PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Antonio Ken Iannillo

XXX Cycle

Training and Research Activities Report – First Year

Tutor: Domenico Cotroneo

1. Information

This report is on the training and research activities of Antonio Ken Iannillo during his first year of the PhD Course "Information Technologies and Electrical Engineering", XXX cycle, at University of Naples Federico II.

Antonio graduated cum laude with a master degree in "Ingegneria Informatica" (Information technologies engineering) from the University of Naples Federico II.

Antonio works within the DIETI MobiLab group, and he also co-operates with Critiware s.r.l., an innovative start-up company in the field of software dependability.

2. Study and Training Activities

Antonio Ken Iannillo attended the following courses in order to enforce his research activities:

- Ad-hoc modules:
  - "The Entrepreneurial Analysis of Engineering Research projects", to have an overall knowledge of the entrepreneurial world;
  - "Project Management", to have the knowledge to organise a better PhD plan;
  - "Modelli, metodi e software per l'Ottimizzazione", to have more instruments to use in research projects;
- Master degree courses:
  - "Sistemi real time", to better understand the logic behind the real-time counterpart of smartphones;
  - "Metodi Formali", to have knowledge of formal methods and models actively used in the SAR research.

Furthermore, he is actually attending other two master degree courses on security, a part of great interest for smartphone dependability and of utility in the understanding of Android internal mechanisms. They are "Secure System Design" and "Network Security".

The seminars Antonio attended are:

- "UML Profiles for the specification of non functional properties of software system", to have a new methodology to specify dependability properties;

- "Risk management meets model checking: fault tree analysis and model-based testing via games", to improve knowledge in the fault analysis specific area;
- "Linked Open Data-enabled Strategies for Top-N Recommendations", to gain general knowledge on new technologies;
- "Modelli matematici e calcolo scientifico nell'ingegneria e nell'innovazione tecnologica", to give a broader glance at the scientific research;
- "The Memories of Tomorrow: Technologies, Design, Test and Dependability", to have a deeper knowledge of ever-evolving memories in computer systems;
- "Designing and writing scientific manuscripts for publication in English language scholarly journals, and related topics", to improve English writing production of scientific documents.

3. Research Activities

At the begin of his first year, Antonio Ken Iannillo participates to the 25th IEEE International Symposium on Software Reliability Engineering (ISSRE 2014), where he published two conference papers: *"Network Function Virtualization: Challenges and Directions for Reliability Assurance"* and *"Improving Usability of Fault Injection"*, with his colleagues at DIETI Mobilab. He also presented the latter to the software reliability community during the conference.

Antonio continued on studying software system dependability, focusing on robustness testing and the emerging Network Function Virtualization (NFV) technologies. He closely worked with the PhD student from XXIX cycle Luigi De Simone, both supervised by prof. Domenico Cotroneo and the whole MobiLab group. After designing a complete test plan, they started testing activities on NFV: where Luigi focused on a fault injection tool for the virtualization layer, Antonio worked on setting up a laboratory NFV system, and designed and implemented a test orchestrator able to execute automatically several tests and gather results. The analysis of these results brought to the publication of the paper "Dependability Evaluation and Benchmarking of Network Function Virtualization Infrastructures" to the IEEE Conference on Network Softwarization (NetSoft 2015), that also won the conference best paper award.

Antonio had an intense period of study of the Android technology, in order to have the necessary knowledge and start his own research. He also participated at DroidCon Italy 2015, that offered high-class talks covering different aspects of the ecosystem, including core development, embedded solutions, architectural insights, and business solutions.

After this first period of study, Antonio focused on the understanding the dependability threats of the Android OS. On one hand, he designed and developed an Android application that monitors the Android system launching an experimental campaign to gather failures data[1], successively helped by Critiware srl staff (including Stefano Rosiello, a new PhD student from the XXXI cycle); on the other, he analysed bug reports from Android users and developers, publicly available on the internet, together with his research group Mobilab. Here the research took two directions: while actual faults can help research to understand what are the threats of Android and inject them to assess the overall dependability; performance failures, due to error accumulation and aging faults, showed up the necessity to design ad-hoc rejuvenation techniques for these system. The study of software aging and rejuvenation (SAR) research brought Antonio and the MobiLab group to realise a leak of SAR artefacts that could help new work in this area. The Sarry repository, an initiative with the aim of sharing these artefacts, was built and promoted in the paper "The Software Aging and Rejuvenation Repository" that is going to be presented at ISREE 2015.

In the last period, Antonio was deeply studying Android source code and internal mechanism to prepare a fault injection test plan and a fault injection tool suite, for the dependability assessment of the Android system. In the future, a paper with the first results of failure analysis is in progress, and an experimental phase is going to be designed based on these results.

The final aim of Antonio's research, co-operating with the already mentioned collaborations, is to give a methodology to assess mobile dependability, a methodology to build rejuvenation techniques, and a significant contribute in the Android architecture to make it more dependable.

Meanwhile, Antonio had the possibility to review the following papers:

- "Data Synchronization on Android Clients", SRDS 2015;
- "Proactive Diagnosis and Recovery of Failures in HTTP Video-Streaming Services", ICDCS 2015;
- "KeyGuard: Protecting Encryption Keys in Mobile System Against Memory Errors", DSN 2015;
- "Protecting Encryption Keys in Mobile Systems Against Memory Errors", ISSRE 2015;
- "A proactive decision making for effective Template Provisioning through Cloud Orchestration Service.", TSCSI 2015.

[1] http://www.mobilab.unina.it/android_en.html

4. Products

Already published conference papers:

- "**Improving Usability of Fault Injection**" – Cotroneo, D.; De Simone, L. ; Iannillo, A.K. ; Lanzaro, A. ; Natella, R.
  Published in: *Software Reliability Engineering Workshops (ISSREW), 2014 IEEE International Symposium on*
  Date of Conference: 3-6 November 2014

- "**Network Function Virtualization: Challenges and Directions for Reliability Assurance**" – Cotroneo, D.; De Simone, L.; Iannillo, A.K.; Lanzaro, A.; Natella, R.
  Published in: *Software Reliability Engineering Workshops (ISSREW), 2014 IEEE International Symposium on*
  Date of Conference: 3-6 November 2014

- "**Dependability Evaluation and Benchmarking of Network Function Virtualization Infrastructures**" – Cotroneo, D.; De Simone, L.; Iannillo, A.K.; Lanzaro, A.; Natella, R.
  Published in: *Network Softwarization (NetSoft), 2015 1st IEEE Conference on*
  Date of Conference: 13-17 April 2015

To be published, already accepted conference papers:

- "**The Software Aging and Rejuvenation Repository**" – Cotroneo, D.; Iannillo, A.K.; Natella, R.; Pietrantuono, R.; Russo, S.
  To be published in: *Software Reliability Engineering Workshops (ISSREW), 2014 IEEE International Symposium on*
  Date of Conference: 2-5 November 2015

In-progress paper is on the Android failures analysis and its results, as product on first studies and research activities.

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Credits year 1	Bimonthly Period		Modules	Seminars	Research	Credits year 1
	Estimated		**20**	**5**	**35**	**60**
	nov-dec 2014	1	0	0,5	10	10,5
	jan-feb 2015	2	3	0,7	8	11,7
	mar-apr 2015	3	3	1	6	10
	may-jun 2015	4	15	3	6	24
	jul-aug 2015	5	0	0	10	10
	sep-oct 2015	6	0	0	8	8
	Summary		**21**	**5,2**	**48**	**74,2**
Credits year 2	**Estimated**		**10**	**5**	**45**	**60**
	nov-dec 2015	1				0
	jan-feb 2016	2				0
	mar-apr 2016	3				0
	may-jun 2016	4				0
	jul-aug 2016	5				0
	sep-oct 2016	6				0
	Summary		**0**	**0**	**0**	**0**
Credits year 3	**Estimated**		**0**	**0**	**60**	**60**
	nov-dec 2016	1				0
	jan-feb 2017	2				0
	mar-apr 2017	3				0
	may-jun 2017	4				0
	jul-aug 2017	5				0
	sep-oct 2017	6				0
	Summary		**0**	**0**	**0**	**0**
	Total		**21**	**5,2**	**48**	**74,2**