Introduction to Computer Networks
計算機網路概論

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(2 hrs)

網路(Computer Networks) **?**

• 有甚麼好學的?

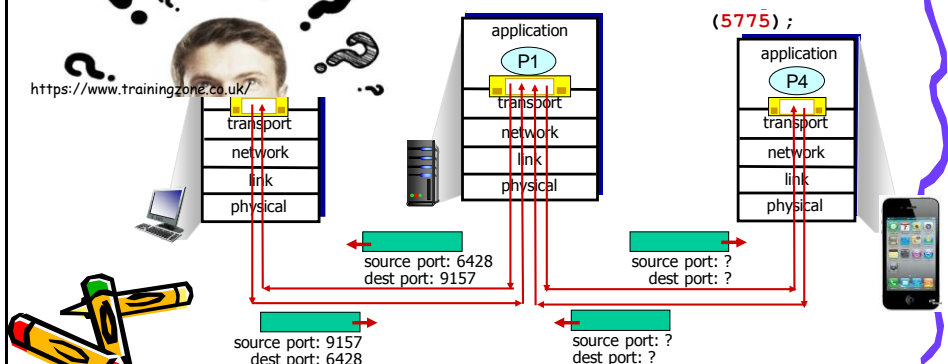Source: https://cc0.wfublog.com/ & http://photopin.com/

什麼是
"網路(Computer Networks)"?

- 找工作面試問你懂網路嗎?
  - 網際網路(Internet; 互聯網)?
  - 網際網路的**使用**?
  - Line, FB, IG, Email, **Google** ?
  - 聊天,遊戲,訂票,購物, ,定位?
  - 網路電視,追劇,音樂,Youtube?
- 以上叫常識

Source: https://cc0.wfublog.com/ & http://photopin.com/

"網路(Computer Networks)"
設備/CPU/OS都不同,如何溝通?

比我們想像的還要複雜!

https://www.trainingzone.co.uk/

(5775) ;

application
P1
transport
network
link
physical

application
P4
transport
network
link
physical

transport
network
link
physical

source port: 6428
dest port: 9157

source port: ?
dest port: ?

source port: 9157
dest port: 6428

source port: ?
dest port: ?

Source: *Computer Networking: A Top Down Approach Featuring the Internet*, Jim Kurose, Keith Ross

"網路(Computer Networks)"
重要嗎?

• 每天我起床的第一件事?

• 上班/上學/生活要電、要網路
  –提高工作/學習效率、提升生活品質

• AI←大數據←物聯網(IoT)←網路
  –網路程式設計

Source: https://cc0.wfublog.com/ & http://photopin.com/

(物聯網)

IT Industry undergoes significant evolution every 15 years

• Green IT and sustainable development
• IPv6-ready
• Mobile broadband getting mature
• Cost effective intelligent devices
• Mobile backhaul expansion and migration
• Convergence of billing system
• Large processing capacity/cloud computing

Internet of Things (M2M)

IT capability expands from supporting people to supporting "things", realizing communication and collaboration among things

Internet

IT capability extends from desktop to value chain and business partners, supporting service and collaboration

Rise of PC

IT capability moves from back office to desktop

Mainframe

IT capability limit to back office computer room

Emergence of Computer

1950   1965   1980   1995   2010

IDC

www.youtube.com: 2016物聯網(黃能富教授之物聯網基礎架構與應用簡介)

Internet of Things (IoT): 物聯網

- 萬物聯網; 物物聯網; T2T; M2M

http://www.3g.co.uk/g_phones/large/internet-of-things-everything-you-need-to-know.jpg

- Sensor network感測器蒐集數據➔網路伺服器
- 雲端再做分析➔再透過網路回饋(循環系統)

www.youtube.com: 2016物聯網(黃能富教授之物聯網基礎架構與應用簡介)

"網路(Computer Networks)" 重要嗎?

- 網路安全: ATM jackpotting

2016年東歐駭客集團駭入一銀倫敦分行，利用一臺電話錄音伺服器，橫跨1萬公里，遠端遙控北中兩地22家一銀分行的41臺ATM，十多名車手盜領8,327萬多元。

By Emsisoft Blog

－Backdoor, Firewall, Broadcast, DDoS

Source: http://mkamericas.com/atm-jackpotting-hits-us/

1m:16s 駭客入侵一銀 隔空吐鈔8000萬

蘋果日報2016/7/13
https://tw.appledaily.com/headline/daily/20160713/37305883

"網路(Computer Networks)" 重要嗎?

• 網路管理/網路分析
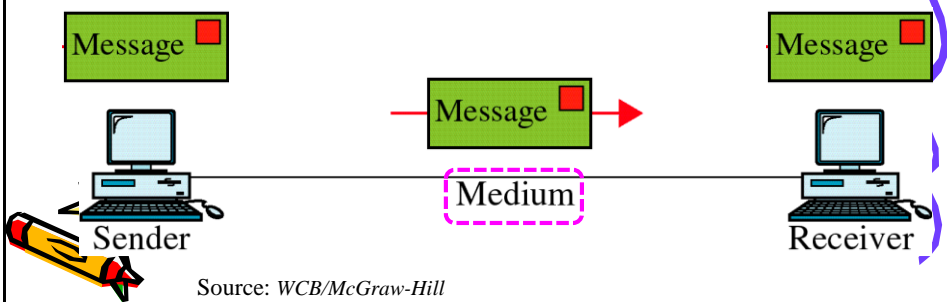
Source: https://wiki.mbalib.com/zh-tw网络管理系统

Course Goals

- Network organization
- Network design principle
- Network service
- Network engineering
- Network management

Did you know?

- Network Components
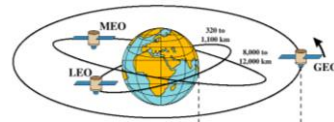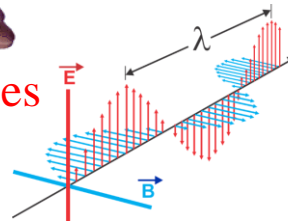 - Sender/Receiver
  - Message
  - Medium

Message

Message

Message

Medium

Sender

Receiver

Source: *WCB/McGraw-Hill*

2018/9/10

Did you know?

- Transmission media
  - Copper: Gold? Silver?
  - Coaxial cable
  - Optical fiber
  - Electromagnetic waves
    - Infrared
    - Radio
    - Microwave
    - Satellite communication

Source: https://cc0.wfublog.com/ & http://photopin.com/

Did you know?

- Network Components
  - Message
  - Sender/Receiver
  - Medium
  - Protocol

Message

Step 1:
Step 2:
Step 3:
....
....
Protocol

Message

Step 1:
Step 2:
Step 3:
....
....
Protocol

Message

Medium

Sender

Receiver

Source: *WCB/McGraw-Hill* &https://cc0.wfublog.com/ & http://photopin.com/

Protocol(通訊協定; 遊戲規則)

Source: https://newtalk.tw/news/view/2018-07-12/131171
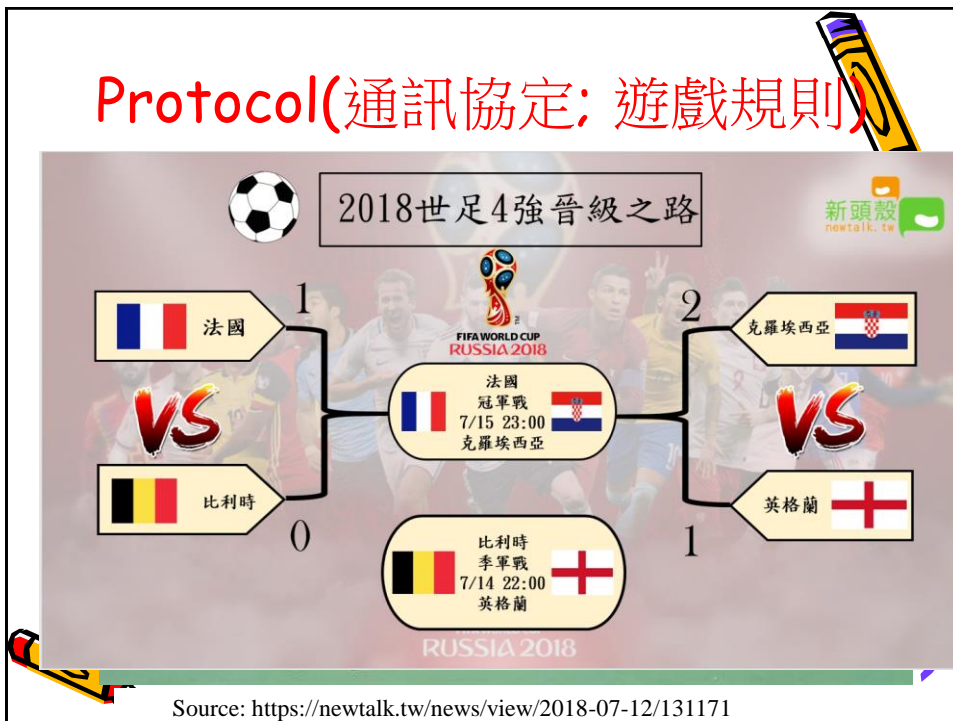
TCP/IP: 傳輸控制協定/ 網際網路協定，欲連上**Internet**所必需使用的兩種通訊協定。

TCP/IP　網際網路　TCP/IP

1. 工作站　2.工作站
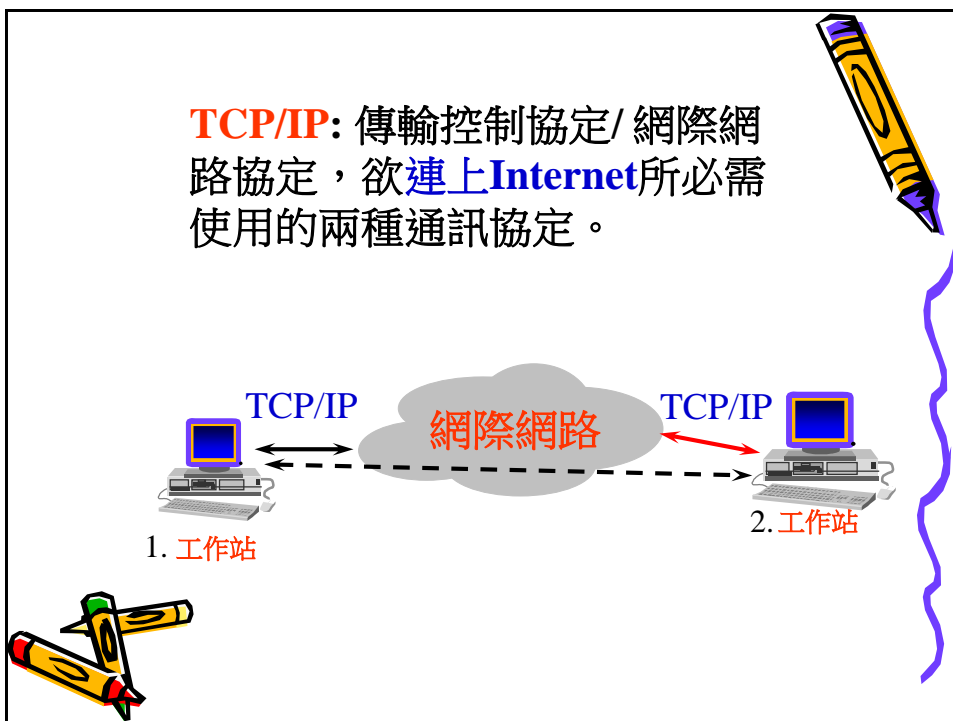
Did you know?

- IP (Internet Protocol)
  - Addressing
    - IPv4
    - IPv6
    - Ping
  - Routing
    - Router
    - Traceroute

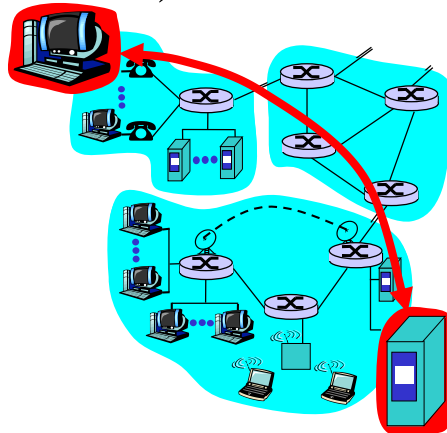*Computer Networking: A Top Down Approach Featuring the Internet*
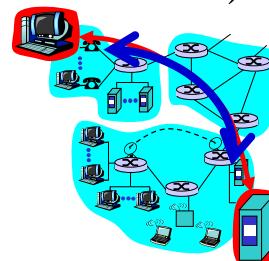*Jim Kurose, Keith Ross*

Did you know?

- TCP (Transmission Control Protocol) vs. UDP
  - Flow control
    - Socket
  - Congestion control

Bursty flow
Leaky bucket
Fixed flow

Source: https://cc0.wfublog.com/ or http://photopin.com/ or Google

Did you know?

- Network issues
  - Congestion
    - Queueing
    - Delay
    - Loss
    - Utilization
    - QoS
    - Performance
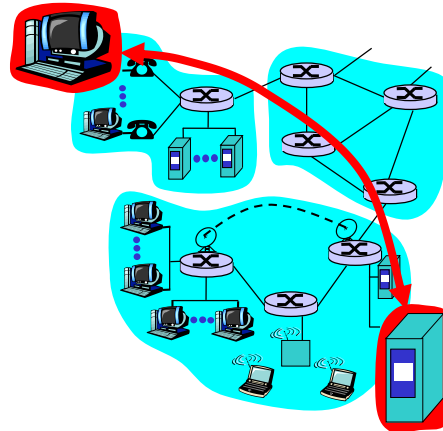
Computer Networking: A Top Down Approach Featuring the Internet,
Jim Kurose, Keith Ross

Source: https://cc0.wfublog.com/ or http://photopin.com/ or Google

Did you know?

- Network issues
  - Error Control
    - Damage
    - ACK/NACK
    - Loss (Timer)
  - Error Detection
  - Error Correction
  - ARQ

Computer Networking: A Top Down Approach Featuring the Internet,
Jim Kurose, Keith Ross

Source: https://cc0.wfublog.com/ or http://photopin.com/ or Google

2018/9/10

Did you know?

- Protocol layering
  - Standardization

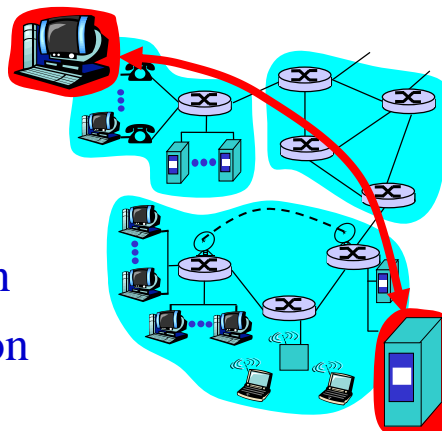TCP/IP Model   OSI Model

TCP/IP Model
Application layer: http, telnet, snmp, smtp, nfs, ftp
TCP, **UDP**
IPv4, **IPv6**
Host-to-Network layer

OSI Model
Application
Presentation
Session
Transport
Network
Data Link
Physical

Standardization

Source: https://cc0.wfublog.com/ or http://photopin.com/ or Google

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Did you know?

X	A	B	C	Y
應用層				應用層
展示層				展示層
會談層				會談層
傳輸層				傳輸層
網路層	網路層	網路層	網路層	網路層
資料鏈結層	資料鏈結層	資料鏈結層	資料鏈結層	資料鏈結層
實體層	實體層	實體層	實體層	實體層

Source: https://www.cisco.com/

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Did you know?

- Protocol layering and data

Message ■

source	destination	

Message ■

M	application	application		M	message
H_t M	transport	transport	H_t M	segment
H_n H_t M	network	network	H_n H_t M	datagram
H_l H_n H_t M	link	link	H_l H_n H_t M	frame
	physical	physical		
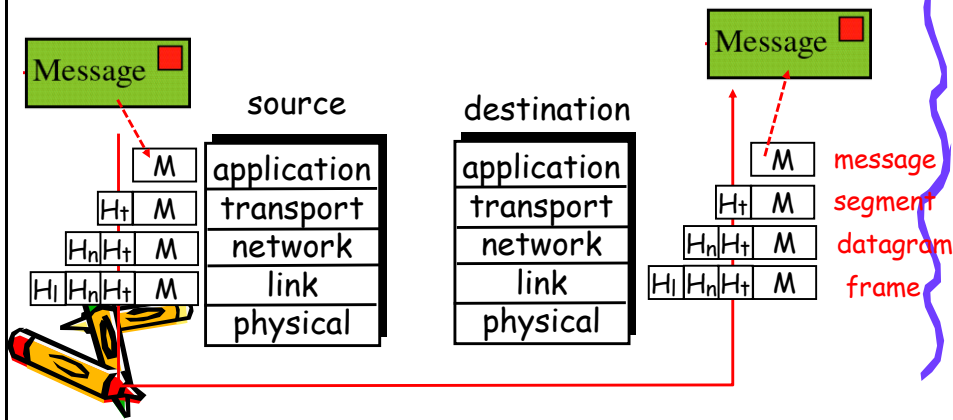
Did you know?

- Protocols
  - MAC: CSMA/CD, CSMA/CA, …
  - IPv4, IPv6, IPX, AppleTalk, …
    - IPv4: 140.113.149.57
  - DHCP/NAT
  - DNS (Domain Name):
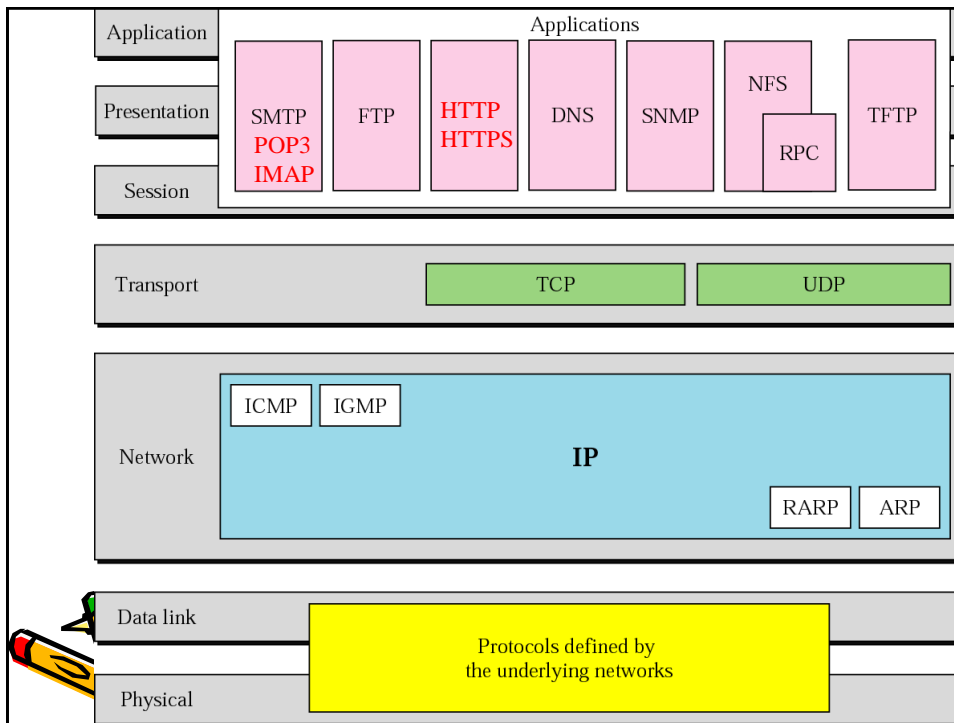   - http://www.asia.edu.tw   (IANA)
    - http://亞洲大學.tw   (TWNIC)

Source: https://cc0.wfublog.com/ or http://photopin.com/ or Google

Application	Applications							
Presentation	SMTP POP3 IMAP	FTP	HTTP HTTPS	DNS	SNMP	NFS RPC		TFTP
Session								

Transport	TCP	UDP

Network	ICMP IGMP IP RARP ARP

Data link	Protocols defined by the underlying networks
Physical	

Did you know?

- LAN
  - Ethernet, WiFi, …
  - NIC/Hub/Switch/Router
- WAN
  - Internet, 3G/4G/5G
  - Intranet, VPN
  - ISP, ADSL, Cable, FTTH/B/C

Source: https://cc0.wfublog.com/ or http://photopin.com/ or Google

Did you know?

- Circuit switching
  - FDM
  - TDM
- Packet switching
  - Datagram network
  - Virtual circuit network

Source: https://cc0.wfublog.com/ or http://photopin.com/ or Google

Administration

- Text:
 Andrew S. Tanenbaum, "Computer Networks," 5th ed., Pearson Education (東華書局), 2012。

- Reference:
1. 邵喻美、潘育群譯, "電腦網路(第五版)," 東華書局, 2012.
2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach," 7th ed., Pearson, 2016.

Computer Networks
Fifth Edition
Andrew S. Tanenbaum • David J. Wetherall
PEARSON

COMPUTER NETWORKS
電腦網路
Andrew S. Tanenbaum
David J. Wetherall

Administration (cont.)

🌐 Reference:
2. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach," 7th ed., Global Edition, Pearson, 2016, ISBN: 9781292153599

GLOBAL EDITION

Computer Networking
A Top-Down Approach

SEVENTH EDITION

Kurose • Ross

Ⓟ Pearson
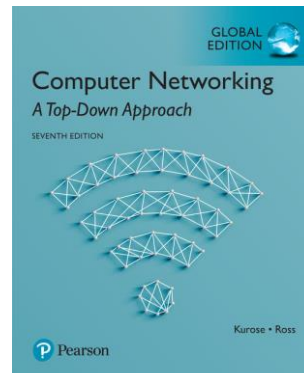
Administration(cont.)

- Instructor:
  陳瑞奇 **(rikki)**　　資訊工程學系
  Office: Room **HB13** (資訊大樓電梯下地下室往西走到底)
  Email: **rikki@asia.edu.tw**
  Tel: 04-23323456 ext. 20013
  http://asia.edu.tw/~rikki
- Office hours:
  Tue.(二) 13:10 – 15:00　　　　Thu.(四) 9:10 – 12:00
  Fri.(五) 9:10 – 12:00
- Grade:

Attendance (including Q&A)	10%
Homework Assignments	30%
Mid-term Exam (open book)	30%
Final Exam (open book)	30%

Administration(cont.)

- Submission of your homework
① By Email
  Email To: TA3.rikki@gmail.com
  Email Subject: Computer Networks HWn, Name: XXX, ID#:YY
  Attachment: ID#_HWn.doc

② or With Papers (A4 size)
  Title: Computer Networks HWn, Name: XXX, ID#:YYYYYY

Note: Submission after deadline will be graded a 30% discount.

Administration(cont.)

- 學校電腦教室管理規則(節錄):

1. 請依分組座號入座。

2. 請勿在電腦教室中喝飲料或吃東西。

3. 離開時, 關機關螢幕, 並請將椅子靠回桌邊, 鍵盤、滑鼠等 歸定位。

4. 下課前整理個人座位環境。

Thanks a lot!

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Textbook Contents

Source: https://cc0.wfublog.com/ & http://photopin.com/

WCB/McGraw· *2002*

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(Optional)

Thank you!