

Overview of the Project

Apostolos Dollas

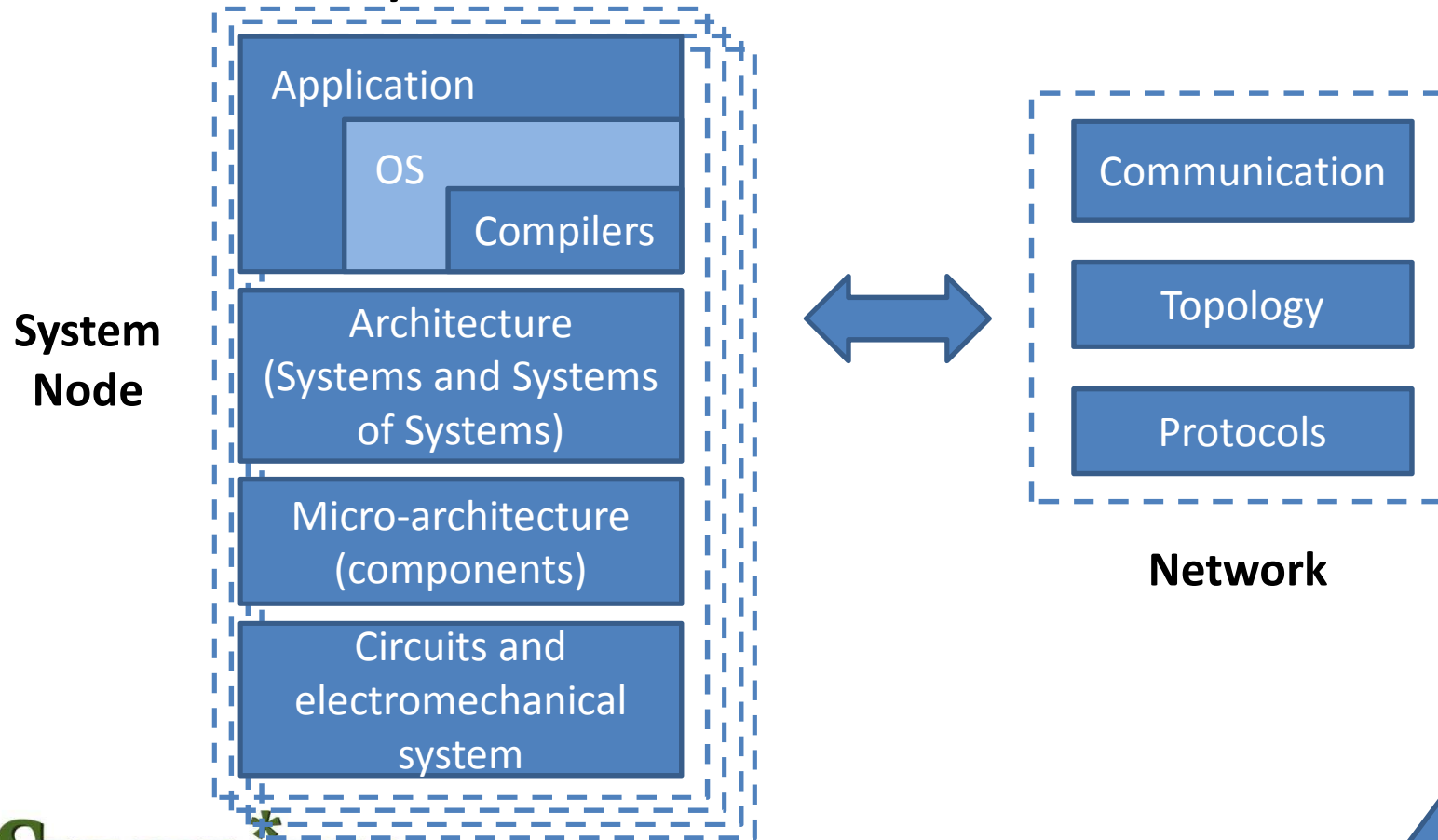
Telecommunication Systems Institute

dollas@ece.tuc.gr



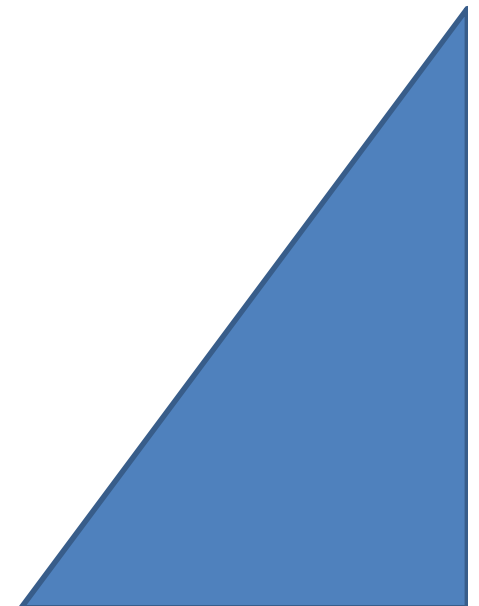
Let's start from the Basics

- A CPS System



Requirements of CPS simulation tools

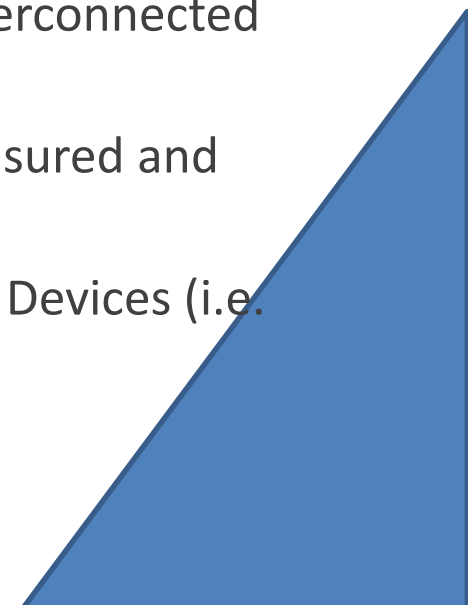
- ▶ Support **multi-core CPUs** (e.g. multi-core ARM) including **several levels of memory hierarchy**, complex peripherals.
- ▶ Support **complex and heterogeneous real network protocols** (e.g. wireless 802.15.4 protocol).
- ▶ **Instruction-Accurate** simulator.
- ▶ Must have **widely-used** interface (familiar to the community)
- ▶ **Open-source simulation tool**
- ▶ **Fast execution time**
- ▶ Support **power consumption models**



What is COSSIM ???

COSSIM will be the first CPS simulation framework that will:

- ▶ Simulate at Instruction Level software execution of CPS multi-core nodes and extract highly accurate performance and energy estimations
- ▶ Incorporate network-related aspects of CPS together with CPU processing aspects in one single framework
- ▶ Develop new models for more accurate energy consumption estimations including consumption of both complex CPS nodes and interconnected networks,
- ▶ Provide new security metrics and features that will be measured and reported by the simulation tool
- ▶ Execute certain parts of the simulations on Reconfigurable Devices (i.e. FPGAs);



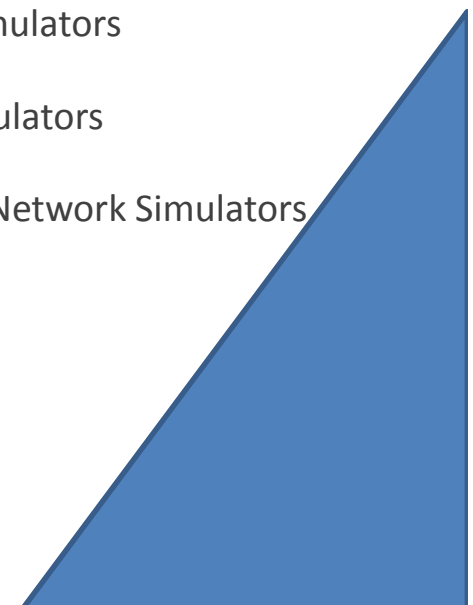
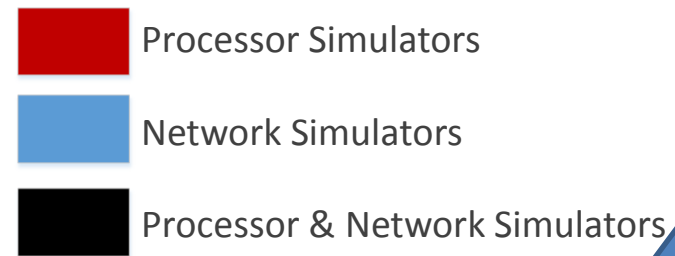
State of the art (WSN Simulation tools)

Do not support instruction Level	Support instruction Level (CA)
TOSSIM (extens: PowerTOSSIM)	Imperas Open Virtual Platforms (OVP)
OMNet++ (frameworks: Castalia/MIXIM - Realistic Radio Channel, PAWIS - power)	SimpleScalar (Single Processor simulator- cannot model OS) – Watch – power measurements
NS-2, MannaSim (ns-2 framework)	ATEMU, AVRORA (TinyOS – supports Mica-based and AVR-based CPUs)
NS-3	WorldSens <ul style="list-style-type: none"> ↙ Wsim (MSP430) ↘ WSNNet (event-driven WNS)
SunShine <ul style="list-style-type: none"> GEZEL (H/W) SimuAVR (proc) TOSSIM (network) 	Cooja (Network simulator for the ContikiOS - MSP430 and AVR-based motes)

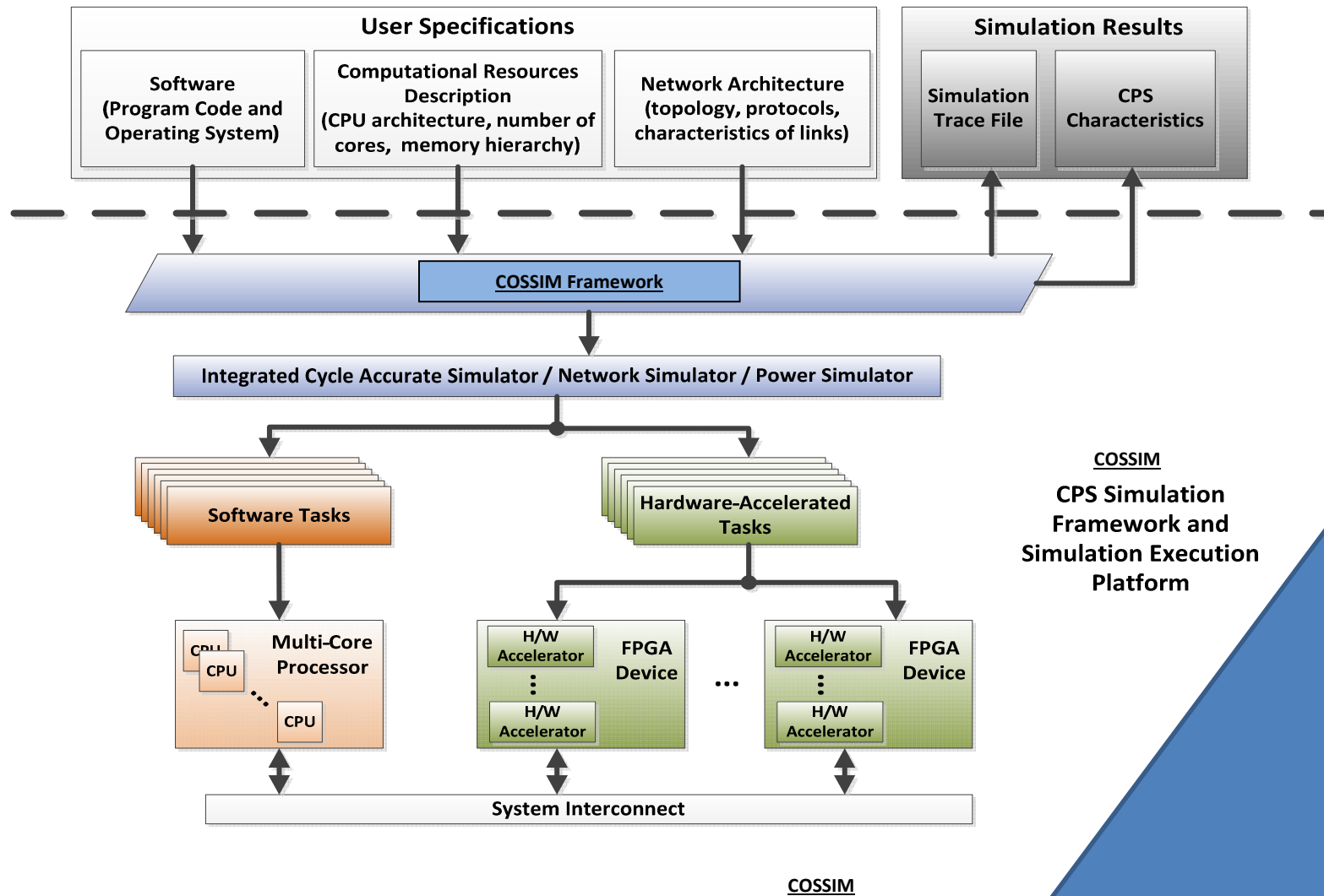
WSN simulators can be mainly placed

in the following two categories:

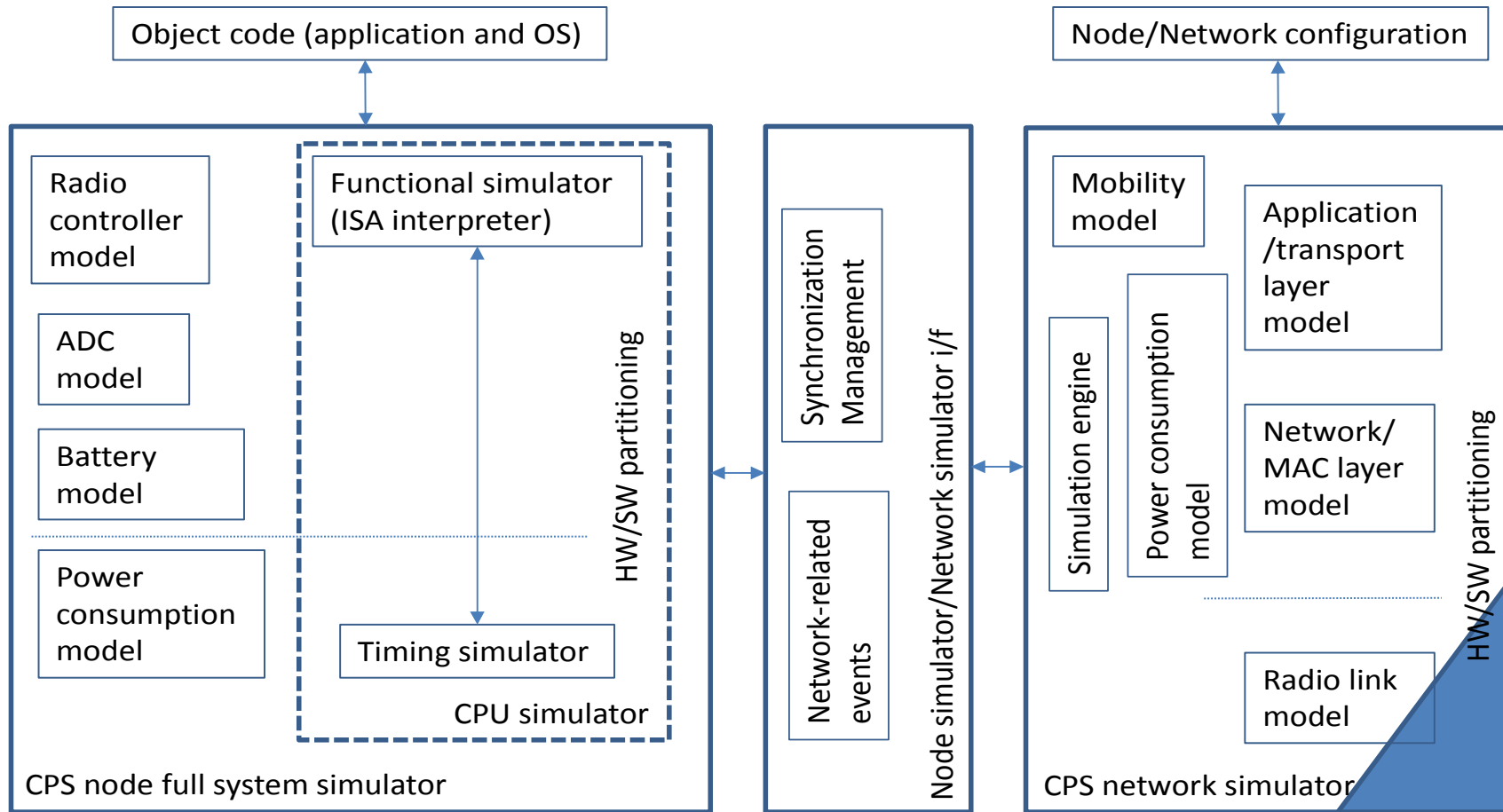
- Those that **do not support instruction level simulation**
- **support simulation at the instruction level**



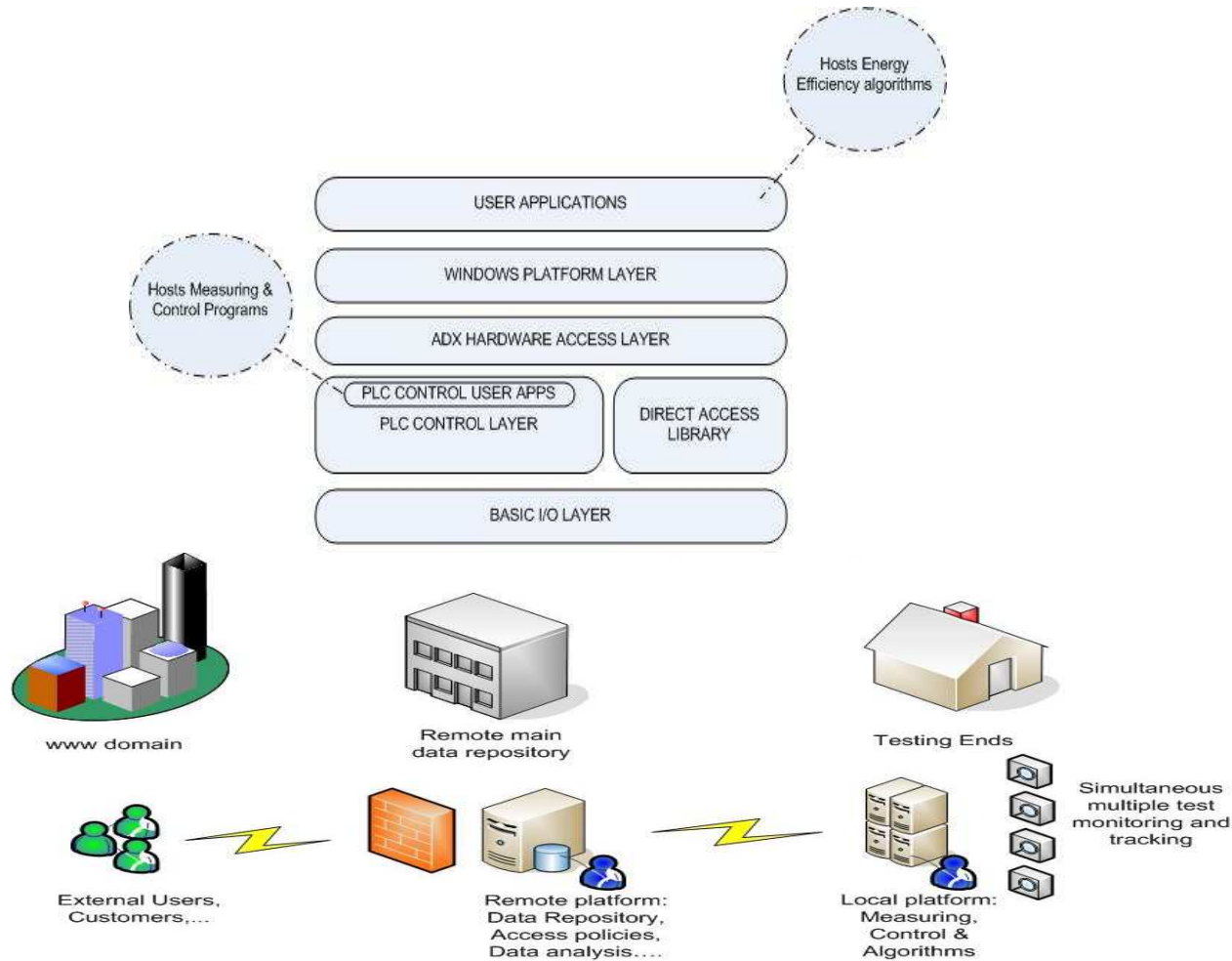
Overall COSSIM architecture



Overall COSSIM low level architecture

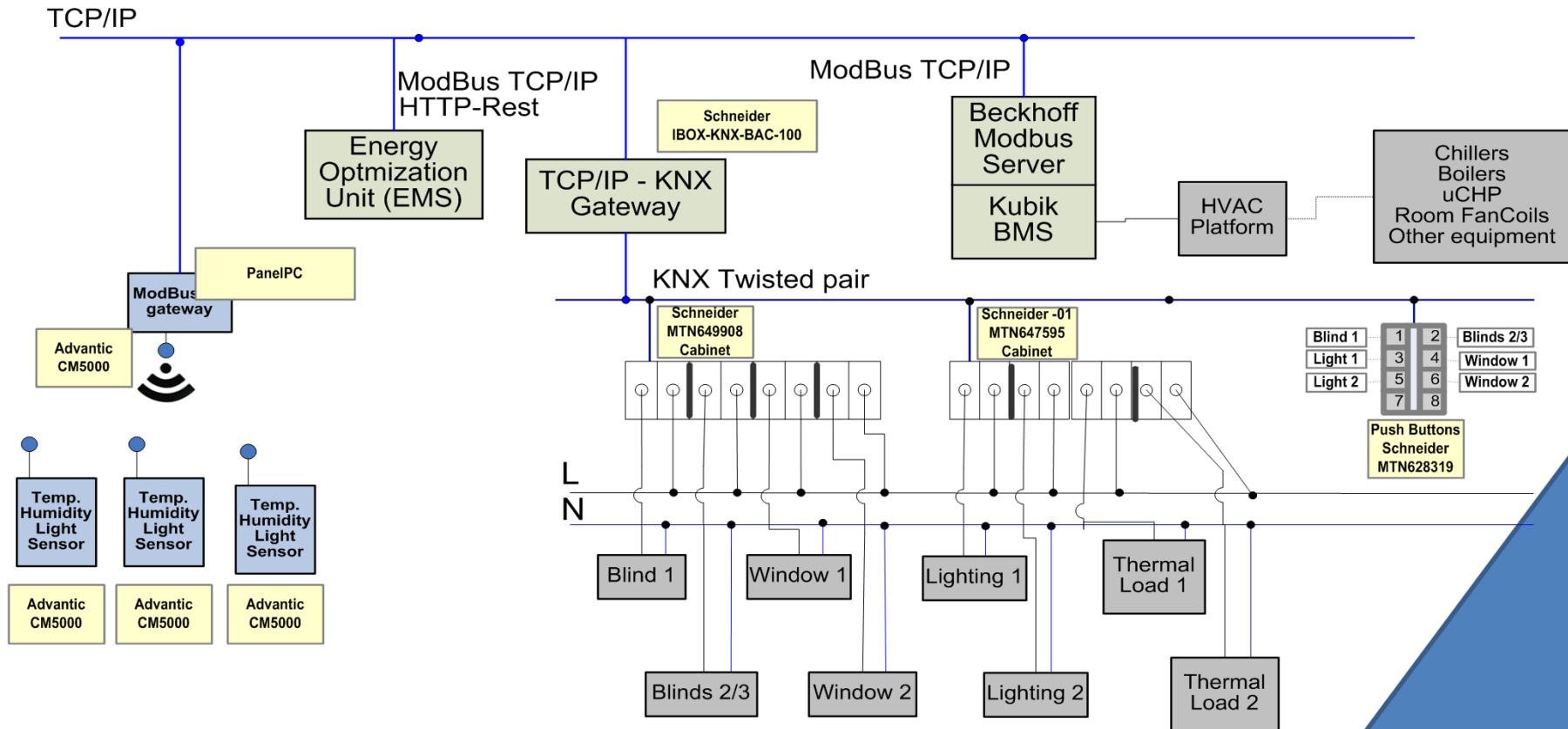


BMS (Building Management System) use case (1) Overall Architecture



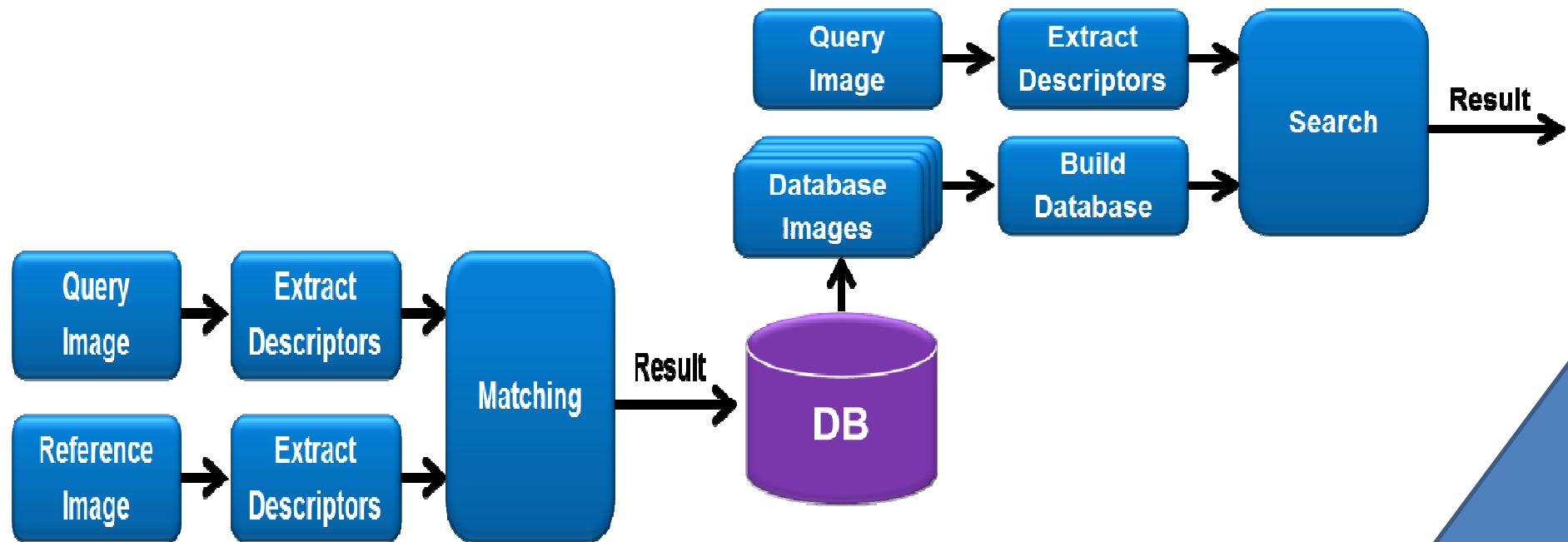
BMS (Building Management System) use case (2)

CPS Topology



Visual Search use case (1)

Overall Architecture



Visual Search use case (2) CPS Topology

