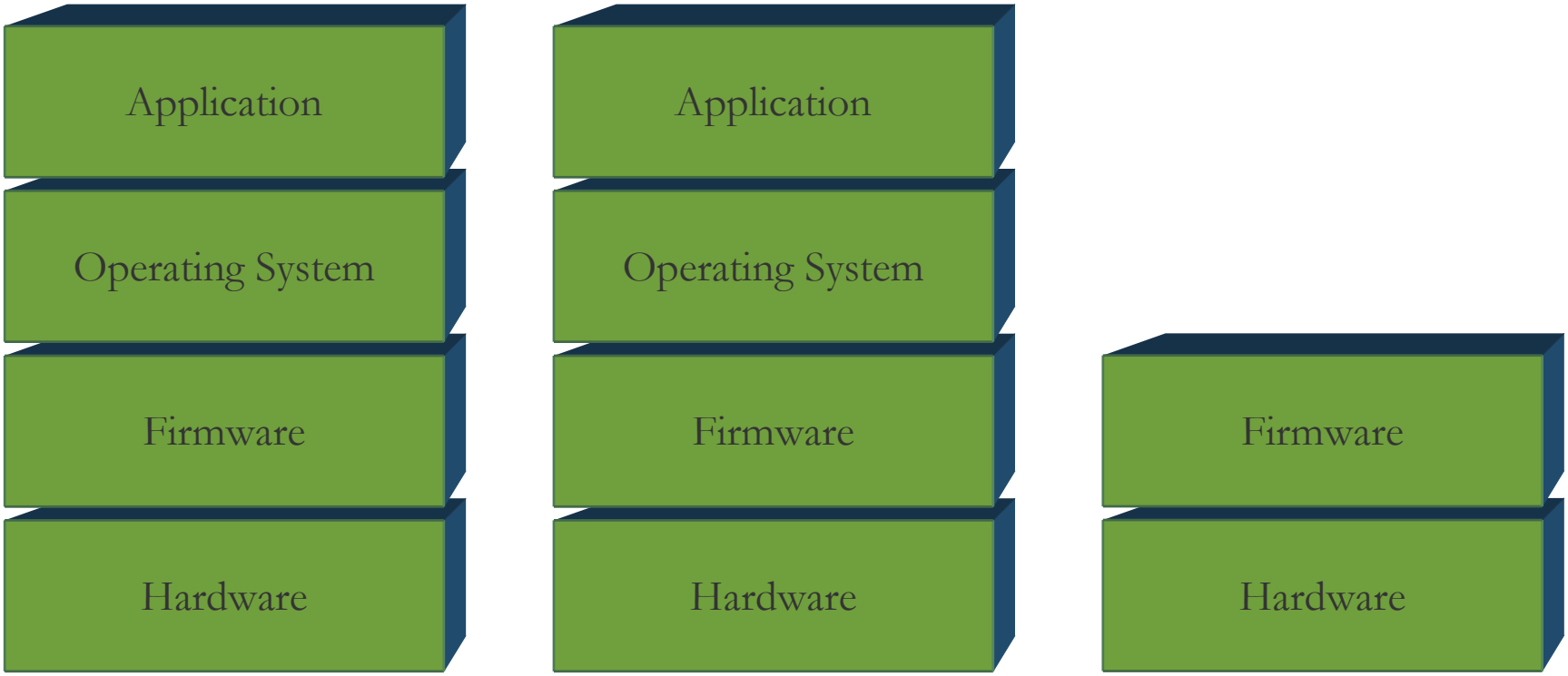
Embedded System Introduction

❖Embedded System vs Desktop

- 相同點
  - CPU
  - Storage
  - I/O
- 相異點
  - Desktop
    - 可執行多種功能
    - 作業系統對於系統資源的管理較為複雜
  - Embedded System
    - 執行特定功能
    - 作業系統對於系統資源的管理較為簡單

System Layer

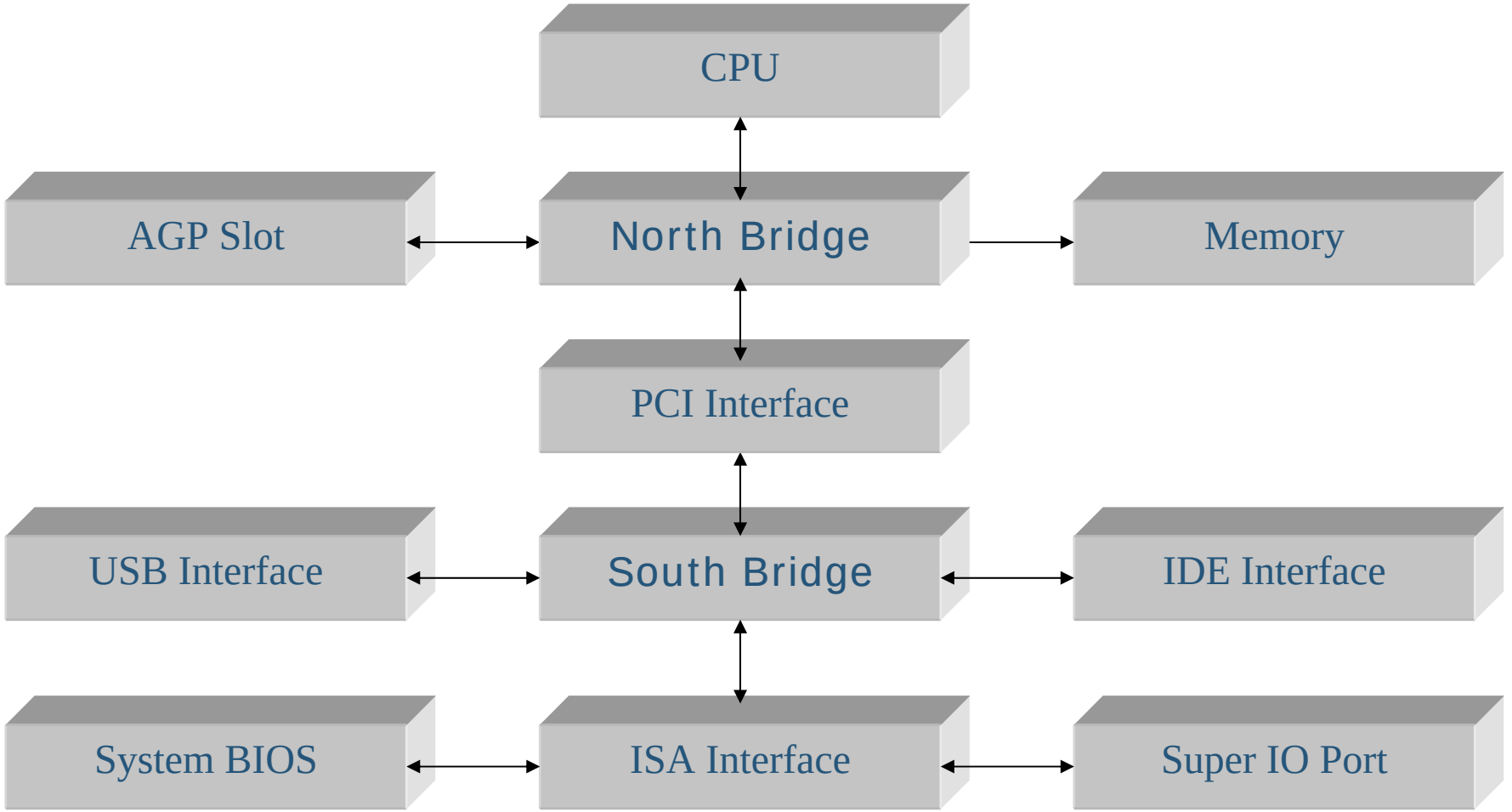


Desktop computer

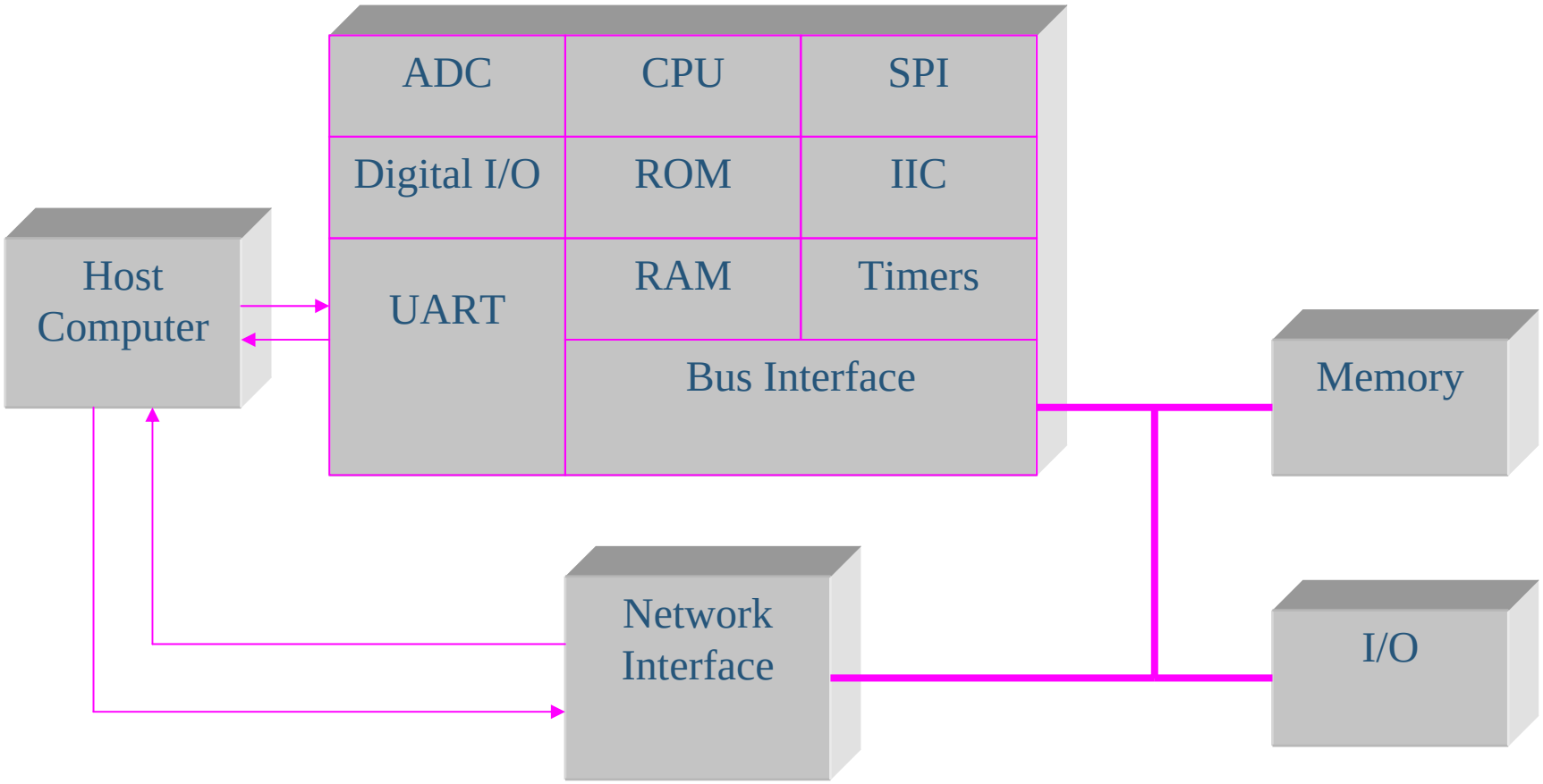
Complex embedded computer

Simple embedded computer

Hardware Architecture
Desktop Computer System Hardware Architecture



Hardware Architecture
Embedded System Computer Hardware Architecture



❖What is the Embedded System?

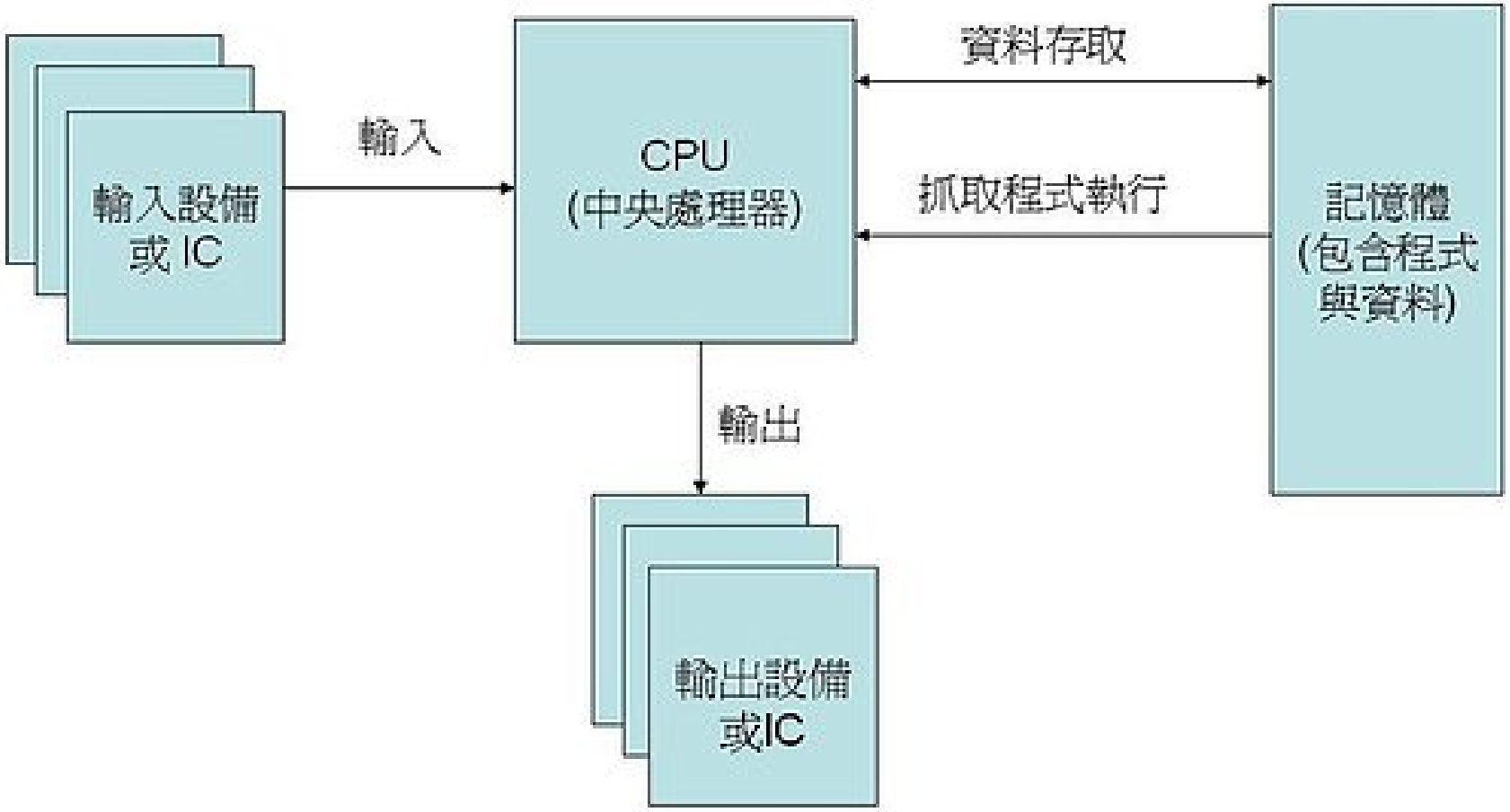
Introduction

- Challenges in embedded system design.
- Design methodologies.

Embedded System ?

- An **embedded system** is a special-purpose **computer** system designed to perform one or a few dedicated functions
- with **real-time computing** constraints
- include hardware, software and mechanical parts

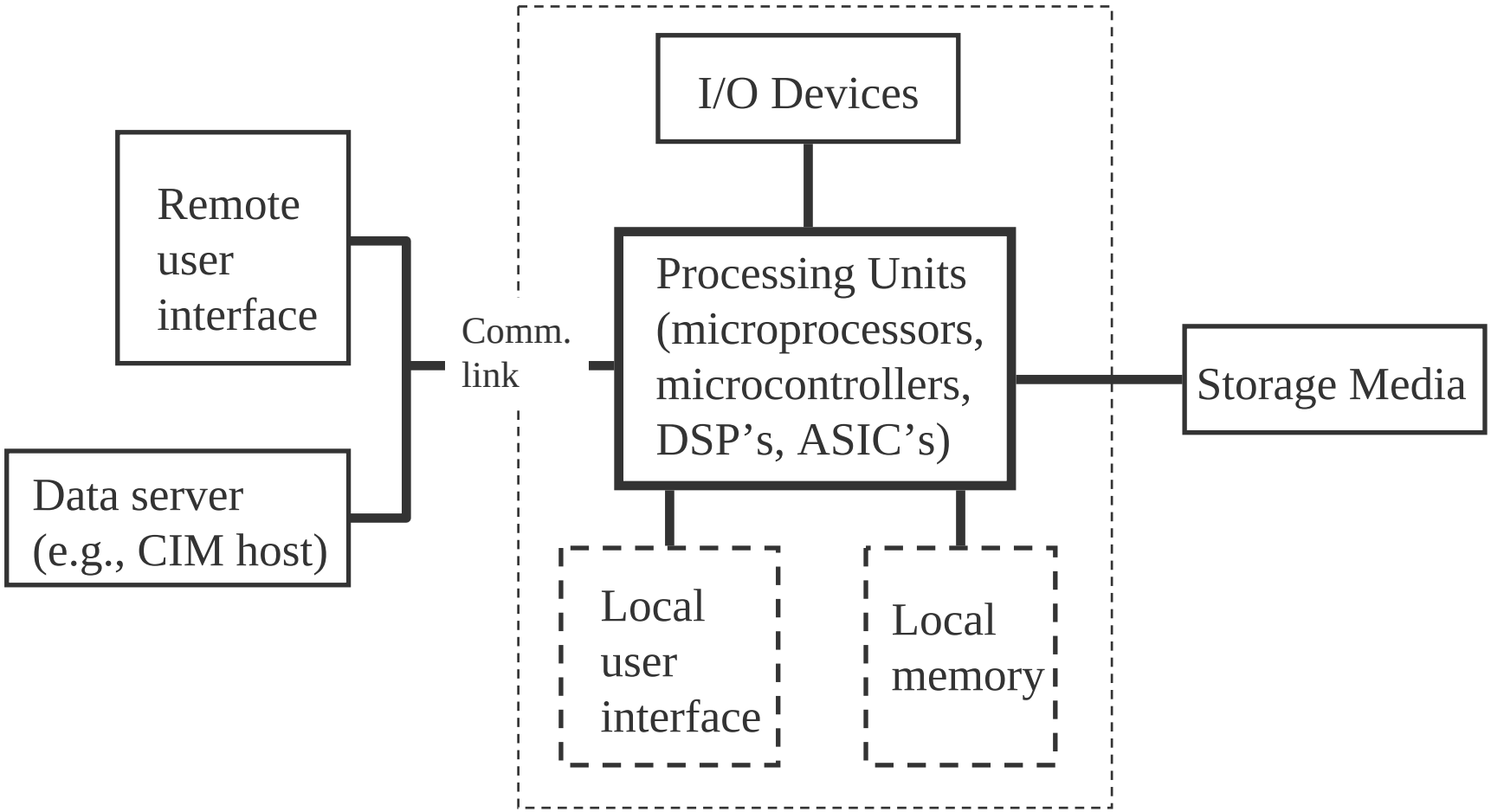
Embedding a computer



Components of an embedded system

- Characteristics
  - Low power
  - Closed operating environment
  - Cost sensitive

Components of an embedded system



Embedded Processor

- How To Design A Good Embedded Processor?
  - Understand the functional requirements of the applications
  - Know all the related design techniques
    - Software
      - C/C++
      - Assembly
    - Hardware
      - Verilog/VHDL
      - PCB
  - Select those features you want, and abandon those that you don't need
  - Evaluate the design, goal: either the fastest possible for future expansion reasons, or slowest possible for cost reasons

The processing units (1/2)

- Microprocessor vs. Microcontrollers
  - Meeting the I/O needs
  - Software development platform
  - Operating system support
  - Operating system popularity (e.g., Windows CE, Embedded Linux)

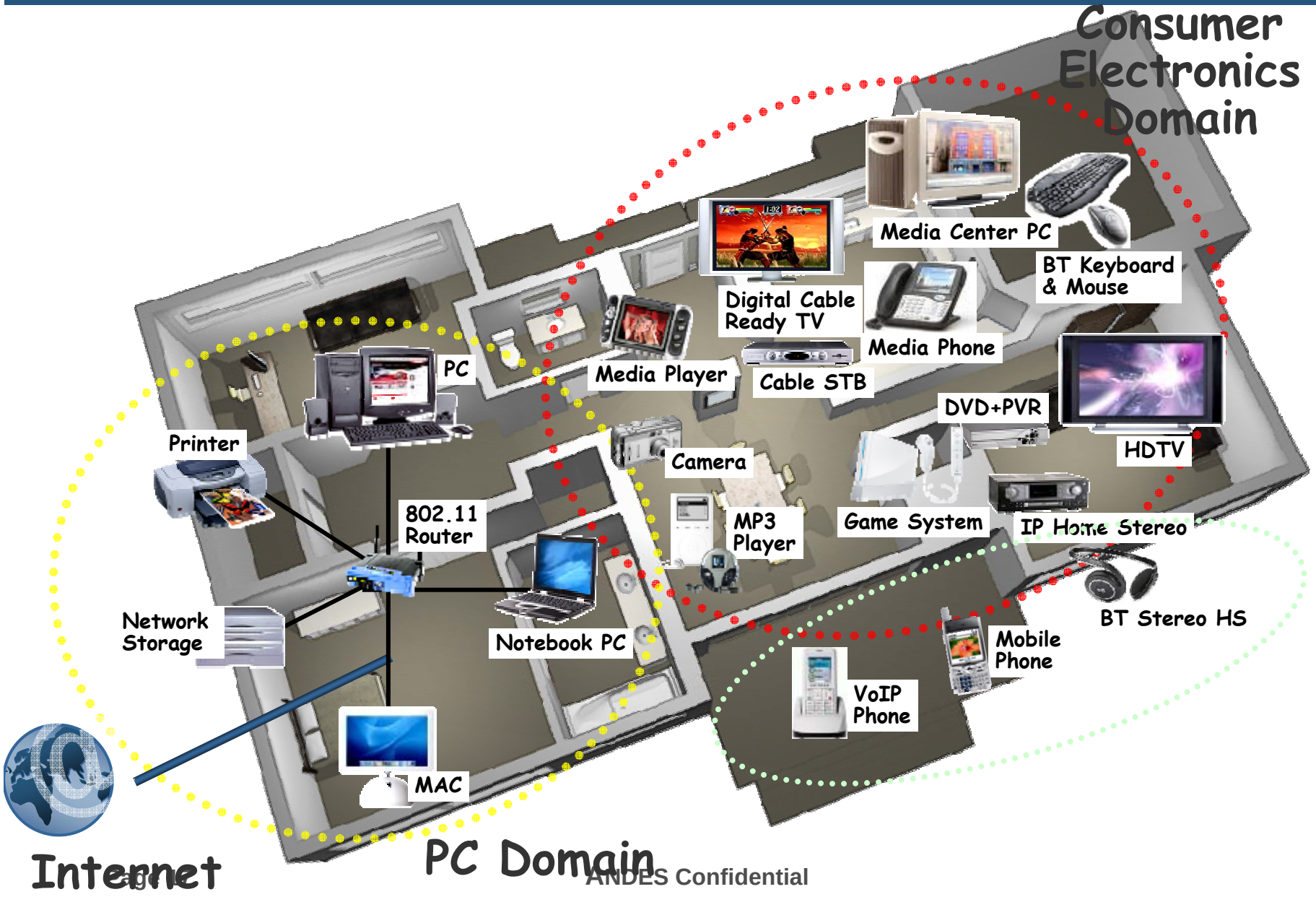
The processing units (2/2)

- DSP's vs. generic processors
  - Computation capability
  - Dedicated hardware for sophisticated algorithms, e.g., FFT
  - I/O capability
  - Software development platform
  - Multi-processor support

Applications

- Personal digital assistant
- Printer
- GPS
- Cell phone
- Automobile: engine, brakes, etc.
- Television
- Set-Top Box

Embedded Systems Connect Your Life



Embedded Systems Connect Your Life (cont.)

Characteristics of Embedded Systems (1/2)

- Sophisticated functionality.
- Real-time operation.
- Low cost.
- Low power.
- Designed to tight deadlines by small teams.

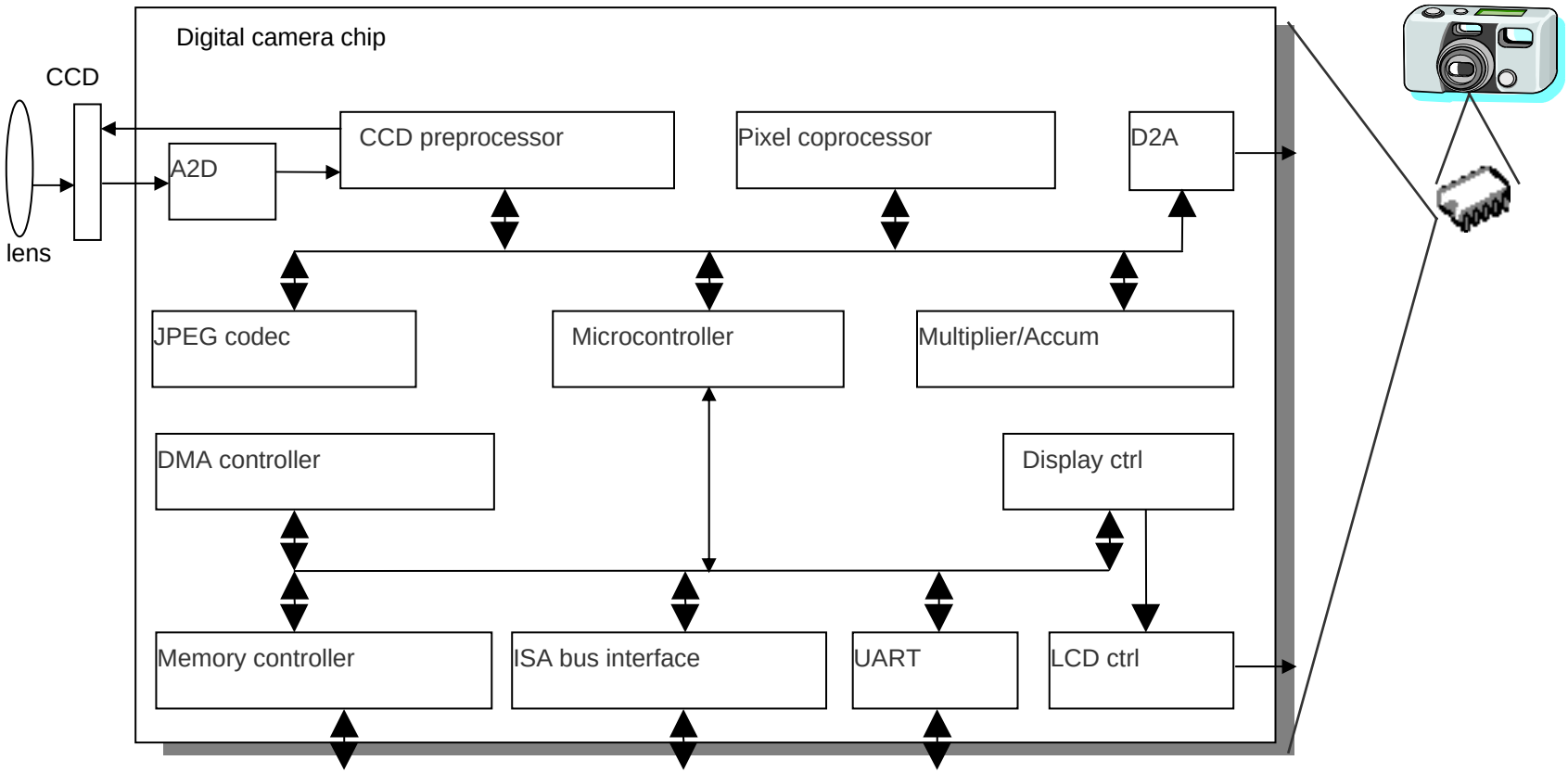
Characteristics of Embedded Systems (2/2)

- Sophisticated functionality.
- Real-time operation.
- Low cost.
- Low power.
- Designed to tight deadlines by small teams.

Three key embedded system technologies

- Technology
  - A manner of accomplishing a task, especially using technical processes, methods, or knowledge
- Three key technologies for embedded systems
  - Processor technology
  - IC technology
  - Design technology

An embedded system example -- a digital camera



- Single-functioned -- always a digital camera
- Tightly-constrained -- Low cost, low power, small, fast
- Reactive and real-time -- only to a small extent

Thank You