



**Faculty of Technology and Environment**

**School of Computing and Mathematical  
Sciences**

**16<sup>th</sup> Annual Post-graduate  
Research Conference**

**Wednesday 17 & Thursday 18 march 2010  
Room 705, Byrom street**

# *Annual POSTGRADUATE RESEARCH CONFERENCE*

*Wednesday 17th March 2010*

**Opening and Welcome by Professor Madjid Merabti  
(09:15 - 09:30)**

**(Tea/Coffee from 9.00am)**

**Session Chair: Thar Baker    Session Rapporteur: Dr David Llewellyn-Jones**

TIME	NAME	YEAR	TITLE
9.30	Stephen Tang	3 <sup>rd</sup> (PT)	State of the Art in Model Driven Game Development
9.50	Brett Lempereur	2 <sup>nd</sup>	Information Flow Monitoring and Analysis for Digital Forensic Investigations

**Session Chair: Abdullahi Arabo    Session Rapporteur: Dr David Llewellyn-Jones**

10.10	Amjad Shaheed	3 <sup>rd</sup>	A framework for the Visualisation and Control of Ubiquitous Devices, Services and Digital Content
10.30	Jasim Saeed	4 <sup>th</sup>	Pre-emptive routing based on variable range MAC protocol

**Tea/Coffee Break (10.50 - 11.10)**

**Session Chair: Amjad Shaheed    Session Rapporteur: Dr Bob Askwith**

11.10	Rob Hegarty	2 <sup>nd</sup>	Forensic Analysis of Distributed Service Oriented Computing
11.30	Stewart Blakeway	2 <sup>nd</sup> (PT)	Mobile Ad-Hoc Networks with Cognitive Characteristics
11.50	Mark Evans	2 <sup>nd</sup>	Autonomic System Policy
12.10	Chunlin Song	2 <sup>nd</sup>	Analysis Different Watermark Attack and Region-Based Watermark
12.30	Mohammed Zaki (Remotely)	2 <sup>nd</sup> (PT)	Teleporting in Virtual worlds (hyperlinks implementations in virtual worlds)

**Lunch (12.50 - 13.40 - Post Room)**

**Session Chair: Haseeb Ur-Rahman    Session Rapporteur: Professor Abdennour El Rhalibi**

<b>13.40</b>	<b>Oliver Drew</b>	<b>3<sup>rd</sup></b>	<b>The Need for Extensible Policy Translation in the System-of-Systems Domain</b>
<b>14.00</b>	<b>Muhammad Zahid Khan</b>	<b>3<sup>rd</sup></b>	<b>Fault-Tolerant Management Architecture for Wireless Sensor Networks</b>
<b>14.20</b>	<b>Azizan Ismail</b>	<b>3<sup>rd</sup></b>	<b>My Memories and Shared Experiences through the Analysis of Digital Memories in P2P Networks</b>
<b>14.40</b>	<b>Abdullahi Arabo</b>	<b>2<sup>nd</sup> (PT)</b>	<b>Identity Management in Mobile ad-hoc Networks</b>
<b>15.00</b>	<b>Andrew Attwood</b>	<b>1<sup>st</sup></b>	<b>Increasing Fidelity through the Internetworking of Autonomous Ad Hoc Networks</b>

**Tea/Coffee Break (15:20 – 15:40)**

**Session Chair: Brett Lempereur**

**Session Rapporteur: Dr. Sud Sudirman**

<b>15.40</b>	<b>Sohail Abbas</b>	<b>3<sup>rd</sup></b>	<b>Deterring Whitewashing Attacks in Reputation Based Schemes for MANET</b>
<b>16.00</b>	<b>Andrew Hardy</b>	<b>1<sup>st</sup></b>	<b>Managing Residential Energy Resources through Environmental and Contextual Awareness</b>
<b>16.20</b>	<b>Simon Cooper</b>	<b>3<sup>rd</sup></b>	<b>Dynamic Interactive Storytelling for Computer Games Using AI Techniques</b>
<b>16.40</b>	<b>Chris Carter</b>	<b>2<sup>nd</sup></b>	<b>Scalability Study of Massively Multiplayer Online Games</b>

**Close 17:00**

*Thursday 18<sup>th</sup> March 2010*

(Tea/Coffee from 9.15am)

Session Chair: Sohail Abbas

Session Rapporteur: Professor Qi Shi

TIME	NAME	YEAR	TITLE
9.30	Taimur Farooq	2 <sup>nd</sup>	Preventing DoS Attacks in IEEE 802.11 Networks through Visualisation
9.50	Ruth Thompson	3 <sup>rd</sup>	A set Theory Interpretation of Stafford Beer's Cybernetic Viable Systems Model: Aspirant of Innovatively Surpassing Autonomic Computing with Viable Computing Systems

Session Chair: Simon Cooper

Session Rapporteur: Dr Qi Shi

10.10	Thar Baker	4 <sup>th</sup>	Support for Intention Oriented Autonomic Cloud-Based Applications
10.30	Michal Kennedy	1 <sup>st</sup>	Security Concerns within the System-of-Systems Domain

Tea/Coffee Break (10.50 - 11.10)

Session Chair: Christopher Dennett

Session Rapporteur: Dr Hala Mokhtar

11.10	Ahmed Ejaz	2 <sup>nd</sup>	Secure and Efficient Handover Scheme for Mobile WiMAX/ IEEE 802.16e Networks
11.30	Asim Muhammad	3 <sup>rd</sup>	A cellular approach for sensor relocation in wireless sensor networks
11.50	Adnan Sultan	2 <sup>nd</sup>	Survey of Network connectivity in Wireless Sensor Networks
12.10	Hermína Duratovic	1 <sup>st</sup>	An Overview of Trust in Service Oriented Computing
12.30	Mubasher Paracha (Remotely)	2 <sup>nd</sup> (PT)	Techniques to Sense human body

Lunch (12.50 - 13.40 - Post Room)

Session Chair: Mohammad Zahid Khan

Session Rapporteur: Dr Dave England

13.40	Arshad Haroon	3 <sup>rd</sup>	Medical Healthcare Provisioning in Networked Appliance Homes
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<b>14.00</b>	<b>Zaynab Ahmed</b>	<b>1<sup>st</sup></b>	<b>Image and Video Compression</b>
<b>14.20</b>	<b>Batoul Al Lawti</b>	<b>1<sup>st</sup></b>	<b>The effectiveness of applying game based-learning methods upon the educational environment in geography curriculum within Oman secondary classroom</b>
<b>14.40</b>	<b>Mazhar Ul Hassan</b>	<b>3<sup>rd</sup></b>	<b>A Composition Security Service for Network Appliances in Peer-To-Peer Networks</b>
<b>15.00</b>	<b>Mohamed Ahmed Al. Zawi (remotely)</b>	<b>4<sup>th</sup> (PT)</b>	<b>Self-adaptation implementation using Pipelined Recursive Neural Network</b>

**Tea/Coffee Break (15:20 - 15.40)**

**Session Chair Taimur Farooq**

**Session Rapporteur Dr Martin Hanneghan**

<b>15.40</b>	<b>Glyn Hughes</b>	<b>2<sup>nd</sup></b>	<b>Supporting Cloud Computing Management through an Object Mapping Declarative Language</b>
<b>16.00</b>	<b>Haseeb Ur Rahman</b>	<b>3<sup>rd</sup></b>	<b>A Social P2P Model for Memory for Life</b>
<b>16.20</b>	<b>Christopher Dennett</b>	<b>3<sup>rd</sup></b>	<b>Investigating Simulation in the Development of a State Propagation Framework</b>
<b>16.40</b>	<b>Naim Mohd Radi</b>	<b>4<sup>th</sup> (PT)</b>	<b>Dynamic Ridge Polynomial Neural Networks as Nonlinear Predictor for Image Compression System</b>

**Close 17:00**

# **Delivering Professional Projects: The Effectiveness of Project Management in Transformational e-Government Initiatives**

**Shauneen Furlong**  
**[SFurlong@territorialcommunications.com](mailto:SFurlong@territorialcommunications.com)**

Due to inadequate implementations of project management procedures and processes, many large information technology systems projects have failed to deliver its promises. Also, many of the failures in the implementation of large information technology systems projects around the world have been attributed to inadequate project management action. This criticism encompasses eGovernment project initiatives which have attempted ambitious program change, major innovations, large transformations, enterprise wide solutions, collaboration across organizations, governments and private sectors, and the implementation of unprecedented (or ambitious) solutions.

This research attempts to describe, critically evaluate and examine the underlying barriers and challenges in large eGovernment initiatives. It examines change in organizations due to the change in the global economy and global information society as new technology is changing the nature of work. It identifies and examines the current and foreseeing problems with large eGovernment projects and describes how a sociotechnical approach takes into account, technical, business, citizen, and economic needs in the creation of a sociotechnical information technology system for future citizens. This research examines a technology-enabled enhancement to the Project Initiation Phase, the area identified as being particularly weak and inadequate in addressing initial requirements of eGovernment initiatives.

This research demonstrates the value of effective project managers within the wider context of project management in transformational eGovernment initiatives. This research will have an impact on three important areas which are of interest to both academics and practitioners, namely project management practice, eGovernment projects and the transformation process of large projects in the public sector. This research investigates and addresses, not only the transformation process of eGovernment projects, but also, the transformation of the project management professional culture that delivers and works.

# Pre-emptive routing based on variable range MAC protocol

Muhammad Jasim Saeed

The proliferation of the Internet in the last two decades has increased the appetite for information among consumers and the need to have information on the move encouraged the use of wireless networks. Wireless networks and mobile computing research has until recently concentrated on single-hop networks (network nodes communicating directly to a fixed infrastructure), such as cellular or satellite systems. Ad hoc networking covers multi-hop scenarios (network nodes communicating via other network nodes) such as in conference, hospital, battlefield, rescue, monitoring scenarios.

A mobile ad hoc network (MANET) is a wireless network temporarily and spontaneously created by mobile stations without requiring any infrastructure or central control. Network managements and communications are typically performed in a distributed manner. Though ad hoc networks are treated with little difference in IEEE standards for wireless networks as a whole, some unique features make ad hoc networks distinct from other types of wireless networks such as wireless LANs.

The first abnormality is that its infrastructure-less, i.e. there is no centralized mechanism managing the network like a base station in case of cellular network or a hot spot as in case with wireless LAN's. Ad hoc networks are usually deployed in emergency or temporary situations such as accidents or public gatherings, where mobile stations (MSs) may join the network at will and move around, or even leave the network at any time. Global synchronization is hard to achieve in such situations and it is unrealistic to expect such a network to be fully connected, in which case a MS can communicate directly with every other nodes in the network via wireless channels.

As a consequence of the above, the following interesting questions arise: how to support routing, how to support channel access, how to deal with mobility, how to conserve power and how to use bandwidth efficiently.

In this presentation I will discuss new routing techniques based on MAC protocol with variable range controls. A variable range MAC protocol can calculate distance between nodes in a wireless network and provides an opportunity to calculate the loss of a link even before the loss has actually taken place and allow the nodes to discover and shift to a more sustainable link in an efficient manner.

# **Support for Intention Oriented Autonomic Cloud-Based Applications**

Thar Baker

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## **Abstract**

As many other computational models before it, cloud computing is now increasingly promoted as the next piece of the jigsaw required to facilitate the provision of on-demand, flexible and cost-effective delivery of networking, computational and informational service required for modern software applications. Whilst, much research is underway applying research finding emerging from BPM/BPEL, SOA, autonomic computing, grid computing, virtualisation, SOS, etc. to underpin the design, development and management of cloud-based applications. However, the author argues that much research is needed to understand the fundamental requirements of such composition systems including, for instance, how to manage the inherent runtime complexity, scalability concerns.

Based on an ongoing project focusing on design and development of the full adaptive Intention-Oriented web based applications, we see an increasing interest towards developing a dynamic and adaptive Intention-Oriented-Cloud-Based-Applications (IOCBAs) that can be used in particular towards assuring integral cloud-based-applications and allow users to amend their requirements according to the emergent needs at runtime. This allows cloud applications to avoid the negative effects of such anomalies executing compensation actions.

This presentation will highlight the author's research for the specification, design and development of a novel Cloud-Based-Applications introspective modelling and designing approach through the exploitation and utilisation of IM.

# 1. PREVENTING DOS ATTACKS IN IEEE 802.11 NETWORKS THROUGH VISUALISATION

**Tamiur Farooq**

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The MAC and Physical layers of wireless networks possess various vulnerabilities to Denial of Service (DoS) attacks. In this work we discuss DoS attacks which exploit the MAC layer of IEEE 802.11 networks. These attacks can be classified as either resource depletion attacks or masquerading attacks, and in both cases the attacker spoofs the MAC addresses of wireless devices in order to halt the operation of the wireless network. In recent years, DoS attacks in wireless networks have been getting the attention of researchers. However, short-term countermeasures provided by researchers can provide only a partial solution to identifying and isolating the source of DoS attacks. We propose a user friendly solution to such attacks by visualising the topology of the wireless network. To solve the identity vulnerabilities of the MAC layer we propose an identification method based on a node's relationship with its neighbours.

# **State of the Art in Model Driven Game Development**

**Stephen Tang**  
**O.T.Tang@ljmu.ac.uk**

This presentation reviews the state of the art researches related to model-driven game development. It provides a summary on the developments of game design languages, game software modelling languages, game model, game software model, model-driven game framework, game software framework, data interchange format, model-driven engineering tool and assistive user interfaces. It presents the existing approaches to represent computer game ontologically both from a game design and game software perspectives. It studies the characteristics of existing game design techniques and software modelling techniques for modelling computer games. It also surveys the available game model-driven frameworks for strengths and weaknesses, which will be used as guide for development of model-driven serious game framework for this study. The presentation also evaluate a range of middleware that is suitable for representing models and supports transformation of models. Finally, it discusses a collection of model-driven engineering tools and assistive user interfaces appropriate for the serious game modelling environment.

# **Security Concerns within the System-of-Systems Domain**

**Michael Kennedy**

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System-of-Systems is a relatively new area in research fields that has applications across numerous disciplines. The System-of-Systems concepts are focused on improving efficiency and providing the means to address complicated issues that are arising through the increased complexity in the information technology environment. This is being attempted through the combining of multiple systems with the goal of reducing the complexity that faces the users of these systems and providing emergent behaviours by creating systems that are formed from complex independent systems.

The current research taking place is focused on addressing the many issues surrounding these multifaceted developments with the current focus on the creation of frameworks, methods and classifications. There are many challenges within the area of System-of-Systems research and its related areas; one of the areas of interest is that of the security available within the system of systems. Due to the composition of these complex structures, in that they're created from working independent systems, they are subject to the usual security concerns and threats that affect all systems; however their increased complexity, dynamic nature, unique configuration and operation leads to additional security considerations that systems in isolation rarely have to consider.

The author will investigate these threats; the currently available security methods and solutions related to System-of-Systems and seek out a way to create a security solution that will enable the future system of systems to be secured. This presentation will present the background, the results of initial research and the aims and objectives for the project.

## **Deterring Whitewashing Attacks in Reputation Based Schemes for MANET**

**Abbas, Sohail**

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In multihop networks such as mobile ad hoc networks (MANETs), a node can misbehave by selfishly dropping others' packets to save battery life. This selfishness or misbehaviour can disrupt the whole network functionality and can severely degrade network performance. Reputation, credit and trust based models have been developed to enforce cooperation and discourage node misbehaviour. These cooperation enforcement schemes generally have the ability to detect selfish and malicious nodes with a good accuracy. They can further isolate these selfish or malicious nodes. However, these models are vulnerable to whitewashing attacks. Whitewashing occurs when a node having poor reputation/trust changes its identity to start afresh; without checks a malicious node can do this as many times as it wants. This attack can significantly affect the performance of the above mentioned models. We propose a reputation based scheme for MANETs that acts as a deterrent for whitewashing attacks. Rather than try to detect whitewashing attacks, we approach the problem in a novel way by removing the advantages that whitewashing can provide. In our proposed scheme, when a node increases its reputation to a certain level  $Y$  within time  $T$ , for a normal selfish node, it is no longer beneficial to perform a whitewash.

# **Forensic Analysis of Distributed Service Oriented Computing**

**Robert Hegarty**  
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The way in which computer resources are accessed is changing. We no longer rely on standalone machines to store and process our data. Many computer users make use of Web mail, You Tube, Picassa and other online data storage services all of which fall under the umbrella of Cloud Computing a type of Distributed Service Orientated Computing. The ability to access and share data from any computer is a compelling reason to use these services from a user perspective. From a business perspective the ability to dynamically scale resources is attractive as it provides cost savings and the ability to scale on demand. Unfortunately criminals make use of these platforms to store data relating to malicious activities. This trend poses new challenges to existing Digital Forensics techniques.

This emerging model of computer use poses challenges to existing digital forensics techniques. Our goal is to identify and overcome these challenges. We have developed a solution to overcome the first challenge of creating signatures from a large distributed and fragmented data set. Current techniques rely on imaging the hard drive then creating hash values for each file. This is infeasible as the entire platform cannot be imaged and the resulting signatures would introduce a large storage overhead if created pre-emptively.

We have developed a signature creation technique which can pre-emptively create and store small robust signatures. Initial results indicate that we can efficiently utilise 32 Bit signatures and a two round search technique to determine the presence of target files without introducing a large storage overhead and provide a significantly shorter search time than existing post hoc analysis techniques.

Using the data from initial experiments to advise our ongoing research we will develop techniques for; disseminating signature sets, signature detection, collecting results and controlling the analysis process. By overcoming these challenges we will enable the forensic analysis of Distributed Service Orientated Computing platforms.

# **A Readiness Study: E-Government Information Systems Migration to Cloud Computing**

**Rabea Kurdi**

**[R.Kurdi@2009.ljmu.ac.uk](mailto:R.Kurdi@2009.ljmu.ac.uk)**

As a new wave in the IT revolution, e-government presents a tremendous impetus to move forward in the 21st century with higher quality, and cost-effective government services as well as providing a better relationship between citizens and government. Most governments in the developed countries specifically recognize the importance of e-government in creating and encouraging an atmosphere for the wide adoption and success of e-government. The benefit of e-government services over traditional government services can be summarised by increased speed and efficiency, lower progressing costs, 24/7 services, quick adjustment to government services situations and the ability to deal with citizens directly instead of through intermediaries. E-government systems and readiness assessment frameworks are varied in terms of objectives, methodologies and results, and these imply that no assessment framework is likely to cover all e-government concerns.

The main aim of this research is to develop a comprehensive framework and associated guidelines and tools to support E-Government Information Systems (EGIS) readiness analysis, with a specific focus on the EGIS migration to Cloud Computing provisioning model. To this end the proposed framework aims to provide a modelling and analysis method to guide the assessment of EGIS systems migration readiness including assessing the degree of maturity of their e-government systems. The proposed framework will cover four dimensions divided into four categories: 1- Technological Dimension such as ICT infrastructure: (hardware, software), Network infrastructure, security infrastructure to exchange data and IS infrastructure: (information quality, system quality, and services quality). 2- Organisational Dimension such as organisation: (organisation Structure, organisation Culture, organisation size, organisation strategy and vision) Strategy and Planning (Leadership Support, IS Strategy, Funding/ Budget, BPR, Legislations, Data Sharing) Human resources (training and development, staff motivation). 3- People/ Stakeholders Dimension (Citizens, Business, and government). 4- Environment and Society Dimension (demographics characteristics, country profile, social/cultural, political, and economic).

# **The Need for Extensible Policy Translation in the System-of-Systems Domain**

**Oliver Drew**  
**O.J.Drew@2007.ljmu.ac.uk**

The Systems-of-Systems domain has been an actively researched area of computer systems for the past decade. In recent years the focus of this research has shifted from how to architect these systems to how to secure them.

Our work focuses on one specific area of security – policy. Systems-of-Systems are unique in that they are a composition of many individual, diverse systems. Each of these systems potentially uses their own sets of policies, written in one of a multitude of policy specification languages. In order to provide security using policy across a system-of-systems, there first has to be consistency across all the systems. This means that the differing sets of policies must be reconciled. This task is difficult enough, and many people across the world are researching the area of policy reconciliation. However, before policies can be reconciled, the policies themselves must be represented in the same semantic and syntactic structure – i.e. they must be written in the same language.

Therefore there is a need for a policy translation system that can provide scope for translation of any language into a common, fixed language. In this presentation we will explore in detail previous works in the field of policy translation, and look at our solution to the provision of extensible policy translation for systems-of-systems.

# **Title: Dynamic Ridge Polynomial Neural Networks as Nonlinear Predictor for Image Compression System**

**Naeem Radi**  
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In this research project Dynamic Ridge Polynomial Neural Networks (DRPNN) are used as part of novel image compression system as Nonlinear Predictor. The results of the prediction accuracy measures (mse and PSNR) obtained from using the DRPNN on a database of 10 standard test gray level images are compared with the two sets of results obtained from using the MatLab lpc linear predictor and the MatLab newff back propagation neural network on the same set of test images. The results clearly indicate that the DRPNN outperformed both linear predictors and back propagation neural network architectures.

# **FAULT-TOLERANT MANAGEMENT ARCHITECTURE FOR WIRELESS SENSOR NETWORKS**

**Muhammad Zahid Khan**  
**M.Zahid-khan@2008.Ijmu.ac.uk**

Recently, wireless sensor networks have gained a tremendous focus within the Computer Science research community due to their potential applications both in a civil and military domain such as medical health care, habitat monitoring, and battlefield surveillance. With the increase of sensor applications, a number of challenging problems related to sensor network management have emerged – the most important ones relating to energy-efficient network self-organization and fault-tolerance. Unlike traditional networks, wireless sensor networks pose unique challenges for network management, because in wireless sensor networks the primary goals are to minimize energy use and fault-tolerance, and the main reason for doing this is to minimize communication between nodes and detect and recover from faults. Wireless sensor networks are prone to failure due to energy depletion, hardware malfunctioning, communication link errors, malicious attacks, etc. Thus, it is important that the management system must have a fault management platform which provides the capability to tolerate such faults and maintains a network to its running state. Thus, energy-efficient network management and fault-tolerance have been identified as one of the key challenges in the design and operations of wireless sensor networks.

To address the above mentioned challenges, we propose a Zone Based Fault-Tolerant Management Architecture (ZFTMA) for wireless sensor networks. The proposed architecture is composed of two novel contributions: an energy-efficient network self-organization scheme and a fault management architecture that offers efficient fault detection and recovery mechanisms for wireless sensor networks. Our new network organization scheme self-organizes all sensor nodes into multiple clusters to construct a fully connected wireless sensor network. The network self-organization process takes place adaptively and autonomously, avoiding excessive communication with a central management unit, hence saving energy and communication bandwidth. For fault management, we proposed a new fault detection and fault recovery scheme. In this scheme, we concentrate on nodes' permanent and potential fault detection. In our scheme, cluster head nodes are the entities that are responsible for sensor node fault detection in their local cluster, whereas zone managers are responsible for cluster head node fault detection and recovery.

The proposed architecture has been theoretically analyzed and compared with the existing schemes (such as LEACH and HEED) to determine its novelty and usefulness. Analysis and discussion reveal that our proposed ZFTMA architecture self-organizes the network with minimum resource utilization and distributes management tasks through a hierarchy of nodes provides, fault-tolerance, scalability, reliable data dissemination, hence maximize a network lifetime. The performance of our architecture will be further evaluated through modeling and simulation using the GTSNetS simulator. The evaluation will be based on the most important metrics in wireless sensor network, such as: energy consumption, network lifetime, fault management accuracy and response time, network throughput, and scalability. In future, we will investigate the possibility of adapting the proposed architecture to wireless sensor networks that involve sensor nodes' mobility and require more autonomic fault management (self-management and self-healing etc), from sensor nodes.

# **Self-adaptation implementation using Pipelined Recursive Neural Network**

**Mohamed R. Ahmed Mousa Al – zawi**  
**M.R.Ahmed-Al-Zawi@2005.ljmu.ac.uk**

One of the main characteristics of Autonomic Computing (AC) is self – healing, and the main challenge is how to implement monitoring and adaptation in real time while the system is running. The running system is tuned and adapted automatically based on the current changes of the system's behavior. A novel technique is implemented using pipelined recursive neural network (PRNN) with a modification of the original algorithm in order to overcome the self-healing challenging aspects of monitoring, interpretation, resolution, and adaptation. This method enables us to deal with several independent signals and on-fly learning is reached to meet self – healing problem requirements of continues learning rather than supervised learning. Several scenarios of non-stop systems are introduced to test the effectiveness of the new method.

# A COMPOSITION SECURITY SERVICE FOR NETWORK APPLIANCES IN PEER-TO-PEER NETWORKS

Mazhar UI Hassan

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Security is a basic need for all networks as they are under constant threat from attack. The term peer-to-peer (P2P) refers to the concept that in a network of equals (peers) using appropriate information and communication systems, two or more individuals are able to spontaneously collaborate without necessarily needing central coordination. A growing area of application for peer-to-peer networks is that of networked appliances, whereby common household appliances are connected together to form a network in order to improve their capabilities. Peer-to-peer networked appliance systems have become one of the most widely discussed terms in information technology in recent years. For peer-to-peer networked appliance systems to be widely accepted and adopted, they must be secure. Unfortunately, securing applications in a P2P networked appliance environment is much more challenging than the already hard problem of securing client-server or traditional distributed applications. This follows from the openness and autonomous nature of a P2P networked appliance. For P2P networked appliance systems, we need a suitable solution to ensure the correct configuration of devices and provide protection from anonymous attacks. In order to minimize the threats, we propose a security service for use in such P2P networks. This approach uses a service that has been designed primarily to allow testing of secure component composition analysis techniques, and which we are able to apply to a P2P networked appliance framework.

In this talk I will present a solution that we have designed for a P2P network. Suppose any peer tries to access our P2P network then it will be allowed or denied by our proposed design. The acceptance or rejection of an incoming peer entirely depends upon whether the relationship of the peer with other peers is not a threat to our network and is secure. This security check of the incoming peer is undertaken by our designed system that includes a scanner, analyser and a DMP (Decision Making Peer).

# Autonomic System Policy

Mark Evans

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Systems are usually designed to deal with problems. Traditionally, the reductionist approach to problem resolution decrees that problems must be broken down into their constituent components. This notion is often presented on the basis that each part of the problem is more manageable when it has been granularised in this way. Often, even in apparently simple systems, there are many sub-systems at work behind the scenes. The consumer of the output of a particular system just experiences the net result of what the system accepts as input, processes and outputs and with no direct reference to the sub-systems involved.

The sub-systems are designed to interact with each other to accomplish a common goal i.e. the purpose of the system whose output is consumed by an end user of it. The mode of interaction between sub-systems is usually fixed at design time and this essentially freezes the usefulness of the system i.e. it renders it incapable of adaptation to varying load conditions. In this respect, if components have other capabilities other than those that are connected together to form a wider system for a particular purpose, yet these could be used in other fields of endeavour, then by freezing the mode(s) of interaction between them, the system is considered to be disadvantaged because it can never become the whole that it could possibly become.

In terms of systems engineering, the holistic approach is advocated. In this respect, the whole potential that a sub-system, at the finest level of systemic granularity that such an entity can exist at without losing the essence of its functionality, can bring to bear within a problem situation, can be freely admitted to the problem domain as required. The contribution that each such sub-system can make is not constrained in accordance with a supposedly grand plan under the determination and guidance of a central controller of some description. Each sub-system is aware of the other systems attempting to solve the same problem and of the capabilities that each one possesses. The free exchange of such capabilities, coupled with little (if anything) in the way of latency within communications channels betwixt the sub-systems involved, and the appropriate level of response issued by each of them within a problem domain, could equate to a solution that is far better than would otherwise be the case. The emergent properties of the system, as defined by the revised mode of operation of the sub-systems that directly underpin it, could become optimised.

Within the field of autonomic computing, the atomically granularised functionality of the sub-systems alluded to above is usually encapsulated in the capabilities of a software agent. The interaction of all agents within a particular application causes the net result of processing by each of them to become manifest as output of the whole wider system that they each belong to. This is usually a fixed outcome, but if the interactions were essentially left up to the choice of the agents themselves, with the only central aspect to the arrangement being that which encodes and communicates the problem at hand to the agents, then there is potential for the emergent properties of the arrangement to become optimal.

The proposed vehicle for this is that not only could each sub-system 'know' by virtue of its design what it can actually do, it could also know what others in its operational domain can do. Moreover, each agent could also know how the collective of them that are currently targeting a particular problem is doing with respect to the stated goal for the group. Each agent could possibly 'observe' this and act accordingly. The designed response of each agent may not be that necessarily created and produced by it directly, but it may result in the agent being able to issue a request for help for something that another agent possesses (e.g. a particular function or capability). In this respect, it is by continual exchange of each agent's capabilities, via dynamic reconfiguration of the communications network between them, which is contended to be a direct determinant in the optimised emergent properties of the network of sub-systems i.e. the system in focus. The goal of the system could be communicated to each agent via a suitable broadcast from a system controller (or goal-setter) and each agent may receive and interpret this in the context of its own capabilities. The population of agents could then be left to swarm around the problem at hand by continually reconfiguring how they interact and exchange problem/solution data to reach an optimal solution. Each agent could measure its contribution to the overall system goal by reference to both its own contribution and that of the group's contribution to it, continually and in real time until the problem at hand is resolved.

The goal of current research is an attempt to identify how the autonomic agents within systems essentially form a policy through such continual interaction in real time. This being to the extent that optimality within that policy results for the system at all times and, as a direct result of this, that the goal that the system is currently focused upon is rapidly expedited on a consistent basis whilst avoiding any cascading failure within the system.

## **Teleporting in Virtual worlds (hyperlinks implementations in virtual worlds)**

**Muhammad Zaki**

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This presentation discusses the various techniques of implementing hypergrid modes in virtual worlds. These techniques remove the constraints that are applied in the default model of the Opensim when a user teleports. Removing the strong constraints make the teleporting process similar to hyperlinks in normal web pages. Different kind of constraints will be discussed regarding map control known as grid server service other constraints with relation to user database services will be also discussed. The presentation will highlight the possibilities of minimizing the information that needs to be distributed about the teleported users to achieve a fast and seamless process as compared with web applications contexts.

# **AN EXPERIMENTAL INVESTIGATION INTO AN AMORPHIC WAYFINDING FRAMEWORK AND HUMAN-COMPUTER INTERFACE FOR VISUALLY IMPAIRED PEOPLE**

Hulya Francis

## **ABSTRACT**

Navigating urban streets without sight is fraught with difficulty and is often can be dangerous. Visually challenged people rely on ancillary equipment such as a white cane to probe the immediate area in front of them as well as developing other pre-existing personal physiological senses such as tactile, auditory, and olfactory senses, to train themselves to walk along pavements. There has been an escalation of orientation and wayfinding technologies and systems for visually impaired people. These technological advancements, however, have not been matched by a suitable investigation of human-computer interaction (e.g. designing a human-computer interface for people who form different cognitive maps for navigation) on the one hand and, on the other different requirements for signals that describe the spatial context. The first aim of this study is to investigate whether an augmented framework can take into account different visually impaired person's requirements for spatial signals that subsequently form different cognitive maps describing their perception of the spatial context. The second aim of the study is to identify a human-computer interface that can adapt to the needs of individuals with different user requirements based on their visual impairment and deliver suitable information for wayfinding that is tailored to specific user requirements. The objective assessment in this study is to design an experimental amorphic framework and human-computer interface that relies on agent-based software that demonstrates and takes into account different user requirements and provides wayfinding instructions appropriate to different visual impairment. Tests measure the effectiveness of the framework and human-computer interface for a group of people with a range of visually impairment to reach landmarks in an unfamiliar case study area.

# **AN OVERVIEW OF TRUST IN SERVICE ORIENTED COMPUTING**

**Hermina Duratovic**  
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Trust is a vast and subjective field that has been researched in areas such as e-commerce, web services and peer to peer networks. Each of these fields, and more, have the same core requirements of trust. That is, its representation, exchange, establishment, enforcement and storage. Furthermore, trust solutions in each of the areas have been creative and abstract, each yielding positive and negative results. From the research conducted, we have found that trust solutions belong to two main categories. These are experience/reputation based and hybrids. Experience based systems rely heavily on central servers and agents providing usage information of other agents. With these there are many limitations including Sybil attacks, poor ratings for new users and restrictions on the openness of the systems that use them. Hybrid trust solutions attempt to remove the negatives of experience based solutions by crossing areas or focusing on using new technologies. Solutions in these categories have included the encoding of trust in web service languages, producing ontologies based on trust and predictive analytics of trust information. All these solutions have managed to reduce the restrictions in reputation trust; however they have limitations of their own. Many of the solutions are resource heavy and still rely on variations of reputation systems.

The presentation will define what it is to trust in terms of service oriented computing. Furthermore it will critically analyse work conducted across different areas and conclude with research questions that we wish to address in the future.

**A Social P2P Model for Memory for Life**  
**Haseeb Ur Rahman**  
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The growth of social networking sites indicates that people have a natural desire to capture events from their lives, store them for the future and choose to share their memories with other people. The data captured by people via their cameras, mobile phones, sensors etc. has grown to a huge amount in recent years. Although this data is invariably kept stored on the user's hard drive, it will often be left unattended, lacking proper management or annotation. Although the content may remain available over long periods of time, people are liable to forget the details of the situation the data was recorded in. The Memory for Life challenge is an effort to properly store, organize and annotate a user's data and generate meaningful information about a person's life.

To share data from Memory for Life systems, the challenges which need to be overcome are: data privacy, user's control of data and getting proper data from appropriate people. To share these events, peer-to-peer networks provide an ideal technology that allows users to share their files independent of their size or format. However, sharing of data should only take place when chosen by the user, and must remain under a user's control. Therefore, we propose a social peer-to-peer network that will consider the social relationships to allow them to share their life memory data under their control while maintaining their privacy not only from unknown people but also from undesired known people.

We use a novel community-based approach to organize peers in our model, allowing users to control who they make connections with. The structure of the communities is designed from different approaches to social interaction, which allows users to organize themselves as they do in real life. A local reputation system is used to categorize the data and the connections/relationships of a user in terms of the levels of privacy and trust, respectively. The categorization of the data and the relationships keeps the privacy of a user by allowing or denying access to the personal information and ensures that data is kept under the sharer's control. We are now working on a searching technique, which is able to find the correct data from the appropriate people, and the implementation of our proposed design.

# Medical Healthcare Provisioning in Networked Appliance Homes

Arshad Haroon

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Advances in technology and the increased use of home medical devices, such as blood glucose meters, blood pressure monitors and heart monitors, will revolutionise the way public healthcare is administered. Homes and their associated networks in conjunction with such devices will take over many mundane healthcare tasks and manage new and enriched lifestyle choices that are at present dramatically affecting our overall quality of life. Through the combination of wireless and fixed networking infrastructures explicit links will form between the home and its devices and external entities such as gymnasiums, hospitals and general practitioner surgeries. Through these interconnected networks new real-time healthcare management system will emerge that continually provide information and react to adverse or unusual medical conditions received from occupants within the home. Each home user will be empowered to influence all aspects of their health where healthcare practitioners are continually informed and only used for more specialised treatments. Here we can see obvious benefits such a system would afford. For example, we can now make decisions about the actions we are considering too try and influence the effects this may have on our long-term health. Whether this is through real-time monitoring or trend analysis we will gain a better understanding of health and lifestyle choices which at present is not possible. Movement towards this vision is already evident. For example, pacemaker technology is well understood and a natural progression would be to make such devices wireless, allowing easy connectivity to home, hospital and healthcare practitioner networks. This will undoubtedly lead to the development of a multitude of other similar devices designed to carry out some medical function to proactively monitor and act upon adverse factors that may threaten the health of a person. Healthcare practitioners will have direct access to these devices where they could be controlled or queried allowing data to be stored, accessed, and used in assessments. Given this use of networked devices home users could even pose questions about their health to potentially millions of networked sensors either insider or outside the body, with each sensor providing information about a particular aspect of a person's health. Although much work has been done in the home networking and medical device domains separately, there is much to be gained from a convergence of these disciplines to harness the power afforded by networked devices, sensors, wireless technologies and global communication. Doing this will undoubtedly make it easier to monitor, interact and control all aspects of a person's health through the obvious benefits networking home medical devices will bring. We present a new approach using a working prototype to implement networked medical devices within the home capable of monitoring data received from an individual, which could then be accessed by occupants of the home, hospitals, or general practitioner surgeries.

This report provides a detailed overview of our work to date. It provides an overview of the successes we have had and discusses the concerns that have been raised. The report describes how we have developed a firm foundation for our future research and illustrates that there is a great deal of work to be done. More specifically, we describe how our system is still in the design phase and highlight that a number of fundamental requirements still need to be addressed. We need to research and design effective binding and messaging systems within the system to enable us effective service composition. We also need to further research how we can effectively distribute our system. Furthermore a great deal of research is still required to understand how we can dynamically compose services based on service capabilities and resolve conflicts between service using intermediary services and extended interfaces.

## **Increasing Fidelity through the Internetworking of Autonomous Ad Hoc Networks**

**Andrew Attwood**  
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Advances in wireless sensor technology in terms of size, power efficiency and processing ability have driven their use in a range of application areas. From monitoring climate change to identifying an individual's blood pressure, the impact that this technology is having on our lives is great and will only increase in importance over time. The advance in smart object technology will lead to the connectivity of most objects that we interact with in the course of our daily lives. This will increase further the number and range of devices that can take part in data collection and thus increase an individual autonomous MANETs fidelity. Specific research is being conducted into new application areas such as Vehicular Ad Hoc networks this will further extend the "internet of things" and provide us with the connectivity we need to solve a number of long standing problems e.g. collision prevention. The use of technologies such as 6lowPAN will see the connection of these autonomous mesh networks to create large global sensor meshes.

It is likely that the interconnectivity of these autonomous network regions will give higher fidelity and thus enable systems to make better decisions.

For example in the case of a dangerous driving condition occurring, such as the onset of a crash. We can see how a driver's Body Area Network could establish a relationship with the car they are driving. The autonomous BAN of the driver would consist of a range of technologies e.g. heart Monitor. The car would be made up of a number of sensing and responsive components e.g. engine management. Binding the two systems for the duration of the journey would provide valuable information to the car. Enabling the detection of any adverse change in a driver's physiological state and utilising Vehicular Ad Hoc Networks to mitigate the effects associated with road traffic accidents.

The use of interconnected autonomous networks raises a number of research challenges. How do individual autonomous networks converge to provide a single view of security and services to other autonomous systems? How can this be achieved in highly Ad Hoc Environment in real time?

# Survey of Network connectivity in Wireless Sensor Networks

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*Abstract-*Wireless sensor nodes are resource constrained and mostly operate in unsafe environments. Mobility, communication blockage and frequent failure of wireless sensor nodes cause network topology to become very dynamic which affects network connectivity. Lack of topological connectivity between nodes may lead the entire network to break apart into disconnected pieces. The disconnected sub-networks may be unable to communicate with the sink, hence cannot send its data to base station. Many researchers have devoted their efforts to develop network communication schemes that have proven better network connectivity, communication performance and prolonged network lifetime. In this survey paper we develop basic understanding of Wireless Sensor Networks connectivity and provide an overview of the current network connectivity schemes and analyse existing connectivity problems. We also provide possible research directions for future work.

# **A CONTROL SYSTEM FOR ENVIRONMENTAL MODELLING IN SELF-ADAPTIVE SYSTEMS**

**Henry Forsyth**  
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The advancing complexity of software systems and their increasing interaction with their external environment is set to increase dramatically in the near future.

The requirement for adaptive software is made more urgent by the fact that software development is becoming more complex and unpredictable. External pressures such as increasing competition and more sophisticated requirements has meant that traditional software development techniques are likely to find it increasingly difficult to satisfy the requirement for quality software. Future software development will increasingly require software to adapt with its operating environment in order to operate robustly and dependably.

In order for adaptive software to be successfully developed it will be vital to be able to model the external environment in which the software operates. Therefore, this research presents a novel approach utilising cybernetic principles, learning classifier systems and genetic algorithms, which will enable a rule-set to assist in managing these complex environments in order to allow more robust dependable systems to be developed. The main novel contribution of this research is that it provides an evaluation of an approach by which software can monitor their environment and more effectively adapt to changes in their environment. Detailed novel contributions include an environment model approach to improving system robustness, the use of genetic algorithms and learning classifier systems in order to provide the learning element required of adaptive software systems and the concept of an environment control centre (ECC) to manage the various elements required to achieve effective environmental monitoring.

This research is evaluated utilising a virtual world platform called "Second Life". This platform was used for experimental design and testing of results.

## **Supporting Cloud Computing Management through an Object Mapping Declarative Language**

**Glyn Hughes**  
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Due to the inevitable scale of Cloud Computing systems, management of the numerous physical and virtual components may become unwieldy. This presentation examines these emerging problems and then describes the structure and operation of an object mapping declarative language, which is currently under development to support the management of these numerous components.

## **Developing a methodological geographic information system framework to augment identification of anomalous dwelling fires**

**Emma Higgins**  
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There is a need for enhanced methods of anomalous fire identification to employ proactive initiatives to reduce risk of fire occurring. Current methods of anomalous dwelling fire identification assume that fire occurrence is a systematic process linked with levels of deprivation. However, it has been realised that often this is not the case, and often, anomalous dwelling fires occur in out of context and unexplained locations. Recent studies indicated common causes of a anomalous dwelling fires, but there was a gap between identifying these causal factors and modelling them statistically with a Geographical Information System (GIS) framework.

To achieve this, a framework will be developed incorporating soft systems thinking and chaordic systems thinking, which will aid analysis of complex situations and environments that border on the edge of chaos. Unified Modelling Language (UML) will also be incorporated as the technique to represent visually the modelling framework. Combining these approaches will create an innovative and unique method of representing anomalous dwelling fire risk.

The methodological framework will be developed and tested in a UK Fire and Rescue Service, where current fire identification tools and procedures employed do not predict the occurrence of fire based on lifestyle factors. The framework will present the user with a series of procedures, buttons and tools to create both visual and textual representations of risk. The framework will be extensively tested using the MapInfo GIS platform, which will be tailored to suit the development needs of a risk identification framework.

# Analysis Different Watermark Attack and Region-Based Watermark

**Chunlin Song**

**[C.L.Song@2004.ljmu.ac.uk](mailto:C.L.Song@2004.ljmu.ac.uk)**

Digital watermarking is a subset of information hiding technologies which is drawing the attention as a new method of protecting copyrights for digital images. The information to be embedded is called a digital watermark, although in some contexts the phrase digital watermark means the difference between the watermarked signal and the cover signal. The signal where the watermark is to be embedded is called the host signal. A watermarking system is usually divided into three distinct steps, embedding, attack and detection.

However, there are some problems in digital image watermarking system. The major problem of watermarking system is not robustness enough. At the moment, watermark attacks are easily to removing or destroying any watermark signals in the host data. Removal attacks, geometry attacks, cryptographic attacks and protocol attacks are main categories of watermark attacks. Both pixel domain and transform domain watermarking techniques share the same level of exposure to these attacks.

There are also some the other problems during digital watermarking system. The first is embedding effectiveness, it stands for the output of embedder will be watermarked or not. The second problem is fidelity, in also called transparency or invisible, a watermarking system is of no use if it distorts the cover image to the point of being useless, or even highly distracting. Ideally the watermarked imaged should look indistinguishable from the original even on the highest quality equipment. Another problem is capacity, many of the proposed watermarking techniques aim at hiding data with large size. These techniques manage to hide image as large as, or even larger than, the cover image. At the meanwhile, there is a trade-off between robustness, fidelity and capacity, the ideal algorithm need to balance these 3 elements for building watermarking system.

According to the challenges above, analysis different kind of attacks is the foundation method to build digital watermarking system. There are 17 different attacks will be analysed, each of the attack suffers from Fourier spectrum and histogram to analysis. The results tell us different kind of attacks have the different properties.

Region based watermark is one of the possible solutions. Unlike the other algorithms which insert watermark into whole cover image, region based watermark could embed watermark into segmented-region of cover image. This could effectively improve the robustness of watermark system because of the selected region could has its own properties such as full of high frequency area.

**Investigating Simulation in the Development of a State  
Propagation Framework**  
**Christopher Dennett**  
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In this presentation, we focus on the simulation element of a hybrid client-server and peer-to-peer MMOG framework currently in development, created in Java and utilising the NS-3 network simulator through a native interface, discussing the work which has been done so far, future work, and the challenges which we have faced during the development. Our simulation environment allows the user to write a Java network application which is similar to an application using the standard Java API using similar socket, address, and NIO classes. During the simulator setup, the user can set up the topology which can include Point-To-Point and Hub links, the participating nodes, and also assign their applications to these nodes.

The MMOG framework under development is intended eventually for use in the development of networked multiplayer games and will aid in respecting bandwidth, fairness and security requirements while reducing the complexity of programming, facilitating hierarchical state propagation and synchronisation in large-scale systems in the context of real-time MMOG games, and allowing the developer to debug complex network interactions with in-game visualisation.

In this regard, we have developed additional classes which extend the raw application classes and provide additional functionality, providing the user with the functionality they need to write MMOG games. This includes node discovery, client-server enablement, connection management and entity synchronisation facilitated using JavaBeans alongside event management, which are based on abstract ideas from the Unreal Engine.

The novelty of this particular research lies in the interaction between the simulator and the applications in order to provide quality-of-service information by demonstrating the interactivity levels of nodes and how much their state variables are out of sync, and allow adjustments to bandwidth, latency, and throughput on individual connections as the distributed state progresses.

The overall MMOG framework has a state prediction aspect to avoid unnecessary transmission, extrapolating the states of other nodes between sent states or events. Future predictions for variables of particular types are calculated using different methods in prediction classes, perhaps using linear and cubic spline extrapolation. Using this, nodes predict when connected nodes might have excessive deviation and require an update to be sent to correct them, with different results if the unanticipated actions affect the future state or a past state (which in turn may affect the future state). This system works between servers and between servers and clients with a variable visibility system that defines how often variables are transmitted between different tiers.

# **Scalability Study of Massively Multiplayer Online Games**

**Chris Carter**

**C.J.Carter@2007.ljmu.ac.uk**

The mainstream technologies of choice for web-based online gaming applications are Adobe's Flash or Sun's Java Applet Framework. Games which are built on top of these are often casual, two-dimensional games and do not utilise the specialist graphics hardware which has proliferated across modern PCs and Consoles. Multi-user online game-play within these titles is often either non-existent or extremely limited. Games applications which grace the current generation of consoles and personal computers are designed to utilise the increasingly impressive hardware power at their disposal.

However, these are commonly distributed using a physical medium or deployed through custom, proprietary networking mechanisms and rely upon platform-specific networking APIs to facilitate multi-user online game play, traditionally using the inflexible Client-Server architecture. The candidate's previous work as part of the LJMU/BBC Collaboration project known as Homura, has seen the proposal and prototype development of two systems mixing AMP (Apache, MySQL, PHP) web technologies with Java Web Start application deployment and JXTA Peer-to-Peer (P2P) technologies in order to provide a platform-independent library capable of deploying hardware-accelerated cross-platform, cross-browser, online-enabled Java games, resulting in the Homura and Net Homura application frameworks.

The PhD research aims to considerably expand upon these frameworks, with a focus towards developing a unified deployment and networking system which combines Java Enterprise Edition (EE) 5/6 application technologies with low-level networking support to provide a unified platform for the deployment and execution of both P2P and Client-Server based games, which can be analysed within a real-world context. The research will build upon the most recent investigations into algorithms and techniques that are central for the production of scalable, massively multiplayer online game applications capable of consistent, responsive game play in low-bandwidth environments and determine how these methods can be applied and tested within the context of the Net Homura framework. The system produced will serve as an open test-bed for the future development and analysis of algorithms within the field, with the objective of providing a platform for rapid prototyping and comparison with existing methods.

## **Managing Residential Energy Resources through Environmental and Contextual Awareness**

**Andrew Hardy**

**A.Hardy@2009.ljmu.ac.uk**

Concerns about climate change, dwindling legacy energy sources and the slow inception of new sources has lead to urgent energy management focus from utilities and conservation interest by consumers is now common place. Consequent legislation and purchaser demands have made this issue a very significant component in all product design and been a significant factor in the design of industry standards. Many household appliances publish an energy efficiency rating, Consumer Electronics must meet ever strengthening standby power regulations, computer devices support common standards for power management and slowly new initiatives such as demand response arrangements with utilities, smart meters, and real-time intelligent energy monitoring are coming on line. Existing technologies and current research are focused mainly on two approaches. First is appliance efficiency through power efficient components or through preset operational constraints. Second is the effort to change consumer behaviour. Our aim is to research sensing and communication technologies and to investigate how these technologies could be introduced into homes for the purpose of controlling energy consumption through environmental and contextual awareness. We believe that environmentally and contextually responsive appliances will enable consumers and utilities to achieve significant savings. Additionally these technologies will allow consumers and utilities monitoring and control at greater granularity allowing users to make better informed decisions and utilities to anticipate and manage demand with greater intelligence.

## **Abstract for the Annual Research Conference 2010**

**Researcher: Stewart J Blakeway**

### **Abstract**

Communication networks are increasingly becoming an integral part of our lives. Conventional network architecture and infrastructure previously provided a communications service for applications to facilitate email, file transfer and remote login. Much heavier demands are now being placed on the communications infrastructure currently in place. The communications infrastructures are being pushed to their limits in order to provide for applications that are data centric focused, such as: video, audio and gaming. This indicates more and more services are demanding high data link speeds, however, the growth of internet mobile wireless devices has complicated the traditional solution of upgrading or replacing existing wired medium for fibre optic or other high speed medium. Wireless devices have contributed to the need to think past conventional network solutions and move towards a network that can adapt in order to meet the needs of the application.

Joseph Mitola pioneered the concept of cognitive networks. Mitola describes a cognitive network as a network that is able to sense the external environment, learn from previous history and, when appropriate, adjust parameters to influence the operation of the network. Although there has been some research into cognitive networks, there has been little research in respect to incorporating the cognitive features of this network into a mobile ad-hoc network (MANET) environment. A MANET can be defined as a network of self-configuring nodes that are mobile, the nodes can join or leave the network at any given time without prior notice and the nodes usually transmit wirelessly. The MANET environment is one in which there is not a predefined infrastructure and each node on the network facilitates the operation of the network by effectively taking on the role of a router in order to facilitate the communication of data from source to destination. Both cognitive network research and MANET research are closely related in that most of the research is based on the fact that wireless devices are being used. The focus of this research is that of a MANET being able to incorporate cognitive behaviour, thus, being able to adjust parameters depending on the external environment in order to improve the performance of the network in terms of end-to-end delay. This research attempts to: present the research area cognitive networks before briefly discussing MANETs, then moving to a discussion that details the motivation for this research. Related research will be highlighted and an identification of the novel aspect of this research will be detailed. This research will also discuss the findings so far before concluding with a projected future direction for this research.

# **Information Flow Monitoring and Analysis for Digital Forensic Investigations**

**Brett Lempereur**  
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In complicated, multi-stage, network attacks and information security breaches it is likely that multiple machines will be implicated, and thus require forensic analysis by a trained investigator. With the increasing scale of digital forensic investigations, there is a need for approaches that are capable of reducing the quantities of data forensic examiners are required to search. Current digital forensic techniques focus primarily on the identification and capture of stored information, with standard practices dictating that interaction with a running system should, where possible, be avoided. Our research has, however, identified three classes of digital forensic evidence: stored information, information pending storage, and operational information; only the first of which is available to traditional off-line analysis.

Operational information is the data required to support the operation of a computer system, such as process tables and network connections, which will be lost when the system is powered down, unless explicit auditing is configured. It can provide invaluable information in digital forensic investigations, reducing the scope of the search on storage media to only those files which are implicated by records of operational information. Our model of information flow consists of a stream of operations (create, read, write, and destroy) applied to pairs of channels, which represent operating system primitives such as network sockets, pipes, files, and processes. By combining the event streams generated by a network of computers, we have been able to construct a graph-based model that allows us to visualise the flow of information throughout the monitored domain. In the case of information security breaches, this allows us to map the possible routes through which the secured information could have been transported outside the boundary of the domain.

Future work will focus on reducing the overhead of the auditing mechanism by targeting in-depth auditing at systems on the boundary of the domain, and to those with vulnerable processes. This talk will also discuss some of the problems faced by researchers trying to increase the acceptance of live digital forensic techniques among investigators, and our early work on developing mechanisms to validate live digital forensic tools.

## **A SOCIAL P2P MODEL FOR MEMORY FOR LIFE**

**Haseeb Ur Rahman**

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The growth of social networking sites indicates that people have a natural desire to capture events from their lives, store them for the future and choose to share their memories with other people. The data captured by people via their cameras, mobile phones, sensors etc. has grown to a huge amount in recent years. Although this data is invariably kept stored on the user's hard drive, it will often be left unattended, lacking proper management or annotation. Although the content may remain available over long periods of time, people are liable to forget the details of the situation the data was recorded in. The Memory for Life challenge is an effort to properly store, organize and annotate a user's data and generate meaningful information about a person's life.

To share data of Memory for Life systems, the challenges which need to be overcome are: data privacy, users' control of data and getting proper data from appropriate people. To share these events, peer-to-peer networks provide an ideal environment that allows users to share their files independent of their size or format. However, sharing of data should only take place when chosen by the user, and must remain under a user's control. Therefore, we propose a social peer-to-peer network that will consider the social relationships to allow them to share their life memory data under their control while keeping their privacy not only from unknown people but also from undesired known people.

We will present the design of our model that uses a novel community-based approach to organize peers, allowing users to control who they make connections with. The structure of the communities is designed to reflect different elements of a person's social life, allowing users to organize themselves as they might do in their real lives. A local reputation system is used to categorize the data and the connections/relationships of a user in terms of the levels of privacy and trust, respectively. The categorization of the data and relationships ensures a user's privacy is maintained by allowing them to grant or deny access to their personal information, thereby keeping data under the sharer's control. We will also discuss our current extensions to this work developing a searching technique able to find the correct data from appropriate people, and the implementation of our proposed design.

## **Techniques to Sense human body**

**Mubasher Paracha**  
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The use of various sensors for detection and diagnostic tools in medical examinations falls under title of remote health care. Although the target or surface being analyzed is close to the sensor, which may be exterior to the body, placed on the body's surface, as in this case in a blanket. Most medical remote sensing is designed to see into the body without having it cut open. Some techniques produce only static images; others can actually display the features being examined in dynamic, real time images which show the functional movements of the organs within the body. In this presentation I will highlight several techniques used for sensing and collecting data from human body.

# **Technology Enhanced Learning: An Investigation into the Effective Provision of Geography E-learning Applications within the Oman Secondary Education Sector**

**Batoul AL-Lawati**  
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The radical changes in knowledge and technology based -societies, has required individuals to be knowledgeable about information and communication technologies because of the ubiquitous usage in all aspects of our daily life. Educational institutes thus need to strengthen their ICT curriculum in every subject area. As the level of technology rises, the acquisition of technological skills will cease to be regarded as anything other than essential. Proficiency in the use of technology will become an indispensable skill at almost all levels of work and the criterion will be not whether an individual can use technological equipment but the extent to which an individual can solve problems and enhance procedures using the available technology. Using information technologies in the field of the social studies such as geography contributes to rendering abstract phenomena concepts visualization and increases student's interest in social studies. Geography is a subject that is particularly suitable for teaching through the use of technology, and it offers many opportunities for the development of skills in ICT and other technology areas.

The aim of this research is to explain how technology has enhanced teaching; learning and assessment in field of education especially in geography in Sultanate of Oman schools. It attempts to develop and design software tools to create an active and effective education environment that support the teaching and learning process. Thus, we will compare between two samples of secondary school students, one will study via the traditional education method and another one will study using software in the classroom to explore if the technologies can enhance the teaching and learning of geography.

# **A framework for the Visualisation and Control of Ubiquitous Devices, Services and Digital Content**

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There is undoubtedly an increase in the number of consumer appliances that are enjoying networking capabilities. With data throughput increasing among devices that are renowned to be less capable than personal computers, we see an increase in the consumption of multimedia. In parallel, gaming and social networking are at the forefront of next generation entertainment systems where new and novel usage scenarios are pushing technological boundaries. These advances have undoubtedly provided a platform for innovation, where a natural progression would be to blur the gap between the aforementioned technologies. For example content sharing over networked devices, beyond simple file sharing is becoming a reality.

Furthermore, many devices are forming closer relationships with different virtual worlds, such as World of Warcraft and Second Life. In one sense the gap between the two is becoming increasingly more blurred. Consequently, this opens up many new avenues for content sharing, not only between devices but also between sophisticated virtual worlds. Given such interoperable platforms a natural progression sees content that seamlessly resides within either. This will open up new opportunities where third-party content providers and users alike will now be able to create and share content over these new platforms.

This provides obvious benefits. First, it allows us to very easily move between real and virtual environments where the content and services we use are always at our disposal. Second, utilising the benefits of being connected will allow us to manage our content and services independently of where they reside. Lastly, and perhaps less obvious, it will significantly influence the applications underpinned by digital content where solutions not yet envisioned will emerge, such as dynamic game development, immersive and interactive 3D multimedia, and on-the-fly scene analysis. We aim to provide a basis on which this vision can be realised where mechanisms have been developed that facilitate the sharing of objects across different environments (both virtual and real).

We describe how we aim to extend our initial work on object sharing between both virtual and real-world environments that have been developed in the Networked Appliances Lab at Liverpool John Moores University. New services has developed to semantically describe objects and to dynamically assign scripted behaviours to these objects. This performed in a flexible way where such objects can be consumed by containers within different real and virtual environments. Using the semantic descriptions of the behaviours objects support, target environments will create scripted behaviours based on interpretations of the functionality it provides.

# Identity Management in Mobile ad-hoc Networks

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The concept of ubiquitous/pervasive computing is almost intrinsically tied to wireless communications. Apart from many remote services, proximity services (context-awareness) will also be widely available. People currently rely on numerous forms of identities to access these services. The inconvenience of possessing and using these identities creates significant security vulnerability, especially from network and device point of view in MANet (Mobile Ad-hoc Networks) environments. The area of MANets is still in its infancy in the research community, but it plays a vital role surrounded by the growing trend of mobile technology for business as well as private and governmental uses. Digital identities are at the heart of many contemporary strategic innovations for crime prevention and detection, internal and external security, business models etc. This requires disclosing personal information and the applicability of contextual information as well as allowing users to be in control of their identities. The presentation will mainly focus on 1) our novel framework within this work, 2) protocols and mechanism that will enable users to be in full control of their identity information within MANet environments, with the help of contextual information, 3) speculative mechanism on how to filter contextual information to suit user needs (i.e. Social Identity Theory and Google PageRank).

*A Set Theory Interpretation of Stafford Beer's Cybernetic Viable System Model: Aspirant of Innovatively Surpassing Autonomic Computing with Viable Computing Systems*

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This research articulates a novel technology progressing resource management within self organising systems. By examining both a priori cybernetic and autonomic computing techniques, a set-theory atomically derived emergent model is evolved that reflects a decomposition of Beer's human-agencied Viable System Model (VSM), pertinent by its composition of both multiple and independent entities sharing one or more objectives. Integrated management promotes each recursive level as a whole within a closed metaboundary. The relationship between the subsystems is demonstrated via syntax subscripts while the relationship linking the recursive levels is recognized via the syntax superscripts. Case studies demonstrate inherent systemic learning and control through system-environment interplay. The self-organising system exhibits evolution of systemic elements via conservation and management of appropriate resources provided by each entity. This research provides a reference framework that ultimately aspires to augment the state of the art of autonomic computing into the original field of Viable Computing Systems (VCS).

# **Dynamic Interactive Storytelling for Computer Games Using AI Techniques**

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In this research project we investigate software engineering methodology and framework development methods for an interactive storytelling engine and the artificial intelligence techniques that will enable novel approaches to procedurally generating digital interactive storytelling for computer games.

We propose to provide an editing tool to allow easier modification and creation of story based game content and to create procedurally the story environment. To date we have designed the overall structure of the separate components that make up our engine and designed how they will interact, worked on the underlying game engine 'Homura' to create a strong foundation to power our digital interactive storytelling engine (DISE), created a physics based story world editor, and implemented the action menu interface. We have also created an editor for procedural generation of terrains, water, roads and cities, which will be part of the story world. We intend to apply and evaluate our engine within a variety of game genres involving interaction, non-player-character groups, dialogue and cinematography.

DISE will dynamically create interactive narratives which are focused on user's actions to create alternative storylines and points of dramatic tension. The engine is provided with knowledge of generic story actions met in many storytelling domains. The story designer is required to provide domain specific information, for example regarding characters and their relationships, locations and actions. A planner creates sequences of actions that each lead to a situation where many new actions are possible for a character. The user interacts with the story-world by making decisions on relevant actions. Using this action the engine chooses and adapts new story lines according to the users' past behavior, surrounding character's moods, environment and other variable factors.

This presentation will provide an overview of DISE. We will show the progress made to date on our engine design and implementation, our new level editors and procedurally generated content. Finally in the last section we will detail the future work to be completed in order to reach our goal.

# **The use of Autonomic Computing in enhancing Cloud Environments**

## **Abstract**

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In 2001 IBM launched the Autonomic Computing initiative. IBM's use of the word 'autonomic' draws an analogy to the human body's autonomic central nervous system; a system that performs *below* the conscious level thus freeing the brain from having to deal with lower level, albeit essential, bodily functions. In undertaking similar initiatives, Hewlett-Packard use the term Adaptive Enterprise whereas Microsoft use the term Dynamic Systems. Terminology aside, *all* of these related industry efforts share the common goal of imbuing software systems with the ability to be self-managing. There is a common concern that the present rate of growth in system complexity will eventually lead to even the most skilled IT professionals being unable to administer their IT environments. It is therefore essential that systems are designed to be self-configuring, self-healing, self-optimising and self-protecting.

The author asserts that to further reduce the administrative burdens on IT professionals, end users need to be provided with some basic tools that will allow them to modify given applications to suit their needs. A level of autonomy would therefore have to exist as part of the system design (the process orientation), allowing for end users to add new processes or modify the system itself. Furthermore, could autonomic computing be used to enhance a cloud environment in allowing systems to decide where end users ought to go? How do we model the end user requirements? How do we deploy them? The author will seek answers to these questions through a comprehensive exploration of the University-advocated Process Orientated Programming as well as exploring the viability of model driven development and transformation within a cloud environment.

# **MyMemories and Shared Experiences through the Analysis of Digital Memories in P2P Networks**

**Azizan Ismail**

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In the digital era, people have many options to choose to capture their images through compact or DSLR cameras, camcorders, web cameras, or using their mobile phones. People love to capture themselves, family, friends, animals, panoramic scenes, buildings, living things and other objects. Every image captured has its own name automatically generated by the digital camera and it is common for people to be too lazy to rename them from this automatically assigned name. Therefore when users need to search for an image based on a specific event, place or name, they invariably need to browse through their entire collection in order to find it. Moreover we often can't remember things such as names of people, places and events, and to identify relevant information and evidence in our minds. Sometimes we may even fail to remember when some event happened, what happened there, with whom, where, why and how it happened. The worst possibility is that we might forget or lose some of our memories forever. Nonetheless the images that we capture might be important in the future. A digital memory might allow us to evaluate, justify or identify our memories using the collection of digital content held in our memory storage. With currently available technology, there exists the opportunity to keep a life's worth of digital images, analyze them and produce reports about our memories.

In this talk I will present the design the MyMemories prototype that allows the user to create a text summary of an individual or time frame based event. We generate a personality summary report by analyzing stored photographic images by detecting faces, whether an image is taken indoors or outdoors, the GPS location, contained objects and detailed file information (based on EXIF data). MyMemories is a prototype system designed to minimize the effort needed to view every single photo in order to establish the story behind it. Automatic text summarization for groups of photo based on the event or time frame can make it easier for a user to understand the content of photos without viewing each of them individually. MyMemories combines a cluster engine, photo metadata extraction, text or voice story summary, tagging of related video, sharing of images (selected images or whole collections), comments from friends, image processing to obtain a personality summary report and correlated stories between two or more people using digital photos. MyMemories also allows users to share all or a selection of their images, as well as the results established by the system, with our trusted friends by using peer to peer groups. We demonstrate our approach using a collection of personal photo images, showing the ability to automatically generate a text summary of a selected group of images and produce a summary report of the whole collection. We used JXTA peer to peer networking technology since this provides an open set of peer to peer protocols that enables any devices on a network to communicate, collaborate, and share resources.

Additionally, more powerful capabilities, such as access using metadata – including written and spoken comments about an item – and the ability to organize items in multiple ways, might allow the system to undertake deeper searches outside of a peer group and to discover further personal memories and identify those of a more unexpected nature.

# **Image and Video Compression**

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The present work deals with image and video compression. The digital video consists of a series of orthogonal bitmap digital images displayed in rapid succession at a constant rate. So images are very important representative objects. They can represent transmitted television, satellite, medical, computer storage pictures and many more. When a two-dimensional light intensity signal is sampled and quantized to create a digital image, a huge amount of data is produced. The size of the digitized picture could be so great that results in impractical storage or transmission requirements. The compression deals with this problem such that the information required to represent the image is reduced thus making the transmission or storage requirements of images more practical. The prospect of compression for storage purposes is to reduce the memory requirements, while the purpose of compression for transmission is to minimize the bandwidth

Compression techniques are classified into “lossless” and “lossy” approaches. The lossless technique has low compression ratio but can recover the original or actual data representation perfectly. On the other hand, the lossy technique provide higher compression ratio, however some of the information will be lost therefore this technique are often applied more in image and video compression than the lossless technique.

# **A cellular approach for sensor relocation in wireless sensor networks**

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In the past few years wireless sensor networks have received a greater interest in application such as disaster management, border protection, combat field reconnaissance and security surveillance. Sensor nodes are expected to operate autonomously in unattended environments and potentially in large numbers. Among various challenges faced while designing wireless sensor networks, maintaining network connectivity, coverage and maximizing the network lifetime stand out as critical considerations. The connectivity and coverage issues are generally met by deploying a sufficient number of sensor nodes, or using specialized nodes with long-range capabilities to maintain a connected graph. Mobile devices can be used as orthogonal methods to address the network connectivity, coverage, and network life time problems in WSNs. Mobile sensors are useful as they can move to locations that meet sensing coverage requirements.

This paper explores the motion capability to relocate sensors to deal with sensor failure or respond to new events. We define the problem of sensor relocation and propose a two-phase sensor relocation solution: redundant sensors are first identified and then relocated to the target location. We propose a hierarchical cellular architecture to quickly locate the closest redundant sensor with low message complexity, and propose to use cascaded movement to relocate the redundant sensor in a timely, efficient and balanced way. Simulation results verify that the proposed solution outperforms others in terms of relocation time and total energy consumption.