

Florence

Robot Platform to Assist Elderly at Home

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Overview

1. Florence project
2. Florence Architecture Aspects – Lessons learned
3. Conclusions

The Florence Project

- *Goal: “How to support elderly at home using current robotic technologies”*
 - Which application, which technologies?

- Approach:
 - Low-cost (~ 1000 Euro BoM)
 - Pragmatic: current technology
 - Platform: open and easy API
 - User centered approach

- Applications
 1. Remote Assistance
 2. Unobtrusive Monitoring
 3. User Friendly Autonomous Assistance



- FP7: ICT-AAL
 - 3 years (2010 – 2013)
 - Coordinator: Philips
 - NEC, Philips, Telefonica, - Novay, Tecnalía, OFFIS - Wany - ASSDA,

Elderly Needs

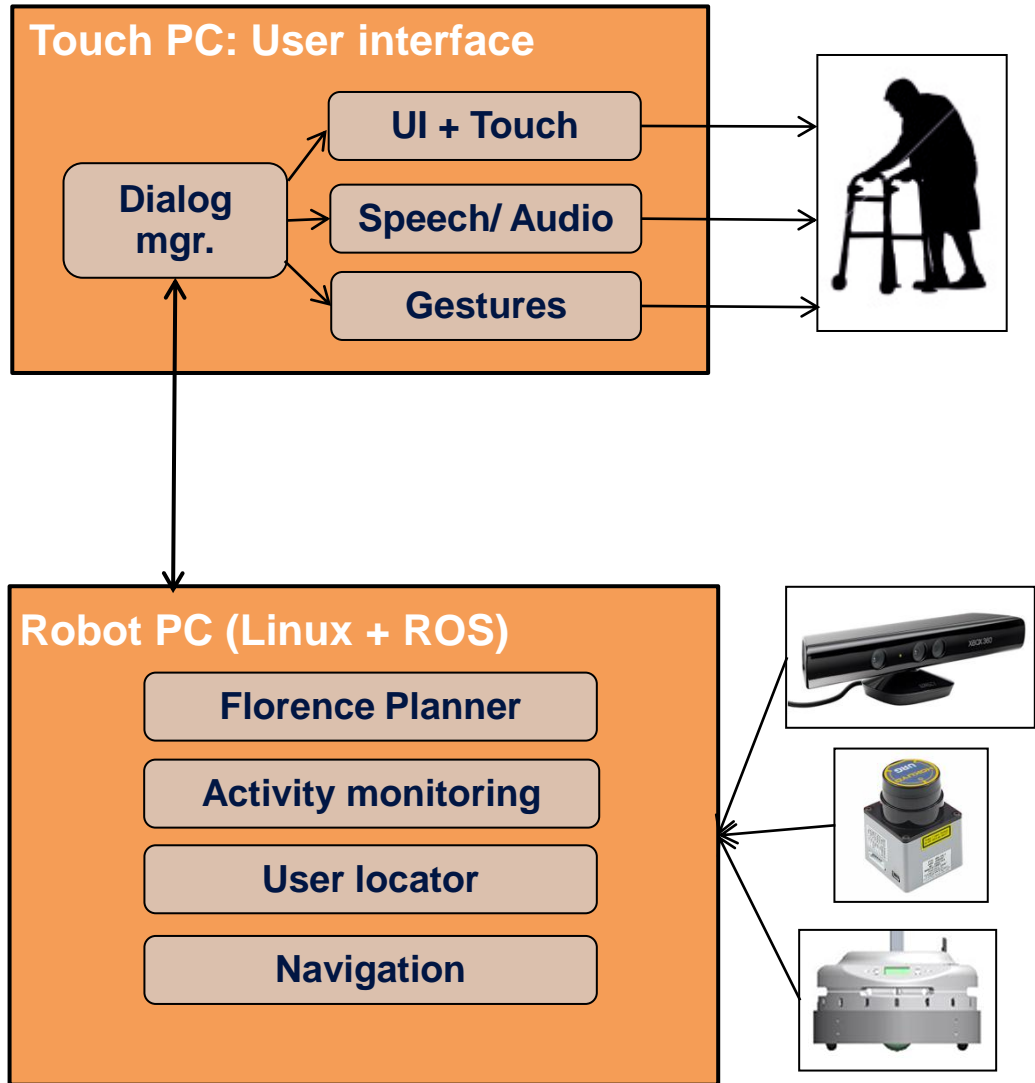
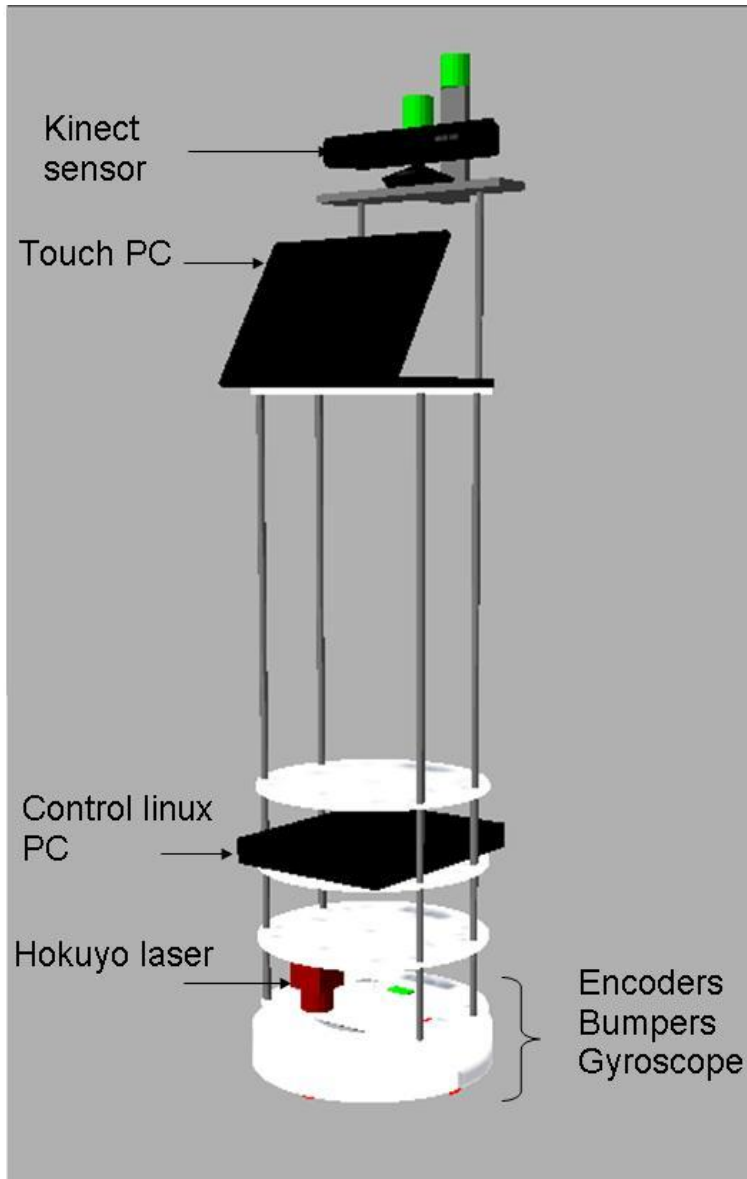
- Medical: Chronic diseases
 - Heart failure,
 - COPD,
 - Cancer,
 - Diabetes,
 -

- **Non-medical:** gradual decline of physical and cognitive functions:
 - Limited mobility
 - Lack of social contact
 - Increased risk of falling
 - Lack of exercise
 - Memory loss
 - Difficulty with medication adherence
 - ...

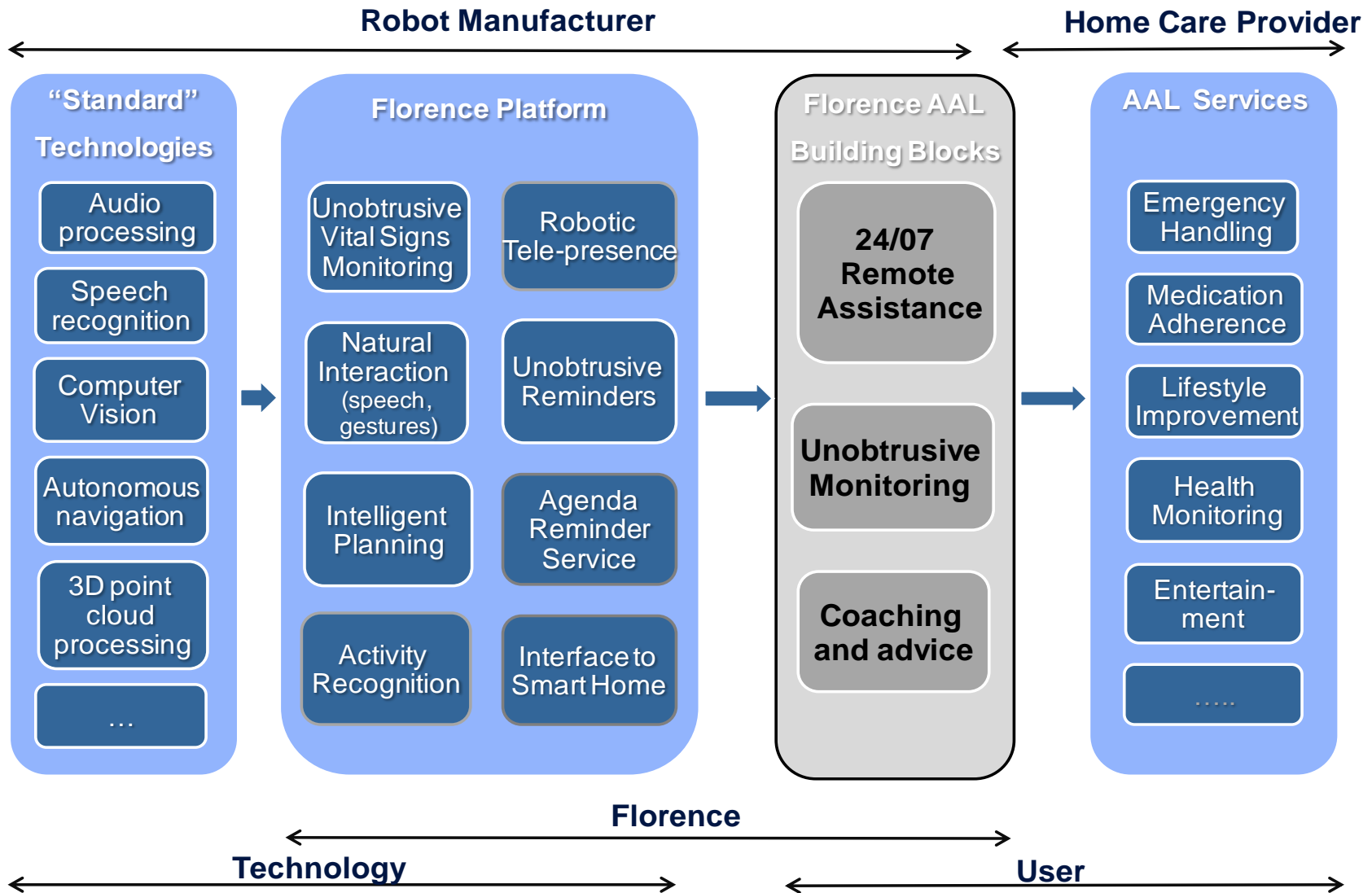
- => Loss of autonomy
- => Need for Assistance



The Florence Robot



AAL building blocks



Robotic Telepresence

➤ Applications

1. 24/07 Remote Assistance
 - Emergencies
 - Medication
 - Daily issues
2. Daily checkup
3. Social contact

➤ Benefits:

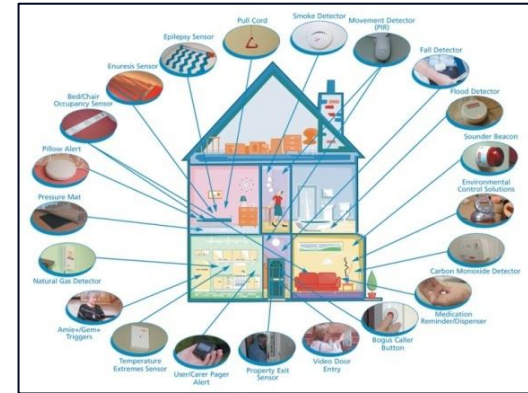
- Assistance at the place needed
- More intuitive and user friendly communication
- Increased presence



Unobtrusive Monitoring

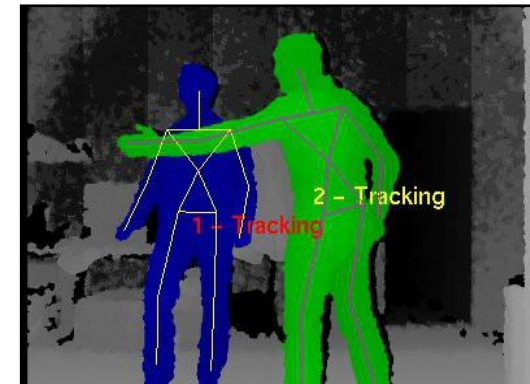
➤ Applications

- Vital signs monitoring...
- Detecting daily activities:
- Context-aware!



➤ Benefits

- Better context detection with **high-bandwidth sensors**,
- ... without compromising **privacy**.
- No rewiring of house
- **Subjective data** via speech



Cognitive Assistance

- Applications
 1. Reminders: medication, physical exercise, appointments,
 2. Answer simple questions
 3. Interface to the smart home

- Benefits: Social Actor:
 - Easy and natural interaction
 - Well-known metaphor
 - Taking initiative
 - Smart and unobtrusive reminders
 - Better adherence

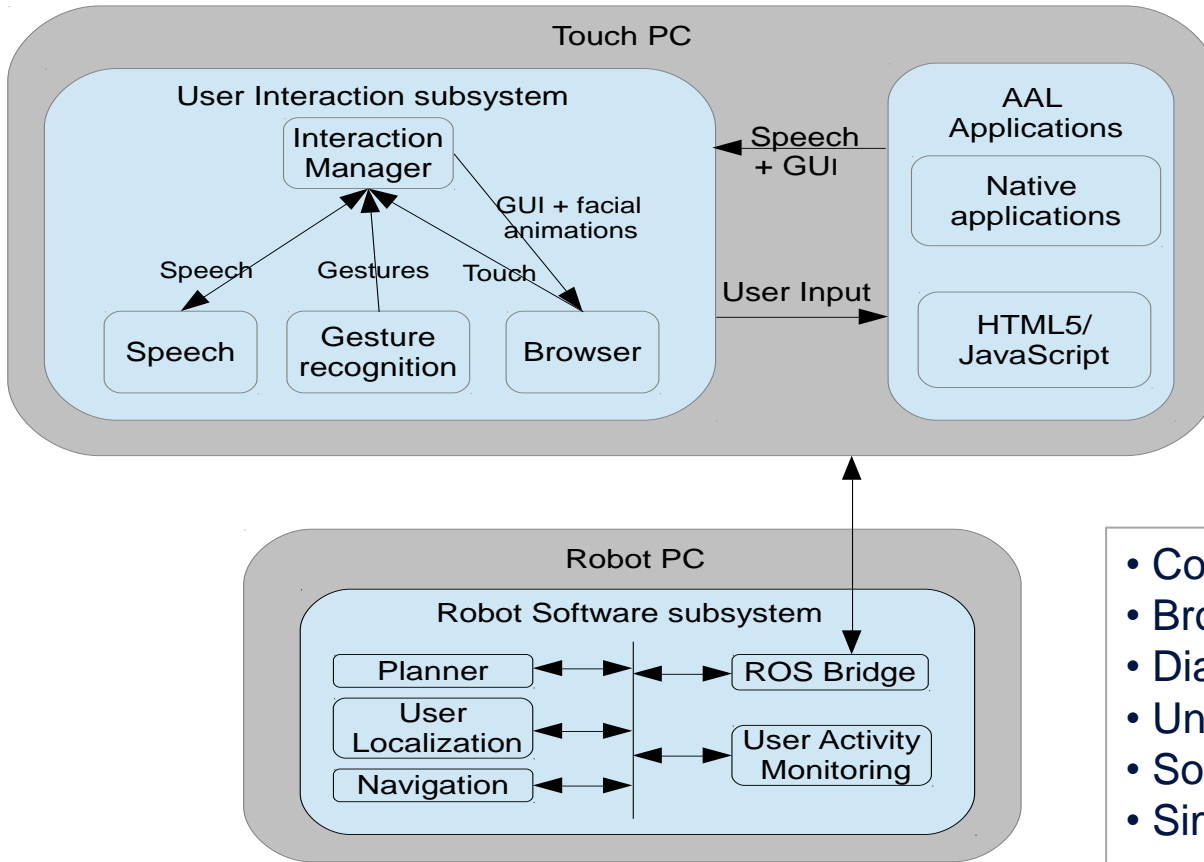


Pill Dispenser

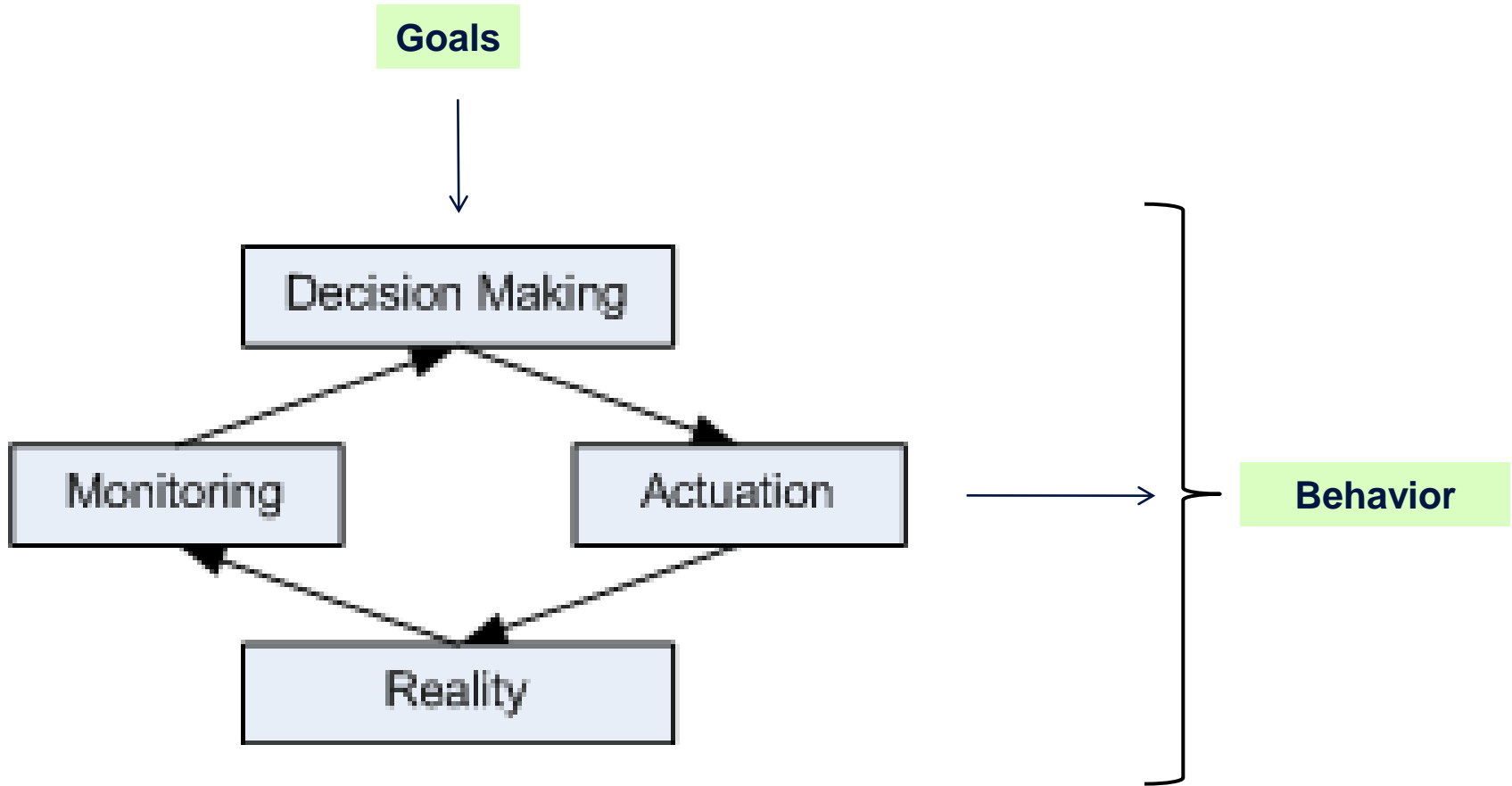


Medication Reminder

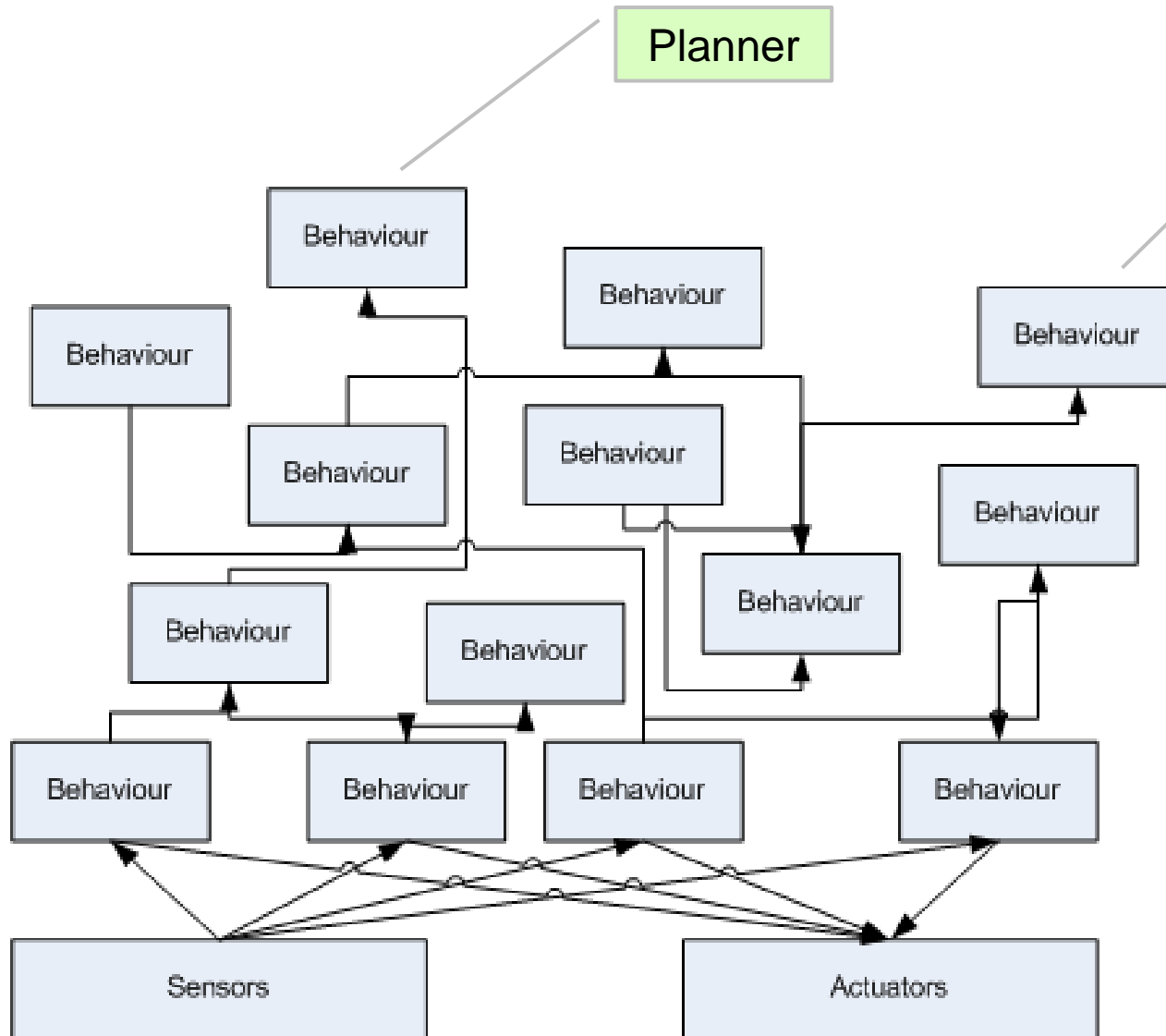
Architecture Robot part



- Collection of frameworks:
- Browser-based GUI
- Dialogue based Interaction
- Unified input and output
- Socket based messaging
- Simple protocols (websockets, json)

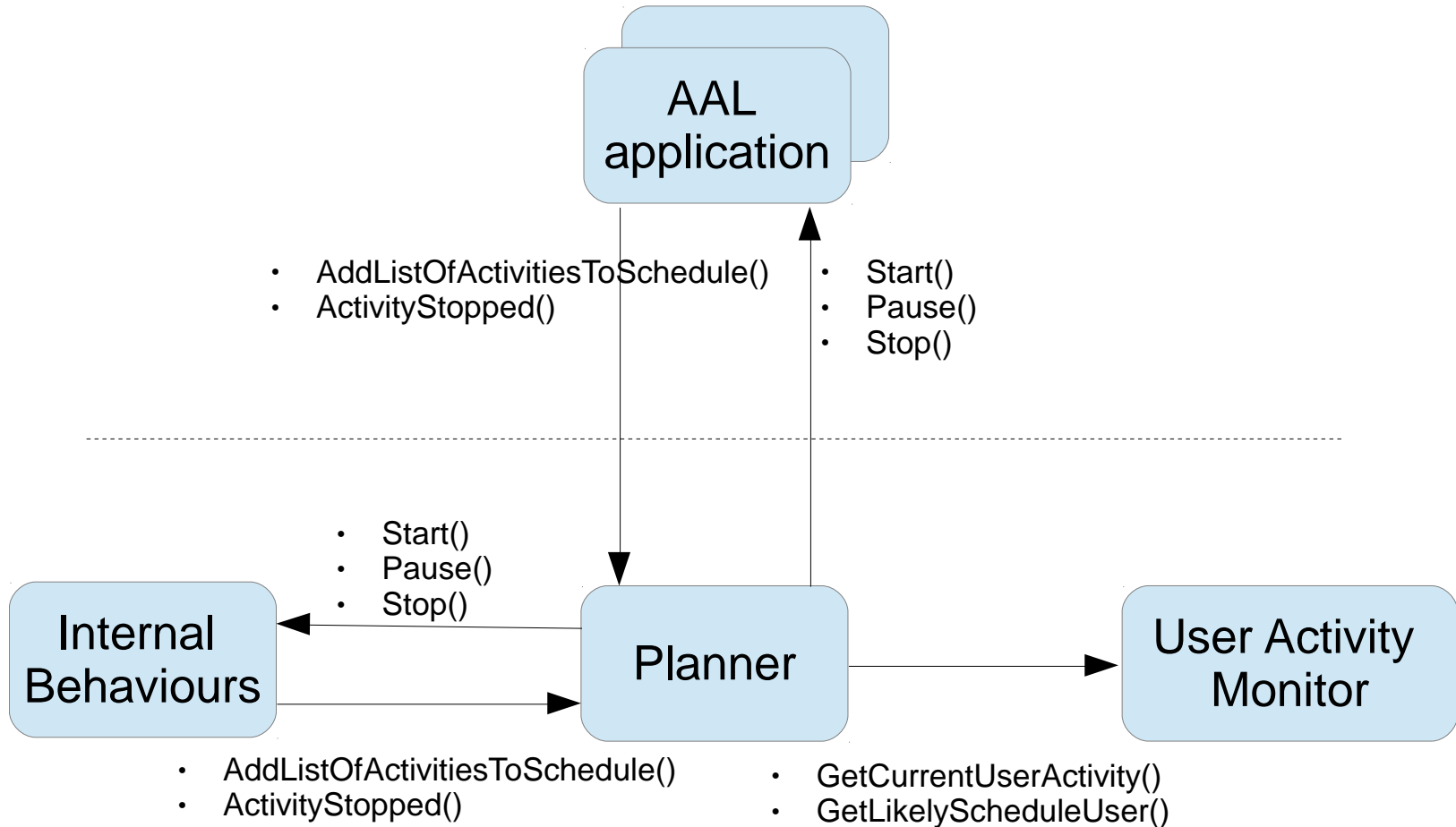


Decision Making



- Gesture detection
- Face detection
- Speech recognition
- User localization
- Battery monitoring
- Navigation
- Obstacle avoidance
- Medication reminder,
- Telepresence,
- Fall detection,
- ...

Florence Planner



Integration Smart Home and Robot

1. Two different Paradigms

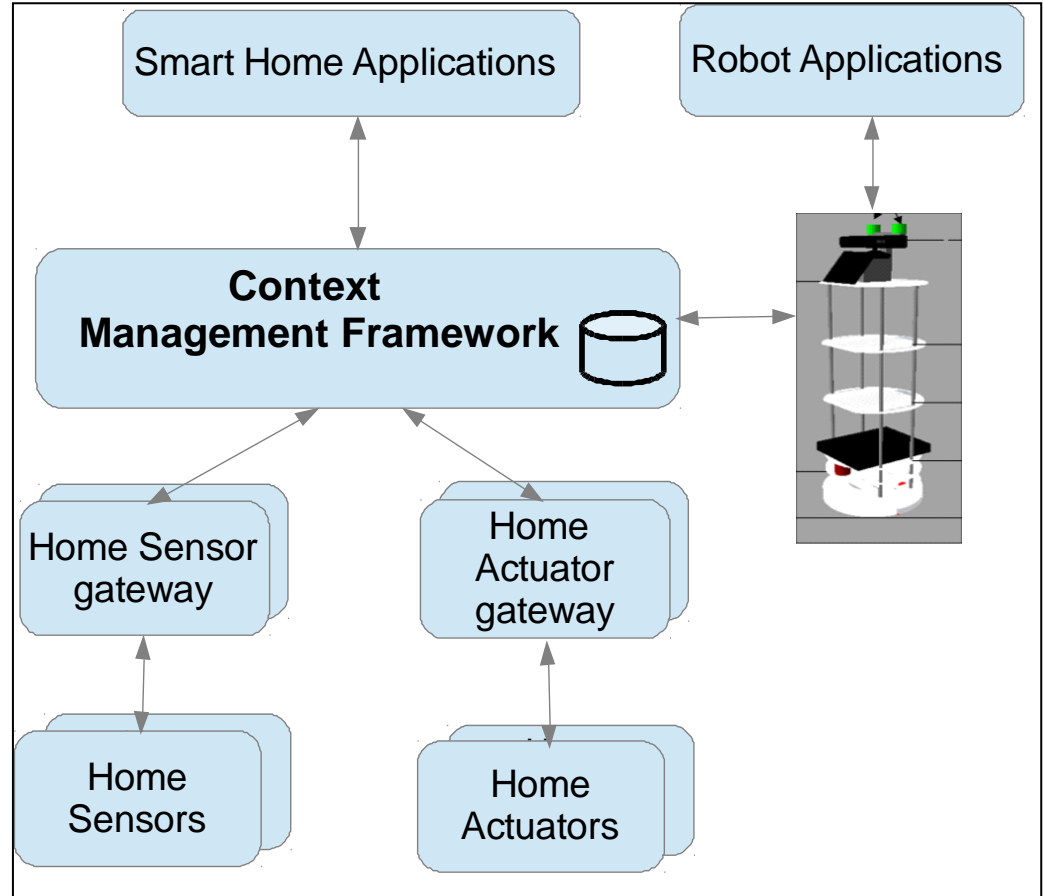
Domotica (AMI)	Robotica
Distributed Intelligence	Centralized intelligence
Hidden	Visible
Unclear Interaction Model	“Social Actor” metaphor
Privacy ?	Easier to understand
Low-bandwidth sensors	High-bandwidth sensors

2. Smart home: multiple vendors and standards => Two options:

1. Standardization: e.g. upnp extensions
2. Organic: => start as simple as possible

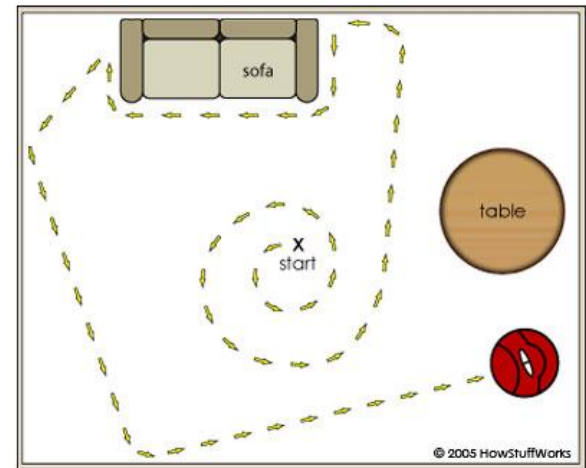
Integration Smart Home and Robot

1. Sensor/Actuator gateways
2. CMF (~ smart spaces)
 1. Device/service Discovery
 2. Sensor protocol -> IP
 3. Semantic Definitions
 4. Storage of data
 5. Centralized access point
3. Robot as easy interface to smart home



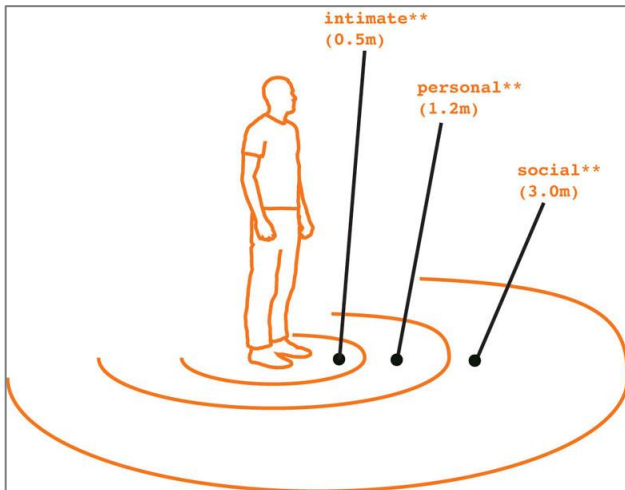
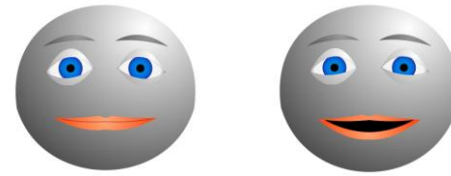
Mental Model for Intelligent Devices

1. Intelligent devices/services are difficult to understand.
 - Vacuum robot: optimal algorithm is not what people understand.
 - Smart home: *“Why are the blinds going up?”*
2. **Mental model:** User should at every moment know what the robot is doing and what its intentions are.
3. **Personality:** for designing the different behaviors of the robot.
 1. Define the personality of the robot
 2. Map the personality to behaviors that are required in different situations.
 3. Test with users.



How to convey personality?

1. Facial Expressions
2. Voice characteristics
 - Volume, Rate, Variation frequency
3. Wording
4. Distance to user



Example: “wording” + distance



Introvert

*“Madam. Madam, I believe it's time for your medicine. **I hope that you don't mind that I have asked Annie, the home care lady to place the medication on the table.**”*

Extravert

*“Sir, I have to disturb you. It's time you know. Yes, you got it. It's time again for you medication. **Take your medication quickly, so you can continue watching the movie. I have asked Annie, the home care lady to place the medication on the table. So, you don't have to go far. Good thinking of me, don't you think so?**”*

- Low-cost robotics addresses important needs of elderly at home:
 - 1) 24/07 remote assistance
 - 2) Unobtrusive Monitoring: high-bandwidth sensors, privacy
 - 3) Cognitive Assistance
 - 4) Easy Interface towards the smart home
- Open platform that shields application developers from complex robotic technologies.
- User acceptance: users need a “Mental Model” for complex devices. Personality design is a way to provide a Mental Model.

Lessons learned

1. Different paradigms: combination has high potential

Domotica (AMI)	Robotica
Distributed Intelligence	Centralized intelligence
Hidden	Visible
Interaction Model?	“Social Actor” Metaphor
Privacy ?	Easier to understand
Low-bandwidth sensors	High-bandwidth sensors

2. Multiple standards and vendors =>

1. Two layers: Sensor/Actuator gateways and CMF
2. Use simple protocols: e.g. http/websockets/json (cf. SOAP)
3. cf. *“The bazaar and the Cathedral”*

3. Decision Making:

- Divide and conquer: hierarchy of behaviors
- Process based – message based communication
- Next steps application: from software code to recipe (cf. RoboEarth)

4. Personality design to provide mental model for intelligent devices and services

5. Machine Learning to process high-bandwidth sensors: e.g. activity recognition and other context.

Thank you for your attention!

- If you have any further questions, be invited to contact:

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- Consortium:

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- Tecnalia (ES)
- Novay (NL)
- NEC (GE)
- ASSDA (ES)