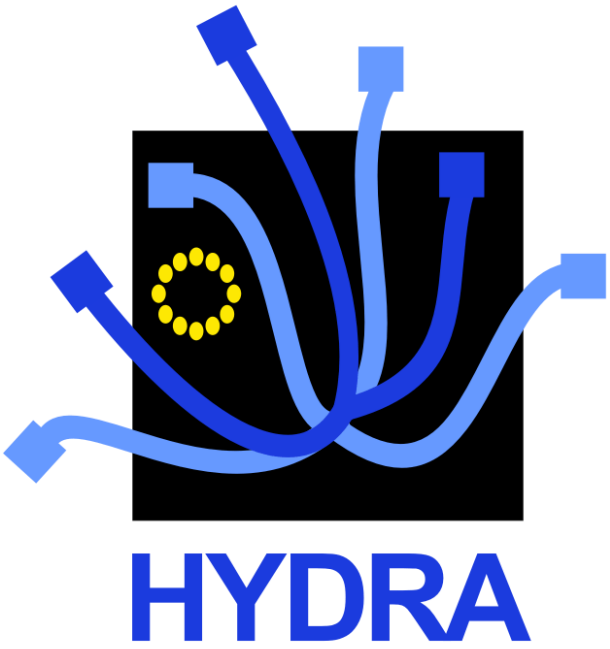

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http://www.hydramiddleware.eu

Contents

March 2010

Status quo of the project – Plans for the last year and beyond

Hydra continues its success story in the last project year. Hydra brings closer a world of ambient intelligence, or ubiquitous computing, where artificial intelligence becomes part of our everyday surroundings. It is an enabler of the vision that Mark Weiser, the founder of ubiquitous computing, had of the 'disappearing computer'. Hydra is an enabling technology that would make this dream come true. Hydra received a lot of interest from the networking community and requests from other projects who want to take Hydra as their basic technology and to build upon that. As well Hydra partners launched successor projects addressing the areas of Energy Efficiency, Ambient Assisted Living, Healthcare and Internet of Things.

Hydra is currently preparing for the period after the end of the project. Currently partners are in the process of setting up an association that will take care of all issues related to the Hydra software, i.e. its maintenance, further development, its distribution and promotion after the end of the project. The association will maintain the necessary development infrastructure, and support the open source community that is forming around the Hydra software. The underlying idea is to be able to react on market demands without high investment costs.

The licensing model of the middleware and its components has been a debate in the consortium as the great success of the Hydra project raised new questions related to the commercialization of the middleware and its services and applications. Hydra has decided to release the complete middleware under open source. But there will also be a commercial version for exploitation. This decision implies a clean-up of the middleware to remove any copyrighted or incompatible copyleft material.

In this last project year the focus of Hydra is on the implementation of the IDE tools, integrated in well-known development environments, i.e. Visual Studio and Eclipse.

Hydra is continuing on being active in promoting project results and creating synergies with other projects:

Hydra is showing demonstrations focusing on the energy efficiency domain at the GSMA Mobile World Congress in Barcelona February 15th-18th, on ICT 2020 High level Event on EE February 23-24th in Brussels and currently at the CeBIT in Hannover March 2nd-6th.

In addition, Hydra has organized a joined workshop together with the Pobicos and Sofia project to establish cross-project collaboration and for future clustering of projects addressing embedded system middleware for home automation.

The final demonstrations will focus on the full Hydra path, from enabling of devices using the DDK to the distribution and use of the Hydra applications. As demonstrations have now reached a high level of maturity they will be realized in a real home, the Casa Domotica from Telefonica in Valladolid, Spain.

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Business modelling workshop for the energy industry

The prices for energy on the European energy markets are increasing steadily. During the last four years the average price for one kWh of energy increased by 50 percent to 18.20 € Cent. Thus the realization of energy savings and efficiency are important for consumers. Furthermore ecological aspects are crucial. As reaction to this development, governments throughout Europe stimulate the market introduction of smart meters and grid concepts.

To gain input for the development of innovative solutions and business models a workshop has been conducted with experts in the energy domain from EON, Vattenfall Europe, Dong Energy, Fichtner IT Consulting and Siemens.

Situation on the market

The energy market is being broken up into smaller parts since its de-regulation and other legal changes. The purpose was to strengthen competition on the market and to decrease energy prices by breaking market power. Apart from the fact that utility companies have started to sell their grid as well as to outsource the metering business, a contrary development with respect to the energy prices started. Furthermore the climate change has initiated a change in thinking. Sustainable energy production and consumption has now become an objective. A rising amount of customers is asking for energy from renewable sources. Due to the steadily rising demand of energy from renewable sources utility companies have to integrate those volatile energy sources like wind or solar power plants into their offerings. Thus they are facing a lot more volatility in energy supply. The likelihood for situations of undercoverage increases as the electricity demand is volatile, too. Accordingly the frequent and flexible balancing of energy fluctuations is very expensive compared to stable load situations, which is a main reason for the increasing energy prices.

1st generation of solution and service concepts

These shifts on the electricity market prepare the stage for new stakeholders that are currently entering the market providing innovative services and solutions. Therefore new business models need to be developed and discussed. Metering service providers for instance are entering the market as a new stakeholder offering metering services. Due to the information gained from the smart meters they can offer a service around the provision of real time consumption data to their customers or to third parties. Today the main benefit of smart metering is the improved transparency of energy consumption. Private customers are able to check their current energy demand on a web portal. Utility companies can use this consumption data and patterns today to improve their energy demand forecasting.

This approach already helps customers to realize first savings by optimizing their consumption patterns. However, the limitation of this solution concept is the lack of integration. Figure 1 demonstrates that the focus of current smart metering solutions is to make the meter data available to the utilities companies.

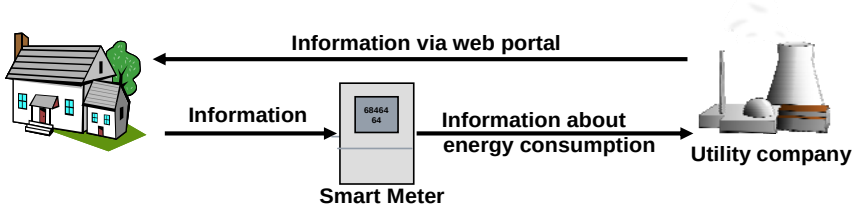

Figure 1 - Current focus of smart metering

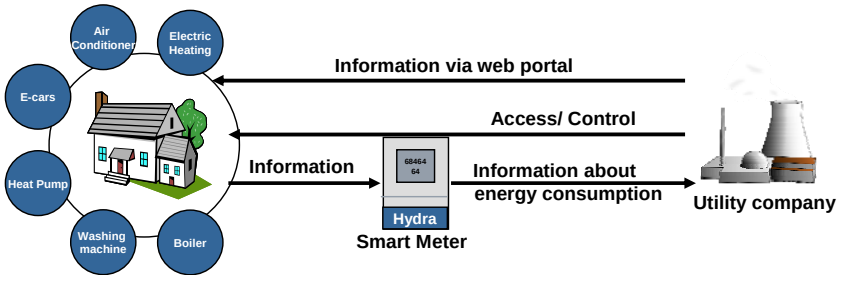

Figure 2 - New possibilities when using Hydra

During the workshop we learned that it will be necessary to make the metering data directly available in the households and to extend smart metering concepts by adding load management solutions.

2nd generation of solution and service concepts

Load management allows the utility companies to influence the energy demand of their customers in the range of prearranged service level agreements. By combining smart metering and load management concepts innovative services can be introduced (Figure 2). Utilities can for instance offer flexible tariffs. Based on contractual agreements between the metering service provider, the private households and the retailer, the retailer could possibly trigger the smart meters to lower the households' energy consumption at peak times offering an overall discount on the energy bill in exchange. Vice versa in situations of low energy demand very low prices at short notice can stimulate the energy consumption. Smart meters are seen as access point for these innovative services as Smart meters open the door to the millions of devices operated by private households and companies.

Conclusion of the workshop

Utilities experience increased competition due to liberated markets. With the increasing amount of renewable energy they are also forced to match energy supply and demand within their grids.

Existing load management solutions are foremost applied in industry and are therefore oversized as well as too expensive for private consumers. Furthermore these concepts are not accepted by them due to privacy and security reasons. Hydra will allow the development of load balancing solutions for private households as the economic benefits of load balancing are very convincing:

- A reduction of peak situations by 10% would lead to savings of about 100 million $ per year, estimated for the Californian electric power market.
- Avoiding a significant wear out of the grid infrastructure by lowering peaks would help to extend the life cycle of the whole grid infrastructure.

At the same time consumers will be more and more aware of sustainability issues and rising prices. Thus they will look for opportunities to save energy. Innovative services are needed in order to enable utility companies to deliver extra value to their customers. In return this will have a positive effect on customer retention as well as profitability of retailers and service providers.

Hydra's added value

Hydra has the potential to easily integrate devices and smart meters and to support load management applications in levelling demand fluctuations on device level in the households:

(1) All home facilities within the house can be networked with the Hydra middleware including the smart meter. Thus energy consumption on device level can be metered and transparency is increased.

(2) A context engine integrated in the middleware allows the individual setting of rules in order to adapt the energy consumption of dedicated devices. (Example: Switch on air conditioning when the temperature is higher than 26 degrees and the price for energy is below 18 € Cent per kWH.)

(3) Customers can adapt the rules on the context engine with respect to their preferences, which increases customer acceptance.

Further information can be found on the Hydra website:

www.hydramiddleware.eu/hydra_documents/D10.6_Business_Modeling_in_Building_Automation.pdf

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Business ideas for integrating Hydra in agriculture

Applying Information and Communication Technology (ICT) in the agriculture domain is of increasing importance. ICT is focussed on the enhancement of agricultural and rural development through improved information and communication processes. Besides technical challenges the stakeholders are also facing regulatory pressure, which turns into a need for documentation and also addresses a need for increased economical efficiency. In order to identify and discuss possible business ideas and business models that can address the above challenges and also satisfy the involved stakeholders, the Hydra project conducted a one-day high level workshop in Rome, organized and hosted by Innova.

General market overview

The priority of the European Common Agricultural Policy (CAP) is to ensure that agricultural products are healthy and safe, protect the environment and help farmers, especially medium or small sized farms, to adapt their production to consumer expectations. In this context, the major issues are sustainability, food quality, animal welfare, food safety, and control mechanisms.

As a general trend in this sector, there is the emphasis on networked solutions; e.g. for animal housing and control processing inside the farms, in order to monitor climate (temperature, humidity, ventilation, CO2 concentration), electronic feeding systems, water flow management and animal status (weight, temperature, localisation). All accompanied by a centralised management software (resident on a dedicated server). The collected data can be used for calculating statistics and obtaining forecasts. Current technology developments are going into the direction of integrating sensors directly into the network to be able to communicate with the remote controller, e.g. animals equipped with small sensors able to transmit a 3D monitoring measurement to the central controller, as well as new electronic ID for animals, based on UHF – RFID, able to be read from a distance of 2/3 meters.

Therefore, producers of devices and components are increasingly facing the need for networking their own as well as complementary products. An enormous amount of heterogeneous devices with embedded systems is already in place. The diversity of the producers and manufactures, without a proper standardisation framework, makes the selection of the right technology and devices to be installed in the farm more difficult. Often, different clock speed of technology deployment is an issue, thus there is a large need for tools that easily can add, implement and exploit the intelligence embedded in these devices.

Supporting the ubiquitous nature of these sensor applications is one of the core features of the future Internet of Things and Services, and thus also an objective of the Hydra project. Due to the growing complexity it is an essential prerequisite for the deployment and exploitation of new solutions and services in this domain to understand the business framework in the agriculture ecosystem. Therefore, a one-day high level workshop was organised in Rome, Italy, on 27 January 2010. High-level agriculture experts from a range of different stakeholders in Italy, Denmark and Germany were invited to this workshop.

Wrap up of the workshop

The workshop started with a key note lecture about interoperability and security issues in networked applications for agriculture. The lecture reported a general overview of the State of the Art of the ICT applied to the agriculture sector

in Denmark and a presentation of the country best practice related to the livestock field, especially regarding pig-breeding. The presentation emphasized the recent shift in technology which is leading toward a broader use of networked installations inside farms.

A second lecture introduced the current vision and possibilities on networking systems and devices in the Internet of Things and Services and how the Hydra middleware fits such a vision.

Then, two existing e-Agriculture scenarios (i.e. scenarios where ICT solutions are employed) were also presented to lead into the discussions that followed. The reported scenarios were: (i) food traceability in the fishing domain and (ii) wireless sensor network for precision agriculture. After the presentations, the rest of the day was devoted to expert discussions on the following topics:

- potential innovative applications using Hydra middleware;
- business drivers and elements of a potential business model for the envisioned applications;
- potential stakeholders to approach.

Outcome of the workshop

In all identified innovative applications, the Hydra technology could intervene in the interoperability aspect by integrating the technologies pointed out in the scenarios (mostly heterogeneous sensors seamlessly connected to the central intelligence) and by creating a homogeneous mean where the data can flow easily, allowing a smart (or unique) central equipment to get the single data converged and processed into the central elaboration system.

According to the experts, the potential enablers and drivers for making business in future agriculture scenarios are changing/evolving regulations and legal constraints at regional and national level, as well as the environmental efficiency (e.g. farms' economic optimisation, quality assurance and maintenance, eco-sustainability) which could be obtained by optimising the use of ICT, the innovation in farming techniques and improved technology together with improved methods.

The experts' discussion session drafted a basic business model focussed on the collected experiences and proposals, whose building layers represent also the actors/tasks present in a simplified agriculture value chain. Each stakeholder/function is necessary for the layer above. The final user dimension is left out, but it would be of course at the top of the stack.

Finally, the workshop participants agreed on the idea to realise a prototype to be showcased for verifying the potential market accessibility of the application and its impact towards early adopters and interest groups.

If you would like to have further details on the workshop, or even better be involved in future Hydra prototypes in the agriculture domain, please do not hesitate to contact us.

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Hydra License Clarified

After a long decision process the Open Source license, to be applied on the Hydra managers, has been appointed. The Hydra code base includes third-party software under more than 20 different licenses. This had to be considered with respect to compatibility, legal aspects and its consequences to the project.

Cleaning process

Well-known licenses like GNU General Public License (GPL), Apache License, Eclipse Public License (EPL), Mozilla Public License (MPL), some flavors of Creative Commons licenses (CC-?), or different BSD-style (Berkeley Software Distribution) licenses had to be evaluated. Besides incompatibilities between some of these open source licenses, there is sometimes even incompatibility between two different versions of the same license. For example, source code under GPL version 2 does not permit being used together with code under GPL version 3, or any other open source license. To make the situation a little bit more complicated, some software libraries are licensed under proprietary licenses or even commercial (closed source) ones. To spare future Hydra users from an impervious license jungle when dealing with Hydra source code, it has been decided to resolve the license issues by removing any copyrighted or incompatibly copylefted material. Unfortunately, this cleaning process requires frequent legal clarifications. But once finished, this will greatly simplify the users' legal relation to the Hydra middleware.

The good news is, however, that several managers (i.e. Hydra middleware components) have already been cleaned up. This includes core components like the powerful Network Manager. Furthermore work is put into the simplification task, and will shortly have the license issues resolved for the whole rest of the software, too. This means that not only parts of Hydra but everything will go open source soon and consumers will grant full access to the source code.

Quality check

As mentioned in the previous newsletter, the Hydra consortium has been concerned with the quality of its software source code since the start of the project. Now, as publication of the code is imminent, the consortium has allocated additional resources to do a rigorous quality check of all code. Therefore a cross-partner review will be conducted in addition to all the other quality assurance activities that were carried out in the past, and still are in progress. This ensures an easy adoption of Hydra in the open source community.

The chosen open source license

The Hydra consortium further foster community uptake by releasing Hydra under the Free Software Foundation's (FSF) flagship license, the GPLv3. It goes without saying that this license is recognized by the Open Source Initiative (OSI). The FSF recommends using this license instead of version 2, because the new GPL is compatible with many other open source licenses like the Apache License but still preserves the spirit and intention of free software. GPL is known as a strong copyleft license that fully protects the rights of its developers, yet it still does permit business; or as FSF put it: *"free"* as in free speech, not as in free beer. If you are an open source developer then you surely appreciate this decision. If users of Hydra are acting on behalf of a company that wants to use Hydra but they are not allowed or unable to comply with the specific conditions of GPL then special licenses as well for fellow EU projects as for commercial closed-source exploitation will be available. Please do not hesitate to contact us or the Hydra Foundation directly.

The Hydra Foundation

The Hydra Foundation will arise from the Hydra consortium towards the end of the project. It will be a non-profit organization that takes care of all issues related to the Hydra software and its distribution. But the primary purpose of the foundation will be to promote the continued development of the middleware, to uphold the necessary development infrastructure, and to support the open

source community that is forming around the Hydra software.

The next issue of the Hydra newsletter will feature detailed information on how to access the Hydra sources and how you can contribute to it.

Further information about the open source release can be obtained from our website:
http://www.hydramiddleware.eu

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New Energy Efficiency Demo

Since the rising energy prices and the climate change have initiated a change in thinking, energy efficiency and sustainability have become important key topics in society. The new Hydra demonstrator therefore shows how Hydra can be used to build innovative applications serving the overall aim of energy efficiency.

Private consumers are interested in saving energy, but there are just few individuals who can tell you exactly how much energy the devices in their homes consume. Therefore it is becoming even more important for private consumers to know the energy footprint of their single devices applied in the household. To answer such questions and to give consumers a sense of where the energy guzzlers hide, Fraunhofer Institut has developed an application within the Hydra project that demonstrates the energy consumption of individual devices in the household. The basis for this is the Hydra middleware co-developed by the institute and adapted to the energy domain. An additional Energy Manager, which is able to process energy price data, has also been set up. In upcoming systems the Energy Manager is designed as interface for incoming pricing data served by energy providers.

Each device in a household is given a power plogg, which is a small adapter located between the power plug and the power outlet. It reports the power consumption at any given time to a PC via a radio signal. People can tell which device is guzzling the most energy by taking a look at the computer monitor.

Figure 5 - Energy monitoring via PC

There exists also a far more convenient way to access the information by using a smart phone. The display and control unit on the smart phone allows people to check the energy consumed by their devices or appliances even remotely. For example, it can be used to display the consumption by room, switch devices on and off, and dim lights as figure 3 demonstrates.

Figure 3 - Energy monitoring via cell phone

Furthermore the demonstrator offers another special attraction. The smart phone's camera can for instance be used as a "magic lens". If a consumer points the camera at the device in question, the real-time power consumption is shown.

Figure 4 - Magic Lens

The technology behind this feature is complex: A server stores pictures of the individual devices, taken from a number of directions. When the function is activated, the cell phone sends the picture taken to the server, which then com-

pares the picture with the ones in its database. As soon as it has recognized the device, it determines the power consumption at the time as reported by the associated power plogg, and sends this information back to the cell phone.

The result is a multitude of options that allow people to analyze the power consumption of their devices: The total energy consumed by a device is a calculation of its power and the respective time that it is in use. In addition to the power at any given time, it is also possible to examine a device's total consumption, for example, extrapolated across the average time in use during a year. This even makes it possible to detect energy guzzlers in the household that are not always turned on, such as the oven. Thus it is possible to calculate if and when an investment into a more energy efficient device could pay off.

Various other scenarios can also be run through. It is possible, for example, to try out the room lighting with energy-saving bulbs and compare this consumption with conventional light bulbs to see the impact on the electric bill. A display of the current energy consumption along with the energy and cost savings per year facilitates this comparison. Similarly, it is possible to compare the energy used to play DVDs on a PlayStation with that when a DVD player is used.

The system is already equipped for the future: Electricity prices will in short term be determined by the time of consumption. This system allows people to easily switch their devices on or off depending on the actual price or day time thus realizing certain efficiency and saving effects.

From the 2nd to the 6th March 2010 this Hydra demonstrator application is exposed **at CeBIT 2010, hall 9, stand B36**. Experts form Fraunhofer Institute will be happy to welcome you there.

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Training in Ethics

Awareness and reflection of existing and potential ethical issues should be an integral part of the development process of new ICT services and applications. Therefore new training material is currently in development within the Hydra project.

The ethics of ICT is a rapidly growing field and the source of increased attention. Various important EC publications, e.g. the Riga Declaration, i2010 and Aging well in the Information Society, call for an increased awareness of the ethical issues of ICTs. New ICT products must not only comply with legal requirements but should also be ethically sound in order to fully reach their potential benefits for all citizens. For example, the promotion and achievement of e-Inclusion rests in large part on ICT services and applications that do not exclude certain end-users by default, i.e. due to a complex user interface design that may in effect exclude the less ICT experienced (e.g. senior citizens) or disabled end-user.

A course material for training in ethical considerations in the design of HYDRA enabled services and applications will therefore shortly be published. The course material is aimed at software developers who will gain an insight into the potential ethical dilemmas embedded in the design of ICT services and applications. However, anyone with an interest in the ethics of ICT may benefit from this course material.

Ethical problems may be far away from the developer's mind and often the ethical problems only become apparent once an ICT service or application is ready to enter the market. The objective of the training is therefore also to promote a *preventative* approach to ethical problems by helping developers identify the ethical issues in the first stage of the development and design process. By doing so, one can avoid the expensive and complicated readjustments or redesigning of a service or application at a later stage in order to meet the ethical requirements for the product's successful deployment on the market.

The training material will use case studies and probing questions that will prompt and help developers to identify how and which ethical issues are caused by each decision made concerning the design of new services and applications. Some of the ethical issues that will be dealt with in the training material are privacy, informed consent, accessibility, data protection and design for all.

Once the training material is ready, further information can be found on our website:
http://www.hydramiddleware.eu

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Outlook for the next months

Planned workshops, conferences and exhibitions

23rd – 24th February
The Hydra consortium attends the High level event on Energy Efficiency in Brussels in order to share and discuss the Hydra results with respect to energy efficiency.

2nd – 6th March 2010 –
The new Hydra demonstrator and its applications will be exposed at CeBIT 2010, hall 9, stand B36. Experts form Fraunhofer Institute will be happy to welcome interested people there.

24th – 26th March 2010
University of Aarhus will attend the Fifteenth IEEE International Conference on Engineering of Complex Computer Systems and present the paper about "Modeling and Implementing Ontology-Based Publish/Subscribe using Semantic Web Technologies

Papers presented

A Development Platform for Integrating Wireless Devices and Sensors into Ambient Intelligence System
Markus Eisenhauer, Fraunhofer Institute for Applied Information Technology, Germany; Peter Rosengren, CNet Svenska AB, Sweden; Pablo Antolin, Telefónica I+D, Spain.

A genetic algorithms-based approach for optimized self-protection in a pervasive service middleware
Weishan Zhang, Klaus Marius Hansen and Mats Ingstrup, University of Aarhus, Denmark; Julian Schütte, Fraunhofer Institute for Secure Information Technology, Germany.

Automizing Home Environments and Supervising Patients at Home with the Hydra Middleware: Application
René Reiners, Andreas Zimmermann, Marc Jentsch and Yan Zhang, Fraunhofer Institute for Applied Information Technology, Germany.

Collaborative Moderation - Fostering Creativity with a Corporate Wiki
S. Dencheva, Christian R. Prause, Andreas Zimmermann, Fraunhofer Institute for Applied Information Technology, Germany.

Enhancing Intelligence of a Product Line Enabled Pervasive Middleware
Weishan Zang and Klaus Marius Hansen, University of Aarhus, Denmark; Thomas Kunz, University of Iceland, Carleton University, Iceland.

Hydra Middleware for Developing Pervasive Systems: a Case Study in the eHealth Domain
Marco Jahn, F. Pramudianto and A. Al-Akkad, Fraunhofer Institute for Applied Information Technology, Germany.

Maintaining Fine-Grained Code Metadata regardless of Moving, Copying and Merging
Christian R. Prause, Fraunhofer Institute for Applied Information Technology, Germany.

Middleware for Building Pervasive Systems
A. Al-Akkad, F. Pramudianto, Marco Jahn and Andreas Zimmermann, Fraunhofer Institute for Applied Information Technology, Germany.

Modeling Architectural Change: Architectural scripting and its applications to reconfiguration
Mats Ingstrup and Klaus Marius Hansen, University of Aarhus, Denmark; University of Iceland, Iceland

All papers can be downloaded from the Hydra website: www.hydramiddleware.eu

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