2023 33rd International Telecommunication Networks and Applications Conference (ITNAC)

Time	Room 1	Room 2	Welcome
Tuesday, November 28			
16:00-18:00			WR: Welcome Reception

Wednesday, November 29

08:00-08:30	R1: Registration		
08:30-10:30	S1: Session 1: Mobile	S2: Session 2: Wireless	
10:30-11:00	MT1: Morning Tea		
11:00-12:00	K1: Opening Keynote - Dealing with Spatial and Temporal Complexities in Cyber-Physical Systems: Simple solutions for complex problems		
12:00-12:45	K2: Keynote - Neoteric Frontiers in Cloud, Edge, and Quantum Computing		
12:45-13:30	L1: Lunch		
13:30-15:30	S3: Session 3: General	S4: Session 4: Networks	
15:30-16:00	AT1: Afternoon Tea		
16:00-18:00	S5: Session 5: IoT and wireless	S6: Session 6: Networking and General	

Thursday, November 30

08:30-10:30	S7: Session 7: Optical networking	S8: Session 8: IoT	
10:30-11:00	MT2: Morning Tea		
11:00-11:45	K3: Keynote - Automation and Orchestration of 5G Network Slices across RAN, Core, and Transport domains in the context of 5G Network Slicing		
11:45-12:30	L2: Lunch		
12:30-16:30	T1: Conference Tour		
16:30-18:00		W2: Workshop 2: 5G Labkit Demonstration	
18:00-22:00	D1: Conference Dinner		

Friday, December 1

08:30-10:30	S9: Session 9: IoT and General	S10: Session 10: Networks and Security	
10:30-11:00	MT3: Morning Tea		
11:00-12:00	K4: Keynote - Addressing Data Leakage in Split Learning: Attacks and Defence Strategies		
12:00-13:00	L3: Lunch		
13:00-15:00	S11: Session 11: Networks and Design	S12: Session 12: Wireless and Security	
15:00-15:30	AT3: Afternoon Tea		
15:30-15:40	CR: Closing Remarks		

Tuesday, November 28

Tuesday, November 28 16:00 - 18:00 (Australia/Melbourne)

WR: Welcome Reception

Shuo Li

Room: Welcome

Venue: Building 10, Level 7, Room 52 Portal (it is the open area)

Wednesday, November 29

Wednesday, November 29 8:00 - 8:30 (Australia/Melbourne)

R1: Registration

Venue: Level 7 Building 16 Green Brain, Swanston St

Wednesday, November 29 8:30 - 10:30 (Australia/Melbourne)

S1: Session 1: Mobile

Room 1

Chair: Leith H. Campbell (RMIT University, Australia)

8:30 ***Energy Efficient Data Collection Using Predefined Path Constrained Mobility for Mobile Sinks in Wireless Sensor Networks***

Mohammed F Suleiman (Teesside University, United Kingdom (Great Britain)); Usman Adeel (Teesside University & Intel UK, United Kingdom (Great Britain))

Recently, the utilization of mobile sinks (MSs) has gained significant attention in wireless sensor networks (WSNs) research due to its potential for improving network lifetime compared to traditional static sinks. However, mobility in WSNs still presents challenges such as node failures in random mobility techniques and high computational and processing resources required in predicted mobility approaches, which can impact long-term stability and network lifetime. In this study, we propose a Predefined Path Constrained Mobility (PPCM) routing protocol utilizing multiple sinks stationed at different areas of the network. These sinks move in a fixed pattern to collect data from sensor nodes. Through evaluation, we demonstrate that the PPCM protocol outperforms existing routing protocols such as Random Multiple Mobile Sink (RMMS) and Multiple Random Mobile Sink Confined (MRMS-C) protocols in terms of overall network lifetime. The proposed protocol offers a potential solution to address routing challenges in WSNs with the use of mobile sinks.

pp. 1-6

8:54 ***Exploring Cellular Communications for Remote Offshore Aquaculture Monitoring***

Johannus Kristmundsson (University of the Faroe Islands, Faroe Islands); Øystein Patursson (RAO, Faroe Islands); John R Potter (NTNU, Norway); Qin Xin (University of the Faroe Islands, Faroe Islands)

In the evolving landscape of aquaculture, remote offshore fish farms present unique challenges and opportunities. This paper investigates the potential of harnessing cellular communications, with a particular emphasis on 5G, to enhance connectivity in these distant marine environments. Through link budget analysis, we evaluate the channel conditions over the vast distances that remote offshore fish farms require. The research sheds light on how various environmental factors impact signal strength and highlights the transformative role of machine learning in streamlining farm operation data, paving the way for efficient real-time monitoring. The findings underscore the potential of cellular communications in advancing offshore aquaculture monitoring, ensuring efficient data transmission, and fostering sustainable marine farming practices.

pp. 7-10

9:18 ***Mutual Authentication between Aerial Base Stations and Core Network: A Lightweight Security Scheme***

Kai-Chun Yang and Po-Ching Lin (National Chung Cheng University, Taiwan)

The 3rd Generation Partnership Project (3GPP) is actively working on incorporating non-terrestrial networks (NTNs) into the 5G system. NTNs integrate various aerial and space components like uncrewed aerial vehicles

(UAVs), airships, and satellites to offer flexible solutions for extending the ground systems. In the context of aerial radio access networks (ARANs), aerial base stations (ABSs) are deployed in clusters. However, due to the dynamic nature of ABSs, additional identity authentication is required between user equipment (UE), core network (CN), and ABSs. It is crucial to design lightweight authentication protocols that are subject to the limited computing resources and energy constraints of UAVs. We observe that aerial facilities possess multiple attributes, which can be leveraged to integrate identity authentication of the involved entities based on specific attribute sets. This study proposes an attribute-based authentication and key agreement protocol for ABSs and the CN, utilizing ciphertext-policy attribute-based encryption (CP-ABE). This approach enables access control based on physical attributes, ensuring secure communication and identity authentication in the ARANs. The protocol reduces the need for repeated execution of the authentication and key agreement (AKA) protocols between UE and the CN during ABS replacement. It employs elliptic curve cryptography (ECC) and fixed-length keys to minimize computational overhead during decryption, and also supports mutual authentication between ABSs during UE handover. The design aligns with the 3GPP specifications, aiming for practical field application in the future.

pp. 11-18

9:42 ***A New Class of Optimal Frequency Hopping Sequences with Applications to Secure Communication Waveforms***

Krishnasamy T Arasu, Michael Clark and Timothy McManus (Riverside Research, USA)

Frequency hopping (FH) is a spread spectrum technique used to protect against detection, interception, location, and jamming where the transmission frequency is changed in a seemingly random manner, only occupying a given frequency band for a very short amount of time. FH systems provide low probability of intercept (LPI) capabilities mainly by using large hop bandwidths. Using large portions of the electromagnetic spectrum is beneficial because it makes it potentially more difficult for a third party to monitor the entire bandwidth at once. A popular way to implement FH is by using specially designed pseudorandom sequences known only to the intended users. The pseudorandom sequences must be designed according to certain mathematical properties in order to guarantee that an attacker cannot easily learn the hopping sequence and defeat the protection. Prior research has revealed an interesting equivalence relation between mathematically optimal FH sequences and partitioned difference families in cyclic groups. Using this relationship, we provide a method that yields new families of optimal FH sequences, inequivalent to known ones. The resulting FH sequence families contain several members whose underlying pseudorandom sequences possess high linear span, thereby making them desirable for secure communications. Our research shows exponential growth of the linear span, which is a significant increase in security over the state of the art (SOA).

pp. 19-24

10:06 ***URLLC in B5G Networks: Use cases, TSN/DetNet extension, and Pending issues***

Aiman Nait abbou (Aalto University, Finland); Konstantinos Samdanis (Lenovo, Germany); Jukka M J Manner (Aalto University, Finland)

Originally, 5th Generation (5G) mobile networks were expected to carry the demands of the Internet of Everything (IoE) and Ultra-Reliable and Low-Latency Communications (URLLC) services. However, state-of-the-art of wireless mobile technologies failed to meet these expectations. Beyond 5G (BG5) wireless networks have the potential to leverage the benefits of a mature transported network, and enhanced capabilities related to high reliability and extremely low End-to-End Latency. This paper investigates the potential of B5G with extreme URLLC use cases. It also provides an overview and vision of the potential integration of B5G with Time-Sensitive Networking (TSN) for indoor scenarios, and Deterministic Networking (DetNet) with Segment Routing (SR) for outdoor scenarios.

pp. 25-30

Wednesday, November 29 8:30 - 10:30 (Australia/Melbourne)

S2: Session 2: Wireless

Room 2

Chair: Mohammad Hasan (UKM, Malaysia)

8:30 ***Modeling and Evaluation of Geophone Energy Consumption in Wireless Seismic Data Acquisition Networks***

Aliyu Makama (Hamburg University of Technology, Germany); Koojana Kuladinithi (Hamburg University of Technology & Institute of Communication Networks, Germany); Andreas Timm-Giel (Hamburg University of Technology, Germany)

Impediments associated with cable-based seismic data acquisition (SDA) have led to increased interest in enabling reliable wireless seismic data acquisition (WSDA)systems. As the SDA process can last for several days or weeks, it is imperative to ensure geophones remain active for extended data acquisition periods without frequent recharging or battery replacements. This paper presents an evaluation of geophone energy consumption based on a proposed IEEE 802.11-based WSDA network architecture operating in ad hoc mode that employs Routing Protocol for Low-Power and Lossy Networks (RPL). The evaluation was carried out using simulation in OMNeT++ simulator employing metrics like percentage energy consumed and network lifetime. Results show that geophones can operate continuously for up to a month, with energy consumption primarily influenced by geophone hardware specifications, especially the radio or transceiver unit and battery capacity. In addition, we present an analytical model that estimates geophone energy consumption based on the proposed architecture. The model is an extension of our proposed IEEE 802.11 Distributed Coordination Function (DCF) model, incorporating geophone radio hardware specifications. The model was validated using simulations in the OMNeT++ simulator.

pp. 31-37

8:54 ***Feasibility Study on Position Verification in Urban UAV Networks***

Konrad Fuger (Hamburg University of Technology, Germany); Koojana Kuladinithi (Hamburg University of Technology & Institute of Communication Networks, Germany); Manav Sood and Andreas Timm-Giel (Hamburg University of Technology, Germany)

Unmanned Aerial Vehicles (UAVs) hold transformative potential across industries like delivery, surveillance, and maintenance. In urban settings, ensuring safe UAV operations demands position exchange to prevent collisions and monitor the airspace. This poses the problem that malicious UAV operators could falsify their announced position. Our study evaluates four mechanisms to detect falsified positions, differentiating between autonomous and cooperative approaches. We present a theoretical analysis highlighting the strengths and limitations of these mechanisms, alongside comprehensive simulations. Our results show that the best-performing mechanism needs less than 1s to detect all malicious nodes present. In addition, this mechanism can detect more than 98% of falsified packets given a sufficient difference between real and claimed position. Further, we show that the cooperative mechanisms produce a data overhead of less than 30%. Our work demonstrates the feasibility of position verification for urban UAV networks.

pp. 38-43

9:18 ***DANCE: Dynamic Anchor Node-based Cooperative Enhancement of Wireless Indoor Localization for Internet of Things***

Jin-Min Lee (Sungshin Women's University, Korea (South)); Na-Yeon Shin and Jung-Hyun Moon (Sungshin University, Korea (South)); Il-Gu Lee (Sungshin Women's University, Korea (South))

With the recent widespread use of ultra-high-speed, ultra-low-latency wireless sensor network applications, the demand for location-based services in wireless indoor environments is increasing. In addition, wireless sensors are used to improve industrial productivity and safety using cyberphysical system automatic control technology. However, wireless sensor devices have limited computing power and battery capacity, making

frequent trilateration operations or complex machine learning-based operations challenging. Therefore, this study proposes a dynamic anchor node-based cooperative enhancement (DANCE) technique that improves accuracy and reduces computation costs compared to the conventional trilateration method. The proposed DANCE technique improves localization efficiency and accuracy by adjusting the number of anchor nodes used for localization according to the node's speed. Experimental results demonstrated that when the fading index was 1 in Nakagami-m fading and the node to be localized was at an average speed of 1-5 m/s, the error rate decreased by at least 24.5% compared to the conventional method, and the computation cost was reduced by at least 8.4% compared to the conventional method.

pp. 44-50

9:42 ***Adaptive compression of operational commands for remote network management over LPWA***

Kodai Tanabe and Go Hasegawa (Tohoku University, Japan); Gen Kitagata (Morioka University, Japan)

When LPWA can be employed as a management network in out-of-band management of network equipment, the advantages of the low power consumption and long communication distance of LPWA allow for low-cost operation. However, the small datarate of LPWA degrades the performance of remote management. Therefore, in our work, we aim to improve the effective datarate of LPWA by applying highly efficient compression using command history. We introduce a command tree to efficiently maintain the appearance frequency of the command and codes for encoding. We employ Huffman coding-based compression method, exploiting the biases of used commands. In the proposed method, we dynamically construct the command tree according to the command input from the administrator, which allow the proposed method to be applied to various network equipment regardless of its command grammar. Through experimental evaluation, we show that the compression ratio is up to 3.5%, which is significantly better than the traditional compression method, while it has enough small memory usage and computation overhead. Also, the proposed method can provide 10 kbps for the effective datarate with LPWA, which is almost equivalent to standard datarate for management using serial communication.

pp. 51-56

10:06 ***Detection of Crucial Power Side Channel Data Leakage in Neural Networks***

Amjed Ahmed (Imam Kadhim (A) for Isalmic Science University, Iraq); Mohammad Hasan (UKM, Malaysia); Nurhizam Safie Mohd Satar (The National University of Malaysia (UKM), Malaysia); Nazmus Shaker Nafi (Kellogg Brown and Root, Australia); Azana Hafizah Mohd Aman (Universiti Kebangsaan Malaysia, Malaysia); Shayla Islam (UCSI University, Malaysia); Saif Aamer Fadhil (Imam Al Kadhum College IKC, Iraq)

Neural network (NN) accelerators are now extensively utilized in a range of applications that need a high degree of security, such as driverless cars, NLP, and image recognition. Due to privacy issues and the high cost, hardware implementations contained within NN Propagators were often not accessible for general populace. Additionally with power and time data, accelerators also disclose critical data by electro-magnetic (EM) sided channels. Within this study, we demonstrate a side-channel information-based attack that can successfully steal models from large-scale NN accelerators deployed on real-world hardware. The use of these accelerators is widespread. The proposed method of attack consists of two distinct phases: 1) Using EM side-channel data to estimate networking's underlying architecture; 2) Using margin-dependent, attackers learning actively in estimating parameters, notably weights. Deducing the underlying network structure from EM sidechannel data. Inferring the underlying network structure from EM sidechannel data. Experimental findings demonstrate that the disclosed attack technique can be used to precisely retrieve the large-scale NN via the use of EM side-channel information leaking. Overall, our attack shows how critical it is to conceal electromagnetic (EM) traces for massive NN accelerators in practical settings.

pp. 57-62

Wednesday, November 29 10:30 - 11:00 (Australia/Melbourne)

MT1: Morning Tea

Mark Gregory
Venue: Level 6 Building 16 Green Brain, Swanston St

Wednesday, November 29 11:00 - 12:00 (Australia/Melbourne)

K1: Opening Keynote - Dealing with Spatial and Temporal Complexities in Cyber-Physical Systems: Simple solutions for complex problems

Professor Xinghuo Yu, RMIT University

Room 1

Chair: Mark A. Gregory (RMIT University, Australia)

The fast advances in information and communication technologies have made it possible to enable ambient data intelligence and situational awareness in large-scale Cyber-Physical Systems such as smart grids, logistic networks, and transportation, for optimal, reliable operations and management. However, it has also led to explosive growth of spatial and temporal information and computational complexity. An innovative way of thinking is required to tackle these large-scale complex network problems efficiently and effectively. In this talk, we advocate a novel problem-solving approach, which embraces a philosophy of 'simple solutions for complex problems', to deal with the spatial and temporal complexities in order to deliver just-enough just-in-time reliable solutions. Key to the successful problem solving by this approach is to balance problem simplification and solution accuracy. Well known nature-inspired methodologies such as AI, machine learning, neural networks, swarm intelligence, complex networks, will be examined. Several real-world problems we have tackled, such as money laundering network detection, spectrum occupancy prediction in wireless communications, autonomous microgrid networks, etc, will be used as case studies to inform the discussions.

Wednesday, November 29 12:00 - 12:45 (Australia/Melbourne)

K2: Keynote - Neoteric Frontiers in Cloud, Edge, and Quantum Computing

Professor Rajkumar Buyya, University of Melbourne, IEEE Fellow

Room 1

Chair: Mark A. Gregory (RMIT University, Australia)

Computing is being transformed to a model consisting of services that are delivered in a manner similar to utilities such as water, electricity, gas, and telephony. In such a model, users access services based on their requirements without regard to where the services are hosted or how they are delivered. Cloud computing paradigm has turned this vision of "computing utilities" into a reality. It offers infrastructure, platform, and software as services, which are made available to consumers as subscription-oriented services. Cloud application platforms need to offer (1) APIs and tools for rapid creation of elastic applications and (2) a runtime system for deployment of applications on geographically distributed Data Centre infrastructures (with Quantum computing nodes) in a seamless manner. The Internet of Things (IoT) paradigm enables seamless integration of cyber-and-physical worlds and opening opportunities for creating new class of applications for domains such as smart cities, smart robotics, and smart healthcare. The emerging Fog/Edge computing paradigms support latency sensitive/real-time IoT applications with a seamless integration of network-wide resources all the way from edge to the Cloud. This keynote presentation will cover (a) 21st century vision of computing and identifies various IT paradigms promising to deliver the vision of computing utilities; (b) innovative architecture for creating elastic Clouds integrating edge resources and managed Clouds, (c) Aneka 5G, a Cloud Application Platform, for rapid development of Cloud/Big Data applications and their deployment on private/public Clouds with resource provisioning driven by SLAs, (d) a novel FogBus software framework with Blockchain-based data-integrity management for facilitating end-to-end IoTFog/Edge-Cloud integration for execution of sensitive IoT applications, (e) experimental results on deploying Cloud and Big Data/ IoT applications in engineering, and health care (e.g., COVID19), deep learning/Artificial intelligence (AI), satellite image processing, and natural language processing (mining COVID-19 research literature for new insights) on elastic Clouds, (f) QFaaS: A Serverless Function-as-a-Service Framework for

Quantum Computing, and (g) directions for delivering our 21st century vision along with pathways for future research in Cloud and Edge/Fog computing.

Wednesday, November 29 12:45 - 13:30 (Australia/Melbourne)

L1: Lunch

Venue: Level 6 Building 16 Green Brain, Swanston St

Wednesday, November 29 13:30 - 15:30 (Australia/Melbourne)

S3: Session 3: General

Room 1

Chair: Mohammad Hasan (UKM, Malaysia)

13:30 ***Digital Twin Migration using the OKD platform: A Use-Case for Emergency Vehicles***

Bruno Ribeiro (University of Aveiro, Portugal); Pedro A. Gonçalves (Universidade de Aveiro, Portugal); Paulo C. Bartolomeu (University of Aveiro, Portugal)

The compute capabilities in modern vehicles are on the rise, resulting in increasingly advanced driving assist features accompanied by increased vehicle costs. To reduce cost while providing similar assistance features, research in autonomous vehicles has focused on cooperative scenarios where mobile entities with sensing capabilities share their knowledge and are supported by the roadside infrastructure that provides computing, storage and network resources.

We present a use case for container migration on edge networks to reduce application downtime concerning autonomous emergency response vehicles and their coordination in the field. To provide lower communication delay and faster access to data, the digital twins of the vehicles are implemented as containers placed at network edge nodes.

By measuring the time necessary to perform a complete migration of a running container to a different edge node, while keeping its execution state, we attained the goal of keeping application downtime low through container migration and identifying possible improvements to the system.

pp. 63-69

14:00 ***CaliProb: Probability-based Calibration Model for Robust Predictions in Environments with Data Biases***

Yu-Ran Jeon (Sungshin Women's University, Korea (South)); Jung-Hwa Ryu (Seoul, Korea (South)); So-Yeon Kim (Sungshin Women's University, Korea (South)); Na-Eun Park (Seoul, Korea (South)); Il-Gu Lee (Sungshin Women's University, Korea (South))

Various studies have focused on solving data bias problems in artificial intelligence. However, conventional approaches have primarily focused on data biases originating from imbalanced data distributions between sensor nodes and algorithms owing to overfitting. However, methods handling the biases between sensors have rarely been considered. In general, when data are trained using multiple heterogeneous devices, a device bias occurs due to process, voltage, and temperature variations, differences in the preprocessing methods for each device and the aging of specific devices, resulting in a data bias. In this study, we prove that a data bias can occur due to a device bias, which deteriorates the training performance. In response, we propose the probability-based calibration (CaliProb) model. This model compares the predicted probabilities for each piece of data, selects the data with the best training performance as the reference data, and calibrates the data bias using these reference data. We experimentally verify the CaliProb model. It exhibits an accuracy greater than that of the uncalibrated general model in situations with low and high data biases and achieves an accuracy that is approximately 12.2% higher than that of the Non-calibrated model in a case with abundant data bias.

pp. 70-75

14:30 ***Spreading Sequence Blind Estimation in DSSS System Using Gradient Ascent Method***

Yooncheol Choi, Dongyeong Kim, Mingyu Jang and Dongweon Yoon (Hanyang University, Korea (South))

In direct sequence spread spectrum systems, a receiver must know the spreading code to despread a signal. In non-cooperative contexts, there is no prior information about the spreading code, and it must be blindly estimated. Generally, the maximum likelihood-based method is known to show optimal performance in terms of estimation accuracy, but its computational complexity hinders its practicality. In this paper, we propose an estimation algorithm for the spreading sequence that reduces the computational complexity of the maximum likelihood-based algorithm by applying the gradient ascent method. To validate the proposed method, we compare the estimation performance of the proposed algorithm with that of an existing method in terms of their computational complexity and the error rate of a chip in the estimated spreading sequence.

pp. 76-79

15:00 ***Optimization Technique for Deep Learning Methodology on Power Side Channel Attacks***

Amjed Ahmed (Imam Kadhim (A) for Isalmic Science University, Iraq); Mohammad Hasan (UKM, Malaysia); Nazmus Shaker Nafi (Kellogg Brown and Root, Australia); Azana Hafizah Mohd Aman (Universiti Kebangsaan Malaysia, Malaysia); Shayla Islam (UCSI University, Malaysia); Mohammed S Nahi (Imam AL-Kadhum College, Iraq)

The first non-profiled side-channel attack (SCA) method using deep learning is Timon's Differential Deep Learning Analysis (DDLA). Timon recommended this method. The method is effective in retrieving the secret key with the help of deep learning metrics. The Neural Network (NN) has to be trained numerous times since the proposed approach increases the learning cost with the key sizes, making it hard to assess the results from the intermediate stage. In this research, we provide three possible answers to the issues raised above, along with any challenges that could result from trying to solve these issues. We will start by offering an updated algorithm that has been modified to be able to keep track of the metrics during the intermediary stage. Next, we provide a parallel NN structure and training technique for a single network. This saves a lot of time by eliminating the need to repeatedly retrain the same model. The newly designed algorithm significantly sped up attacks when compared to the previous one. Thus, we propose employing shared layers to overcome memory challenges in parallel structure and improve performance. We evaluated our approaches by presenting non-profiled attacks on ASCAD dataset and a ChipWhisperer-Lite power usage dataset. Power utilisation was studied using both datasets. The shared layers strategy we created was up to 134 times more successful than the prior technique when used to the ASCAD database.

pp. 80-83

Wednesday, November 29 13:30 - 15:30 (Australia/Melbourne)

S4: Session 4: Networks

Room 2

Chair: Leith H. Campbell (RMIT University, Australia)

13:30 ***Optimal Scheduling of Multipath Multicast with In-network Cache for One-to-many Transfer***

Ryota Fukuda, Masahiro Shibata and Masato Tsuru (Kyushu Institute of Technology, Japan)

The need for fast and efficient one-to-many file transfers is growing with the rapid increase in traffic among distributed servers for replicating and distributing large files. Assuming centrally-managed Software Defined Networking (SDN) environments, the authors have been developing a framework of one-to-many file transfers for networks with full-duplex links by which every receiver can fully utilize its own max-flow from the sender throughout the file transfer duration. In our framework, a file is divided into multiple blocks that are transmitted to receivers on a set of multicast trees according to a block transmission schedule designed for a given network topology with the locations of the sender and the receivers (called MPMC). Our previous study proposed an

extension of MPMC in which the sender generates additional coded blocks from the original blocks and transmits those blocks, but it may suffer from the processing delays of encoding and decoding at the sender and all the receivers. Therefore, this paper proposes a new extension of MPMC (called Rainbow-MPMC) by incorporating in-network cache at tailored switches, in which a block in transmission can be replaced (overwritten) at a switch on the way by another block previously passing the switch and cached, instead of just being forwarded to downstream. Through a variety of network topology examples, we verify that many different optimal schedules of Rainbow-MPMC can be generated in a given network, each of which minimizes every receiver's reception completion time simultaneously while requiring a different number of block replacements. We also showed that the minimum number of block replacements among different optimal schedules varies significantly by network even over similar-sized networks.

pp. 84-91

14:00 ***Deep Learning based Path Planning using Integer Linear Programming Method to Teacher Signal***

Makoto Ito, Taiju Mikoshi and Kouichi Genda (Nihon University, Japan)

It is an important research topic to suppress the occurrence of congestion caused by rapid increases and decreases in traffic flowing within a network. Traffic Engineering is a technology for controlling such traffic and efficiently using network resources. For sophisticated traffic control, it is necessary to perform complex calculations, and the issue of calculation time cannot be ignored. To solve these problems, we proposed a centralized path planning method for congestion control using machine learning. This method shows that by using the Dijkstra method for the teacher signal, paths can be designed in a short calculation time while achieving a very high path estimation success rate and load balancing. In this paper, we use Integer Linear Programming for the teacher signal to further improve performance. It is expected that this will enable better load distribution than before. Through performance evaluation experiments, we demonstrate the effectiveness of our proposal in terms of bandwidth usage and calculation time on the maximum load link.

pp. 92-97

14:30 ***Meta-TFEN: A Multi-Modal Deep Learning Approach for Encrypted Malicious Traffic Detection and Classification***

RuoYang Gu (China)

Malware poses a significant threat to internet security. Existing deep learning-based methods for malware traffic detection typically rely on single-modal features, overlooking the heterogeneity of encrypted traffic, thus limiting their detection performance. To address this limitation, this paper proposes a multi-modal deep learning approach called Meta-TFEN for detecting encrypted malicious traffic. The method utilizes TCN, Bi-GRU, and LSTM to extract multi-modal features including the payload of secure transport layer protocols, statistical features, and TLS encryption behavior features. It employs an fusion network to capture the dependencies between modalities and integrates discriminative features to enhance detection performance. Additionally, this paper uses a meta-learning framework for classification to enable rapid deployment of the model. The performance of Meta-TFEN is evaluated on public datasets and its applicability in real-world environments is explored using real samples. The experimental results clearly demonstrate that the Meta-TFEN method surpasses other state-of-the-art methods in terms of accuracy.

pp. 98-104

15:00 ***Achieving Sub-meter Accuracy for 5G Localization at FR1 Bandwidth Limitations***

Bjarne Frischkorn (TU Dortmund University, Germany); Michael Knitter (University of Dortmund, Germany); Wolfgang Endemann (Dortmund University of Technology, Germany); Ruediger Kays (TU Dortmund University, Germany)

This Paper describes an approach to achieve improved localization accuracy in indoor and other scenarios with close line of sight and echo paths. The approach makes use of statistical commonalities of the channel impulse response, arriving from line of sight and echo paths superposition. By using a rising edge detection algorithm, the presented approach achieves an accuracy of less than one meter for line-of-sight scenarios at 5G FR1 bandwidth limitations. The paper presents results derived from simulation and measurement to support the

proposed approach. Compared to conventional peak detection algorithms, the accuracy increases by a factor of at least two.

pp. 105-109

Wednesday, November 29 15:30 - 16:00 (Australia/Melbourne)

AT1: Afternoon Tea

Venue: Level 6 Building 16 Green Brain, Swanston St

Wednesday, November 29 16:00 - 18:00 (Australia/Melbourne)

S5: Session 5: IoT and wireless

Room 1

Chair: Ron Addie (University of Southern Queensland, Australia)

16:00 ***Malicious Lateral Movement in 5G Core With Network Slicing And Its Detection***

Ayush Kumar and Vrizlynn L. L. Thing (ST Engineering, Singapore)

5G networks are susceptible to cyber attacks due to reasons such as implementation issues and vulnerabilities in 3GPP standard specifications. In this work, we propose lateral movement strategies in a 5G Core (5GC) with network slicing enabled, as part of a larger attack campaign by well-resourced adversaries such as APT groups. Further, we present 5GLatte, a system to detect such malicious lateral movement. 5GLatte operates on a NF container-host access graph built using host/container logs collected from the 5GC. Paths inferred from the access graph are scored based on selected filtering criteria and subsequently presented as input to a threshold-based anomaly detection algorithm to reveal malicious lateral movement paths. We evaluate 5GLatte on a dataset containing attack campaigns (based on MITRE ATT&CK and FiGHT frameworks) launched in a 5G test environment which shows that compared to other lateral movement detectors based on state-of-the-art, it can achieve higher true positive rates with similar false positive rates.

pp. 110-117

16:30 ***Sharing, Licensing, Buying, Selling and Operationalizing ML Models: A Deep Learning based Co-operative and Co-ordinated Security usecase***

Deven Panchal, Dan Musgrove, Isilay Baran and David Lu (AT&T, USA)

Many problems that utilize Machine Learning in fact require multiple cooperative efforts to train models on different data on different targets so as to then be able to utilize all these results or the models themselves to do certain tasks. Problems in Remote sensing, Cybersecurity, Network analytics lend themselves very well to this co-operative paradigm where models built elsewhere on other data can be of direct and immediate use or at least be retrained and used at a different site. These models could in fact also come from some other organization or company (model supplier) who might charge (monetize) the usage of these models to another organization or company (model consumer) who may want to deploy them for their own use. Model sharing becomes all the more important in scenarios in which the data is subject to data sovereignty and data location requirements and, requirements over data transfer like GDPR, CCPA, etc. This sharing, monetizing, licensing, writing terms of sale of the models can be done in a very easy and streamlined fashion using the Acumos Federation and Acumos Licensing components that have been built for the exact same purpose. In this paper, we will talk about Acumos Federation, Acumos Licensing and build an ML model to automatically classify different types of Distributed Denial of Service (DDoS) attacks. We will later see how to set up N-site wide federation across 'N' Acumos instances (N=3 in the paper for demo purposes, which could represent 3 companies or 3 different physical sites) to share and use the models built elsewhere to cooperate on the task of identifying DDoS attack types. This paper shows how we can set up a coordinated and cooperative defense against a cooperative attack like DDoS, and more generally solve a variety of problems from different industries in a cooperative fashion using ML with Acumos.

pp. 118-123

17:00 ***Nanoplasmonic Broadband Filters Using Broadside Edge Coupled Coplanar Waveguide***

Thirupathaiah Kola (Koneru Lakshmaiah Education Foundation Hyderabad, India & Abu Dhabi University, United Arab Emirates); Montasir Qasymeh (Abu Dhabi University, United Arab Emirates); Ramakrishna Akella (Koneru Lakshmaiah Education Society, India)

This article presents the study and numerical analysis of three new broadband filters such as broadband bandpass filters based on broadside edge coupled coplanar waveguide with double-sided parallel step impedance resonators (SIRs) at optical frequency bands. The designed three broadband filters can perform

effectively with a lower than 1 dB pass-band insertion loss. The basic transmission line characteristics of the broadside coupled CPW for the even-mode and odd-mode excitations are determined by using the quasi-static conformal mapping technique. These three filters are designed within a higher impedance transmission line section inserted between two lower impedance transmission line sections using cross-coupled resonance conditions. Among all these three filters, filter (III) gives better performance at optical frequencies, which is designed based on the design of the other two initial filters (I), (II). Due to their well-balanced characteristics, these filters provide both broadband operation and ultra-compact circuit size and are useful in the design of nanoscale subwavelength wireless networks.

pp. 124-127

17:30 ***Ergodic Performance Analysis of Reconfigurable Intelligent Surface Enabled Bidirectional NOMA***

Ashish Rauniyar (SINTEF, Norway); Olav Østerbø (Olav Østerbø & Telenor, Norway); Jan Erik Håkegård (SINTEF, Norway); Paal Engelstad (University of Oslo, Norway)

This paper proposes and investigates a reconfigurable intelligent surface (RIS) enabled bidirectional nonorthogonal multiple access (NOMA) network termed as NOMA-RIS. Here, RIS allows multiple NOMA users in one group to communicate with or share information with multiple NOMA users in another group. Specifically, the two NOMA user groups send the data intended for exchange to the RIS. RIS reflects the NOMA signals allowing bidirectional communication between two NOMA user groups. In particular, under the Rician fading environment, we pay close attention to how well RIS-enabled bidirectional NOMA networks operate. Analytical expressions for tight upper bounds for the ergodic capacity are mathematically derived and verified with the simulation results. Comprehensive performance comparisons are presented, showing that our proposed bidirectional NOMA-RIS system can achieve enhanced capacity gains than RIS-enabled traditional orthogonal multiple access schemes. These comparisons also offer practical insights into the impact of various system parameters on the overall network performance.

pp. 128-133

Wednesday, November 29 16:00 - 18:00 (Australia/Melbourne)

S6: Session 6: Networking and General

Room 2

Chair: Shuo Li (RMIT University, Australia)

16:00 ***Comprehensive Browser Extension for Analysing YouTube User Engagement, Controversy, User Requirements, and Trending Keywords***

Praveen Peiris, Thursha Herath, Roshani Dissanayaka, Kanishka Saranga, Samantha Thelijjagoda and Ishara Weerathunga (Sri Lanka Institute of Information Technology, Sri Lanka)

In the dynamic realm of YouTube, addressing the diverse needs of its extensive audience while empowering content creators is of paramount importance. This research paper introduces a robust solution encapsulated in a Chrome extension, meticulously designed to enhance user engagement and fortify YouTube content creators, specifically in the sphere of information technology-related videos. Our approach leverages state-of-the-art Natural Language Processing (NLP) methodologies and Machine Learning (ML) techniques. The extension provides a comprehensive suite of four critical functionalities: analysis of user engagement, extraction of user requirements, identification of controversial topics, and provision of invaluable keyword and title recommendations. To achieve these goals, we employed a range of techniques and algorithms, including Random Forest, VADER (Valence Aware Dictionary and Sentiment Reasoner) Lexicon, Multinomial Naïve Bayes (MNB), Latent Dirichlet Allocation (LDA), Bag of Words (BOW), and the GPT-3 model. The system boasts an impressive overall accuracy of 89.72%, with individual components achieving accuracies of 83.04%, 92.83%, 94%, and 89%, respectively. Beyond its direct application to information technology-themed YouTube content, the methodologies presented can be adapted for other platforms and a variety of categories, such as entertainment, gaming, cooking, travel, and tourism, among others. This research not only redefines the possibilities in YouTube analytics but also offers tangible tools and insights to help creators optimize engagement and foster deeper online dialogues.

pp. 134-139

16:30 ***Zero Trust Security Framework for 5G MEC Applications: Evaluating UE Dynamic Network Behaviour***

Belal Ali (RMIT, Australia); Mark A. Gregory and Shuo Li (RMIT University, Australia); Omar Amjad Atieh Dib (KCST University, Kuwait)

This paper presents a Zero Trust Security (ZTS) framework that enhances the security of Multi-Access Edge Computing (MEC) applications and services for 5G / 6G mobile networks. The ZTS framework incorporates a zero trust policy engine deployed in the 5G Core (5GC) network, which assesses User Equipment (UE) trustworthiness to access the MEC applications. The policy engine evaluates the UE Dynamic Network Behaviour (UDNB). Interactive procedures were designed to realise the proposed framework in a 3GPP-defined 5G network. Cooperation between mobile operators and vertical industries is achieved by leveraging the 5G Network Exposure Function and open interfaces. We propose that behaviour entropy be used as a quantitative measure to evaluate the UE trust value. An access control matrix was developed based on UE behaviour attributes. The performance evaluation demonstrates the effectiveness of our scheme in preventing unauthorised access to various MEC applications.

pp. 140-144

17:00 ***Service-driven User Plane Architecture for Future Cellular Networks and Multi-access Edge Computing***

Bin Liang (RMIT University, China); Mark A. Gregory and Shuo Li (RMIT University, Australia)

The proliferation of 5G applications that delay sensitive has increased demand for computing and storage capability at the network edge. User mobility results in frequent reallocation application state between edge servers and increased User Plane Function (UPF) requirements. Currently there is a complicated interaction between the Control Plane (CP) and User Plane (UP) that reduces the effective utilisation of network and

computation resources, and degrades the Quality of Service (QoS). A service-driven UP selection mechanism plays a key role in fulfilling the heterogeneous service requirements, such as low latency and high speed, and the trade-off between cost and performance. This paper focuses on optimizing Xn-based post-handover UP management in 5G/6G networks by enabling the Uplink Classifier (ULCL) function and Application Function (AF) with refined QoS flow in the integration of 5G/6G with a multi-access edge computing environment. A service-driven UP reallocation mechanism and architecture are proposed for dynamic UP management to balance resource cost and performance.

pp. 145-151

17:30 ***Server Search and Selection Algorithm for a Pre-Handover in Multi-Access Edge Computing***

Shaima Alkaabi, Mark A. Gregory and Shuo Li (RMIT University, Australia)

MEC technology has become instrumental in enhancing the efficiency of content delivery, particularly at the network's edge, facilitating the rise of 5G and the evolution towards 6G. Within MEC, handover is a fundamental technology crucial to maintaining uninterrupted service provision and enhancing reliability. The need for handover is to guarantee seamless transitions between different network access points or cells, ensuring that users and devices are connected and receive consistent, high-quality service as they move. This work presentsan MEC Server Search and Select Algorithm (SSSA) employed during the pre-handover stage for optimization and a seamless handover between MEC servers. SSSA ensures uninterrupted, high-quality service with reduced latency, optimizing MEC's operational efficiency and reliability during the handover process. We discuss the cost equation with four network metrics for the server search and selection process in detail in this paper.

pp. 152-155

Thursday, November 30

Thursday, November 30 8:30 - 10:30 (Australia/Melbourne)

S7: Session 7: Optical networking

Room 1

Chair: Farhad Arpanaei (Universidad Carlos III de Madrid, Spain)

8:30 ***Clipping Noise Mitigation for Coherent OFDM Systems Using Decision-Aided Reconstruction Combined with Neural Networks***

Alexander Frömming and Lars Haering (University of Duisburg-Essen, Germany); Stefan Diederich (Universität Duisburg Essen, Germany); Andreas Czylwik (Universität Duisburg-Essen, Germany)

Clipping noise constitutes a prominent challenge within transmission systems employing orthogonal frequency division multiplexing (OFDM) due to its high peak-to-average power ratio (PAPR). This paper introduces a novel algorithm for mitigating clipping noise at the receiver end of a coherent transmission system. The approach utilizes a recurrent neural network (RNN), specifically based on long short-term memory (LSTM) cells, to reduce the initial symbol error probability by reconstructing the clipped signal in time domain. Subsequently, an adapted iterative decision-aided reconstruction (DAR) algorithm is proposed. This algorithm incorporates two major improvements: Oversampling in time domain, which allows the filtering of residual out-of-band clipping noise after the nonlinear combination, and a novel method for phase management during reconstruction within a coherent system. Numerical simulations show the superior performance of the neural network in comparison to model-based strategies in terms of reducing the initial symbol error probability. Moreover, the application of oversampling and filtering achieves an additional performance gain. Finally, the symbol error ratio can be further reduced by exclusively combining magnitudes during a nonlinear combination process while retaining the phase of the received signal. The interaction of the neural network with the proposed algorithm is able to reduce the symbol error probability by up to five orders of magnitude, solely by processing the identical received signal.

pp. 156-161

8:54 ***Analysis of Adapted Tone Reservation PAPR Reduction Techniques in OTSM System***

Rafee Al Ahsan, Fadhel Ghannouchi and Abraham O Fapojuwo (University of Calgary, Canada)

Orthogonal time sequency multiplexing (OTSM) is one of the novel modulation candidates which has been recently proposed for future 6G wireless communications, as it outperforms the well-known orthogonal frequency division multiplexing (OFDM) and orthogonal time frequency space (OTFS) systems in terms of bit error rate (BER) and computational complexity, respectively in a high-mobility doubly dispersive wireless channel. However, a current analysis reveals that OTSM suffers from a very high peak-to-average power ratio (PAPR) problem like the conventional OFDM. As a result, this paper takes the initiative of analyzing the efficacy of the adapted versions of the classical tone reservation (TR) PAPR reduction technique in the sequency-delay domain of the new OTSM systems, in terms of PAPR reduction gains, computational complexity and BER performance as currently, none exists in the literature. This research reveals how the TR can be adapted with reserved-tone vectors (RVs) to the new delay-sequency domains and how its PAPR reduction capability and computation complexity vary with each new algorithmic change. The results provide analytical and simulation-wise insights into the newly-adapted TR (A-TR) algorithms in OTSM systems which will prove to be useful for carrying out future research in 6G.

pp. 162-168

9:18 ***From Strings to Streams: A Multi-Period Analysis of QKD over EONs, Showcasing Multi-Band vs. Multi-Fiber Solutions***

Mohammad Reza Dibaj (AmirKabir University of Technology, Iran); Pouya Mehdizadeh, Mohammad Sadegh Ghasrizadeh and Hamzeh Beyranvand (Amirkabir University of Technology, Iran); Juan Carlos Hernandez-Hernandez (University Carlos III de Madrid, Spain); José Alberto Hernández, David Larrabeiti and Farhad Arpanaei (Universidad Carlos III de Madrid, Spain)

Quantum key distribution over optical networks has been noted as a state-of-the-art approach to next-generation secure communication. We propose two approaches to manage the signal for quantum key exchange between two trusted nodes; in the first approach, the quantum channel (QCh) uses distinct fiber whereas the classic channel (CCh) and public interaction channel (PICh) use another fiber to be transmitted on C-band (C+L band), and in the second approach CCh and PICh are transmitted over C+L band and QCh only uses O-band, both routed on a same fiber. In this context, two variations of the initial approach have been put forth, namely scenario 1 and scenario 2. In scenario 1, the CChs are positioned within the extended C-band, while in scenario 2, they find their place within the extended C+L-band. Concerning the secondary approach, denoted as scenario 3, the CChs and QChs+PIChs are situated in the extended C+L-band and low-loss O-band, respectively. The simulation outcomes demonstrate the advantages of adopting scenario 3 in relation to fiber deployment. This is highlighted by an 86% (34%) enhancement in fiber efficiency when compared to scenario 1 (2), all while employing an equal count of quantum transmitters and receivers over the initial eight years. As per the specifications of scenario 3, during the concluding year, there has been a notable 44% surge in quantum transmitter and receiver utilization for both scenarios 1 and 2. This upsurge is accompanied by a substantial reduction in fiber utilization, amounting to a 117% (34%) reduction concerning scenario 1 (2).

pp. 169-175

9:42 ***Using Intent Directed Acyclic Graphs in Multi-Domain IP-Optical Networks***

Filippos Christou and Andreas Kirstaedter (University of Stuttgart, Germany)

The global internet relies on a well-coordinated operation of distinct networking domains. This renders multidomain networking at the heart of today's massive digital information exchange. Although Software-Defined Networking (SDN) undoubtedly helps advance network operation within a single organization, non-centralized multi-domain networking has received less attention. To significantly advance the state of networking, we are inherently bound to provide progress and evolve the current multi-domain networking scheme. This work exploits the Intent-Based Networking (IBN) paradigm and the Directed Acyclic Graphs (DAGs) data structure to design a novel architecture for multi-domain IP-Optical networking. We highlight the benefits of our approach leading to seamless operation of non-centralized networks, such as optically transparent domain boundaries and cross-domain grooming. We evaluate this approach in a realistic scenario using our novel open-source tool MINDFul.jl, which we shortly introduce and can be broadly used for related research.

pp. 176-179

10:06 ***Modulation Bandwidth Study on SQW GaN LEDs for High-speed Visible Light Communication***

Md Jahid Faruki (Monash University, Australia); Nemai Karmakar (MONASH University, Australia)

Modulation bandwidth of Light Emitting Diode is an important parameter for visible light communication system performance. Crystal orientation of an LED plays an important role in determining the modulation bandwidth. In this study, 5 different crystal orientations based GaN LEDs have been simulated to understand the impact of crystal orientations on recombination rates, carrier lifetime, and modulation bandwidth to meet the industry requirements for high-speed visible light communication applications.

pp. 180-182

Thursday, November 30 8:30 - 10:30 (Australia/Melbourne)

S8: Session 8: IoT

Room 2

Chair: Navid Shaghaghi (Santa Clara University, USA)

8:30 ***Optimizing Data Latency for Time-Critical Avionic Sensors***

Yevhenii Shudrenko (Hamburg University of Technology, Germany); Koojana Kuladinithi (Hamburg University of Technology & Institute of Communication Networks, Germany); Daniel Plöger and Andreas Timm-Giel (Hamburg University of Technology, Germany)

Wireless Sensor Networks (WSNs) are widely used in industries, healthcare, and smart cities due to their cost-effectiveness, low power consumption, and seamless connectivity. In aviation, the Wireless Avionics Intra-Communication (WAIC) standard aims to integrate WSNs, replacing some wired communication within aircraft for enhanced redundancy and new applications. We propose and evaluate the 6TiSCH with Hybrid Priority Queuing (6TiSCH-HPQ) mechanism, which differentiates traffic by priorities on the link layer. 6TiSCH-HPQ improves Quality of Service (QoS) for time-critical avionic applications without compromising the performance of other traffic types. Analytical modeling with queuing theory and simulations in OMNeT++ demonstrate that up to three times reduction of the end-to-end delay for high-priority traffic is feasible.

pp. 183-189

8:54 ***Multi Sensor Network System for Early Detection and Prediction of Forest Fires in Southeast Asia***

Evizal Abdul Kadir (Universitas Islam Riau, Indonesia); Akram Alomainy (Queen Mary University of London, United Kingdom (Great Britain)); Hanita Daud (Universiti Teknologi PETRONAS, Malaysia); Warih Maharani (Telkom University, Indonesia); Muhammad Noryanti (Universiti Malaysia Pahang Al-Sultan Abdullah, Malaysia); Nesi Syafitri N (Universitas Islam Riau, Indonesia)

The increasing frequency and severity of forest and land fires have become a significant environmental concern, necessitating the development of effective early detection and prediction systems. This paper presents a novel approach to address the issue through the implementation of a multi sensor network system for forest and land fires. The proposed system integrates an array of advanced multi sensors strategically placed across the targeted regions to capture and analyze a wide range of fire related data. The key objective of the system is to enable timely identification of potential fire hotspots by continuously monitoring various environmental parameters, including temperature, humidity, and infrared radiation. The collected data is then processed and analyzed using machine learning algorithms to identify fire patterns and predict the likelihood of fire outbreaks. The system is utilizing a network of sensors, the system offers real-time and comprehensive coverage, allowing for rapid response and timely deployment of fire suppression resources. Furthermore, the results of extensive field tests and evaluations, demonstrating the system accuracy and efficiency in early fire detection and prediction. The proposed system offers a case in Indonesia which Riau Province with high-risk case most of every year. Plotting results data achieved and forecasting of incident for future in the year 2023 with successfully percentage up to 93.6%. Ultimately, the integration of the multi sensor network system into existing fire management frameworks promises to enhance emergency response capabilities and foster proactive measures in preserving our valuable forests and lands.

pp. 190-195

9:18 ***A LoRa-Based Monitoring System for Agriculture***

Steven Cumming and Philip Branch (Swinburne University of Technology, Australia)

In this paper, we present a LoRa-based monitoring system implementing LoRa with simple MAC (medium access control) architecture as a lightweight alternative to the more complex LoRaWAN systems for agricultural applications. Our developed system consists of several low cost and low power remote sensor nodes with LoRa transceivers in a star topology with a custom-built .NET data-logging and control application acting as the central node. Despite using LoRa without LoRaWAN, we were able to demonstrate the reliable collection of remote sensor data and control of remote nodes through field trials of the novel system conducted on a working cattle farm.

pp. 196-203

9:42 *A Deep Learning-based Air Quality Index Prediction Model using LSTM and Reference Stations A Real Application in Taiwan*

Ping-Hui Hsieh, Ming-Hui Hu, Hsin-Hsiung Chen and Shih-Jung Wang (Ministry of Environment, Taiwan)

Air pollution has attracted significant attention as a public concern, prompting government efforts towards air quality monitoring. With the accumulation of data, the feasibility of utilizing artificial intelligence (AI) to aid in air quality prediction has grown. Air quality prediction plays a pivotal role in policy formulation and environmental management. We proposed a neural network model framework constructed using LSTM (Long Short-Term Memory) model and fully connected model. It employs pollutant and meteorological data from target stations, neighboring stations, and outpost stations as feature factors. By utilizing the previous 24 hours monitoring data, it predicts the hourly air quality index (AQI) for the next 12 hours. Experimental results demonstrated the effectiveness of this approach in enhancing prediction accuracy and providing early forecasts of long-range transport of air pollutants. This prediction model is applied within Taiwan Air Quality Monitoring Network [1] and Environment Info Push app [2] both maintained by Ministry of Environment of Taiwan (MOENV), allowing citizens to access information of environment at any time and receive activity recommendations based on real-time monitoring values.

pp. 204-209

10:06 *Sensor-Centric Link Adaptation and Transmit Power Control for Energy-Efficient and Quality-of-Service WBANs*

Da-Ren Chen (National Taichung University of Science and Technology, Taiwan)

Due to the imbalanced power supply and computing capabilities between sensors and the coordinator in Wireless Body Area Networks (WBANs), challenges arise in terms of shortening service duration and increased delay for computation and data transmission tasks. To address this issue while meeting Quality of Service (QoS) requirements, Transmit Power Control (TPC) and Link Adaptation (LA) techniques, widely used in cellular or WiFi communications, are applied to determine suitable transmit power level and modulation and coding schemes (MCS) to enhance energy efficiency. The proposed reinforcement learning algorithm leverages latent path loss and shadowing (PLS) and Signal-to-Noise Ratio (SNR), and transmit power to effectively exploit the corresponding transmit power level and MCS, enabling efficient learning. It aims to minimize energy consumption while satisfying target QoS requirements, including data rate and error ratio. We adapt both models using an efficient Levenberg- Marquardt-Fletcher (LMF) method. By integrating LMF and dTS over the received channel SNR and PLS, the proposed approach automatically adapts to the channel SNR and fading conditions surrounding the human body. The results demonstrate that our method achieves significant power savings, with transmit energy reductions of up to 11.1%. Additionally, it extends the operating time of the sensors by up to 22.4% compared to existing methods.

pp. 210-213

Thursday, November 30 10:30 - 11:00 (Australia/Melbourne)

MT2: Morning Tea

Thursday, November 30 11:00 - 11:45 (Australia/Melbourne)

K3: Keynote - Automation and Orchestration of 5G Network Slices across RAN, Core, and Transport domains in the context of 5G Network Slicing

Sukhdev Kapur, Juniper Networks

Room 1

Chair: Mark A. Gregory (RMIT University, Australia)

Thursday, November 30 11:45 - 12:30 (Australia/Melbourne)

L2: Lunch

Venue: Level 6 Building 16 Green Brain, Swanston St

Thursday, November 30 12:30 - 16:30 (Australia/Melbourne)

T1: Conference Tour

meet outside Building 16, Swanston St

Thursday, November 30 16:30 - 18:00 (Australia/Melbourne)

W2: Workshop 2: 5G Labkit Demonstration

Ms Safa Alghadi, RMIT University, Lukman Iwan, RMIT University

Room 2

Chair: Safa Yahia Alghadi (RMIT University, Australia)

Supports 4G and 5G Standalone (SA) 5G Non-Standalone (NSA) support with optional additional radio Supports all sub-6 GHz frequency bands in TDD and FDD Supports LTE-M Integrates 4G and 5G Firecell Core & RAN Smartphone with SIM included O-RAN split 7.2 compatible via SFP+ port

Thursday, November 30 18:00 - 22:00 (Australia/Melbourne)

D1: Conference Dinner

Level 6, Building 16, Green Brain, Swanston St

Friday, December 1

Friday, December 1 8:30 - 10:30 (Australia/Melbourne)

S9: Session 9: IoT and General

Room 1

Chair: Jahan Hassan (Central Queensland University, Australia)

8:30 ***Functional Programming for the Internet of Things: A LoRa-MQTT Gateway written in Elixir***

Philip Branch and Phillip Seth Weinstock (Swinburne University of Technology, Australia)

Networks for the Internet of Things typically use a gateway to provide connectivity between a low bit rate, low capability sensor network and the broader Internet. The gateway can be subject to very high traffic loads, many concurrent processes and needs to be highly reliable. Functional programming languages such as Erlang and Elixir have proven to be an effective programming paradigm for such scenarios, notably in large scale telecommunications switches. In this paper we report on our experiences of developing a gateway between a LoRa network and an MQTT broker using the functional programming language Elixir. Our experience suggests that the discipline imposed by functional programming results in a system that is more compact, supports concurrent processes well and is more reliable than similar systems developed using conventional languages. However, we also note that subsystems to support the development of such systems are primitive and that functional programming has a considerably steep learning curve. Nevertheless we conclude that functional programming has considerable potential for the Internet of Things and plan to continue research in this area.

pp. 214-217

8:54 ***RSU placement considering V2X services requirements and available radio resources***

Camilo Anzola-Rojas, Ramón J. Durán Barroso, Juan Carlos Aguado, Ignacio de Miguel and Noemí Merayo (Universidad de Valladolid, Spain); Patricia Fernández, Rubén M. Lorenzo and Evaristo J. Abril (University of Valladolid, Spain)

Connected, cooperative and automated mobility (CCAM) is a growing field as the services required by connected vehicles increase in quantity and complexity. To be able to be connected, vehicles need network infrastructure to communicate with. Roadside Units (RSUs) are communication devices that are placed beside highways and roads and offer connectivity and processing services to the vehicles. The 3rd Generation Partnership Project (3GPP) has developed some standards which specify the characteristics of the services, as well as the spectral bands used to offer vehicle to everything (V2X) connectivity. In this paper, we study the optimal placement of RSUs in a V2X network for different service requirements and channel quality scenarios, considering the 3GPP standards. We formulate an Integer Linear Programming (ILP) model to minimize the number of RSUs needed and solve it for different traffic and channel conditions given by the 3GPP specifications. Results offer the number of required RSUs and their placement for vehicular access networks deployments.

pp. 218-221

9:18 ***On the Spatial Correlation of UAV-to-Ground Excess Path-Loss***

Mohammed Elsagher (RMIT, Australia); Akram Al-Hourani and Ke Wang (RMIT University, Australia)

Non-terrestrial networks have been gaining momentum in recent years as an integral part of current 3GPP releases and future networks. It is imperative to capture the intrinsic features of the Unmanned Aerial Non-terrestrial networks have been gaining momentum in recent years as an integral part of current 3GPP releases and future networks. It is imperative to capture the intrinsic features of the Unmanned Aerial Vehicle (UAV)-to-Ground radio channel to achieve higher throughput and minimize interference. One such aspect that has been overlooked thus far is the spatial correlation in the shadowing component of the excess path-loss resulting from near-ground clutter. In this article, we investigate the spatial correlation in the Excess Path-Loss caused by the propagation environment. We employ controlled and extensive ray-tracing simulations to explore the impact of different scenarios, ranging from suburban and urban to high-rise, on the spatial correlation of excess path-loss. We present a systematic method for processing the collected simulation data and propose an empirically derived expression for the spatial correlation in each use case. The results reveal a distinct variation in the spatial correlation of the excess path-loss across various city models, mandating a distinct correlation model for each scenario.Vehicle (UAV)-to-Ground radio channel to achieve higher throughput and minimize interference. One such aspect that has been overlooked thus far is the spatial correlation in the shadowing component of the excess path-loss resulting from near-ground clutter. In this article, we investigate the spatial correlation in the Excess Path-Loss caused by the propagation environment. We employ controlled and

extensive ray-tracing simulations to explore the impact of different scenarios, ranging from suburban and urban to high-rise, on the spatial correlation of excess path-loss. We present a systematic method for processing the collected simulation data and propose an empirically derived expression for the spatial correlation in each use case. The results reveal a distinct variation in the spatial correlation of the excess path-loss across various city models, mandating a distinct correlation model for each scenario.

pp. 222-227

9:42 *International Deployment of Visual IoT for Disaster Mitigation*

Ken T. Murata (National Institute of Information and Communications Technology & NICT, Japan); Kazutaka Kikuta, Tsutomu Nagatsuma and Hideo Imanaka (National Institute of Information and Communications Technology, Japan); Praphan Pavarangkoon (King Mongkut's Institute of Technology Ladkrabang, Thailand)

This paper proposes a novel methodology that utilizes a newly developed visual Internet of Things (IoT) system for resilient natural disaster mitigation. This system enables the detection of disasters through remote control functions integrated with visual IoT sensors and artificial intelligence (AI)-based image processing of images captured by these sensors. The system is designed using commercial off-the-shelf (COTS) components to reduce installation costs, making it feasible for deployment worldwide, including in developing countries. In 2023, the proposal for this system was presented to the ITU-D with the aim of widespread implementation in developing nations. The paper introduces innovative methodologies for visual IoT in international disaster mitigation, accompanied by use cases and detailed technological insights.

pp. 228-233

10:06 *Assessing the Capability of Random Forest to Estimate Received Power in LoRaWAN for Agricultural Settings using Climate Data*

Boris Ramos (Escuela Superior Politécnica del Litoral (ESPOL), Ecuador); Nelson Tovar, Jr (ESPOL, Ecuador); Edison I Del Rosario (Escuela Superior Politecnica del Litoral, Ecuador)

Low power wide area networks (LPWANs) such as LoRaWAN, enable long range wireless communication for internet of things (IoT) devices implemented in different settings, including agricultural crop fields. However, estimating RSSI values for these devices remains a challenge, due to the multipath effect, weather conditions, and the dynamic environment that surrounds these networks. This research evaluates the capability of a low-cost system that uses Random Forest Regression and climate data to estimate RSSI values in a LoRaWAN network deployed in a maize crop field. The Random Forest model uses eleven days of available data from twenty-nine nodes placed at different locations and heights in a maize crop field. In addition, the weather variables used as inputs to the model include temperature, humidity, and solar radiation. The model proved its efficacy to predict RSSI values for a recently inserted node in the network, and when it was used to forecast future and unknow RSSI values of a particular node.

pp. 234-239

Friday, December 1 8:30 - 10:30 (Australia/Melbourne)

S10: Session 10: Networks and Security

Room 2

Chair: Tomotaka Wada (Kansai University, Japan)

8:30 *Evaluation of RTT as an estimation of interactivity time for QoE evaluation in remote desktop environments*

Jesus Arellano-Uson (Public University of Navarre, Spain); Eduardo Magaña and Daniel Morato (Universidad Publica de Navarra, Spain); Mikel Izal (Public University of Navarra (UPNA), Spain)

In recent years, there has been a notable surge in the utilization of remote desktop services, largely driven by the emergence of new remote work models introduced during the pandemic. Traditional evaluation of the

quality of experience (QoE) of users in remote desktop environments has relied on measures such as round-trip time (RTT). However, these measures are insufficient to capture all the factors that influence QoE. This study evaluated RTT and interactivity time in an enterprise environment over a period of 6 months and analysed the suitability of using RTT drawing previously unexplored connections between RTT, interactivity, and QoE. The results indicate that RTT is an insufficient indicator of QoE in productive environments with low RTT values. We outline some precise measures of interactivity needed to capture all the factors that contribute to QoE in remote desktop environments.

pp. 240-245

8:54 ***Pedestrian-Vehicle Collision Avoidance Support System Considering the Left and Right Positions of Pedestrians***

Sota Uchida (University of Kansai, Japan); Hikaru Shimada and Tomotaka Wada (Kansai University, Japan); Naohisa Hashimoto (National Institute of Advanced Industrial Science and Technology, Japan)

The increase in the number of automobiles has caused social problems such as traffic accidents and chronic traffic congestion in urban areas. We focus on the Pedestrian-Vehicle Collision Avoidance Assistance System (P-VCASS), which assists drivers in avoiding collisions between vehicles and pedestrians. P-VCASS warns a driver when a potential collision is predicted. However, this method does not consider differences in danger depending on the position of pedestrians in a pedestrian crossing. In addition, it does not assume the case where there are multiple pedestrians. To solve these problems, we propose a warning system that assumes multiple pedestrians and calculates the degree of danger by considering the left and right positions of pedestrians. The effectiveness of the proposed system is demonstrated through experiments using vehicle and pedestrian terminals in pedestrian crossings. The results show that the proposed system can calculate the degree of danger for each pedestrian and provide appropriate warnings to drivers.

pp. 246-251

9:18 ***Hybrid Encryption Technique for Low-Latency Multi-Hop Communications***

Hye Yeon Shim and Tae Rim Park (Sungshin University, Korea (South)); Il-Gu Lee (Sungshin Women's University, Korea (South))

With the recent widespread use of 5G networks, real-time ultra-high-definition multimedia applications, video conferencing, and telecommuting have become possible. As a result, ultra-low-latency communication has become essential for ensuring human safety. In addition, as attacks on communication data gradually increase with the development of networks, packet encryption is applied to most services to protect data. However, in a multi-hop encrypted communication environment, it is challenging to achieve the low latency required for communication due to the significant overhead of encryption and decryption during information processing at the intermediate node. Conventional routing path optimization and caching techniques have evolved to reduce latency. However, the improvement in latency is significantly diminished in multi-hop encryption communication. Therefore, research is needed on low-latency and high-reliability encryption communication methods in a multi-hop communication environment. To this end, this paper proposes a hybrid encryption technique. The proposed technique improves latency while maintaining memory usage at a similar level in a multi-hop encrypted communication environment. Experimental results show that the proposed technique could reduce latency by an average of 10% compared to single-encrypted communication.

pp. 252-258

9:42 ***Anomaly Detection via Federated Learning***

Marc Vucovich (Deloitte, USA); Amogh Suhas Kamat Tarcar and Penjo Rebelo (Persistent Systems Limited, India); Abdul Rahman, Dhruv Nandakumar and Christopher Redino (Deloitte & Touche LLP, USA); Kevin Choi (Deloitte and Touche LLP, USA); Robert Schiller (Deloitte, USA); Sanmitra Bhattacharya and Balaji Veeramani (Deloitte & Touche LLP, USA); Alexandra West (Deloitte, USA); Edward Bowen (Deloitte & Touche LLP, USA)

Machine learning has helped advance the field of anomaly detection by incorporating classifiers and autoencoders to decipher between normal and anomalous behavior. Additionally, federated learning has provided a way for a global model to be trained with multiple clients' data without requiring the client to directly share their data. This paper proposes a novel anomaly detector via federated learning to detect malicious network activity on a client's server. In our experiments, we use an autoencoder with a classifier in a federated learning framework to determine if the network activity is benign or malicious. By using FedSam, our novel min-max scalar and sampling technique, we created a federated learning framework that allows the global model to learn from heterogenous clients and, in turn, provide a means for each client to improve their intrusion detection system's defense against cyber-attacks.

pp. 259-266

10:06 ***Ensemble Defense System: A Hybrid IDS Approach for Effective Cyber Threat Detection***

Sarah Alharbi (University of Delaware, USA); Arshiya Khan (Graduate Research Assistant, USA)

Sophisticated cyber attacks present significant challenges for organizations in detecting and preventing such threats. To address this critical need for advanced defense mechanisms, we propose an Ensemble Defense System (EDS). An EDS is a cybersecurity framework aggregating multiple security tools designed to monitor and alert an organization during cyber attacks. The proposed EDS leverages a comprehensive range of Intrusion Detection System (IDS) capabilities by introducing a hybrid of signature-based IDS and anomaly-based IDS tools. It also incorporates Elasticsearch, an open-source Security Information and Event Management (SIEM) tool, to facilitate data analysis and interactive visualization of alerts generated from IDSs. The effectiveness of the EDS is evaluated through a payload from a bash script that executes various attacks, including port scanning, privilege escalation, and Denial-of-Service (DoS). The evaluation demonstrates the EDS's ability to detect diverse cyber attacks.

pp. 267-270

Friday, December 1 10:30 - 11:00 (Australia/Melbourne)

MT3: Morning Tea

Friday, December 1 11:00 - 12:00 (Australia/Melbourne)

K4: Keynote - Addressing Data Leakage in Split Learning: Attacks and Defence Strategies

Professor Naveen Chilamkurti, Fellow IET (UK), La Trobe University

Room 1

Chair: Mark A. Gregory (RMIT University, Australia)

Split Learning (SL) has emerged as an innovative framework designed to enable deep learning applications on resource-constrained devices such as IoT or mobiles. Its core concept involves dividing a deep model into multiple parts and distributing them between data owners and a central cloud computing server. During the training process, only processed data is transmitted from the client to the server, safeguarding user data privacy. However, SL encounters several challenges, including (i) the high computational burden on low-end devices, (ii) potential privacy risks arising from the exposed intermediate data, and (iii) susceptibility to model inversion attacks capable of reconstructing raw input data. In this presentation, we will first delve into recent research addressing privacy attacks and defence mechanisms within the context of SL that could potentially lead to the leakage of users' private data. Subsequently, we will introduce our ongoing work aimed at enhancing the learning performance and privacy preservation of SL. This includes (i) the exploration of binarization in SL's local layers to expedite computation and reduce memory usage on the client side; (ii) an investigation into SL without local weight sharing to strengthen client-side data privacy, especially in environments with semi-trusted participants; and (iii) an examination of the integration of Differential Privacy into SL to further fortify user data privacy. We will identify potential accuracy degradation when training multiple clients with varying privacy requirements and present an approach to mitigate this challenge. By the

end of this presentation, you will gain insights into the latest trends in the development of attacks and defences aimed at enhancing the privacy preservation of SL, which plays a crucial role in extending AI to pervasive devices while addressing data privacy concerns.

Friday, December 1 12:00 - 13:00 (Australia/Melbourne)

L3: Lunch

Venue: Level 6 Building 16 Green Brain Swanston St

Friday, December 1 13:00 - 15:00 (Australia/Melbourne)

S11: Session 11: Networks and Design

Room 1

Chair: Philip Branch (Swinburne University of Technology, Australia)

13:00 ***Enhancing Intent-driven Networking With Granular and Aspect Approach***

Nenad Dragun (Croatia); Nikola Bogunovic (University of Zagreb, Croatia)

Intent-driven networking propelled by new networking concepts as well as the introduction of achievements from machine learning and artificial intelligence domains in network management, has gained a significant momentum in telco networks automation realm. The fact of being closely related to machine learning and artificial intelligence domains, implied the necessity for its interaction with the knowledge management domain. Knowledge management supports intent-driven networking in various ways, ranging from user intent translation, across network feedback analysis, to activity deciding mechanisms. This paper presents the granular and aspect-driven approach in knowledge management as a convenient methodology intrinsically compatible with intent-driven core principles.

pp. 271-276

13:30 ***An Analysis of Pre-trained Models Versus Custom Deep Learning Models for Forest Fire Detection***

Shouthiri Partheepan (Central Queensland University & Eastern University, Australia); Farzad Sanati and Jahan Hassan (Central Queensland University, Australia)

The detection of forest fires is crucial for human and environmental safety due to their catastrophic impacts. Utilizing machine learning (ML) and deep learning (DL) enhances forest fire management by analyzing data, enabling early warning systems, monitoring fire behaviour, and optimizing resource allocation. The DL algorithms provide a significant influence in the context of forest fire detection. The result of many research studies in the recent past is evident that it is becoming increasingly important in future detection tasks. The majority of research studies use DL models that have been pre-trained. Nevertheless, an investigation should examine how custom models perform compared to pre-trained models in detection tasks. This study aims to compare the performance of the simple CNN model with that of the pre-trained DL model and also compare the pre-trained model as a feature extractor for the custom model. Five CNN pre-trained models, such as VGG16, ResNet50, MobileNetV2, Xception, and Inception were used for our study. The Xception model achieved high accuracy in both scenarios as a pre-trained model and feature extractor with custom layers for fire detection. Also, the result proved that combining CNN models as a feature extractor with custom layers performed well compared with the custom and pre-trained models.

pp. 277-282

14:00 ***Federated Learning Integration in O-RAN: A Concise Review***

Noureen Islam (Independent University Bangladesh, Bangladesh); Md Fahad Monir (Independent University, Bangladesh); M M Mahbubul Syeed (Independent University Bangladesh, Bangladesh); Mahady Hasan (Independant University Bangladesh, Bangladesh); Mohammad Faisal Uddin (Independent University Bangladesh, Bangladesh)

The rapid growth of the telecommunication industry presents a global challenge in maintaining data security and privacy amid increasing data traffic and diverse applications. Applying Federated Learning (FL) to the upcoming Next Generation Wireless Networks (NextG) or Open Radio Access Network (O-RAN) holds great potential as a solution for addressing these challenges. With this in consideration, our paper explores a secure and privacy-conscious solution, focusing on the potential of FL in upcoming wireless networks or O-RAN. FL's cooperative learning approach ensures data confidentiality, offering significant advancements in security issues associated with growing user numbers, and supports the migration to the NextG. In this paper, the concise review provides valuable insights into O-RAN, FL, and related works, with an emphasis on security and privacy. Additionally, it explores framework utilization and outlines future research directions for integrating FL within O-RAN. This approach aims to offer the readers a quick and clear understanding of FL integration within O-RAN, avoiding the need to navigate through extensive survey papers.

pp. 283-288

14:30 ***Understanding Statistical Correlation of Application Security Vulnerability Data from Detection and Monitoring Tools***

Santanam Kasturi and Xiaolong Li (Indiana State University, USA); John Pickard and Peng Li (East Carolina University, USA)

Vulnerability data gathered from multiple detection and monitoring capabilities at different layers of an application using a time-series analysis will provide value and insights by doing a statistical correlation with attack requests observed using a Web Application Firewall (WAF) monitoring solution. Static Analysis Security Testing, Software Composition Analysis, Dynamic Analysis Security Testing (DAST), Application Ethical Hack, Application Programming Interface (API) testing are the tests / scans that have been used to gather vulnerability data for this study. Correlations can further help track abnormal transaction paths if we follow specific ones pointed out by the statistical analysis for those requests that are not blocked by the rules and are allowed as valid transactions to pass through. This provides a narrowed down focus on the convergence of observability and security, critical to realizing a near-real time rapid action. Observations must continue for many days as a time series ensuring consistency and reliability in data collections and analysis. Multiple applications must be observed in a similar manner for ensuring validity of the process for analysis. Also, gathering sufficient data that is large enough to represent a reasonable population of web applications within an organization is a significant factor in achieving reliable correlation. Applying Pearson Correlation (or Spearman Correlation for distributions that are not normal) technique provides insight into Significance (two-tailed) as to whether a correlation is present over large number of data points. Results of analysis show evidence of correlations among specific attack requests monitored by the WAF and corresponding vulnerabilities in applications, detected using one or more methods. This is significant to looking for more insights into how these correlations can further explored into predicting attack patterns based on existing vulnerabilities.

pp. 289-296

Friday, December 1 13:00 - 15:00 (Australia/Melbourne)

S12: Session 12: Wireless and Security

Room 2

Chair: Mohammad Hasan (UKM, Malaysia)

13:00 ***Information-Theoretic Security in BB84 QKD***

Shawn Arnold Prestridge, James Dunham and Dinesh Rajan (Southern Methodist University, USA)

This paper demonstrates ways to improve the post-processing phase of BB84-based Quantum Key Distribution (QKD) while maintaining Information-Theoretic security. Maximum entropy in the distilled bits can be achieved provided that we follow certain rules on which bits are sacrificed, and these rules follow naturally from the properties of the generator matrix. We use standard decoder techniques to distill bits and establish

Information-Theoretic security, but give insights into how those techniques can be adapted to provide greater bit throughput. Finally, we compare popular coding schemes in BB84 post-processing as a basis for code selection and discover at low initial Bit Error Rates (BER), a Polar 4/5 or Hamming *give the best performance and for higher initial BER, the LDPC 3/4 and Hamming* give the best performance.

pp. 297-303

13:24 *An RF-based Low Rate DDoS Attack Real-time Detection System*

Shijin Liu and Hiroaki Fukuda (Shibaura Institute of Technology, Japan); Paul Leger (Universidad Católica del Norte, Chile)

Software Defined Networking (SDN) is a new paradigm in network architecture. It improves network flexibility, scalability and network management by separating data forwarding logic and control logic. SDN controllers have a global view of the entire network and provide the ability to dynamically change traffic forwarding rules. However, the introduction of SDN brings some new vulnerabilities to DDoS attacks, such as single point of failure. DDoS attack is a network attack that floods network links by transferring illegal traffic at high speed. Illegal data traffic can overload network links, causing legal data to be lost and network services to be unavailable. Low Rate Distributed Denial of Service (LRDDoS) is the latest evolution of DDoS attacks and has become one of the most serious vulnerabilities in the Internet, cloud computing platforms, the Internet of Things (IoT), and large data centers. LRDDoS attacks consume network resources by periodically sending a relatively small number of packets. Therefore, LRDDoS attacks are more difficult to detect. This paper proposes a real-time system for LRDDoS defense in SDN. The system uses Random Forest(RF) to detect attacks. We call this system as RFLRS. In addition, we propose a feature subset that is the most suitable for RFLRS for reducing the classification time based on the CIC dataset. Our experimental results show that RF performs a 99.8% accuracy with a reduction of 28% classification time.

pp. 304-309

13:48 *Combining Decentralized IDentifiers with Proof of Membership to Enable Trust in IoT Networks*

Alessandro Pino, Davide Margaria and Andrea Vesco (LINKS Foundation, Italy)

The Self-Sovereign Identity (SSI) is a decentralized paradigm enabling full control over the data used to build and prove the identity. In Internet of Things networks with security requirements, the Self-Sovereign Identity can play a key role and bring benefits with respect to centralized identity solutions. The challenge is to make the SSI compatible with resource-constraint IoT networks. In line with this objective, the paper proposes and discusses an alternative (mutual) authentication process for IoT nodes under the same administration domain. The main idea is to combine the Decentralized IDentifier (DID)-based verification of private key ownership with the verification of a proof that the DID belongs to an evolving trusted set. The solution is built around the proof of membership notion. The paper analyzes two membership solutions, a novel solution designed by the Authors based on Merkle trees and a second one based on the adaptation of Boneh, Boyen and Shacham (BBS) group signature scheme. The paper concludes with a performance estimation and a comparative analysis.

pp. 310-317

14:12 *TGP-based dynamic traffic camouflage method*

Hao Yu (China)

n order to address the issue of attackers leveraging traffic analysis to steal users' network behavioral patterns, this paper proposes a dynamic traffic camouflage method based on Twin Gaussian Processes (TGP). TTC utilizes Twin Gaussian Processes to capture the pattern changes in the target traffic for feature prediction of the undisguised traffic. After obtaining the predicted features, constraints are applied and traffic reconstruction is performed based on these constrained features. The reconstructed traffic is indistinguishable from the target traffic, leading to misclassification by attackers. Experimental results using the ISCXTor2016 public dataset demonstrate that the proposed TTC method has stronger obfuscation capabilities in traffic classification compared to previous traffic obfuscation methods. It effectively protects user privacy.

pp. 318-324

14:36 ***Design of Lightweight Cryptography Based Deep Learning Model for Side Channel Attacks***

Amjed Ahmed (Imam Kadhim (A) for Isalmic Science University, Iraq); Mohammad Hasan (UKM, Malaysia); Nazmus Shaker Nafi (Kellogg Brown and Root, Australia); Azana Hafizah Mohd Aman (Universiti Kebangsaan Malaysia, Malaysia); Shayla Islam (UCSI University, Malaysia); Saif Aamer Fadhil (Imam Al Kadhum College IKC, Iraq)

Depending on the device's encryption mechanism, a wide variety of tangible details could be exposed. These leaks are used in side-channel analysis, which is used to get keys. Due to deep learning's sensitivity to the characteristics of the data being processed, using such algorithms can significantly improve the accuracy and efficiency of side channel analysis. However, classic neural networks are now used for the vast majority of the work that is being done. When the number of nodes in a network grows, so does the efficiency with which key recovery can function. However, the method's computing complexity grows in direct proportion. Overfitting, inadequate capacity for feature extraction, and inefficient training are all potential issues. In this study, we develop a compact convolutional neural network by enhancing a previously existing combination of characteristic network. Novel network of neural nature along with previous neural network both have their own implementations of the side-channel analysis used in comparative trials. Statistically, the new network has better accuracy, quicker convergence, and more robustness. Overfitting did not occur in any of the cases. As part of the research, heatmaps were provided as a means of data visualisation. The critical interval concentration is higher and the heat value is higher in the new network. Conventional neural networks, which serve as the foundation for various kinds of neural networks, perform much worse than side channel studies based on feature fusion networks.

pp. 325-328

Friday, December 1 15:00 - 15:30 (Australia/Melbourne)

AT3: Afternoon Tea

Venue: Level 6, Building 16 Green Brain, Swanston St

Friday, December 1 15:30 - 15:40 (Australia/Melbourne)

CR: Closing Remarks

ITNAC 2024 is in Sydney, Australia

Mark Gregory, General Chair, RMIT University

Chair: Mark A. Gregory (RMIT University, Australia)

Venue: Level 6 Building 16 Green Brain, Swanston St