



Department of Computer Science and Software Engineering

2017 Departmental Postgraduate Conference

September 7-8, 2017
Lecture Theatre 031, Erskine Building

Principal Sponsor



Also sponsored by:



Thursday 7 September (Erskine room 031)

Session 1 *Chair Tanja*

CS Honours (Judges: Mukund, Walter)

9:00	Welcome: Richard Keynote Speaker: Ross Atkins (Telogis): Telematic Data is for Everyone
9:30	Dion Woolley: Can I Have Your Attention
9:45	Logan Glasson: Lazy Execution in Imperative Languages
10:00	Matthew Gordon: Effect of Nudges in Active Video Watching
10:15	Joshua Krijnen: Markerless 3D motion estimation using 2D anatomical landmarks
10:30	Amelia Samandari: Security Modeling for Mobile IoT Networks
10:45	Christian Suppan: GPU accelerated reconstruction of 3D meshes from HRCT contours

11:00 **MORNING REFRESHMENTS upstairs in the level 2 tea room**

Session 2 *Chair: Mukund*

Masters (Judges:, Andreas, Mukund, Walter)

11:30	Timothy Irving: Autonomous Tree Pruning UAV: The Cut
11:45	Sam Schofield: Visual Odometry for Autonomous UAVs.
12:00	Chathrie Wimalasooriya: Effort estimation of software maintenance tasks
12:15	Di Wang: Understanding the Software Development Industry in New Zealand
12:30	Zane Barker: Penguins to People: Drone Based Signal Detection

12:45 **LUNCH upstairs in the level 2 tea room**

Session 3 *Chair: Tom*

PhD (Judges: Tanja, Tom, Matthias)

1:45	Orion Health – Diana Venter
2:00	Daniel Barry: UAV Search Formations For Wireless Signal Detection
2:20	Andrew Curtis-Black : An Enterprise Policy Description Framework for Software Defined Networking
2:40	Geela Fabric: A Comparison of Different Types of Learning Activities in a Mobile Python Tutor

3:00 **AFTERNOON REFRESHMENTS upstairs in the level 2 tea room**

Session 4 *Chair: Andreas*

3:20	Joshua McCulloch: Modelling overhead utility networks using LIDAR to predict network behaviour and outages
3:40	Mengmeng Ge: Proactive Defense Mechanisms for the Software-Defined Internet of Things with Non Patchable Vulnerabilities
4:00	Matthew Ruffell: Dapper Linux: A Family of Secure, Easy to Use Operating Systems for Modern Computing Environments

Friday 8 September (Erskine room 031)

Session 5 *Chair: Matthias*

- 10:00** **Huyuan Shangguan**
Video based motion capture in environments with non-stationary background
- 10:20** **Ashish Sharma**
Using Animated pedagogical agents to Promote Collaboration and Self-Regulated Learning in Intelligent Tutoring Systems
- 10:40** **Prerna Singh**
Modelling, speckle simulation and quality evaluation of synthetic ultrasound Images.
- 11:00** **Manpreet Manpreet**
Tracing software architecture design decisions to their implementation in source code

11:20 **MORNING REFRESHMENTS upstairs in the level 2 tea room**

Session 6 *Chair: Walter*

- 11:40** **Matthew Young**
LiDAR Terrain Mapping with an Autonomous Ground Vehicle
- 12:00** **Simon Yusuf**
Evaluating the Effectiveness of Security Metrics for Security Analysis
- 12:20** **Dilli Sharma**
Moving Target Defenses for Software-Defined Networking Security

12:40 **LUNCH upstairs in the level 2 tea room**

Session 7 *Chair: Dongseong*

- 1:20** **Matthew Edwards**
High-accuracy fiducial markers for ground truth in challenging environments
- 1:40** **Ashley Williams**
Toward the use of practitioner-generated evidence for software engineering research.
- 2:00** **Enos Chen**
Maximising Learning by adaptively providing learning support in SQL-Tutor

2:20 **AFTERNOON REFRESHMENTS upstairs in the level 2 tea room**

Session 8 *Chair: Kourosh*

- 2:40** **Tieta Putri**
Learning the style of great masters using computational creativity
- 3:00** **Shinichi Yamada**
Multiple Kernel Learning with One-level Optimization of Radius and Margin
- 3:20** **Ori Ganoni**
Using Game Engines for Scientific Simulations

4pm **Social gathering/Awards Ceremony in the Staff Club**

Location: www.staffclub.canterbury.ac.nz/contact.shtml

Abstracts

Keynote Speaker

Ross Atkins - Telogis

Dr Ross Atkins is a Data Scientist in the Data Trust Team at Telogis. Prior to working at Telogis he was at the University of Oxford, researching random graphs and genetics. He has a PhD in Statistics and a masters in Computer Science, both from the University of Oxford.

Telematic Data is for Everyone

Telematic data is becoming more valuable everyday, and there is growing demand for computer scientists to handle this data. Through examples in chaos theory and the Braess paradox, we know that telematic data doesn't always behave the way you might expect. This talk will focus on the challenges faced by the computer scientists who work in this industry and how everyone benefits, from good solutions to these problems.

CS Honours

Logan Glasson

Lazy Execution in Imperative Languages

Lazy evaluation is a feature found in some functional languages, such as Haskell. It means that rather than computing the value of an expression when it is first encountered, the computation of the value of an expression is deferred until that value is actually needed. This allows for interesting things such as the definition of infinite data structures, which are only evaluated as they are used. We explore how a similar concept of laziness could apply to a more familiar imperative language. A simple imperative language featuring lazy execution is presented, and some examples which demonstrate this feature are given.

Matthew Gordon

Effect of Nudges in Active Video Watching

Video-based learning is becoming more pervasive across a variety of educational situations. However, video watching suffers from being inherently passive; previous research has shown that students who interact with videos learn more effectively, but interaction rates remain low nonetheless. Recent research has looked to add interactivity to videos to avoid disengagement. We encourage interactivity by introducing nudges into AVW-Space, a platform for teaching presentation skills by active video watching. These nudges build on AVW-Space's existing commenting approach by reminding users to make comments on different features of the video at opportune times based on student progress and video interaction patterns, as well as surfacing other relevant comments as stimulus for students. Accompanying visualisations of other student activity are also described. Results of a recent evaluative study are presented and possible improvements discussed.

Joshua Krijnen

Markerless 3D motion estimation using 2D anatomical landmarks.

I will present my research into extending and testing the capabilities of a state-of-the-art method of 3D human pose reconstruction developed by V. Ramakrishna, T. Kanade, and Y. Sheikh (2012). This

method allows for the estimation of 3D human joint locations from joint locations in a 2D image. The goal of the study is to analyse the accuracy and performance of this method, identifying failure cases, and exploring potential improvements. The presentation will detail the contribution of this study, prior work, progress to date, and future progress.

Amelia Samandari

Security Modeling for Mobile IoT Networks

The Internet of Things (IoT) is a network comprised of heterogeneous devices that may contain security vulnerabilities. Since IoT devices communicate wirelessly and can therefore be mobile, the attack surfaces of IoT networks can change. The results of static network analysis cannot capture these changes in the attack surface.

Our approach uses mobility models to describe patterns in the movement of mobile IoT devices. Graphical security models are used to capture potential attack paths in IoT networks with respect to the devices' connections and vulnerabilities. Security metrics are then used to analyse the security of the network.

The feasibility of the proposed approach is demonstrated by analysing the security of an example mobile IoT network using three existing mobility models: Random Waypoint, Gauss-Markov and Reference Point Group Mobility. The resulting security analysis of the IoT network can be used as a tool to better support security decisions.

Dion Woolley

Can I Have Your Attention

Increasingly manufacturers of cars and other vehicles are consolidating more of the vehicles non-critical controls into centralised touch displays. This poses a problem of attention deficit by the operator of a vehicle. With traditional analogue controls, the operator can reach out and use haptics to find the switch or dial they want to change, with little deviation of attention from their primary task of operating the vehicle. However, touch displays offer no haptic feedback, so the operator is forced to deviate their attention from their primary task to perform the same non-critical action. A frequent occurrence of this interaction is changing the radio station while operating a car on the road. To solve this problem, we propose using a capacitively permeable stencil like overlays on the touch displays, which produce a different haptic response above UI elements on the display. Haptic responses are created using divots in the stencil overlaying the UI elements, in combination with changes in materials. The haptic response enables an operator to distinguish where their fingers are on the display while minimising their attention required to perform a non-critical task.

Masters students

Zane Barker

Penguins to People: Drone Based Signal Detection

Finding victims quickly is crucial to minimising the number of casualties after a major natural disaster. As it so happens, people are increasingly carrying around wireless "beacons" (cellphones, fitness trackers, etc.) which can theoretically be used to determine their location. The purpose of this research is to develop a method of localising victims using a drone based software defined radio (SDR) platform. A similar problem is locating animals for conservation reasons. A much simpler platform has been developed following the population distribution of penguins in the Auckland Islands.

Timothy Irving

Autonomous Tree Pruning UAV: The Cut

An autonomous tree pruning UAV is currently being developed as a proof of concept. The long term goal of this technology is to have a UAV or UAVs perform large scale tree pruning for the forestry sector. The project consists of several components which are being completed by multiple individuals. This presentation focuses on work being completed to identify a cut location on a branch, and accurately position a pruner attached to the UAV to prune the branch. The pruner is attached to the UAV via a servo to provide one degree of freedom for improved pruner precision and stabilisation. The cut location is to be detected in three-dimensional computer vision. The detector needs to be robust and accurate. A number of methods from machine learning have been identified as potential solutions. Machine learning has only recently established itself as a state of the art method for three-dimensional object recognition problems. There is little work published that uses these methods for precise feature location, so the effectiveness and adaptability of these methods stands as a question of research.

Sam Schofield

Visual Odometry for Autonomous UAVs.

For a UAV to navigate autonomously in situations that require precise control, an accurate, real-time estimate of its position and orientation (pose) is needed. When GPS is not available, a common method for UAV pose estimation is visual odometry. Visual odometry is the process of estimating the pose of a camera using a sequence of images. Visual odometry has been applied to UAV flight in the past, but current open-source solutions are often CPU-intensive, inaccurate, or require an awkward initialisation process. The goal of this research is to provide an open-source visual odometry algorithm with characteristics ideal for UAV pose estimation.

Di Wang

Understanding the Software Development Industry in New Zealand

The software industry is growing dramatically globally and domestically. This research aims at understanding the software development industry in New Zealand (and how it may potentially differ to that in other countries) from the perspective of characteristics of software developing organizations in New Zealand, software processes, processes and tools used in the New Zealand industry, the types of products and services developed in New Zealand, as well as the characteristics of software professionals. The presentation will motivate the research and discuss the current progress.

Chathrie Wimalasooriya

Effort estimation of software maintenance tasks

Software development projects require estimating the effort and cost of development activities at different stages (initial project planning, release planning, iteration planning, etc.) and for different purposes (budgeting, allocation of tasks to developers, etc.). Maintenance tasks and tasks performed to reduce technical debt (and other forms of “debt” in architecture, design, code, tests), such as bug fixing, refactoring, redesign, are difficult to estimate. Furthermore, recent studies on estimating effort of maintenance-related tasks show that current approaches are mostly based on the experience of developers or not used at all. In this research, we aim at better understanding what types of maintenance tasks would benefit from what types of estimation techniques and at proposing an approach for effort estimation of tasks related to maintenance. This research is at an early stage, so the talk will outline the initial goals and plans.

PhD students

Daniel Barry

UAV Search Formations For Wireless Signal Detection

Unmanned aerial vehicles (UAVs) provide exciting opportunities in the problem space of autonomous exploration, particularly for search and rescue. The focus of this work is to explore the problem of wireless signal detection, where transmitter location, number of transmitters and whether the signal is of interest, is all unknown to the UAVs. The goal of the UAVs is to optimize the search time for one or more transmitters and time taken to search the entire environment. The main research direction is to explore how to efficiently have multiple drones form their own adaptable flight formations without centralized control, with robustness and adaptability being a driving factor. Areas of interest for search are measured with potential information gain, with decentralized communication used to communicate UAV intent and local objective data.

Enos Chen

Maximising Learning by adaptively providing learning support in SQL-Tutor

An important question for human tutors and developers of computer-based educational tools is how much guidance or learning support should be provided to maximise learning. Problem Solving (PS), Worked Examples (WE) and Erroneous Examples (ErrEx) have all been proven to be effective learning support in Intelligent Tutoring Systems (ITSs). In previous work, alternating WE and PS (AEP) was found to be superior to learning only from WE or only from PS. In our first study, we investigated whether the addition of erroneous examples further improves learning in comparison to AEP in SQL-Tutor. The results indicated that ErrEx prepared students better for problem solving compared with WE. Explaining and correcting erroneous examples also led to improved debugging and problem solving skills. However, students may not necessarily need all learning activities. We later introduced an adaptive strategy which adaptively decided what learning activities (a worked example, an erroneous example with one error or two errors, a problem to be solved) is appropriate for students based on their performance. We found that students who studied with the adaptive strategy improved their post-test scores on conceptual, procedural and debugging questions with significantly fewer learning activities than their peers who learned from a fixed sequence of WE/PS and ErrEx/PS.

Andrew Curtis-Black

An Enterprise Policy Description Framework for Software Defined Networking.

Computer networks support the day-to-day operation of many modern enterprises by providing access to resources (e.g. the internet, messaging applications, data repositories etc.) Enterprises control access to these resources by creating policies like "don't let students use more than 50GB of data per month". However, existing processes for specifying and implementing policies are complex and error-prone. Our research aims to improve this situation in the context of software defined networking (SDN). SDN is a new paradigm which allows us to program networks the same way we program computers. With SDN, networks can be upgraded like operating systems, and services can be added like smartphone apps. Our work so far has involved a systematic review of existing approaches to policy specification, and a qualitative study of network administrators. Based on this, we propose to improve the process of policy specification and implementation by 1) introducing high-level concepts — intuitive, standardised building blocks for policies — and 2) making them available to network programmers (e.g. via an API).

Matthew Edwards

High-accuracy fiducial markers for ground truth in challenging environments

Our project involves flying UAVs through forests. Developing visual simultaneous localization and mapping (SLAM) algorithms for this environment requires test data with accurate ground truth. The accuracy of modern visual SLAM is approaching that of high-end GPS under open sky and outperforms

it under a forest canopy, which makes this a challenge for our project. This presentation will give an overview of ground truth methods currently used in practise, and introduce a fiducial marker which can be used for high-accuracy pose estimation.

Geela Fabric

A Comparison of Different Types of Learning Activities in a Mobile Python Tutor

Programming is becoming one of the skills expected for successful careers in the knowledge economy, and is being taught at all levels, including primary and secondary schools. Programming skills are difficult to acquire, as the student needs to learn the specific programming language and many related concepts to write good programs. We present PyKinetic, a mobile tutor for Python that serves as a complement to traditional courses. The overall goal of our project is to design learning activities that maximize learning. In this presentation, we present several types of learning activities designed for PyKinetic. The first version of the tutor implemented Parsons problems with incomplete lines, which support code-understanding and code-writing skills. The second version of PyKinetic included various types of activities aimed at code-tracing and code-writing skills. The results of two studies we conducted show that Parsons problems are beneficial for novices, while advanced students benefitted more from learning activities which required them to identify and fix incorrect lines of code.

Ori Ganoni

Using Game Engines for Scientific Simulations

This presentation will focus on a simulation architecture that uses the Unreal Engine4 game engine for generating both optical and depth sensor outputs from any position and orientation within the environment and provides several key domain specific simulation capabilities. The simulation engine also allows users to test and validate a broad range of computer vision algorithms involving different drone configurations under many types of environmental effects such as wind gusts. I will demonstrate the effectiveness of the system by giving experimental results for a test scenario where one drone tracks the simulated motion of another in a complex natural environment.

Mengmeng Ge

Proactive Defense Mechanisms for the Software-Defined Internet of Things with Non Patchable Vulnerabilities

The Internet of Things (IoT) contains a large number of heterogeneous devices with a variety of vulnerabilities. As the vulnerabilities can be exploited by the attackers to break into the system, it is of vital importance to patch all vulnerabilities. However, some vulnerabilities are impossible to patch (e.g., forever-day vulnerabilities). In order to deal with non-patchable vulnerabilities, we propose to change the attack surface of the IoT network to increase the attack effort. With the support of software-defined networking (SDN), we develop two proactive defense mechanisms that reconfigure the IoT network topology. We analyse how the security and performance change when the proposed solutions are deployed by using a graphical security model and various metrics in simulations. The results show our proactive defense mechanisms in the SD-IoT effectively increase the attack effort, while maintaining the average shortest path length.

Manpreet Manpreet

Tracing software architecture design decisions to their implementation in source code

Software architectures are the result of a set of architectural design decisions (ADDs). Design decisions, such as choosing architectural patterns or tactics, play a critical role in ensuring software quality. Sometimes, inconsistency occur between design decisions and their implementation because ADDs might be implemented incorrectly or not at all in the code. Even if design decisions are implemented correctly initially, during software maintenance and evolution, developers may make significant changes to code without being aware of the impact on design decisions. This can lead to

undoing previously implemented design decisions in code or to breaking the implementation of previously implemented design decisions.

In this presentation, I will discuss about my PhD proposal how can we do to manage inconsistency between ADDs and their implementation in source code.

Joshua Mathew McCulloch

Modelling overhead utility networks using LIDAR to predict network behaviour and outages

Once installed, a wooden utility pole can expect to have a working lifetime of 50 years. As expected it can be near impossible to predict energy demands over such time spans. In the past, the capacity of any stretch of the network could be increased by running additional conductors along it. The maximum capacity of these conductors is estimated by taking into account the local climate, characteristics of the conductor, and configuration of the installation. Once installed these estimations have remained fixed. In our research, we are building detailed 3D models of the overhead utility networks to rate the capacity of individual conductors dynamically. By recovering an accurate representation of the conductor's physical characteristics, and combining this with local weather and line loading, the sag of the line can be predicted in real time; allowing for the conductor to be loaded much closer to its theoretical capacity.

Tieta Putri

Learning the style of great masters using computational creativity

Computational creativity is one of the area of Artificial Intelligence (AI) field which is related to the philosophy, science, and engineering of computational systems which is expected to exhibit creative behaviours by taking on particular responsibilities. One of the applications of Computational Creativity can be done in the area of Painterly Non-Photorealistic Rendering (NPR) which aims to generate image outputs with painterly effects. This talk will discuss the production of such effects by learning the brush stroke characteristics of the great masters and remapping their style in a digital painting simulation.

Matthew Ruffell

Dapper Linux: A Family of Secure, Easy to Use Operating Systems for Modern Computing Environments

Operating system security has stagnated in the last twenty years, with the design of modern operating systems looking very similar those of twenty years ago in terms of security features and how the components of an operating system work together. Many of the latest attempts at enhancing operating system security are not adopted by primary operating system vendors, largely due to the maintenance burden these features bring, and the extreme difficulty of use they bring to a platform. In order to fix this, a new secure operating system called Dapper Linux is being actively developed in the cyber security lab by Matthew, and Dapper Linux boasts an exploit resistant Linux kernel, fully sandboxed graphical applications, an interactive firewall, full hard disk encryption by default (even /boot), intrusion detection systems (network and host based), and more, all configured and automated to provide the best out of the box experience. Desktop, Server and Embedded versions will soon be available, and Desktop can be downloaded right now at <https://dapperlinux.com>

Dilli Prasad Sharma

Moving Target Defenses for Software-Defined Networking Security

In cyber security, static nature of the computing system has made easy to attack and harder to defend. The cloud is homogeneously and statically configured and that provides the opportunity for attacker to penetrate the security level of the system. A moving target defense (MTD) is proposed to prevent cyber-attacks by continuously changing the attack surface dynamically. There are numerous MTD techniques have proposed for the different domains and levels, but there are still shortage and lacks of MTD techniques and frameworks that are perfectly suitable for addressing the security requirements of cloud in software-defined networking (SDN) environment. To address these

problems, we propose a flexible virtual IP multiplexing MTD technique that enables a host to have multiple, random, time-varying IP addresses. This technique invalidates the address information collected by attackers by remapping the IP addresses and disturb the attackers scanning strategy effectively. The proposed technique will be assessed for random and cooperative scanning strategies. In addition, we also propose a MTD deployment framework in SDN environment that helps how the MTD can be dynamically deployed and adapted for defending the security attacks in SDN-based cloud infrastructure.

Huyuan Shangguan

Video based motion capture in environments with non-stationary background

Several methods for capturing motion data from single video have been reported in computer vision literature, and most of them deal with stationary background. The problem becomes more complex and challenging in a moving scene where traditional background subtraction algorithms often fail. We require robust algorithms for marker-less tracking of human body's movements and for extracting motion information from them. This presentation reviews recent research work done in the area of video based 3D motion capture through marker-less tracking, learning and detection algorithms, and identifies their usefulness and limitations. The presentation then proposes a novel framework based on state-of-the-art methods for object detection and pose estimation for obtaining the 3D joint positions of a tracked human model in a single view video stream. Experimental results are presented to show the effectiveness of the proposed algorithm in capturing 3D motion information.

Ashish Sharma

Using Animated pedagogical agents to Promote Collaboration and Self-Regulated Learning in Intelligent Tutoring Systems

In recent years, there has been a surge in the use of intelligent computer-supported collaborative learning (CSCL) tools for improving student learning. The aim of this project is to provide adaptive support for collaboration. My work will focus on designing effective interventions to enhance collaboration in the context of an ITS, as well as to promote socially-shared regulation of learning (SSRL).

In online collaborative learning environments, it is challenging to engage students. The lack of genuine interactions, social identity, background and user empowerment may have negative effects on the learning process. My work will further focusses on virtualization of the online collaboration, such that the sessions will be animated and students' can observe how avatars gets involved in discussions and collaborate. In addition to this, conversational agent will be included in the study to trigger productive learning. The conversational agent will provide timely intervention for the effective collaboration.

Prerna Singh

Modelling, speckle simulation and quality evaluation of synthetic ultrasound Images.

Speckle noise reduction is an important area of research in the field of ultrasound image processing. Several algorithms for speckle noise characterization and analysis have been recently proposed in the area. Synthetic ultrasound images can play a key role in noise evaluation methods as they can be used to generate a variety of speckle noise models under different interpolation and sampling schemes, and can also provide valuable ground truth data for estimating the accuracy of the chosen methods. However, not much work has been done in the area of modelling synthetic ultrasound images, and in simulating speckle noise generation to get images that are as close as possible to real ultrasound images. This work discusses these aspects, presents novel algorithms for speckle simulation and modelling based on three sampling schemes, and also evaluates the quality of the outputs using image quality metrics. Detailed experimental analysis including both quantitative and subjective assessments are also presented.

Ashley Williams

Toward the use of practitioner-generated evidence for software engineering research.

Blog articles have potential value as a source of practitioner-generated evidence to complement already accepted sources of evidence in software engineering research e.g. interviews and surveys. To be valuable to research, a method for extracting the high quality articles from the vast quantity available needs to be developed. In this presentation, we provide an overview of how we define high quality articles and present a working methodology for extracting these high quality articles from the web.

Shinichi Yamada

Multiple Kernel Learning with One-level Optimization of Radius and Margin

Abstract; Generalization error rates of support vector machines are closely related to the ratio of radius of sphere which includes all the data and the margin between the separating hyperplane and the data. There are already several attempts to formulate the multiple kernel learning of SVMs using the ratio rather than only the margin. Our approach is to combine the well known formulations of SVMs and SVDDs. The proposed model is a closed system and always reaches the global optimal solutions.

Matthew Young

LiDAR Terrain Mapping with an Autonomous Ground Vehicle

Terrain mapping methods typically have one or more major flaw. They can be time consuming, inaccurate, or (in the case of aerial vehicles) restricted by aviation laws. This can be a problem on industrial sites which need to be periodically re-mapped. Examples include construction sites, mines or stock piles. Mobile robotics can revolutionize an industry by providing a balance of accuracy, speed and repeatability not available using conventional methods. The objective of this research is to develop an autonomous ground vehicle (AGV) for terrain mapping with an on-board LiDAR unit. The AGV will use a baseline map and feature matching to improve mapping accuracy.

Simon Yusuf

Evaluating the Effectiveness of Security Metrics for Security Analysis

It is difficult to assess the security of modern enterprise networks because they are usually dynamic with configuration changes (such as changes in topology, firewall rules, etc). Graphical security models and security metrics are widely used to systematically analyse the security posture of network systems. However, there are problems using them to assess the security of dynamic networks. First, most models are unable to capture dynamic changes occurring in the networks over time. Secondly, the existing security metrics are not designed for the analysis of dynamic networks and hence their effectiveness to the dynamic changes in the network still remains unclear. In our research, we conduct a comprehensive analysis via simulations to evaluate the effectiveness of security metrics using a Temporal Hierarchical Attack Representation Model. Further, we investigate the varying effects of security metrics when changes are observed in the dynamic networks. Our simulation analysis shows that different security metrics (except the shortest attack path) have varying security posture changes with respect to changes in the network.

The organisers are grateful for the support of the following sponsors:



Principal Sponsor

Helping mobile workforces operate more efficiently, serve their customers better and shrink their carbon footprint is at the heart of Telogis solutions, which includes web-based software, mobile apps and integration tools.

Products include fleet management software using GPS fleet tracking, driver safety applications, commercial navigation, work order management, dispatch and route optimisation.

Telogis works directly with some of the world's biggest car, truck and equipment manufacturers, including Ford, GM, Hino, Volvo Trucks, Mack, Isuzu, Nissan, John Deere and Manitowoc, to offer fleet managers a cost-effective solution that is faster and easier to deploy than traditional fleet management solutions.

Telogis is part of [Verizon Telematics](#), a company that manages nearly 10 million connected vehicles around the world, and processes over 2.6 billion GPS data points every month. Globally, Verizon Telematics has 30 offices, with more than 3,000 employees and a heavy investment in R&D to maintain its reputation for industry-leading innovation.

The R & D team in Christchurch is growing rapidly and Telogis is always looking for top talent. Offering a fantastic working environment, alongside some of the brightest minds in the industry. If you're interested in finding out more about the amazing career opportunities at Telogis, email nicki.graf@telogis.com or visit careers.telogis.com/nz



Allied Telesis: For nearly 30 years, Allied Telesis has been delivering reliable, intelligent connectivity for everything from enterprise organizations to complex, critical infrastructure projects around the globe.

Allied Telesis is recognized for innovating the way in which services and applications are delivered and managed, resulting in increased value and lower operating costs.

Originally part of the DSIR, Allied Telesis Labs - based in Christchurch, New Zealand - joined the international Allied Telesis Group in 1999, and is now the largest research and development centre for the group.

As one of the world's leading producers of computer networking equipment, the group employs more than 3000 people worldwide.

Allied Telesis smart technologies, such as Allied Telesis Management Framework™ (AMF) and Enterprise SDN, drive network evolution, and deliver efficient and secure solutions for people, organizations, and “things”.

More than one million customers worldwide have chosen our technology for their networks.

The success of Allied Telesis Labs is built on the skills of our talented employees, who enable the company to compete on an equal footing with the world's largest communications and networking equipment manufacturers.

www.alliedtelesis.co.nz



The **Christchurch City Council** is one of the South Island's largest employers – a progressive local authority, responsible for ensuring the continued successful growth and development of one of New Zealand's greatest cities.

More than 2300 staff works for the Council across 60 locations around the city and Banks Peninsula. These include professional and administrative positions in core infrastructural areas such as water, waste, roading and parks; as well as jobs within the Council's broader activities including its library network, art gallery and recreation facilities.

The Christchurch City Council is an organisation committed to achieving sustainable outcomes for the community, environment and people of Christchurch and Banks Peninsula. By working for the Christchurch City Council you will have an opportunity to work on a wide range of projects providing you with opportunities to further develop your breadth of skills whilst contributing toward the development of our beautiful city and surrounding areas.

www.ccc.govt.nz



Dynamic Controls is a world leading designer and manufacturer of electronic controls for power wheelchairs and scooters. Focusing on innovation and growth in the bio medical engineering sector, Dynamic Controls works to go above and beyond expectations to ensure end users receive the best product possible in order to enhance their quality of life. Dynamic Controls is unique in that we specialize in the medical mobility market. Products range from cost effective controllers to a world leading modular control system that can be customised to suit a wide range of user needs. In addition we have a range of scooter controllers suitable for small, lightweight mini shoppers to rugged outdoor scooters. All our products are renowned for reliability. Dynamic Controls is a global organization which employs over three hundred people, with corporate headquarters in New Zealand and regional offices in the United Kingdom, North America and Asia.

www.dynamiccontrols.com

Intranel

Intranel provides industry leading business and development teams so you can accelerate technology delivery. We can help you align a tech project with business needs then either take on end-end delivery or provide capacity to enhance your existing team. We'll help you implement lean, fast, cost-effective development and build genuine agile capability so you get to market before your competitors, with better products. Intranel has vast experience with Cloud technologies, Web and Mobile Apps and we can help you leverage emerging technologies including Blockchain, IoT and Virtual Reality.



Since 1978, Jade Software has been solving complex business problems through the design, delivery, and support of innovative software and technology for leading companies around the world. We're natural innovators, and a trusted technology partner in industries including logistics, energy utilities, financial services, retail, telecommunications, and primary production.

Over 220 Jade employees create and manage high performance enterprise systems, work on digital strategy and experience design, and develop software platforms. We collaborate closely with our customers, working with industry standard technology as well as our own JADE™ development environment.

Jade systems sit at the core of banks and building societies, at the logistical centre of shipping ports all around the world, and at 2.1 million electricity and gas connection points in New Zealand.

Today we have three lines of business: Jade Logistics for ports and freight; Jade Technologies for developers and technology partners, and for clients in other industries a multi-skilled team of digital business transformation experts.

Our global headquarters are in Christchurch, where we started out. There are also Jade offices in Auckland, Dunedin, Australia, USA, UK, Netherlands, Indonesia and the United Arab Emirates.

www.jadeworld.com



Orion Health's 350 (and expanding) employees supply technology and services to over 1100 clients worldwide. Orion Health is a leading provider of clinical workflow and integration technology for the healthcare sector. Orion Health's clinical information software meets the information needs of clinical staff and healthcare managers, delivering secure, universal access to healthcare information and helping healthcare providers proactively manage and coordinate patient care across the community. Orion Health's integration and messaging products streamline the exchange of healthcare data within organisations and between business partners. Integrating healthcare systems throughout the world since 1993, Orion Health contributes to integration and clinical workflow projects across the globe for clients including Abbott Laboratories, New York State Department of Health, Capital Health, New South Wales Health, and the New Zealand Ministry of Health. Orion Health has offices in the United States, Canada, United Kingdom, Spain, Dubai, Singapore, Bangkok, France, Australia and New Zealand, and our growing network of partners includes leaders in technology and services such as Oracle Corporation, LogicaCMG, Sierra Systems, Sun Microsystems, Philips Medical Systems, Hewlett-Packard and IBM. Further information including a video featuring staff in our Auckland office can be found at www.orionhealth.com.



Ravensdown exists to enable smarter farming for a better New Zealand.

We're owned by farmers and work for farmers. We are driven to challenge and improve; to provide exceptional service to customers and contribute to their success.

We help our customers farm with greater certainty by:

- Choosing the best people, keeping them safe and enabling them to be the best.
- Putting our customers at the centre of everything we do.
- Helping our staff positively thrive
- Developing long-term relationships based on integrity and trust.
- Driving our business forward by finding better solutions.



Tait customers protect communities, power cities, move people, harness resources and save lives all over the world. We create and support their critical communications.

From our strong position as leaders in radio communication technology, we work hard to gain a deep understanding of the issues, problems, and day-to-day working environments our customers' experience. That is how we deliver robust, fit-for-purpose products, exceptional customer service, and world class communication system performance.

Our LMR products and systems are designed and built by our people. We stand by their quality, integrating, testing and perfecting everything we sell. Our specialties include P25 (Phase 1 and Phase 2), DMR (Tier 2 and Tier 3), MPT-1327, Analog Conventional, and software to manage and monitor those radio networks.

We also recognize the increasing importance of business systems like dispatch, AVL, LTE, cellular, voice recorders, SCADA, and many more to come. We integrate these diverse technologies to deliver stronger, simpler, and smarter solutions. Through these efforts, we're redefining critical communications.



Positioning-centric information is changing the way people, businesses and governments work throughout the world. By applying **Trimble's** advanced positioning solutions, productivity increases and safety improvements are being realized.

Though best known for GPS technology, Trimble integrates a wide range of positioning technologies including GPS, laser, optical and inertial technologies with application software, wireless communications, and services to provide complete commercial solutions. Its integrated solutions allow customers to collect, manage and analyze complex information faster and easier, making them more productive, efficient and profitable.

Trimble products are used in over 141 countries around the world. Employees in more than 30 countries, coupled with a highly capable network of dealers and distribution partners serve and support our customers.

For over 33 years, Trimble has created unique positioning products that help customers grow their business. Our portfolio includes over 1,800 patents and serves as the basis for the broadest positioning offerings in the industry. Trimble augments its organic product development with strategic acquisitions to bring the latest positioning technologies to a wider market.

www.trimble.com