RESEARCH SCIENTIST · SNT

Yehia **Elrakaiby**

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Education

IMT-Atlantique

Ph.D. IN COMPUTER SCIENCE - TELECOM-BRETAGNE

- Prof. Frédéric Cuppens, Dr. Nora Cuppens-Boulahia
- Thesis Title: Specification and Management of Obligations for Usage Control
- · Formal Methods, Logic, Security Models, Policy Languages, Privacy Policies, Obligations, Data Usage Control, Deontic Logic

IMT-Atlantique

DIPLÔME D'INGÉNIEUR - TELECOM-BRETAGNE (M.Sc.)

- Department: Network, Security and Multimedia (RSM)
- Specialization: System and Network Security
- Networks, Network Security, Cryptography, Mathematics, Computer Science, Network Protocols, System Security, Electronics, Signal Processing, Computer Science, Software Development, Distributed Systems, Economics, Humanities

Electronics & Electrical Communications Engineering, Cairo University

B.Sc. in Electrical Engineering

- Department: Electronics & Electrical Communications Engineering Department
- Mathematics, Physics, Computers, Electronics, Communications, Electrical Power, Mechanics, Circuits, Electric and Magnetic Fields, Signal Analysis, Electromagnetic Waves, Computer, Active Circuits, Programming, Systems and Control, Humanities

Experience

Interdisciplinary Center for Security, Reliability and Trust

RESEARCH ASSOCIATE

- Team: Software Verification and Validation Lab (SVV) lead by Prof. Lionel Briand
- Development of Tools to Support Data Quality Activities using Machine Learning
- Extraction of Data Quality Rules and Dependencies
- Use of Bayesian Networks to Provide Auto-completion Support for Data Entry

Lero - the Irish Software Research Centre

RESEARCH FELLOW

- Team: Security, Privacy, Adaptation & Requirements Engineering (SPARE) lead by Prof. Bashar Nuseibeh
- Developed REact: a Model-Driven Engineering Approach for Synthesis of Optimal Controllers for Autonomous Systems
- Developed an Argumentation-based Approach to Explain and Detect Ambiguities in Requirements Elicitation Interviews
- Developed an Expressive Calculus for Requirements Elicitation, Negotiation and Refinement to Support Documentation of the Process, Agreement between Stakeholders and Management of Change

Fraunhofer IESE

Scientist

- Department: Security Engineering lead by Dr. Jörg Dörr
- Implemented a Stateless Logic-based Policy Decision Point for the Integrated Distributed Data Usage Control Framework (IND2UCE)
- Developed a Methodology for the Systematic Evaluation of Compliance of IT Architectures with the EU Privacy Directive 95/46/EC
- Lead the Usage Control Work Package and Implemented Controls to Protect Users' Privacy in the FP7 EU project RESCUER

Interdisciplinary Center for Security, Reliability and Trust

RESEARCH ASSOCIATE

- Team: Serval lead by Prof. Yves Le Traon
- Developed Security@Runtime: A Model-Driven Engineering Framework for Enforcement of Fine-grained Security Policies in Java
- Defined a Formal Enforcement Model for Usage Controls and Automated their Verification using Model Checking
- Grants: AFR Postdoc Grant

Luxembourg, Luxembourg

Kaiserslautern, Germany May 2014 - Dec. 2015

Aug. 2011 - Jan. 2014

Jan. 2006 - Dec. 2010

Rennes, France

Luxembourg, Luxembourg Since Jan. 2019

Limerick, Ireland

loctronics Signal

Sep. 1998 - July 2003

Cairo, Egypt

(ctoppe

April 2016 October 2018

Rennes, France Sep. 2003 - Sep. 2005

IMT-Atlantique

Ph.D. Candidate

- Defined an Expressive Security Policy Language and Model to Specify, Enforce and Manage Obligations and Usage Controls
- Grants: Brittany Region Ph.D. Scholarship

Selected Research Projects

Leveraging Historical Data to Address Data Quality Problems at the Front-end

Jan 2019 - present

Jul. 2016 - present

Jan. 2017 - present

Rennes, France

Data Quality; Data Dependencies; Data Profiling; Relational Data; Machine Learning; Decision Trees; Random Forests; Association Rule Mining; Bayesian Networks;

Data has become central to the success of many organizations: it could help them provide personalized services, make data-driven decisions, gain insight into their markets, identify fraudulent activities, etc. Thus, it has become one of the main areas where organizations seek to differentiate themselves from their competitors. However, in industry, enterprises typically expect anywhere between 1%-5% of data errors, causing significant losses to their businesses and their ability to maximize the value of their data. Data quality problems can be addressed mainly at two locations, namely at the back- or front-end. The database community has thoroughly studied data quality and cleaning at the back-end by developing algorithms to discover data dependencies (functional dependencies, conditional functional dependencies, denial constraints, etc) and leverage those discovered dependencies to clean the data. In this research, we propose to take a reactive approach to data quality by addressing it at the front-end. In particular, we analyze historical data and introduce an entropy-based approach that leverages machine learning and Bayesian networks to optimize the design of data entry forms and to provide data entry support to reduce the probability of data entry errors. In particular, we develop tools to minimize data that needs to be entered by employees and to provide them with probabilistic auto-completion and anomaly detection support.

Model-driven Development of Optimal Controllers for Autonomous Systems

MARKOV MODELS; PROBABILISTIC MODEL CHECKING; STRATEGY SYNTHESIS; DECISION-THEORETIC PLANNING; AUTONOMOUS & SELF-ADAPTIVE SYSTEMS; DOMAIN SPECIFIC MODELING LANGUAGES; SYNTAX; SEMANTICS; SOFTWARE ENGINEERING; REQUIREMENTS ENGINEERING; SECURITY; Autonomous systems such as unmanned vehicles and robotic systems play an increasingly relevant role in our societies. Their software has become too large and complex to be managed efficiently by human administrators. The complexity of autonomous systems arises from many factors. First, they operate in dynamic and uncontrollable environments. Decision-making must be almost instantaneous to enable timely responses, e.g., to avoid car accidents. Moreover, adaptations should be optimal with respect to various (possibly conflicting) requirements, e.g., ensuring passenger safety and pedestrians. From software management perspective, it is highly desirable to simplify system design and to enable the runtime updating of requirements, in order to reduce development and operational costs. In this project, we developed REACT , a framework for the synthesis of optimal controllers for autonomous systems based on a description of the environment and their (possibly conflicting) requirements. This ongoing project resulted in one technical report and one journal paper is in preparation.

Requirements Elicitation, Negotiation, Refinements and Reasoning

Argumentation; Structured Argumentation; Reasoning; Non-monotonic Logics; Requirements Elicitation; Refinement; Negotiation; Agreement; Documentation;

The core problem in Requirements Engineering (RE) consists of transforming initial stakeholders' requirements – however informal, ambiguous, conflicting, unattainable, imprecise and incomplete – into consistent, complete and realizable specifications. This is a challenging task as it involves multiple stakeholders and, therefore, it requires support of communication, agreement about requirements, managing change and reasoning. In this work, we developed an argumentation-based systematic process for requirements elicitation, negotiation and refinement that supports documentation of the process, agreement between stakeholders, management of change and reasoning. In particular, we viewed the requirements engineering process as an exchange of arguments between stakeholders and requirements engineers. Throughout this process, requirements are iteratively proposed by stakeholders, attacked and refined until all the initial requirements are *acceptable through refinement* or *rejected*. In support of this process, we developed a powerful calculus that formally defines when requirements, attacks on requirements and refinements are *justified*. This work is conducted in collaboration with Prof. John Mylopoulos from University of Toronto and Dr. Alessio Ferrari from CNR-Pisa. This ongoing project resulted in two conference papers (one is currently under submission).

Modeling, Analysis and Practical Enforcement of Obligations and Usage Controls

Dec. 2006 - Dec. 2013

FORMAL METHODS; MODEL DRIVEN ENGINEERING; LOGIC PROGRAMMING; MODEL CHECKING; JAVA; ASPECT ORIENTED PROGRAMMING; DOMAIN SPECIFIC MODELING LANGUAGES; SYNTAX; SEMANTICS; ACTION LANGUAGES; ECA RULES; PROLOG; SECURITY; KNOWLEDGE REPRESENTATION; SEMANTIC WEB; Traditional security policy languages and models include permissions and prohibitions, enabling the specification of only access controls. However, many modern systems and applications have other security requirements such as privacy, availability, regulatory compliance and data rights management (DRM). The support of those requirements requires adding *obligations* to traditional access control policies. We therefore started this project by studying individual and collective obligations, i.e. their specification, semantics, management, enforcement as well as their interaction with access control policies. Afterwards, due to criticality of security policies, we defined a model and a language to formally describe the target system and its usage control policy, enabling their formal verification and analysis using model checking. We also identified and formalized several important properties that *correct* security and usage control policies should satisfy. Finally, to enforce security policies and usage control in practice, we developed the Security@Runtime framework (S@R) for Java-based applications. S@R includes a Domain Specific modeling Language (DsL) which supports specification of fine-grained contextual authorization, obligation, sanction and reaction policies, thus covering many of the sophisticated requirements of modern applications. On the other hand, S@R policies are enforced using an architecture which includes a Policy Administration Point (PAP), a Policy Enforcement Point (PEP) and a Policy Decision Point (PDP). This application-indepedent architecture supports non-intrusive security enforcement, separation of concerns (through the use Aspect-Oriented Programming (AOP)) and the *runtime updating* of policies. This work resulted in 3 journal and 8 conference publications.

Publications

2020	Optimal Adaptation Strategies for Autonomous Systems , Yehia Elrakaiby, Paola Spoletini and Bashar Nuseibeh. CoRR abs/2001.08525	Journal	
	CaRE: A Refinement Calculus for Requirements Engineering Based on Argumentation		
2018	Somantics Value Elrakaiby Alassia Forrari and John Mylonoulos DE 2019: 264 260	Conference	
	Jeing Argumontation to Evaluin Ambiguity in Doguiroments Elicitation Interviews		
2017	Vehia Electricity Alessia Eagreeni Deale Constantini, Stafenia Consti and Dealey Nussibab. DE	Conference	
2014	Terria Errakaiby, Alessio Ferrari, Paola Spoterini, Stelania Gresi and Bashar Nuseiberi. RE.	C C	
2014	Dynamic Analysis of Usage Control Policies, Yenia Elrakaiby, Jun Pang. SECRYPT.	Conference	
2014	Security@kuntime: A Flexible MDE approach to Enforce Fine-grained Security Policies,	Conference	
	Yehia Elrakaiby, Moussa Amrani, Yves Le Traon. ESSoS.		
	Reasoning on Robot Knowledge from Discrete and Asynchronous Observations , Pouyan		
2014	Ziafati, Yehia Elrakaiby, Mehdi Dastani, Leendert van der Torre, Marc Van Zee, Jon-Jules Meyer and	Conference	
2011	Holger Voos. Knowledge Representation and Reasoning in Robotics Symposium at AAAI Spring	conterence	
	Symposium Series.		
	Normative Multi-Agent Systems, Jan Broersen, Stephen Cranefield, Yehia Elrakaiby, Dov M.		
2013	Gabbay, Davide Grossi, Emiliano Lorini, Xavier Parent, Leendert W. N. van der Torre, Luca	Book Chapter	
	Tummolini, Paolo Turrini, François Schwarzentruber: Normative Reasoning and Consequence.		
	Formal Specification and Management of Security Policies with Collective Group Obligations,		
2013	Frédéric Cuppens, Nora Cuppens-Boulahia, Yehia Elrakaiby. Journal of Computer Security 21(1):	Journal	
	149-190.		
	Compliance in Resource-based Process Models. Silvano Colombo Tosatto, Yehia Elrakaiby,		
2013	Pouyan Zyafiti. BNAIC.	Conference	
	Formal Enforcement and Management of Obligation Policies, Yehia Elrakaiby, Frédéric	_	
2012	Cuppens, Nora Cuppens-Boulahia. Data Knowl. Eng. 71(1): 127-147.	Journal	
0011	An Integrated Approach for the Enforcement of Contextual Permissions and Pre-Obligations,		
2011	Yehia Elrakaiby, Frédéric Cuppens, Nora Cuppens-Boulahia. IJMCMC 3(2): 33-51 (2011).	Journal	
2010	From Contextual Permission to Dynamic Pre-obligation: An Integrated Approach,	Conformer	
2010	Yehia Elrakaiby, Frédéric Cuppens, Nora Cuppens-Boulahia. ARES.	Conference	
2000	Semantic Context Aware Security Policy Deployment, Stere Preda, Frédéric Cuppens, Nora		
2009	Cuppens-Boulahia, Joaquín García-Alfaro, Laurent Toutain, Yehia Elrakaiby. ASIACCS.	Conference	
2009	Formalization and Management of Group Obligations, Yehia Elrakaiby, Frédéric Cuppens, Nora		
	Cuppens-Boulahia. POLICY.	Conterence	
2008	Interactivity for Reactive Access Control, Yehia Elrakaiby, Frédéric Cuppens, Nora		
	Cuppens-Boulahia. SECRYPT.	Conterence	

2013	Argument Revival in Annotated Argumentation Networks, Diego Ambrossio, Alessio Antonini,	Warkshap
	Yehia Elrakaiby, Dov M. Gabbay, Marc van Zee. ARGAIP.	workshop
2013	A PEP-PDP Architecture to Monitor and Enforce Security Policies in Java Applications,	
	Yehia Elrakaiby, Yves Le Traon. FARES.	
2012	Access Control Enforcement Testing, Donia Elkateb, Yehia Elrakaiby, Tejeddine Mouelhi and Yves	
	Le Traon. AST.	workshop
2012	Testing Obligation Policy Enforcement Using Mutation Analysis , <u>Yehia Elrakaiby</u> , Tejeddine Mouelhi, Yves Le Traon. Mutation.	
Cuppens, Nora Cuppens-Boulahia. ICDIM.		
	GOOGLE SCHOLAR STATS: h-index: 8 publications: 24 primary author: 14 citations: 283	

Selected Invited Talks _____

Optimal Strategies for Autonomous Systems	Pisa, Italy
CNR - Formal Methods and Tools Group at ISTI	24 Nov. 2017
Requirements-driven Security, Adaptation and Argumentation	Dublin, Ireland
University College Dublin - Computer Science group	7 Nov. 2017
Security@Runtime for Usage Control Specification and Enforcement	Luxembourg, Luxembourg
University of Luxembourg - Individual and Collective Reasoning Group (ICR)	19 Nov. 2014
Usage Control: Specification, Enforcement and Analysis	Munich, Germany
Technical University of Munich - Software Engineering Group	31 Mar. 2014

Students Supervision _____

Usage Control for Multi-media Data Objects	Kaiserslautern, Germany
Yokanand Tributhi - MSc Thesis	2016
Redressable Access Control Policies	Luxembourg, Luxembourg
Ronan Huggard - MSc Thesis	2013
Security Policy Enforcement using Aspect-Oriented Programming	Luxembourg, Luxembourg
Ana Maria Gaggero - BSc Student Worker	2013

Teaching _____

CS4111 Foundations of Computer Science 1			
Lecturer			
Networks and Security Labs			
For BSC and MSc students			

Recent Service Activities _____

2018 PC Member, International Workshop on Security for and by Model-Driven Engineering - SecureMDE

- 2018 Reviewer, IEEE Transactions on Network and Service Management
- 2018 Reviewer, Computer Networks Journal
- 2018 Sub-Reviewer, Tools and Algorithms for the Construction and Analysis of Systems (TACAS)

References

Prof. John Mylopoulos

DEPARTMENT OF COMPUTER SCIENCE

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2008-2010

Shandong, China 2018 Rennes, France

University of Toronto

Collaborator

Prof. Bashar Nuseibeh	The Open University
Department of Computing.	Team Supervisor
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Dr. Jörg Dörr	Fraunhofer IESE
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Dr. Jun Pang	Université du Luxembourg
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Prof. Leon van der Torre	Université du Luxembourg
Computer Science and Communications Research Unit.	Collaborator
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Prof. Frédéric Cuppens	IMT Atlantique

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