# Managing Your Android Phone

*Alan German*

*Ottawa PC Users' Group*

# Motorola G3

- MotoG3 2015 (Osprey)
- Android Lollipop 5.1.1
- Qualcomm Snapdragon 410
- Quad-core, 1.4 GHz
- 8 GB storage, 1 GB RAM

# Android

- Operating system for mobile devices (touch screens)
- Developed by Android Inc.
- Purchased by Google (2005)
- Based on the Linux kernel
- Recent Android versions: Marshmallow, Nougat, Oreo, Pie, 10, 11

# Android

- Android Open Source Project (AOSP)
- Designed for small screens, limited storage and battery life
- Comprehensive system, easily modified
- Android Software Development Kit (SDK)
- Multiple versions – “vanilla” Android, but can also have add-ons, remix, etc.

# Biggest Downsides

- Over-the-air (OTA) updates are only available for a limited time
- OEM's are slow to upgrade
- End-of-life schedule is not well understood (When will your phone's Android OS no longer be supported?)
- Often, there is no path to a new release of the Android OS (So, what then? – There is a solution!)

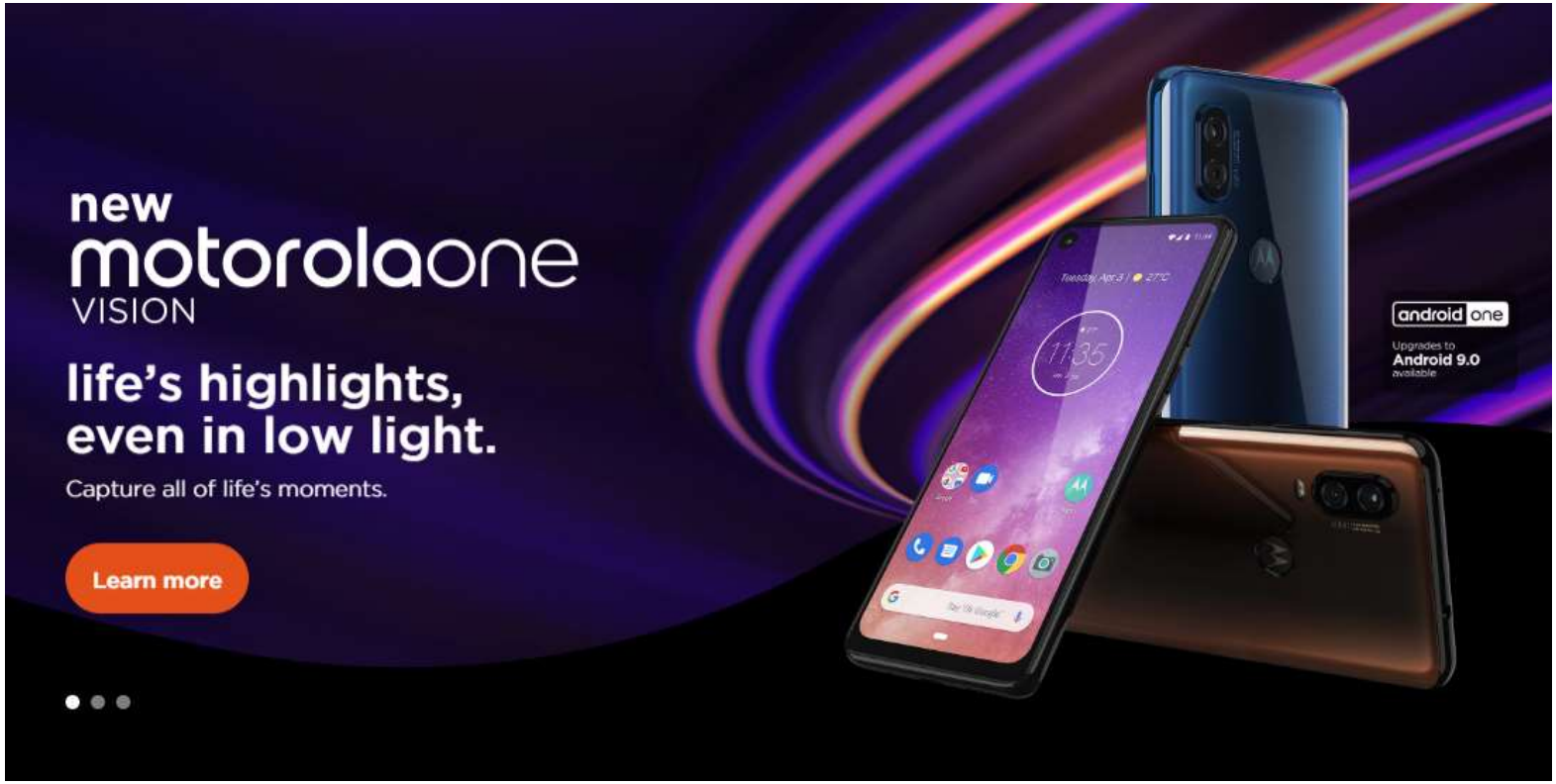
# Google's EOL Policies

**Nexus/Pixel devices:**

Version updates for at least two years
(three years for Pixel)
Security patches for three years
(or 18 months after a device is no longer being sold)

**The rest of us:**

Updates are managed by the manufacturer
System updates may take two weeks
Version updates may be discontinued
after 18 months




Octa-core CPU
128 GB
48/25 Mpx

Buy now

CAD599.99 − 1 +

ADD TO CART

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# YOUR HOME FOR UPGRADES

We know what you're thinking. "Will my device receive an upgrade? How?" Never fear...all the information's right here.

Motorola is committed to regular and timely security upgrades as recommended by Google/Android. While phones cannot be upgraded indefinitely, we provide security upgrades within the industry standard on both our regular and our Android One devices.

The latest generation of Android™ - Android 9.x Pie - has been released to the Android Open Source Project (AOSP). We will be working with our technology and carrier partners to bring it to you.

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# Basic Apps

- Phone
- Message (SMS)
- K-9 Mail* (E-mail)
- Opera* (Browser)
- Contacts
- Camera
- Settings
- Play Store

**** User-installed apps***

# User-Installed Apps

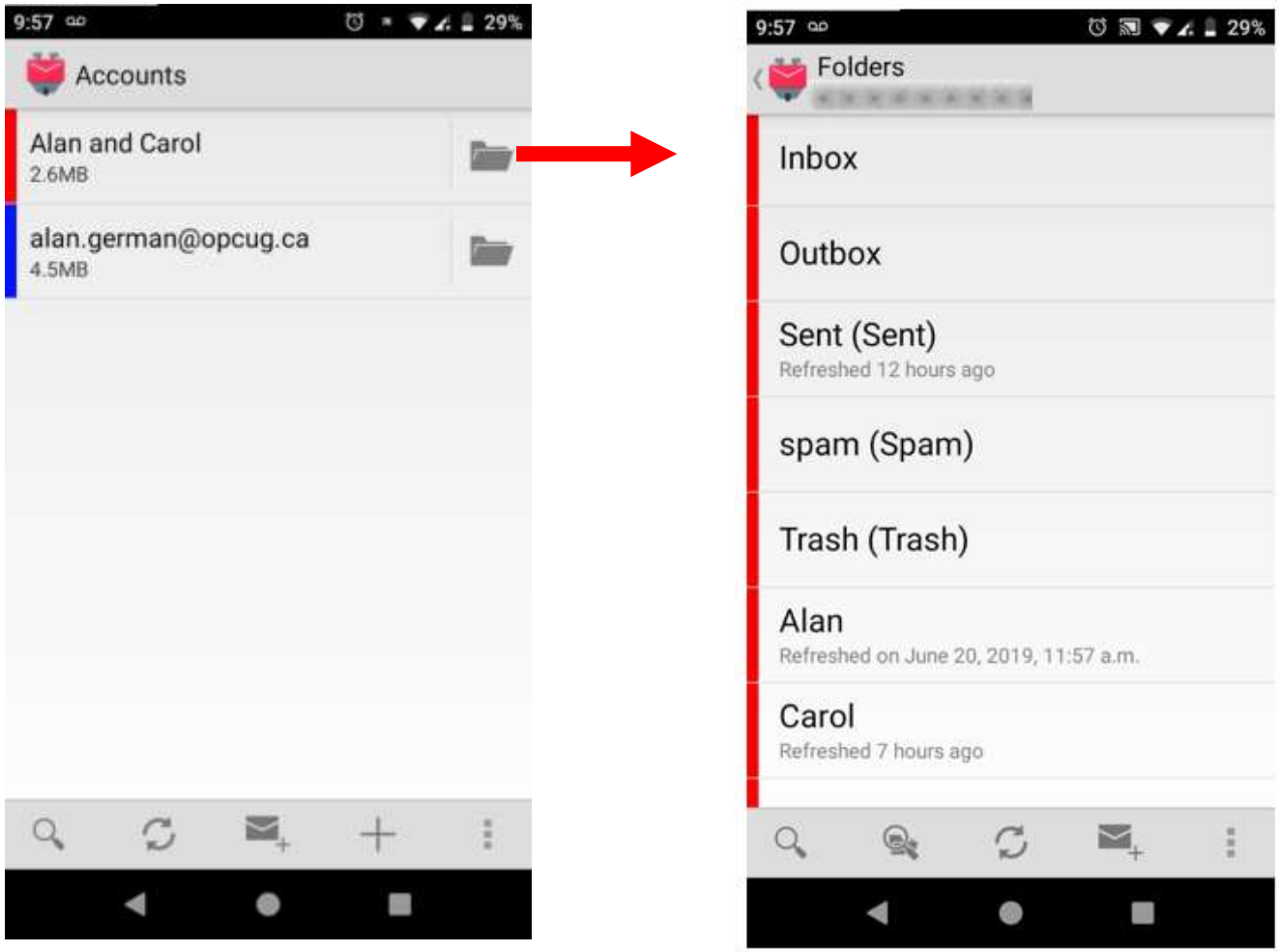
The default apps bundled with the Android OS don't necessarily provide all the required/desired functionality.

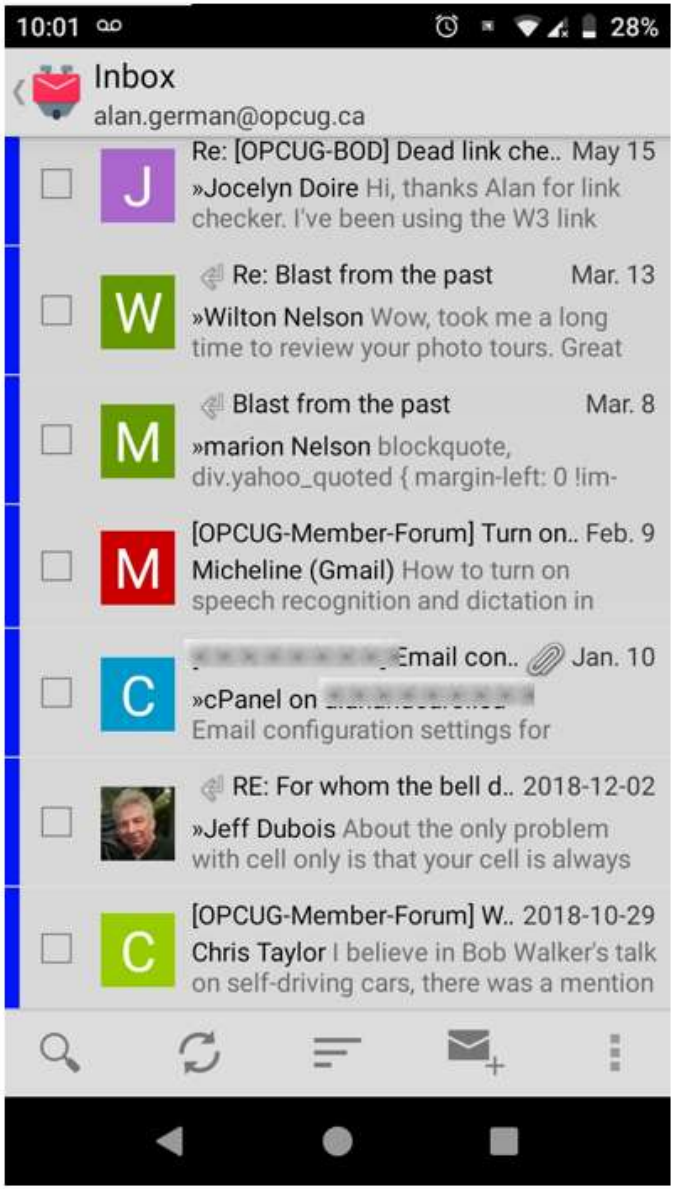
Other apps are available from Google's Play Store (and some third parties – including OPCUG!)

# K-9 Mail
## Multiple accounts and folders

# K-9 Mail

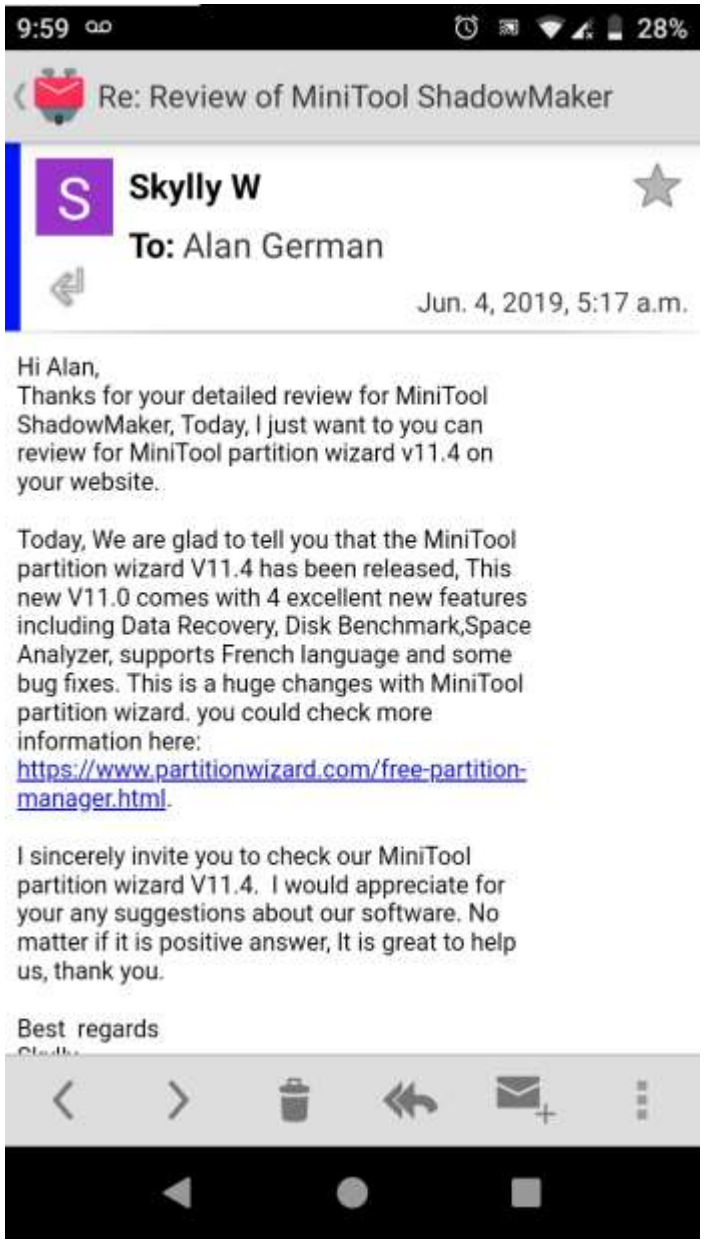
## Multiple accounts and folders



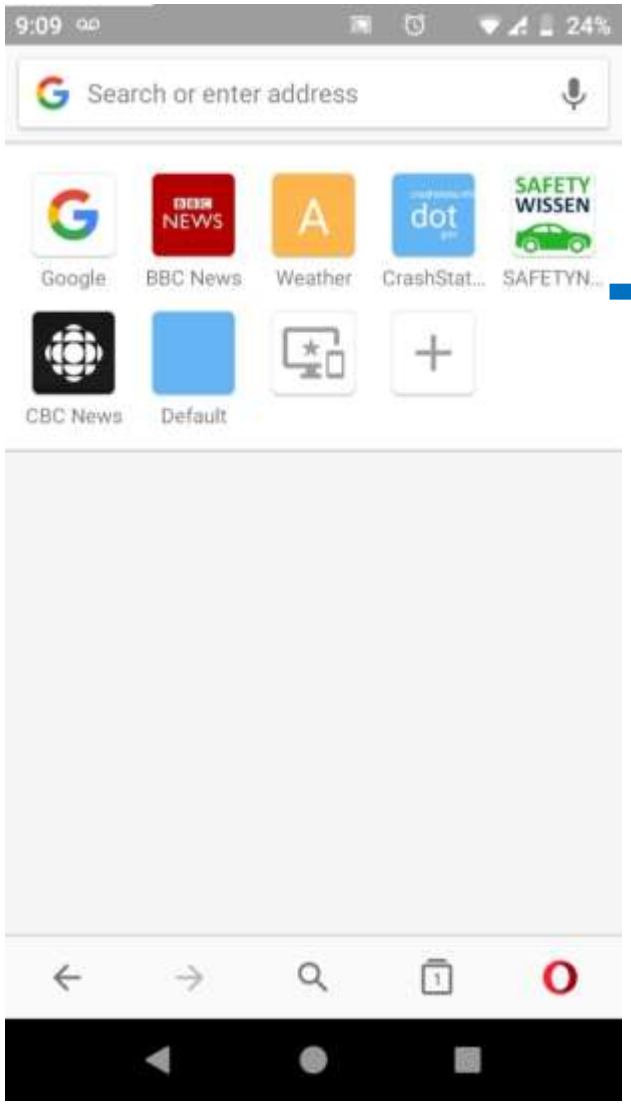



By default, the Inbox is displayed for any account

Click on any message to display the message content


9:59
28%
Re: Review of MiniTool ShadowMaker
S
Skylly W
To: Alan German
Jun. 4, 2019, 5:17 a.m.
Hi Alan,
Thanks for your detailed review for MiniTool ShadowMaker, Today, I just want to you can review for MiniTool partition wizard v11.4 on your website.
Today, We are glad to tell you that the MiniTool partition wizard V11.4 has been released, This new V11.0 comes with 4 excellent new features including Data Recovery, Disk Benchmark,Space Analyzer, supports French language and some bug fixes. This is a huge changes with MiniTool partition wizard. you could check more information here:
https://www.partitionwizard.com/free-partition-manager.html.
I sincerely invite you to check our MiniTool partition wizard V11.4. I would appreciate for your any suggestions about our software. No matter if it is positive answer, It is great to help us, thank you.
Best regards

# Opera

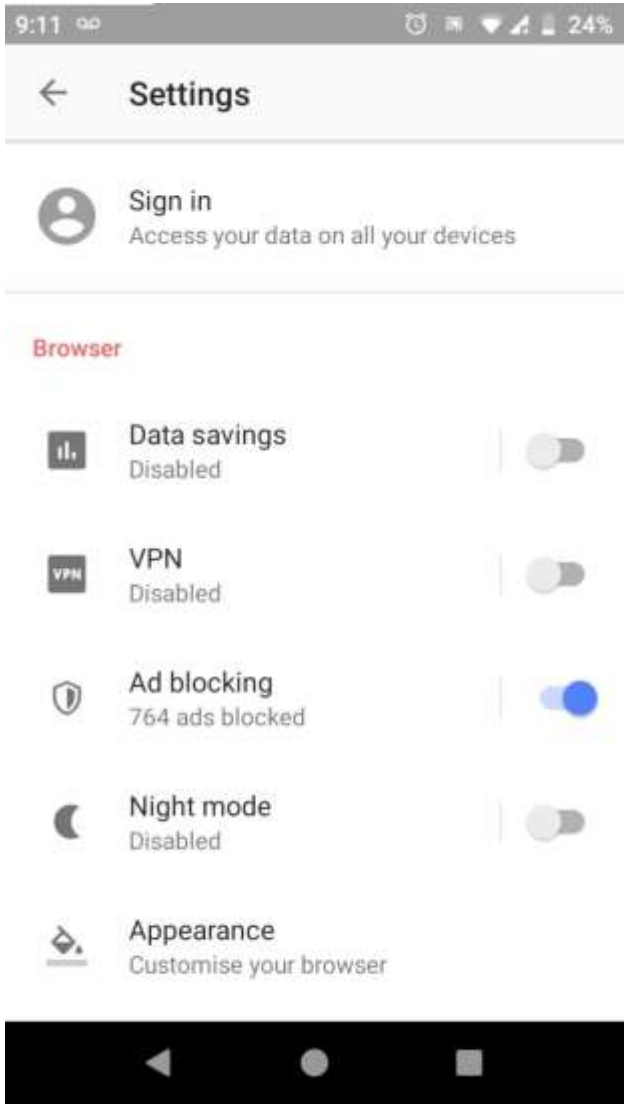



"Speed dial"

# Opera

Google search with dictation

# Opera




Note options for:

Built-in VPN

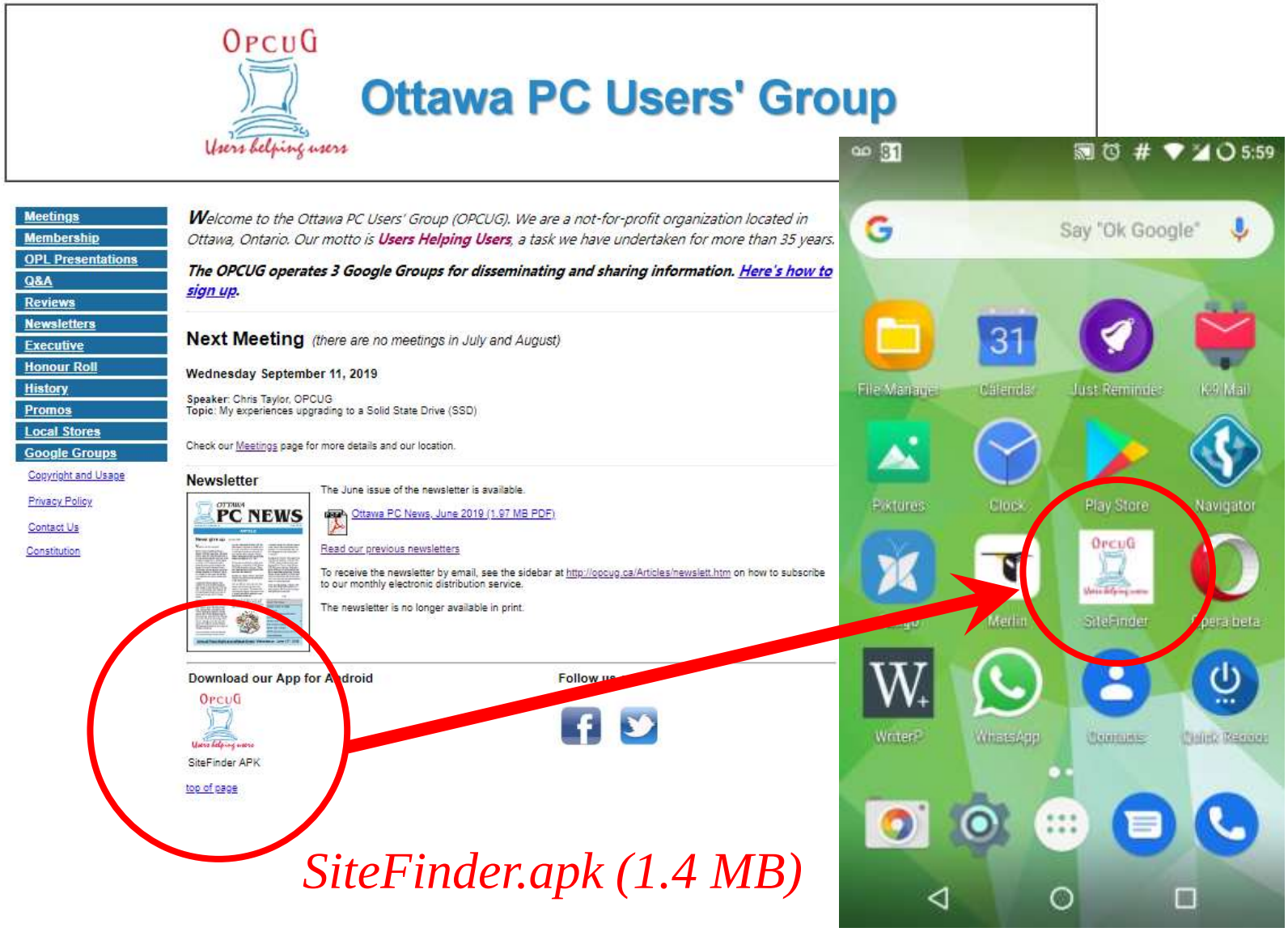
Ad blocking

# Where is opcug.ca?

# Where is opcug.ca?

We have other technology for that!

# SiteFinder




*SiteFinder.apk (1.4 MB)*

*Splash screen*

*Splash screen*

6:11
http://www.opcug.ca/
OPCUG
Ottawa PC Users' Group
Next Meeting
PC NEWS

*Back button*

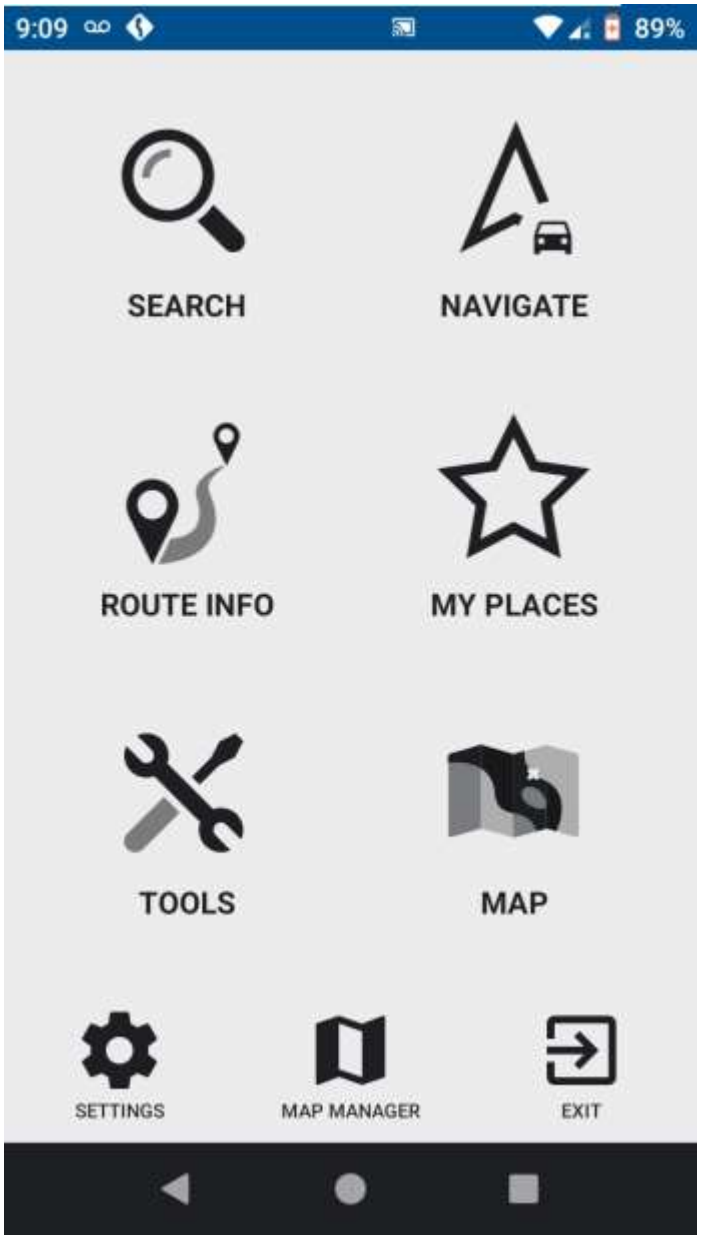
*Live link*

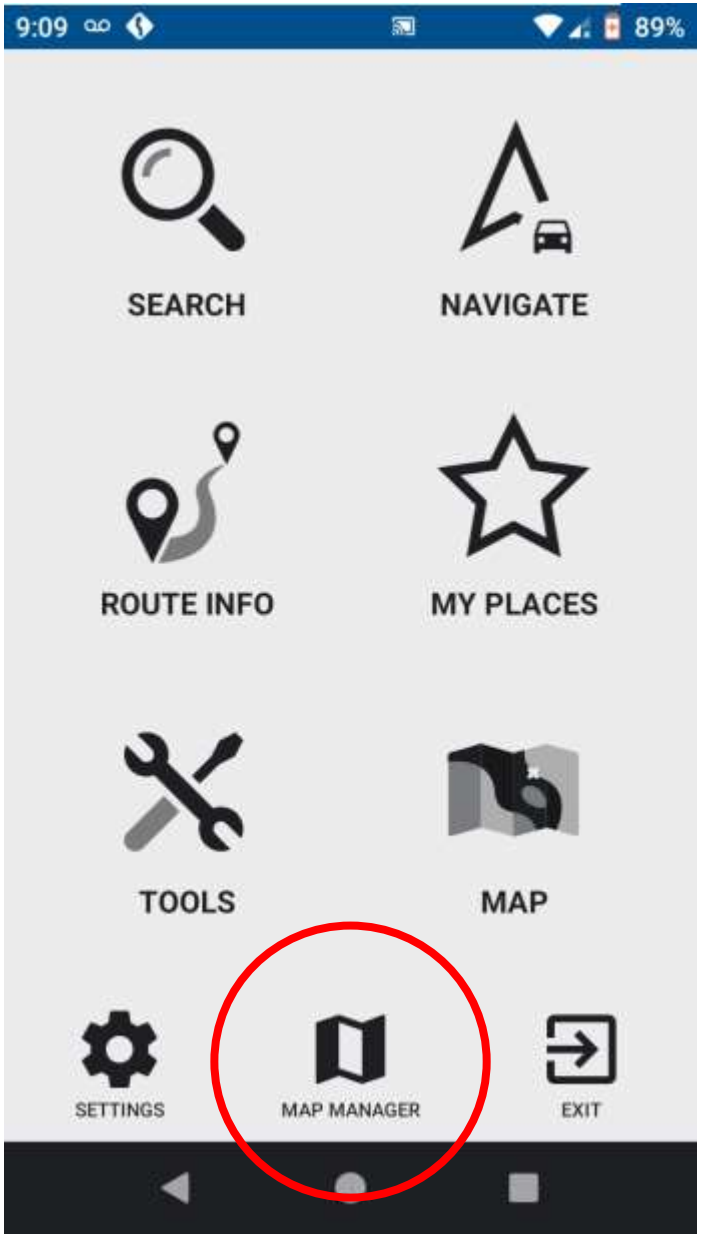
*Back button*

# Some other very useful apps…

**MapFactor Navigator - GPS Navigation Maps**

- Off-line maps
- Worldwide OSM (or TomTom)
- Search address or POI
- Turn-by-turn navigation
- My Places (Favourites)
- Speed/camera warnings


9:09
89%
SEARCH
NAVIGATE
ROUTE INFO
MY PLACES
TOOLS
MAP
SETTINGS
MAP MANAGER
EXIT


9:09
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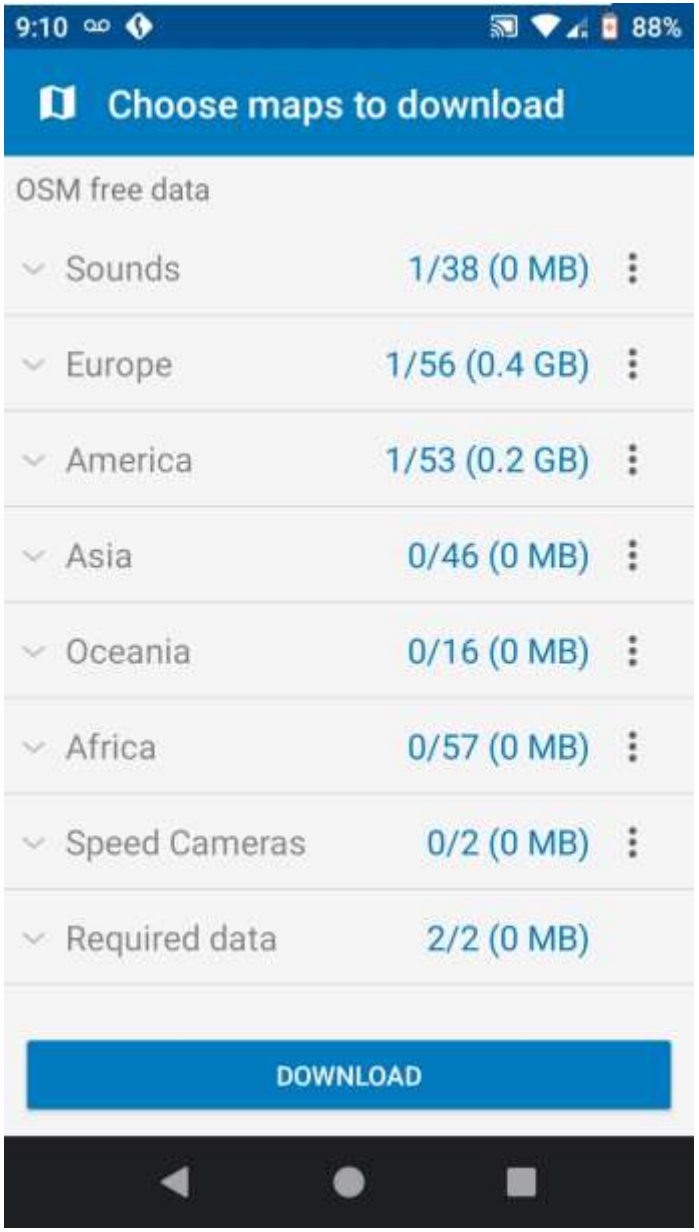
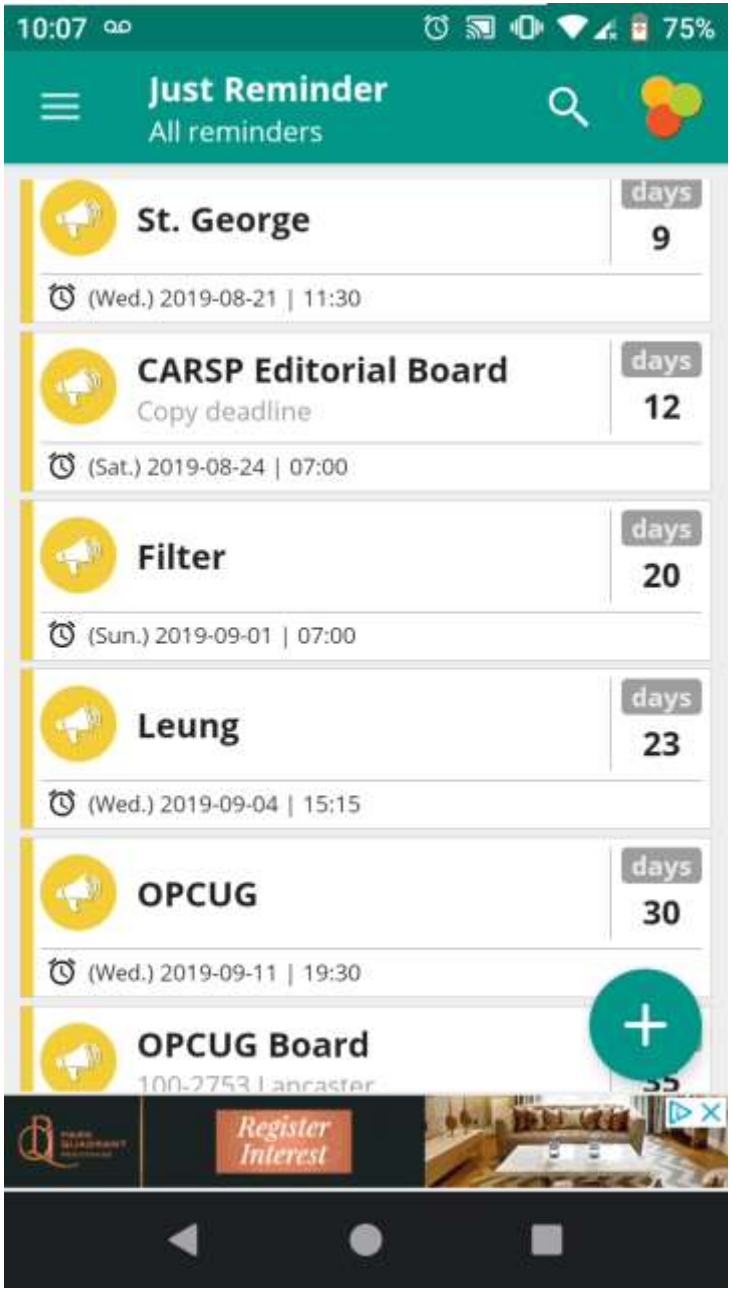

9:10
88%
Choose maps to download
OSM free data
Sounds 1/38 (0 MB)
Europe 1/56 (0.4 GB)
America 1/53 (0.2 GB)
Asia 0/46 (0 MB)
Oceania 0/16 (0 MB)
Africa 0/57 (0 MB)
Speed Cameras 0/2 (0 MB)
Required data 2/2 (0 MB)
DOWNLOAD

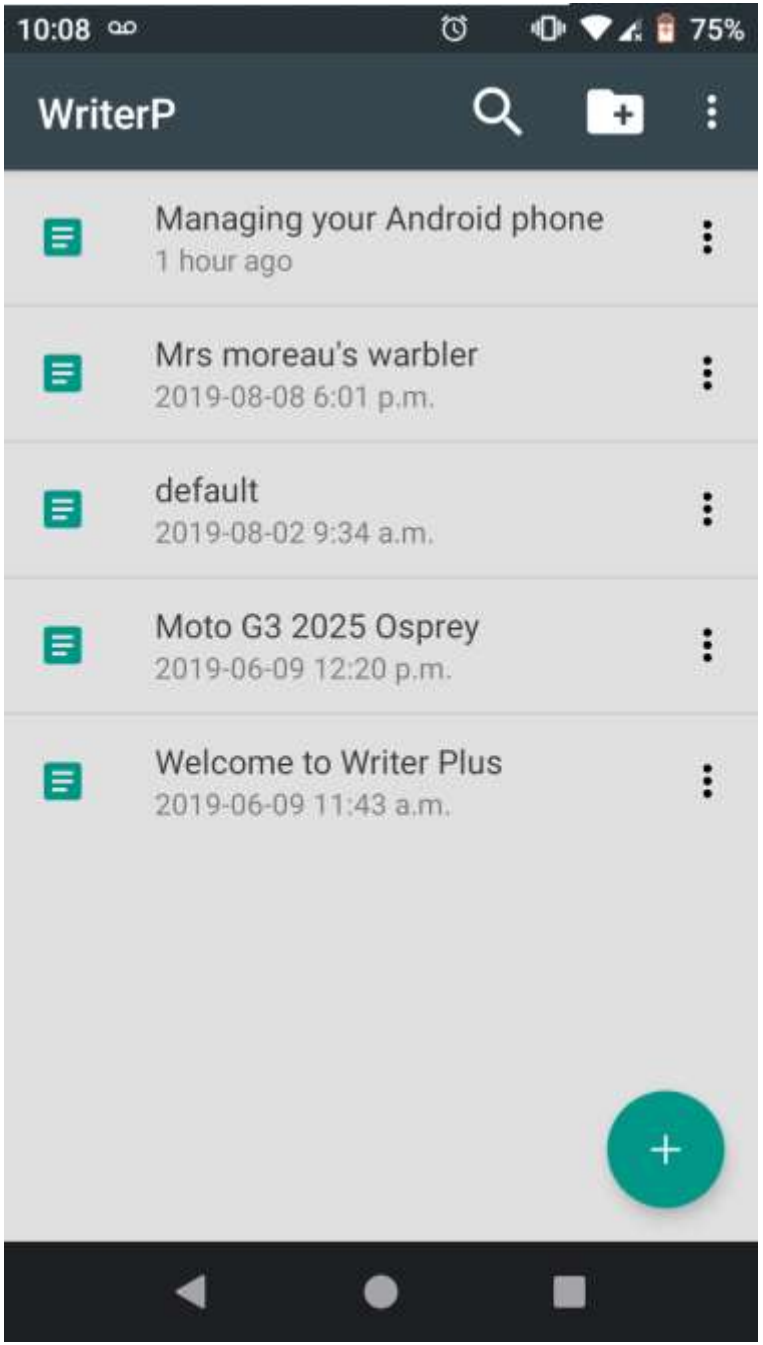
"Home" from My Places

[Actually, just a major intersection near my house]




**Just Reminder with Alarm**
(AppHouse Co)

Task reminder/to-do list
Configurable alarm
(hours/minutes prior)
Categories
(e.g. birthdays, bill payments)

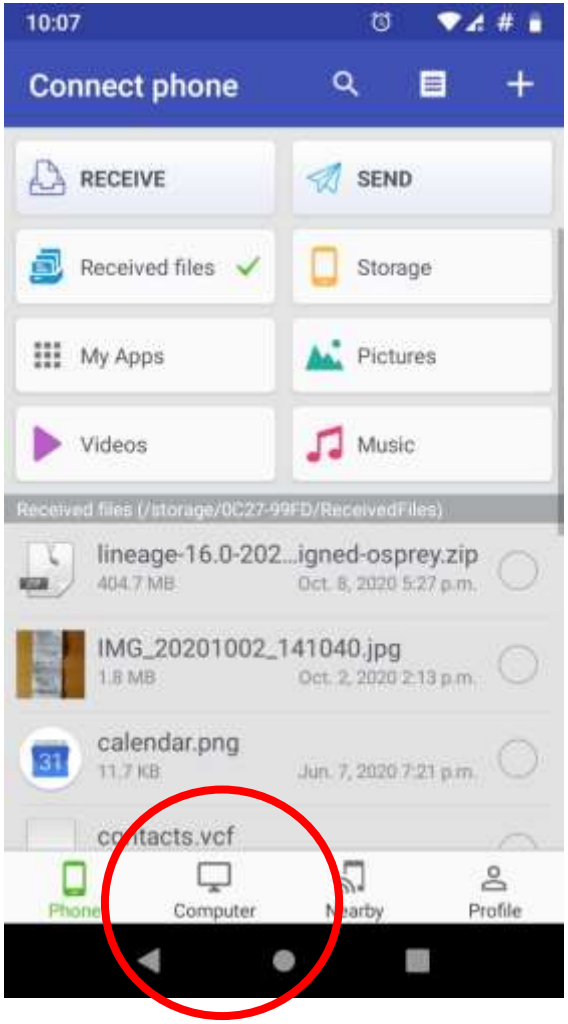



**Writer Plus**
**(Write on the Go)**
(Easy4U Ltd.)

Local text editor
Open/edit/save plain text
Make notes “on-the-fly”
Markdown (e.g. bold, italic, bullets, numbered lists)
Folder support

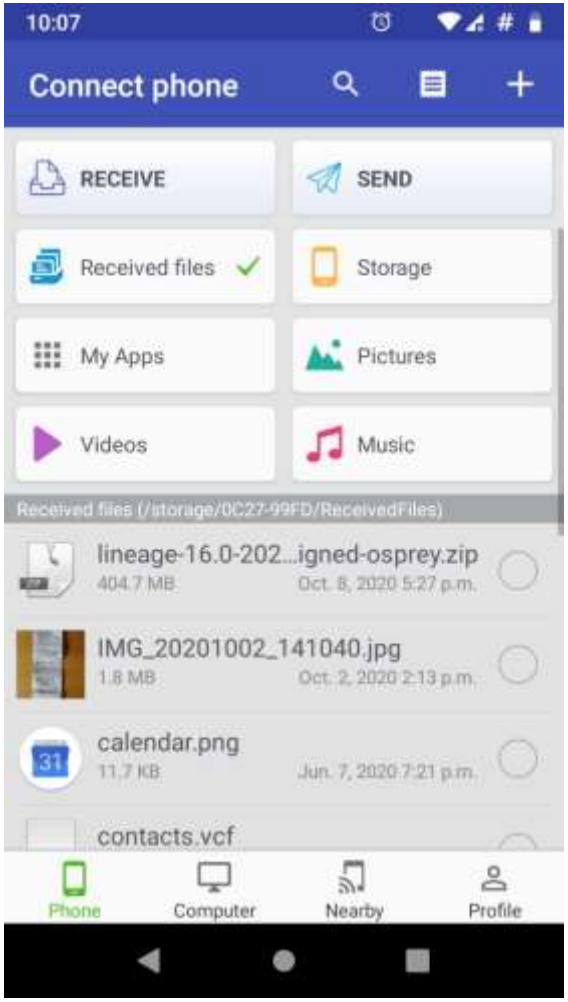
# Software Data Cable

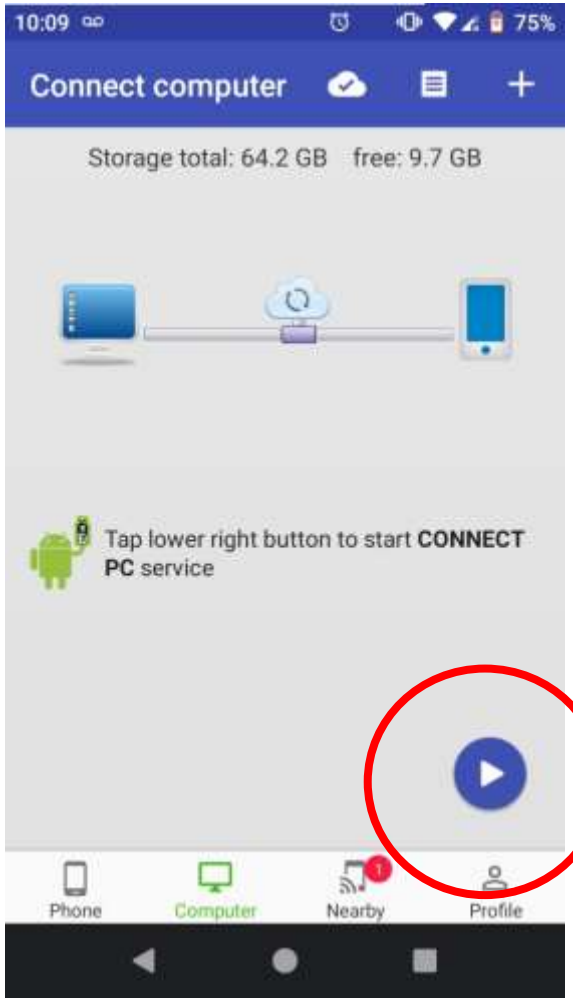
(DAMI APP)



# Software Data Cable

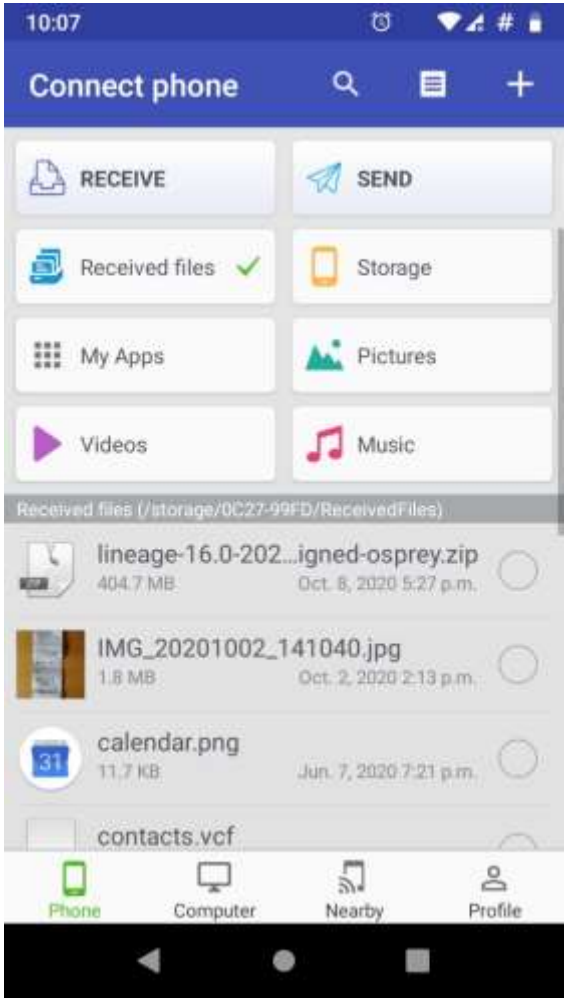
(DAMI APP)

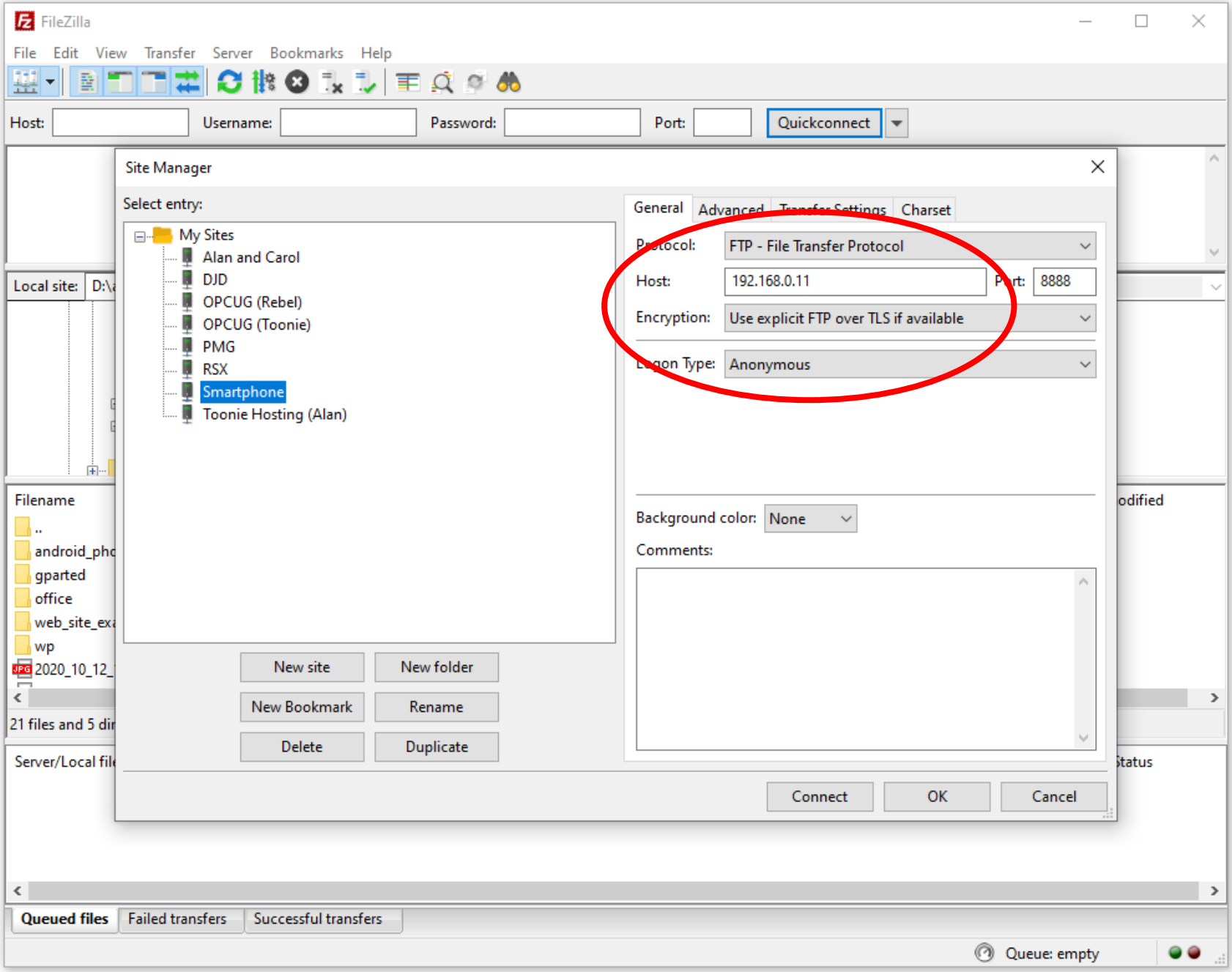


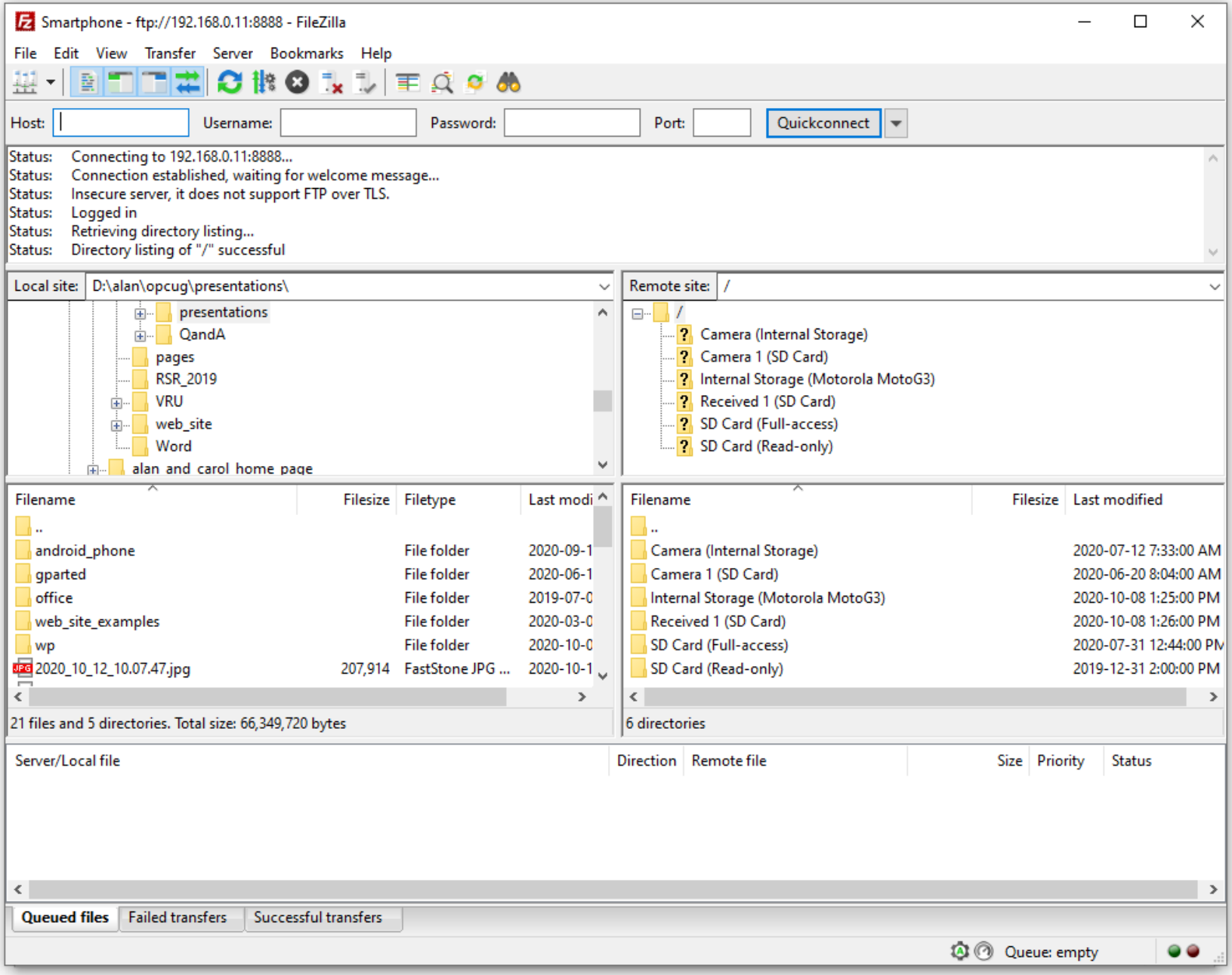



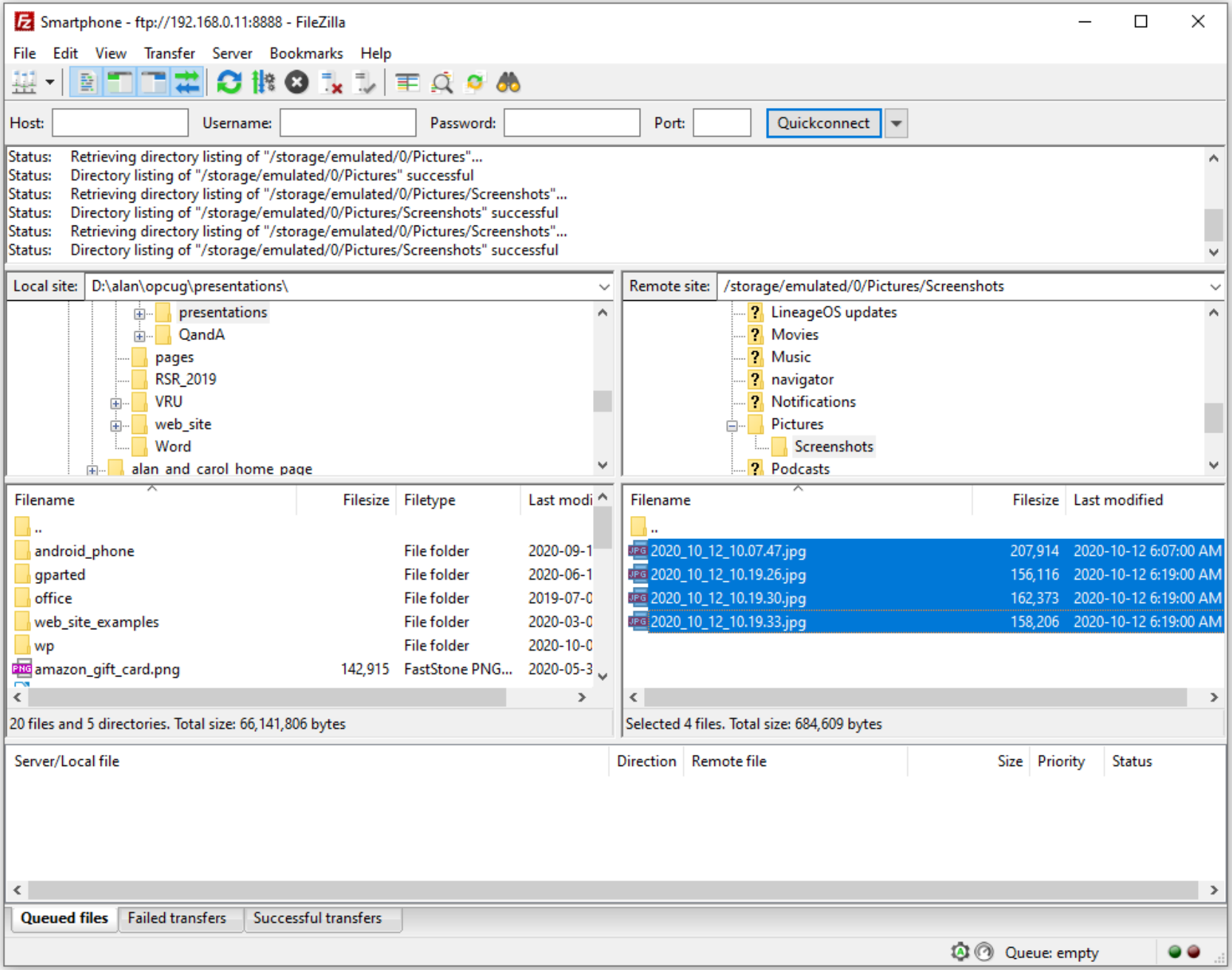
# Software Data Cable

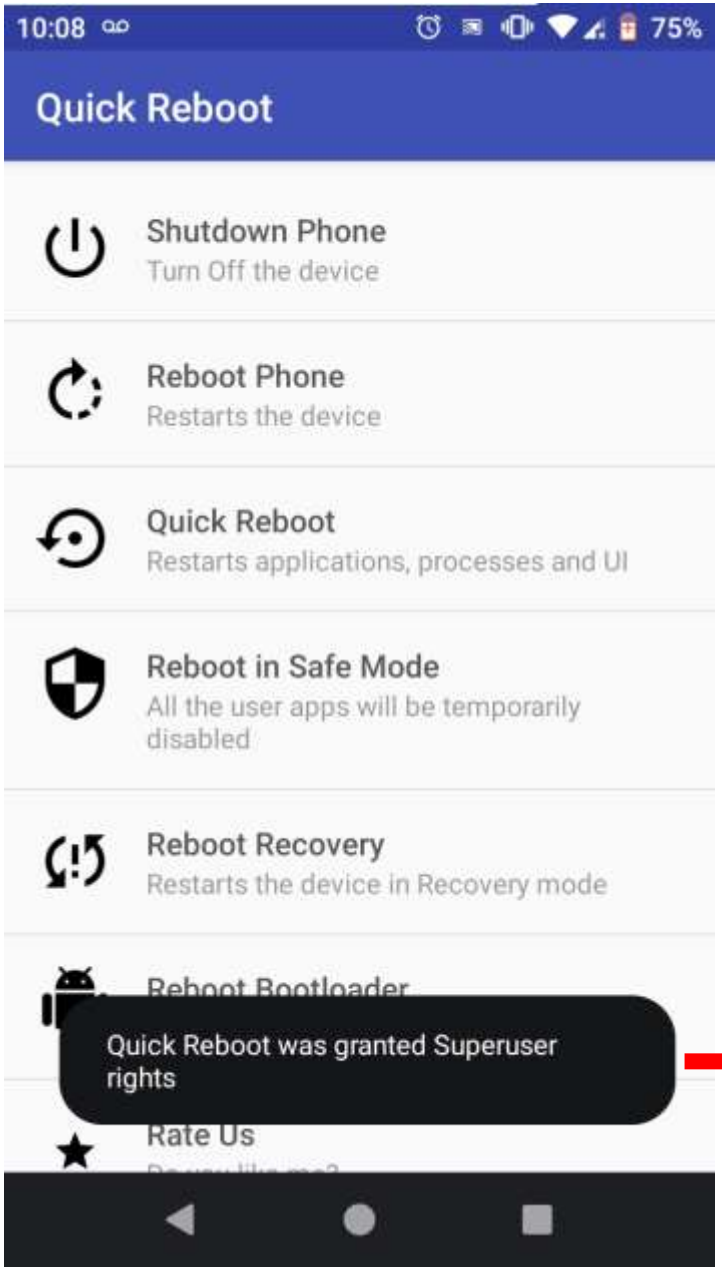
## (DAMI APP)




FileZilla
File Edit View Transfer Server Bookmarks Help
Host: Username: Password: Port: Quickconnect
Site Manager
Select entry:
My Sites
Alan and Carol
DJD
OPCUG (Rebel)
OPCUG (Toonie)
PMG
RSX
Smartphone
Toonie Hosting (Alan)
New site
New folder
New Bookmark
Rename
Delete
Duplicate
General
Advanced
Transfer Settings
Charset
Protocol: FTP - File Transfer Protocol
Host: 192.168.0.11
Port: 8888
Encryption: Use explicit FTP over TLS if available
Logon Type: Anonymous
Background color: None
Comments:
Connect
OK
Cancel
Local site:
Filename
android_phc
gparted
office
web_site_ex
wp
2020_10_12_
21 files and 5 dir
Server/Local file
Queued files
Failed transfers
Successful transfers
Queue: empty


Smartphone - ftp://192.168.0.11:8888 - FileZilla
File Edit View Transfer Server Bookmarks Help
Host: Username: Password: Port: Quickconnect
Status: Connecting to 192.168.0.11:8888...
Status: Connection established, waiting for welcome message...
Status: Insecure server, it does not support FTP over TLS.
Status: Logged in
Status: Retrieving directory listing...
Status: Directory listing of "/" successful
Local site: D:\alan\opcug\presentations\
presentations
QandA
pages
RSR_2019
VRU
web_site
Word
alan_and_carol_home_page
Remote site: /
/
Camera (Internal Storage)
Camera 1 (SD Card)
Internal Storage (Motorola MotoG3)
Received 1 (SD Card)
SD Card (Full-access)
SD Card (Read-only)
Filename Filesize Filetype Last modi
.. android_phone File folder 2020-09-1
gparted File folder 2020-06-1
office File folder 2019-07-0
web_site_examples File folder 2020-03-0
wp File folder 2020-10-0
2020_10_12_10.07.47.jpg 207,914 FastStone JPG ... 2020-10-1
21 files and 5 directories. Total size: 66,349,720 bytes
Filename Filesize Last modified
.. Camera (Internal Storage) 2020-07-12 7:33:00 AM
Camera 1 (SD Card) 2020-06-20 8:04:00 AM
Internal Storage (Motorola MotoG3) 2020-10-08 1:25:00 PM
Received 1 (SD Card) 2020-10-08 1:26:00 PM
SD Card (Full-access) 2020-07-31 12:44:00 PM
SD Card (Read-only) 2019-12-31 2:00:00 PM
6 directories
Server/Local file Direction Remote file Size Priority Status
Queued files Failed transfers Successful transfers
Queue: empty


Smartphone - ftp://192.168.0.11:8888 - FileZilla
File Edit View Transfer Server Bookmarks Help
Host: Username: Password: Port: Quickconnect
Status: Retrieving directory listing of "/storage/emulated/0/Pictures"...
Status: Directory listing of "/storage/emulated/0/Pictures" successful
Status: Retrieving directory listing of "/storage/emulated/0/Pictures/Screenshots"...
Status: Directory listing of "/storage/emulated/0/Pictures/Screenshots" successful
Status: Retrieving directory listing of "/storage/emulated/0/Pictures/Screenshots"...
Status: Directory listing of "/storage/emulated/0/Pictures/Screenshots" successful
Local site: D:\alan\opcug\presentations\
presentations
QandA
pages
RSR_2019
VRU
web_site
Word
alan_and_carol_home_page
Remote site: /storage/emulated/0/Pictures/Screenshots
LineageOS updates
Movies
Music
navigator
Notifications
Pictures
Screenshots
Podcasts
Filename Filesize Filetype Last modi
.. android_phone File folder 2020-09-1
gparted File folder 2020-06-1
office File folder 2019-07-0
web_site_examples File folder 2020-03-0
wp File folder 2020-10-0
amazon_gift_card.png 142,915 FastStone PNG... 2020-05-3
20 files and 5 directories. Total size: 66,141,806 bytes
Filename Filesize Last modified
.. 2020_10_12_10.07.47.jpg 207,914 2020-10-12 6:07:00 AM
2020_10_12_10.19.26.jpg 156,116 2020-10-12 6:19:00 AM
2020_10_12_10.19.30.jpg 162,373 2020-10-12 6:19:00 AM
2020_10_12_10.19.33.jpg 158,206 2020-10-12 6:19:00 AM
Selected 4 files. Total size: 684,609 bytes
Server/Local file Direction Remote file Size Priority Status
Queued files Failed transfers Successful transfers
Queue: empty



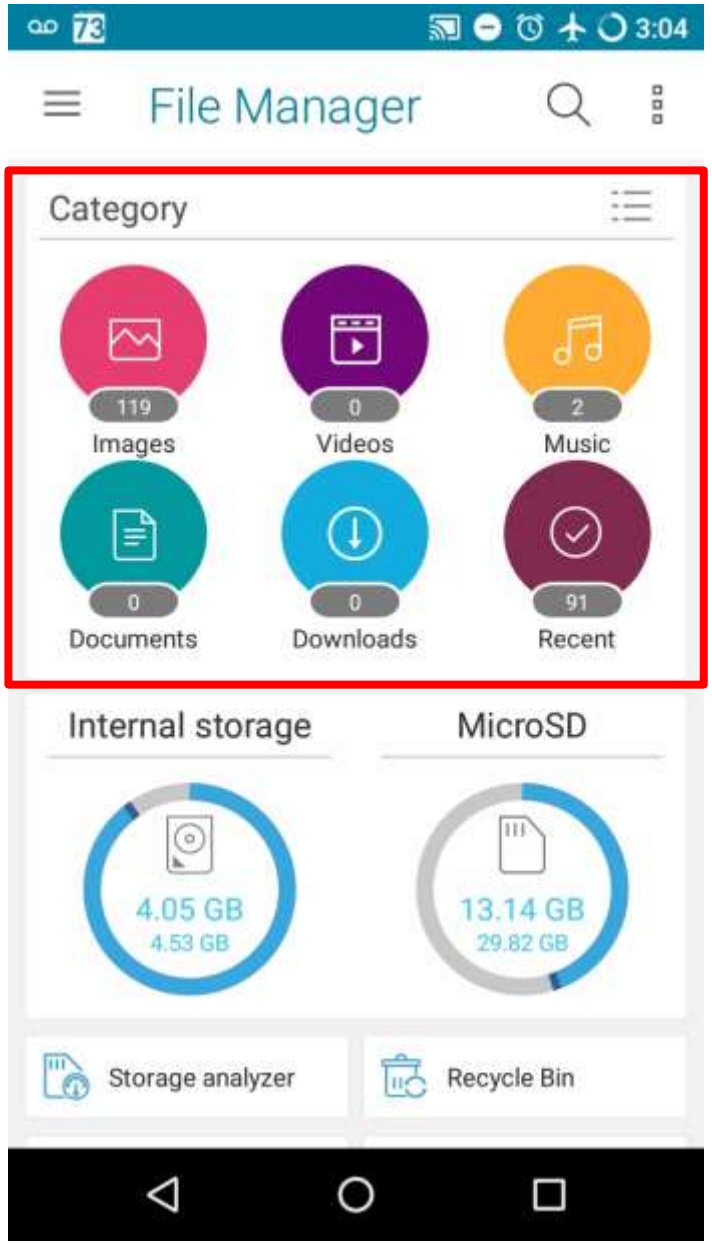

# Quick Reboot
(Awiserk)

Shutdown/Restart
using the touchscreen
Reboot to recovery mode
to flash software
(e.g. Custom ROM)

→ Needs root access!

**File Manager**
(ASUSTek Computer Inc.)

**Supports internal memory, SDcard, LAN, Cloud**




**File Manager**
(ASUSTek Computer Inc.)

Supports internal memory, SDcard, LAN, Cloud
**Selectable categories**

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(ASUSTek Computer Inc.)

Supports internal memory, SDcard, LAN, Cloud

Selectable categories

**Storage analyzer**

**File sizes by category**

**Folder sizes**

**Large files, duplicates…**

Main storage = 4.53 GB
Micro-SDcard = 29.82 GB

BUT, the MotoG3 is supposed to have 8 GB of on-board storage!

**memory?**

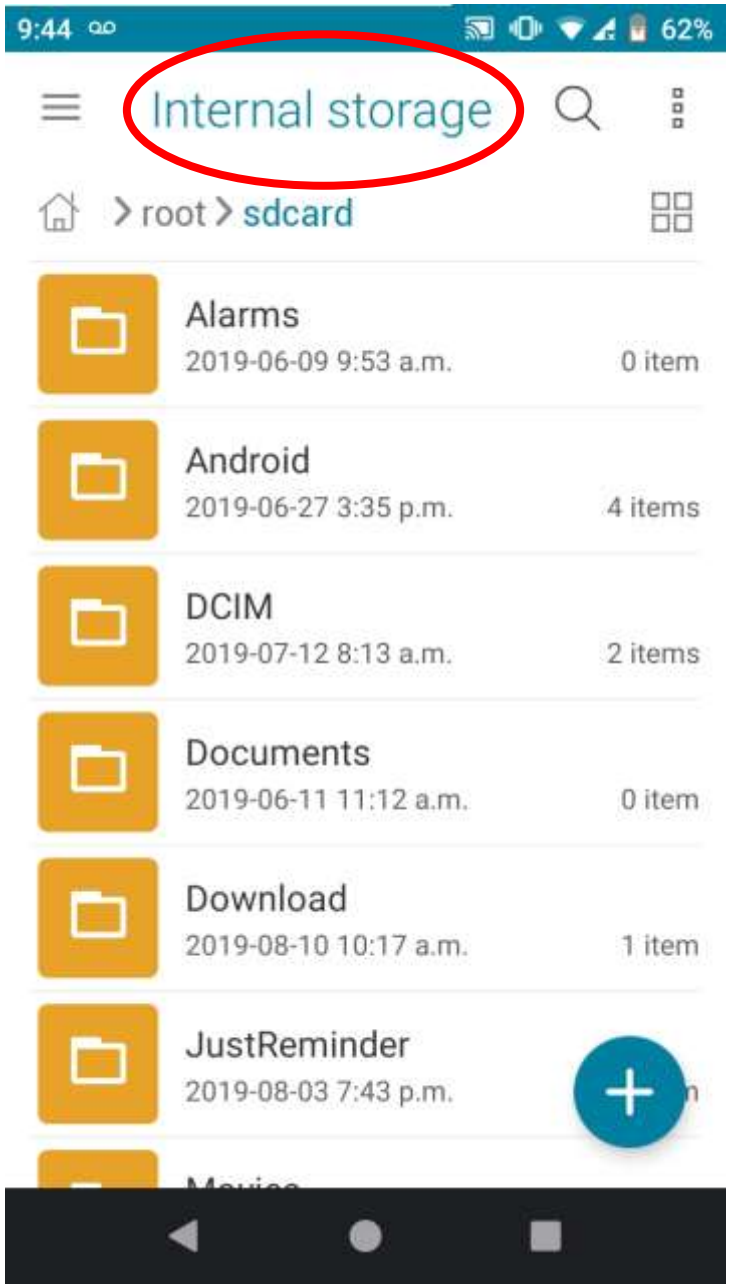
Am I losing my mind

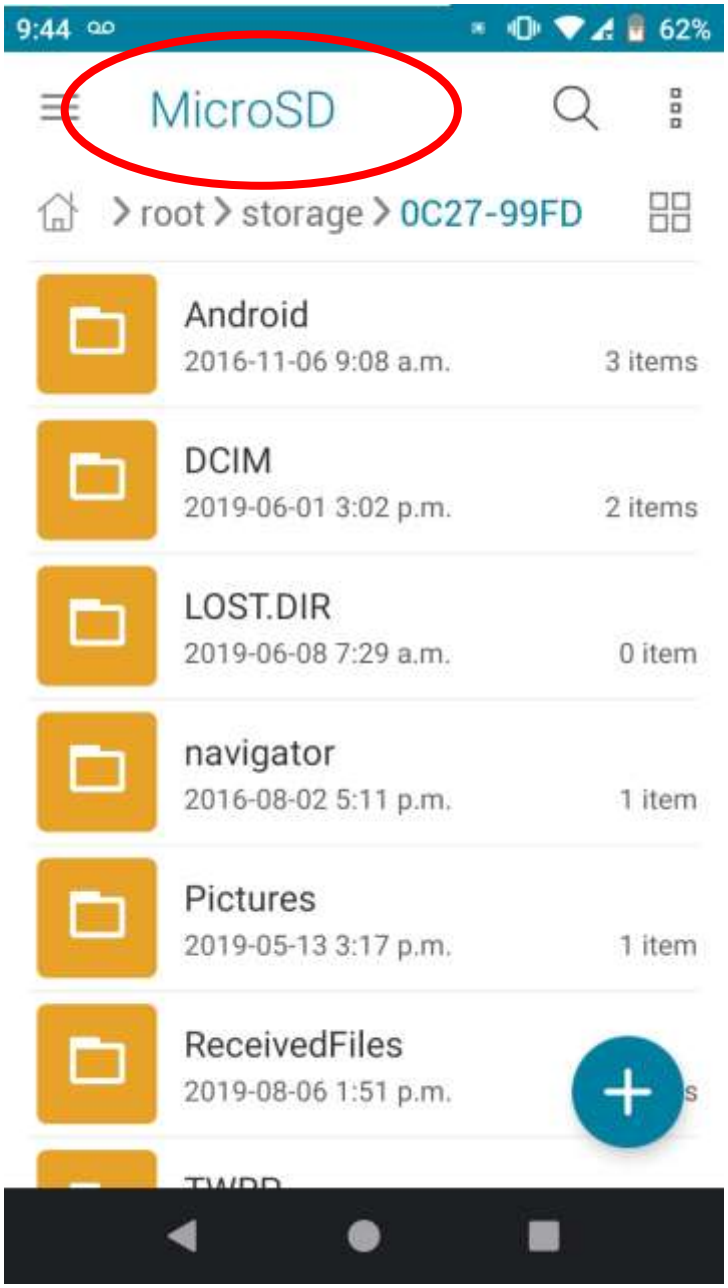
# Android File Structure

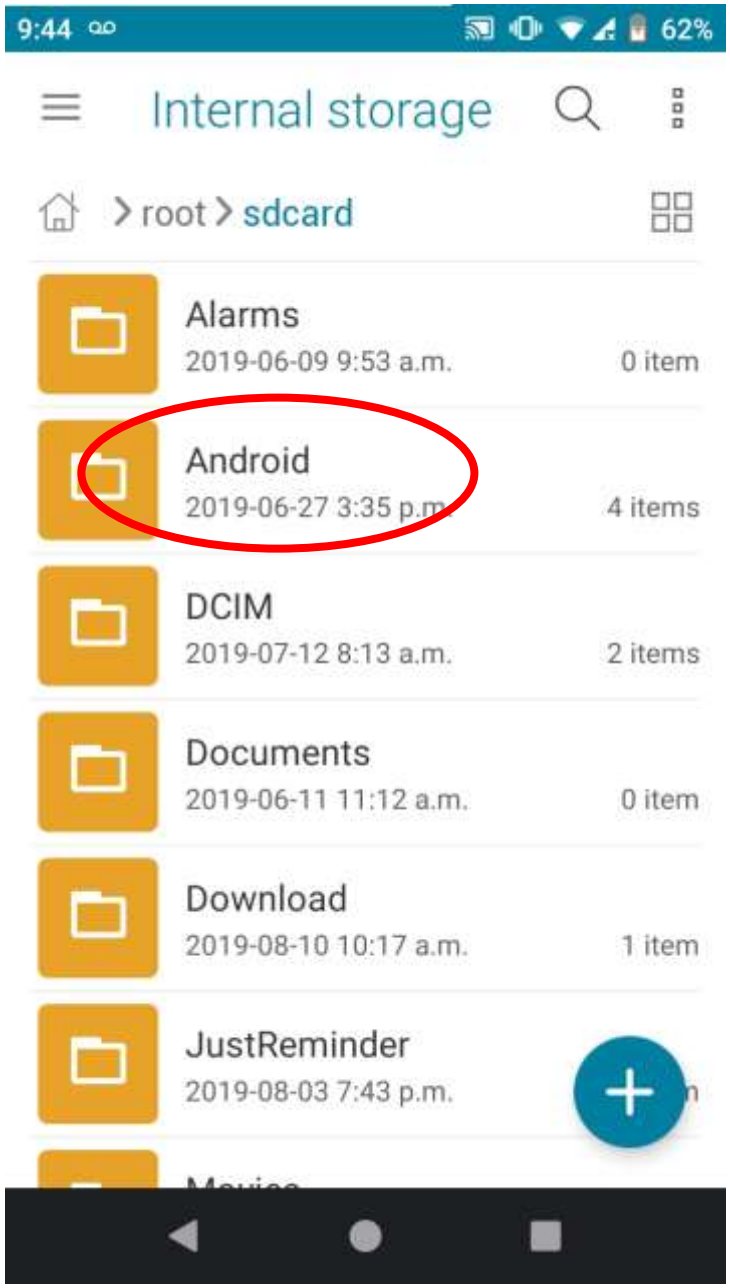
- My 8 GB MotoG3 can only account for about 4.5 GB of “internal storage”
- Where are the other GB’s and what are they used for?
- Many of Android’s folders are “empty”
- Much of the file system is hidden
- A mystery!

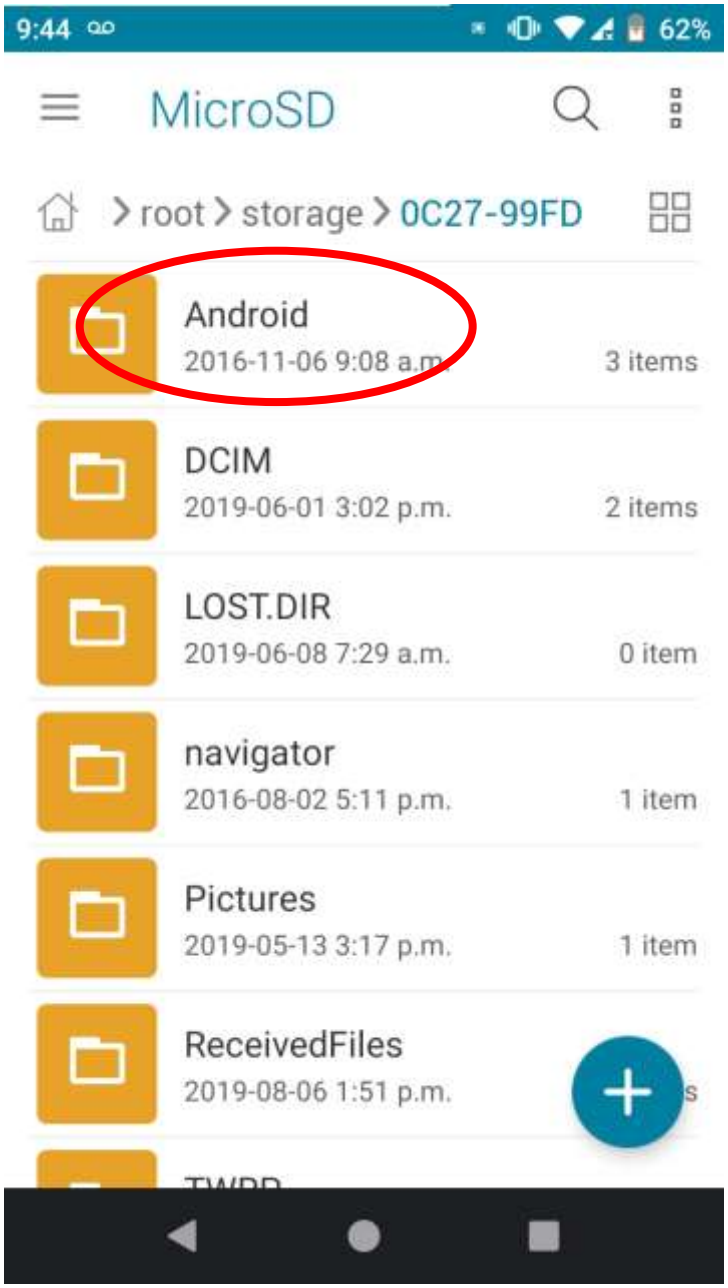
# Android File Structure

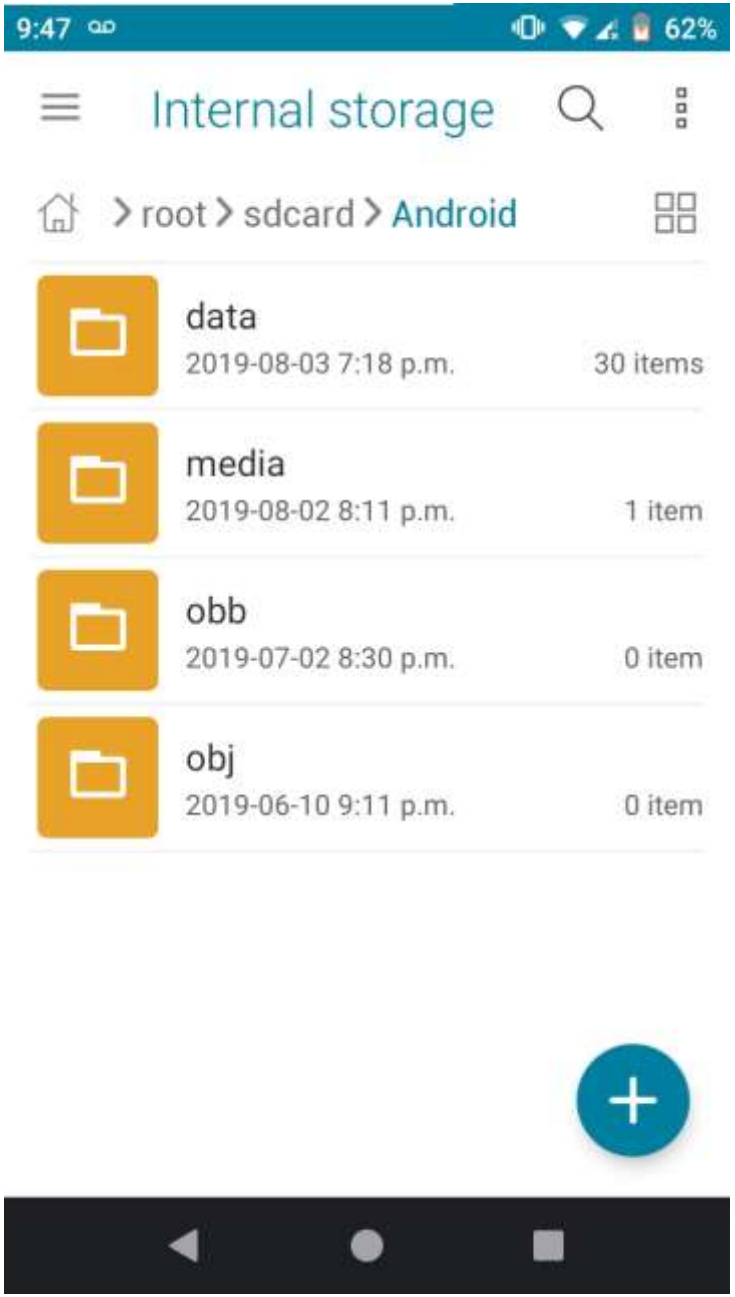
- A mystery?
- Actually a Linux file system
- The main storage is labelled
  > root > sdcard
  while the Micro SDcard is labelled
  (on my phone)
  > root > storage > OC27-99FD
- Each drive has multiple folders…

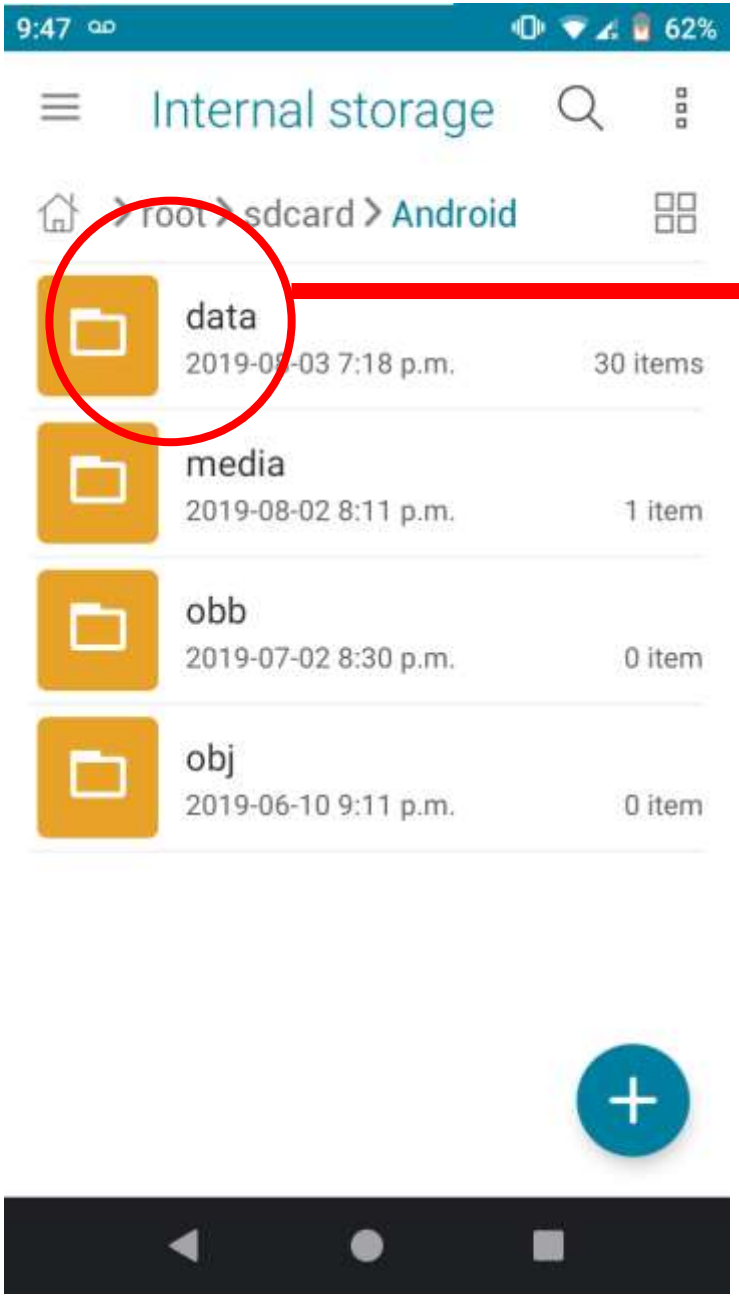

9:44
62%
Internal storage
root > sdcard
Alarms
2019-06-09 9:53 a.m.
0 item
Android
2019-06-27 3:35 p.m.
4 items
DCIM
2019-07-12 8:13 a.m.
2 items
Documents
2019-06-11 11:12 a.m.
0 item
Download
2019-08-10 10:17 a.m.
1 item
JustReminder
2019-08-03 7:43 p.m.

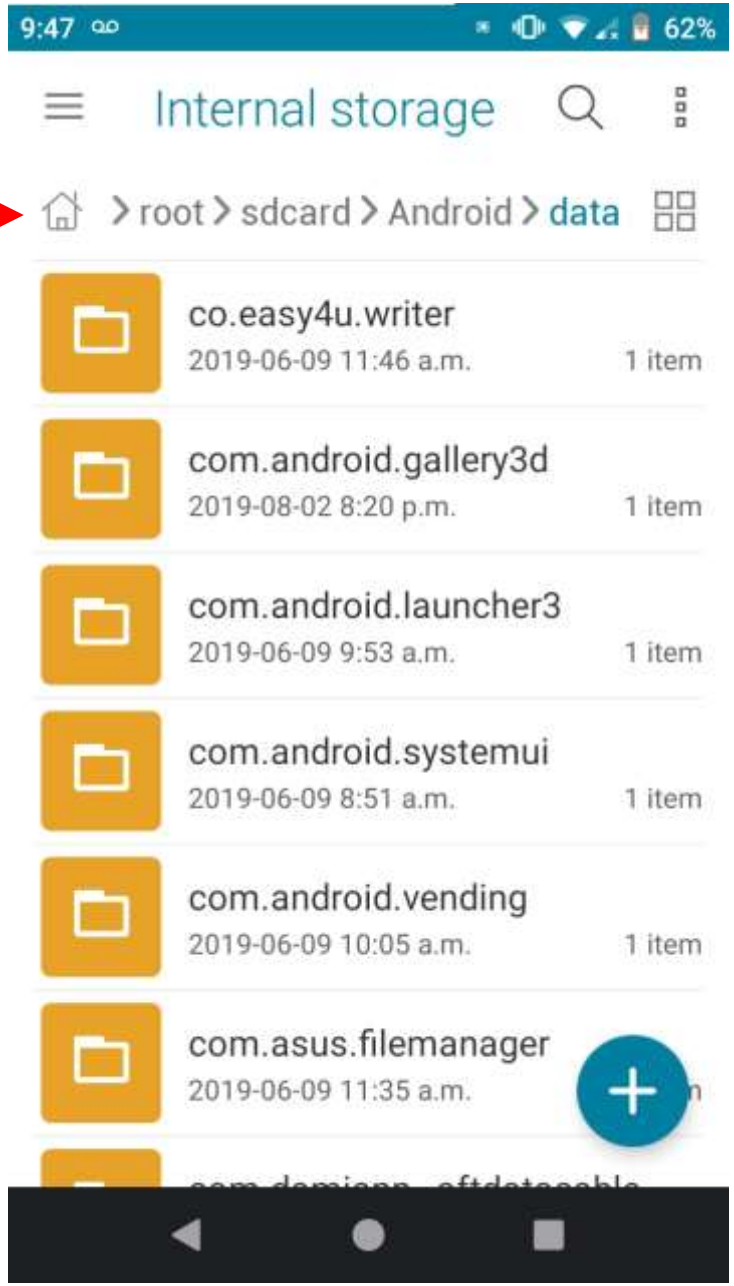

9:44
62%
MicroSD
root > storage > 0C27-99FD
Android
2016-11-06 9:08 a.m.
3 items
DCIM
2019-06-01 3:02 p.m.
2 items
LOST.DIR
2019-06-08 7:29 a.m.
0 item
navigator
2016-08-02 5:11 p.m.
1 item
Pictures
2019-05-13 3:17 p.m.
1 item
ReceivedFiles
2019-08-06 1:51 p.m.

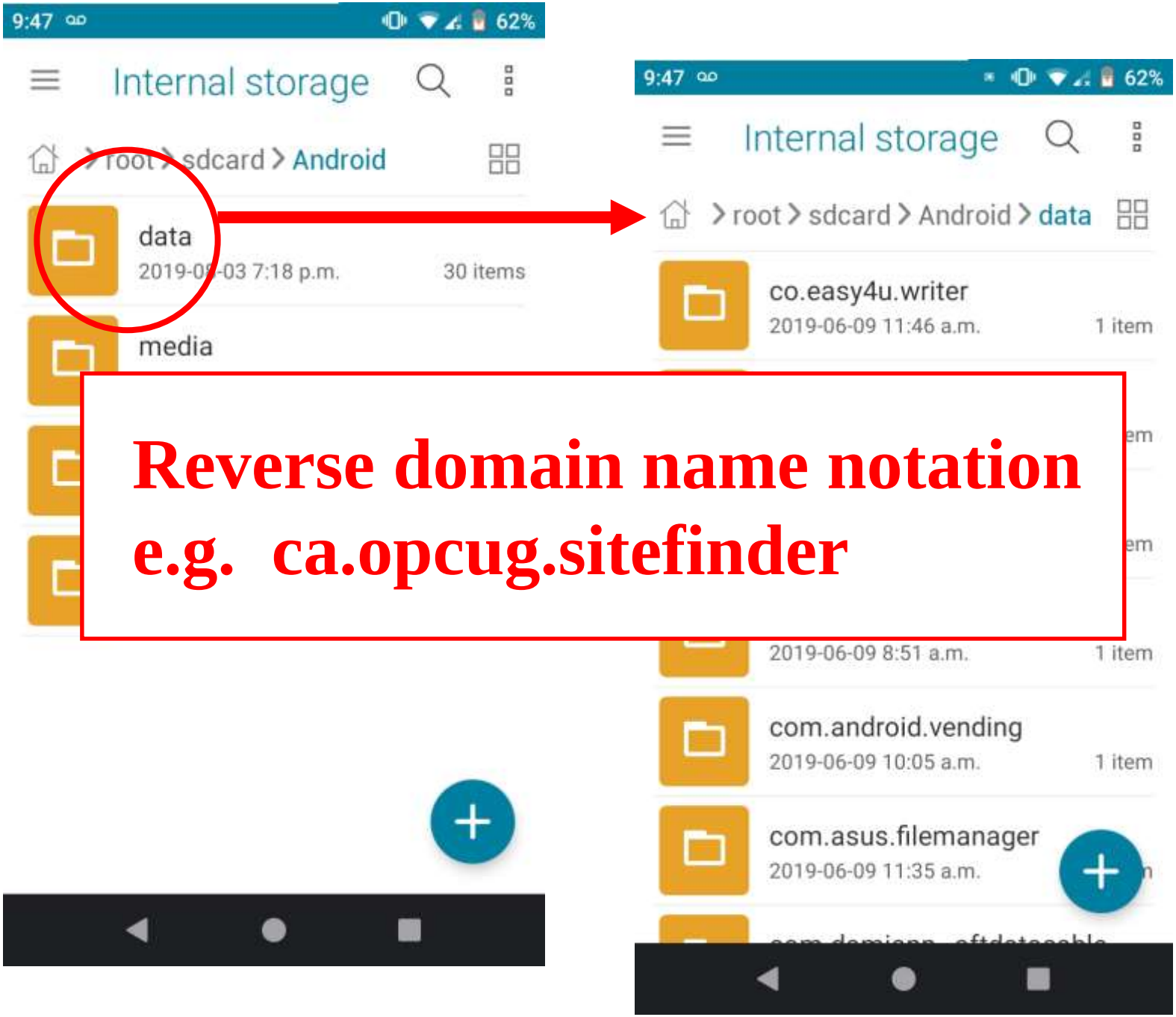

9:44
62%
Internal storage
root > sdcard
Alarms
2019-06-09 9:53 a.m.
0 item
Android
2019-06-27 3:35 p.m.
4 items
DCIM
2019-07-12 8:13 a.m.
2 items
Documents
2019-06-11 11:12 a.m.
0 item
Download
2019-08-10 10:17 a.m.
1 item
JustReminder
2019-08-03 7:43 p.m.


9:44
62%
MicroSD
root > storage > 0C27-99FD
Android
2016-11-06 9:08 a.m.
3 items
DCIM
2019-06-01 3:02 p.m.
2 items
LOST.DIR
2019-06-08 7:29 a.m.
0 item
navigator
2016-08-02 5:11 p.m.
1 item
Pictures
2019-05-13 3:17 p.m.
1 item
ReceivedFiles
2019-08-06 1:51 p.m.

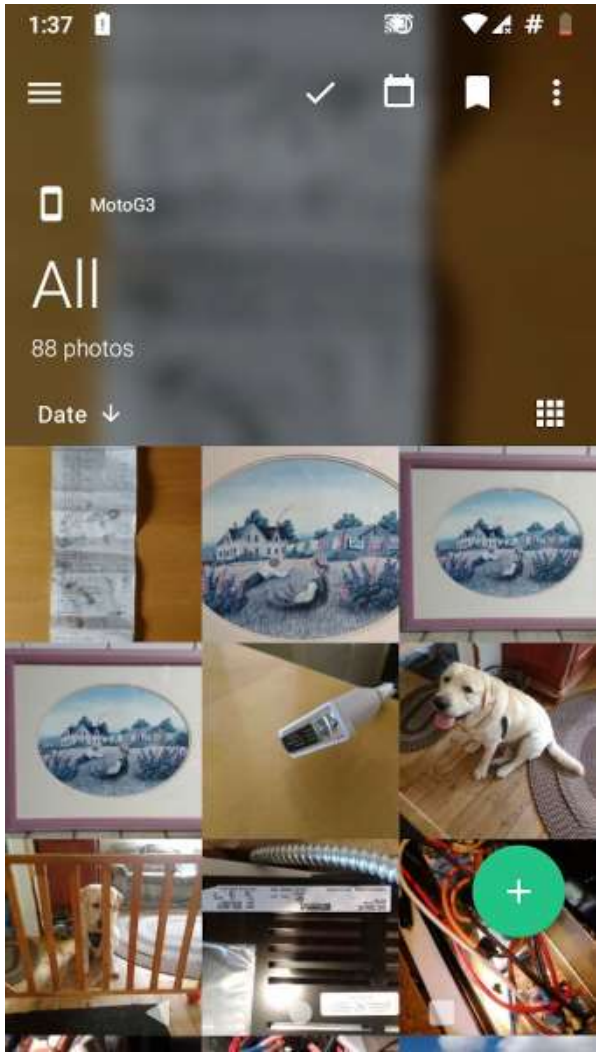

9:47
62%
Internal storage
root
sdcard
Android
data
2019-08-03 7:18 p.m.
30 items
media
2019-08-02 8:11 p.m.
1 item
obb
2019-07-02 8:30 p.m.
0 item
obj
2019-06-10 9:11 p.m.
0 item


9:47
62%
Internal storage
root > sdcard > Android
data
2019-08-03 7:18 p.m.
30 items
media
2019-08-02 8:11 p.m.
1 item
obb
2019-07-02 8:30 p.m.
0 item
obj
2019-06-10 9:11 p.m.
0 item


9:47
62%
Internal storage
root > sdcard > Android > data
co.easy4u.writer
2019-06-09 11:46 a.m.
1 item
com.android.gallery3d
2019-08-02 8:20 p.m.
1 item
com.android.launcher3
2019-06-09 9:53 a.m.
1 item
com.android.systemui
2019-06-09 8:51 a.m.
1 item
com.android.vending
2019-06-09 10:05 a.m.
1 item
com.asus.filemanager
2019-06-09 11:35 a.m.


9:47
62%
Internal storage
root > sdcard > Android
data
2019-06-03 7:18 p.m.
30 items
media
Reverse domain name notation
e.g. ca.opcug.sitefinder
9:47
62%
Internal storage
root > sdcard > Android > data
co.easy4u.writer
2019-06-09 11:46 a.m.
1 item
2019-06-09 8:51 a.m.
1 item
com.android.vending
2019-06-09 10:05 a.m.
1 item
com.asus.filemanager
2019-06-09 11:35 a.m.

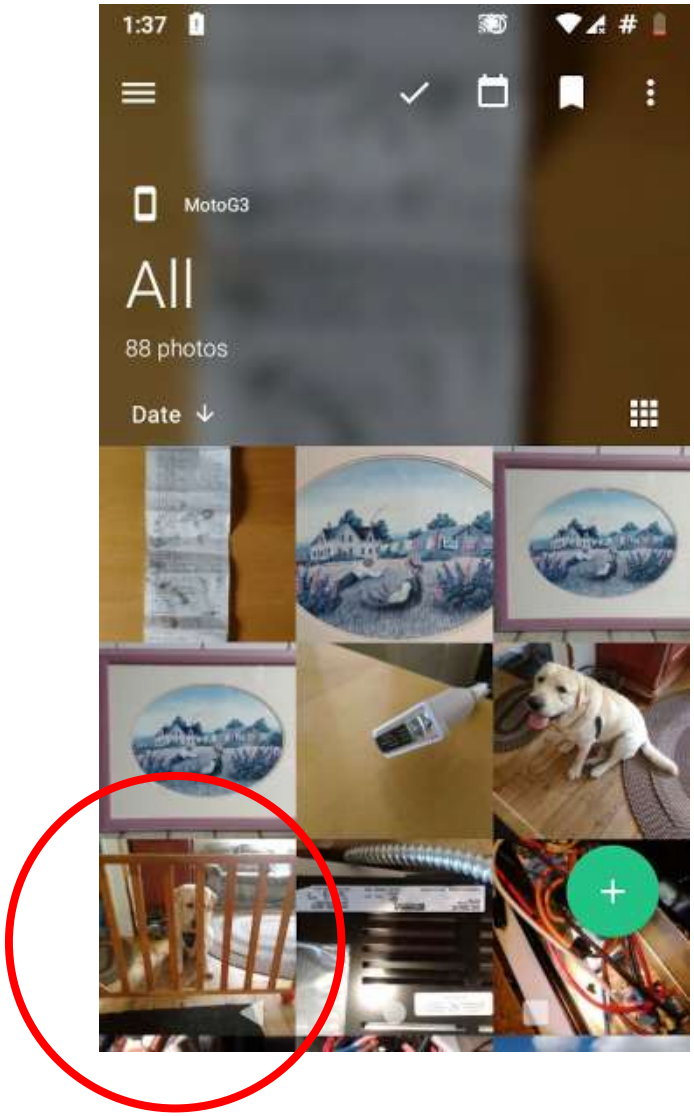
# Where are my photos stored?

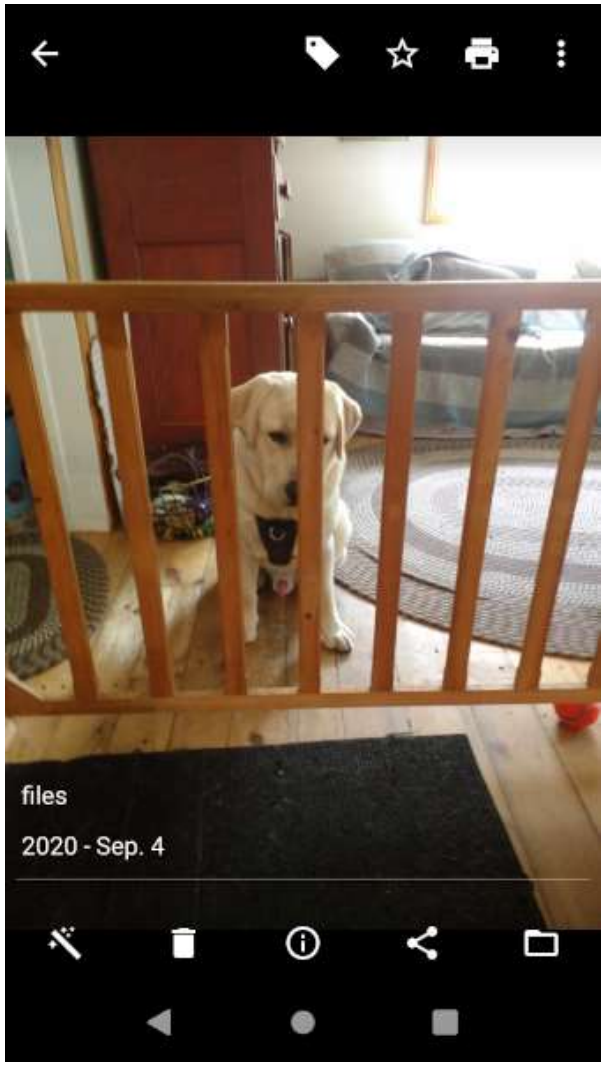



This is the *Piktures: Gallery, Photos & Videos* app

It provides access to all the photos found on the phone

# Where are my photos stored?



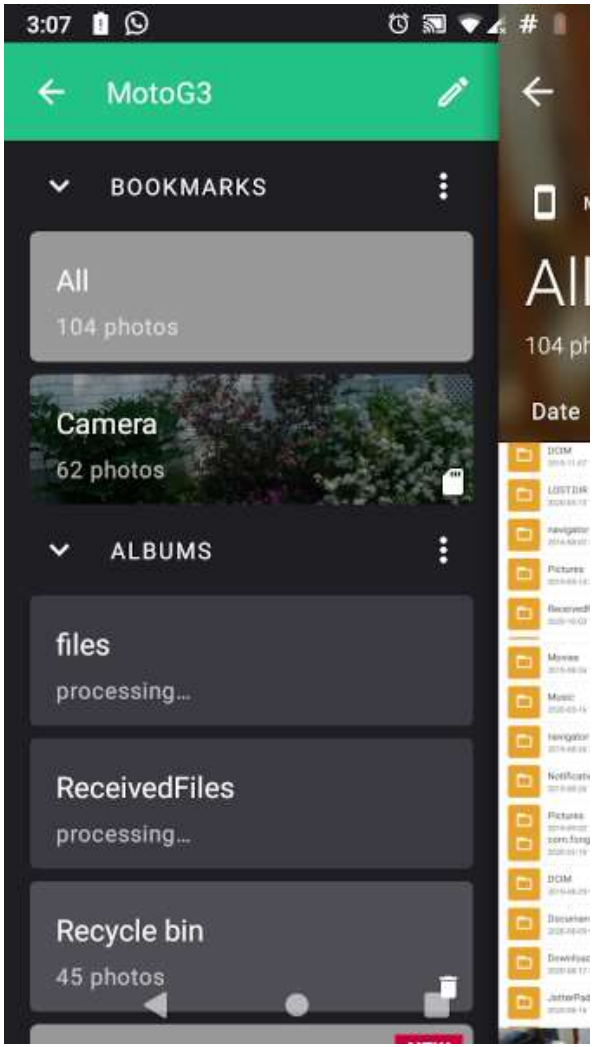
# Where are my photos stored?

Piktures has several locations (bookmarks and albums) for photos

ReceivedFiles is a folder set up to transfer files

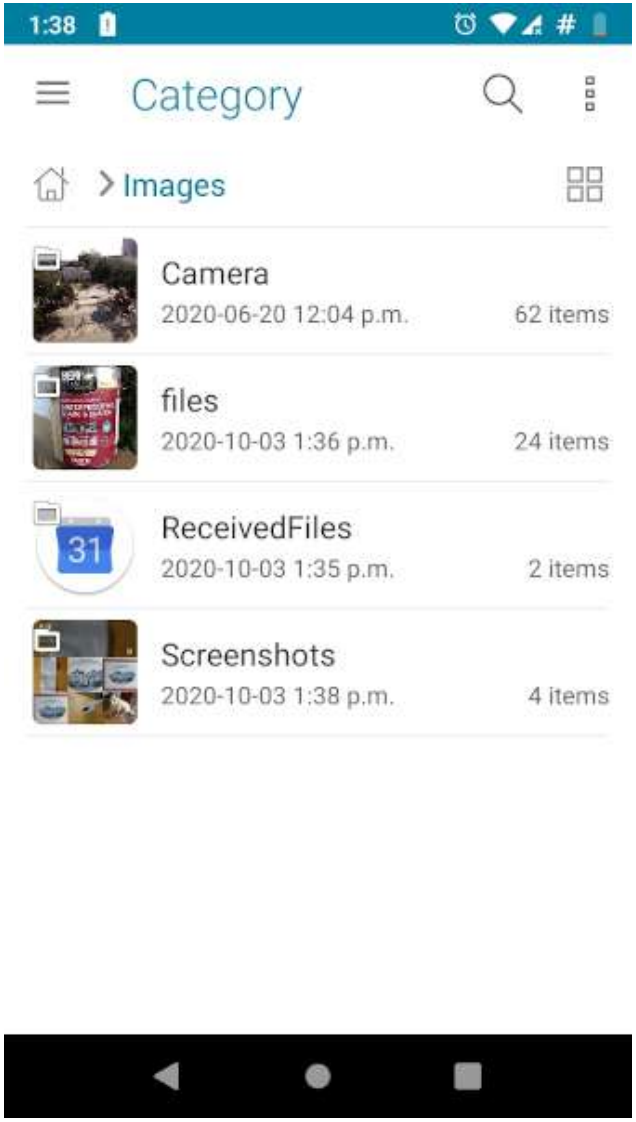
What is files?

Note that it also sees photos in the Recycle bin!



# Where are my photos stored?

This is the view of the image category in Asus File Manager

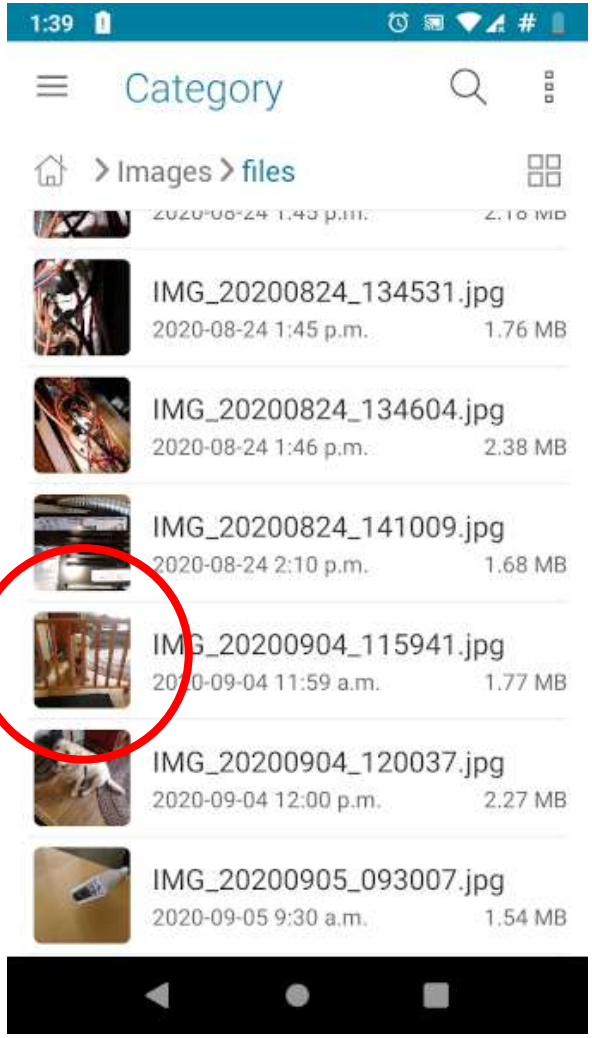


# Where are my photos stored?

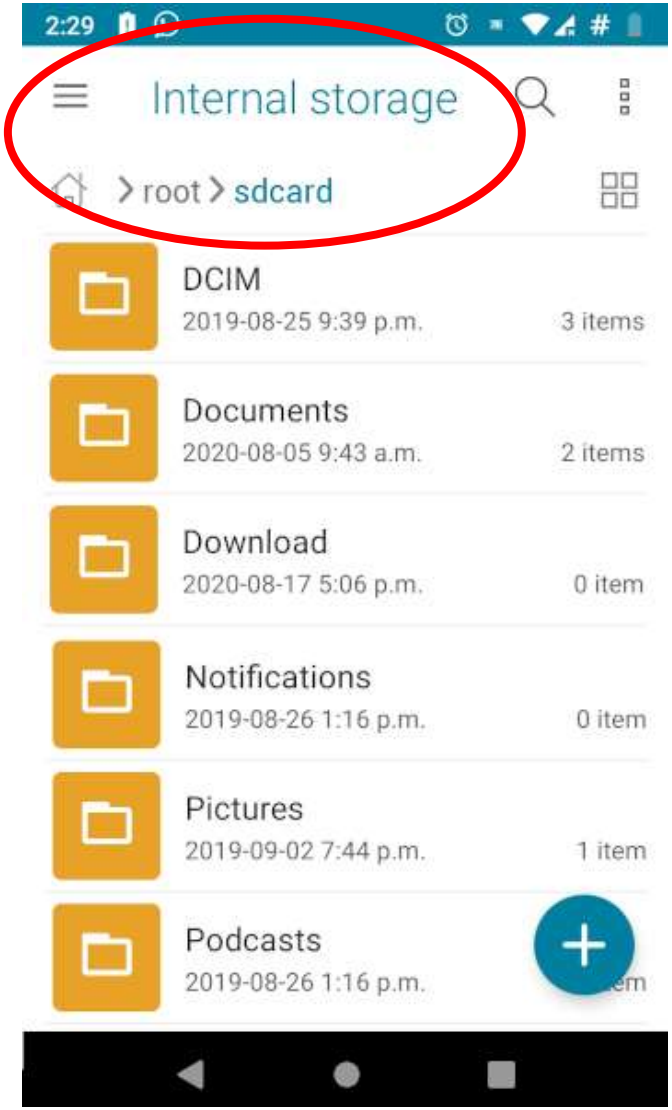
Our jailbird is located in *Images/files*

This is probably the "files" folder

But, where is this in the actual file system?

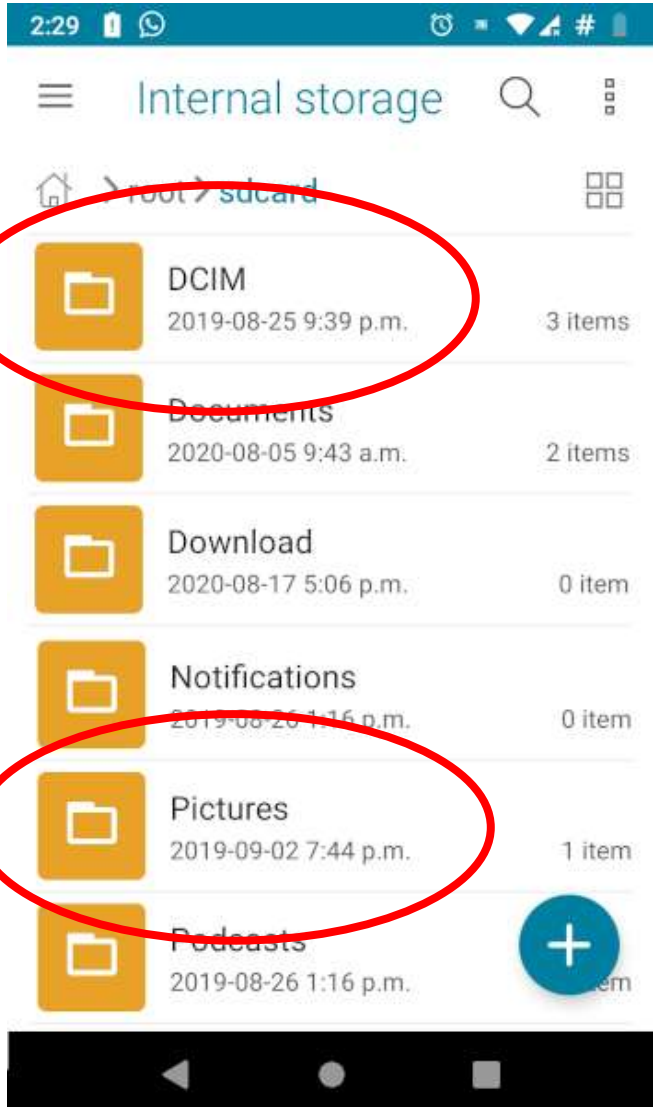


# Where are my photos stored?




Internal storage is the phone's main memory

# Where are my photos stored?



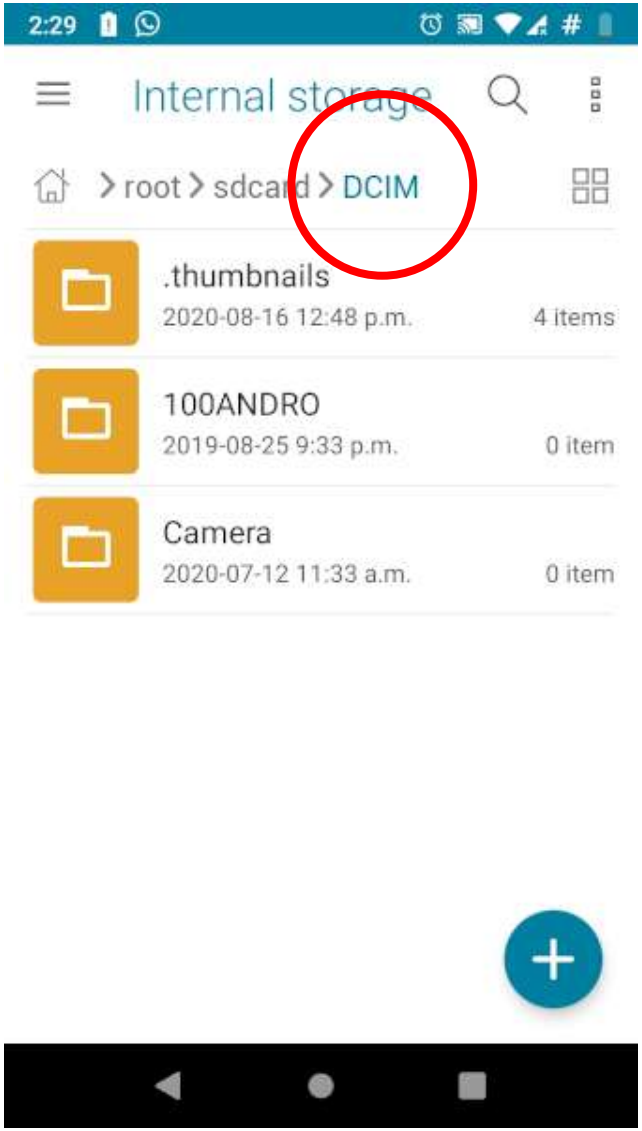

Internal storage is the phone's main memory

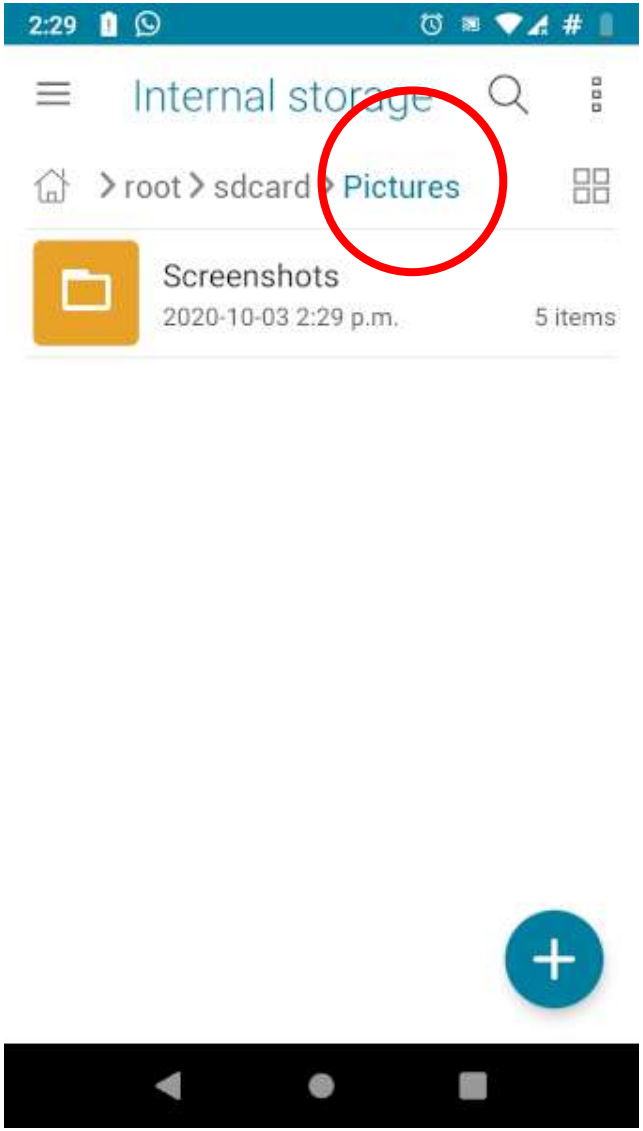
Images could be in:

DCIM

Pictures

# Where are my photos stored?

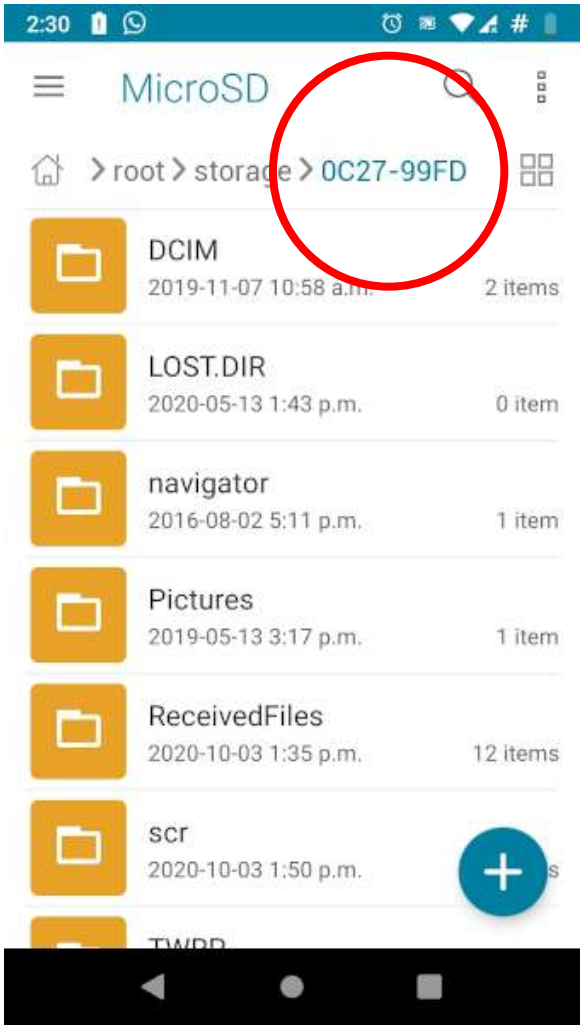


# Where are my photos stored?

But, wait!

OC27-99FD is the phone's micro-SDcard

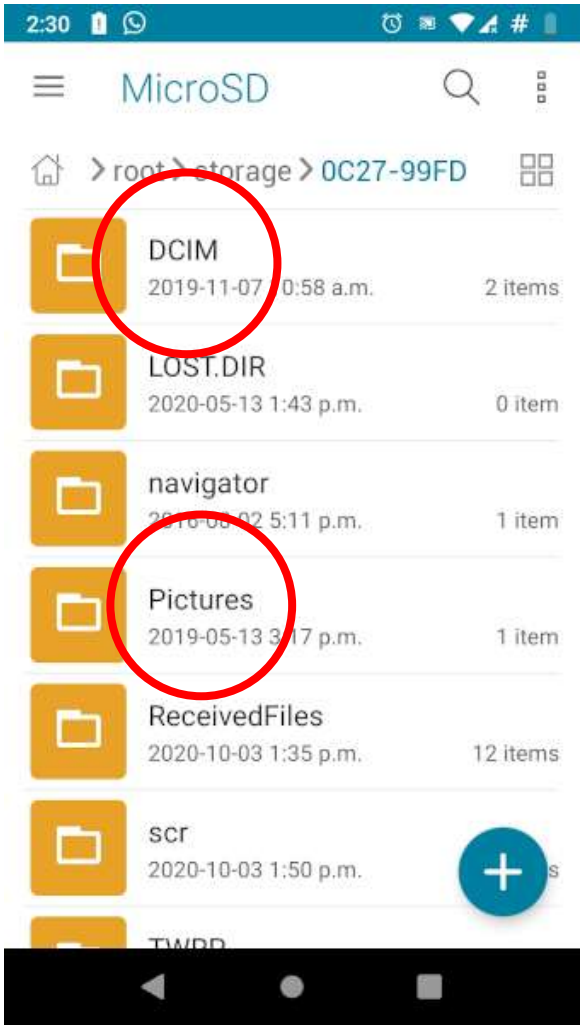


# Where are my photos stored?

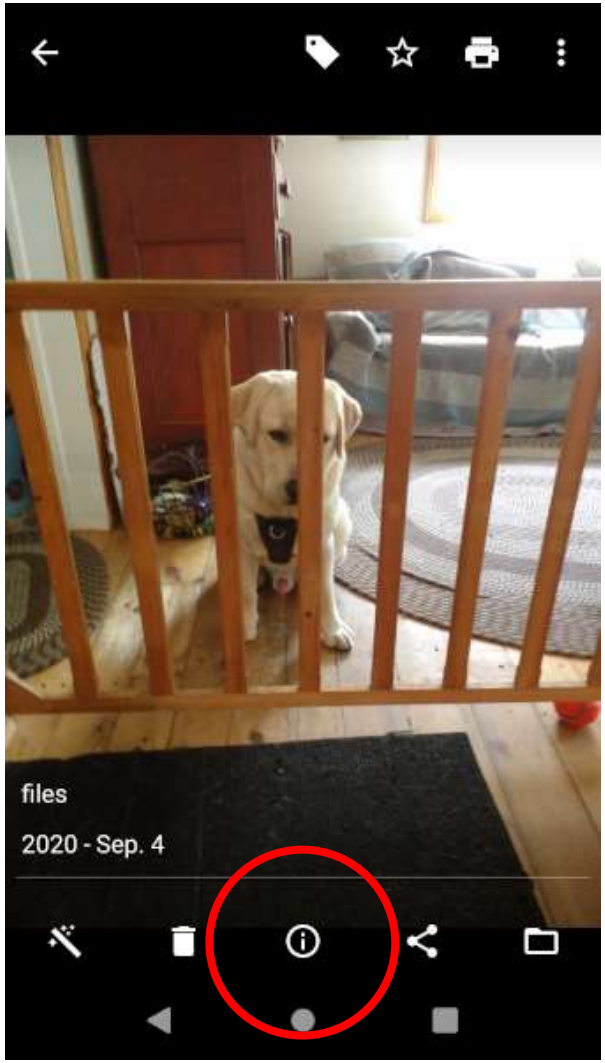
But, wait!

OC27-99FD is the phone's micro-SDcard

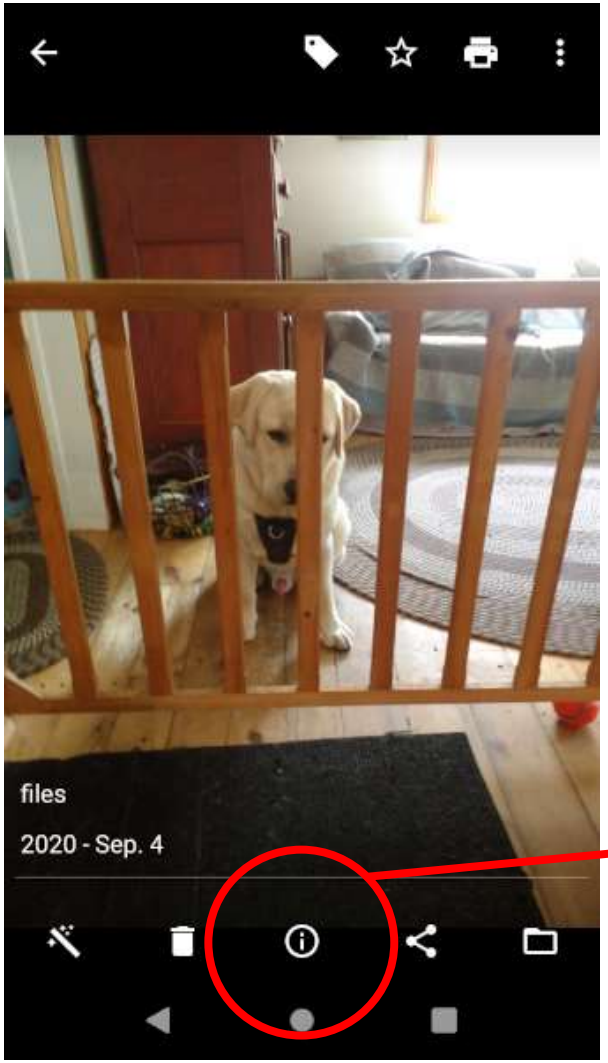
It also has *DCIM* and *Pictures* folders!

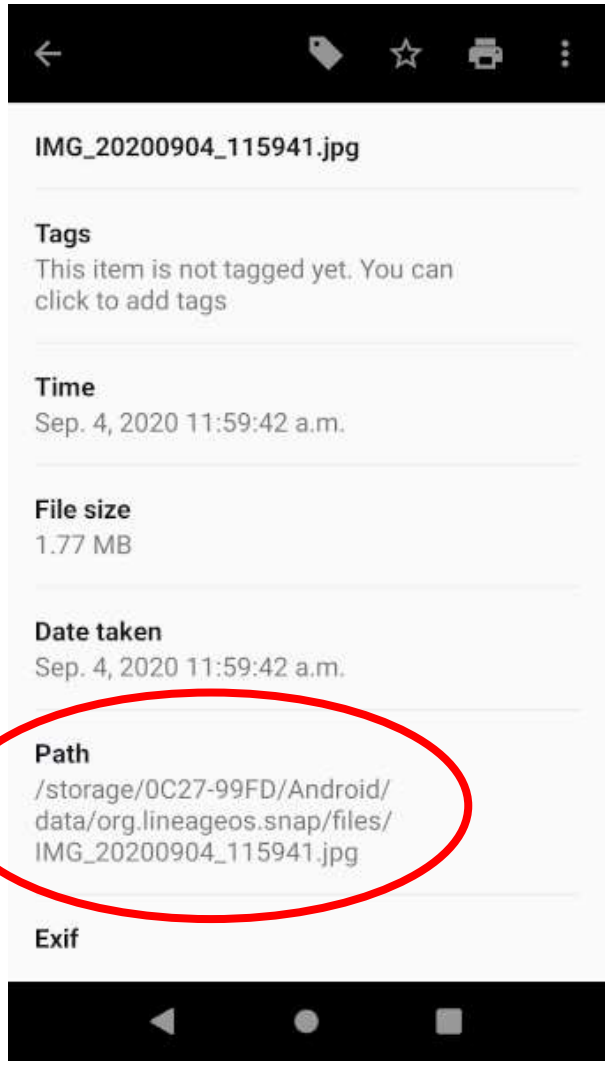


# Where are my photos stored?

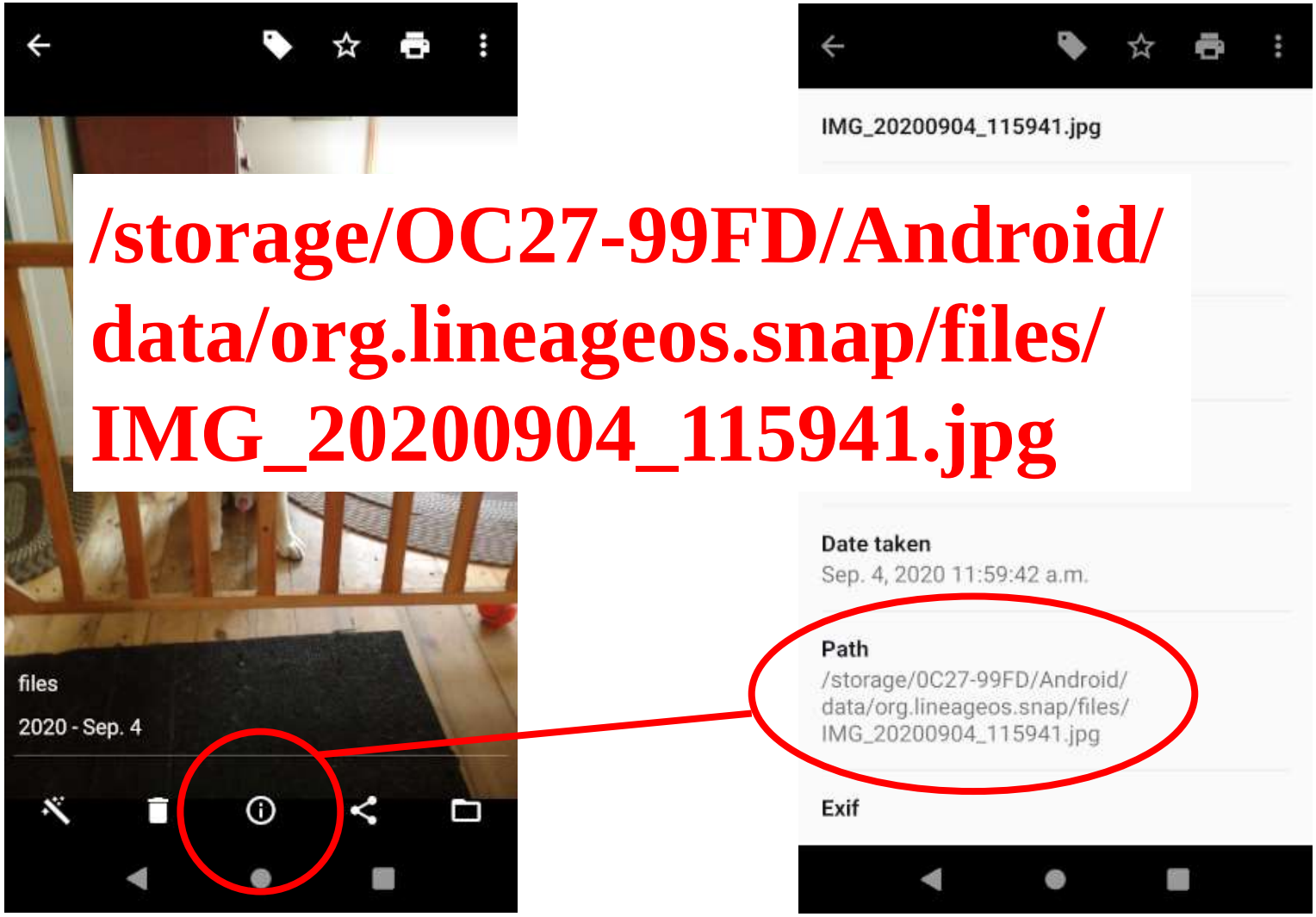


# Where are my photos stored?



# Where are my photos stored?



# Confused yet?

**/storage/OC27-99FD/Android/data/org.lineageos.snap/files/IMG_20200904_115941.jpg**

This is the micro-SDcard

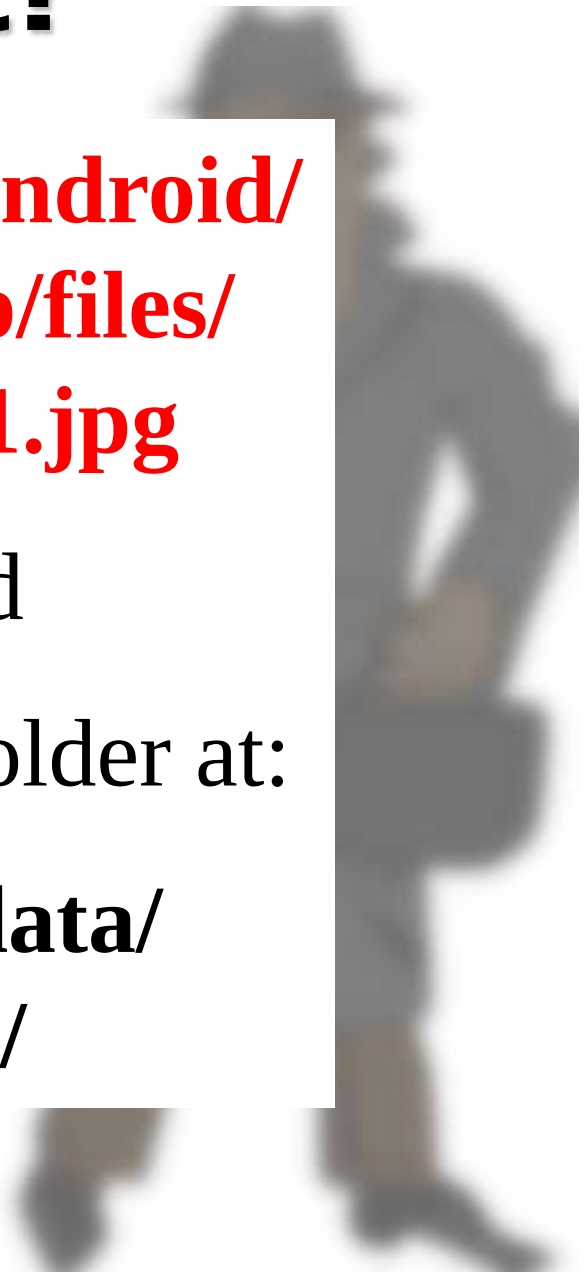
# Confused yet?

**/storage/OC27-99FD/Android/data/org.lineageos.snap/files/IMG_20200904_115941.jpg**

This is the micro-SDcard

But, there is an **empty** folder at:

**/root/sdcard/Android/data/org.lineageos.snap/files/**



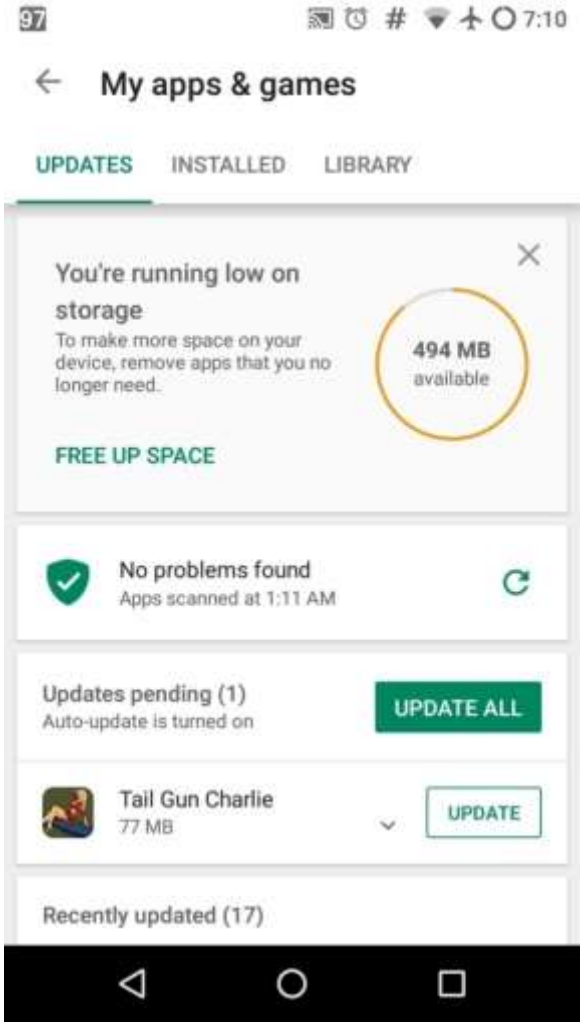
# Android Annoyances

Android apps don’t always work “as advertised” – and certainly not always as desired!

# Where are apps stored?

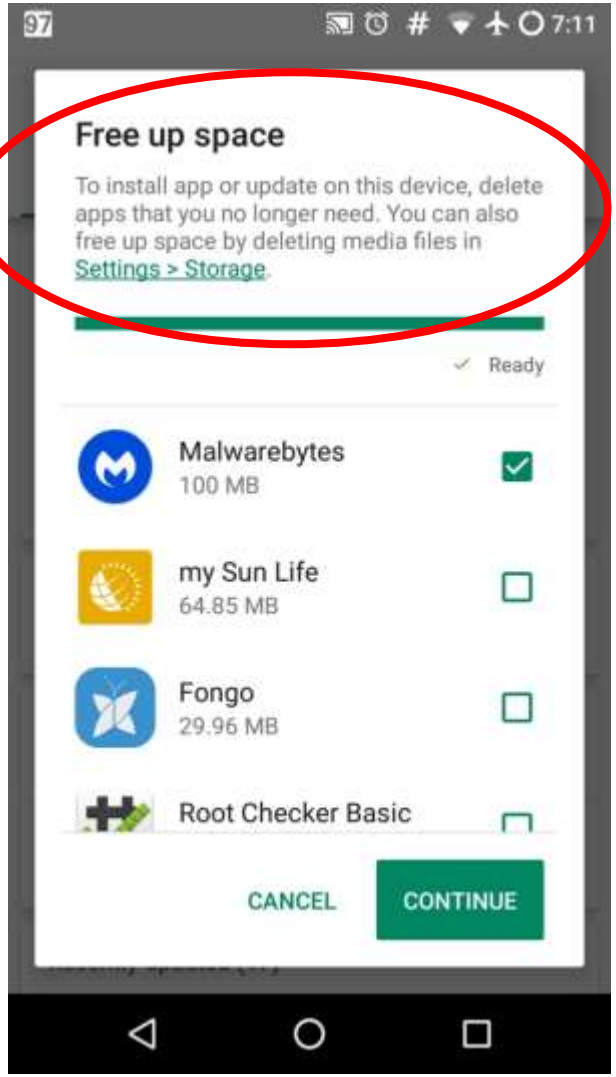
- Many apps are stored in the phone's main memory
- But, this can be a problem when internal storage is limited
- For example, my MotoG3 has 8 GB, but, the OS, the pre-installed apps, and just a few user-installed apps leave about 500 MB free!

# Annoyances – “Free” space




- Play Store
  My apps & games
  Updates pending
- **494 MB available**
  in main storage
- Pending update
  is **77 MB** - but
  much smaller
  updates also cause…

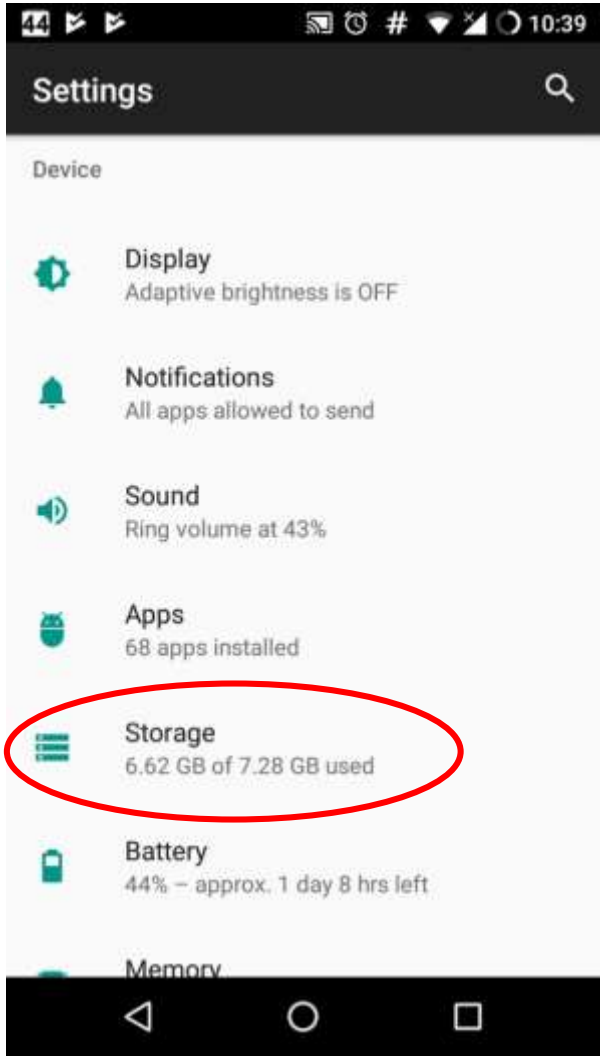
# Annoyances – "Free" space




- Nice of Android to suggest that I remove the virus scanner!
- Why do I need to remove anything?

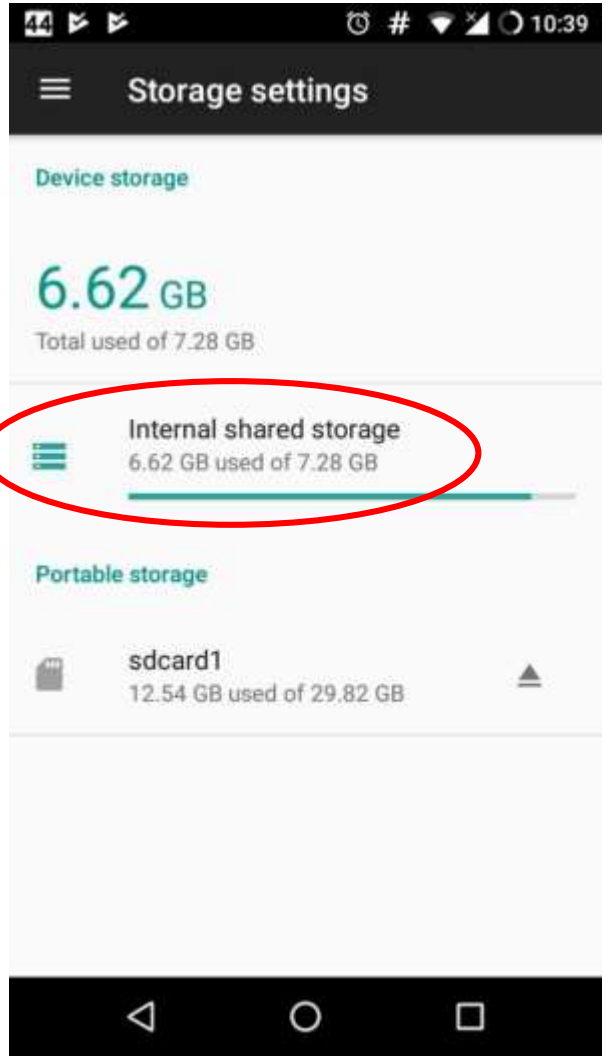
**494 MB >> 77 MB !**

# Workaround – Clear cache



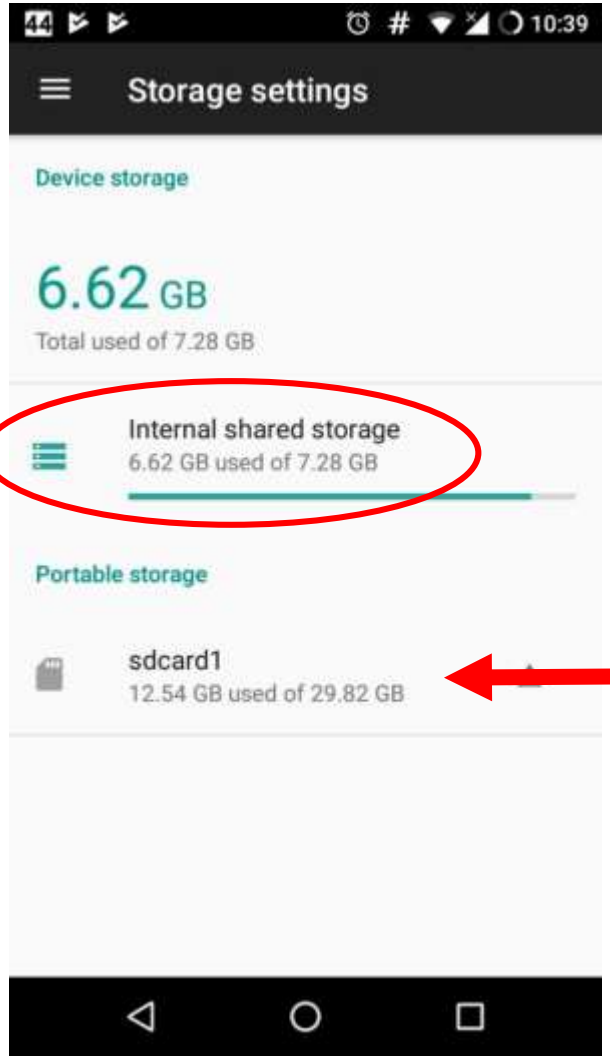

- Settings
- Storage

# Workaround – Clear cache




- Settings
- Storage
- Internal shared storage

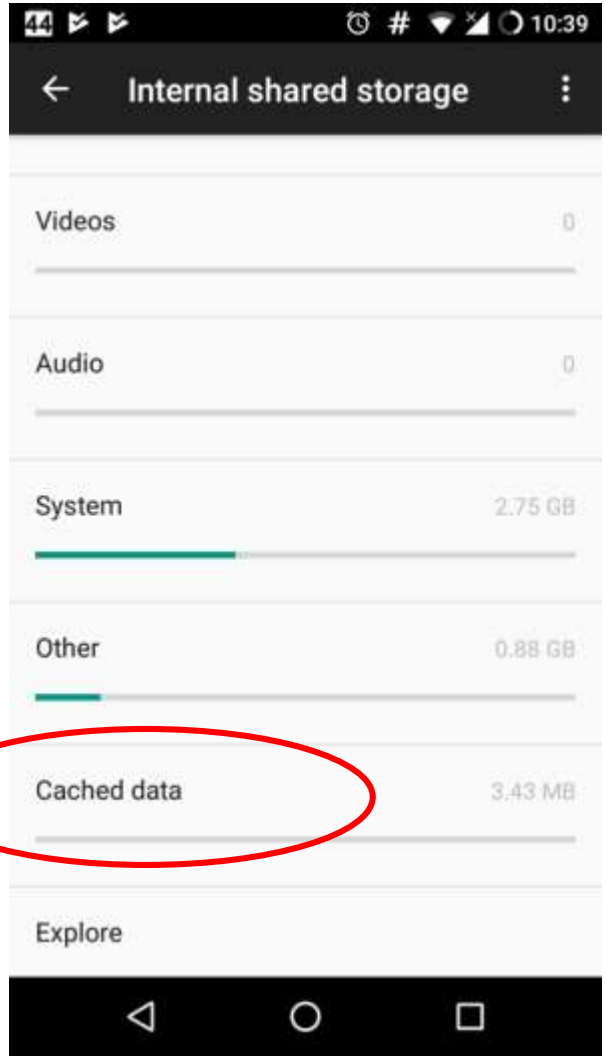
# Workaround – Clear cache




- Settings
- Storage
- Internal shared storage

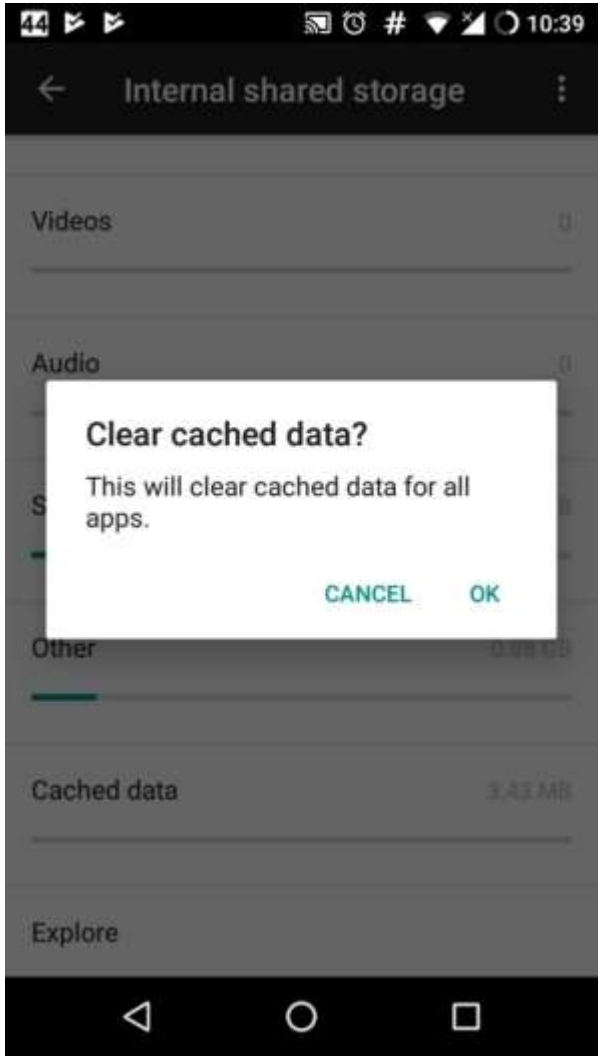
**[Note that the SDcard has 17 GB free!]**

# Workaround – Clear cache



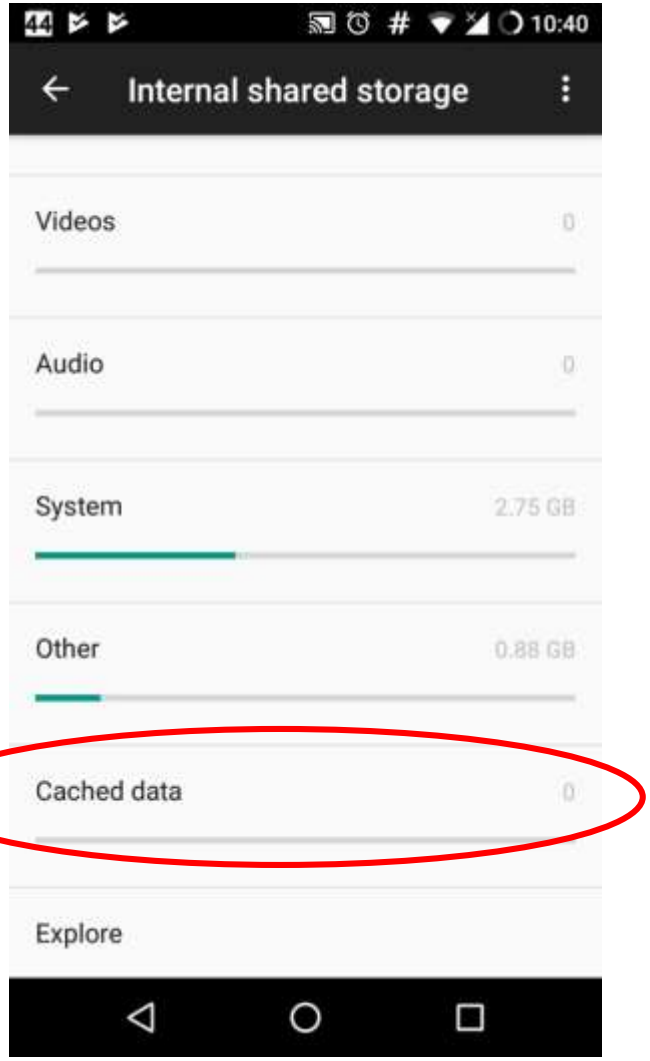

- Settings
- Storage
- Internal shared storage
- Cached data

# Workaround – Clear cache




- Settings
- Storage
- Internal shared storage
- Cached data
- Clear cached data – OK

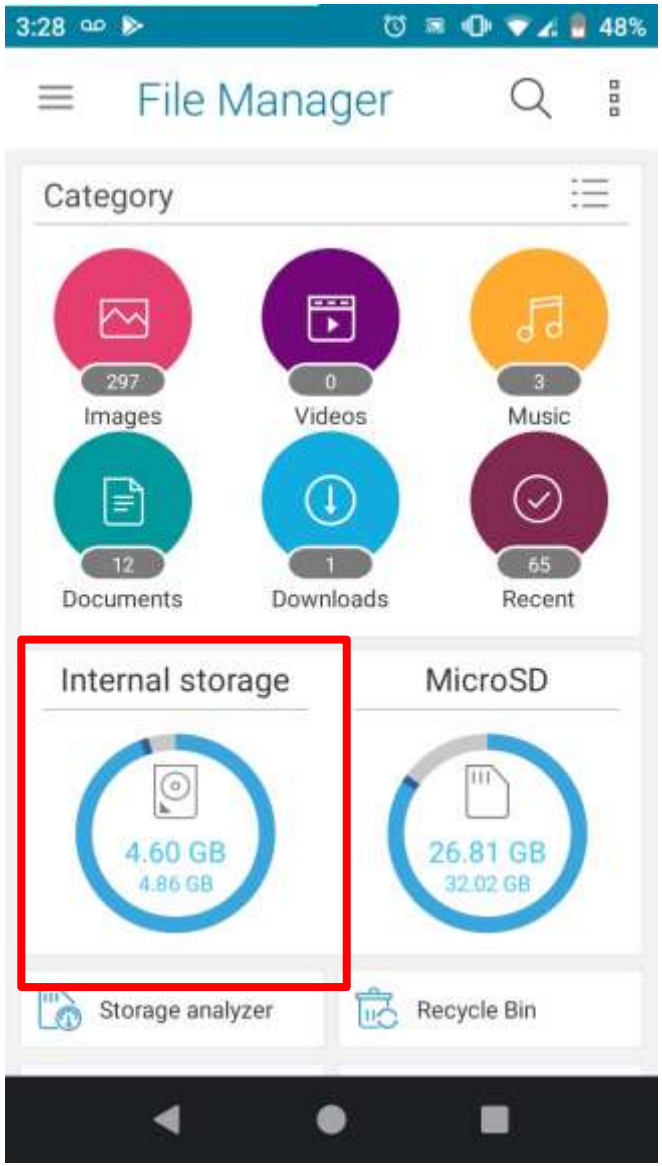
# Workaround – Clear cache




- Settings
- Storage
- Internal shared storage
- Cached data
- Clear cached data – OK
- Cached data = 0*

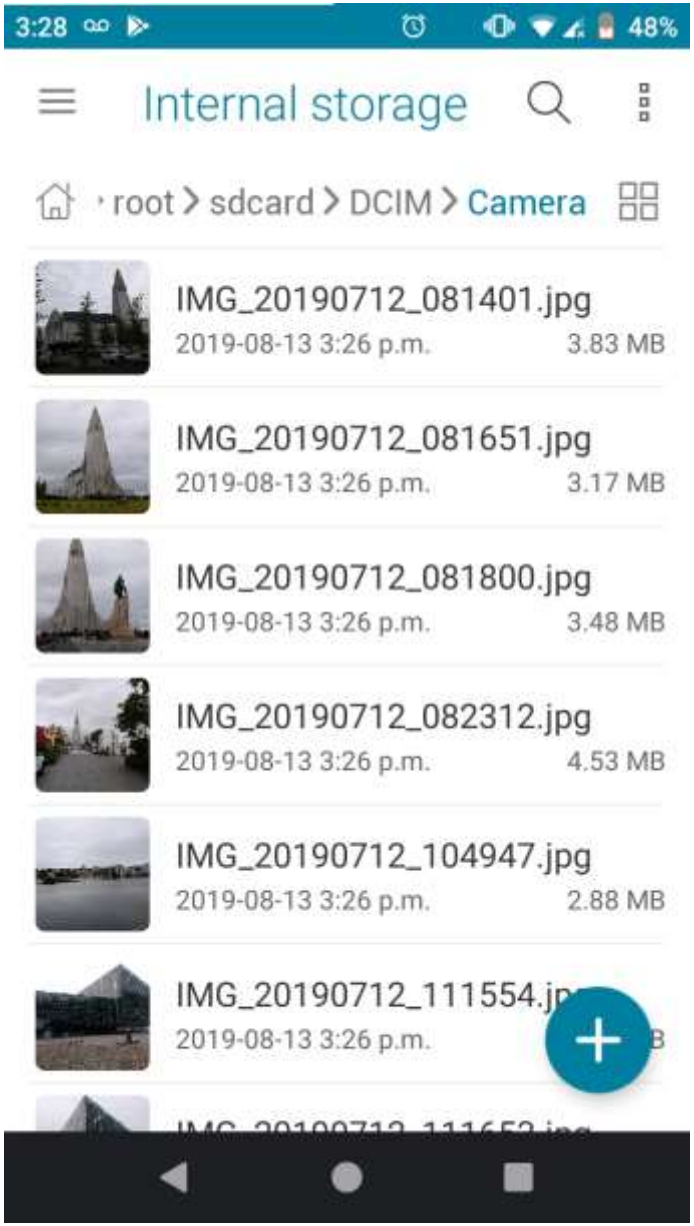
* Sometimes the cache has to be cleared twice to get to zero

# Workaround – Move photos




Internal storage

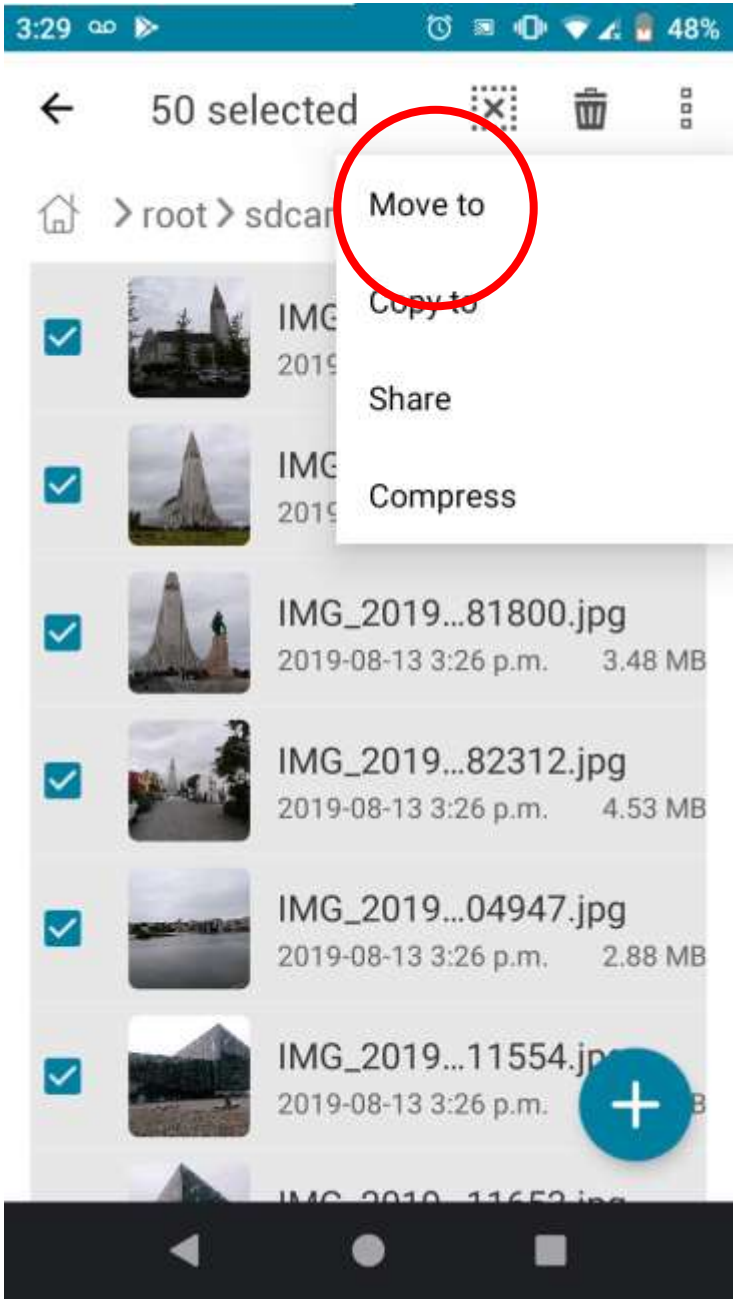
Available = 4.86 GB
Used = 4.60 GB
Free = 260 MB




# Locate photos from camera stored at:

Internal storage* (root/sdcard) DCIM/Camera

* *Note – There is no option in the stock camera to store the photos, on the Micro-SDcard*




Tag all the photos

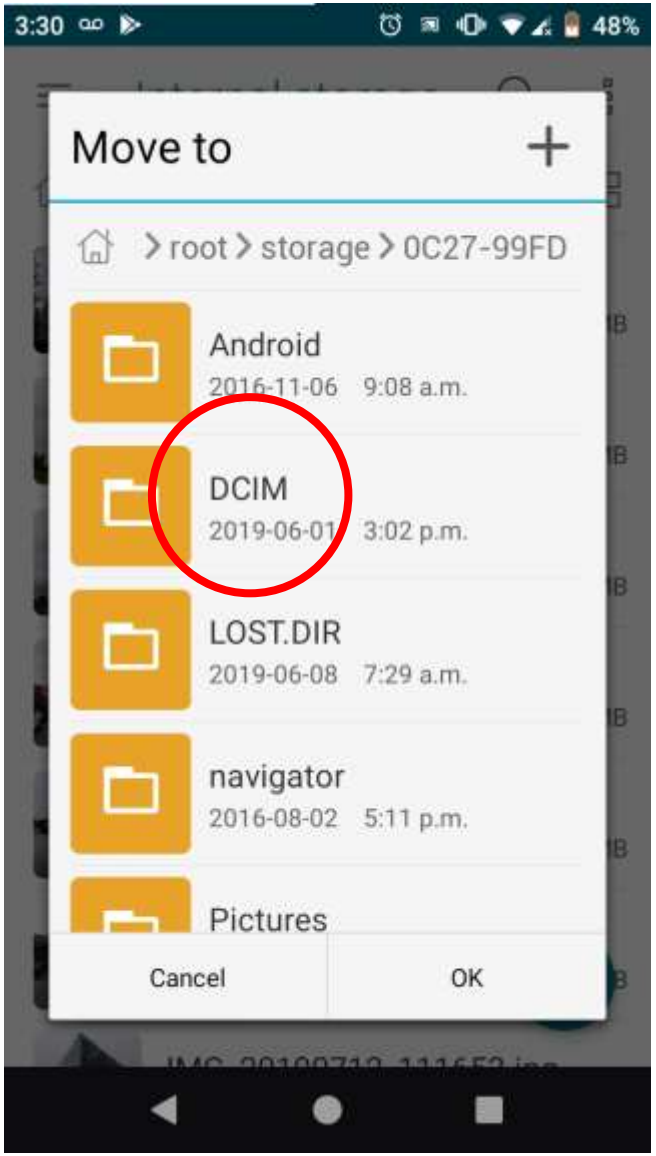
Select first photo.

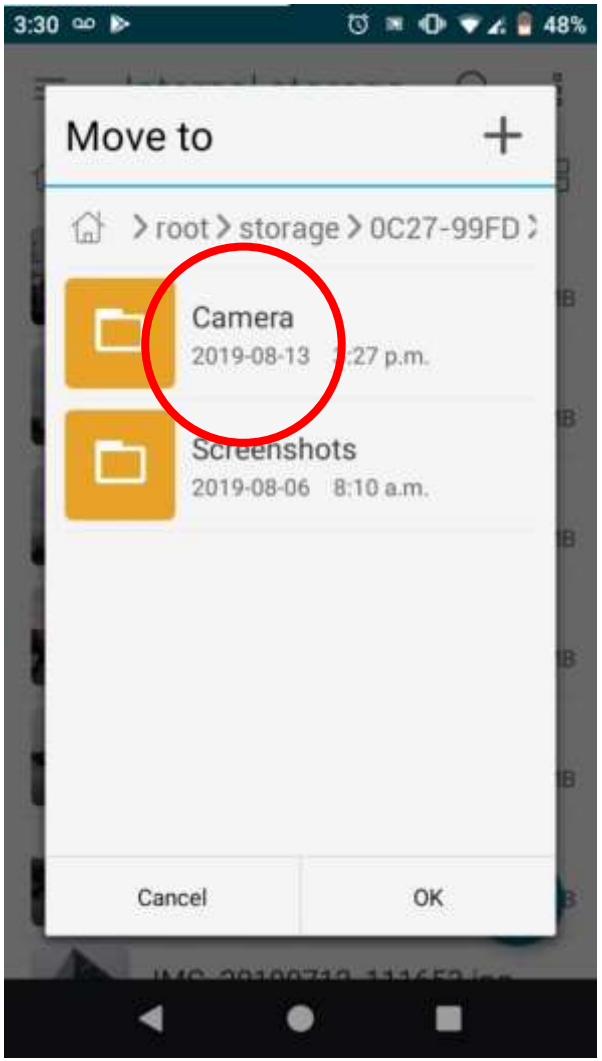
Select all (icon)

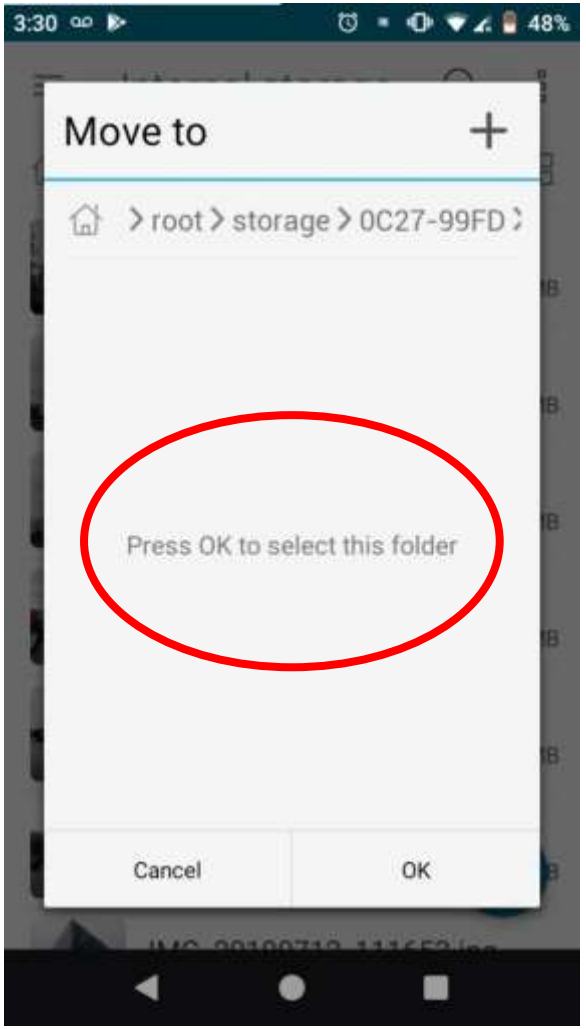
Select menu (three dots)

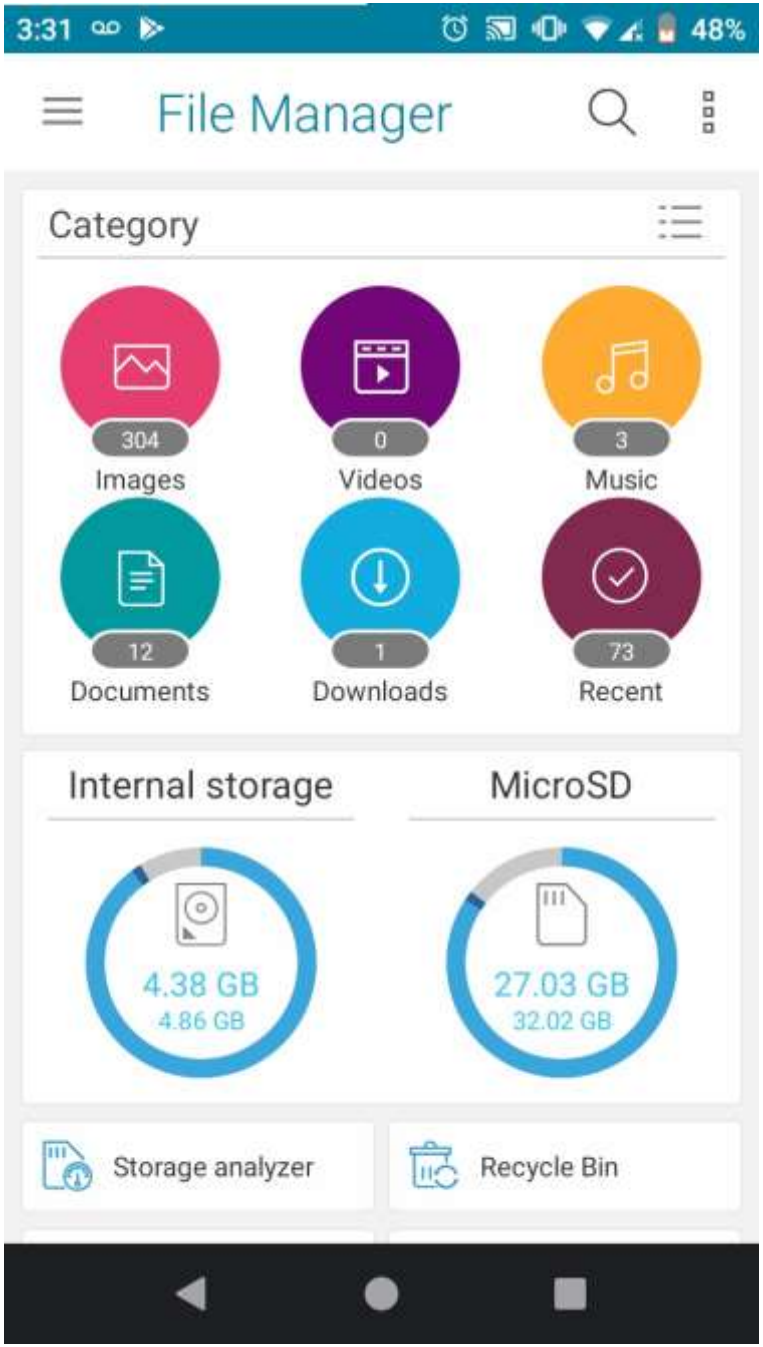
Select “Move to”

*OC27-99FD is the Micro SDcard*





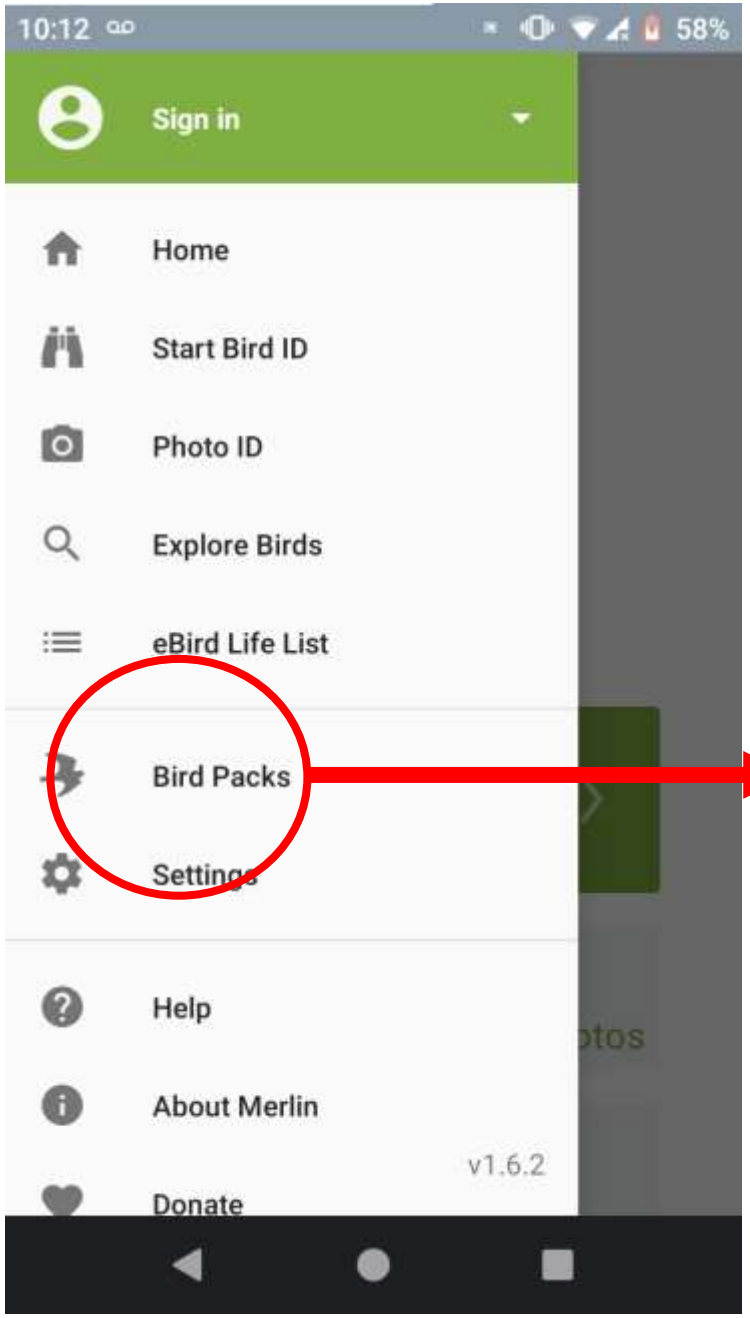

# Internal storage

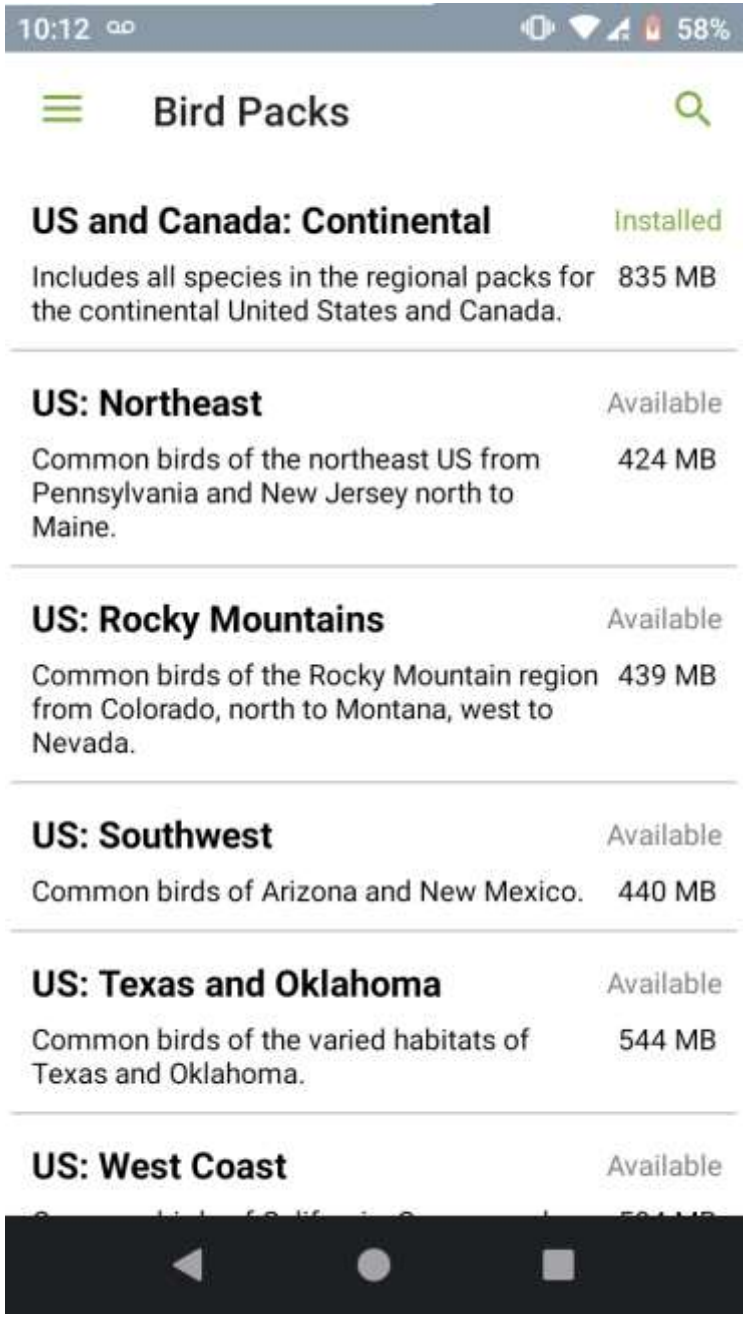
Available = 4.86 GB
Used = 4.38 GB
Free = 480 MB

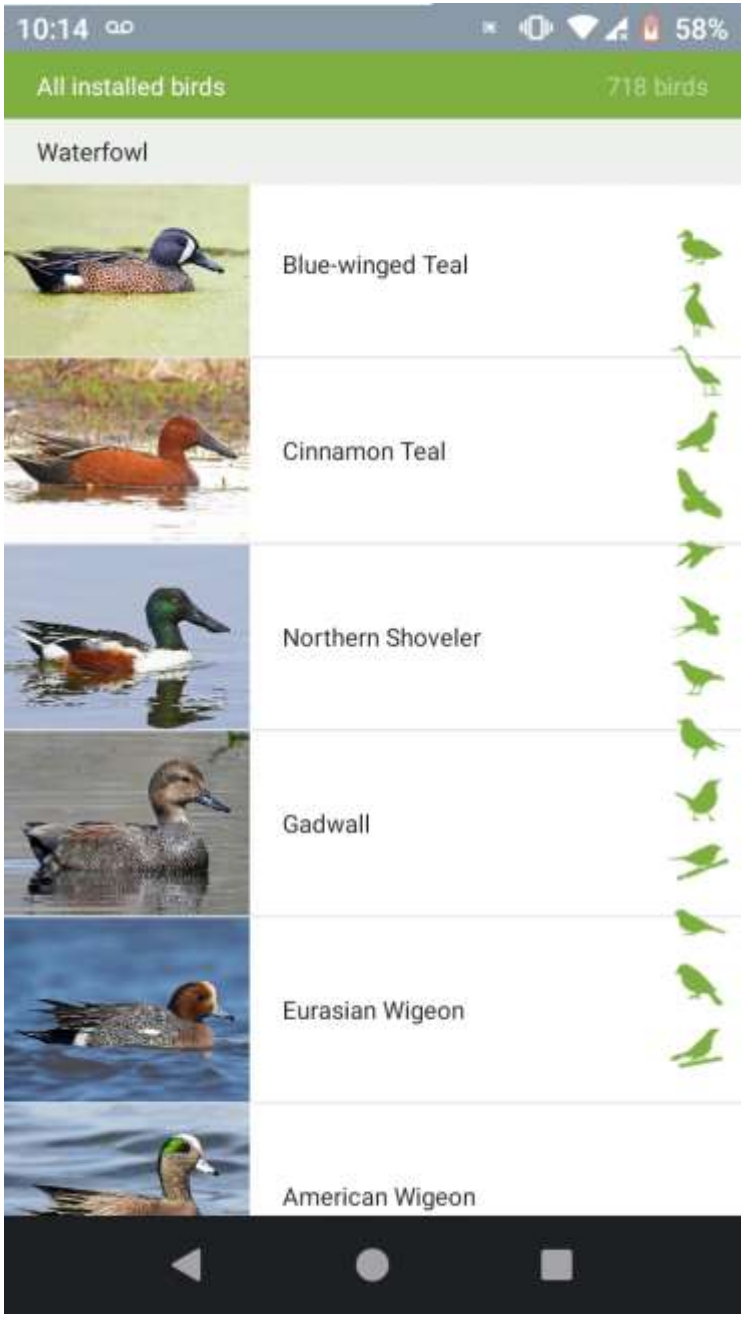
* *Note that we still have about 5 GB free on the Micro SDcard*

# Other storage solutions?

Bird field guide
Multiple locations
e.g. Canada, US, Mexico, UK…
Multiple guides! (bird packs)


10:12
58%
Sign in
Home
Start Bird ID
Photo ID
Explore Birds
eBird Life List
Bird Packs
Settings
Help
About Merlin
v1.6.2
Donate


10:12
58%
Bird Packs
US and Canada: Continental
Installed
Includes all species in the regional packs for the continental United States and Canada.
835 MB
US: Northeast
Available
Common birds of the northeast US from Pennsylvania and New Jersey north to Maine.
424 MB
US: Rocky Mountains
Available
Common birds of the Rocky Mountain region from Colorado, north to Montana, west to Nevada.
439 MB
US: Southwest
Available
Common birds of Arizona and New Mexico.
440 MB
US: Texas and Oklahoma
Available
Common birds of the varied habitats of Texas and Oklahoma.
544 MB
US: West Coast
Available




Species lists
- Photographs
- Descriptions
- Songs
- Range maps

10:16

Northern Cardinal

ID INFO | SOUNDS | MAP

Males are entirely red with black around the base of the bill. Females are brown overall with red tail, red on wings, and red bill. Note distinctive crest in both sexes. Forages mainly for seeds in dense shrubby areas. Regularly visits feeders

PREV NEXT

10:16 57%

Northern Cardinal

ID INFO | SOUNDS | MAP

- Song (Common)
- Song (Common)
- Calls (Common)
- Calls (Common)
- Song (Long-crested)
- Calls (Long-crested)

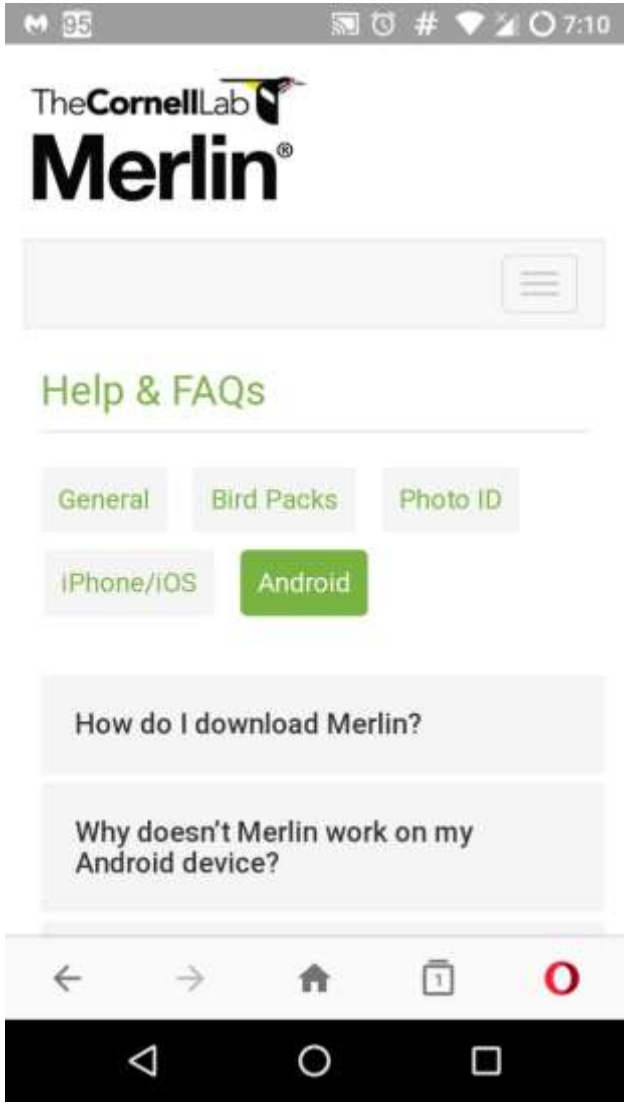
PREV

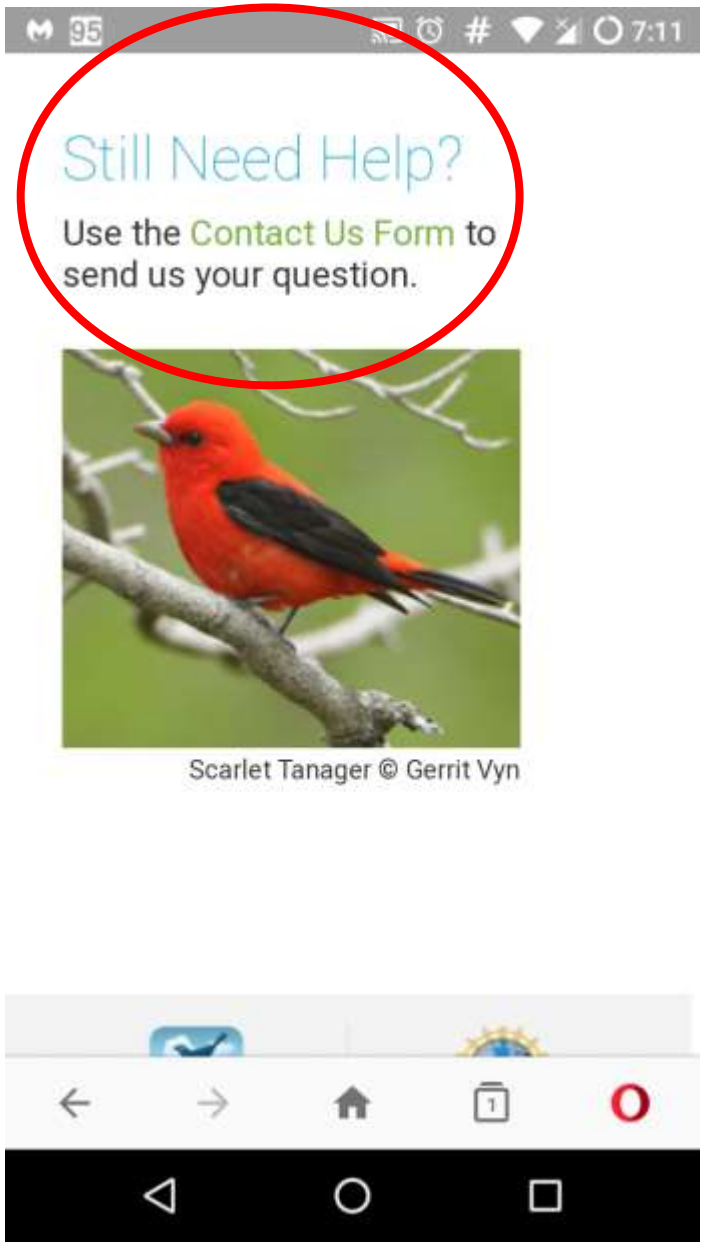
10:16 57%

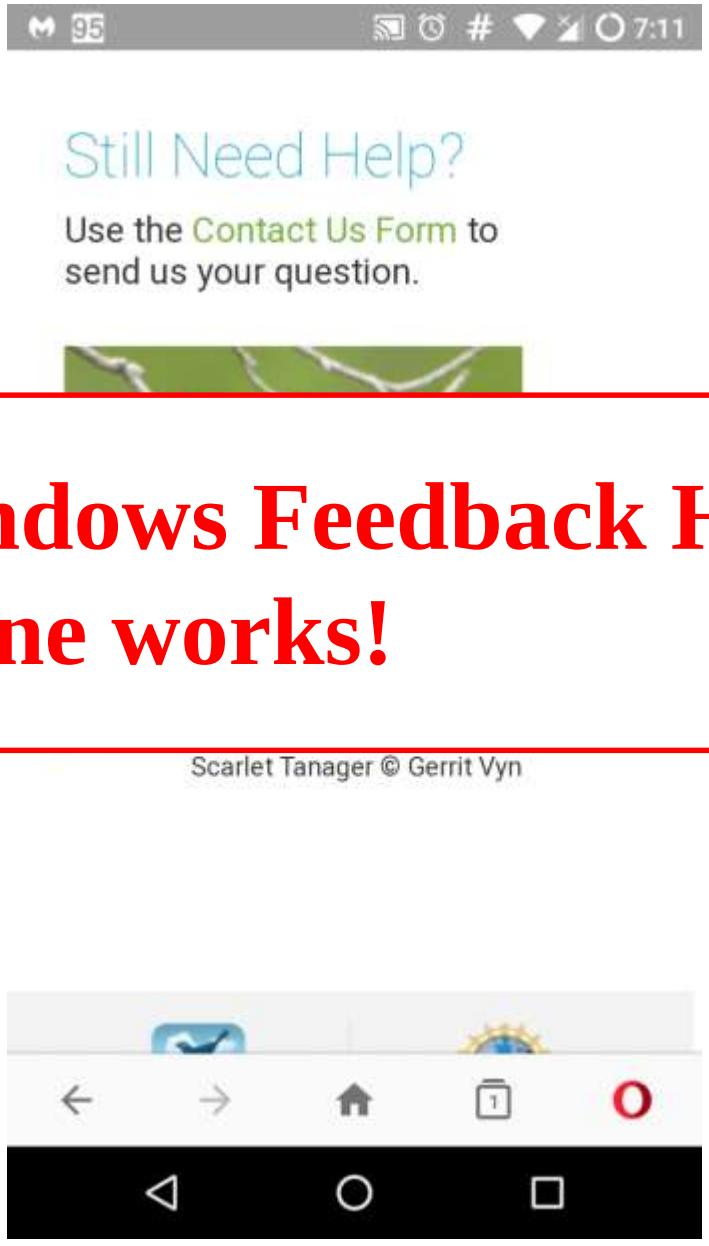
Northern Cardinal

ID INFO | SOUNDS | MAP

PREV NEXT

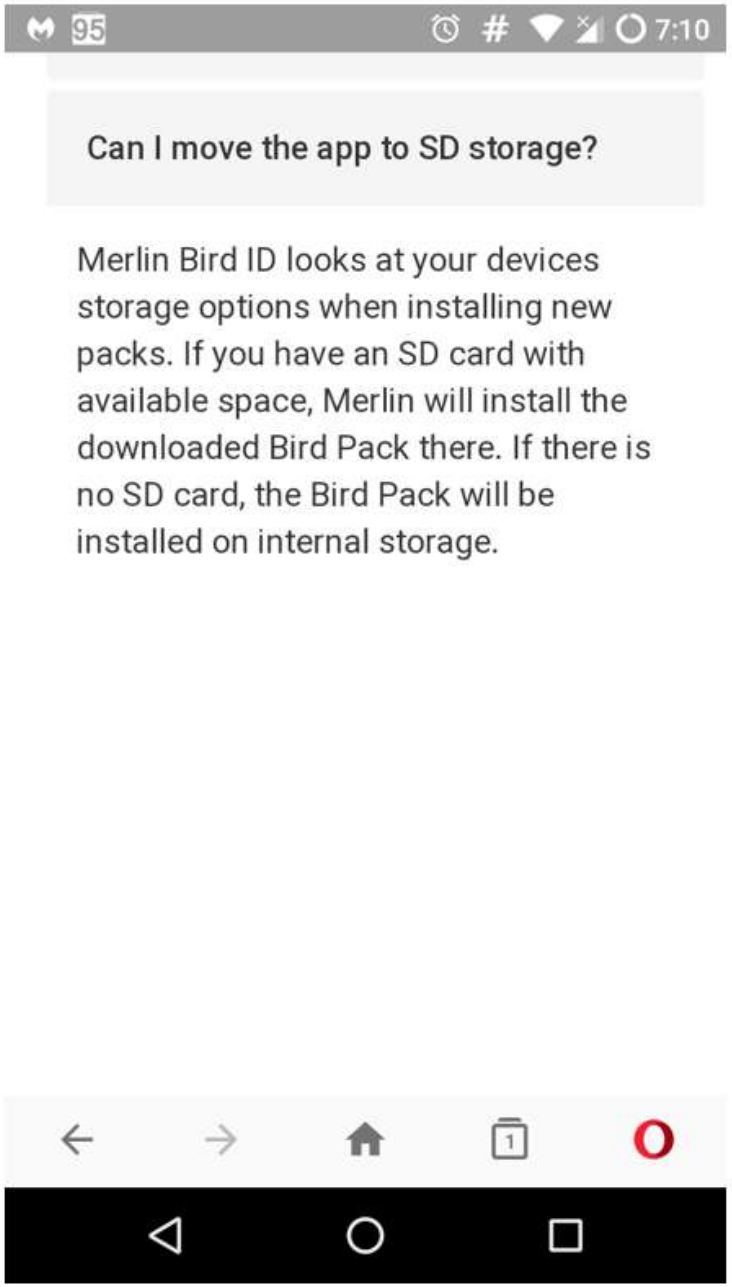

7:10
TheCornellLab
Merlin®
Help & FAQs
General
Bird Packs
Photo ID
iPhone/iOS
Android
How do I download Merlin?
Why doesn't Merlin work on my Android device?


7:11
Still Need Help?
Use the Contact Us Form to send us your question.
Scarlet Tanager © Gerrit Vyn




**Like the Windows Feedback Hub except this one works!**

# Updated version…



Updated version…

# More Android Annoyances

Sometimes, there's a workaround. The alternative may be to find a different app…

# Annoyances – Camera

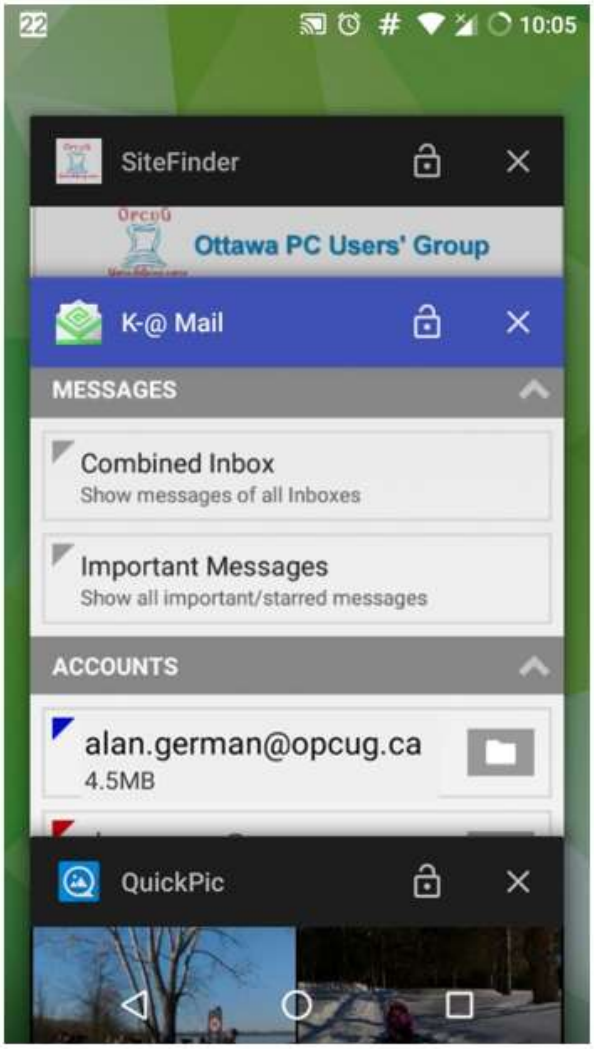
Google doesn't like Micro SDcards!

Stock camera (Oreo and Pie) won't save to the SDcard

Workaround:

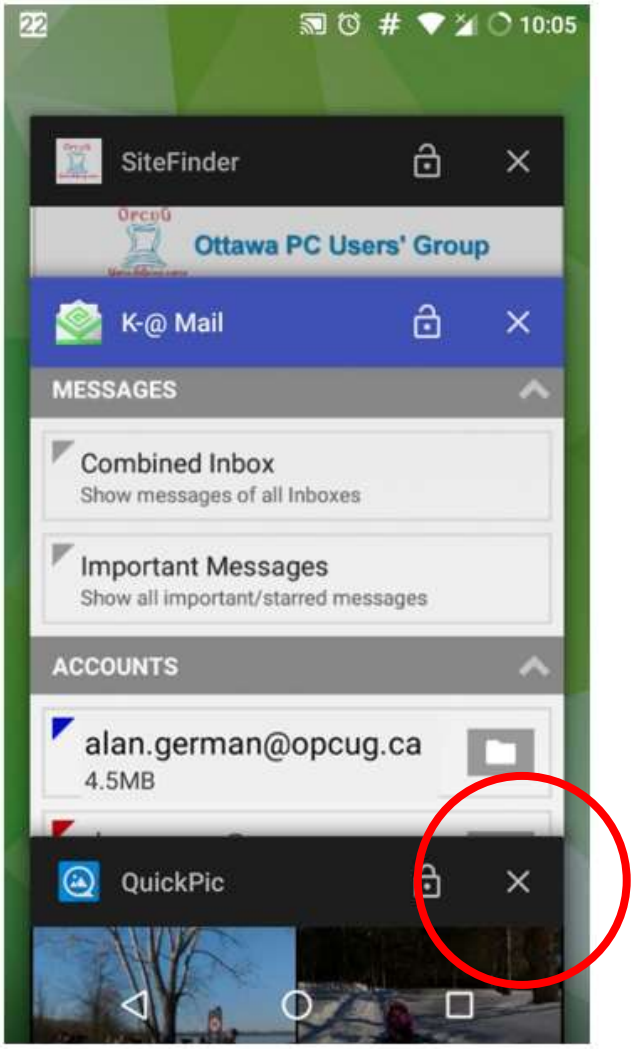
- Download a different camera app
- Set Micro SDcard as (extended) internal storage

# Annoyances – Clear "All"



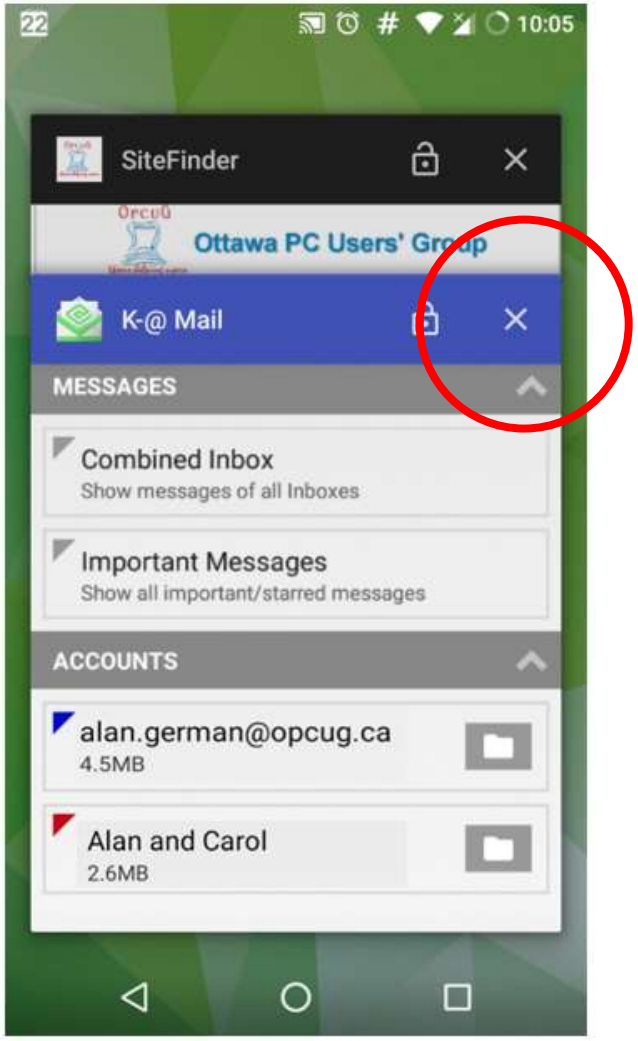

- We have three apps open

# Annoyances – Clear "All"




- We have three apps open
- Let's clear QuickPic by hitting the "X"

# Annoyances – Clear "All"



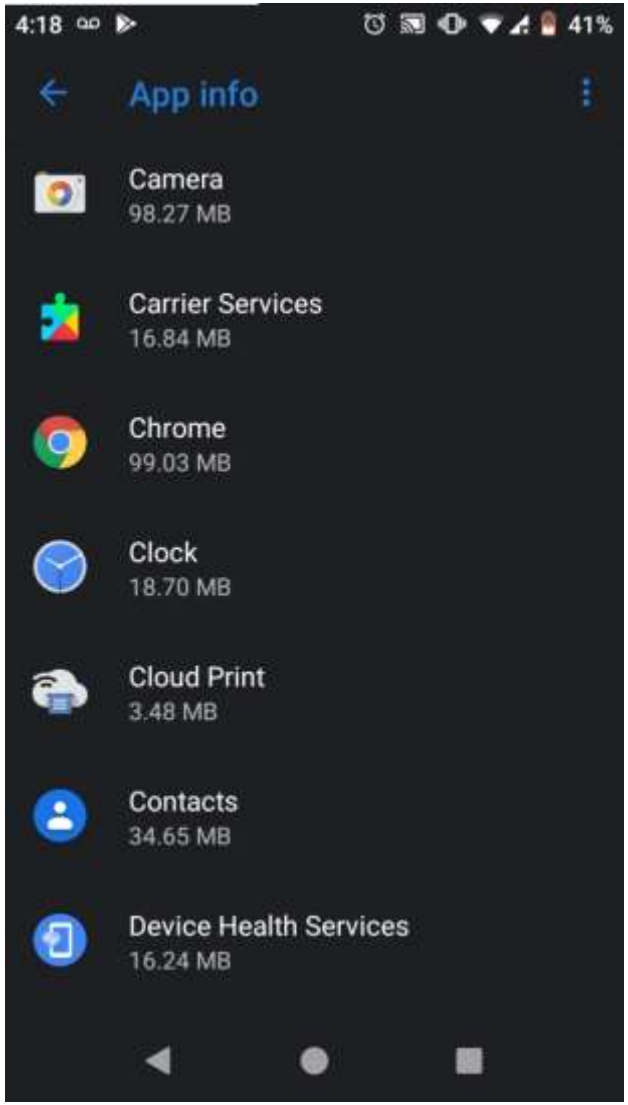

- Now, we have two apps open
- Let's clear K-@ Mail

# Annoyances – Clear "All"

- We have one app open
- And now we can "CLEAR ALL"

  Aaghh!!!!

# Annoyances – Default apps




Default apps are “sticky”

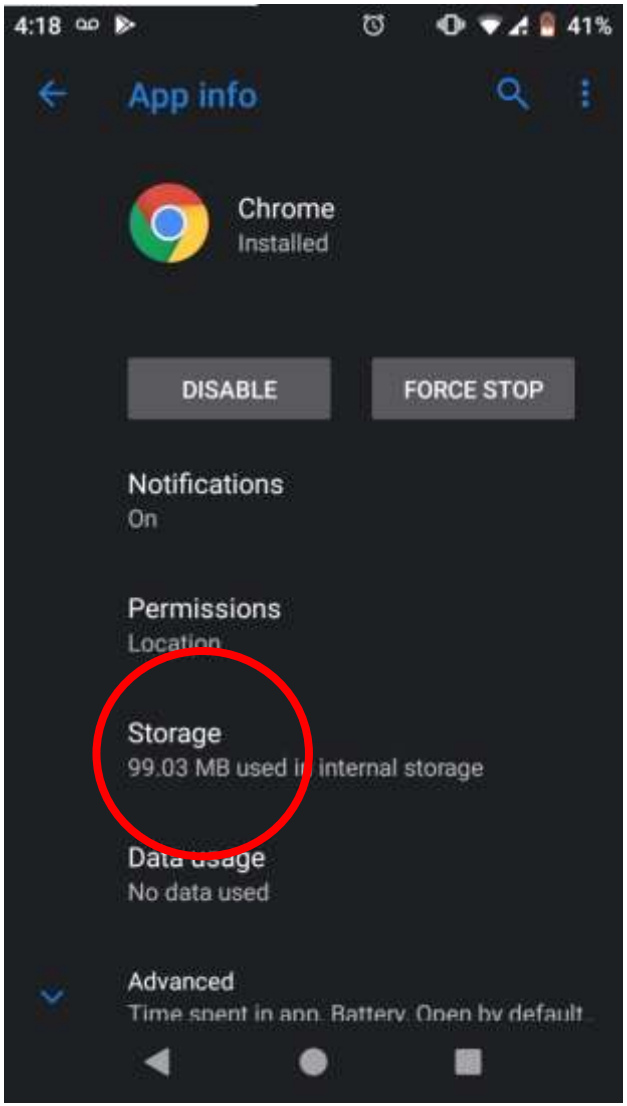
Pre-installed Google apps can’t be uninstalled

There are lots of Google apps!

There are many that I don’t use

They take up lots of **internal storage** space!

# Annoyances – Default apps

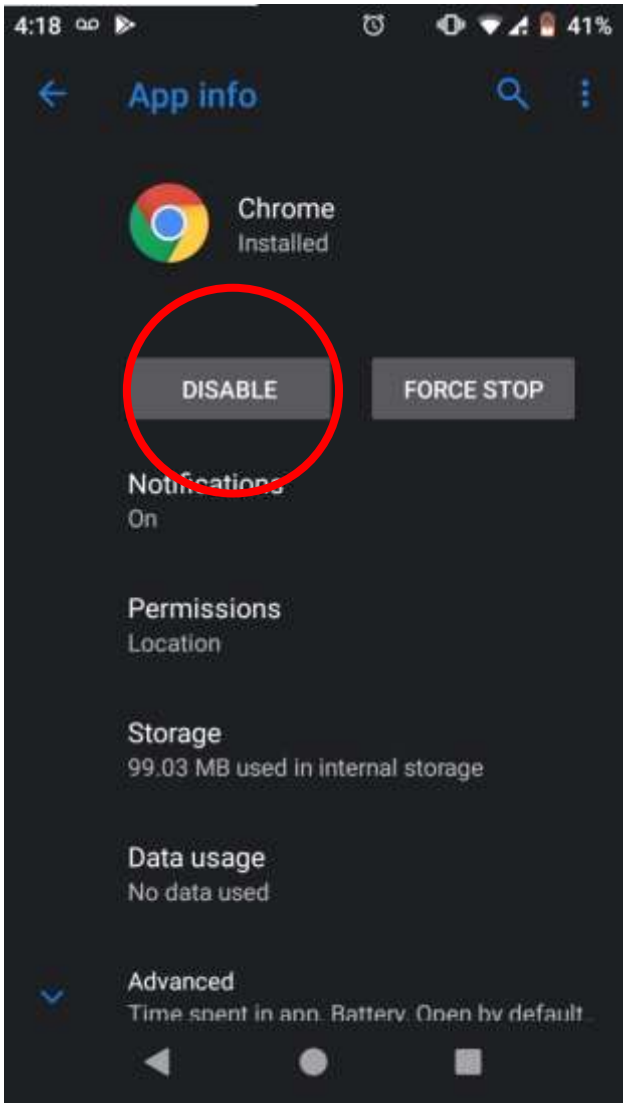



Chrome browser (My preference is to use Opera)

Uses 99.03 MB of internal storage

There is no uninstall option

# Annoyances – Default apps

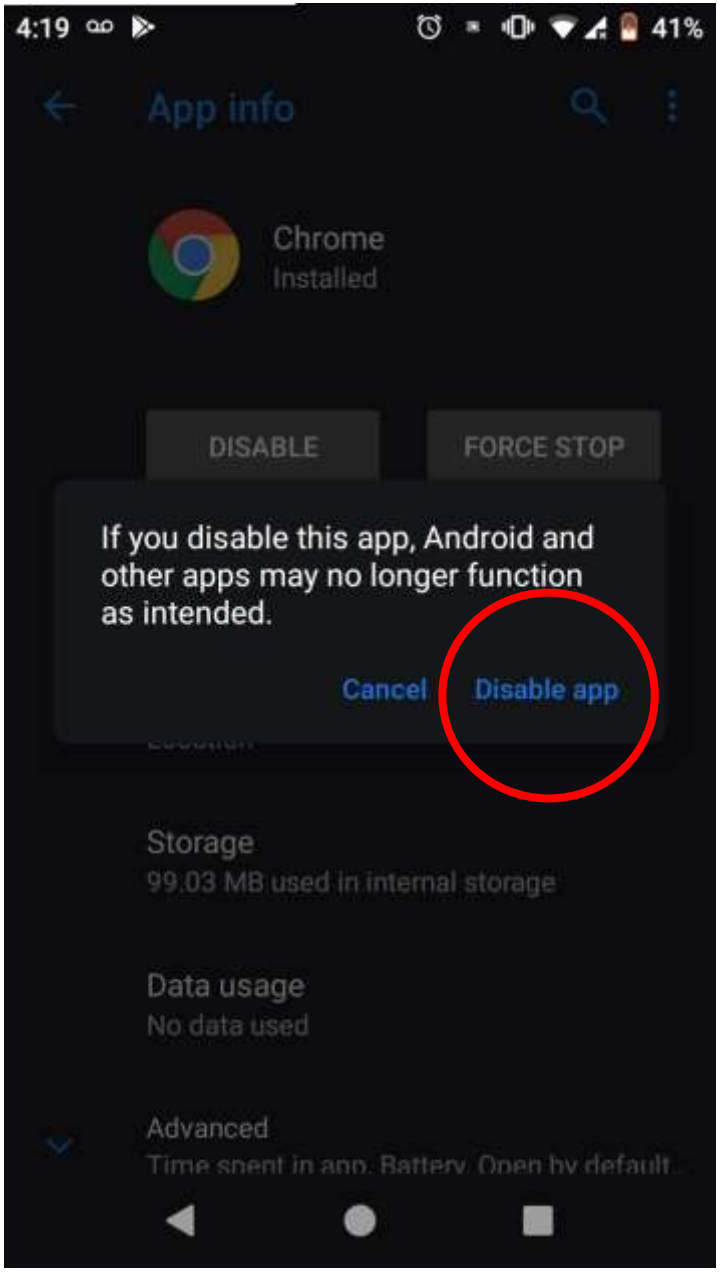


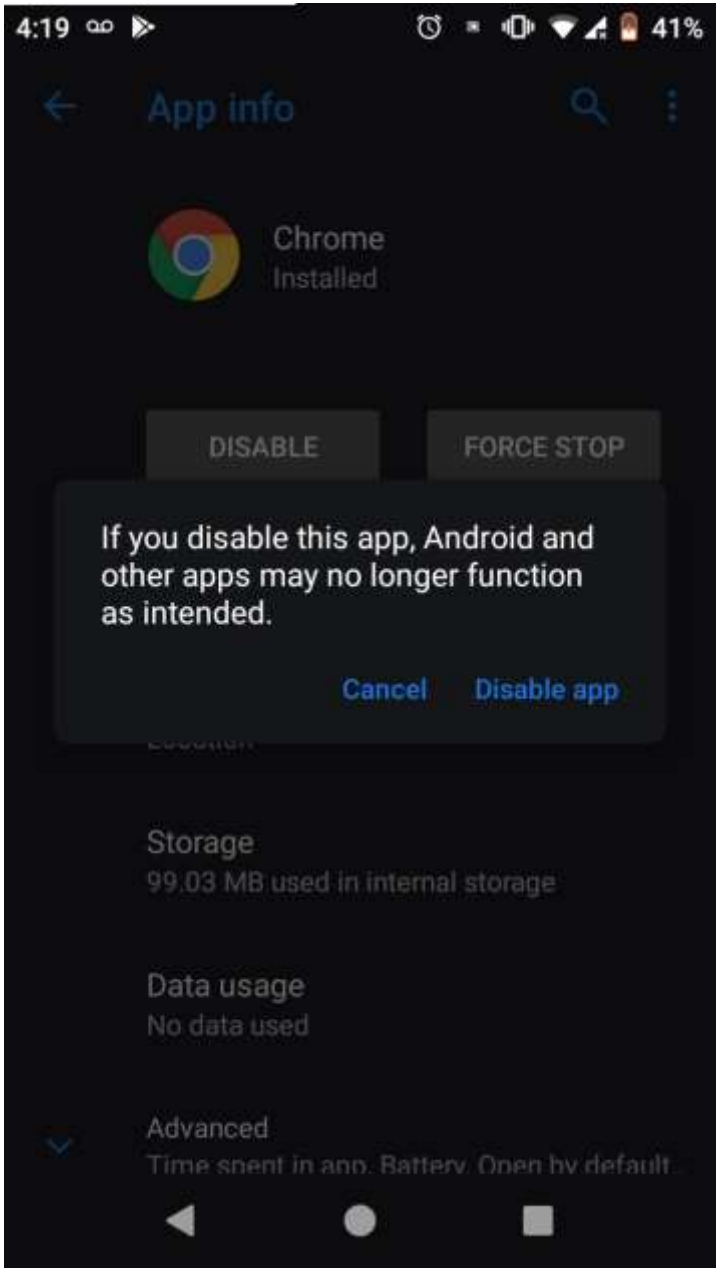

Chrome browser (My preference is to use Opera)

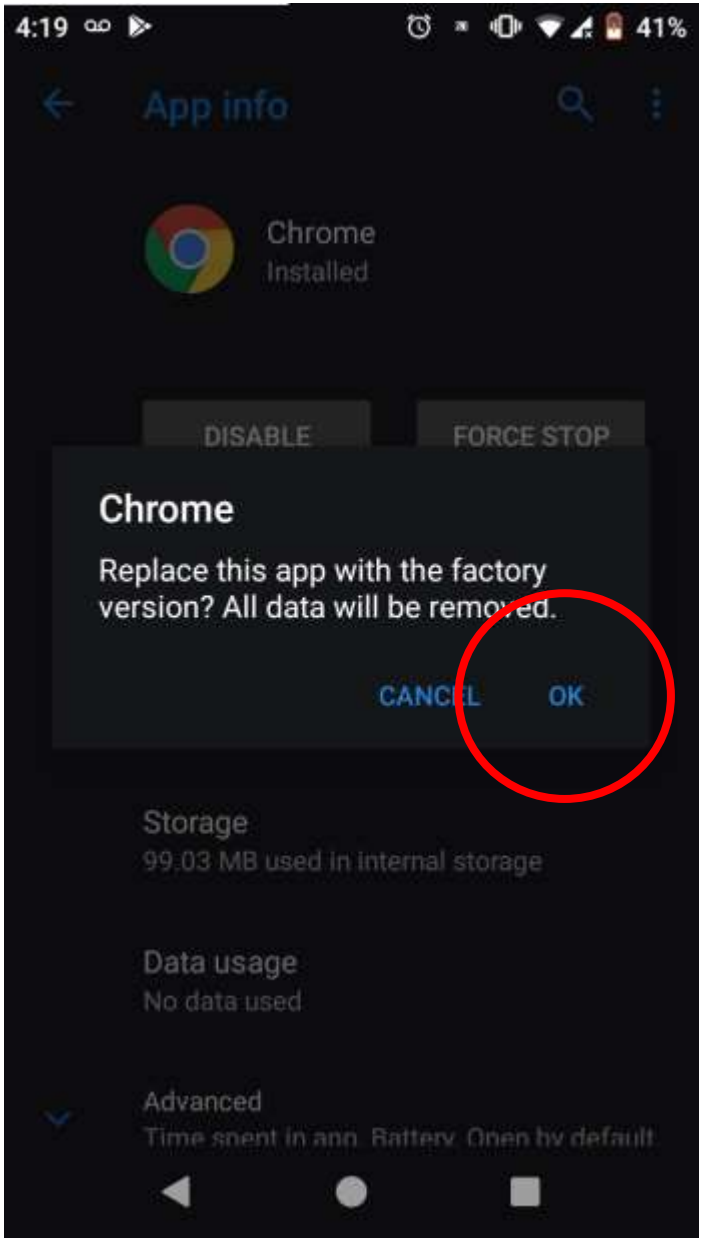
Uses 99.03 MB of internal storage

There is no uninstall option

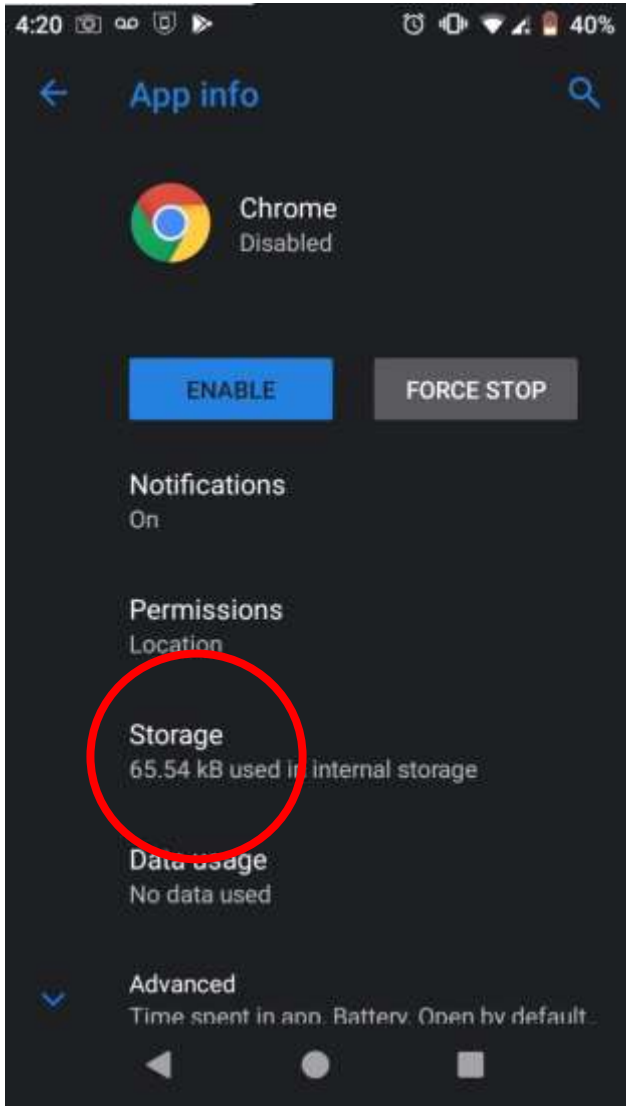
But, we can “disable” the app


4:19
41%
App info
Chrome
Installed
DISABLE
FORCE STOP
If you disable this app, Android and other apps may no longer function as intended.
Cancel
Disable app
Storage
99.03 MB used in internal storage
Data usage
No data used
Advanced


4:19
41%
App info
Chrome
Installed
DISABLE
FORCE STOP
If you disable this app, Android and other apps may no longer function as intended.
Cancel
Disable app
Storage
99.03 MB used in internal storage
Data usage
No data used
Advanced


4:19
41%
App info
Chrome
Installed
DISABLE
FORCE STOP
Chrome
Replace this app with the factory version? All data will be removed.
CANCEL
OK
Storage
99.03 MB used in internal storage
Data usage
No data used
Advanced

# Annoyances – Default apps




"Factory version"

Now uses only 65 kB of internal storage

It will not receive updates (saves time and storage space)

We can re-enable the app (doesn't need re-installing)

# More Android Annoyances

Sometimes, there's a workaround. The alternative may be to find a different app…

# More Android Annoyances

Sometimes, there's a workaround. The alternative may be to find a different app… **or a different version of Android!**

# Custom ROM's

- Android is open-source
- Third-party developers create custom ROM's (i.e. different versions of the OS and the apps)
- Bootloader must be unlocked (phone not tied to a specific carrier)
- Custom ROM is flashed to phone
- Phone can be rooted (if desired)

# Custom ROM's

Installing a custom ROM will
**void the phone's warranty**

** Not a problem if the phone is already out of warranty!*

# Custom ROM's

- Unlock the bootloader
- Install recovery software
  (TWRP - TeamWin Recovery Project)
- Install custom ROM
  (XDA Developers support forums,
  specific for any given smartphone)
- Install Open GApps (Google apps)

# Moto G3 - Process is crazy!

- Enable USB Debugging Mode
  *Settings – About Phone – Build Number*
  Tap on the build number 7 times
  *"You are now a developer!"*
- Install the latest USB drivers
- Obtain the unlock code

# Moto G3 - Process is crazy!

- Use Android Debug Bridge (ADB) and Fastboot
- Powershell command:
  **.\fastboot oem get_unlock_data**
- Fastboot returns the “Device ID”

# Device ID !

```
(bootloader) 3A55840886780068#5A593232333451
(bootloader) 474C42004D6F746F4733000000#8482
(bootloader) AA403C7B9BBC375978A9DE77EF180B9
(bootloader) 41259#822EC71600000000000000000
(bootloader) 0000000
```

Our task is now to convert this to a single string of alpha-numeric characters, eliminating “(bootloader)”, all spaces, and the line-feed characters

# Device ID !

```
(bootloader) 3A55840886780068#5A593232333451
(bootloader) 474C42004D6F746F4733000000#8482
(bootloader) AA403C7B9BBC375978A9DE77EF180B9
(bootloader) 41259#822EC71600000000000000000
(bootloader) 0000000
```

Our task is now to convert this to a single string of alpha-numeric characters, eliminating “(bootloader)”, all spaces, and the line-feed characters

**Why not just give us the actual code string?!**

# Moto G3 - Process is crazy!

- Copy and paste the string to Motorola's web site
- Request an unlock key
- The unlock code is sent by E-mail ! (U6LLR4MDUC2EVZ5Q5DIY)

# Moto G3 - Process is crazy!

- Copy and paste the string to Motorola's web site
- Request an unlock key
- The unlock code is sent by E-mail ! (U6LLR4MDUC2EVZ5Q5DIY)

**Why not send the unlock code in the first place – sigh…**

# Moto G3 - Process is crazy!

- Powershell command:

  **.\fastboot oem unlock**

  **U6LLR4MDUC2EVZ5Q5DIY**
- *"Phone is successfully unlocked"*
- Reboot…

# WARNING
# BOOTLOADER UNLOCKED

Your device's bootloader has been unlocked, allowing critical software components to be altered in a manner that may cause damage to the device or result in injury to users.

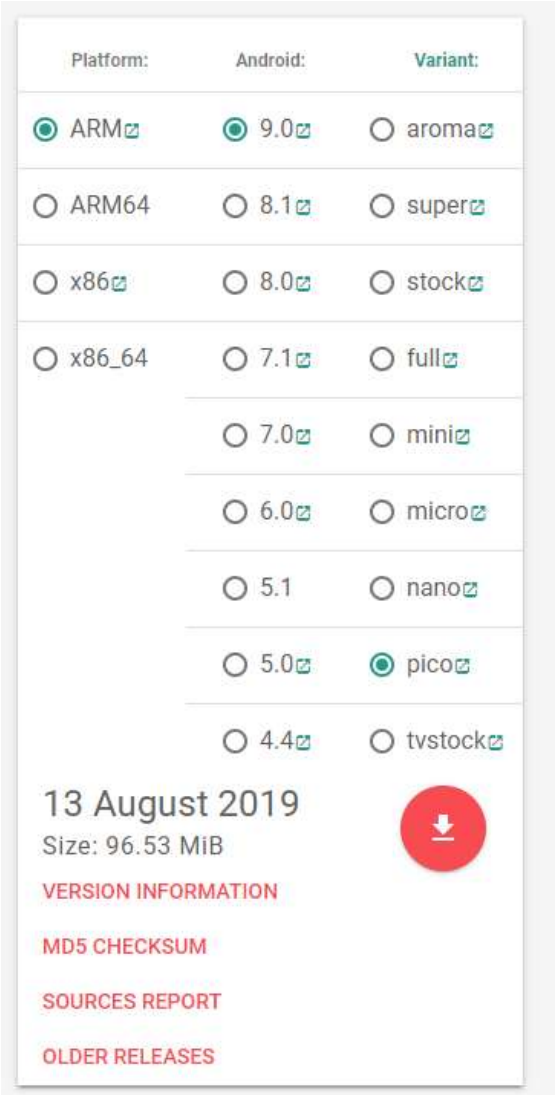
Motorola disclaims any liability for harm to person or property resulting from use of this device. Except for Developer Edition devices, all warranties are null and void.

Visit **www.motorola.com/unlockbootloader** for more information, and a copy of the applicable legal agreement.

# Moto G3 – Now, the process gets more rational

- Run TWRP
- Make a full system backup
- Wipe the system (but not the Micro SDcard!)
- Install (flash) the custom ROM
- Install Open GApps…

# Open GApps




Version of GApps must be compatible with:
CPU (e.g. ARM)
Version of Android (e.g. 9.0 = Pie)
Multiple variants (e.g. stock, pico…)

# GApps Variants

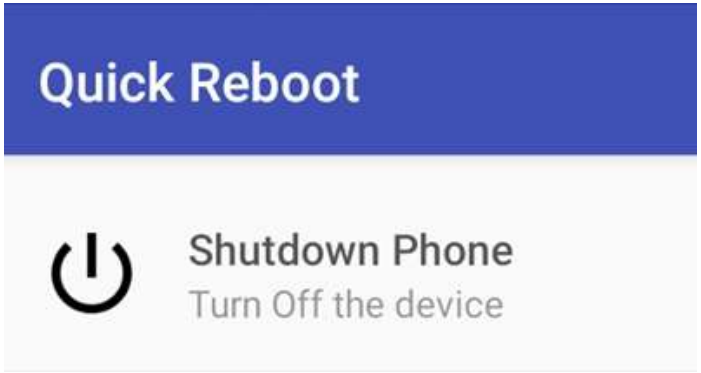
| Application Name | gapps-config keyword | pico | nano | micro | mini | full | stock | super |
|---|---|---|---|---|---|---|---|---|
| Google System Base | | X | X | X | X | X | X | X |
| Google Play Store | | X | X | X | X | X | X | X |
| Google Calendar Sync | `CalSync` | X | X | + | + | + | + | + |
| Google Play Services | | X | X | X | X | X | X | X |
| Sounds[4] | | X | X | X | X | X | X | X |
| Device Health Services | `BatteryUsage` | | X | X | X | X | X | X |
| Google Calendar[1] | `CalendarGoogle` | | | O | O | O | O | O |
| Google Exchange Services[1] | `ExchangeGoogle` | | | O | O | O | O | O |
| Gmail | `Gmail` | | | X | X | X | O | O |

# Rooting the phone

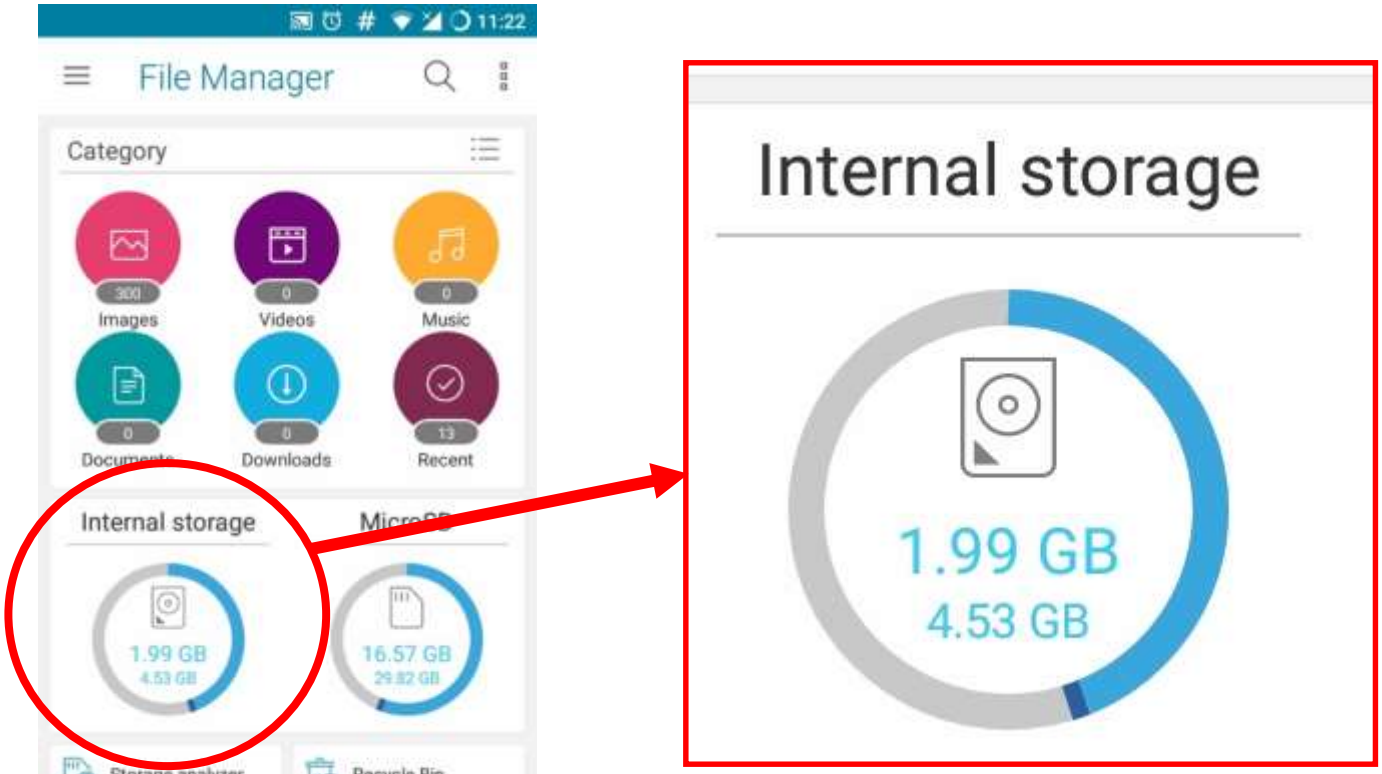
- Obtain root (superuser) access to the OS and file system
- Various methods:
  - SuperSU
  - Magisk/Magisk Manager
  - AddonSU (LineageOS)
- Check root access
  - Root Checker (joeykrim)

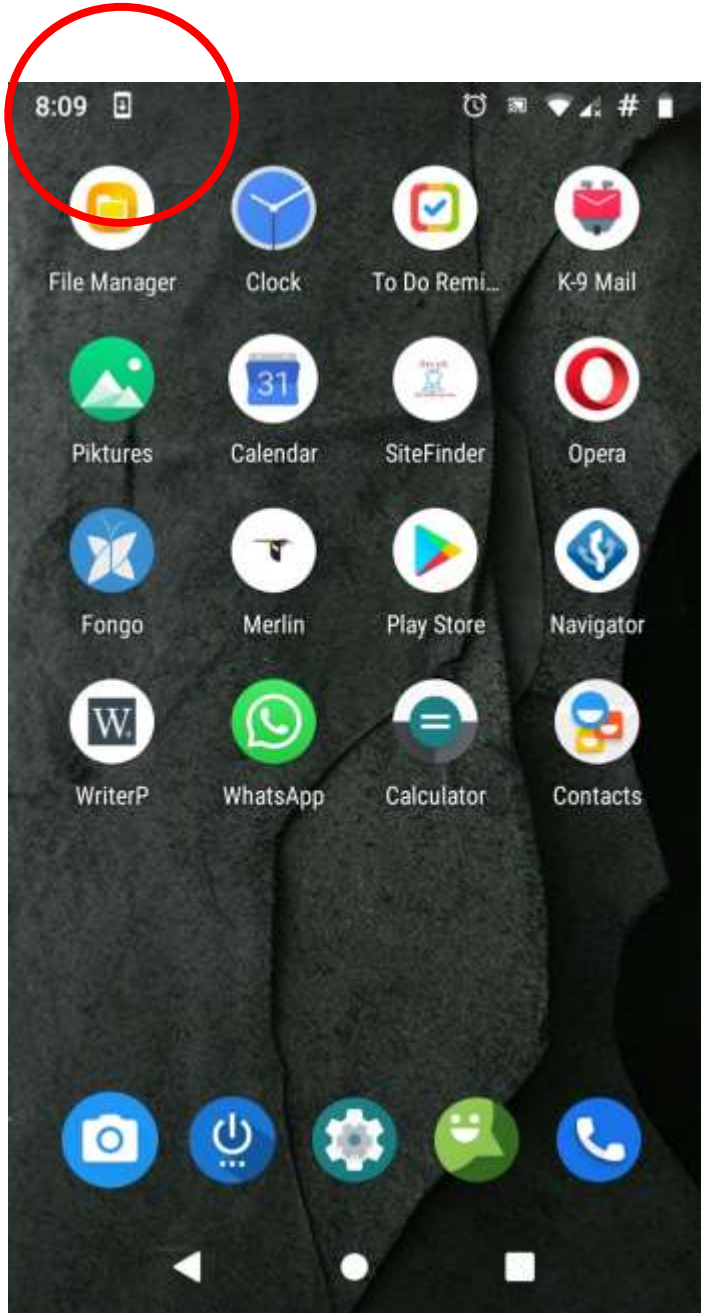
# Benefits of Custom ROM/Root

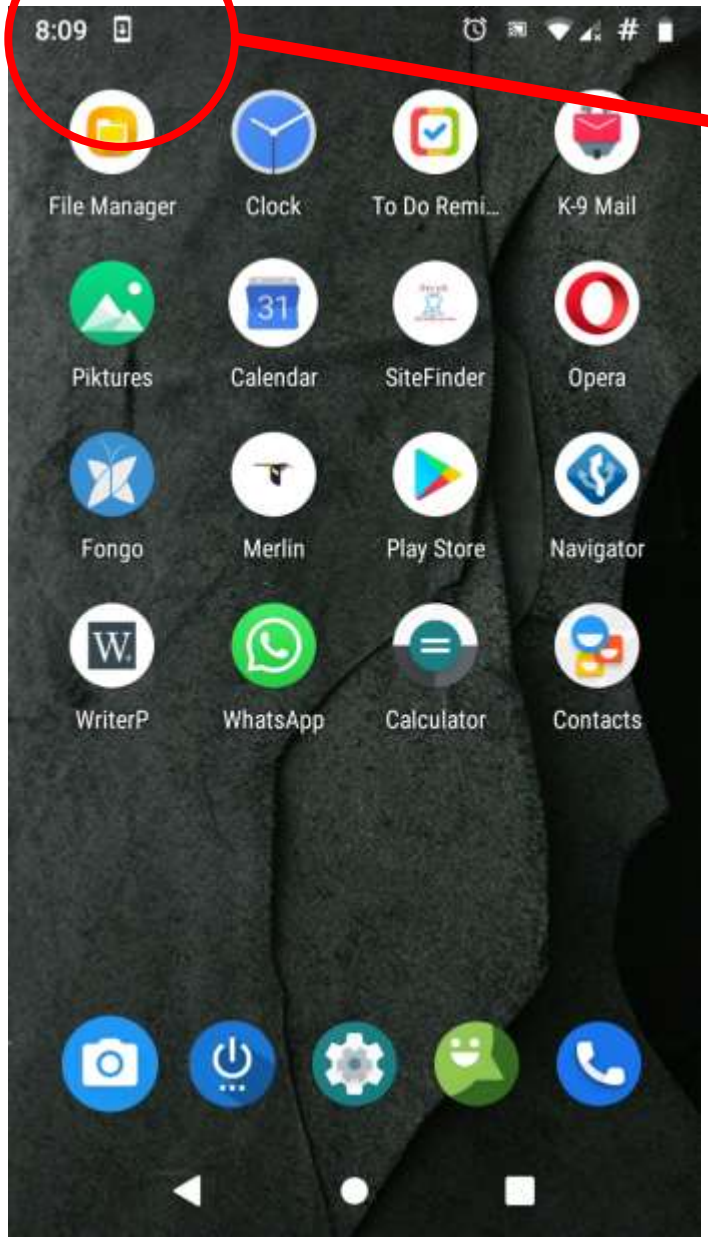
- Install a newer version of Android with more, better features
- Obtain regular security updates for the custom ROM
- Root allows running specific software (e.g. Quick Reboot, Titanium Backup)

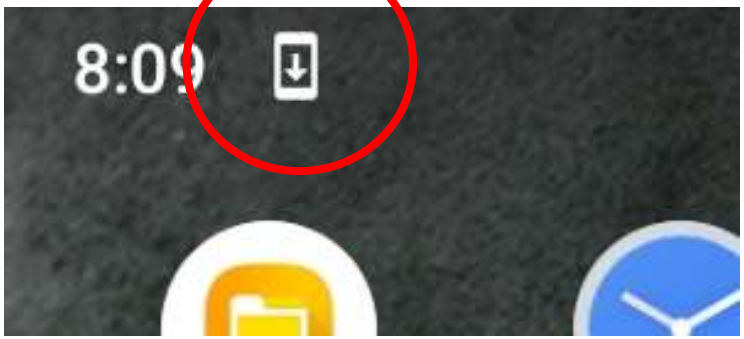


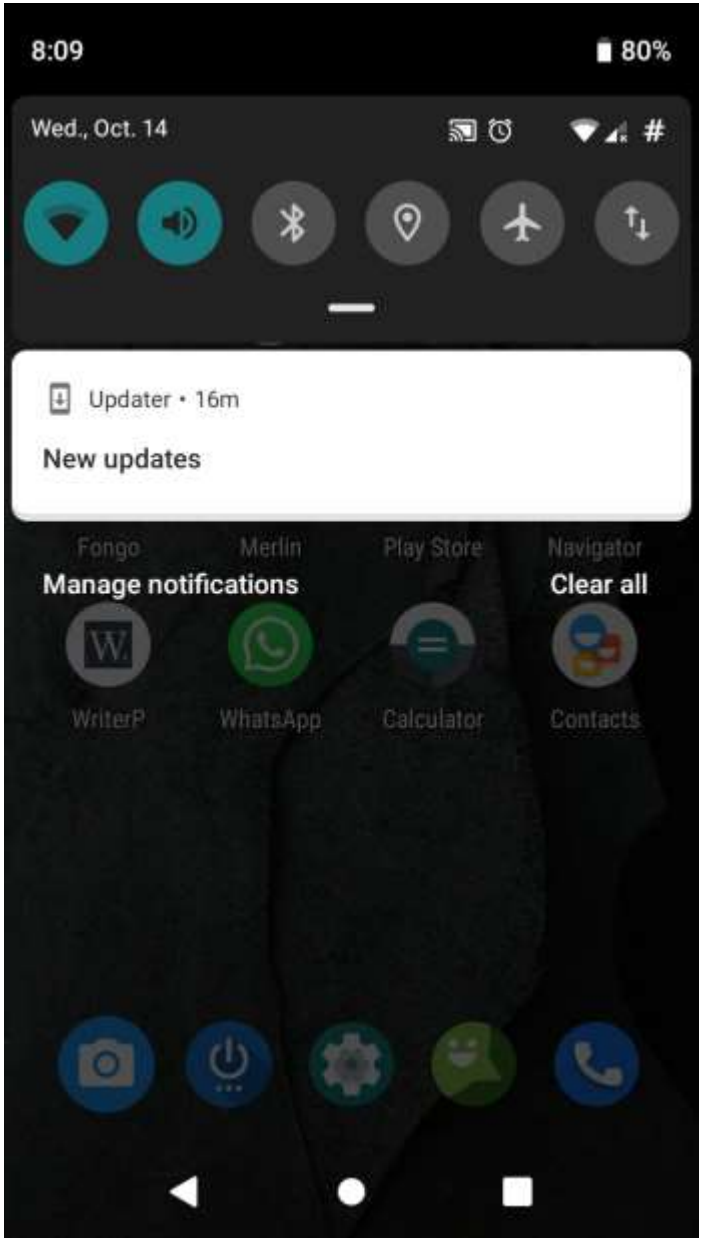
# LineageOS 14.1 with Pico-Gapps

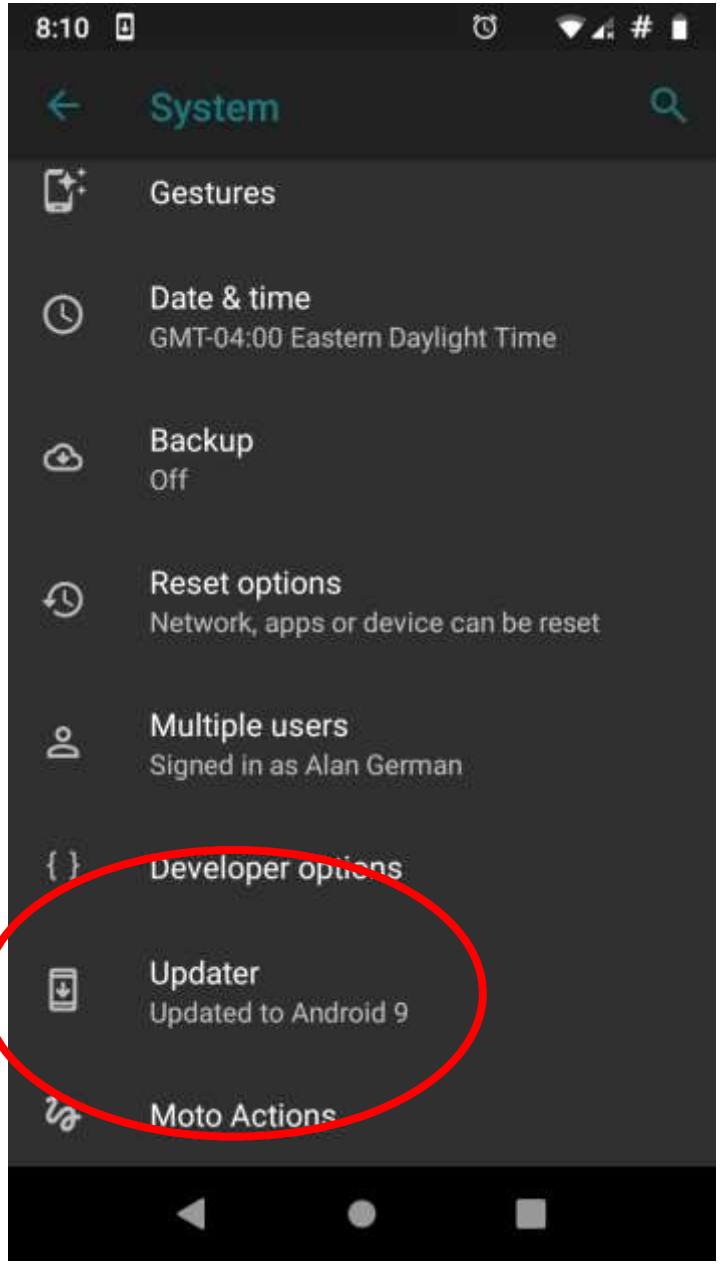



8:09
File Manager
Clock
To Do Remi...
K-9 Mail
Piktures
Calendar
SiteFinder
Opera
Fongo
Merlin
Play Store
Navigator
WriterP
WhatsApp
Calculator
Contacts


8:09
File Manager
Clock
To Do Remi...
K-9 Mail
Piktures
Calendar
SiteFinder
Opera
Fongo
Merlin
Play Store
Navigator
WriterP
WhatsApp
Calculator
Contacts


8:09

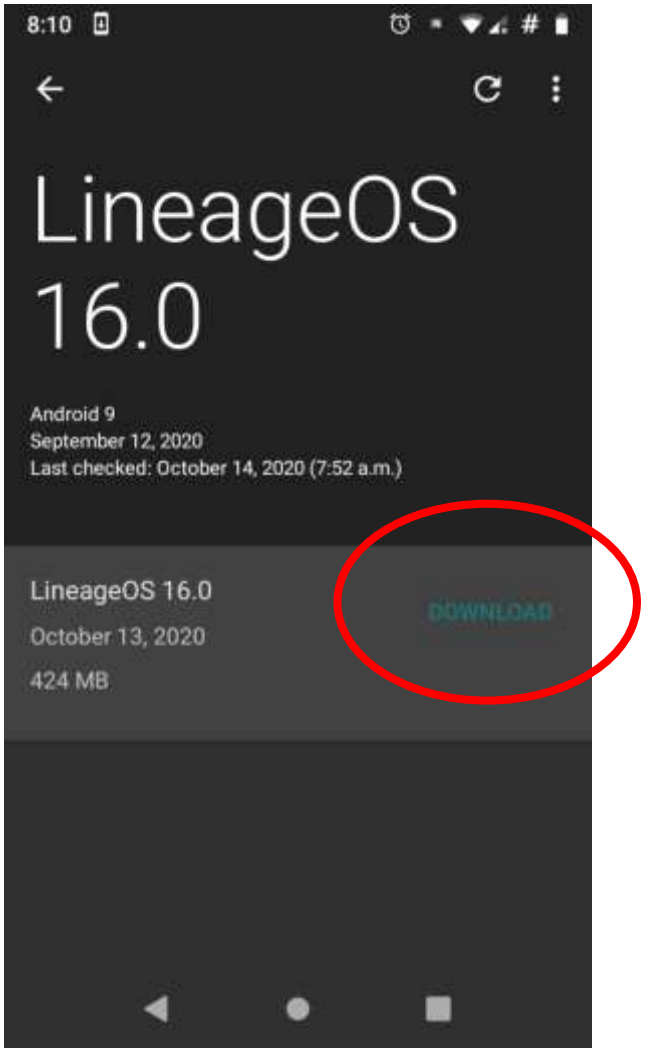

8:09
80%
Wed., Oct. 14
Updater • 16m
New updates
Fongo
Merlin
Play Store
Navigator
Manage notifications
Clear all
WriterP
WhatsApp
Calculator
Contacts




Navigate to:

System -
Settings -
Updater

8:10
LineageOS 16.0
Android 9
September 12, 2020
Last checked: October 14, 2020 (7:52 a.m.)
LineageOS 16.0
October 13, 2020
424 MB
DOWNLOAD


8:10
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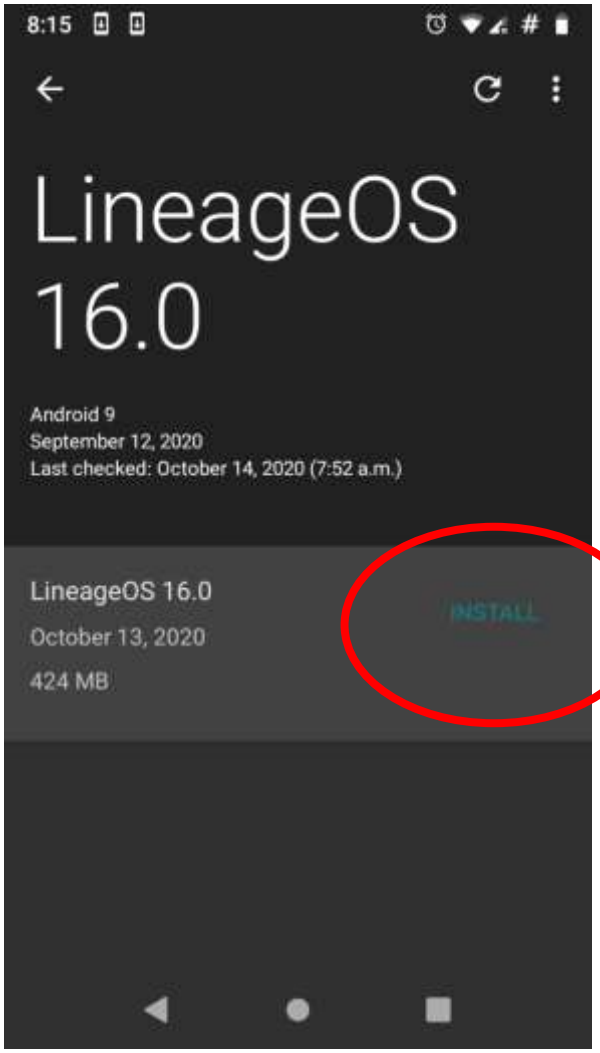
8:15
LineageOS 16.0
Android 9
September 12, 2020
Last checked: October 14, 2020 (7:52 a.m.)
LineageOS 16.0
October 13, 2020
424 MB
INSTALL

8:10
LineageOS 16.0
Android 9
September 12, 2020
Last checked: October 14, 2020 (7:52 a.m.)
LineageOS 16.0
October 13, 2020
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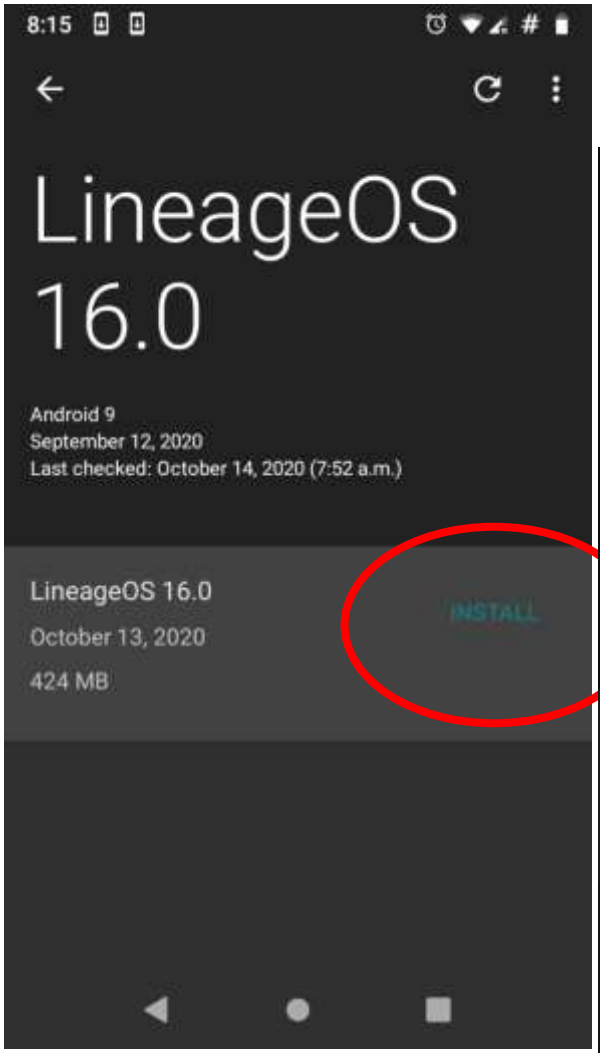
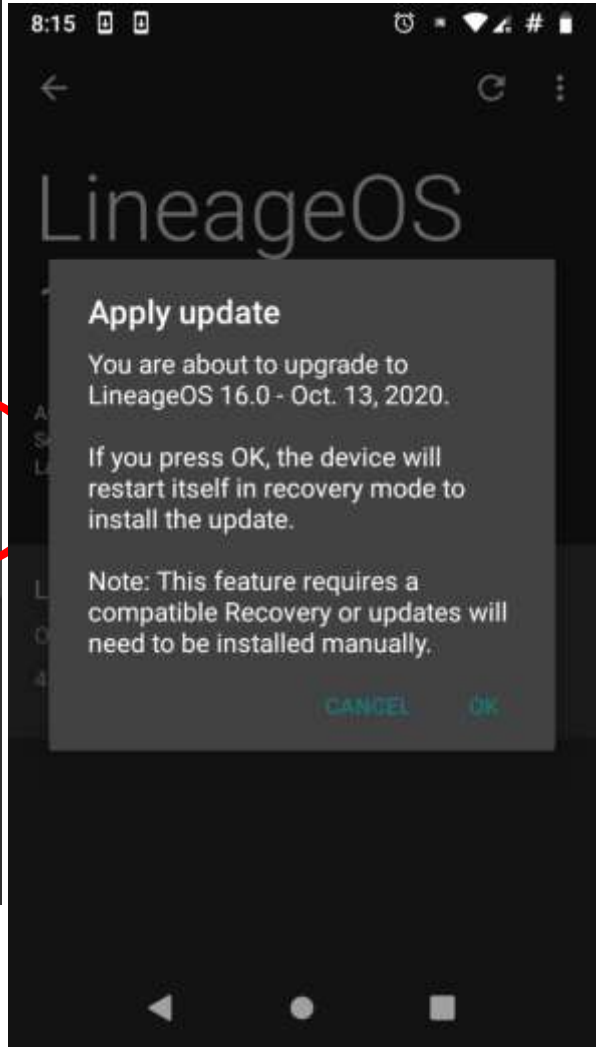
DOWNLOAD


8:15
LineageOS 16.0
Android 9
September 12, 2020
Last checked: October 14, 2020 (7:52 a.m.)
LineageOS 16.0
October 13, 2020
424 MB
INSTALL


8:15
LineageOS
Apply update
You are about to upgrade to LineageOS 16.0 - Oct. 13, 2020.
If you press OK, the device will restart itself in recovery mode to install the update.
Note: This feature requires a compatible Recovery or updates will need to be installed manually.
CANCEL
OK

# The Ultimate Solution?

**How to build your own custom Android ROM**

**https://www.youtube.com/watch?v=99LUjX63LhU**

## Hardware requirements

Your development workstation should meet or exceed these hardware requirements:

- A 64-bit environment is required for Android 2.3.x (Gingerbread) and higher versions, including the master branch. You can compile older versions on 32-bit systems.
- At least 250GB of free disk space to check out the code and an extra 150 GB to build it. If you conduct multiple builds, you need additional space.

## Software requirements

### OS

If you're developing against the AOSP `master` branch, use either Ubuntu 14.04 (Trusty) or the latest versions of macOS and Xcode with command line tools installed.

### JDK

### Key packages

### Device binaries

### Build toolchain

## Hardware requirements

Your development workstation should meet or exceed these hardware requirements:

- A 64-bit environment is required for Android 2.3.x (Gingerbread) and higher versions, including the master branch. You can compile older versions on 32-bit systems.
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## Software requirements

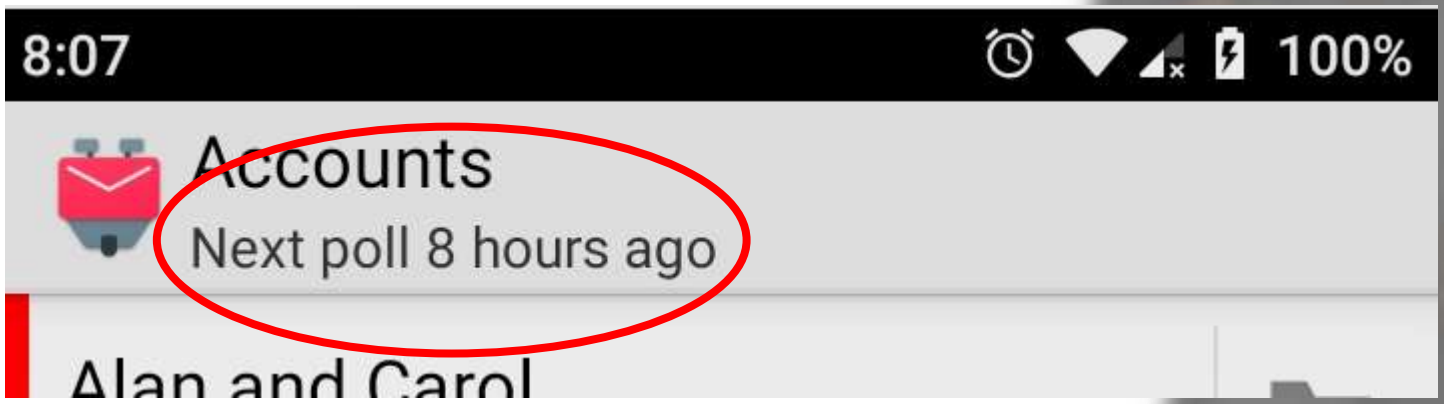
### OS

If you're develo

Linux with 8 GB+ RAM and
120 GB+ free disk space
Know about makefile, Java compiler…
**Lots of time/patience!**

# Finally
## What's wrong with this picture?

# Sometimes, Android is just a mystery!



# Any questions?