Mobile Devices have made us the most monitored individuals in history

SEM2220 - Assignment 4

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1 Introduction

There has been a lot of news in the press in the last year about surveillance programs run by many countries security agencies, particularly focused on the collection of phone records by the National Security Agency (NSA)[1].

It comes as no surprise that this has brought about the question:

"Have mobile devices made us the most monitored individuals in history?"

To fully understand the depth of this question, one must consider the technical methods which are employed to monitor mobile devices and how these methods differ across different mobile platforms. In hand with this, one must investigate the methods for preventing unwanted monitoring on mobile devices and how effective these methods really are.

Finally there are many legal and professional issues which govern the collection of data from mobile devices; but there are also a host of ethical and social issues which legal and professional element cannot, necessarily, cover.

Of course monitoring of data, especially from mobile devices, doesn't have to be used for nefarious purposes. Applications commonly use data mining techniques to provide a better experience for their users and cloud services are so popular that imagining a world where all a users data is stored solely on a single device is almost impossible.

2 Technical Methods for Monitoring Mobile Devices

Because of the structure of the Global System for Mobile Communications (GSM), any mobile device which accesses the mobile network can be tracked to, at worst, the nearest cell tower. In fact the NSA is known to use this data to track targets and identify possible accomplices[2]. There are also other stories of UK public organisations performing similar actions[3][4].

Though this is a worrying concept, there is some important information that the U.S. has given in [5] which denies that any information collected cannot be used to target any individual without a prior specific and documented reason to do so. In the case of monitoring of non-U.S. citizens there must also be a agreement with the country of their citizenship.

It is the monitoring which the users agrees to have performed upon them that is perhaps more worrying.

Mobile devices, especially tablets and smart phones, have a range of sensors which third-party applications may be able to access. These sensors typically include a camera, microphone, WiFi antenna and GPS system. As technology progresses the accuracy of these sensors is increasing and other sensors such as accelerometers are becoming more prevalent.

It could, therefore, be easy for an attacker to write a malicious application which simply monitored the GPS location of a person or recorded their conversations through the microphone. Or even use any of these systems combined to gather a lot of sensitive data.

There have been cases which have been formally investigated[6] in which legitimate applications collect data from users on the side, which are then sold to other companies for advertisement revenue.

However, a lot of applications have legitimate uses for these sensors. Most applications require network access to load data from external servers. More specific applications, which perform tasks like route tracking, will require the use of more than one of these sensors.

3 Protection Against Unwanted Monitoring

Unfortunately, due to the structure of the GSM network, as long as a mobile device is on and allowed to connect to the network it can be tracked. With the addition of a Subscriber Identity Module (SIM) card it can even be tied to a specific individual. Under [7]

Modern mobile platforms typically have some sort of security system and ways in which applications can be given access to secure elements of the mobile device. Most of these platforms sandbox third-party application allowing the kernel to control the access to the various facilities of the device.

3.1 Android Security Facilities

[8] describes the methods that the Android system uses to secure the environment. The main advantage Android gains in this area is that uses Security-Enhanced Linux (SELinux), which confines the access of programs based on different policies.

Android adds many features on top of this, the most applicable of these to the question of monitoring is the permission model. For a third party application to access protected APIs such at GPS positioning or network connections they must implicitly define which of these elements they require in the manifest file of the application.

This information is displayed to the user when they first install the application and when the application updates to add new access to secure APIs.

There are also certain APIs which are not available to third-party applications, but which may be used by pre-installed applications if they are signed as part of the OS.

Because applications are sandboxed from one another it should be an impossible task to gain confidential information from another application, unless it provides it somehow.

3.1.1 Additional Security Features Provided by the Google Play Store

Obviously, telling legitimate use of secure API elements from illegitimate use is not an easy task, especially for automated systems.

In the mobile ecosystem, the typical method of performing this is to have a trusted place, where developers can distribute their applications. In the case of Android this is usually the Google Play store, however other stores such as the Amazon Appstore do also exist.

The maintainers of such places can then regulate the applications accepted, monitor them for any malicious activities and remove them where needed. Google even added a service in 2012 which scanned the Play store for applications with a malicious intent by running them on a range of emulated services[9].

3.2 iOS Security Facilities

[10] defines the methods that the iOS system uses to secure the environment. Similar to Android iOS third-party applications are sandboxed from each other, although a lot

of this is done by the iOS runtime. All applications have their own file spaces which can only be accessed through the iOS defined API.

Access to secure API elements is defined through entitlements; signed key-value pairs specific to applications. However, it should be noted that these entitlements are not required to access elements such as the GPS or microphone and are more typically used by system applications and daemons to perform tasks that would typically require root access.

The iOS ecosystem is heavily reliant on the Apple App Store to provide security against the malicious collection of data from iOS applications.

4 Implications of Mobile-based Monitoring

This section will focus on the four main implications of developing software which gathers data from mobile devices; legal, professional, social and ethical.

4.1 Legal Implications

There are several laws which govern the legalities of computer software and the storage of personal data. The notable laws which apply to the monitoring of data gathered by mobile devices are:

- Data Protection Act[11]
- Computer Misuse Act[12]

Other laws may still apply to the process of developing the software which performs this, but are less relevant to the actual collection of data.

4.1.1 Impacts of the Data Protection Act

Monitoring data undoubtedly also means storing data and any computerised data falls under the Data Protection Act; therefore, any monitoring is going to be affected by the Data Protection Act.

Information Commissioner's Office (ICO) has released guidelines[13] on the use of cloud computing and how it can be kept legal within the Data Protection Act. These mainly state that it is essential to have a contract in place with a trusted cloud storage provider that will adhere to UK law. This might be especially difficult with many cloud providers being non-UK or even -EU based.

The EU has made agreements with the US government for a safe harbour for private data that could be stored on US servers[14], this does help with some issues that storing data on a non-EU cloud, but given the way in which clouds tend to operate, there is no non-contractual way in which this can be guaranteed.

4.1.2 Impacts of the Computer Misuse Act

The Computer Misuse Act does not affect the use of mobile devices for monitoring purposes as much as one would suspect. The main issue comes that section 1 of this act defines misuse as "the unauthorised access to computer material"[12]. Sections 2 and 3 also define other forms of misuse, but as monitoring would fall under the access of computer material, they do not apply.

The problem comes that the access could be implied simply by the user installing the application. Most applications will also have terms and conditions or will be distributed in such a way that the user is accepting the access to information providing by sensors before they install the application (e.g. the Android permission system).

Obviously, if an application could hide the fact it was collecting data from a permission system and does not disclose this use in terms and conditions, then an argument could be made that it is breaking this act.

4.2 Professional Implications

Section 1.a of the BSC Code of Conduct states that "[You shall] have due regard for the public health, privacy, security and wellbeing of others and the environment"[15]. This would imply that you must secure any data collected through the monitoring of mobile devices. Having due regard for an individuals privacy, might also imply that the results of the monitoring must be kept private, and not, for example, sold to another company to generate revenue.

Section 2.f also discusses avoidance of malicious and negligent action which could imply that any professional should not be developing a system which monitors mobile devices for malicious purposes.

4.3 Social Implications

There is a lot of good that can come from the monitoring of mobile devices and as mentioned there may be many good reasons for application developers to perform monitoring. Android 4.0 added the ability to monitor roaming data usage, so a user could set a warning message when they reach a certain amount of usage, and to cap their usage at a different limit[16]; this feature gives the user more control over the use of their mobile phone, and prevents them from spending more than they need to on their phone bill.

Given that less that 1% of all UK premises receive no 3G connection from any provider and that only around 23% of all geographical areas in the UK receive no 3G connection from any provider[17] and that the figures for 2G connections are even less, it is difficult to not be connected to a form of network. With the recent adoption of 4G networks these figures are likely to decrease even further.

Given that a lot of services provide synchronisation to the cloud, it is difficult to escape the pressures of work when emails can be delivered to a mobile device so easily. There have been studies into the affects of using email constantly against taking vacations from emails leading to reduced stress and increased productivity[18]. Similar studies have also been performed on the mental welfare through the increased use of Facebook[19], where increased use lead to the increased chances of depression in young adults.

Monitoring data could be one of the possible reasons why there are such stresses in modern day life, but it could also allow stress to be reduced by limiting access to certain applications or suggesting improvements to fitness and diet.

4.4 Ethical Implications

The final consideration is that of ethics; it may be legal, professional and socially acceptable to develop an application which monitors some information from a users device, but the purpose or reasons for doing so may not be ethical.

Of course ethics are a very personal viewpoint, to help standardise ethics, the Computer Ethics Institute has released ten commandments[20] which, if followed, would deem a application ethical.

The author has his own views on what makes an application ethical; using Android as an example, there should be a reasonable explanation as to why an application wants to access a protected API and this reason should be presented to the user, rather than just the protect API elements an application has.

5 Conclusions

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