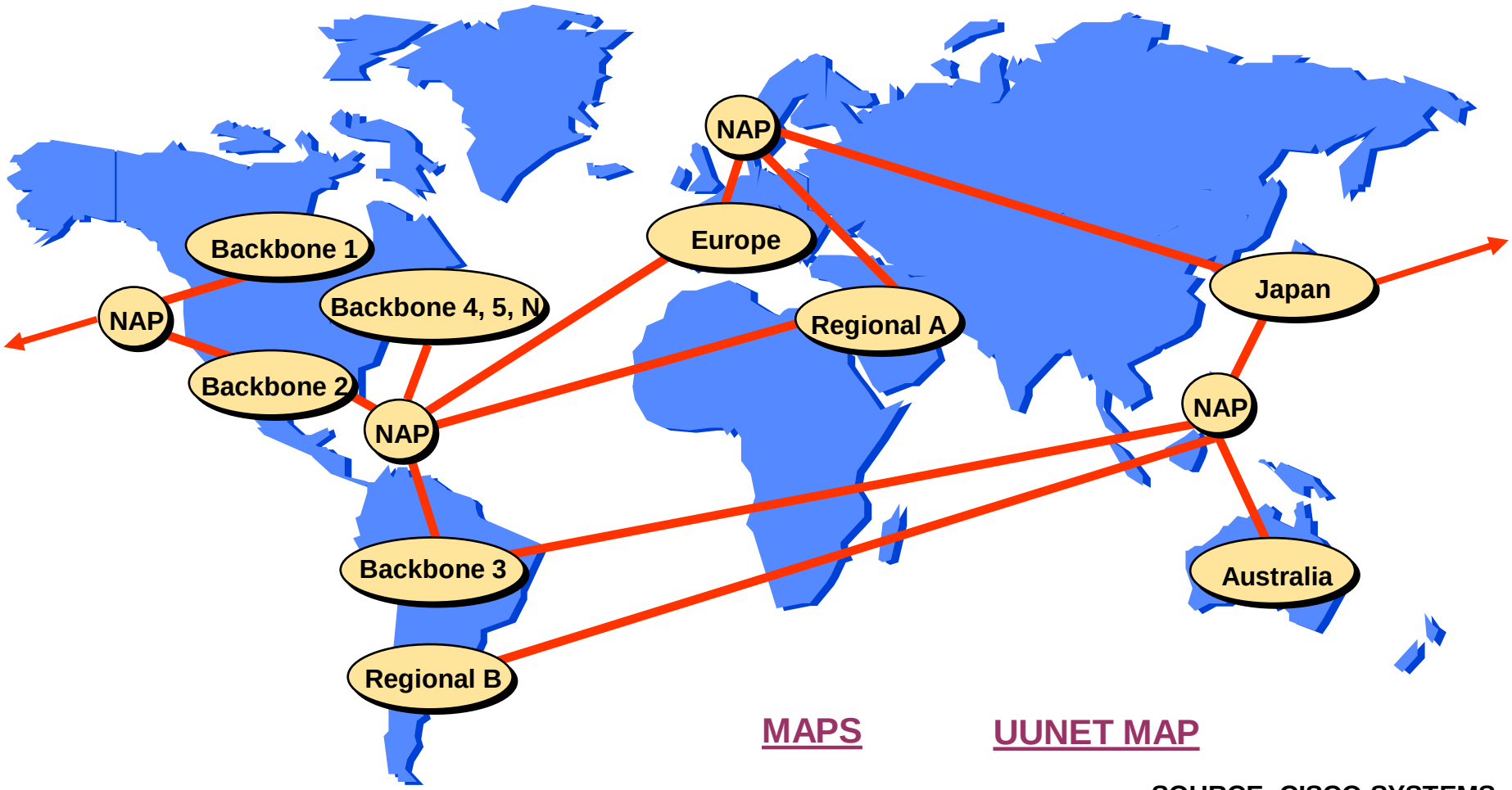
1981	Microsoft has 40 employees; IBM PC
1982	Sun formed
1983	ARPAnet uses TCP/IP -> birth of internet
1983	Design of DNS
1984	launch of Macintosh; 1000 hosts on ARPAnet
1985	Symbolic.com first registered domain name
1989	100,000 hosts on Internet
1990	Cisco Systems goes public $288 M
	Tim Berners-Lee creates WWW at CERN
	First web page on November 13, 1990

… Abbreviated History

1993	Mosaic developed at UIUC
	Web grows by 341,000% in a year
1994	Netscape, Amazon, Archtext formed
1995	Netscape, Windows 95, MetaCrawler
1997	Amazon
2000	Internet “bubble” bursts
Jan 2004	233,101,481: Number of Hosts advertised in the DNS (Source: `http://www.isc.org/`)

How Many Online ?

Structure of the Internet



MAPS UUNET MAP

SOURCE: CISCO SYSTEMS