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 – Second Year

Tutor: Domenico Cotroneo

1. Information

This report is on the training and research activities of Antonio Ken Iannillo during his second 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 Dependable Systems and Software Engineering Research Team (DeSSERT), former known as MobiLab, 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:

- Seminars:
    - "Beyond the data: how to achieve actionable insights with machine learning", by prof. Matteo Santoro;
    - "Model Based Testing", by prof. Ana Paiva;
    - "Pattern Based GUI Testing", by prof. Ana Paiva;
    - "Adversial testing of protocol implementations", by prof. Cristina Nita Notaru;
    - "Speech technology at Trinity College", by dr. Loredana Cerrato;
- Ad-hoc modules:
    - "Designing and writing scientific manuscripts for publication in English language scholarly journal and related topics", by prof. Chie Shin Fraser
- Master degree courses:
    - "Network Security", by prof. Simon Pietro Romano;
    - "Computer Security", by prof. Valentina Casola, where I also performed a brief presentation on Android security attack surface.

Furthermore, he attended the "SecureCI: Securing Critical Infrastructures" 2016 winter school, from January, 17th to 24th, 2016. The winter school focused on security topics, and Antonio audited 36 hours of

seminars from several researchers and professors. In the meanwhile, he designed and presented a small project on the study and potential vulnerability of an Android sandboxing solution.

In September, Antonio moved to North Eastern University for a seven-month period of study, where he already attended a couple of seminars, that are:

- "Arabesque: A System for Distributed Graph Mining", from Dr. Marco Serafini, Qatar Computing Research Institute;
- "Do Deep Nets Really Need to be Deep?", from Dr. Rich Caruana, Microsoft Research.

3. Research Activities

During the first few months of the second year, Antonio Ken Iannillo designed a failure model for Android OS. The failure model consists of more than 600 failure modes, spread in 27 Android internal components. Meanwhile, the development of the fault injection tool focused on three subsystem: sensors, telephony and camera subsystem. The fault injector is able to inject more than 150 failures. After designing and implementing a testing framework for the automation and analysis of experiment, the experimental campaign started on three physical devices as benchmarking test. After that, the fault injection tool was extended with failures for Binder and System Server subsystem.

During the second part of the year, Antonio with his colleagues from DESSERT (DEpendable System and Software Engineering Team, formerly known as MobiLab group) designed and executed stress tests on Android OS in order to collect measurements of launch times, memory and storage. He then analysed these data and demonstrated the presence of Software Aging in Android OS, providing insights useful to software rejuvenation research.

In September, Antonio moved to Boston in order to spend a period of seven months at North Eastern University, tutored by prof. Cristina Rita-Notaru. Since prof. Rita-Notaru is from the security research community, they spend this first period in understanding potential gaps in the research that could be useful from both the reliability and security research. The research idea came out from this period of study and brainstorming, is to analyse bug reports in order to figure out how previous information can help new testing to discover both classic defects and vulnerabilities.

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At the end of his second year (22-27 October 2016), Antonio Ken Iannillo participates to the 27th IEEE International Symposium on Software Reliability Engineering (ISSRE 2016) in Ottawa, Canada, where he published and presented a conference paper in the main research track with Android aging results. The conference paper is entitled *"Software Aging Analysis of Android OS"*.

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

- "Risk Assessment of User-Defined Security Configurations for Android Devices", DSN 2016;
- "A Testing Methodology for Safety Critical Systems", RESS journal;
- "Active Deployment Infrastructure for Android Applications", EDCC 2016;
- "Fixing Resource Leaks in Android Apps with Light-weight Static Analysis and Low-overhead Instrumentation", ISSRE 2016;
- "Out with the old, in with the new – on rejuvenating binary programs", ISSRE 2016.

4. Products

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

- "**Software Aging Analysis of Android OS**" – Cotroneo D.; Fucci F.; Iannillo A.K.; Natella R.; Pietrantuono R.
  Published in: *Software Reliability Engineering (ISSRE), 2016 IEEE International Symposium on*
  Date of Conference: 22-27 October 16

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Bimonthly Period		Modules	Seminars	Research	Total
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	1	7	8
	jan-feb 2016 (2)	12	8	7	27
	mar-apr 2016 (3)	0	0	7	7
	may-jun 2016 (4)	3	7	7	17
	jul-aug 2016 (5)	0	0	7	7
	sep-oct 2016 (6)	0	0	9	9
	Summary	15	16	44	75
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	36	21.3	92	149

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