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10/20/2005

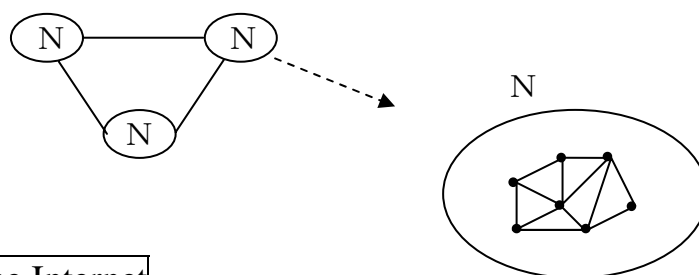# Economics of the Internet
EE/W1 (No.2E)

A. Outline

1. Definitions

collection of digital networks

computers interconnected by communications media

2. Technical terms

The Internet

Upper-case (a pronoun)

3. Internet viewed from a user

a. Access terminals

computers

mobile handset, TV, game terminal

connected to the Internet via communications media

b. ISP（**Internet service providers**）

access service for the Internet (with fees)

c. LAN（**local area network**）

network used in offices and schools

cost paid by an organization

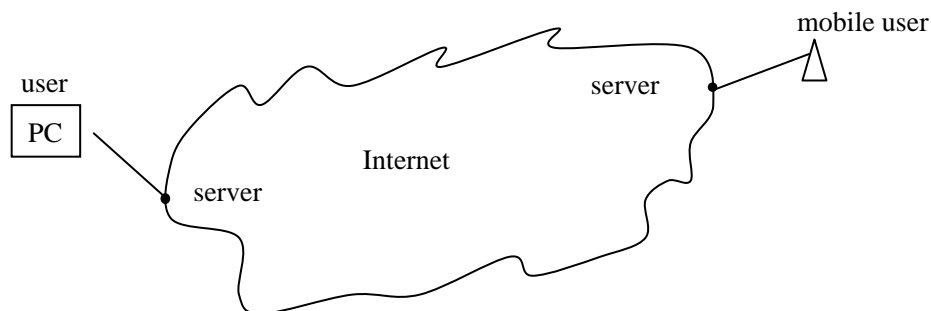Internet use in campus is "free to students"

d. Internet services

(1) E-mail

(2) web（www）

$$\left\{ \begin{array}{l} \text{documents (charactors), images, voice and music,} \\ \text{video images, smell (?) --- anything expressed in digital data} \end{array} \right.$$

e.   Structure of the Internet

user

```
┌────┐
│ PC │
└────┘
```

mobile user

server

Internet

server

B.   How does the Internet work?

1.   Outline

a. Internet is a collection of computers.

address attached to each computer
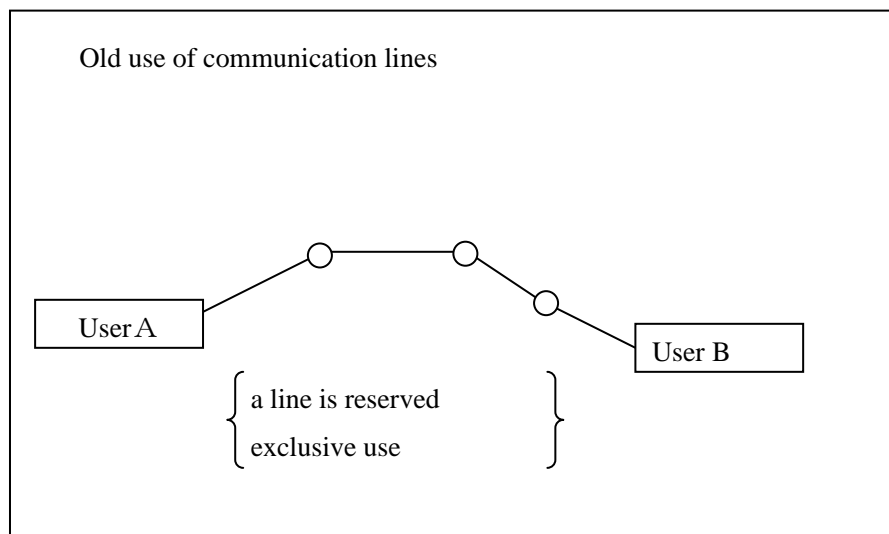
IP address

unique globally

terminals (for users)

servers (for mail, web. etc.)

routers (for data transmission)

b. How is a message sent over the internet?

１．A user submits a message to the nearest server.

２．The message is sent from the server to a nearby router, which sends it to another

router, and so on, so that the message will be delivered finally to a destination.

Old use of communication lines

User A

User B

$\left\{\begin{array}{l} \text{a line is reserved} \\ \text{exclusive use} \end{array}\right\}$

New use with packets：shared use (like streets, highways in transportation)

Old use(exclusive)   cost ＝1,000   no congestion

Packet use (shared)   cost ＝1   delay if congested

↓

more efficient

(example) telephone ：   conventional telephone ： US-JAPAN   ¥400／3 min

IP-phone：US-JAPAN   ¥8／3 min.

2.   Division of labor in the Internet

(1)   Division of labor is established in the Internet so as to perform each task
efficiently.

(2)   Consequently, the cost of using Internet services is decreased significantly.

C.   The IP platform – the global engine for information transmission

1.   Characteristics of information transmission over the Internet

a. Outline

A system of routers (computers) interconnected in order to transmit and exchange

IP-packets.

b. Characteristics

simple and easy task to each counter

a large-scale complicated task achieved by the system as a whole

c. Sources of the efficiency

（1） Concentration and specialization

Routers concentrate on sending and receiving IP-packet data only.

IP-packets may be transmitted over any media.

IP-packets may carry any content.

（2） Operations

Internet is composed of many networks.

IP-format and IP-addressing are the only rule to be observed.

Otherwise, member networks may operate freely except that the connection

cost should be borne by a new-member network.

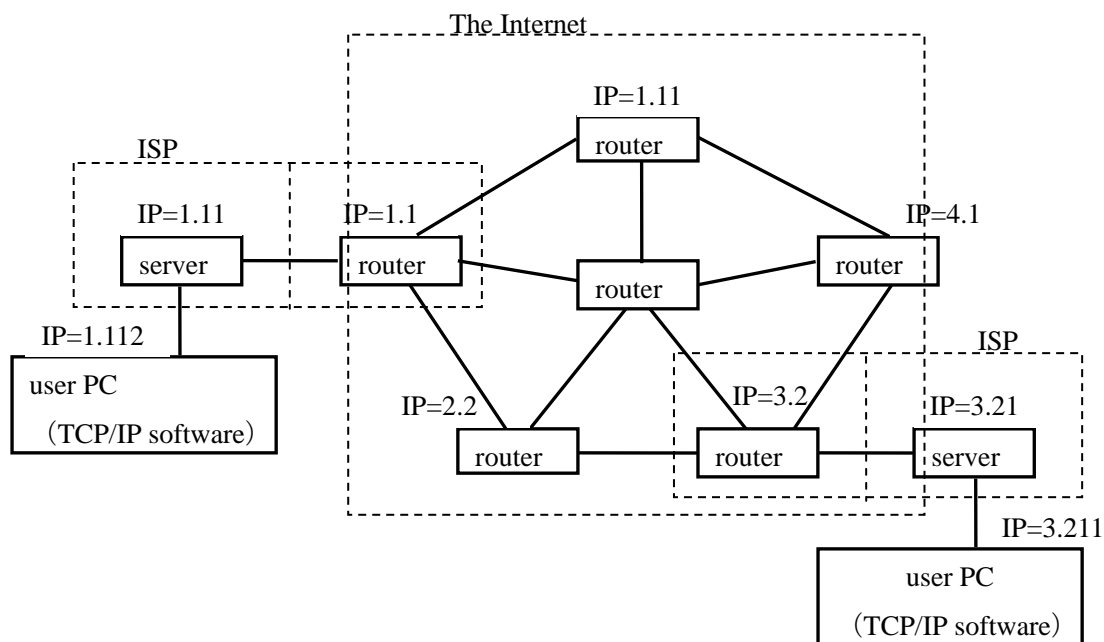(the issue of the cost of cross-pacific connections)

Figure. A simple IP-network
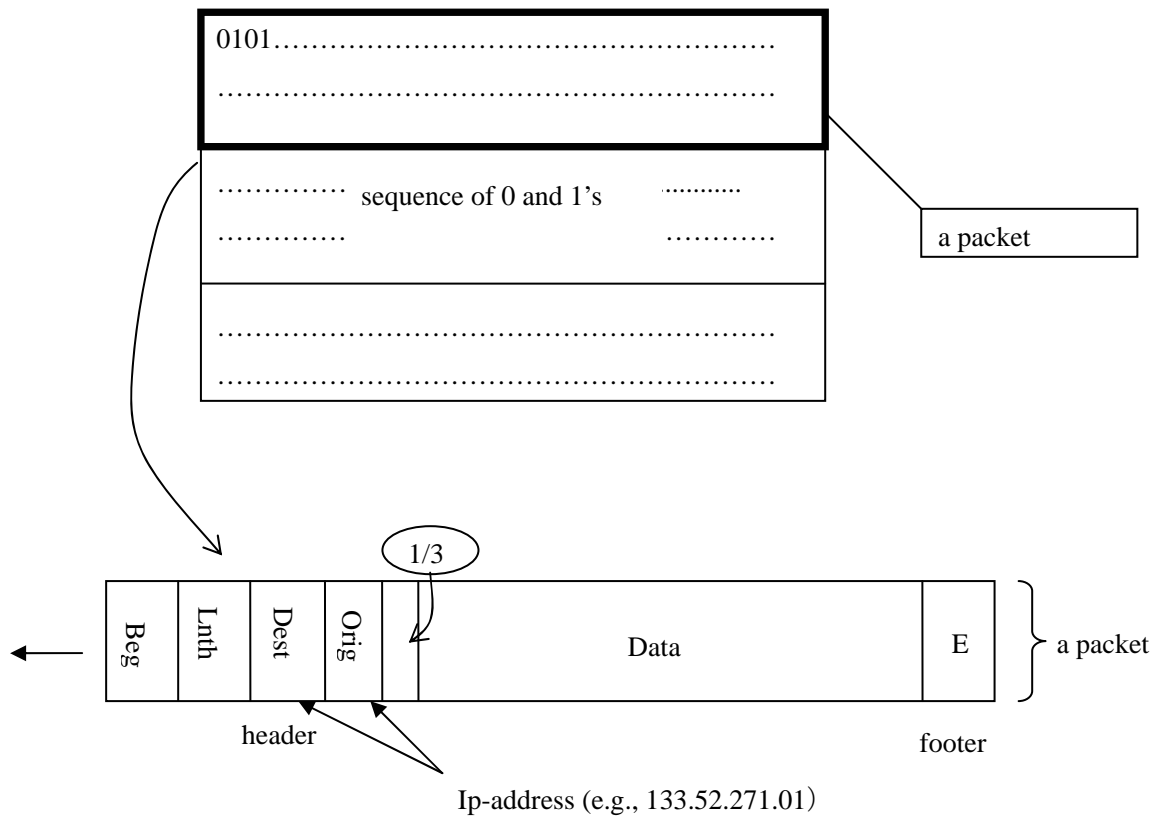
2. **IP-address**

An address of a "number" of 32-bits (0 and 1's) given to a computer. Every router, server, and user PC connected to the Internet must have a unique IP-address.

3. **IP-packets**

the standard in the internet

IP ： Internet Protocol

example: a piece of music may be transformed into a few number of IP-packets

D:¥Web¥oniki¥noframe¥jpn¥lecture¥gu-under-e¥EE¥2005¥VI-ABCD-E.doc

0101…………………………………………………

………………………………………………………

………… sequence of 0 and 1's ···········

…………… …………

a packet

………………………………………………………

………………………………………………………

1/3

| Beg | Lnth | Dest | Orig | | Data | E | a packet |

header

footer

Ip-address (e.g., 133.52.271.01）

4. **Routers**

Each router is interconnected to a number of routers. When a router A receives a packet from an interconnected router B, the router B transmits the packet to another interconnected router C which is located near to the destination of the packet.

D.   Internet Applications --- Mail and Web Systems

1. Domain-name system

a.   Outline

domain name: an address for mail and web services

taro：user name

osaka-gu.ac.jp：domain name

taro@osaka-gu.ac.jp：mail address

"at mark"

domain name： human friendly

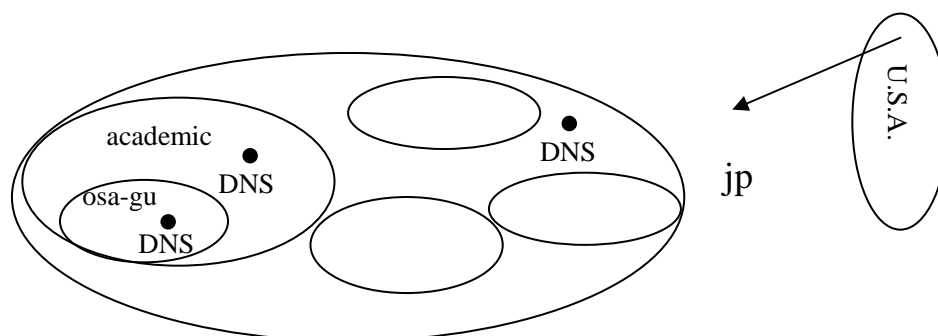（IP-address: OK to routers, not to human beings）
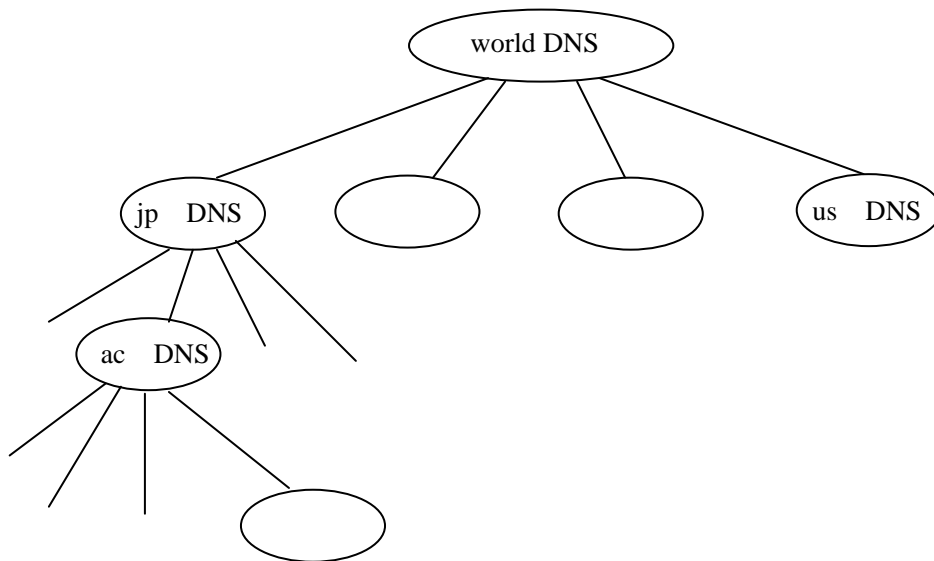
b.   Domain-name servers (DNS)

(1) Outline

Each network of the Internet should have a DNS.

abc@def.eg.jp ——— an address for sending a mail

What is the IP-address of a computer with the given domain name?

(2) Inquiry to DNS

(3) Assignment of domain names

2. Mail system

a. Outline

The first application of the Internet.

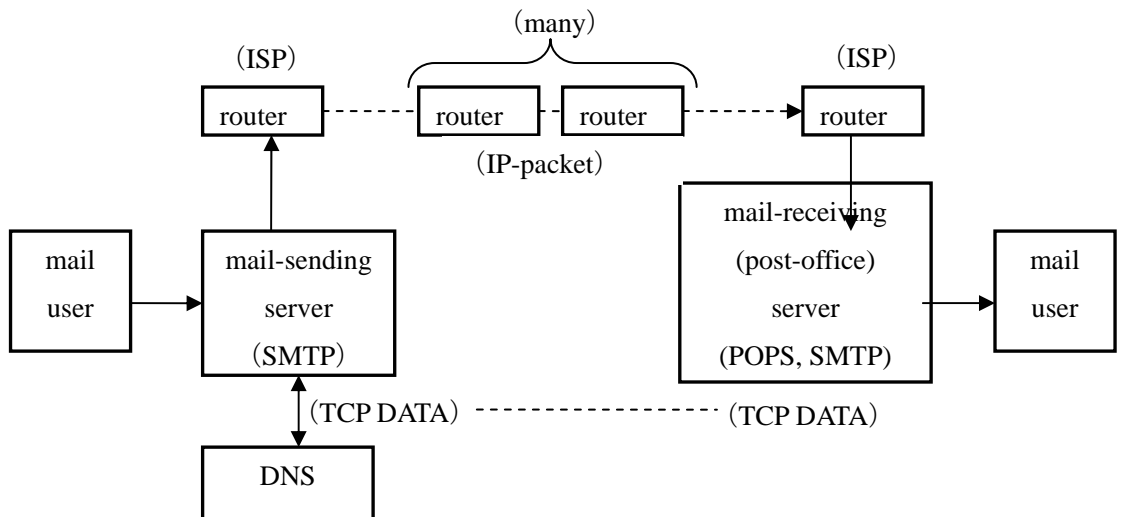Mail texts are sent in IP-packets to a destination specified by a domain name.

Figure: Sending a mail with mail servers and routers

b. Mail addresses

mail address = user name @ domain name

Ex. : t a r o @ u t s . o s a k a - g u . a c . j p

user name   domain name

(individual)   (students) (academic) (japan)

2. Web System

a. Outline

The second major application of the Internet.   On receiving a request from a web user, the web server sends a copy of the requested file (web pages, characters, graphs, tables, musics, or video images) by putting it into one or more IP-packets.   The user, receiving the file, reconstructs the original content on a terminal computer by means of a browser software (such as Intenet Explore).

Web system
‖

A method for obtaining a file stored in a distant computer

web as a network image

WWW=World Wide Web

Anybody can get a distant file at hand with a single mouse click. ⟶ The system
gives an impression that the user, not a file, is moving around.

（ISP）　　　　　　　　　（many）　　　　　　　　　　　（Web site）

router　⟷　router　⟷　router　⟷　router

user PC
(browsing
software)
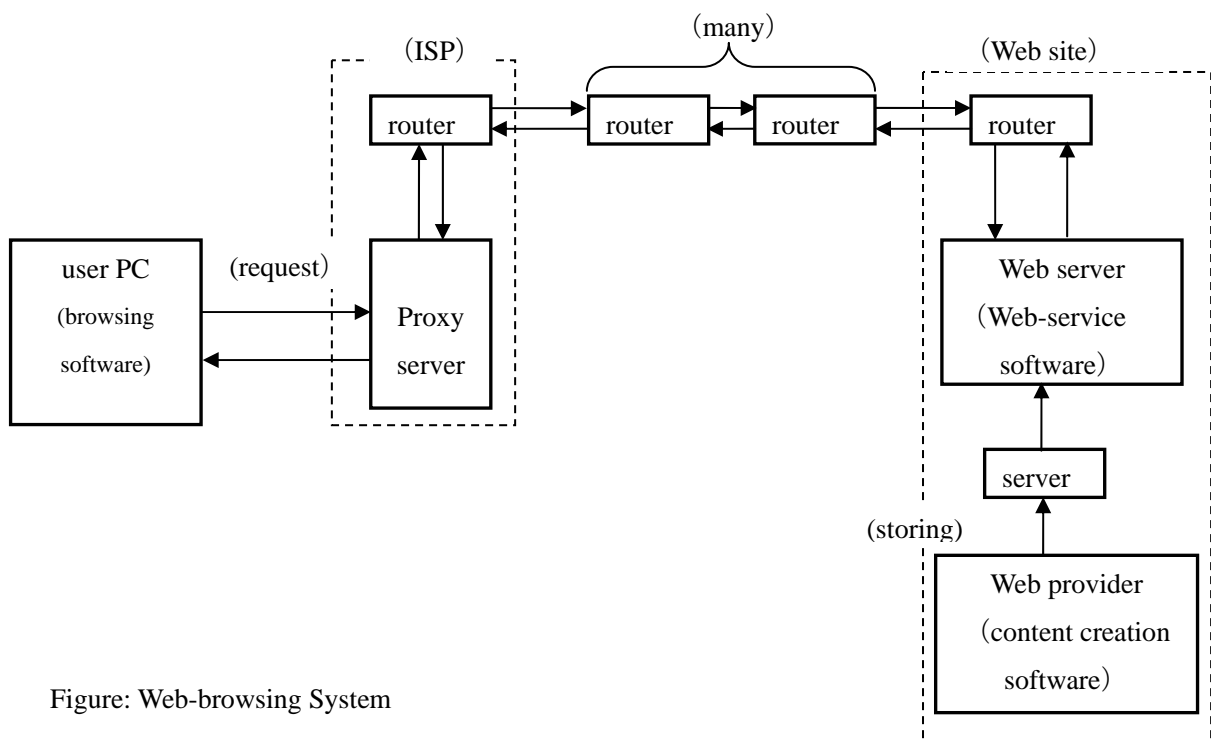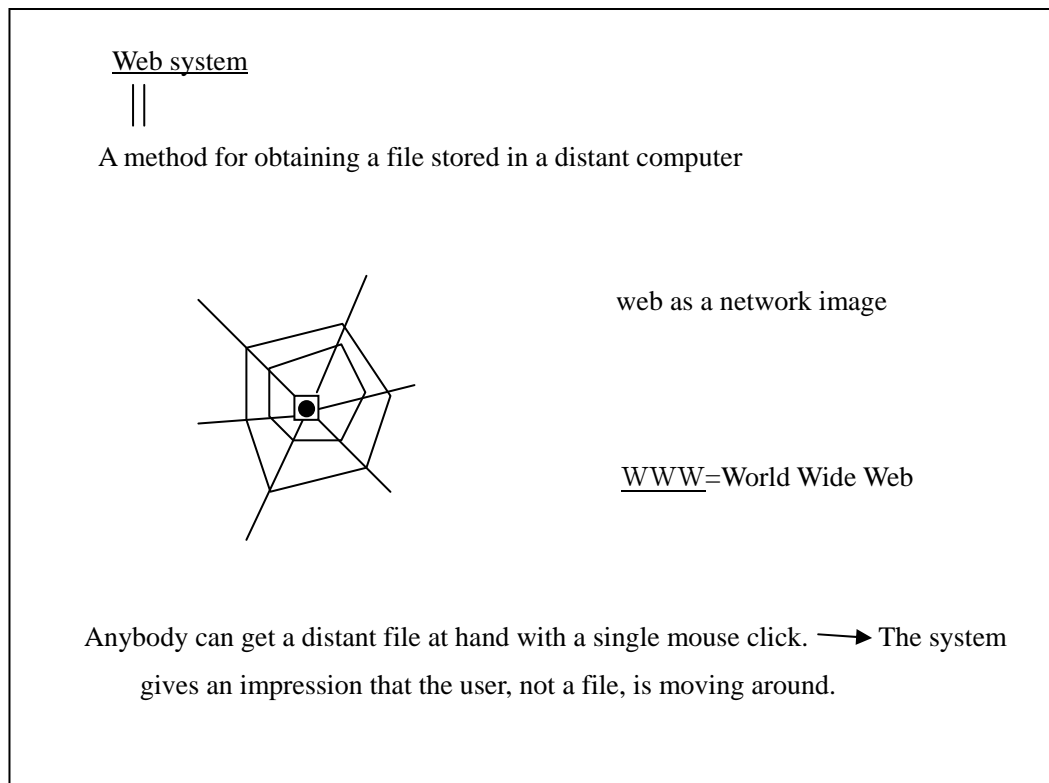　(request)　→　Proxy server

Web server
（Web-service
software）

server
(storing)

Web provider
（content creation
software）

Figure: Web-browsing System