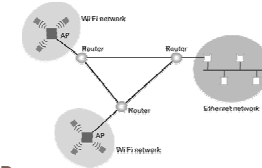


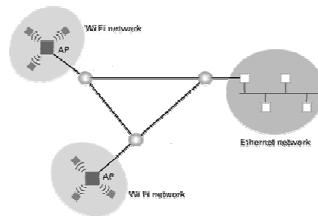
Terminology

- ▶ An internet:
 - ▶ a **network of networks**
 - ▶ It is different from “the Internet”.
- ▶ **The Internet**: a global internet that uses **TCP/IP protocol suite**.
 - ▶ TCP/IP protocol suite: IP+TCP+UDP
 - ▶ **TCP** and **UDP**: Transport layer protocols
 - ▶ **IP**: Network layer protocol



Internet Protocol (IP)

- ▶ A protocol used for communicating data across an internet.
- ▶ It is a *connectionless protocol*.
 - ▶ Telephone network is *connection-oriented*.
 - ▶ For the same source and destination, different message may be routed differently.



IP address

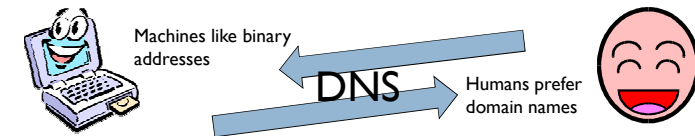
- ▶ How to design a **global address**
 - ▶ 台灣新竹市光復路二段101號 nation-city-road-number
 - ▶ 886-3-571-5131 nation-area-phone number
- ▶ IP address: the global identification for each computer connected to an internet
 - ▶ Pattern of 32 or 128 bits, usually represented in the **dotted decimal notation**.
 - ▶ For example: 140.114.87.5 is for 楓橋驛站

Domain name

- ▶ The mnemonic address for human
 - ▶ For example, **bbs.cs.nthu.edu.tw** is the domain name for 楓橋驛站
 - ▶ Top level domains (TLD): suffixes in the domain name: **.gov, .edu, .com, .net, .org, ...**
 - ▶ Country-code TLD: **.tw, .ca, .jp, .au, ...**
 - ▶ Subdomains: prefixes of an domain name, **bbs., www., ...**



Domain Name System (DNS)



- ▶ Provides translation between IP addresses and domain names.

- ▶ Name server
- ▶ DNS lookup

Bookmark	楓橋驛站
Domain name	bbs.cs.nthu.edu.tw
IP address	140.114.87.5



Circuit switch vs package switch

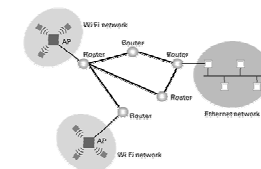
- ▶ Traditional telephone system uses circuit switch
 - ▶ Establishes a circuit (or channel) between nodes and terminals before the users may communicate.
 - ▶ All signals use a fixed, established circuit.
 - ▶ Each established circuit cannot be used by other connections.
- ▶ Internet Protocol uses package switch
 - ▶ Messages are packed into packages
 - ▶ Each package contains source IP address, destination IP address, data, checksum, length, time to live, and other information
 - ▶ Each package is routed (switched) independently, which means it may go different routes to destination.



Gateway and router

- ▶ Gateway: the "point" linked to an internet
- ▶ Router: forwards and routes messages
 - ▶ Forwarding: relay messages on an internet
 - ▶ Routing: select a route to reach destination
 - ▶ Update and maintain the **forwarding table**

Destination	Next hop	Cost
140.114.87.5	103.121.1.2	...
140.114.79.3



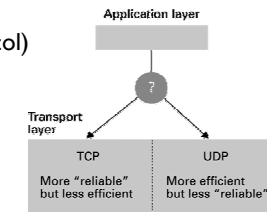
Examples in windows

The screenshot shows the 'Internet Protocol Version 4 (TCP/IPv4) Properties' dialog box. The 'General' tab is selected. The 'Use the following IP address' radio button is chosen. The IP address is 140.114.76.195, the Subnet mask is 255.255.255.0, and the Default gateway is 140.114.76.254. The 'Use the following DNS server addresses' radio button is also chosen, with Preferred DNS server at 140.114.63.1 and Alternate DNS server at 140.114.64.1. Four callout boxes point to these fields:

- The IP address of your computer (points to IP address)
- The mask for gateway (points to Subnet mask)
- The IP address of gateway (points to Default gateway)
- The IP addresses of domain name servers (points to Preferred DNS server)

Transport layer

- Two protocols
 - TCP (Transmission Control Protocol)
 - UDP (User Datagram Protocol)



	TCP	UDP
Handshaking	√	X
Retransmission	√	X
Flow control	√	X
Congestion control	√	X

Transmission control examples

- ▶ **Handshaking:**
 - ▶ Make reservation before go to a restaurant
- ▶ **Retransmission:**
 - ▶ Ask someone to repeat what he/she said when you did not hear it clearly
- ▶ **Flow control:**
 - ▶ Ask someone to talk slower
- ▶ **Congestion control:**
 - ▶ 匝道管制 or line up a crowd of people

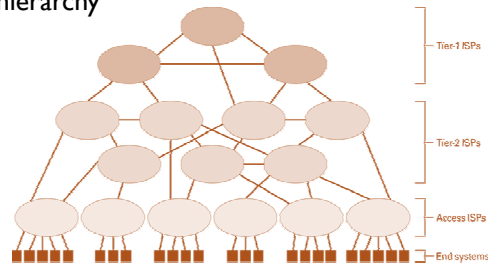
Port number

- ▶ TCP/UDP need to know which application should a received message be sent to
 - ▶ This is identified by port numbers
 - ▶ IP address is for the address of computers
- ▶ Examples

Port number	Application
53/TCP,UDP	Domain Name System (DNS)
80/TCP,UDP	Hypertext Transfer Protocol (HTTP)
513/TCP	Login

Internet Service Provider (ISP)

- ▶ A company/organization that offers its customers access to the Internet.
- ▶ The ISP hierarchy



How ISPs work

- ▶ Connection method to ISPs

- ▶ Direct connection
- ▶ Dial-up, **DSL**
- ▶ Cable **modem**
- ▶ Wireless

TANet	台灣學術網路
SeedNet	新世紀資通
Hinet	中華電信
Cable modem	東森有線電視

<http://rms.twnic.net.tw/twnic/User/Member/Search/main7.jsp?Order=ORG.ID>

