SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

System Design using general purpose processor /19ECT312/Embedded systems Design / Mrs.E.Ramya/AP/ECE/SNSCT

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III YEAR/ VI SEMESTER
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UNIT 1 – INTRODUCTION TO EMBEDDED SYSTEMS

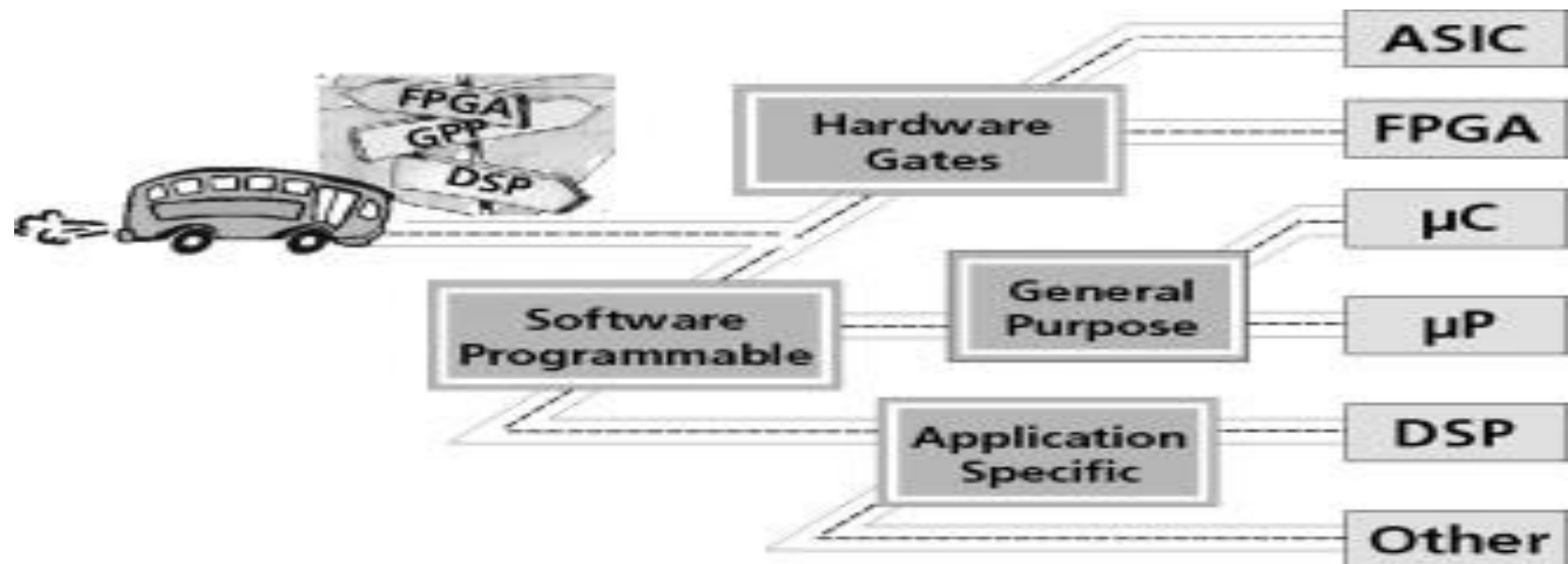# TOPIC - SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

General-purpose processors are **the target processors that probably first come to mind to anyone writing a computer program**.

GPPs are the processors that power desktop computers and are at the centre of the computer revolution that began in the 1970s.

SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

What is a general purpose processor in embedded system?

General Purpose Processor (GPP): GPP is **used for processing signal from input to output by controlling the operation of system bus, address bus and data bus inside** an embedded system.
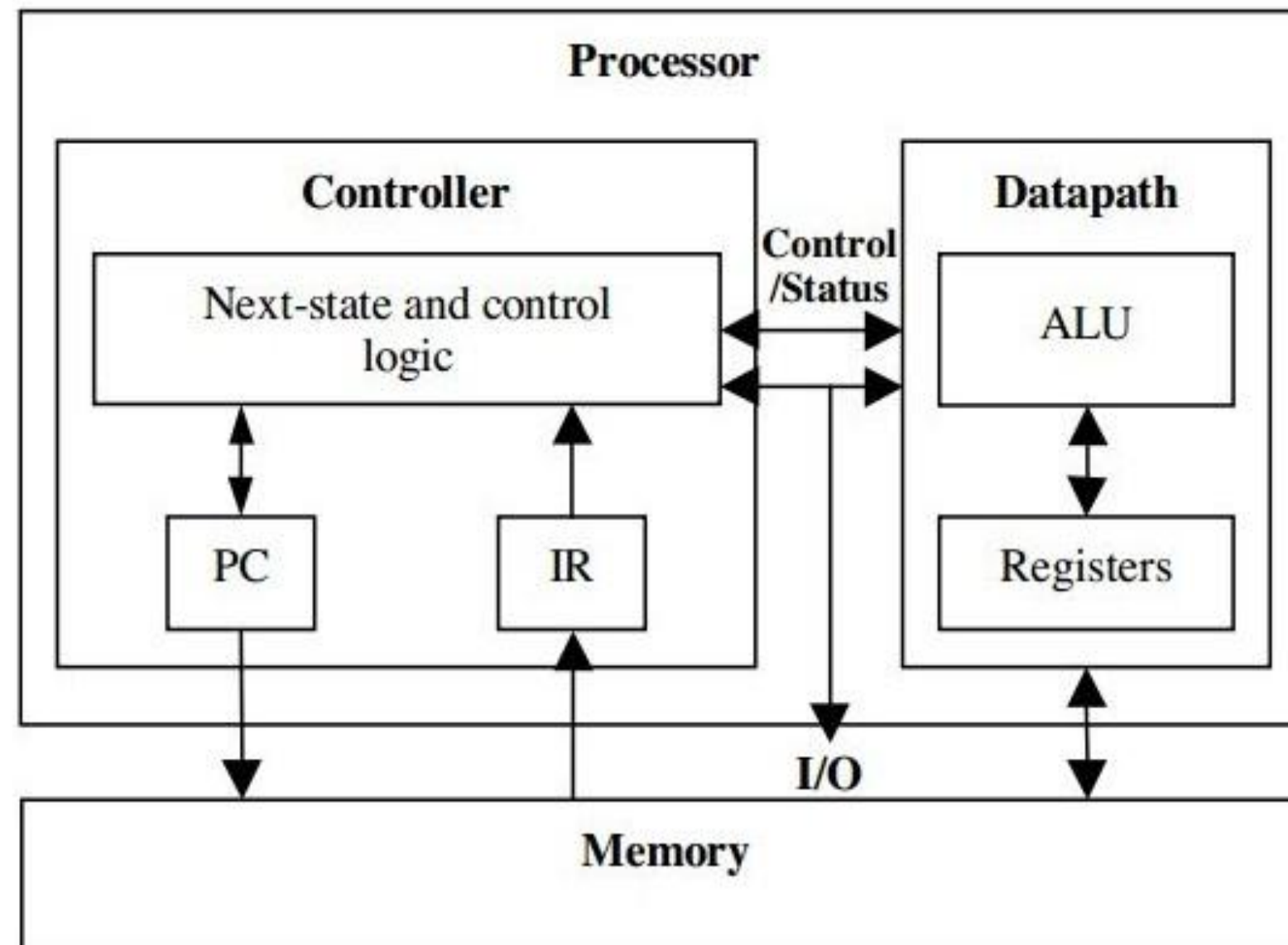
General purpose microprocessors make use of **Von Neumann architecture** .

SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

Figure   : General-purpose processor basic architecture.

SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

Four General Embedded System Types

◆ **General Computing**
- Applications similar to desktop computing, but in an embedded package
- Video games, set-top boxes, wearable computers, automatic tellers

◆ **Control Systems**
- Closed-loop feedback control of real-time system
- Vehicle engines, chemical processes, nuclear power, flight control

◆ **Signal Processing**
- Computations involving large data streams
- Radar, Sonar, video compression

◆ **Communication & Networking**
- Switching and information transmission
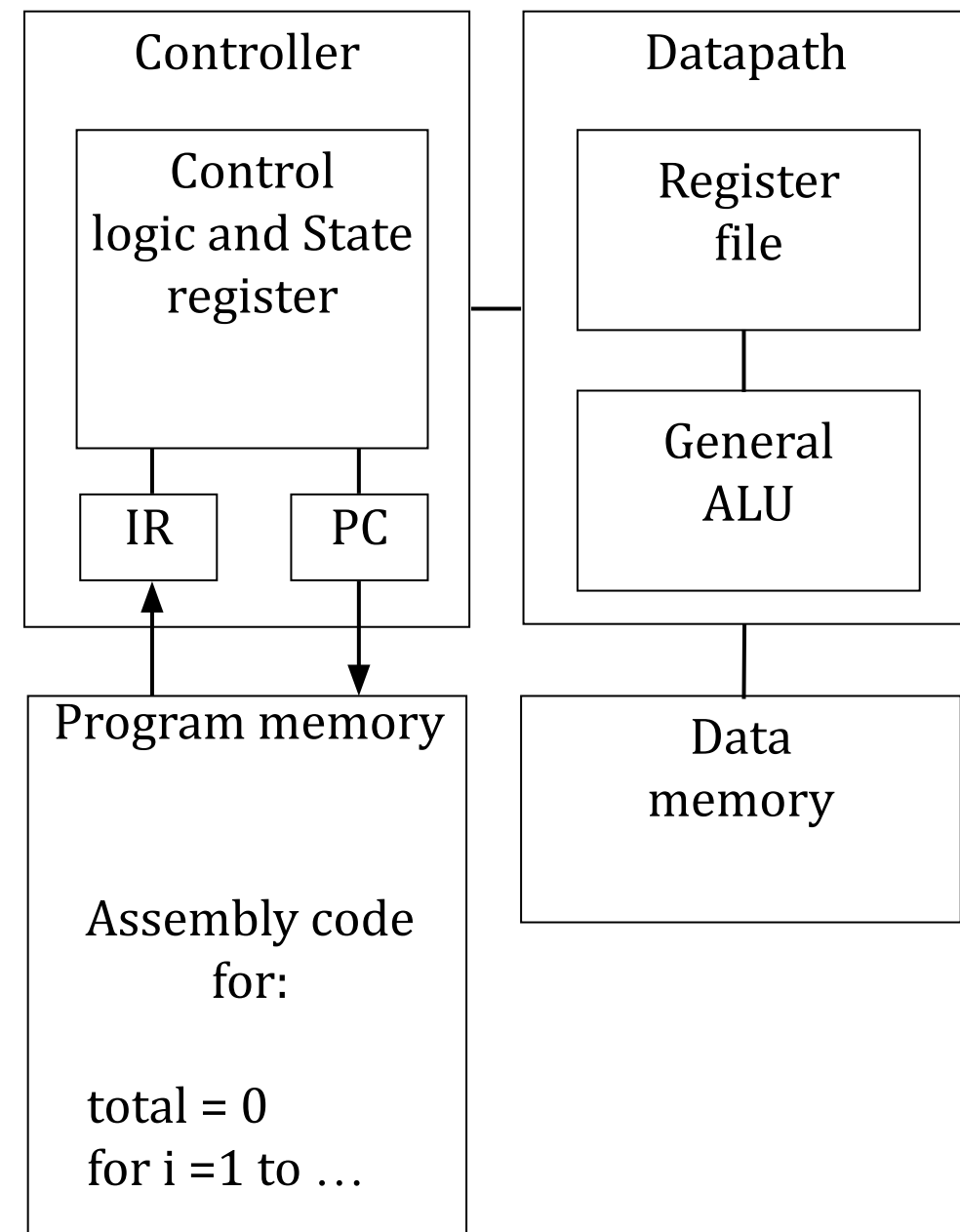- Telephone system, Internet

SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

- Programmable device used in a variety of applications
  - Also known as "microprocessor"
- Features
  - Program memory
  - General datapath with large register file and general ALU
- User benefits
  - Low time-to-market and NRE costs
  - High flexibility
- "Pentium" the most well-known, but there are hundreds of others

Controller	Datapath
Control logic and State register	Register file
IR PC	General ALU
Program memory	Data memory

Assembly code for:

total = 0
for i =1 to …

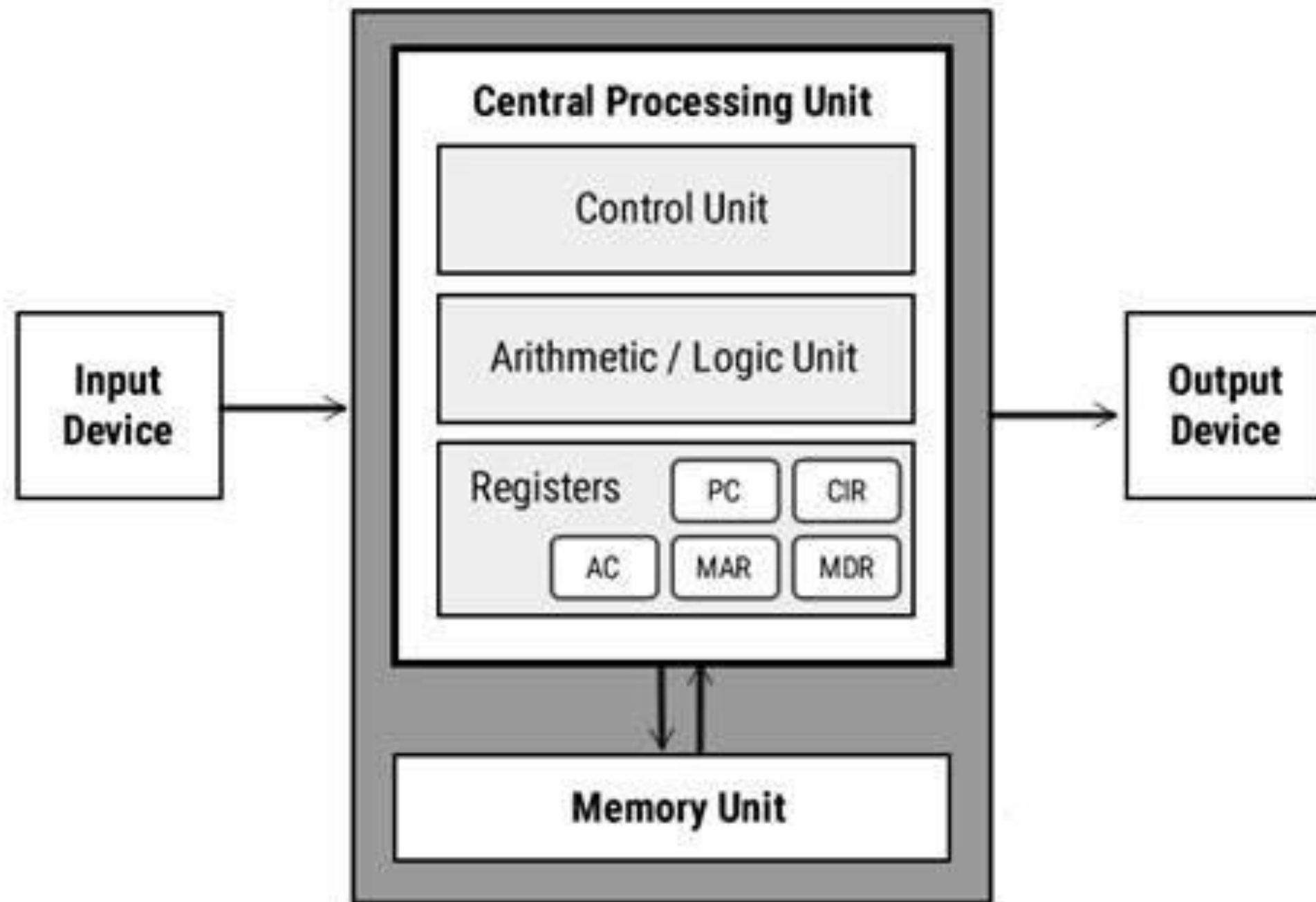# SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

Single-purpose processors

- Digital circuit designed to execute exactly one program
  - a.k.a. coprocessor, accelerator or peripheral
- Features
  - Contains only the components needed to execute a single program
  - No program memory
- Benefits
  - Fast
  - Low power
  - Small size

Controller	Datapath
Control logic	index
State register	total
	+

Data memory
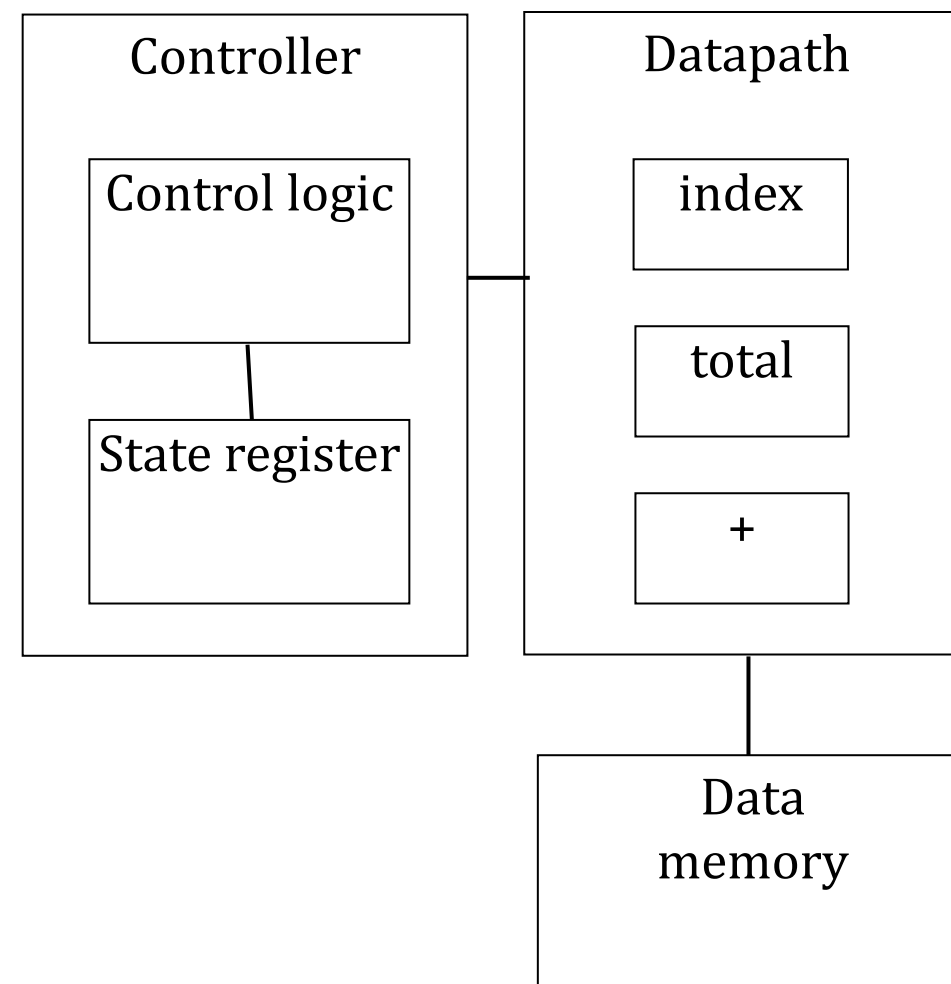
SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

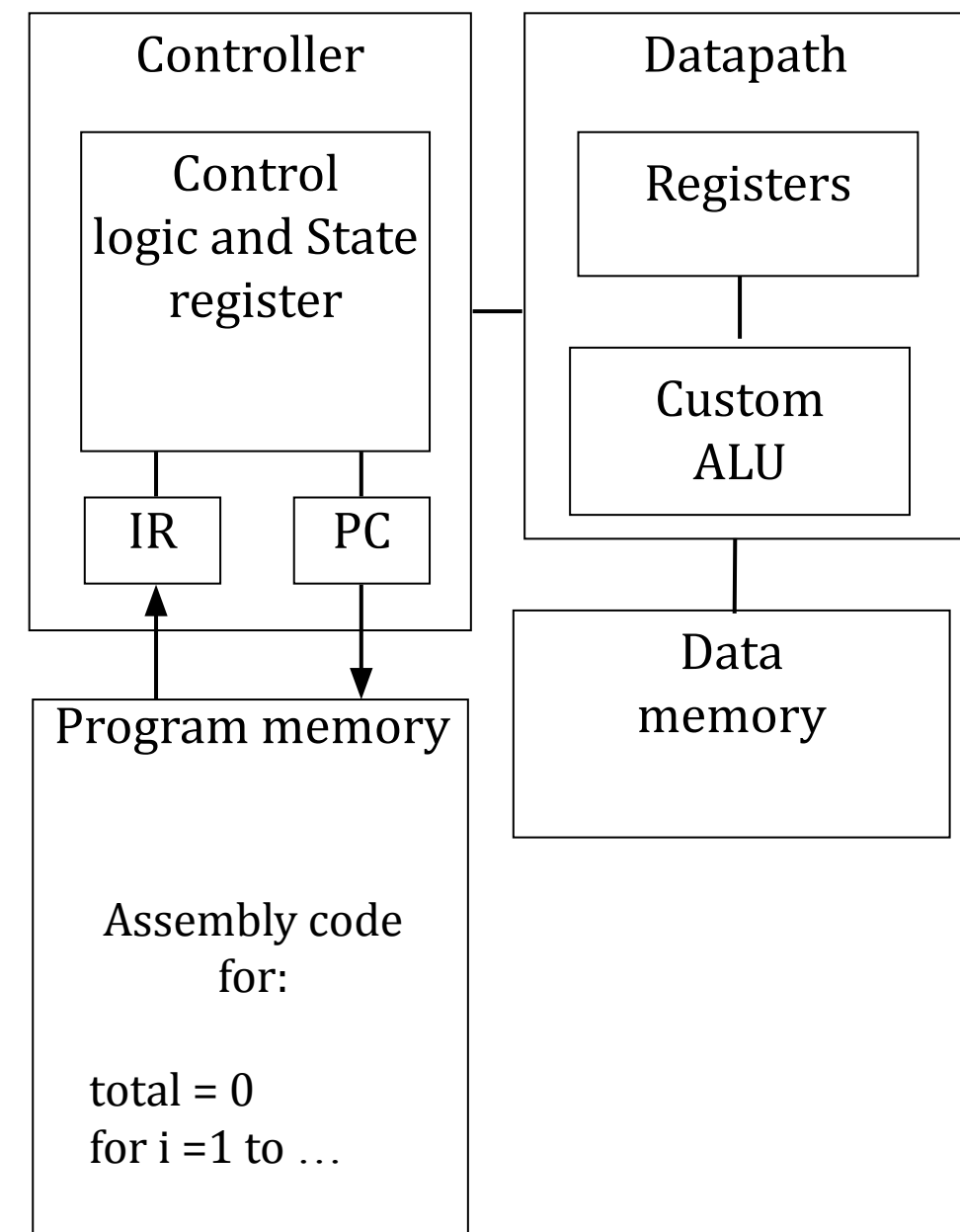Reference::https://th.bing.com/th/id/OIP.RjIFGl59y5rihQ6_Mro1bAAAAA?rs=1&pid=ImgDetMain

Application-specific processors

- Programmable processor optimized for a particular class of applications having common characteristics
  - Compromise between general-purpose and single-purpose processors
- Features
  - Program memory
  - Optimized datapath
  - Special functional units
- Benefits
  - Some flexibility, good performance, size and power
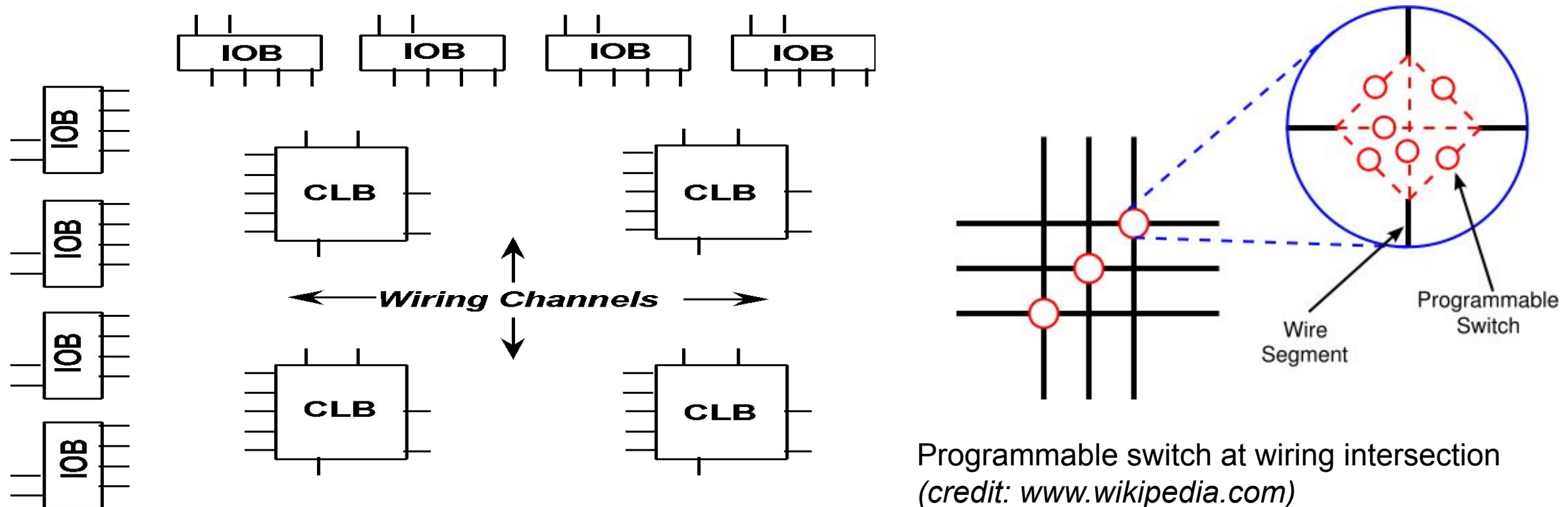- DSP

Controller	Datapath
Control logic and State register	Registers
IR PC	Custom ALU

Program memory

Data memory

Assembly code for:

total = 0
for i =1 to …

SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

FPGA Architecture

Programmable switch at wiring intersection
(credit: www.wikipedia.com)

FPGA layout with Configurable Logic Blocks (CLB) and I/O Blocks (IOB) *(credit: Katz's Contemporary Logic Design)*
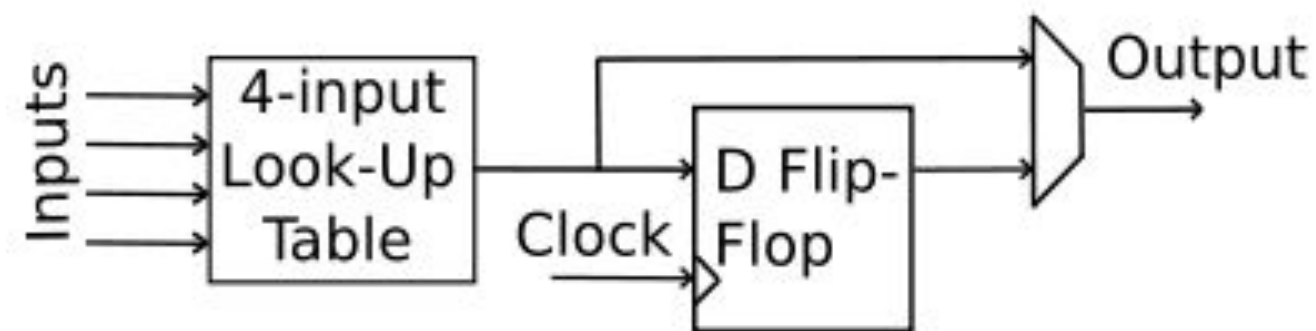
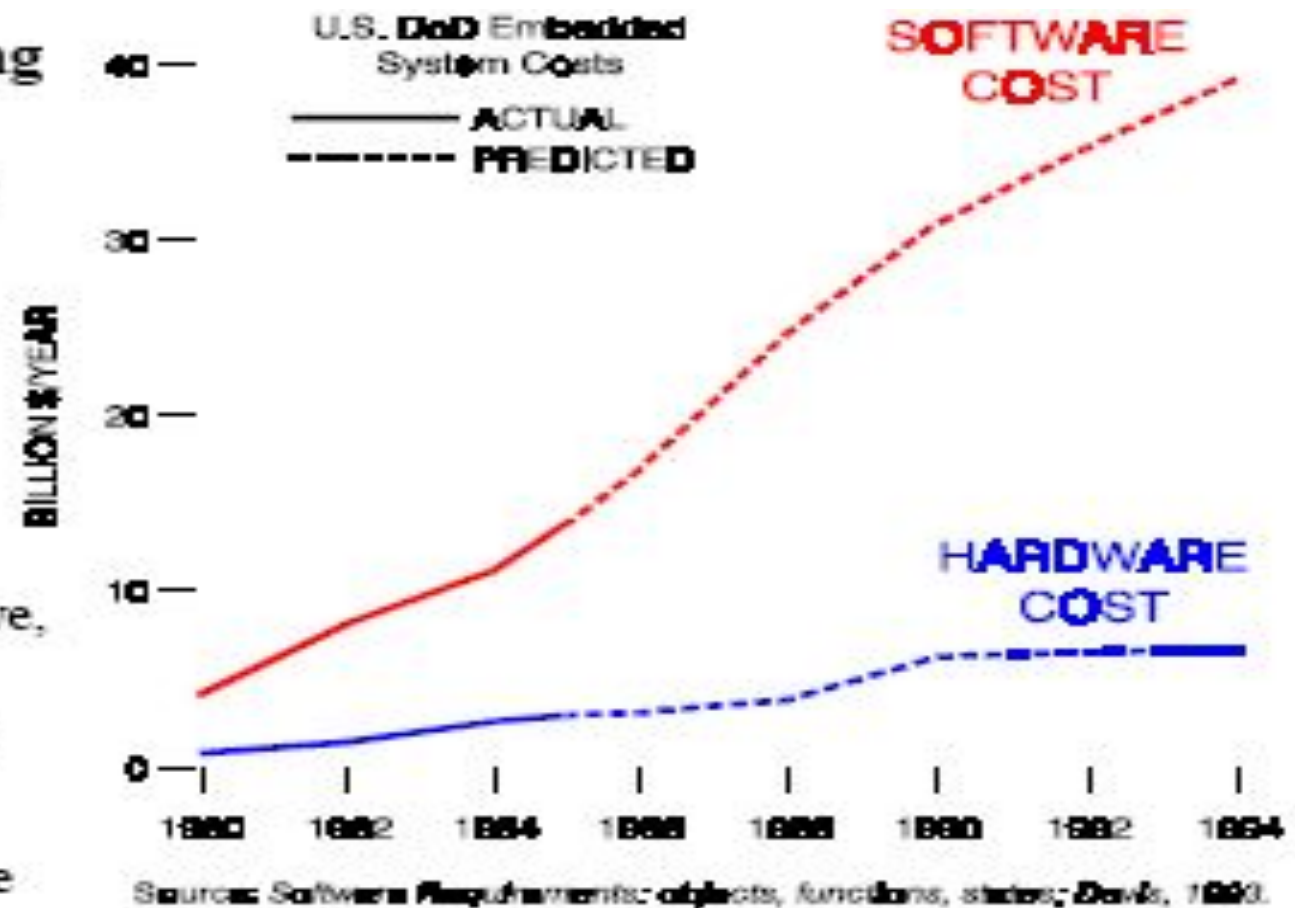# SYSTEM DESIGN USING GENERAL PURPOSE PROCESSOR

- Highly constrained products tend to use application specific processors

  - Many mobile phones (power & size constrained) contain ARM chips

  - Hi-Fi (high performance & time constrained) contain DSP chips

◆ **Hardware is mostly a recurring cost**
  - Cost proportional to number of units manufactured

◆ **Software is a "one-time" non-recurring engineering design cost (NRE)**
  - Paid for "only once"
    - But bug fixes may be expensive, or impossible
  - Cost is related to complexity & number of functions
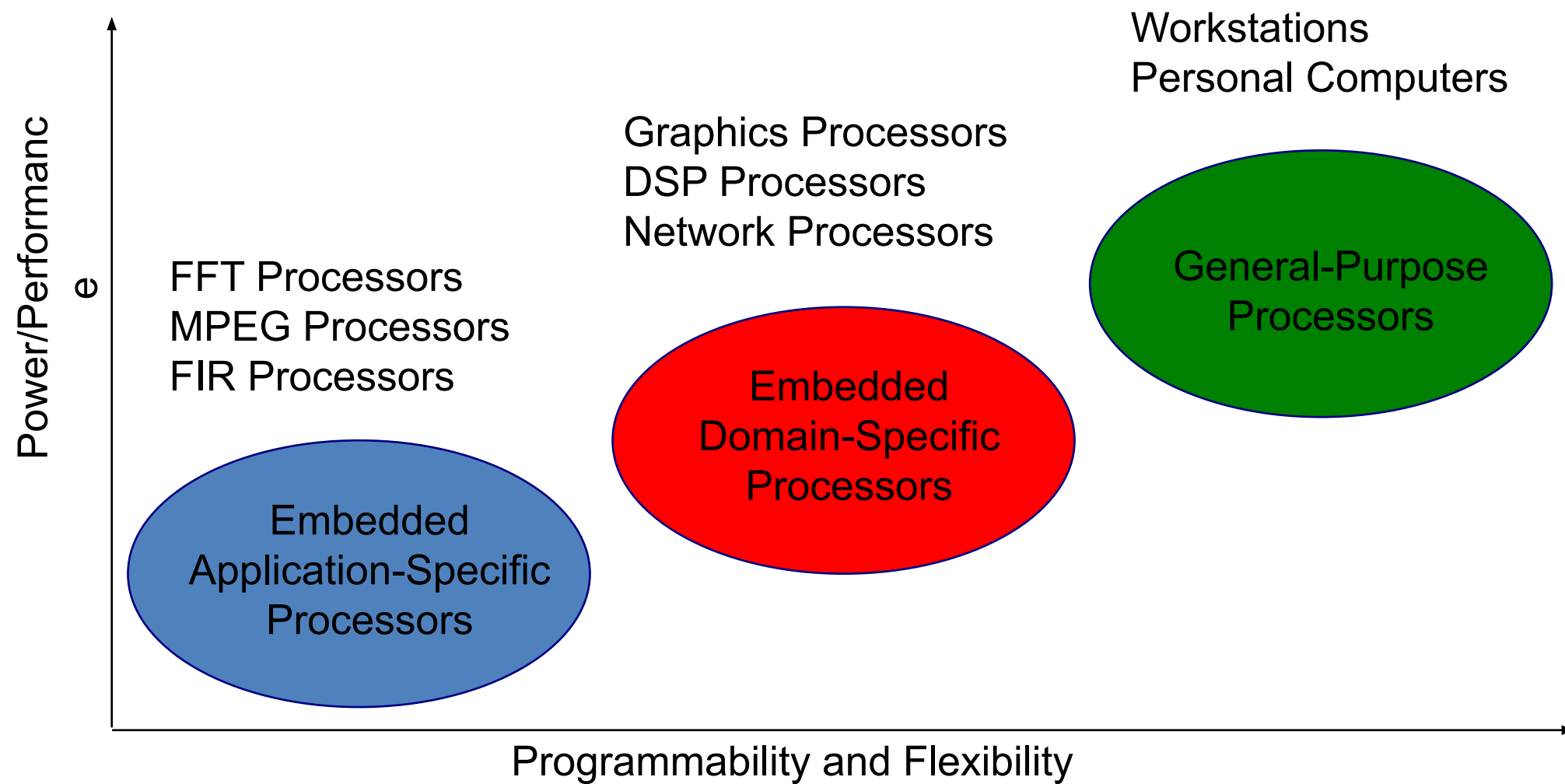 - Market pressures lead to feature creep
  - *SOFTWARE Is Not FREE!!!!!*

U.S. DoD Embedded System Costs
ACTUAL
PREDICTED
SOFTWARE COST
HARDWARE COST
BILLION $/YEAR

Source: Software Requirements: objects, functions, states; Davis, 1993.

Hardware vs Software

Workstations
Personal Computers

Graphics Processors
DSP Processors
Network Processors

General-Purpose
Processors

FFT Processors
MPEG Processors
FIR Processors

Embedded
Domain-Specific
Processors

Embedded
Application-Specific
Processors

Power/Performance

Programmability and Flexibility

Levels of Embedded System Design

- Specification
  - Design productivity increases with the level of abstraction
  - The task of functional verification is very difficult at low abstraction levels

- Implementation
  - Efficient implementations require to exploit the low-level features of the target architecture

Idea (Specification)

Design

abstract

Abstraction Gap

detailed

Assessment

1. How to choose processor for Embedded system design?
2. What's is FPGA?

SUMMARY & THANK YOU