

ELDA PAJA

Curriculum Vitae

Personal Information



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Sex F | Date of birth 29 Jul. 83 | Nationality Albanian

Current Position

May 2014 – now

Post-doctoral Research Fellow

Università degli Studi di Trento, Italy,
Department of Information Engineering and Computer Science (DISI)
Prof. John Mylopoulos

Research Interests

Security Requirements Engineering, Requirements Modeling Languages, Conceptual Modeling, Socio-technical Systems, Compliance, Trust, Adaptation, Evolution, Business Intelligence, Reasoning Techniques

Education

November 2010 – May 2014

PhD in Computer Science

Università degli Studi di Trento, Italy,
Department of Information Engineering and Computer Science (DISI)

Sep 2007 – Mar 2010

European Master in Informatics (EuMI)

RWTH Aachen, Germany,
and University of Trento, Italy.

Sep 2001 – Jun 2006

Diploma of Science in Computer Science

Faculty of Natural Sciences,
University of Tirana, Albania

Theses

PhD Thesis

“STS: A Security Requirements Engineering Methodology for Socio-Technical Systems”

Supervisor: Prof. Paolo Giorgini

Committee: Prof. Oscar Pastor, Prof. Harambalos Mouratidis,
Prof. Fabio Massacci

Abstract: *Today’s software systems are situated within larger socio-technical systems, wherein they interact—by exchanging data and delegating tasks—with other technical components, humans, and organisations. The components (actors) of a socio-technical system are autonomous and loosely controllable. Therefore, when interacting, they may endanger security by, for example, disclosing confidential information, breaking the integrity of others’ data, and relying on untrusted third parties, among others. The design of a secure software system cannot disregard its collocation within a socio-technical context, where security is threatened not only by technical attacks, but also by social and organisational threats.*

This thesis proposes a tool-supported model-driven methodology, namely STS, for conducting security requirements engineering for socio-technical systems. In STS, security requirements are specified—using the STS-ml requirements modelling language—as social contracts that constrain the social interactions and the responsibilities of the actors in the socio-technical system. A particular feature of STS-ml is that it clearly distinguishes information from its representation—in terms of documents, and separates information flow from the permissions or prohibitions actors specify to others over their interactions. This separation allows STS-ml to support a rich set of security requirements. The requirements models of STS-ml have a formal semantics which enables automated reasoning for detecting possible conflicts among security requirements as well as conflicts between security requirements and actors’ business policies—how they intend to achieve their objectives. Importantly, automated reasoning techniques are proposed to calculate the impact of social threats on actors’ information and their objectives. Modelling and reasoning capabilities are supported by STS-Tool.

The effectiveness of STS methodology in modelling and ultimately specifying security requirements for various socio-technical systems is validated with the help of three case studies from three different domains. We assess the scalability for the implementation of the conflict identification algorithms conducting a scalability study using data from one of the case studies. Finally, we report on the results from user-oriented empirical evaluations of the STS methodology, the STS-ml modelling language, and the STS-Tool. These studies have been conducted over the past three years starting from the initial proposal of the methodology, language, and tool, in order to improve them after each evaluation.

Master

“Modeling Design patterns with Description Logics”

Supervisors: Prof. John Mylopoulos, Prof. Gerhard Lakemeyer

Bachelor

*“Comparison of different types of intelligent agents:
A case study and a simulation”*

Supervisor: Prof. Betim Cico

Honors and Awards

Starting Grant 2014 recipient, University of Trento, October 2014

Postdoctoral Fellowship, University of Trento, May 2014

PhD on The Move Programme Grant recipient, Trento Rise, June 2013

PhD Fellowship, DISI, University of Trento, November 2010

Erasmus Mundus Scholarship for the EuMI Master Programme, June 2007

Research Projects

PACAS

PACAS is a H2020 SESAR funded project that will deliver a Change Management Platform, which will facilitate understanding, modelling and analyzing changes in the ATM System at different layers of abstraction. To achieve this aim, PACAS will rely on the end-to-end inclusion of ATM domain stakeholders by conceiving a novel participatory design process to handle change management. The process will rely on the provision of multiple views (to accommodate the expertise of the various domain stakeholders), as well as the representation and analysis of multiple objectives, such as those related to economical, organizational, security, and safety concerns.

Involvement: coordinator role. On the technical side, will be responsible for the definition of modeling concepts and reasoning techniques for change management; provide input and feedback on the platform architecture, in particular to how the different methods will interoperate for better representation of information to the various domain experts.

Project website: <http://www.pacasproject.eu/>

Period: February 2016 - ongoing

VISION

Visual Privacy Management in User Centric Open Environments—this H2020 funded project is focused on developing high Technology Readiness Level (TRL) Visual Privacy Management Platform, which empowers any citizen to achieve desired levels of privacy by creating and monitoring a personal Privacy Level Agreement. The platform will provide clear visualization of privacy preferences, relevant threats and trust issues along with an insight into the economic value of user data.

Involvement: design and provide guidance for the definition of scenarios and pilots for conducting requirements elicitation; design of a modeling framework (language, reasoning techniques, support tool) to specify privacy requirements at the organizational and procedural level; provide input and feedback on the platform architecture, in particular to how the Vision Software Components and methods will interoperate.

Project website: <http://www.visioneuproject.eu/>

Period: July 2015 – ongoing

LUCRETIVUS

Foundations for Software Evolution—this ERC project is focused on developing techniques for designing software systems that evolve in response to changes in their requirements and operational environment. The Lucretius project aims at developing a framework for modeling and reasoning on requirements for evolution along different research lines.

Involvement: Advance current security requirements engineering techniques in order to manage the effects of evolution of socio-technical systems to maintain compliance with security requirements, exploiting not only strategic goal reasoning techniques, but also business intelligence.

Project website: <http://www.lucretius.eu/>

Period: 2011 - ongoing

ANIKETOS

Ensuring Trustworthiness and Security in Service Composition—funded by the EU Commission, FP7—is concerned with the design and implementation of secure and trustworthy service compositions. The project lies within the scope of the *Future Internet*, which will provide an environment wherein a diverse range of services are offered by a diverse range of suppliers, and users are likely to unknowingly invoke underlying services in a dynamic and ad hoc manner. Such services have to be composed and recomposed, transparently to the end user, to guarantee security and trustworthiness.

Involvement: design of a modeling framework (language, reasoning techniques, support tool) to specify security requirements at the organizational level.

Project website: <http://www.aniketos.eu/>

Period: 2010–July 2015

NESSOS

Trustworthiness of Software Services and Systems for the Future Internet—the Network of Excellence on Engineering Secure Future Internet Software Services and Systems (NESSoS) aims at constituting and integrating a long lasting research community on engineering secure software-based services and systems.

Involvement: presented a tool-supported security requirements engineering technique, and gave talks and tutorials on the proposed technique; contributed to the Nessos Book.

Project website: <http://www.nessos-project.eu/>

Period: October 2010 – March 2014

ERise Challenge

Engineering of Risk and Security Requirements Challenge—conducted for empirical evaluation of security engineering methods. ERise has the objective of providing the method designer with empirical evaluation of security engineering methods; intentions of adopting the tool.

Involvement: participated as an observer during the focus group discussions
Project website: <https://securitylab.disi.unitn.it/doku.php?id=erise>
Period: Repeated in three consecutive years, from 2011 to 2014, April – June

SEEGRID Albania

Involvement: in the initial phases of the implementation of the grid infrastructure for the Faculty of Natural Sciences at the University of Tirana.
Period: January 2007 – June 2007

Tools

STS-Tool is a graphical modeling tool for the design of secure socio-technical systems. It is the support tool for the security requirements modeling language STS-ml, providing modeling and reasoning capabilities, as well as derivation of security requirements and the generation of a requirements document both in pdf and rtf formats. It is available for download from <http://www.sts-tool.eu/> and is available for multiple platforms (Windows, Linux, OSX).

Involvement: proposed and designed the modeling language STS-ml, participated in the design of the STS-Tool, developed the reasoning techniques supported by the tool.

Period: 2010 – ongoing

Visiting

Sep 2013 – Nov 2013

**Institute of Software Research International
Carnegie Mellon University – CMU**
Hosted by Professor Travis Breaux

During my visit at CMU I interacted with the hosting research group to extend my PhD thesis work on security requirements engineering with new concepts to capture privacy requirements. I presented and discussed my work with various members of the group and other colleagues from the software engineering department. I had the chance to attend courses on privacy policy, law and technology, as well as various seminars, such as the Privacy seminar.

Internships

Mar 2010 – Nov 2011

Università degli Studi di Trento – DISI
*Modeling and reasoning about service-oriented applications
via goals and commitments*

Nov 2007 – Feb 2008

Fraunhofer Institute Bonn

Access Management for shared applications in Ubiquitous Computing

Sep 2003 – Nov 2003

Albanian Ministry of Finances
Database administration

Mar 2002 – Jun 2002

MABS Albania
Computer Networks and Programming in Cache

Teaching

Summer Semester 2016

Università degli Studi di Trento

MSc course on Organizational Information Systems – Lecturer and Teaching Assistant (Responsible for the overall course, lectures and tutorials)

Summer Semester 2015

Università degli Studi di Trento

MSc course on Organizational Information Systems – Lecturer and Teaching Assistant (Responsible for the overall course, lectures and tutorials)

Summer Semester 2014

Università degli Studi di Trento

MSc course on Organizational Information Systems – Lecturer and Teaching Assistant

Summer Semester 2013

Università degli Studi di Trento

MSc course on Organizational Information Systems – Teaching Assistant

Winter Semester 2012

Università degli Studi di Trento

MSc course on Agent-Oriented Software Engineering – Lectures on the final version of the socio-technical security modeling language (STS-ml) and tool (STS-Tool)

Winter Semester 2011

Università degli Studi di Trento

MSc course on Agent-Oriented Software Engineering – Lectures on the initial version of the socio-technical security modeling language (STS-ml) and tool (STS-Tool)

Winter Semester 2010

Università degli Studi di Trento

Agent-Oriented Software Engineering – Series of lectures on the importance of *trust* in multi-agent systems

Summer Semester 2007

University of Tirana

Introduction to Algorithms – Teaching assistant

Seminars and Tutorials

Security Requirements Engineering: Designing Secure Socio-Technical Systems, Seminar given at the University of British Columbia, April 2016

Security Requirements Engineering: Designing Secure Socio-Technical Systems, Seminar given at the Polytechnic University of Catalonia, April 2016

Security Requirements Engineering: Designing Secure Socio-Technical Systems, Seminar given at the University of Alicante, April 2016

Security Requirements Engineering: Designing Secure Socio-Technical Systems, Seminar given at ATOS Research, April 2016

Security Requirements Engineering: Designing Secure Socio-Technical Systems, Seminar given at the University of Malaga, April 2016

Designing Secure Socio-Technical Systems with STS-ml and STS-Tool, Seminar given at the Institute for Software Research, Carnegie Mellon University, October 2013

Socio-Technical Security Modelling Language and Tool, Seminar given at Bruno Kessler Foundation, December 2012

Modelling Trust and Security Requirements, Demo and Poster at the Trento ICT Days, March 2012

Aniketos Socio-Technical Security Modelling Language, Seminar given at the Nessos general meeting, Trento, August 2011

Security requirements engineering via commitments, Seminar given at the University of Salerno as part of the student presentations at the International Summer School in Software Engineering, July 2011

The initial version of the Socio-Technical Security Modelling Language and Tool, Seminar given at the University of Trento as part of the Formative User-Oriented Evaluation Workshop, July 2011

Remark: paper presentations at workshops and conferences are not listed.

Involvement in Scientific Events

Program committee

23rd International Conference on Requirements Engineering Foundation for Software Quality [[REFSQ'17](#)]
Re:Next 2016 [[RE:Next!](#)]
Posters&Demos session – 24th IEEE Int. Conf. on Requirements Engineering - RE2016 [[RE'16 P&D](#)]
Posters&Demos session – 23rd IEEE Int. Conf. on Requirements Engineering - RE2015 [[RE'15 P&D](#)]
International i* Teaching Workshop: 2015 [[iStarT'15](#)]
International i* (iStar) Workshop: [2014](#), [2015](#), and [2016](#)

Reviewing

ACM Transactions on Management Information Systems [[TMIS'16](#)]
International Journal of Human-Computer Studies [[IJHCS'16](#)]
Expert Systems Journal of Knowledge Engineering [[ESJKE'16](#)]
Software Quality Journal [[SQJ'16](#)]
Journal of Computer Security [[JCS'15](#)]
IEEE Security and Privacy [[SP'15](#)]
Expert Systems Journal of Knowledge Engineering [[ESJKE'15](#)]
IEEE Transactions on Software Engineering [[TSE'14](#)]
International Journal of Information Security [[IJIS'13](#)]

Co-reviewing

15th IEEE International Conference on Trust , Security and Privacy in Computing and Communications [[TrustCom'16](#)]
35th International Conference on Conceptual Modeling [[ER'16](#)]
10th IEEE International Conference on Research Challenges in Information Science [[RCIS'16](#)]
28th International Conference on Advanced Information Systems Engineering [[CAiSE'16](#)]
38th International Conference on Software Engineering [[ICSE'16](#)]
27th International Conference on Advanced Information Systems [[CAiSE'15](#)]
12th International Conference on Service Oriented Computing [[ICSOC'14](#)]
26th International Conference on Advanced Information Systems [[CAiSE'14](#)]
7th IEEE International Conference on Research Challenges in Information Systems [[RCIS'13](#)]

Student Volunteer

19th IEEE International Conference in Requirements Engineering [[RE'11](#)]

Publications

Books

- [1] Fabiano Dalpiaz, Elda Paja and Paolo Giorgini, *Security Requirements Engineering: Designing Secure Socio-Technical Systems*, MIT Press, Jan 2016.

Journal Papers

- [1] Elda Paja, Fabiano Dalpiaz, and Paolo Giorgini (2015), *Modelling and Reasoning about Security Requirements in Socio-Technical Systems*, Data and Knowledge Engineering (DKE), 2015, pp. 123-143.
- [2] Per Håkon Meland, Elda Paja, Erlend Andreas Gjære, Stéphane Paul, Fabiano Dalpiaz, and Paolo Giorgini (2014), *Threat Analysis in Goal-Oriented Security Requirements Modelling*, International Journal of Secure Software Engineering, Volume 5(2), 2014, pp. 1-19.
- [3] Elda Paja, Amit K. Chopra, and Paolo Giorgini (2012), *Trust-based Specification of Sociotechnical Systems*, Data and Knowledge Engineering (DKE) Special Issue ER 2011, pp. 339-353.
- [4] Sandra Trösterer, Elke Beck, Fabiano Dalpiaz, Elda Paja, Paolo Giorgini, and Manfred Tscheligi (2012), *Formative User-Centered Evaluation of Security Modeling: Results from a Case Study*, International Journal of Secure Software Engineering 3 (1), pp. 1-19.
- [5] Betim Cico, Alketa Hyso, and Elda Paja, *Comparison of different types of intelligent agents: a case study and a simulation*, AJNTS (Albanian Journal of Natural and Technical Sciences), Tirana, Albania, 2007 (1), XIII (21), pp. 116-125.

International Conference Papers

- [1] Tong Li, Jennifer Horkoff, Elda Paja, Kristian Beckers, John Mylopoulos: *Security Attack Analysis Using Attack Patterns*, In Proceedings of the 10th International Conference on Research Challenges in Information Science, RCIS 2016, 2016, To Appear, Grenoble, France.
- [2] Tong Li, Jennifer Horkoff, Elda Paja, Kristian Beckers, John Mylopoulos: *Analyzing Attack Strategies Through Anti-goal Refinement*, In Proceedings of the 8th IFIP WG8.1 Working Conference on the Practice of Enterprise Modelling, PoEM 2015, 2015, pp. 75-90, Valencia, Spain.
- [3] Elda Paja, Fabiano Dalpiaz and Paolo Giorgini, *Managing Security Requirements Conflicts in Socio-Technical Systems*, In Proceedings of the 32nd International Conference on Conceptual Modeling, ER 2013, pp. 270–283.

- [4] Amit K. Chopra, Elda Paja, and Paolo Giorgini. *Socio-Technical Trust: An Architectural Approach*, In Proceeding of the 30th International Conference on Conceptual Modeling, ER 2011, pp. 104-117.
- [5] Yulistira Asnar, Elda Paja, and John Mylopoulos, *Modeling Design Patterns with Description Logics*, In proceedings of the 23rd International Conference on Advanced Information Systems Engineering (CAISE'11), pp. 169-183, London, UK.
- [6] Betim Cico, Alketa Hyso, and Elda Paja, *Comparison of different types of intelligent agents: a case study and a simulation*, Proceedings of Third International Bulgarian - Turkish Conference, Computer Science'06, 12-15 October 2006, Part I, pp. 273-278, Istanbul, Turkey.

International Workshop Papers

- [1] Elda Paja, Jennifer Horkoff, and John Mylopoulos, *The importance of teaching Systematic Analysis for Conceptual Models: An Experience Report*. In Proceedings of the 34th International Conference in Conceptual Modelling - Workshops (ER'15 Workshops), pp. 347-357, Stockholm, Sweden.
- [2] Elda Paja, Jennifer Horkoff, and John Mylopoulos, *The importance of teaching goal-oriented analysis techniques: an experience report*, Proceedings of the 1st iStar Teaching Workshop, iStarT 2015, pp. 37-42, Stockholm, Sweden.
- [3] Mattia Salnitri, Elda Paja, Mauro Poggianella, and Paolo Giorgini, *STS-Tool 3.0: Maintaining Security in Socio-Technical Systems*, CAiSE Forum 2015, pp. 205-212, Stockholm, Sweden.
- [4] Tong Li, Jennifer Horkoff, Kristian Beckers, Elda Paja, and John Mylopoulos, *A Holistic Approach to Attack Modeling and Analysis*, iStar'15, pp. 49-54, Ottawa, Canada.
- [5] Tong Li, Elda Paja, John Mylopoulos, Jennifer Horkoff, and Kristian Beckers, *Holistic Security Requirements Analysis: An Attackers Perspective*, RE'15 Posters and Demo, pp. 282-283, Ottawa, Canada.
- [6] Mattia Salnitri, Elda Paja, and Paolo Giorgini, *Preserving compliance with security requirements in socio-technical systems*, 3rd CSP Forum 2014, pp. 49-61, Athens, Greece
- [7] Elda Paja, Fabiano Dalpiaz, Mauro Poggianella, Pierluigi Roberti, and Paolo Giorgini, *Security requirements engineering for socio-technical systems with STS- Tool*, 3rd CSP Forum 2014, Athens, Greece.
- [8] Elda Paja, Fabiano Dalpiaz, Mauro Poggianella, Pierluigi Roberti, and Paolo Giorgini, *Specifying and Reasoning over Socio-Technical Security Requirements with STS-Tool*, In Proceedings of the 32nd International Conference in Conceptual Modelling - Workshops (ER'13 Workshops), pp. 504-507, Hong Kong.
- [9] Elda Paja, Fabiano Dalpiaz, and Paolo Giorgini, *Designing Secure Socio-Technical Systems with STS-ml*, Sixth International i* Workshop (iStar'13), pp. 79-84, Valencia, Spain.
- [10] Elda Paja, Fabiano Dalpiaz, Mauro Poggianella, Pierluigi Roberti, and Paolo Giorgini, *STS-Tool: Specifying and Reasoning over Socio-Technical Security*

Requirements, Sixth International i* Workshop (iStar'13), pp. 131-133, Valencia, Spain.

- [11] Elda Paja, Fabiano Dalpiaz, Mauro Poggianella, Pierluigi Roberti, and Paolo Giorgini, *STS-Tool: Socio-Technical Security Requirements through Social Commitments*, pp. 331-332, RE'12 Demo and Posters, Chicago, IL, USA.
- [12] Elda Paja, Fabiano Dalpiaz, Mauro Poggianella, Pierluigi Roberti, and Paolo Giorgini, *STS-Tool: Using Commitments to Specify Socio-Technical Security Requirements*, pp. 396-399, ER'12 Demonstrations, Florence, Italy.
- [13] Elda Paja, Fabiano Dalpiaz, Mauro Poggianella, Pierluigi Roberti, and Paolo Giorgini, *Modelling Security Requirements in Socio-Technical Systems with STS-Tool*, pp. 155-162, CAiSE'12 Forum, Gdańsk, Poland.
- [14] Elda Paja, Paolo Giorgini, Stephane Paul, and Per Hakon Meland, *Security Requirements Engineering for Business Processes*, In Proceedings of the First International Workshop on Alignment of Business Process and Security Modelling (ABPSM 2011), Riga, Latvia.
- [15] Fabiano Dalpiaz, Elda Paja, and Paolo Giorgini, *Security Requirements Engineering via Commitments*, First Workshop on Socio-Technical Aspects in Security and Trust (STAST'2011), pp. 1-8, Milan, Italy.
- [16] Fabiano Dalpiaz, Elda Paja, and Paolo Giorgini, *Security Requirements Engineering for Service-Oriented Applications*, Fifth International i* Workshop (iStar'11), pp. 102-107, Trento, Italy.
- [17] Elda Paja, Fabiano Dalpiaz, Paolo Giorgini, Stephane Paul, and Per Hakon Meland, *Modelling Trust and Security Requirements: the Air Traffic Management Experience*. In Proceedings of the 1st iStar Showcase (2011), London, UK.

Book chapters

- [1] Elda Paja, Fabiano Dalpiaz, and Paolo Giorgini, *STS-Tool: Security Requirements Engineering for Socio-Technical Systems*, In Advances in Engineering Secure Future Internet Services and Systems, volume 8431 of LNCS, 2014, pp. 65-96.
- [2] Elda Paja, Fabiano Dalpiaz, and Paolo Giorgini, *The Socio-Technical Security Requirements Modelling Language for Secure Composite Services*, In Secure and Trustworthy Service Composition: The Aniketos Approach, Lecture Notes in Computer Science, Volume 8900, 2014, pp. 63-78.
- [3] Elda Paja, Mauro Poggianella, Fabiano Dalpiaz, Pierluigi Roberti and Paolo Giorgini, *Security Requirements Engineering with STS-Tool*, In Secure and Trustworthy Service Composition: The Aniketos Approach, Lecture Notes in Computer Science, Volume 8900, 2014, pp. 95-109.

Professional Experience: Work History

Apr 2007 – Jul 2007

External Consultant, FFZM Albania

- Guided and supported the transition to the new core information system

- Trained users for the new system and procedures
- Provided computer related hardware/software maintenance and support to employees throughout the company

Jul 2006 – Sep 2007

IT Auditor, Banka Popullore, Societe Generale Group

- Performed regular inspections based on IT audit plans for hardware/software systems of the bank
- Created exception reports
- Created plans for the minimization of the operational risk
- Accessed relevant to inspection documentations and restricted areas facilities of the Bank
- Proposed administrative or financial measurements in case of discrepancies
- Conserved banking secret

May 2004 – Jul 2006

IT Specialist, Banka Popullore, Societe Generale Group

- Ensured normal functioning of the core banking system
- Integrated different software systems of the bank
- Developed required software systems
- Implemented new technologies to favor Bank development
- User administration
- Trained users
- Database management
- End of Day procedures

Personal Capabilities and Competencies

Languages

- Mother tongue: Albanian
- Other languages:
 - English expert
 - Italian expert
 - German advanced
 - Spanish beginner

Technical

- Operating systems:
 - Windows, Mac OSX, UNIX and BSD, Red Hat Linux, Scientific Linux

- Logic programming
 - Datalog, DLV^K
- Programming languages:
 - C#, Java, Asp, Flash, PHP
- Other languages:
 - HTML, XML, XACML

Relational and Organizational

- Dynamic, creative person, willing to learn and develop myself
- Able to perform both individual and team work
- Good decisional making abilities
- Open-minded, willing to meet new people
- Fully prepared to work in flexible hours
- Self-motivated and able to work with minimal supervision