



**PhD in Information Technology and Electrical Engineering**  
Università degli Studi di Napoli Federico II

**PhD Student: Riccardo Carbone**

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**Cycle: XXXVII**

**Training and Research Activities Report**

**Year: First**

student signature

*Riccardo Carbone*

**Tutor: prof. Valentina Casola**

tutor signature

**Co-Tutor:**

*Valentina Casola*

**Date: October 31, 2022**

# Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

Cycle: XXXVII

Author: Riccardo Carbone

## 1. Information:

- **PhD student:** Riccardo Carbone
- **DR number:** DR995859
- **Date of birth:** 21/06/1995
- **Master Science degree:** Computer Engineering    **University:** Università degli Studi di Napoli Federico II
- **Doctoral Cycle:** XXXVII
- **Scholarship type:** *no scholarship*
- **Tutor:** Valentina Casola
- **Co-tutor:**

## 2. Study and training activities:

Activity	Type <sup>1</sup>	Hours	Credits	Dates	Organizer	Certificate <sup>2</sup>
GDPR basics for computer scientists	Seminar	2	0.4	14/12/2021	Prof. Piero Bonatti, DIETI - Unina	N
The learning landscape in deep neural networks and its exploitation by learning algorithms	Seminar	1	0.2	21/01/2022	Prof. Michele Ceccarelli, DIETI - Unina	N
Virtualization technologies and their applications	Courses	20	5	17/01-18/02/2022	Prof. Luigi De Simone, DIETI - Unina	Y
Seeqc the digital quantum computing company	Seminar	1	0.2	24/02/2022	Prof. P. Lucignano, Department of Physics - Unina	N
Workshop “La Piattaforma ACC di RFI”	Seminar	16	3.2	17/03-18/03/2022	Rete Ferroviaria Italiana (RFI), Università di Napoli Federico II, Università di Salerno	Y

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Statistical data analysis for science and engineering research	Courses	12	4	22/03-7/04/2022	Prof. Roberto Pietrantuono, DIETI - Unina	Y
IEEE Authorship and Open Access Symposium: Tips and Best Practices to Get Published from IEEE Editors	Seminar	1.5	0.3	30/03/2022	IEEE	Y
AR for remote use of measurement instrumentation	Seminar	1.5	0.3	24/05/2022	Prof. Annalisa Liccardo, DIETI - Unina	Y
Innovation management, entrepreneurship and intellectual property	Courses	9.5	4	26/05 - 14/06 2022	Prof. Rippa (Direttore StartCup Campania 2022 "Mario Raffa")	Y
Introduction to Model Based System Engineering and System Validation with SLRT	Seminar	0.6	3	15/07/2022	Dr. Vincenzo Petrella, Dr. Marco Cavallone, MathWorks srl	Y

- 1) Courses, Seminar, Doctoral School, Research, Tutorship
- 2) Choose: Y or N

## 2.1. Study and training activities - credits earned

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	0	0.4	6	0	6.4
Bimonth 2	0	0.4	6	0	6.4
Bimonth 3	5	3.5	5	0	13.5
Bimonth 4	4	0.3	6	0	10.3
Bimonth 5	4	0.6	6	0	10.6
Bimonth 6	0	0	6	0	6
<b>Total</b>	13	5.2	35	0	53.2
<b>Expected</b>	30 - 70	10 - 30	80 - 140	0 - 4.8	

## 3. Research activity:

### 3.1. Agile Software Development for critical-systems

*In this first year, I worked to define an agile software development process for safety-critical software. The need came directly from the Research and Development department of Rete Ferroviaria Italiana (RFI), where I am currently working as a Software Embedded Engineer.*

*About the topic, I have investigated the potential opportunities and challenges of adopting agile methodologies in critical fields. In particular, working on an RFI project, I defined an agile methodology, Scrum for Safety (S4S), which combines the current literacy practices and guidelines about agile development for safety-critical software.*

*I used the methodology to create an initial experimental setup (Research product 1) to measure how the agile mindset may impact process efficiency, safety, and traceability, which are essential aspects of critical software.*

*The preliminary results showed that the application of an evolutive life-cycle helps to reduce the requirements uncertainty of the project while obtaining (compared to the V-model):*

- *a decreased software delivery time;*
- *continuous customer involvement;*
- *reduced documentation reworking cost.*

*Then, the execution of quality assurance activities, such as testing, during each development cycle made developers much more reactive and aware of the effect of each design decision.*

*However, the creation of an environment where engineers can perform safe and rapid experimentations requires to face some challenges, summarized in:*

- *the presence of time constraints due to short iteration cycles;*
- *the need for formal procedures and proper tools to perform iterative testing and integration of software;*
- *the development of simulated environments to allow agile integration testing;*
- *the production of documentation requested by the certification authority.*

*For the second year, I plan to face the above and new challenges for safety and other non-functional requirements (such as security, performance, etc.) in order to improve and generalize the Scrum for Safety methodology.*

### 3.2. SIL4 Middleware for railway signaling applications

*During the first year, I also worked to implement a Middleware for railway signaling applications for RFI.*

*The research project aims to define a uniform communication platform for onboard and interlocking applications capable of supporting different communication protocols and replication of signaling infrastructure nodes.*

*Over this first year, I contributed to defining the requirements, the design, and a prototype of a SIL4 Middleware for the RFI infrastructure, following the CENELEC EN 50128 standard. In particular, I focused on the definition of a prototype capable of managing 2oo2 redundant architectures and different communication protocols, such as the TCP/IP protocol suite.*

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*For the second year, I plan to review the prototype in order to prepare the first software release for the Verification and Validation process, which will give essential feedback on research validity.*

## 4. Research products:

### 4.1. Agile Software Development for critical-systems

1. *Scrum for safety: an agile methodology for safety-critical software systems.*
  - a. **Type:** Journal Article;
  - b. **Author(s):** M. Barbareschi, S. Barone, R. Carbone, V. Casola;
  - c. **Journal:** Springer - Software Quality Journal (SQJ);
  - d. **Current status:** published;
  - e. **Year:** 2022.
2. *S4S: Agile Methodology Compliant to EN50128.*
  - a. **Type:** Conference Poster;
  - b. **Author(s):** M. Barbareschi, S. Barone, R. Carbone, V. Casola;
  - c. **Conference:** International Railway Safety Council (IRSC);
  - d. **Year:** 2022.

### 4.2. SIL4 Middleware for railway signalling applications

1. *“Specifica dei Requisiti Software del Middleware”.*
  - a. **Type:** Project Deliverable;
  - b. **Author(s):** M. Barbareschi, S. Barone, R. Carbone, V. Casola, G. Ricci;
  - c. **Project:** RFI SIL4 Platforms;
  - d. **Current status:** under revision;
  - e. **Year:** 2022.
2. *“Specifica di Design dello strato Middleware”.*
  - a. **Type:** Project Deliverable;
  - b. **Author(s):** S. Barone, R. Carbone, V. Casola, V. Coppola, S. Della Torca;
  - c. **Project:** RFI SIL4 Platforms;
  - d. **Current status:** under revision;
  - e. **Year:** 2022.
3. *Middleware Prototype.*
  - a. **Type:** Project Deliverable;
  - b. **Author(s):** S. Barone, R. Carbone, V. Coppola, S. Della Torca;
  - c. **Project:** RFI SIL4 Platforms;
  - d. **Current status:** under testing;
  - e. **Year:** 2022.

## 5. Conferences and seminars attended

1. *“GDPR basics for computer scientists”.*
  - a. **Type:** Seminar;

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- b. **Speaker(s):** Dr. Rigo Wenning - European Research Consortium for Informatics and Mathematics;
      - c. **Place:** Online – MS Teams;
      - d. **Date:** 14/12/2021;
2. “The learning landscape in deep neural networks and its exploitation by learning algorithms”.
  - a. **Type:** Seminar;
  - b. **Speaker(s):** Dr. Riccardo Zecchina - Department of Computing Sciences, Università Bocconi, Milano, Italy;
  - c. **Place:** Online – Cisco Webex;
  - d. **Date:** 21/01/2022;
3. “Seeqc the digital quantum computing company”.
  - a. **Type:** Seminar;
  - b. **Speaker(s):** Marco Arzeo - Seeqc-EU srl;
  - c. **Place:** Aula Caianiello, Department of Physics - Federico II;
  - d. **Date:** 24/02/2022;
4. “Workshop “La Piattaforma ACC di RFI””.
  - a. **Type:** Workshop;
  - b. **Speaker(s):** Dr. Mario Barbareschi, Dr. Ciro Donnarumma, Ing. Giuseppe Panariello - Rete Ferroviaria Italiana S.p.A. – Ricerca e Sviluppo Sistemi;
  - c. **Place:** Stazione di Napoli-Afragola AV;
  - d. **Date:** 17/03-18/03/2022;
5. “IEEE Authorship and Open Access Symposium: Tips and Best Practices to Get Published from IEEE Editors”.
  - a. **Type:** Seminar;
  - b. **Speaker(s):** Dr. Derek Abbott - Editor-in-Chief IEEE Access, Dr. Paolo Bonato - Editor-in-Chief IEEE Open Journal of Engineering in Medicine and Biology, Eszter Lukács – Client Services Manager IEEE, Judy Brady - IEEE Regional Manager for Europe, the Middle East, Africa & Latin America;
  - c. **Place:** Online;
  - d. **Date:** 30/03/2022;
6. “AR for remote use of measurement instrumentation”.
  - a. **Type:** Seminar;
  - b. **Speaker(s):** Prof. Annalisa Liccardo, DIETI, Unina;
  - c. **Place:** Online – MS Teams;
  - d. **Date:** 24/05/2022;
7. “Introduction to Model Based System Engineering and System Validation with SLRT”.
  - a. **Type:** Seminar;
  - b. **Speaker(s):** Dr. Vincenzo Petrella, Dr. Marco Cavallone – Mathworks Srl;
  - c. **Place:** Stazione di Napoli-Afragola AV;
  - d. **Date:** 15/07/2022.

## 6. Activity abroad:

## 7. Tutorship

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