Custom Android ROM's

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Abstract - *Various aspects of Android rooting, getting Superuser permission, and moving from a stock to a custom ROM are explained in this article. It covers topics such as what is rooting, stock ROMs, and custom ROMs, how to install them, and the benefits and drawbacks of installing and using custom ROMs.*

Key Words: Android, Root, Custom ROM, Stock ROM

1. INTRODUCTION

A ROM is the operating system of the device. It is the device's firmware. When purchasing an Android device, it by default comes with a pre-installed ROM, which is known as the "stock ROM". These stock ROMs may include custom UX designed by the manufacturer of the device. For example, Samsung has O UI, Oneplus devices come with Oxygen OS, and Oppo has Color OS. These stock ROMs come with a lot of restrictions, fewer features, and less customizability. These restrictions can be removed by unlocking the bootloader of the device and flashing a custom ROM based on the Android Open Source Project. For example, if you own a Xiaomi phone running MIUI as the default UI, you may install a custom ROM with a stock Android interface or another UI. Aside from these, there are several additional advantages to utilizing a custom ROM, like bloatware-free operating systems, ad-free UI, and, most crucially, the most recent security updates and the Android versions, which increase the phone's security and privacy.

2. FUNDAMENTALS

2.1 Bootloader

A bootloader, as its name suggests, loads the boot image, i.e., the kernel image, to start the operating system. It is a vendor-proprietary image that boots first and loads the kernel and ramdisk images into the memory, which defines the start of the operating system. By default, it is locked by the OEM to prevent modification and to maintain the integrity of the boot and the recovery partition. But the user can choose to unlock the bootloader using a specific toolset. Some OEMs require the user to have permission to unlock the bootloader, although they provide the necessary tools to unlock. [7]

2.2 Rooting

Rooting is the process of gaining administrative rights, more commonly known as "Superuser," to modify the Android system. It allows the user to modify the system files and grants low-level access to the hardware itself. [3]

2.3 Recovery mode

It is a separate partition in the Android system that handles the updates of the Android system and provides tools for the user to format, mount, or backup various partitions such as system, vendor, data, cache, and Dalvik cache. By default, OEM recovery does not allow these features, except for formatting and flashing OEM-signed updates. To boot into the recovery mode, specific key combinations need to be held. Most commonly, it is Power + Volume UP on the latest devices. [2]

2.4 Fastboot

Fastboot is a tool that allows flashing images, especially custom recovery images, using an Android debugging bridge from a computer using a specific set of commands. [1]

3. FLASHING CUSTOM ROM

3.1 Prerequisites

Unlocked bootloader
ADB drivers
fastboot drivers
Custom recovery
Custom ROM
Gapps(optional)

3.2 How to unlock the bootloader?

The method for unlocking the bootloader varies according to the device owned. For Xiaomi phones, there is usually a tool named "Mi Unlock Tool" to unlock the bootloader of the device. For generic devices, there is a fastboot command called "**fastboot OEM unlock.**"

3.3 How to flash a custom recovery?

1. Make sure the device's bootloader is unlocked.
2. Boot to fastboot mode using specific key combinations for your device. In my case, Power + Volume Down on the Xiaomi Redmi Note 7 Pro (violet).
3. Download the device-specific recovery from XDA developers (Team Win Recovery Project (TWRP) is preferable).
4. Using **fastboot devices** check if the drivers are installed properly and if the device is detected in fastboot mode. Now flash the recovery using the **fastboot flash recovery "location of the**

recovery file" command and boot into the recovery using Power + Volume UP.
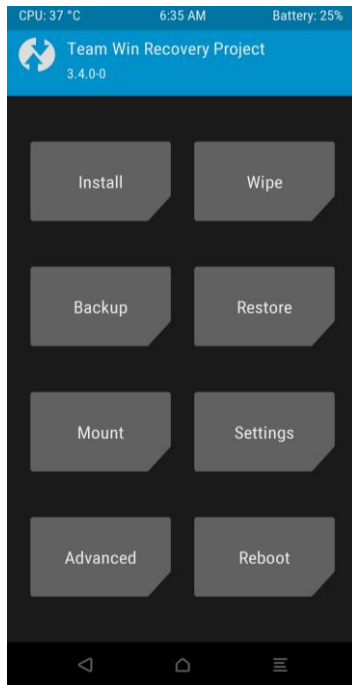

Fig -1: TWRP Recovery

3.3 How to flash a custom ROM?

1. After booting into TWRP recovery, format data to remove MIUI encryption so there are no encryption issues later on.
2. Now wipe the Dalvik/ART cache, Cache, System, Vendor, and Data partitions.
3. Select Install and find your ROM zip file to flash. (Note: The ROM can also be flashed using the ADB sideload feature available in the Advanced menu > ADB sideload. Keep the ROM zip on your PC and use **adb sideload "location of the ROM zip"** to start flashing the ROM.
4. Once the ROM is flashed, reboot the device, complete the setup wizard, and you can enjoy the completely new UI with extra features, bloatware, and an AD-free user interface. [5]
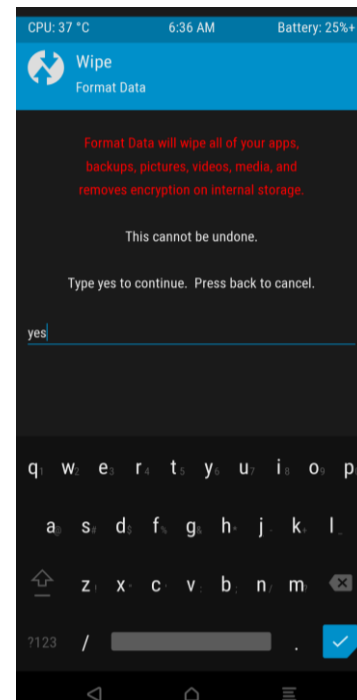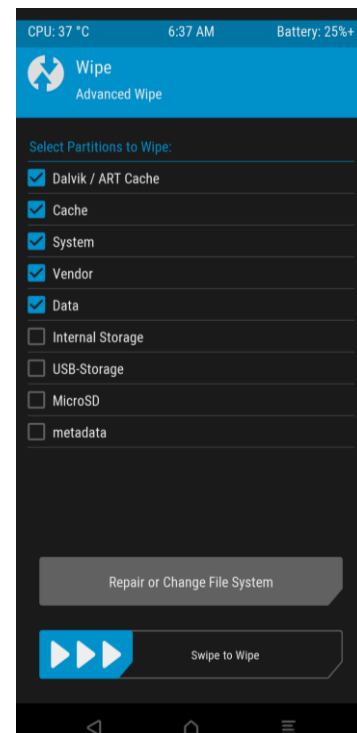

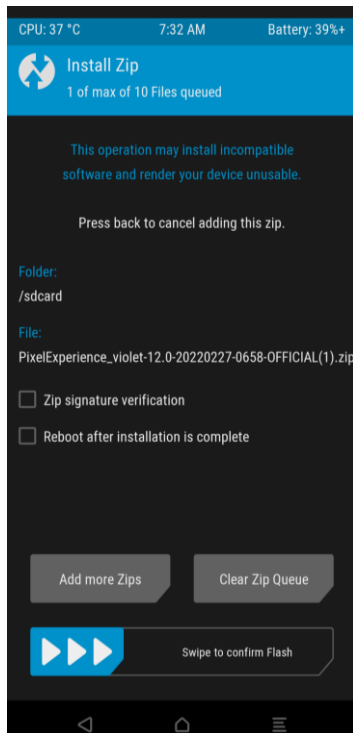**Fig -2**: Format Data

Fig -3: Wipe Partitions

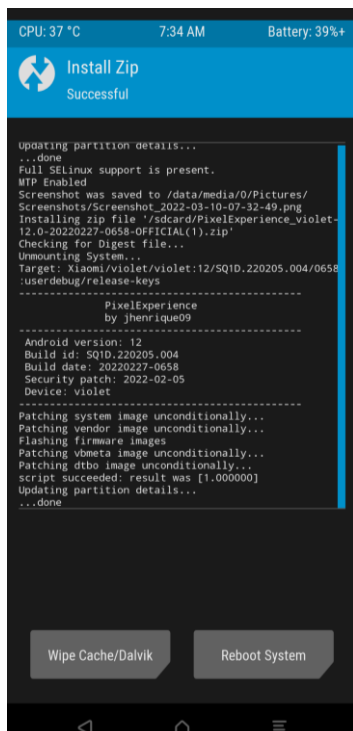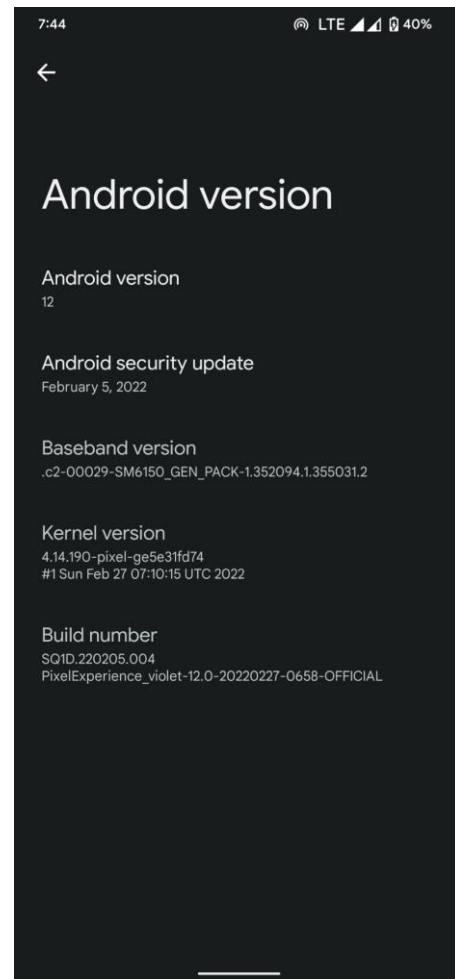**Fig -4**: Install ROM

Fig -5: ROM Flashed

Fig -6: ROM Booted

4. HOW TO ROOT THE DEVICE?

To obtain superuser rights or root the device, flash magisk using a similar method after flashing the ROM.

5. BENEFITS OF FLASHING CUSTOM ROM

1. Faster Android updates since the user do not have to rely on the manufacturer to release the update. Manufacturers usually cease delivering updates after two years, but because custom ROMs have device-specific developers working on them, they give long-term support.
2. The delivery of periodic security fixes enhances device security and prevents vulnerabilities.
3. Driver updates and kernel enhancements improve device performance, to some extent, and lengthen battery life.
4. Unnecessary system apps can be uninstalled easily.
5. Custom ROMs provide plenty of customization options while also ensuring stability.
6. The user may effortlessly backup crucial partitions on the phone.

6. DISADVANTAGES OF FLASHING ROM

1. If the user does not follow the procedures correctly, the device may be bricked and rendered inoperable.
2. The user has two options when flashing the ROM: stay encrypted or stay decrypted. If the user chooses to stay decrypted and the phone is stolen, the thief can retrieve the personal data using the custom recovery. However, if the user remains encrypted, the recovery will request a password to decrypt the data.
3. In some circumstances, the manufacturer does not allow modification to their devices, so if it is discovered that the user has modified the device and unlocked the bootloader, the phone's warranty will be voided.
4. Some custom ROMs may be in a testing phase, so there are chances that users may face bugs and glitches.

7. CONCLUSION

The smartphone has been flashed with an Android 12 based custom ROM called Pixel Experience, which delivers a far more dependable UI than the default MIUI. Furthermore, the manufacturer only supported the device up to Android 10, but with custom ROM support, the device is now running Android 12. To conclude, provided the user follows the necessary instructions and chooses the appropriate techniques, he or she may simply flash custom ROMs on their smartphones without bricking them or worrying about data privacy.

ACKNOWLEDGEMENT

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