

Do Mobile-App Users Care about Privacy?

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Abstract. Smartphone users can easily install mobile apps on their mobile devices with a just single click on the “accept” button of the privacy conditions review page. Indeed, privacy is a key requirement of mobile apps. This motivates us to propose an empirical study aiming at investigating how users perceive and evaluate privacy in this context.

In this proposal for Empirical Studies at REFSQ (ESR), we intend to study how mobile-app’s users perceive privacy issues, using an on-line questionnaire.

1 Problem definition

Nowadays mobile-apps can be easily installed on mobile devices (smartphones and tablets) by their end-users upon a simple click on the “accept” button, which comes at the end of a 1-screen description of main functionalities of the app, including requests of access to device’ components or user’s data. Possible privacy risks are sometimes made clearly explicit — e.g. “Malicious apps may use this to erase or modify your contact data” is used to describe the risk associated to enabling an app to access the user contact data —, sometime they are left implicit, — e.g. “An app with this permission, when a call is active, can determine the phone number, and serial number of the caller’s phone” that brings as consequence that phone state and caller identity can be detected—. That is, there can be strong implications between app’s features and user privacy, and the actual solution adopted by app providers seem to rest on letting the end-user to decide if accepting or not risks for their privacy violations. However, it is questionable if users really understand (or even care about) privacy implications when installing new apps. Nonetheless the variety of apps is growing very rapidly (nowadays you can find an app for almost everything), as well as their diffusion, resembling virus spread out phenomenon.

This motivates us to investigate on what is the actual process that users adopt when deciding to install new apps, in-spite of, or according to, their attitude to privacy. One step in our research will consist in investigating if end-user care about privacy issues when selecting and installing apps on their mobile device, and how do they decide whether to install them.

2 The On-Line Questionnaire

Objective Our study is driven by the two following main research questions:

- RQ1 How do end-users *care about privacy* issues when selecting and installing apps on their mobile devices?
RQ2 How do end-users *evaluate* app features implications on their privacy, when selecting and installing apps on their mobile devices?

The questionnaire has an *explorative* purpose [1].

Proper hypotheses and observations will be formulated according to the collected data, and support further investigation.

Procedure The on-line questionnaire will recall concrete app-installation scenarios, with reference to popular app categories (e.g., car navigators or restaurant advisers) with the aim to motivate a subject to revisit her/his own experience as app-user. Then, open and closed questions will be formulated to ask participants to describe their concrete experiences when selecting and installing these apps, for instance if/why apps have been installed and if there were any potential generic *drawback*.

After collecting qualitative data with free feedback, closed questions will be formulated to have more quantitative data. For instance, with reference to *RQ1*, close questions will refer to whether users paid attention to privacy implications which could have emerged during the installation of an app.

requests for accessing With reference to *RQ2*, questions will concern how users considered possible requests of accessing device' components or user's data, when installing an app. Quantitative feedback will be collected using ordinal scales.

The last part of the questionnaire will be devoted to profile the participant from the point of view of her/his skill, expertise, experience in ICT and apps, their attitude to privacy, e.g. they exposure to social networks.

Open answers will be subject to grounded theory [2], while quantitative data collected with closed questions will be analyzed using descriptive statistics [3].

Subjects We expect at least 15 participants to fill the questionnaire. We do not set any maximum number. The participants should be apps users, who select, download and use apps on their mobile device for their personal or daily life activities.

REFSQ participants can be considered as representative of expert in ICT, and particularly in requirements engineering for ICT. To get a more complete view of the phenomenon, the same questionnaire will be proposed also to different categories of users, e.g. Humanities research scholars.

Benefits of the Study The main benefit for the *Requirements Engineering community* will be to get insights into app-users' awareness and concern about privacy issues. In particular, considering different types of users, and different kind of functionalities the aim is that of identifying if there exists any correlations

between attitude to privacy and user characteristics. The scientific community seems to lack this type of studies with respect to mobile apps.

As part of the requirement engineering community, *participant to the questionnaire* will be able to access to the results of our study and possibly reuse them in their research or industrial initiatives.

Threats to Validity Performing the questionnaire at REFSQ might originate a threat to the *external validity* of the study, limiting the generalization of our findings. To mitigate this threat, we plan to replicate the study with different categories of subjects, e.g. experts in software system security; and non expert in ICT engineering.

Moreover, a threat to *construct validity* can originate if subjects will try to guess our study hypotheses. In fact, participants might be biased by their professional interests and their answers may come from their knowledge in the field of apps engineering, rather than from their actual experience as apps users. In order to mitigate this threat, we carefully designed the questionnaire by recalling concrete usage experiences, avoiding to use words like “privacy” (so the title of our survey will be different w.r.t. the actual one used in this proposal).

We will mitigate the threat to the *conclusion validity* of our findings by using objective statistical tests.

Previous Studies The submitters of this proposal have a long experience in empirical studies on many aspects of software engineering and social science.

Software Engineering. Among the most relevant experiments in this area are: empirical evaluation of requirements modelling with the Tropos4AS framework [4]; controlled experiments to evaluate requirements model understanding, comparing *Use Case* vs. *Tropos* models [5]; evaluating tool-supported requirements prioritization: a controlled experiment comparing AHP and CBRank [6]; evaluating the effectiveness of using acceptance test to clarify change requirements [7] [8] [9] evaluating the effectiveness of stereotypes to support the comprehension of UML diagrams [10] [11] [12] [13]; evaluating the improved understandability of new programming languages with respect to software maintenance [14]; evaluating how the different types of test cases affect debugging [15]; evaluating the level of protection offered by source code obfuscation against malicious code tampering [16].

Social Science. Quantitative empirical study techniques have been exploited to investigate the relationship between Humanity and Scientific research domains, as perceived by researchers in the two domains [17]. Network analysis techniques and quantitative empirical study approaches have been adopted to investigate about social cohesion [18], and about the role of gender in the context of Humanity and Scientific research [19], respectively.

Publicizing the Study In the study, quality of answers and quantity of participants are two important factors. In the case of the experiment at REFSQ we will exploit the mailing lists of the authors, and conference attendants, to

stimulate participation via appropriate mail messages. Other groups of participants will be involved exploiting ongoing national and international projects as well as other ongoing initiatives involving our research center and other local organizations (e.g. secondary schools, university campus).

Equipment An Internet connection is required to fill the on-line questionnaire. No other special equipment is required.

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