微算機系統 課程介紹

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Introduction to Microprocessor System

1. Software Overview of the Microprocessor System

- *Machine Language*
  - *CPU is passive, and only "recognizes" 0-1* ***machine language****.*
  - *In the past, in order to tell a CPU to do some proper JOB, a programmer needs to memorize (or look-up) the machine language corresponding to the JOB, which is really a heavy burden (to a programmer).*

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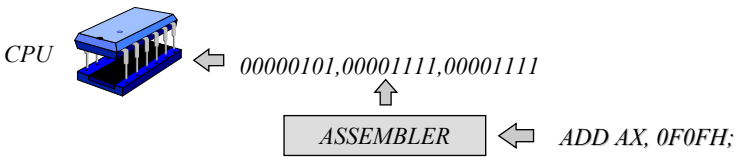
- *Assembly Language*
  - *A solution of this problem is to give each specific JOB a "name", and to write an ASSEMBLER to translate the name to its corresponding machine language.*



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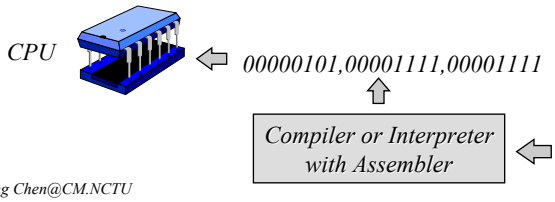
- *High-Level Programming Language*
  - *But, the **Assembly language** is still uneasy to memorize. Hence, people design a **high-level language** that assembles everyday language, and let the **Compiler** or **Interpreter** to translate the high-level language to its respective machine codes.*
- *Object Oriented Programming Language*
  - *Recently, programmers are still not satisfied on conventional high-level languages because of the program **maintenance, re-usability** and **other problems**. Thus, object-oriented language becomes a new trend.*



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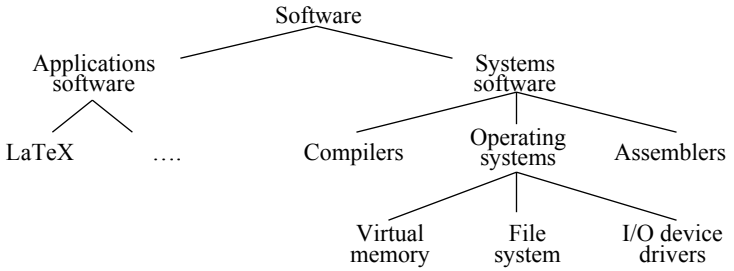
- *It soon becomes apparent that a set of programs could run more efficiently if there was a separate program that supervise these programs, and therefore differentiation between **application software** and **system software** becomes necessary.*



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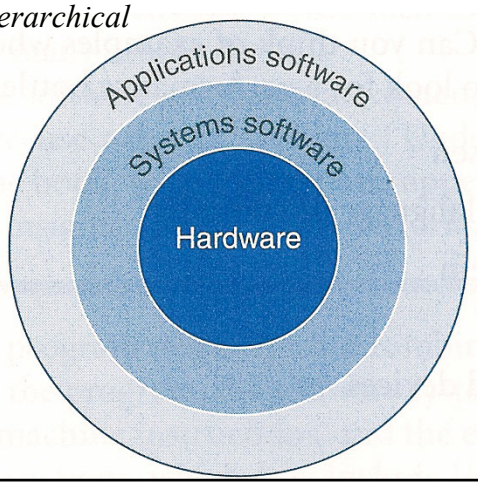
- *A simplified view of hardware and software as hierarchical layers.*



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2. Hardware Overview of the Microprocessor System

- *Vacuum Tube → Transistor → IC → VLSI*
- *Exponentially increase:*
  - Memory capacity
  - Processor speed

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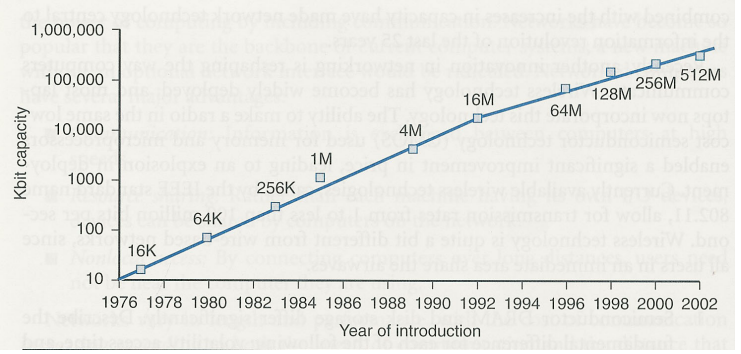
- *Growth of capacity per DRAM chip over time*
  - *From around quadrupled capacity every 3 years*
  - *To around quadrupled capacity every 4 years*



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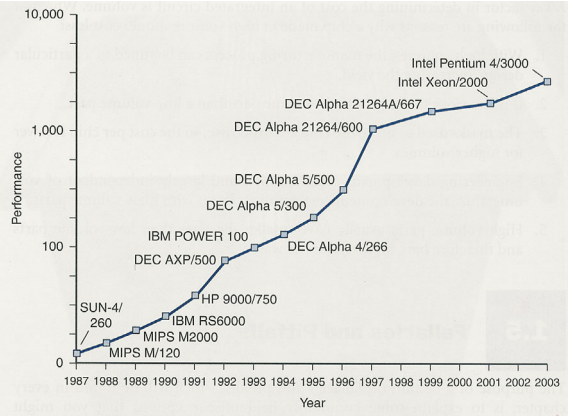
- *Performance increment of workstations (relative to SPECint performance of VAX-11/780)*
  - *Around 1.5~1.6 times per year*



Introduction to Microprocessor System

3. Things you'll be learning in this course

- *How computers work, a basic foundation*
- *How to analyze their performance*
- *Issues affecting modern processors (caches, pipelines, etc).*

Syllabus

- *Textbook*
  - David A. Patterson and John L. Hennessy, *Computer Organization & Design: The Hardware/Software Interface*, 3rd edition**,** Morgan Kaufmann Publishers, Inc: San Francisso, 2004.

Syllabus

- 授課教師資訊
  - Po-Ning Chen (陳伯寧)
  - Office：ED 831
  - E-mail: qponing@mail.nctu.edu.tw
  - Homepage: http://shannon.cm.nctu.edu.tw or http://140.113.13.233
- 上課時間
  - 週二EF 與 週五B

Syllabus

- **成績計算標準**
  - 期中考: 11/09舉行, 考兩小時，佔學期成績的40%。
  - 期末考: 01/11舉行，考兩小時，佔學期成績的40%。
  - 隨堂考: 10/01、10/19、11/30、12/21共四次，以1~2題為原則，考試時間為10分鐘，每次佔學期成績的5%。

Syllabus

- **講義網站**
  - http://shannon.cm.nctu.edu.tw
  - 請自行下載影印 或 至系上影印室影印

What is included in the exam?

- *What is included in the exam?*
  - *The syllabus-listed parts in textbook, including those which are covered by the lectures, and those which are not.*
  - *Some additional materials introduced in the lectures.*
- *50% of the exam problems will come from the text exercises.*

Syllabus

- ***Schedule***

日期	預定進度
9/14	Course Requirement and Syllabus Chapter 1: Computer Abstractions and Technology
9/17與9/21	教師出國(10月2日9:30am~12:30pm補課)
9/24	Chapter 1: Computer Abstractions and Technology
10/01與10/05	Chapter 2: Instructions: Language of the Computer 2.2 Operations of the Computer Hardware 2.3 Operands of the Computer Hardware 2.4 Representing Instructions in the Computer 2.5 Logical Operations 2.6 Instructions for Making Decisions 2.7 Supporting Procedures in Computer Hardware
10/02	2.8 Communicating with People 2.9 MIPS Addressing for 32-Bit Immediates and Addresses 2.10 Translating and Starting a Program 2.11 How Compilers Optimize 2.12 How Compilers Work: An Introduction 2.13 A C Sort Example to Put It All Together
10/08與10/12	2.14 Implementing an Object-Oriented Language 2.15 Arrays versus Pointers 2.16 Real Stuff: IA-32 Instructions
10/15與10/19	Chapter 3: Arithmetic for Computers 3.2 Signed and Unsigned Numbers 3.3 Addition and Subtraction 3.4 Multiplication 3.5 Division 3.6 Floating Point

Syllabus

- ***Schedule***

10/22與10/26	3.7 Real Stuff: Floating Point in the IA-32
10/29與11/02與 11/05	Chapter 4: Accessing and Understanding Performance 2.2 CPU Performance and Its Factors 2.3 Evaluating Performance 2.4 Real Stuff: Two SPEC Benchmarks and the Performance of Recent Intel Processors
11/09	期中考 (考一～四章)
11/12	Chapter 5: The Processor: Datapath and Control 5.2 Logic Design and Conventions 5.3 Building a Datapath
11/16與11/19	5.4 A Simple Implementation Scheme 5.5 A Multicycle Implementation
11/23與11/26	5.6 Exceptions 5.7 Microprogramming: Simplifying Control Design 5.8 An Introduction to Digital Design Using a Hardware Design Language 5.9 Real Stuff: The Organization of Recent Pentium Implementations Chapter 6: Enhancing Performance with Pipelining 6.1 An Overview of Pipelining 6.2 A Pipelined Datapath
11/30與12/03	6.3 Pipelined Control 6.4 Data Hazards and Forwarding 6.5 Data Hazards and Stalls 6.6 Branch Hazards 6.7 Using a Hardware Description Language to Describe and Model a Pipeline 6.8 Exceptions

Syllabus

- ***Schedule***

12/07與12/10	6.9 Advanced Pipelining: Extracting More Performance 6.10 Real Stuff: The Pentium 4 Pipeline
12/14與12/17	Chapter 7: Large and Fast: Exploiting Memory Hierarchy 7.2 The Basics of Caches 7.3 Measuring and Improving Cache Performance 7.4 Virtual Memory
12/21與12/24	7.5 A Common Framework for Memory Hierarchies 7.6 Real Stuff: The Pentium P4 and the AMD Opteron Memory Hierarchies
12/28與12/31	Chapter 8: Storage, Networks, and Other Peripherals 8.2 Disk Storage and Dependability 8.3 Networks 8.4 Buses and Other Connections between Processors, Memory, and I/O Devices 8.5 Interfacing I/O Devices to the Processor, Memory, and Operating System
1/04與1/07	8.6 I/O Performance Measures: Examples from Disk and File Systems 8.7 Designing an I/O System 8.8 Real Stuff: A Digital Camera
1/11	期末考(考五～八章)

Syllabus

- 助教
  - 蔣名駿 bluepig.cm88@nctu.edu.tw 工程四館823實驗室：分機5457
  - 卓雅婷 yatingcho.cm88@nctu.edu.tw 工程四館823實驗室：分機54570
- 助教Q&A時間與地點
  - 時間: Wednesday GH
  - 地點:工程四館823實驗室