Final Attack Models Report

Mobile Plataform	Web Application
Application domain type	m-Health
Authentication	Yes
Authentication schemes	Biometric-based authentication ; Factors-based authentication
Has DB	Yes
Type of data storage	SQL
Which DB	MySQL
Type of data stored	Personal Information ; Confidential Data ; Critical Data
User Registration	Yes
Type of Registration	The users will register themselves
Programming Languages	HTML5 ; PHP ; Javascript
Input Forms	Yes
Upload Files	Yes
The system has logs	Yes
The system has regular updates	Yes
The system has third-party	Yes
System Cloud Environments	Private Cloud
Hardware Specification	Yes
HW Authentication	Basic Authentication (user/pass)
HW Wireless Tech	3G ; 4G/LTE ; 5G ; Wi-Fi ; GPS
Data Center Phisical Access	Yes

Cross Site Scripting Attacks

In short, Cross Site Scripting (XSS) allows an attacker to execute a browser script bypassing access control mechanisms such as the same origin policy. During this attack a malicious script is injected into web content and user considering it to be authentic executes it over its own machine, thus giving either control of the machine or exposure of confidential information to the attacker.

Definition

Being an attack that exploits vulnerabilities in web applications, the attacker in this type of attack executes malicious database claims, exploiting improper validation of data flowing from the user to the database. The attacker's goal is to access the intended party's confidential data by inserting malicious code into the user's web page in order to redirect them to their site. There are two ways to forge this type of attack:

- Stored XSS (uninterruptedly stores malicious code in a resource managed by the web application);
- Reflective XSS (promptly reflects malicious code against the user and therefore does not store it permanently;
- XSS based on DOM (Document Object Model).

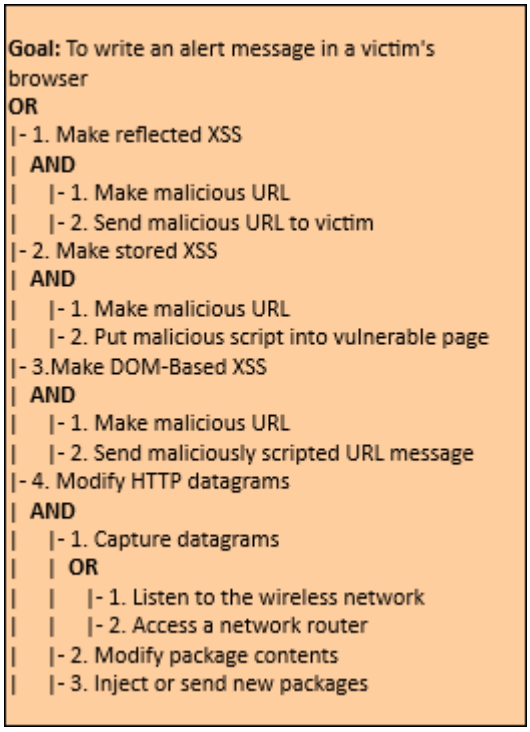
Attacker Powers

- Circumvent the policy of same origin;
- Impersonate you to websites and/or web applications you regularly use by obtaining/altering/destroying various types of content.

Recommendations

To ensure that the mobile application is resilient or immune to XSS attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity, privacy and authenticity of the data.

Cross Site Scripting Attacks Diagram



Malicious QR Code Attacks

In this type of attack, one of the strategies used by the attackers, after coding the malicious links, is to take them to phishing sites or execute fraudulent codes. In addition, in order to end this type of attack, the attackers often print the malicious QR codes on small stickers that are pasted on pre-existing QR codes. On the other hand, attackers often change selected modules from white to black and vice versa in order to replace the original encoded content.

Definition

QR code-based attack is defined as an attack that attempts to lure victims into scanning a QR code that directs them to malicious websites. The key idea behind QR code attacks is that victims might trust the web page or the printed material on which the QR code is displayed, and assume that the associated code is harmless. In addition, attackers use malicious QR codes to direct users to fraudulent web sites, which masquerade as legitimate web sites aiming to steal sensitive personal information such as usernames, passwords or credit card information.

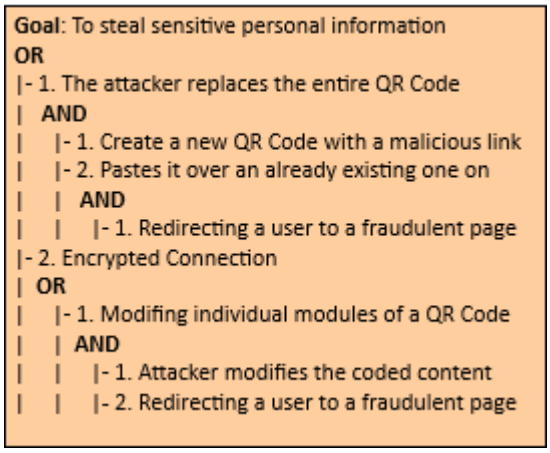
Attacker Powers

- Direct the user to an exploit or phishing site;
- Perform other attacks such as phishing, farming and botnet; * Distribute malware; * Extraction of personal and confidential data from smartphones and tablets via command injection or traditional buffer overflows by reader software;
- Steal users' Money via fraud;
- Social Engineering attacks via spear phishing e.g. leaving a poster of a QR Code on the parking lot of a company (instead of the traditional attack with an USB drive) offering discount in a nearby restaurant is a new attack vector which is likely to be successful.

Recommendations

To ensure that the mobile application is resilient or immune to malicious QR Code attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity and authenticity of the data.

Malicious QR Code Attacks Diagram



SQL Injection Attacks

In this type of attack, an attacker could provide malicious input with a clever mix of characters and meta characters from a form (e.g., login form) to alter the logic of the SQL command.

Definition

Structured Query Language (SQL) Injection Attack is a code injection technique commonly used to attack web applications where an attacker enters SQL characters or keywords into an SQL statement through superuser input parameters for the purpose. to change the logic of the desired query.

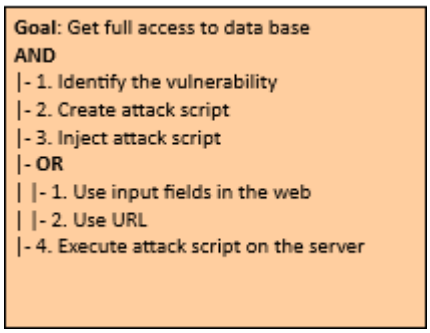
Attacker Powers

- Identify parameters vulnerable to injection; * Discover DBMS and version; * Discover relational scheme; * Extract data; * Add / modify data; * Cause denial of service; * Evade detection; * Bypass authentication; * Execute commands; * Elevate privileges.

Recommendations

To ensure that the mobile application is resilient or immune to SQLi attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity, privacy and authenticity of the data.

SQL Injection Attacks Diagram



Denial of Services

In a DoS attack scenario, the attacker attempts to disrupt the network or disable services provisioned by a server by sending uninterrupted data packets to the target server and without changing nodes, data packets, or decrypting encrypted data. Typically, these data packets take up bandwidth and consume server resources.

Definition

In such attacks, the attacker attempts to prevent a service or feature that is signed by authorized users from being released by launching various types of floods - SYN flooding, User Datagram Protocol (UDP) flooding, Internet Control Message Protocol (ICMP) attacks) flooding, etc - on the server.

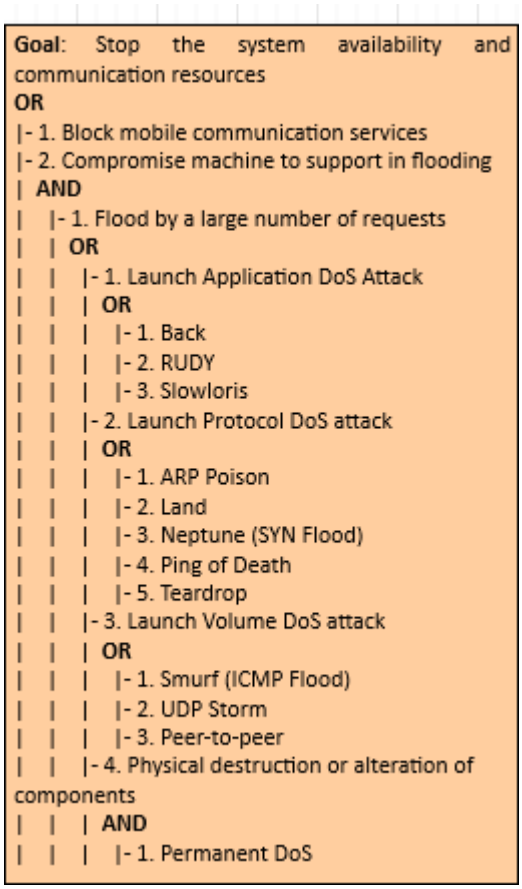
Attacker Powers

- Prevent the availability of a service or resource to authorized users;
- Perpetrating other types of attacks while services or features are unavailable, such as Spoofing.

Recommendations

In order to ensure that the mobile application is resilient or immune to the DoS attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed.

Denial of Services Attacks Diagram



Distributed Denial of Services Attacks

Distributed Denial of Services (DDoS) is an enhanced DoS attack type, originating from multiple network attack surfaces that were previously compromised to disrupt the services or resources provided by the target server. It differs from DoS in that it generates more traffic, so that the targeted server cannot handle requests.

Definition

The DDoS attack attempts to make a service unavailable to intended users by draining the system or network resource. Attackers can now launch various DDoS attacks, including resource-focused attacks (eg, network bandwidth, memory, and CPU) and app-focused attacks (eg, mobile applications, database service) from almost every attack. places.

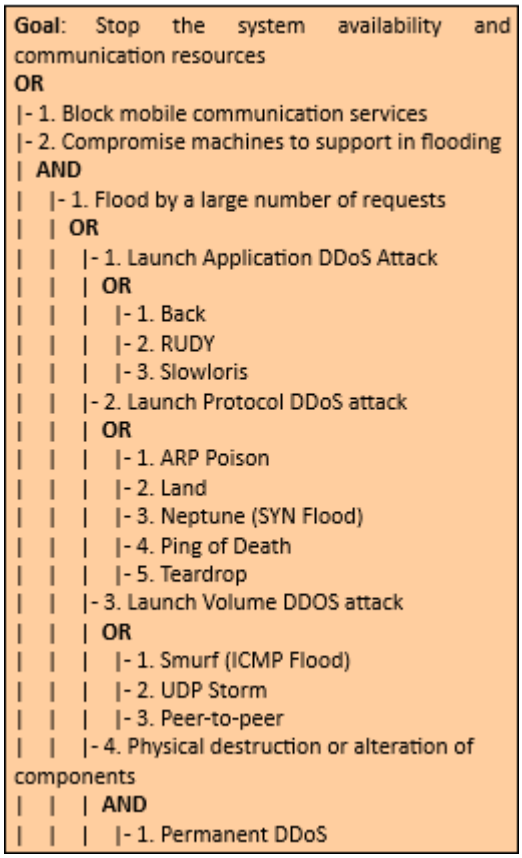
Attacker Powers

- Make features and services unavailable to authorized users; * Perpetrate other types of attacks and even extract sensitive and critical data.

Recommendations

n order to ensure that the mobile application is resilient or immune to the DDoS attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed.

Distributed Denial of Services Attacks Diagram



Domain Name Server Attacks

In this type of attack the attacker uses DNS to convert the domain name to an IP address for the purpose of accessing the user's confidential data. On the other hand, sender and a receiver get rerouted through some evil connection.

Definition

In DNS reflection attacks, attackers send DNS requests toward multiple open DNS servers with spoofed source address of the target, which results in a large number of DNS responses to the target from DNS servers. Since the cloud has its own DNS servers to answer DNS queries from hosted tenants, there should not be any DNS responses from the Internet to the cloud. Therefore, any activity of inbound DNS responses may signify a potential DNS reflection attack. Inbound DNS reflection attacks often come from up to 6K distinct sources (with 1500 byte full-size packets). We only observed outbound DNS responses from a single VIP hosting a DNS server at 5666 packets per second for a couple of days repeatedly.

Attacker Powers

- Access confidential information from legitimate/authorized users; * Perpetrate other types of attacks like DDoS and Main-in-the-Middle.

Recommendations

In order to ensure that the mobile application is resilient or immune to the DNS attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed.

DNS Attacks Diagram

Reused IP Address Attacks

IP address is reassigned and reused by other customer. The address still exists in the DNS cache, it violating the privacy of the original user.

Definition

Each node of a network has an IP address which is allocated to a particular user when that user leaves the network, the IP address associated with him is assigned to a new user. The chances of accessing previous user data by the new user exist as the address still exist in DNS cache and hence the data belonging to one person can be accessed by another.

Attacker Powers

- Access confidential information from legitimate/authorized users.

Recommendations

To ensure that the mobile application is resilient or immune to malicious Reused IP Address attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity, privacy and authenticity of the data.

Reused IP Address Attacks Diagram

Goal: Gain unauthorised access to a device on Cloud and Mobile Ecosystem

AND
|- 1. Obtain a target
|- 2. Obtain an IP address of a trusted device
|- 3. Disable communicaition of the trusted machine
|- 4. Sample communication between the target and trusted hosts
|- 5. Guess the seguence numbers of the trusted machine
|- 6. Modificai the packet headers
|- 7. Attempt connection to an address authenticated service or port

XML Injection Attacks

It is an attacking technique used against XML-based applications to modify or compromise their normal operation.

Definition

XML Injection (XMLi) attacks are carried out by injecting pieces of XML code along with malicious content into user inputs in order to produce harmful XML messages. The aim of this type of attacks is to compromise the system or system component that receives user inputs, making it malfunction (e.g. crash), or to attack other systems or subsequent components that process those injected XML messages. This type of attack can be classified into 4 categories:

- Deforming: Attack input values of Type 1 are XML meta-characters, such as <, >,]] >, that are intro- duced to compromise the structure of generated XML messages;
- Random closing tags: Attack input values of Type 2 are random XML closing tags (e.g., < /test>), aiming at deforming the generated XML messages to reveal their structure;
- Replicating: Attack input values of Type 3 are strings of characters consisting of XML tag names and malicious content;
- Replacing: Attack input values of Type 4 are similar to those of Type 3 but they involve multiple input fields in order to comment out some existing XML elements and inject new ones with malicious content.

Attacker Powers

- Obtain confidential information;
- Change the underlying business logic of the destination.

Recommendations

To ensure that the mobile application is resilient or immune to Spoofing attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity, privacy and authenticity of the data.

XML Injection Attacks Diagram

Goal: Disclosure or modification of the internal data

AND
|- 1. Create malicious content
|- 2. Inject pieces of XML code along with malicious content into user inputs
|- **OR**
|- |- 1. Deforming
|- |- 2. Random closing tags
|- |- 3. Replicating
|- |- 4. Replacing

Spoofing Attacks

In a nutshell, spoofing attacks consist of spoofing the caller ID in order to impersonate a trusted entity and thus obtain confidential information in a disguised manner.

Definition

In this type of attack, the attacker can spoof the "Caller ID" and impersonate him as a legitimate user, i.e., an attacker could spoof the "Caller ID" and impersonate a trusted party. Recent studies have also shown how to spoof MMS messages that appeared to be messages from a number that operators use to send alerts or update notifications. In addition, base stations can also be counterfeited. On the other hand, there is also the mobile application spoofing attack, which consists of an attack where a malicious mobile application mimics the visual appearance of another one. The goal of the adversary is to trick the user into believing that she is interacting with a genuine application while she interacts with one controlled by the adversary. If such an attack is successful, the integrity of what the user sees as well as the confidentiality of what she inputs into the system can be violated by the adversary.

Attacker Powers

- Faker caller ID;
- Monitoring of calls and access to the confidential information of legitimate users from voice or text messages.

Recommendations

To ensure that the mobile application is resilient or immune to Spoofing attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity, privacy and authenticity of the data.

Spoofing Attacks Diagram

Goal: Access resources or obtain banking and other critical information
OR
|- 1. IP Spoofing
| **AND**
| |- 1. Obtains the IP address of a legitimate user
| |- 2. Alter TCP/IP packet headers to MTH
| |- 3. Hides the identity
|- 2. Metadata Spoofing
| **AND**
| |- 1. Obtains the IP address of a legitimate user
| |- 2. Alter TCP/IP packet headers to MTH
|- 3. DNS Spoofing
| **AND**
| |- 1. Supplie false DNS information to a VM
| |- 2. Alter TCP/IP packet headers to MTH
| |- 3. Hides Its identity
| |- 4. The user reach the attackers fake site
|- 4. ARP Spoofing
| **AND**
| |- 1- Binds its MAC address to IP address ...
| |- 2. Sends spoofed ARP messages
|- 5. Mobile User ID Spoof
| **OR**
| |- 1. Spoof caller ID
| |- 2. Spoof MMS sender ID

VM Migration Attacks

A malicious user can start or redirect the migration process to a different network in which he has access or untrusted host, or it can just be copied and used elsewhere, which compromise the VM with the passwords, credentials on it and in case of coping it makes it difficult to trace the attacker.

Definition

VMs roll back to their previous state if an error occurs. Unfortunately, this factor can re-expose them to security vulnerabilities, and attackers can gain benefit to attack on this compromised hypervisor. It is important to protect the data during migration. In fact, this is the defending of data privacy and integrity from various network attacks during migration. Live migration might be susceptible to many attacks like ”man-in-the-middle”, ”denial-of-service” and ”replay. The data during the migration can be sniffed or tampered easily as it is not encrypted.

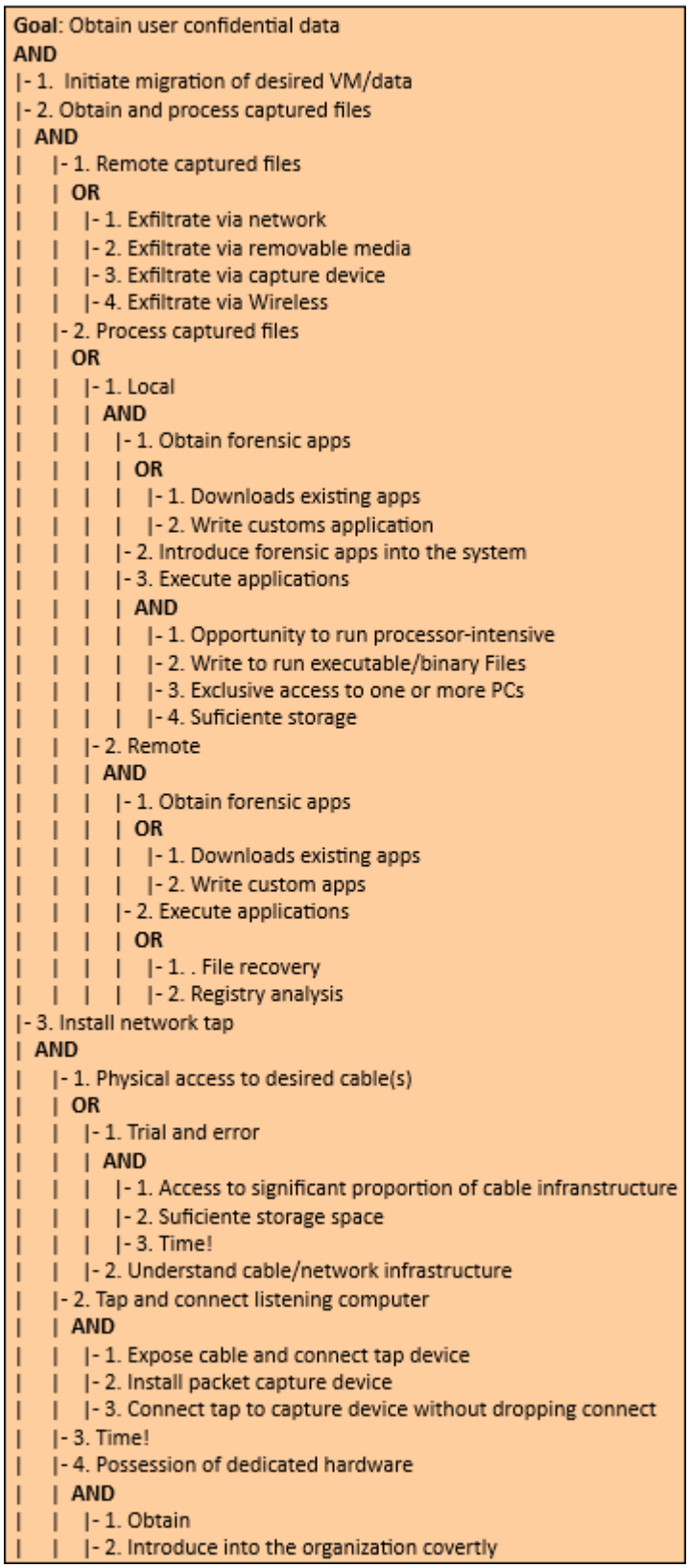
Attacker Powers

- Launch attacks such as man-in-the-middle, DoS and replay;
- Detect or tamper with data during migration as it is not encrypted.

Recommendations

To ensure that the mobile application is resilient or immune to VM Migration attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity, privacy, confinement, and authenticity of the data.

VM Migration Attacks Diagram



Malicious Insiders Attacks

This type of attacks ocurre when there is a malicious entity (client, employee, Hypervisor, Cloud Provider/Broker, etc.) takes advantage of its privileges to covertly carry out any malicious activity such as information theft and data destruction or physical infrastructures.

Definition

Malicious Hypervisor, Malicious Clients, Malicious Cloud Provider/Broker, etc. are all the other terms which can also be used as an alternative to malicious insiders. This kind of attack occurs from client to server when the person, employee or staffs who know how the system runs, can implant malicious codes to destroy everything in the cloud system.

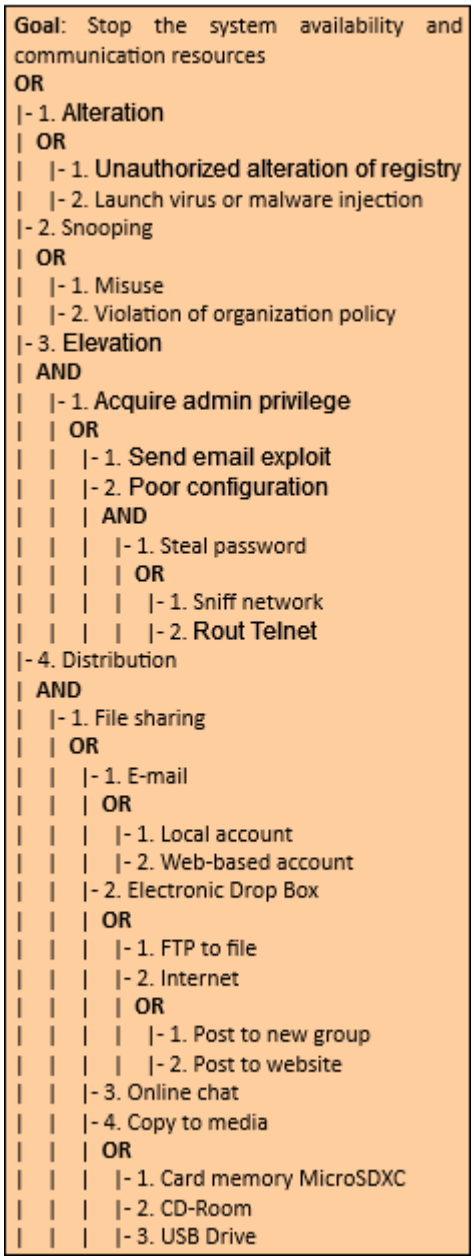
Attacker Powers

- Implants malicious codes to destroy everything in the cloud system; * Steals confidential data.

Recommendations

In order to ensure that the mobile application is resilient or immune to Malicious Insiders attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed.

Malicious Insiders Attacks Diagram



VM Escape Attacks

This type of attack occurs when an application escapes from the VM and gains control of VMM, as it escapes the VM privilege and obtains the root privilege.

Definition

VM escape is where an application running on a VM can directly have access to the host machine by bypassing the hypervisor, being the root of the system it makes this application escape the VM privilege and gain the root privilege. In this type of attack the attackers attempt to break down the guest OS in order to access the hypervisor or to penetrate the functionalities of other guest OS and underlying host OS. This breaking of the guest OS is called as escape. If the

attackers escapes the guest OS it may compromise the hypervisor and as a result it may control over the entire guest OS. In this way the security breach in single point in hypervisor may break down all the hypervisor. If the attacker controls the hypervisor, it can do anything to the VM on the host system.

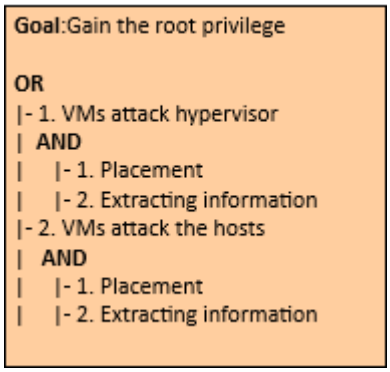
Attacker Powers

- Shutdown and eliminate target or victim VMs, resulting in the loss and destruction of data or information;
- Compromise the hypervisor and other resources.

Recommendations

To ensure that the mobile application is resilient or immune to VM Escape attacks, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity, privacy, authenticity and confinement of the data.

VM Escape Attacks Diagram



Cross VM Attacks (Side channel attacks)

Side-channel attacks are used to extract cryptographic keys from a victim device or process in a virtualized layer of the cloud ecosystem where a Cross-VM attack exploits the nature of multi-tenancy, which enables that VMs belonging to different customers may co-reside on the same physical machine.

Definition

The side-channel attack takes advantage of low-bandwidth message channels in a system to leak sensitive security information. There is no doubt that this type of attack exists and is real for today's computer systems, including modern smartphones and tablets. Here we highlight the cache-based side-channel attacks that have been used to steal cryptographic information from a single OS. Furthermore, the weak link is in the fact that cryptographic algorithms usually have data-dependent memory access patterns, giving the possibility of being revealed by the observation and statistical analysis of hits / errors from the associated cache. Recent research has shown attackers can build up cross-VM side channels to obtain sensitive information. However, currently these channels are mostly based on shared CPU cache, networks, CPU loads and so on. These attacks are generally categorized into one of three classes:

- Time-driven side-channel attack;
- Trace-driven side-channel attacks;
- Access-driven side-channel attacks.

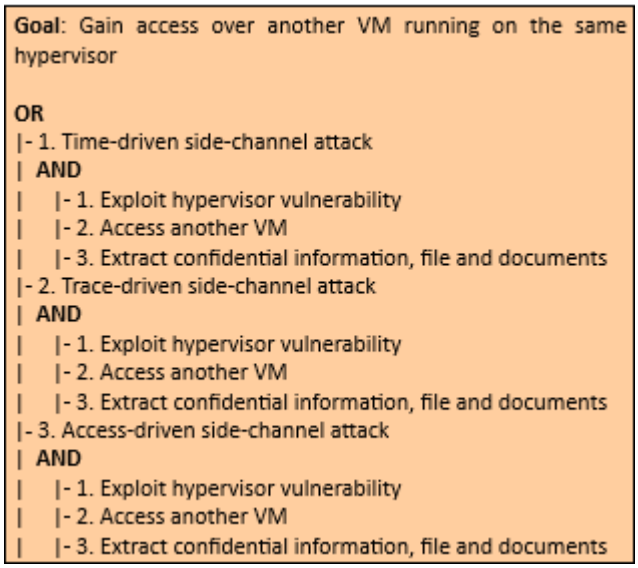
Attacker Powers

- Steal cryptographic information;
- Extract cryptographic key;
- Obtains confidential data or sensitive information.

Recommendations

In order to ensure that the mobile application is resilient or immune to the side-channel attacks, it is recommended that the measures described in the good practice report and the security testing present in the full report are followed.

Cross VM Attacks Diagram



Tampering Attacks

In this type of attack an attacker preforms physical modifications on the hardware where the software is implemented.

Definition

This type of attack occurs whenever an unauthorized user has physical access to the device. When this access is realized, it is possible to loss, leakage, access or unintentionally disclose of the data or applications to unauthorized users, if the mobile devices are misplaced, lost or theft.

Attacker Powers

- Sending high malicious traffic stream;
- Huge messages to targeting mobile devices to make unused or reducing the capability;
- Access and steal users confidential data.

Recommendations

To ensure that the mobile application is resilient or immune to malicious Tampering attack, it is recommended that the measures described in the good practice report and the security tests present in the full report are followed to ensure authenticity, integrity, privacy and authenticity of the data.

Tampering Attacks Diagram