

# Computer sciences

Community of computers  
(connect to internet)

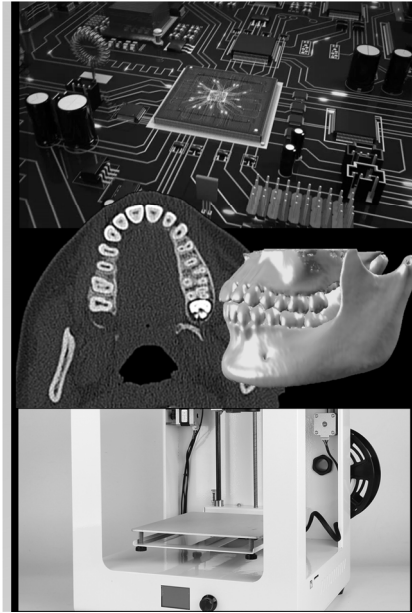
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# Computer Sciences - Syllabus

	Topics
Class 10	Community of computers (Introduction of internet)
Class 11	Security of computers
Class 12 (11/27) 非同步教學	Introduction of artificial intelligence
Class 13 (12/4) 非同步教學	Introduction and practice of ChatGPT
Class 14	Application of ChatGPT
Class 15 (12/18)	<b>Final Report &amp; Discussion, Part I</b>
Class 16 (12/25)	<b>Final Report &amp; Discussion, Part II</b>

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# Computer Network

- Network Introduction and Development
- Network Components and Settings

Please download handouts from (Week 8)  
[http://cflu.lab.nycu.edu.tw/CFLU\\_course\\_CompSci.html](http://cflu.lab.nycu.edu.tw/CFLU_course_CompSci.html)

電腦網路概論與實務(第六版),  
蕭文龍、徐瑋廷, 碁峯資訊出版

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# Network Introduction and Development

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## Purpose and Benefits

- **Information Exchange**
  - Internet search (google) and social media (facebook)
- **Resource Sharing**
  - Hardware (printers, cloud drives and computing), software (files or programs)
- **Resource Saving**
  - Save paper and manpower for delivery, increase timeliness and storage
- **Communication Capability and Flexibility**
  - Electronic communication to integrate text, graphics, and video (multimedia).

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## Network Category Based on the connection method and distance

- **Local Area Network (LAN) 區域網路**
  - A block network within the same home or department.
  - It is the lowest cost, easy to set up, easy to manage, and the number of computers is about 100 or less.
- **Metropolitan Area Network (MAN) 都會網路**
  - Connection between several LANs.
  - The linkage distance should not exceed several kilometers.
- **Wide Area Network (WAN) 廣域網路**
  - Long-distance connection requires backbone network for signal transmission.
  - Optical fiber, submarine cable, satellite (cross cities and countries) °

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## Network Category Based on the use and scale

- **Intranet 企業內網路**
- **Campus Area Network (CAN) 校園網路**
- **Internet 網際網路**

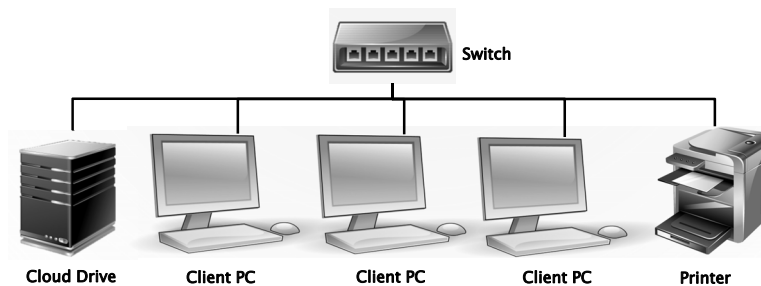


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## Network Connection Architecture

- **Local Area Network, LAN**
  - Lowest cost, easy to set up, easy to manage

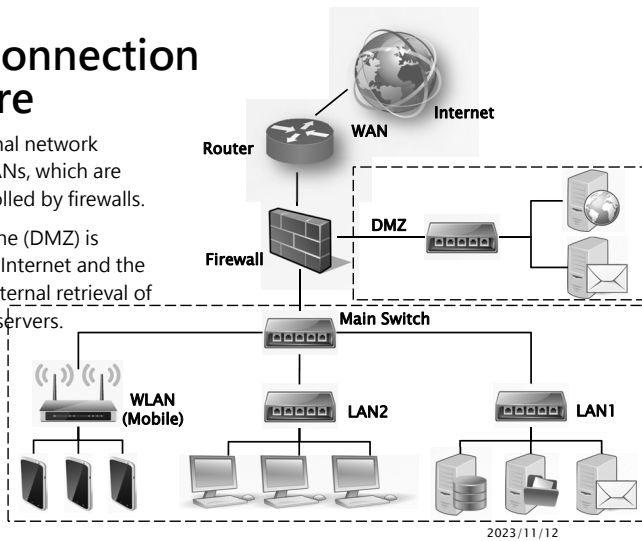


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# Network Connection Architecture

- The company's internal network consists of several LANs, which are protected and controlled by firewalls.
- The Demilitarized zone (DMZ) is located between the Internet and the intranet and hosts external retrieval of web pages and mail servers.



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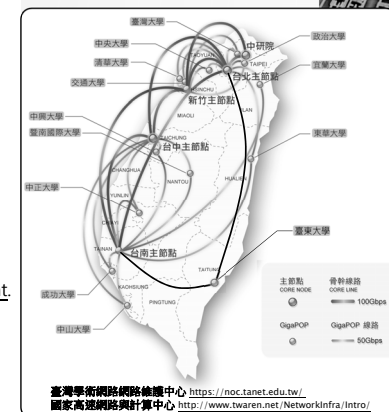
# Internet Service Providers (ISP)

## Key ISPs in Taiwan

- Taiwan Academic Network, TANet
  - 1990 Ministry of Education, for all levels of school units.
- TaiWan Advanced Research and Education Network, TWAREN
  - 1998 National Science Council, TANet2.
  - 2002 National Science Council, TWAREN for academic research.
- SEEDNet (Far EastOne Telecom)
  - 1992 Ministry of Economic Affairs, for industry development.
- HiNet (Chunghwa Telecom)
  - 1994 General Telecommunications Bureau, for civil use.

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TANet/TWAREN



臺灣學術網路網絡維護中心 <https://noc.tanet.edu.tw/>  
 國家高速網路與計算中心 <http://www.twaren.net/NetworkInfra/Intro/>

# ADSL vs. CABLE modem

Items	ADSL/光世代	Cable modem
傳輸介質	電話線/光纖	有線電視同軸電纜
頻寬特性	頻寬獨享 下載: 2M~12Mbps / 16M~1Gbps 上傳: 64K~1Mbps / 3M~600Mbps	頻寬共享 下載: 24M~1Gbps 上傳: 5M~50Mbps
IP位址	固定制: 固定IP位址 非固定制: 動態IP位址	多為配發之動態IP位址
網路安全性	獨立線路, 安全較佳	共享線路, 安全較差
傳輸距離限制	用戶距離機房5公里內為佳	傳輸距離無限制
連接方式	星形連接, 用戶不互相干擾	串接式, 個別障礙會互相影響
適合對象	個人/家庭、企業	個人/家庭
收取費用	上網費用+電路費	單一有線電視費用 (單向式仍需電話費)
台灣ISP	中華電信Hinet、So-net、遠傳Seednet ...	bb寬頻、凱擘大寬頻、台灣大寬頻 ...

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[註]使用光纖骨幹搭配VDSL(Very-high-bit-rate digital subscriber line)可達更高速度

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# Speed Test Website /App <http://www.speedtest.net/>

Wired Network (PC)



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Wireless Network (Mobile phone)



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## Actual Download Speed?

- There is a difference between MB/s and Mb/s. Where B stands for Byte and b stands for bit.
- 1 Byte = 8 bits
- 1Mb/s = 0.125MB/s = 128KB/s
- The fastest download speed of 10M broadband is 1.25MB/s, and the fastest download speed of 100M broadband is 12.5MB/s.



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## Ethernet 乙太網路

- Ethernet is currently the most popular technology for local area networks.
- The IEEE 802.3 protocol sets the technical standards for Ethernet.

Name	Speed	Standard	Cable
乙太網路雛型 (Xerox Ethernet)	1~2 Mbps	1BASE5	CAT 1
乙太網路 (Ethernet)	10 Mbps	10BASE5, 10BASE2, 10BASE-T, 10BASE5-FL	CAT 2/3
高速乙太網路 (Fast Ethernet)	100 Mbps	100BASE-TX, 100BASE-FX	CAT 4/5
超高速乙太網路 (Gigabit Ethernet)	1Gbps	1000BASE-T	CAT 5e/6
	10Gbps	10GBASE	CAT 6/7
	40/100Gbps	40GBASE, 100GBASE	CAT 8

RJ45 connector

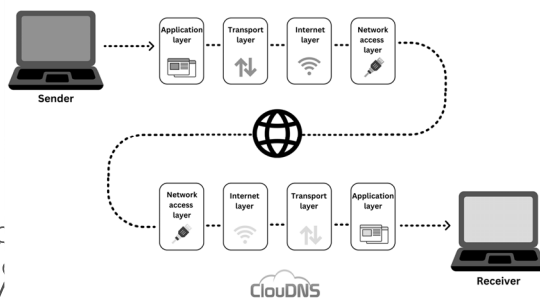
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## TCP/IP

- Transmission Control Protocol (TCP) & Internet Protocol (IP)

How does TCP/IP work?



- When an Internet application is used (e.g., viewing a web page with a browser), the message is generated and sent from the application layer to the network access layer, and then sent out over the network line.
- When the other party receives the message, the message is sent in the reverse direction, up through the layers of protocols, and finally interpreted by the application at the top.

<https://www.cloudns.net/blog/tcp-transmission-control-protocol-what-is-it-and-how-does-it-work/>

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## IP Address

- Each Internet-connected computer has a unique address for easy differentiation and identification, ensuring that no data is sent to the wrong computer.
  - IPv4: xxx.xxx.xxx.xxx (8 bits per number, 0~255, total 32 bits)
- The numbers are too difficult to remember, so the corresponding domain names are generated.
  - Naming: machine.subdomain.subdomain.domain
  - Machine: www, ftp, ...
  - Subdomain (additional level, optional): Organization Name
  - Subdomain (first level): Organization Name
  - Domain : generic (edu, org, com,...) +country code (tw,jp,...)

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# IP Address

- Domain names
  - machine.subdomain.subdomain.domain
- Examples:
  - www.nycu.edu.tw
  - www.edu.tw
  - www.google.com.tw
  - www.facebook.com
- IPv4
  - xxx.xxx.xxx.xxx
- Corresponding IP:
  - 140.113.199.53
  - 140.111.14.180
  - 142.250.176.3
  - 157.240.11.35

Global WHOIS Search: <http://www.whois365.com/tw/ip>

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# Domain Name System (DNS)

- Established in 1984.
- The DNS server is responsible for the conversion of domain names to IP addresses.
  - When a domain name is entered, the DNS server can find the corresponding IP address.
  - If you do not set the DNS server address correctly, you may not be able to connect to any website.
  - If you type in the IP address, you will not have any problem.

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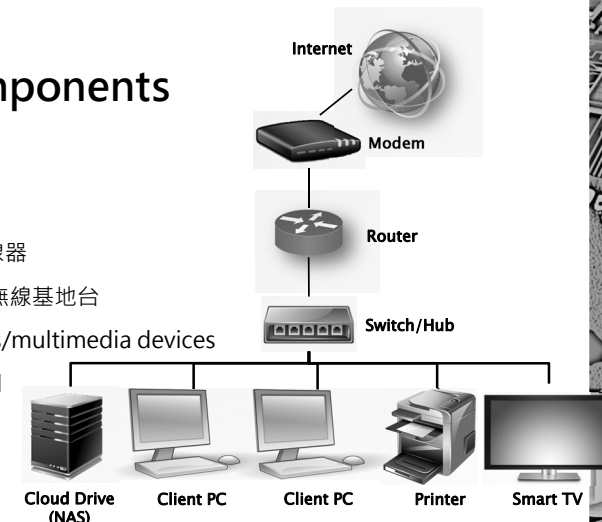
# Network Components and Settings

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# Network Components

- Modem 數據機
- Router 路由器
- Switch/hub 交換器/集線器
- Wireless access point 無線基地台
- Computer/cloud drives/multimedia devices
- Network interface Card 網路介面卡
- Cable 網路線



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## Network Interface Card 網路介面卡(網卡)


- The hardware that allows users to communicate on a computer network.
- It's mostly built into the motherboard.
- Each network card has a unique 48-bit serial number known as the MAC address (physical location).
- Example: 00-14-a5-51-61-6f (Hexadecimal)

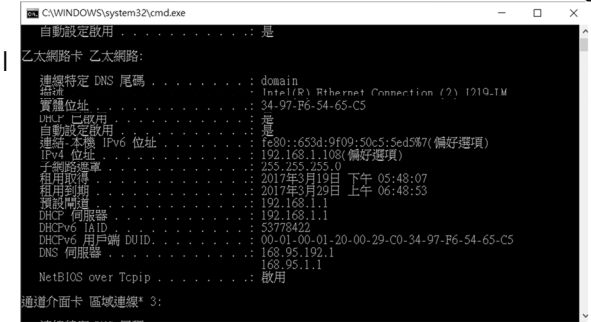
IP address is like a home address  
MAC address is like a resident ID card  
There is usually a 1-to-1 relationship.

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## Check Your MAC

- Windows OS: Hot key 
- Key in cmd
- Key in ipconfig /all



```
C:\WINDOWS\system32\cmd.exe
自動設定啟用: 是
: 是
乙太網路卡 乙太網路:
  連線特定 DNS 尾碼: . . . . . domain
  描述: . . . . . Intel(R) Ethernet Connection (2) I219-LM
  實體位址: . . . . . 34-97-P6-54-65-C5
  DNS 已啟用: . . . . . 是
  自動設定啟用: . . . . . 是
  連線本機 IPv6 位址: . . . . . fe80::653d:9f09:50c5:5ed5b7(偏好選項)
  IPv4 位址: . . . . . 192.168.1.108(偏好選項)
  子網的掩碼: . . . . . 255.255.255.0
  租用期限: . . . . . 2017年3月19日 下午 05:48:07
  租用到期: . . . . . 2017年3月29日 上午 06:48:53
  預設閘道: . . . . . 192.168.1.1
  DHCP 伺服器: . . . . . 192.168.1.1
  DHCPv6 位址: . . . . . 53778422
  DHCPv6 用戶端 DUID: . . . . . 00-01-00-01-20-00-29-C0-34-97-P6-54-65-C5
  DNS 伺服器: . . . . . 168.95.192.1
  . . . . . 168.95.1.1
  NetBIOS over Tcpi: . . . . . 啟用
  通訊介面卡 區域連線* 3:
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## Modem 數據機

- Perform analog (telephone line) to digital (computer) signal conversion.
- This is required when the network signal is to be transmitted over a telephone line, such as home network (ADSL, VDSL, one-way CABLE).
- Two-way CABLE, both download and upload go through the TV cable, no data machine is required.
- But TANet or TWAREN set up the dedicated line (not through the phone line), also do not need data machine.

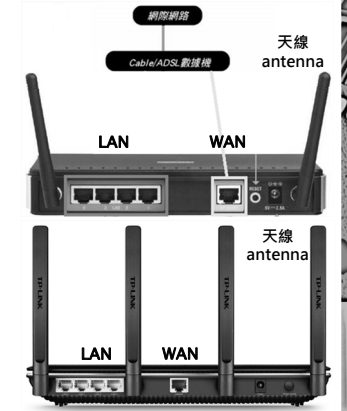


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## Network Components

- IP Sharer 分享器
  - 1 WAN port: connect to modem/internet
  - 4~8 LAN ports: connect to LAN devices
  - Allocate virtual IPs to LAN-connected devices (DHCP mode)
    - 192.168.0.X or 192.168.1.X
  - May equip antennas for wireless function.
- Router 路由器
  - IP sharer is a kind of router.
  - However, both interfaces of the router are physical IP, which is expensive.



Usually 5GHz speed is faster than 2.4GHz wireless!  
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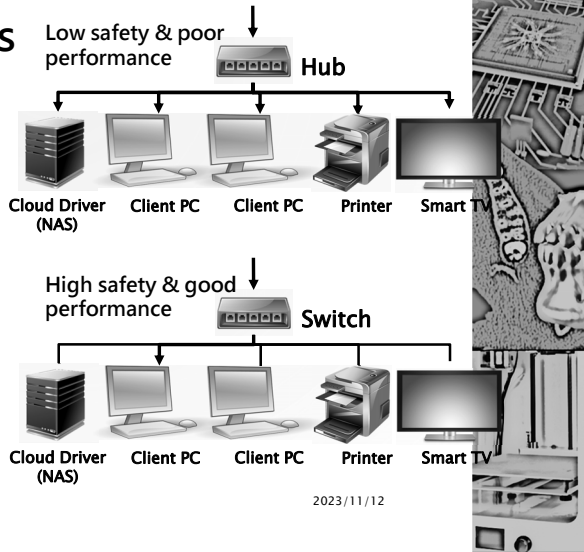
# Network Components

## • Hub 集線器

- Broadcast: data will be transmitted to all computers that are connected to the hub.
- Incoming/outgoing data cannot be sent simultaneously.
- Bandwidth sharing: Use for up to 5 devices.

## • Switch 交換器

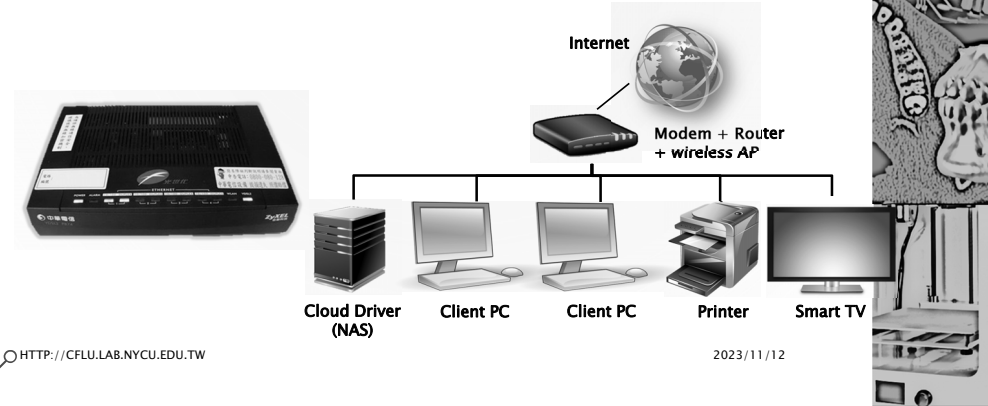
- MAC-specific data transmission.
- Send and receive data simultaneously.
- Independent bandwidth.



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# Network Components

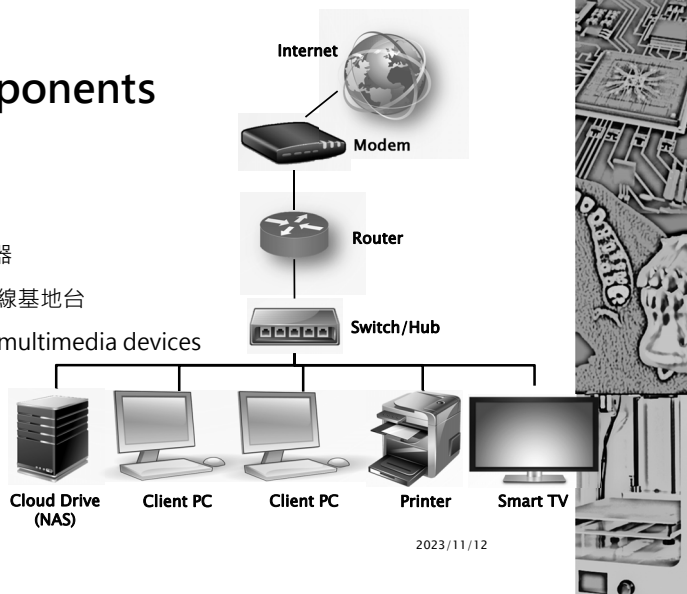
- Nowadays, the functions are integrated within the same device.



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