Research Methodology in Computer and Information Science

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Title of reseach project	*Graphical Passwords: Litterature Review and Research Design*
Responsible people	Marte Løge, Lillian Røstad, Per Thorsheim
Time period	August 2014 - June 2015
Amount of resources	-
Web address for the project	-

Research Plan

My research are divided into two phases, a research project in the fall and master thesis in the following spring. This research plan will cover both phases.

Purpose

In todays society, people tends to spend a lot of time on their mobile devices. Mobile devices are not just a communication tool for calling and texting, but also an important tool for every day tasks like doing our work, reading mail, pay our bills, and keeping up with our social life. Our whole life is contained in one device. When such a small device is so important, it makes it vulnerable in terms of security.

Passwords are human-chosen secrets that are connected to you as a person. When the password are created you might create a password that is a association to something you know or recognize; passwords are more than just words and numbers. Because of the shortcomings with text-based passwords [3], there is an increased interest in graphical passwords. The interest in graphical passwords started by the assumption that pictures are easier to remember and more secure than words and numbers [2]. Google's Android platform released the functionality for the Android Unlock Pattern in 2008, that is a security mechanism for locking the mobile phone. Since its release, there have been a lot of discussion of its security, but few researchers have done a scientific research on the Android Unlock Pattern. The problem is not just the theoretical password space, but the password space in practice.

In 2013 a research group conducted the first large-scale user study on the Android Unlock Patterns [4]. The outcome of the research was a analysis of 2900 collected Android Unlock Patterns. They found a lot of bias in the pattern making process concluding that the scheme are less secure than its theoretical security. The human brain interpret visual elements in a different way than numbers and words. An interesting observation could be found by analyzing bias introduced in the password making process introduced as a cause of human properties.

My research aims to take the analysis of peoples choice in Android Unlock Patterns a step further by including the human properties that may impact the user choice in graphical passwords. The study adds to the body of knowledge with proving/disproving a theory that human properties affects users choice of graphical passwords. It is also desired to look further into improvements of the scheme if the observations is finding people choice in patterns to be a security risk.

*RQ*1**: What is the status of current research on graphical passwords?**

*RQ*2**: What human properties may affect our choice of graphical passwords on mobile devices?**

*RQ*3**: How is users choice of patterns based on human properties affecting the security of the Android Unlock Pattern?**

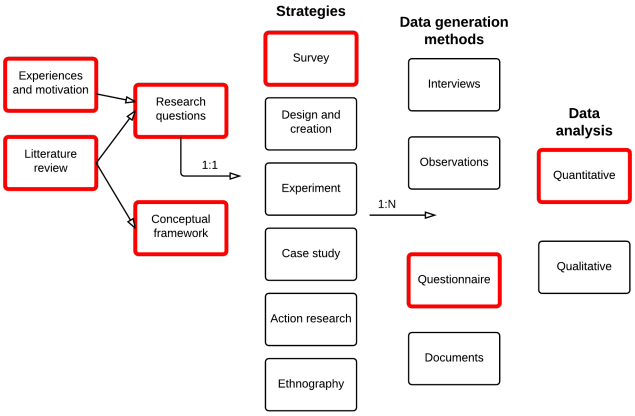
*RQ*3.1**: If any security risks is observed, how can the Android Unlock Pattern scheme be improved in order to reduce the security risks?**

Products

The main product of this research is to prove or disprove a new theory in mobile security. The hypothesis states that there is a connection between users choice in graphical passwords based on human properties like physical conditions and demographics. Towards reaching this goal, there is other sub-products made during the research process. The literature review and the research design is two sub-products delivered in the project thesis. In my master thesis, a data collection and analysis is conducted. The data itself is a valuable product, alongside with the analysis, it can be used to prove or disprove a new theory.

Research on passwords is not easy to conduct because of the nature of passwords. Passwords should remain a secret for the user, and as we have learned, we should not share our password due to security concerns. Research on text-based passwords is often based on leaked password on the web. When analyzing Android Unlock Patterns, there is no such data source available. This research design can provide insight into a new way of solving the problem of collecting user chosen passwords from mobile devices. The research design provides a detailed description of the strategy chosen to collect Android Unlock Patterns from users through a questionnaire over the Internet. This can provide knowledge for future research on graphical passwords on mobile devices.

Process



This research started by the the experience and motivation that graphical passwords is an interesting form of authentication, supporting users to remember more complex passwords that should provide better security. To find the research questions, I started with a literature review, providing a conceptual framework for the thesis. From the literature review, there was found that there is a lack of research on human choices of graphical passwords based on human properties. Beside the literature review, the research projects also includes a research design for my master thesis. In order to find out if there is possible to see a pattern between users choice in passwords and human properties, a survey is planned along with a questionnaire for the data collection. The research require a large sample of data for finding patterns in users choice of Android Unlock Patterns, as well as diversity in the data in terms of demographics. With a questionnaire it is possible to distribute the questionnaire over the Internet. A questionnaire also provide a standardized format of the data that can be helpful in the analysis. The selected research strategy and data generation method will provide quantitative data for the analysis.

Participants

As a researcher, I am also included as a participant. My work is to plan and conduct the research.

The research is supervised by Lillian Røstad and Per Thorsheim. Lillian is my main supervisor and is contributing with her experience with research in computer science and security. Per has the role as my co-supervisor and is an external participant outside the academic field. He is contributing in this research because of his personal interest in passwords and security, as well as providing a

network of contacts within the field of information security. Both have the right to the results form this research.

In this research, there is not a narrow target population. The aim is to collect data world wide were everyone with a mobile phone is considered as the target population. All the volunteered respondents are considered as participants in this research. Myself, as a researcher, have no personal contact with the respondents, but need to carefully handle the information from the respondents according to a legal and ethical perspective. It should not be able to track the information back to the respondents. All the data from the respondents are kept anonymous and will not be used outside of this research. Information concerning legal and ethical aspects of this research should be described in the questionnaire.

Paradigm

With a survey as the a chosen research strategy, this research seek to find patterns that is assumed to exist. This is a way of thinking is closely related to the positivism paradigm. This research is based on empirical testing of a hypothesis, with a desire to confirm or refuse the assumptions made in the hypothesis. When conducting the research, my beliefs as a researcher are independent of my research and my research can be stated to be objective. It is conducted with minimal interaction with the participants and the research is based on facts, that is the the quantitative data collected.

Presentation

The presentation of the result from this research will be presented in two deliverable documents, project thesis and master thesis. The research will also be presented at the conference "Passwords14"[1] in December. The presentation will provide insightful feedback from researcher, as well as providing knowledge about the gap in the research that need to be filled.

References

[1] Passwords Conference 2014. https://passwordscon.org/, December 2014.

[2] Antonella De Angeli, Lynne Coventry, Graham Johnson, and Karen Renaud. Is a picture really worth a thousand words? exploring the feasibility of graphical authentication systems. *Int. J. Hum.-Comput. Stud.*, 63(1-2):128–152, July 2005.

[3] D V Klein. Foiling the cracker: A survey of, and improvements to, password security. *Proceedings of the 2nd USENIX Security Workshop*, 1990.

[4] Sebastian Uellenbeck, Markus Dürmuth, Christopher Wolf, and Thorsten Holz. Quantifying the security of graphical passwords: The case of android unlock patterns. In *Proceedings of the 2013 ACM SIGSAC Conference on Computer & Communications Security*, 2013.