CSE3026: Web Application Development
The Internet & World Wide Web

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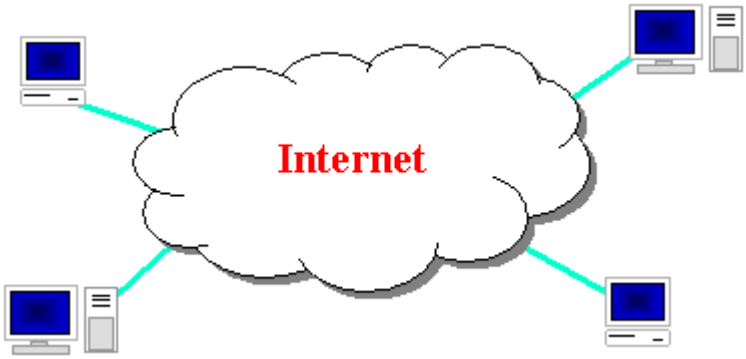
1.1: The Internet

The Internet



- Wikipedia: http://en.wikipedia.org/wiki/Internet
  - network of networks
  - a connection of computer networks using the Internet Protocol (IP)
- layers of communication protocols:
  - IP → TCP/UDP → HTTP/FTP/POP/SMTP/SSH…
- What's the difference between the Internet and the World Wide Web (WWW)?

- the Web is the collection of web sites and pages around the world; the Internet is larger and also includes other services such as email, chat, online games, etc.

Brief history

- began as a US Department of Defense network called ARPANET (1960s-70s)
- initial services: electronic mail, file transfer
- opened to commercial interests in late 80s
- WWW created in 1989-91 by Tim Berners-Lee
- popular web browsers released: Netscape 1994, IE 1995
- Amazon.com opens in 1995; Google January 1996
- Hamster Dance web page created in 1999

Key aspects of the internet

- subnetworks can stand on their own
- computers can dynamically join and leave the network
- built on open standards
  - anyone can create a new internet device
- lack of centralized control (mostly)
- everyone can use it with simple, commonly available software

People and organizations

- Internet Engineering Task Force (IETF):
  - internet protocol standards
- Internet Corporation for Assigned Names and Numbers (ICANN):
  - decides top-level domain names
- World Wide Web Consortium (W3C):
  - web standards

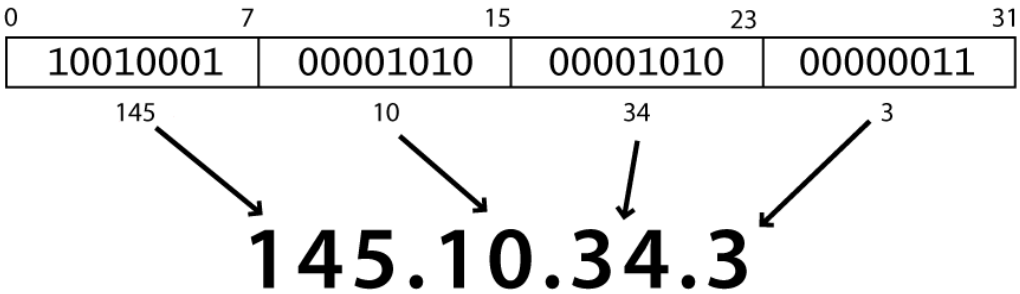
Layered architecture

The internet uses a layered hardware/software architecture (OSI model):

- physical layer
  - devices such as ethernet, coaxial cables, fiber-optic lines, modems
- data link layer
  - basic hardware protocols (ethernet protocol, wifi protocol, DSL's PPP)
- network / internet layer
  - basic software protocol (IP)
- transport layer
  - adds reliability to network layer (TCP, UDP)
- application layer
  - implements specific communication for each kind of program (HTTP, POP3/IMAP, SSH, FTP)

Internet Protocol (IP)

- a simple protocol for attempting to send data between two computers
- each device has a 32-bit IP address written as four 8-bit numbers (0-255)



- find out your internet IP address: whatismyip.com
- find out your local IP address:
  - in a terminal, type: `ipconfig` (Windows) or `ifconfig` (Mac/Linux)

Transmission Control Protocol (TCP)

- adds multiplexing, guaranteed message delivery on top of IP
- **multiplexing**: multiple programs using the same IP address
  - **port**: a number given to each program or service
  - port 80: web browser (port 443 for secure browsing)
  - port 25,110: email (SMTP, POP3)
  - port 22: secure shell (SSH)
  - port 21: file transfers (FTP)
  - more common ports
- some programs (games, streaming media programs) use simpler UDP protocol instead of TCP

1.2: The World Wide Web (WWW)

Web servers and browsers

- **web server**: software that listens for web page requests
  - Apache
  - Microsoft Internet Information Server (IIS) (part of Windows)
- **web browser**: fetches/displays documents from web servers
  - Mozilla Firefox
  - Microsoft Internet Explorer (IE)
  - Apple Safari
  - Google Chrome
  - Opera

Domain Name System (DNS)

- a set of servers that map written names to IP addresses
  - e.g.: `cse.hanyang.ac.kr` → `166.104.239.93`
- many systems maintain a local cache called a hosts file
  - Windows: `C:\Windows\system32\drivers\etc\hosts`
  - Mac: `/private/etc/hosts`
  - Linux: `/etc/hosts`

Uniform Resource Locator (URL)

- an identifier for the location of a document on a web site
- a basic URL:

```
http://www.aw-bc.com/info/regesstepp/index.html
~~~~   ~~~~~~~~~~~~~ ~~~~~~~~~~~~~~~~~~~~~~~~~~
protocol    host                  path
```

- upon entering this URL into the browser, it would:
  - ask the DNS server for the IP address of `www.aw-bc.com`
  - connect to that IP address at port 80
  - ask the server to `GET /info/regesstepp/index.html`
  - display the resulting page on the screen

More advanced URLs

- **anchor**: jumps to a given section of a web page

  `http://www.textpad.com/download/index.html#downloads`

  - fetches `index.html` then jumps down to part of the page labeled `downloads`
- **port**: for web servers on ports other than the default 80

  `http://selab.hanyang.ac.kr:8080/secret/money.txt`

- **query string**: a set of parameters passed to a web program

  `http://www.google.com/search?q=miserable+failure&start=10`

  - parameter `q` is set to `"miserable+failure"`
  - parameter `start` is set to `10`

Hypertext Transport Protocol (HTTP)

- the set of commands understood by a web server and sent from a browser
- some HTTP commands (your browser sends these internally):
  - `GET` **`filename`** : download
  - `POST` **`filename`** : send a web form response
  - `PUT` **`filename`** : upload
- simulating a browser with a terminal window:

```
$ telnet cse.hanyang.ac.kr 80
Trying 166.104.239.93...
Connected to cse.hanyang.ac.kr.
Escape character is '^]'.
GET /index.html
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 ...">
<html>
...
```

HTTP error codes

- when something goes wrong, the web server returns a special "error code" number to the browser, possibly followed by an HTML document
- common error codes:

Number	Meaning
200	OK
301-303	page has moved (permanently or temporarily)
403	you are forbidden to access this page
404	page not found
500	internal server error
complete list	

Internet media ("MIME") types

- sometimes when including resources in a page (style sheet, icon, multimedia object), we specify their type of data

MIME type	file extension
`text/html`	`.html`
`text/plain`	`.txt`
`image/gif`	`.gif`
`image/jpeg`	`.jpg`
`video/quicktime`	`.mov`
`application/octet-stream`	`.exe`

- Lists of MIME types: by type, by extension

Web languages / technologies

- Hypertext Markup Language (HTML): used for writing web pages
- Cascading Style Sheets (CSS): stylistic info for web pages
- PHP Hypertext Processor (PHP): dynamically create pages on a web server
- JavaScript: interactive and programmable web pages
- Asynchronous JavaScript and XML (Ajax): accessing data for web applications
- eXtensible Markup Language (XML): metalanguage for organizing data
- Structured Query Language (SQL): interaction with databases