



CRITIS

2016

**11TH INTERNATIONAL CONFERENCE
ON CRITICAL INFORMATION
INFRASTRUCTURES SECURITY**

PROGRAMME

10-12 October 2016
Paris, UIC Headquarters

WELCOME

IN 2016, THE INTERNATIONAL CONFERENCE ON CRITICAL INFORMATION INFRASTRUCTURES SECURITY REACHES ITS 11TH ANNIVERSARY.

CRITIS 2016 continues the tradition of presenting innovative research and exploring new challenges in the field of critical (information) infrastructures protection (C(I)IP) and fostering the dialogue with stakeholders. CRITIS 2016 aims at bringing together researchers and professionals from academia, industry and governmental organisations working in the field of the security of critical (information) infrastructure systems.

The programme is based on the 30 technical papers (22 full papers and 8 short papers) which cover five topics grouped into thematic sessions. In continuation of an initiative first taken up at the 2014 CRITIS, the conference includes one session and an award for young researchers (the 3rd CIPRNet Young CRITIS Award - CYCA).

As in previous years, invited speakers and special events complement a programme of original research contributions. The conference invites the different research communities and disciplines involved in the C(I)IP space, and encourages discussions and multi-disciplinary approaches to relevant C(I)IP problems.

This year's edition of CRITIS is hosted in Paris, France by the International Union of Railways (Union Internationale des Chemins de Fer - UIC) - the worldwide professional association representing the railway sector and promoting rail transport.



MONDAY 10 OCTOBER 2016

12:00 - Registration and get together

UIC Main Hall

13:50 - Take Seats

14:00 - 14:30 Conference Opening

Welcome address from *Jean-Pierre Loubinoux (UIC Director General)*
Opening by UIC Security Division and CRITIS Steering Committee Chairs

14:30 - 16:00 Session 1a - Smart Grids and Interdependencies in CI

14:30-15:00 Keynote: *Dr. Artūras Petkus - CEIP and Energy Security in Perspective of NATO Energy Security Center of Excellence (CIPRNet Lecture)*

15:00-15:20 *Selecting Privacy Solutions to Prioritise Control in Smart Metering Systems.*
Juan E. Rubio, Cristina Alcaraz and Javier Lopez

15:20-15:40 *Access Control and Availability Vulnerabilities in the ISO/IEC 61850 Substation Automation Protocol.*
James Wright and Stephen Wolthusen

15:40-16:00 *Power Auctioning in Resource Constrained Micro-Grids: Cases of Cheating.*
Anesu Marufu, Anne V.D.M. Kayem and Stephen Wolthusen

16:00 - 16:30 Coffee Break

16:30 - 17:50 Session 1b - Smart Grids and Interdependencies in CI

16:30-16:50 *Stealth Low-Level Manipulation of Programmable Logic Controllers I/O by Pin Control Exploitation.*
Ali Abbasi, Majid Hashemi, Emmanuele Zambon and Sandro Etalle

16:50-17:10 *On Auxiliary Entity Allocation Problem in Multi-layered Interdependent Critical Infrastructures.*
Joydeep Banerjee, Arun Sen and Chenyang Zhou

17:10-17:30 *An Operator-driven Approach for Modeling Interdependencies in Critical Infrastructures based on Critical Services and Sectors (Short paper).*
Elisa Canzani, Helmut Kaufmann and Ulrike Lechner

17:30-17:50 *Reliable Key Distribution in Smart Micro-Grids: Attack Models and Countermeasures (Short paper).*
Heinrich Strauss, Anne Kayem and Stephen Wolthusen

18:00 - Networking Cocktail (UIC HQ)

TUESDAY 11 OCTOBER 2016

08:50 - Take Seats

09:00 - 10:30 Session 2a - Human Factors, decision support, and cross-sector C(I)IP approaches

09:00-9:30 Keynote: *CDR Cyril Stylianidis - The "Cellule Interministeriel de Crise" (CIC), the French tool for interministerial level crisis management*

09:30-9:50 Security validation for data diode with reverse channel. *Jeong-Han Yun, Yeop Chang, Kyoung-Ho Kim and Woo-Nyon Kim*

09:50-10:10 A Synthesis of Optimization Approaches for Tackling Critical Information Infrastructure Survivability. *Annunziata Esposito Amideo and Maria Paola Scaparra*

10:10-10:30 Developing a Cyber Incident Communication Management Exercise for CI Stakeholders. *Tomomi Aoyama, Kenji Watanabe, Yoshihiro Hashimoto and Ichiro Koshijima*

10:30 - 11:00 Coffee Break

11:00 - 12:00 Session 2b - Human Factors, decision support, and cross-sector C(I)IP approaches

11:00-11:20 Towards a Cybersecurity Game: Operation Digital Chameleon (Short paper). *Andreas Rieb and Ulrike Lechner*

11:20-11:40 Behavioral intentions and threat perception during terrorist, fire and earthquake scenarios (Short paper). *Simona Popușoi, Cornelia Măirean and Grigore Havârneanu*

11:40-12:00 Simulation of cascading outages in (inter)-dependent services and estimate of their societal consequences (Short paper). *Antonio Di Pietro, Luisa Lavalle, Maurizio Pollino, Vittorio Rosato and Alberto Tofani*

12:00 - 13:20 Lunch (UIC HQ)

13:20 - Take Seats

13:30 - 14:40 Session 3 - Challenges for the railway sector

13:30-14:00 Keynote: *Mr. Kris Christmann - Findings from the PRE-EMPT Project: Establishing Best Practice for Reducing Serious Crime and Terrorism at Multi-Modal Passenger Terminals (MMPT)*

14:00-14:20 Railway station surveillance system design: a real application of an optimal coverage approach. *Francesca De Cillis, Stefano De Muro, Franco Fiumara, Roberto Setola, Antonio Sforza and Claudio Sterle*

14:20-14:40 Railway System Failure Scenario Analysis. *William G. Temple, Yuan Li, Bao Anh N. Tran, Yan Liu and Binbin Chen*

14:40 - 15:20 Session 4a - CIPRNet Young CRITIS Award (CYCA)

14:40-15:00 A Dataset to Support Research in the Design of Secure Water Treatment Systems (CYCA paper). *Jonathan Goh, Sridhar Adepu, Khurum Nazir Junejo and Aditya Mathur*

15:00-15:20 Integrated Safety and Security Risk Assessment Methods: A Survey of Key Characteristics and Applications (CYCA paper). *Sabarathinam Chockalingam, Dina Hadziosmanovic, Wolter Pieters, Andre Teixeira and Pieter van Gelder*

15:20 - 15:50 Coffee break

15:50 - 17:10 Session 4b - CIPRNet Young CRITIS Award (CYCA)

15:50-16:10 Availability Study of the Italian Electricity SCADA System in the Cloud (CYCA paper). *Stefano Sebastio, Antonio Scala and Gregorio D'Agostino*

16:10-16:30 Dynamic Risk Analyses Based on a Risk Taxonomy for Critical Infrastructures (CYCA paper). *Steve Muller, Carlo Harpes, Yves Le Traon, Sylvain Gombault, Jean-Marie Bonnin and Paul Hoffmann*

16:30-16:50 Effective Defence Against Zero-Day Exploits Using Bayesian Networks (CYCA paper). *Tingting Li and Chris Hankin*

16:50-17:10 Human vulnerability mapping facing critical service disruptions for crisis managers (CYCA paper). *Amélie Grangeat, Julie Sina, Vittorio Rosato, Aurélie Bony and Marianthi Theocharidou*

19:30 - Official Dinner (Paris Wine Museum)

WEDNESDAY 12 OCTOBER 2016

08:50 - Take Seats

09:00 - 10:30 Session 5a - Innovative technologies and procedures in cybersecurity

09:00-9:30 Keynote: *Dr. Paul Théron - A way towards a fully bridged European certification of IACS cybersecurity*

09:30-9:50 Using incentives to foster security information sharing and cooperation: A general theory and application to critical infrastructure protection. *Alain Mermoud, Solange Ghernaouti, Marcus Keupp and Dimitri Percia David*

09:50-10:10 A Six-Step Model for Safety and Security Analysis of Cyber-Physical Systems. *Giedre Sabaliauskaite, Sridhar Adepu and Aditya Mathur*

10:10-10:30 A Methodology for Optimal Control Network Design. *István Kiss and Bela Genge*

10:30 - 11:00 Coffee break

11:00 - 12:30 Session 5b - Innovative technologies and procedures in cybersecurity

11:00-11:20 Cyber Targets Water Management. *Pieter Burghouwt, Marinus Maris, Sjaak van Peski, Eric Luijff, Imelda van de Voorde and Marcel Spruit*

11:20-11:40 A Case Study Assessing the Effects of Cyber Attacks on a River Zonal Dispatcher. *Ronald Wright, Ken Keefe, Brett Feddersen and William Sanders*

1:40-12:00 Tamper Resistant Secure Digital Silo for Log Storage in Critical Infrastructures. *Khan Ferdous Wahid, Helmut Kaufmann and Kevin Jones*

12:00-12:20 Cyber Security Investment in the Age of Big Data: A Reassessment of the Gordon-Loeb Model and Application to Critical Infrastructure Protection (Short paper). *Dimitri Percia David, Solange Ghernaouti, Marcus Matthias Keupp and Alain Mermoud*

12:20-12:30 CYCA results debriefing and winner announcement

12:30 - 13:50 Lunch (UIC HQ)

13:50 - Take Seats

14:00 - 14:40 Session 5c - Innovative technologies and procedures in cybersecurity

14:00-14:20 Domain Specific Stateful Filtering with Worst-Case Bandwidth (Short paper). *Maxime Puys, Marie-Laure Potet and Jean-Louis Roch*

14:20-14:40 Securing SCADA critical network against internal and external threats (Short paper). *El Anbal Mounia, Abou El Kalam Anas, Benhadou Siham and Hicham Medromi*

14:40 - 15:20 Session 6 - Concluding remarks and end of CRITIS 2016

14:40-14:55 Round table with the Chairs and closing remarks

14:55-15:05 Synthesis and main future challenges. *Jerzy Wisniewski (Director of UIC Fundamental Values Department)*

15:05-15:20 Pre-announcement of CRITIS 2017

15:20 - End of CRITIS 2016

ASSOCIATED EVENTS

THURSDAY 13 OCTOBER 2016

10:00 - 17:00 IMPROVER Workshop

Room 203 (Second floor)

9:00 - 17:00 CIPRNet Plenary Meeting

Room 205 (Second floor)

FRIDAY 14 OCTOBER 2016

9:00 - 15:00 CIPRNet Plenary Meeting

Room 205 (Second floor)

DR ARTŪRAS PETKUS

*NATO Energy Security Centre of Excellence
NATO ENSEC COE
Lithuania*

CEIP and Energy Security in Perspective of NATO Energy Security Center of Excellence (CIPRNet Lecture)



Cyber attacks on key energy infrastructure – and on the electricity system in particular – are increasing, both in frequency and sophistication (U.S. Department of Homeland Security). Some countries adopt military doctrines, that could be called "Hybrid War". Unlike its conventional counterpart, hybrid war blends elements of diplomacy, clandestine action, disinformation, sabotage, irregular troops and standard kinetic force to achieve strategic objectives. While hybrid war takes place over several dimensions, it appears that critical energy infrastructure and energy industry of any country could be targeted as part of a wider campaign to reduce the country's ability and willingness to resist. Therefore NATO strives to «continue to develop NATO's capacity to support national authorities in protecting critical infrastructure, as well as enhancing their resilience against energy supply disruptions that could affect national and collective defence, including hybrid and cyber threats» (NATO Warsaw Summit Declaration). NATO Energy Security Center's of Excellence contribution to this priority will be presented.

Dr. Artūras Petkus joined the Strategic Analysis and Research Division of the NATO Energy Security Centre of Excellence in 2015 as a Head of division. His main areas of responsibility are: performance of energy security related analysis on strategic level; development of methodology and theoretical approach for assessment of energy security risks and threats, contribution to development of NATO Strategic Foresight Analysis; research in field of Energy Security (contribution to NATO CMX scenario, etc.)

COMMANDER (FRENCH NAVY) CYRIL STYLIANIDIS

*Ministry of Interior
General Directorate for Civil Protection
and Crisis Management
France*



The "Cellule Interministeriel de Crise" (CIC), the French tool for interministerial level crisis management

The increasing use of the Crisis Interministerial Cell (CIC) in France demonstrates how most crisis situations are now quickly rated as joint, interministerial ones. This reveals the important need for a smooth strategic level coordination in order to bring a response as efficient as possible to these crises. After a brief introduction on how crisis management is organized in France, I will introduce the Crisis Interministerial Cell (CIC) in all aspects: When, What, Why etc. and will intend to show how this tool complements efficiently, from a strategic level perspective, the actions taken by local level crisis managers and decision makers. I will illustrate this presentation with examples picked up from relatively recent critical situations from France, ranging from Bataclan's terrorist attacks to large events such as COP 21, EURO 2016 and even... waves of farmers converging on Paris to protest.

CDR Stylianidis is currently appointed to the French ministry of interior, Directorate of civil security and crisis management in the office in charge of planning regarding crisis management. Amongst other tasks, he brings naval expertise to projects involving crisis management within a maritime environment and is a member of the coordination cell running the CIC. He is more specifically in charge of coordinating the activation of the anticipation CIC cell. He is also a naval liaison officer with the French Joint and Naval HQs in Paris. Surface warfare officer since 1989, he has been fulfilling numerous positions at sea on various ships as well as in joint and international HQs, including 7 years in NATO in England and Italy. He is an alumnus from the Cranfield (UK) and Paris VI (France) universities, from which he has respectively graduated with an MSc in "Resilience" and a degree in Biophysics.

MR KRIS CHRISTMANN

*University of Huddersfield
Applied Criminology Centre (ACC), UK*

Findings from the PRE-EMPT Project: Establishing Best Practice for Reducing Serious Crime and Terrorism at Multi-Modal Passenger Terminals (MMPT)

Crowded places such as large land-based transport hubs (multi-modal passenger terminals: MMPTs) are attractive sites for terrorist attack. MMPTs also present acute security challenges due to their complexity. They bring together different forms of transport (often above and below ground) different land uses (shopping and leisure as well as transportation) and different jurisdictional control (multiple owners) whilst at the same time needing to ensure the free flow of large transitory populations. I report on findings from a recent EU project called PRE-EMPT ("Process Review and Evaluation of Multi-Modal Passenger Terminals Resilience for Counter Terrorism") which was aimed at establishing 'best practice' in preventing terrorist attacks and serious crime for MMPTs. The study draws on our findings from a comprehensive search of published literature, experience-based knowledge gained from MMPT site visits, and the development of a Conceptual Attack Framework (CAF) which draws on theories from the fields of Crime Prevention and Counterterrorism to identify 'theoretically plausible' attack opportunities. We derived 8 general principles in providing the steps that would need to be achieved to establish a baseline level of security for MMPTs across the EU and to make MMPTs safer.

Kris Christmann is an applied criminologist and Research Fellow at the Applied Criminology Centre (ACC) at the University of Huddersfield. His main research interests include the study of terrorism; radicalisation; and hate crime (for clients such as the: Youth Justice Board, Office for Security and Counter Terrorism, the Home Office, and the European Union's Fundamental Rights Agency). This work includes how to improve reporting measures and interventions to prevent and control violent extremism and terrorism. Kris and ACC colleagues have recently completed research in counter terrorism for the EU (DG Move - Directorate-General for Mobility and Transport) examining how to protect large, multi-modal transport hubs across Europe from terrorist attack as well as from serious crime. The suite of reports delivered are currently being studied by commissioners and it is anticipated that some of this material will be published in the near future.



DR PAUL THERON

*Thales Communications & Security
France*

A way towards a fully bridged European certification of IACS cybersecurity

This presentation relates the work of DG JRC's ERNCIP Thematic Group on IACS cybersecurity certification. First we present the history of the TG, its goals and its methodology. The 2014 first phase of its activity led to a report that established a 2015-2020 plan of action to help IACS cybersecurity certification progress in Europe. We mainly present the principles and levels of the European Compliance & Certification Scheme advocated by the TG. We also provide details about the 7 projects for the 2015-2020 period and we propose a review of its progress to date.

Paul Théron, PhD, FBCI, is Thales Communications & Security's cyber-defence bids manager (export) and expert on cyber resilience. He is co-head of the Aerspatial Cyber Resilience research chair. Former member of ENISA's Permanent Stakeholders Group, he also leads DG JRC's European Thematic Group on the "Certification of the cybersecurity of Industrial Automation & Control Systems". His work in cybersecurity includes cyber intelligence, C2 systems, cyber-attack strategies, awareness raising, the cyber resilience of massively collaborative systems such as the future European ATM system, and European studies of the resilience of telecommunications.



CHAIRS AND CO-CHAIRS

GENERAL CHAIR

Jean-Pierre Loubinoux, *UIC Director General, represented by UIC Security Division*

LOCAL CHAIR

Jacques Colliard, *Head of UIC Security Division, Paris, France*

PROGRAMME CHAIR

Grigore M. Havârneanu, *Research Advisor, UIC Security Division, Paris, France*

PROGRAMME CO-CHAIRS

Roberto Setola, *Università Campus Bio-Medico di Roma, Italy*

Hypatia Nassopoulos, *Ecole des Ingénieurs de la Ville de Paris, France*

PUBLICITY AND COMMUNICATION CHAIRS

Cristina Alcaraz, *University of Malaga, Spain*

UIC Communications Department

STEERING COMMITTEE

CHAIRS

Bernhard M. Hämmerli, *Technical University Lucerne and ACRIS GmbH, Switzerland*

Javier Lopez, *University of Malaga, Spain*

Stephen D. Wolthusen, *Gjøvik College, Norway, and Royal Holloway, UK*

MEMBERS

Robin Bloomfield, *City University London, UK*

Sandro Bologna, *AiIC, Italy*

Sokratis K. Katsikas, *Norwegian University of Science and Technology, Norway and University of Piraeus, Greece*

Elias Kyriakides, *University of Cyprus*

Eric Luijff, *TNO, the Netherlands*

Marios M. Polycarpou, *University of Cyprus*

Reinhard Posch, *Technical University Graz, Austria*

Saifur Rahman, *Advanced Research Institute, Virginia Tech, USA*

Erich Rome, *Fraunhofer IAIS, Germany*

Roberto Setola, *Università Campus Bio-Medico di Roma, Italy*

Nils Kalstad Svendsen, *Gjøvik University College, Norway*

Marianthi Theocharidou, *EC Joint Research Centre, IPSC, Italy*

PROGRAMME COMMITTEE MEMBERS

Marc ANTONI, *UIC (Infrastructure), Paris, France*

Fabrizio BAIARDI, *University of Pisa, Italy*

Yohan BARBARIN, *CEA, France*

Arslan BRÖMME, *Vattenfall, Germany*

Maria Cristina BRUGNOLI, *CNIT, Italy*

Emiliano CASALICCHIO, *Blekinge Institute of Technology, Sweden*

Michal CHORAS, *University of Technology Poland*

Kris CHRISTMANN, *University of Huddersfield, UK*

Gregorio D'AGOSTINO, *ENEA and AIIC, Italy*

Myriam DUNN, *ETH Zurich, Switzerland*

Mohamed EID, *CEA, France*

Adrian GHEORGHE, *Old Dominion University, USA*

Luigi GLIELMO, *University Sannio, Italy*

Stefanos GRITZALIS, *University of the Aegean, Greece*

Chris L. HANKIN, *Imperial College London, UK*

Apiniti JOTISANKASA, *Kasetsart University, Bangkok, Thailand*

Marieke KLAVER, *TNO, the Netherlands*

Panayiotis KOTZANIKOLAOU, *University of Piraeus, Greece*

Rafal KOZIK, *University of Technology Poland (UTP)*

José R. MARTI, *UBC, Canada*

Maddalen MENDIZABAL, *Tecnalia, Spain*

Igor NAI FOVINO, *EC Joint Research Centre (JRC)*

Aristotelis NANOPOULOS, *Aristotle University of Thessaloniki, Greece*

Eiji OKAMOTO, *University of Tsukuba, Japan*

Gabriele OLIVA, *University Campus Bio Medico di Roma, Italy*

Evangelos OUZOUNIS, *ENISA*

Stefano PANZIERI, *University Roma Tre, Italy*

Alexander PAZ-CRUZ, *University of Nevada, USA*

Vittorio ROSATO, *ENEA, Italy*

Brendan RYAN, *University of Nottingham, UK*

Andre SAMBERG, *The International Emergency Management Society (TIEMS), Belgium*

Antonio SCALA, *CNR (and LIMS, OSN, IMT fellow), Italy*

Maria Paola SCAPARRA, *University of Kent, UK*

Eric SCHELLEKENS, *ARCADIS, the Netherlands*

Dominique SERAFIN, *CEA, France*

George STERGIPOULOS, *Athens University of Economics & Business, Greece*

André H. TEIXEIRA, *TU Delft, the Netherlands*

Alberto TOFANI, *ENEA, Italy*

William J. TOLONE, *University of North Carolina at Charlotte (UNCC), USA*

Simona Louise VORONCA, *Transelectrica, Romania*

Marc VUILLET, *Ecole des Ingénieurs de la Ville de Paris, France*

René WILLEMS, *TNO, the Netherlands*

Christos XENAKIS, *University of Piraeus, Greece*

Enrico ZIO, *Ecole Centrale Paris and Supelec, France*

Inga ŽUTAUTAITĖ, *Lithuanian Energy Institute*



CRITIS

2016

ORGANISER



INTERNATIONAL UNION
OF RAILWAYS

PARTNERS



[HTTP://CRITIS2016.ORG](http://CRITIS2016.ORG)

