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INS2I and INSIS

Computer Science, Control Theory, Robotics
Micro & Nano Systems (RENATECH)

Disciplinary Domains (Perm. + Post-Doc & PhD Students) and Scientific Themes

Computer Science	• Crucial Computing [IC] Karama Kanoun (62) • Networks & Communications [RC] Khalil Drira (62)
Robotics	• Robotics [ROB] Florent Lamiraux (82)
Automatic Control	• Decision & Optimization [DO] Didier Henrion (85)
Micro and Nano Systems	• Microwaves and Optics: From Electromagnetism to Systems [HOPES] Daniela Dragomirescu (64) • Nano Engineering & Integration [N2I] Carole Rossi (45) • Micro Nano Bio Technologies [MNBT] Bernard Legrand (58) • Energy Management [GE] Frédéric Morancho (49)

Panel: 360° on CNRS vision of FoF and Smart Cities

Tailoring Cyber-Physical Systems to Suit Industry of the Future and Smart City Requirements: Some Examples

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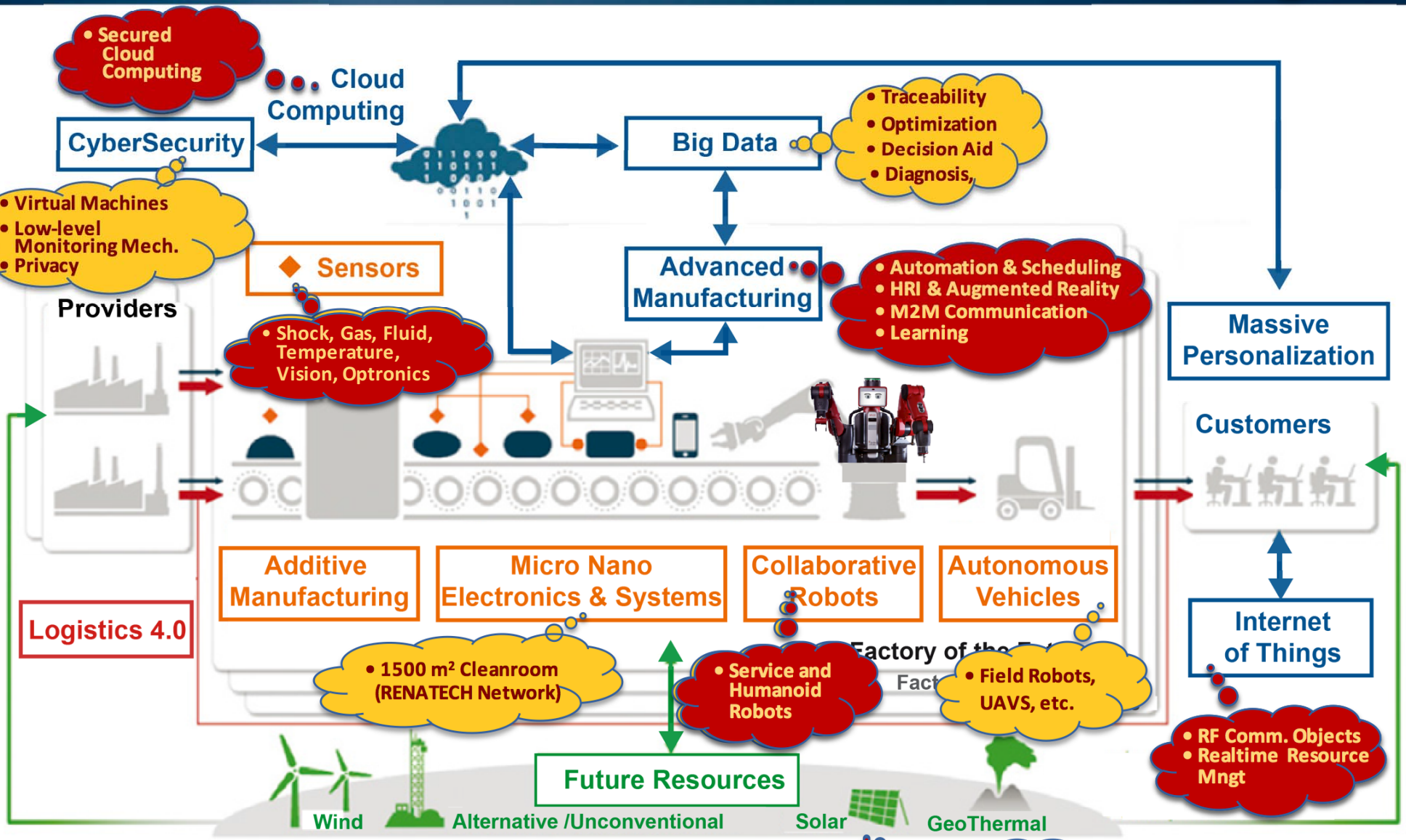
Some Key Issues

- Global Perspective: “Smart” People, Home, City, Factory…, but also in the Country Side
  —> Farm of the Future!
- Convergence of Requirements
  —> Generic Solutions —> STICs the Corner Stone
- Autonomous, Mobile, Increasingly Connected and Interdependent Users/Systems
- More dependency on the infrastructure
  —> Resilience: a Must
- More Open Systems, thus Attack-prone
  —> Security —> Safety
- Multidiciplinary Vision Mandatory
  - Privacy, Acceptability, Legal Issues,…

About the Factory of the Future

LAAS-CNRS Activities

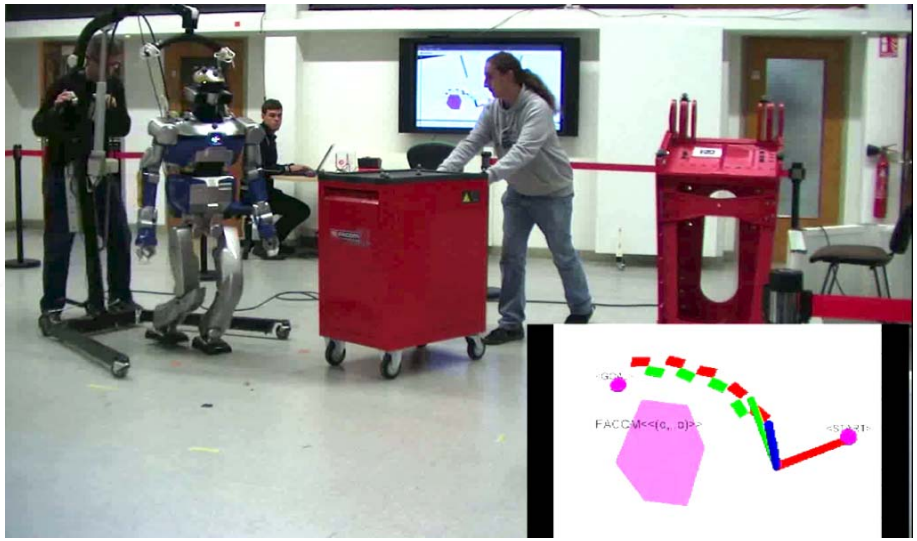


Adapted from: INDUSTRY 4.0 - The new industrial revolution - How Europe will succeed
Roland Berger Strategy Consultants, March 2014

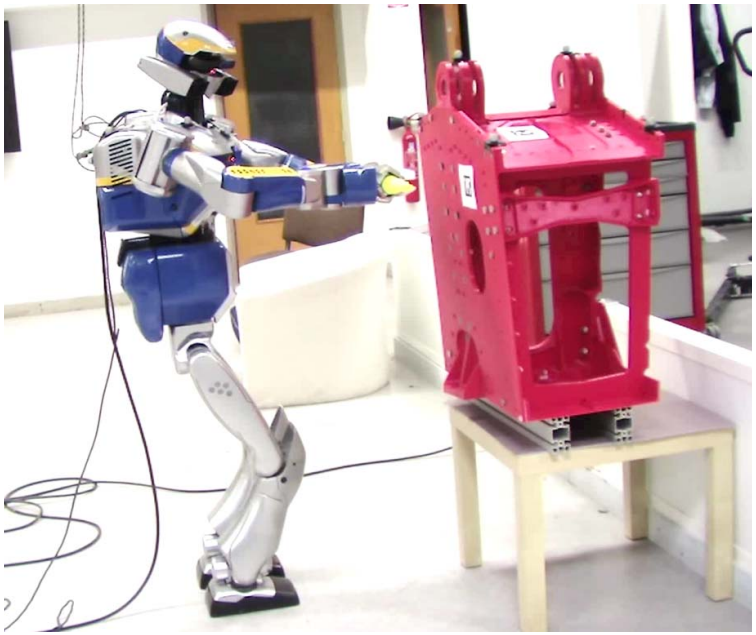
Collaborative Robots: Humanoid Robots in the context of the FoF

- HRP-2 as a Universal Worker? - "Proof" of Concept…
- Collaboration with AIRBUS

Future Aircraft Factory



Real time footstep replanning in an evolutive environment



Whole-body movement for the execution of a screwing task on an A350 part

Advanced Manufacturing: EASY - Energy Aware feeding SYstems

- **Objectives**
  - Energy efficiency
  - Sustainable Supply Chains
  - Trade-offs between economic, environmental and social objectives
- **From: Pure JIT manufacturing**
  To: Energy-aware JIT manufacturing
- Focus on the internal logistic of assembly lines feeding

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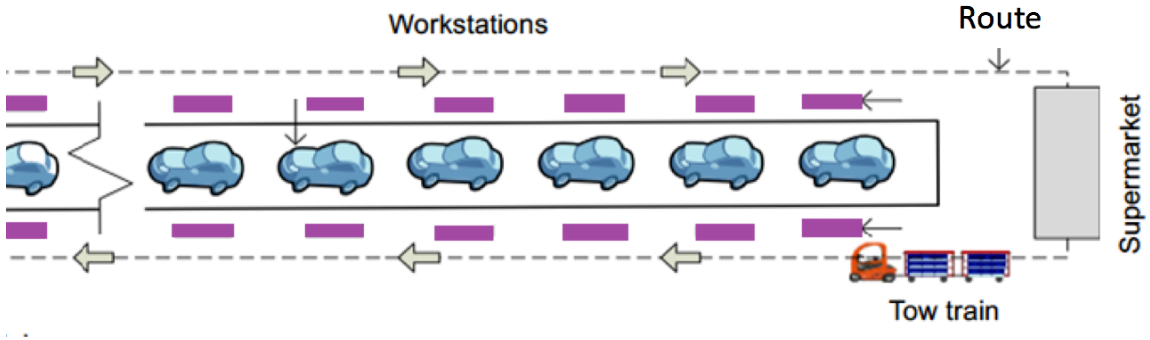
www.eco-innovera.eu



Mixed-integer linear programming : scheduling the tow train trips to feed the workstations optimizing energy cos /delay tradeoffs

ECO-Innovera project (2013-2016) - Partners: LAAS-CNRS, U. Skövde (SE), U. Navarra (ES); Volvo, Volkswagen

Innovative Sensors: Programmable Hyperspectral Imager

- **Current solutions: spacial or spectral scanning**
- **Recent "Snapshot" solutions: => compromises in the resolutions**

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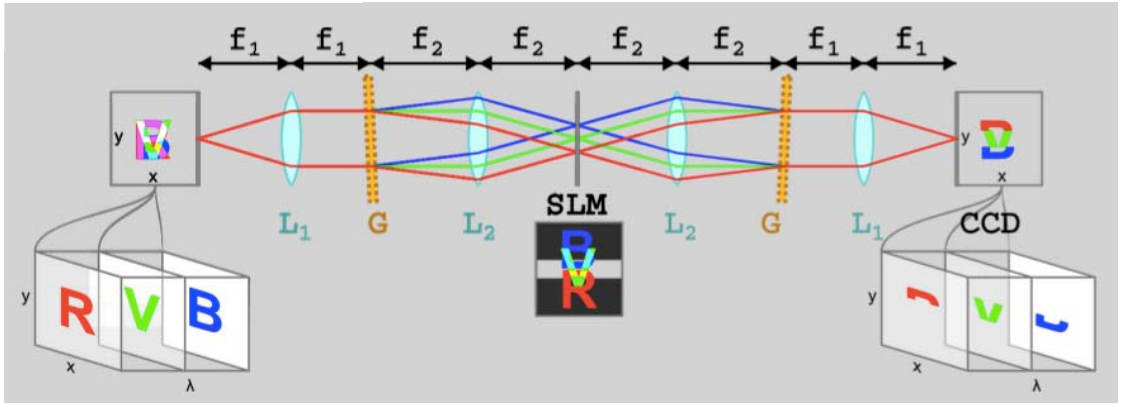
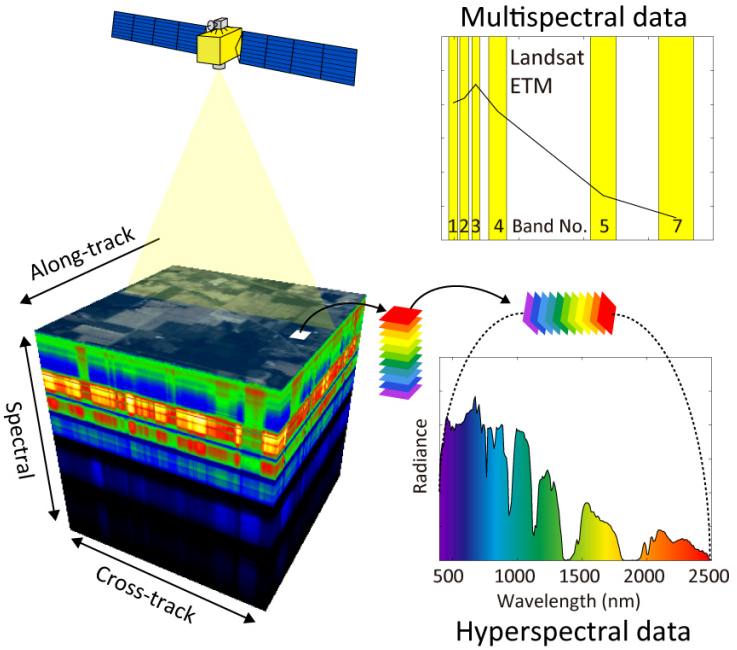
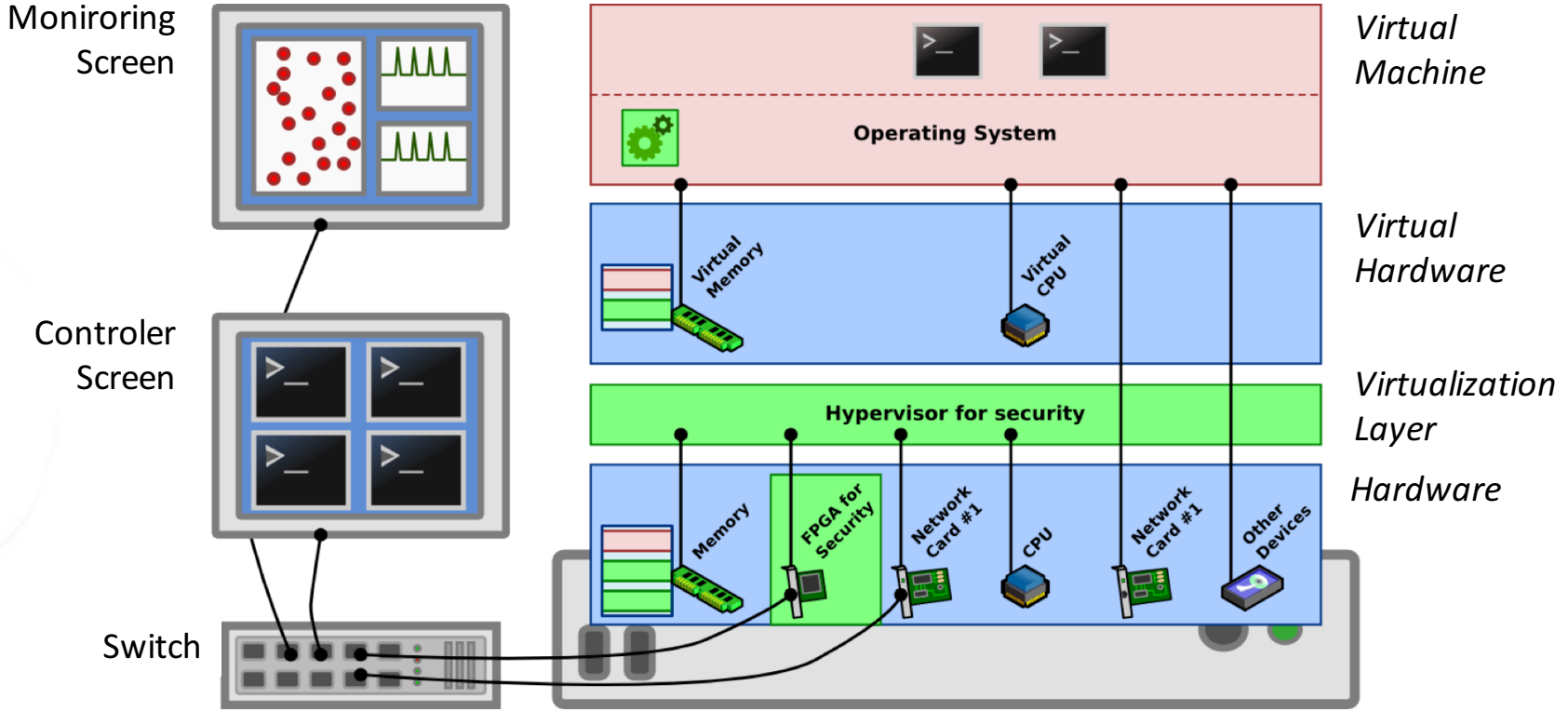
⇒ **Proposal: "co-design" (optics design and control & processing algorithms)**





- Spatial Light Modulator:
  - Active selection of data
  - No mix of spacial and frequency components
- Proof of concept validated by a prototype
- **Transfer via** TOULOUSE TECH TRANSFER ***and application to autonomous vehicules being assessed***

Cyber Security: Trusted Architecture for Virtualized Infrastructures Protection



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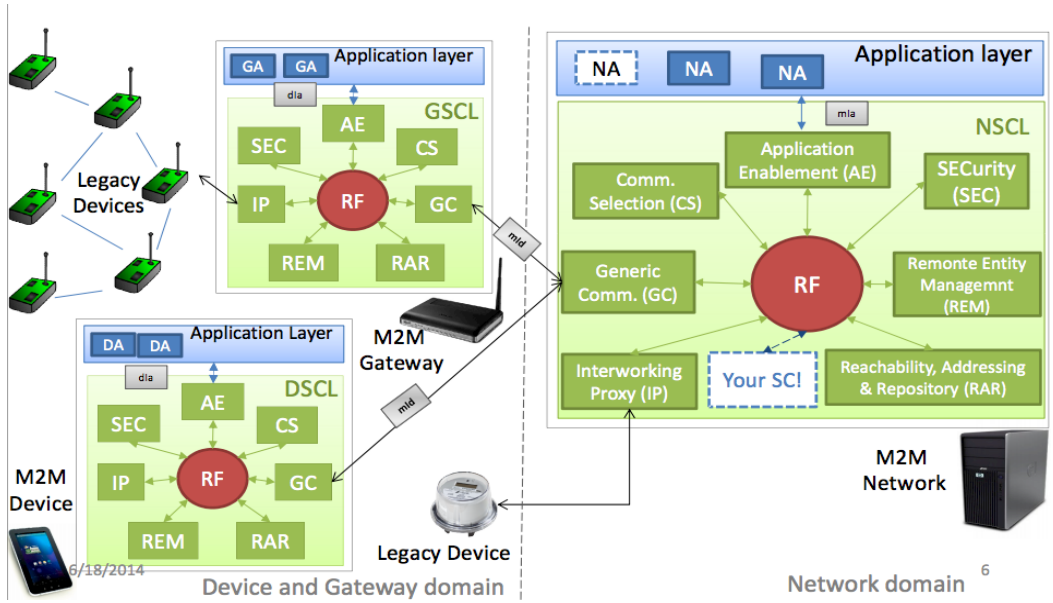
- **Contribution: A Security Hypervisor**
  - Virtualizing the VMM + Detection of attacks targeting the VMM
  - Dedicated trusted hardware component (FPGA board)
- **Application to Cloud Infrastructures: SVC project**

Internet of Things : M2M Communication Services

OM2M.org

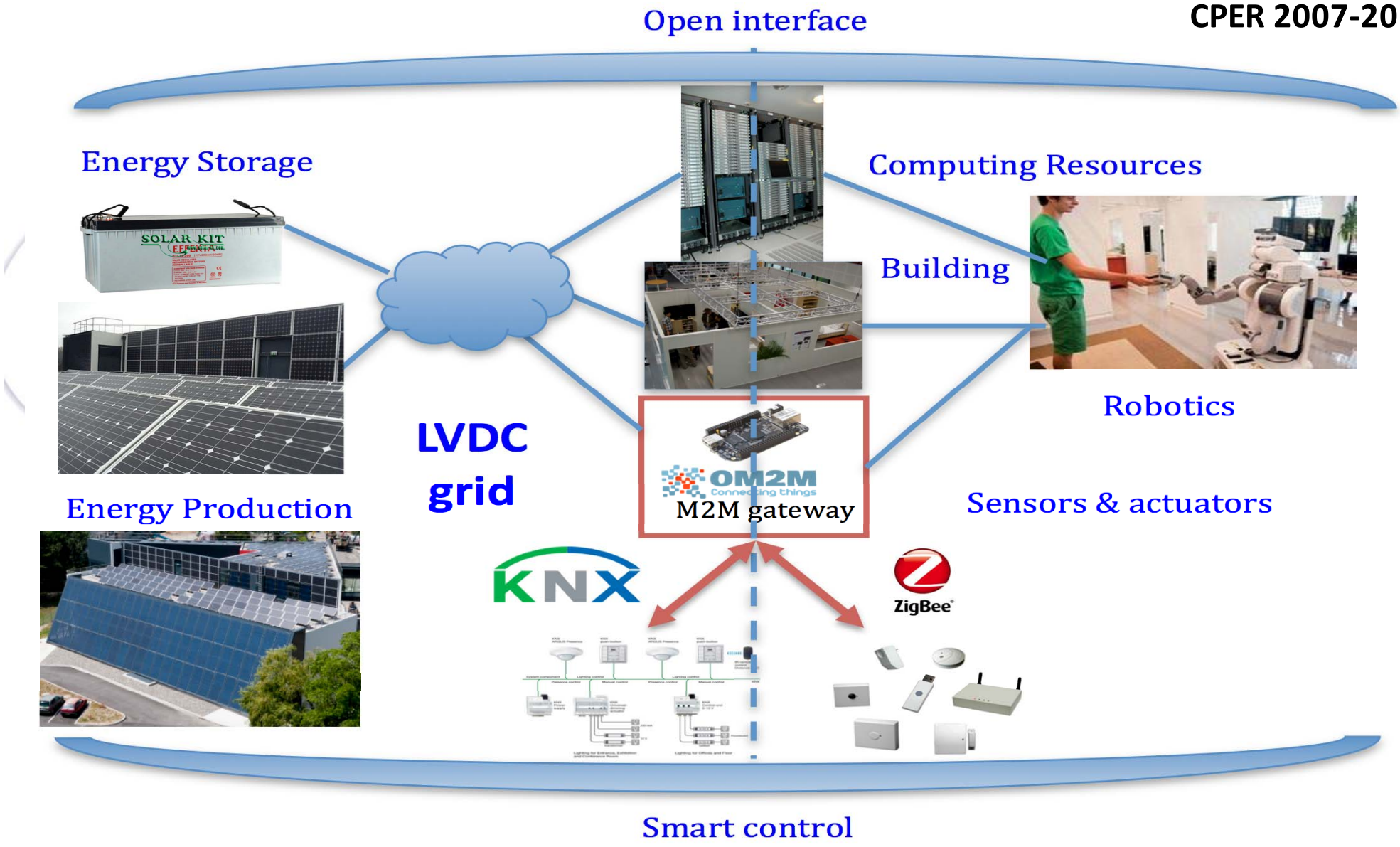
- Open Source ETSI-compliant M2M Platform,
- Supported by Eclipse foundation (om2m.org).
- Next release : compliance to international standard **OneM2M**



- Fleet management [ITEA2-USENET]
- Smart metering [ITEA2-A2NETS]
- Smart vehicles [PIA-S2C2]

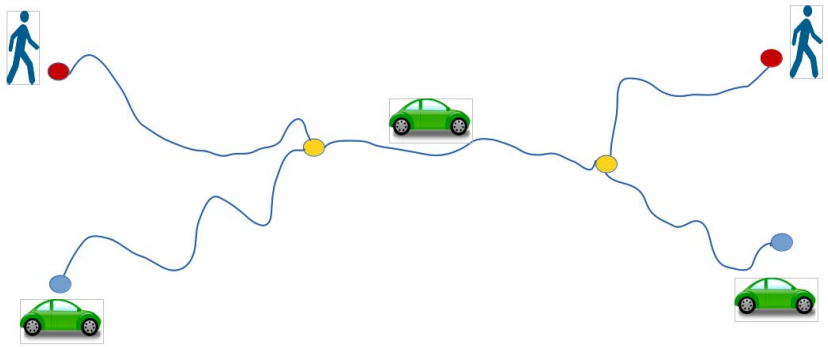
The Georges Giralt *(Energy Optimized & Instrumented)* Building: An Open Platform

CPER 2007-2013



Big Data & Cyber Security : Privacy-Preserving Carpooling

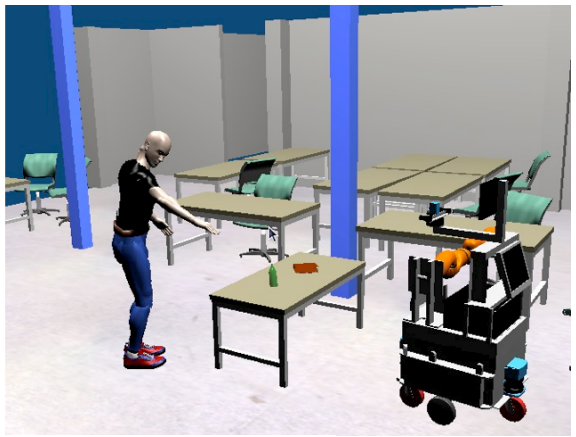
- **How to travel together without disclosing the whereabouts?**
  - Carpooling objective
    - Find pickup and drop-off locations
    - Optimize arrival times
  - Privacy constraints
    - Hide mobility data of participants

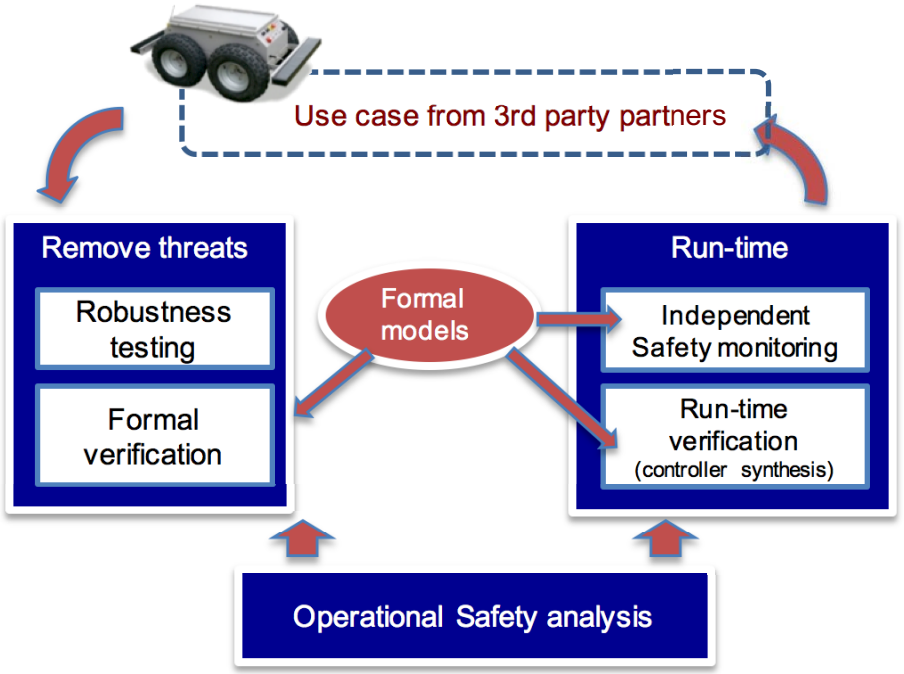


- **Approach**
  - Based on distributed computation, to avoid single-point-of-trust
  - Methodologies used:
    - Graph algorithmics: shortest path, isochrones, etc.
    - Privacy enhancing technologies: private set intersection, homomorphous crypto
- **Preliminary results**
  - Privacy-preserving version:
    - Cost x 1.1
    - Computing x 0.6 (40% gain)

Safety: Testing Robots via the Generation of Virtual Worlds

- **Objective: Testing the system in a large spectrum of situations**
- **For safety and cost reasons**
  - Testing via simulation
  - The MORSE** open simulation infrastructure
- **Challenges :**
  - **Existence of dangerous/stressing characteristics?**
  - **Criteria for selecting test sets?**
  - **How to satisfy them?**





CPSELabs Project : H2020

MORSE: the **Modular **O**pen**R**obots ***Simulation*** **E**ngine
LAAS-CNRS & ONERA