

ITM1010

Computer and Communication Technologies

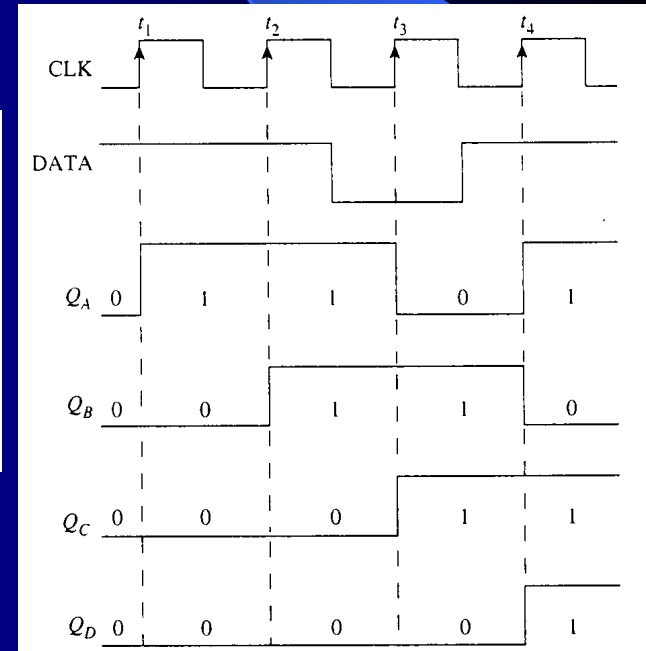
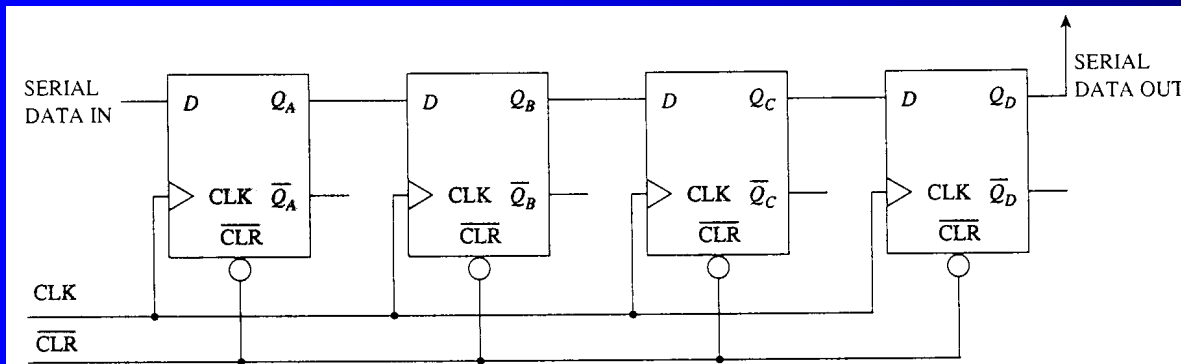
Lecture #8

Part I: Introduction to Computer Technologies

Sequential Circuits and Introduction to
Computer Organization

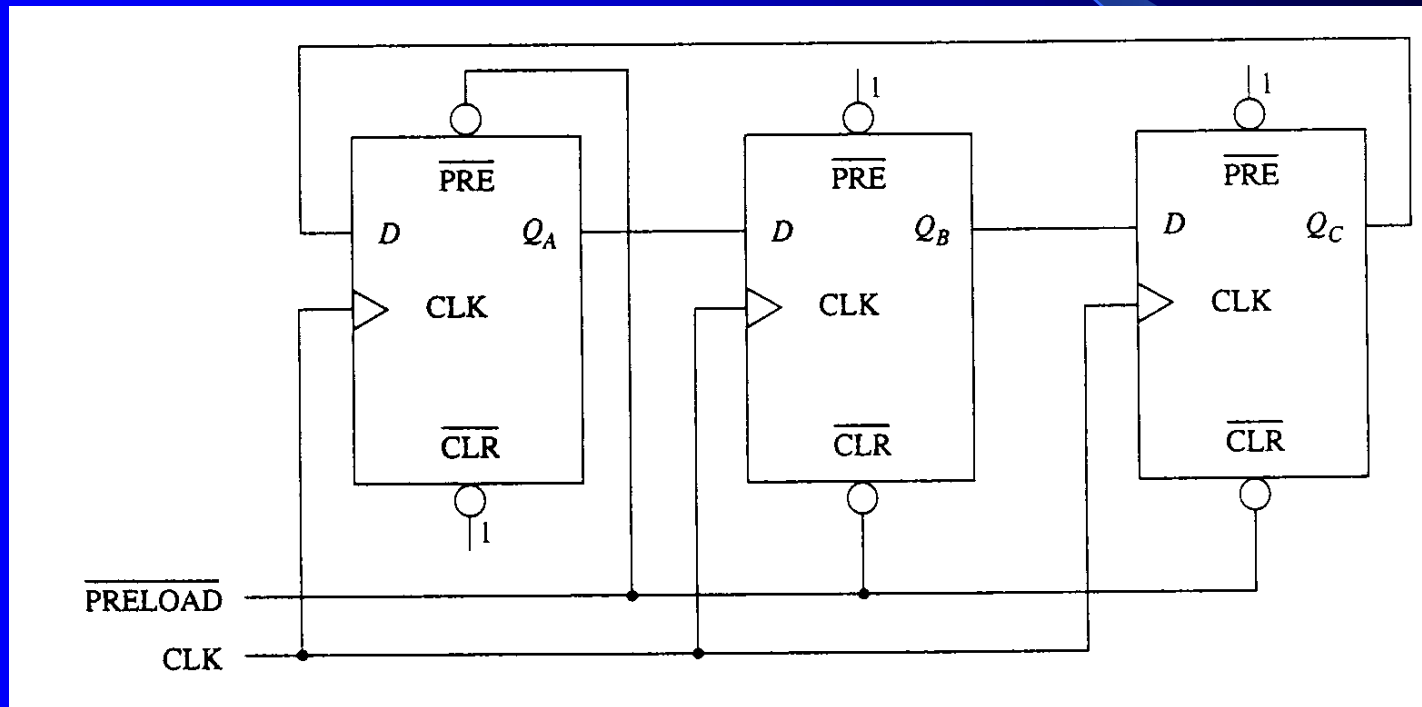
REGISTERS

- A group of latches or flip-flops used to store, transfer, or shift data
- Serial Shift Register
 - Data is clocked into the register bit by bit



RING COUNTER

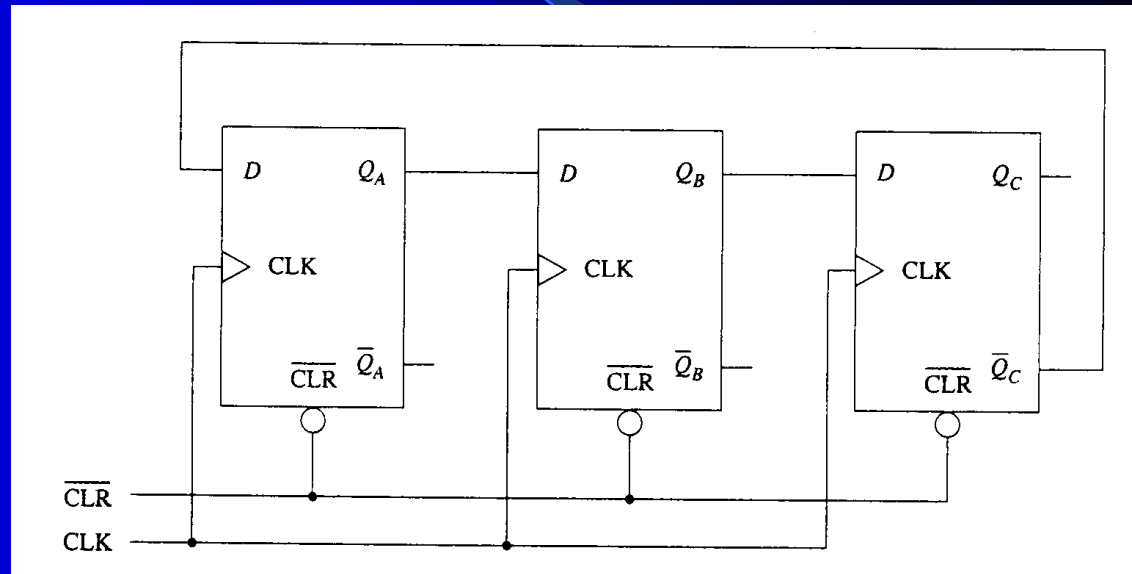
- The counter is a shift register that has its output connected back to its own input



JONHSON COUNTER

- Each bit is toggled in turn
- Mod-6

- 000
- 100
- 110
- 111
- 011
- 001
- 000

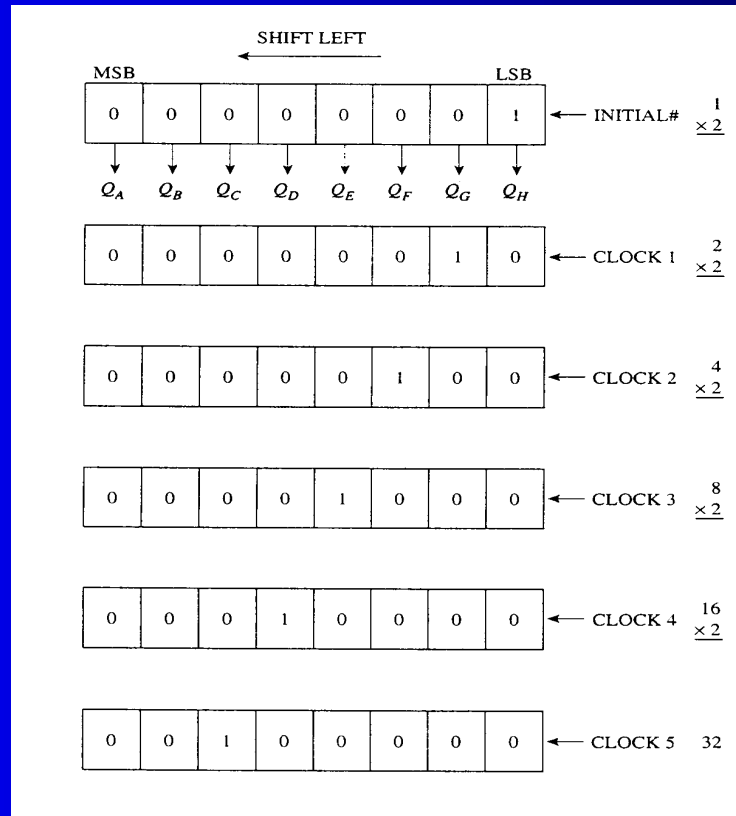


- With its unique bit pattern, any sequence can be detected with a 2-input gate

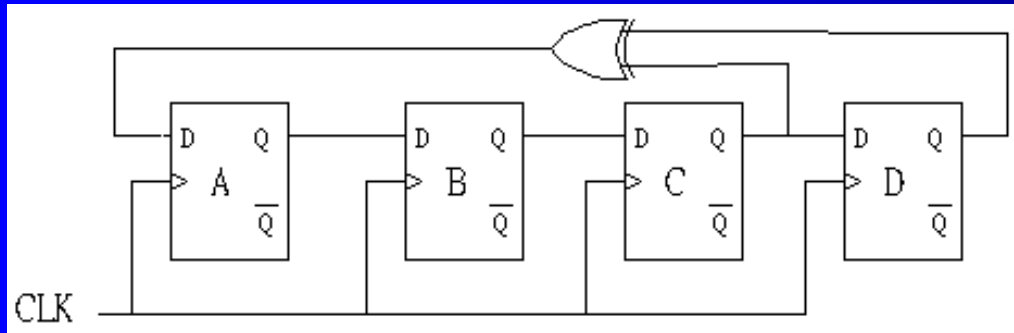


MULTIPLY/DIVIDE REGISTER

- A left shift operation multiplies a binary number by a factor of 2
- A right shift operation divides a binary number by a factor of 2



Pseudo-random sequence generator



Q_A	Q_B	Q_C	Q_D
0	0	0	0
1	0	0	0
0	1	0	0
0	0	1	0
1	0	0	1
1	1	0	0
0	1	1	0
1	0	1	1
0	1	0	1
1	0	1	0
1	1	0	1
1	1	1	0
1	1	1	1
0	1	1	1
0	0	1	1
0	0	0	1
1	0	0	0

INVALID CONDITION



A brief overview of computer programming

Programs

- Programs are instructions to make a computer perform a task.
- The part of the computer that actually executes the “program” is the microprocessor or central processing unit, CPU.
- CPU is a digital component that decodes and execute instructions.



Types of Instructions

- **Data Transfer Instructions:** Move data from one place to another including
 - REGISTERS, MEMORIES, I/O DEVICES
- **Data Operation Instructions:** Perform operations using one or two data and store the result. Operations include
 - ARITHMETIC, LOGIC, SHIFT
- **Program Control Instructions:** Change the sequence of operations (consecutive instruction flow) conditionally or non-conditionally
- **Others**
 - INTERRUPT
 - HALT



Instruction codes

- A binary pattern in a specific format. Example of a microprocessor which has a simple instruction set:

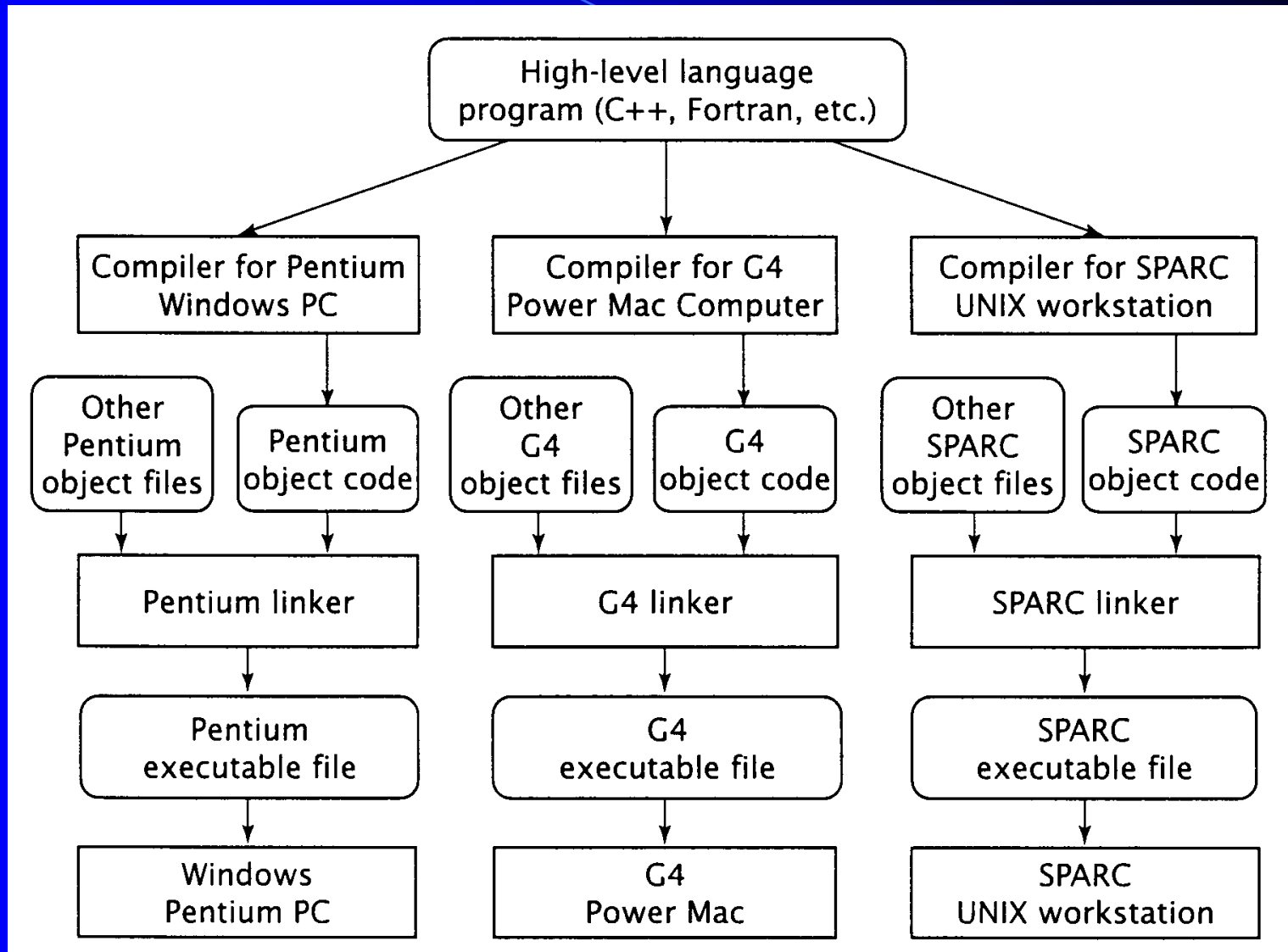
4 bits	2 bits	2 bits	2 bits		
opcode	operand #1	operand #2	operand #3	ADD A,B,C ($A = B + C$)	1010 00 01 10
4 bits	2 bits	2 bits			
opcode	operand #1	operand #2		MOVE A,B ($A = B$)	1000 00 01
				ADD A,C ($A = A + C$)	1010 00 10
4 bits	2 bits				
opcode	operand			LOAD B ($Acc = B$)	0000 01
				ADD C ($Acc = Acc + C$)	1010 10
				STORE A ($A = Acc$)	0001 00
4 bits					
opcode				PUSH B ($Stack = B$)	0101
				PUSH C ($Stack = C, B$)	0110
				ADD ($Stack = B + C$)	1010
				POP A ($A = stack$)	1100

Levels of programming languages

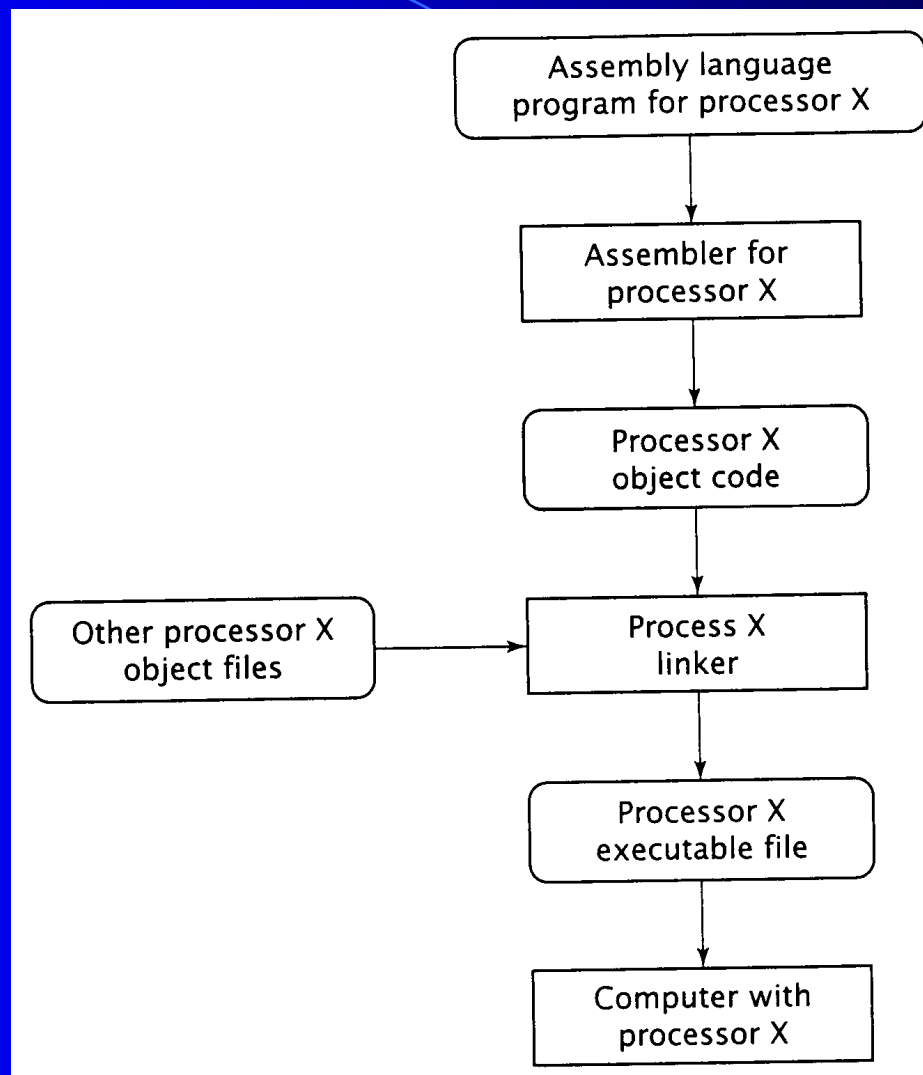
- High-level – platform independent
 - C++
 - JAVA
 - FORTRAN
- Assembly Language – microprocessor dependent
 - Instruction mnemonics representing individual instruction codes
- Machine Language – microprocessor dependent
 - Actual instruction codes



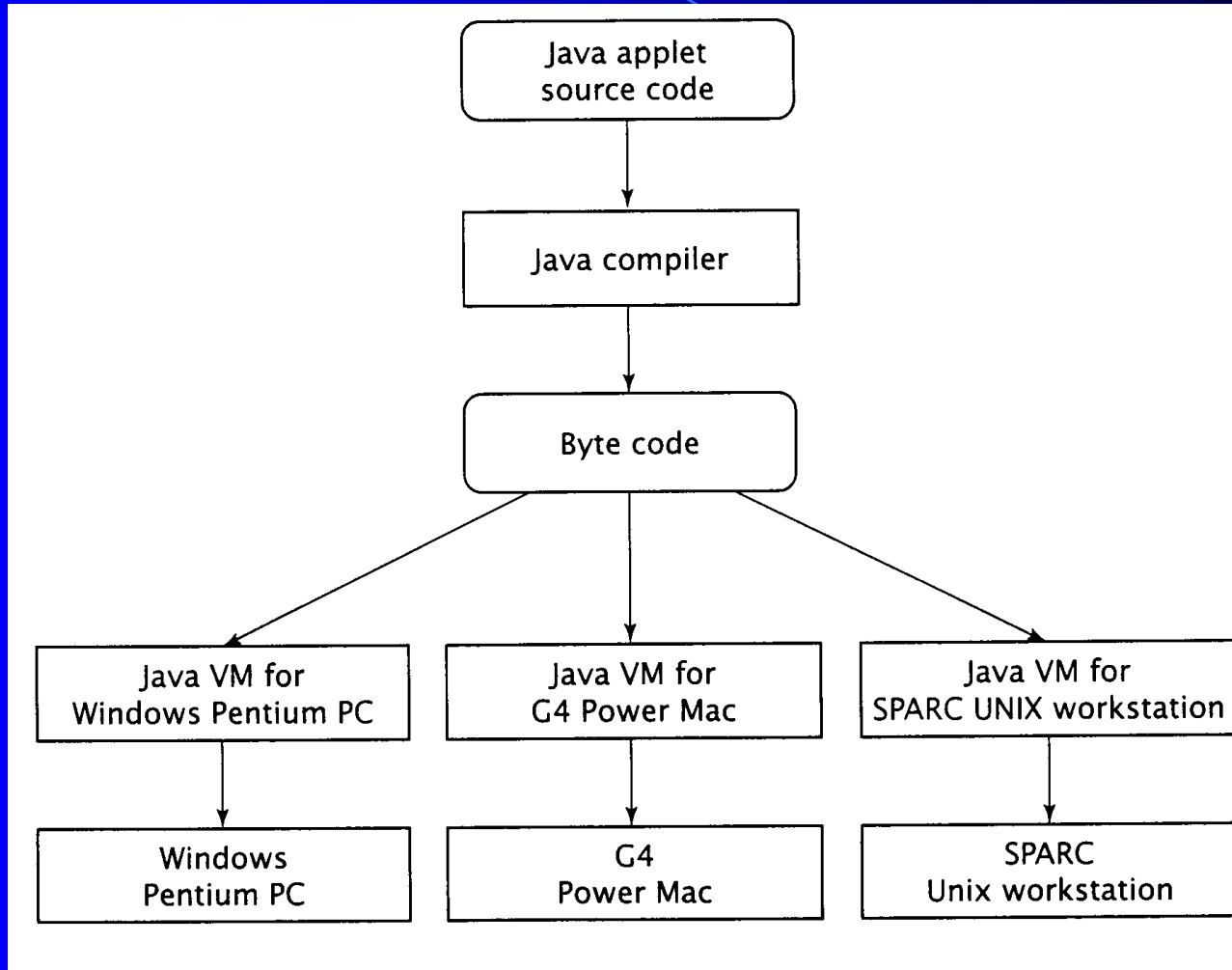
Compiling



Assembling



Java Compilation process



Computer Organization

What is inside a computer?

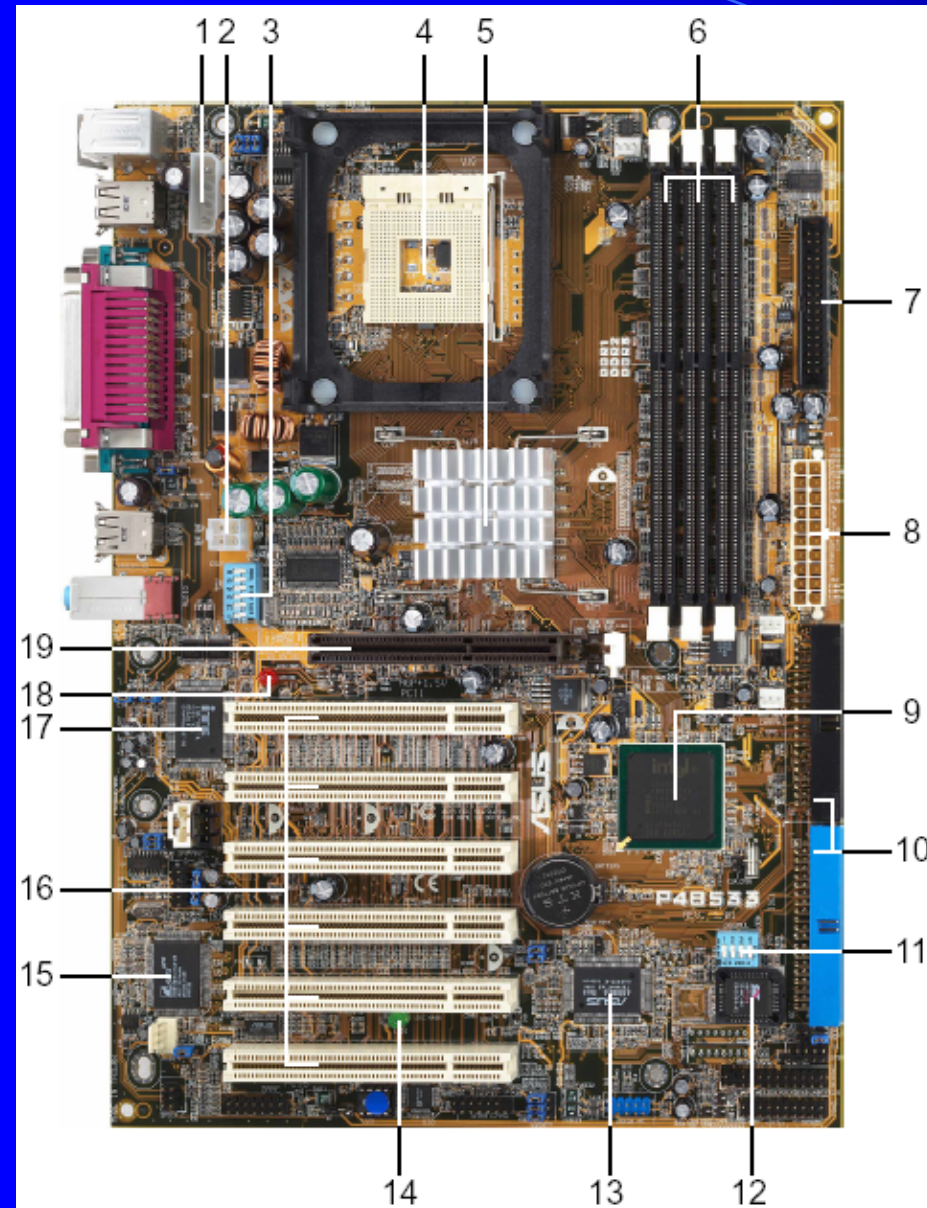


Motherboard

Sometimes called the system board or main board, the motherboard is the main circuit board of a PC. The motherboard typically contains the processor (or CPU), BIOS (basic input/output system), memory, mass storage interfaces, serial and parallel ports, expansion slots, and all the controllers required to communicate with standard peripheral devices, such as the display screen, mouse, keyboard and disk drive.



ASUS P4B533 Motherboard



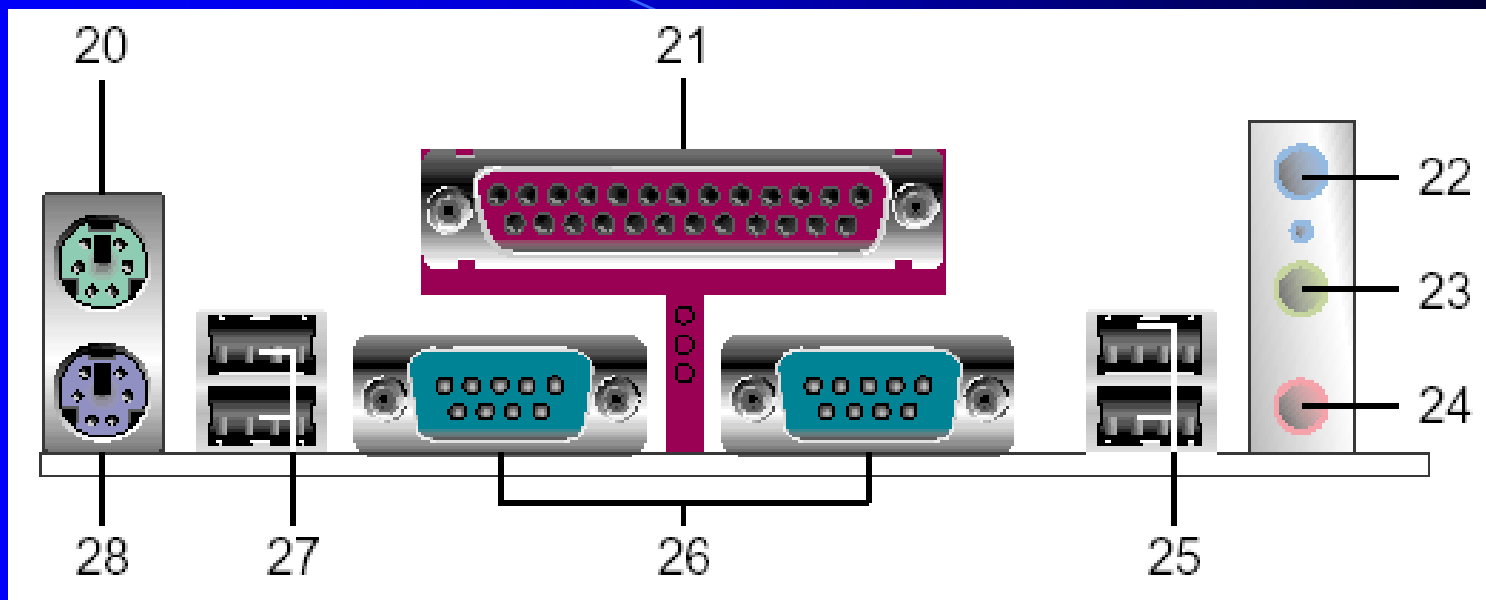
1. +12V connector
2. ATX (**AT** e**X**tended) 12V connector
3. **D**IP switches for CPU external frequency
4. CPU socket
5. North bridge controller (MCH)
6. DDR (**D**ouble **D**ata **R**ate) DRAM sockets
7. Floppy disk connector
8. ATX power supply
9. South bridge controller (ICH4)
10. IDE connectors
11. DIP switches for CPU frequency multiple
12. Flash EEPROM (4MB)
13. ASUS ASIC for voltage & IRQ control
14. Standby power LED (**L**ight **E**mitting **D**iode)
15. Audio controller
16. PCI slots
17. Super I/O controller for floppy, PP, SP etc
18. AGP warning LED
19. AGP slot

DIP: **D**ual **I**n-line **P**ackage

Electrically **E**rasable **P**rogramable **R**ead **O**nly **M**emory

Interrupt **R**e**Q**uest

ASUS P4B533 Motherboard



- 20. PS/2 (Personal System 2) mouse port
- 21. Parallel port (0.15 – 2MBPS)
- 22. Audio line in jack
- 23. Audio line out jack
- 24. Microphone jack

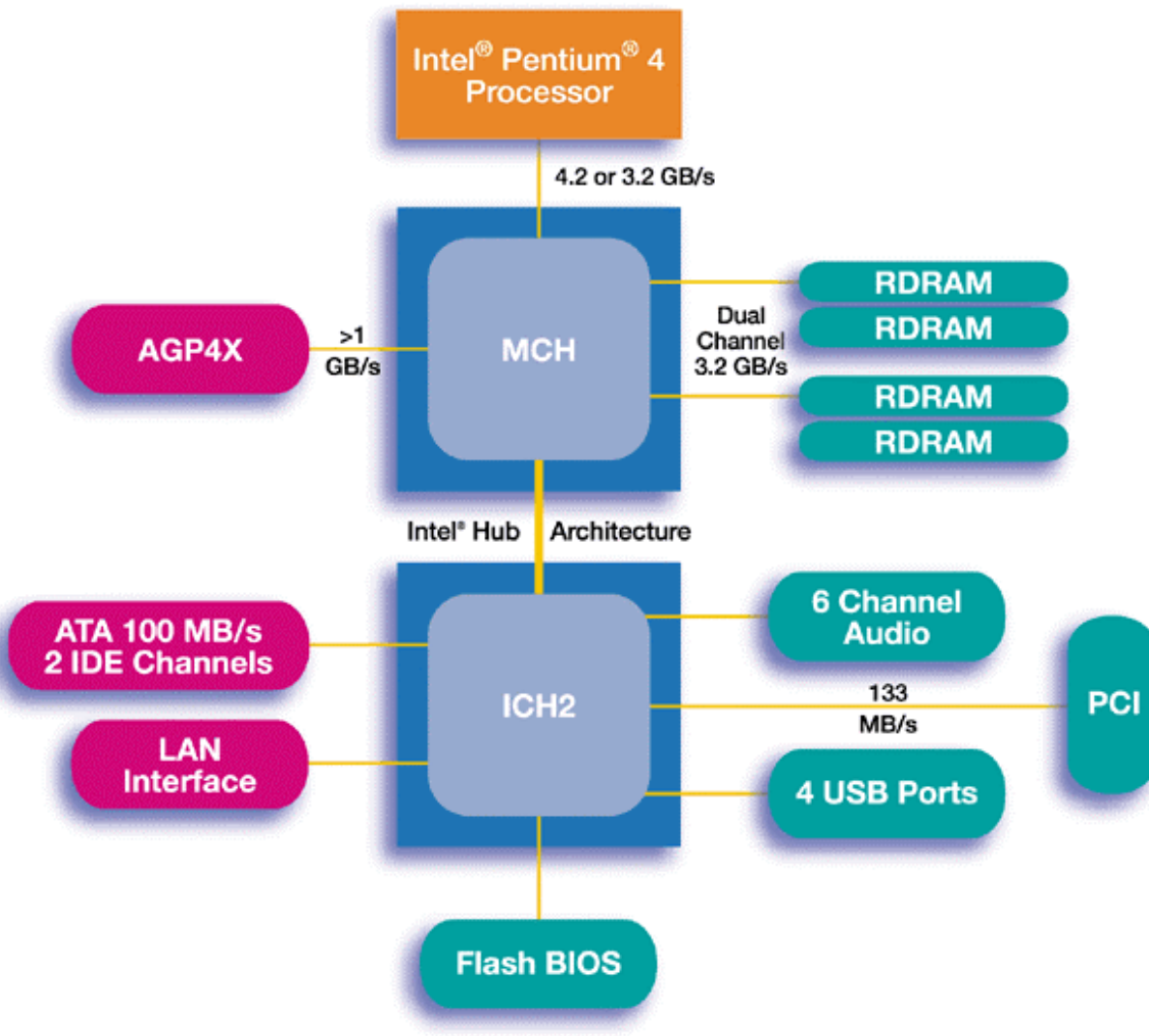
- 25. USB 2.0 ports 1 and 2
- 26. Serial port (0.23MBPS)
- 27. USB 2.0 port 3 and 4
- 28. PS/2 keyboard port

USB 1.1: 1.5 - 12MBPS

USB 2.0: 1.5 - 480MBPS

FireWire is a cross-platform implementation of the high-speed serial data bus - defined by IEEE Standard 1394: 400MBPS – 1600MBPS.

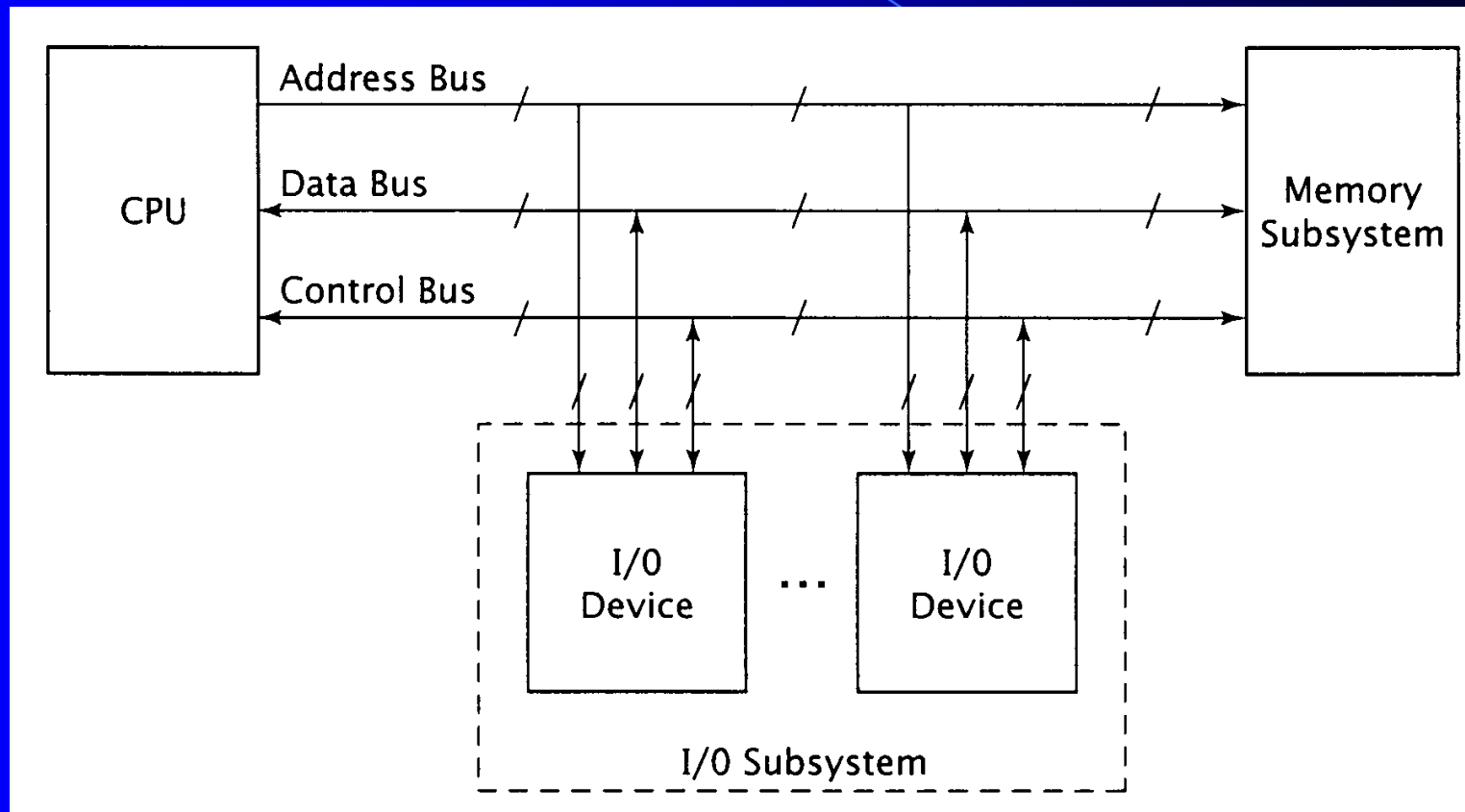
Intel 850 Chipset Family for P4 CPUs



Memory Controller Hub
I/O Controller Hub 2
Basic Input Output System
Universal Serial Bus
Local Area Network
Accelerated Graphics Port
Advanced Technology
AT Attachment
Integrated Drive Electronics
Peripheral Component
Interconnect
Random Access Memory
Dynamic RAM
Rambus DRAM
Read Only Memory
Central Processing Unit
Graphics Processing Unit



Generic Computer Organization



System Buses

- **Address Bus**
 - Specify a memory location for access by CPU
- **Data Bus**
 - Data channel between CPU and other components
- **Control Bus**
 - A collection of individual control signals
 - e.g. a signal to indicate whether a data is to be read into or written out of CPU

A system may have a hierarchy of buses. For example, it may use its address, data, and control buses to access memory, and an I/O controller. The I/O controller, in turn, may access all I/O devices using a second bus, often called an I/O bus or a local bus.

- e.g. PCI bus

