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Understanding Security Requirement Engineering

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ABSTRACT

Security requirements must be developed during the initial part of software development. In most of the cases, security is dealt in the later stages of software development which results in higher cost and time constraints. Security must be given more priority so that large complex problems and issues can be solved initially itself of solving it during final phases of software development life cycle. The objective of this work is to present security requirement engineering process so that users can completely understand the methods involved. Steps in security requirement engineering have been proposed. Systematic approach is used to integrate software requirement engineering process into developing security requirements.

Keywords : Security Requirements; Software Development; Requirement Engineering; Requirement Document

Introduction

Security requirement is considered a non-functional requirement (NFR), currently security does not receive much attention during these early phases, resulting in more vulnerable software. Non-functional requirement (also known as quality requirements) are generally more difficult to express in a measurable way, making them more difficult to analyze [1]. Secure software engineering is the process of designing, building, and testing software so that it becomes secure. Software security includes secure software development life cycle (SSDLC) processes and secures software development (SSD) methods. A SSDLC process considers security aspects of the software during the development life cycle by using SSD methods. SSD methods include among others, security specification languages, security requirements engineering processes, and software security assurance methods [2]. In Common Criteria (CC) security requirements are sorted into two categories i.e. security functional requirement and security assurance requirement. Security functional requirements emphasize on detecting and countering threats while security assurance requirements focus on possible threats in a more active way [3]. Security requirements engineering is essential for secure software product line (SPL) and products development, it provides techniques, methods, standards and systematic and repeatable procedures for tackling SPL security requirement issues throughout the SPL development lifecycle both to ensure the definition of security quality requirements and to manage the variability of security properties. Nevertheless, software engineering methodologies and standard proposals of SPL engineering have traditionally ignored security requirements and security variability issues. Although some of them include a few security requirements activities, most of them focus only on the design of implementation aspects of SPL development [4]. The biggest problem, however, is that in the majority of software projects security is dealt with when the system has already been designed and put into operation. Added to this, the actual security requirements themselves are often not well understood. This being so, even when there is an attempt to define security requirements, many developers tend to describe design solution in terms of protection mechanisms, instead of making declarative propositions regarding the level of protection required. Security Requirements Engineering Process (SERP) is a standard-centered process and a reuse-based approach which deals with security requirements at the earlier stages of software development in a systematic and intuitive way by providing a security resources repository and by integrating the Common Criteria into the software development lifecycle. Security requirements for a security critical information system can be obtained in a guided and systematic way by applying security requirements engineering processes [5].

Understanding Security Requirement Engineering

Requirement engineering is the foundation of developing quality software. The main objective of software security requirements is to specify that availability, confidentiality and integrity of the software should be preserved. Usually, these requirements specify the security features needed for the software system. However, such requirements are not precise enough and need to be more explicit about who can do what and when [6]. Usually, security requirements are considered from the following three aspects:

(1) Confidentiality: Each data is specified to its owner and only legal users can see that data. What kind of security measures shall we take to avoid the unauthorized use of data?
(2) Availability: People who need the data can easily access the data. Who are the legitimate users? How to prevent the loss of the data? How to avoid that the legitimate cannot use the data?
(3) Integrity: The transformation from the input data to the output data is correct and the records of all the data from the adjacent system are accurate. If the system is not under the control of legitimate users, the data cannot be changed [7].

Several works on security requirement engineering [8, 9, 10] has been proposed. In this work, security requirement engineering can be divided into seven different steps as shown in Fig. 1.

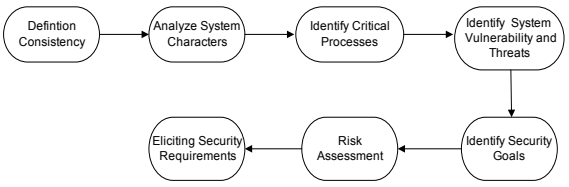


Fig. 1. Security Requirement Engineering Process

Steps in security engineering process are explained as shown below:

(1) Define Consistency: Since security requirement members consist of large number of persons and each person's idea and experience differs with one another, different answers exist for the same question. So a common dictionary must be built upon which the team can have consistency of different opinions. Software engineering body of knowledge can be used wherein each terminology has only one definition.

(2 Analyze System Characters: Security requirement members must understand how the system is being build, its components are interconnected and identify their dependencies. Thus the members should completely analyze and understand the characters of the system.

(3) Identify Critical Processes: Processes can be thought as resources for which the system must protect from threats. Members must know what kind of information can be lost or misplaced as well as damages to the system. So all the critical processes must be identified.

(4) Identify System Vulnerabilities and Threats: Analyzing and predicting all the system vulnerabilities is not possible But at the same time all the possible vulnerabilities must be identified to a large extent. Threat can be either in form of a human or an event. In most of the cases, human threats are severe. So all the system vulnerabilities and threats must be identified.

(5) Identify Security Goals: Security goals can use threats identified mainly to avoid the actions being performed on the processes. Security requirement members must agree upon the complete security goals which are identified. They must periodically conduct review for security goals and submit the feedback.

(6) Risk Assessment: Risk assessment starts before the system is acquired and continues throughout the system development process. It determines the likelihood and assesses the impact of risk. Once the threats have been identified by risk assessment method, all the threats should be classified based upon their likelihood.

(7) Eliciting Security Requirements: Final security requirements can be derived though eliciting security requirements. Correct security requirements can be obtained by analyzing security goal, identifying the threats, executing risk assessment and bringing down the risk to a manageable level.

Conclusion

Security requirement engineering is an important part of requirement engineering process. Security is dealt with only during the later stages of software development lifecycle. It has not been given major importance during the initial part of software development. Hence security must be given the highest priority so that large complex problems and issues can be solved initially itself instead of solving during the final phases of software development process. Systematic approach is used to integrate software requirement engineering process into developing security requirements. Concepts of security requirement engineering have been explained clearly so that all the users can easily understand security requirement engineering process. Various steps in security requirement engineering have been presented systematically and efficiently.

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