

## Final Attack Models Report

Architecture	Android App
Application domain type	m-Health
Authentication	Username and Password
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	Java
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	Public Cloud
Hardware Specification	Yes
HW Authentication	Basic Authentication (user/pass)
HW Wireless Tech	5G ; 4G/LTE ; 5G ; Bluetooth ; Wi-Fi ; GPS ; NFC
Data Center Physical Access	Yes

## Man-in-the-Middle Attack

In this type of attack an active man listen and change communications between Mobile Device and Cloud. In other hand, in this attack an intruder enters in the ongoing conversation between sender and the receiver and makes them believe that conversation is taking place between them only.

### Definition

This type of attack occurs whenever an attacker intends to intercept communications in order to interpret or alter the original data in transit between the sender and the receiver establishing a conversation.

### Attacker Powers

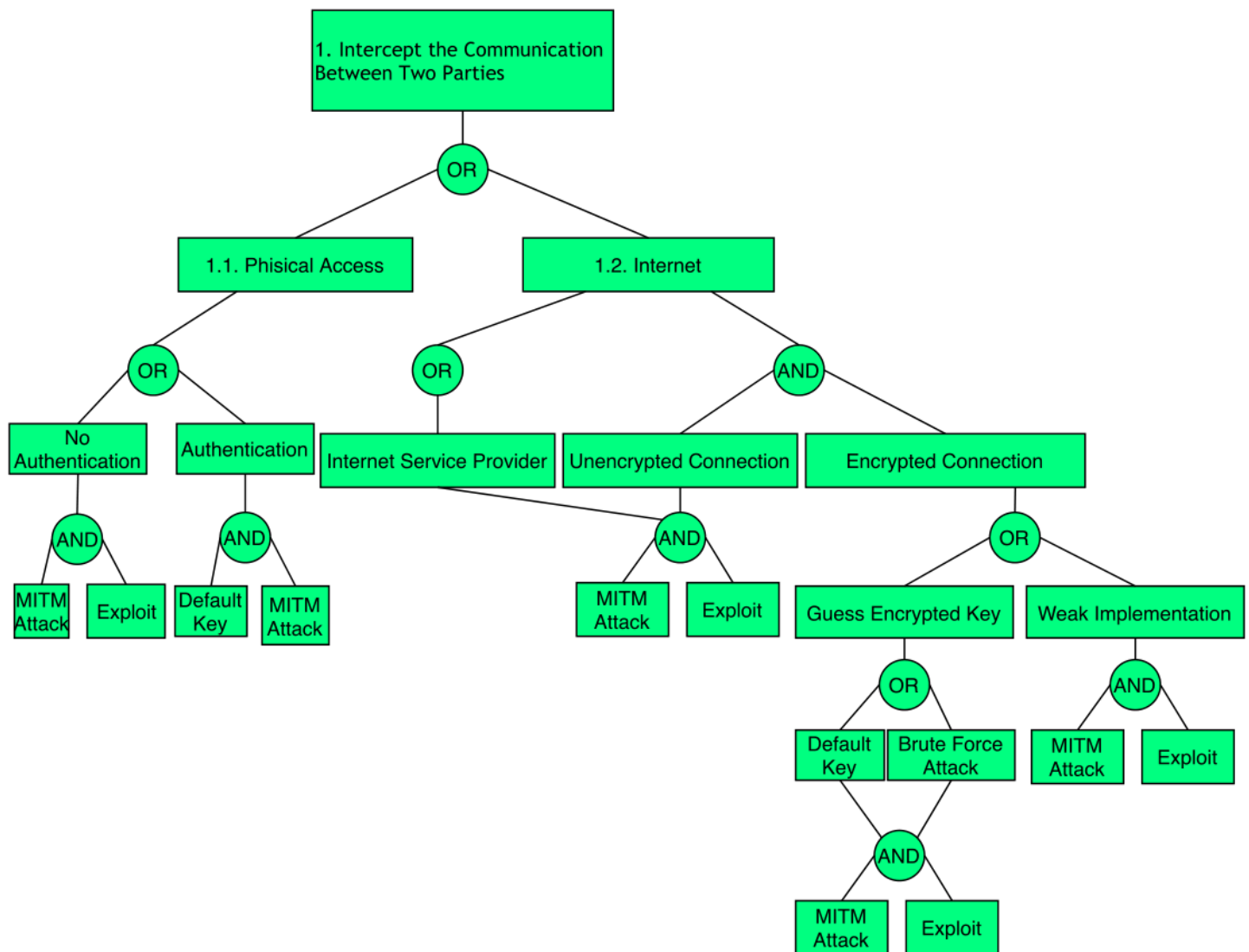
The attacker generally and depending on whether the communication situation is encrypted or not, is able to modify the cryptographically unprotected communication or modify the cryptographically protected communication. More specifically, it will have the following powers:

- Steal encryption key;
- Discover cryptographic key using cryptanalysis;
- Exploit vulnerabilities in cryptographic algorithm;
- Exploit vulnerabilities in cryptographic protocol.

### Recommendations

To ensure that the mobile application is resilient or immune to malicious MitM 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.

## Man-in-the-Middle Attack 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.

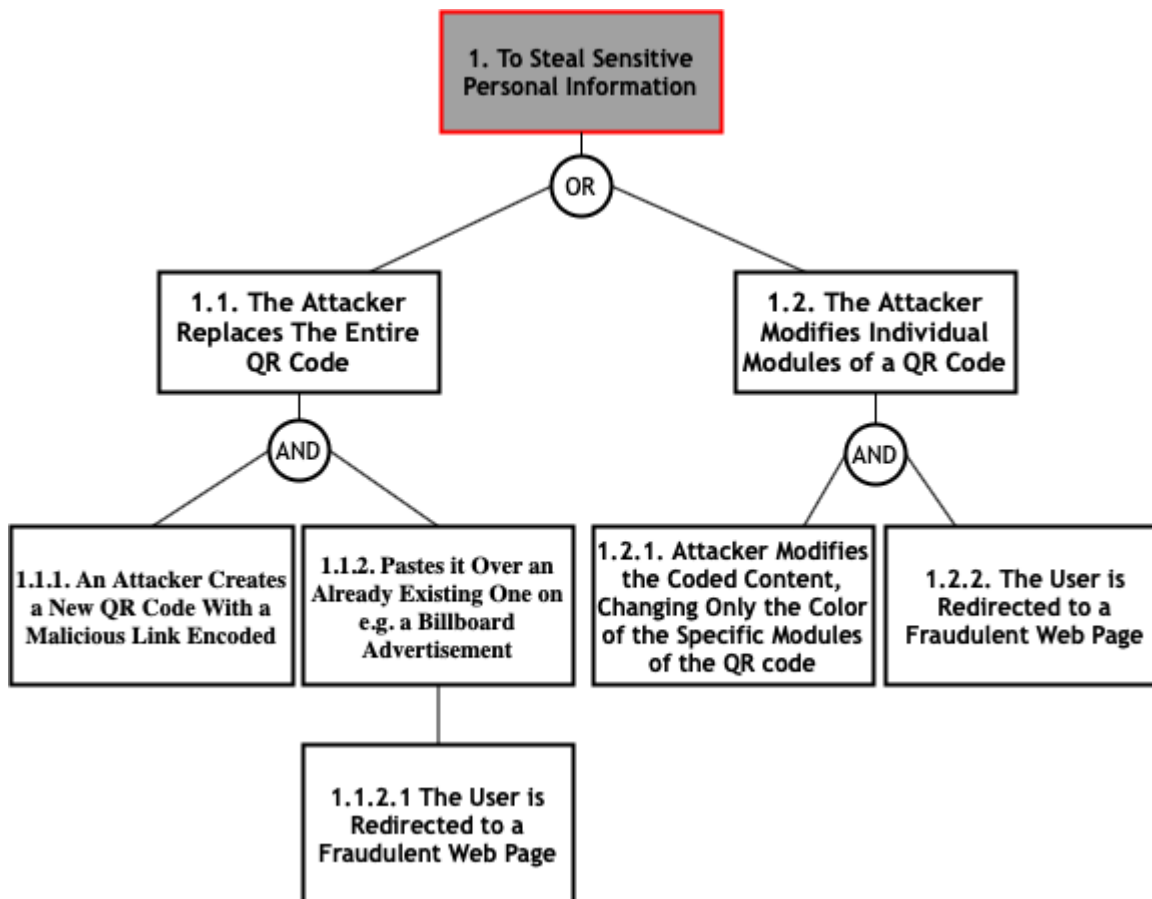
### Attacker Powers

- 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



## 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.

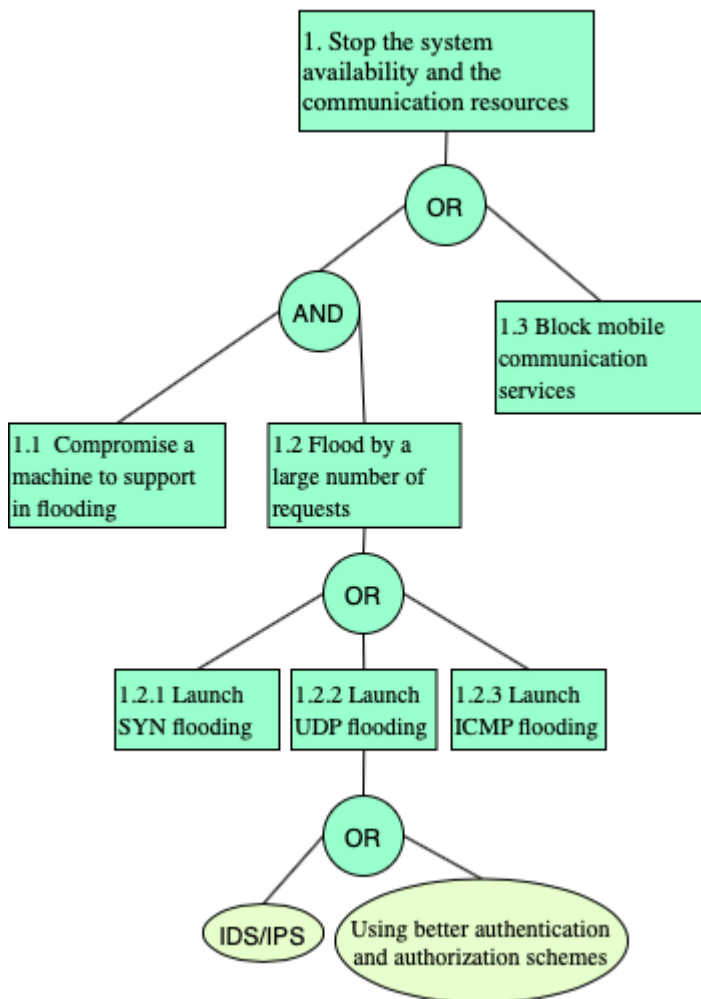
### Attacker Powers

- 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.

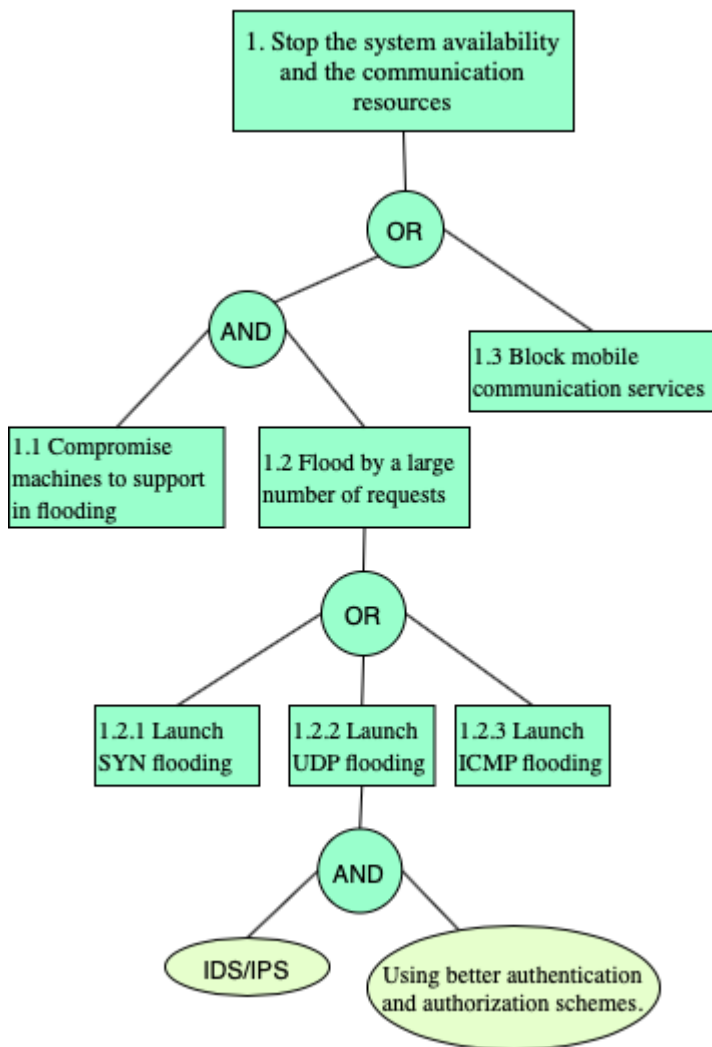
### Attacker Powers

- 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



## Eavesdropping or Sniffing

This type of attack is carried out by attackers who use applications that can capture data packets in transit over a network, and if they are not heavily encrypted, can be read or interpreted. The goal of the attacker is to spy on all kinds of conversations and recordings and to listen to communication channels.

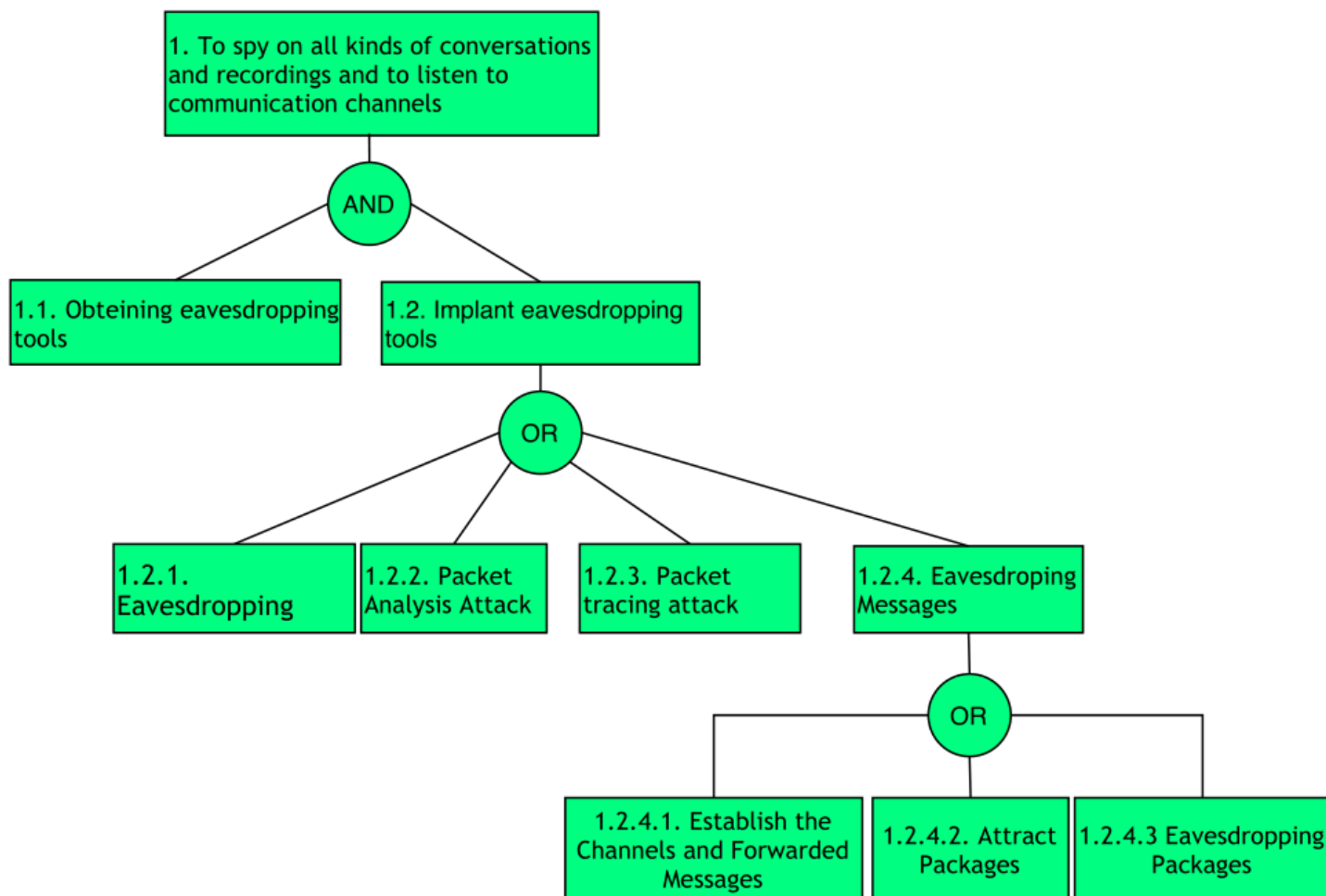
### Definition

This type of attack consists of implant eavesdropping tools in specific network for spying on communication channels, capturing the network traffic behavior and getting the network map. Eavesdropping is dangerous threat that leads to break down the integrity and confidentiality which causes financial and personal failures. There are several ways to get a sniffing attack on a smartphone, as there is a vulnerability in GSM's encryption function for call and SMS privacy, A5 / 1 (it can be stopped second). This vulnerability puts all GSM subscribers at risk of sniffing attacks.

### Attacker Powers

- Tracking, capture and theft of confidential information;

### Sniffing Attacks Diagram



## Phishing Attack

In phishing attack, an adversary sets up a fake URL identical to real Web application fooling the users to enter a valid credentials and certificates.

### Definition

Phishing is the attempt to acquire sensitive information or to make somebody act in a desired way by masquerading as a trustworthy entity in an electronic communication medium. They are usually targeted at large groups of people. Phishing attacks can be performed over almost any channel, from physical presence of the attacker to websites, social networks or even cloud services. On the other hand, phishing attacks are typically fraudulent email messages which directs to spoofed website. In PaaS cloud environment, these attacks affect both enterprise and users. This is a type of social engineering attack. These attackers convince the customers to reveal their most important data like password or other sensitive information by using bogus web pages, emails, or bloggers.

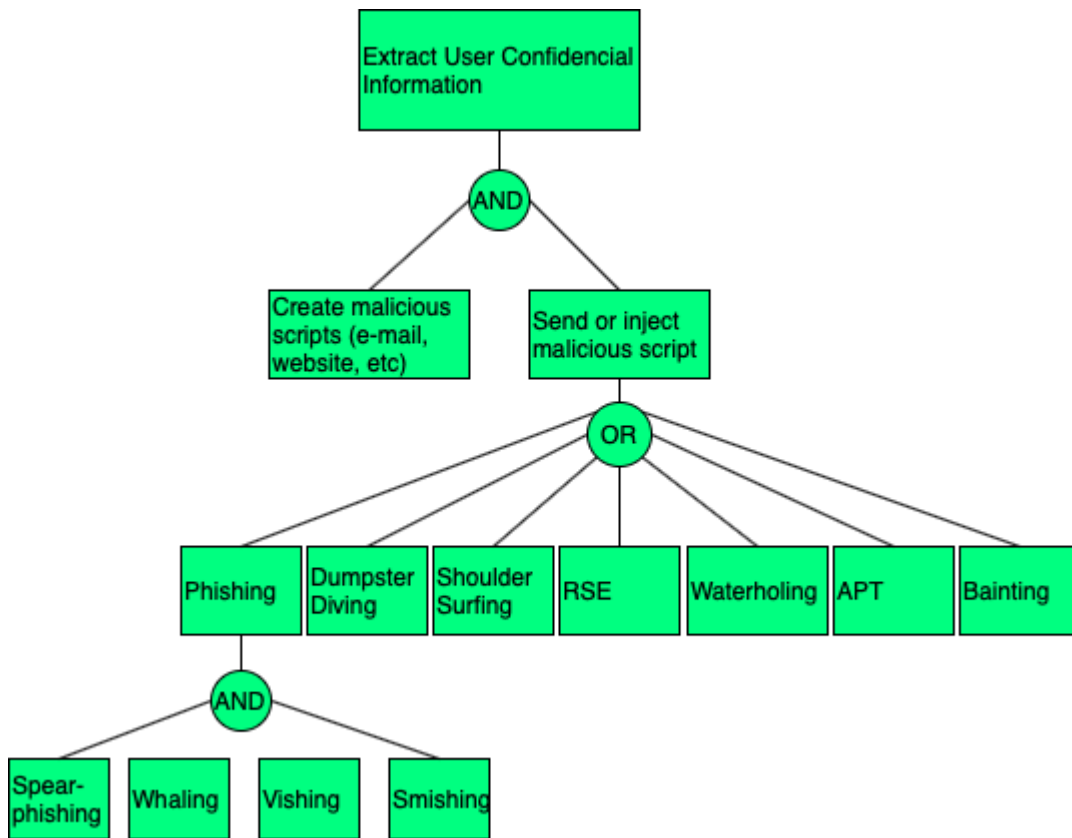
### Attacker Powers

- Access confidential information from legitimate users by collecting data through malware; \* Perpetrate other types of attacks like Botnet.

### Recommendations

To ensure that the mobile application is resilient or immune to malicious Phishing 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.

## Phishing Attack Diagram



## Botnet Attacks

In a nutshell, in a botnet attack scenario the attacker hijacks a set of mobile devices, creating a network of remote controlled zombie devices. This network is called Botnet, from which various types of attacks can be carried out, such as denial of service attacks, malware distribution, phishing, etc.

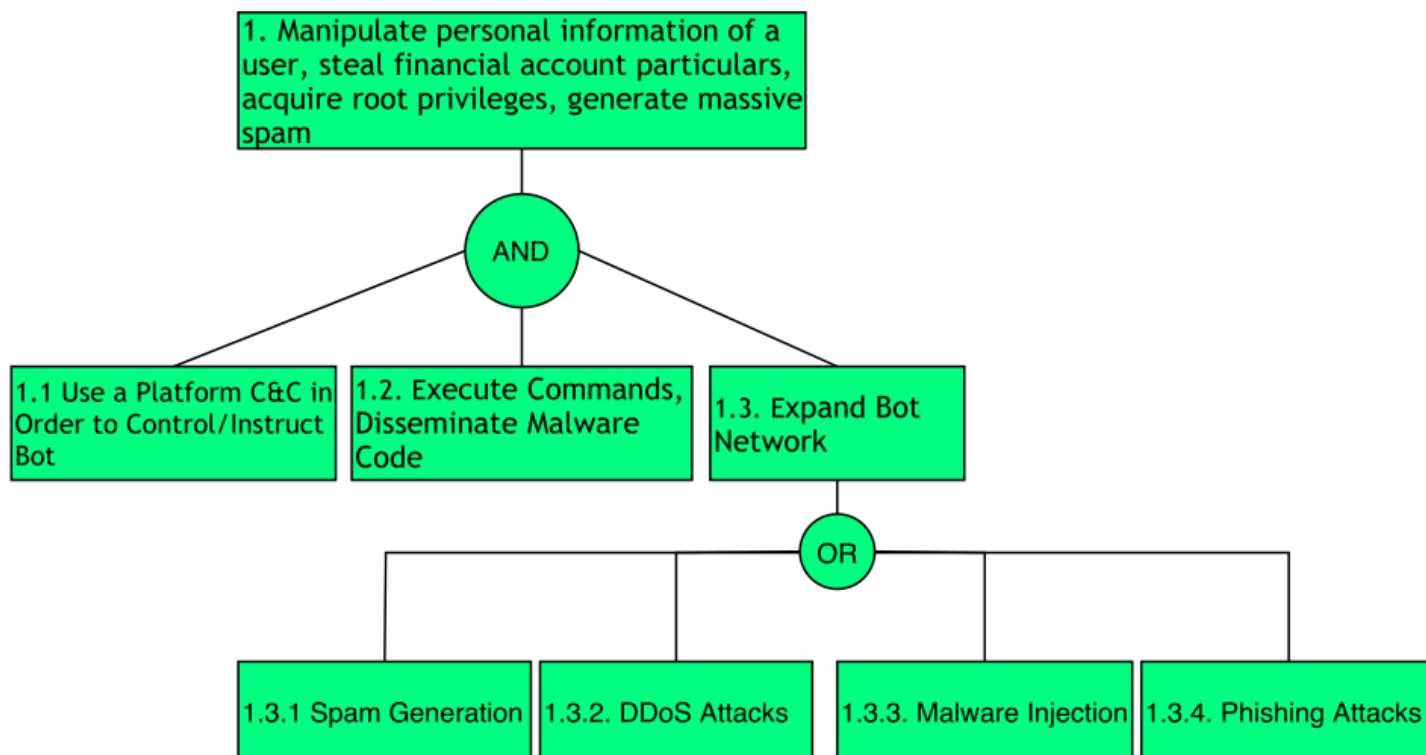
### Definition

A botnet is a set of compromised mobile devices. A necessary condition for these devices to be compromised is their infection by malware. This allows attackers/hackers to remotely control this botnet and launch other types of attacks, such as DoS, Phishing, malware injection, etc.

### Attacker Powers

- Sending spam;
- Perform attacks like DoS;
- Collecting information that can be used for illegal purposes;

## Botnet Attacks Diagram



## 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

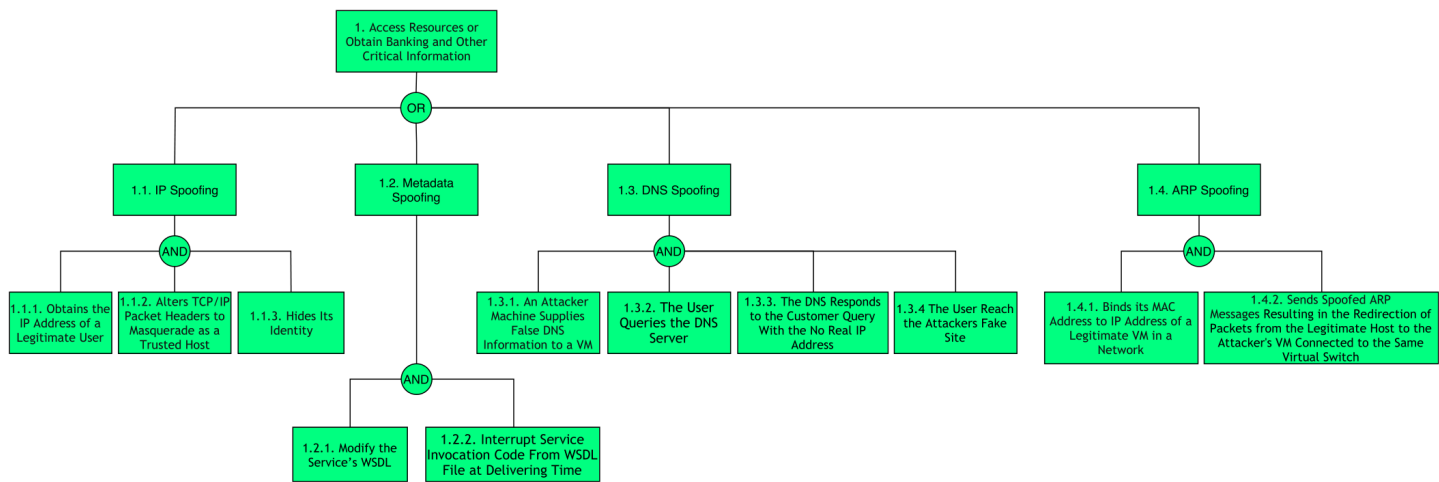
- Faker caller ID;
- Monitoring of calls and access to the confidential information of legitimate users from voice or text messages.

### 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





## 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.

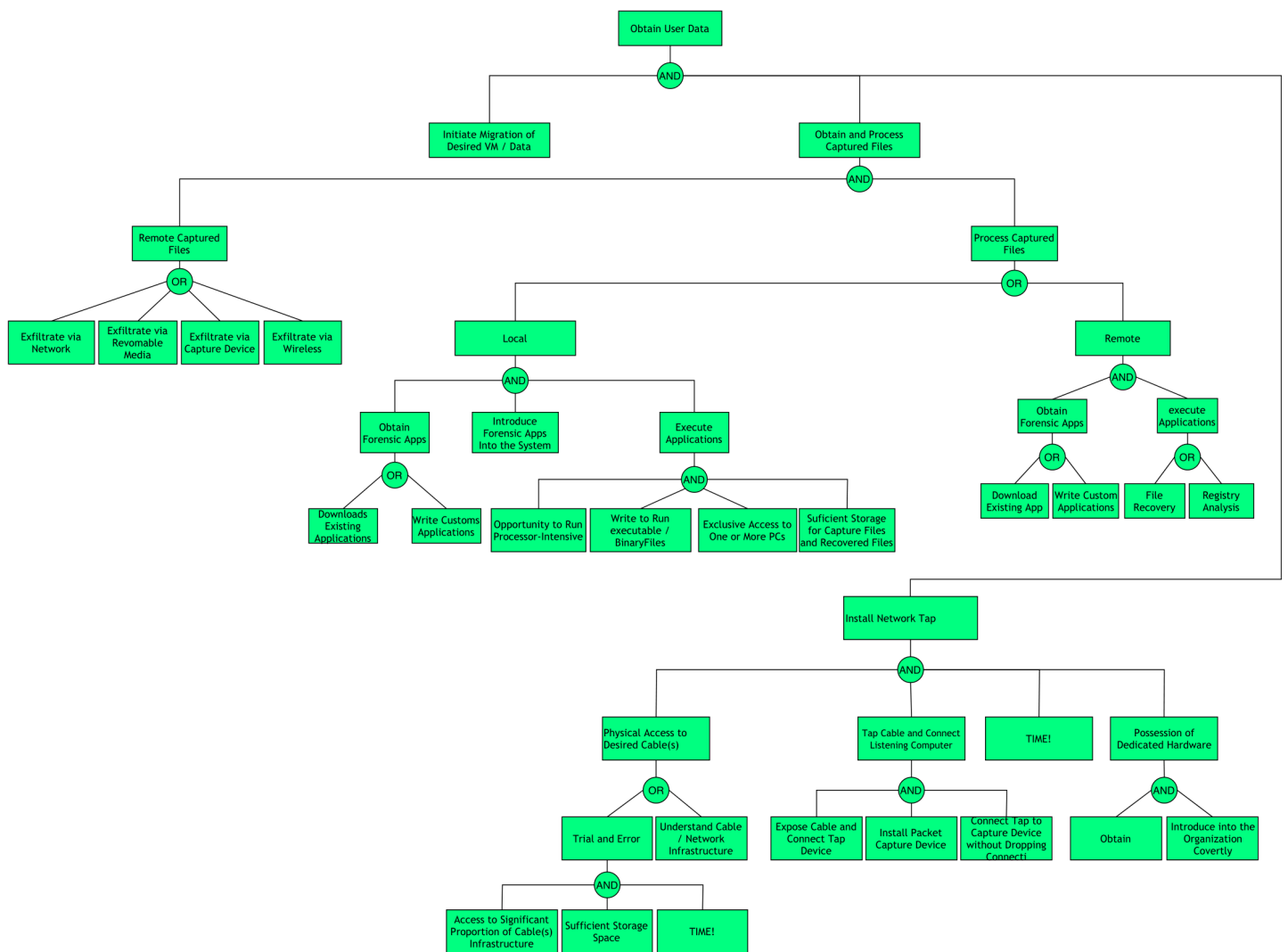
### Attacker Powers

- 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 occur 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.

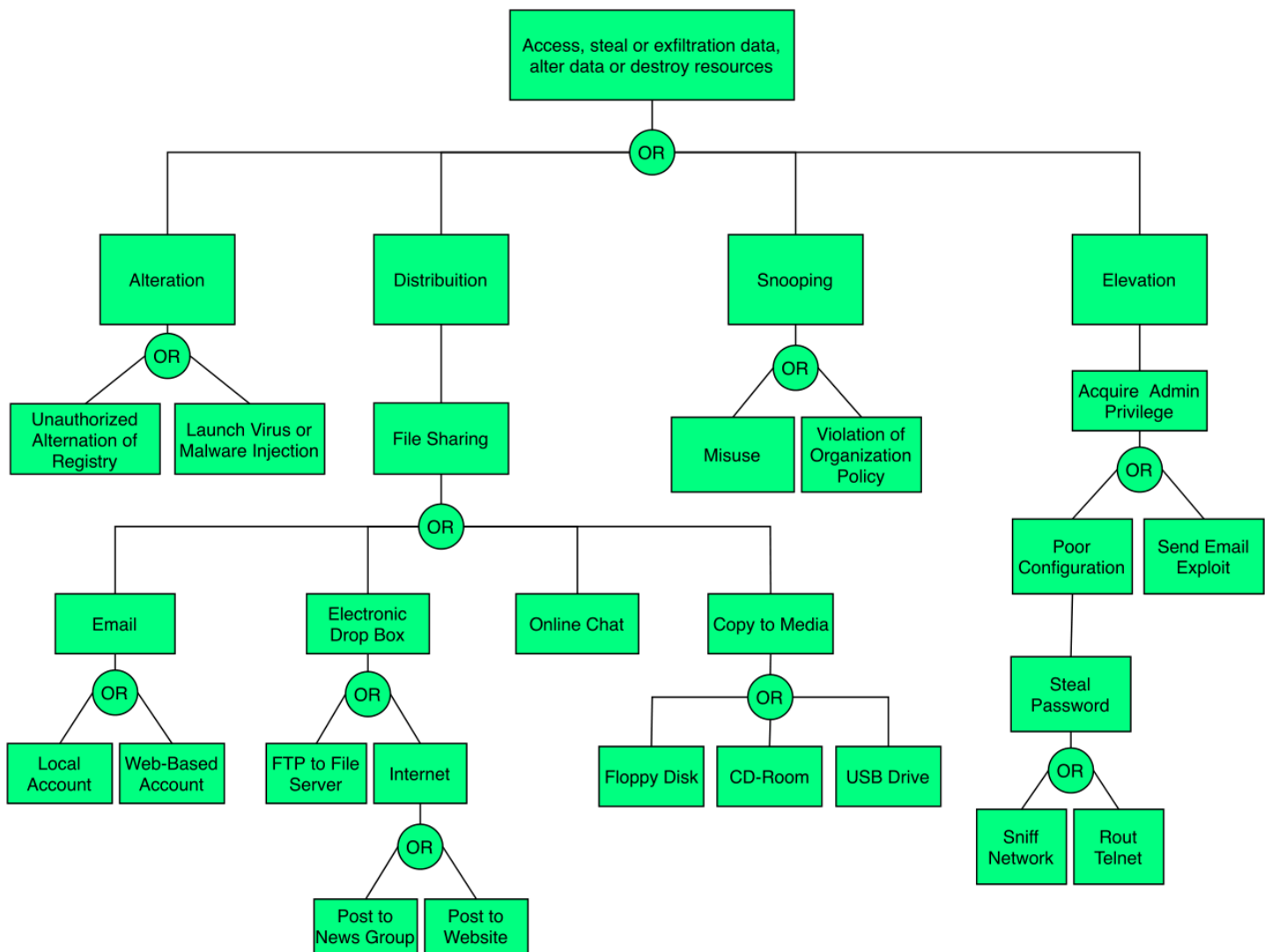
### Attacker Powers

- 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.

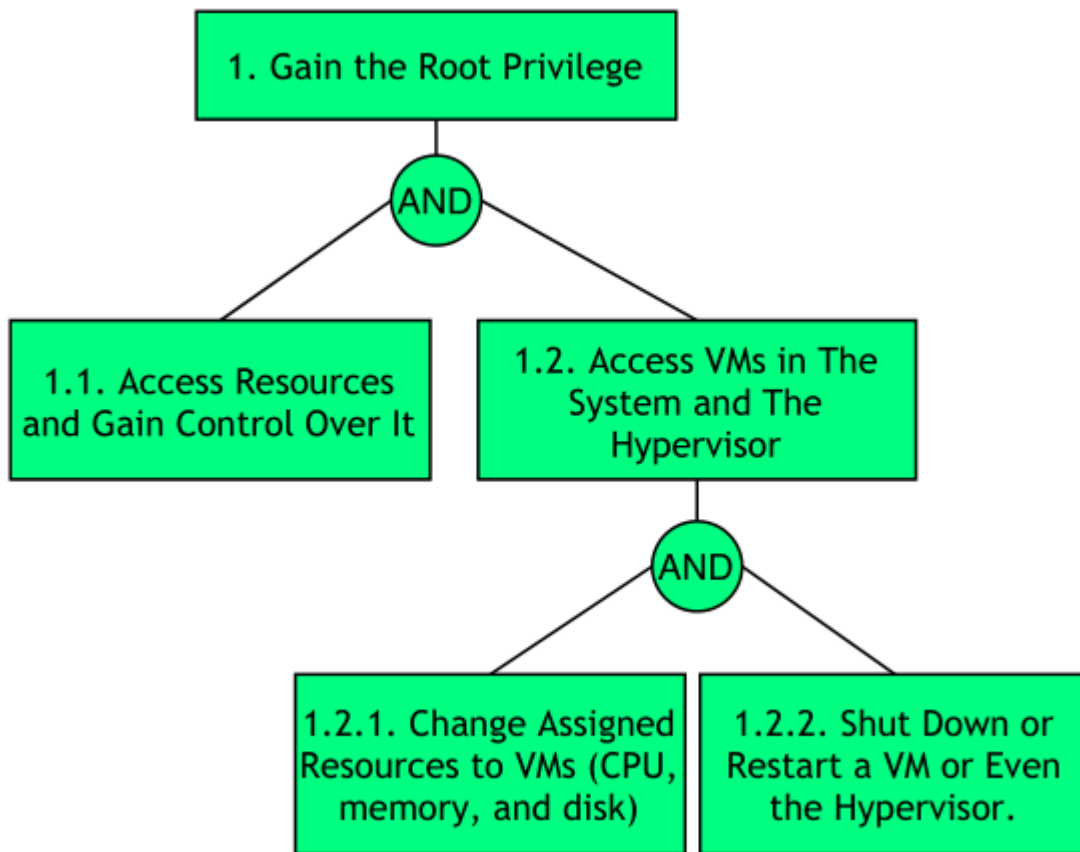
### Attacker Powers

- 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.

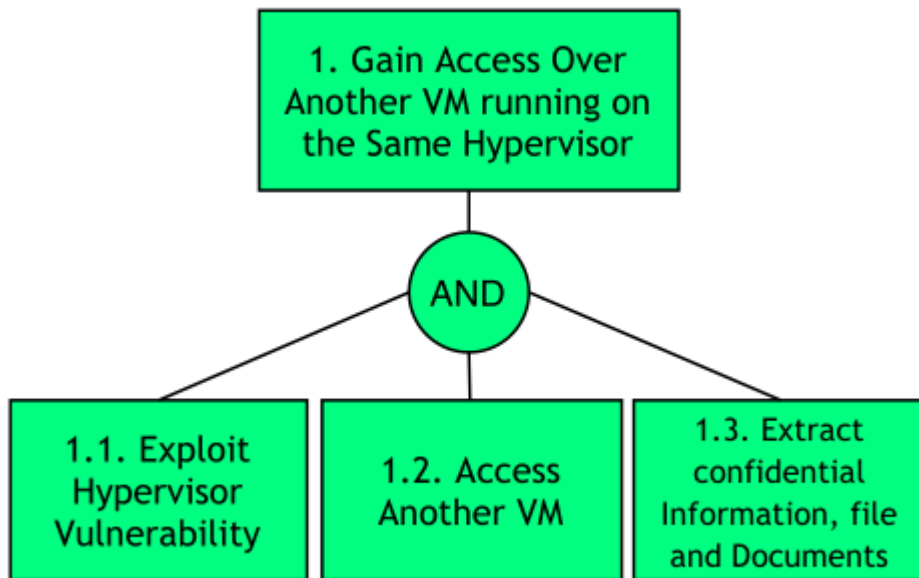
#### Attacker Powers

- 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

