

Platform for Opportunistic Behaviour in Incompletely Specified, Heterogeneous Object Communities

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POBICOS — Platform for Opportunistic Behaviour in Incompletely Specified, Heterogeneous Object Communities

Goals

- Transform object communities into distributed computing platforms for opportunistic applications
- Provide a toolchain for the design of opportunistic applications
- Ease up application acquisition and deployment
- Target domain: Home automation



Terminology

Objects communities

Devices with embedded and networked sense-compute-actuate functionality.

Opportunistic applications

Applications with the ability to discover and exploit whatever resources are available at runtime in order to achieve the best possible functionality according to the application requirements.

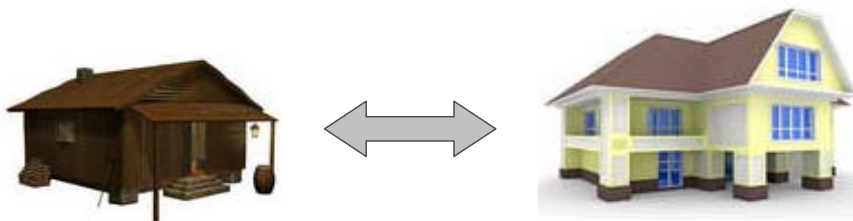
Motivation

- Regular objects (e.g. appliances) are more and more equipped with sense-compute-actuate nodes



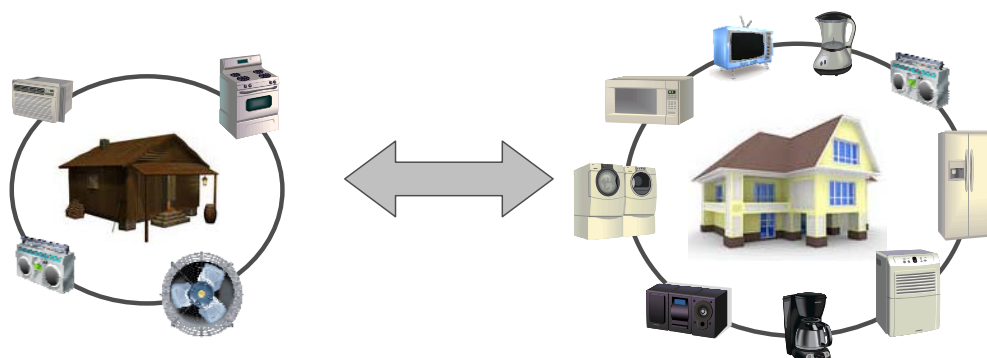
Motivation

- Regular objects (e.g. appliances) are more and more equipped with sense-compute-actuate nodes
- Environment is heterogeneous (e.g. Studio flat vs. family home)



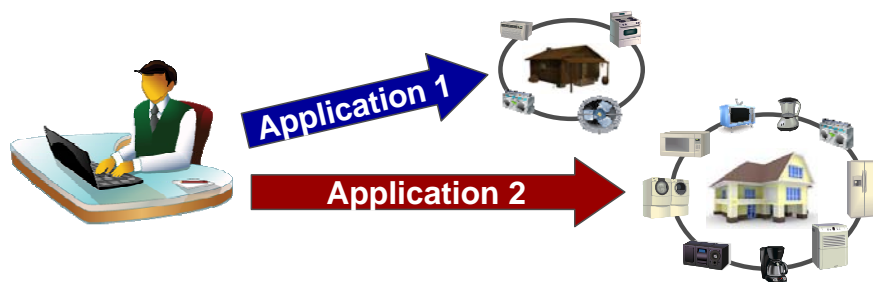
Motivation

- Regular objects (e.g. appliances) are more and more equipped with sense-compute-actuate nodes
- Environment is heterogeneous (e.g. Studio flat vs. family home)
- Number and type of objects unknown (e.g. different brands of appliances, households with several TVs)



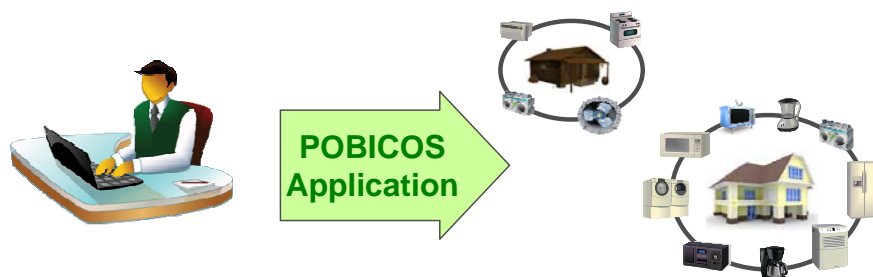
Motivation

- Application development is complex and time consuming
- Current systems are fairly customised

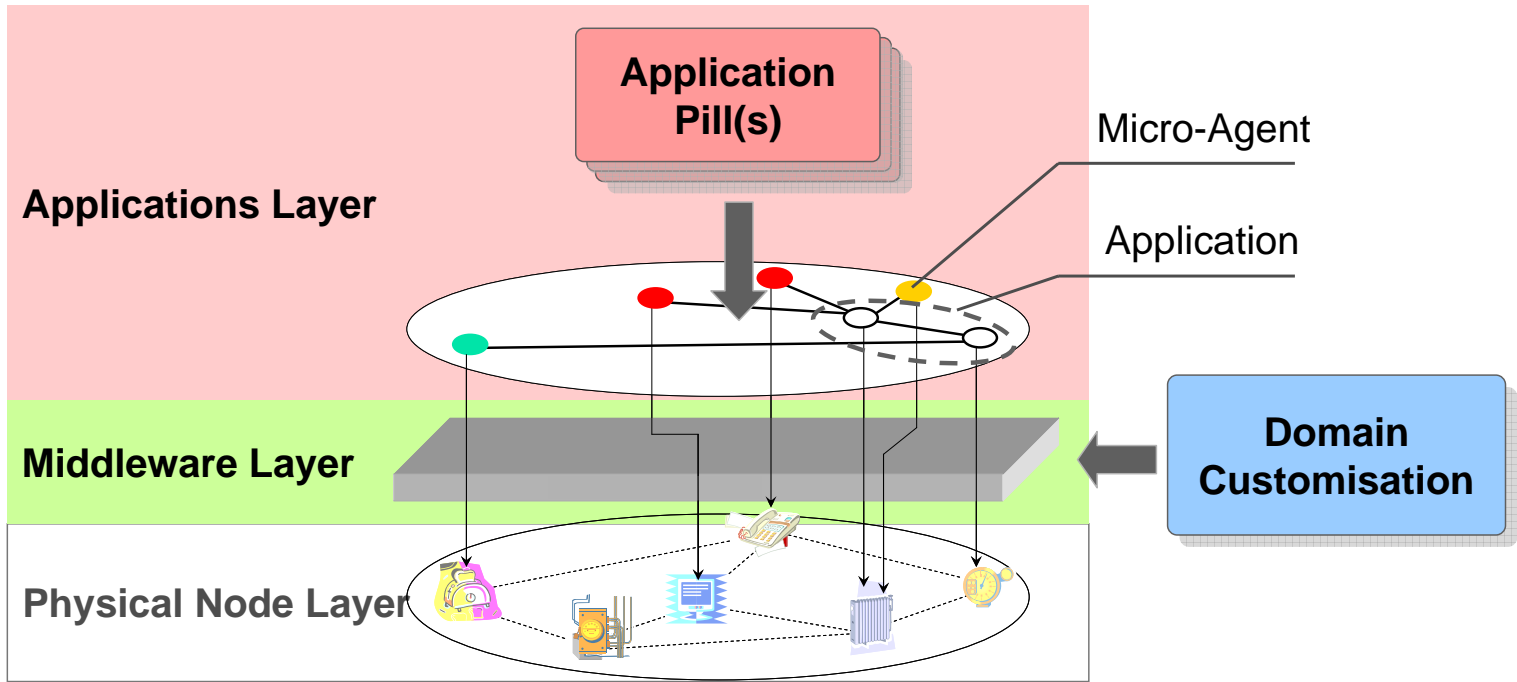


Motivation

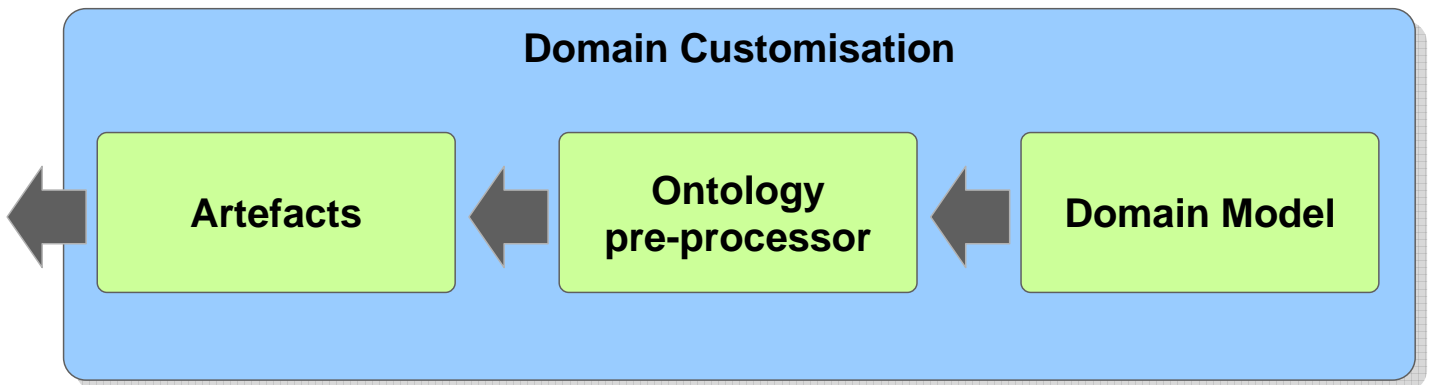
- The POBICOS platform enables the development of opportunistic applications that exploit whatever resources happen to be available at runtime.
- This ensures that the very same application is operating in different environments.



Architecture

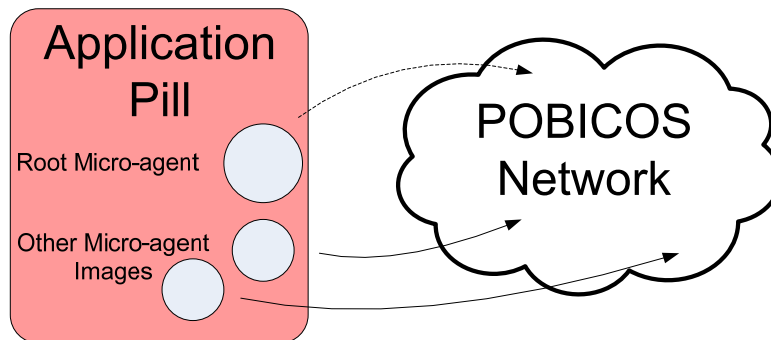


Architecture – Domain Customisation



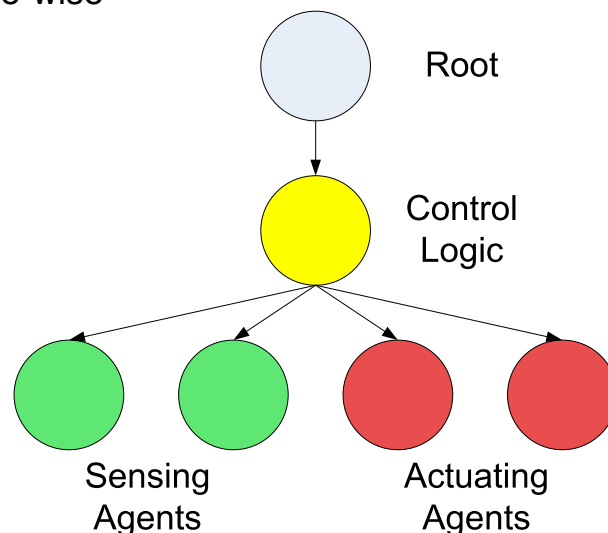
Architecture – Application Pill

- The role of the application pill is to add, activate, deactivate and remove an application in/from an object community
- Simple deployment model and simple user interaction



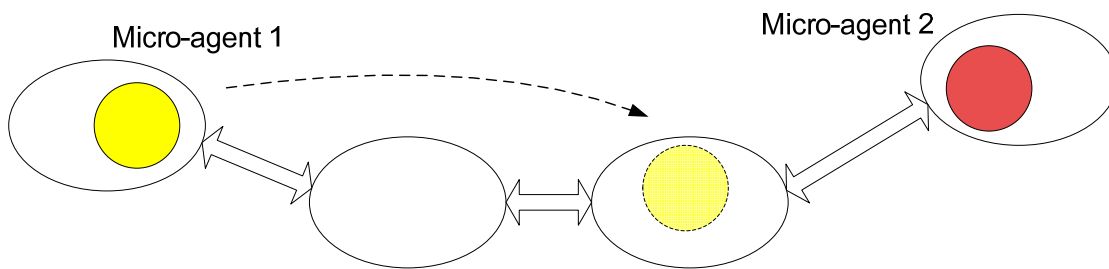
Architecture – Micro-Agents (1/2)

- Logical units of POBICOS applications; concurrently running and interacting
- An application is a tree-formed hierarchical agent team
- Simplifies application programming – the programmer thinks agent-wise, not physical-node-wise

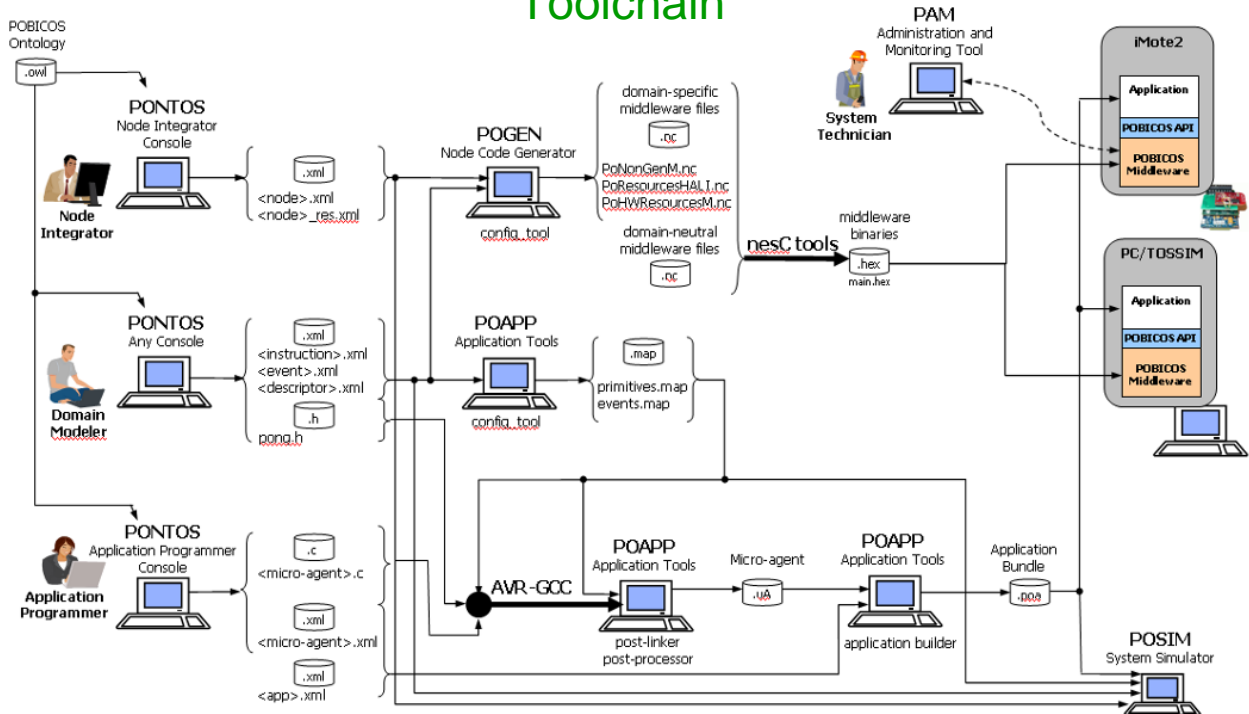


Architecture – Micro-Agents (2/2)

- System and application requirements
 - Load balancing and power management
 - Reduction of communication hops between micro-agents
 - Implicit discovery and selection of sensor/actuator resources
 - Replication for data aggregation and fault-tolerance
- Virtual machine approach

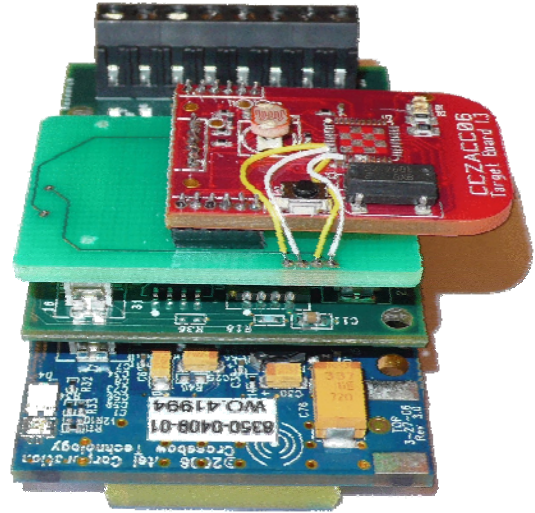


Toolchain

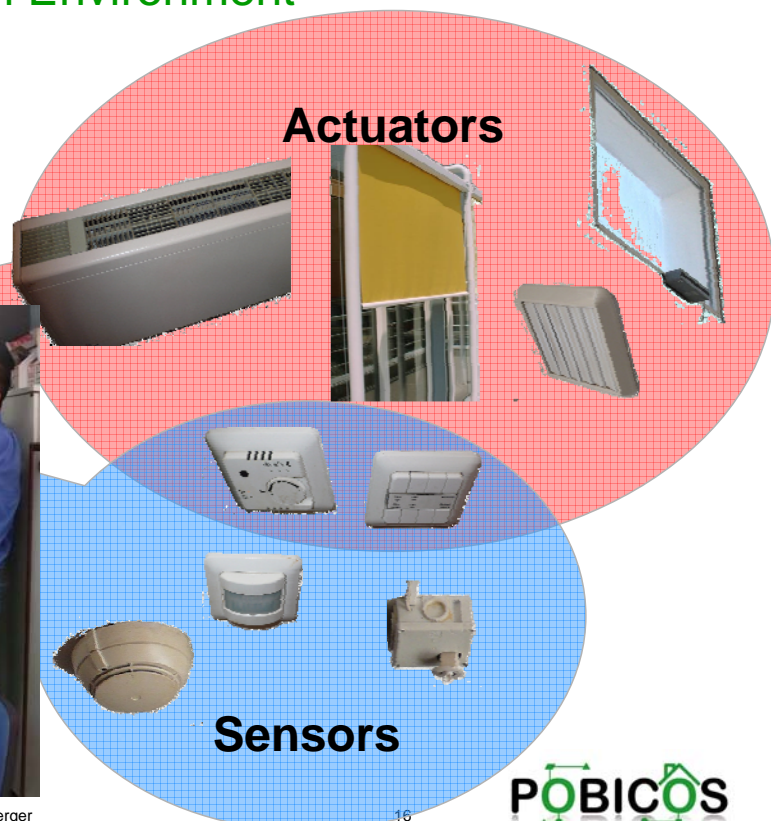


Development Platform

- Imote2
- Sensor board
- Adaptor board
- ZigBee module TI-2480
- TinyOS 2.0



Demonstration Environment



Home Automation

Challenges

- Heterogeneity in the sensing-computing-actuating resources
- Uncontrolled and ad-hoc fashion in which living environments are set up

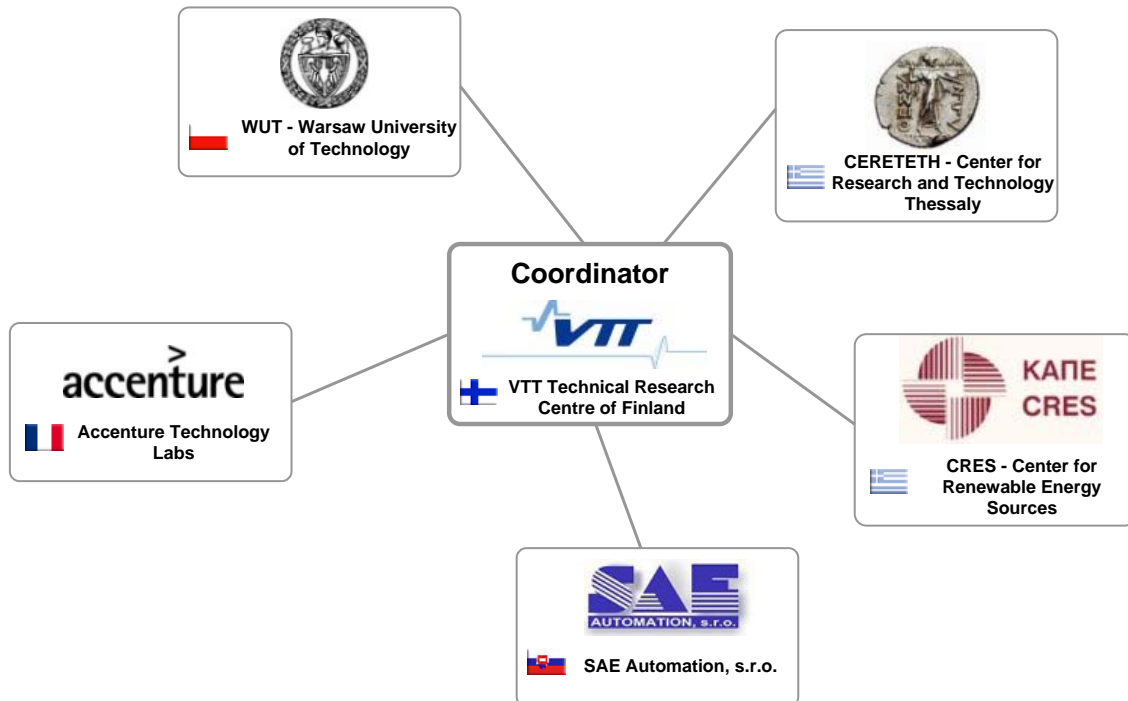
Approach

- **Reduced user intervention:** Upon deployment, the application will seamlessly spread itself in the object community
- **Opportunistic behaviour:** Possibility for programmers to write portable applications that will automatically deploy themselves in different environments
- **Open API** makes application development attractive for third parties

Application Scenario: On demand energy management

- According request / price of the electricity provider application lowers the mode of operation or turns off all appliances whose (full-mode) operation is not crucial
- Application does not need to know the exact type of devices at runtime
- High-level classification of appliances in terms of power consumption and criticality of operation is used

Consortium



Thank you!

Additional information:
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