


Editor-in-Chief

Kai Rannenber, Goethe University Frankfurt, Germany

Editorial Board Members

TC 1 – Foundations of Computer Science

Luis Soares Barbosa , University of Minho, Braga, Portugal

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

Burkhard Stiller, University of Zurich, Zürich, Switzerland


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 , National University of Ireland, Galway, Ireland

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

Eunika Mercier-Laurent , University of Reims Champagne-Ardenne, Reims, France

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 · Natalia Miloslavskaya ·
Wai Sze Leung · Suné von Solms (Eds.)


Information Security Education for Cyber Resilience


14th IFIP WG 11.8 World Conference, WISE 2021
Virtual Event, June 22–24, 2021
Proceedings

Editors

Lynette Drevin 
North-West University
Potchefstroom, South Africa

Wai Sze Leung 
University of Johannesburg
Johannesburg, South Africa

Natalia Miloslavskaya 
The National Research Nuclear University
MEPhI
Moscow, Russia

Suné von Solms 
University of Johannesburg
Johannesburg, South Africa

ISSN 1868-4238 ISSN 1868-422X (electronic)
IFIP Advances in Information and Communication Technology
ISBN 978-3-030-80864-8 ISBN 978-3-030-80865-5 (eBook)
<https://doi.org/10.1007/978-3-030-80865-5>

© IFIP International Federation for Information Processing 2021

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 14th World Conference on Information Security Education (WISE 14) held during June 22–24, 2021. It was held in conjunction with the 36th IFIP TC-11 SEC 2021 International Information Security and Privacy Conference (IFIP SEC 2021).

WISE 14 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, WG 11.8 organized the 14th conference of the successful WISE series under the theme “Information Security Education for Cyber Resilience.” We received 19 submissions from around the world. Each submission was blind reviewed by at least three international Program Committee members. The committee decided to accept 8 full papers. The acceptance rate for the conference was thus 42%.

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 the WG 11.8 Officers: Erik Moore, Jacques Ophoff, and Matt Bishop. In addition, the hosting of WISE would not have been possible without the efforts of the SEC 2021 organizers, Audun Jøsang and Nils Gruschka. Finally, we would like to thank the IFIP SEC 2021 organizers for their support. Furthermore, we wish to acknowledge the EasyChair conference management system which was used for managing the submissions and reviews of WISE 14 papers. As for the preparation of this volume, we sincerely thank Miriam Costales and our publisher Springer for their assistance.

June 2021

Lynette Drevin
Natalia Miloslavskaya
Wai Sze Leung
Suné von Solms

Costas Lambrinouidakis	University of Piraeus, Greece
Dan Likarish	Regis University, USA
Javier Lopez	University of Malaga, Spain
Emmanouil Magkos	Ionian University, Greece
Annlize Marnewick	University of Johannesburg, South Africa
Herbert Mattord	Kennesaw State University, USA
Stig Mjolsnes	Norwegian University of Science and Technology, Norway
Ruxandra F. Olimid	Norwegian University of Science and Technology, Norway
Günther Pernul	University of Regensburg, Germany
Tobias Pulls	Karlstad University, Sweden
Kai Rannenber	Goethe University Frankfurt, Germany
Carlos Rieder	isec ag, Switzerland
Leo Robert	Laboratory of Informatics, Modelling and Optimization of the Systems, France
Rudi Serfontein	North-West University, South Africa
Alireza Shojafar	University of Applied Sciences and Arts Northwestern Switzerland, Switzerland
Kerry-Lynn Thomson	Nelson Mandela University, South Africa
Alexander Tolstoy	National Research Nuclear University MEPhI, Russia
Rossouw von Solms	Nelson Mandela University, South Africa
Edgar Weippl	University of Vienna, Austria
Susanne Wetzel	Stevens Institute of Technology, USA

Contents

A Roadmap for Building Resilience

- A Brief History and Overview of WISE. 3
*Matt Bishop, Lynette Drevin, Lynn Futcher, Wai Sze Leung,
Natalia Miloslavskaya, Erik L. Moore, Jacques Ophoff,
and Suné von Solms*

Innovation in Curricula

- Formation of General Professional Competencies in Academic Training
of Information Security Professionals. 13
Natalia Miloslavskaya and Alexander Tolstoy
- Electronic Voting Technology Inspired Interactive Teaching and Learning
Pedagogy and Curriculum Development for Cybersecurity Education 27
Ryan Hosler, Xukai Zou, and Matt Bishop

Teaching Methods and Tools

- Minimizing Cognitive Overload in Cybersecurity Learning Materials:
An Experimental Study Using Eye-Tracking. 47
Leon Bernard, Sagar Raina, Blair Taylor, and Siddharth Kaza
- A Layered Model for Building Cyber Defense Training Capacity 64
*Erik L. Moore, Steven P. Fulton, Roberta A. Mancuso,
Tristen K. Amador, and Daniel M. Likarish*
- Measuring Self-efficacy in Secure Programming 81
Matt Bishop, Ida Ngambeki, Shiven Mian, Jun Dai, and Phillip Nico

End-User Security

- Children’s Awareness of Digital Wellness: A Serious Games Approach. 95
J. Allers, G. R. Drevin, D. P. Snyman, H. A. Kruger, and L. Drevin
- Environmental Uncertainty and End-User Security Behaviour:
A Study During the COVID-19 Pandemic 111
Popyeni Kautondokwa, Zainab Ruhwanya, and Jacques Ophoff

What Parts of Usable Security Are Most Important to Users? 126
Joakim Kävrestad, Steven Furnell, and Marcus Nohlberg

WISE Workshops

Foundations for Collaborative Cyber Security Learning: Exploring
Educator and Learner Requirements 143
*Jerry Andriessen, Steven Furnell, Gregor Langner, Gerald Quirchmayr,
Vittorio Scarno, and Teemu Tokola*

Reimaging Inclusive Pedagogy in Cybersecurity Education
(A Workshop Proposal) 146
Angela G. Jackson-Summers

Author Index 151