



**A flexible and reflective middleware for low-power mobile heterogeneous embedded systems connected to the Internet  
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Your connection to ICT research

## ❑ CETIC

- ❑ Independent R&D center in Belgium (Charleroi) on Information and Communication Technologies
- ❑ Experience through Walloon and European projects and service missions to enterprises

## ❑ Embedded and Communication (ECS) Departm.

Intelligent and communicating wireless embedded systems for a wide range of applications (transportation/logistics, ehealth, home automation, aeronautics, ...)

## ❑ Software and System Technologies (SST) Departm.

SoA, Web services, cloud computing/SaaS, semantic information processing,

## Systems considered

### Wireless embedded systems

### Heterogeneous

- different technologies (Zigbee, 6LoWPAN, RFID, Bluetooth low-power, ...)
- different hardwares/devices (sensors, actuators, RFID tags, wireless medical implants, smartphones, ...)
- fixed and mobile nodes
- mainly battery-powered nodes, a few mains-powered nodes
- Some nodes are connected to the Internet (**Internet of Things**)
- possibly different OS,

### Mobile

Some network nodes are mobile:  
smartphones, nodes attached to people, ...

### Low-power

Low-power technologies, battery-constrained nodes, ...

## A flexible and reflective middleware for such systems

- ❑ Lightweight interface to application programmer to ensure the rapid deployment of applications
- ❑ Focus on resource/information discovery and resource management services
- ❑ Flexible (scalable, adaptive, parametrable)  
due to changing environment/context (mobility, device failure, moving obstacles, interference, ...)  
=> New information/resource can be discovered and exploited
- ❑ Reflective
  - ❑ Context-aware: ability to discover, learn, reason about context
  - ❑ Adaptive: adapt its behavior (acts) to it, even pro-active aspects

## Ambient and assisted living IoT applications

Heterogeneous systems/devices ('things') must interoperate in a flexible and intelligent way, e.g. in:

- ❑ **Medical/health monitoring (ehealth)**

= Remote monitoring of patients or elderly people.

Motion sensor, glucometer, blood pressure, pacemaker, wireless neural implant, micro-robots) need to automatically communicate data/alerts to doctors/hospitals/relatives via a smartphone or a home network (+ possible remote questioning or reconfiguration of medical devices by doctors)

- ❑ **Intelligent homes & buildings (home/building automation)**

Sensors (temperature, humidity, motion, smoke, ...), actuators, smartphones but also fridges, stove... are interconnected to form a smart environment