



# 系統程式設計 Systems Programming

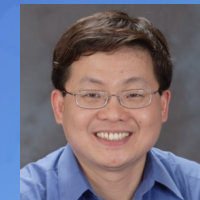
鄭卜壬教授  
臺灣大學資訊工程系



# Who am I?



- **Director** (Office: R220)  
Graduate Institute of Networking and Multimedia
- **Professor** (Office: R323)  
Dept. of Computer Science and Information Engineering
- **Appier AI Chair Professor**
- **Visiting Professor**  
Dept. of Computer Science  
University of Illinois Urbana-Champaign
- **Coach**  
ICPC teams, National Taiwan University
- **Research Fields:**  
Information Retrieval, Deep Learning, Machine Learning,  
Data Mining, Natural Language Processing
- **Google & Microsoft Research Awards**
- **PI of Web Mining and Retrieval Lab (R302)**





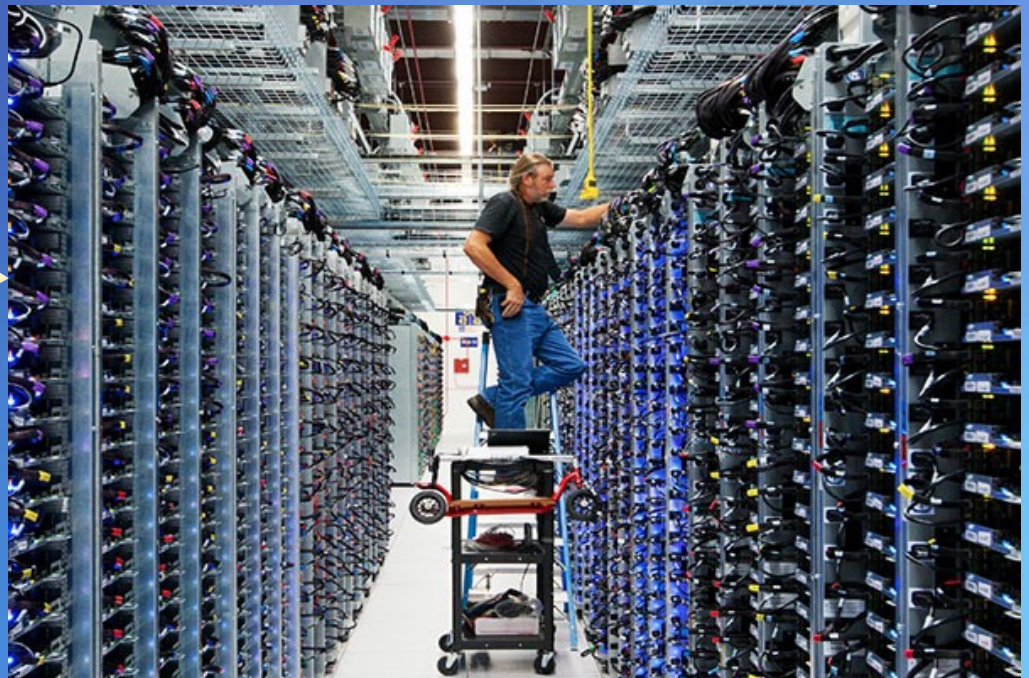
# Goal of SP Course

You are expected ....

to be familiar with the UNIX-like systems  
to become good system programmers

**Server**

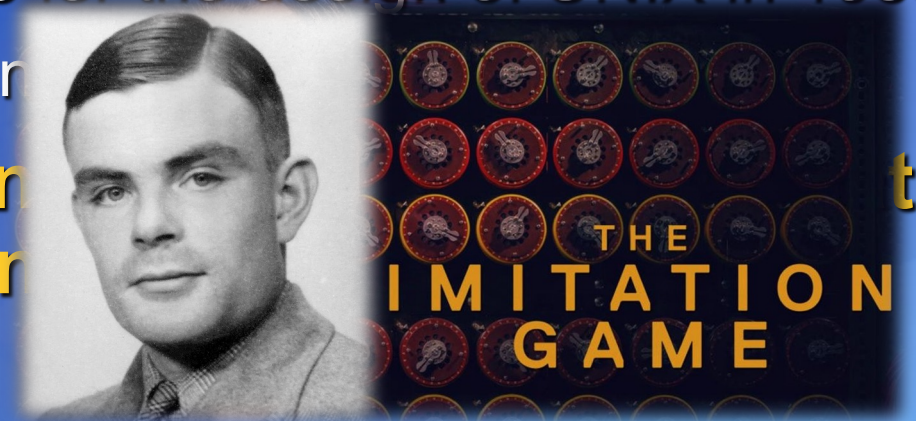
**Client**



# UNIX

MIT – CTSS (Compatible Time-Sharing System)  
MIT, GE, AT&T Bell Lab – MULTICS  
(MULTiplexed Information and Computing System)

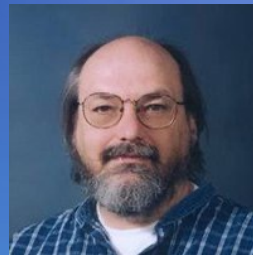
- Created by Ken Thompson & Dennis Ritchie at Bell Lab in 1969 & on PDP-7
  - ACM Turing award winners for the design of UNIX in 1983
  - C programming language in
- Support many users run the same time, all sharing system
- Major Contributors:
  - Bell Laboratories, Computer Systems Research Group (CSRG) of the University of California at Berkley (released in BSD), UNIX System Laboratories (USG/USDL/ATTIS/DSG/USO/USL), etc.



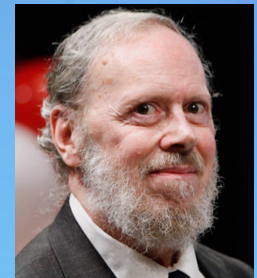




PDP-7



PDP-11 (1972)  
Ken (sitting) &  
Dennis (standing)



**D. Ritchie and K. Thompson. The UNIX Time-Sharing System. *Communications of the ACM*, 1974**

# UNIX

**UNIX System  
Laboratories  
(USG/USDL/  
ATTIS/DSG/  
USO/USL)**

**Bell Labs  
Research**

**Berkley  
Software  
Distributions**



**\* POSIX.1 (IEEE, ISO) standard!**



## ● Required Text Book

- “Advanced Programming in the Unix Environment” by W. Richard Stevens and Stephen A Rago, Addison-Wesley, 3rd Edition, 2013. ([source code](#))

## ● Reference Book:

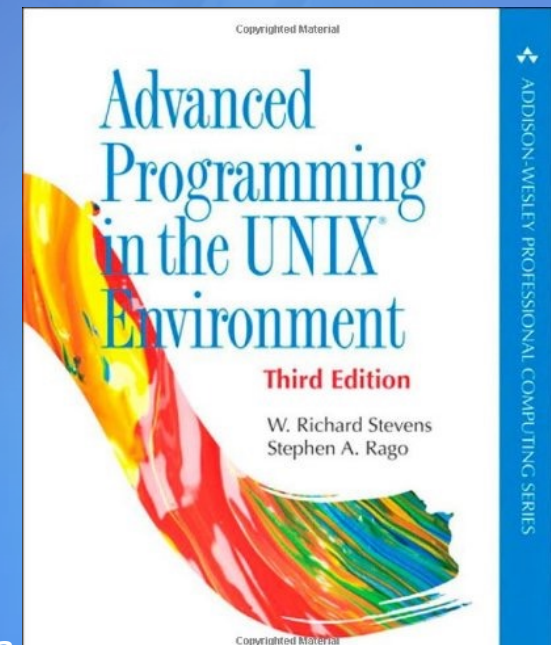
- “Understanding UNIX/LINUX Programming: A Guide to Theory and Practice” by Bruce Molay, Prentice Hall, 2002.
- “The Art of UNIX Programming” by Eric S. Raymond (<http://www.catb.org/~esr/writings/taoup/html/>)

## ● Prerequisites:

- Basic C/C++ programming skill

## ● Getting started with UNIX:

- A material from Stanford ([link](#))  
Compile, link & debug program, gcc, make, gdb, shell commands



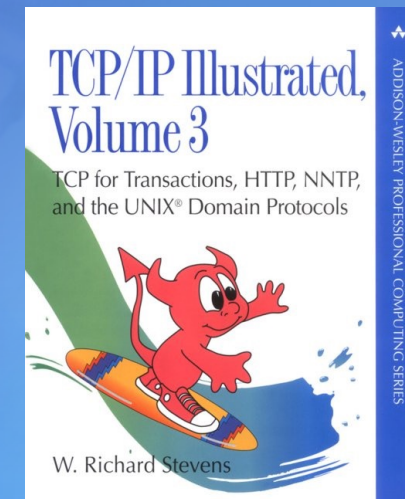
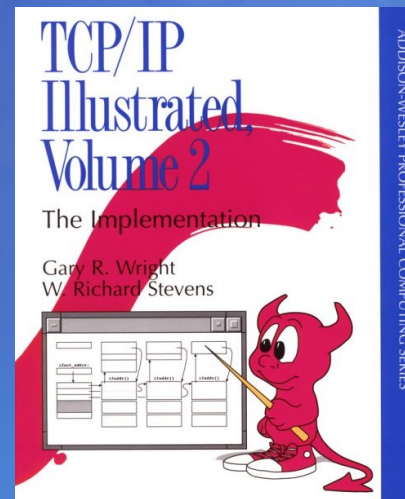
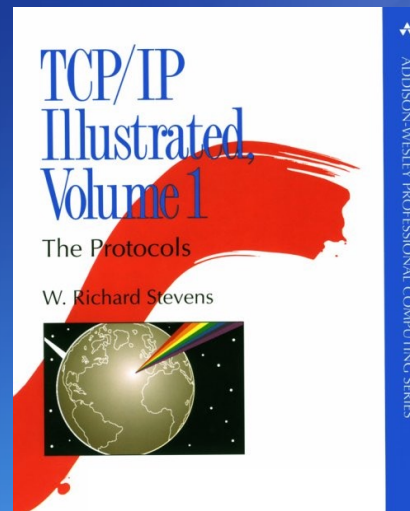
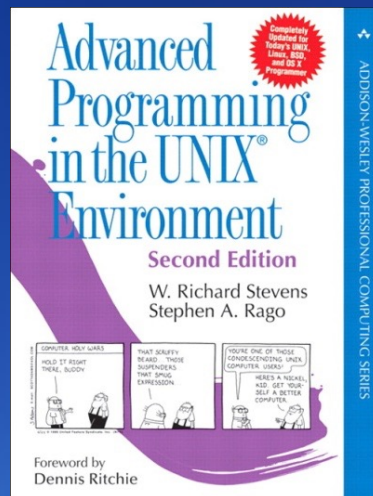
# W. Richard Stevens (1951~1999)



Ph.D. (Systems Engineering), Univ. of Arizona, 1982

<http://www.kohala.com/start/>

[http://en.wikipedia.org/wiki/W.\\_Richard\\_Stevens](http://en.wikipedia.org/wiki/W._Richard_Stevens)





# Administration Misc.

- **Class slides & hand-written assignments**

<http://www.csie.ntu.edu.tw/~pjcheng/course/sp2025>

- **Programming assignments, videos & grades (NTU COOL)**

<https://cool.ntu.edu.tw/courses/55597>

- **Code submission**

GitHub (TBA)

- **Office hours**

R218, 9:30~11:30, Tuesday (make appointments first)

- **Forum for reference**

ptt2: **SysProgram** board



# ptt2 SysProgram

1	m	3/14	todo2015	□	[分享]	安裝 ubuntu
2	m	3/15	anfranion	□	[問題]	pipe
3	m	8 3/15	LoganChien	R:	[問題]	pipe
4	m	3/18	pj2	R:	[問題]	pipe
5	m	3/22	jimmyken793	□	[筆記]	系程攻略
6	m	3/22	jimmyken793	□	[筆記]	系程攻略 2
7	m	3/22	jimmyken793	□	[筆記]	系程攻略 3
8	m	3/22	jimmyken793	□	[筆記]	系程攻略 番外 HTTP Protocol
9	1	3/23	jimmyken793	□	[分享]	用Browser看HTTP Header的工具
10	m	3/24	hrxxx3x5x	□	[分享]	structure alignment/padding
11	m	1 3/24	LoganChien	□	[分享]	struct and C standard
12	m	4 3/27	LoganChien	□	[分享]	系程攻略 4
13	m	3/31	zenixls2	□	[轉][閒聊]	setting open file limit
14	m	2 4/11	LoganChien	□	[分享]	簡介 link, stat, chdir, opendir (1)
15	m	2 4/11	LoganChien	□	[分享]	簡介 link, stat, chdir, opendir (2)
16	m	5 4/12	LoganChien	□	[分享]	簡介 link, stat, chdir, opendir (3)
17	m	1 6/15	benck	□	[教學][小倫]	系程HW1 (select)
18		6/15	benck	□	[教學][顆顆]	系程HW2攻略1 (題目敘述)
19	m	6/15	benck	□	[教學][顆顆]	系程HW2攻略2 (dir系列函式)
20	m	6/15	benck	□	[教學][顆顆]	系程HW2攻略3 (symbolic link)
21	m	6/15	benck	□	[教學][顆顆]	系程HW2攻略4 (常見問題)
22	m	6/15	benck	□	[教學][小倫]	系程HW3攻略1 (mergesort)
23	m	6/15	benck	□	[教學][小倫]	系程HW3攻略2 (fork)
24	m	6/15	benck	□	[教學][小倫]	系程HW3攻略3 (資料結構)
25	m	6/15	benck	□	[教學][小倫]	系程HW3攻略4 (實作buffer)
26	m	6/15	benck	□	[教學][小倫]	系程HW3攻略5 (加速mergesort)
27	m	6/15	benck	□	[教學][小倫]	系程HW3攻略6 (其他)
28	m	6/15	benck	□	[教學][小倫]	系程HW4攻略 (何謂get/post)
29	m	6/15	benck	□	[教學][小倫]	系程HW4攻略 (pipe)
30	m	6/15	benck	□	[教學][小倫]	系程HW4攻略 (exec/環境變數)
31	m	6/15	benck	□	[教學][小倫]	系程HW4攻略 (signal)
32	m	6/15	benck	□	[教學][小倫]	系程HW4攻略 (各case說明)
33	m	6/15	benck	□	[教學][小倫]	系程HW4攻略 (header)
34	m	6/15	benck	□	[教學][小倫]	系程Thread簡介
35	m	6/15	LoganChien	□	[教學]	簡介 Kernel/User Mode
36	m	6/15	LoganChien	R:	[教學]	簡介 Kernel/User Mode
37	m	6/15	LoganChien	□	[教學]	簡介 fork, exec*, pipe, dup2 (1)
38	m	6/15	LoganChien	□	[教學]	簡介 fork, exec*, pipe, dup2 (2)



# Topics to be Covered

- **Basic OS Preface/Introduction**
- **File I/O**
- **Standard I/O Library**
- **Files and Directories**
- **System Data Files and Information (optional)**
- **Environment of a Unix Process**
- **Process Control & Relationships**
- **Signals**
- **Inter-process Communication**
- **Thread Programming**
- **Network Programming**

# Grading Criteria

- **Mid-term exam: 30%**
- **Final exam: 30%**
- **Several hand-written exercises: 8%**
- **4 programming assignments (GitHub): 32%**
  - ▣ Not allow to deliver hand-written exercises late
  - ▣ Late for programming assignments: 100%→0%
  - ▣ Plagiarism: no credit



# Relation to Other CS Courses

- **Prescribed courses**

- Programming language
  - Introduction to computer programming
  - Data structures and algorithms
  - Systems programming (this course)
- System
  - Operating systems, computer network

- **Advanced courses**

- Cloud computing, large-scale information system, embedded system...

# Enrollment

CS majors, double majors >

CS minors >

Others

Slide/assignment password:

\*\*\*\*\*

Workstation account application

Chinese form   English form

If classroom is not fully occupied,  
students can sit in on this class.



# Enjoy & Have Fun!



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Graduate Institute of Multimedia and Networking, National Taiwan University

