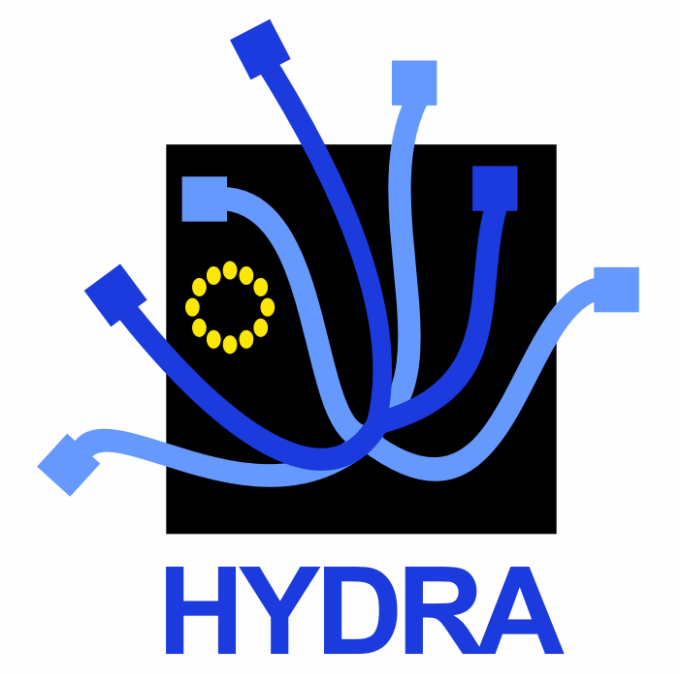


The Hydra project is co-funded by the European Commission within the Sixth Framework Programme under contract IST-2005-034891


# Newsletter No. 02

http://www.hydramiddleware.eu

## Content



September 2008

# Hydra – economic impulse for embedded systems

Embedded Systems denotes modular systems that are combined to form complex higher-order systems. They are included in healthcare devices, in building automation systems and home appliances, in mobile phones and even in agriculture systems and production facilities. Advanced applications in these fields require connecting a growing numbers of devices, typically from many manufacturers. The situation is even more complex considering the differences in their speed of innovation and the quantity of heterogeneous devices, sensors and actuators in the field.

**Embedded Systems:**
A specialized computing unit that is part of a larger system or machine. Typically, an embedded system is housed on a single microprocessor board with the programs stored in ROM. Virtually all appliances that have a digital interface utilize embedded systems. Some embedded systems include an operating system, but many are so specialized that the entire logic can be implemented as a single program. Embedded systems are thus often limited in memory and processing power.

An urgent need for technologies and tools that make it easier to benefit from networked systems is evident. The complexity of supporting technologies and tools grows exponentially with the number of devices, manufacturers and protocols involved.

At this point the research project "Hydra", funded by the European Commission, is most relevant. The project's vision is to create the most widely deployed middleware for networked mobile and embedded systems that will enable producers to develop cost-effective and innovative applications for new and already existing devices. Manufacturers and systems integrators will be enabled to build devices and systems that can be networked easily and flexibly to create cost-effective high performance solutions.

The results of the Hydra project will reduce design complexity by providing well-defined open interfaces between different types of devices.

Besides the core middleware the Hydra project will provide developer kits that will form the instrument to create innovative and cost-effective applications and that will feature access to the entire capabilities of the Hydra middleware. In this way ambient intelligence will bring added value to application providers as well as end users of Hydra-based applications and Hydra-enabled devices.

The Hydra project will develop a SDK (Software Development Kit), a DDK (Device Development Kit) and an IDE (Integrated Development Environment) to support software as well as hardware developers in their work to produce cost effective and innovative ambient intelligence applications and to grant easy access to all Hydra middleware functionalities.

**Middleware:**
In a distributed computing system, middleware is defined as the software layer that lies between the operating system and the applications.
The functionality of middleware is:

- Hide distribution of individual components of a system
- Hide heterogeneity (of software, hardware, protocols)
- Provide high level programming interfaces to developers
- Supply a set of common services

For field-tests and validation of the Hydra middleware, three application fields have been chosen: building automation, healthcare, and agriculture. In order to gain high awareness among the scientific and commercial community as well as to gain a proper exploitation of the project results, dissemination and exploitation are major elements within the project.

**Dissemination**
The Hydra dissemination strategy is to progressively increase dissemination efforts as project results are obtained, in order to assure a wide awareness of the Hydra project and favourable conditions to facilitate exploitation after the end of the project. The dissemination strategy is intended to optimise dissemination of project knowledge and results to companies and organisations, which share an interest in the scientific results and the applications or are potential service providers of Hydra.

Hydra has intensified dissemination activities addressing the scientific and commercial community and the general public as is evident by its recent success at the CeBIT 08, the ICT Mobile Summit in Stockholm (see below) and the acceptance to the ICT 2008 Conference in Lyon.

**Exploitation**
Exploitation involves a comprehensive presentation program to interested stakeholders and potential customers across Europe, allowing them to get a first hand view of the new middleware. During this process, the industrial partners are working on implementing proper exploitation strategies. In alignment with the exploitation process, LGPL has been chosen as an appropriate licensing model as basis for further work and the definition of suitable business models.

Hydra also plans to develop demonstrations of the prototype applications for each application domain to external end-users, such as system integrators, component manufacturers and organisations dealing with devices and network systems. A first building automation demonstrator has been developed and a second demonstrator for the healthcare domain is in preparation currently. Other target groups are public stakeholders, decision makers, research organisations, and the general audience that are also addressed by exploitation activities. Industrial partners will exploit research results by enhancing existing or creating new products and services. These products and services will lead to a competitive advantage for these partners and will create substantial benefits for the end users. The domain partners and the SME's will exploit the project results by incorporating the components in existing and new applications and thus improve performance and marketability of their products.

**Ambient Intelligence:**
In computing, ambient intelligence (AmI) refers to electronic environments that are sensitive and responsive to the presence of people. In an ambient intelligence world, devices work in concert to support people in carrying out their everyday life activities, tasks and rituals in easy, natural way using information and intelligence that is hidden in the network connecting these devices. The ambient intelligence paradigm builds upon ubiquitous computing and human-centric computer interaction design and is characterized by systems and technologies that are:

- embedded: many networked devices are integrated into the environment
- context aware: these devices can recognize you and your situational context
- personalized: they can be tailored to your needs
- adaptive: they can change in response to you
- anticipatory: they can anticipate your desires without conscious mediation.

**Contact:**
Dr. Markus Eisenhauer

**Company:**
Fraunhofer FIT

**Email:**
markus.eisenhauer@fit.fraunhofer.de

# The importance of Security

Enabling Inclusiveness and Semantic Interoperability are two significant objectives of the Hydra middleware. Inclusiveness means that the Hydra model is not only committed to be open to all models and communicating technologies that someone wants to make interoperable by mapping it semantically and using the middleware to facilitate. Additionally that middleware is not committed to create mechanisms that in itself prevent inclusion or dictate a certain legacy standard or understanding. Therefore it is possible to create even the most insecure and most privacy-invasive solutions with the Hydra middleware. Hydra does not secure an unsecure application. This raises significant challenges both in terms of securing Hydra middleware itself and in terms of enabling security resolution in a heterogeneous environment.

**Semantic Interoperability:**
Machine interaction based on data with meaning in the sense that a computer program can interpret the means behind data in order to process it.

The two strategies to solve this issue are:

1) Virtualisation as the main tool to secure Hydra itself.
   Virtualisation is in general the key to security and flexibility in a digital world, but to ensure that the middleware does not turn into untrustworthy controlware, the core security mechanism is to guarantee that Hydra does not have to be trusted. Therefore fault tolerance principles are built into the core system design. Middleware data sharing as well as device and application representation is always virtualised and Hydra middleware has no administrator rights or capabilities.
   Even if a device has been allowed by access control rules to become part of the logical Hydra domain, it does not get access to non-revocable keys or identifiers. As such Hydra does not work with a black/white security model. Devices or applications are neither trusted nor not trusted, but always a potential threat that can fail accidentally or deliberately as part of an attack. Devices and applications get access to context specific information and device representations in a way where all can be revoked.

   The purpose of this strictly enforced design principle is security (to ensure Hydra can be trusted even if attacks or errors occur – Hydra does not fail, applications in devices and security policies fail, but Hydra helps to enable recoverability), interoperability (Hydra use virtualisation to force delinking the native protocol or device standards from the upper semantic layers) and innovation (by delinking the physical implementation from the logical representation, developers can replace/ upgrade/ combine devices and application independently).

**Virtualisation:**
Within the Hydra project virtualisation is defined as "a method to create logical entities that are present within a certain scope (e.g., an application) but do not need to physically exist in the same form".
The logical entity which is created by virtualisation can be an exact copy of a physical device' capabilities, it can provide a different interface by adding or removing capabilities or create a completely new representation by merging the capabilities of a number of different entities (e.g., provide an interface for all light switches in a room at once or to any kind of sensor network). This definition does not limit the concept of virtualisation to software or hardware entities. Even personas, identities or natural persons can be "virtualised" and thus be integrated into the Hydra enabled environment in a suited representation.

2) Open Security Meta Standardisation as the main tool to enable interoperable security and resolution of security.
In Hydra all middleware-resolvable application security is supposed to be mapped using devices models and ontologies into an overall security model that is intended to be inclusive and interoperable. Each primitive and mechanism and groups of these to meet a security purpose are expanded into all the potential solutions to facilitate comparisons, upgrades and pluralism in facilitating different mechanisms to meet a specific requirement.
Existing security models are primitive reductions of a more overall meta-standard trying to accommodate very different security purposes. They are protocol or technology specific and thereby often security limiting and non-interoperable – deliberate or not intended.

To illustrate just some of the breakthrough differences in security and ICT development, four different examples can illustrate the changes introduced with Hydra.
[Read more]

Nevertheless it must be clear, that Hydra does not secure or Privacy-enable any application or device, but it makes it possible and easier to make secure and privacy-enhanced applications and devices.

**Contact:**
Stephan Engberg

**Company:**
Priway ApS

**Email:**
Stephan.Engberg@priway.com

# Healthcare Scenario using Hydra Technology

During the first Annual Review the Hydra middleware was demonstrated in the context of a building automation prototype able to recognise and alert the home owner about a not properly working device in the house, as described in the previous newsletter. **[1st newsletter]**

The second iteration of the prototype development focuses on the healthcare domain, in which the selected scenario, called "Overload", gives the opportunity to combine the different functions and components derived from the building automation prototype with the healthcare scenario.

and the glucose level; he fulfils this task by using two small wireless devices.
After the physical "check" he is able to see the analysis of his bio-data on his mobile PC; he feels relieved that everything is under control and sends the results to his personal repository.
Michael decides to go running and half an hour run later he is back at his truck. He immediately connects with his home to download the music he prefers to listen while doing some stretching.
As soon as the exercises are completed, he chats with a friend asking him what distance he ran the day before. He can also show to his friends where he is on a

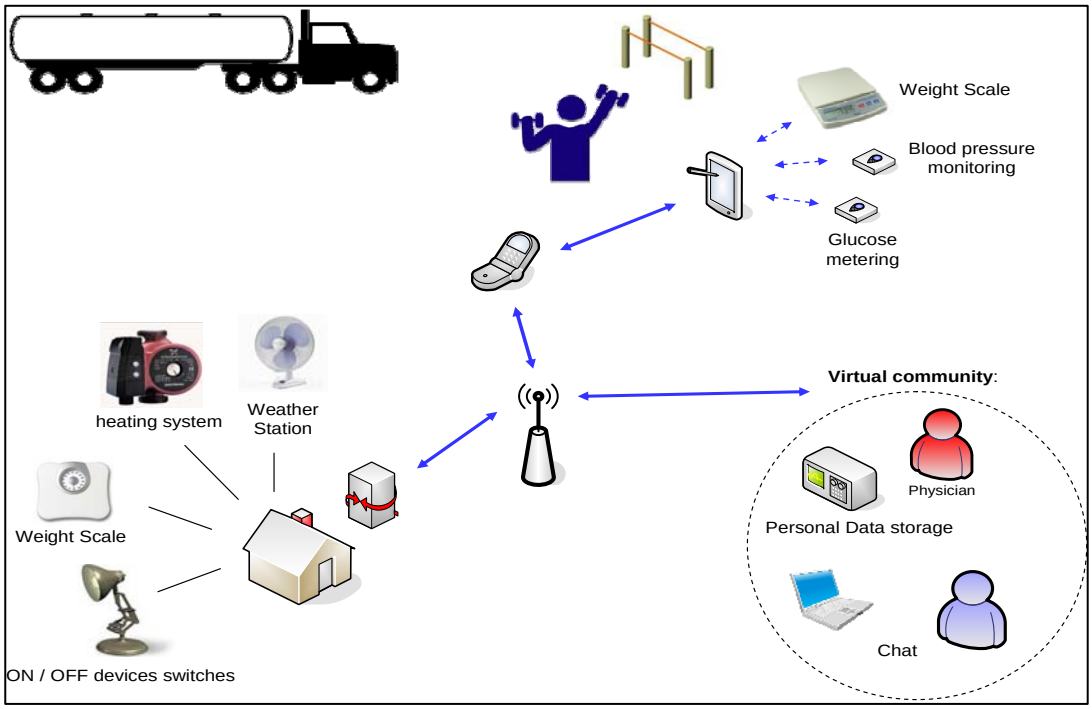


**Figure 1 - Modules integrated in the scenario**

Figure 1 sketches the major components foreseen in the story derived from the vision scenario.
Michael is a truck driver far from home due to his work. As he just stopped at a service area along the highway the calendar (TODO) function on his device reminds him he has to check his blood pressure

Google map, as it is possible to see the position of the Hydra-enabled devices. There is a challenge in the virtual community on who is making the longest run.

Michael has a passion for orchids. Before going to eat he remotely turns on the lights in the little glasshouse he has at home and he checks the temperature in-

side. At his home it is rather cold today (10 °C). So he turns on the heating system, too. Now he feels comfortable and hungry enough to get a nice meal.
In the following section about the 2nd demonstrator there is a more technical view on the modules taken from the use case and already implemented in the demonstrator.
Additional information about this scenario and the other three scenarios in the healthcare domain can be downloaded here: **www.hydramiddleware.eu**.

**Contact:**
Andrea Guarise

**Company:**
Innova Spa

**Email:**
a.guarise@innova-eu.net

# Description of the 2nd Demonstrator

One activity of Hydra is focussed on the development of real user applications exploited as an example of the potentialities of the project prototypes. The Hydra SDK, output expected at the project 2nd iteration, can be so appreciated as a helpful and efficient platform where to rely the software development for implementing functionalities useful to a potential final user. This approach is also valuable for measuring the effectiveness of the realised prototype and verifying the level of integration reached.

The demonstration of the 2nd prototype will be displayed in a web based tactile interface. The user experience is based on rotary sections included in the building automation and healthcare domains to be covered for the patient/home user. This interface is deployed on a portable device with web browsing capabilities, the Samsung Q1 Ultra (see Figure 2), chosen for its processing power, ability to integrate the Hydra middleware, screen size, tactile interface and flexibility.

The prototype framework gives a high level of flexibility for the module developers. PHP, DHTML, JSP, AJAX, and any required web programming language are supported due to the use of a web-based application. XAMPP, a free, cross-platform web server, consisting mainly of the


**Figure 2 - Ultra mobile PC used in the applications' demonstrator**

Apache HTTP Server, MySQL database, and interpreters for scripts written in the PHP and Perl programming languages has been chosen to support this iteration of the Hydra Application Prototypes.
In Figure 3 there is as an example a brief introduction on the steps followed to configure the devices while collecting data from a medical sensor.

The complete list of the deployed components (taken from the storyboard) has been divided with reference to their use.
Building automation

- automatic switches for in-house power control (lamps, …),
- automatic heating system,
- electronic entrance system,
- meter reading,
- weather station.

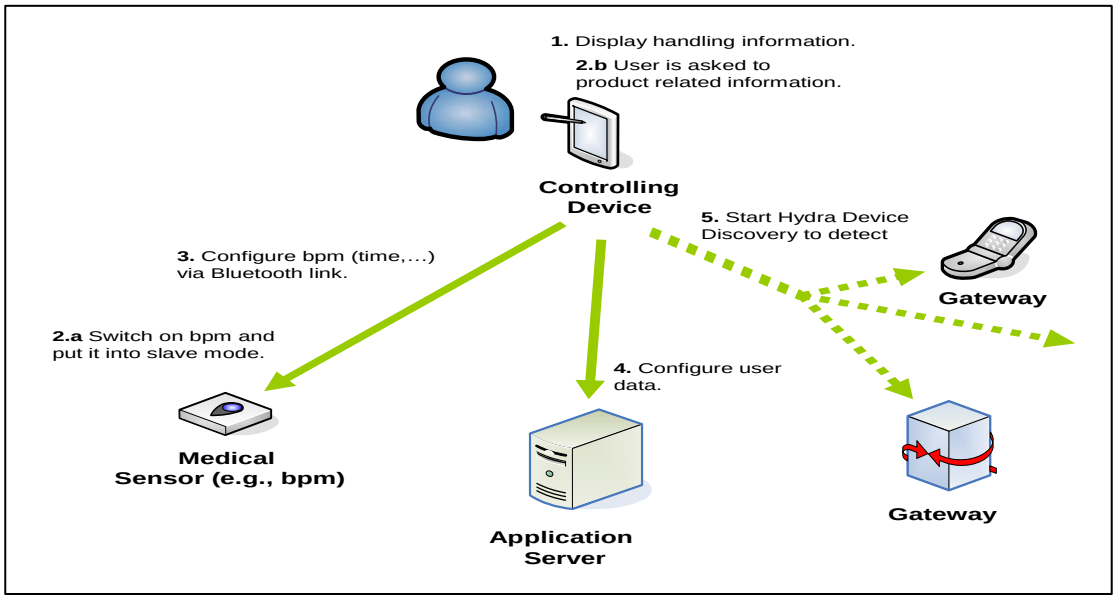


**Figure 3 - Device configuration and setup of measuring environment**

Healthcare

- wireless Bluetooth sensors measuring weight, blood pressure and glucose level,
- the cellular or 3G broadband network while being on the move,
- a calendar and a community chat application for user's need,
- a storage system (web community database).

Generic

- mobile phone with Bluetooth and java processor,
- the end-user's domestic network (e.g., WLAN, Bluetooth, …) or overlay network,
- desktop PC,
- other programmable stationary devices (like set-top box, home gateways) etc.
- mobile PC / laptop and tablet PC, PDA.

**Contact:**
Andrea Guarise

**Company:**
Innova Spa

**Email:**
a.guarise@innova-eu.net

# Hydra Middleware
# Runner-Up at Best Demonstrator Award

At the ICT Mobile Summit in Stockholm (June 10 - 12, 2008), the Hydra middleware for networked embedded systems was awarded the runner-up Best Demonstrator Award.

Researchers from FIT, the Fraunhofer Institute for Applied Information Technology, and from the Fraunhofer Institute for Secure Information Technology (SIT) demonstrated Hydra at the Mobile Summit and stood up to eighteen competitors. The demo of the Hydra middleware showed impressively its main features context awareness and semantic security resolution with a sensor-equipped intelligent building that sends short messages to inform about an attempted intrusion or a technical defect and enables residents and maintenance crews to send and receive remote access keys and authorisation credentials.

Visualising flexibility and functionality in a way that impressed the ICT Mobile Summit jury, the Hydra middleware networked the Lego® Mindstorm® technology of a model building, a Sony® PlayStation® 3 for management tasks and an oversized fully functional model of a mobile phone. The demo included a situation where a sensor detects water in the house and alerts the inhabitants by sending a message to their mobile phone. In the next step, an order for an emergency repair is sent to a service company, including a limited-validity electronic key to the building.


**Photo 1 - The winning team with the demonstrator**

"A main issue in the Hydra project is networking a broad range of heterogeneous devices", Dr. Markus Eisenhauer from Fraunhofer FIT, the project's coordinator, explained. "The middleware makes it easy for developers to integrate additional devices and sensors into a distributed infrastructure. And it helps them taking care of privacy and security requirements."

**ICT Mobile Summit:**

The ICT Mobile and Wireless Communications Summit 2008 was the seventeenth in a series of Annual Conferences supported by the European Commission, which regularly attracts over 600 delegates from industry and research to share experiences and research results, identify future trends, discuss business opportunities and identify opportunities for international research collaboration. It contributed to showcasing European research in the field, and positioning it within the multiplicity of related initiatives supported in other regions of the world.

http://www.ict-mobilesummit.eu/2008/

Typical application fields for the Hydra middleware include smart homes and building automation, industrial services, healthcare including home care and assisted living. Here, security and privacy have long been major issues. Hence, the concepts for minimising information exchange and the mechanisms for secure communication, which were developed by the Fraunhofer Institute for Secure Information Technology SIT, are significant features of the Hydra middleware.

**Contact:**
Dr. Markus Eisenhauer
Mario Hoffmann

**Company:**
Fraunhofer FIT
Fraunhofer SIT

**Email:**
markus.eisenhauer@fit.fraunhofer.de
mario.hoffmann@sit.fraunhofer.de

# Related Projects – The SENIOR Project

SENIOR – "Social Ethical and Privacy Needs in ICT for older people: A Dialogue Roadmap" – is a 24 month support action project which aims to provide a systematic assessment of the social, ethical, and privacy issues involved in ICT and Ageing, to understand what lessons should be learnt from current technological trends, and to plan strategies for governing future trends.

This objective will be achieved through a series of thematic expert meetings on different technologies such as ubiquitous computing, ubiquitous communication, intelligent user interface, adaptive software, and assistive technology. Each expert meeting will (i) define ICT systemic solutions and technology trends; (ii) discuss different ethical and privacy approaches; (iii) weigh the trade-offs between privacy, ethics and technological innovation. Issues such as interoperability, standardisation, access and affordability raise other important ethical questions which will be examined.

ICT can alleviate the burden of dependency by allowing people to live partially, or even totally, autonomously at home or in an assisted environment. Yet ICT can also seriously threaten people's autonomy. Modern information technology has increased the possibilities for the supervision and surveillance of elderly people. Technology surveillance is facilitated to an even greater extent by smart tags and RFID technology, which are beginning to be deployed on a large scale. The human body is equated to any moving object that can be monitored remotely via satellite and/or RFID technology. These applications pose serious ethical questions. For instance, what protocols should be followed when introducing technology for supervision? What guidelines should an ethical review board follow when they evaluate clinical trials in this field?
The issue of privacy is important when evaluating the feasibility of deploying ICT for ageing. It is crucial to ensure transparency in the processing of personal information related to the data subject. The "Individual Participation Principle" states that information may not be collected without the informed consent of the data subject. In relation to senior citizens, the issue of informed consent raises additional ethical problems, e.g. in cases of dementia, and becomes yet more complex in relation to ambient intelligence and embedded systems. Other principles to be considered are: openness, limitation of data, control of data, and purpose specification.

**RFID:**
Radio Frequency Identification: A method of identifying unique items using radio waves. Typically, a reader communicates with a tag, which holds digital information in a microchip. There are even chipless forms of RFID tags that use material to reflect back a portion of the radio waves beamed at them.

At the end of the project, SENIOR will produce a roadmap (2020) specifying key actions, priorities for investments and investment strategies, resources, risks, and milestones. [SENIOR Project website]

**Contact:**
Trine Fuglkjær Sørensen

**Company:**
In-JeT ApS

**Email:**
tfs@in-jet.dk

# Outlook for the next months

## Confirmed workshops, conferences and exhibitions

**18th - 19th September 2008 – 1st international "Internet of Things and Services" research workshop in Sophia Antipolis, France**

The 1st international Internet of Things & Services research workshop, organised by the Hydra consortium, is one out of three workshops related to security issues in ambient intelligence environments featured by the Smart Event'08. The workshop is designed for the exchange of insight between leading researchers and experts in the whole area of Semantic Interoperability, Ambient Intelligence, Sensor Networking, and generally the Internet of People, Things and Services. [Read more]

**29th September - 4th October 2008 – UBICOMM 2008 in Valencia, Spain**

Fraunhofer SIT is participating in the second international conference on mobile ubiquitous computing, systems, services and technologies and is going to present a paper with the title: "Requirements Analysis for Identity Management in Ambient Environments.

**15th October 2008 – ehome 2008 in Berlin, Germany**

Siemens is going to participate in a workshop so called "Integration – From individual solutions to integrated concepts" and present the Hydra project, its results and impact for new and integrated living concepts.

**26th - 31st October 2008 – I-CENTRIC 2008 in Sliema, Malta**

Fraunhofer SIT is participating in the international conference on advances in human-oriented and personalised mechanisms, technologies, and devices and will also present a paper with the title: "Support for Identity Management in Ambient Environments: The Hydra Architecture". [Read more]

**20th - 24th October 2008 – SASO 2008 in Venice, Italy**

University of Aarhus is participating in the second IEEE international conference on self-adaptive and self-organising systems. They will present two papers with the titles: (1) "Semantic Web based Self-management for a Pervasive Service Middleware" and (2) "Towards Self-Managed Executable Petri Nets". [Read more]

**25th - 27th November 2008 – ICT 2008 in Lyon, France**

Fraunhofer FIT and SIT are participating in Europe's biggest research event for information and communication technologies. The theme of the event is "I's To The Future – invention - innovation – impact". [Read more]

**3rd - 5th December 2008 – APSEC 2008 in Beijing, China**

University of Reading is going to participate in the leading international conference in software engineering and technology in the Asia-Pacific region. The APSEC 2008 will bring together researchers and practitioners from industry, academia, and government to share the state of the art technology in software engineering. This year theme is Software for Dependable Systems. The conference plans to explore emerging challenges in software for dependable systems. [Read more]

## New Hydra Publications

**An OWL/SWRL based Diagnosis Approach in a Pervasive Middleware**

*Published by: Weishan Zhang and Klaus Marius Hansen, Department of Computer Science, University of Aarhus, Denmark .*
[Download paper]

**First Demonstrator of Hydra Middleware Architecture for Building Automation**

*Published by: Martin Sarnovský, Peter Kostelník, Peter Butka, Ján Hreňo, Dáša Lacková, Technical University of Kosice, Slovak Republic*
[Download paper]

**Limbo: an Ontology based Web Service Compiler for Networked Embedded Devices**

*Published by:Klaus Marius Hansen, Weishan Zhang, and Goncalo Soares, Department of Computer Science, University of Aarhus, Denmark.*
[Download paper]

**Ontology-Enabled Generation of Embedded Web Services**

*Published by: Klaus Marius Hansen and Weishan Zhang and Goncalo Soares, Department of Computer Science, University of Aarhus, Denmark.*
[Download paper]

**Towards Self-managed Pervasive Middleware using OWL/SWRL ontologies**

*Published by: Weishan Zhang and Klaus Marius Hansen, Department of Computer Science, University of Aarhus, Denmark.* [Download paper]

**Business Modelling of Emerging Service Opportunities in the IoTS Ecosystem**

*Submitted by: Jesper Thestrup, In-JET ApS; Andreas Guarise, Innova SPA, and Gernot Graefe, Siemens AG*

**Contact:**
Florian Röhr

**Company:**
Siemens AG, Siemens IT Solutions and Services, C-LAB

**Email:**
florian-roehr@siemens.com

# Hydra Consortium Partners

CNET SVENSKA AB
DANDERYD, SWEDEN

FRAUNHOFER - APPLIED
INFORMATION TECHNOLOGY, DE

FRAUNHOFER - SECURE
INFORMATION TECHNOLOGY, DE

IN-JET APS
BIRKERØD, DENMARK

INNOVA S.P.A.
ROME, ITALY

PRIWAY
KGS. LYNGBY, DENMARK

SIEMENS AG
SIEMENS IT SOLUTIONS AND SERVICES, C-LAB
PADERBORN, GERMANY

T-CONNECT S.R.L
TRIESTE, ITALY

TECHNICAL UNIVERSITY OF KOSICE,
KOSICE, SLOVAKIA

TELEFONICA I+D SA
MADRID, SPAIN

UNIVERSITY OF AARHUS
AARHUS, DENMARK

UNIVERSITY OF READING
READING, UNITED KINGDOM

UNIVERSITY OF PADERBORN
PADERBORN, GERMANY

## Imprint

Fraunhofer Gesellschaft (Project Coordinator) on behalf of the Hydra Consortium:

FIT - Fraunhofer Institute for applied Information Technology
Dr. Markus Eisenhauer
Schloss Birlinghoven

53754 Sankt Augustin, Germany