issue 6  Autumn 2012
newsletter of the awareness proactive initiative
www.aware-project.eu

awareness
newsletter

News from the Awareness Co-ordination Action project

FP7 FET Awareness projects:
ASCENS
Autonomic Service-Component Ensembles
EPICS
Engineering Proprioception in Computing Systems
RECOGNITION
Relevance and cognition for self-awareness in a content-centric Internet
SAPERE
Self-aware Pervasive Service Ecosystems

Also supporting:
SYMBRION
Symbiotic Evolutionary Robot Organisms (funded by PerAda)
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Organic Computing Initiative
(funded by Deutsche Forschungsgemeinschaft, DFG)

Ecosystems of displays: SAPERE project
www.sapere-project.eu

Awareness is a Future and Emerging Technologies Proactive Initiative funded by the European Commission under FP7
The Autumn 2012 edition of the AWARENESS newsletter is packed with reports on what has been a very busy few months for AWARENESS: we've supported or organised five events across the globe, including in the USA, Scandinavia, and Europe. Check out the inside of the newsletter for reports on invited speakers sponsored by AWARENESS at the Internet of Things workshop at ICAC 2012, the workshop on Adaptive Computing (and Agents) for Enhanced Collaboration at WETICE 2012, and the workshop on Self-Awareness in Reconfigurable Computing Systems in Oslo, Norway. You’ll also find the latest information on the Best Paper awards we sponsored at WETICE and UKCI, as well as a detailed programme from the 2nd AWARENESS workshop at SASO 2012, which promises to be a busy event with plenary speaker (Prof. Marco Aiello), an invited paper from Prof. Satoh in Japan, several paper and poster sessions, as well as Doctoral Forum to encourage early-career researchers.

You can also find a report on the successful AWARENESS summer school held in Edinburgh earlier this summer. Look out for the advert for next year’s event that will be held in the beautiful city of Lucca from 24th-30th June 2013. Some people have already booked their place: get the date in your diary now!

As usual, you’ll also find inside the latest updates on the most recent magazine articles published in the AWARENESS magazine, and the deadline for the forthcoming rounds of the AWARENESS Exchange Programme. In this final year of AWARENESS, don’t miss the final opportunities to obtain financial support to visit researchers in another institution or in industry, in order to instigate new collaborations or progress existing ones.

Wishing all those working on AWARENESS projects a productive year as we move into the final year of the proactive initiative.

The Awareness team

Awareness sponsor invited speaker Dr Lamia Youseff


Awareness was pleased to sponsor Dr Lamia Youseff from Google Seattle as an invited speaker at the Workshop on Self-Awareness in Reconfigurable Computing Systems (SRCS) on 1 September. This event took place alongside the 22nd International Conference on Field Programmable Logic and Applications (FPL2012), held at the Department of Informatics at the University of Oslo, Norway from 29-31 August 2012.

The EPiCS project organized the workshop, and as organizer Tobias Becker from Imperial College explained, there is a growing range of work being carried out related to self-awareness, autonomic computing and organic computing, resulting in a need to devise a consistent framework for understanding the terminology and defining the challenges. This SRCS workshop contributes significantly to the wide community dialogue which the Awareness coordination action is encouraging and supporting.

Three invited talks were presented to an audience of approximately 30, by Peter Lewis, University of Birmingham, on Self-Awareness in Computing Systems, Marco Santambrogio, Politecnico di Milano, on Enabling Technologies for Self-Aware Adaptive Computing Systems and Lamia Youseff, Google Seattle, who considered the Future of Operating Systems relevant to Self-Awareness and Adaptive Technologies. In addition a number of technical papers and posters were presented and the workshop also featured a visionary discussion session, highlights of which will be summarized on the Awareness website. Workshop programme details at http://srcs12.doc.ic.ac.uk/program.html

SRCS 2012: Workshop on Self-Awareness in Reconfigurable Computing Systems in Oslo, Norway

Dr Lamia Youseff from Google Seattle
Awareness workshop & PhD Forum at SASO 2012


The goal of the workshop is to identify key challenges involved in creating self-aware systems which are capable of autonomous management, and consider methods by which these challenges can be addressed. The workshop specifically targets an interdisciplinary community of researchers in the hope that collective expertise from a range of domains can be leveraged to drive forward research in the area.

**Invited Speaker:**
Prof. Dr. ir. Marco Aiello
*University of Groningen, The Netherlands*

Marco Aiello is Professor of Distributed Information Systems at the Johann Bernoulli Institute.

**Are Homes Smart if they are Aware?**
Pervasive computing environments such as our future homes are the prototypical example of dynamic and complex systems where the interaction with the user generates a large degree of uncertainty in the state of the environment. While a home equipped with heterogeneous devices, whose services and location constantly change, needs to behave as a coherent system supporting its inhabitants. I will present software architectures that enhance homes by making them smarter with the goal of supporting user’s desires or saving energy. The discussion of the presented architectures will enable to draw some conclusions on the role of awareness in smart spaces. The examples illustrated are drawn from two EU projects: Smart Homes for All and Greener Buildings.

**Invited paper:**
Prof. Ichiro Satoh
*Experiences from Context-aware Services in the Real World*

There are serious gaps between laboratory-level and real context-aware services. To bridge the gap, we constructed several context-aware services and provided them in the real world. This talk presents our problems with our services in the real world. For example, it is difficult for users to know who, where, and when context-aware services are available, because such services are provided at only their target context. Some of them have been essential and common in real context-aware services. We discuss how to solve to these problems, which you may be confronted.
Around 50 students and researchers representing twelve countries arriving in Edinburgh for the Awareness Summer School in June. As can be seen in the photos here the picturesque location at Edinburgh Napier University inspired everyone to work hard and make some new friends and future research collaborations. The Awareness team is already looking forward to next year’s summer school in Lucca, Italy!

Check out the video highlights here:
http://www.aware-project.eu/2012/awass-2012-video-highlights/

**AWASS 2012 Speakers:**
Alberto Lluch Lafuente *(Ascens Project)*
Jim Torresen *(Epics Project)*
Giovanna di Marzo *(Sapere Project)*
Roger Whitaker *(Recognition Project)*
Jon Timmis *(Cocoro Project)*
Serge Kernbach *(Symbrion Project)*

AWASS 2012 took place at the historic Craighouse Campus, part of Edinburgh Napier University in Scotland.
The events for the week included lectures, tutorials and a PhD poster session. Students worked in groups on four Case Studies during the week with presentations on the Friday:

**Self-assembling strategies**
Alberto Lluch Lafuente (lecturer) and Andrea Vandin (mentor)

**Crowd steering in a music festival**
Giovanna Di Marzo Serugendo (lecturer) and Jose Luis Fernandez Marquez (mentor)

**Cognitive modelling of community detection/definition, and cognitive based forecasting models of epidemics**
Andrea Guazzini

**Classifying human motion for active music systems**
Jim Torresen (lecturer) & Arjun Chandra (mentor)

There were prizes awarded to students, below, who came up with the best Self-Awareness ideas over the week.

The “Nessies” were awarded for ideas including: Most Dangerous idea, Strangest idea, Most Impossible idea, Most Social Impact, Most Innovative idea, Most Entrepreneurial idea.

Congratulations to all the winning students!
Bio-inspired self-organising mechanisms are presented as design patterns, analysed, classified and their relationships identified. Basic mechanisms are provided as “core” services around which other mechanisms and services are built. This supports reuse of code and provides a modular way to design and implement bio-inspired applications.

Nowadays, emergent technologies are providing new communication devices (e.g. mobile phones, PDAs, smart sensors, laptops, intelligent displays), forming huge (even millions of nodes) and complex infrastructures. Pervasive systems exploit these new networking technologies in diverse applications domains such as: crowd steering (e.g. emergency evacuation in a building or a city, or visits guided in a museum), recommender systems (e.g. personalised advertisements, music or films recommendations, instant suggestion base on geo-location) or social networks (e.g. spatial social networks, agreements based on spatial networks).

The development of these applications faces a number of important challenges such as, scalability, real time responses or failure tolerance. Their large-scale, the highly dynamic environment in which they evolve prevent those systems to be designed or implemented using traditional approaches (mainly centralized with limited adaptation capabilities). In order to deal with these challenges and to exploit these new infrastructures the SAPERE European Project aims to develop a highly innovative theoretical and practical framework for the decentralised deployment and execution of self-aware adaptive services for future and emerging pervasive network scenarios. This innovative framework aims to ease the development of self-aware applications, providing resilience and scalability properties and allowing the execution of applications on top of complex infrastructures.

Self-organisation principles, as observed in natural systems (ant colonies, flocks of birds) are increasingly applied to artificial systems. They provide robustness and dependability to systems having to cope with highly changing environments, but still allowing individual system components to remain simple. Taking inspiration from these systems, researchers have identified bio-inspired self-organising mechanisms that allow achieving robustness, adaptability and scalability results that go beyond traditional approaches. However, these self-organising mechanisms have usually been applied in an ad hoc manner, with varying interpretations and no defined boundary among the mechanisms used, thus limiting systematic reuse and predictability.

Design Patterns have been proposed in the literature as the description of a frequently used and common solution for recurrent problems arising in the design of software systems. We presented a series of such patterns describing a series of bio-inspired self-organising mechanisms [1]. For each mechanism, we specify the problem it solves, the specific solution it provides, we list examples of use and describe consequences linked to the use of the pattern. Furthermore, we identify and analyse the inter-relations among the different patterns, providing a comprehensive compositional view of their relationships.
The major contribution of this work is the differentiation between basic, composed and high-level patterns, and the actual descriptions of the patterns proposed. The basic patterns allow a better understanding of complex patterns. Their identification is a step forwards the modelling of self-organising mechanisms and applications in a modular way. A typical example is provided by Digital Pheromones. We show that Digital Pheromones is a pattern composed of the Spreading, Aggregation and Evaporation Patterns. Spreading allows ant-like entities to sense pheromones that are far, beyond their sense. Aggregation increments the concentration of pheromones when there are two or more pheromones, allowing the ants to follow those paths with higher pheromones' concentration, and finally Evaporation allows the ant system to adapt to environmental changes, forgetting old paths. Similarly at higher-levels, design patterns descriptions of self-organising mechanisms, such as Gossip, Morphogenesis, or Foraging, show that these higher-level mechanisms rely on basic or composed bio-inspired mechanisms (e.g. Gossip needs Aggregation and Spreading, while Foraging exploits Digital Pheromone).

Leveraging this work on bio-inspired design patterns, and as a preliminary step to deal with the SAPERE objectives, we developed the notion of “core bio-inspired services”. They are low-level services providing basic bio-inspired mechanisms, such as evaporation, aggregation or spreading – shared by higher-level services or applications. In order to ease design and implementation of self-organising applications (or high-level services), by supporting reuse of code and algorithms, we proposed BIO-CORE, an execution model that provides these low-level services at the heart of any middleware or infrastructure supporting such applications, and provides them as “core” built-in services around which all other services are built [2].

The implementation of BIO-CORE inside the SAPERE framework allows applications to be designed and implemented by requesting low-level services (actually enacting basic bio-inspired mechanisms). As an example, let’s consider an application requiring the transmission of some information to a series of nodes across the system. The application can concentrate on its functionality, while the actual shipping of the information across the network (including any error recovery) is left to a dedicated environmental service (e.g. the Spreading service). To activate the appropriate service, the application only needs to deposit in the environment (i.e. the underlying infrastructure) the information indicating that this information requests the Spreading service.

BIO-CORE presents several advantages: (1) several applications or higher-level bio-inspired services can be running in the same virtual environment re-using the services provided by BIO-CORE (i.e. reusing code); (2) it makes it easier to model and implement bio-inspired applications, since agents’ behaviour and responsibilities are decoupled from the environment (i.e. the low-level services provided by BIO-CORE are still running in the middleware, ready to be executed on demand; (3) since several bio-inspired mechanisms can be running at the same time, BIO-CORE is a first step towards self-composition of mechanisms.

References


10th Adaptive Computing (and Agents) for Enhanced Collaboration (ACEC)
Conference Track @ IEEE WETICE 2012
June 25 – 27, 2012. Toulouse, France

Sponsored Invited Talk:
Jeremy Pitt, Imperial College London
The Logical Axiomatisation of Socio-Economic Principles for Self-Organising Electronic Institutions

Awareness sponsored a plenary talk, and best paper and student paper awards at ACEC, the 10th Track on Adaptive Computing (and Agents) for Enhanced Collaboration hosted at WETICE 2012. Over it’s nine years in existence, ACEC has focused on projects that leverage the adaptability, autonomy and intelligence of first-class software agents for the collaboration that occurs across enterprise software systems.

Best ACEC track paper award: Nicola Capodieci, Università di Modena e Reggio Emilia

Best paper
A Context-aware Agent-based Approach for Deregulated Energy Market
Nicola Capodieci, Emanuel Federico Alsina and Giacomo Cabri Information Engineering Department, University of Modena and Reggio Emilia, Modena, Italy

Abstract
A deregulated energy market is a typical scenario in which software agents are used for simulation and/or application purposes. Agents act on behalf of end users, thus implying the necessity of being aware of multiple aspects connected to the distribution of electricity. These aspects refer to outside world variables like weather, stock market trends, location of the users etc. therefore an architecture highly context aware is needed. We propose a web service integration in which agents contracting energy will automatically retrieve data to be used in adaptive and collaborative aspects; an explicative example, is represented by the retrieval of weather forecasting, that provides input on ongoing demand and data for the predicted availability (in case of photovoltaic or wind powered environments). The challenge lies in how to correctly use data coming from different sources, since these information are crucial for user profiling and balancing in the short-term contracts in the Smart Grid.

Best student paper
An Agent-based Services Framework with Adaptive Monitoring in Cloud Environments
Yi Wei and M. Brian Blake
Department of Computer Science and Engineering University of Notre Dame

Abstract
Cloud computing environments provide flexible infrastructures for third-party management of organizations’ information technology (IT) assets. With web services being a standard for realizing web-based business capabilities, the emergence of cloud computing will bring new challenges to different web service activities. In this paper, the authors propose an agent-based framework that provides effective integration of services within clouds. To tackle the dynamism in service operations, an adaptive monitoring algorithm is proposed. The algorithm is inspired by the congestion control approach from the TCP protocol and provides efficient, up-to-date information about service status without exhaustive monitoring. Experimental results show that the monitoring algorithm provides significant benefits when compared to the more exhaustive methods. This approach also facilitates other service activities, such as cross cloud service discovery.
More new articles have been added to the Awareness online magazine. These short articles, covering recent advances and research news, are informal and aimed at a general audience. They can be viewed online or downloaded in pdf format.

If you would like to write for the Awareness magazine, contact Jeremy Pitt: j.pitt@imperial.ac.uk

www.awareness-mag.eu

Magazine Themes:
Artificial Intelligence : Computer Organisation :
Interactive Robotics : Networks & Infrastructure :
Situational Awareness : Swarm Robotics

Latest articles:

Modelling is key to engineering self-organizing software systems
Giuseppe Valetto and Paul L. Snyder
“Designing self-organizing software requires an integrated modelling toolkit that encompasses design, validation and analysis.”

Smart environments for Alzheimer’s patients
Antonio Coronato
“A situation calculus approach enables situation-aware intelligent environments to interpret the behaviour of people with cognitive impairments.”

Modelling is key to engineering self-organizing software systems
Giuseppe Valetto and Paul L. Snyder
“Designing self-organizing software requires an integrated modelling toolkit that encompasses design, validation and analysis.”

Building the pyramid of awareness
Emil Vassev
“Awareness for computerized systems is possible by chaining functions in a control loop that monitors sensors, recognizes objects, predicts problems and, ultimately, learns.”

Cognitive-based capabilities allow Future Internet devices to select relevant information among huge amounts of data.

Cognitive heuristics for data dissemination in opportunistic networks
Marco Conti, Matteo Mordacchini, and Andrea Passarella
“Including cognitive heuristics in Future Internet protocols will allow users’ devices to select information efficiently, achieving a fast and effective dissemination of data in an opportunistic network.”

Converging and coexisting systems towards smart surveillance
Katina Michael and M. G. Michael
“Tracking and monitoring people as they operate within their personal networks benefits service providers and their constituents but involves hidden risks and costs.”

An x-ray of Eduardo Kac’s left leg in November 1997. Kac was the first artist to implant himself with a microchip (seen at upper left). (Courtesy of Eduardo Kac.)

Keep up to date with Awareness activities:
Website: www.aware-project.eu
Facebook page: www.facebook.com/aware.eu
Twitter @euawareness
Linkedin group: Awareness CA
**Self-Aware Internet of Things at ICAC 2012**

Self-IoT 1st International workshop on Self-Aware Internet of Things at ICAC 2012

17 September, San Jose, California

The Self-IoT aims to be a reference workshop that will gather different scientific communities from academia and industry under one common objective: realizing plug & play, context-aware and autonomous Internet of things that will be self-configured, self-organized, self-optimized and self-healed without (or with minimum) human intervention.


**Awareness is sponsoring an invited speaker:**

Joerg Denzinger, *University of Calgary*

Testing cooperative autonomous systems for unwanted emergent behaviour and dangerous self-adaptations

“While self-organization and self-adaptation offer enormous advantages to the Internet of Things, they also come with the possibility of unwanted emergent behavior and adaptations that can be dangerous for such a distributed system. Even more, we will have to deal with attempts to manipulate such systems into these unwanted behaviors, either by criminals for economic gains or by activists to hurt or just inconvenience people. Therefore, testing of such systems both before deployment and also during their lifetime is important and requires concepts to find unwanted emergent behavior and dangerous adaptations, which conventional testing is not able to do well.”

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**Awareness Sponsor UKCI 2012**

Awareness was pleased to sponsor an award of £350 to the best paper submitted to UKCI 2012 that deals with the topic of self-awareness in autonomic systems. Judging was based on the opinions of the reviews obtained from the Programme Committee in conjunction with a panel from the Awareness project consisting of Prof. Emma Hart, Dr Jeremy Pitt, Prof. A.E Eiben and Dr G. Cabri.

**Winning Paper:**

Introducing DOWSN: Distributed Optimization in Wireless Sensor Networks


**Abstract**

Driven by a broad range of applications, the Computational Intelligence research community has recently put a growing interest on the emergent technology of Wireless Sensor Networks (WSNs). Due to their distributed structure, WSNs pose several technical challenges caused by local failures, network issues and severely constrained hardware resources. Nevertheless, the possibility to perform an online optimization within WSNs is appealing since it might lead the path to advanced network features like intelligent sensing, distributed modelling, self-optimizing protocols, anomaly detection, etc. just to name a few. In this paper we present DOWSN, a novel Distributed Optimization framework for WSNs. Based on an island model, DOWSN is characterized by a peer-to-peer infrastructure in which each node executes an optimization process and shares pieces of information, i.e., local achievements, with its neighbors. Preliminary experiments show that DOWSN is able to efficiently exploit the communication capabilities and the inherently parallel nature of WSNs, thus finding optimal solutions fast and reliably.

UKCI 2012, the 12th Annual Workshop on Computational Intelligence, was hosted by Heriot-Watt University, Edinburgh on Wednesday 5th September to Friday 7th September 2012. Visit the UKCI Website for more details: [www.macs.hw.ac.uk/ukci2012](http://www.macs.hw.ac.uk/ukci2012)
Working in the field of Self-Aware Autonomic Systems?

- Are you a researcher looking to collaborate with another researcher from another institution?
- Do you want to kick-start a collaboration with someone from a different discipline?
- Have you some experience to share with companies or SMEs?
- Would you like to invite an expert from another institution to work with you, or explain their ideas to your own research group?
- Would your Awareness project benefit by sharing ideas with other FET-funded projects?

Awareness is the European Commission’s FET Proactive Initiative on Self-Awareness in Autonomic Systems. The coordination action funds research exchanges to encourage interaction between institutions, organisations, industry and SMEs. We can “match-fund” travel and accommodation costs for researchers engaged in research related to self-awareness in autonomic systems, especially if they aim to learn from different disciplines or transfer knowledge between academia and industry. This means we can pay up to 50% of the costs as long as the host organisation or the individual visiting researcher pays the balance of costs.

Full details including an FAQ and application form are available on the Awareness website:

www.aware-project.eu

Next Deadline 30th September!

Deadlines: 30th September/December/March/June 2011-2013
The **Awareness Coordination Action** project provides a collaborative environment for research into self-awareness in autonomic systems, supporting the network of researchers and engaging with a wider scientific and technological audience.

Awareness reaches out to a diverse, multidisciplinary scientific community that researches self-aware autonomic systems. As technology continues to rapidly advance, the management of systems becomes more difficult, and they must increasingly be able to manage themselves implying that they must be self-aware. Achieving truly self-aware systems is of interest to almost everyone in society as it will have technical, social and economic impacts. The FET funded projects that we support are:

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- **ASCENS**
  Autonomic Service-Component Ensembles
- **EPICS**
  Engineering Proprioception in Computing Systems
- **RECOGNITION**
  Relevance and cognition for self-awareness in a content-centric Internet
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- **Organic Computing Initiative**
  (funded by Deutsche Forschungsgemeinschaft, DFG)

**What the Awareness project does:**
Organises *summer schools* and *virtual lectures* to train the researchers of the future and for interdisciplinary knowledge exchange. Arranges *workshops* relevant to the self-awareness community of researchers. Presents *public showcase events*. Creates widely accessible *publications*, and *training materials* for use in *teaching* and *outreach work*. Provides *funding* for *research exchanges*. Disseminates the research output of our supported FET funded projects. Shapes the *Research Agenda of the future*: this will gather opinion relating to the Awareness Initiative from expert researchers and scientists.

[
**www.aware-project.eu**
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