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Wednesday, July 5 9:00 - 10:00

Keynote Lecture I

Dr. Marco Di Renzo

Wednesday, July 5 10:20 - 12:00

Resource Allocation

Chair: Dongmei Zhao (McMaster University, Canada)

Integrated Sensing and Multi-Access Computation Offloading in Smart Oceans: A Utility Maximization Design.....N/A

Minghui Dai (University of Macau, Macao); Ning Huang (University of Macau, China); Yuan Wu (University of Macau, Macao); Liping Qian (Zhejiang University of Technology, China); Bin Lin (Dalian Maritime University, China); Zhou Su (Xi'an Jiaotong University, China)

With the increasing exploration of smart oceans, a large number of marine wireless devices have been deployed for different marine applications such as ocean environment monitoring and seabed resource exploitation. Although the paradigm of marine edge computing networks is expected to process a variety of marine tasks with low delay and high data rate, the efficiency of computation offloading is a critical issue due to the complex environment in smart oceans. In this paper, we propose an integrated sensing and multi-access computation offloading scheme in smart oceans, with the objective of maximizing marine wireless devices' utilities. Specifically, underwater wireless sensor (UWS) first perceives ocean information via radar sensing and then uploads its workloads to an unmanned underwater vehicle (UUV) and a sea surface sink node (SN) via non-orthogonal multiple access (NOMA) transmission. To improve the offloading efficiency, we formulate the utility of each party and model the task offloading process among UWS, UUV and SN as a Stackelberg game to optimize the UWS's offloading strategy, UUV's and SN's price strategies. Numerical results demonstrate that the proposed algorithms can obtain the optimal solutions and increase the utilities for marine wireless devices.

Optimum Digital Twin Response Time for Time-Sensitive Applications.....7

Amirhosein Aghaei and Dongmei Zhao (McMaster University, Canada)

As the digital replica of a physical system (PS), a digital twin (DT) is responsible for providing real-time information of its PS to applications. However, random network conditions result in uncertainty in future age of information (AoI) at the DT, which makes it complicated for a DT to decide when to respond an application request in order to maintain the best information freshness at the application. In this work, we consider the effect of random wireless channel condition between the PS and the DT on the AoI changes at the DT, and formulate a Markov decision process that finds the optimum response time for the DT to send the PS information to an application after receiving a request from the application. The objective is to minimize the average AoI at the application. The MDP has delayed reward, and is solved by redistributing the reward with LSTM network and then finding the optimal policies using Dueling Double Deep Q-learning. Numerical results show that the solutions provide close-to-optimum average AoI performance.

Buffer-state Aware Task Offloading in Edge Networks With Task Splitting for IoV.....13

Abbas Yekanlou, Ahmed I Salameh and Jun Cai (Concordia University, Canada)

The expansion of internet of vehicles (IoV) to host new applications for end users (EUs), such as extended reality (XR) and in-vehicle streaming services, is restrained by the computing capacity available at EUs locally. To accelerate IoV expansion and abate the computation capacity limitation at EU side, edge computing (EC) has exploded in recent years. In this work, we devise a workframe to optimize task offloading (TO) and results caching from EUs to an edge network made of two EC nodes with the objective of queuing delay risk assessment to minimize task dropping and maximize earned task credit by the primary EC node. We first formulate an integer non-linear programming (INLP) problem. Then, an algorithm based on the genetics algorithm (GA) is proposed to solve the problem. Our results show that the proposed algorithm achieves the best performance in terms of average task execution time, dropping rate, and earned credit by the primary EC node, compared to traditional task offloading methods.

A Pricing Model for Energy Transactions in a Blockchain-based Smart Grid with Game Theory.....N/A

Yiwen Zhang, Ziyu Huang, Ting Li, Dajiang Chen and Zhiguang Qin (University of Electronic Science and Technology of China, China)

The conventional grid is undergoing significant changes to overcome the challenge of growing supply-demand imbalances. Smart grids integrate state-of-the-art communication, metering, and control technologies to address power imbalances and grid instability. In this paper, we propose a Stackelberg-game-based pricing model in a demand response way by using user-side energy storage to maximize the interests of users on all sides of the grid. Moreover, blockchain technology is used to write smart contracts for multi-party power transactions, empower the transaction process using blockchain, and automate the processing, storage and transmission of transaction information to greatly improve the transaction efficiency of power transactions, ensure the fairness of all parties, and prevent the repeated consumption of power and currency. The experimental result shows that the proposed method can address power imbalances and grid instability to a great extent.

Entangled Pair Resource Allocation under Uncertain Fidelity Requirements.....25

Rakpong Kaewpuang and Minrui Xu (Nanyang Technological University, Singapore); Stephen J Turner (Vidyasirimedhi Institute of Science and Technology, Thailand); Dusit Niyato and Han Yu (Nanyang Technological University, Singapore); Dong In Kim (Sungkyunkwan University (SKKU), Korea (South))

In quantum networks, effective entanglement routing enables remote entanglement communication between quantum source and quantum destination nodes. However, different from routing in classical networks, entanglement routing in quantum networks needs to consider the quality of entanglement qubits (i.e., entanglement fidelity), which is challenging when ensuring entanglement fidelity over long distances. To address this issue, we propose a resource allocation model for entangled pairs and an entanglement routing model with fidelity guarantee, in which entangled resources (i.e., entangled pairs) and an entanglement routing are jointly optimized to support applications in quantum networks. The proposed model is formulated via two-stage stochastic programming. In this model, the uncertainty of the requirements of quantum applications is taken into account. With the objective of minimizing the total cost, the proposed model ensures sufficient utilization of entangled pairs and energy conservation of quantum repeaters under uncertain fidelity requirements. The experimental results demonstrate that the proposed model can reduce the total cost by at least 20% compared to the baseline model.

Wednesday, July 5 14:00 - 16:00

Communication System 1

Chair: M. Reza Soleymani (Concordia University, Canada)

Rate-Distortion-Perception Tradeoff Based on the Conditional Perception Measure.....31

Sadaf Salehkalaibar, Buu Phan, Ashish Khisti and Wei Yu (University of Toronto, Canada)

In this paper, we study the rate-distortion-perception tradeoff generalizing the classical rate-distortion theory where the perception constraint is introduced to generate perceptually qualified reconstructions. The perception metric measures the divergence between distributions of the input and reconstruction when both distributions are conditioned on the encoder's output. This metric was originally introduced by Mentzer et al. for the video compression setting. We characterize the rate-distortion-perception tradeoff for a general source. In the Gaussian setting, we show that jointly Gaussian reconstructions are indeed optimal. Interestingly, to achieve a perceptually perfect reconstruction, comparing to the minimum mean square error (MMSE) reconstruction, we only need extra 0.5 bits/sample for the compression rate.

A Novel Framework for Relating Quasi-Cyclic Codes and Quasi-Twisted Codes.....38

Akram Saleh (Concordia University, Canada); M. Reza Soleymani (Concordia University, Canada)

In this paper, we aim to analyze the algebraic structure of repeated-root quasi-cyclic codes of length $(p^k n \setminus \ell)$ and index $(\setminus \ell)$ over the finite field $(\mathbb{F}\{q\})$, where (k) is a positive integer, $(q=p^{\alpha})$ and $((n, p) = 1)$. For this purpose, a quasi-cyclic code over $(\mathbb{F}\{q\})$ is regarded as a linear code over an auxiliary ring. By introducing a ring isomorphism, we provide a one-to-one correspondence between this class of quasi-cyclic codes and nonrepeated-root $(1-u)$ -quasi-twisted codes of length $(n \setminus \ell)$ and index $(\setminus \ell)$ over the chain ring $(\mathbb{F}\{q\}+u\mathbb{F}\{q\}+\dots+u^{p^k-1}\mathbb{F}\{q\})$, where $(u^{p^k}=0)$. Our approach enables us to extend the results regarding non-repeated-root quasi-twisted codes over rings to repeated-root quasi-cyclic codes over finite fields. To illustrate the effectiveness of our method, we provide examples that demonstrate how it simplifies the structure of this class of codes.

Distributed Multi-Pair Computation for Intra C-RAN Bidirectional Communications.....42

Mahmoud Hasabelnaby (The University of British Columbia, Canada); Anas Chaaban (University of British Columbia, Canada)

Cloud radio-access network (C-RAN) performance is limited by fronthaul capacity constraints. To alleviate this limitation, distributed processing between the distributed radio units (RUs) and the central processing unit (CPU) can be used to relax the communication overhead over the fronthaul links. In this paper, a distributed multi-pair computation approach is proposed for a C-RAN with intra-cloud bidirectional communication, wherein some user-pairs are served locally by an RU whereas others are served centrally at the CPU. The achievable end-to-end rate is derived, optimized, and numerically evaluated under limited fronthaul capacity and power constraints. Numerical evaluations reveal the proposed scheme can overcome the fronthaul capacity limitation and significantly improve the achievable end-to-end sum-rate compared to conventional centralized ones.

An Adaptive Modulation Coding Cross-Layer Optimization Strategy with Packet Successful Transmission and Delay Constraints.....48

Taotao Tian and Xiaojie Fang (Harbin Institute of Technology, China); Lizhe Liu (54th Research Institute

of China Electronics Technology Group Corporation, China); Zunqi Li and Kaiwen Huang (Harbin Institute of Technology, China)

In this paper, we analyze the impact of the general data link layer queue service status and application layer data flow on the physical layer of wireless communication. We propose a cross-layer optimization strategy that considers the information from the upper layers to adjust the adaptive modulation and coding (AMC) transmission mode and transmission power of the physical layer. Furthermore, we present an algorithm that maximizes energy efficiency by selecting the optimal AMC threshold interval and transmission power with the constraints of packet success rate (PSR) and delays. The numerical results demonstrate the significant advantages of the proposed strategy in terms of energy efficiency.

Non-Reciprocal RIS-Assisted Wireless Communications: Channel Modeling.....54

Zahra Taheri and Mohammad Reza Soleymani (Concordia University, Canada); Gursimran Singh Sethi (LATYS Intelligence Inc., Canada)

Non-reciprocal reconfigurable intelligent surface (NR-RIS) has emerged as a promising technology for enhancing the performance of wireless communication systems. Unlike conventional RIS, NR-RIS can support asymmetric signal transmission, which enables different signal paths between the transmitter and receiver. In this paper, we investigate the potential of NRRIS-assisted wireless communication systems and analyze the impact of various system parameters on performance metrics, including the signal-to-noise ratio(SNR) and the bit error rate (BER). Specifically, we first develop a path loss model for a simple RIS-aided system, and we study the effect of different parameters, such as the number of RIS elements, and the distance between the base station, RIS, and user. We then derive a channel model for nonreciprocal RISs, and we study the effects of non-reciprocity on the channel coefficients and phase shift matrix at RIS in both uplink and downlink channels. Simulation results show that nonreciprocity can significantly affect the performance of RIS-aided systems and that a careful design of the RIS is necessary to achieve optimal performance.

Information Theoretical Security: Generating Encryption Keys by Recording Round-Trip Travel Times over the Internet.....59

Amir K. Khandani (University of Waterloo, Canada)

Current key sharing techniques rely on the hardness of solving a solvable, but complex, mathematical problem. This entails, in Information Theoretical sense, the encryption key is not secret, it can be found by solving the underlying mathematical problem. Sensitive data we encrypt today using traditional techniques can be recorded by malicious parties and be deciphered in the future whenever improved hacking techniques and supporting computing technology permit. Information Theory proves the existence of methods for sharing of encryption keys that are unconditionally secure, but does not show how to bring such theoretical results to practical use. One of the central Information theoretical approaches to key sharing is based on exploiting common randomness. This theoretical result establishes that if two dependent random variables, A and B, are available at Alice and Bob, then by communicating through a public channel between them, it is possible to securely share a key of size $I(A;B)$. To bridge the gap between theory and practice, one needs a method to generate two sets of dependent random variables, one at Alice's side and one at the Bob' side, as well as a method to extract two identical keys from the dependent random pair. This article presents a novel technique to achieve this goal over the Internet. Dependent random variables are generated by measuring packet travel times between Alice and Bob, and error-free key extraction from dependent random variables is realized by using a randomized Low Density Parity Check Code (LDPC). Through looping of packets between Alice and Bob, the mutual information between random variables

is increased. Finally, methods are presented to measure the likelihood values required in decoding the underlying LDPC. It is shown that the key rate is approximately equal to $0.5\log_2(4L^2/(4L-1)) \sim 0.5\log_2(L)$ where L is the number of looping. Test results (based on measurements between distant nodes over the Internet) are presented, demonstrating the feasibility of the proposed technique. The proposed method is implemented entirely in software (through standard programming at the application layer) without the need to make any changes in the underlying network.

Thursday, July 6 9:00 - 10:00

Keynote Lecture II

Dr. Xuemin (Sherman) Shen

Thursday, July 6 10:20 - 12:00

Communication Systems 2

Chair: Wei-Ping Zhu (Concordia University, Canada)

Optimizing Uniform Linear Arrays for Massive MIMO Applications.....65

Elhamsadat Anarakifirooz and Sergey Loyka (University of Ottawa, Canada)

Massive MIMO (mMIMO) systems with uniform linear arrays (ULA) are considered in the non-asymptotic regime, when the number of antennas is bounded. To reduce the complexity of implementation, their design is optimized subject to signal-to-noise plus interference (SINR) constraints. While the resulting constrained optimization problems have difficult analytical structure (due to their non-convex nature), a novel analytical approach is proposed and a number of globally-optimal solutions/designs are obtained. The proposed designs are robust, they do not require a precise knowledge of directions of arrival for interfering users and preserve other important properties of mMIMO.

Compressive Sensing-Based Channel Estimation for MIMO OTFS Systems.....71

Ali Mohebbi, Wei-Ping Zhu and M. Omair Ahmad (Concordia University, Canada)

Orthogonal time frequency space (OTFS) modulation is a novel two-dimensional modulation technique that performs in the delay-Doppler (DD) domain. In this work, we present a new compressive sensing (CS)-based algorithm for estimating the channel in the DD domain for multiple-input multiple-output (MIMO) OTFS systems. Exploiting the property that the MIMO channel in the DD domain exhibits structured sparsity, we first obtain a row-block sparse formulation for channel estimation (CE) problem. Then, we propose a row-block orthogonal matching pursuit (RBOMP) algorithm to estimate the channel. Computer simulations demonstrate that the proposed algorithm enhances the estimation accuracy compared with the conventional minimum mean squared error (MMSE)-based and the existing CS-based CE techniques.

Principal-Minimum Eigenvalue Algorithm for Signal Sensing.....N/A

Yumin Zhong and Yanhua Li (Beijing Research Institute of Telemetry, China)

In this paper we propose a promising signal sensing method based on principal components of eigenvalue to minimum of eigenvalue of the received signal. The signal model and performance of theoretical analysis are provided in detail. In comparison with energy detection, the proposed method does not need prior

information of signal and noise. Therefore, it can be widely used in noise power uncertainty scenarios, such as signal transmission in hypersonic plasma sheath. Simulation results show the proposed method has excellent performance even for very low signal-noise-ratio (SNR) signals. Besides, compared with other state-of-the-art methods including MME, EME and AGM, the performance of PME is close to MME method, and has advantages over other methods 5~8dB better respectively.

Thursday, July 6 14:00 - 15:00

Keynote Lecture III

Dr. Olgica Milenkovic

Thursday, July 6 15:20 - 16:40

Integrated Computation and Communication

Chair: Weiyang Feng (Beijing Jiaotong University, China)

Edge-Coordinated On-Road Perception for Connected Autonomous Vehicles Using Point Cloud.....77

Jiawei Hou, Peng Yang and Tian Qin (Huazhong University of Science and Technology, China); Wen Wu (Peng Cheng Laboratory, China)

In this paper, we tackle the problem of selecting connected autonomous vehicles (CAVs) with the most valuable point cloud data for edge-coordinated on-road perception. Through extensive experiments, we find that adding a CAV for collaborative perception yields diminishing gain in understanding the on-road environments, while the generated point cloud data size grows linearly with the number of employed CAVs. Meanwhile, both vehicular mobility and diversified road topology lead to the dynamics of data size of the captured point clouds. Based on those findings, we then formulate an optimization problem that maximizes the utility of collaborative perception at edge nodes. Considering the submodularity of collaborative perception utility and heterogeneity of point cloud data size from individual vehicles, a CAV candidate selection algorithm is proposed. The marginal gain of processing the point cloud data of each candidate is firstly evaluated and ranked, based on which a subset of CAVs are selected subject to bandwidth capacity. Finally, experimental results on an open dataset are presented to demonstrate the superiority of the proposed algorithm under dynamic traffic conditions and bandwidth fluctuations.

Worker Assignment in Deadline-aware Heterogeneous Distributed Computing Systems.....83

Mehrad Mehrabi, Maryam Ardakani and Masoud Ardakani (University of Alberta, Canada)

Recently, distributed computing systems have become prevalent due to their ability to manage large-scale computations required by emerging machine learning algorithms and signal processing tasks. In real-world scenarios, distributed computing systems often receive multiple tasks that have to be completed within specific deadlines. Additionally, service providers may provide varying levels of services based on the subscription tiers of their users. In this work, we consider worker assignment for a heterogeneous coded distributed computing system consists of multiple masters with different subscription tiers. Each master has a time-sensitive matrix-vector multiplication task, needs to be done before a deadline. The system receives reward by finishing tasks before their deadlines and prioritizing tasks with higher subscription tiers. The goal is to develop a worker assignment policy that maximizes the system's total reward. To do so, we propose a worker assignment policy namely "reward greedy". Simulation results show that our proposed algorithm

performs very close to the brute-force search while enjoys much smaller complexity.

Edge-Assisted Video Transmission with Adaptive Key Frame Selection: A Hierarchical DRL Approach.....89

Wenjie Zhu, Ruoyang Chen and Changyan Yi (Nanjing University of Aeronautics and Astronautics, China); Jun Cai (Concordia University, Canada)

This paper proposes a novel hierarchical deep reinforcement learning (HDRL) framework for edge-assisted real-time video transmission in Industrial Internet of Things (IIoT). The system model consists of a gateway, multiple edge servers, and a central controller. The gateway performs key frames selection to compress video chunks from terminal cameras, which are then transmitted through multi-hop links to edge servers for video analysis. The central controller determines the key frames selection and routing path for each video chunk to minimize the transmission delay while ensuring video data accuracy. Different from the existing work, we investigate video transmission under system dynamics that the bandwidth of each link is time-varying and both real-time and accuracy requirements of each chunk are unpredictable. We decompose such problem into routing path and key frames selection sub-problems. To this end, we introduce a deep Q network-based optimal routing approach and an adaptive key frames selection approach to solve the two sub-problems, respectively. An HDRL training framework is further developed to integrates these two approaches jointly for improving the overall performance. Simulation results show the superiority of the proposed solution over counterparts.

Joint Computation Offloading and Energy Trading in Electric Vehicular Networks.....95

Weiyang Feng (Beijing Jiaotong University, China); Xiao Xiao (Traffic Control Technology, China); Siyu Lin (Beijing Jiaotong University, China); Ashab Uddin, Niloofar Naghdi Pour and Ning Zhang (University of Windsor, Canada)

With the rising number of electric vehicles (EVs), the high computational task and energy management of vehicles bring great challenges to the intelligent transportation system. In this work, we investigate the joint offloading and energy trading strategy in vehicular edge computing (VEC) network. We propose an offloading-trading framework, in which EVs can offload tasks to road side unit (RSU) equipped with edge servers or Energy Fog Center (EFC), i.e, edge nodes and fog nodes, and sell excess power to EFC through Vehicle-to-grid (V2G) technology to improve energy efficiency. We aim to maximize the system utility while satisfying the offloading-trading requirements. Since the original problem is non-convex, we decompose it into two subproblems, i.e., trading energy subproblem and trading-offloading subproblem, and proposed the Farthest and Nearest Comparison Searching (FNC-S) algorithm. Specifically, we derive the closed-form expressions of trading electric energy in the trading energy subproblem. Besides, trading-offloading strategy is obtained at two boundaries of distance based on optimal moving distance searching in the trading-offloading subproblem. Simulation results show that the proposed FNCS algorithm can significantly improve the utility compared with other baseline schemes.

Friday, July 7 9:00 - 10:00

Keynote Lecture IV

Dr. Octavia A. Dobre

Friday, July 7 10:20 - 12:20

Communication Networks

Chair: Samuel Dayo Okegbile (Concordia University, Canada)

Towards Modeling Computation Capacity of a Vehicular Cloud while Overcoming Resource Volatility.....101

Chinh Tran and Mustafa Mehmet-Ali (Concordia University, Canada)

Future vehicles will become more computationally powerful to support safe, autonomous, and convenient features for passengers. However, the computing resources onboard are often underutilized and can be pooled to form a computing cluster called vehicular cloud (VC). The VC operators inherently want to know the capabilities of the VC to predict its performance adequately. Since the vehicles are mobile, resources in the vehicular cloud are often volatile. In this work, we provide an analysis of the computing capacity of VC while overcoming its volatility characteristics. We employ a task assignment strategy that guarantees task completion when the vehicles move in and out of the VCs. Using a stochastic modeling approach, we provide a tractable solution to the distribution of the number of completed jobs during the lifetime of the VC. Then we employ the Monte Carlo simulation method to verify the numerical results from the analytical model.

High-Reliability, Low-Latency, and Load-Balancing Multipath Routing for LEO Satellite Networks.....107

Yufei Wang (Northeastern University, China); Lin Cai (University of Victoria, Canada); Jun Liu (Northeastern University, China)

Being a critical part of the sixth generation mobile networks (6G) infrastructure, satellite networks have been witnessed rapid development in recent years. With the increasing number of satellites and high mobility, the challenges of load balancing and high reliability are increasingly prominent. The regular topology and orbital movement of low earth orbit (LEO) satellites provide a new opportunity for the design of network routing schemes. In this paper, we propose a new routing scheme named High-Reliability, Low-Latency, and Load-Balancing Multipath Routing (HLLMR). It aims to provide reliable and load-balanced communication services for the LEO satellite networks. To ensure the reliability of satellite network transmission, a packet is transmitted through multiple path. The path and link selection strategy avoids hotspots through load balancing to ensure end-to-end reliability, and minimize the link cost. Based on the Starlink constellation, we illustrate the advantages of HLLMR routing in delay and reliability.

Millimeter Wave Full-Duplex Networks: MAC Design and Throughput Optimization.....112

Shengbo Liu and Wen Wu (Peng Cheng Laboratory, China); Liqun Fu (Xiamen University, China); Kaige Qu (University of Waterloo, Canada); Qiang Ye (Memorial University of Newfoundland, Canada); Weihua Zhuang and Sherman Shen (University of Waterloo, Canada)

Full-duplex (FD) technique can remarkably boost the network capacity in the millimeter wave (mmWave) bands by enabling simultaneous transmission and reception. However, due to directional transmission and large bandwidth, the throughput and fairness performance of a mmWave FD network are affected by deafness and directional hidden-node (HN) problems and severe residual self-interference (RSI). To address these challenges, this paper proposes a directional FD medium access control protocol, named DFDMAC to support typical directional FD transmission modes by exploiting FD to transmit control frames to reduce signaling overhead. Furthermore, a novel busy-tone mechanism is designed to avoid deafness and directional HN problems and improve fairness of channel access. To reduce the impact of RSI on

link throughput, we formulate a throughput maximization problem for different FD transmission modes and propose a power control algorithm to obtain the optimal transmit power. Simulation results show that the proposed DFDMAC can improve the network throughput and fairness by over 60% and 32%, respectively, compared with the existing MAC protocol in IEEE 802.11ay. Moreover, the proposed power control algorithm can effectively enhance the network throughput.

An Analysis of DHCP Vulnerabilities, Attacks, and Countermeasures.....119

Abdulaziz Abdulghaffar (Carleton University, Canada); Sumit Kumar Paul (University of Ottawa, Canada); Ashraf Matrawy (Carleton University, Canada)

A large number of devices use the Dynamic Host Control Protocol (DHCP) protocol to obtain network configurations like IP address, gateway, Domain Name System (DNS) address, etc. However, the security aspect was not considered thoroughly during its design phase. As a result, it has several very lucrative vulnerabilities to many attackers. In this analysis, we discuss the major vulnerabilities of the DHCP protocol that can result in different attacks. These vulnerabilities include a lack of authentication, confidentiality, and integrity. We also explain different attacks that can be performed by exploiting these vulnerabilities, like rogue DHCP server attacks, DHCP starvation attacks, or replay attacks. Furthermore, we summarize the countermeasures proposed by the researchers to nullify and mitigate these attacks. Moreover, the advantages and drawbacks of the countermeasures are also discussed in this paper.

A Buffer Occupancy Estimation Model for Opportunistic Networks.....125

Jagdeep Singh (University of Delhi & Sant Longowal Institute of Engineering and Technology, Longowal, Punjab, India - Govt. of India, India); Sanjay Kumar Dhurandher (Netaji Subhas University of Technology, New Delhi, India); Isaac Woungang (Toronto Metropolitan University, Canada); Periklis Chatzimisios (International Hellenic University (Greece), Greece & University of New Mexico (USA), USA)

When designing routing schemes for Opportunistic networks (OppNets), node's buffer congestion is one of the major concerns. Most buffer management schemes for OppNets are reactive ones, which require that more messages be transmitted. In this paper, a Buffer Occupancy Estimation Model (denoted BOEM) for OppNets is proposed, which uses the Chernoff's bound to estimate the expected buffer occupancy of any node without involving the communication of messages. Through simulations using both the realistic and synthetic mobility models, the effectiveness of the proposed model is proven, showing that it can significantly reduce the overall quantity of messages sent while leading to reduced node's buffer congestion.

Adaptive Application Deployment for Multi-Access Edge Computing Based on Mobility Prediction.....131

Jian Wang, Changyan Yi, Ran Wang and Qiang Wu (Nanjing University of Aeronautics and Astronautics, China); Jun Cai (Concordia University, Canada)

In this paper, the proactive application deployment based on mobility prediction for multi-access edge computing (MEC) is studied. Since mobility prediction is commonly imperfect, there is an inherent conflict between the prediction accuracy and the prediction duration (i.e., the length of time ahead). As a result, proactively deploying applications for MEC based on a shorter (longer) term mobility prediction may lead to a higher (lower) accuracy, and thus reduces (increases) the service delay while suffers (avoids) from a larger deployment cost. To strike such balance, we propose a novel adaptive application deployment scheme, taking the mobility predictions of different mobile users in multiple future time periods as the input,

for optimizing their corresponding application deployments (i.e., which applications should be deployed on which edge nodes and how long they should be deployed in advance). Specifically, a residual LSTM framework is utilized for mobility prediction, and based on this, a low-complexity greedy algorithm is developed. Simulation shows the feasibility of the proposed scheme and demonstrate its superiority over counterparts.