ESD Electronic Systems Design

Synthesis Verification Testing Power Communication

Design of networked embedded systems

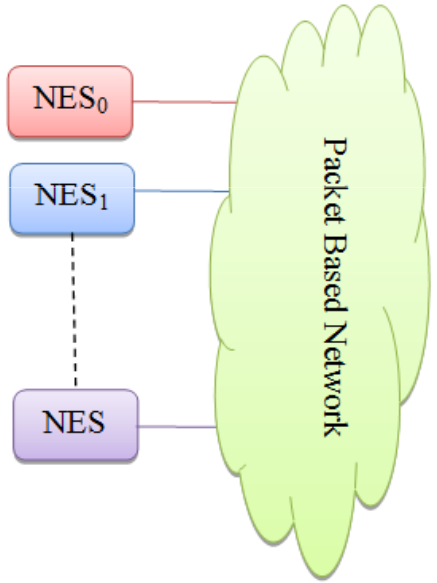
Davide Quaglia

Outline

- Definition of networked embedded system (NES)
- Traditional design flow for embedded systems
- New design flow for NES
- Concepts to be explained

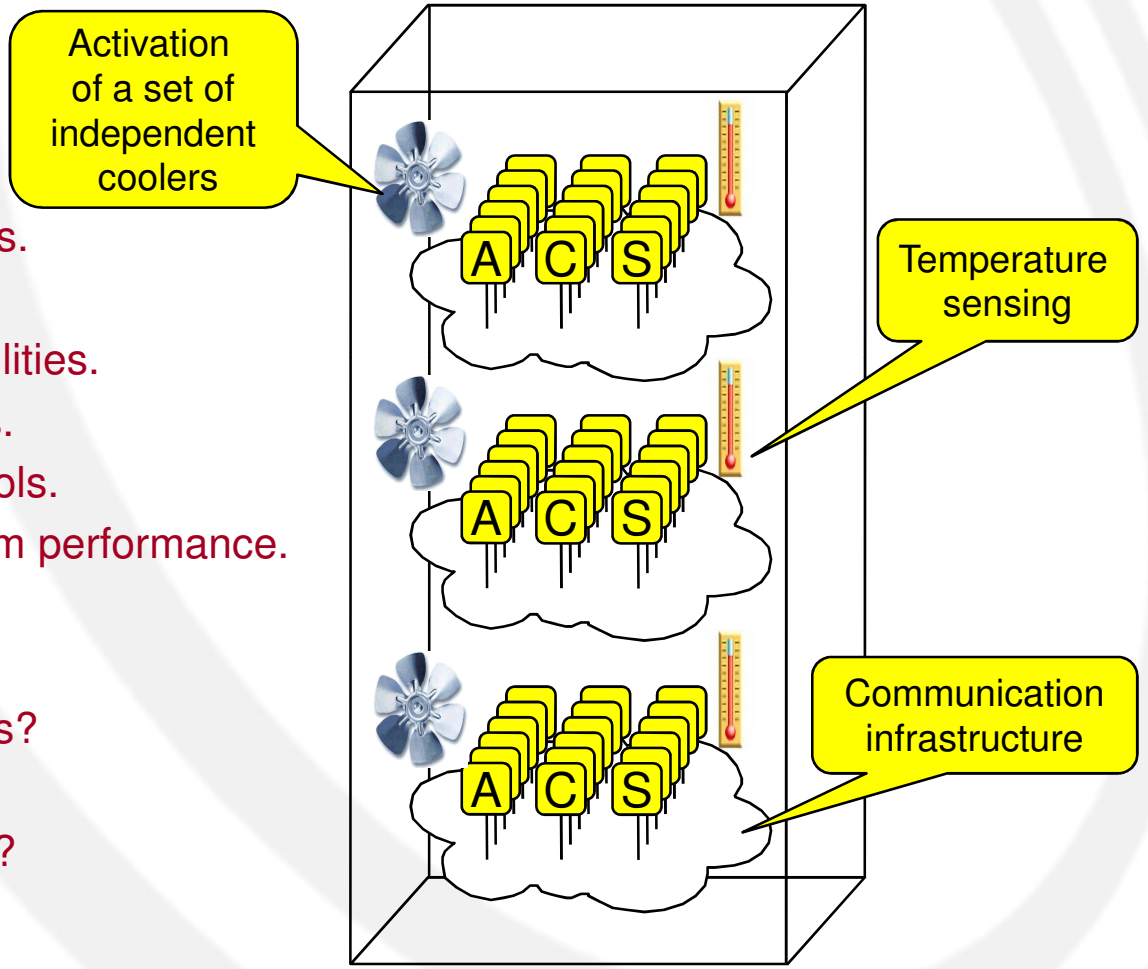
Networked embedded systems

- Networked embedded systems are an important class of devices
  - Network functionalities are at the core of design objectives
  - Network requirements come together with traditional requirements
- Distributed embedded systems are group of networked embedded systems (NES) which are connected together using network interfaces, standardized protocols and channels
  - Example: Temperature control of a building



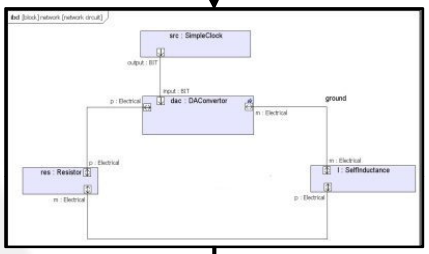
Temperature control of a building

- Scenario:
  - Hundreds of concurrent tasks.
  - Heterogeneous tasks.
  - Devices with different capabilities.
  - Wireless and wired channels.
  - Many communication protocols.
  - Nodes position affects system performance.
- Questions:
  - How many nodes?
  - How to assign tasks to nodes?
  - Which network protocols?
  - Which intermediate systems?



Traditional design flow for embedded systems

Application requirements: functional & non-functional

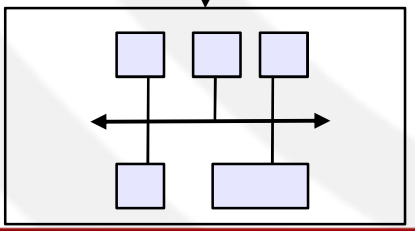


Model-driven design

Platform description:
IP blocks (CPU, memory, ASIC)

Design-space Exploration (DSE)

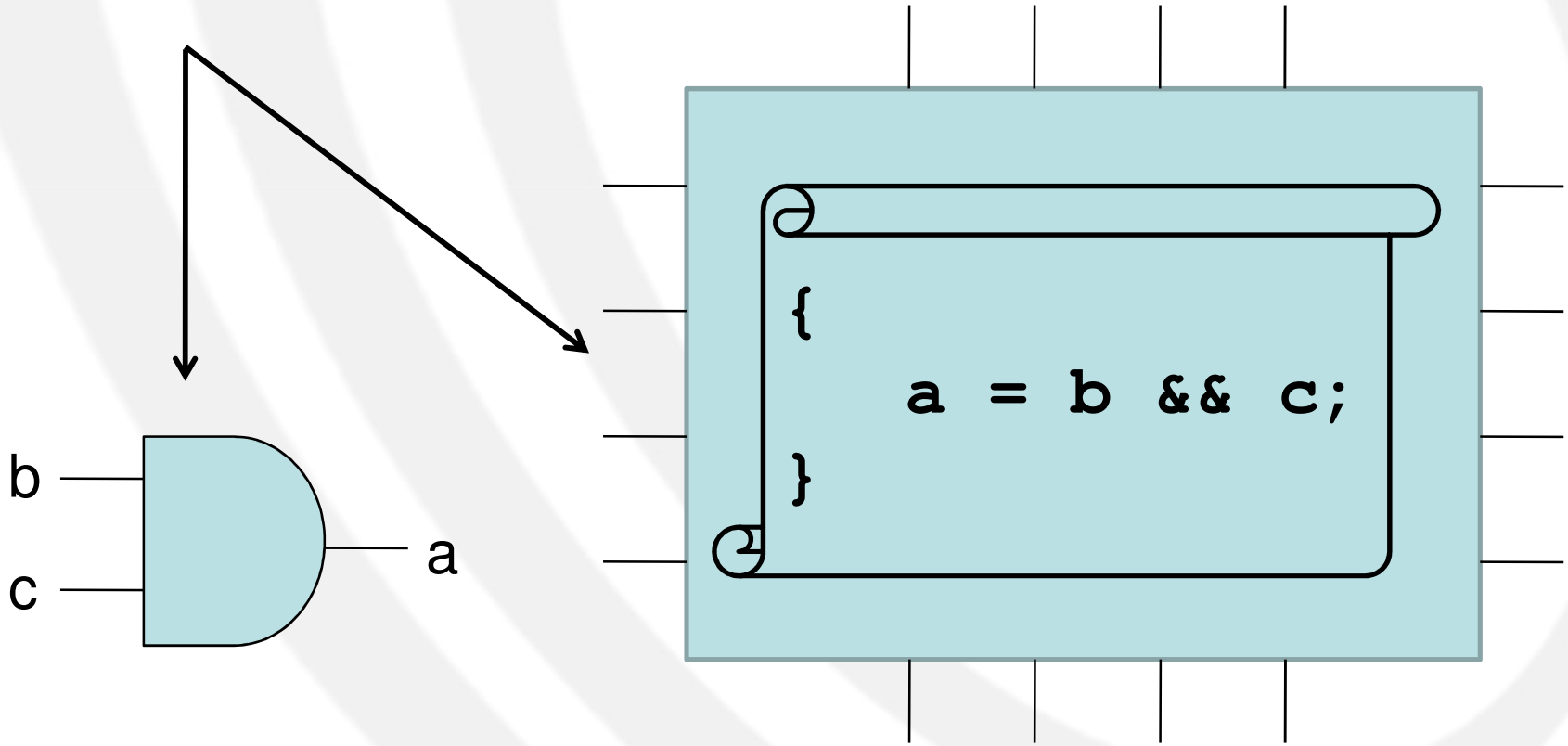
HW/SW partitioning



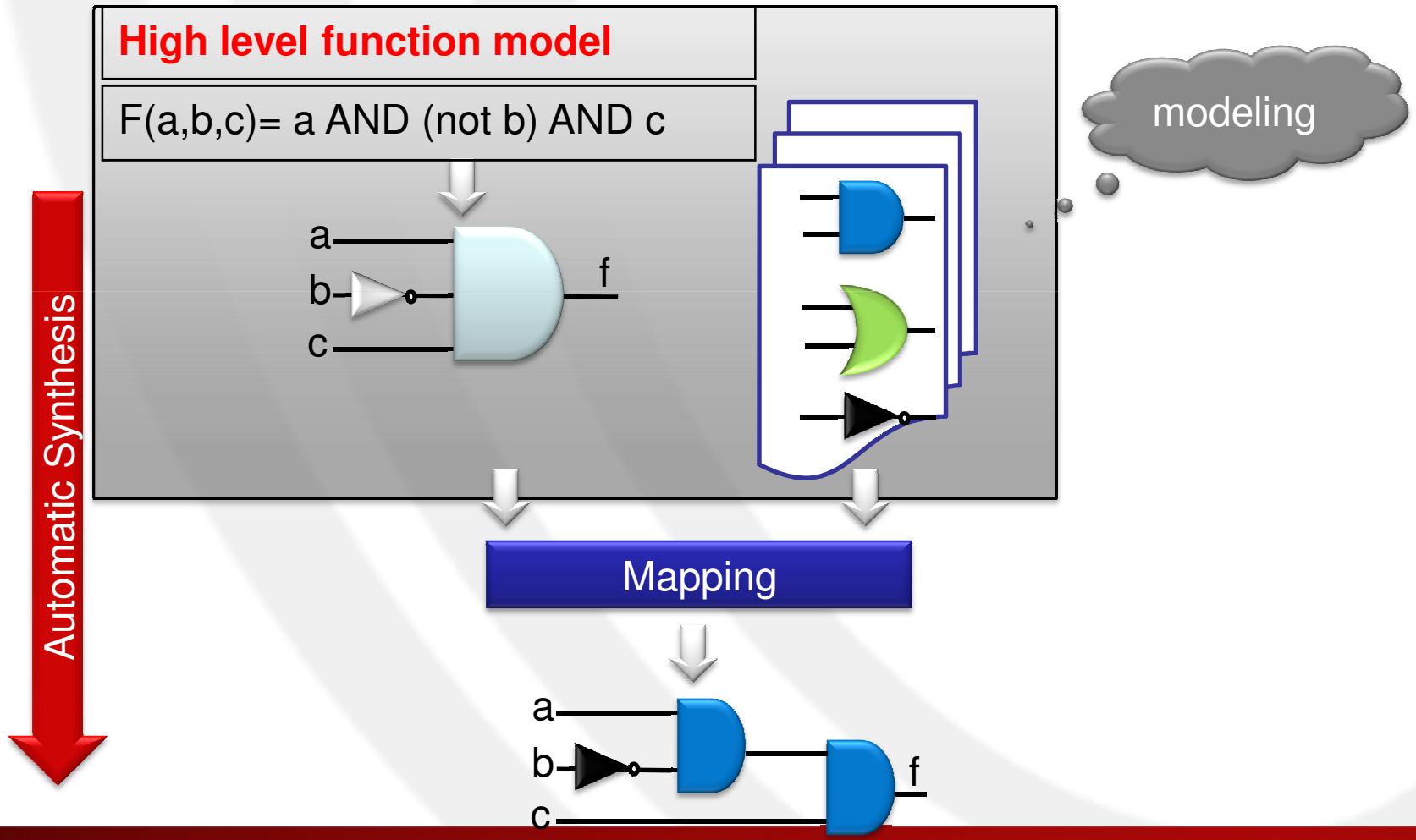
Final result

HW/SW partitioning

a = b AND c

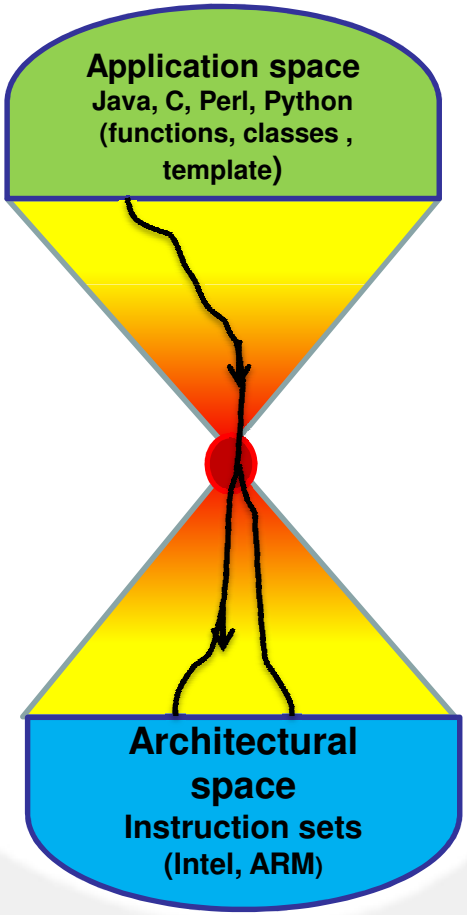


Hardware design

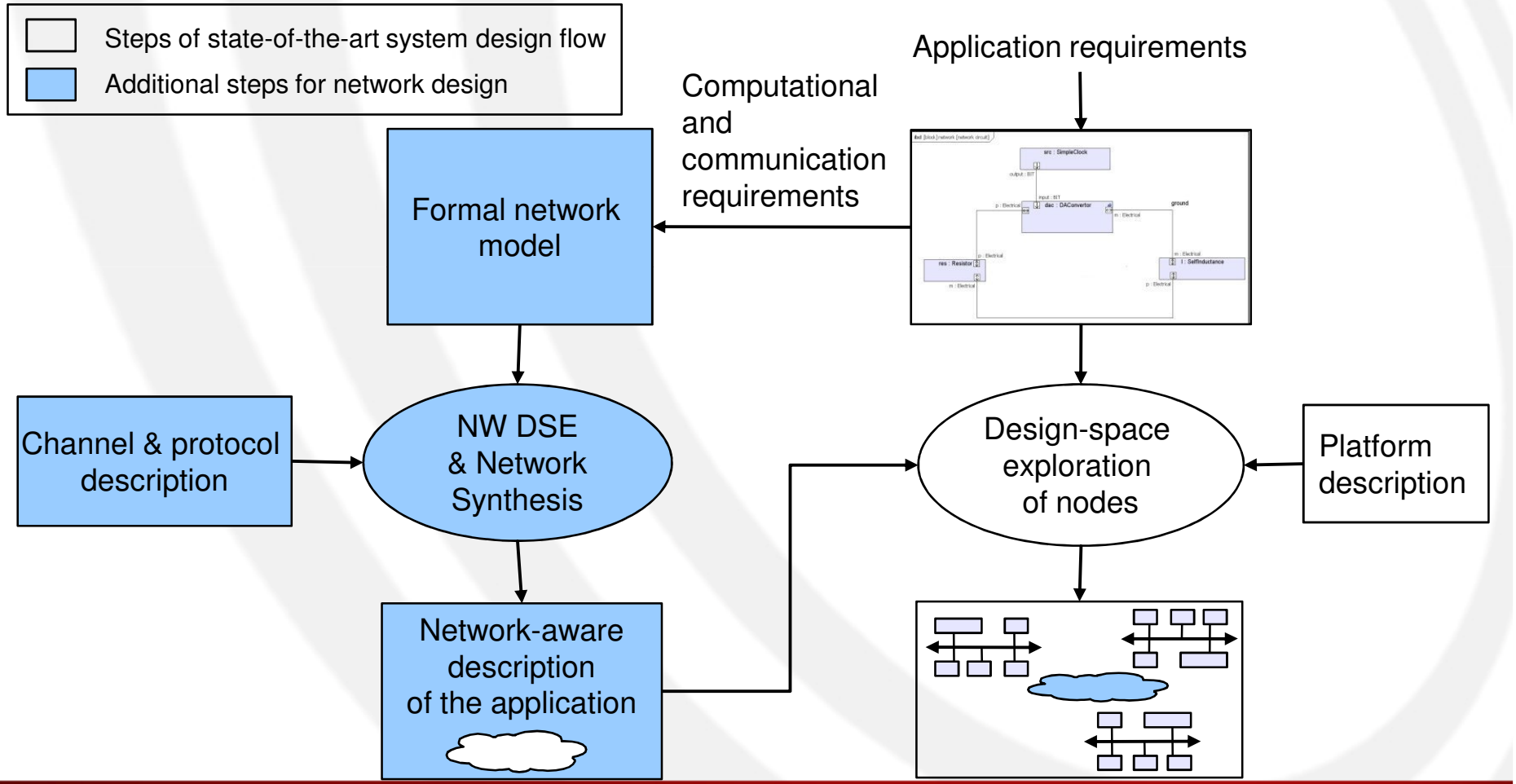


Software development

- Functionality is described with different languages and an automatic process is used to generate assembly code for different target CPU's
- **Modeling** of the functionality: High level languages
- **Automatic synthesis**: Compilers



New design flow for NES



Concepts to be explained

- Model-driven design
- SystemC/TLM
- Simulation of the network
- Network synthesis
- Network-driven verification