

Communications in Computer and Information Science

1247

Commenced Publication in 2007

Founding and Former Series Editors:

Simone Diniz Junqueira Barbosa, Phoebe Chen, Alfredo Cuzzocrea,
Xiaoyong Du, Orhun Kara, Ting Liu, Krishna M. Sivalingam,
Dominik Ślezak, Takashi Washio, Xiaokang Yang, and Junsong Yuan

Editorial Board Members

Joaquim Filipe 

Polytechnic Institute of Setúbal, Setúbal, Portugal

Ashish Ghosh

Indian Statistical Institute, Kolkata, India

Igor Kotenko 

St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences, St. Petersburg, Russia

Raquel Oliveira Prates 

Federal University of Minas Gerais (UFMG), Belo Horizonte, Brazil

Lizhu Zhou

Tsinghua University, Beijing, China

More information about this series at <http://www.springer.com/series/7899>

Mohammad S. Obaidat (Ed.)

E-Business and Telecommunications

16th International Conference, ICETE 2019
Prague, Czech Republic, July 26–28, 2019
Revised Selected Papers



Springer

Editor

Mohammad S. Obaidat
Fellow of IEEE, Dean of College
of Computing & Informatics
University of Sharjah
Sharjah, UAE

University of Jordan
Amman, Jordan

University of Science
and Technology Beijing
Beijing, China

ISSN 1865-0929 ISSN 1865-0937 (electronic)
Communications in Computer and Information Science
ISBN 978-3-030-52685-6 ISBN 978-3-030-52686-3 (eBook)
<https://doi.org/10.1007/978-3-030-52686-3>

© Springer Nature Switzerland AG 2020

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The present book includes extended and revised versions of a set of selected papers from the 16th International Joint Conference on e-Business and Telecommunications (ICETE 2019), held in Prague, Czech Republic, in the period July 26–28, 2019.

ICETE 2019 received 166 paper submissions from 41 countries, of which 6% were included in this book. The papers were selected by the event chairs and their selection is based on a number of criteria that includes the reviews and suggested comments provided by the Program Committee members, the session chairs' assessments, and also the program chairs' global view of all papers included in the technical program. The authors of selected papers were then invited to submit a revised and extended version of their papers having at least 30% new material.

ICETE 2019 is a joint conference aimed at bringing together researchers, engineers, and practitioners interested in information and communication technologies, including data communication networking, e-business, optical communication systems, security and cryptography, signal processing and multimedia applications, and wireless networks and mobile systems. These are the main knowledge areas that define the six component conferences, namely: DCNET, ICE-B, OPTICS, SECRIPT, SIGMAP, and WINSYS, which together form the ICETE joint conference.

The papers selected and included in this book contribute to the understanding of relevant trends of current research in “Secure and Efficient Matrix Multiplication with MapReduce,” “Evaluation of Floating-Point Arithmetic Protocols Based on Shamir Secret Sharing,” “Polyphonic Recordings Applied to Single-Channel Audio Source Separation,” “Automatic Sleep Scoring Toolbox and Its Application in Sleep Apnea,” “Copyright Protection Method for Vector Map Data,” “Ways in which Classification and Typification Contribute to Comprehensibility,” “Dynamic Taint Tracking Simulation,” “Invisible Hybrid 3D Video Watermarking Robust against Malicious Attacks,” “Reconfigurable Implementation of Elliptic Curve Cryptography over GF (2ⁿ),” and “Application of Error Detection in Networks by Protocol Behavior Model.” They basically cover the areas of ICETE 2019.

We would like to thank all the authors for their contributions and also to the reviewers who helped ensure the quality of this publication.

July 2019

Mohammad S. Obaidat

Organization

Conference Chair

Mohammad S. Obaidat

University of Sharjah, UAE, University of Jordan, Jordan, and University of Science and Technology Beijing, China

Program Co-chairs

DCNET

Christian Callegari

Dip Ing Informaz, Italy

ICE-B

Marten van Sinderen

Paulo Novais

University of Twente, The Netherlands
Universidade do Minho, Portugal

OPTICS

Panagiotis Sarigiannidis

University of Western Macedonia, Greece

SECRYPT

Pierangela Samarati

Università degli Studi di Milano, Italy

SIGMAP

Sebastiano Battiato

Ángel Serrano Sánchez
de León

University of Catania, Italy
Universidad Rey Juan Carlos, Spain

WINSYS

Pascal Lorenz

Franco Davoli

University of Upper Alsace, France
University of Genoa, Italy

DCNET Program Committee

Gianni Antichi

Queen Mary University of London, UK

Pablo Belzarena

UdelaR, Uruguay

Valentín Carela-Español

Auvik Networks Inc., Spain

Paolo Castagno

University of Torino, Italy

Zesheng Chen

Purdue University Fort Wayne, USA

Luca Deri

Ntop, Italy

Hiroaki Fukuda

Shibaura Institute of Technology, Japan

Francesco Gringoli

University of Brescia, Italy

Pascal Lorenz	University of Upper Alsace, France
Eliane Martins	Universidade Estadual de Campinas, Brazil
Matteo Sereno	University of Torino, Italy
Giovanni Stea	University of Pisa, Italy
Tatsuya Suda	University Netgroup Inc., USA

DCNET Additional Reviewers

Gabriel Gomez Sena	Universidad de la República, Uruguay
Federico Larroca	Universidad de la República, Uruguay

ICE-B Program Committee

Andreas Ahrens	Hochschule Wismar, University of Technology, Business and Design, Germany
Dimitris Apostolou	University of Piraeus, Greece
Ana Azevedo	CEOS, ISCAP, PPORTO, Portugal
Efthimios Bothos	Institute of Communication and Computer Systems, Greece
Alexandros Bousdekis	Information Management Unit, National Technical University of Athens, Greece
Rebecca Bulander	Pforzheim University of Applied Science, Germany
Christoph Bussler	Google, Inc., USA
Wojciech Cellary	Poznan University of Economics and Business, Poland
Chun-Liang Chen	National Taiwan University of Arts, Taiwan, China
Dickson Chiu	The University of Hong Kong, Hong Kong
Ritesh Chugh	Central Queensland University, Australia
Michele Colajanni	University of Modena and Reggio Emilia, Italy
Rafael Corchuelo	University of Sevilla, Spain
Mariana Curado Malta	CEOS, Polytechnic of Porto, Portugal
Ioanna Dionysiou	University of Nicosia, Cyprus
Peter Dolog	Aalborg University, Denmark
Inma Hernández	Universidad de Sevilla, Spain
Abderrahmane Leshob	University of Quebec at Montreal, Canada
Olga Levina	FZI Research Center for Information Technology, Germany
Yung-Ming Li	National Chiao Tung University, Taiwan, China
Rungtai Lin	National Taiwan University of Arts, Taiwan, China
Liping Liu	University of Akron, USA
Peter Loos	German Research Center for Artificial Intelligence, Germany
Babis Magoutas	Information Management Unit, National Technical University of Athens, Greece
Wilma Penzo	University of Bologna, Italy
Ruben Pereira	ISCTE, Portugal
Krassie Petrova	Auckland University of Technology, New Zealand

Agostinho Pinto	CEOS, ISCAP, PPORTO, Portugal
Charmaine Plessis	University of South Africa, South Africa
Pak-Lok Poon	Central Queensland University, Australia
Ela Pustulka-Hunt	FHNW Olten, Switzerland
Manuel Resinas	Universidad de Sevilla, Spain
Fernando Romero	University of Minho, Portugal
Jarogniew Rykowski	Poznan University of Economics and Business, Poland
Ahm Shamsuzzoha	University of Vaasa, Finland
Hassan Sleiman	Renault Group, France
Riccardo Spinelli	Università degli Studi di Genova, Italy
Zhaohao Sun	PNG University of Technology, Papua New Guinea, and Federation University Australia, Australia
James Thong	Hong Kong University of Science and Technology, Hong Kong
Ben van Lier	Centric, The Netherlands
Alfredo Vellido	Universitat Politècnica de Catalunya (UPC), Spain
Yiannis Verginadis	ICCS, National Technical University of Athens, Greece

ICE-B Additional Reviewers

Patrick Lübbecke	German Research Center for Artificial Intelligence GmbH, Germany
------------------	---

OPTICS Program Committee

Siti Barirah Ahmad Anas	Universiti Putra Malaysia, Malaysia
Tiago Alves	Instituto Superior Técnico, Instituto de Telecomunicações, Portugal
Nicola Andriolli	Scuola Superiore Sant'Anna, Italy
Gaetano Assanto	Università degli Studi Roma Tre, Italy
Hercules Avramopoulos	National Technical University of Athens, Greece
Adolfo Cartaxo	Instituto de Telecomunicações, ISCTE - Instituto Universitário de Lisboa, Portugal
C. Chow	National Chiao Tung University, Taiwan, China
Giampiero Contestabile	Scuola Superiore Sant'Anna, Italy
Bernard Cousin	University of Rennes 1, France
Fred Daneshgaran	California State University, Los Angeles, USA
Marija Furdek	Chalmers University of Technology, Sweden
Marco Genovese	INRIM, Italy
Habib Hamam	Université de Moncton, Canada
Sang-Kook Han	Yonsei University, South Korea
Nicholas Ioannides	London Metropolitan University, UK
Miroslaw Klinkowski	National Institute of Telecommunications, Poland
Koteswararao Kondepudi	Scuola Superiore Sant'Anna, Italy
Guo-Wei Lu	Tokai University, Japan
Lenin Mehedy	IBM Research, Australia

Tetsuya Miyazaki	National Institute of Information and Communications, Japan
Maria Morant	Universitat Politècnica de València, Spain
John Moscholios	University of Peloponnese, Greece
Masayuki Murata	Osaka University, Japan
Syed Murshid	Florida Institute of Technology, USA
Scott Newman	Optiwave, Canada
Yasutake Ohishi	Research Center for Advanced Photon Technology, Japan
Satoru Okamoto	Keio University, Japan
Albert Pagès	Universitat Politècnica de Catalunya (UPC), Spain
Jordi Perelló	Universitat Politècnica de Catalunya (UPC), Spain
João Rebola	Instituto de Telecomunicações, ISCTE-IUL, Portugal
Shaymaa Riyadh Tahhan	Al-Nahrain University, Iraq
Enrique Rodriguez-Colina	Universidad Autónoma Metropolitana, Mexico
Mehdi Shadaram	The University of Texas at San Antonio, USA
Salvatore Spadaro	Universitat Politècnica de Catalunya (UPC), Spain
Ripalta Stabile	Eindhoven University of Technology, The Netherlands
Takuo Tanaka	RIKEN, Japan
Bal Virdee	London Metropolitan University, UK
Hui Yang	Beijing University of Posts and Telecommunications, China
Alessandro Zavatta	CNR, Italy

SECRYPT Program Committee

Ehab Al-Shaer	University of North Carolina at Charlotte, USA
Muhammad Asghar	The University of Auckland, New Zealand
Francesco Buccafurri	University of Reggio Calabria, Italy
Cagri Cetin	USF, USA
Frederic Cuppens	Télécom Bretagne, France
Nora Cuppens	IMT Atlantique, France
Sabrina De Capitani di Vimercati	Università degli Studi di Milano, Italy
Roberto Di Pietro	Hamad Bin Khalifa University, Qatar
Mario Di Raimondo	Università di Catania, Italy
Josep Domingo-Ferrer	Rovira i Virgili University, Spain
Ruggero Donida Labati	Università degli Studi di Milano, Italy
Alberto Ferrante	Università della Svizzera Italiana, Switzerland
Josep-Lluis Ferrer-Gomila	Balearic Islands University, Spain
Sara Foresti	Università degli Studi di Milano, Italy
Steven Furnell	University of Plymouth, UK
Joaquin Garcia-Alfaro	Télécom SudParis, France
Angelo Genovese	Università degli Studi di Milano, Italy
Dimitris Gritzalis	AUEB, Greece
Stefanos Gritzalis	University of Piraeus, Greece

Jinguang Han	Queen's University Belfast, UK
Xinyi Huang	Fujian Normal University, China
Vasilis Katos	Bournemouth University, UK
Sokratis Katsikas	Norwegian University of Science and Technology, Norway
Shinsaku Kiyomoto	KDDI Research Inc., Japan
Albert Levi	Sabanci University, Turkey
Kaitai Liang	University of Surrey, UK
Jay Ligatti	University of South Florida, USA
Giovanni Livraga	Università degli Studi di Milano, Italy
Javier Lopez	University of Malaga, Spain
Masahiro Mambo	Kanazawa University, Japan
Yunlong Mao	Nanjing University, China
Evangelos Markatos	ICS, Forth, Greece
Fabio Martinelli	CNR, Italy
Ahmed Meddahi	IMT Lille Douai, France
David Megias	Universitat Oberta de Catalunya, Spain
Alessio Merlo	University of Genoa, Italy
Haralambos Mouratidis	University of Brighton, UK
Farid Naït-Abdesselam	Paris Descartes University, France
Rolf Oppliger	eSECURITY Technologies, Switzerland
Stefano Paraboschi	University of Bergamo, Italy
Joon Park	Syracuse University, USA
Gerardo Pelosi	Politecnico di Milano, Italy
Günther Pernul	University of Regensburg, Germany
Silvio Ranise	Fondazione Bruno Kessler, Italy
Indrakshi Ray	Colorado State University, USA
Pierangela Samarati	Università degli Studi di Milano, Italy
Nuno Santos	INESC, Portugal
Andreas Schaad	University of Applied Sciences Offenburg, Germany
Fabio Scotti	Università degli Studi di Milano, Italy
Cristina Serban	AT&T, USA
Daniele Sgandurra	Royal Holloway, University of London, UK
Basit Shafiq	Lahore University of Management Sciences (LUMS), Pakistan
Vicenc Torra	University of Skövde, Sweden
Juan Ramon Troncoso-Pastoriza	EPFL, Switzerland
Corrado Visaggio	Università degli Studi del Sannio, Italy
Haining Wang	University of Delaware, USA
Lingyu Wang	Concordia University, Canada
Xinyuan Wang	George Mason University, USA
Edgar Weippl	University of Vienna, SBA Research, Austria
Zheng Yan	Xidian University, China
Meng Yu	The University of Texas at San Antonio, USA
Mo Yu	Google, USA

Jiawei Yuan	University of Massachusetts Dartmouth, USA
Qiang Zeng	University of South Carolina, USA
Lei Zhang	Refinitiv, USA
Shengzhi Zhang	Boston University, Metropolitan College, USA
Yongjun Zhao	The Chinese University of Hong Kong, Hong Kong

SECRYPT Additional Reviewers

Giada Sciarretta	Fondazione Bruno Kessler, Italy
Bruhadeshwar Bezawada	Colorado State University, USA
Roberto Carbone	Fondazione Bruno Kessler, Italy
Cagri Cetin	University of South Florida, USA
Vasiliki Diamantopoulou	University of the Aegean, Greece
Giacomo Giorgi	CNR-IIT, Italy
Qinwen Hu	The University of Auckland, New Zealand
Christos Kalloniatis	University of the Aegean, Greece
Diptendu Kar	Colorado State University, USA
Elisavet Konstantinou	University of the Aegean, Greece
Chao Lin	Wuhan University, China
Chengjun Lin	The Chinese Academy of Sciences, China
Salvatore Manfredi	Fondazione Bruno Kessler, Italy
Lorenzo Musarella	University of Reggio Calabria, Italy
Manos Panaousis	University of Greenwich, UK
Ivan Pryvalov	CISPA, Germany
Athanasiос Rizos	CNR, Italy
Antonia Russo	University of Reggio Calabria, Italy
Neetesh Saxena	Bournemouth University, UK
Stavros Shiaeles	Plymouth University, UK
Yifan Tian	Embry-Riddle Aeronautical University, USA
Xu Yang	RMIT University, Australia
Yuxin Zhang	Swinburne University of Technology, Australia

SIGMAP Program Committee

Harry Agius	Brunel University London, UK
Rajeev Agrawal	North Carolina Agricultural and Technical State University, USA
Fadoua Ataa Allah	Royal Institute of Amazigh Culture (IRCAM), Morocco
Arvind Bansal	Kent State University, USA
Adrian Bors	University of York, UK
Kaushik Das Sharma	University of Calcutta, India
Carl Debono	University of Malta, Malta
Zongming Fei	University of Kentucky, USA
Jakub Galka	University of Science and Technology, Poland
Jerry Gibson	University of California, Santa Barbara, USA

Seiichi Gohshi	Kogakuin University, Japan
William Grosky	University of Michigan, USA
Amarnath Gupta	University of California, San Diego, USA
Haci Ilhan	Yildiz Technical University, Turkey
Razib Iqbal	Missouri State University, USA
Li-Wei Kang	National Yunlin University of Science and Technology, Taiwan, China
Sokratis Katsikas	Norwegian University of Science and Technology, Norway
Constantine Kotropoulos	Aristotle University of Thessaloniki, Greece
Choong-Soo Lee	St. Lawrence University, USA
Chengqing Li	Xiangtan University, China
Martin Lopez-Nores	University of Vigo, Spain
Ilias Maglogiannis	University of Piraeus, Greece
Hong Man	Stevens Institute of Technology, USA
Daniela Moctezuma	Conacyt (CentroGEO), Mexico
Chamin Morikawa	Morpho, Inc., Japan
Alejandro Murua	University of Montreal, Canada
Hiroshi Nagahashi	Japan Women's University, Japan
Ioannis Paliokas	Centre for Research and Technology - Hellas, Greece
Joao Paulo da Costa	University of Brasília, Brazil
Yiming Qian	Simon Fraser University, Canada
Peter Quax	Hasselt University, Belgium
Paula Queluz	Instituto Superior Técnico, Instituto de Telecomunicações, Portugal
Simone Santini	Universidad Autónoma de Madrid, Spain
Ángel Serrano Sánchez de León	Universidad Rey Juan Carlos, Spain
Andreas Uhl	University of Salzburg, Austria
Sudanthy Wijewickrema	The University of Melbourne, Australia

WINSYS Program Committee

Ali Abu-El Humos	Jackson State University, USA
Fatemeh Afghah	Northern Arizona University, USA
Andreas Ahrens	Hochschule Wismar, University of Technology, Business and Design, Germany
Aydin Akan	Istanbul University, Turkey
Vicente Alarcon-Aquino	Universidad de las Americas Puebla, Mexico
Jose Barcelo-Ordinas	Universitat Politècnica de Catalunya (UPC), Spain
Marko Beko	Universidade Lusófona de Humanidades e Tecnologias, Portugal
Luis Bernardo	Universidade Nova de Lisboa, Portugal
Llorenç Cerdà-Alabern	Universitat Politècnica de Catalunya (UPC), Spain
Gerard Chalhoub	Université Clermont Auvergne, France
Sungrae Cho	Chung-Ang University, South Korea

Carl Debono	University of Malta, Malta
Panagiotis Fouliras	University of Macedonia, Greece
Janusz Gozdecki	AGH University of Science and Technology, Poland
Fabrizio Granelli	Università degli Studi di Trento, Italy
Stefanos Gritzalis	University of Piraeus, Greece
Aaron Gulliver	University of Victoria, Canada
David Haccoun	École Polytechnique de Montréal, Canada
Chih-Lin Hu	National Central University, Taiwan, China
A. R. Hurson	Missouri S&T, USA
Georgios Kambourakis	University of the Aegean, Greece
Majid Khabbazian	University of Alberta, Canada
Charalampos Konstantopoulos	University of Piraeus, Greece
Gurhan Kucuk	Yeditepe University, Turkey
Wookwon Lee	Gannon University, USA
David Lin	National Chiao Tung University, Taiwan, China
Ju Liu	Shandong University, China
Elsa Macias López	University of Las Palmas de G.C., Spain
Koosha Marashi	Romeo Power Technology, USA
Sarandis Mitropoulos	Ionio University, Greece
Marek Natkaniec	AGH University of Science and Technology, Poland
Amiya Nayak	University of Ottawa, Canada
Gregory O'Hare	University College Dublin (UCD), Ireland
Cristiano Panazio	Escola Politécnica of São Paulo University, Brazil
Grammati Pantziou	University of West Attica, Greece
Jordi Pérez-Romero	Universitat Politècnica de Catalunya (UPC), Spain
Dennis Pfisterer	University of Lübeck, Germany
Symon Podvalny	Voronezh State Technical University, Russia
Jorge Portilla	Universidad Politécnica de Madrid, Spain
Neeli Prasad	International Technological University, USA
Julian Reichwald	Cooperative State University Mannheim, Germany
Heverson B. Ribeiro	IRT b>>com (Institute of Research and Technology), France
Jörg Roth	University of Applied Sciences Nuremberg, Germany
Angelos Rouskas	University of Piraeus, Greece
Farag Sallabi	United Arab Emirates University, UAE
Manuel García Sánchez	Universidade de Vigo, Spain
Altair Santin	Pontifical Catholic University of Paraná (PUCPR), Brazil
Nicola Santoro	Carleton University, Canada
Christian Schindelhauer	University of Freiburg, Germany
Winston Seah	Victoria University of Wellington, New Zealand
Christopher Silva	The Aerospace Corporation, USA
Alvaro Suárez-Sarmiento	University of Las Palmas de Gran Canaria, Spain
Bishal Thapa	Raytheon BBN Technology, USA
César Vargas Rosales	Tecnológico de Monterrey, Mexico

Shibing Zhang Nantong University, China
Zhenyun zhuang Facebook, USA

Invited Speakers

Jalel Ben-Othman	University of Paris 13, France
Adlen Ksentini	Eurecom, France
Soon Xin Ng	University of Southampton, UK
Sebastiano Battiato	University of Catania, Italy

Contents

Data Communication Networking

- Application Error Detection in Networks by Protocol Behavior Model 3
Martin Holkovič, Libor Polčák, and Ondřej Ryšavý

- Cooperative Communications, Distributed Coding and Machine Learning 29
Soon Xin Ng

e-Business

- Product-Service Systems at a Glance: How Classification and Typification Contribute to Comprehensibility 61
Lukas Waidelich, Alexander Richter, Rebecca Bulander, Bernhard Kölmel, and Patrice Glaser

Security and Cryptography

- A Reconfigurable Implementation of Elliptic Curve Cryptography over GF (2^n) 87
Salah Harb, M. Omair Ahmad, and M. N. S. Swamy

- Evaluation of Floating-Point Arithmetic Protocols Based on Shamir Secret Sharing 108
Octavian Catrina

- Secure and Efficient Matrix Multiplication with MapReduce 132
Radu Ciucanu, Matthieu Giraud, Pascal Lafourcade, and Lihua Ye

- An Invisible Hybrid 3D Video Watermarking Robust Against Malicious Attacks 157
Dorra Dhaou, Saoussen Ben Jabra, and Ezzeddine Zagrouba

- Copyright Protection Method for Vector Map Data 180
Yuliya Vybornova and Vladislav Sergeev

- Dynamic Taint Tracking Simulation 203
Fabian Berner, René Mayrhofer, and Johannes Sametinger

Signal Processing and Multimedia Applications

A Note Event-Based Decomposition of Polyphonic Recordings Applied to Single-channel Audio Source Separation	231
<i>Alejandro Delgado Castro and John E. Szymanski</i>	
Automatic Sleep Scoring Toolbox and Its Application in Sleep Apnea.	256
<i>Rui Yan, Fan Li, Xiaoyu Wang, Tapani Ristaniemi, and Fengyu Cong</i>	
Author Index	277