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XXXI Cycle - I<sup>st</sup> year presentation

# Automated Software Testing Techniques

# Background

- **Graduation:** MSc cum laude in Computer Engineering at the University of Naples *“Federico II”*
- **Research:** REVERSE Group
- **Fellowship:** PhD grant
- **Research field:** Software Engineering

# Context



- The total number of smartphone users worldwide is forecast to surpass 2.5 billion in 2019. This causes a constant demand for new mobile apps

[<https://www.statista.com/statistics/330695>]

- The demand for app quality has grown together with their spread

# Problem

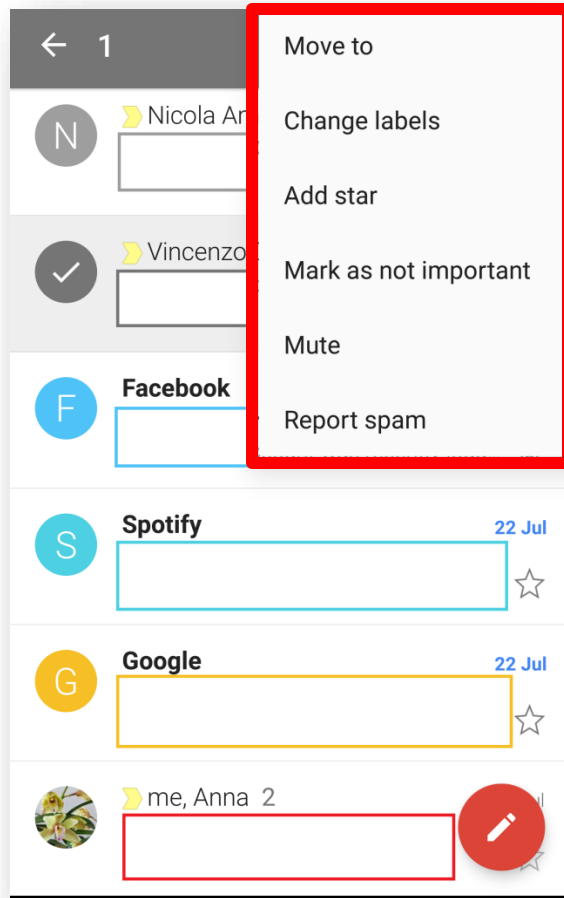
**Software testing** is a well-known approach for assuring the quality of mobile applications

- Mobile apps are event-driven systems
- Existing techniques often focus on exercising apps through their GUIs but neglect mobile-specific events (putting an app in background and resuming it, receiving a call, rotating the device)
- Most approaches aim to maximize the code coverage or to find crashes. Few of them face the problem of detecting unexpected states of the GUI (GUI failures)

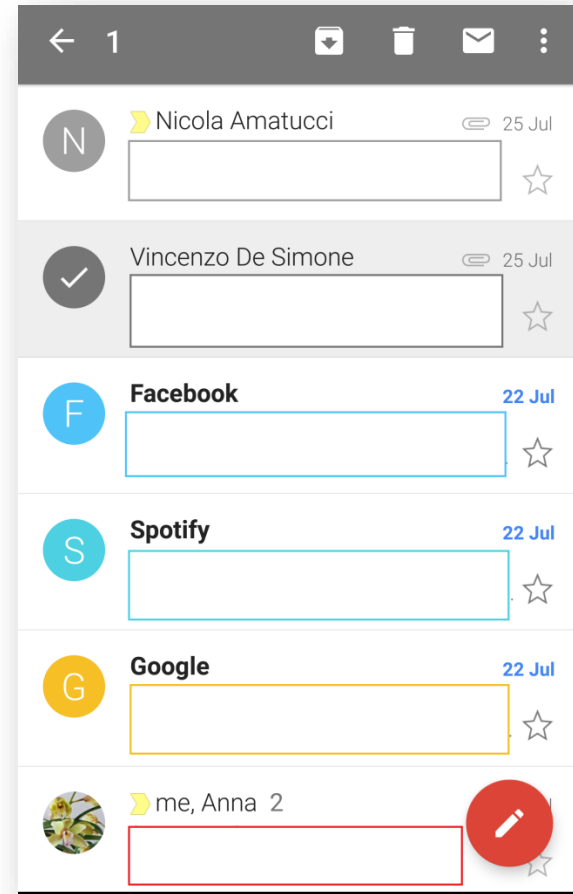


Need for testing techniques, strategies and tools to address the problem of **GUI failures due to mobile-specific events**

# GUI Failures due to orientation changes



*"Double orientation change" event*

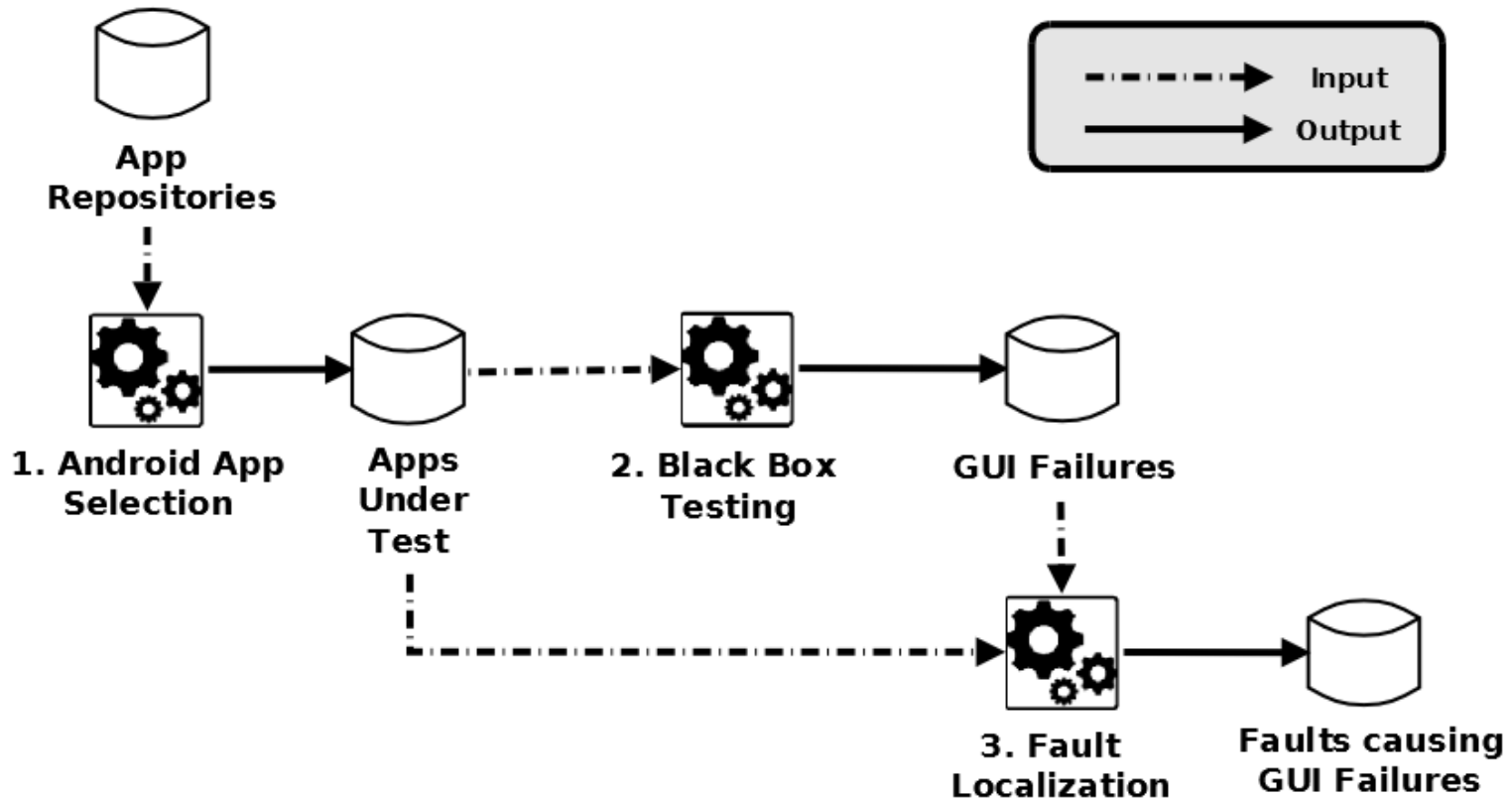


# GUI Failures Classification

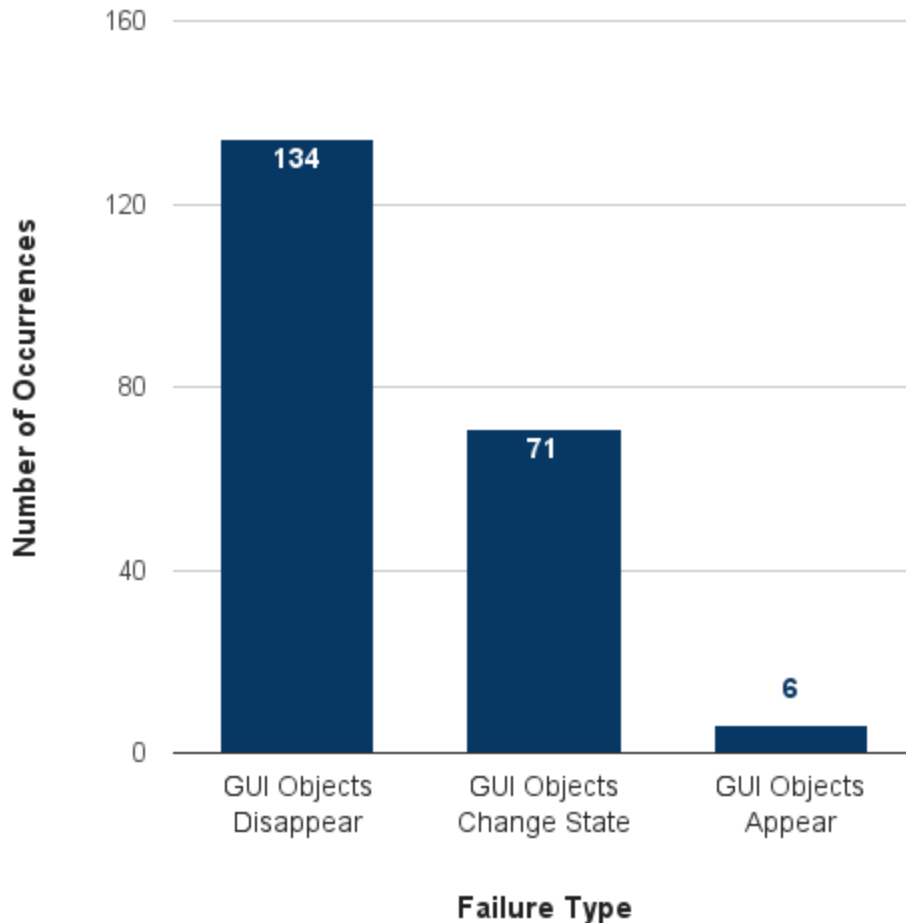
We propose a high level GUI failures model that abstracts three main classes of failure that may be triggered by a double orientation change

- 1. GUI Objects Disappear**
- 2. GUI Objects Appear**
- 3. GUI Objects Change State**

# Exploratory Study



# Results



GUI failures due to orientation changes emerge as an issue in the context of mobile apps

- 41 out of 50 apps show at least one GUI failure
- 211 unique GUI failures in 41 applications
- Some **GUI Object Types** are more frequently involved than others (*e.g., Dialog involved in 93 failures*)



# Future Work

- To consider other mobile operating systems (iOS, Windows 10 Mobile)
- To consider other mobile-specific events which may cause GUI failures
  - Receiving a Call
  - Sending an app in Background
  - Pressing a physical button
- To develop fault localization techniques focused on source code bugs that may cause GUI failures
- To consider other quality aspects (e.g., Robustness)

# Products

## Conference Papers

D. Amalfitano, V. De Simone, A. R. Fasolino, and V. Riccio, “*Comparing Model Coverage and Code Coverage in Model Driven Testing: An Exploratory Study*”, 2015 30th IEEE/ACM International Conference on Automated Software Engineering Workshop (ASEW), Lincoln, NE, 2015, pp. 70-73. doi: 10.1109/ASEW.2015.1830

## Submitted Papers

D. Amalfitano, I. Coimbra Morgado, A. R. Fasolino, A. Paiva, and V. Riccio, “*Exploring GUI Failures in Mobile Applications due to Device Orientation Change*”, Journal of Software: Evolution and Process, Wiley, submitted on 26 September 2016

# In preparation

- D. Amalfitano, V. De Simone, A. R. Fasolino, and V. Riccio, *“aRTETECA - Robustness TEsting TEChnique for Android: an Exploratory Study”*
- D. Amalfitano, V. De Simone, A. R. Fasolino, and V. Riccio, *“aRTETECA: Tool Demonstration”, ICST 2017 Tool Demo Track*

# Next Years

	Credits year 1											
	Estimated Year 1	bimonth 1	bimonth 2	bimonth 3	bimonth 4	bimonth 5	bimonth 6	Summary	Estimated Year 2	Estimated Year 3	Total	Check
Modules	20	0	6	3	8	0	0	17	15	0	32	30-70
Seminars	10	6,8	1,4	0,7	0,8	0	0,5	10,2	5	0	15,2	10-30
Research	30	4	4	5	3	8	10	34	45	60	139	80-140
	60	10,8	11,4	8,7	11,8	8	10,5	61,2	65	60	186	180