

# Replicant and Android freedom



# Why phone freedom matters? (I)

- Smartphones gather way too much data on you:
  - Non democratic countries.
  - If you want to organize a protest(Occupy Wall Street)?
  - In which hands should this power be?
  - What happens to the data if a democratic country becomes non-democratic
  - Commercial usage of the Data?
    - Unintended consequences



# Why phone freedom matters? (II)

- smartphones are computers?
  - Yes because they run user-installable applications
  - => they have the same freedom issues
- It's too hard to support a device with proprietary parts in the long run: Cyanogenmod dropped the Nexus one for that exact reason.
- It's Hard to port GNU/Linux on it when there are blobs



# What are the freedom issues?

- AOSP(the official android sources) is/are incomplete: if you install the result on your device without extracting the proprietary libraries from your device, not much will work:
  - Telephony won't work for instance
  - Graphics will be too slow
  - Etc...
- Cyanogen uses theses exact same libraries.
- We fix that to make the phone work without theses libraries:
  - Telephony will work
  - Graphics will be fast
  - Etc...

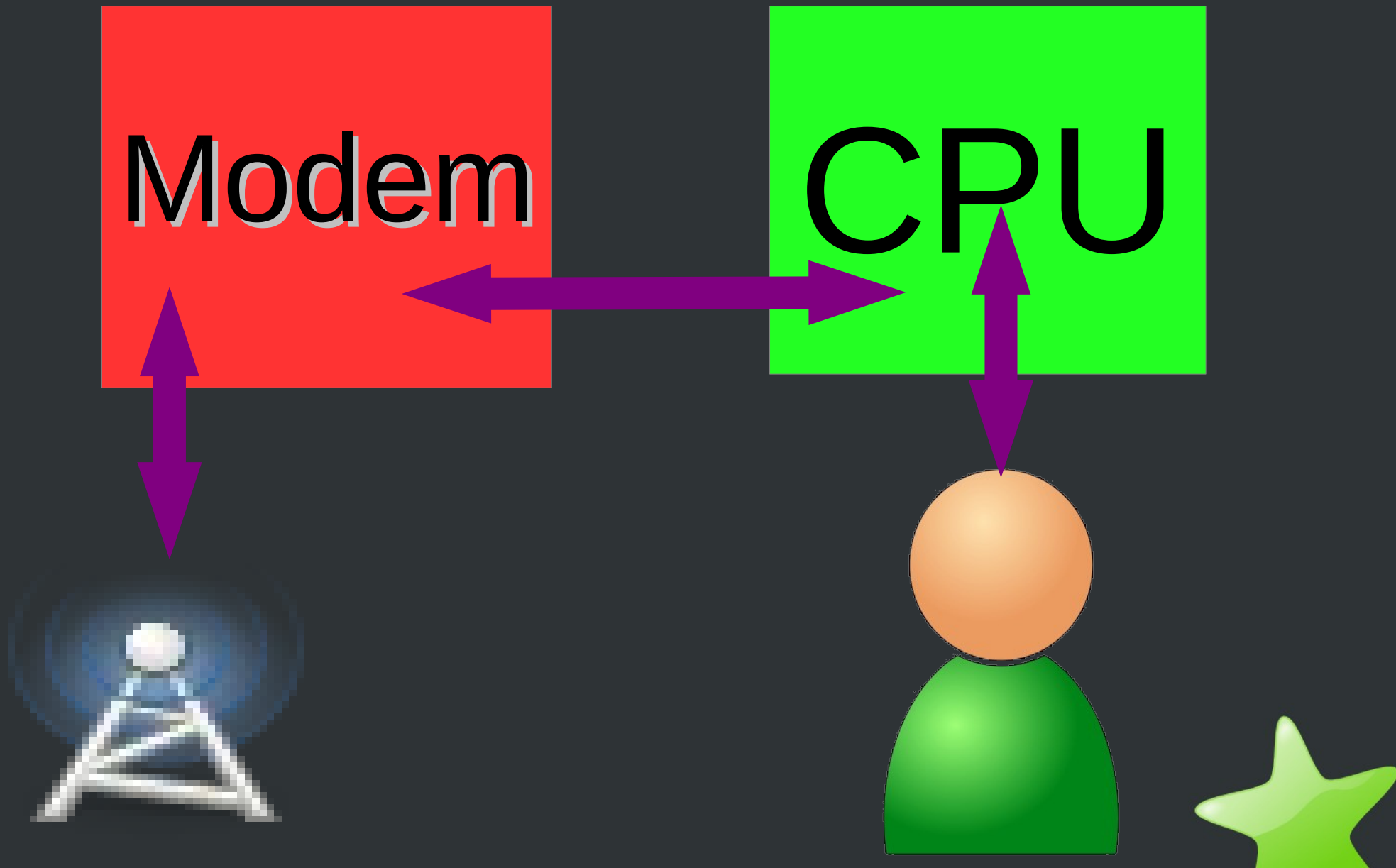


# First part

- Introduction to the freedom issues
- Solutions



# What is a smartphone



# Average Joe user



# Problem

## Average Joe User

Free  
software  
applications

Proprietary  
Applications

Android

Linux Kernel





# Advanced User



# Supported devices

- A lot of devices(too much to be listed here) are supported but not all

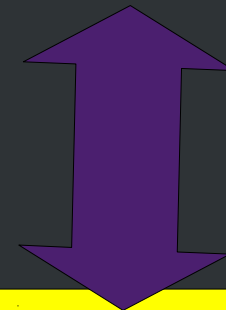
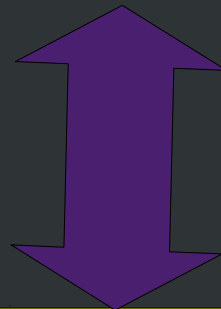
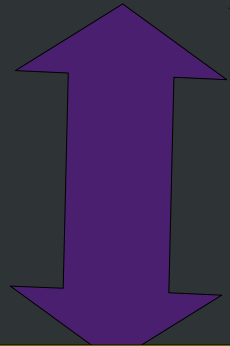


# Problem I (AdvancedUser)

Google  
Applications(  
market,  
youtube etc...)

Proprietary  
applications

Free  
software  
applications

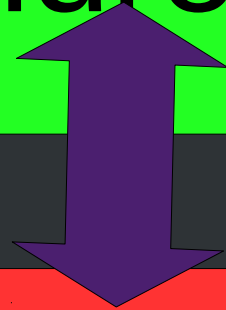


Cyanogenmod

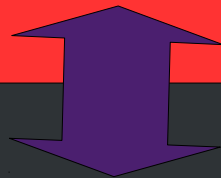


# Problem II (Advanced user)

Android GUI



Proprietary hardware libraries:  
Ril, Graphics, GPS etc....



Linux kernel



# Nexus S: Proprietary parts I

- `/system/etc/gps.conf`
- `/system/lib/libpn544_fw.so`
- `/system/lib/libsecril-client.so`
- `/system/vendor/bin/gpsd`
- `/system/vendor/bin/pvrsvinit`
- `/system/vendor/etc/gps.xml`
- `/system/vendor/firmware/bcm4329.hcd`
- `/system/vendor/firmware/cypress-touchkey.bin`



# Nexus S: Proprietary parts II

- `/system/vendor/firmware/nvram_net.txt`
- `/system/vendor/firmware/samsung_mfc_fw.bin`
- `system/vendor/lib/egl/libEGL_POWERVR_SGX540_120.so`
- `system/vendor/lib/egl/libGLESv1_CM_POWERVR_SGX540_120.so`
- `system/vendor/lib/egl/libGLESv2_POWERVR_SGX540_120.so`
- `/system/vendor/lib/hw/gps.s5pc110.so`



# Nexus S: prorpietary parts III

- `/system/vendor/lib/hw/gralloc.s5pc110.so`
- `/system/vendor/lib/libakm.so`
- `/system/vendor/lib/libglslcompiler.so`
- `/system/vendor/lib/libIMGegl.so`
- `/system/vendor/lib/libpvr2d.so`
- `/system/vendor/lib/libpvrANDROID_WSEGL.so`
- `/system/vendor/lib/libPVRScopeServices.so`
- `/system/vendor/lib/libsec-ril.so`



# Nexus S: Proprietary parts IV

- `/system/vendor/lib/libsrv_init.so`
- `/system/vendor/lib/libsrv_um.so`
- `/system/vendor/lib/libusc.so`





**User with hardware  
supported by Replicant**



**Replicant**

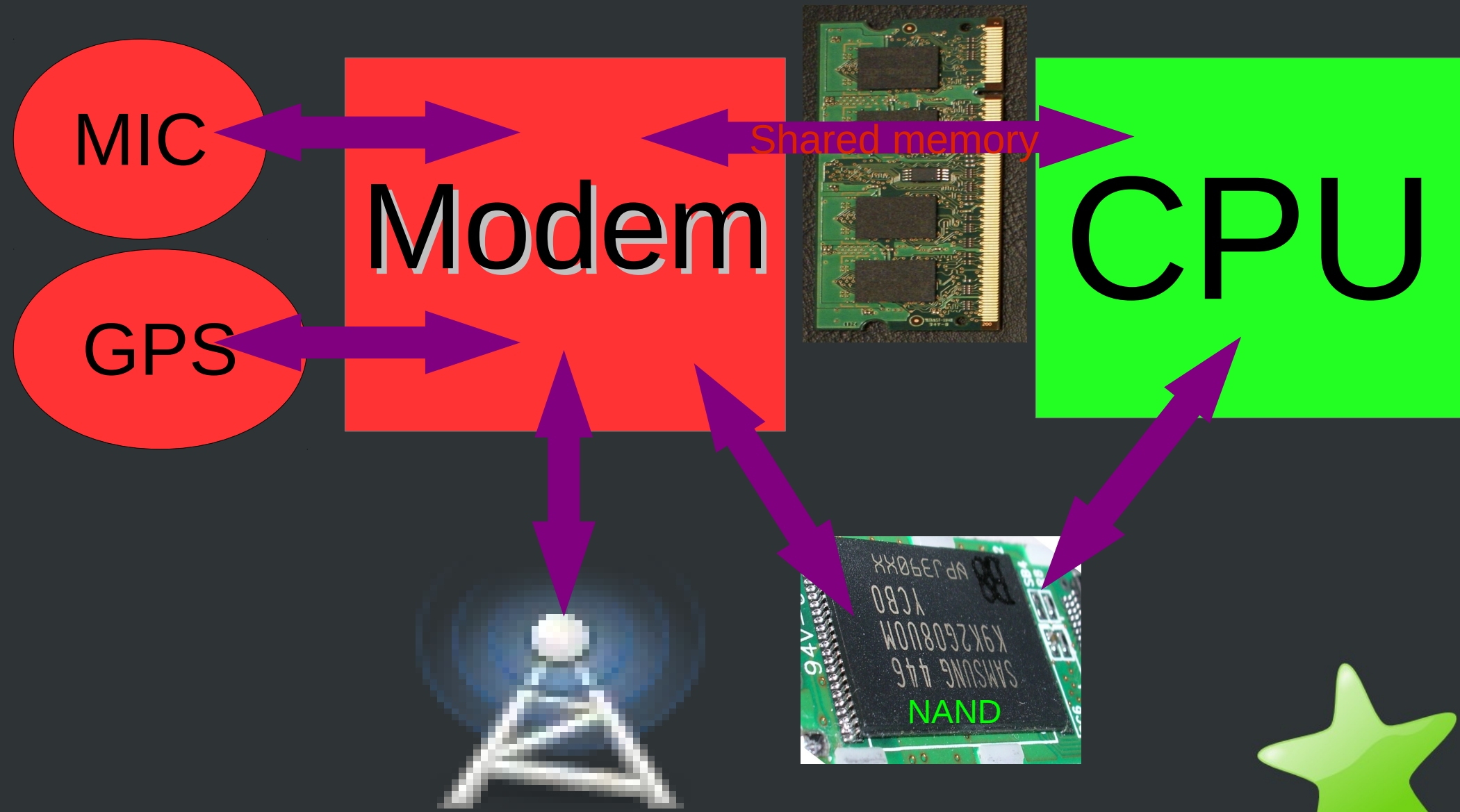


# Supported devices

- HTC Dream (by old versions)
- HTC Magic (by old versions)
- Nexus One (by old versions)
- Nexus S
- Galaxy S
- Galaxy Nexus
- GTA04(Work in progress)
- Galaxy SII



# Hardware issues with some (old) replicant devices



# Solution I

- Install Fdroid to have free software on top of android
- Usefull if your phone is not supported by replicant,cyanogenmod or any other community distribution.



# Solution II

- Cyanogenmod(or something similar if cyanogenmod does not support your hardware)
  - Issue: cyanogenmod redistribute non-free libraries and firmwares
  - But in another hand it's more free than the default android.
- Do not install Google applications, Install FDroid instead
- Usefull when your phone is not supported by Replicant or that you depend on something that doesn't work in your phone on Replicant(for instance the GPS on the Nexus S).



# Solution III

- Replicant on a supported device
  - Issues will be explained later.



# Solution IV (if possible)



# References

- <http://www.guardian.co.uk/technology/2011/sep/19/android-free-software-stallman>
- <http://replicant.us/>
- <http://fdroid.org/>
- [https://raw.githubusercontent.com/CyanogenMod/android\\_device\\_samsung\\_crespo/gingerbread-release/extract-files.sh](https://raw.githubusercontent.com/CyanogenMod/android_device_samsung_crespo/gingerbread-release/extract-files.sh)





# Second Part

- The replicant project



# History

- The replicant project started at the time of the HTC Dream, the first Android phone, in order to free android.
- It was founded by:
  - Bradley M. Kuhn: Project setup
  - Aaron Williamson: He tried to do a Free Android market replacement, and a bit of low level work
  - Graziano Sorbaioli : Infrastructure work(website etc...)
  - Me (Denis Carikli(GNUtoo on Internet)) : I did most of the low level work(freeing Android on the htc dream)
- At that time we based our work on AOSP( Android Open source project, the official android source).



# History II

- The touchscreen, display, wifi and bluetooth (requires non-free firmware), rotation triggered through keyboard sliding worked out of the box already.
- I replaced the non-free audio part simply by replacing the functions in the dlopened non-free acoustic library, by using a test program named playwav2 which was a better version of the playwav test program in the android sources.
- I replaced the non-free ril library(The library that talks to the modem, and that runs on the CPU) by using and improving the reference ril.



# History III

- GPS was reversed(not by me) and I integrated the reversed library
- I solved a long-standing issue where the phone didn't work in the USA at all.



# History IV

- Later we integrated FDroid, switched to cyanogenmod and added new devices
- I ported Replicant to the Nexus one (given by google (we were based on AOSP if I remember well)):
  - 2D graphics accelerations had a nasty bug that had to be solved
  - Audio was easier to fix but required a non-free firmware
  - GPS library was already free (maybe a consequence of the reversing of the htc dream library?)

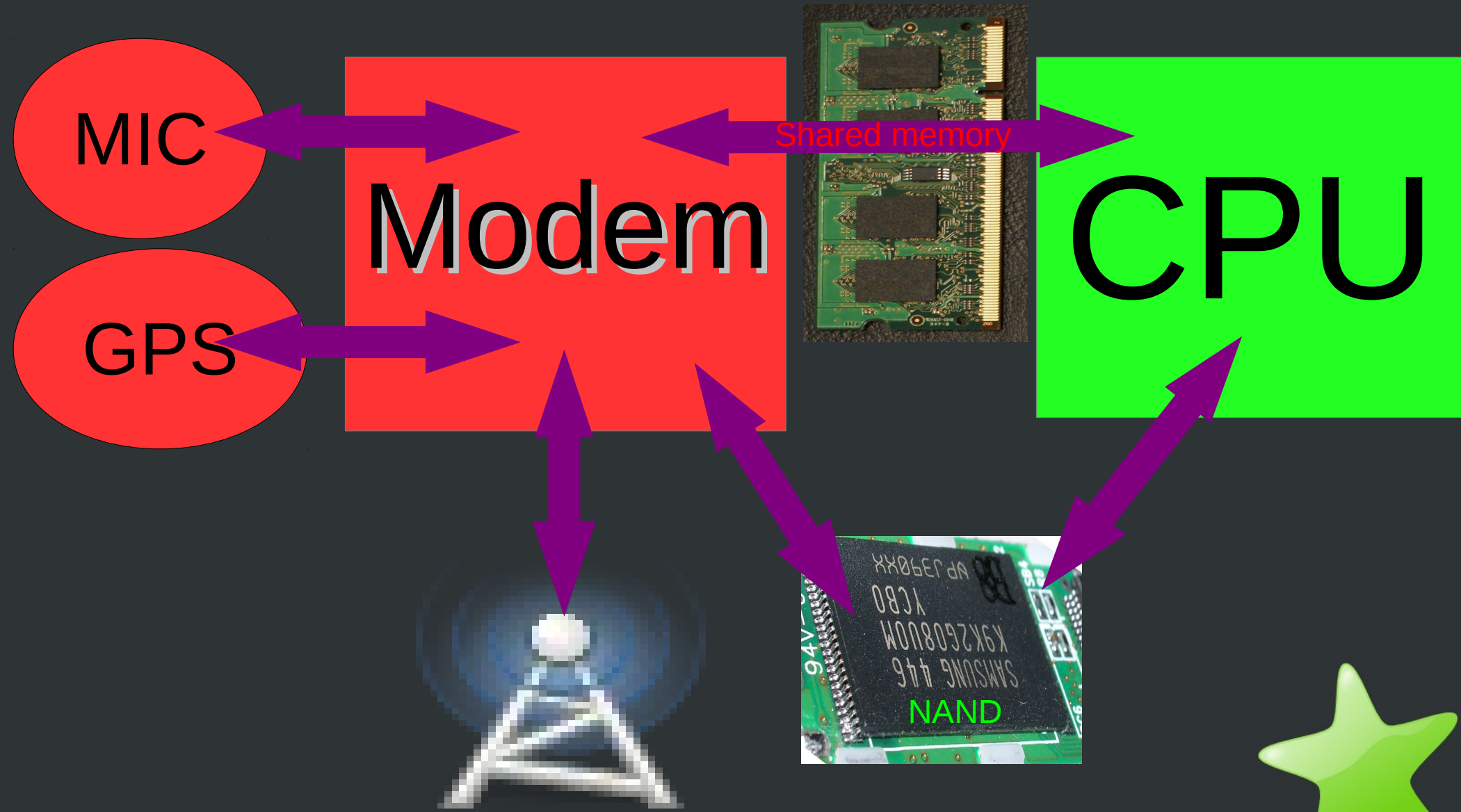


# HTC Dream characteristics

- The modem speaks AT over a virtual serial port
- The GPS has NMEA once you activate it.
- The audio is *\*not\** alsa, it's a custom DSP protocol.
- Wifi was non-standard but we didn't care since we had android free software drivers(which required non-free firmware by the way).
- Non-free bootloader



# Freedom issues with The qualcomm-based phones



# History IV

- Paul Kocialkowski(paulk) joined the project and added the support for the Nexus S:
  - He made the accelerometer work (it was buggy at the beginning but now it's perfectly stable).
  - After making the modem work, the camera was working too.
  - Only trust the kernel sources(don't trust schematics)
  - Only the GPS(and 3d but that's not strictly necessary) is not working nowadays.





# The Modem

- The big part of the work was to make the Modem work:
  - There was preliminary code for the Samsung H1 GNU/Linux phone.
  - The RIL was very verbose.
  - He shared the work with Simon Busch (who wanted GNU/Linux on his Nexus S).



# The Modem (II)

- The result was libsamsung-ipc:
  - shared between GNU/Linux and Android:
    - Used by samsung ril(for Android)
    - Also used by fsogsmd or webOS-ports's ofono version(both for different GNU/Linux phone distributions)

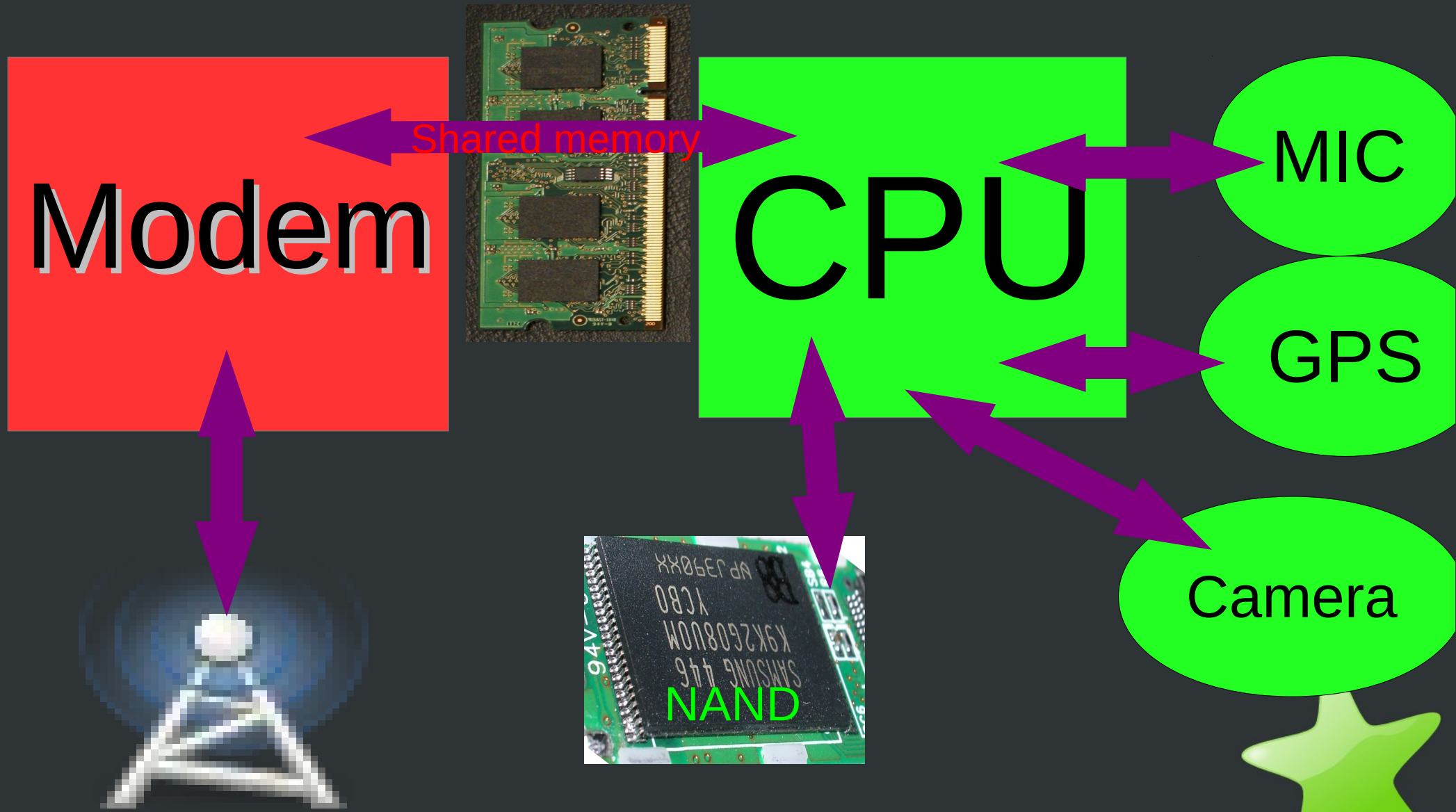


# Modem Issues

- The modem has a firmware:
  - It's in a NAND (like a hard drive) partition
  - We don't ship it
  - We don't modify it
  - But we have to use it.
- Ironically, having to load it means that it doesn't have access to the whole NAND by default...



# Nexus S/Galaxy S Hardware

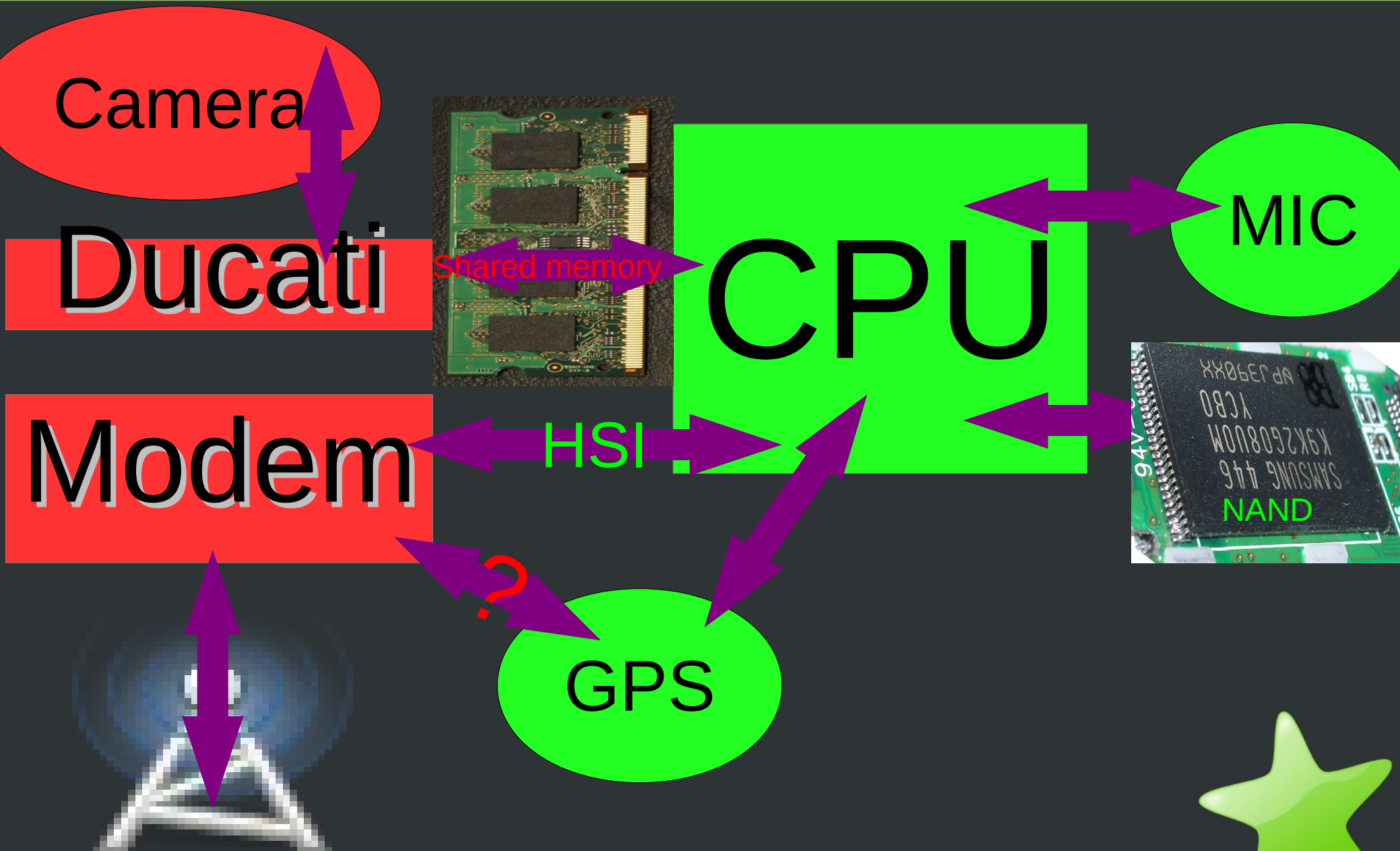


# Newer devices

- The modem work made it easy to add support for:
  - The galaxy S (Added by paulk)
  - The galaxy SII(Added by paulk)
    - Its freed audio library went into cyanogenmod.
    - Its freed camera library also went into cyanogenmod.
  - The Galaxy Nexus(Added by me)
  - The Galaxy Tab II 7.0 GSM (Added by me and paulk(sound,sensors,gsm))
- A nearly ideal device appeared: the GTA04
  - It has a free, non-signed bootloader(unlike all other devices)
  - And an Isolated modem
  - The only issues is the non-free Wifi firmware



# Galaxy Nexus/Galaxy Tab II 7.0/10.1 GSM Hardware (I)

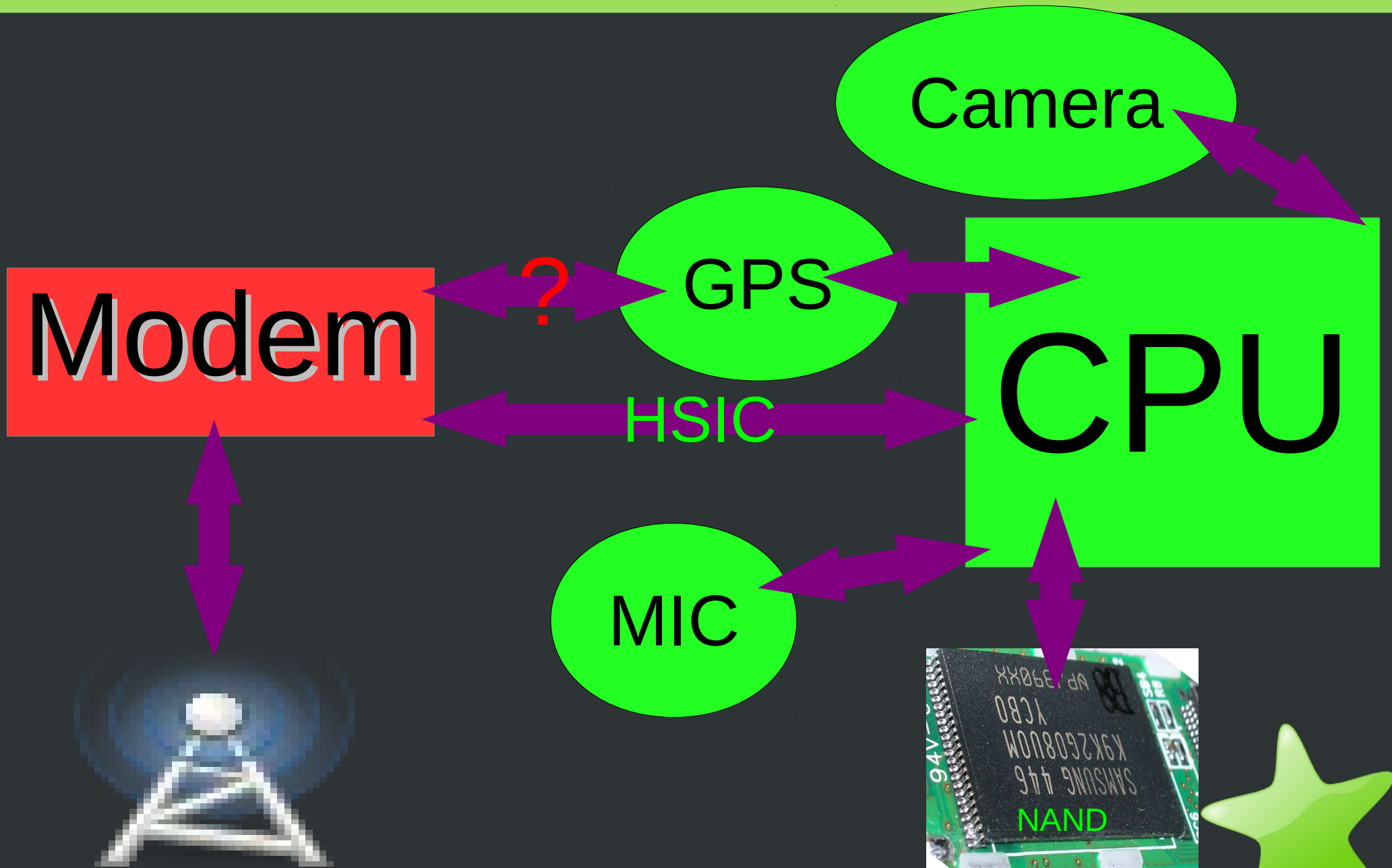


# Galaxy Nexus/Galaxy Tab II 7.0/10.1 GSM Hardware (II)

- Same Samsung-ipc modem protocol, different transport.
- New kind of SIRF GPS(gsd4t)(doesn't work with the GNU/Linux gpsd, but doable) for the Galaxy Nexus
- Same GPS than the Nexus S(Broadcom 4751) for the Galaxy Tab II 7.0 GSM. (really hard, doesn't work).
- Ducati issue and non-standard camera interface which depend on the powervr trough rpmsg.
- Non-free and partially signed bootloaders, and non-free firmwares
  - Xloader source code for the galaxy tabs released, but because of signatures we can't modify it.



# Galaxy SII



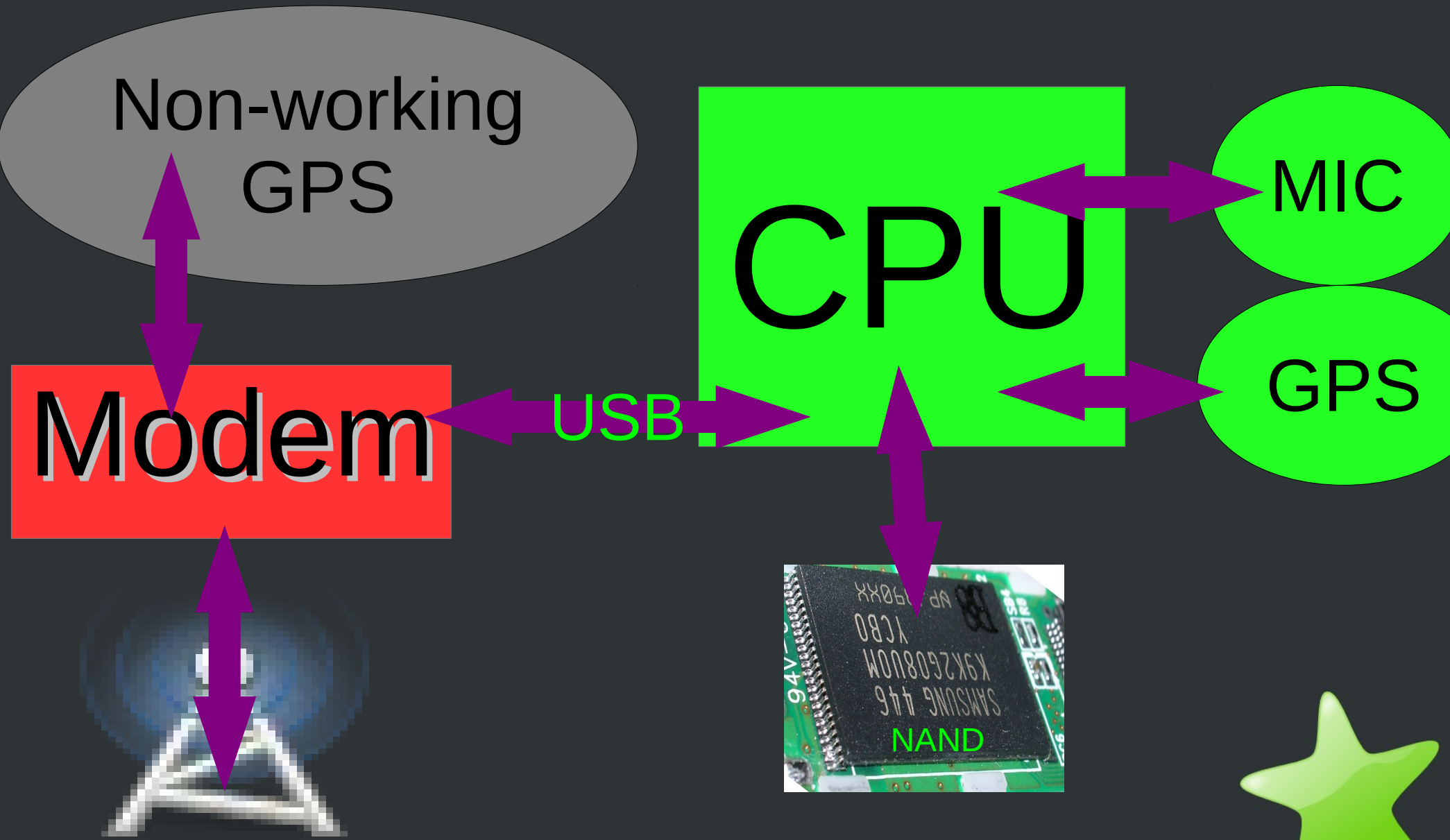


# Galaxy SII

- Same Samsung-ipc modem protocol, different transport
- Also has a SIRF GPS(gsd4t)(doesn't work with the GNU/Linux gpsd, but doable)
- Non-standard ALSA
- Non-free bootloader



# GTA04 hardware (I)



# GTA04 hardware (II)

- AT interface over virtual serial port(Physical USB interface)
- NMEA/SIRF GPS
- Alsa Audio
- Made for GNU/Linux in mind(different from Android).
- Free software bootloader



# Replicant characteristics

- Doesn't ship anything proprietary
- Non-free firmware not even redistributed(although we don't have any mechanism in place for preventing their installation).
- Uses FDroid by default
- Has no 3D acceleration:
  - At each new android release it's said that 3D acceleration is mandatory, until now we always found workarounds.
  - It's fast enough without 3d acceleration, if you use the right tricks: I don't see the difference on the galaxy Nexus.



# Host utilities

- We ship Free software versions of adb, fastboot, mkbooting etc...
- There are autotoolized (./configure && make && make install) versions of these tools too, which made it in some GNU/Linux distributions.
- We have a Free software SDK too.
- We make sure that Replicant builds without the non-free Java versions
  - Build works well on trisquel 5.5
  - Issues with parabola(parabola has java7 now)



# Android versions

- 2.2 : HTC Dream, HTC Magic
- 2.3: Nexus one, GTA04, (and Nexus S, Galaxy S)
- 4.0: Nexus S, Galaxy Nexus, Galaxy S, Galaxy SII, Galaxy Tab 2 (7.0 and 10.1) GSM(No images yet, only sources), GTA04 is a work in progress for 4.0(kernel work has to be done)



# We need you

- We are not enough developers
  - Because of that we cannot support fully all our devices and at the same time add support for many new devices.
  - We need help for the GTA04.
- We gather on #replicant on Freenode and we also have a mailing list.
- We can help people wanting to port replicant on their device, by giving them pointers and helping them.



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