Computer Organization and Assembly Language

August 21, 2000

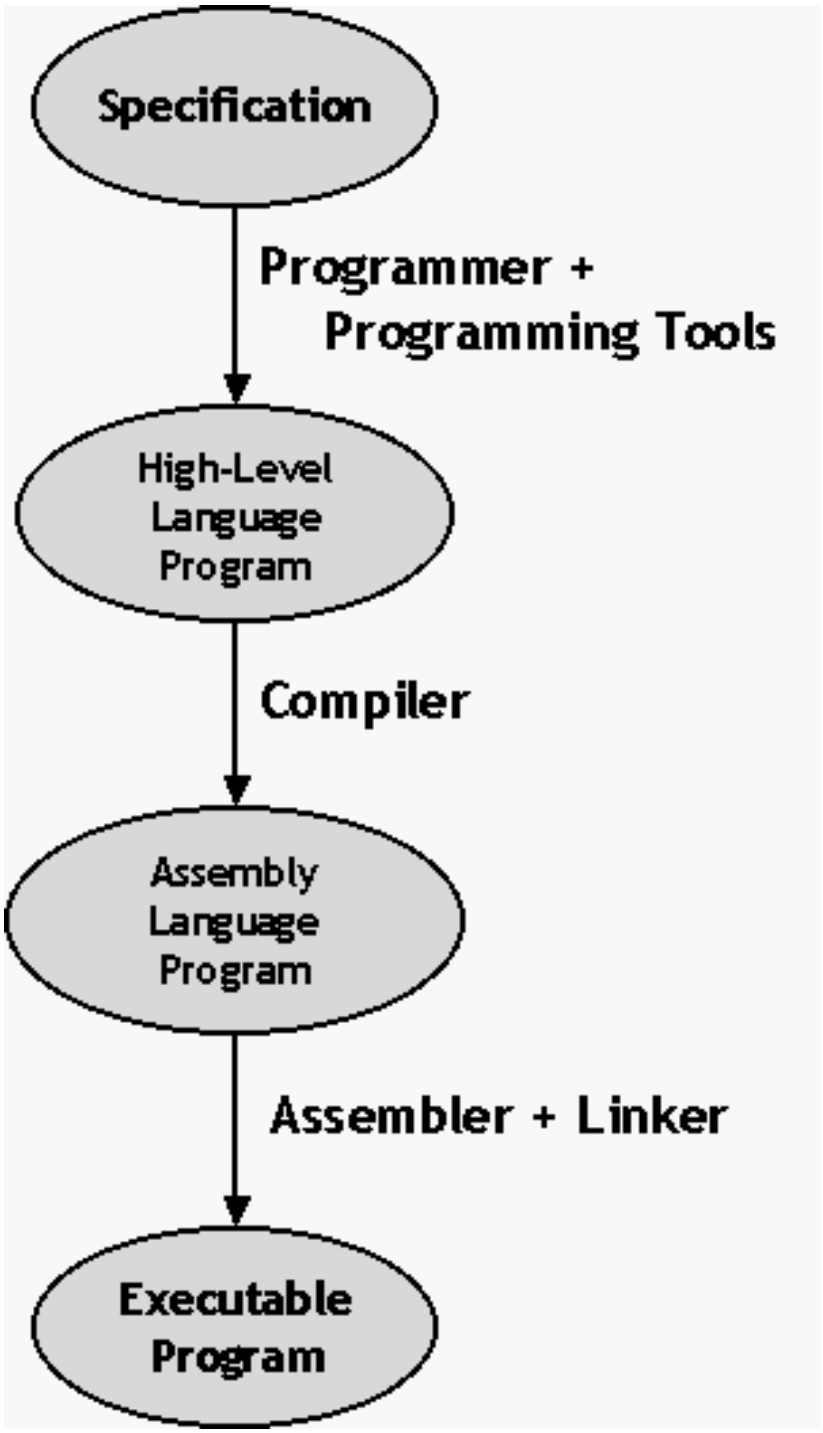
CSC201 Section 002

Fall, 2000

Plans for Today

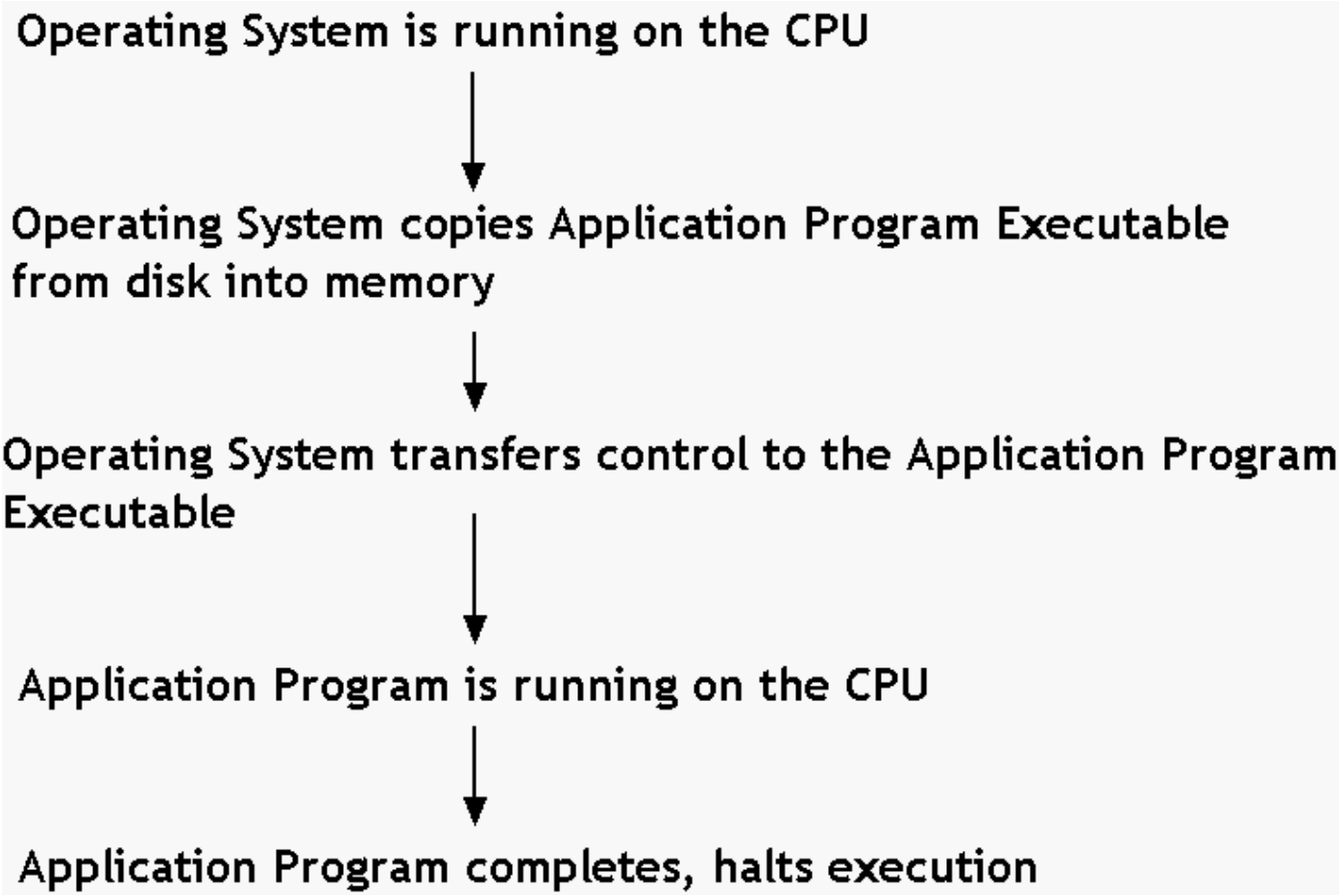
- Some Important Definitions
- Discussion of Course Structure
- Handouts and handins

The Software Translation Process



- We will study these parts in CSC201

The Software Execution Process



- We will study these parts in CSC201

Computer Architecture

- The set of instructions implemented directly by the hardware, and available to the assembly language programmer
- Example: the add instruction

- We will study this (in depth) in CSC201

Computer Organization

- The major parts or components of the computer, and what their function is
- Example: The arithmetic-logic unit (ALU)

- We will study this (somewhat) in CSC201

Computer Design

- The detailed implementation (in logic gates) of all of the parts of the computer
- Example: an adder circuit

- We will not study this in CSC201

Some Important Milestones

- The invention of the mechanical calculator (Pascal and Leibniz, 1600's)
- The design of the Differential Engine for computing logarithms, polynomials, trigonometric functions (Babbage, 1820's)
- The design of the Analytical Engine, the first real computer (Babbage, 1830's)

Milestones (cont.)

- The invention of electro-mechanical and electrical (vacuum-tube based) computers (1930-1960)
- The invention of the "stored-program" computer (late 1940's)
- The invention of cheap, fast "core" memory (1950's)
- The invention of caches (and the memory hierarchy) (1950's)
- The invention of pipelined instruction execution (1950's)
- The invention of floating point number representations and arithmetic (1940's to 1950's)

Milestones (cont.)

- The invention of the transistor (late 1940's, early 1950's)
- The invention of integrated circuits (late 1950's, early 1960's)
- The invention of the microprocessor (1970's)
- The invention of optimized instruction sets and superscalar processors (1980's and 1990's)

Some Technology Trends

- Microprocessor performance has been improving 50-60% per year since the mid-80's!
- Memory prices (per MB) have dropped by a factor of 5,000x in 24 years!
- Disk prices (per MB) have dropped by a factor of 20,000x in 18 years!

The Intel x86 Microprocessor Family

Chip	Date	MHz	Transistors	Memory	Notes
4004	1971	.1	2,300	640	First microprocessor on a chip
8008	1972	.1	3,500	16KB	First 8-bit microprocessor
8080	1974	2	6,000	64KB	First general-purpose CPU on a chip
8086	1978	5-10	29,000	1MB	First 16-bit CPU on a chip
8088	1979	5-8	29,000	1MB	Used in IBM PC
80286	1982	8-12	134,000	16MB	Memory protection present
80386	1989	16-33	275,000	4GB	First 32-bit CPU
80486	1989	25-100	1.2M	4GB	Built-in cache memory
Pentium	1993	60-233	3.1M	4GB	Two pipelines
Pentium Pro	1995	150-200	5.5M	4GB	Two levels of cache built-in
Pentium II	1997	233-400	7.5M	4GB	MMX instructions introduced

Why Study the Intel Architecture?

- It's worth studying one real assembly language, to see typical capabilities and complexities
- The Intel architecture isn't the best, but it's the most successful (and available to us)

What is SASM?

- A "higher-level" assembly language
- No registers; all operands are in memory
- Relies on Microsoft compiler, and macro definitions, to do a lot

Why Use SASM + High-Level Programming Tools?

- Real assembly languages are quite complex
  - 300+ instruction types, 10+ addressing modes, effect on condition codes, constraints on operand lengths, exceptions to *every* rule, …
- Real I/O is quite complex
  - conversions, interface to interrupt routines, details of device control, …
- SASM hides the details so we can concentrate on important concepts
- Later, we'll also look at some of the details

The Syllabus

- How to contact me
  - Before and after class
  - 1:15-2:15pm, Withers 220 (phone 515-7479)
  - E-mail: reeves@eos.ncsu.edu
  - My "home" office: EGRC 450 (phone 515-2044)
- The textbook
- Course is for CSC majors
- CSC210 is a prerequisite
- The Windows NT lab

Syllabus (cont.)

- Grading
  - 25% Homeworks
  - 40% Exams
  - 30% Final
  - 5% in-class
- Homeworks
- Exams
- Excused absences and late work
- Academic integrity

The Calendar

CALENDAR

Week	Monday	Wednesday	Friday	Readings in Textbook
ıgust 21-25				Chapter 1 Chapter 2
ıugust 28- ptember 01				Chapter 3
:ember 04-08	*Labor Day* *(no class)*			Chapter 4 (except Approximate Values
:ember 11-15	Homework #1 Due			Chapter 5 (except 1's complement, biased representation, some of 5.4, all of 5.5)
:ember 18-22	**Exam #1**			Chapter 6 Chapter 7 (except binary representation)
:ember 25-29				Chapter 9 (plus some of Chapter 8)
tober 02-06	Homework #2 Due			Chapter 10
tober 09-13	**Exam #2**			
tober 16-20	*Fall Break* *(no class)*			
:tober 23-27		Homework #3 Due		Chapter 11
ctober 30- ›vember 03		**Exam #3**		Chapter 12
ember 06-10				
ember 13-17		Homework #4 Due		Chapter 14
ember 20-24	**Exam #4**		*Thanksgiving Break* *(no class)*	
vember 27- :cember 01				Chapter 13
ember 04-08		Homework #5 Due		TBD
:cember 19 'uesday) → **ınal Exam!**				

Get Acquainted

Some Information