

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...

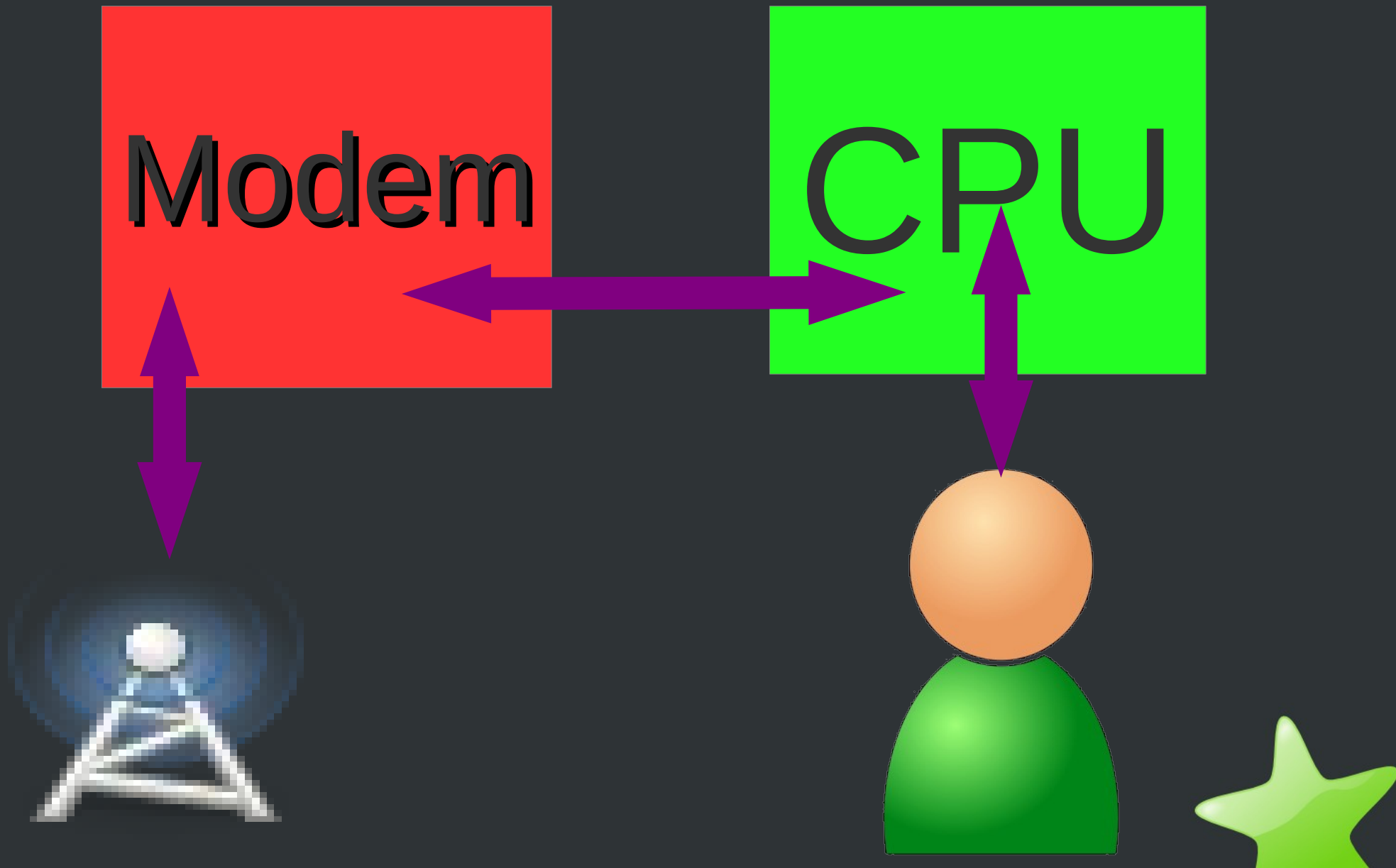


First part

- 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

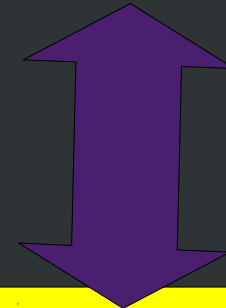
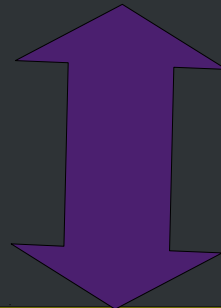
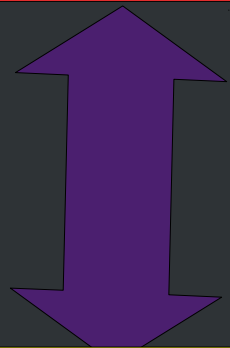


Problem I (AdvancedUser)

Google
Applications(
market,
youtube etc...)

Proprietary
applications

Free
software
applications

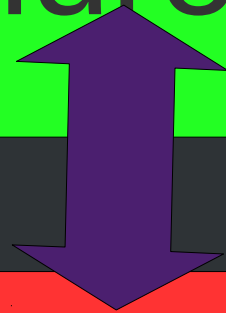


Cyanogenmod

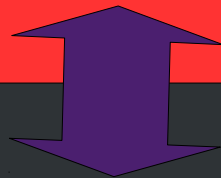


Problem II (Advanced user)

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/libGLSv1_CM_POWERVR_SGX540_120.so`
- `system/vendor/lib/egl/libGLSv2_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

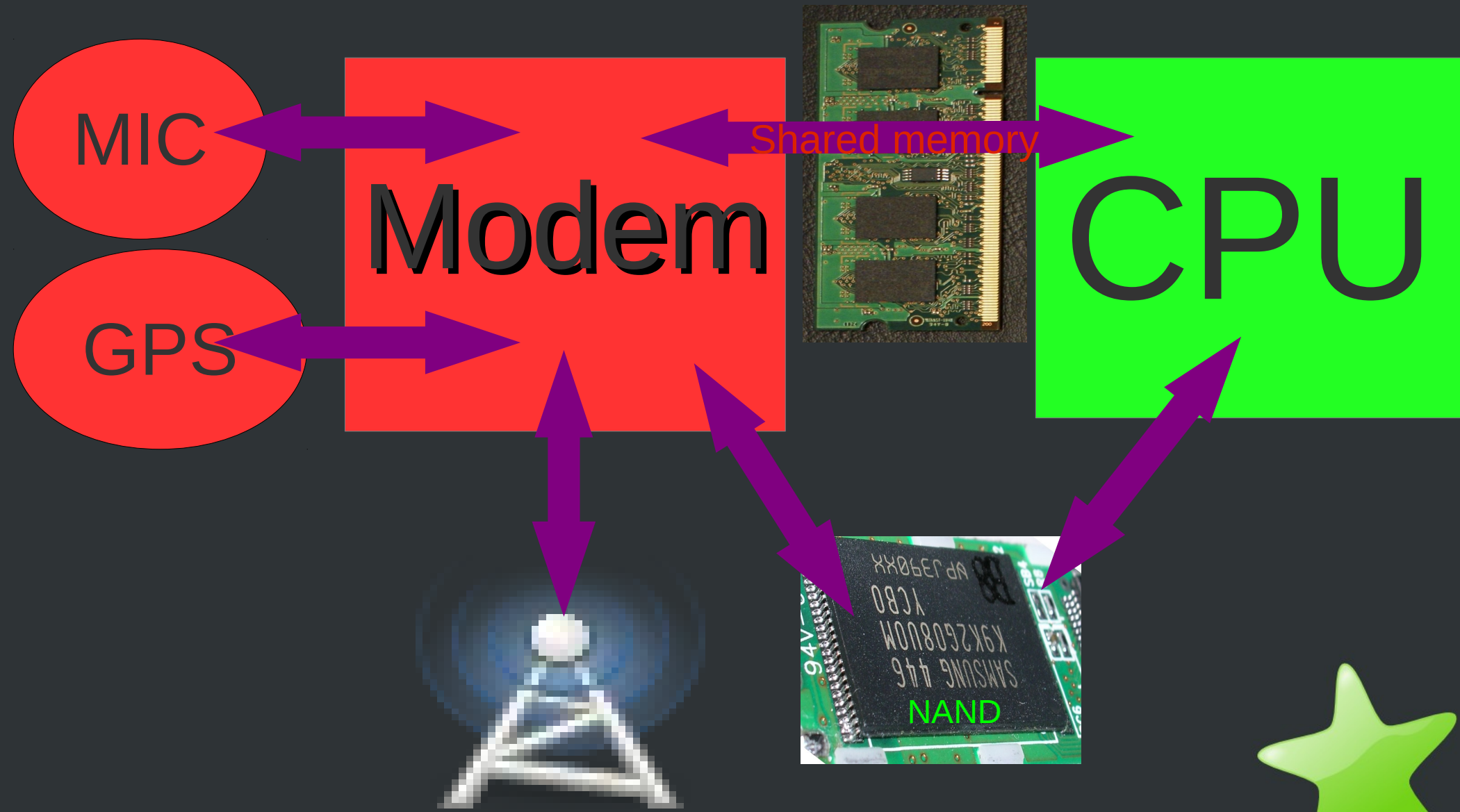


Supported devices

- 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



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?)

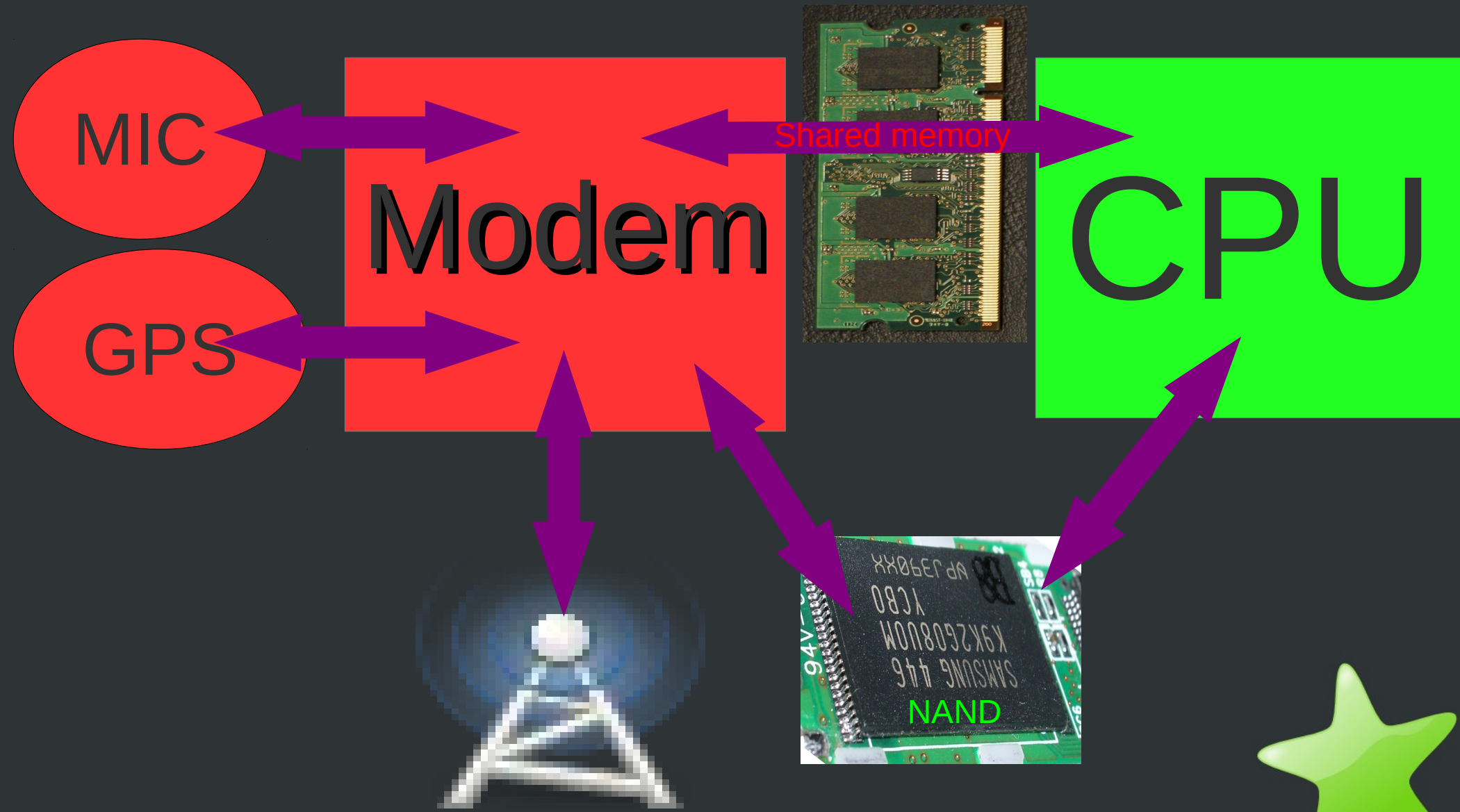


HTC Dream characteristics

- 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)

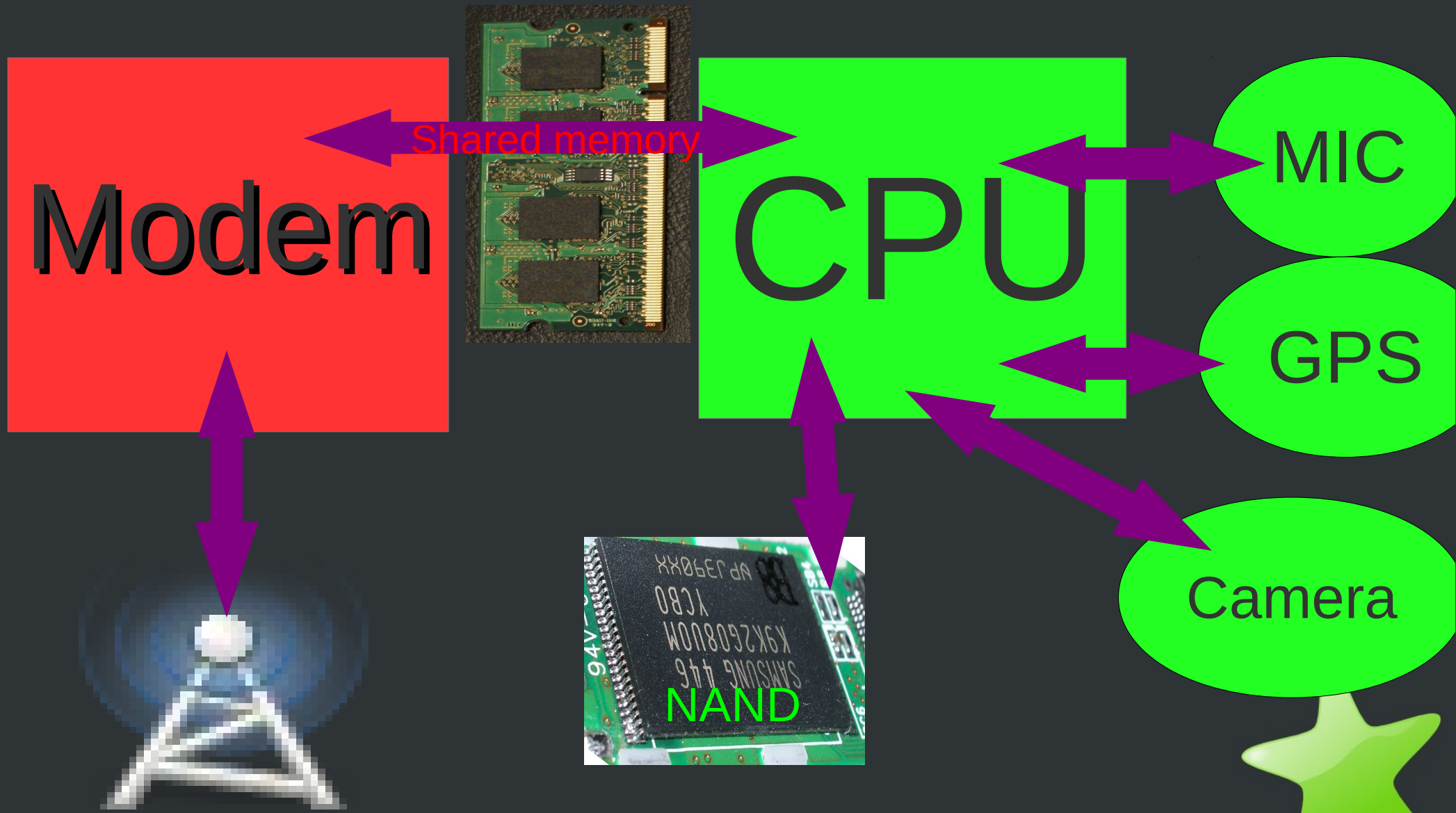


Modem Issues

- 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

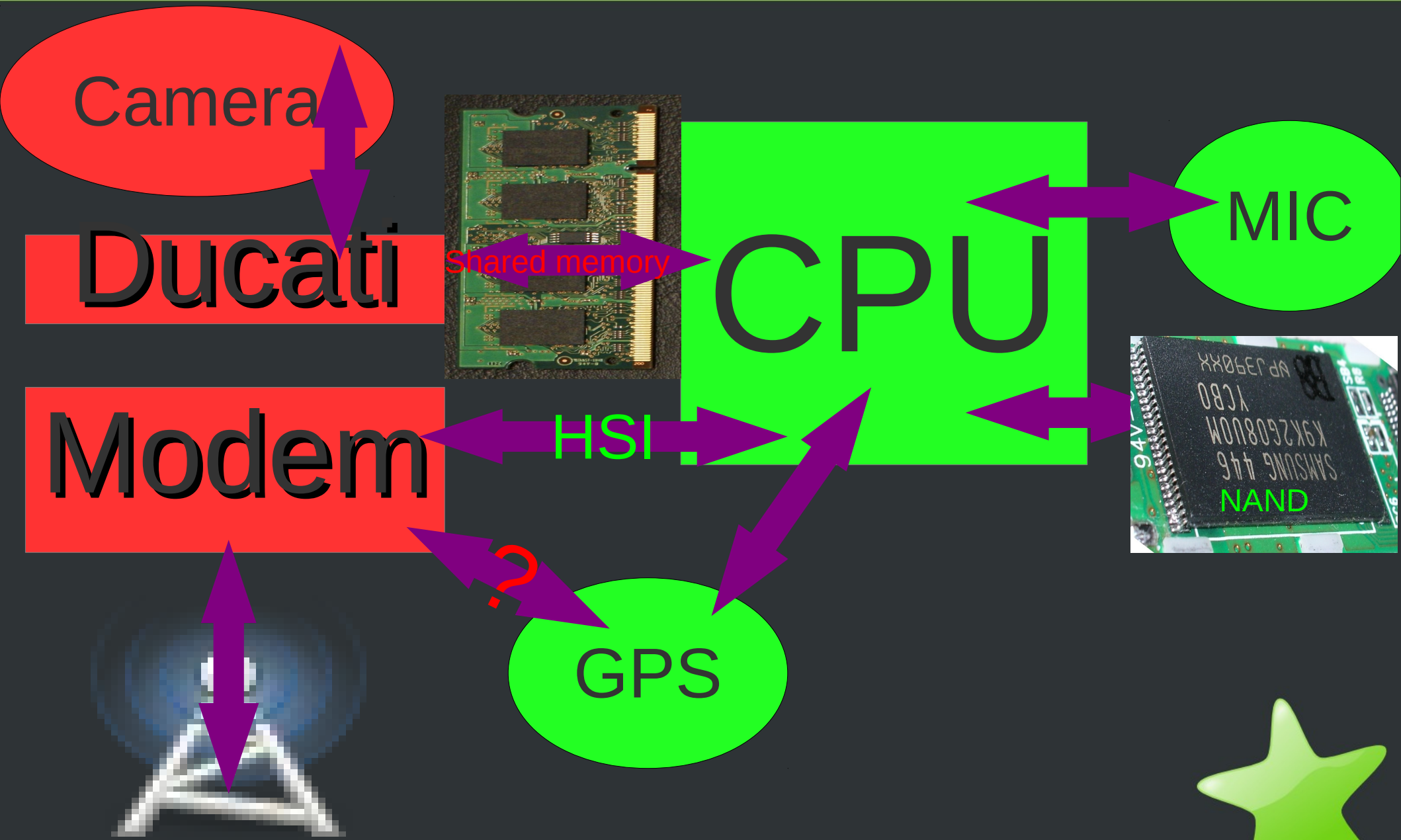


Newer devices

- 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)



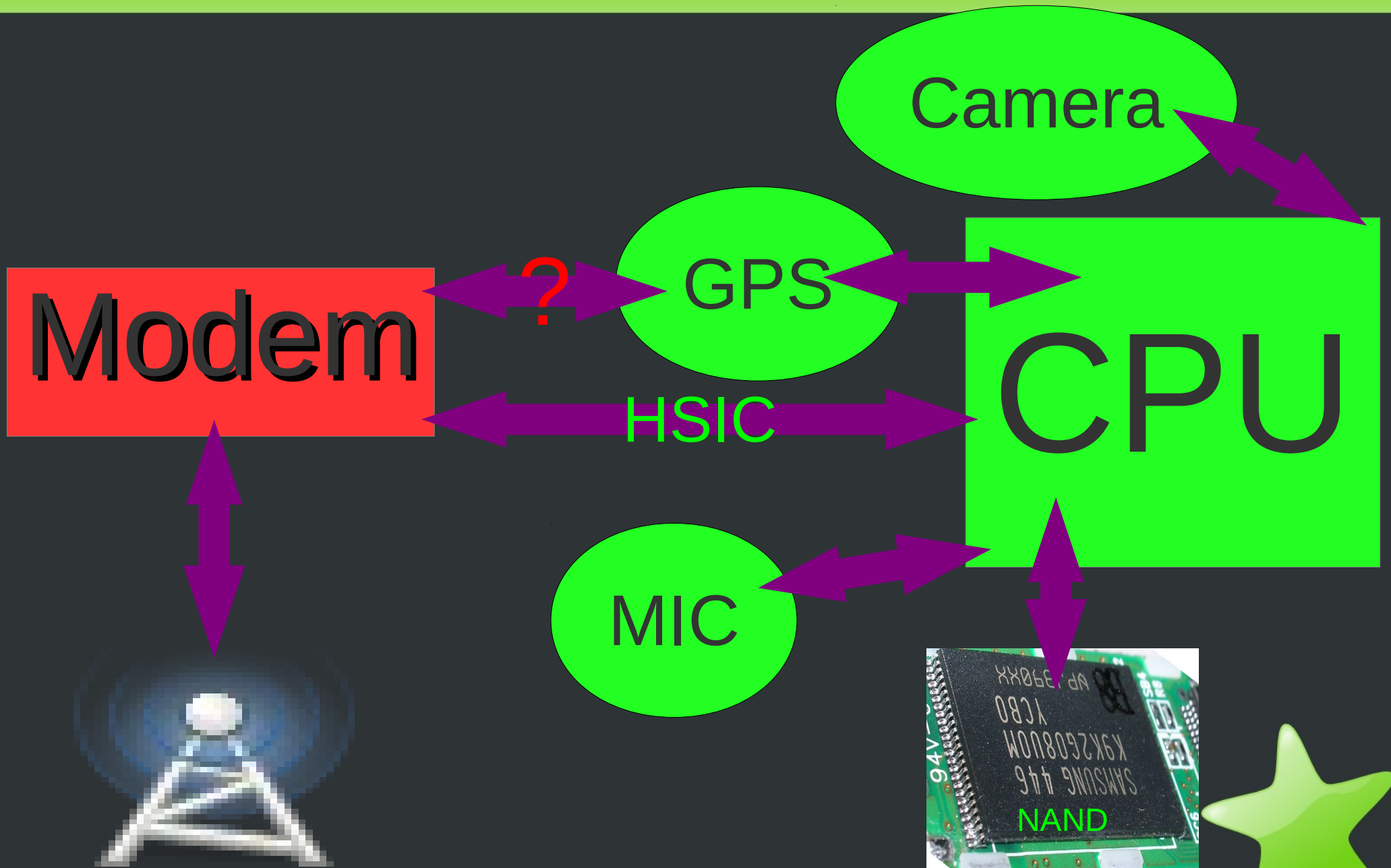
Galaxy Nexus/Galaxy Tab II

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

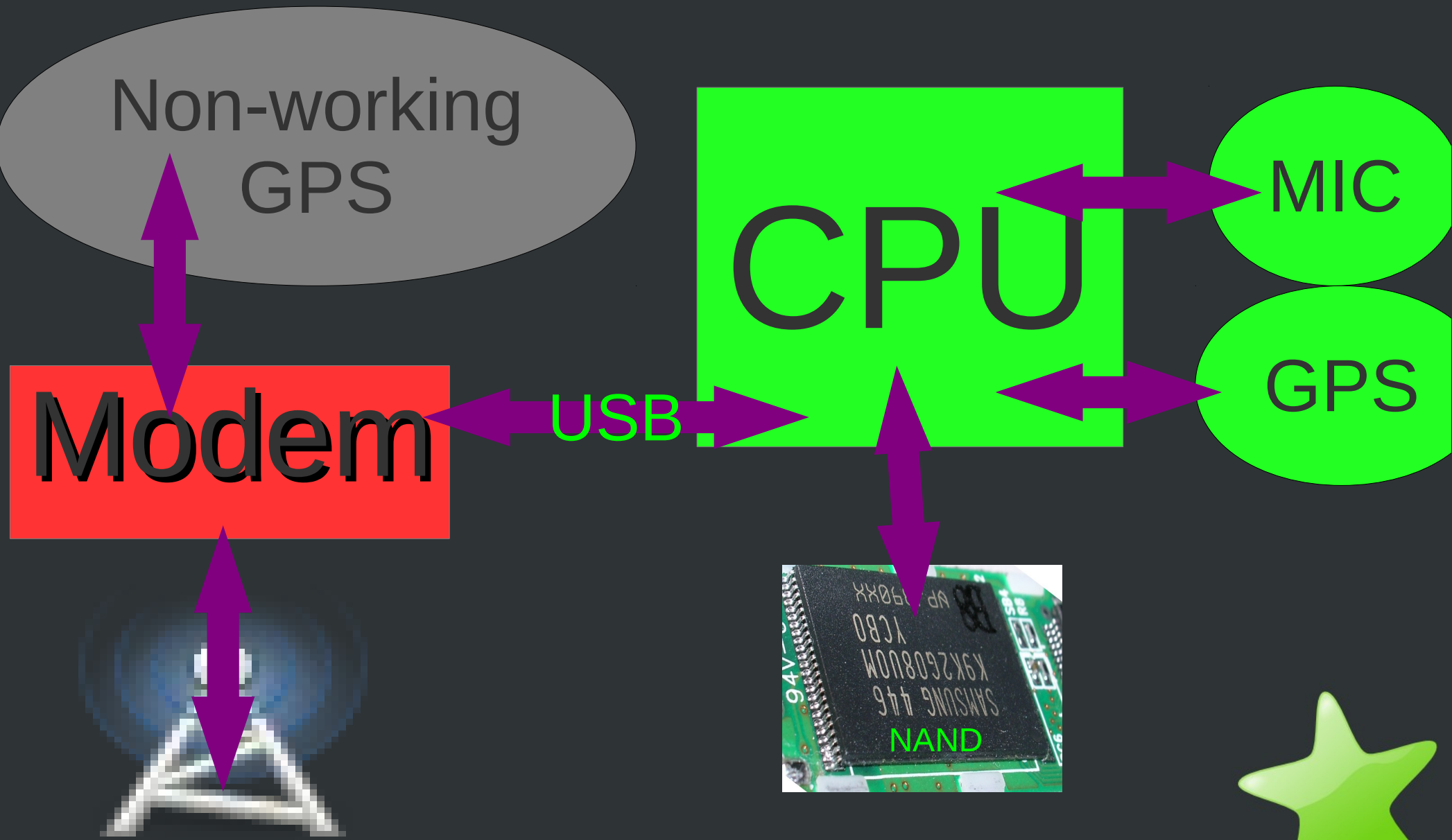


Galaxy SII

- 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 F-Droid 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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