# 系統程式設計
# Systems Programming

鄭卜壬教授
臺灣大學資訊工程系

Tei-Wei Kuo, Chi-Sheng Shih, Hao-Hua Chu, and Pu-Jen Cheng©2008
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

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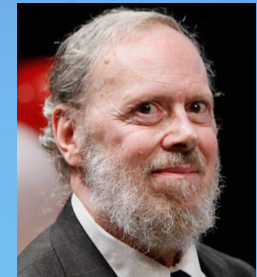
**D. Ritchie and K. Thompson. The UNIX Time-Sharing System. *Communications of the ACM,* 1974**

# UNIX

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

**Bell Labs Research**

**Berkley Software Distributions**

First Edition

Sixth Edition
Seventh Edition

1BSD,…, 4.0BSD

System V Release 2,3

XENIX

MINIX

Chorus

UNIX System V Release 4

Mach

SUNOS
Solaris
Solaris 2

4.3BSD
4.3BSD Tahoe
4.3BSD Reno
4.4BSD Lite

\* 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)
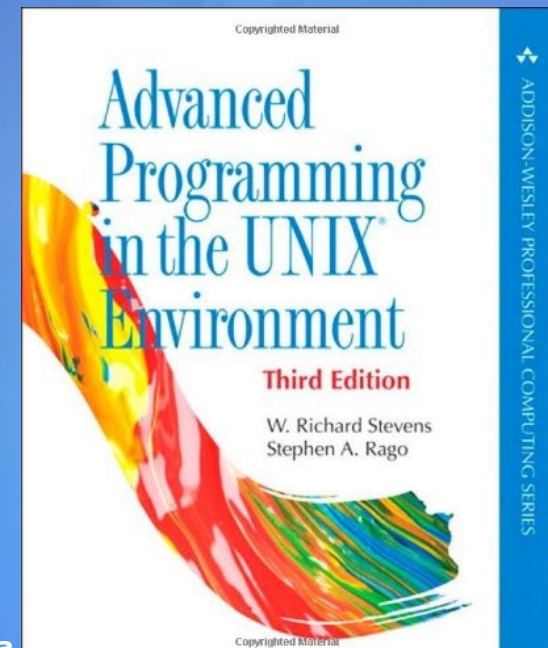- **Reference Book:**
  - "Understanding UNIX/LINUX Programming: A Guide to Theory and Practice" by Bruce Molay, Prentice Hall, 2002.
  - "The Art of UNIX Programming" by Eric S. Raymond (http://www.catb.org/~esr/writings/taoup/html/)
- **Prerequisites:**
  - Basic C/C++ programming skill
- **Getting started with UNIX:**
  - A material from Stanford (link) Compile, link & debug program, gcc, make, gdb, shell commands



Copyrighted Material

Advanced Programming in the UNIX® Environment

**Third Edition**

W. Richard Stevens
Stephen A. Rago

ADDISON-WESLEY PROFESSIONAL COMPUTING SERIES

Copyrighted Material

**Tei-Wei Kuo, Chi-Sheng Shih, Hao-Hua
Department of Computer Science and Information Engineering
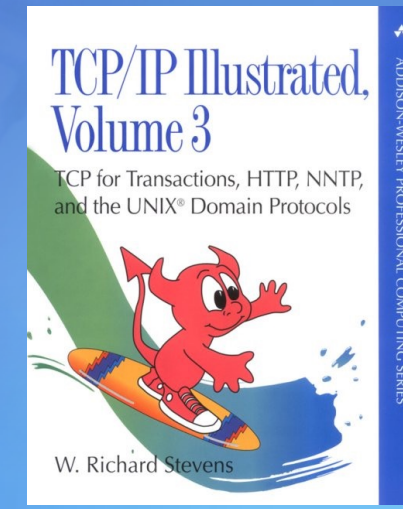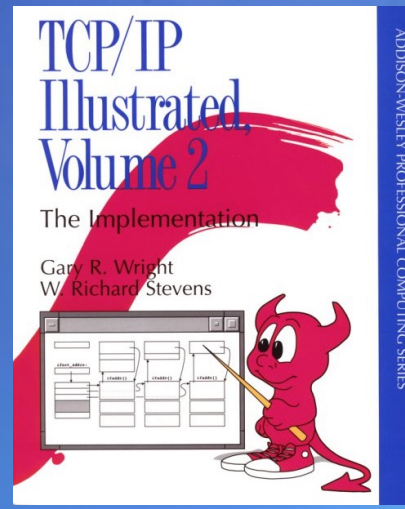Graduate institute of Multimedia and Networking, National Taiwan University**

# 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
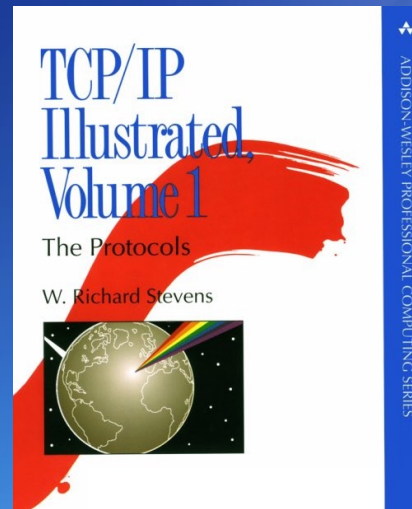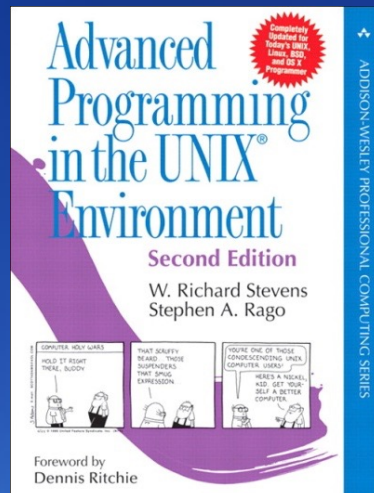
# Administration Misc.

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

  http://www.csie.ntu.edu.tw/~pjcheng/course/sp2023

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

  https://cool.ntu.edu.tw/courses/32435

- **Code submission**

  GitHub (TBA)

- **Office hours**

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

- **Forum for reference**

  ptt2: **SysProgram** board

# Systems Programming
Fall 2023

| LAST NEWS | DESCRIPTION | LECTURE SLIDES | ASSIGNMENTS | GRADES | RESOURCES | CONTACT |
|-----------|-------------|----------------|-------------|--------|-----------|---------|

## 2023/09/05

- [slide] **Overview of the Course**

- [slide] **Introduction to OS and UNIX**

- [info] The course will be offered face-to-face in R102.

This course is designed for sophomore CS-major students. Students will learn how to write programs using system services provided by Unix-like systems.

| LAST NEWS | DESCRIPTION | LECTURE SLIDES | ASSIGNMENTS | GRADES | RESOURCES | CONTACT |
|-----------|-------------|----------------|-------------|--------|-----------|---------|

## Schedule

| Date | Topic | Reading & Material |
|------|-------|--------------------|
| 2023/09/07 | **Course Overview**<br>**OS Concepts** | **Concept of System Call**<br>**UNIX Programming Tools**<br>Capter 1 (partial) |

**NTU COOL**

*112-1 (2023 Fall)*

搜尋內容

首頁

課程資訊

課程內容

成績

▼ **Week 1 - 9/7**

🔗 **Tutorial - Unix Basics (demo) (by TAs)**

🔗 **Tutorial - Makefile Basics (demo) (by TAs)**

🔗 **Tutorial - GDB Basics (by TAs)**

🔗 **Tutorial - GDB Basics (demo) (by TAs)**

🔗 **Tutorial - Git/GitHub Basics (by TAs)**

🔗 **Tutorial - Vim Basics (by TAs)**

```
 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)
```

**ptt2
SysProgram**

# 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
# Workstation account application
Chinese form   English form

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