Embedded System Design

Dr. Anas Youssef

anas.youssef@ci.menofia.edu.eg

Embedded System Design

- The Design Problem
- System Architecture
- Traditional Methodology
- HW/SW Co-Design Methodology
- Behavior/Architecture Co-Design Methodology

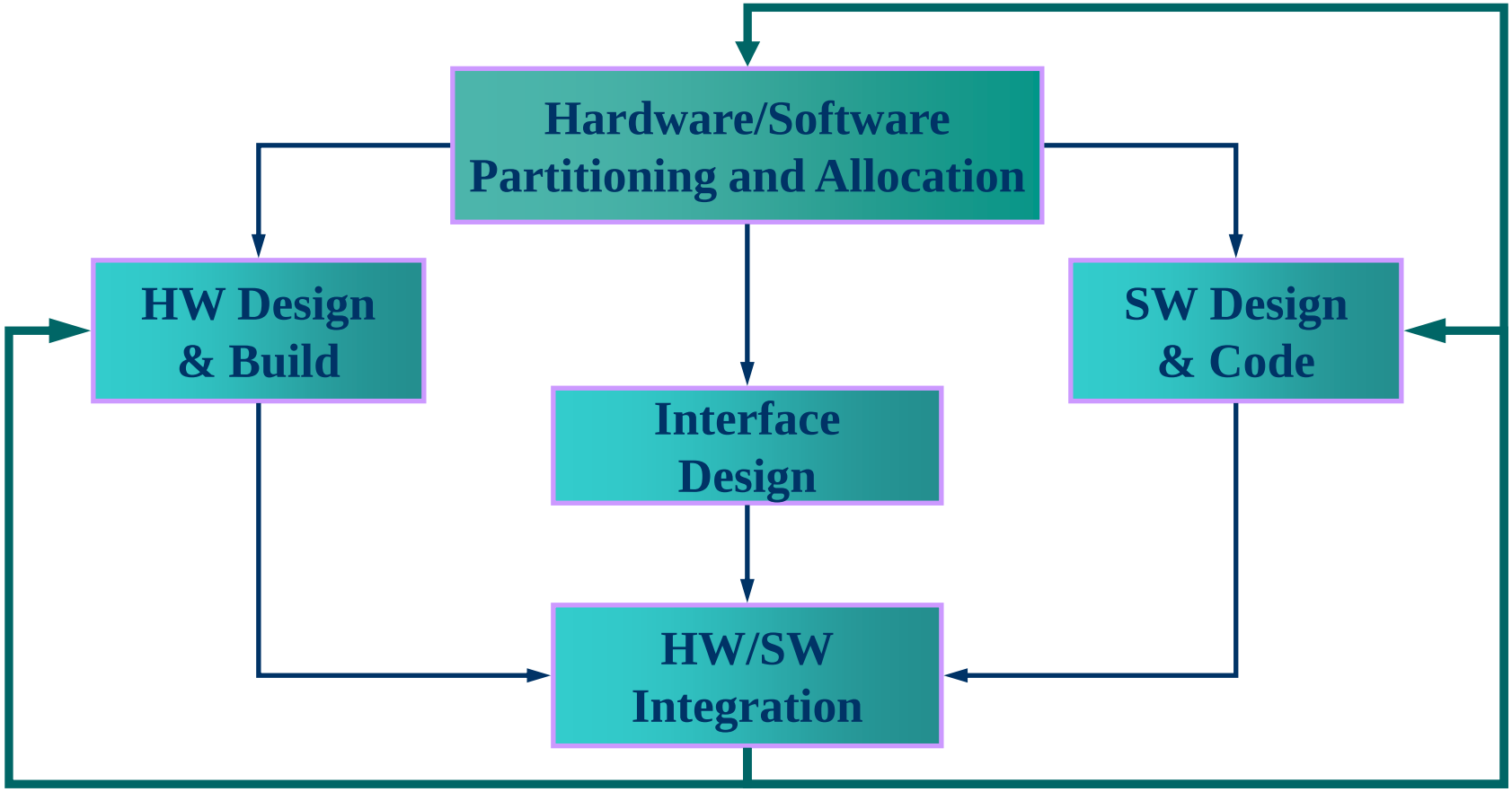
The Design Problem

- Deciding the software and hardware architecture for the system
  - which parts should be implemented in software running on the programmable components
  - and which should be implemented in more specialized hardware


System Architecture

- **Hardware**
  - One micro-controller (to be extended later…)
  - ASICs
- **Software**
  - Set of concurrent *tasks*
  - Customized operating system
    (**Real-Time scheduler**)
- **Interfaces**
  - Hardware modules
  - Software I/O drivers
    (polling, interrupt handlers, ...)

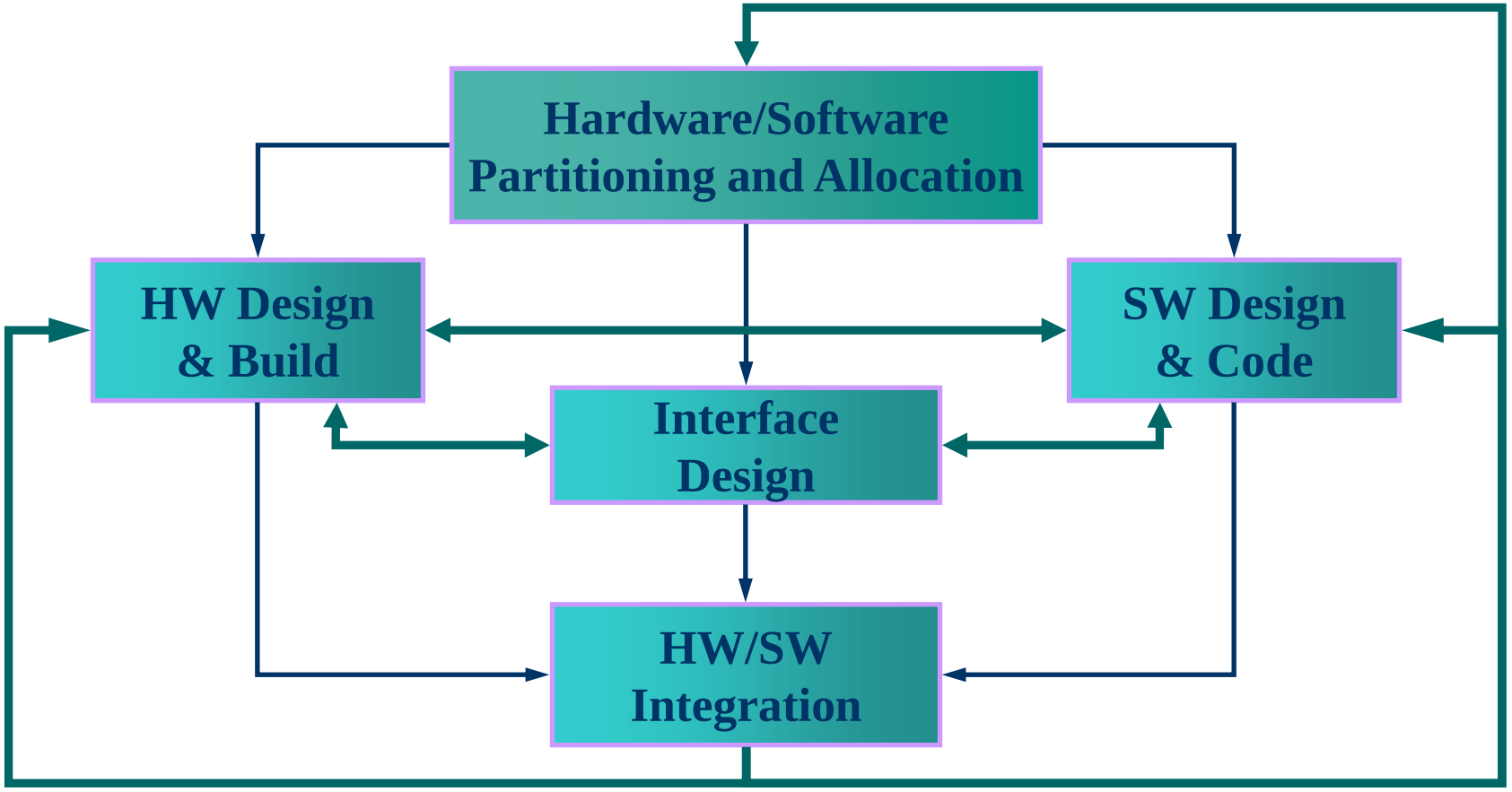

Embedded System Design
Traditional Methodology



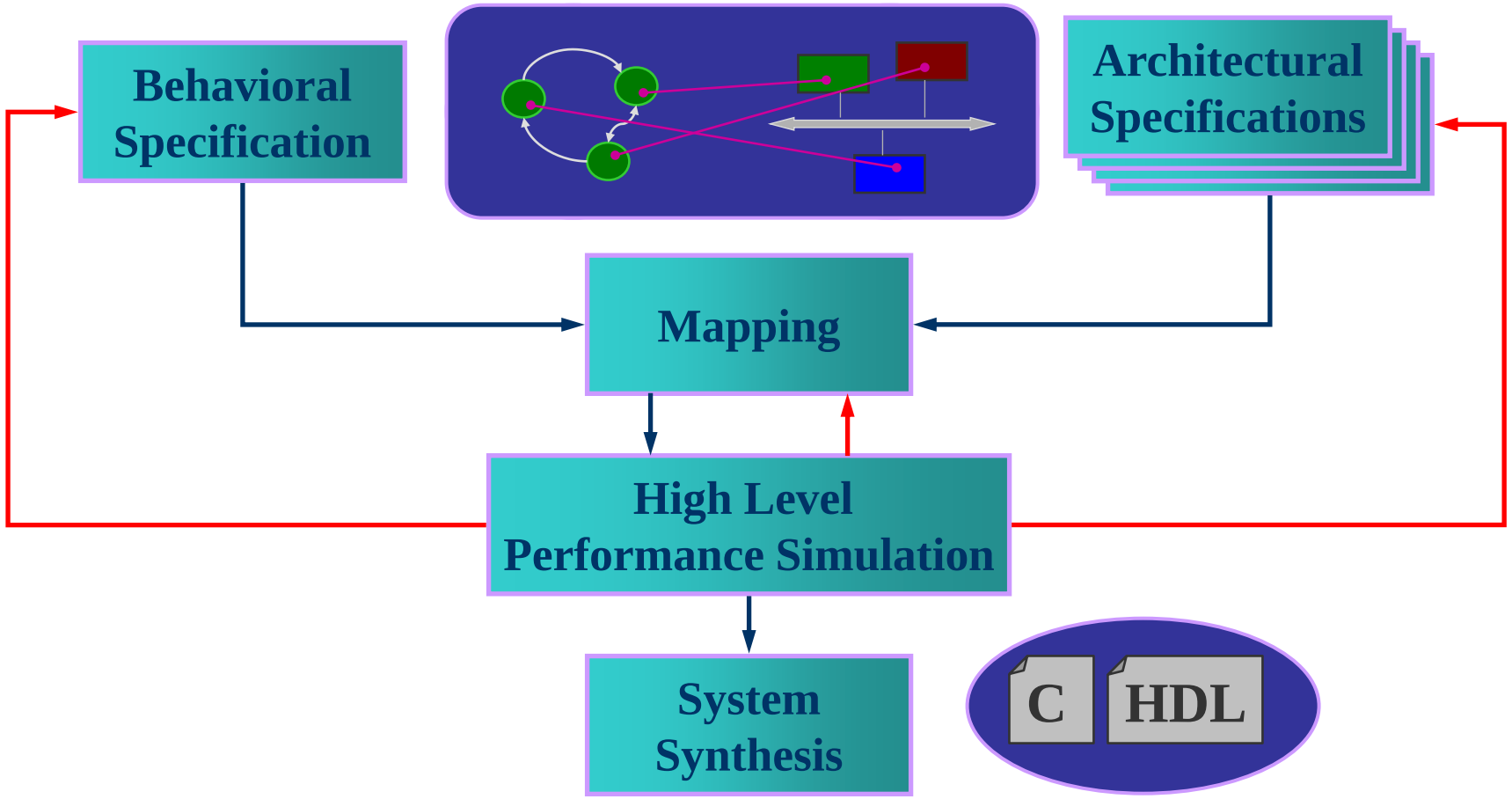
Problems with Past Design Method

- **Lack of unified system-level representation**
  - Can not verify the entire HW-SW system
  - Hard to find incompatibilities across HW-SW boundary
    (often found only when prototype is built)
- **Architecture is defined *a priori*, based on expert evaluation of the functionality and constraints**
- **Lack of well-defined design flow**
  - Time-to-market problems
  - Specification revision becomes difficult


Embedded System Design
HW/SW Co-Design Methodology



Embedded System Design
Behavior/Architecture Co-Design Methodology



Behavior/Architecture Co-Design
Goals

- **Clear separation between**
  - behavior
  - architecture
  - communication
- **Same framework for**
  - specification and behavioral simulation
  - performance simulation
  - refinement to implementation
    - HW, SW and interface synthesis
    - rapid prototyping


Sample Behavioral Diagram