Written by Thapanapong Rukkanchanunt

Updated by Prakarn Unachak

# The Internet

# Outline

- History of Internet
- Internet Properties
- TCP/IP
- IP Address
- Domain Name/URL
- Internet Infrastructure
- Server and Clients

# The Internet

- The Internet is the computer network that connect computers throughout the world.
- https://www.youtube.com/watch?v=Dxcc6ycZ73M
- A computer network can be connected by:
    - copper or optical wire (wired network)
    - Through radio-like signal (wireless network)
    - or both
- https://www.youtube.com/watch?v=ZhEf7e4kopM

# History of Internet

- ARPANET is the first project that tried to connect many different computer networks together

- The first connection happens in 1969 between University of California, Los Angeles and Stanford Research Institute

- In 1983, TCP/IP was invented and became a backbone the Internet

- In 1990, ARPANET underwent a big upgrade which later becomes the Internet

# Internet Properties

- Each computer network will select a presentative called host to join the Internet

- All hosts must speak the same language, TCP/IP protocol.

- Different parts of the Internet are operated by different entities such as universities, governments, telephone companies

- No one owns the Internet

# What does it mean to be on the Internet

- Run TCP/IP protocol
- Have an IP Address
- Can send IP packets to other computers on the Internet

# TCP/IP Protocol

- IP or Internet Protocol moves data packets from one host to another. No connection stays so there is no guarantee of successful delivery
- TCP or Transmission Control Protocol establishes a reliable connection between two hosts. TCP can resend lost packets.
- Internet uses both protocols because both of them compliments each other
- https://www.youtube.com/watch?v=5o8CwafCxnU

# Transmission Control Protocol (TCP)

- On Sender Side:
    - TCP breaks message into packets.
    - TCP then pass packets to IP, sending packets to the sender.
    - Wait for acknowledgement/resend message, resend packets as necessary.

- On Receiver Side:
    - TCP receive packets from IP.
    - If all packets are received, send acknowledgement message to sender, the reconstruct the message from packets.
    - If some packets are missing, send resend message.

<

# Internet Protocol (IP)

- IP uses IP Address to relay packets across networks
- IP also decides which datagram (packet) path to take, this process is called **Routing**.



Data Flow of the Internet Protocol Suite
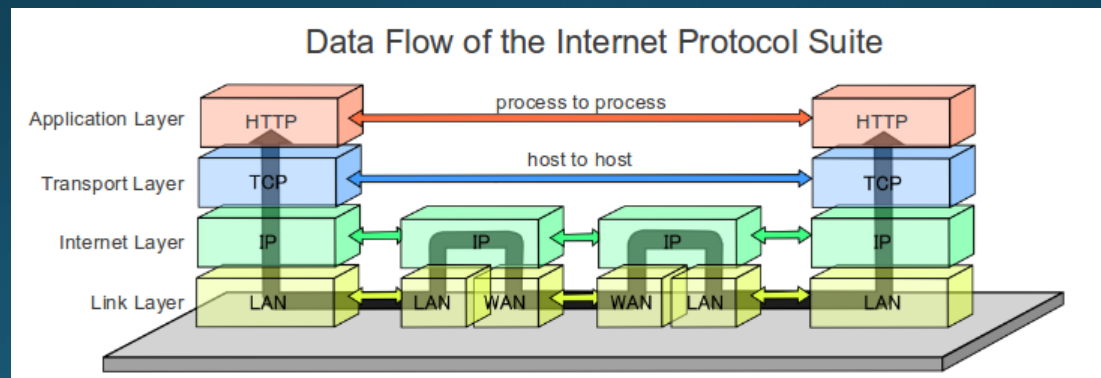
# IP Address

- Each computer on the Internet must have unique IP Address
- IP Address consists of 4 numbers separated by dots. Each number ranges from 0 to 255
- Current version of IP is IPv4 Address
- For example, 202.28.249.7 is an IP address for www.cmu.ac.th

# Future IP Address

- Internet users start to reach billion active users but IP Address is limited
  - IP Address that begins with 18 is IP Address of computers at MIT but MIT doesn't have enough computers to use all those IP Address

- One solution is to increase the size of IP Address

- IPv6 Address are currently being developed and tested along side IPv4 Address. In the near future, IPv4 Address will be retired. (just like when phone number changes form 9 digits to 10 digits)

- Example: IPv6 address for www.cmu.ac.th is 2001:3C8:5007::98

# Domain Name

- IP Address is hard to memorize. For example, if we want to access Facebook, we have to type its IP Address of 69.63.176.13

- Domain Name is invented to cover IP Address so we can only need to type www.facebook.com instead of 69.63.176.13

- Web Browser will connect to Domain Name Server (DNS) to translate www.facebook.com to 69.63.176.13

- https://www.youtube.com/watch?v=5o8CwafCxnU

# DNS Server



Domain Name → DNS Server → IP address

www.cs.science.cmu.ac.th

202.28.248.60

# Reading Domain Name

- To read a domain name, we start from the **rightmost** part of the domain name, or Top Level Domain (TLD)

- 3-letter (or more) TLD usually indicates Type of the entity (commercial, governmental organization, etc.)

- 2-letter TLD usually indicates where the domain is registered (China, Thailand, Myanmar, etc.)

- More information at
  - https://en.wikipedia.org/wiki/List_of_Internet_top-level_domains

# Examples of TLD

| 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 |

| TLD | Country |
|-----|---------|
| .cm | Cameroon |
| .cn | China |
| .mm | Myanmar |
| .mn | Mongolia |
| .th | Thailand |
| .tv | Tuvalu |
| .uk | United Kingdom |
| .us | United States |
| .vn | Vietnam |

# Reading Domain Name (cont.)

- After the TLD, the next level domain can be:
  - Type of entity (if the TLD is country code)
  - Name of the entity (if the TLD is type of entity)
- The domain will get more specific the lower (right) level it gets.
- The leftmost characters indicate <u>service</u> the entity provides.
  - For example, *www* is web service.
- Example domain name: www.cs.science.cmu.ac.th

# Uniform Resource Locator (URL)

- To get to a specific item (webpage, file, etc) on the Internet, we need a URL, or web address.

- An example of URL (basic version):

  http://www.cs.science.cmu.ac.th/course/201110/doku.php

  ① ② ③ ④

- A URL consists of:
  1. Protocol
  2. Domain Name
  3. Path
  4. Item Name

# Internet Infrastructure (First Layer)

- Each computer or computer network will connect to Internet Service Provider (ISP) such as TOT, 3BB, True, AIS Fiber

- Because ISP needs to provide service to customers all over the country, it has multiple connections in many provinces called Point of Presence (POP)
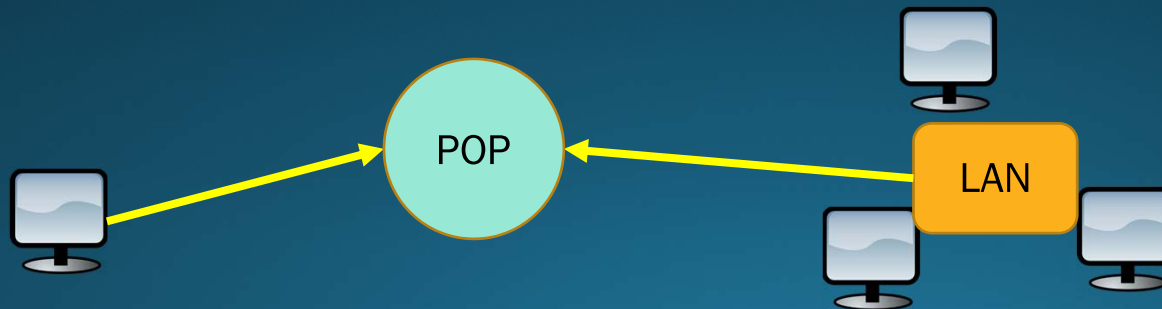
# Internet Infrastructure (Second Layer)

- Each POP connects to bigger connection points called Network Access Points (NAPs)

- NAPs has no owners because it accepts all connection from POP in different ISP
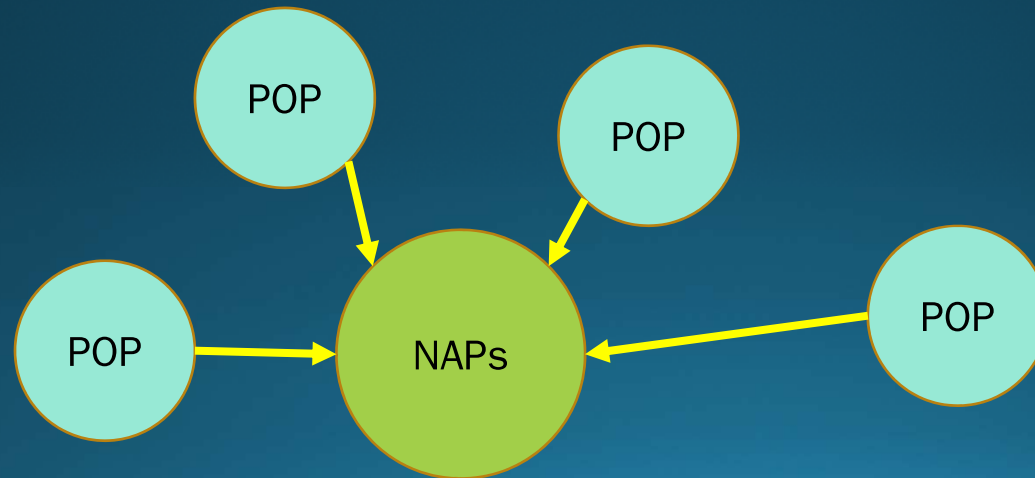
# Internet Infrastructure (Final Layer)

- NAPs from different countries communicate via wired and wireless. We call this communication the Internet!!!
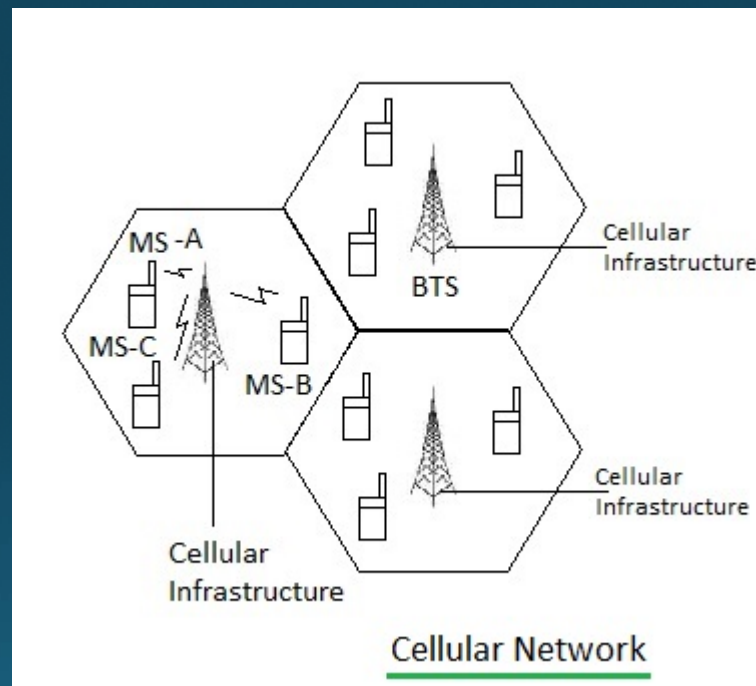
NAPs

Internet

NAPs

NAPs
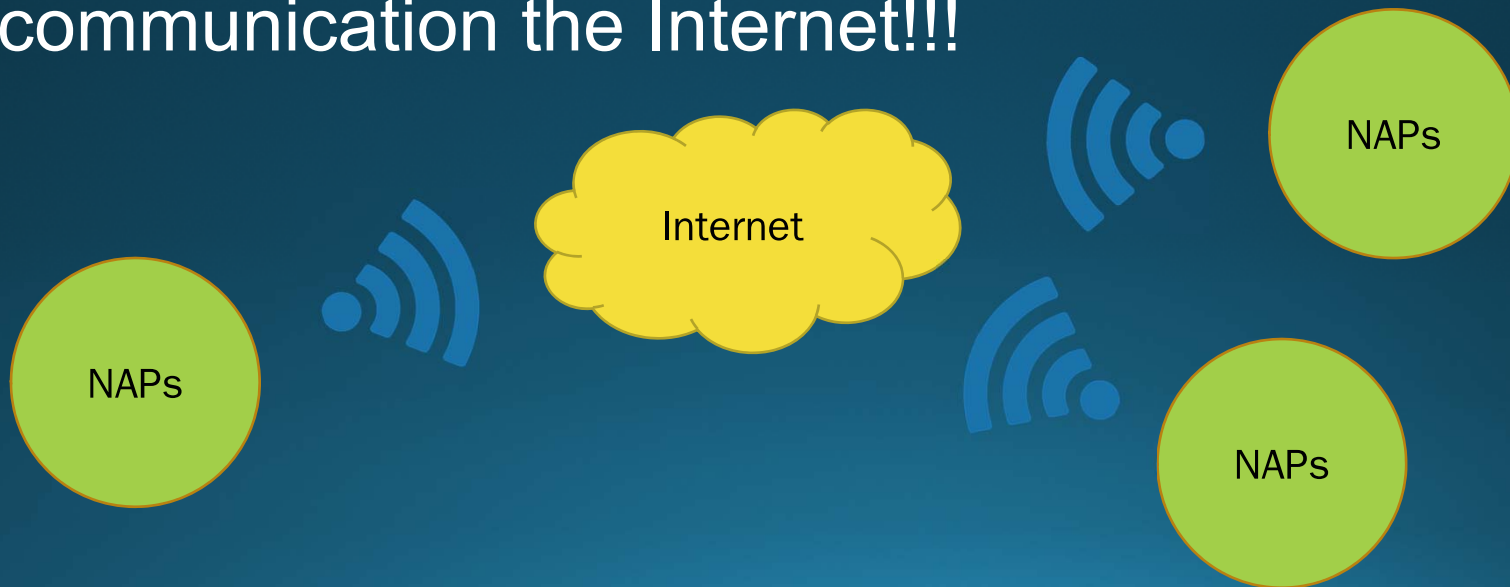
# Cellular Networks

- For mobile phone (2G, 3G, 4G networks)

- Devices (phones) connect wirelessly to the network via cellular towers

- When you move, the phone will switch from one cellular tower to another automatically



A cell tower (source: wikipedia)

# An Example of Cellular Network



Source: http://www.rfwireless-world.com

# Internet Servers and Clients

- Every component in the internet acts as server or client or both

- Servers are service providers for other computers such as Web servers, e-mail servers, FTP servers, etc.

- Clients are users of those services

# How Big is The Internet?

- TCP/IP is the most crucial part of the Internet because we can connect to people in different networks without hassle. If you want to be on the internet, you must obey TCP/IP.

- No one controls the (entire) Internet so we feel "freedom" on the Internet

- There are over 3.3 billions users and 45 billions registered websites. Technology that involves the Internet takes a huge leap in development in the past 10 years.

# How Fast is Your Internet Connection?

- There are two ways to measure internet connection speed: Bandwidth and Latency (Lag).

- 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
  - Measure delay (seconds)
  - Time it takes for data to reach you
  - Affect real-time communication/ online gaming

# 1 Minute in 2017

- 900,000 Facebook logins
- 4.1 million YouTube views
- 3.5 million Google searches
- 46,200 Instagram posts

Image Source: Visual Capitalist



2017 This Is What Happens In An Internet Minute

facebook — 900,000 Logins

16 Million Text Messages

YouTube — 4.1 Million Videos Viewed

342,000 Apps Downloaded

Instagram — 46,200 Posts Uploaded

452,000 Tweets Sent

tinder — 990,000 Swipes

156 Million Emails Sent

Spotify — 40,000 Hours Listened

amazon echo — 50 Voice-First Devices Shipped

LinkedIn — 120 New Accounts Created

Messenger — 15,000 GIFs Sent via Messenger

Snapchat — 1.8 Million Snaps Created

$751,522 Spent Online

NETFLIX — 70,017 Hours Watched

Google — 3.5 Million Search Queries

60 SECONDS

Created By: @LoriLewis @OfficiallyChadd