



HAL
open science

Information Security Education. Education in Proactive Information Security

Lynette Drevin, Marianthi Theocharidou

► **To cite this version:**

Lynette Drevin, Marianthi Theocharidou. Information Security Education. Education in Proactive Information Security: 12th IFIP WG 11.8 World Conference, WISE 12, Lisbon, Portugal, June 25–27, 2019, Proceedings. Springer International Publishing, AICT-557, 2019, IFIP Advances in Information and Communication Technology, 978-3-030-23450-8. 10.1007/978-3-030-23451-5 . hal-02365723

HAL Id: hal-02365723

<https://inria.hal.science/hal-02365723>

Submitted on 15 Nov 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

Editor-in-Chief

Kai Rannenberg, Goethe University Frankfurt, Germany

Editorial Board Members

TC 1 – Foundations of Computer Science

Jacques Sakarovitch, Télécom ParisTech, France

TC 2 – Software: Theory and Practice

Michael Goedicke, University of Duisburg-Essen, Germany

TC 3 – Education

Arthur Tatnall, Victoria University, Melbourne, Australia

TC 5 – Information Technology Applications

Erich J. Neuhold, University of Vienna, Austria

TC 6 – Communication Systems

Aiko Pras, University of Twente, Enschede, The Netherlands

TC 7 – System Modeling and Optimization

Fredi Tröltzsch, TU Berlin, Germany

TC 8 – Information Systems

Jan Pries-Heje, Roskilde University, Denmark

TC 9 – ICT and Society

David Kreps, University of Salford, Greater Manchester, UK

TC 10 – Computer Systems Technology

Ricardo Reis, Federal University of Rio Grande do Sul, Porto Alegre, Brazil

TC 11 – Security and Privacy Protection in Information Processing Systems

Steven Furnell, Plymouth University, UK

TC 12 – Artificial Intelligence

Ulrich Furbach, University of Koblenz-Landau, Germany

TC 13 – Human-Computer Interaction

Marco Winckler, University of Nice Sophia Antipolis, France

TC 14 – Entertainment Computing

Rainer Malaka, University of Bremen, Germany

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the first World Computer Congress held in Paris the previous year. A federation for societies working in information processing, IFIP's aim is two-fold: to support information processing in the countries of its members and to encourage technology transfer to developing nations. As its mission statement clearly states:

IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is generally smaller and occasionally by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

IFIP distinguishes three types of institutional membership: Country Representative Members, Members at Large, and Associate Members. The type of organization that can apply for membership is a wide variety and includes national or international societies of individual computer scientists/ICT professionals, associations or federations of such societies, government institutions/government related organizations, national or international research institutes or consortia, universities, academies of sciences, companies, national or international associations or federations of companies.

More information about this series at <http://www.springer.com/series/6102>

Lynette Drevin · Marianthi Theocharidou (Eds.)


Information Security Education

Education in Proactive Information Security

12th IFIP WG 11.8 World Conference, WISE 12
Lisbon, Portugal, June 25–27, 2019
Proceedings

Editors

Lynette Drevin 
North-West University
Potchefstroom, South Africa

Marianthi Theocharidou 
European Commission
Joint Research Center
Ispra, Italy

ISSN 1868-4238 ISSN 1868-422X (electronic)
IFIP Advances in Information and Communication Technology
ISBN 978-3-030-23450-8 ISBN 978-3-030-23451-5 (eBook)
<https://doi.org/10.1007/978-3-030-23451-5>

© IFIP International Federation for Information Processing 2019

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

This volume contains the papers presented at the 12th World Conference on Information Security Education (WISE 12) held during June 25–27, 2019, in Lisbon. It was held in conjunction with the 34th IFIP International Conference on Information Security and Privacy Protection (IFIP SEC 2019). WISE 12 was organized by the IFIP Working Group 11.8, which is an international group of people from academia, government, and private organizations who volunteer their time and effort to increase knowledge in the very broad field of information security through education. WG 11.8 has worked to increase information security education and awareness for almost two decades. This year, WG11.8 organized the 12th conference of a successful series under the theme “Education in Proactive Information Security.” We received 26 submissions from around the world. Each submission was blind reviewed by at least three international Program Committee members. The committee decided to accept 12 full papers, and thus the acceptance rate for the papers is 46%.

During the conference, a working group discussion addressed the “Graduate Student Pipeline Problem in Cybersecurity.” It was chaired by Susanne Wetzel of Stevens Institute of Technology (USA). The topic is driven by surveys and observations in the USA, which indicate a mismatch between open faculty positions in cybersecurity and the number of accepted academic positions from the newly awarded PhDs in cybersecurity. In fact, the majority of them joined industry. The workgroup discussed the effect on education of the next generation of students in cybersecurity and explored options to address the problem. With high-paying jobs in industry that are already available to graduates from bachelor or master programs, what is the incentive for someone to pursue a PhD? What can and needs to be done in order to attract graduates to academic instead of industry jobs?

This conference took place thanks to the support and commitment of many individuals. First, we would like to thank all TC-11 members for continually giving us the opportunity to serve the working group and organize the WISE conferences. Our sincere appreciation also goes to the members of the Program Committee, to the external reviewers, and to the authors who trusted us with their intellectual work. We are grateful for the support of WISE11.8 Officers Lynn Futcher, Matt Bishop, Natalia Miloslavskaya, and Erik Moore. Finally, we would like to thank the local organizers for the support. As for the preparation of this volume, we sincerely thank Erika Siebert-Cole and our publisher Springer for their assistance.

June 2019

Lynette Drevin
Marianthi Theocharidou

Organization

Wise12 Conference Chair

Lynn Futcher Nelson Mandela University, South Africa

WISE12 Program Chair

Lynette Drevin North-West University, South Africa

WISE12 Conference Secretariat

Matt Bishop University of California, Davis, USA

WISE12 Publications Chair

Marianthi Theodoridou European Commission, Joint Research Centre, Italy

WISE12 Local and Logistics Chair

Natalia Miloslavskaya National Research Nuclear University MEPhI, Russia

WISE12 Web Chair

Erik Moore Regis University, Colorado, USA

Program Committee

Maria Bada	University of Cambridge, UK
Matt Bishop	University of California, Davis, USA
Jun Dai	California State University, Sacramento, USA
Melissa Dark	Purdue University, USA
Lynette Drevin	North-West University, South Africa
Steven Furnell	Plymouth University, UK
Lynn Futcher	Nelson Mandela Metropolitan University, South Africa
Ram Herkanaidu	Plymouth University, UK
Lech Janczewski	The University of Auckland, New Zealand
Audun Josang	University of Oslo, Norway
Christos Kalloniatis	University of the Aegean, Greece
Sokratis Katsikas	Center for Cyber and Information Security, NTNU, Norway
Basel Katt	Norwegian University of Science and Technology, NTNU, Norway

Siddharth Kaza	Towson University, USA
Andrea Kolberger	University of Applied Sciences, Upper Austria
Elmarie Kritzinger	UNISA, South Africa
Hennie Kruger	North-West University, South Africa
Wai Sze Leung	University of Johannesburg, South Africa
Dan Likarish	Regis University, Colorado, USA
Javier Lopez	University of Malaga, Spain
Edgar Alonso Lopez-Rojas	Norwegian University of Science and Technology, NTNU, Norway
Annalize Marnewick	University of Johannesburg, South Africa
Natalia Miloslavskaya	National Research Nuclear University MEPhI, Russia
Stig Mjolsnes	Norwegian University of Science and Technology, Norway
Erik Moore	Regis University, Colorado, USA
Ida Ngambeki	Purdue University, USA
Jason Nurse	University of Kent, UK
Ruxandra F. Olimid	Norwegian University of Science, Norway and Technology and University of Bucharest, Romania
Jacques Ophoff	University of Cape Town, South Africa
Günther Pernul	Universität Regensburg, Germany
Carlos Rieder	isec ag, Switzerland
Rudi Serfontein	North-West University, South Africa
Chien-Chung Shen	University of Delaware, USA
Marianthi Theocharidou	European Commission, Joint Research Centre, Italy
Alexander Tolstoy	National Research Nuclear University MEPhI, Russia
Ismini Vasileiou	Plymouth University, UK
Sune von Solms	University of Johannesburg, South Africa
Susanne Wetzel	Stevens Institute of Technology, USA
Louise Yngstrom	Stockholm University, Sweden
Sergey Zapechnikov	National Research Nuclear University MEPhI, Russia

Additional Reviewer

Ludwig Englbrecht

Contents

Innovation in Curricula

An Educational Intervention for Teaching Secure Coding Practices	3
<i>Vuyolwethu Mdunyelwa, Lynn Fitcher, and Johan van Niekerk</i>	
Learning Principles and the Secure Programming Clinic.	16
<i>Matt Bishop, Melissa Dark, Lynn Fitcher, Johan Van Niekerk, Ida Ngambeki, Somdutta Bose, and Minghua Zhu</i>	
Introducing Research into the Undergraduate Curriculum in Cybersecurity . . .	30
<i>Dimitrios Damopoulos and Susanne Wetzel</i>	

Training

A Short-Cycle Framework Approach to Integrating Psychometric Feedback and Data Analytics to Rapid Cyber Defense.	45
<i>Erik L. Moore, Steven P. Fulton, Roberta A. Mancuso, Tristen K. Amador, and Daniel M. Likarish</i>	
Identifying Security Requirements Body of Knowledge for the Security Systems Engineer	59
<i>Suné von Solms and Annlizé Marnewick</i>	
Andragogy as a Scientific Basis for Training Professionals in Information Security	72
<i>Alexander Tolstoy and Natalia Miloslavskaya</i>	

Applications and Cryptography

Light Cryptography	89
<i>Pascal Lafourcade, Takaaki Mizuki, Atsuki Nagao, and Kazumasa Shinagawa</i>	
Blockchain and Its Security: Ignore or Insert into Academic Training?.	102
<i>Natalia Miloslavskaya and Alexander Tolstoy</i>	
Identifying Information Security Risks in a Social Network Using Self-organising Maps.	114
<i>Rudi Serfontein, Hennie Kruger, and Lynette Drevin</i>	

Organisational Aspects

Lessons Learned from an Organizational Information Security
Awareness Campaign 129
Juan-Marc Scrimgeour and Jacques Ophoff

A Comprehensive Framework for Understanding Security Culture
in Organizations 143
Alaa Tolah, Steven M. Furnell, and Maria Papadaki

Using Gamification to Improve Information Security Behavior:
A Password Strength Experiment 157
Jacques Ophoff and Frauke Dietz

Author Index 171