系統程式設計
Systems Programming

鄭卜壬教授
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Department of Computer Science and Information Engineering
Graduate institute of Multimedia and Networking, National Taiwan University

Who am I?

- **Director** (Office: R218)
  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

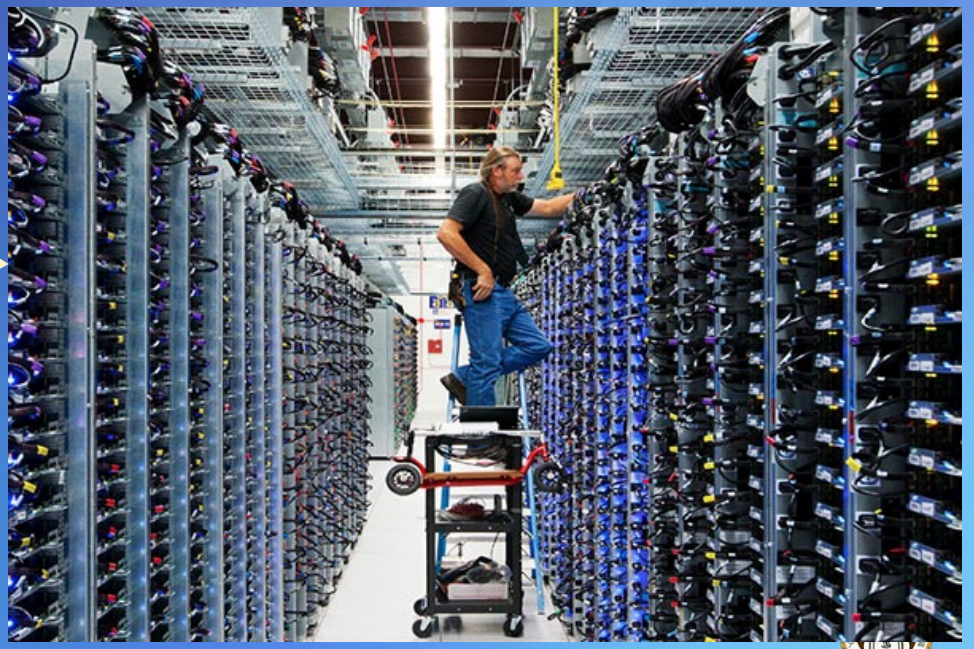
You are expected ….

to be familiar with the UNIX-like systems

to become good system programmers

Server

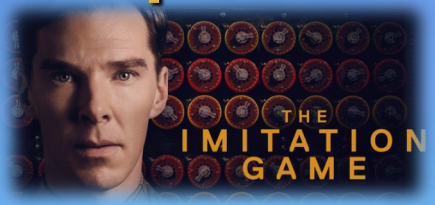
Client



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 inventor: Dennis Ritchie
- **Support many users running many programs at the same time, all sharing the same computer 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

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UNIX

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

Bell Labs Research

Berkley Software Distributions

* POSIX.1 (IEEE, ISO) standard!

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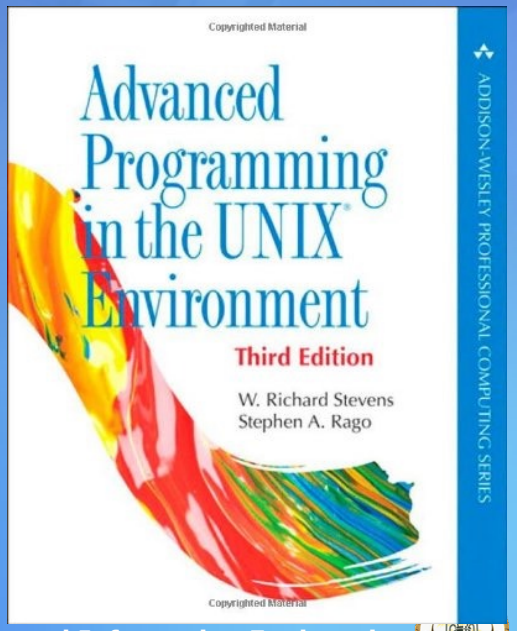
- **Required Text Book**
  - "Advanced Programming in the Unix Environment" by W. Richard Stevens and Stephen A Rago, Addison-Wesley, 3rd Edition, 2013. (source code)
- **Reference Book:**
  - "Understanding UNIX/LINUX Programming: A Guide to Theory and Practice" by Bruce Molay, Prentice Hall, 2002.
  - "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



Tei-Wei Kuo, Chi-Sheng Shih, Hao-Hua
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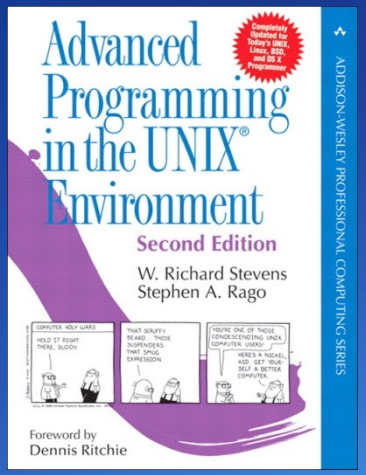
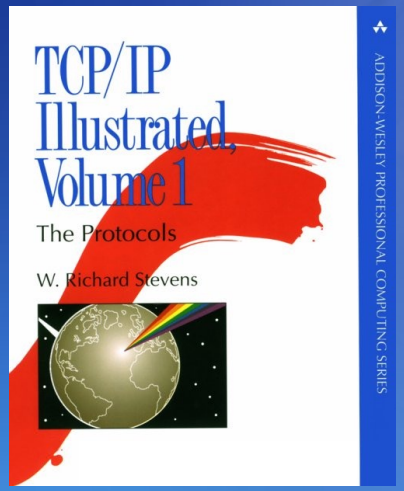
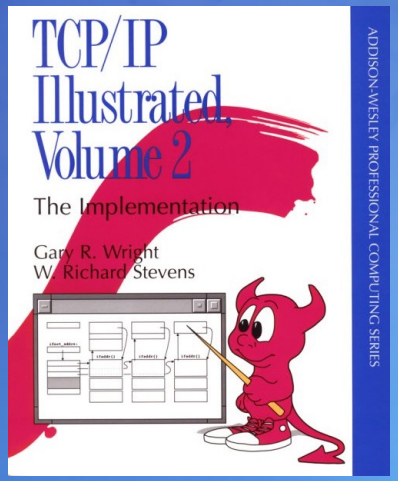
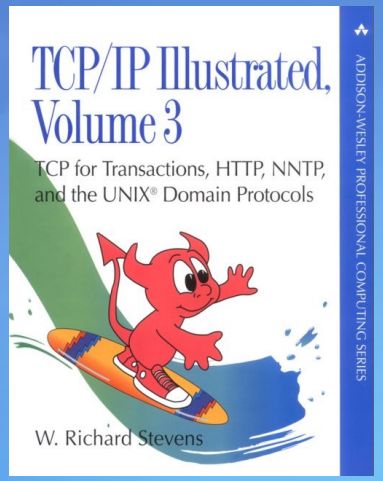
W. Richard Stevens (1951~1999)

Ph.D. (Systems Engineering), Univ. of Arizona, 1982
http://www.kohala.com/start/
http://en.wikipedia.org/wiki/W._Richard_Stevens









Administration Misc.

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

  http://www.csie.ntu.edu.tw/~pjcheng/course/sp2024
- **Programming assignments, videos & grades (NTU COOL)**

  https://cool.ntu.edu.tw/courses/43773
- **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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