CASE STUDY

Is rooted mobile the right solution for wireless network testing?

Introduction

In the last few years, rooted phone-based drive test (DT) tools have gained popularity among service providers' radio network optimization teams and network optimization companies. Lately, many software services companies have entered this domain, despite their limited depth in test and measurement.

In simple terms, a rooted phone-based DT solution enables one's smartphone to become a radio network measurement device. The solution has the potential to replace the phone-laptop-GPS combination that has been used for network troubleshooting and optimization since the 2G wireless network days. On the surface, this may seem like an excellent idea, but there are downsides.

The intent of this white paper is to examine the rooted mobile solution, why it is being used as a DT tool, and provide a recommendation for when to use rooted mobile, considering the upsides and downsides.

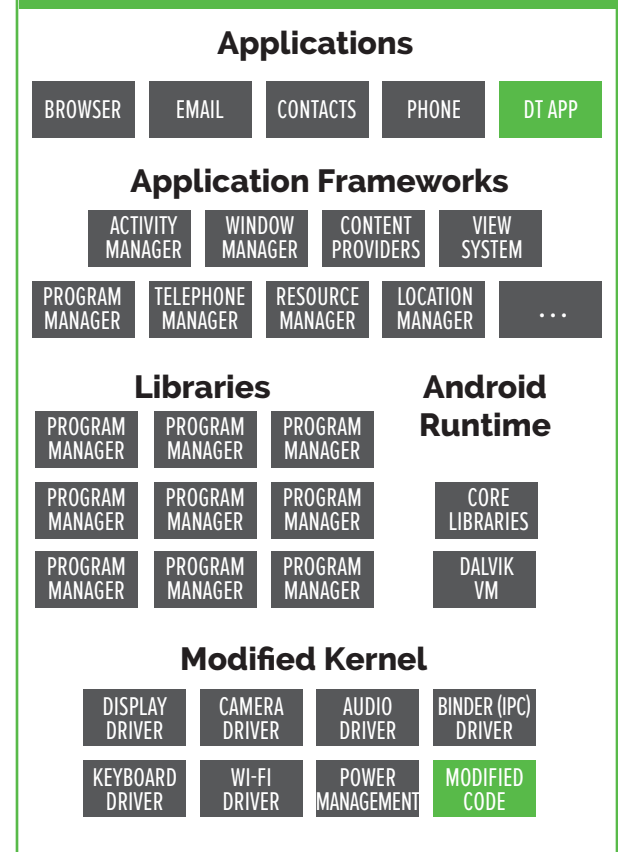### So, what is phone rooting, after all?

Smartphone vendors consider phone rooting the act of jailbreaking a device. Regardless of whether it is an "authorized" or "unauthorized" jailbreak, it results in the modification of the mobile Android OS kernel. That modification allows the DT tool vendor's software to be installed as an app on the phone (see Figure 1). After it is jailbroken, the phone is ready to start collecting and displaying network KPIs for network troubleshooting and optimization.

Why use a rooted phone for wireless measurements?

Simply put, a rooted phone offers greater convenience for wireless measurements. A smartphone that can display and capture a variety of network KPIs is a dream come true for RF optimization engineers and technicians. It eliminates the need for bulky add-on gear, like a laptop with a complex set of connecting wires for GPS and power supply units. As such, it is seen as an easily scalable and economical solution by RF engineering organizations. The solution is also compact, flexible, and agile.

FIGURE 1: ANDROID KERNEL MODIFICATION TO ACCOMMODATE DT TOOL SOFTWARE

Applications

BROWSER · EMAIL · CONTACTS · PHONE · DT APP

Application Frameworks

ACTIVITY MANAGER · WINDOW MANAGER · CONTENT PROVIDERS · VIEW SYSTEM

PROGRAM MANAGER · TELEPHONE MANAGER · RESOURCE MANAGER · LOCATION MANAGER · …

Libraries

PROGRAM MANAGER · PROGRAM MANAGER · PROGRAM MANAGER

PROGRAM MANAGER · PROGRAM MANAGER · PROGRAM MANAGER

PROGRAM MANAGER · PROGRAM MANAGER · PROGRAM MANAGER

Android Runtime

CORE LIBRARIES

DALVIK VM

Modified Kernel

DISPLAY DRIVER · CAMERA DRIVER · AUDIO DRIVER · BINDER (IPC) DRIVER

KEYBOARD DRIVER · WI-FI DRIVER · POWER MANAGEMENT · MODIFIED CODE

Factors to consider when using a rooted phone as a DT tool

A rooted phone is NOT the same as regular phone

A rooted smartphone is NOT the same as an off-the-shelf phone. Modifying the phone OS kernel fundamentally changes the phone itself. Moreover, once a phone is rooted, the mobile OS updates stop, and any new features rolled out by the service provider are not supported.

Capturing valid user experience

During the days of 2G wireless networks, DT tool vendors would provide a custom DT phone to measure network KPIs, and it was assumed that other phone models would function and perceive the network the same way.

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This logic worked reasonably well then because voice was the primary application. Gathering voice KPIs was the main focus for RF optimization teams.

Today, DT tools can interface with the latest smart-phones and capture relevant user experience KPIs – for a wide variety of data applications as well as voice. Subsequently, wireless carriers want to use these tools to gauge the experience of all new smartphone users. The problem is, as mentioned earlier, a rooted phone is NOT the same as a regular phone. Using a rooted device defeats the purpose of measuring the new phone's user experience. This is the biggest downside of using a rooted phone as a DT tool.

Proper measurement of voice/VoLTE quality

Since rooted phones do not simulate actual voice conversations, they cannot provide accurate voice/VoLTE quality Mean Opinion Score (MOS) measurement. Simulating a real voice conversation requires the soundwave to be generated externally (i.e. simulating a person talking to the phone) and not internally inside the smartphone (see Figure 2). For the same reason, a rooted phone DT tool cannot measure VoLTE mouth-to-ear (M2E) delay accurately.

Other considerations

» Rooting delays. It takes time for jailbreakers to figure out jailbreaking shortcuts. Therefore, it can often take months to root a new model of smartphone.

» Security concerns. Rooting a phone prevents future operating system updates, which directly impacts the security of the device. Users must then be actively responsible for protecting the phone's applications and data.

» Warranty issues. Rooting, particularly when it is unauthorized, effectively voids a smartphone's warrantee.

A current trend in rooting: The authorized jailbreak

With the advent of mobile payments, security has become extraordinarily important and smartphone vendors have made phone rooting extremely difficult. As an alternative, they have come up with what could essentially be called an "authorized" jailbreak using a "token." In this system, DT tool vendors buy the tokens, notify the smartphone vendor of their intent to access and modify the OS kernel, and install their DT app. However, this method could potentially remove the cost advantage of phone rooting while maintaining the downsides.

FIGURE 2: Accurate voice/VoLTE MOS measurements need external voice simulation
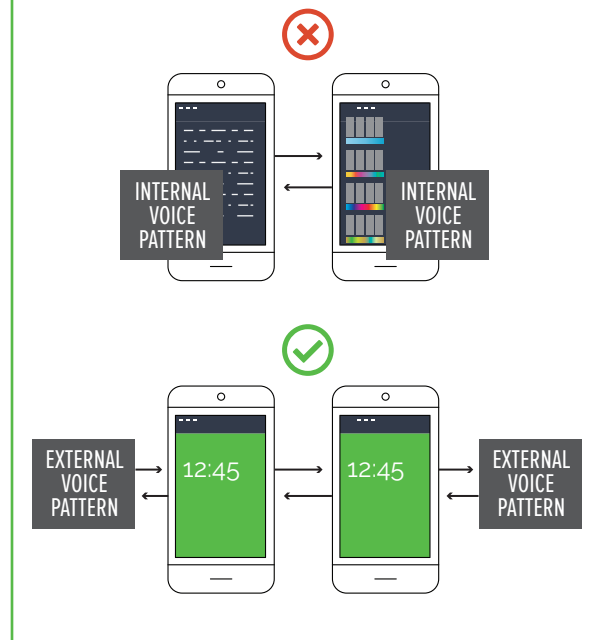
To root or not to root?

To summarize, a rooted phone is not the same as a regular off-the-shelf phone, and its radio measurements cannot be used to gauge the real experience of that phone model's user base. Given these factors, is rooting still worth it?

There are scenarios where a rooted phone can work for network optimization, and some where it will not. If aiming for a generic view of a network's quality, a rooted phone (whether it is a current or past model) will likely deliver similar results to a regular off-the-shelf phone. However, if the intent is to understand the real experience of smartphone users, rooted solutions could offer potentially misleading results. Wireless service providers, benchmarking companies, and network optimization service companies need to weigh the pros and cons to best decide.

FURTHER READINGS

Hildenbrand, J. (2016, June 6). Everything you need to know about rooting your Android. Android Central.

Summerson, C. (2018, January 21). Rooting Android just isn't worth it anymore. How-To Geek.

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