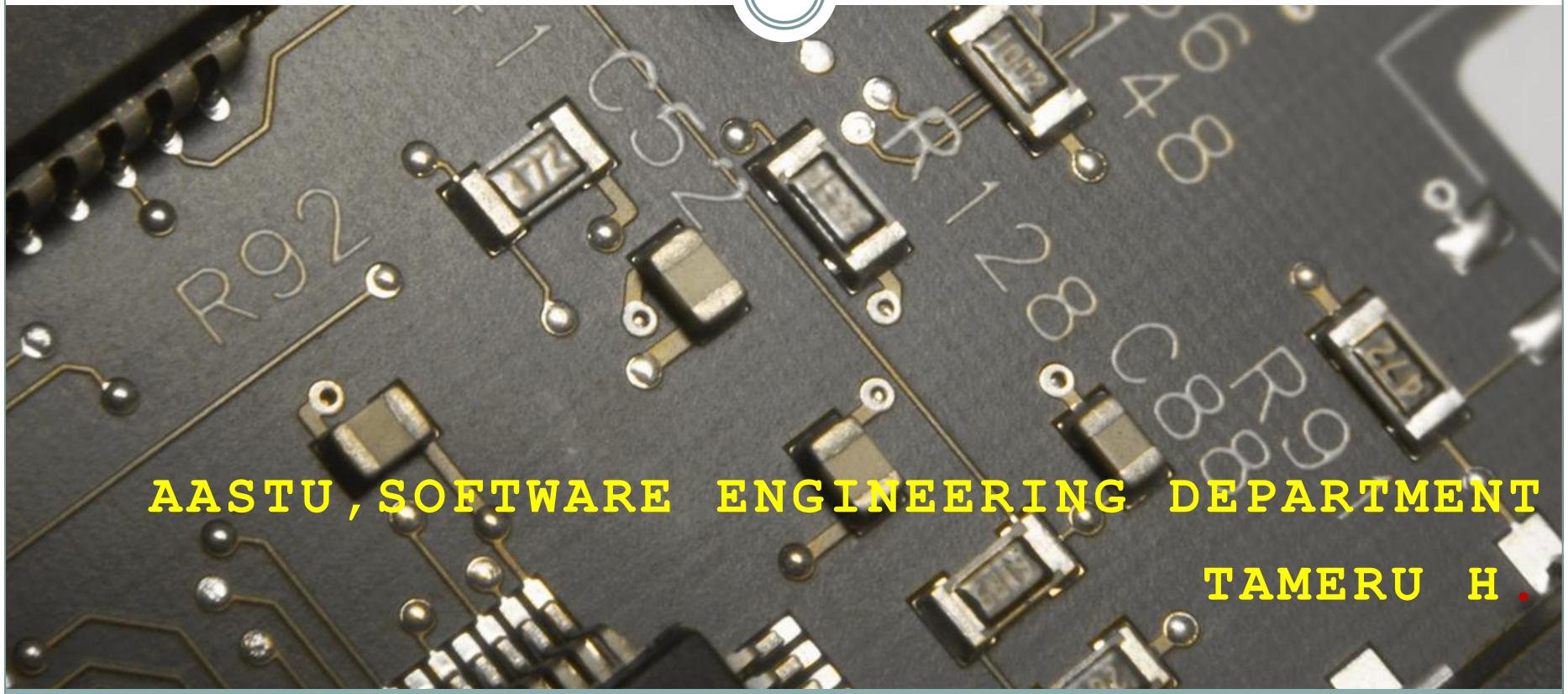
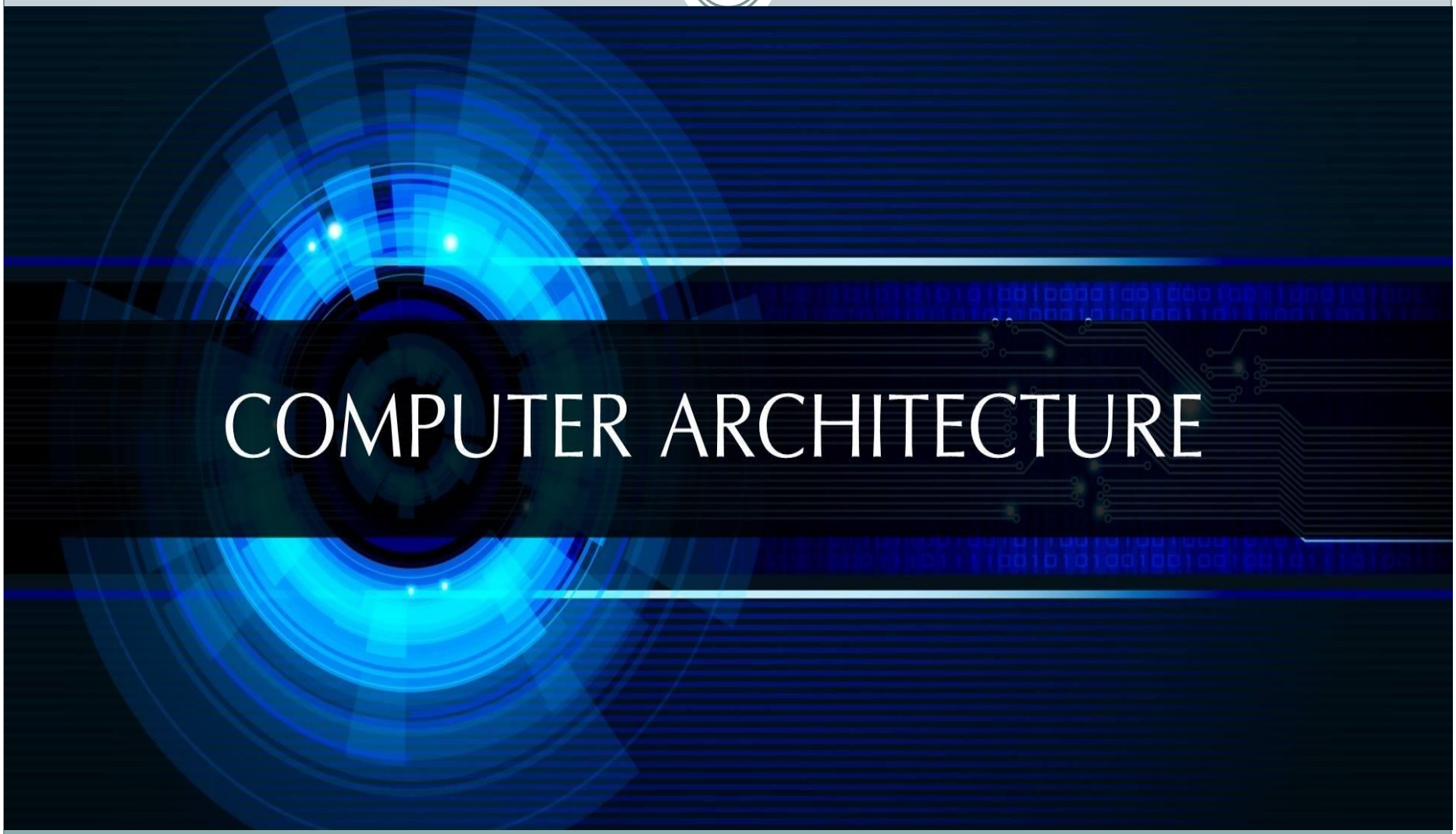
Computer Architecture and Assembly Language



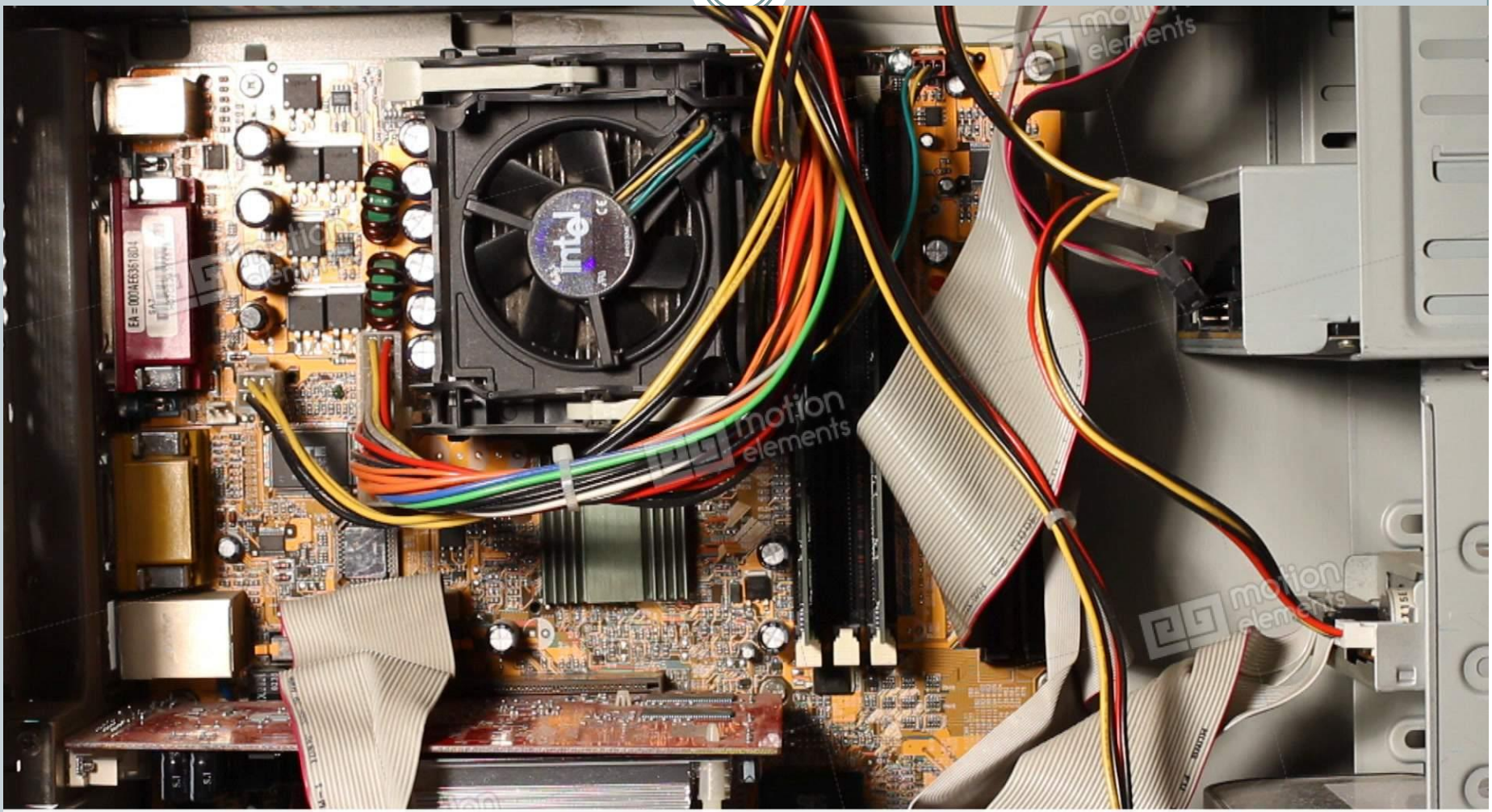
AASTU,SOFTWARE ENGINEERING DEPARTMENT

TAMERU H.

What do you expect?



Why study this course?



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- Architecture is a very **satisfying** profession
- A course in Architecture is a lot of fun.
- Architecture gives you the liberty to use the right side of your brain, the **creative part**.

What's Wrong With Assembly Language

Assembly language has a pretty bad reputation. Here are the reasons:

- Assembly is hard to learn.
- Assembly is hard to read and understand.
- Assembly is hard to debug.
- Assembly is hard to maintain.
- Assembly is hard to write.

Why Assembly language?

An old joke goes something like this:

"There are three reasons for using assembly language: speed, speed, and more speed."

- Assembly language has several benefits other than speed:

Cont'd…

- **Speed**. Assembly language programs are generally the fastest programs around.
- **Space**. Assembly language programs are often the smallest.
- **Capability**. You can do things in assembly which are difficult or impossible in HLLs.
- **Knowledge**. Your knowledge of assembly language will help you write better programs, even when using HLLs.

What can you do Assembly?

- Anything you want in the software world
- boot loader, or device drivers that live in ROM
- Operating System

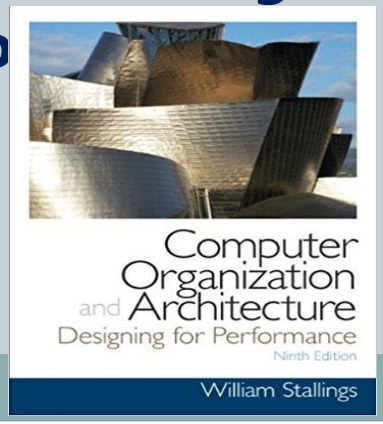
Course Outcome

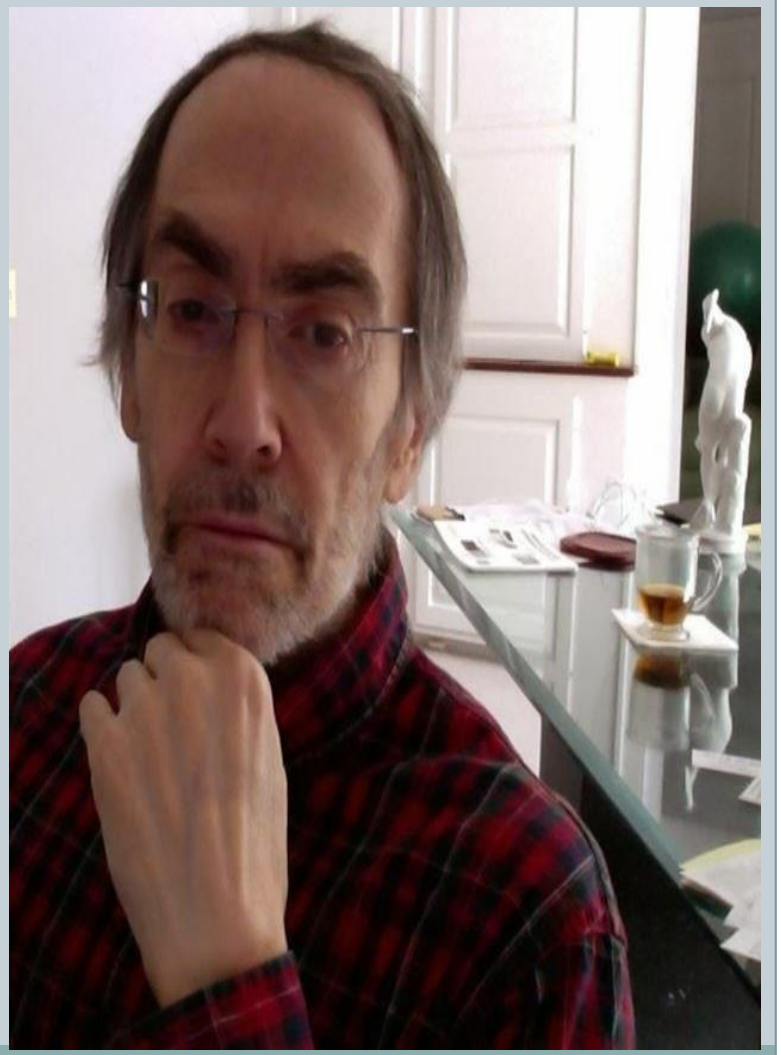
At the end of this course you'll be abele to:

- Understand the basics of computer hardware and how software interacts with computer hardware
- Analyze and evaluate computer *performance*
- Understand how computers *represent and manipulate data*
- Understand basics of *Instruction Set Architecture* (ISA) – MIPS
- Understand Assembly Programming Language

Text Book

- American Computer Science, Cryptography and Security textbook author.
- Written textbooks on computer science topics such as **Operating System, computer networks, computer organization, and crypto**





Who is the Computer Architect ?

The computer architect need to have the following principles:

- **Look Backward** (to the past): understand trade-offs, analyse the past
- **Look forward** (to the future): be the dreamer, and create new design.
- **Look Up** (towards problems in the computing stack): understand problems, Develop architecture to solve them.
- **Look down** (towards device/circuit technology: platform for the future

Chapter 1: Introduction

Organization and Structure

- **Computer architecture** refers to those attributes of a system visible to a programmer.
- **Computer organization** refers to the operational units and their interconnections that realize the architectural specifications.

Cont'd..

Example:

Architectural design issue: whether a computer will have a multiply instruction.

An organizational issue: whether that instruction will be implemented by a special multiply unit or by a mechanism that makes repeated use of the add unit of the system.

Cont'd…

How to make the organizational decision on this issue?

Cont'd…

The organizational decision may be based on:

- The anticipated *frequency* of use of the multiply instruction,
- The relative *speed* of the two approaches,
- And the *cost and physical size* of a special multiply unit.

STRUCTURE AND FUNCTION

- **Structure:** The way in which the components are interrelated.

- **Function:** The operation of each individual component as part of the structure.

Function

In general terms, there are only four basic functions that a computer can perform:

- **Data processing**
- **Data storage**
- **Data movement**
- **Control**

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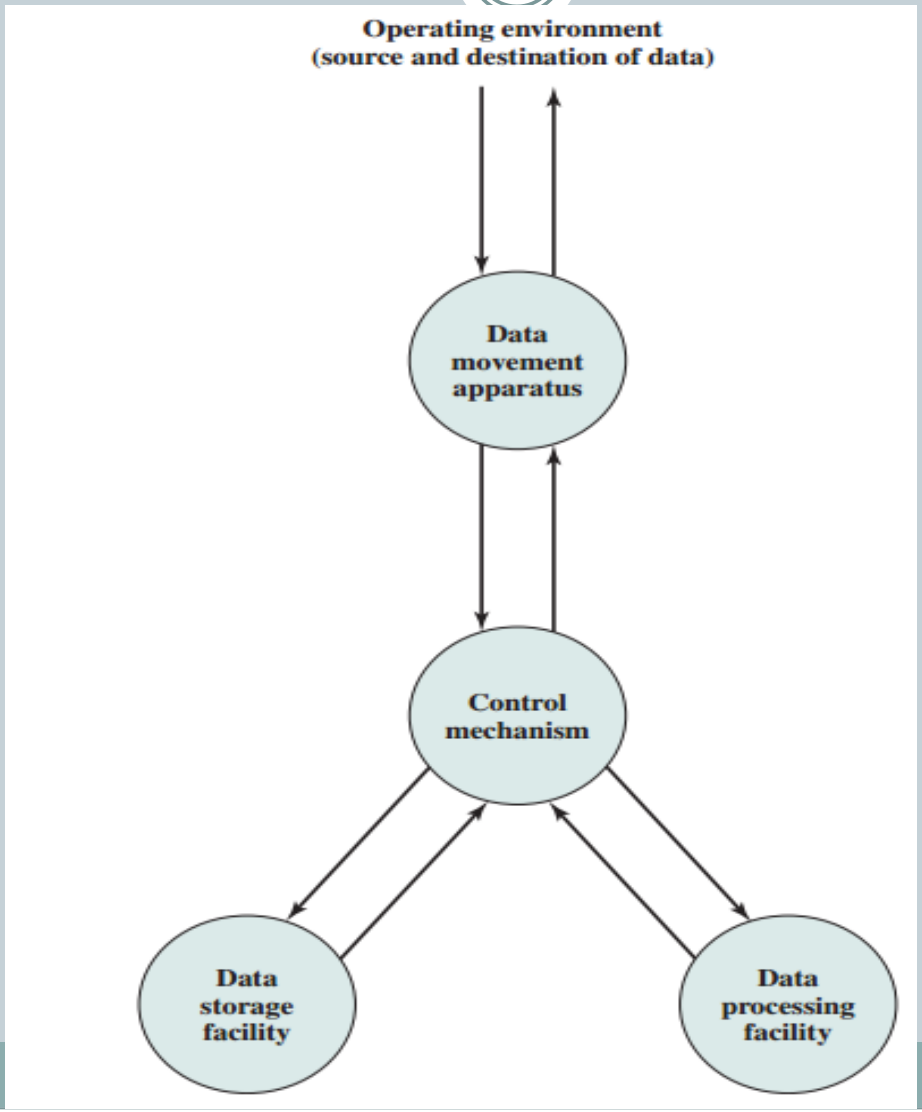
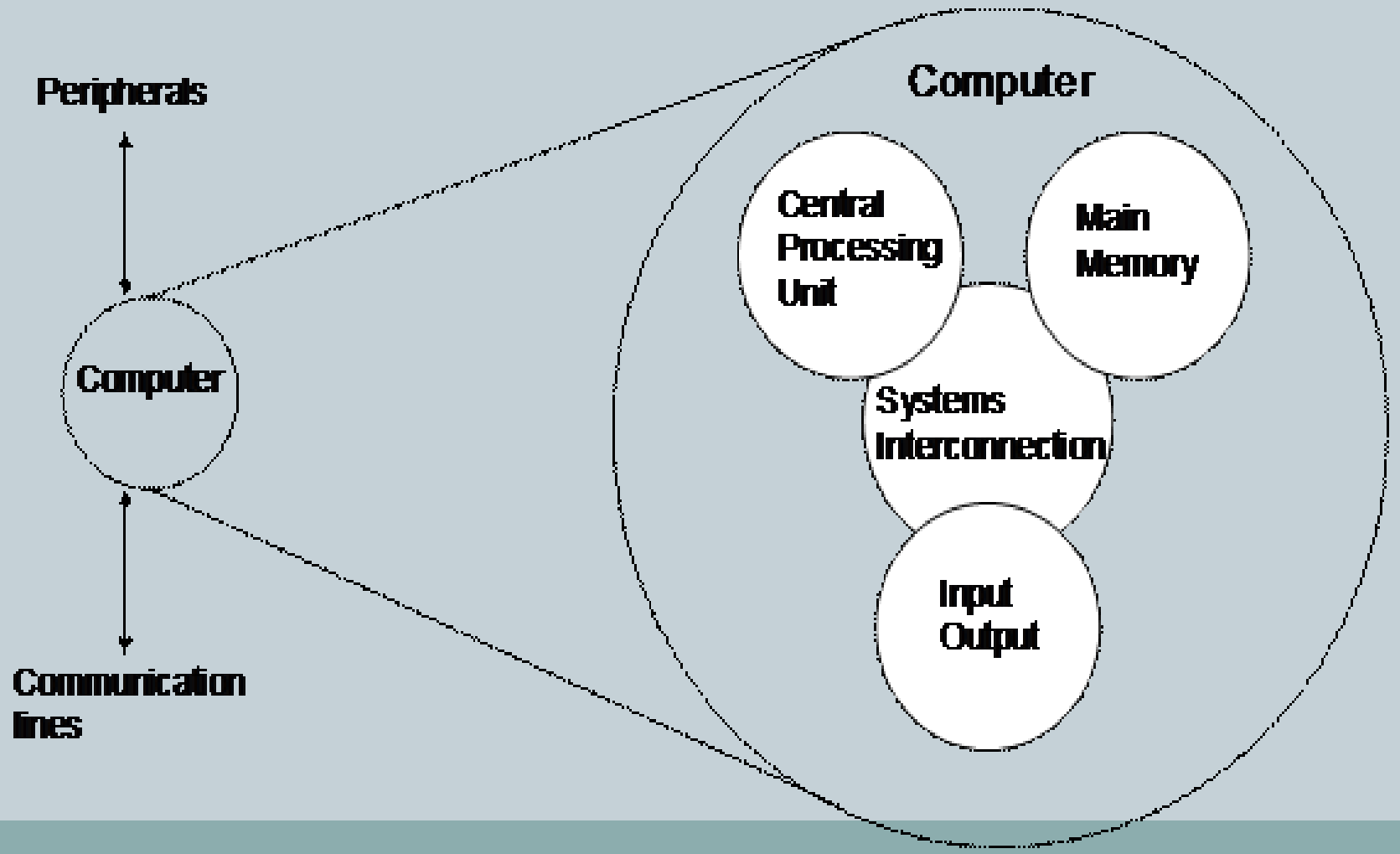

Operating environment
(source and destination of data)
Data movement apparatus
Control mechanism
Data storage facility
Data processing facility

Structure

There are four main structural components:

- **Central processing unit (CPU):** Controls the operation of the computer and performs its data processing functions; often simply referred to as **processor**.
- **Main memory:** Stores data.
- **I/O:** Moves data between the computer and its external environment.
- **System interconnection:** Some mechanism that provides for communication among CPU, main memory, and I/O. A common example of system interconnection is by means of a **system bus**, consisting of a number of conducting wires to which all the other components attach.

The Computer: Top-Level Structure



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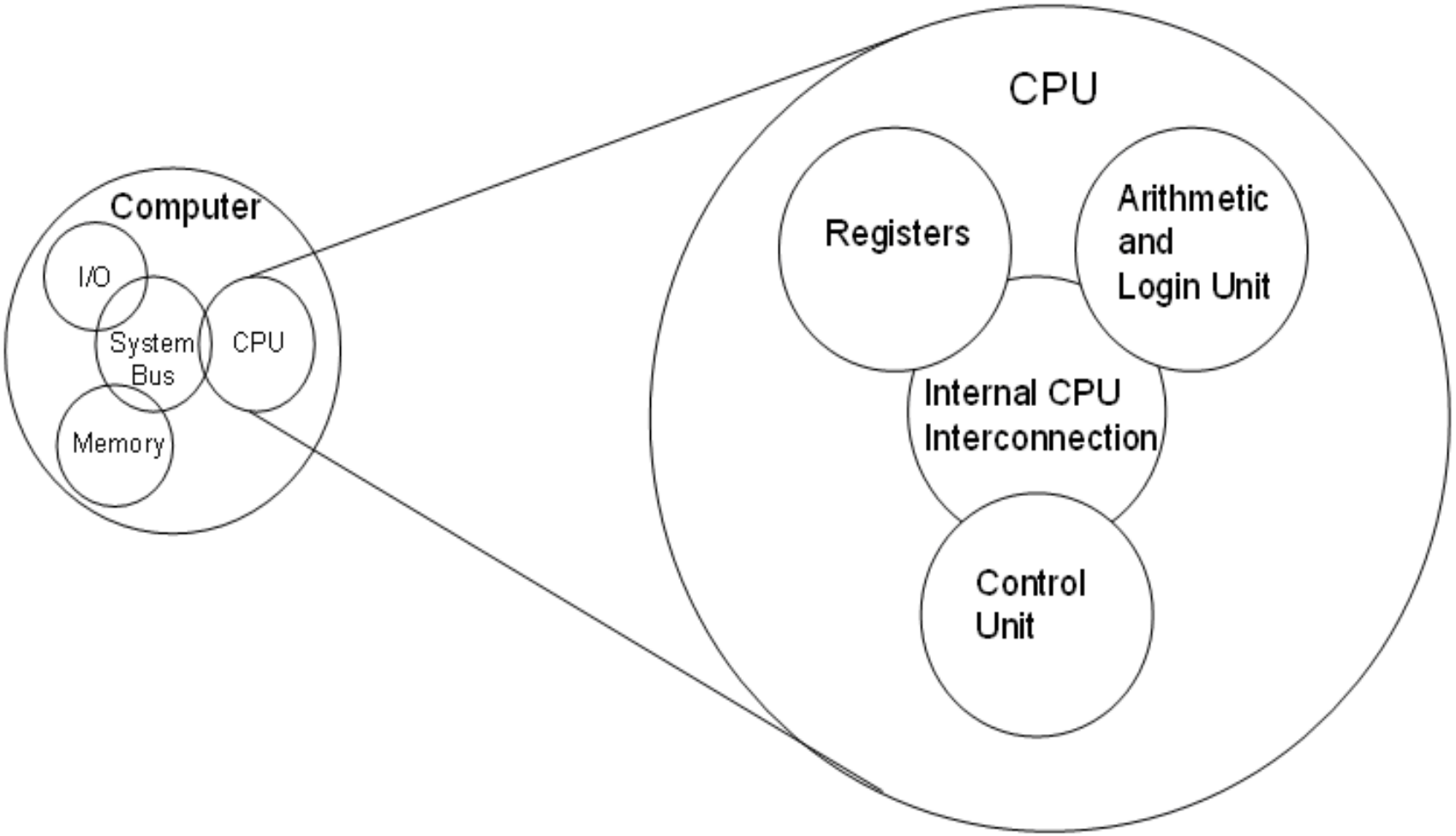
Computer
I/O
System Bus
CPU
Memory
CPU
Registers
Arithmetic and Login Unit
Internal CPU Interconnection
Control Unit

Question?

Next Lecture

Chapter Two

Computer Evolution and Performance