

## ***HOMe Event Recognition System***



HOMER is an open and flexible OSGi-based software platform which aims at the integration of various home automation systems and consequential event and situation recognition for smart home (addressing comfort, energy efficiency, etc.) and Ambient Assisted Living (AAL) applications (addressing safety, autonomy, self-confidence, etc.). HOMER core components will be exploited by applying the Open Source model.

The HOMER platform is flexible in integration of various sensor networks through appropriate drivers, which can be Open Source or proprietary, depending on the field of application and availability. Applied to all connected sensor technologies is a mapping within HOMER components to one central, standardized data model. This is essential for further data processing in terms of event recognition and reasoning.

HOMER implements the ISO/IEEE 11073-10741 standard (Health informatics - Personal health device communication Part 10471: Device specialization-Independent living activity hub) as its primary internal data model. This standard is currently pushed by the Continua Health Alliance. The Continua Design Guidelines (version October 1, 2010) propose this standard for LAN (Local Area Network) and PAN (Person Area Network) devices. The scope of LAN (also named Sensor-LAN) is a house or building where else PAN is a certain range around a person. The Independent Living Activity Hub Specialization (ISO 11073-10471) is defined for both of these networks, PAN and LAN, in the Continua Design Guidelines. Already specified devices are: Fall Sensor, PERS Sensor, Environmental Sensors (Smoke, CO, Water, Gas), Motion Sensor, Property Exit Sensor, Enuresis Sensor, Contact Closure Sensor, Usage Sensor, Switch Sensor, Medication Dosage Sensor, Temperature Sensor. Besides a list of device specializations ISO 11073 defines also a Data Exchange Protocol and Communication Procedure.

AIT has implemented a Java library for the ISO 11073-10471 standard which is integrated in the HOMER platform and is a central component for sensor data exchange.

HOMER consists of an extendable graphical user interface which features configuration and design of the home environment including sensors and actuators, logging and monitoring panels. The GUI facilitates creation and maintenance of a floor plan and positioning and assignment of sensors.

Another basic component of HOMER is a finite state machine engine for rule-based reasoning. Therefore the Open Source project *UniMod* is integrated and extended with a graphical interface to enable easy to handle manipulation of individual state machines.

Summing up HOMER's core features are reasoning over incoming sensor data along with several graphical configuration and monitoring facilities.

### ***Description of the initial code base***

The software project at hand represents the *HOMER Core* components (*homer.core*). This set can be further extended by other components (e.g. non open source) which are bundled under the term *HOMER Core Extensions* (*homer.core.ext*). Those extensions are e.g. proprietary drivers for sensor networks, graphical user interfaces for end users, more sophisticated statistics, speech processing and others. Information on existing extensions can be requested from the AIT development team.

This software is part of the results of the nationally funded project *NovaHome* (Austria), developed by AIT Austrian Institute of Technology GmbH. The kind of open source license under which the software will be published is still to be defined. The license will be announced with the first release of the code.

HOMER Core software consists of a set of OSGi bundles:

**Common** (homer.core.common)

Provides basic data model for state machine scenarios and the database abstraction model.

**Database** (homer.core.database)

Provides database access functionality.

**GUI** (homer.core.gui)

Provides basic components for the graphical user interface, management of dynamic window components and functionality for configuration and monitoring of objects (floorplan, rooms, doors, sensors,...). Provides tools for graphical creation and editing of state machine scenarios.

**IsoAgent** (homer.core.isoagent)

Provides an implementation of the ISO 11073 standard including nomenclature, application profiles, device specializations (mainly 10471 Independent Living Hub) and communication structures.

**Event processing** (homer.core.processing.event)

Provides interfaces to and from the *UniMod* state machine engine. Manages loading and storing of state machine configurations. Additional features like sensor input simulator and playback of existing sensor data sets.

**unimod** (homer.core.unimod)

Encapsulates the *core* package of the *UniMod* state machine open source project (com.evelopers.unimod.core). *UniMod* runtime environment.

### ***Standards and Technologies:***

- ISO/IEEE 11073-10471:2008 Health Informatics - Personal health device communication Part 10471: Device specialization-Independent living activity hub
- Apache Felix OSGi framework (Open Service Gateway Initiative)
- Spring Dynamic Modules for OSGi Service Platforms
- Maven for building and modular configuration
- UniMod - Java Finite State Machine Framework for designing object-oriented event-driven applications (<http://unimod.sourceforge.net>) Version 1.3.38, published under LGPL v2.1
- Openhealth Morfeo
- BinaryNotes ASN.1 framework

### ***Reference projects:***

HOMER Core is currently used in following projects

- **BEDMOND**  
**B**ehavior Pattern Based Assistant for **E**arly **D**etection and **M**anagement **O**f **N**eurodegenerative **D**iseases

AAL-JP Project

For further information see: <http://www.bedmond.eu>

- **NovaHome**

Build-up of smart home know-how and expertise for safe and energy-efficient living

Funded by Province of Lower Austria and co-financed by the EC (ERDF)

For further information see: <http://www.novahome.at> (under construction; release date: 24.03.2011)

### ***Roadmap and invitation to contribute***

All the code base should be further tested and engineered. Immediate next step is the integration of an Open Source driver for KNX sensor network. Direct integration of ISO 11073 compatible devices is already under development.

### ***Involved people***

This software was developed by the Biomedical Systems Team within the Health & Environment department at AIT Austrian Institute of Technology GmbH in Wiener Neustadt, Austria.

Technical Contact and Development Lead: Thomas Fuxreiter - AIT ([thomas.fuxreiter@ait.ac.at](mailto:thomas.fuxreiter@ait.ac.at))

Involved people: Mathias Gira (AIT), Lukas Roedl (AIT), Johannes Kropf (AIT), Andreas Hochgatterer (AIT), Sten Hanke (AIT), Christopher Mayer (AIT), Miroslav Sili (AIT)