

Mattia Salnitri

Curriculum Vitae – Summary



1. GENERAL INFORMATION

EDUCATION

- 2016 **Ph.D. Degree** in Information and Communication Technology, University of Trento, Italy.
- 2011 **Master of Science Degree** in Computer Science, University of Trento, Italy (Final Grade 103/110).
- 2009 **Bachelor of Science Degree** in Computer Science, University of Trento, Italy (Final Grade 99/110).

CAREER

- 2022 – now **Assistant Professor** (RTD-A) at Politecnico di Milano, Italy (1/1/2022 - 31/12/2024)
- 2020 – 2026 **Visiting Researcher** at the University of Bournemouth, UK
- 2017 – 2021 **Post-Doc Researcher** (Assegnista di Ricerca) at Politecnico di Milano, Italy
- 2016 – 2017 **Post-Doc Researcher** (Assegnista di Ricerca) at the University of Trento, Italy
- 2011 – 2016 **Ph.D. Student**, University of Trento, Italy

ITALIAN NATIONAL SCIENTIFIC QUALIFICATION (ABILITAZIONE SCIENTIFICA NAZIONALE)

Type of habilitation	Country	SSD (if Italian habilitation) or topic area	Date of achievement
Associate Professor	Italy	ING-INF/05 (Sett. Conc.:09/H1)	07/07/2023
Associate Professor	Italy	INF/01 (Sett. Conc.:01/B1)	21/07/2023

RESEARCH INTERESTS

- **Secure Socio-technical systems:** cybersecurity, privacy, socio-technical systems, social engineering, business processes modelling, goal modelling.
- **Design of secure systems:** (security) requirement engineering, blockchain.
- **Fog computing:** data movement, computation movement, reinforcement learning, decision systems, adaptive systems.

ORGANIZATION, COORDINATION AND PARTICIPATION OF NATIONAL AND INTERNATIONAL RESEARCH GROUPS

- 2017-now Research on Advanced Information Systems Engineering - **Politecnico di Milano (IT)**. I contributed to the **research** activities of the group with relevant research publications that span from information systems to database and software engineering. I **connected** the members of the research group with other researchers of my network. I am **coordinating**, as working group leader and task leader, two founded projects that involve members of the research group.
- 2020-now Cyber Security Research Group - **Bournemouth University (UK)**. I contributed to the activities of the group with **research** that spans the security and sociology research fields. I have led the research activities of a sub-group formed by a researcher, a professor and myself.
- 2011-2017 Software Engineering and Formal Methods - **University of Trento (IT)**. I took part in the group at the start of my research career. Nevertheless, I have contributed to the group with several **research** publications spanning from journals, book chapters, conferences, and workshop papers. I had **coordination** responsibilities since I was part of three EU-founded projects, being WP leader and task leader. I have coordinated a team of two developers for the creation of software tools (see technology transfer section).

2. QUALITY OF SCIENTIFIC AND PROJECT PRODUCTION

PRODUCTIVITY AND IMPACT METRICS

- **Scientific Productivity:** 44 publications (43 documents on Scopus, 80 co-authors according to Scopus):
 - Author/Co-author of 3 top-ranked Q1 journal papers based on SCIMAGO
 - Author/Co-author of 14 scientific publications on peer-reviewed conferences (including 2 Top Conference publications);
- **Publication Impact:**

Based on Google Scholar:	h-index 14	citations 878
Based on Scopus:	h-index 12	citations 517

AWARDS AND RECOGNITIONS

2014 Best Paper Award at RCIS Conference

TALKS AND SEMINARS AT NATIONAL AND INTERNATIONAL EVENTS

2024 Invited talk at Fondazione Bassetti (IT, Milan)
2024 Tutorial at RE (Reikiavik - Iceland)
2021-2024 Moderator at ESPRE
2023 Moderator at SAPD
2023 Invited Talk at Bournemouth University (UK)
2023 Talk at ITADATA (Naples)
2020-2021 Moderator at NeGIS
2020-2021 Moderator at RCIS
2020 Invited Talk at Bournemouth University (UK)
2019 Tutorial at RE (Jeju – South Korea)
2016 Tutorial at RE (Beijing- China)
2018 Talk at RE (Tallin)
2016 Talk at RE (Beijing)
2016 Talk at ISACA (Trento)
2014 Talk at BPMDS (Stockholm)
2015 Talk at CAiSE Forum (Stockholm)
2014 Talk at BPMDS (Thessaloniki)
2014 Talk at IStar (Thessaloniki)
2014 Talk at SHCPS (Bologna)
2012 Talk at CoopIS (Rome)

INSTITUTIONAL RESPONSIBILITIES

2023 – now **Task Leader** of EU Horizon funded project TEADAL
2021 – now **Work package leader** of Italian founded project Health Big Data
2016 – 2017 **Co-PI and Work package leader** of EU 2020 funded project PACAS

ORGANIZATION OF SCIENTIFIC MEETINGS

2024	Program committee Member, Working Conference on the Practice of Enterprise Modeling [POEM]
2024	Co-Organizing Chair, international workshop on Blockchain for Process and Information Science [B4PIS]
2022	Publicity chair of International Conference on Evaluation and Assessment in Software Engineering (EASE)
2022	Workshop chair, BigDataService Conference
2020-2024	Co-Organizing Chair, International Workshop on Evolving Security & Privacy Requirements Engineering [ESPRE]
2023	Co-Organizing Chair of the first international workshop on Secure, Accountable and Privacy-Preserving Data-Driven Service- Oriented Computing (SAPD). Workshop co-located with ICSSOC.
2020-2021	Co-Organizing Chair, NeGIS workshop
2022-2024	Associate Editor, European Conference on Information Systems (ECIS)
2019-2024	Program Committee Member, BPM demo
2021-2022	Program Committee Member, International Conference on Behavioral and Social Computing [BESC]
2020-2021	Program Committee Member, International conference on Research Challenges in Information Science [RCIS]
2020-2021	Program Committee Member, International working conference on Exploring Modeling Methods for Systems Analysis and Development [EMMSAD]
2020-2021	Program Committee Member, International Workshop on Artificial Intelligence and Requirements Engineering [AIRE]
2019	Program Committee Member, Strategic Modeling and Reasoning meets Process Mining Workshop [SMRPM]
2019	Program Committee Member, DAMove-2019 workshop
2018	Program Committee Member, International Workshop on Petri Nets and Software Engineering [PNSE]
2017-2019	Program Committee Member, SECurity and Privacy Requirements Engineering [SECPRE]
2017	Program Committee Member, International Workshop on Requirements Prioritization and Enactment [Priore]
2016 - 2020	Program Committee Member, Federated Conference on Computer science and Information Systems [FedCSIS]
2015	Program Committee Member, Workshop on Methodologies for Robustness Injection into Business Processes [MRI-BP]

PARTICIPATION IN EDITORIAL BOARDS

- 2024 **Member of Editorial Board** of IEEE Discover Computing (Springer)
- 2019-2022 **Member of review board** of Sensor international journal [SENSOR]
- 2019-2024 **Associate Editor** of International Journal of Information Security and Privacy [IJISP]
- 2019-2024 **Member of review board** of International Journal of Information System Modeling and Design [IJISMD]

More details in Section [Error! Reference source not found.](#)

3. TEACHING ACTIVITIES

COURSES WITH A PRIMARY RESPONSIBILITY

Institution name	Course name	Credits	No. of students	Reference Study Course	Time period	Students Evaluation
University of Trento	Security and Privacy in Socio-Technical Systems	3	~10	CSE – PhD Level	AA 2020/2021 2021/2022	High
Politecnico di Milano	Digital technologies 1	5	~250	CSE – Bachelor Level	AA 2019/2020 2020/2021 2021/2022 2022/2023 2023/2024 2024/2025	Medium/High
Politecnico di Milano	Information systems	5	~60	CSE – Bachelor Level	2024/2025	N/A
Politecnico di Milano	Software engineering – final exam - Online	3	~120	CSE – Bachelor Level	AA 2021/2022 2022/2023 2023/2024 2024/2025	N/A

OTHER TEACHING ACTIVITY

Institution name	Course name	Credits	Role	Reference Study Course	Time period	Students Evaluation
Politecnico di Milano	Software Engineering (28 hours/year)	5	Teaching assistant	CSE – Bachelor Level	AA 2018/2019 2019/2020 2020/2021 2021/2022	High
Politecnico di Milano	Software Engineering – prova finale (12 hours/year)	5	Teaching assistant	CSE – Bachelor Level	AA 2018/2019 2019/2020 2020/2021 2021/2022	High
Politecnico di Milano	Service and Process Design (8 hours/year)	5	Teaching assistant	CSE – Master Level	AA 2018/2019	High
Politecnico di Milano	Information Systems (Leonardo) (20 hours/year)	5	Teaching assistant	CSE – Bachelor Level	AA 2017/2018, 2018/2019, 2019/2020	High
Politecnico di Milano	Information Systems (Como) (10 hours/year)	5	Teaching assistant	CSE – Bachelor Level	AA 2017/2018, 2018/2019, 2019/2020	High
University of Trento	Organizational Information Systems (42 hours/year)	6	Teaching assistant	CSE – Master Level	AA 2016/2017	High
University of Trento	Software Engineering II (30 hours/year)	12	Teaching assistant	CSE – Bachelor Level	AA 2016/2017	High
University of Trento	Agent Oriented Software Engineering (10 hours/year)	6	Teaching assistant	CSE – Master Level	AA 2012/2013	High

SUPERVISION OF MASTER, DOCTORAL STUDENTS

2022 – present **Advisor** of **6** Master Students in Computer Science, Politecnico di Milano, Italy
2017 – present **Co-advisor** of **6** Master Students in Computer Science, Politecnico di Milano, Italy
2015 – 2017 **Co-advisor** of **3** Master Students in Computer Science, University of Trento, Italy
2015 – 2017 **Co-advisor** of **9** Bachelor Students in Computer Science, University of Trento, Italy

More Details in Section [ERROR! REFERENCE SOURCE NOT FOUND.](#)

4. PARTICIPATION/RESPONSIBILITY FOR FUNDED PROJECTS

PARTICIPATION IN COMPETITIVE RESEARCH PROJECTS

Project Acronym	Time Period	Funding Institution	Funding Scheme	Role of the applicant	Budget for the applicant's institution
TEADAL	2022-2025	EU	Horizon	Task Leader	€ 657 500,00
Health Big Data (HBD)	2021-2031	Ministero della Salute - IT		Working Group leader – WG7 Privacy, Cybersecurity and Ethics	Overall funding for 2024: € 300.000
DITAS	2017-2020	EU	H2020	Participant	€ 542 500
PACAS	2016-2017	EU	H2020	Working Package leader/Responsible Local Unit	€ 283 950
VisiOn	2016-2017	EU	H2020	Participant	€ 289 375
Aniketos	2011-2014	EU	FP7	Participant	€ 483 546

More Details in Section [ERROR! REFERENCE SOURCE NOT FOUND.](#)

5. TECHNOLOGY TRANSFER

PARTICIPATION OR LEADERSHIP IN INDUSTRY-RELEVANT EXPLOITATION OR STANDARDIZATION INITIATIVES

I have been collaborating with companies from the beginning of my research career. Many of the collaborations of companies resulted in publications. My current position in Politecnico di Milano has a formal collaboration with Al maviva (Italy), which resulted in a publication on a method for the design of green security policies [30] and another paper that is closed to submission.

The collaboration with **ATOS** (Spain) resulted in an extension of a framework I created for the definition of security policies [2], while a collaboration with **Business-E** (now **Maticmind**) (Italy) resulted in multiple publications: (i) about the extension of SecBPMN, a framework I created [2]; (ii) on a requirement engineering methodology [3], (ii) a contribution on an article collection that I edited, on privacy management [1]. A collaboration with DAEM (Greece) and Bambino Gesu' (Hospital, Italy) led to a publication on the empirical evaluation of a privacy platform [7]. I have been also collaborating with the SAP research center (Germany) and wrote collaborative a paper on the automatic enforcement of security properties [26].

DEVELOPMENT OF PRODUCTS / OPEN-SOURCE TOOLS / APPLICATIONS / SYSTEMS / SERVICES

STS-tool: I coordinated a team of two developers for the design and development of STS-Tool (www.sts-tool.eu), a software tool that supports SEBE, the method I designed in my Ph.D. thesis. The software, and the method, have been used in industrial case studies, and extended by other researchers. For further information,

please refer to my Ph.D. thesis and papers [36, 28]¹.

Security requirement Composition Module (SRCM): I developed a module of a software platform designed for the European project Aniketos². The module has been used as part of the platform and as a standalone service for the secure composition of web services using an extension of BPMN with security requirements. For further information, please refer to papers [2, 38].

Decision System for data and computation Movement (DSM): I developed a module that was integrated in a platform designed for the European project DITAS (<https://github.com/DITAS-Project/decision-system-for-data-and-computation-movement>). The module has been used as part of the platform, and as a standalone service for the decision of the best data and computation movement in Fog computing. For further information, please refer to papers [15, 17, 19].

6. TWELVE MOST RELEVANT PUBLICATIONS

- Julius Kopke, Giovanni Meroni, *Mattia Salnitri* **Designing Secure Business Processes for Blockchains with SecBPMN2BC**. Future Generation Computer Systems. Vol141, 382-398 (2023) DOI: <https://doi.org/10.1016/j.future.2022.11.013>
 - Classification of the journal: Q1
 - 18 pages
 - I contributed on the paper with SecBPMN2, that is the language I developed. I define the research method, defined and performed the evaluation of the method. I am the corresponding author.
- Giulia Mangiaracina, Pierluigi Plebani, *Mattia Salnitri*, Monica Vitali. **Efficient Data as a Service in Fog Computing: an Adaptive Multi-agent Based Approach**. IEEE Transactions on Cloud Computing (2022). DOI: <https://doi.org/10.1109/TCC.2022.3220811>
 - Classification of the journal: Q1
 - 18 pages
 - I contributed on the paper with the formalization of the framework, part of the implementation and the validation. I am the corresponding author.
- Jennifer Horkoff, Fatma Başak Aydemir, Evellin Cardoso, Tong Li, Alejandro Maté, Elda Paja, *Mattia Salnitri*, Luca Piras, John Mylopoulos, Paolo Giorgini. **Goal-Oriented Requirements Engineering An Extended Systematic Mapping Study**. Requirement Engineering Journal Vol. 24, 133–160 (2019). DOI: <https://doi.org/10.1007/s00766-017-0280-z>
 - Classification of the journal: Q1
 - 28 pages
 - I created the data structure for the mapping study. I contributed to the definition of the mapping study process and the definition of the classification method. I also contributed to the classification (mapping) of the selected papers. This publication is relevant since it reports the method and results of an extensive work that is well received by the research community.
- Cinzia Cappiello, Giovanni Meroni, Barbara Pernici, Pierluigi Plebani, *Mattia Salnitri*, Monica Vitali, Diana Trojaniello, Ilio Catalo, Alberto Sanna. **Improving health monitoring with adaptive data movement in Fog Computing**. Frontiers in Robotics and AI, section Sensor Fusion and Machine Perception. Vol 7:96, 2020 DOI: <https://doi.org/10.3389/frobt.2020.00096>
 - Classification of the journal: Q2
 - 19 pages
 - This paper is based on paper [16]. For this paper, I contributed to the framework sections (sect 5,6) and to the evaluation sections (Sect 7). This publication is relevant since it describes the extension and application of one of my research lines on data and computation movement in Fog computing.
- Qusai Ramadan, Daniel Strüber, *Mattia Salnitri*, Jan Jürjens, Volker Riediger, Steffen Staab. **A Semi-Automated BPMN-based Framework for Detecting Conflicts between Security, Data-Minimization and Fairness**

¹ Numbers refer to the full list of my publications that can be found later in the CV

² <https://cordis.europa.eu/project/id/257930>

Requirements. Software and Systems Modeling., 2020 DOI: <https://doi.org/10.1007/s10270-020-00781-x>.

- Classification of the journal: Q2
- 37 Pages
- I was the main contributor to the definition of the modelling language proposed in this paper. I contributed to the identification of privacy concepts and the heuristics for conflict detection, in terms of SecBPMN2-Q patterns. I contributed to the mapping of patterns in Datalog programs. This publication is relevant since it addresses a relevant issue on information systems and privacy management.
- *Mattia Salnitri*, Konstantinos Angelopoulos, Michalis Pavlidis, Vasiliki Diamantopoulou, Haralambos Mouratidis, Paolo Giorgini. **Modeling the Interplay of Security, Privacy and Trust in Sociotechnical Systems: A Computer-Aided Design Approach.** Software and System Modeling, vol. 19, 467–491 (2019). <https://doi.org/10.1007/s10270-019-00744-x>
 - Classification of the journal: Q2
 - 25 pages
 - I was the creator of the framework, in particular I defined the method and coordinated its application within the case study for its evaluation. I was the main author. This publication is relevant since it presents the integration of one of the modelling languages I defined in my research work, with other security and trust-related modelling languages, for the creation of a comprehensive design method.
- *Mattia Salnitri*, Fabiano Dalpiaz and Paolo Giorgini. **Designing secure business processes with SecBPMN.** Software and Systems Modeling. Vol. 16, 737–757 (2017). DOI: <https://doi.org/10.1007/s10270-015-0499-4>
 - Classification of the journal: Q2
 - 21 pages
 - I was the creator of the modelling language (SecBPMN), I developed the software tool that supports the language, I evaluated the modelling language and the software tool. I was the main author. This publication is relevant since it depicts a modelling language I created and was used as central contribution in my Ph.D. thesis and as starting point for numerous publications of other researchers.
- Pierluigi Plebani, *Mattia Salnitri*, Monica Vitali. **Fog Computing and Data as a Service: A Goal-Based Modeling Approach to Enable Effective Data Movements.** In Advanced Information Systems Engineering. CAiSE 2018. Lecture Notes in Computer Science, vol 10816, 203-219. Springer, Cham. DOI: https://doi.org/10.1007/978-3-319-91563-0_13 ISBN: 978-3-319-91562-3
 - Class 2
 - 17 pages
 - I contributed to the definition of the framework, especially on the goal-model part. I developed the software tool used to support the framework, I was responsible for the evaluation of the framework. This publication is relevant since it depicts the basis for a “smart” decision system applicable to distributed and highly dynamic environment as Fog computing.
- Mohamad Gharib, *Mattia Salnitri*, Elda Paja, Paolo Giorgini, Haralambos Mouratidis, Michalis Pavlidis, Jose F. Ruiz, Sandra Fernandez, Andrea Della Siria. **Privacy Requirements: Findings and Lessons Learned in Developing a Privacy Platform.** IEEE International Requirements Engineering Conference. RE 256-265 (2016). DOI: <https://doi.org/10.1109/RE.2016.13> ISBN: 978-1-5090-4122-0
 - Class 2
 - 10 pages
 - I contributed at the definition of the method, the design of the goal-based diagram and the classification of requirements. This publication is relevant since it lays the basis for future development of privacy-aware design of socio-technical systems.
- Jennifer Horkoff, Fatma Basak Aydemir, Evellin Cardoso, Tong Li, Alejandro Mate, Elda Paja, *Mattia Salnitri*, John Mylopoulos, Paolo Giorgini. **Goal-Oriented Requirements Engineering: A Systematic Literature Map.** IEEE International Requirements Engineering Conference. RE 106-115 (2016). DOI: <https://doi.org/10.1109/RE.2016.41> ISBN: 978-1-5090-4122-0
 - Class 2
 - 10 pages
 - I contributed to the definition of the method, and the definition of classifications of publications. I also reviewed part of selected papers and contributed to the application of alignment tests between reviewers. This publication is relevant since it delivers a systematic method for the classification of publications collected and analysed during surveys.

- Michele Cantarutti, Pierluigi Plebani, *Mattia Salnitri*. **Fast Replica of Polyglot Persistence in Microservice Architectures for Fog Computing**. International Conference on Service Oriented Computing. ICSOC 2020. pp 45-55 DOI: https://doi.org/10.1007/978-3-030-65310-1_4 ISBN: 978-3-030-65309-5
 - Class 2
 - 11 pages
 - I contributed to the definition of the framework, I coordinated the development of the software tool used for the evaluation. This publication is relevant since it proposes a framework with a realistic and implementable solution for data movement and alignment for Fog computing.
- Qusai Ramadan, *Mattia Salnitri*, Daniel Strüber, Jan Jürjens and Paolo Giorgini. **From Secure Business Process Modeling to Design-Level Security Verification**. In ACM/IEEE 20th International Conference on Model Driven Engineering Languages and Systems. MODELS. 123-133 (2017). DOI: <https://doi.org/10.1109/MODELS.2017.10> ISBN: 978-1-5386-3493-6
 - Class 2
 - 11 pages
 - I was the creator of the modelling language used for the extension proposed in this paper, I contributed at the definition the mapping relations between the procedural language and the UML-based language. This publication is relevant since it reports the details and evaluation of a framework that allows the definition of the architecture of secure Socio-Technical Systems, one of my main research lines.

More Details in Section [ERROR! REFERENCE SOURCE NOT FOUND.](#)

7. LIST OF THREE PEERS WHO COULD PROVIDE A REFERENCE LETTER

- Barbara Pernici, Professor at Politecnico di Milano (IT) barbara.pernici@polimi.it
- Haralambos Mouratidis, Professor at University of Essex (UK), h.mouratidis@essex.ac.uk
- Achim Brucker, Professor at University of Exeter (UK), achim@brucker.ch

RESEARCH STATEMENTS

ON-GOING RESEARCH AND RECENT ACHIEVEMENTS

My research work focuses on the design of Socio-Technical Systems (STSs), i.e., decentralized systems that are composed of autonomous actors, such as people, organizations and technical components, that interact with each other to achieve common objectives. Examples of STSs are smart cities, hospitals and airports. In particular, my research is centered on cybersecurity and privacy and how to deliver secure and privacy preserving Socio-Technical Systems with methods that support experts from the early design stages until the implementation of these systems. This not only includes the analysis of technical aspects, but also human aspects and how cybersecurity and privacy behaviors can be considered in the design of STSs and nudged in the human part of these systems.

For what concerns strictly the technical part of STSs, their architecture can be considered composed of Cloud and IoT resources (also called Edge resources, since they lie at the edge of the network), and a substantial set of resources between these two far ends. These three layers form a continuous of resources, called Fog computing, that can be used to increment the performance of the overall system by moving data near where it is processed or by moving computation near the data it uses. This can improve drastically performances of STSs components, for example by reducing the response time. My research work focuses on the creation of methods that allow to take advantage of the continuous of resources considered in Fog computing by defining and using methods that dynamically allocate, move, duplicate data or computation while keeping them aligned and conflict-free. Below you will find more details on my on-going research work and recent achievements.

Secure Business process engineering

Business processes are an integral part of the design of Socio-Technical Systems since they are used to specify the expected behaviors of people, technical components and organizations in terms of sequences of activities that are executed to achieve shared objectives. Their central role in the design of STSs calls for an additional

level of attention when security and privacy aspects are considered. My research work consists in creating methods that support security experts in the design of secure and privacy-compliant business processes, from the early design phases, where the objective of actors involved in the system are defined, through the actual definition of business processes, until their implementation.

In particular, I have proposed in my Ph.D. thesis, a comprehensive framework for the engineering of secure business processes that supports security experts from the specification security requirements from a social point of view, using a goal-based modelling language I contributed to survey [13, 14, 25] and develop. The information specified is then used to automatically generate the structure of a secure business process that can be extended by experts [34]. Such generated processes are defined using a modelling language I created that allows to specify security properties on business processes, called SecBPMN2 [15, 28, 29]. Such business processes are used to generate a skeleton of the implementation that implements security mechanisms that enforce security properties specified at the procedural level [26, 38]. This method, therefore, ensures the enforcement of security requirements in technical components of Socio-Technical Systems.

Business processes can be used to define several aspects of STSs, including contracts (that can be seen as a sequence of mandatory actions to be executed, along with penalties or rewards) between different entities of STSs. I focused on electronic contracts, i.e., contracts human and machine-readable, frequently used in many aspects of STS, called smart contracts. Smart contracts are an extremely relevant asset of STSs and must be designed considering security and privacy aspects. A not secure smart contract may lead to unauthorized access to sensitive information or to security breaches. With this perspective in mind, I created an extension of SecBPMN2, called SecBPMN2BC, that allows the definition of secure smart contracts, leveraging blockchain technology as a security mechanism to enforce part of its security and privacy requirements [9]. The objective of the defined method is twofold: it allows to design of secure smart contracts and it maximises the security and privacy requirements that can be enforced using different blockchain technologies.

Privacy in Socio-technical systems

Privacy is a critical factor for any system that manages data, and Socio-Technical Systems are no exception. Their design is highly influenced by any privacy-related issues since the amount of personal, sensitive and particular data exchanged and stored is very relevant. The definition of methods and frameworks for privacy-aware design and implementation of STSs is, therefore, a priority that has become even more urgent with the new global trend of privacy laws, starting with the General Data Privacy Regulation (GDPR). My research work focuses on the privacy-by-design approach of STSs.

I tackled the privacy issue in STSs by extending the framework I created for secure business process engineering, with privacy concepts [1]. The framework was created as the output of the H2020 European project VISION³, where it was extended by industrial and academic partners and applied to several case studies of large STSs [2, 7, 12, 24].

In my research work, I also faced compliance issues on privacy laws for STSs, in particular, I collaborated on the creation of a framework for the specification and compliance management of consent, as defined by the GDPR. The research work builds on top of the SecBPMN2 language and method I defined, by adding compliance-specific concepts and analysis [18, 21]. On a similar line, I also worked on a more ethical perspective of security by addressing a topic that is becoming more and more relevant with new data mining and artificial intelligence techniques: data minimization and fairness. In particular, I focused on the detection of conflicts between these two properties and other common privacy requirements [10, 20].

Data movement in fog computing

Considering Fog computing as the backbone of resources of STSs opens new possibilities to improve the performance of technical components. The continuous of resources between Edge and Cloud computing allows for the movement of data and/or computation, to move closer to the data needed by data consumers or vice-versa. The decision of where and which part of data to move depends on the status and configuration of the Fog computing, which is highly dynamic, and on the requirements of all data consumers that need the data. “Wrong” movements may clog the STSs network and/or prevent many data consumers from accessing data with reasonable performance. My research work consists in enabling data and computation movement in fog computing [16] and creating “smart” decision systems. Such systems monitor Fog computing, detect violations of performance requirements of data consumers and react by moving data in the “best” fog computing resource.

³ <https://cordis.europa.eu/project/id/653642>

Currently, I defined a centralized [17] and distributed [8] decision systems.

SHORT-TO-MID-TERM RESEARCH DIRECTIONS (UP TO 5 YEARS)

Socio-technical systems and the needs of their stakeholders are rapidly evolving: their design process needs to include aspects that were not considered a few years ago. In particular, the inclusion of people, as active components that form STSs, from the early design phases of STSs brings several security and privacy strategic advantages in terms of design choices.

When considering the security and privacy of Socio-Technical Systems, impacts on different design aspects must be considered. Many security requirements have a considerable impact on the amount of energy used and, therefore, a cost in terms of environmental impacts. Every cyber security measure, starting from encryption, adds a layer of computation that, inevitably adds energy consumption and, therefore, increases the carbon footprint of the system. The environment is, today, a very precious resource that we cannot waste, and it needs to be considered and preserved reducing the carbon footprint of every technology. The fast spread of STSs and security-related issues calls for immediate action to design systems that minimize environmental impact while preserving their security and privacy.

Below you will find more details on my short-term research directions.

Socio-technical engineering: behavioural requirements in socio-technical systems

Unlike technical systems, people are considered in Socio-Technical Systems as active components that contribute to the services used and offered by these systems. The human part has always been considered during the latest phases of the design, or even later, after the system had been deployed. This is especially critical when considering security since people, unfortunately, are the weak part of the security chain: too many security breaches happen because of human errors. Approaches, such as serious games and gamification, are used to correct the security-critical behaviours of people (e.g., from writing passwords in post-its, to falling into social engineering attacks). Yet, their efficacy is limited because bad habits are frequently already established in deployed STSs, and the characteristics of people and (organizational) culture are not specified by design.

My research line, on this topic, consists of exploring and defining how to include human characteristics in the design of socio-technical systems, reshaping system engineering processes into socio-technical engineering one. In particular, I am collaborating with the Engineering and Social Informatics Research Group (ESOTICS) at Bournemouth University (UK) to consider cultural dimensions as factors that impact security critical behaviors, and how to include them right from the design of STSs. This is the first step towards methods that will include human characteristics for the design of more secure STSs.

Energy efficiency and security

Energy efficiency is a change driver and the focus of many communities such as the European Union and the USA. The reduction of energy used is, therefore, a priority for all systems, including STSs where there is a considerable margin of improvement. This is particularly true when considering security enforcement mechanisms, that add outstanding computational complexity and therefore heavily impact the amount of overall energy used by STSs. This issue is magnified by the size of STSs that may comprehend thousands of autonomous components, in systems such as airports or hospitals, to hundreds of thousands of components and even more, in systems such as smart cities. For example, the selection of the type of blockchain technology has a huge energy-consumption impact. The decision of which security mechanisms to implement and the analyses of the tradeoff between security and energy consumption are critical and extremely complex. It must consider factors such as security requirements, security strategies, risk management, the context of deployment of STSs, and so on.

My research line consists of creating innovative solutions and methods to design secure and energy-efficient socio-technical systems. The collaboration with the industry is a key factor for the success and adoption of these solutions, therefore, especially for this research line, I keep close ties with the enterprise world, which generates frequent research collaborations on this topic. Currently, I'm collaborating with a relevant Italian industrial player, to define a method for the definition of energy-aware security policies. The objective of the method consists in defining security policies that minimize the energy consumption of the security strategy of a STS, while maintaining the level of security and risk desired.

TEACHING STATEMENT

SHORT-TO-MID-TERM TEACHING PLAN (UP TO 5 YEARS)

During my academy career, I taught university and master courses, as a primary lecturer and as a Teaching Assistant (TA). I have been involved mainly in information systems, software engineering and security-related courses.

I am the primary lecturer of a Ph.D. level course I called “Security and Privacy in Socio-Technical Systems” organized at the University of Trento, where I introduce to students, security and privacy approaches to Socio-Technical Systems (STSs), both from the technical and social (human) perspectives. The course covers the design of STSs facing different aspects and design problems of security and privacy, including socio-organizational and procedural analyses and examples of security mechanisms such as blockchain. Being this a Ph.D. course, I am focused on giving students an introduction to the security and privacy field using a research perspective, providing them with a conceptual map of the most important concepts. The objective of the course is twofold: it aims to introduce privacy and security, and it aims to guide students in cross-disciplinary research work. Indeed, the assessment of the course consists of writing a research proposal that considers one of the arguments explored during the course and applying research arguments/fields of the students. The exam consists of one round of a peer review process where I review the research proposals and give feedback to the students. This type of assessment triggers Ph.D. students to think laterally and view possible collaborations out of their research comfort zone. Indeed, I have received very positive evaluations from the students both for the teaching approach and the type of assessment. Given the positive feedback, I am planning to continue giving this course at the University of Trento and proposing it at Politecnico di Milano.

I am the primary lecturer of “Digital Technology 1” course, taught at BSc students at Politecnico di Milano. This course introduces students to information systems approach, lifecycle, and technologies. During the course, I introduce students to database theory with exercises on the design of logical and conceptual modelling and on SQL language. The objective of this course is to give students a conceptual map they can use to easily retrieve notions on information systems after they graduate. I also give students contextual information on the history and the rationale behind the most important concepts to avoid giving them dry notions. The course received positive evaluations, and I plan to continue giving the course for the years to come. The content of the course is not static and every year, along with my colleagues we adapt the content of the course based on the feedback of the students and the new available technologies and solutions.

In general, I avoid giving a course based on factual knowledge, but I rather structure my course to give students conceptual tools and methods that they will use in the context of the course or for other disciplines. My courses give students a conceptual map of the research field/sector, which is necessary, in the era of the internet, search engines and generative AI, to find the right piece of knowledge. Depending on the level of the course, I push students to a critical thinking of the information they receive. My lessons, where possible, are highly interactive: I stimulate the discussion with short exercises or controversial arguments.

During my career, I was a TA for courses similar to “Digital Technologies 1” both at the University of Trento and Politecnico di Milano, where I focused on teaching information systems and BPMN, BOAT and ArchiMate modelling languages. In these courses, especially the ones where I taught modelling languages, I focused on stimulating the critical thinking of students, where I encouraged students to discuss solutions proposed and evaluate their positive and negative aspects.

I was a TA of “Software Engineering”, a BSc course at Politecnico di Milano, where I taught students the basics of object-oriented coding, developing patterns and contract programming. The programming language used was Java. This is a key course for bachelor students since it delivers concepts and methods fundamental for the career of developers. In this course, I explained how to apply the theoretical concepts in practical cases, from the basic Java instructions to the application of object-oriented approaches to follow the most known design patterns.

In the next years, I would like to teach courses on software engineering, security, privacy, and information systems. For MSc students, I would like to give courses for the design of socio-technical systems, that include human-related aspects, as described in the research statement. This is to increase the awareness of future designers and developers on security and privacy and how they can be faced considering non-technical aspects and using technical aspects to support them. For BSc students, I would like to teach courses on security and privacy in information systems. Recently, I proposed a course on data and information security by design, for the MSc of computer science at Politecnico di Milano. The proposal for the course is under revision.