

DESIGNING A LOGICAL SECURITY FRAMEWORK FOR ENTERPRISE
SERVICE ORIENTED ARCHITECTURE (ESOA)

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A thesis submitted in fulfillment of the
requirements for the award of the degree of
Master of Computer Science (Information Security)

Centre for Advanced Software Engineering (CASE)
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MARCH 2009

ABSTRACT

Enterprise Service Oriented Architecture (ESOA) is an appropriate strategy to provide an integrated, flexible, adaptable, and cost efficient enterprise Service-based that derives from various set of Web Services combined with business logic to support a particular business process. Despite the benefit of SOA, integration of application makes security design more complex. It brings several security problems. There is no comprehensive security framework for helping developers to design an adequate security solution. In order to alleviate these problems, some additional non-functional security requirements are needed. This project aims to analyze the security requirements raised by real world SOA in an enterprise and proposes a logical security framework to meet these needs. This framework can support all three security levels (content, communication, and network) of IT infrastructure. The proposed Security Service Oriented Reference Architecture (SSORA) shows which security service defined by the proposed security framework can be applied on each layer of Service Oriented Reference Architecture. In the real world, the location of each service is an important element of security design. In order to decrease the holes of the inner firewall, a Service Routing Coordinator (SRC) is located in the internal network. This service acts as an intermediary between the Web Services and the internal network servers. The proposed framework is applied on the logical SOA deployment architecture in order to design a security solution for an enterprise. Designing a security solution for Razavi Financial Institute (RFI) shows that proposed security framework can be applied for any SOA based environment.

ABSTRAK

Seni Bina Orientasi Servis “Enterprise” (ESOA) adalah satu strategi bagi menyediakan satu asas servis integrasi, fleksibel dan berkesan yang terhasil daripada gabungan pelbagai servis ‘web’ dengan logik perniagaan untuk menyokong satu proses khusus perniagaan. Selain daripada faedah SOA, integrasi applikasi menjadikan rekabentuk keselamatan bertambah kompleks. Ini akan membawa beberapa masalah keselamatan. Tidak terdapat rangka keselamatan yang menyeluruh untuk membantu pembangun-pembangun sistem bagi merekabentuk penyelesaian keselamatan yang terbaik. Untuk mengatasi masalah ini, beberapa keperluan keselamatan yang tidak berfungsi adalah di perlukan. Projek ini bertujuan untuk menganalisis keperluan keselamatan yang di bangkitkan oleh dunia sebenar SOA dalam satu “enterprise” dan mencadangkan satu rangkakerja keselamatan logik untuk mencapai keperluan tersebut. Rangkakerja ini boleh menyokong kesemua tiga peringkat keselamatan infrastruktur teknologi maklumat seperti kandungan, komunikasi, dan rangkaian. Cadangan servis keselamatan berorientasikan Seni Bina Unjukkan (SSORA) mencadangkan servis keselamatan yang dicadangkan oleh rangkakerja keselamatan yang boleh diaplikasikan ke atas setiap lapisan Seni Bina Berorientasikan Servis (SORA). Dalam dunia sebenar, lokasi setiap servis adalah elemen penting dalam merekabentuk keselamatan. Untuk mengurangkan kelemahan yang terdapat di dalam “firewall”, perkhidmatan ”Service Routing Coordinator” (SRC) akan di tempatkan di dalam rangkaian. Servis ini bertindak sebagai pengantara di antara servis ‘web’ dan rangkaian dalaman ‘server’. Satu cadangan rangka kerja digunakan ke atas logik seni bina SOA bagi merekabentuk satu penyelesaian keselamatan bagi sesuatu perusahaan. Merekabentuk satu penyelesaian keselamatan untuk RFI mempamerkan rangka kerja yang dicadangkan boleh diaplikasikan kepada mana-mana persekitaran asas SOA.

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CHAPTER 1

INTRODUCTION

In this chapter an introduction to research proposal is provided. First of all, the background of the problem to be solved is described. After that, the problem statement, and also objective, scope, and importance of the study are described respectively.

1.1 Background of the Problem

Nowadays, the demands of collaboration, integration and Web Service based application increased and, organizations need to share their databases and application to work together efficiently, reliably and cost-effectively [1]. To meet these needs, organizations are embarking on to use infrastructure strategy based on Service Oriented Architecture (SOA). SOA uses services as building blocks with several different ways to organize and architect the application within an enterprise. SOA shifts IT from an application-centric to service-centric [4].

Despite the benefit of SOA, designing and implementing an enterprise SOA-based involves some challenges. One of the critical issues is security in Enterprise Service Oriented Architecture (ESOA). To meet such issue, the philosophy of SOA should be investigated. That is, security should keep the services as open and easy to use as possible, and interoperability should not suffer because of security. There are

three main approaches to secure SOA [1] such as message-level security, security as service, and Policy-driven security. Notice that, the boundaries between these three aspects of classification are not always strictly defined. Moreover, there are several standards such as XML Signature [41], XML Encryption [42], WS-Security [44], XKMS [47], SAML [43], and XACML [45] that have been developed to provide comprehensive security schemes for Web Services to achieve aforementioned approaches in SOA.

In order to achieve an ESOA, a typical ESOA will encompass a complete infrastructure composed of various software and hardware components, partners and standards [12]. Some of the existing SOA security solutions can be adopted. However, due to the nature of Enterprise, they are still not enough. Moving data from one place to other place securely within an enterprise is a hot issue. This problem derives from heterogeneous use of security standards [37]. In fact, incorrect use of them may lead an enterprise to loss data and be failed. For example, if two parsers format the same message differently, XML-Signature validation will be failed [37].

In an enterprise where multiple applications come together to provide a service, security breaches may increase much higher than in a single application especially, when an enterprise communicate with external service provider such as partners and agents. In such case, data should be protected itself even during a transportation through the trustable intermediary and policy management should be placed.

Furthermore, new SOA developers who do not security expert make SOA implementation errors or end up with security loopholes. It occurs when developers don't understand SOA clearly. However, there are several providers that have been provided their products to consider security feature during SOA development lifecycle such as IBM [17], SAP [56], Vordel [34], and Oracle[22].

1.2 Statement of the Problem

Enterprise SOA (ESOA) is a blueprint for an adaptable, flexible, and open IT architecture for developing enterprise Web Services-based that derives from various set of Web Services combined with business logic to support a particular business process [2]. Integration of applications makes security design more complex than it would otherwise be [12]. Unlike other integration technologies, SOA is positioned well to deal with security challenges in integration. Due to the nature of SOA and by being standards-based, SOA lets standards to alleviate old problem of integration security. As mentioned before, *1) these techniques are not yet known widely enough to practitioners of SOA* and most practitioners are often not very clear on how to address security challenges.

In order to provide security within an enterprise SOA-based, most developer and products use WS-Security [44] that defines a standard set of SOAP extensions that can be used to provide message content integrity and confidentiality. Theoretically, it accommodates a variety of security models and encryption technologies and is extensible to support multiple security token formats. *2) In practice, improper use of them can make SOA environment vulnerable as SOAP message could be modified by unauthorized parties[6] .*

According to [13], tools and technology will not automatically give SOA. Implementing SOA within an enterprise evolves different concepts of business process. In the real world, the location of a security service is an important element of security design that needs to take into account network design and user locations. Because of this concept, developers have to build their own architecture strategy related to enterprise business requirements. ESOA introduces new security threats that need to be considered within SOA life cycle. Therefore, a security framework, guideline or model for Enterprise SOA must consider all security aspects in SOA environment.

According to two problems that mentioned above, the heterogeneous use of security standards and products lead Enterprise SOA to be failed. Some current

scenarios and solutions can be used to tackle this problem. ***But, the most important problem is the lack of unified security framework for Enterprise SOA.*** The general research question that this research will answer is:

What comprehensive security framework can be used to design infrastructure architecture for an Enterprise SOA to assure its business process?

In order to be able to answer this question, a set of research questions that address the problem in detail are defined, as follows:

1. **RQ1:** What is SOA and how it is deployed?
 - What is the interaction within the SOA?
 - What platforms are required to support the designing, implementing and maintaining of SOA?
2. **RQ2:** why security is important to SOA?
3. **RQ3:** what is ESOA?
 - How an ESOA is designed?
 - What platforms are required to support the designing, implementing and maintaining of ESOA?
4. **RQ4:** what security architecture and framework can be considered for securing an ESOA?
 - What security model and framework can support existing approaches and standards to design ESOA security solution?

1.3 Aim

The aim of this project is to propose a logical security framework for ESOA by analyzing the security requirements raised by real world ESOA and based on current standards and technologies that meet these requirements.

1.4 Objectives of the Study

Based on the above description of problem statement the objectives of this project are:

- (i) To identify all known security challenges and requirements in ESOA.
- (ii) To investigate current security approaches for ESOA.
- (iii) To analyze and determine a logical security framework to support ESOA based on current approaches and standards.
- (iv) To design typical logical ESOA deployment architecture.
- (v) To demonstrate ESOA security solution design based on proposed Security framework and using a case study such as Razavi Financial Institute (RFI).

1.5 Scope of the Study

This project was inspired by research directions such as Web Services, Service Oriented Architecture (SOA), security standards and technology in SOA, and Enterprise SOA. Those directions are presented here as the scope of the research subject in this proposal.

- First of all, this research was inspired by the concepts of the Web Service and its initiatives proposed both in academic and in industry. This concept is XML based and uses standard protocols such as Universal Description, Discovery, and Integration (UDDI) [26], Web Services Description Language (WSDL)[27], and Simple Object Access Protocol (SOAP) [28]. Web Services are described in section 2.3.
- Secondly, this project only focuses on using conceptual aspects of current security standards and technologies in SOA to propose a security framework. Any problem of these standards is beyond the scope of this project. Those standards are described in section 2.4.

- SOA is a way of planning, designing, implementing and testing IT systems. This project is going to propose a logical security framework for ESOA and design a security solution architecture based on proposed framework. It only focuses on design as security architecture. It does not go through the other phases of SOA lifecycle.
- In addition, this project using a case study such as Razavi Financial Institute (RFI) to demonstrate the security solution based on the proposed framework and logical deployment.
- Finally, this project focuses on those enterprises that are designed based on Service Oriented References Architecture (S3) [63].

1.6 Significance of the Study

SOA is an architectural style for an enterprise system composed from a set of loosely coupled services that interact with each other by sending message. In this architectural style, applications are created by coordinating and assembling services. A key principle about services is that they should be easily reusable and discoverable in a securely manner.

The significant of this study can be described as following items:

- The channels of communication between the participating entities in a SOA are much more vulnerable than in operating systems or within the boundaries of an organization's computer network, since they are established on public networks.
- Many efforts have been made to alleviate those security vulnerabilities that were induced in the complex context of SOA. They principally consisted in the production of numerous, often overlapping security standards by the industry actors [8],[9]. But there is still no clear view of how to use them in order to produce secure ESOA.

- SOA enables the design of flexible and modular software application that can be used in cross-organization context. Unfortunately, those qualities generally have a negative impact on the security of software application.

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