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Building Secure Cloud Architectures using Patterns

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***Abstract*—Patterns abstract good practices to define basic models that can be used to build new systems and evaluate existing systems. Security patterns join the extensive knowledge accumulated about security with the structure provided by patterns to provide guidelines for secure system requirements, design, and evaluation. We built a catalog of over 100 security patterns, which is still growing. We complement these patterns with misuse patterns, which describe how an attack is performed from the point of view of the attacker and describe how it can be stopped. We integrate patterns in the form of security reference architectures (SRAs) and we extend them to their ecosystems. We show how to build a SRA for clouds and their ecosystems. The use of patterns can provide a holistic view of security, which is a fundamental principle to build secure systems. The patterns and reference architectures are shown using UML models and examples are taken from my two books on security patterns as well as from my recent publications.**

Overview

Patterns combine experience and good practices to develop basic models that can be used to build new systems and to evaluate existing systems. Security patterns join the extensive knowledge accumulated about security with the structure provided by patterns to provide guidelines for secure system requirements, design, and evaluation. We consider the structure and purpose of security patterns, show a variety of security patterns, and illustrate their use in the construction of secure systems. These patterns include among others Authentication, Authorization/Access Control, Firewalls, Secure Broker, Web Services Security, and Cloud Security. We have built a catalog of over 100 security patterns. We introduce Abstract Security Patterns (ASPs) which are used in the requirements and analysis stages. We complement these patterns with misuse patterns, which describe how an attack is performed from the point of view of the attacker and how it can be stopped. We integrate patterns in the form of security reference architectures. Reference architectures have not been used much in security and we explore their possibilities. We introduce patterns in a conceptual way, relating them to their purposes and to the functional parts of the architecture. Example architectures include a security cloud reference architecture (SRA) and a cloud ecosystem. The use of patterns can provide a holistic view of security, which is a fundamental principle to build secure systems. Patterns can be applied throughout the software lifecycle and provide a good communication tool for the builders of the system. The patterns and reference architectures are shown using UML models and examples are taken from my two books on security patterns as well as from my recent publications. The patterns are put in context; that is, we do not present a disjoint collection of patterns but instead present a logical architectural structuring where the patterns are added where needed. In fact, we present a complete methodology to apply the patterns along the system lifecycle to build secure systems and a process to build reference architectures.

Biography

Eduardo B. Fernandez

Eduardo B. Fernandez (Eduardo Fernandez-Buglioni) is a professor in the Department of Computer Science and Engineering at Florida Atlantic University in Boca Raton, Florida, USA. He has published numerous papers on authorization models, object-oriented analysis and design, and security patterns. He has written four books on these subjects, the most recent being a book on security patterns. He has lectured all over the world at both academic and industrial meetings. He has created and taught several graduate and undergraduate courses and industrial tutorials. His current interests include security patterns, cloud computing security, and software architecture. He holds a MS degree in Electrical Engineering from Purdue University and a Ph.D. in Computer Science from UCLA. He is a Senior Member of the IEEE, and a Member of the ACM. He is an active consultant for industry, including assignments with IBM, Allied Signal, Motorola, Lucent, Huawei, and others.

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