VICTORIA UNIVERSITY OF WELLINGTON Te Whare Wānanga o te Ūpoko o te Ika a Māui



School of Engineering and Computer Science Te Kura Mātai Pūkaha, Pūrorohiko

PO Box 600 Wellington New Zealand

Tel: +64 4 463 5341 Fax: +64 4 463 5045 Internet: office@ecs.vuw.ac.nz

Cloud Key Management

Sriram Venkatesh

Supervisor: NOT STATED

Submitted in partial fulfilment of the requirements for Master of Computer Science.

Abstract

A short description of the project goes here.

Acknowledgments

Any acknowledgments should go in here, between the title page and the table of contents. The acknowledgments do not form a proper chapter, and so don't get a number or appear in the table of contents.

Contents

1	Intr	oduction 1
	1.1	Motivation
	1.2	<u>Problem</u>
	1.3	Contributions
2	Bacl	kground 3
	2.1	System Security
	2.1	CryptographySecurity System
	2.2	Authentication and Authorization Protocols
		2.1.1 What defines a secure system?
		2.1.2 Cryptography
		2.1.3 Trust
		2.1.4 Authentication
		2.1.5 Authorization
		2.1.6 Access Control
	2.2	Key Management
		2.2.1 What is Key Management?
		2.2.2 Importance of Key Management
		2.2.3 Public Key Infrastructures
	2.3	Trust Management Systems
		2.2.1 Kerberos
	2.3	Threat Modeling
		2.2.1 OWASP Threat Modeling Technique
		2.2.1 Microsoft Threat Modeling Technique
	2.3	Defining the Cloud
		2.3.1 Cloud Service Models
		2.3.2 Security in the Cloud
	2.4	Vendors
		2.4.1 Amazon Web Services
		2.4.2 Luna SA
		2.4.3 DNSSEC
3	Trac	litional Use CaseProblem Domain 5
	3.1	Description of Baseline model
	3.2	Decoupling the application Threat Modeling
		3.2.1 OWASP Threat Modeling Technique
		3.2.2 Application Components
	3.3	Application Architecture
		3.3.1 User Roles
	3.4	Interaction between different components

	3.3.1	Key Retrieval 5
	3.3.2	Running Application Key Bootstrapping
3.4	Trust l	Model Assumptions
	3.4.1	Application Assumptions
	3.4.2	Power of attacker
3.5	Threat	Scenario Evaluation
	3.5.1	Threat Analysis
	3.5.2	Threat Matrix
		lel Analysis Possible Solutions 7
4.1		
		What is Eso?
	4.1.2	System Process
		4.1.2.1 Key Retrieval
		4.1.2.2 Key Bootstrapping Process
		4.1.2.3 Key Revocation
	4.1.3	Security Analysis
		4.1.3.1 System Threats
		4.1.3.2 Threat Model Evaluation
4.2	HSM	
	4.2.1	What is HSM?
	4.2.2	System Process
	4.2.3	Architectural Overview
		4.2.3.1 Key Retrieval
		4.2.3.2 Key Bootstrapping Process
		4.2.3.3 Key Revocation
	4.2.4	Security Analysis
		4.2.4.1 System Threats
		4.2.4.2 Threat Model Evaluation
4.3	SoftH	6M
	4.3.1	What is SoftHSM?
	4.3.2	System Process
	4.3.3	Architectural Overview
		4.3.3.1 Key Retrieval
		4.3.3.2 Key Bootstrapping Process
		4.3.3.3 Key Revocation
	4.3.4	Security Analysis
		4.3.4.1 System Threats
		4.3.4.2 Threat Model Evaluation
4.4	Securi	ty Matrix Comparison
Imp	lement	ation 9
5.1	Progra	nm Architecture
	5.1.1	Scenario
	5.1.2	High Level Overview
	5.1.3	Process Overview
	5.1.4	Key Bootstrap Process
	5.1.5	Key Retrieval Process
		5.1.5.1 Credential Storage
		5.1.5.2 Design
	3.5 Thr. 4.1 4.2 4.3	3.3.2 3.4 Trust No.4 3.4.1 3.4.2 3.5 Threat 3.5.1 3.5.2 Threat Mod 4.1 Eso . 4.1.1 4.1.2 4.1.3 4.2.1 4.2.2 4.2.3 4.3.1 4.3.2 4.3.3 4.3.4 4.4 Securi Implement 5.1 Progra 5.1.1 5.1.2 5.1.3 5.1.4

	5.2	Experimental Design	9
		5.2.1 Performance Metrics	9
		5.2.2 Comparison with traditional use case	9
6	Eva	lation	11
	6.1	Security Threat Matrix Evaluation	11
	6.2	Results and Findings	11
		6.2.1 Security Analysis	11
		6.2.2 Performance Tests and Comparaison	11
	6.3	Costing Analysis	11
7	Con	clusions	13

Figures



Introduction

This chapter gives an introduction to the project report.

- 1.1 Motivation
- 1.2 Problem
- 1.3 Contributions

2.4 Vendors

2.4.2 Luna SA

2.4.1 Amazon Web Services

Background

2.1	System Security
2.1	CryptographySecurity System
2.2	Authentication and Authorization Protocols
2.1.1	What defines a secure system?
2.1.2	Cryptography
2.1.3	Trust
2.1.4	Authentication
2.1.5	Authorization
2.1.6	Access Control
2.2	Key Management
2.2.1	What is Key Management?
2.2.2	Importance of Key Management
2.2.3	Public Key Infrastructures
2.3	Trust Management Systems
2.2.1	Kerberos
2.3	Threat Modeling
2.2.1	OWASP Threat Modeling Technique
2.2.1	Microsoft Threat Modeling Technique
2.3	Defining the Cloud
2.3.1	Cloud Service Models
2.3.2	Security in the Cloud

4

Traditional Use CaseProblem Domain

3.1	Description of Baseline model
3.2	Decoupling the application Threat Modeling
3.2.1	OWASP Threat Modeling Technique
3.2.2	Application Components
3.3	Application Architecture
3.3.1	User Roles
3.4	Interaction between different components
3.3.1	Key Retrieval
3.3.2	Running ApplicationKey Bootstrapping
3.4	Trust Model Assumptions
3.4.1	Application Assumptions
3.4.2	Power of attacker
3.5	Threat Scenario Evaluation
3.5.1	Threat Analysis
3.5.2	Threat Matrix

Threat Model AnalysisPossible Solutions

4.1.1 What is Eso?
4.1.2 System Process
4.1.2.1 Key Retrieval
4.1.2.2 Key Bootstrapping Process
4.1.2.3 Key Revocation
4.1.3 Security Analysis
4.1.3.1 System Threats
4.1.3.2 Threat Model Evaluation
4.2 HSM
4.2.1 What is HSM?
4.2.2 System Process
4.2.3 Architectural Overview
4.2.3.1 Key Retrieval
4.2.3.2 Key Bootstrapping Process
4.2.3.3 Key Revocation
4.2.4 Security Analysis
4.2.4.1 System Threats
4.2.4.2 Threat Model Evaluation
4.3 SoftHSM
4.3.1 What is SoftHSM?
4.3.2 System Process
4.3.3 Architectural Overview
4.3.3.1 Key Retrieval
4.3.3.2 Key Bootstrapping Process
4.3.3.3 Key Revocation
4.3.4 Security Analysis
4.3.4.1 System Threats
4.3.4.2 Threat Model Evaluation

4.1 Eso

8

Implementation

- 5.1 Program Architecture
- 5.1.1 Scenario
- 5.1.2 High Level Overview
- 5.1.3 Process Overview
- 5.1.4 Key Bootstrap Process
- 5.1.5 Key Retrieval Process
- 5.1.5.1 Credential Storage
- 5.1.5.2 Design
- 5.2 Experimental Design
- **5.2.1** Performance Metrics
- 5.2.2 Comparison with traditional use case

Evaulation

- **6.1** Security Threat Matrix Evaluation
- 6.2 Results and Findings
- 6.2.1 Security Analysis
- 6.2.2 Performance Tests and Comparaison
- 6.3 Costing Analysis

Conclusions

The conclusions are presented in this Chapter.

Bibliography