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Southern Africa Telecommunication Networks and Applications Conference (SATNAC) 2012
SATNAC 2012 Review Process

A formal ‘Call for Papers’ was issued, inviting anyone interested to submit a paper within categories specified by the Organizing Committee. Authors uploaded their papers via web interface onto a database. Papers were assigned to the review panel in the field to judge on the possible acceptance of the submission, based on the scope and depth of the subject matter.

The review process is based on the international de facto standard for blind paper reviews. The review process was undertaken by at least three experienced and well respected individuals. In the blind peer-review process, papers were scrutinized by a panel of South African reviewers, consisting of mainly respected academics, as well as several international experts. The reviewers were asked to provide specific feedback, both positive and negative. This was the only information from the review process disclosed to the authors; all other information was kept confidential.

Reviewers used a 4 point scale to rate the following criteria:

- Originality
- References
- Technical Quality
- Presentation Style

Reviewers gave an overall rating. This was followed by the reviewer comments, which assists the authors in improving and correcting their papers. Reviewers were asked to be as comprehensive as possible.

The reviewers submitted their scoring and comments via web interface onto the database. The Technical Programme Committee drew reports and aggregated the individual scores. The papers were ranked on their average weighted score. The programme dictated the number of papers that could be accepted. Papers were submitted to an online plagiarism database, before being accepted.

The reviewers’ comments were forwarded to the author’s, with a request to submit a final revised version. Only those papers of high enough quality as recommended by the respective reviewers are included in the SATNAC 2012 Proceedings as Full Reviewed Papers.

Two page Work-In-Progess papers were also invited but were not reviewed as rigorously. Several were accepted for oral presentations, while others for poster presentations. The poster session papers do not form part of the official conference proceedings.

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Mr. Frikkie de Lange, University of Pretoria
Mr. Jacques van Wyk, University of Pretoria
Prof. Louis Linde, University of Pretoria
Mr. Mohau Ramakhula, University of Pretoria
Mr. Nikolai de Figueiredo, University of Pretoria
Mr. Rogerio dos Santos, University of Pretoria
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Dr. Jide Julius Popoola, Witwatersrand University
Dr. Ling Cheng, Witwatersrand University
Mr. Nikesh Nageshar, Witwatersrand University
Prof. Rex van Olst, Witwatersrand University
## 1. Access Network Technologies

**Title:** 10: Prediction of Specific Attenuation of Rain for Wireless Networks by Probability Density Analysis in South Africa  
**Authors:** Akintunde Ayodeji Alonge (University of KwaZulu-Natal) and Thomas Joachim Afullo (University of KwaZulu-Natal)  
**Abstract:** In this paper, specific attenuation of rainfall is examined at four locations in South Africa using the lognormal rainfall dropsize distribution (DSD) from Durban. The probability density function (PDF) analysis undertaken for each location, relative to the control site in Durban, is applied to develop equivalent lognormal models. By applying the scattering parameters for each location at 2.5 GHz, 12 GHz and 25 GHz, the specific attenuation accrued to each location is predicted. From the results, it is seen that the coastal city of Durban may experience higher specific attenuations at the examined frequencies. This is followed by the cities of Richards Bay, Pretoria and Pietermaritzburg, particularly beyond 10 GHz transmission frequency.

**Title:** 31: Design of dual-band filters using frequency mapping  
**Authors:** Tobias G. Brand (Stellenbosch University) and Riana H. Geschke (Stellenbosch University)  
**Abstract:** The design of multi-band microwave filters is investigated. Lagrange basis functions are used to extend the traditional approximation problem to accommodate multi-band transfer functions. In order to validate the theory, the synthesis and realisation of all-pole transfer functions are reviewed. These techniques are then used to design a test filter. A dual-band filter is designed using the presented theory and fabricated using multi-layer stripline technology. There is good correlation between the measured results and the theoretical predictions.

**Title:** 27: Application of De-embedding Methods to Characterise a Mode Transformer  
**Authors:** Adam Swiatko (University of Pretoria)  
**Abstract:** De-embedding is the process whereby the transmission properties of a section of microwave circuit are characterised. In this paper it is proposed that a new analysis mechanism be developed by applying a de-embedding method implemented in a numerical computational software package. The analysis mechanism can then be applied to a horn antenna to separate the transmission properties of the horn structure from the transmission properties of the mode transformer that is used to feed the system.

**Title:** 129: Performance Analysis of M-LWDF and EXP-PF Schedulers for Real Time Traffic in Satellite LTE Networks  
**Authors:** Gbolahan Aiyetoro (University of KwaZulu-Natal), Giovanni Giambene (University of Siena) and Fambirai Takawira (University of the Witwatersrand)  
**Abstract:** This paper investigates the performance of the Modified Largest Weighted Delay First (M-LWDF) and Exponential Proportional Fairness (EXP-PF) scheduling schemes for satellite LTE with the adoption of MIMO technology. The Satellite LTE air interface will provide global coverage and hence complement its terrestrial counterpart in the provision of LTE services to mobile users. A land mobile dual-polarized GEO satellite system has been considered for this work. The packet scheduling scheme is a vital element that is needed in order to effectively utilize the resources of the satellite LTE network. The aim of this paper is to conduct a performance evaluation of the two scheduling algorithms through simulations, using throughput, average delay, packet loss ratio, and fairness indices as metrics. Video streaming and VoIP flows have been considered to model real-time traffic.

**Title:** 79: CE-OFDM with a Block Channel Estimator  
**Authors:** Nikolai de Figueiredo (University of Pretoria) and Louis Linde (University of Pretoria)  
**Abstract:** A simple minimum mean-square error channel estimation algorithm was implemented for a constant envelope orthogonal frequency division multiplexing communication platform. The system was shown to have 1 dB to 3 dB bit error rate degradation for a range of system parameters. This technology has the potential for application in slow fading wireless environments where power efficiency is paramount.

**Title:** 13: Formal Verification of Hash-based Authentication Protocol in WiMAX Networks  
**Authors:** Beth Njiri Komu (Tshwane University of Technology), Prof. Mjumo Mzyece (Tshwane University of Technology) and Prof. Karim Djouani (Tshwane University of Technology)  
**Abstract:** The Initial Network Entry procedure is the first stage in establishing a connection in an IEEE 802.16 (WiMAX) network. The process involves the transmission of unencrypted management messages, which constitutes a major security flaw that is exploited by the Man-in-the-Middle (MITM) attack. This security defect necessitates the need for the implementation of appropriate security protocols. Research has shown that developing secure protocols has proved to be a difficult task as is evident from the presence of flaws in published protocols such as the Needham-Schroeder public key authentication protocol that had a bug that remained undetected for 17 years. With the use of formal verification techniques, bugs can be discovered very early in the design of the system and automatically validated, thereby increasing confidence in their use.

In this paper, we analyse a security protocol proposed to mitigate the MITM attack at the initial network entry point in WiMAX referred to as Secure Initial Network Entry Protocol (SINEP), and model the protocol and an intruder process with MITM capabilities in Process/Protocol Meta-language (PROMELA) formalism. We then use Linear Temporal Logic (LTL) to define the attributes the protocol should satisfy and carry out verification by...
use of the SPIN model checker. Using our intruder model, we conclude that the protocol fulfills its confidentiality objective by concealing the most valuable messages in the protocol run.

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<th>Title:</th>
<th>38: Optimization of PON Planning for FTTH Deployment Based on Coverage</th>
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<tr>
<td>Authors:</td>
<td>S.P. van Loggenberg (North-West University), M.J. Grobler (North-West University) and S.E. Terblanche (North-West University)</td>
</tr>
<tr>
<td>Abstract:</td>
<td>With the growing demand of very high bandwidth services such as high definition IP Television (IPTV), Service Providers (SPs) are moving to fiber-based solutions such as Passive Optical Networks (PONs) to meet current and future bandwidth needs. As these networks are deployed, coverage tends to directly affect Capital Expenditure (CAPEX) per subscriber served, with a minimum cost per Optical Network Unit (ONU) translating to a maximum Return on Investment (ROI). By including coverage and Economies of Scale (EOS) into the optimized planning model, a more accurate representation of deployment scenarios can be determined. In this paper, the incorporation of deployment coverage and EOS into a Mixed Integer Linear Programming (MILP) formulation is presented and solved for a number of EOS scenarios. Results suggest that stepped approximations of on-linear costs based on the number of Optical Network Units (ONUs) can be effectively included in the MILP model without sacrificing the ability to compute solutions for larger scale networks.</td>
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<th>Title:</th>
<th>117: Performance Evaluation of Raptor codes in TCP/IP-based Wireless Networks</th>
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<tr>
<td>Authors:</td>
<td>Mokesiolumwa Fanoro (Tshwane University of Technology), Mujumo Mzyece (Tshwane University of Technology) and Guillaume Noel (Tshwane University of Technology)</td>
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<tr>
<td>Abstract:</td>
<td>This paper evaluates the performance of raptor codes on Transport Control Protocol/Internet Protocol (TCP/IP) packet-based wireless networks. Performance metrics such as packet loss rate and recovery rate are studied closely. This is carried out by building a functional module in a network simulator 2 (ns2) environment that models the raptor transmitter and raptor receiver. At completion of this, the standalone platform for the development of the actual Raptor module as an ns2 compatible protocol is implemented. The results show that packet recovery rate increases to over 60% when raptor code was integrated into the transport layer.</td>
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<th>Title:</th>
<th>18: Tropospheric Propagation Mechanisms Influencing Multipath Fading Based on Local Measurements</th>
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<tr>
<td>Authors:</td>
<td>Mike Asiiyo (University of KwaZulu-Natal) and Thomas Afullo (University of KwaZulu-Natal)</td>
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<tr>
<td>Abstract:</td>
<td>Abstract - Knowledge of the refractivity index in the lower atmosphere is very important in the design, transmission and performance analysis of line-of-sight (LOS) terrestrial links. In oceanic environments, radio wave propagation is affected by the high variability with space and time of the meteorological parameters. Radiosonde data have been used in the analysis of the effect of climatic conditions in the coastal regions of South Africa and there influence in estimating the occurrence of multipath fading in LOS links. The values of temperature, pressure and relative humidity in the lower atmosphere have been used to compute refractivity and refractivity gradients. The percentage of occurrences of super refractivity and ducting conditions which affect the occurrence of multipath fading are determined from the estimated refractivity gradients.</td>
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<th>Title:</th>
<th>60: Multiband Support Recovery in 1.2GHz Bandwidth using Modulated Wideband Converter</th>
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<tr>
<td>Authors:</td>
<td>Shaniu Aziz (North-West University) and Albert Helberg (North-West University)</td>
</tr>
<tr>
<td>Abstract:</td>
<td>This paper deals with a sub-Nyquist sampling method, Modulated Wideband Converter(MWC) that can efficiently recover the support for sparse wideband analog signals. This approach can be mainly used in spectrum sensing and blind sub-Nyquist support recovery of the frequency bands for cognitive radio (CR) operation. The ModelSim simulation results obtained for MWC of 1.2GHz bandwidth is presented.</td>
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<th>Title:</th>
<th>14: Rate and Reliability Implementation Scheme for Polar Codes</th>
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<tr>
<td>Authors:</td>
<td>Peter Akuon (University of KwaZulu-Natal) and Hongjun Xu (University of KwaZulu-Natal)</td>
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<td>Abstract:</td>
<td>Research has shown that polar codes are capacity achieving. The performance of polar codes is evaluated for a block-size of n = 512 for three ‘adaptive’ binary symmetric memoryless channels. These are the BEC, BSC, and the AWGN channel. Binary erasure, binary symmetric and additive white Gaussian Noise channels are respectively. The performance of these channels is initially evaluated by generating the codeword through the rate parameter, g_I(W) to compute the channel capacity. The performance is based on average bit-error-rate (BER) criterion. Consequently, the channels are adapted for a BEC through the reliability parameter, g_I(W) to generate the codeword. This parameter is similar to the Bhattacharyya parameter. Improvements in BER are noted for all the rates and probability of errors tested in this experiment. However, in-as-much-as the computational latency is seen to remain fairly constant, the memory space complexity of the code construction is expected to increase due to the additional recursion. As a result, the trade off between BER and reliability is proposed and implementation of such system on the application platform is briefly discussed.</td>
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<th>Title:</th>
<th>98: Efficient Resource Allocation through Bandwidth Degradation of Non-Real-Time Polling Service in IEEE 802.16 Network</th>
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<tr>
<td>Authors:</td>
<td>Samuel Falowo (University of Cape Town) and Neco Ventura (University of Cape Town)</td>
</tr>
<tr>
<td>Abstract:</td>
<td>Connection admission control (CAC) is an important element for quality of service (QoS) provisioning in wireless networks, such as IEEE 802.16 standard, which is also known as worldwide interoperability for microwave access (WiMAX). While the standard defines PHY and MAC requirements, CAC is left to the vendors to design and implement for service differentiation and QoS support. In this paper, a resource allocation with bandwidth degradation mechanisms for IEEE 802.16 network is proposed. The proposed CAC employs a threshold-based mechanism to allocate bandwidth for the four connection types namely, UGS, erPS, rtPS and nrtPS services. A Bandwidth degradation of nrtPS connections is used to admit more connection requests in other to increase connection throughput. A performance analysis model based on Markov decision process is used and numerical results are presented to demonstrate the performance of the proposed scheme. The scheme when compared with partitioning scheme and scheme without CAC performs better in terms of connection throughput.</td>
</tr>
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</table>
2. Core Network Technologies

Title: 47: Reduction of Handover Interruptions in Mobile WiMAX Based on Signal Strength and Distance  
Authors: Mary Alatise (Tshwane University of Technology), Mjumo Mzyece (Tshwane University of Technology) and Anish Kurien (Tshwane University of Technology)  
Abstract: The issue of mobility in mobile wireless networks has been seen as one major challenge that it faces. To support mobility in any wireless network, the application of an efficient handover control scheme is crucial. During transmission in hard handover scenarios in mobile wireless networks, a Mobile Station (MS) could experience handover disruption and handover delays which could result in connection drops and waste of resources. In order to solve some of the problems associated with handover, a Relative Signal Strength with Threshold and adaptive Hysteresis and Distance (RSTH-D) scheme is proposed in this paper. This scheme seeks to initiate quick handover so as to reduce handover delays, avoid interruption of transmission and effectively utilise available radio resources. It is shown through the simulation results obtained that the proposed scheme has significant potential performance benefits compared to relative signal strength with hysteresis and threshold scheme. The performance of the scheme is measured in terms of handover delay, handover probability and the average number of handovers.

Title: 7: Orthogonal MC-DS-CDMA Modem using CRCCCs  
Authors: Frederick de Lange (University of Pretoria), Jacques van Wyk (University of Pretoria) and Prof. Louis P. Linde (University of Pretoria)  
Abstract: In this paper we describe an orthogonal multicarrier direct sequence code division multiple access (MC-DS-CDMA) modem using cyclic rotated complete complementary codes (CRCCCs). The use of CRCCCs provides an attractive alternative to conventional spreading sequences for next generation mobile digital communications. Both time and frequency domain spreading are used in order to improve the processing gain. The use of complete complementary codes (CCC) eliminates multi user interference and thus removes the need for complex multi user detection receivers. The application of CRCCCs mitigates the loss in spectral efficiency (SE) due to the use of CCCs, and returns the system to the SE of a conventional CDMA system. The performance of the system in an asynchronous mobile uplink was compared to the existing 3G standard. The system was implemented on FPGA in a back-to-back configuration, in order to determine the feasibility of implementation of such a system.

Title: 56: Influence of Errors in the Dimensions of a Switched Parasitic Array on Gain and Impedance Match  
Authors: MofoRo MofoLo (CSIR), Albert A. Lysko (CSIR) and Willem A. Clarke (University of Johannesburg)  
Abstract: The dimensions of an antenna system defines its performance. This implies proper calibration and fabrication process are vital. Thus, there is a need to investigate the influence of the variations in the dimensions of the antenna on its performance. A switched parasitic array antenna is modelled in MATLAB. The variations in the antenna dimensions: length, thickness and spacing of the array elements, are randomly generated based on the Gaussian distribution. The overall influence of these variations on the antenna performance attributes (e.g. gain and impedance match) is estimated using a Monte Carlo simulation. The simulation results demonstrate that the combined effect of all variations in the structural parameters quantify the impact of these variations on the performance of the antenna system, for the given antenna specifications.

Title: 112: RUCRG IMS Client: Design and Implementation of Presence and XCAP  
Authors: Walter Tawanda Muswere (Rhodes University) and Alfredo Terzoli (Rhodes University)  
Abstract: Presence is rapidly becoming the cornerstone for building context aware applications. It was originally developed for communicating the willingness and/or ability of a user to communicate with other users on the network in Instant Messaging (IM) systems. Presence has since been adopted for online collaboration, within enterprises as well as by service providers through the adoption of the IP Multimedia Subsystem (IMS). It has thus become important to manage application configuration data effectively and efficiently to allow for accuracy and availability of such information. This paper presents the integration of XML Configuration and Access Protocol (XCAP) support in the Rhodes University Convergence Research Group (RUCRG) IMS client to help in the management of application configuration data.

2. Core Network Technologies
In terrestrial optical communications, optical fiber transmission links are vital for both short and long distances networks. This is due to their high bandwidth capability that translates into high speed data transmission. However, trench digging to lay the optical fiber cables makes their installation intricate and time consuming compared to optical wireless transmission. Meanwhile, Free Space Optical communication (FSO) links often employed in short distance, line of sight wireless transmission present competitive data rates if their bandwidth is maximized. We have considered using the Wavelength Division Multiplexing (WDM) technique in the development of a FSO link prototype to increase the capacity of the link. Currently, most FSO links use single wavelength Laser Diodes (LD) in their transmitters. We propose the design of a multi-wavelength Erbium doped fiber laser (EDFL) source, to avoid the use of multiple LD in the prototype. In this paper, an EDFL source with emission wavelengths at 1540nm, 1547nm and 1555nm is presented. Characteristics of the Laser source such as output optical power and laser wavelengths are controlled by optimizing the laser parameters such as length of the gain medium, coupling ratio of the output mirrors and the laser pump power.

Table: 113: A Multi-wavelength Erbium Doped Fiber Laser for Free Space Optical Communication link
Title: 113: A Multi-wavelength Erbium Doped Fiber Laser for Free Space Optical Communication link
Authors: Siyanda Ohumayo (University of Johannesburg), R Martinez (University of Johannesburg) and JJM Kaboko (University of Johannesburg)
Abstract: In terrestrial optical communications, optical fiber transmission links are vital for both short and long distances networks. This is due to their high bandwidth capability that translates into high speed data transmission. However, trench digging to lay the optical fiber cables makes their installation intricate and time consuming compared to optical wireless transmission. Meanwhile, Free Space Optical communication (FSO) links often employed in short distance, line of sight wireless transmission present competitive data rates if their bandwidth is maximized. We have considered using the Wavelength Division Multiplexing (WDM) technique in the development of a FSO link prototype to increase the capacity of the link. Currently, most FSO links use single wavelength Laser Diodes (LD) in their transmitters. We propose the design of a multi-wavelength Erbium doped fiber laser (EDFL) source, to avoid the use of multiple LD in the prototype. In this paper, an EDFL source with emission wavelengths at 1540nm, 1547nm and 1555nm is presented. Characteristics of the Laser source such as output optical power and laser wavelengths are controlled by optimizing the laser parameters such as length of the gain medium, coupling ratio of the output mirrors and the laser pump power.

Table: 76: Routing Enhancements for Selectively Offloaded IP Traffic in the Evolved Packet System (EPS)
Title: 76: Routing Enhancements for Selectively Offloaded IP Traffic in the Evolved Packet System (EPS)
Authors: Nicholas Katanekwa (University of Cape Town) and Neco Ventura (University of Cape Town)
Abstract: In an effort to optimize the network for IP traffic, the third generation partnership project (3GPP) recently introduced several offloadable Selected IP traffic Offload (SIPTO) solutions which include Selected IP traffic Offload (SIPTO). SIPTO facilitates offloading of selected traffic (e.g. internet or access to a corporate network) at appropriate points in the radio access network in a cost-efficient manner through distributed core network nodes. This reduces the overloading of backhaul and central core network resources and further allows optimization of these resources. The use of SIPTO technology has the potential to greatly increase system scalability and flexibility to cope with the increase in mobile data traffic. Within the framework of the suggested SIPTO architecture, mobility for SIPTO traffic results in nonoptimal paths which fall back on the use of central core network resources defeating the purpose of SIPTO. Furthermore, in a scenario where a user equipment (UE) has multiple packet data network (PDN) connections active, there is a high likelihood of the occurrence of nonoptimal paths for SIPTO traffic. The problem becomes further significant because such nonoptimal paths may result in degradation of quality of service for delay sensitive applications. This paper proposes a SIPTO optimized PDN connection and handoff procedure to ensure break out of SIPTO traffic as locally as possible to the UE even under the identified scenarios and hence maintain an optimized route at all times.

Table: 130: FH-MIPv6-based Handover for Wireless Mesh Networks
Title: 130: FH-MIPv6-based Handover for Wireless Mesh Networks
Authors: Zimani Chitedze (University of the Western Cape) and William Tucker (University of the Western Cape)
Abstract: This paper shows that mobility management protocols for infrastructure Internet may be used in a wireless mesh network environment. Mesh topology tends to be an unplanned graph and routes change dynamically and in this research Mobile IPv6 and Fast Handover for Hierarchical Mobile IPv6 are successfully implemented in a wireless mesh network environment. Horizontal handover simulation with ns2 involved Mobile IPv6 and Fast Handover for Hierarchical Mobile IPv6 applied to wireless mesh networks. Mobile IPv6 was used as a baseline to compare the performance of the two protocols. The result of the performance of the two protocols, Fast Handover for Hierarchical Mobile IPv6’s performance is superior to Mobile IPv6. Fast Handover for Hierarchical Mobile IPv6 generates more throughput and less delay than Mobile IPv6. Furthermore, Fast Handover for Hierarchical Mobile IPv6 drops fewer data packets than Mobile IPv6. Even though MIPv6 and its extensions are for infrastructure networks, they can be used effectively in mesh networks.

Table: 99: An investigation into the AES X170 project for control of Ethernet AVB networks
Title: 99: An investigation into the AES X170 project for control of Ethernet AVB networks
Authors: James Dibley (Rhodes University) and Richard Foss (Rhodes University)
Abstract: The AES X170 project aims to define a control and management protocol for audio distribution networks. This paper describes recent investigations and developments in AES X170, including the development of an XFN implementation specification and the implementation of native XFN control over an Ethernet AVB endpoint.

Table: 75: On MAP Decoding of High-Rate Non-Binary Linear Block Codes
Title: 75: On MAP Decoding of High-Rate Non-Binary Linear Block Codes
Authors: Farzad Ghayour (University of KwaZulu-Natal), Fambirai Takawira (University of Witwatersrand) and Hongjun Xu (University of KwaZulu-Natal)
Abstract: Optimum or sub-optimum maximum a posteriori (MAP) algorithms are usually good candidates to be used in “soft-in/soft-out” decoders. However, the MAP algorithm, especially for the non-binary codes, is a computationally complicated decoding method. In this paper, an optimum MAP decoding rule for non-binary codes based on the dual space of the code is presented. Since, the complexity of this proposed algorithm is related to the inverse of the code-rate, it can be attractive for the codes with high coding rates.

Table: 82: Towards Improved Multi-Hop Effective Bandwidth Routing Metric in Wireless Mesh Networks
Title: 82: Towards Improved Multi-Hop Effective Bandwidth Routing Metric in Wireless Mesh Networks
Authors: Michel Mbougni (North West University) and Obeten Ekabua (North West University)
Abstract: It is unarguably that routing metrics are essential when determining the performance of Wireless Mesh Networks (WMNs). During the implementation of routing protocols, routing metrics are assigned to different paths and the calculation of the best paths is a function for predicting the best routing path. This paper proposes an enhancement to the Multi-Hop Effective Bandwidth (MHEB) routing metric commonly used in WMNs. The proposed routing metric, called improved Multi-Hop Effective Bandwidth (IMEbE) takes into
3. Internet Services & End User Applications

Title: 21: A Framework for Independent Hand Tracking in Unconstrained Environments
Authors: Imran Achmed (University of the Western Cape), Isabella Venter (University of the Western Cape) and Peter Eisert (Fraunhofer Heinrich Hertz Institute)
Abstract: Communication is an essential life skill used to interact with and share information between people. The Deaf, who are not able to participate in normal communication with the hearing community, are therefore marginalised. To address this communication gap, this paper presents a novel learning-based framework that provides sign-language recognition in unconstrained environments by tracking the right and left hands independently. A segmentation algorithm that assists the tracking process of multiple moving objects that share similar characteristics, such as the hands, is suggested and referred to as region reference points. The proposed framework combines region reference points with skin detection, motion detection and the selection of skin-identified clusters. To address the problem of ambiguity caused by occlusion, the hands are learnt while tracking using a support vector machine and predicted when separated from the occlusion state. The framework is evaluated on ten isolated South African Sign Language gestures performed by six individuals. The experimental results show that the framework achieved an average rate of 81.63% on a hand tracking system.

Title: 81: Near Miss Detection for Software Failure Prevention
Authors: Madeleine Bihina Bella (University of Pretoria), Martin Olivier (University of Pretoria) and Jan Elof (University of Pretoria)
Abstract: The increased complexity of IT systems can lead to software operational failures with disastrous consequences. In order to correct and prevent the recurrence of such failures, a thorough post-mortem investigation is required to localize their root causes. However, this cannot be effectively addressed by existing failure investigation disciplines as they are reactive by definition and only applied after major accidents occur. We therefore suggest a proactive approach through the detection and analysis of near misses. Contrary to failures, near misses do not result in loss or damage but rather indicate a system weakness that could lead to a malfunction under different circumstances. Thus, they are warning signs that provide an opportunity to prevent serious failures and improve the system’s reliability. Though near miss management is successfully implemented in other industries it is not yet used in the IT field. As near misses cannot be successfully managed without a proper detection and prioritisation mechanism, this paper proposes an IT specific definition of a near miss and then presents a high-level process for detecting and prioritising such events. We illustrate the application of the definition and prioritisation scheme with a practical example of a real-life mobile application developed by SAP Research Pretoria. We further outline some of the difficulties in the successful implementation of the process.

Title: 92: A Mobile Phone Solution to Improve Geographic Mobility
Authors: Sacha Miteche (Rhodes University), Alfredo Terzoli (Rhodes University) and Hannah Thinyane (Rhodes University)
Abstract: Motor vehicle ride sharing is another way of collective travel other than the public transport systems. Dynamic Ride Sharing (DRS) systems targeting mobile phone platforms have been developed to enable spontaneous ride share agreements between drivers and unknown commuters with similar travel destinations. Such spontaneous ride sharing agreements are also popular in South Africa through hitch hiking. The DRS systems that are available have been designed for use within a developed world context, and are therefore not relevant to the majority of the population of developing nations like South Africa. This paper presents the work that was done in developing an appropriate DRS system for people who use hitch hiking travels in South Africa.

Title: 48: Analyzing The Software Bug Lifecycle
Authors: Jaco Geldenhuys (Stellenbosch University) and Willem Visser (Stellenbosch University)
Abstract: We describe the Impendulo tool suite and how we use it to analyze how programmers develop code and more importantly how they introduce and correct errors. In addition we also evaluate state-of-the-art static analysis tools to see whether they can detect the errors the programmers introduce. Our results indicate that these tools find almost no errors. This clearly shows that we need to develop new static analysis tools if we want to improve the software development process. We also illustrate how the results of our programmer observations can be used to determine programmer performance in an objective fashion.

Title: 53: An e-Safety Educational Framework in South Africa
Authors: Mariska de Lange (Nelson Mandela Metropolitan University) and Rossouw von Solms (Nelson Mandela Metropolitan University)
Abstract: Information and Communication Technology (ICT) has become an integral part of most individuals’ lives. The Internet, in particular, may offer numerous opportunities, but individuals should also be aware of the associated risks. Young children are especially vulnerable to online dangers. They utilize Internet technologies from an early age, and should know how to keep themselves and others safe. However, most do not have the required knowledge and expertise to protect themselves. Parents mostly do not understand their children’s online behaviour, and are unable to teach their children how to access the web safely and responsibly. A school is the perfect place to teach children safe online behaviour. However, there is currently a lack of e-Safety education in South African schools. The objective of this paper is to propose a framework that might contribute towards...
the development of an e-Safety culture. The focus is primarily on learners from primary and secondary schools.

| Title: 87: Faster Upper Body Pose Estimation and Recognition Using CUDA |
| Authors: Dane Lesley Brown (University of the Western Cape), Mehrdad Ghaziasgar (University of the Western Cape) and James Connan (Rhodes University) |
| Abstract: The dependence of sensitivity and dynamic range of a stress sensor on orientation of input polarizations in Single Mode Fibre (SMF), Large Effective Area Fibre (LEAF) and Polarization Maintaining Fibre (PMF) is reported. The degree of polarization (DOP) and power were the parameters used to measure sensitivity. Interferometry technique was applied because it has a high resolution and it is geometrically simple. Fibre sensors of this type find important applications like in mining, sensing rock, and mud slides. The results show that the relative angles between the polarizations in sensor arm and reference arm determines the sensitivity of the sensor. In addition the sensitivity also depends on the type of fibre used as sensing element. |

| Title: 59: Termination of Periodically Monotonic Affine Loops |
| Authors: Kevin Durant (Stellenbosch University) and Willein Visser (Stellenbosch University) |
| Abstract: We present a technique for locating infinite paths within a program’s loop blocks, in particular examining loops whose defining variables are updated by transformations of an affine nature. Along with a few auxiliary results, we show that this technique will always locate such paths, if they exist, for update transformations which periodically shift the values of the loop’s variables with their relevant ranges, which are defined in the loop’s guard condition. This includes all single-variable and cyclic affine loops. Finally we describe this technique’s implementation, which has been performed with the aid of Java Pathfinder, NASA’s open-source software verifier, and also note how our technique can be adapted to prove that termination holds for affine loops which exhibit periodically decreasing behaviour. |

| Title: 84: Prototyping an Enhanced SMS Service for the Teleweaver Application Server |
| Authors: Mosiuoa Tsitsi (Rhodes University) and Alfredo Terzoli (Rhodes University) |
| Abstract: The Siyakhula Living Lab is a joint initiative between Rhodes University and the University of Fort Hare. Its main aim is to introduce Information and communication Technology (ICT) services into a rural area in the Eastern Cape province of South Africa. The living lab provides an ideal environment for the delivery of such services due to the network connections and equipment that have been deployed at various locations in the area. In conjunction with the Siyakhula Living Lab, Reedhouse Systems — a software company born out of Rhodes University — is in the process of integrating a software system called Teleweaver which is intended to become the main access point for the consumption of these services. Previous research has documented mobile phone use in the area. This data shows that the majority of villagers use mobile phones to communicate, particularly with surrounding villages. Thus mobile phones have an important role to play in supporting communication between people in the area. This paper describes a software prototype that has been developed using an open source software platform called Mobicents that is able to peer with Teleweaver to provide an SMS messaging service accessible through the web. The two platforms work in tandem to create a system that enables villagers to create digital versions of their social groups and send messages to them in bulk. |

| Title: 40: MobiTel: A Interactive Mobile Tool for the Visualisation of Telecommunication Service Utilisation |
| Authors: Gianni Twigg (Nelson Mandela Metropolitan University), Janet Wesson (Nelson Mandela Metropolitan University) and Lester Cowley (Nelson Mandela Metropolitan University) |
| Abstract: Analysing information about how customers use telecommunication services can provide valuable knowledge for a telecommunication service provider. The knowledge gained can help improve the quality of the company’s services. There is currently a lack of software tools that effectively support the visualisation of telecommunication service utilisation. Current systems used to visualise service utilisation also lack dynamic interaction, which is supported on mobile devices. This paper introduces MobiTel, an interactive prototype for the visualisation of service usage information on a tablet device. MobiTel combines touch interaction with two-dimensional and multi-dimensional visualisation techniques to allow dynamic exploration of service usage information. This paper discusses mobile information visualisation and identifies requirements for visualising service utilisation. The design and implementation of MobiTel is discussed together with future work to be completed. |

| Title: 77: Video Fingerprinting Using Robust Hashing of Scale Invariant Features of Frames |
| Authors: Ruan Moolman (North-West University) and Willie C. Venter (North-West University) |
| Abstract: Video fingerprinting is a technique used to identify unknown video by matching the video’s fingerprint to a database of video fingerprints. The fingerprints are derived through algorithms and characterizes the video’s content. Video fingerprinting automates video identification and it has many uses these days with the exponential increase in video usage. A high quality video fingerprinting system should be fast, robust to distortions and use storage space efficiently. All these aspects are dependant on the technique used to fingerprint the video. In this paper a novel video fingerprinting technique is proposed. This technique was developed with the intention to detect videos in real time, with its primary use being advertisement tracking. The technique makes use of the Scale Invariant Feature Transform (SIFT) algorithm, combined with the idea of hashing introduced by Shazam, an audio fingerprinting technique, to fingerprint and detect single frames. The aspects of the frame detector are discussed and tested, after which the optimal variable values are chosen for frame detection. |

| Title: 39: SELPRO: An Online Self-Service Telecommunication Provisioning System for SMMEs |
| Authors: Sherwin Barlow (Nelson Mandela Metropolitan University), Janet Wesson (Nelson Mandela Metropolitan University) and Lester Cowley (Nelson Mandela Metropolitan University) |
| Abstract: Current methods for telecommunication service provisioning result in unsatisfied customers and businesses losing money. The current service provisioning methods do not efficiently support small, medium and micro enterprises (SMMEs) in identifying telecommunication services which can improve their business operations. |
SMMEs are required to follow manual and time intensive procedures in order to receive telecommunication services which meet their business needs. An online Knowledge-based Recommender System (KBRS) is proposed to overcome this concern. This paper presents SELPRO, a prototype KBRS using conjunctive queries to provision telecommunication services to SMMEs. It highlights the requirements for an online self-service provisioning (SSP) system and discusses how these requirements are supported by SELPRO. The design and implementation of SELPRO as well as future work to be completed are also discussed.

### 4. Limited Range Communications

| Title:  | 104: A Survey on the Cryptanalysis of Wireless Sensor Networks using Side-Channel Analysis |
| Authors: | Terrence Moabalobelo (University of Johannesburg), Fulufhelo Nelwamondo (University of Johannesburg) and Hippolyte Djonon Tsague (CSIR) |
| Abstract: | Since the inception of side channel attacks, research has gone a long way in proving that embedded devices capable of running cryptographic algorithms are highly susceptible to these attacks. These attacks are non-invasive in which an attacker can obtain confidential information such as secret keys by simply observing the side channel information leakage (such as the power consumption, timing, and electromagnetic emissions). Wireless sensor networks are particularly vulnerable to these attacks as they are deployed in open environments with no protective physical shielding. In this paper we, give an overview of the side channel attacks (particularly power analysis attacks) against wireless sensor networks and in addition discuss some of the suggested countermeasures against power analysis attacks. |

| Title:  | 9: Encoding for belief propagation decoding in random network codes |
| Authors: | Sune von Solms (North-West University) and Albert S. J. Helberg (North-West University) |
| Abstract: | The Hybrid- Luby Transform network code is an encoding method proposed for the implementation in communication networks employing random linear network coding. This method enables receiver nodes to implement low complexity belief propagation decoding. In this paper we show that the implementation of sparse random linear network coding and a less frequent buffer flushing policy to H-LTNC enables near optimal belief propagation decoding in a random linear network coding scenario. |

| Title:  | 126: Significant Performance Improvement Obtained in a Wireless Mesh Network Using a Beam-Switching Antenna |

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**5: User Generated Content for an IMS-Based IPTV**

**Authors:** Denys Vera (University of Cape Town) and Neco Venture (University of Cape Town)

**Abstract:** Offering an IPTV service is one possible tactic for a Telco to stay relevant in the ever changing market. However, unless there is something to differentiate the offer from the competition, users will question why they need to subscribe. There has to be a unique selling point (USP) something that represents a compelling emotional reason to sign up for the service. This can be done by adding an extra service that has the potential to attract more users to the service. One such service is user-generated content (UGC). With the high success of UGC websites in terms of generating revenue through advertisements the success can be shared with IPTV channel attacks (particularly power analysis attacks) against wireless sensor networks and in addition discuss environments with no protective physical shielding. In this survey paper, we give an overview of the side channel information leakage (such as the power consumption, timing, and electromagnetic emanations). Wireless sensor networks are particularly vulnerable to these attacks as they are deployed in open environments with no protective physical shielding. These attacks are non-invasive in which an attacker can obtain confidential information such as secret keys by simply observing the side channel information leakage (such as the power consumption, timing, and electromagnetic emissions). Wireless sensor networks are particularly vulnerable to these attacks as they are deployed in open environments with no protective physical shielding. In this survey paper, we give an overview of the side channel attacks (particularly power analysis attacks) against wireless sensor networks and in addition discuss some of the suggested countermeasures against power analysis attacks.

**Fish Identification System**

**Authors:** Diego Keegan Mushfieldt (University of the Western Cape), Mehrdad Ghaziasgar (University of the Western Cape) and James Connan (Rhodes University)

**Abstract:** The Two Ocean’s Aquarium displays a large number of fish in its high-quality exhibits. Information about fish can only be obtained by asking an expert or by scanning through documentation in the aquarium. Therefore, information is not readily available. This research lays the foundation for the development of an interactive system that provides the user with instant feedback about a specific fish. A video camera captures a video sequence of fish swimming in a tank at the aquarium. The footage is displayed on the screen and the user can click on a fish. The system recognizes the fish species and displays the recognition result to the user. The system was tested on a total of 20 fish and achieved an overall recognition accuracy of 88.5% across all fish.

**107: Towards a Multilingual Recognition System Based on Phone-Clustering Scheme for Decoding Local Languages**

**Authors:** Edward Lebese (University of Limpopo), Jonas Manamela (University of Limpopo) and Nalson Gasela (University of Limpopo)

**Abstract:** This paper presents the development of a multilingual speech recognizer for Northern Sotho mixed with English. This multilingual style communication has inspired South African research groups affiliated to speech and language technology (SLT) to work towards the development of multilingual speech recognition systems that accept, accommodate and handle mixed speech encountered in daily communication episodes. The multi-pass and one-pass recognition frameworks are two reported schemes for development of a mixed speech recognition systems. To obviate problems of language boundary detection and language identification (LID) involved in the former scheme, the one-pass recognizer with a multilingual language and acoustic models is preferred. These models are used to support clustering of similar speech sounds across the targeted languages so as to reduce the recognition system training data and thereby contribute to the performance improvement of one-pass recognizer. The preliminary results of an HMM-based one-pass recognizer are presented.
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<th>Title</th>
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<td>4: Reliable Source Based Reactive Routing Protocol for Wireless Sensor Networks</td>
<td>Chabalala Stephen Chabalala (University of KwaZulu-Natal), Thippetswamy Nagendrappa Muddenahalli (Visvesvaraya Technological University, India) and Fambirai Takawira (University of the Witwatersrand)</td>
<td>Wireless sensor networks (WSNs) are characterized by scarcity of resources and highly unreliable wireless channels, whereby minimizing energy-consumption is a key issue in design of communication protocols for the battery powered sensor nodes. The work in this paper addresses the problem of finding energy-efficient routes for delivery of packets through multihop communication with modification to the standard dynamic source routing (DSR) algorithm, aiming to prolong the overall network lifetime in WSN. Simulation based performance evaluation is presented for the energy-efficient DSR (EEDSR) protocol in comparison with the DSR protocol. The simulation results reveal improved performance on energy-efficiency and network lifetime when using the new routing metric which incorporates link reliability for establishment of minimum energy routes for reliable delivery of packets; illustrating therefore that routing algorithms in WSNs should consider not only hopcount and the distance of individual links along a route, but also quality of the routes in terms error rates.</td>
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<td>20: Analysis of achievable capacity in irregularly-placed high performance mesh nodes</td>
<td>Thomas Olwal (CSIR), Albert A. Lysko (CSIR), David L. Johnson (University of California) and Mofolo O.R. Mofolo (CSIR)</td>
<td>Research has shown that wireless mesh network capacity improves with the increase of number of radio interfaces per node and the non-overlapping frequency channels. Recently, such high performance nodes (HPNs) have been successfully deployed in many areas including the rural South Africa. However, the problem of finding the achievable capacity of such network deployments, taking into account multipath channel links and irregular placements, has been considered a challenge. This paper derives the analytical results show that network capacity increases with the irregularity of HPNs placements, the number of antennas as well as the multiplicity of radios per HPN. Compared to the recent analytical results in literature, the HPN showed superior numerical capacity.</td>
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<td>45: Investigating the Effects of Packet Dropping and Packet Pollution Attacks in Network Coding Networks</td>
<td>HLHC Terblanche (North-West University), MJ Grobler (North-West University) and H Marais (North-West University)</td>
<td>Network Coding (NC) has introduced a new way to increase the capacity of networks, especially Wireless Mesh Networks (WMNs). There are many security threats when using NC in WMNs; We investigate the effects of packet pollution and packet dropping attacks in a NC environment. Packet pollution decreases the throughput of the network dramatically, while packet dropping does not have such a big effect. By adding security to NC the effects of these attacks can be decreased.</td>
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<td>89: Development of an Energy and Geographic Aware Opportunistic Network Coding Scheme</td>
<td>Mario Johann Engelbrecht (North-West University) and Magdalena Grobler (North-West University)</td>
<td>Mobile Ad-Hoc Networks and Wireless Sensor Networks are communication networks that consist of nodes with limited energy resources. Therefore, routing protocols implemented in such networks need to be aware of the energy levels in a network to enable them to route in an energy effective manner. Network Coding (NC) is a technique that optimises the throughput of a network. In this paper we investigate the effect of power failure of energy-constraint nodes on network throughput, and propose a NC scheme that not only increases the throughput of a network as opposed to traditional routing mechanisms, but also does so in an energy effective manner. The proposed scheme incorporates geo-routing into one of the leading NC schemes, CORE, and while it delivers more throughput than CORE, it also focusses on energy awareness resulting in extended lifespans of nodes in a network. The NC scheme is implemented and simulated in OMNET++ and the results show significant improvement in both network throughput and lifespans of nodes.</td>
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| 78: Soft decoding of Raptor codes over AWGN channels using Probabilistic Graphical Models | Rian Singels (University of Stellenbosch), Johan A. du Preez (University of Stellenbosch) and Riaan Wolhuter (University of Stellenbosch) | Raptor codes are a class of Fountain codes which can reach data transmission rates at the capacity of the Binary Erasure Channels (BEC’s) and has, therefore, been extensively researched and refined for hard-
decoding over these channels. These Raptor codes are ideal for packet transmission over the internet as it is a real world realization of the BEC's. This article extends the Raptor codes for soft-decoding, investigates its performance over Additive White Gaussian Noise (AWGN) channels, which can potentially be used for wireless broadcast with asynchronous data access. We start by reviewing the conventional problem formalization for Fountain codes and consider the constraints common for both hard- and soft-decoding. We explain how the traditional belief propagation (BP) update rules can be transformed in order to avoid computation over large distributions. The loopy BP algorithm (a.k.a. sum-product algorithm) as well as 2 improvements, expectation propagation and inactivation decoding, are applied for soft-decoding in order to maximize the usage of the information available at the decoder. Simulation results over the AWGN channel of the decoding methods are compared.

Title: 3: Performance Comparison of Routing Protocols in Mobile Ad hoc Networks using ftp Traffic
Authors: Michel Mbougni (North West University), Zenzo Polite Ncube (North West University) and Albert Helberg (North West University)
Abstract: Mobile Ad Hoc Networks (MANETs) are receiving a significant interest and are becoming very popular in the world of wireless networks and telecommunication. MANETs consist of mobile nodes which can communicate with each other without any infrastructure or centralized administration. In MANETs, the movement of nodes is unpredictable and complex; thus making the routing of the packets challenging. As the result, routing protocols play an important role in managing the formation, configuration, and maintenance of the topology of the network. A lot of routing protocols have been proposed as well as compared in the literature. However, most of the work done on the performance evaluation of routing protocols is done using the Constant Bit Rate (CBR) traffic. This paper involves the evaluation of MANETs routing protocols such as Ad hoc on Demand Distance Vector (AODV), Dynamic Source Routing (DSR), Temporary Ordered Routing Algorithm (TORA), and Optimized Link State Routing (OLSR) using file transfer protocol (ftp) traffic. The performance metrics used for the evaluation of these routing protocols are delay and throughput as function of the load; that is under light load and heavy load. The overall results showed that the proactive routing protocol (OLSR) performs better in terms of delay and throughput than the reactive routing protocols AODV, DSR and TORA for medium size MANETs.

Title: 111: Near Field Communication in Smart Sensing Applications
Authors: Charl Anton Opperman (University of Pretoria) and Gerhard Petrus Hancke (University of London)
Abstract: High-end smartphones have recently started to feature NFC capability. Since these smartphones are capable of performing an array of sensing tasks, in addition to having powerful processing and memory specifications, the possibility exists to use them as a platform for smart sensing. NFC communication can aid in making sensing applications more user-friendly by allowing quick data transfers between peer devices. In addition, NFC can be used to store data on RFID tags or to communicate with low power external sensors that may feature a passive NFC interface. In this way, low power or passive sensors can effectively outsource their processing and long-range communication needs to a smartphone. This paper discusses the implementation of a biometric verification system on an Android smartphone as a proof-of-concept.

Title: 28: Granting Privacy and Authentication in Mobile Ad Hoc Networks
Authors: Reevana Balmahoon (University of Kwazulu Natal) and Prof Roger Peplow (University of Kwazulu Natal)
Abstract: Privacy is implemented in the form of an anonymous identity or pseudonym, and ideally has no link to the real identity. Authentication ensures that the real identity can be verified. Privacy and authentication are conflicting tenets of security as the former hides a user's identity and the latter ensures a user's identity is known and certified. This paper proposes a novel approach for granting both privacy and authentication in VANETs.

Title: 64: Evaluating the Effect of a Topology Control Scheme on Application Layer Traffic Scenarios in Infrastructure Wireless Mesh Networks
Authors: Pragashen Mudali (University of Zululand), Murimo Mutanga (University of Zululand), Matthew Adigun (University of Zululand) and Ntsibane Ntlatlapa (CSIR)
Abstract: Infrastructure Wireless Mesh Networks (I-WMNs) are increasingly used to bridge the digital divide in rural areas around the world. Rural African areas in particular require energy efficient I-WMNs as the nodes comprising the I-WMN backbone network may be battery-powered in the absence of reliable power supplies. These networks are deployed to support a variety of applications, the most common being a combination of Web browsing, local telephony and video-conferencing. In this paper the effect of the PlainTC Topology Control scheme on the performance of Web traffic and local intra-mesh traffic is investigated via simulations. The evaluation has indicated that the PlainTC scheme is able to maintain a high level of network connectivity whilst producing cumulative transceiver power savings. PlainTC was also shown to negatively affect the performance of the two traffic scenarios being considered. The results indicate that PlainTC may be more suited to smaller network sizes. This finding is largely a result of the higher data rates enabled by reduced transceiver power levels, where a higher data rate enables greater throughput but has the unfortunate side-effect of saturating node buffers leading to higher packet losses in some scenarios.

Title: 55: Vehicular Ad-Hoc Networks: An Introduction to Privacy
Authors: Reevana Balmahoon (University of KwaZulu Natal) and Prof Roger Peplow (University of KwaZulu Natal)
Abstract: Vehicular Ad-Hoc Networks (VANETs) is an application of MANETs that allows for communication between road transport vehicles and promotes safety on roads. There are however situations that could cause harm to the vehicle and/or its occupants; vehicles could be tracked, followed or have their messages monitored. A method to protect the vehicle is to ensure it remains anonymous. This refers to privacy, i.e. hiding the vehicle’s real identity.

This paper provides an introduction to VANETs and puts into context authentication and privacy in VANETs. Reasons for why privacy and authentication are essential for a secure VANET are provided.

5. Converged Services

Title: 72: A Comparison of the bandwidth utilisation of Ethernet AVB and IEEE 1394b for streaming real-time audio with QoS using Network Simulation
Authors: Fred Otten (Rhodes University) and Richard Foss (Rhodes University)
Abstract: Network Simulation techniques can be used to evaluate and compare networks in different scenarios. IEEE 1394b and Ethernet AVB technologies can both be used for streaming real-time audio while maintaining Quality of Service (QoS). AudioNetSim is a network simulator designed specifically for simulating professional audio networks and provides support for both technologies. This paper uses AudioNetSim to compare the bandwidth utilisation of these two technologies using equivalent networks. It shows that, in general, Ethernet AVB networks are more efficient than IEEE 1394b networks for transmitting audio. At 100 Mbps, Ethernet AVB is able to transmit 11 additional audio channels. It also uses 12.975 percent less bandwidth to send a single stream consisting of 16 audio channels on a 100Mbps network.

Title: 29: A Solution for Integrating Layer 2 Controllable Audio Devices into a Layer 3 Network
Authors: Osedum Igumbor (Rhodes University) and Richard Foss (Rhodes University)
Abstract: AVB is an emerging layer 2 networking technology that allows for deterministic and guaranteed delivery of time sensitive data. This technology has been published by the IEEE. Also published by the IEEE is the IEEE 1722 standard which is a solution for encapsulating media for transmission on AVB networks. A IEEE 1722.1 working group was established to define a layer 2 standard for interoperability between networked AVB devices. As the IEEE 1722.1 working group strives to address interoperability between networked AVB devices, there remains the issue of interoperability between devices that conform to this developing standard (IEEE 1722.1) and those of already existing protocols. This paper presents a solution that allows devices that implement the proposed IEEE 1722.1 layer 2 control protocol to be controlled by an existing layer 3 protocol.

Title: 102: An Enhanced Bicasting Scheme for Proxy Mobile IPv6 with Buffering
Authors: Lebajoa Mphatsi (University of Cape Town) and Olabisi Falowo (University of Cape Town)
Abstract: Research trends in mobility management depict that handover delay and packet loss minimization are parameters of utmost importance in an endeavor to formulate a mobility management solution that offers seamless handovers as a mobile node changes points of attachment. This is largely driven by the requirement to offer uninterrupted real-time services to mobile users. It has also been noted that there is a current and future anticipated rapid increase of mobile data traffic volumes with the introduction of new innovative IP-based services. This thus calls for mobility management solutions that will be able to scale with the rapid traffic increase while still achieving seamless handovers. This paper introduces an enhanced Bicasting Proxy Mobile IPv6 (EB-PMIPv6) scheme that incurs minimal packet loss and handover delay while also efficiently utilizing network resources such as backhaul bandwidth and network elements' buffer space by executing the bicasting operation in a timely and accurate manner. This is achieved by using a signal strength prediction algorithm that estimates the viability of a link when a handover is imminent. The paper further provides an in-depth discussion of the proposed solution. The model of the solution has been implemented on the Network Simulator 2 (ns-2) and its performance is analyzed in regard to packet loss, handover delay. The results indeed show that the solution optimizes the performance of PMIPv6 handovers whilst also ensuring efficient network resources utilization, thus making it a much more scalable bicasting solution for PMIPv6.

Title: 100: Distributed Data Path and Mobility Function Scheme for PMIPv6 in Flattened Networks
Authors: Petro Pesha Ernest (University of Cape Town), Falowo E. Olabisi (University of Cape Town) and H. Anthony Chan (Futurerew Technologies, Plano, Texas)
Abstract: Proxy Mobile IPv6 is a most promising mobility management solution to pave a way toward all IP-based networks for the next generation networks. Many researchers are paying attention to PMIPv6 because of its network-based mobility feature. However, PMIPv6 relies on centralized and hierarchical mobility management approach that make it difficult to break away from problems such as single point of failure and bottleneck, and non-optimal routing path. To address these problems, a distributed mobility management scheme for PMIPv6 is proposed. The proposed scheme separates user’s data plane from control plane. It establishes a data path for an MN data along the shortest path between different access networks. The paper presents the scheme's design, operational mechanism and performance evaluation. The performance evaluation of the scheme has been conducted using mathematical models. The numerical results show that the proposed scheme has a much significant better packet delivery latency than PMIPv6.

Title: 68: QoS Management and Network Context Awareness for IPTV Services in the 3GPP Evolved Packet System
Authors: Joyce Mwangama (University of Cape Town) and Neco Ventura (University of Cape Town)
Abstract: In today’s increasingly technological environment the variety of mobile devices, and the types of services that can be offered on these, continues to grow. It becomes increasingly necessary to provide end-to-end guarantees for Quality of Service (QoS) requirements of these services, as required by the application and
6. Management

Title: 11: Analyses of the State-of-the-Art Digital Forensic Investigation Process Models
Authors: Aleksandar Valjarevic (University of Pretoria) and Hein Venter (University of Pretoria)
Abstract: Digital forensics gained much importance over the past decade. This is most prominently seen in the light of steady increase of information security incidents, and due to the fact that our society is so dependent on information technology. Performing a digital forensic investigation requires a standardised and formalised process to be followed. There is currently no international standard formalising the digital forensic investigation process, nor does a harmonised digital forensic investigation process exist. The research focus of this paper is to analyse the state-of-the-art digital forensic investigation process models. Relevant digital forensic investigation process models are analysed and conclusions are made on similarities, differences and possibilities for harmonisation. Based on the comparison performed, the authors conclude that there are numerous disparities among existing digital forensic investigation process models. However, the main and the most important principles for such a harmonised digital forensic investigation process are common amongst many of the models analysed in this paper. The authors believe that this analysis is a noteworthy contribution towards the future development of a harmonised digital forensic investigation process model. Having such a harmonised digital forensic investigation process model is important for the advancement of the digital forensics field, especially in order to reach higher admissibility of digital evidence in courts of law and to achieve better efficiency in digital forensic investigations.

Title: 6: A Practical Subsidy Driven Pricing Model for Heterogenous Communities
Authors: Mbuyu Sumbwanyambe (University of Johannesburg) and Andre’ Nel (University of Johannesburg)
Abstract: Pricing of telecommunication services in heterogeneous communities of developing countries is a daunting task and a very difficult one. The differences in social and economic factors among heterogeneous communities exacerbates the problem of developing a workable subsidy-driven pricing model. In developed countries different subsidy driven pricing mechanisms or economic models exists. In developing countries, however, this may require a different way of identifying potential subsidy beneficiaries, due to steep variations in incomes of users. Actually, the most likely question that governments of developing countries and individuals are likely to ask is; would increased internet penetration levels be realized by incorporating subsidies into communication economic models? The answer to this question is quite difficult and requires an understanding of the intricacies that come with social and economic dynamics of a heterogeneous community. Essentially, the administration of subsidies requires knowledge of the willingness-to-pay and users’ response towards price. In this paper we develop a pricing model through a case study approach conducted in South Africa and Zambia.

Title: 73: An Exploratory Framework for Extrusion Detection
Authors: Etienne Stalmins (Rhodes University) and Barry Irwin (Rhodes University)
Abstract: Modern network architecture allows multiple connectivity options, increasing the number of possible attack vectors. With the number of internet enabled devices constantly increasing, along with employees using these devices to access internal corporate networks, the attack surface has become too large to monitor from a single end-point. Traditional security measures have focused on securing a small number of network end-points, by monitoring inbound connections and are thus blind to attack vectors such as mobile internet connections and removable devices. Once an attacker has gained access to a network they are able to operate undetected on the internal network and ex-filtrate data without hindrance. This paper proposes a framework for extrusion detection, where internal network traffic and outbound connections are monitored to detect malicious activity. The proposed framework consists of prevention, detection, reaction and reporting. Each tier of the framework feeds into the subsequent tier with reporting providing a feedback mechanism to improve each tier based on the outcome of previous incidents.
network security program. One problem encountered by researchers in the sharing of the collected data form these systems. This is either due to the size of the data, or possibly a need to maintain the privacy of the Network address space being used for monitoring. This paper proposes a selection of metrics which can be used to communicate the most salient information contained in the data-set with other researchers, without the need to exchange or disclose the data-sets. Descriptive metrics for the sensor system are discussed along with numerical analysis data. The case for the use of graphical summary data is also presented.

Title: 66: Oligopolistic Competition in Heterogeneous Access Networks under Asymmetries of Cost and Capacity
Authors: Hailing Zhu (University of Johannesburg) and Andre Nel (University of Johannesburg)
Abstract: With the rapid development of broadband wireless access technologies, multiple wireless service provider (WSPs) operating on various wireless access technologies may coexist in one service area to compete for users, leading to a highly competitive environment for the WSPs. In such a competitive heterogeneous wireless access market, different wireless access technologies used by different WSPs have different bandwidth capacities with various costs. In this paper, we set up a noncooperative game model to study how the cost asymmetry and capacity asymmetry among WSPs affect the competition in this market. We first model such a competitive heterogeneous wireless access market as an oligopolistic price competition, in which multiple WSPs compete for a group of price- and delay-sensitive users through their prices, under cost and capacity asymmetries, to maximize their own profits. Then, we develop an analytical framework to investigate whether or not a Nash equilibrium can be achieved among the WSPs in the presence of the cost and capacity asymmetries, how the asymmetries of cost and capacity affect their equilibrium prices and what impact a new WSP with a cost and capacity advantage entering the market has on the equilibrium achieved among existing WSPs.

7. Standards, Regulatory & Environmental

Title: 54: Regulatory Compliance in Cloud Computing: An IT perspective
Authors: Melanie Viljoen (Nelson Mandela Metropolitan University), Rossouw von Solms (Nelson Mandela Metropolitan University) and Vivienne Lawack-Davids (Nelson Mandela Metropolitan University)
Abstract: All well-governed organizations should be able to demonstrate due diligence in ensuring regulatory compliance in applicable fields, including IT. Within the field of IT, a relatively new computing paradigm, cloud computing, is being adopted by organizations around the world. There are concerns regarding compliance with cloud computing. This paper highlights these concerns, and proposes a high-level set of guidelines for cloud computing regulatory compliance.

Title: 17: Comparison of Two Methods to Evaluate the Lognormal Raindrop Size Distribution Model in Durban
Authors: Oluwumi Adetan (University of KwaZulu-Natal) and Thomas. J. Afuollo (University of KwaZulu-Natal)
Abstract: This paper compares two methods of parameter estimation for lognormal raindrop size distribution model in Durban, South Africa. The methods are the maximum likelihood estimation (MLE) and the method of moments (MoM). Parameter estimates with the method of moments is found to give best fit compared with the maximum likelihood estimation technique. Large deviation error was observed between the measured and modelled raindrop size distributions with the MLE estimates over the rainfall rates considered. A comparison of the proposed lognormal model was made with different tropical regions and the results compare favourably well with these other locations.

Title: 33: Development of a Push-pull Converter for Fuel Cell Applications
Authors: Christian Kuyula (Vaal University of Technology) and Janse van Rensburg (Vaal University of Technology)
Abstract: Fuel cells have the advantage that they can be used in remote telecommunication sites with no grid connectivity as the majority of telecommunication equipment operates from a DC voltage supply. However, a fuel cell’s output power is highly unregulated resulting in a drastic drop in the output voltage with increasing load. Therefore, various DC–DC converter topologies with a wide range of input voltages can be used to regulate the fuel cell voltage to a required DC load. This paper presents the design and development of a push-pull converter with a wide voltage input in the 40 W range. The aim of this DC-DC converter is to convert the 22 - 46 V generated by a commercial proton exchange membrane fuel cell to a 13.8 V used to supply portable telecommunication equipment. The preliminary results of the experimental measurements of the prototype design are presented.

Title: 24: The effects of voltage, current and temperature on the operation of a RFC during hydrogen production
Authors: PJM van Tonder (Vaal University of Technology) and HCvZ Plenaar (Vaal University of Technology)
Abstract: This paper describes the effect of temperature on the production of hydrogen in a regenerative fuel cell (RFC). It also addresses the effects of the applied voltage/current on the production of hydrogen in a RFC. The optimum working voltage was found by experiments performed on a custom built three cell stack.

Title: 12: Spectral Opportunity Modelling in the Terrestrial Broadcast Frequency Spectrum
Authors: Melvin Ferreira (North-West University) and Albert Helberg (North-West University)
Abstract: In this paper we develop a model to estimate the Spectral Opportunity in the terrestrial broadcast frequency spectrum. These opportunities are also referred to as TV White Space. To this end we discuss our modelling approach in detail. We apply the model to the latest publicly accessible South African terrestrial broadcast frequency assignments and give a conservative estimate of the available Spectral Opportunity in the Gauteng province of South Africa.
8. Data Centre & Cloud

Title: 74: Proactive dynamic spectrum access based on energy detection
Authors: Simon Daniel Barnes (University of Pretoria), Kahesh Dhuness (University of Pretoria), Robin Rajan Thomas (University of Pretoria) and Bodhaswar Tikanath Jugpershad Maharaj (University of Pretoria)
Abstract: Cognitive radio (CR) is a promising next generation technology which aims to utilise radio frequency spectrum resources in an efficient manner. CR applications, should be able to sense a primary user (PU) by using energy detection. In this paper, the methodology behind energy detection is discussed and a theoretical expression for the probabilities of missed detection and false alarm, for an unknown deterministic signal, is provided. This theoretical expression has been shown to predict receiver operator characteristic (ROC) detection results, which would typically be encountered during energy detection of a TV band. The ROC results further suggest that a SNR value of higher than 11 dB would be required under Rayleigh fading channel conditions in order to conform to the detection characteristics imposed by the IEEE 802.22 standard. Once spectrum sensing has been performed, a secondary user may be allocated radio resources. A proactive approach to dynamic spectrum access is employed in this paper, where channel switching decisions are based on near future channel occupancy predictions. Results indicate that increasing the number of channels available to the SU as well as the number of predicted near future time slots to an optimal point, significantly improves the channel allocation process. For the channel conditions simulated in this paper, results indicate that the optimal number of channels that should be available to the SU is eight and that the optimal number of near future time slots that should be utilised to perform proactive dynamic spectrum access is five.

Title: 80: Dynamic Spectrum Access: regulations, standards and green radio policy considerations
Authors: Luzango Mfupe (Tshwane University of Technology), Moshe Masona (CSIR), Thomas Olwal (CSIR) and Prof. Mjumo Mzeyece (Tshwane University of Technology)
Abstract: Dynamic spectrum access (DSA) technologies are increasingly viewed as a potential solution to improve overall spectrum utilisation efficiency and for bridging the digital divide in the rural areas. In particular, DSA technologies have the ability to sense and opportunistically access radio frequency (RF) spectrum that lies fallow at any particular time or space. However, in order to achieve successful deployment of these technologies, spectrum regulators need to implement reforms to their existing spectrum management regulations. In this context, this paper investigates conventional and emerging RF spectrum regulations and standards necessary to realise maximum benefits that such technologies might bring. In addition, this paper considers the ever-growing negative environmental impact caused by the information and communication technologies (ICT) sector. The paper suggests that any new dynamic spectrum management regulations should go hand-in-hand with the promotion of green communications networks policies.

Title: 125: FSL Based Estimation of White Space Availability in UHF TV bands in Bergvliet, South Africa
Authors: Albert A. Lysko (CSIR), Moshe T. Masona (CSIR), David L. Johnson (CSIR) and Hennie Venter (Grintek Ewation)
Abstract: The paper describes the predictions made for Bergvliet, South Africa in terms of the availability of the frequency spectrum occupied by analogue TV broadcast around that area. The focus is made on the availability of under-used TV channels in the UHF TV frequency bands. The free space loss (FSL) formula, together with a line of sight condition, are applied to the information about the location and power of TV transmitters around this area. The predictions show 61% correlation between the measurements and predictions and indicate that 3 to 12 television channels are available, out of 39 tested (16 to 96 MHz out of 312 MHz measured), where the availability is defined by the strength of signal being less than or equal to -114 dBm.

8. Data Centre & Cloud

Title: 57: Live Migration of VoIP Services in Virtualized Servers
Authors: Phillip Nkubito (University of Cape Town) and Alexandru Murgu (University of Cape Town)
Abstract: Virtual machine (VM) live migration is a core feature in resource management within data centres as it allows running applications to be relocated to another host so as to maintain SLA or for host maintenance purposes, with near zero degradation to the performance of the hosted service. This process however has its shortcomings in that it creates resource constraints on the source host. This in turn negatively affects the performance of the migrating application on the source host. This paper aims at identifying these resource overheads and the performance degradation on the service running in the VM. As a demonstration case, a testbed is setup with Asterisk, an IP telephony application, running within a virtual machine (VM) on a Xen hypervisor.

Title: 122: Procedures for a Harmonised Digital Forensic Process in Live Forensics
Authors: George Sibuya (CSIR), H. S. Venter (University of Pretoria) and Thomas Fogwill (CSIR)
Abstract: Cloud computing is a novel computing paradigm that presents new research opportunities in the field of digital forensics. Cloud computing is based on the following principles: on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service. These principles require that cloud computing be distributed internationally. Even if the cloud is hosted locally, it is based on multi tenancy, which is a challenge when using an advanced "dead" forensic approach. For these reasons, digital forensic investigations in cloud computing need to be performed on live systems. There are challenges in cloud forensics itself, as there are no standardised digital forensic procedures and processes. This paper is part of an effort by the authors to standardise the digital forensic process, and we therefore focus specifically on live forensics. Since cloud computing services are provisioned over the Internet, live forensics and network forensics form an integral part of cloud forensics. In a bid to standardise a digital forensic process in cloud computing, there is a
need to first focus on live forensics and network forensics. In this paper we present digital forensic procedures on live forensics that follow the draft international standard for Investigation Principles and Processes. A standardised live digital forensic process will form part of a standardised cloud forensic process.

**Work In Progress: 1. Access Network Technologies**

**Title:** 108: Authentication in the Cloud: A Risk-based Approach  
**Authors:** Moses Thandokuhle Dlamini (University of Pretoria), H.S. Venter (University of Pretoria), J.H.P Eloff (University of Pretoria) and Yusuf Mitha (University of Pretoria)  
**Abstract:** Most companies are moving their data and applications to the cloud in order to exploit the numerous benefits that this computing paradigm presents. Yet, there is still insufficient research on how user authentication and identity management are to be handled on cloud computing environments. Cloud computing challenges the way people think about authentication and how to manage user identity across multiple domains. Hence, this paper outlines the requirements for user authentication and handling identity on the cloud. It goes further to discuss real world scenarios that illustrates the multi-faceted nature of handling authentication within a cloud environment. The main contribution of this paper is our proposed cloud-based authentication architecture. Our architecture makes a proposal on how to provide flexible, robust and scalable authentication by taking a risk-based approach to user authentication on cloud environments.

**Title:** 136: Polarization Effects on the Phase of a 4.25 GHz Reference Clock Signal Transmitted over Optical Fibre for Applications such as the Square Kilometer Array (SKA)  
**Authors:** Hamed Y. S. Kourouma (Nelson Mandela Metropolitan University), Enoch K. Rotich Kipnoo (Nelson Mandela Metropolitan University), David Waswa (Nelson Mandela Metropolitan University), Romeo Gamatham (Nelson Mandela Metropolitan University), Andrew Leitch (Nelson Mandela Metropolitan University) and Tim B. Gibbon (Nelson Mandela Metropolitan University)  
**Abstract:** The Square Kilometer Array (SKA) project will require the use of extremely accurate timing and reference clock signals to ensure the optimum performance and sensitivity of the telescope network. In this paper, we report on the consequences of polarization mode dispersion (PMD) and polarization fluctuations on the phase of a 4.25 GHz reference clock signal transmitted over optical fibre.

**Title:** 148: An Intelligent Cognitive MAC for Undertermined Primary User Activity Pattern  
**Authors:** Mukiza Bwakea (University of Cape Town) and Olabisi Falowo (University of Cape Town)  
**Abstract:** Dynamic spectrum access and management is poised to be a sustainable solution to the seemingly overcrowded radio spectrum, with cognitive radio forming the basis of this solution. A cognitive user (user implying either a mobile/static node or a BS) operating on a foreign channel has to learn about its environment and transmit accordingly without posing interference to a primary user (PU) with rights to that channel. This non-interference mode of operation imposed on a secondary user essentially abstracts the MAC functionality into three intertwined modules: A channel statistics management module, a dynamic channel allocation module, and a dynamic spectrum access/sharing module. Current solutions to channel statistics collection are partially optimized with respect to the dimensions which have a bearing on the performance of a cognitive network. Sub-optimal channel allocations techniques are prevalent as optimal ones are computationally intensive, hence limiting the degree to which QoS requirements are met. Dynamic spectrum access protocols proposed in the literature do not complement channel sensing and allocation policies, effectively offsetting any optimization gain achieved by them. This research aims at tailoring self-learning techniques (as developed in the Artificial Intelligence front) to enable a cognitive user to autonomously infer Pus activity pattern from accumulated channel statistics, and decide on the optimal channel sensing protocol. Also, an optimal channel allocation algorithm will be developed, as well as a channel access protocol that supports and complement the aforementioned functionality.

**Title:** 137: Analysis of VCSEL Transmission for the Square Kilometre Array (SKA) in South Africa  
**Authors:** Enoch Kinwa Rotich (Nelson Mandela Metropolitan University), Hamed Kourouma (Nelson Mandela Metropolitan University), David Waswa (Nelson Mandela Metropolitan University), Andrew A. R. Leitch (Nelson Mandela Metropolitan University) and Tim B. Gibbon (Nelson Mandela Metropolitan University)  
**Abstract:** For the first time, we propose the use of Vertical Cavity Surface Emitting Lasers (VCSELs) within the optical fibre network supporting data collection and transmission for Square Kilometre Array (SKA) South Africa. We give theoretical analysis for VCSEL transmission over typical SKA required distances. This work is valuable in providing SKA with a VCSEL technology, an option for extremely high network performance at reasonable cost.

**Title:** 189: User Analysis for Effective Resource Planning in Hybrid Computer Networks  
**Authors:** Melanie Delport (North-West University), Magdalena Johanna Grobler (North-West University) and Henri Marais (North-West University)  
**Abstract:** Increased popularity and user demand for networking and resource sharing calls for effective provisioning of network resources. By deriving user requirements with respect to network resources a resource provisioning scheme may be developed to incorporate these requirements. User analysis is introduced as a method of determining the inferred user requirements for the development of such a scheme to more effectively plan network resources in hybrid computer networks.

**Title:** 166: Rate-Compatible Product-Code Scheme for Wireless Channel  
**Authors:** Sibonginkosi Ntuli (University of the Witwatersrand), Jaco Versfeld (University of the Witwatersrand) and Ling Cheng (University of the Witwatersrand)  
**Abstract:** The wireless channel has become one of the leading communication channels in today’s world. Its tether-less
connectivity is very attractive to users. This can be noted in how it has been well adopted in both the developing and developed nations.

As mobile devices move from devices that are used for voice and simple text communication, to devices that are more multimedia oriented, the need to make communication on the relatively noisy communication channel more reliable becomes more imperative. FEC has been used to mitigate the impact of noise on the wireless channel. When developing a FEC scheme one needs to take into account the compromise between the error-correcting capability of the FEC technique, the code rate and the delay introduced by the decoding complexity. In this study we propose to address these three considerations by the use of rate adaptable product codes to mitigate the impact of noise on wireless channel.

### Work In Progress: 2. Converged Services

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<th>Title</th>
<th>Authors</th>
<th>Abstract</th>
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<td><strong>173: A Test-bed Implementation of Energy Efficient Wireless Sensor Network Routing Protocols</strong>&lt;br&gt;Authors: Joubert George Jacobus Krige (North-West University), Magdalena Johanna Grobler (North-West University) and Henri Marais (North-West University)&lt;br&gt;Abstract: Energy consumption plays an important role in wireless sensor networks (WSNs) due to the fact that most sensor nodes are powered by batteries or other limited energy sources. The routing protocol used by the WSN has an impact on the total energy consumption of the system and the performance of routing protocols can differ from simulations when physically implemented. This is due to the assumptions made when modelling the WSN. By physically implementing and comparing energy efficient WSN routing protocols the actual performance of these protocols can be evaluated. As part of the research sensor nodes will be developed and used to construct a WSN test-bed.</td>
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<td><strong>151: Link Quality Aware Routing in Wireless Underground Sensor Networks</strong>&lt;br&gt;Authors: Bruno J. Silva (University of Pretoria) and Gerhard P. Hanccke (University of Pretoria)&lt;br&gt;Abstract: Hop count based metrics utilized in routing protocols do not explicitly reflect link quality. For wireless underground sensor networks, where communication is susceptible to high path loss and dynamic channel conditions, routing protocols with link quality based routing metrics could provide superior performance. An outline for an investigation into how link quality routing metrics perform in wireless underground sensor networks is presented.</td>
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<td><strong>179: Socio-Economic Aspects of Voice-over-IP Technology in Rural SA</strong>&lt;br&gt;Authors: Zukile Roro (University of the Western Cape), Carlos Rey-Moreno (University of the Western Cape), William David Tucker (University of the Western Cape) and Masibulele Jay Siya (University of the Western Cape)&lt;br&gt;Abstract: This paper describes work in progress towards developing a business case and preliminary design for an 802.11-based mesh network in the remote rural community of Mankosi in the Eastern Cape province of South Africa. Aside from the technical challenges to building the network to be sustainable in the long term, this network needs to generate some revenue. Hence, there needs to be a business model that has revenue generation potential. This study will explore the economical and social aspects of voice over Internet-Protocol as service for this community. After talking to the village leaders, we learned that there is a demand for telecommunication services and that most of them were interested only in telephony service. Very few villagers were interested in or had any knowledge about the Internet. We also learned that most of their cellular phone calls are local within the Mankosi community. This allows us to deploy an experimental local telephony service; a perfect opportunity for a low-cost and low-costing inverse mesh infrastructure that can easily be connected to breakout and Internet services in the future.</td>
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<td><strong>138: Robust and Accurate Hand Motion Recognition</strong>&lt;br&gt;Authors: Mehrdad Ghazisaghar (University of the Western Cape) and James Connnan (Rhodes University)&lt;br&gt;Abstract: The SASL Research Group at the University of the Western Cape aims to develop an automatic machine translation system that translates full sentences between South African Sign Language (SASL) and English. A major component of such a system is the recognition of sign language phrases from a video captured by a web or mobile phone camera. Five parameters characterize any sign language phrase uniquely, namely: the shape, motion, orientation and location of the hands, as well as facial expressions. The recognition of sign language would therefore entail the extraction of each of these parameters from a video. This research focuses on the accurate and robust recognition of hand motion sequences from a video.</td>
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### Work In Progress: 3. Data Centre & Cloud

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<th>Title</th>
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<tr>
<td>156: A Cloud Computing Platform to Augment Mobile Phone Use in Marginalized Rural Areas</td>
<td>Thoba Lose (University of Fort Hare) and Mamello Thinyane (University of Fort Hare)</td>
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<tr>
<td>Abstract</td>
<td>The proliferation of mobile devices and the recent developments in computing technology hold the potential of addressing the digital divide challenge, which is pertinent in Marginalized Rural Areas (MRAs). Simultaneous developments in cloud computing also provide new ways of offering innovative ICT solutions, typically in enterprise environments. Mobile Cloud Computing, which is a combination of mobile computing and cloud computing, provides ideal services to support mobile users in MRAs. In Mobile Cloud Computing, mobile devices do not need high-end resources (e.g., processing speed, storage and memory capacity) since all the data and complex computing can be offloaded to the cloud. In this research, we propose the use of Cloud Computing infrastructure to augment the use of mobile phones in Information and Communication Technology for Development (ICTD) contexts. We investigate the kinds of services the cloud can offer to improve and support the use of mobile phones. We also aim to implement a Mobile Cloud Computing Platform for use within an ICTD intervention, called Siyakhula Living Lab (SLL).</td>
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<td>187: Investigating the Use of Proxemic Interaction Support Co-located Group Information Management</td>
<td>Justin Swanepoel (Nelson Mandela Metropolitan University), Dieter Vogts (Nelson Mandela Metropolitan University) and Janet Wesson (Nelson Mandela Metropolitan University)</td>
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<td>Abstract</td>
<td>Group Information Management (GIM) is the management of personal information by multiple people in order to accomplish tasks, often employing simple tools such as email or shared files to accomplish these tasks. Using a multi-touch surface to collaborate, group information can be simultaneously accessed by multiple users, effectively enabling them to coordinate their communication and collaboration. Multi-touch surfaces are limited by touch sensors, which cannot detect or track the user identity. This limitation creates security problems as users may collaborate on sensitive information not intended to be shared with unauthorised users. Proxemic Interaction gathers detailed information about the location, identity and orientation of users and their devices and uses this information to interact with the system. GIM systems could possibly benefit from Proxemic Interaction to address issues such as security and enable interaction from a distance. This research investigates the potential of using Proxemic Interaction to address existing issues with co-located GIM on multi-touch surfaces and identifies opportunities of new interaction methods to support GIM.</td>
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<td>143: Investigating the Use of a Multi-touch Surface to Support Co-located Group Information Management</td>
<td>Mohammed Ali Ditta (Nelson Mandela Metropolitan University), Janet Wesson (Nelson Mandela Metropolitan University) and Lester Cowley (Nelson Mandela Metropolitan University)</td>
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<td>Abstract</td>
<td>Personal Information Management (PIM) involves four major activities: keeping, finding, organising and maintaining information. Group Information Management (GIM) extends PIM by adding the sharing aspect. GIM can be defined as PIM in a public space. GIM is currently supported by non-co-located single user desktop systems. Groups of individuals working on common tasks to achieve shared goals need to coordinate their activities to ensure that no overlapping of work or misunderstandings occur which decrease efficiency. These groups may have to meet face-to-face to discuss and arrange meetings, information discovered and shared information. Multi-touch surfaces have proved successful in aiding collaborative information retrieval (CIR) which is related to GIM. This suggests that GIM can be supported using a multi-touch surface. This research is aimed at determining the effectiveness of using multi-touch interaction techniques to support co-located GIM.</td>
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<td>150: Single-pixel approach for fast people counting and direction estimation</td>
<td>A. O. Adegboye (University of Pretoria), G. P. Hancke (University of Pretoria) and G.P. Hancke Jr. (University of Pretoria)</td>
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<td>Abstract</td>
<td>People detection and counting is an important application in visual surveillance and security. In recent years, it has attracted a lot of attention. However, it remains a challenging and complex task for cases where occlusions, varying illumination and weather conditions are experienced. In order to bypass and resolve these challenges, a two-part method based on feature extraction is proposed. In the first part, a single-pixel method for background segmentation is proposed, and in the second part, a virtual-line direction-estimation method is proposed where the direction in which the person is moving is estimated before counting. This method aims to overcome the shortcomings of people detecting, tracking and counting methods.</td>
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<td>133: Towards Providing Security as a Service for Grid-Based Infrastructures</td>
<td>Ezekiel Olatunji (University of Zululand), Edgar Jembere (University of Zululand) and Matthew Adigun (University of Zululand)</td>
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<tr>
<td>Abstract</td>
<td>A large scale service-oriented computing like grid presents several unique and challenging security issues that are not addressed by traditional client-server / distributed environment, especially with respect to authentication and authorization. The currently existing authentication and authorization frameworks for client-server distributed systems are not satisfactory in meeting the access requirements of a grid environment. Such requirements include the need to have support for multiple authentication and authorization mechanisms. This research work proposes a security framework that will provide the higher-level security functions of authentication and authorization as reusable services for grid-based infrastructures. The proposed security-as-a-service (SecaaS) framework will have support for multiple mechanisms for authentication and authorization, so that grid entities (services, resources, service requestors and service providers) can freely subscribe to their preferred mechanism for authentication and/or authorization. This research will involve in-depth literature survey, prototype implementation of the SecaaS architecture and evaluation of the framework through simulation experiments.</td>
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Work In Progress: 4. Internet Services & End User Applications

Title: 139: Mobile Application Development for Converged Telecommunication/Internet Environments
Authors: Sylvester Honye (Rhodes University), Hannah Thinyane (Rhodes University) and Mosiuoa Tsietsi (Rhodes University)
Abstract: In the last few decades, the telecommunications and Internet worlds have been converging. This has resulted in the proliferation of Open Web APIs, which enable communication to occur over the Internet using telco infrastructure. Ultimately this has led to the emergence of telco-mashups: value added services developed by combining services from both worlds. At the same time, there have been steep increases in the number of high-end mobile devices that support the delivery of rich services. Combined, these two trends have given rise to the need to develop mobile tools and guidelines that support the creation and execution of telco-mashups. This paper discusses work in progress towards the development of these tools and guidelines.

Title: 147: The Potential of Mobile Video As a Medium for Training Low Literate Audiences
Authors: Maletsabisa Molapo (University of Cape Town) and Gary Marsden (University of Cape Town)
Abstract: Current priorities in rural development programs include training low-literate rural inhabitants in areas such as health, agriculture and entrepreneurship. Different research initiatives have been taken to explore ways in which Information and Communication Technologies (ICTs) can be used to facilitate training and information dissemination to the low-literate audiences in developing countries. In this paper, we analyse some of such initiatives and suggest from the analysis that video, when distributed to mobile phones, could be an effective means of delivering non-textual training content in rural areas. We then present our research involving the use of mobile phone videos in training low-literate community health workers in Sierra Leone and Lesotho.

Title: 153: A framework for the static analysis of malware focusing on signal processing techniques
Authors: Sascha Zeisberger (Rhodes University) and Barry Irwin (Rhodes University)
Abstract: The information gathered through conventional static analysis of malicious binaries has become increasingly limited. This is due to the rate at which new malware is being created as well as the increasingly complex methods employed to obfuscating these binaries. This paper discusses the development of a framework to analyse malware using signal processing techniques, the initial iteration of which focuses on common audio processing techniques such as Fourier transforms. The aim of this research is to identify characteristics of malware and the encryption methods used to obfuscate malware. This is achieved through the analysis of their binary structure, potentially providing an additional metric for autonomously fingerprinting malware.

Title: 164: Speech Emotion Recognizer for Northern Sotho
Authors: Pressinah Moloto (University of Limpopo), Jonas Manamela (University of Limpopo) and Nalson Gasela (University of Limpopo)
Abstract: As a component of human-machine interaction, automatic speech recognition (ASR) technology allows a computer to identify words that a person speaks and converts them to written (or equivalent) text format. A speech emotion detector is very important for the proper handling of man-machine interaction and dialogue. It is therefore necessary to automate and identify a speaker’s emotional state when using speech recognition tools. In a public service environment, detection of emotions in communication episodes is more likely to deliver correct and accurate assessment of the service rendering process. This paper proposes and describes the enhancement of a speech detection system to enable it to detect emotions in a Northern Sotho speech. The Hidden Markov Model (HTK) is used to capture and calculate the characteristics: pitch, mel-frequency cepstral coefficients (MFCCs) and formants of speech signal for emotion detection. We first investigated the ability of the people to detect emotions by a person. Preliminary results showed that 72% of the speech data recorded for 54 emotional speech utterances were manually correctly evaluated.

Title: 175: Normandy: A Framework for Implementing High Speed Lexical Classification of Malicious URLs
Authors: Shaun Egan (Rhodes University) and Barry Irwin (Rhodes University)
Abstract: Research has shown that it is possible to classify malicious URLs using state of the art techniques to train Artificial Neural Networks (ANN) using only lexical features of a URL. This has the advantage of being high speed and does not add any overhead to classifications as it does not require look-ups from external services. This paper discusses our method for implementing and testing a framework which automates the generation of these neural networks as well as testing involved in trying to optimize the performance of these ANNs.