



FINAL REPORT

of the PerAda-SICSA International Summer School on Pervasive Adaptation
20-27 June 2009, Edinburgh Napier University, Scotland

prepared by [PerAda](#) Project Manager, Jennifer Willies

The Scottish Informatics and Computer Science Alliance (SICSA) held a summer school in conjunction with the second PerAda International Summer School on Pervasive Adaptation on 20-26 June 2009 at Edinburgh Napier University. All the material contained in this report including presentations and also a short video is available at <http://www.perada.eu/summer-school-09>

A series of tutorials presented by leading international and UK researchers were interwoven with four pervasive adaptation case studies. Summer School participants worked in small interdisciplinary teams during the week and presented a group project on the final day. The PerAda Projects Workshop featuring six research projects funded under the European Commission's Future and Emerging Technologies Proactive Initiative on Pervasive Adaptation was incorporated into the Summer School and included a series of talks and tutorials. The aim was to encourage interdisciplinary exchange between researchers of all levels from a range of different international organisations.

Background to the 2nd PerAda Summer School

Pervasive Adaptation is concerned with technologies used in information and communication systems which are capable of autonomously adapting to highly dynamic user contexts. The development of future systems will increasingly require collaborative systems, involving complex interactions between people, intelligent objects and computers. The real challenge is the constantly changing networked environment which no longer is centrally controlled, or even completely understood, by the developer or user. To be successful especially in such highly dynamic environments, systems themselves will have to adapt, taking into account the

emergent behaviour of the system. This summer school addressed some of these issues and the talks, tutorials and case-studies focussed on:

- Evolve-able and adaptive pervasive systems, able to permanently adjust, self-manage, evolve and self-organise in order to robustly respond to dynamically changing environments, operating conditions, and purposes or practices of use.
- Networked societies of artefacts that adapt to each other and to changing needs, collectively harness dispersed information and pursue immediate or long-term goals for context-sensitive service delivery in rapidly changing and technology-rich environments.
- Adaptive security and dependability: theories, techniques and architectures, able to cope with the volatile landscape of risks, threats, attacks and context dependent user expectations for privacy and security in evolving and heterogeneous pervasive systems.
- Dynamicity of trust: capabilities for establishing trust relationships between humans and/or machines that jointly act and interact within ad-hoc and changing configurations.
- Security for tiny and massively networked devices: efficient, robust and scalable cryptographic protocols, algorithms and other security and privacy mechanisms, including hardware-based ones, as well as collective, biologically or socially inspired ones.

This was a joint event between the Scottish Informatics and Computer Science Alliance, **SICSA** (principally by Edinburgh Napier University, The University of Edinburgh, Heriot-Watt University and The University of Abertay Dundee) and **PerAda** (the Pervasive Adaptation FET pro-active initiative funded by the European Commission under FP7).

Programme & Speakers

Fifteen talks and tutorials were presented during the week in addition to specialist sessions covering the four case studies. The summer school programme is available at:

<http://www.perada.eu/documents/2009/perada-summer-school-programme-2009.pdf>

The speakers were (links included to their presentations)

1. **Adapt or Die! Role of adaptation in wireless sensor networks**

DK Arvind, Director, Research Consortium in Speckled Computing, School of Informatics, University of Edinburgh, UK

2. **FRONTS testbed tutorial**

Claudia Becker, University of Lübeck, Germany

3. **Adaptive Networked Societies of Tiny Artefacts**

Ioannis Chatzigiannakis, Computer Technology Institute, Greece

4. Personal adaptation and interaction

Stephen Fairclough, Liverpool John Moores University, UK

5. Nature Knows Best? How have biological systems been exploited in engineered systems?

Ruth Falconer, SIMBIOS Centre, University of Abertay, UK and

Emma Hart, Centre for Interaction Design, Edinburgh Napier University, UK

6. The challenges for Pervasive Adaptation

Alois Ferscha, Institute for Pervasive Computing, Johannes Kepler University of Linz, Austria

7. System Support for Pervasive Adaptation

Klaus Herrmann, University of Stuttgart, Germany

8. Engineering Emergent Ecologies of Interacting Artefacts

Achilles Kameas, Computer Technology Institute, Greece

9. Self-Organizing Ambient Intelligence: key knowledge gaps and future applications

Serge Kernbach and Eugen Meister, University of Stuttgart, Germany

10. Security for Small Devices

Giuseppe Persiano, University of Salerno, Italy

11. Cooperative Behaviours in Multi-Agent Systems

Jeremy Pitt, Imperial College of Science, Technology and Medicine, UK

12. The Body and the Urban Space: designing for connection between the augmented human and the intensely technological environment

Michael Smyth, Centre for Interaction Design, Edinburgh Napier University

13. 2020 Vision - Personal Smart Spaces

Nick Taylor, School of Mathematical & Computer Sciences, Heriot-Watt University, UK

14. Managing and Engineering of Complex Situations

Mihaela Ulieru, University of New Brunswick, Canada

15. Harnessing adaptive human social structures for tomorrow's wireless networks

Roger Whitaker and Stuart Allen, Cardiff University, UK

Four Summer School Case Studies

The four case studies provided a learning anchor for participants during the week, with talks and tutorials designed to illuminate some of the particular issues addressed in the case studies. Invited speakers and tutorial leaders moved between the teams acting as roving mentors, and informal discussion sessions helped the case study teams.

1. Adapt or Die! - Role of adaptation in wireless sensor networks



Research Consortium in Speckled Computing

Led by [DK Arvind, Director, Research Consortium in Speckled Computing, School of Informatics, University of Edinburgh, UK](#)

Considering the role of adaptation in its different forms in pervasive wireless sensor networks and exploring the role of adaptation at different levels:

- In the architecture, eg, in the way the networks and sub-systems are configured to optimise battery lifetime
- In the firmware, eg, for dependability or in the way mobility is handled
- In the application software for different contexts
- In the personalisation for different users

The application software was developed, and strategies for adaptation were explored, using the SpeckSim simulation environment developed at the Sol, UoE. The implementation platform was the Energy Neutral Speck platform with a 16-bit MCU, a 2.4 GHz Zigbee radio, a Sanyo photovoltaic panel and a LiPoly battery.

Two possible application scenarios were explored:

- Asset or personnel tracking in a public environment, such as in a school or a hospital
- Environmental condition monitoring and control in built environments

[Link to the Adapt or Die! Case Study \(PDF\)](#)

[Link to the final Team Presentation \(PDF\)](#)



2. Personal Smart Spaces: 2020 Vision



Led by [Nick Taylor](#), School of Mathematical & Computer Sciences, Heriot-Watt University, UK

A Personal Smart Space is defined by a set of services within a dynamic space of connectable devices (a personal area network of the devices) and services (running on those devices) that are owned, controlled, or administered by a single user or organization. It facilitates interactions with other smart spaces, is self-improving and capable of pro-active behaviour. The aim of this case study is to consider how this paradigm might evolve over the coming years.

[Link to the Personal Smart Spaces Case Study](#) (PDF)

[Link to the Team Presentation](#) (PDF)

Additional Resources:

1. One page description of [Personal Smart Spaces: 2020 Vision](#) (2009). (PDF)
2. PerAda Magazine article on [Self-Improving Personal Smart Spaces](#) (2009). (PDF)
3. Deliverable from the (SWAMI) EU project (2006) [Safeguards in a World of Ambient Intelligence](#). (PDF)
4. Nokia Technology Insight report on [Location, Context and Mobile Services](#) (2009). (PDF)

3. The Body and the Urban Space : designing for connection between the augmented human and the intensely technological environment



Led by [Michael Smyth](#), Centre for Interaction Design, Edinburgh Napier University

Designing for connection between the augmented human and the intensely technological environment, the urban space of the future will be saturated with both visible and hidden media that gather and transmit information. How we as physical beings connect with, interpret and shape the increase of data residing in our environment will be a significant challenge. The forms in which this data will be presented, and how we decide to conceptualise it, is as yet unknown. Will the technologically enriched environment adapt to accommodate human/city contact points, and, in response, will we choose to adapt and augment our own bodies in order to navigate around, and communicate with and through, this information landscape?

Introduction

It is envisaged that the urban spaces of the future will be saturated with both visible and hidden media that gather and transmit information. How we as physical beings connect with, interpret and shape the increase of data residing in our environment will be a significant challenge. The forms in which this

data will be presented, and how we decide to conceptualise it, is as yet unknown. Will the technologically enriched environment adapt to accommodate human/city contact points, and, in response, how will we choose to interact with and navigate through, this information landscape? Today's urban experience is enhanced by technology that increasingly enables simultaneous existence in both the virtual and real worlds. Such technology offers a number of bridges between these worlds but in so doing places an increased tension on the sense of place and subsequently the identity of the individual. Identity has many components that have to be woven in our everyday lives. It is postulated that in order to cope with the demands of our society, people must be capable of switching between identities actively and quickly while stitching these different identities in place (Hall, 1991).

Approach

Humans have always been in constant engagement with their surroundings, often without being consciously aware of the process or nature of this interaction. By investigating the activities that currently take place in this liminal space we may be able to identify important themes and issues. Taking inspiration from ethnographic design research methods, the workshop took an experimental approach to the recording of these human activities. By using the everyday technologies that people have to hand, workshop participants were provided with a new perspective on the traditional techniques that designers have employed, such as the creation of scrapbooks, mood boards and sketches. The aim was to help widen opportunities for participation in the design process, assisting technologists and designers of the future as they work to shape physical and virtual environments in such a way that they can be made sense of and manipulated.

The case study addressed questions such as: What form will the information landscape take? How will people adapt their behaviours and indeed how will the nature of the urban landscape alter as increased amounts of information is overlaid on the physical environment? What new products and services will be available given the increase of targeted information aimed at specific communities and interest groups? Will this result in an increase in segmentation and fragmentation associated with the urban experience leading to the possibility of the creation of multiple experiences of the same physical space. What will inform the visual aesthetic of the future information landscape?

Topics for Investigation included

- 'OFF=ON' – blurring the boundaries between real and virtual objects.
- 'Urban Computing' – embedding/overlying/blending technology in the physical environment to create new hybrid experiences.
- 'Body Storming' – acting out roles focussing on intuitive responses prompted by the physical environment.

Background Reading/Inspiration/References

- Bullivant, L. (2006) Responsive Environments – Architecture, Art and Design, V&A Publications, London
- Bullivant, L. (2007) 4dsocial interactive design environments, Architectural Design, Vol77, No4.
- Scott R. Klemmer, Bjorn Hartmann and Leila Takayama. "How Bodies Matter: Five Themes for Interaction Design". Proceedings of DIS 2006, pp140-149.
- "Bodystorming" -- see Marion Buchenau and Jane Fulton Suri, "Experience Prototyping". Proceedings of DIS'00, pp424-433.
- "OFF=ON". <http://trendwatching.com/trends/offon.htm>
- Benjamin, W. (1997) Charles Baudelaire: A Lyric Poet in the Era of High Capitalism, Verso Classics, London.
- Hall, S. (1991) Stitching yourself in Place, Annual Magazine of the European Network for Cultural and Media Studies, Vol 1, Amsterdam, 4-13.

[Link to the Team Presentation \(PDF\)](#)



4. Nature knows best? - How can biological systems be exploited in engineered systems?



Led by [Ruth Falconer, SIMBIOS Centre, University of Abertay, UK](#) and [Emma Hart, Centre for Interaction Design, Edinburgh Napier University, UK](#)

Future data communication networks show three emerging trends: increasing size of networks, increasing traffic volumes and dynamic network topologies. Efficient network management solutions are required that are scalable, can cope with large and increasing traffic volumes and provide decentralised and adaptive routing strategies that cope with the dynamics of the network topology. Routing strategies are an important aspect of network management as they have a significant influence on the overall network performance.

[Link to Nature Knows Best? Case Study Overview \(PDF\)](#)

[Link to the Team Presentation \(PDF\)](#)

[Link to Algorithms in Routing Sensor Networks \(PDF\)](#)

[Link to 'Fungi' by Ruth Falconer \(PDF\)](#)

[Link to Nature Knows Best? Notes by Despina Davoudani \(PDF\)](#)

[Link to Ant Colony Optimisation by Dr Bart Craenen and Prof. Emma Hart \(PDF\)](#)

Participants considered how existing biological systems have been exploited in engineered systems such as communication networks in order to determine the shortest path in a network. Determining the shortest path in a network is an important aspect of efficient network traffic management. In this case study the underlying concepts relating to three different routing protocols: spanning tree, ant and fungal systems were explored. These biological systems will be used as the basis of developing efficient and robust routing protocols and the success of each of the algorithms can be assessed under different scenarios.

Using a network simulator (SpeckSim) the students had the opportunity to investigate an implementation of a spanning tree routing protocol. The participants also had access to a basic implementation of an ant colony routing protocol that they could improve and adapt. Finally, the participants had a chance to implement a fungal based routing protocol informed by the robustness and resilience of real fungal networks. Using the simulator the effectiveness of each of the routing protocols were assessed under different conditions:

- Static network
- Limited background traffic density
- Large radii for radio range

The scenarios were increased in complexity and extended to test the effectiveness and robustness of each protocol for dynamic networks with various background traffic densities and radio ranges. This case study explored the possible use of bio-inspired algorithms for data flow in wireless networked systems. The task required research into existing exploitation of biological systems for wireless networks i.e. ant and immune systems and review the potential use of a fungal inspired communication protocol. Participants learned about fungal systems and identified possible ways i.e. mappings between the biological and wireless system, that the resilience and robustness of the biological system can be transferred to wireless systems. Participants implemented the protocol in the SpeckSim simulation environment to investigate:

- How fungal inspired algorithm compares with existing ant algorithm in determination of shortest path



- How robust the algorithm is to nodes dropping out of the network

SpeckSim

For the case-study, a free simulator developed by the [SpeckNet](#) project, called SpeckSim was used. A guide to SpeckSim can be found [here](#).

BACKGROUND MATERIAL INCLUDED:

Spanning Trees (ST) In WSNs

- [Distributed Algorithms for Constructing Approximate Minimum Spanning Trees in Wireless Sensor Networks](#) by Khan M. et al. 2009 (PDF)
- [A Simple Randomized Scheme for Constructing Low-Weight k-Connected Spanning Subgraphs with Applications to Distributed Algorithms](#) by Khan M. et al. 2005 (PDF)
- [A Fast Distribution Approximation Algorithm for Minimum Spanning Trees](#) by Khan M. et al. 2008 (PDF)
- [Energy-Optimal Distributed Algorithms for Minimum Spanning Trees](#) by Choi Y. et al. 2008 (PDF)

Ant Colony Algorithms

- Dorigo M., Stuetzle T., [Ant Colony Optimization](#), MIT Press, 2005
- Dorigo M., Di Caro G., Gambardella L.M., ["Ant Algorithms for Discrete Optimization"](#), *Artificial Life*, Vol. 5, N. 2, 1999
- Dorigo M., Di Caro G., ["The Ant Colony Optimization Meta-Heuristic"](#), in Corne D., Dorigo M., Glover F., *New Ideas in Optimization*, McGraw-Hill, 1999
- A great deal of additional information can be found in the official [Ant Colony Optimization page](#)

ACO Routing Algorithms

Details of an ant-colony algorithm (AntNET) that has been modified specifically to perform routing in telecommunications networks can be found here:

- Ducatelle F., Di Caro G., Gambardella L.M., [Using Ant Agents to Combine Reactive and Proactive Strategies for Routing in Mobile Ad Hoc Networks](#), *International Journal on Computational Intelligence and Applications (IJCIA)*, Special Issue on Nature-Inspired Approaches to Networks and Telecommunications, Vol. 5, N. 2, June 2005
- Di Caro G., Ducatelle F., Gambardella L.M., [AntHocNet: An Adaptive Nature-Inspired Algorithm for Routing in Mobile Ad Hoc Networks](#), *European Transactions on Telecommunications*, Special Issue on Self-organization in Mobile Networking, Vol. 16, N. 5, October 2005
- Di Caro G., Dorigo M., ["AntNet: Distributed Stigmergetic Control for Communications Networks"](#) (reprinted by permission from JAIR), *Vivek, A Quarterly in Artificial Intelligence*, Vol. 12(3-4), Pag. 2-37, 1999.
- Di Caro G., Dorigo M., ["AntNet: Distributed Stigmergetic Control for Communications Networks"](#), *Journal of Artificial Intelligence Research (JAIR)*, Vol. 9, Pag. 317-365, 1998.

Fungal Colonies

- R. Falconer, J. Bown, E. Hart and J. Timmis, [A New Paradigm for SpeckNETs: Inspiration from Fungal Colonies](#). in Workshop on Pervasive Adaptive Systems, second IEEE International Conference on Self-Adaptive and Self-Organizing Systems Venice, Italy, October 20-24, 2008.
- Ruth E. Falconer, James L. Bown, Nia A. White & John W. Crawford (2007). [Biomass Recycling: a key to efficient foraging](#); *Oikos*, 116 (9): 1558-1568.

Some videos:

- **Deadlock**: A simulation of two fungi competing in a 3D soil structure. Due to the limitations on the physical architecture of soil (not shown) the movement of the fungi becomes deadlocked. [Watch Video](#)
- **Poro033**: A simulation of two competing fungi on a 2D environment. [Watch Video](#)

Each case study team presented their findings on the final day and some of them still continue to work together via the [PerAda Facebook site](#)

2020 Vision: Personal Smart Spaces Team

Kevin Chalmers, Anna Kosek, Claudia Becker, M Imran Abbasi, M Mohsin Saleemi, Ahsan Ikram, Eliza Papadopoulou, Sarah McBurney

[Link to presentation](#)

Adapt or Die! Team

Angelo Di Crescenzo, Aris Valtazanos, Marios Karagiannis, Shahriar Bijani, Riaz Ul Amin

[Link to presentation](#)

Nature Knows Best? Team

Cathy Scott, Husna Osman, Ioannis Polyzos, Michael Matscheko, Petros Papadopoulos, Sarah Clayton, Despina Davoudani

[Link to presentation](#)

The Body and the Urban Space Team

Donald McMillan, Michael Knappmeyer, Sylvie Vignes, Andy Guest, Ingi Helgason

[Link to presentation](#)

Summer School Participants

PerAda Summer Schools are seen as a learning opportunity for everyone, irrespective of career position. Tutorial “seniors” are expected to participate as much as the younger researchers, providing a guiding, mentoring role, while also acknowledging that equally they can be students in unfamiliar research fields. The aim is to stimulate discussion across a range of perspectives and from different levels of expertise. The 49 summer school participants were:

Stuart Allen	Cardiff University	UK
DK Arvind	University of Edinburgh	UK
Claudia Becker	University of Lübeck	Germany
Shahriar Bijani	University of Edinburgh	UK
Stefano Cagnoni	University of Parma	Italy
Kevin Chalmers	Edinburgh Napier University	UK
Sarah Clayton	Edinburgh Napier University	UK
Ernesto Costa	University of Coimbra	Portugal
Despina Davoudani	Edinburgh Napier University	UK
Angelo Di Crescenzo	Sapienza" University of Rome	Italy
Stephen Fairclough	Liverpool John Moores University	UK
Ruth Falconer	SIMBIOS Centre, University of Abertay	UK

Alois Ferscha	Johannes Kepler Universität	Austria
Emma Hart	Edinburgh Napier University	UK
Andy Guest	University of Abertay	UK
Ingi Helgason	Edinburgh Napier University	UK
Klaus Herrmann	Universität Stuttgart	Germany
Ahsan Ikram	University of the West of England	UK
Muhammad Imran Abbasi	University Of Glasgow	UK
Achilles Kameas	Computer Technology Institute	Greece
Marios Karagiannis	University of Geneva	Switzerland
Serge Kernbach	Universität Stuttgart	Germany
Michael Knappmeyer	University of Applied Sciences Osnabrueck	Germany
Ana Kosek	Edinburgh Napier University	UK
Alberto Marchetti-Spaccamela	Universita' degli studi di Roma "LA SAPIENZA"	Italy
Michael Matscheko	Institut für Pervasive Computing	Austria
Sarah McBurney	Heriot-Watt University	UK
Donald McMillan	University Of Glasgow	UK
Eugen Meister	Universität Stuttgart	Germany
Muhammad Mohsin Saleemi	Åbo Akademi University	Finland
Husna Osman	Heriot-Watt University	UK
Ben Paechter	Edinburgh Napier University	UK
Eliza Papadopoulou	Heriot-Watt University	UK
Petros Papadopoulos	Glasgow Caledonian	UK
Giuseppe Persiano	Università di Salerno	Italy
Jeremy Pitt	Imperial College London	UK
Ioannis Polyzos	Glasgow Caledonian	Greece
Cathy Scott	Edinburgh Napier University	UK
Michael Smyth	Edinburgh Napier University	UK
Aly Syed	NXP Semiconductors	Netherlands
Nick Taylor	Heriot-Watt University	UK
Jon Timmis	University of York.	UK
Riaz Ul Amin	University of Glasgow	UK
Mihaela Ulieru	University of New Brunswick	Canada
Neil Urquhart	Edinburgh Napier University	UK
Aris Valtazanos	University of Edinburgh	UK
Sylvie Vignes	Telecom ParisTech	France
Howard Williams	Heriot-Watt University	UK
Jennifer Willies	Edinburgh Napier University	UK

PerAda Project Workshop

One day of the summer school was programmed to include demonstrations from each of the six PerAda projects funded by the European Commission under its Future and Emerging Technologies Proactive Initiative on pervasive adaptation under FP7. Project representatives presented some of the main challenges facing pervasive adaptation, including issues such as designing scalable and context-aware systems, the risks of runaway self-organisation, how to embed trust mechanisms and cooperation strategies into pervasive systems.



ALLOW - Adaptable Pervasive Flows

Developing a new programming paradigm for human-oriented pervasive applications.

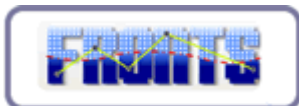
[Link to the ALLOW Project Overview](#) (PDF)



ATRACO - Adaptive and Trusted Ambient Ecologies

Contributing to the realization of trusted ambient ecologies.

[Link to the ATRACO Project Overview](#) (PDF)



FRONTS - Foundations of Adaptive Networked Societies of Tiny Artefacts

Establishing the foundations of adaptive networked societies of small heterogeneous artifacts.

[Link to the FRONTS Project Overview](#) (PDF)



REFLECT - Responsive Flexible Collaborating Ambient

Developing new concepts and means for "pervasive-adaptive systems".

[Link to the REFLECT Project Overview](#) (PDF)



SOCIALNETS - Social Networking for Pervasive Adaptation

Harnessing adaptive human social structures for tomorrow's wireless networks.

[Link to the SOCIALNETS Project Overview](#) (PDF)



SYMBRION - Symbiotic Evolutionary Robot Organisms

A platform for exploring artificial evolution and pervasive evolve-ability.

[Link to the SYMBRION Project Knowledge Gaps](#) (PDF)

General Discussion Areas

During the week, a series of discussions covered a range of topics including:

With respect to the development of adaptive systems for enabling a particular aspect of the user's life :

- How do we retain controllability in a system and still have pro-actively adaptive systems?
- Adaptation within a system may occur either: (1) transparently to the user or (2) by keeping the user aware of the adaptation processes. The challenge is to find the trade-off between minimal user distraction and allowing the user to have control over the system.
- In the event of failure within an adaptive system, how to represent the necessary details to the user in order to enable him/her make a decision?
- Another important challenge is the development of coordination mechanisms to resolve situations when multiple processes attempt to take action, at the same time, within an adaptive system.

With Human – Computer Co-evolution, instead of creating generic applications for any number of users, the adaptive system evolves to fit a single user.

- How does the system monitor the user's state to fine-tune its own adaptive response?
- How does the system revise and evolve the representation of the user and the user's preferences to make sure that they are current?

From the other end, when measuring physiology to deduce a psychological event, personal and private data are accessed by using automation – not a popular approach as people feel disenfranchised and not having control. Ethical issues that appear in such situations include:

- How much autonomy is the user willing to give up to the pervasive computer system?
- How does the user learn to 'trust' the system over sustained exposure?
- How much data will people allow the system to take, who wants the data, and who gets access to that data afterwards?

With regard to the development of intelligent environments to accommodate adaptive systems:

- How do the capabilities of the individual artefacts affect the overall performance of the adaptive system?
- How does heterogeneity, in terms of both the hardware and the role assigned to the devices, affect the system capabilities?
- How do imprecise measurements affect the performance of the adaptive system?
- A major challenge relates to the scaling of the intelligent environments and the adaptive ambient systems. In particular, how to deal with the following factors:
 - multiple users and activity spheres
 - great amounts of data and meta-data
 - uncertainty caused by dynamic context

With respect to developing self-organising systems and measuring their performance in terms of how adaptive they are:

- What metrics to define for quantifying the adaptive and emergent behaviour of self-organising systems?
- What metrics are required for validating an adaptive system, and for comparing two adaptive systems?
- Should any such adaptation metrics be domain specific or can adaptation be defined independently of the nature of the system?

Feedback

Very positive feedback was received from participants from all quarters including favourable comments from young PhD researchers such as *“The summer school ... gave me enough time to discuss my own research work and ideas with many people including senior researchers working in my own area”* and *“the PerAda Summer School has provided us a great opportunity to interact with each other and also provided valuable information about international research collaboration such as the researchers exchange program ... that, I think, is a good chance for us to visit each other”*). Several invited speakers and project mentors particularly welcomed the opportunity to “try out” ideas in an informal environment, saying that the discussion sessions addressing shared challenges and reflecting on future application areas were particularly useful to their own research.

The [Summer School pages](#) at the PerAda website provides all tutorials and presentations and also a short video of the week featuring some of the different activities undertaken by participants.

Acknowledgements

The organisers would like to thank SICSA for their support especially for the twelve PhD students from Scottish universities whose registration fees were covered by SICSA sponsorship. Gratitude is expressed to the invited speakers and tutorial leaders, many of whom travelled great distances and some of whom stayed the whole week. Additional thanks are given to DK Arvind, Nick Taylor, Michael Smyth, Ruth Falconer and Emma Hart and their colleagues for providing the case studies and mentoring the teams, as well as their respective universities, Edinburgh Napier University, The University of Edinburgh, Heriot-Watt University and The University of Abertay Dundee. We are especially grateful to Despina Davoudani and Callum Egan for local support. Finally, full acknowledgement is given to PerAda (the Pervasive Adaptation FET pro-active initiative funded by the European Commission under FP7) for providing the means for training events such as this summer school.

1 September 2009