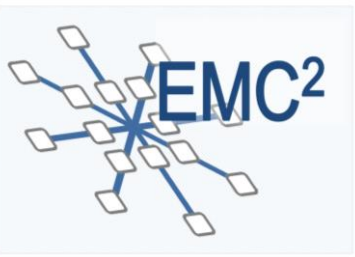


**Embedded Multi-Core Systems
for Mixed Criticality Applications
in dynamic and changeable
Real-time Environments**

WP11 Internet of Things
EMC2 workshop in HiPEAC
January 20, 2015

Use Case 11.3: Autonomic Home Networking

Dr. George Bravos, Harokopion University of Athens, Greece

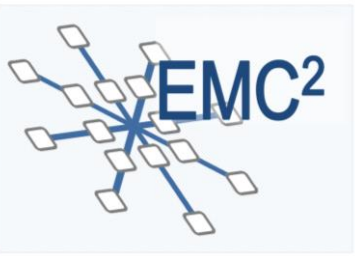


WP11 Internet of Things - HiPEAC workshop

UC11.3: Autonomic Home Networking



- **Outline:**
 - Requirements of the Demonstrator's System
 - Architecture
 - Mixed – criticality issues
 - Partners' roles and contribution
 - Aim towards draft demonstrator in April
 - Current status and further steps



WP11 Internet of Things - HiPEAC workshop

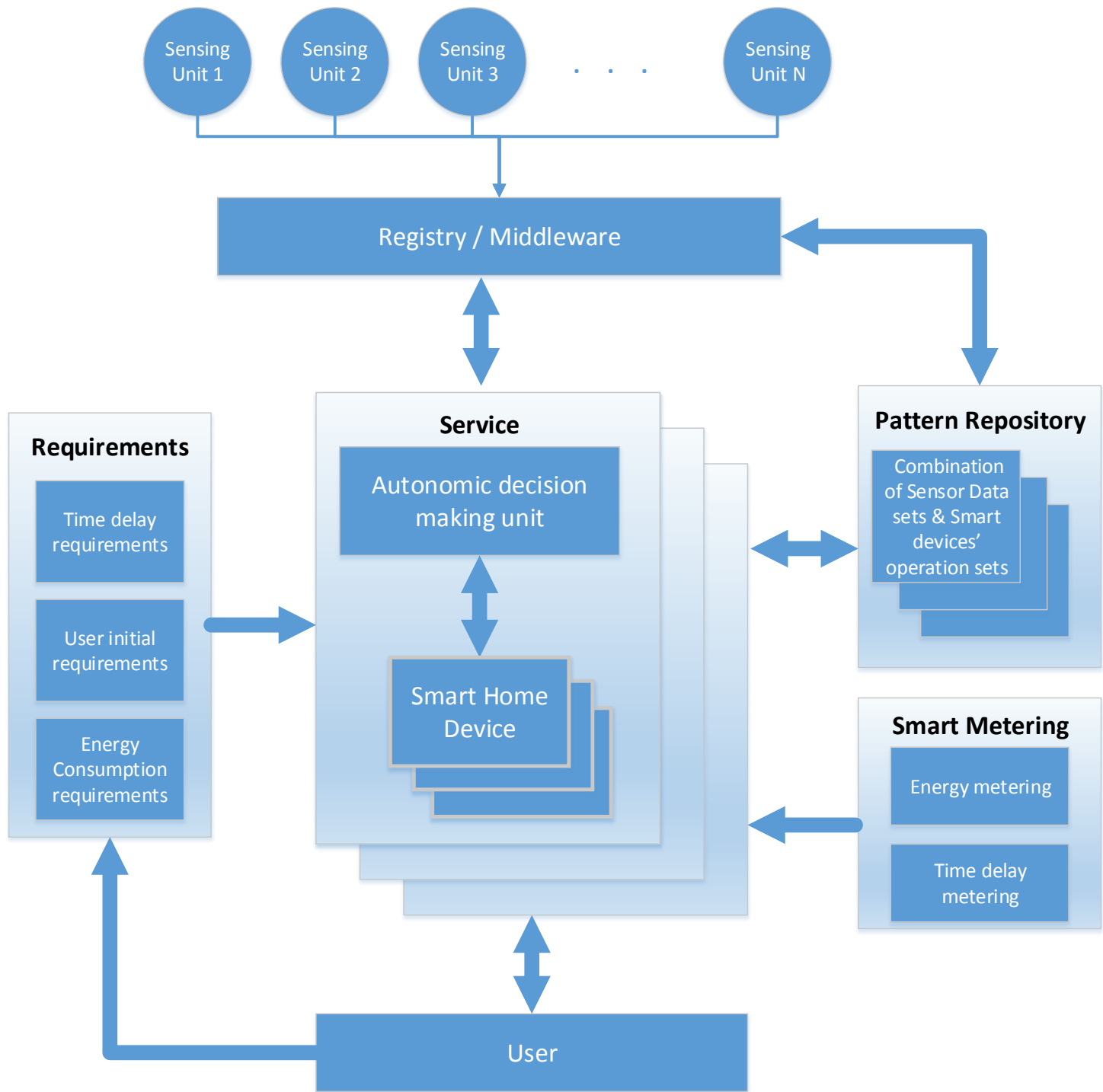
UC11.3: Autonomic Home Networking

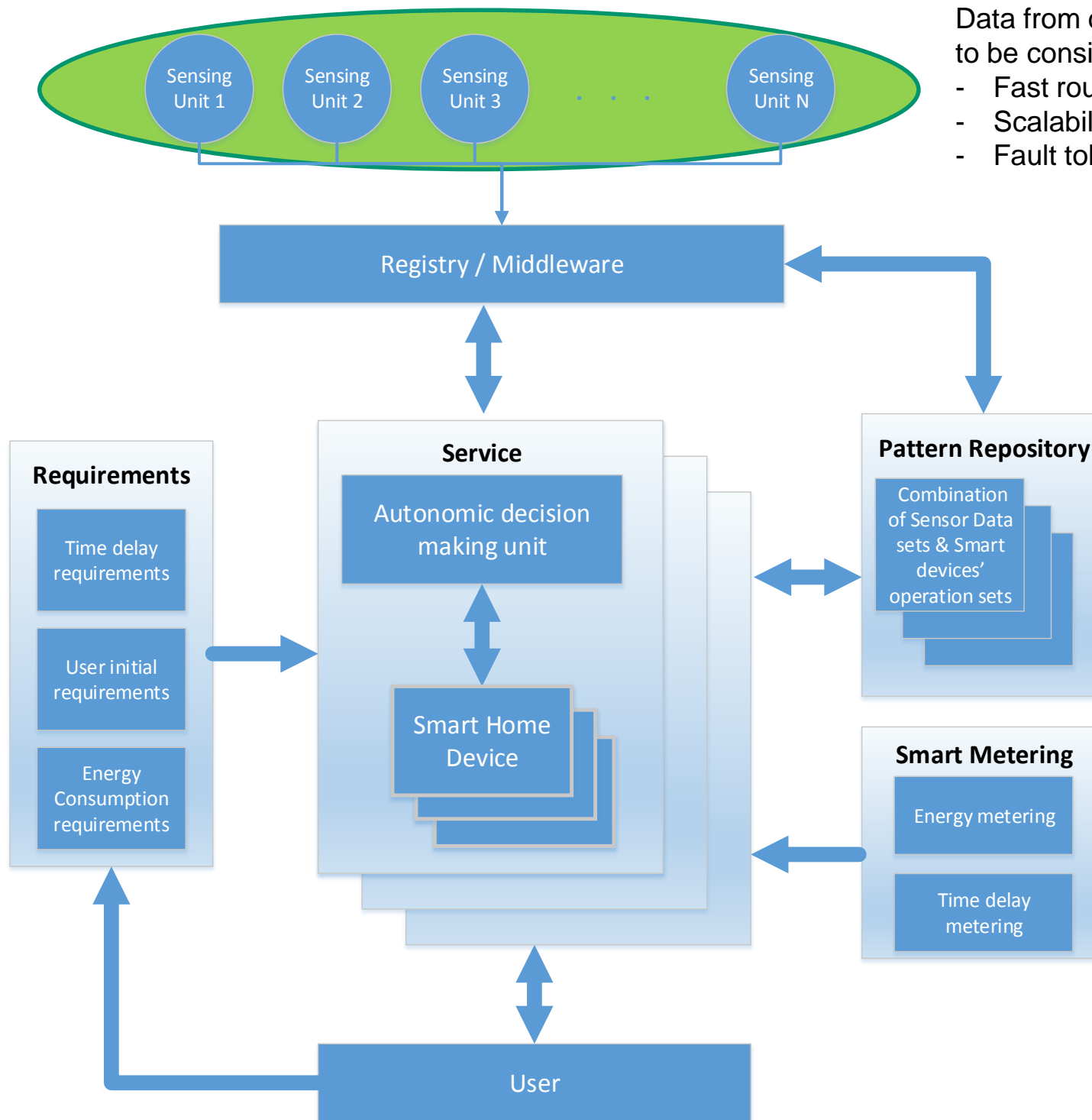


- **Requirements of the Demonstrator's System**

The demonstrator's system should be:

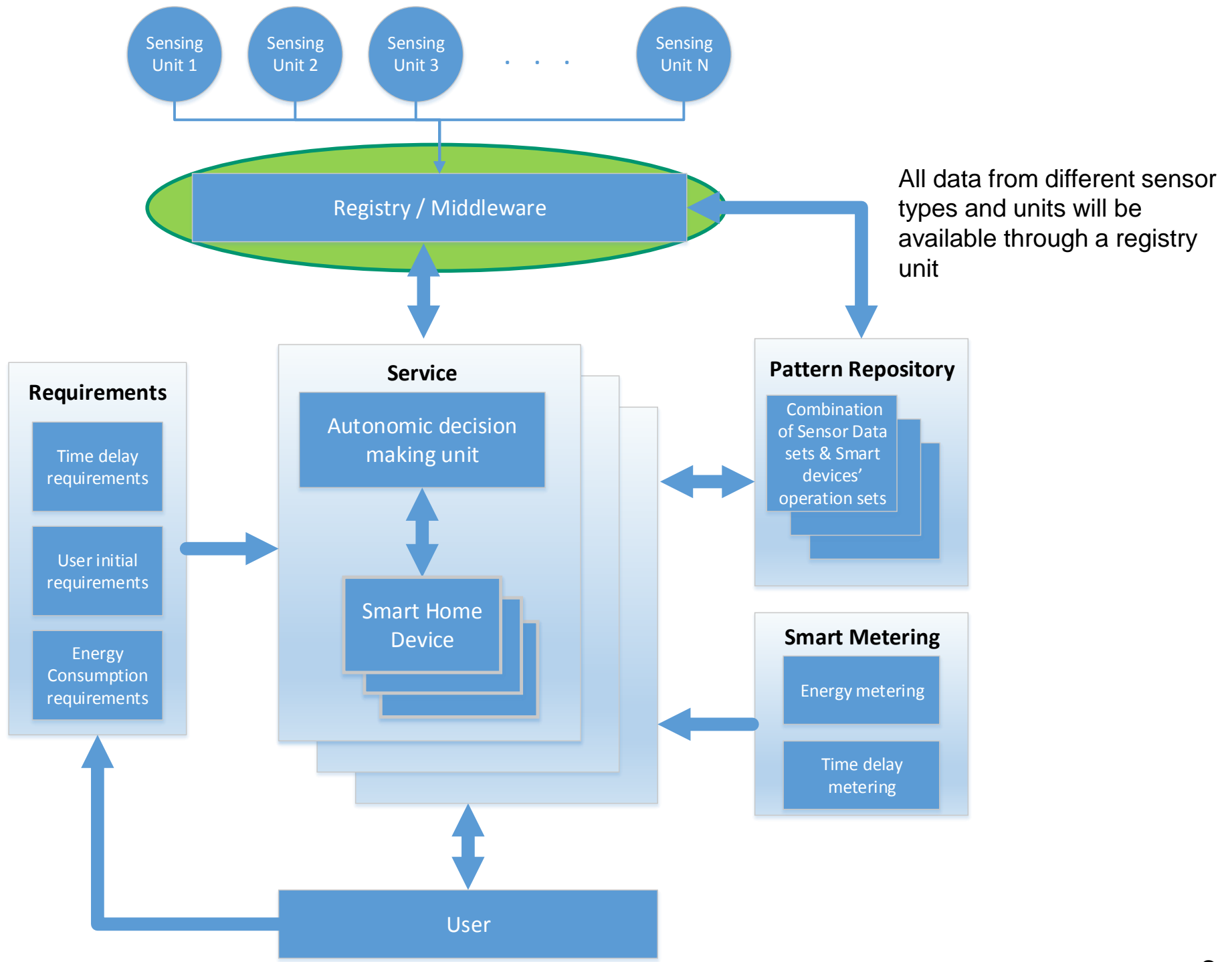
- **Pervasive**, in the terms of becoming as much unnoticed by the user as possible, while fulfilling all his needs (based on context – awareness)
- **Autonomous**, in the terms of being able to apply self – configuration (i.e. a new device should be easy to connect without any intervention from the user) self – healing (i.e. link disruption and/or device failures must be handled in a user transparent manners) and self – optimization procedures
- **Secure**
- **Energy – aware**, ensuring that the system leads to less energy consumption when compared to a typical home's operation.
- **Service oriented**

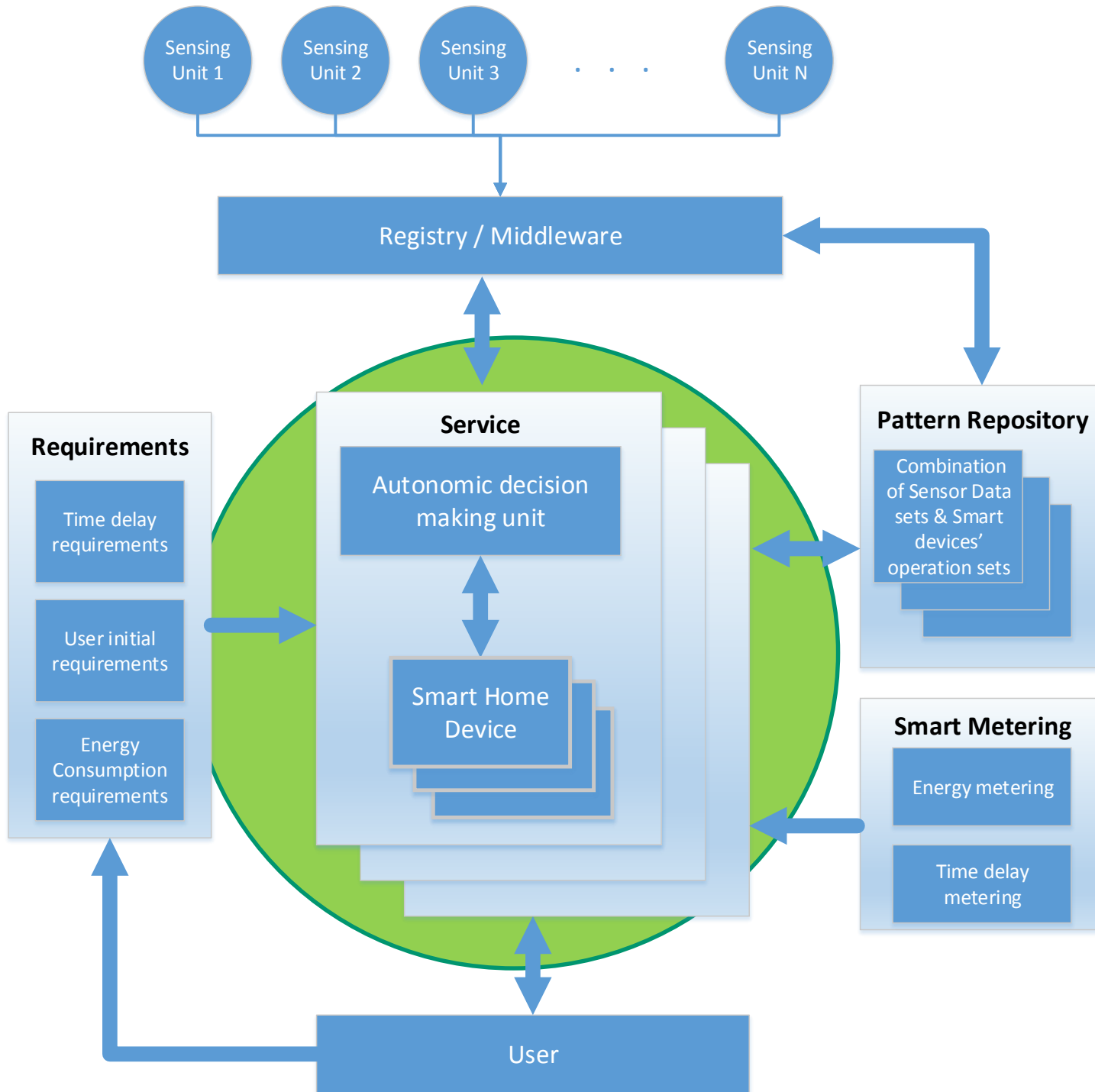




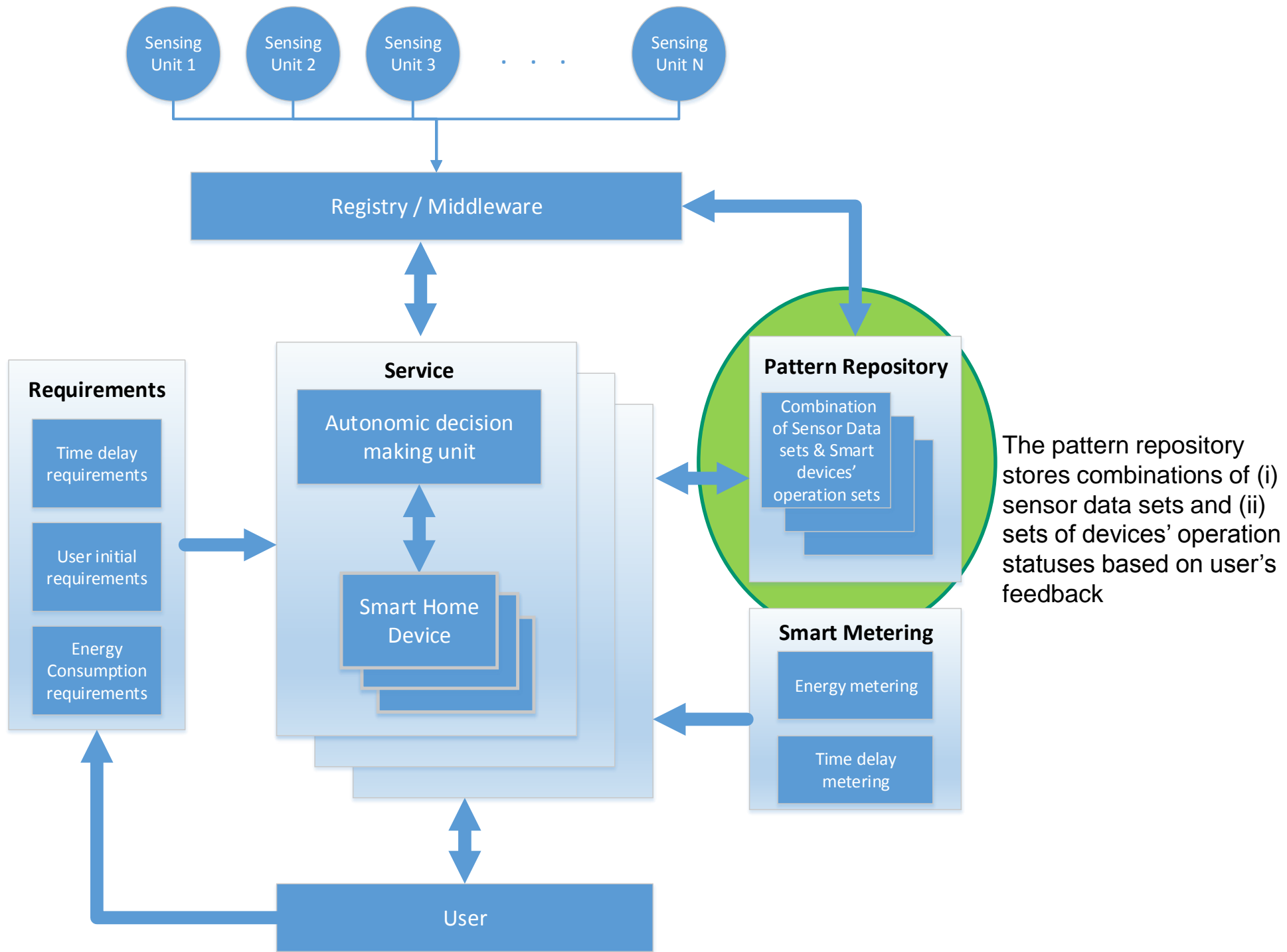
Data from different sensors. Issues to be considered:

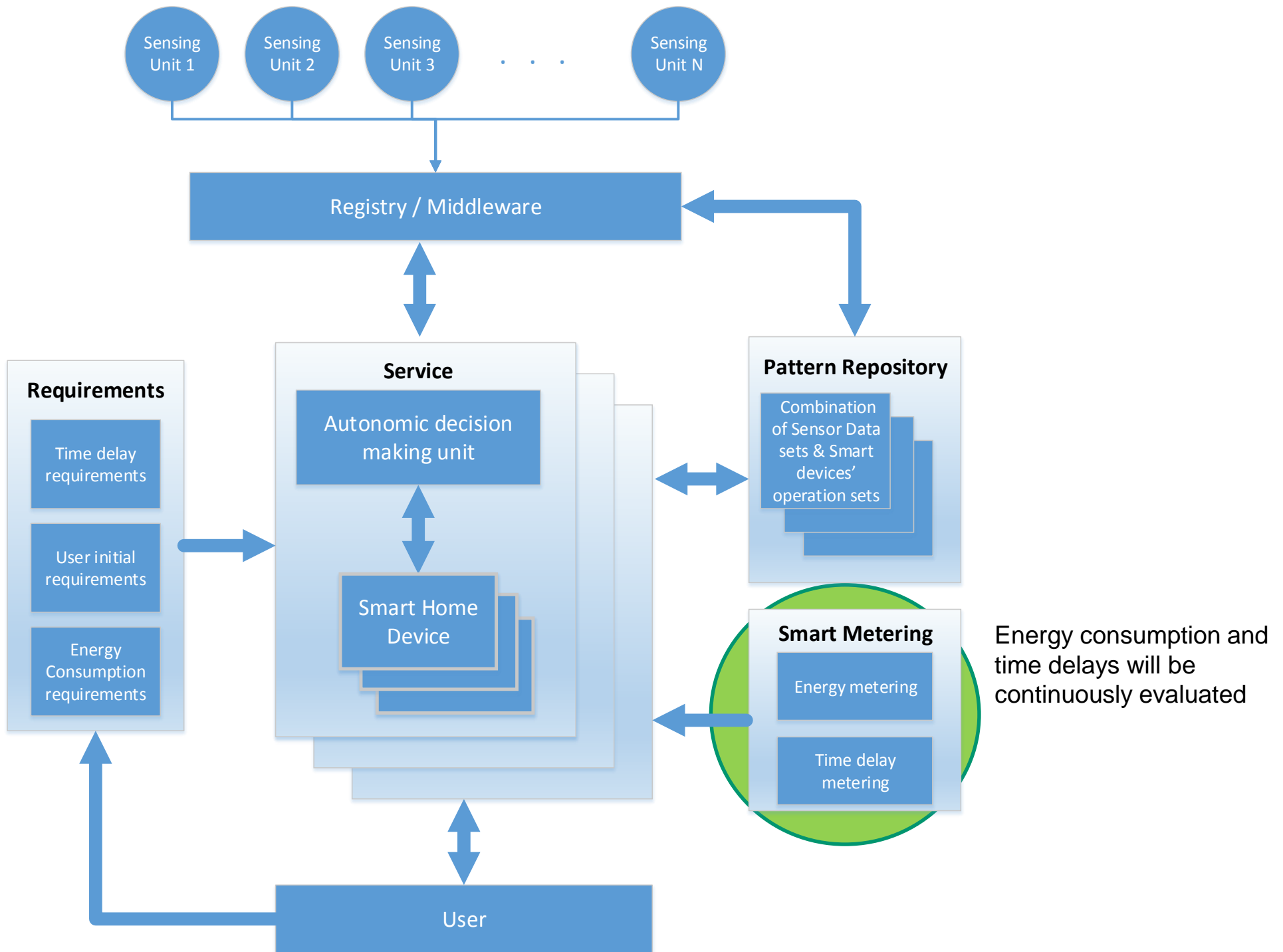
- Fast routing algorithms
- Scalability
- Fault tolerance

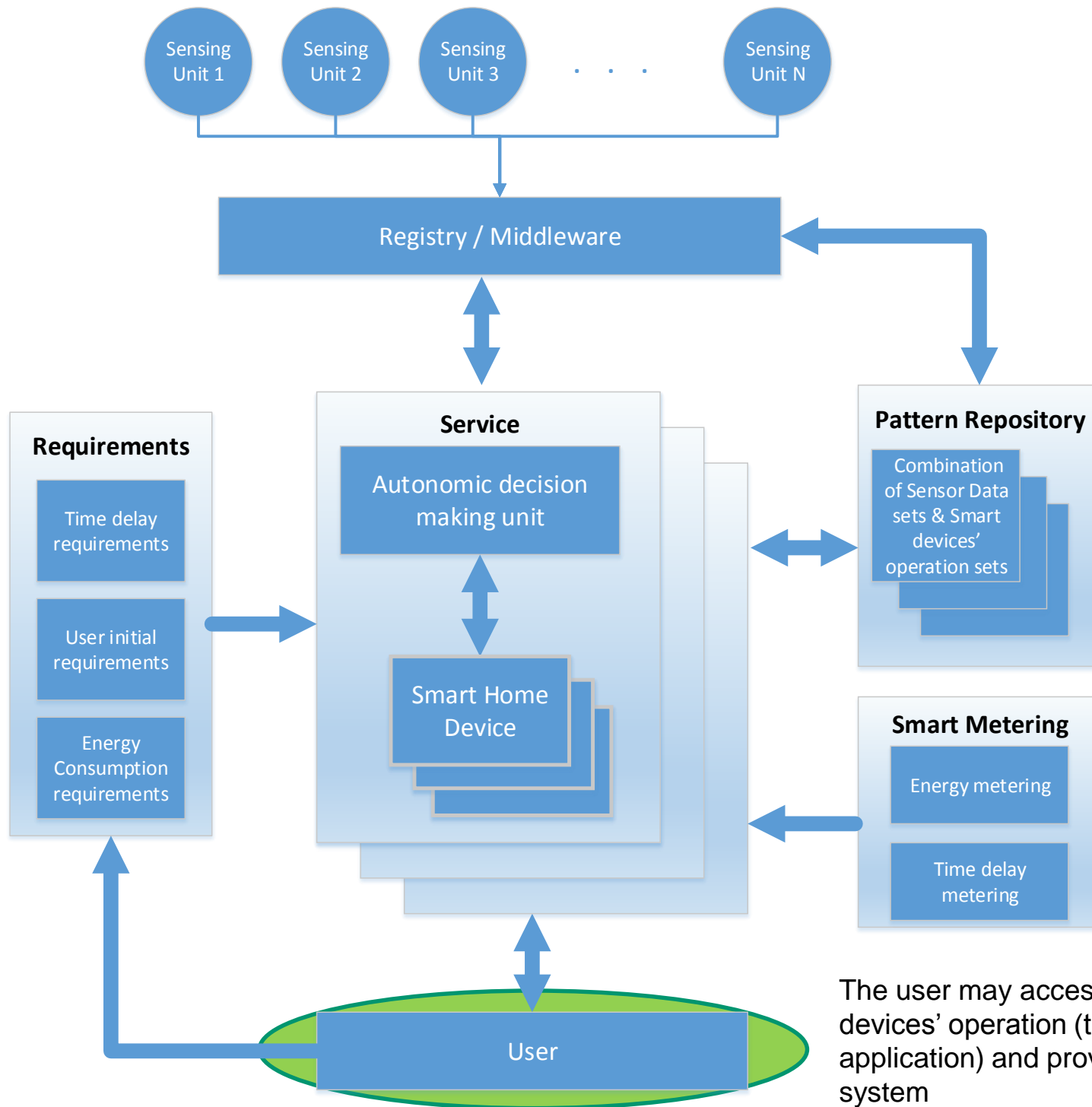




One autonomic decision making unit per service. Each ADM unit may be related to many devices. Each device may be related to many services.



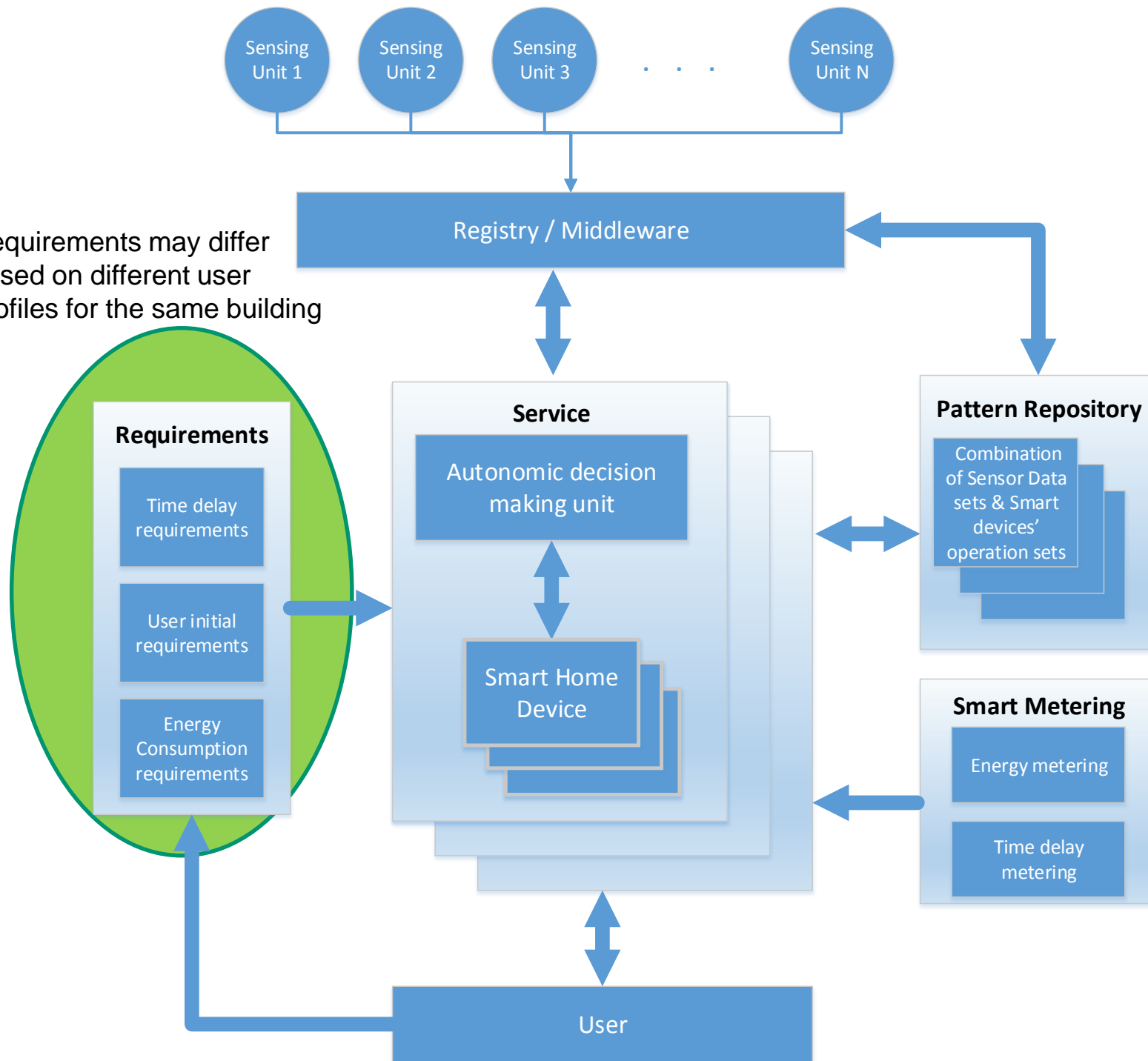


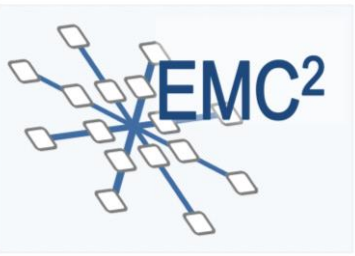


The user may access a report of all devices' operation (through a smartphone application) and provide feedback to the system

- Different user profiles

Requirements may differ based on different user profiles for the same building



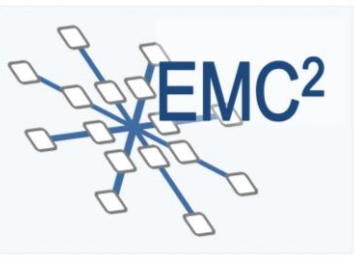


WP11 Internet of Things - HiPEAC workshop

UC11.3: Autonomic Home Networking



- Mixed – criticality issues:
 - Each decision making unit may receive multiple data flows from different sources, maybe contradictory and with different weight / importance
 - This may lead to the same device receiving contradictory commands regarding its functionality
 - The distributed decision making system will be able to evaluate the importance of each data flow / source and provide the best possible directions to the smart home devices.

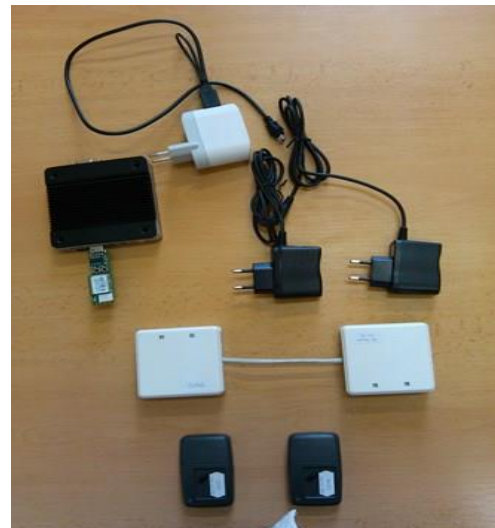


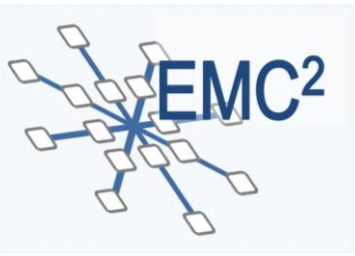
WP11 Internet of Things - HiPEAC workshop

UC11.3: Autonomic Home Networking



- Partners' role and contribution: IMA
 - A basic system is being used, provided by IMA, as a basis for the autonomous smart home demonstrator.
 - Each device in the network performs any subset of these tasks:
 - to be a data source.
 - to be a data collector device.
 - to be a router node.
 - The current gateway system is a tiny power efficient single core x486 compatible device.
 - It runs a full featured Linux OS



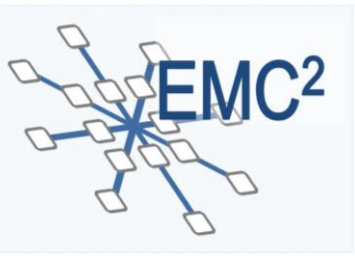


WP11 Internet of Things – HiPEAC workshop

UC11.3: Autonomic Home Networking



- Partners' role and contribution: Ambar
 - In the aforementioned system, Freescale ARM-based wireless transceivers and microcontrollers in the 802.15.4 2.4GHz band will be integrated.
 - Possible sensors to be embedded as add-ons to the existing platform include RFID/NFC, Fingerprint readers, Gyroscopes / Accelerometers / Magnetometers, etc.
 - A custom flexible gateway will also be provided to support different low-power communication interfaces according to open source implementations and standards.
 - The gateway is expected to be available in May 2015

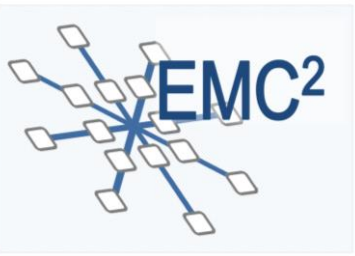


WP11 Internet of Things - HiPEAC workshop

UC11.3: Autonomic Home Networking



- Partners' role and contribution: HUA
 - Advanced data aggregation algorithms will be implemented, towards the minimization of time delays and the maximization of the level of consumer's satisfaction.
 - Registry implementation for services to communicate and request sensor data
 - Autonomic decision making algorithms will be implemented by HUA
 - Energy meters will be adopted to the overall system and exploited in order to ensure minimization of energy consumption in the envisioned smart home.

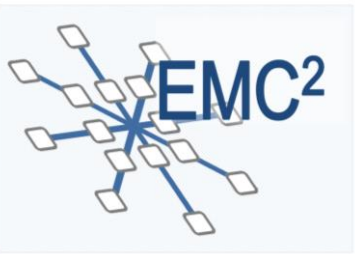


WP11 Internet of Things - HiPEAC workshop

UC11.3: Autonomic Home Networking



- Aim towards 1st draft demonstrator in April
 - Complete architecture design
 - Set – up and working sensor network with several different sensor units
 - Implemented registry / middleware
 - Implemented Graphical User Interface though which requests will be provided to the registry regarding the context (sensor measurements) and responses will be displayed.
 - Draft algorithm of autonomous decision making processes per service

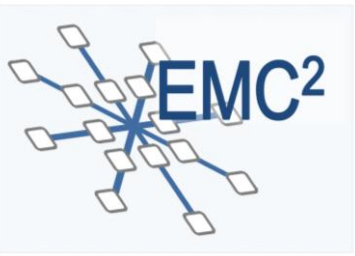


WP11 Internet of Things - HiPEAC workshop

UC11.3: Autonomic Home Networking



- Current status and steps further
 - A WP 11.3 physical meeting was held in Harokopion University of Athens In December
 - HUA's research team has been working on IMA's hardware towards the implementation of a registry unit and a related User Interface
 - Ambar has agreed in providing additional sensor units to be embedded in the system, and its platform will be available for the project after May 2015.
 - A dynamic environment with sensors generating variable data traffic will be created for testing purposes.
 - Service management on the registry will be demonstrated as well as concrete services for handling sensors and data generated by them
 - Openness will be ensured, open API will be provided based on open standards to ensure future integration with third-party systems



WP11 Internet of Things - HiPEAC workshop

UC11.3: Autonomic Home Networking



- THANK YOU!

- Contact information

Dr. George Bravos

Harokopio University of Athens (HUA)

Department of Informatics and Telematics

9, Omirou str, 17778, Athens, GR

Tel: +30 210 9549426, Fax: +30 210 9549281

E-mail: gebravos@hua.gr

Web: www.dit.hua.gr