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# Trends & Issues in the integration between Service Robots and Smart Environments

Track 3 – 13 March 8:30-10:30

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Mauro  
Dragone



<http://fp7rubicon.eu>

Arantxa  
Renteria



# Motivations



MOBISERV



# Motivations

Different viewpoints:

- People-centered initiatives, HRI
- Development of specific services
- Service-agnostic efforts
- ...

# Goals

## Identify common R&D agenda

- **State of the art:** Lessons learned, mature knowledge, tools, shareable results...
- **Issues** preventing further progress, e.g. concerning interoperability, personalization, adaptation ...
- **Opportunities**, to take advantage and combine past advancements in the area, open new applications...

# Agenda

- 8.30-8:40 **Welcome and introduction**
- 8.40-9.45 **Talks by invited speakers**
  - 9 speakers, **5 minutes each !!!!**
  - 1) Your project: goals and approach
  - 2) Lessons learned, (shareable) results/tools
  - 3) Open questions & Opportunities
- 9.45-10.20 **Discussion**
- 10:20-10.30 **Conclusion**

# Proposed Outcome

## Contribute to MAR & Related Topic Groups

- Memo for Wiki, from minutes of this workshop, in terms of:
  - 1) **State of the art:** technologies and abilities particular to this type of project
  - 2) **Issues / step changes**
  - 3) **Opportunities /**  
Possible impact of integrated approaches

# Speakers

- Arantxa Renteria & Mauro Dragone, RUBICON
- Markus Vincze, HOBBIT
- Atta Badi, CompanionAble
- Sanja Dogramadzi, MOBISERV
- Melvin Isken, FLORENCE
- Kerstin Dautenhahn, ACCOMPANY
- Andrea Orlandini, Giraffe+
- Paulo Alvito, MOnarCH
- Filippo Cavallo, Robot-ERA





# RUBICON ICT-2009.2.1 (269914)

Robotic UBIquitous Cognitive Network

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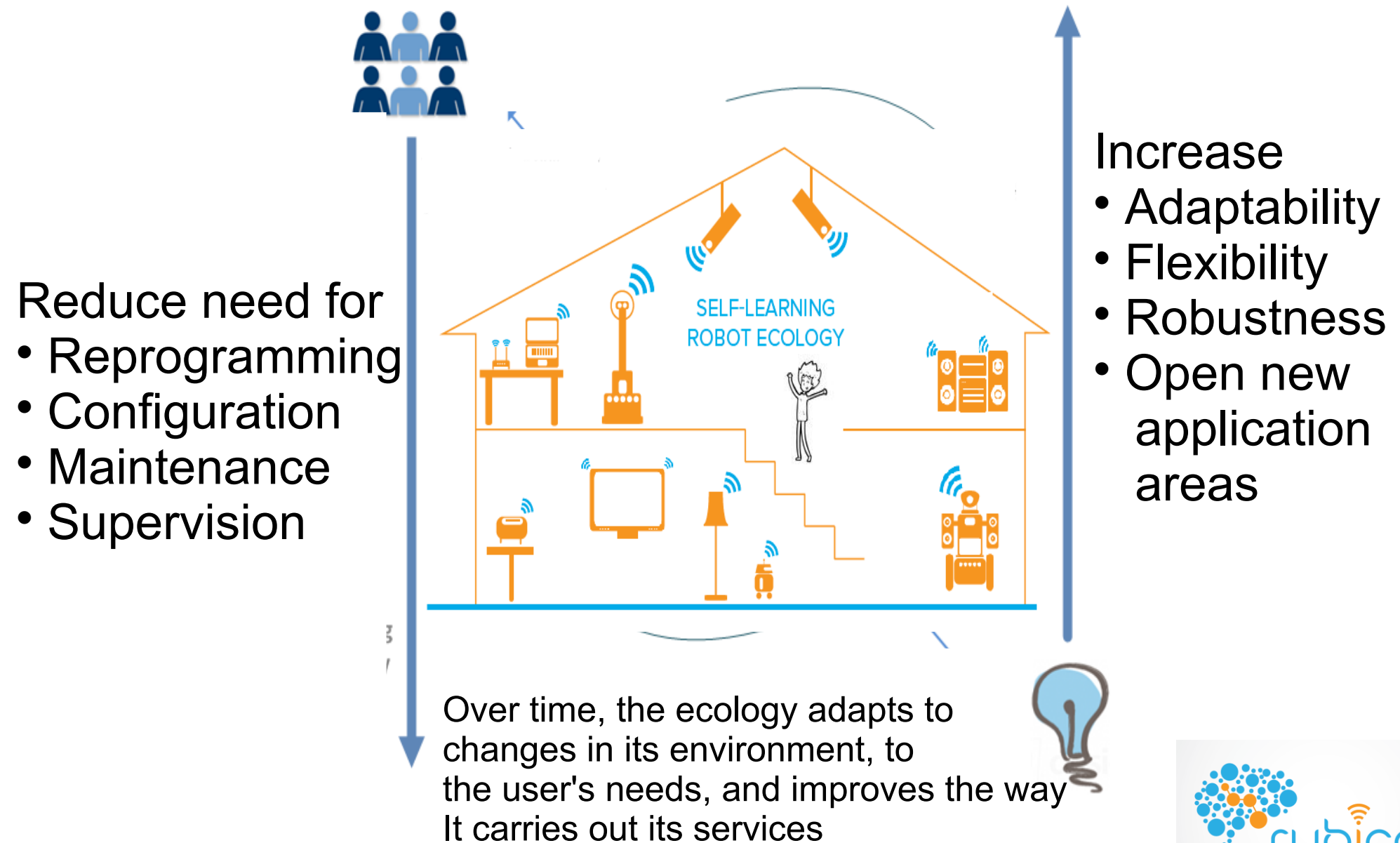
School of Computer Science and Informatics.  
University College Dublin (UCD)  
13 March 2014, Rovereto, ERF-13

**Dr. Mauro Dragone**  
RUBICON Scientific Leader

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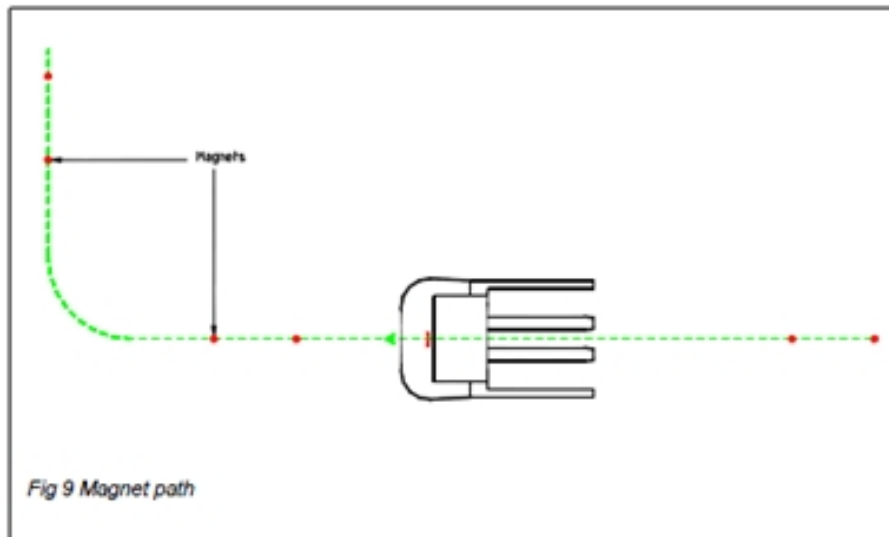
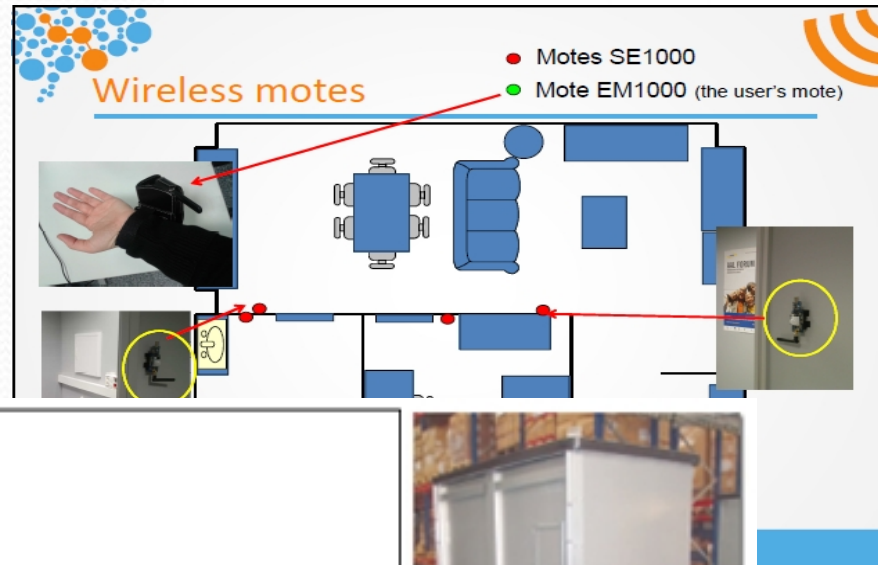
# RUBICON GOAL: Self-Adaptive Robotic Ecologies



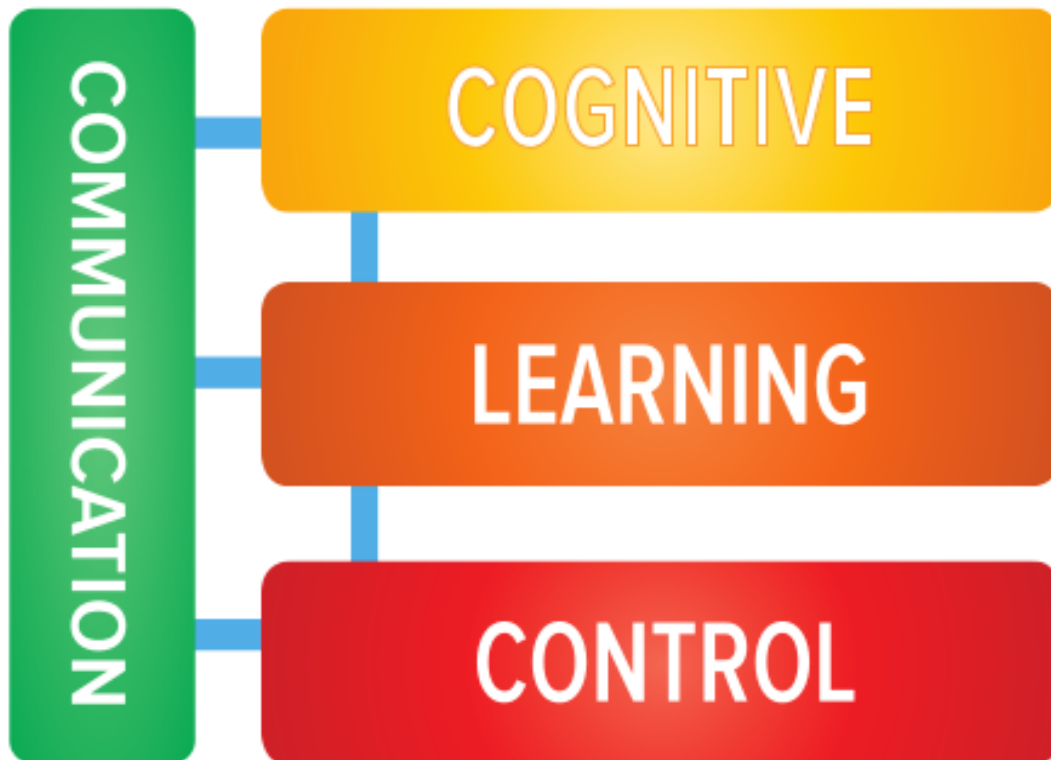
# Test-Beds

RUBICON is validated in in two real-world test-beds

- Ambient Assisted Living in sensorised apartments
- In-Hospital Transport System (ROBOTNIK)

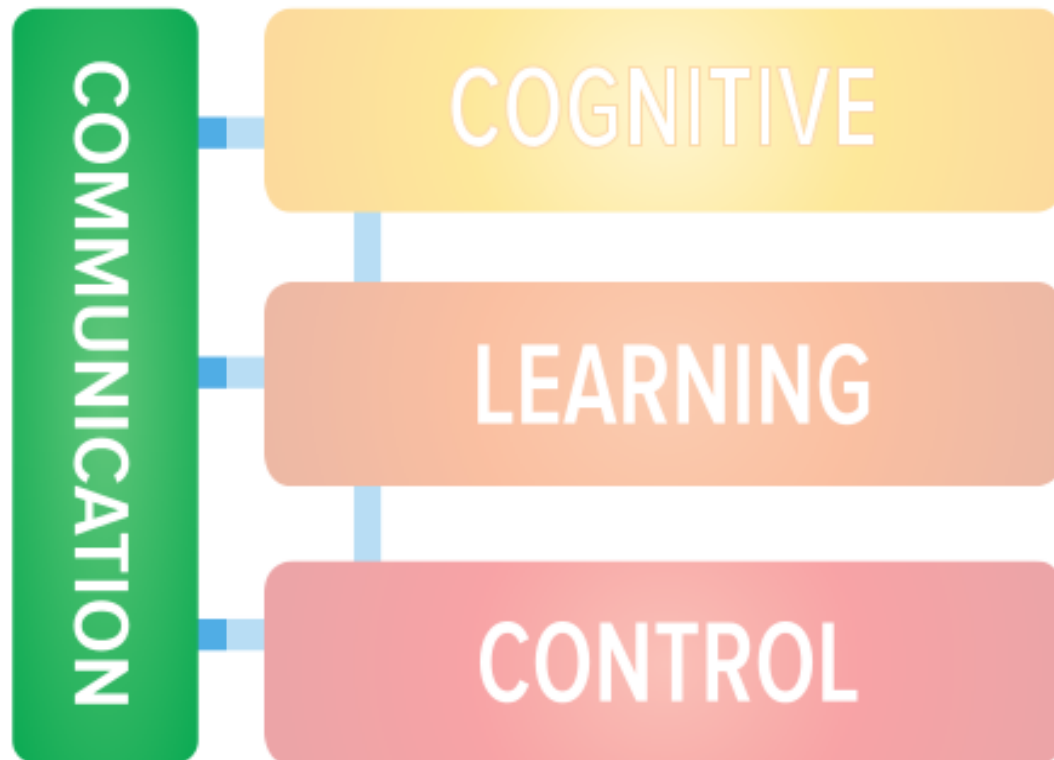


# Approach: Requirements & Architecture for an Autonomous, Self-Adaptive Smart Environment



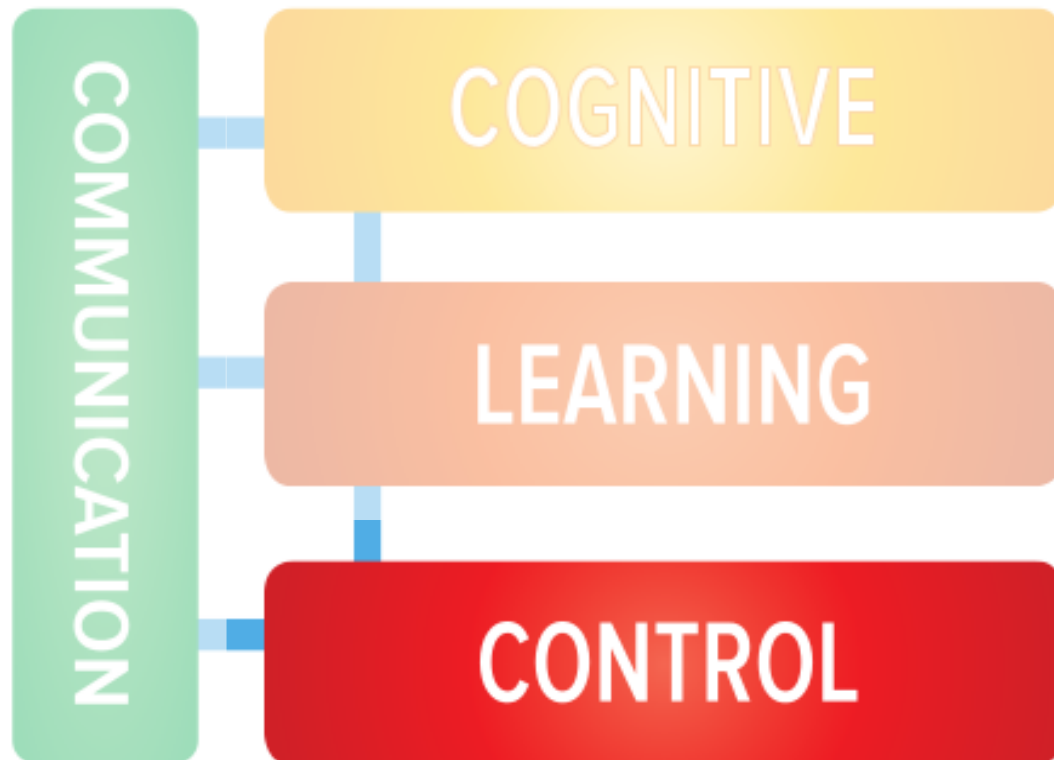


# Approach: Requirements & Architecture for an Autonomous, Self-Adaptive Smart Environment



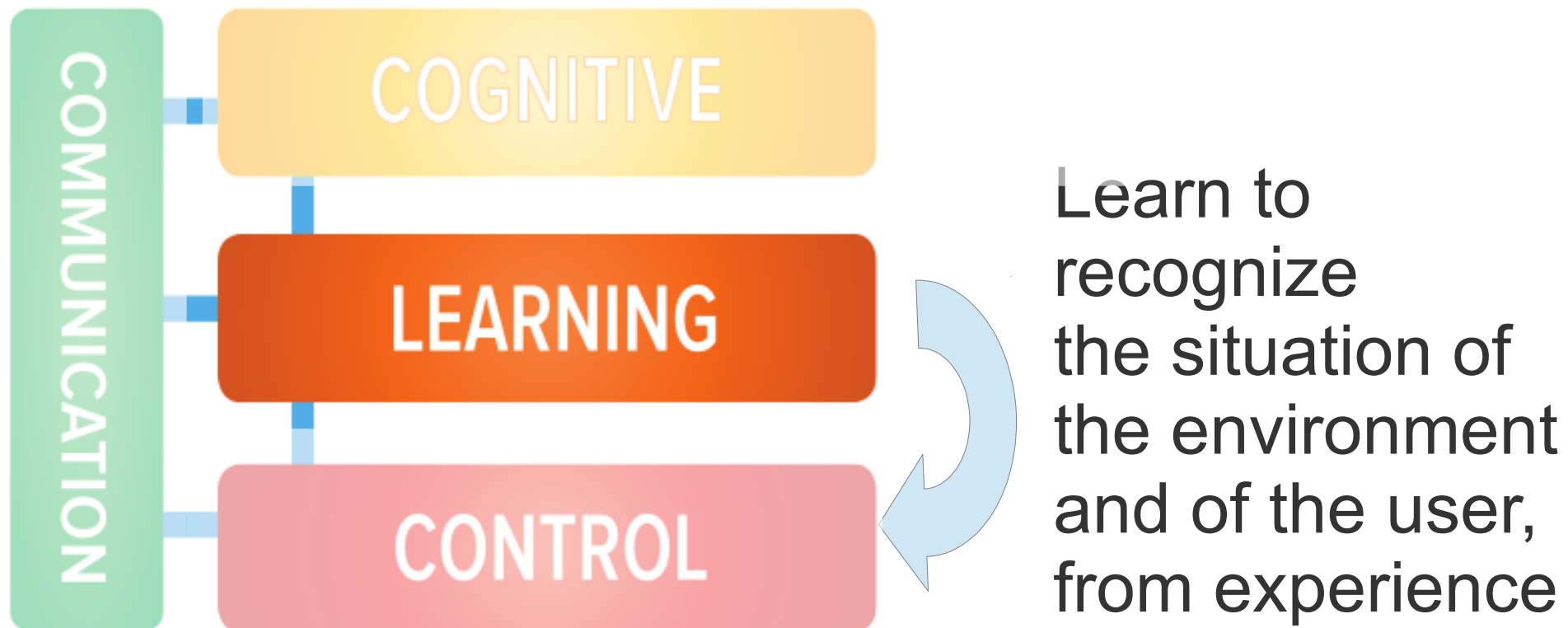
Bind components and enable communications with sensors, actuators and robots

# Approach: Requirements & Architecture for an Autonomous, Self-Adaptive Smart Environment

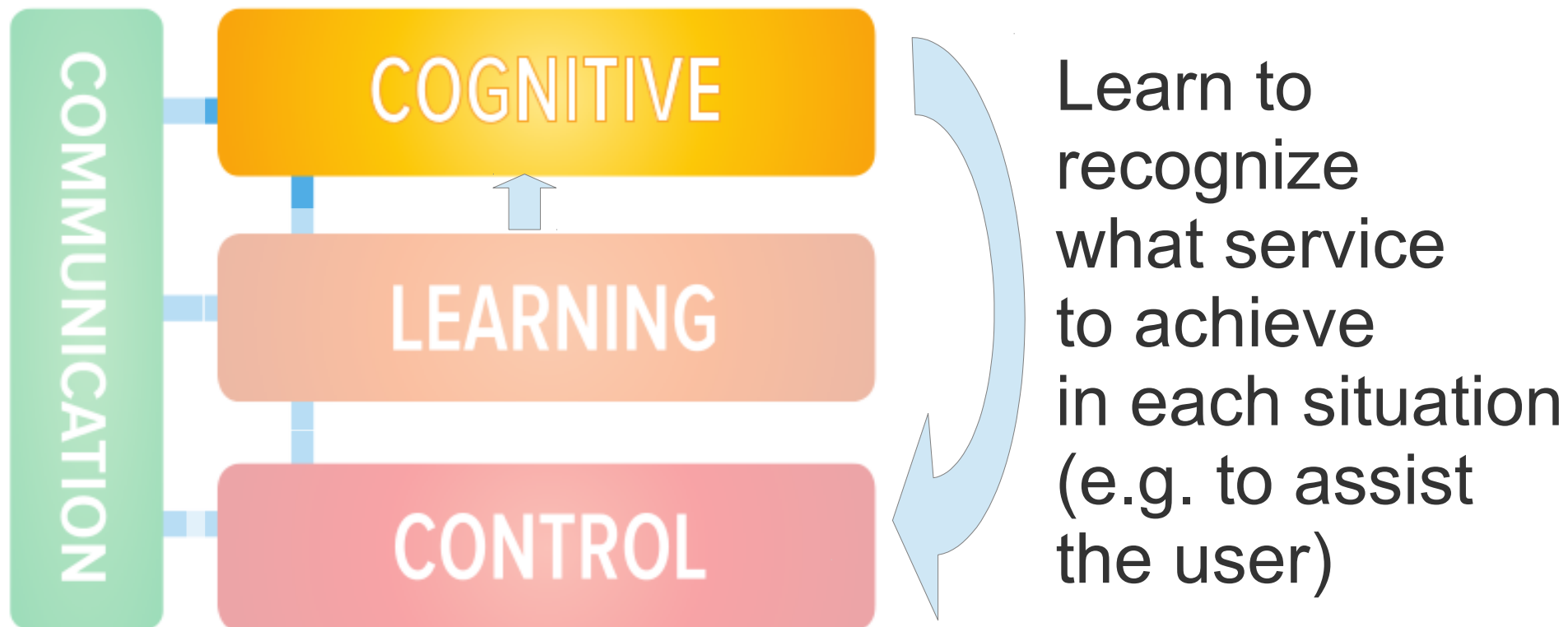


Find and monitor plans  
to carry out useful services

# Approach: Requirements & Architecture for an Autonomous, Self-Adaptive Smart Environment

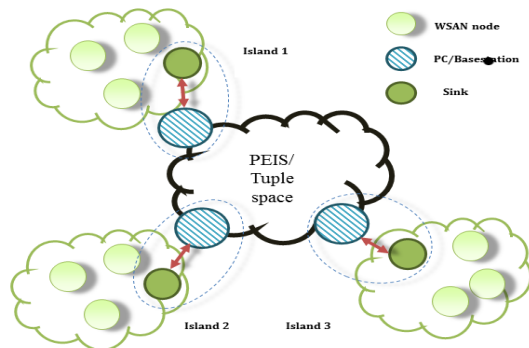


# Approach: Requirements & Architecture for an Autonomous, Self-Adaptive Smart Environment





# Components



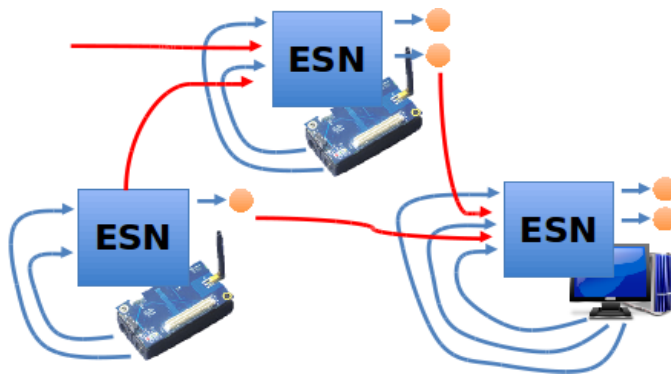
## Communication Layer:

Peer-to-peer tuplespace (PEIS)

+ WSN middleware

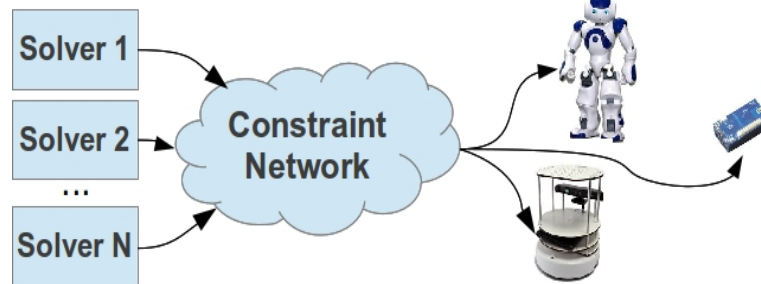
(IEEE 802.15.4 compliant)

+ Proxy for domotic KNX



## Learning Layer:

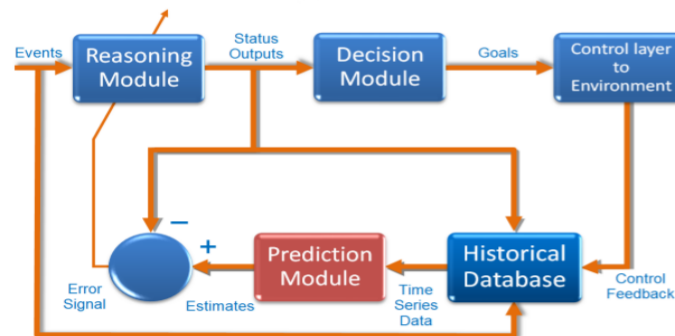
A distributed, adaptive sensor fusion and learning infrastructure used for event prediction, localization, and activity recognition



## Control Layer:

Central configuration planner with multiple solvers

+ multi-agent system



## Cognitive Layer:

Based on Self-Organized Fuzzy Neural Networks (SOFNN)

# Open Questions & Opportunities

- 1) The system is evaluated in realistic environments but not yet used in real applications
- 2) Not yet integrated with AAL infrastructures, e.g. UniversAAL
- 3) Learning takes time ...
- 4) HRI is not a focus
  - it may help to accelerate learning
  - from technological-driven to people-centric
- 5) Rubicon could support online personalization / adaptation of existing solutions.