The Internet - 204100

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Overview

- Computer Networks
- Internet
- TCP/IP
- Domain Names
- Applications on the Web

COMPUTER NETWORKS

- Types of Connections

Computer Network

- Telecommunication network that allows computers to exchange data.
- The physical connection established using either cable media or wireless media.
- The best-known computer network is the Internet.
- Types of Connections:
  - Wired: Over copper wire or fiber optics
  - Wireless: Over electromagnetic waves (radio, microwave)

Computer Network

- Computer network types by spatial scope
  - LAN (Local Area Network) – limited area such as a home, school, computer laboratory, or office building
  - MAN (Metropolitan Area Network) –geographically separated but in same metropolitan city (5-40km)
  - WAN (Wide Area Network) – across metropolitan, regional, or national boundaries -- WWAN

Wired Connection

1. Copper Wire – Telephone Cable
   - Copper wire carries electromagnetic signal
   - Voice and Data share the same wire, but at different frequencies
   - Used in Digital Subscriber Line (DSL) such as ADSL, VDSL
   - Cheap to install/maintain, but link speed depends on distance to telephone exchange

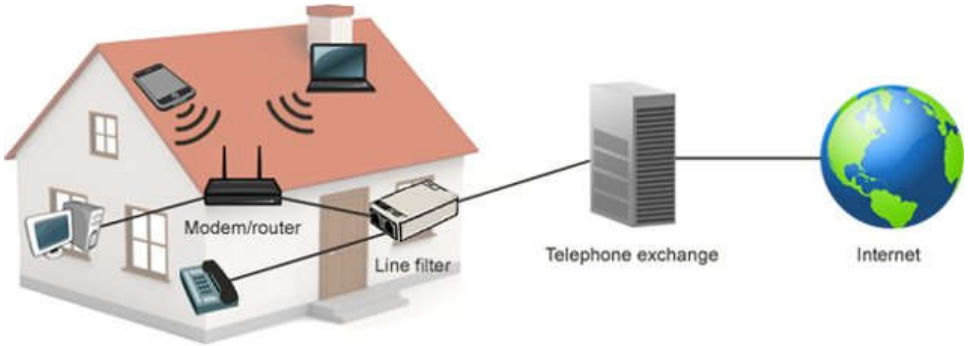


Image credit: dcsi.net.au

Wired Connection (cont.)

2. Copper wire – Unshielded Twisted Pair (UTP) Cable
   - Consists of 8 copper wired, unshielded mean unprotected to outside interference
   - Widely used in LAN connection, so sometime called LAN cable.
   - Many category exists with varying maximum speed, for example:
     - Category 5 : 100 Mbps, 1 Gbps
     - Category 6 : 10 Gbps

Image credit: sattvengg.com, bitmart.co.za

Wired Connection (cont.)

3. Coaxial Cable

- Used in cable TV, cable Internet
- Cable modem will translate digital and analog signal

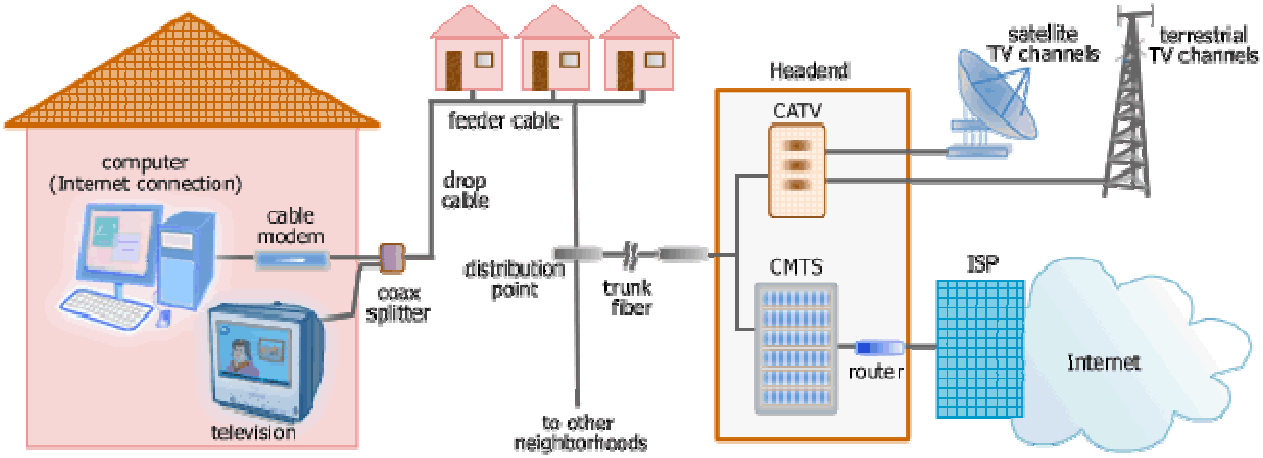


Image credit: litramfg.com, thailandfiberoptics.com

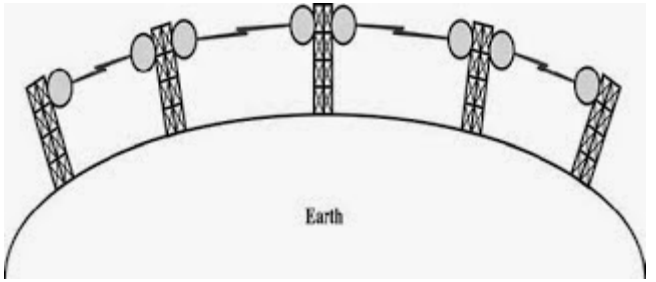
Wired Connection (cont.)

4. Optical Fiber Cable (or Fiber Optics)
   - Use fiberglass cable to transfer optical signal
   - Fast, interference-tolerant but expensive
   - Go from Megabit per seconds (Mbps) to Gigabit per seconds (Gbps)
   - Example: FTTH: Fiber to The Home

Image credit: nestorcables.com, ingellen.com

Wireless Connection

1. Terrestrial Microwave
   - Send radio signal from one ground station directly to another
   - Fast for long-distance signal, but has line-of-sight issue
2. Satellite-based Microwave
   - Use satellites to relay data
   - Longer distance, but slower (both latency and bandwidth)



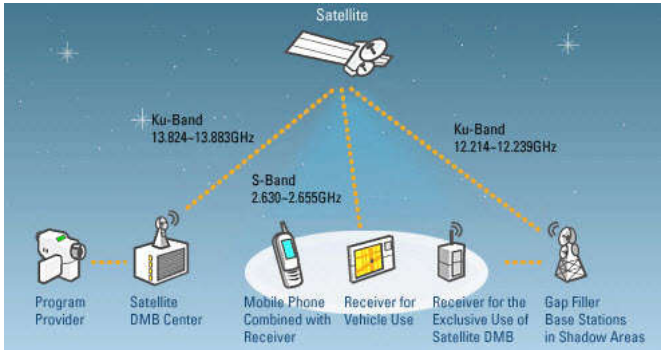
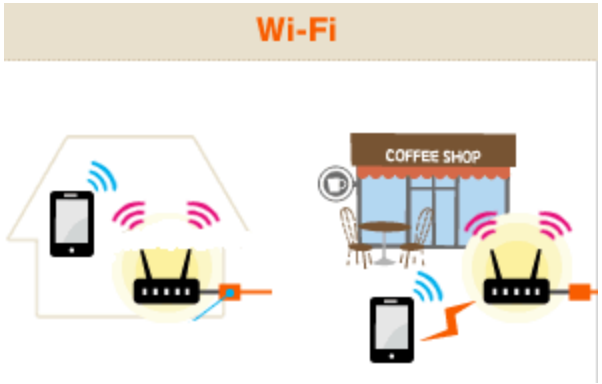


Image credit: theflatearthsociety.org, adli3.tripod.com/Terrestrial.htm, vizocomsat.com, efxkits.us, Richard Bartz

Wireless Connection (cont.)

3. Wireless LAN
   - Use indoor
   - Standard IEEE 802.11 a / b / g / n / ac

4. Wide-area Wireless Access
   - For mobile phones
   - 3G / 4G



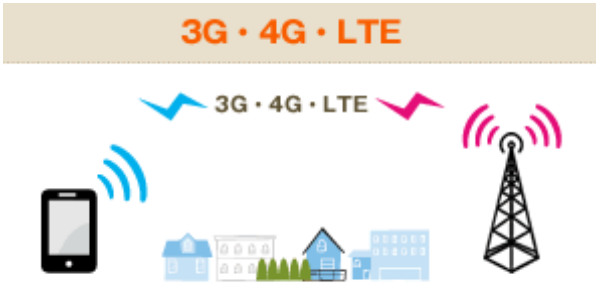


Image credit: au.kddi.com

THE INTERNET

- Short History of the Internet
- Components
- Connection Types
- Internet Speed

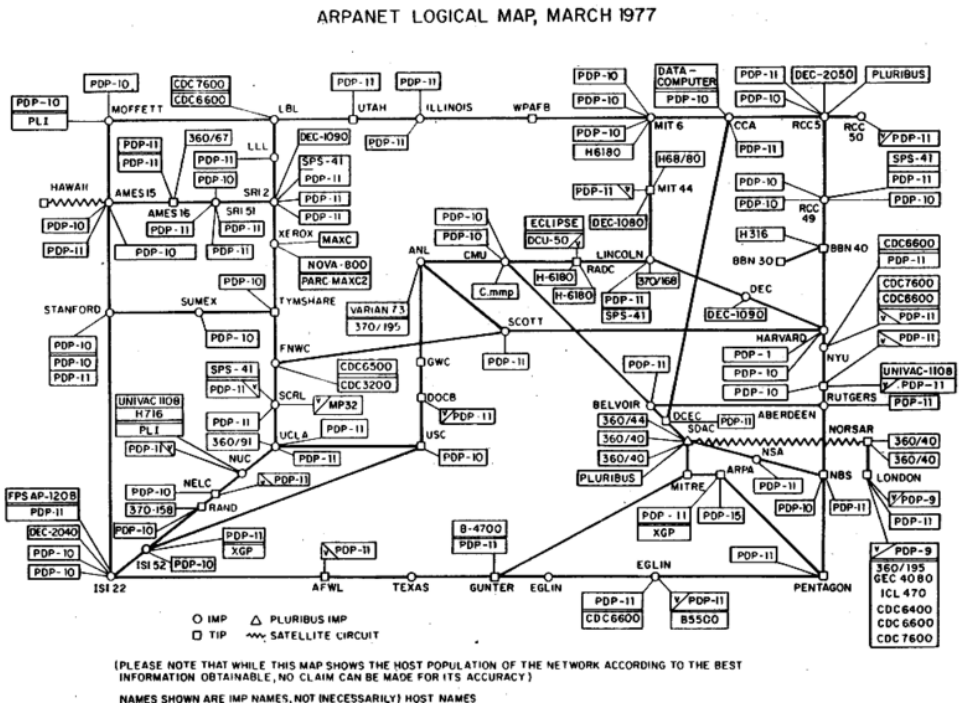
Internet

- The Internet is a global system of interconnected computer networks.
- Uses the standard Internet protocol suite (TCP/IP) to serve several billion users worldwide
- Communications protocol is a system of digital rules for message exchange within or between computers.
- https://www.youtube.com/watch?v=Dxcc6ycZ73M
- https://www.youtube.com/watch?v=ZhEf7e4kopM

video source: code.org

History of Internet

- The public was first introduced to the concepts with ARPANET (Advanced Research Projects Agency NETwork) within the U.S. Department of Defense in 1969

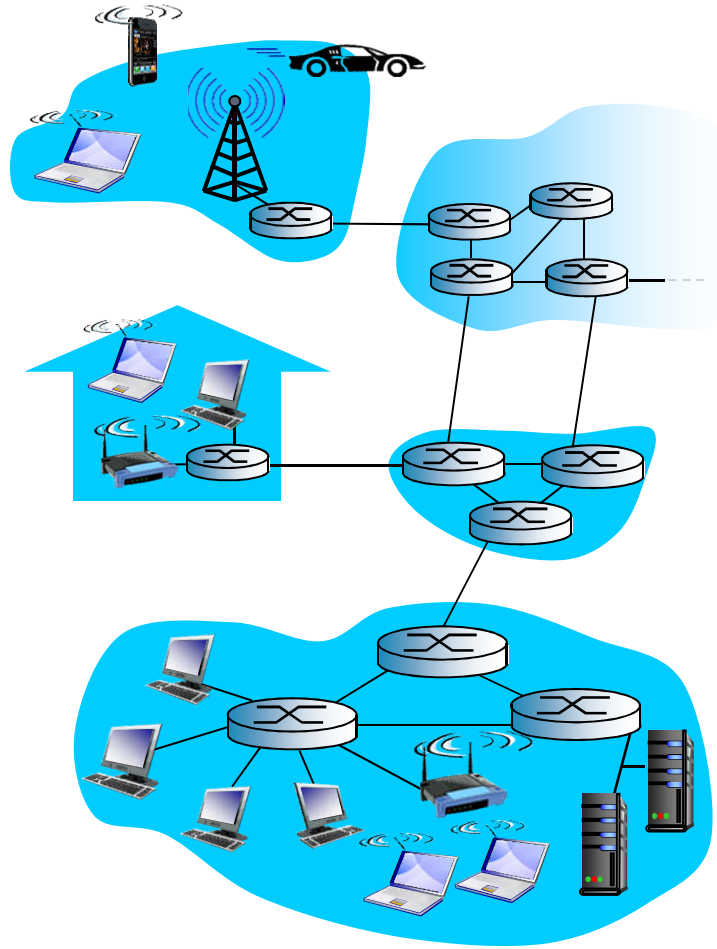


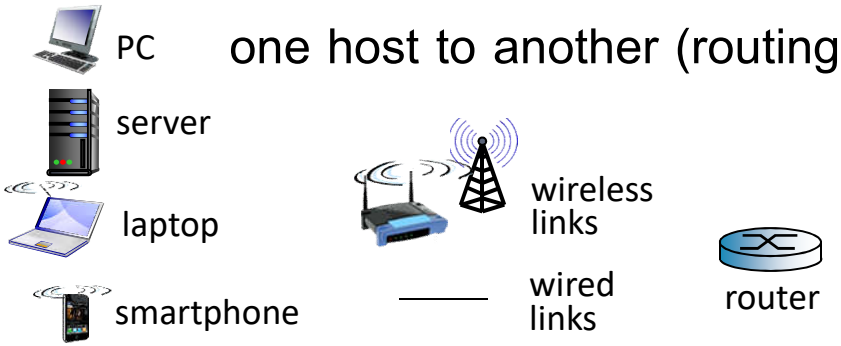
Internet in Thailand

- Thailand obtained internet access in 1996 as the third country in South East Asia.
- About 8.6 million people use the internet every day in Thailand, according to Google Thailand's 2012 figures
- 24 million people have regular access, representing over one-third the population

Components of The Internet

- Host / End System
  - At the endpoint of network
  - Running applications
- Communication Link
  - Wire/wireless
- Packet Switches/ Router
  - Relay and finding path from one host to another (routing)

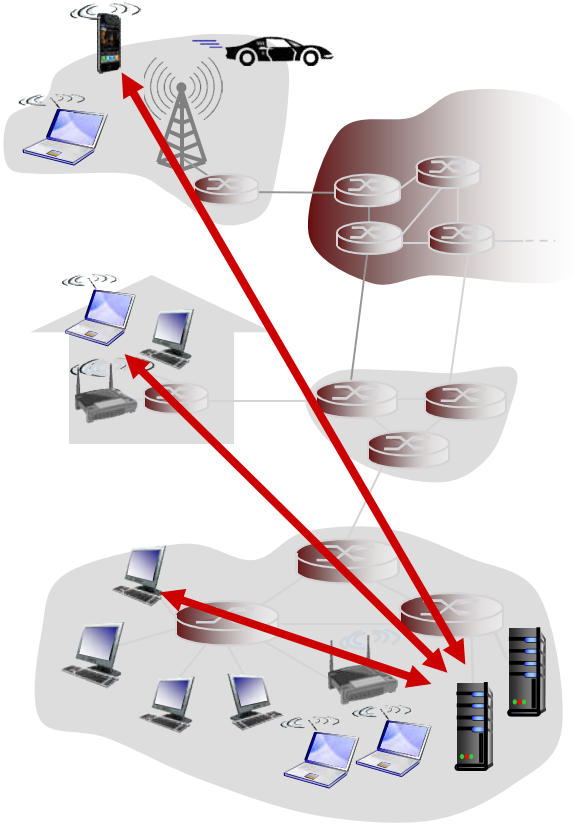




How Computers are Connected on the Internet

1. Client/Server

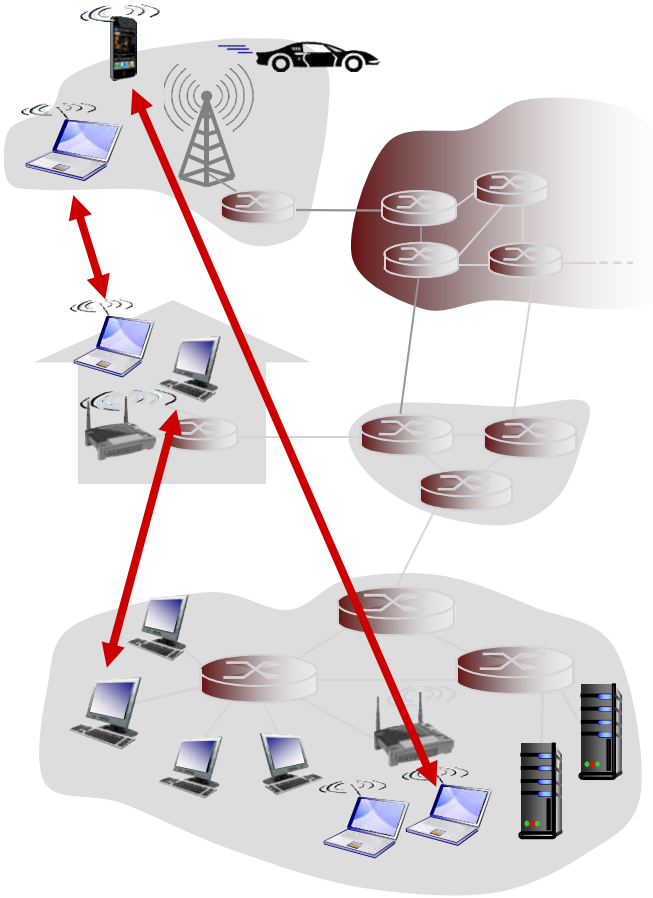
- Servers provide services to clients. Usually running in data center. Up (almost) all the time
- Clients will connect to servers to request services. Not necessary connected all the time.
- **Advantages**: Easy to manage, more secure
- **Disadvantages**: Limit to server's capability, expensive to expand



How Computers are Connected on the the Internet (cont.)

2. Peer-to-peer

- Computers (hosts) in the network can connect and exchange data directly
- Can be Pure P2P (no server) or Hybrid P2P (with managing servers)
- **Advantages**: Cheaper to expand, low managing cost
- **Disadvantages**: Harder to control access, harder to secure, harder to guarantee quality of service



Internet Connection Speed: Bandwidth vs. Latency

- Bandwidth
  - Amount of data that can be transfer during a second
  - Usually measure in (kilo, mega) bytes/second
  - Affect how long it takes to download a file
- Latency (Lag)
  - Measure delay (seconds)
  - Time it takes for data to reach you
  - Depends on distance as well as quality of connection
  - Affect real-time communication/ online gaming

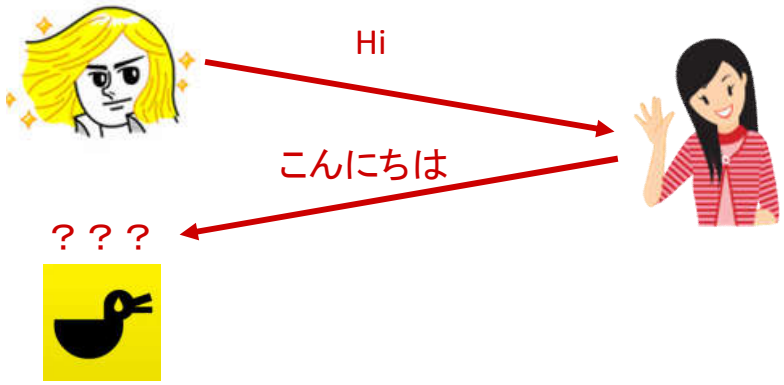
TCP/IP AND DOMAIN NAME

- Protocols
- TCP/IP
- IP Address
- Domain Name

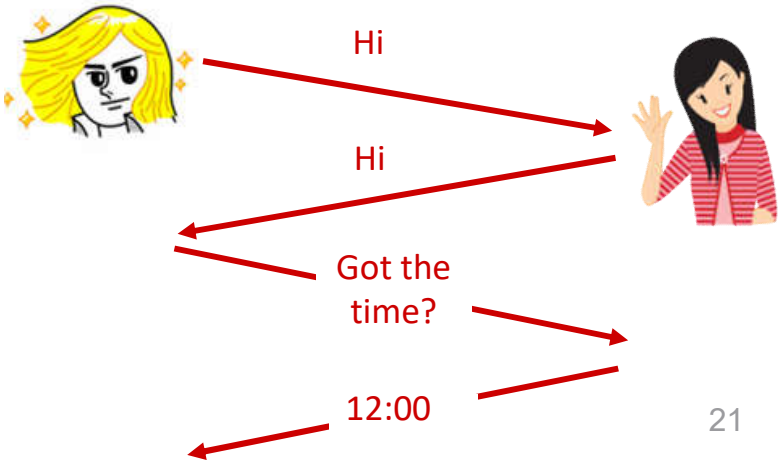
Protocol

- In order for computers in the network to communicate, you need a standard for sending and receiving data (like a language), this is call a protocol.
- Device using the same protocol will be able to communicated

Without common protocol



With common protocol



TCP/IP

- Main protocols for the Internet
- https://www.youtube.com/watch?v=AYdF7b3nMto
- Consists of
  - TCP (Transmission Control Protocol)
    - Breaks data down into packets
    - Combined received packets back into usable data
    - Error Checking/ Request for Resending allow reliable data delivery
  - IP (Internet Protocol)
    - Use IP address to relay datagram across networks
    - Decide/Change datagram path (Routing)

video source: code.org

Internet Protocol

- The Internet Protocol (IP) is the principal communications protocol in the Internet protocol suite for relaying datagrams across network boundaries.

IP Address

- IP address (Internet Protocol address) is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network.
- Originally defined as a 32-bit number and this system, known as Internet Protocol Version 4 (IPv4)
- Newer system called IPv6 but the term IP address typically still refers to the addresses defined by IPv4.

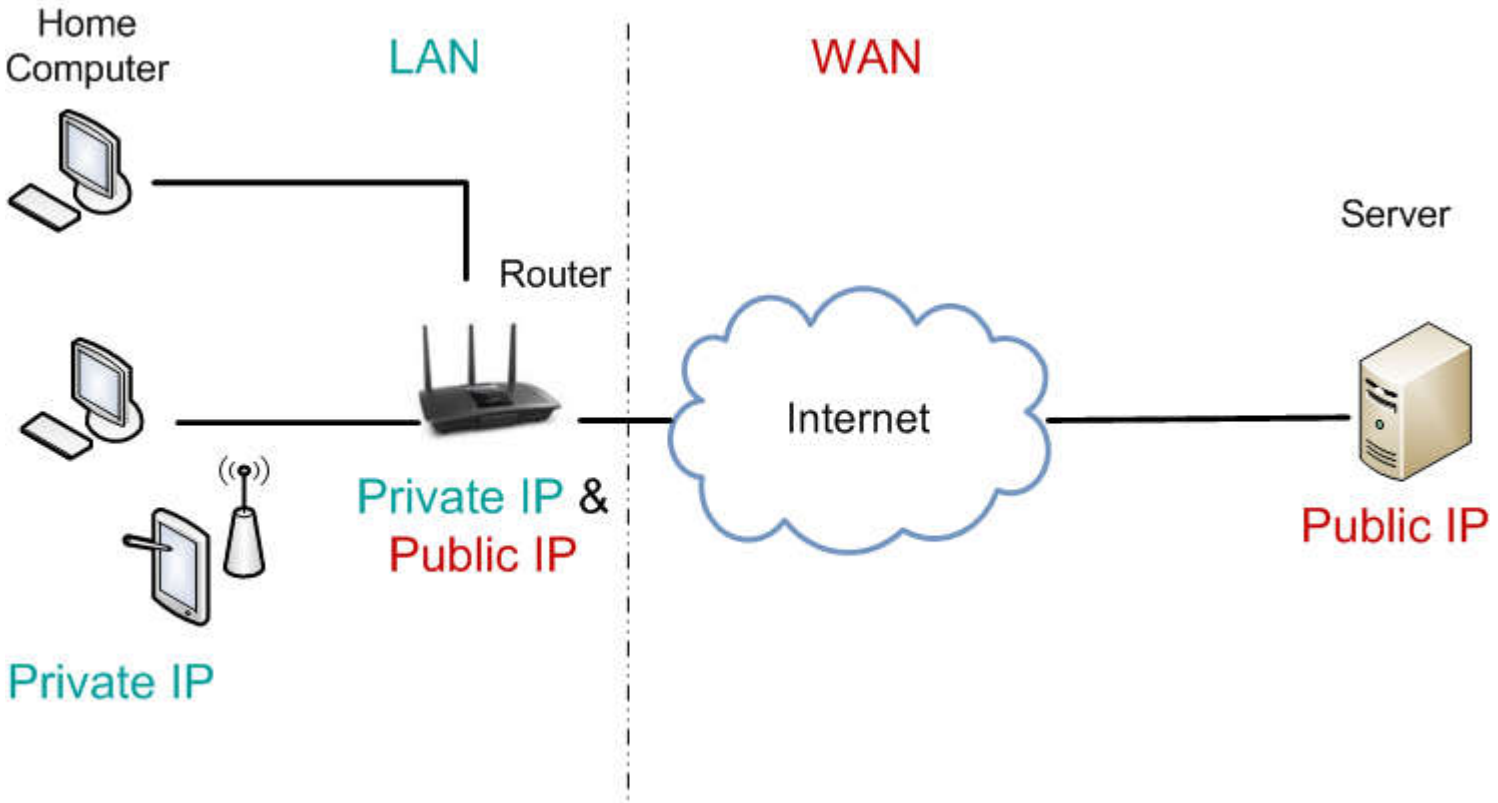
IP(v4) Address

- Consists of four decimal numbers (one byte each), each ranging from 0 to 255 (1 byte = 8 bit -> 2^8 = 256) separated by dots. For example 172.16.254.1

Public vs Private IP

- Public IP
  - Can be referenced across networks
  - Managed/Assigned by governing organizations
    - Network Information Center (NIC)
    - Internet Assigned Numbers Authority (IANA)
- Private IP
  - Within LAN
  - Managed by system administrators

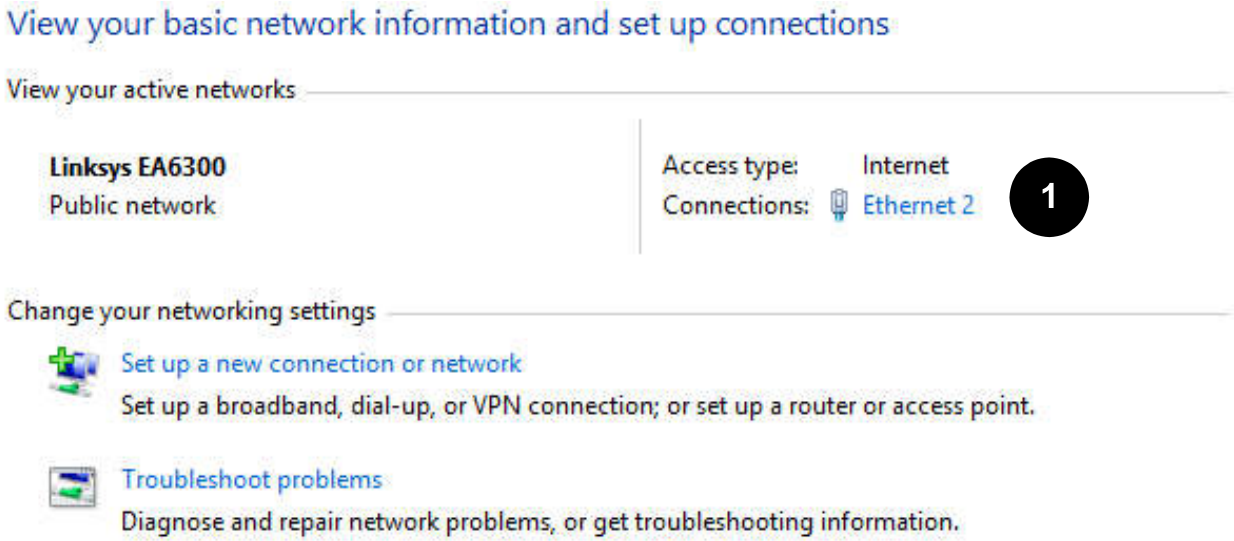
Public vs Private IP (cont.)



Checking IP Address

How to check your IP address on Windows

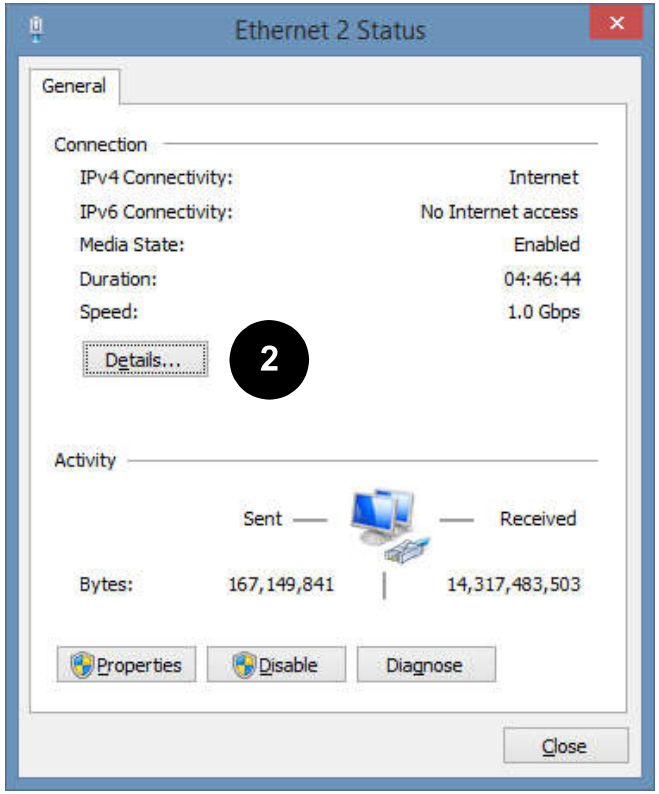
1. Open *Network and Sharing Center* then click on the connection (Ethernet in this case)

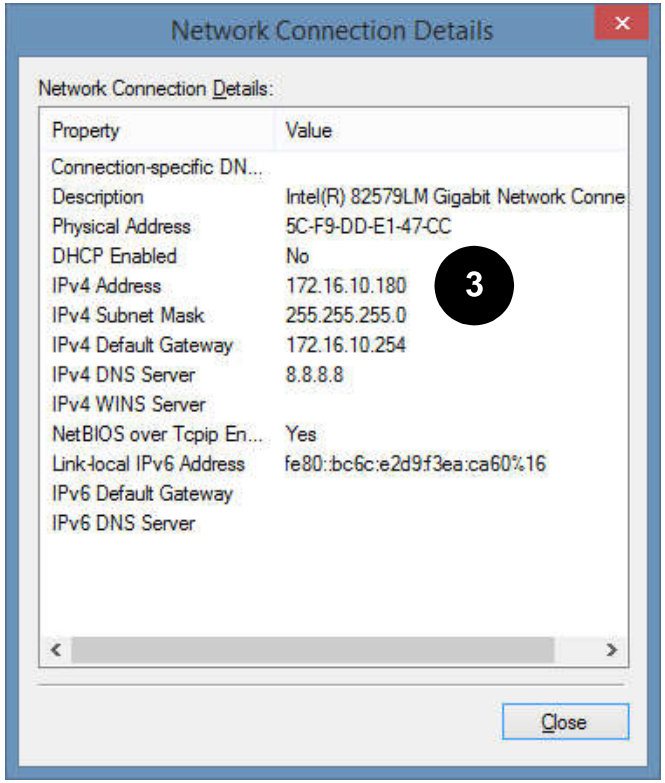


Checking IP Address (cont.)

2. Click *Details*

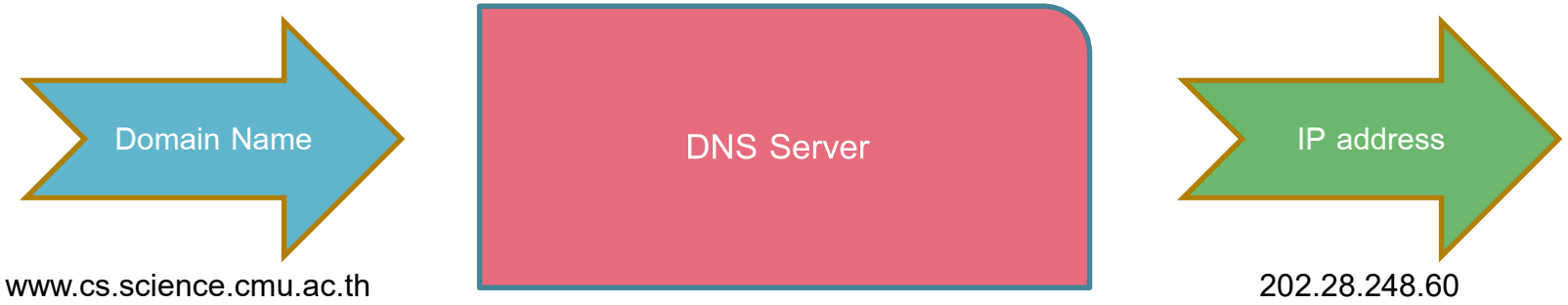
3. Check IP Address from *IPv4 Address*





Domain Name

- Provides recognizable and memorizable names to numerically addressed Internet resources (IP address)
- Translated by Domain Name System (DNS) server to IP address (Name Resolution)
  - This is called DNS lookup
- https://www.youtube.com/watch?v=5o8CwafCxnU



video source: code.org

Top Level of Domain Name

- Rightmost Section
- Can be:
  - Entity Type
    - .com, .gov, .mil, etc.
  - Country Code
    - .th, .jp, .uk, .cn, .mm

TLD	Intended Use (Original)
.com	Commercial
.net	Network Infrastructure
.org	Organization
.gov	Government (US)
.edu	Educational Organization
.mil	Military (US)
.int	International Organization (Treaty)
.biz	Business
.info	Informational Site

Lower Levels of Domain Name

- Second-level Domain
  - Subdomain of TLD
    - .go.th, .ac.uk
  - Not Subdomain of TLD
    - www.google.com
- Other Subdomains
  - www.cs.science.cmu.ac.th
- The leftmost characters (like ‘www’) indicate service.

APPLICATIONS ON THE INTERNET

- WWW
- E-mail
- FTP

Examples of Applications on the internet

- E-mail
- Web
- Instant messaging
- Remote desktop
- P2P file sharing
- Network games
- Video streaming, conferencing
- Voice over IP (VoIP)

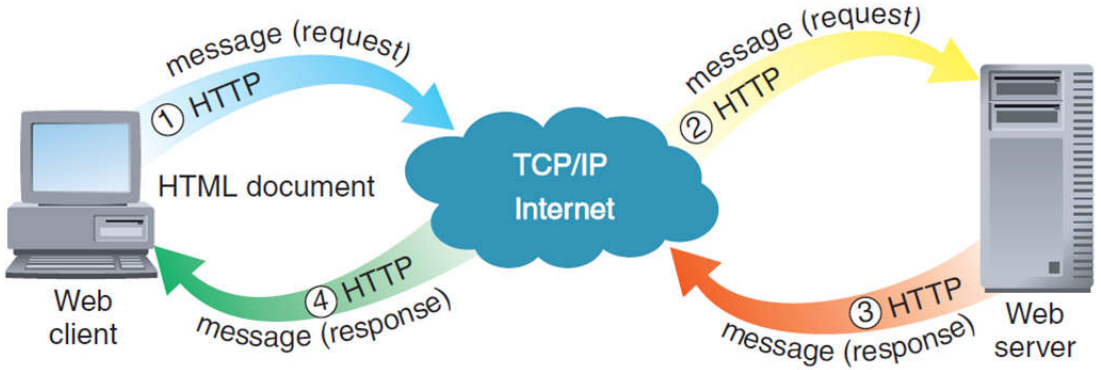
World Wide Web (WWW)

- A system of interlinked documents accessed via the Internet with a web browser to data that are held at web server.
- WWW works in client-server model
- Web pages may contain text, images, videos, and other multimedia.
- Navigation via hyperlinks
- Pages are accessed using Web Address
- Communication are performed by Hypertext Transfer Protocol (HTTP)

World Wide Web (cont.)

- To used WWW, there are three components involved

1. Web Server is the computer that provide web service, hosting data.
   - A clients (using web browser) can send request message to the server to ask for desired data (web pages, image, music, etc.)
   - Web Server will then give a response, such as the data or error message.



World Wide Web (cont.)

2. Web Browser is an application software for accessing data and resources on the Internet.

   Examples are Internet Edge, Firefox, Google Chrome.

3. Contents are the data, usually in web pages, where they can link to other web pages. They usually are encoded in Hypertext Markup Language (HTML), which can only display information. If further processing is required, HTML can be coupled with other programming languages such as PHP, ASP or Java Script

URL

- A **uniform resource locator**, abbreviated URL, also known as web address
- In most web browsers, the URL of a web page is displayed on top inside an address bar
- The format is protocol://domain/path/file e.g. http://www.cs.science.cmu.ac.th/matinee/picture/mypic.jpg

World Wide Web – Related Service

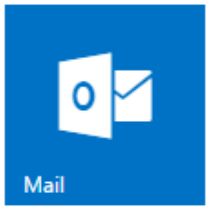
- Web Hosting
  - Host website on server, making it available on the WWW
  - Data storage + web access to the data
- Internet Service Provider (ISP)
  - Provide customer access to the Internet
  - 3BB, AIS, TrueNet, ToT

E-Mail

- method of exchanging digital messages from an author to one or more recipients.
- An email address identifies an email box to which email messages are delivered
- User will use e-mail client to access and manage e-mails
- Popular email clients application include Microsoft Outlook, Mozilla's Thunderbird, Apple Inc.'s Mail.
- Popular web-based email clients include: Gmail, Yahoo! Mail, mail.com, Lycos mail, and Outlook.com

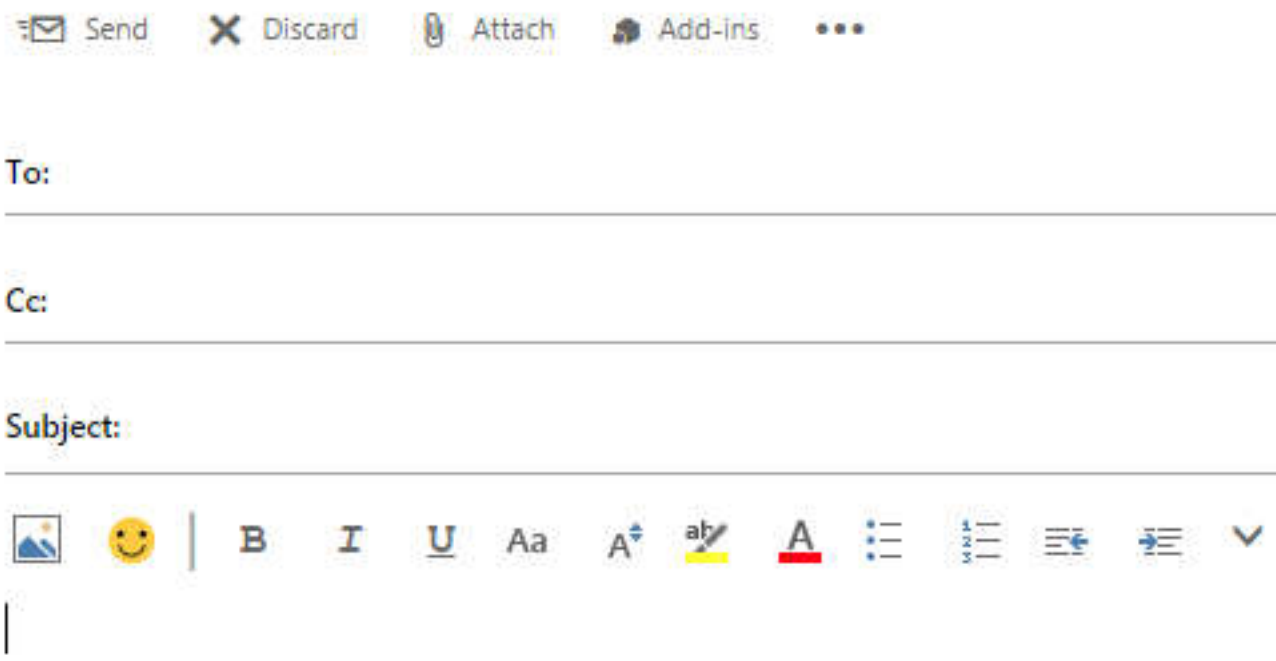
E-mail for CMU students

- The university mail server for student can be accessed at http://portal.cmu.ac.th then click *Student Email*
- Log in with your e-mail address and password.
- You'll be taken to Office 365 page.
- Then select *Mail*.



E-mail addresses for new students from the academic year of 2015 on is firstname_l@cmu.ac.th

When you write an E-mail



To	**The message's primary recipient(s)**
Cc	**The receiver of a copy of a message addressed primarily to other recipient(s)**
Bcc	**addresses added to delivery list but remaining invisible to other recipients.**
Subject	**A brief summary of the topic of the message**
Attach(ment)	**A file to be included with the e-mail**

File Transfer Protocol (FTP)

- Service for copying/moving files between network computers (hosts)
  - Copying files from other host to your computer (local host) is called downloading
  - Copying files from your computer to other host is called uploading
- FTP service can be private (available to selected people) or public (available to everyone)
- Can be done via application software, or through web browser/Windows explorer.

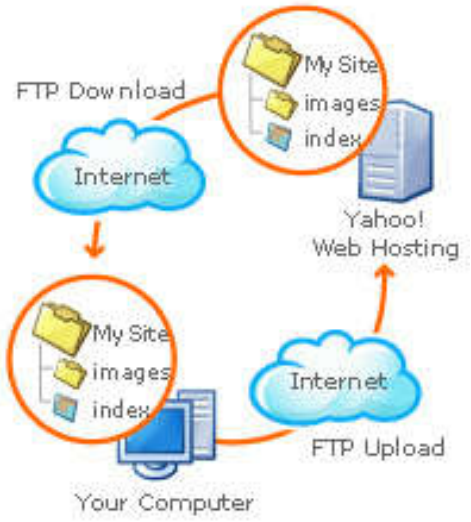


Image credit: smallbusiness.yahoo.net

Review

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