An Interdisciplinary Approach to Develop a Secure, Usable and Economically successful software

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Abstract: Some argue that software developers of security solutions often neglect the importance of incorporating usability and socio-economic aspects and focus more on security and privacy aspects. However, it can be observed that many solutions are not accepted by both the users and the market, even though they are technically sophisticated. This work-in-progress paper proposes an interdisciplinary approach and a prospective supportive tool that guides the developer through the process, which is referred to as the *Wizard*. It consists of selected, carefully analyzed and edited methods and standards from the fields of (a) Usability and User Experience, (b) Socio-economics, and (c) IT-Security and other disciplines. The Wizard proactively recommends various methods according to the status of the development and assists in their selection and application.

Keywords: Usable Security, Viable Security, Socio-Economic Security, Assistant Tool, Wizard

1   Introduction

A common problem observed in developing secure solutions for software often relies on focusing too much on security and privacy requirements and not enough on other disciplines. While security and privacy solutions are important, it is also essential to not neglect user and market needs. However, typically solutions that are easy to use and meet the user demands can successfully exist on the market [ZR11a] [ZR11b] [Gr04]. To our knowledge, there exists no reliable and holistic model that supports software developers in both secure and demand-actuated in and for practice [RZ10]. To close this gap, the research project CUES[2][3] develops an integrated guidance tool, the *Wizard*. The solution is not anticipated to propagate security at all costs; however, its aim is to enable a reliable security that considers user and market preference, which is then able to be integrated into existing business processes. Applying the *Wizard* during the software development process will help developers to ensure that the developed solution is not only sophisticated IT-security, but has a wide acceptance of all important stakeholders, is economically successful, and has viable user benefits and is user friendly. The overall goal of the *Wizard* is to assist developers, who are typically already experts in the IT security field, build on their foundation with assistance to integrate other disciplines in order to establish a secure but also market friendly software.

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2   Interdisciplinary Applications and Importance

The *Wizard* is a tool that will contribute to improving the software development process. The tool will aid developers by providing helpful suggestions during the development process; such as, instating what new measures could be done in other disciplines that could improve the overall success of the product of the developer. By including more disciplines in the development process, the *Wizard* will make the whole development process better-rounded. Further this helps address a common technical bias that is found, which often leads to drawbacks or blind spots that could have been avoided had the development process inquired more disciplines [ZR11a] [ZR12] [RZ10]. For instance, the costs and benefits of security solutions estimated are not often distributed fairly, leading to a lack of incentive for users to adopt the technology. In addition, vendors or developers of security technology often fail to consider the users' willingness to pay when creating their price models, which results in overprizing and eventually a lack of market success [Gr04]. In addition, these technologies often fail to address user requirements like usability and accessibility by individuals and organizations [ZR11b]. This section will dive deeper into how adding disciplines of usability, socio-economic, and security could add great value to the development process by using the *Wizard*.

2.1   Usability and User Experience

Improving the usability and user experience of software can drastically improve the overall perception of the end product. There are many possible constraints at hand; such as, having too little time, an insufficient budget, or the lack of knowledge about existing methods and approaches. Further, these constraints could lead to the aspects that are not considered in software development, but are important in the overall outcome of success. To ensure and measure the ease of use and usability of software, there are a number of established standards that exist, for instance the ISO 9241. Further, the 9241-210 (Human-centered design for interactive systems) [In15] is relevant, which describes the approach and processes. Heuristics, checklists, and guidelines of usability experts [Ni93] [Sc92] are lightweight tools that can be integrated at various points in the development process. User Experience claims a holistic view on the human-computer interface. In this consideration, user needs play a particularly important role, among them the need for security [FP14]. The *Wizard* is responsible for informing the developers of existing usability approaches, methods and standards, to provide prepared methods in accordance with the conditions of development and to assist in their selection and application.

2.2   Socio-economic aspects

Including a socio-economic perspective in the process helps developers avoid making poor decisions that could hinder market success. It is often assumed that those technologies will bring market success, based on their technological sophistication and the elegance of their design. The resulting business models are usually poorly designed

and fail to address important success factors appropriately [ZR11b]. Some methods or theories that could be suggested in the development process would be; Stakeholder Theory [Fr84], Diffusion of Innovations [Ro03], Transaction Costs Economics [Wi81], or Willingness to Pay models [Ro14]. For instance, a common happenstance in the IT-security field is to rely on general assumptions on human behavior to guide the direction of development and to design the end product. This is the case, if a developer designs according to a general assumption of what he/she perceives stakeholders would want instead of what they actually want. A suggestion to hold a Stakeholder analysis in the earlier stages of development would assist the developer in creating a product tailored to this analysis of what is desired from the final product, rather than just by assumption. Further, it would be beneficial to suggest developers to consider an evaluation of the final product to reconsider important parts and if they truly met the goals set. Including the socio-economic discipline is necessary to help developers become aware of the importance of recognizing the needs of the market and the end user.

2.3   IT-Security aspects

While there is an ample amount of literature on the security and privacy aspects of secure solutions for software, this paper's scope relies on other important disciplines needed for the success of software. Further, the purpose of including a stronger security disciplinary influence in the development process is to better analyze security problems that often arise or get over looked [ZR11a] [Zr11b]. However, the *Wizard* serves as a tool to assist developers whom are already expected to be experts in the IT-Security field. Their own knowledge base serves as a foundation of the IT-Security perspective. The goal is for the *Wizard* to help developers decide during the process, how to incorporate other disciplines but to remain at an acceptable security standard. Further, it is to help developers to compromise between having a very secure and privacy friendly tool and to still being user friendly and market ready.

3   Real world application

The *Wizard* can be applied in a variety of areas. Within the project, CUES, the *Wizard* is applied on a pilot basis in two selected application scenarios. These scenarios are in the areas of Smart Home and Industry 4.0. Both domains are characterized by an extremely complex structure and communication of different devices and applications and are therefore very suitable for pilot applications. For each pilot application, industry experts are consulted in order to formulate valid requirements, define a realistic application scenario according to the need within this area and to evaluate the result against meaningful measurements. For each domain, the pilot application will be conducted based on two focus groups [Zi97] [KC15], each of which consists of software developers. Both groups will be asked to develop the same security solution, one group along the traditional software development process whereas the other group develops the

application based on the *Wizard'*s suggestions. Following, the resulting product of each group will be evaluated both argumentatively and empirically. Further, there will be a comparison between the two resulting artefacts. Choosing this in the real world embedded evaluation approach, both the *Wizard* itself, as well as, the developed products can be evaluated by means of an improved usability, effective improvement of the security mechanism, and market success. Moreover, this form of analysis allows for making general and cross-industry statements regarding the effective benefit of the *Wizard*.

4   Approach

Many relevant pieces of knowledge from the fields of IT-Security, Socio-economics, and Usability (including: UX, User Experience Design, and UID, User Interface Design) will be collected in a *toolbox* and analyzed to determine their relevance for software development. To be more concrete, the overall collection of various models, practice approaches, patterns, methods for analyses, implementation and evaluation, as well as, guidelines and checklists will be integrated in an interdisciplinary manner. However, simply providing a potpourri of well researched knowledge would probably not lead to developing better software regarding its security, usability, and market acceptance. In order to help better apply and implement the collected methods properly, they will be further developed, graphically edited, and integrated into a process-accompanying *Wizard*. One of the *Wizard's* many purposes is to be a guide that supports the developer during the various phases of software development. Utilizing a collection of interdisciplinary knowledge-based approaches, allows the *Wizard* to provide context-based recommendations regarding different tools and methods that offers assistance in the developer's selection and application. This allows for context-based recommendations for various methods and tools according to what development phase the developer is in. As a basis for this structure, the general conditions of the development process need to be established; such as, the budget, number of developers, and the time frame.

5   Mutual benefit

By combining Usability, Socio-economic and IT-Security aspects, the *Wizard* assists developers in implementing successful security solutions. As the *Wizard* will be integrated into the actual applied development process, the developer will not be inconvenienced, but will rather benefit from assets of this supportive tool. On the one hand, it raises awareness towards topics that go beyond software development itself and on the other hand it leads to an optimized product. Referring to the other end of the software development chain, we will find the client, who buys and eventually sells the product to their customers. In our scenario, they represent the end-users of the software that is developed. Depending on the type of order, the client and the end-user are the

same person. Although the user has no direct or deeper insight of the actual process of development of the product they use (at least they shouldn't) it indirectly affects them. Both the client and the end-user will most likely recognize the difference in the final product when the software developer had a wider scope in mind while implementing the software, which positively affects both the marketing of the product and the satisfaction during usage. If a developer implements software with the assistance of the *Wizard*, it will both support them in their individual tasks and ultimately create added value for the client and their users. The Figure 1 below gives a visual representation of the mutual benefits gained while utilizing the *Wizard*.
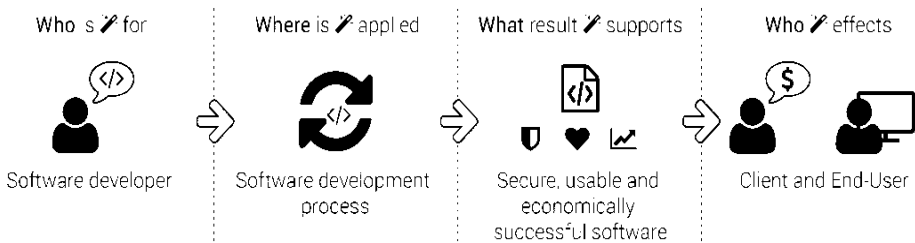

Fig. 1: Mutual Benefits from the *Wizard*

6   Conclusion

Developing secure and usable software that is accepted by various stakeholders and is economically successful is a challenge.   Addressing this challenge, the proposed interdisciplinary approach and the *Wizard* tool supports software developers in taking usability and socio-economic aspects into account during the development process. The *Wizard* will guide developers through the process and assists in selection and application of various IT-Security, Usability and socio-economic methods. Following this approach, secure, usable, and economically successful software can be developed. This work-in-progress paper highlights the strengths, goals, and drive of the results that are to be achieved in the CUES project by the end of 2017.

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