

Replicant history

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Replicant history

- Humans have bad memory
- Unlike RAM it's not self-refreshing
- → Don't hesitate to correct me if I'm wrong or forget things

- Historical context: GNU/Linux on PDA and smartphones
- The Openmoko: a GNU/Linux smartphone
- Replicant creation and comparison with GNU/Linux
- Replicant project focus

Historical context

Rough timeframe

- 1996: Nokia 9000 Communicator: Smartphone, No free software
- 1999: Ericson R380: Smartphone, No free software
- June 2000: Handhelds.org: GNU/Linux port to smartphones and PDA
- 2000: iPAQ H3600: Work started to port GNU/Linux port on it
- 2001: Sharp Zaurus SL-5000D: PDA running GNU/Linux available in Japan
- January 2002: OpenZaurus Beta: Community GNU/Linux distribution for PDAs
- Sharp Zaurus SL-5500 (Collie): PDA running GNU/Linux available worldwide
- 2002: HTC Wallaby: Smartphone, GNU/Linux port
- 2004: Motorola A780: Smartphone running GNU/Linux
- 2005: Open-EZX: Community effort to run free software on the Motorola smartphones

Rough timeframe

- November 2005: Nokia 770 Tablet: Nokia GNU/Linux PDA
- June 2007: Iphone released: Didn't have any App store
- July 2007: the OpenMoko GTA01 is released: Prototype GNU/Linux smartphone made for the community. Nonfree GPS.
- July 2008: App store
- → July 2007: the OpenMoko GTA02 is released: GNU/Linux smartphone for the community. Doesn't require nonfree software in the distribution to work.
- September 2008: the HTC Dream is released: First Android smartphone
- November 2009: Nokia N900: GNU/Linux smartphone
- 2009: Palm pre: GNU/Linux smartphone

Other communities

- Dreambox (2003?): Set top box
- NSLU2 (2004): NAS
- January 2004: First release of OpenWRT
- OpenSIMpad (2003? Earlier?)
- OpenTom (2004? Earlier?)
- OpenPMA (2006? Earlier?)
- 2006: OLPC XO
- 2007: eeepc 701
- Chumby (2008?)

The Openmoko: a GNU/Linux smartphone

The Openmoko hardware

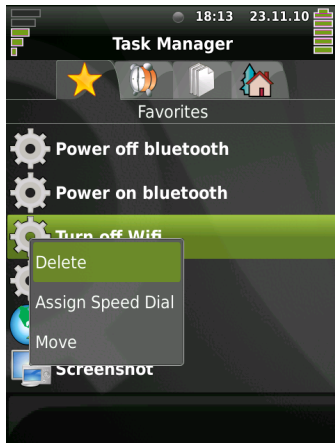
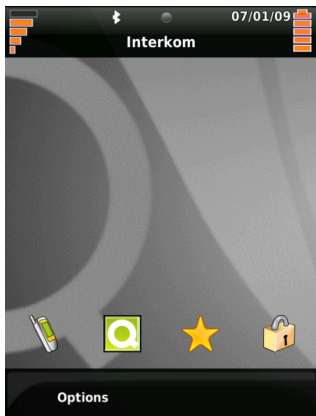
- Made to run GNU/Linux:
 - Had a resistive touchscreen with a stylus
 - Unfortunately lacked a keyboard
 - Unfortunately had high pixel density
- Had many hardware issues:
 - Sound quality on headphones (low pass filter)
 - SD card compatibility
 - In some cases: Metallic sound in calls
 - Modem power management
 - Many were fixed by software over time:
 - GPS not working → kernel fix
 - WiFi instabilities → Driver fix
 - slow graphics → Adapted window manager
 - Modem sound quality → Found undocumented modem commands
 - Other modem issues were also solved by software

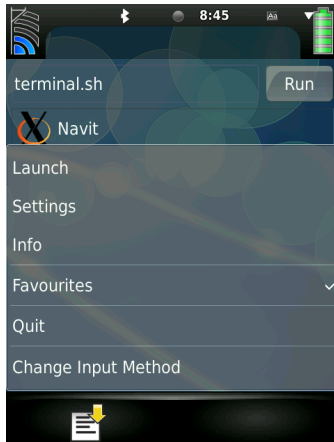
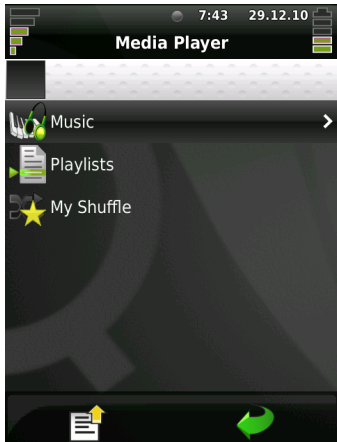
Distribution landscape for the OpenMoko

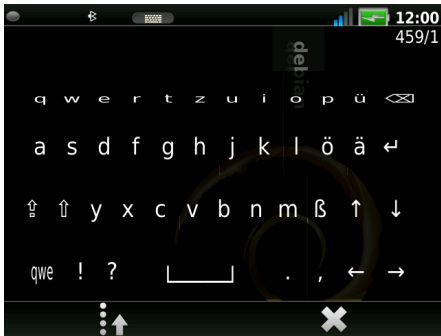
- QtMoko
- Debian
- SHR

QtMoko

- Used Qtopia, a desktop environment that didn't use Xorg. It used the framebuffer interface directly instead.
- Most applications needed to be made specifically for Qtopia.
- Stable enough
- The software was very well adapted for the touchscreen





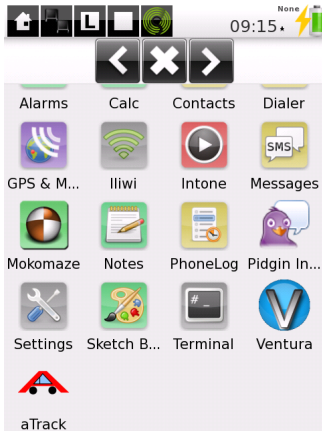
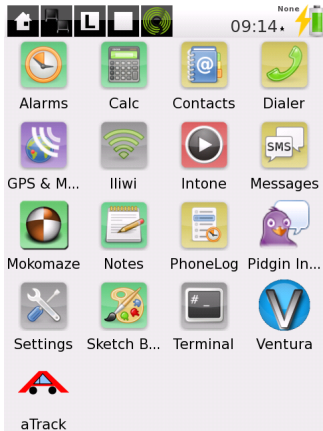




Debian









- Used stock debian
- Typically with Xorg and maybe some custom repository for freesmartphones and Openmoko GUI applications (dialer, etc)
- Had old versions of the userspace hardware support stack (modem support, etc)
- Had old versions of the graphical applications made for the Openmoko
- Most of the software was not adapted for the touchscreen
- Stable(working) enough for daily use

SHR

- Used Xorg
- Some key applications were specifically made for the Openmoko.
- Some adaptation of applications (Openembedded made that easy) + gtkrc etc
- Some applications (like mail clients or browsers) were unusable due to the touchscreen and high DPI
- Couldn't quit games: not very practical when getting a phone call
- Used freemartphones.
- Was very unstable(not working):
 - Was based on Openembedded which was unstable (build output varying depending on build order)
 - And on vala which was unstable for ARM (crashes)
 - And unlightenment which changed API and may have been unstable



09:31 •  

	+42073
	Mikuláš +420571
	Milar. +420
	Miloslav 571
	Mirde 602
	Mirda +4207
	Miroslav +420602
	Miroslav

New	Call	Options
-----	------	---------

09:32 •  

Click to open contactlist.

1	2 ABC	3 DEF
4 GHI	5 JKL	6 MNO
7 PQRS	8 TUV	9 XYZ
*	0 +	#

Call	More	Close
------	------	-------

09:32 •

17.05.2010 08:05	misa
ahoj, nejedu, nejde to, ValMez je pod bodou.. hoj...	
17.05.2010 08:02	misa
Ahoj brasko,jestli jedes dnes do prace,davej na s...	
05.05.2010 21:30	Rada
No uz jo,akorat jsem PREJELA SJEZD A skončila j...	
04.05.2010 12:26	Miroslav
Odesilatel teto zpravy se Vam pokousel 04.05. 1...	
04.05.2010 07:16	Rada
Odesilatel teto zpravy, kteremu jste 04.05. 07:1...	
04.05.2010 07:08	Rada
Jsem v tom novém obchode.	
03.05.2010 16:48	Petra
Vse vyreseno, Petr	







New Options Show

09:33 •

↓ ↑ ↺ ↻

↑ Mirda	17-05-2010 07
↑ but	17-05-2010 07
▶ ↓ Ermanno (2)	05-05-2010 17
↻ Rada	05-05-2010 16
▶ ↑ but (3)	04-05-2010 12:
↓ Jarmila	04-05-2010 11
↑ Pavel	04-05-2010 09:
↻ +420	04-05-2010 09:

Call Add Numbers Duration






None  16:29

Profile/Power Network

Phone profiles

Airplane mode:

OFF default

Power settings

Auto-dimming: Allow

Auto-suspend: Allow

< Settings 13:19 Plus GSM   >

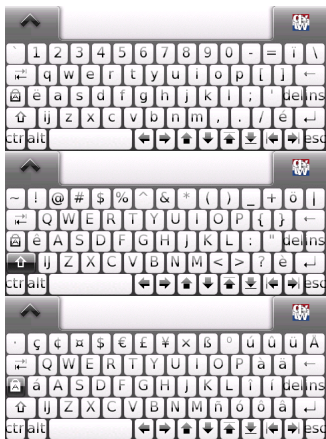
 Phone
 Profiles

 Connectivity
 GPS

 Date/time
 Power

 Services
 Others

 Quit



Software components

Freesmartphone.org: middleware

- Middleware doing everything
 - power management (suspend, rfcill, etc)
 - modem (protocol and power management)
 - gps (protocol and power management)
 - audio (scenarios etc)
 - accelerometers
 - etc
- dbus interface → can be used in most programming language and GUI toolkit.
- Separate daemons for different tasks (modem, gps, power management, etc).
- Plugin architecture. Example for the modem:
 - protocols: Generic AT, Openmoko AT, etc
 - power management, OpenMoko modem on-off, etc

The decline of the OpenMoko community

- More recent phones came out...
- Without the hardware and software issues of the OpenMoko...
- But with many more freedom issues...
- → People were leaving the community and started using other smartphones

Ports to other smartphones

- Over time people also ported SHR and freesmartphone.org to other devices.
- Tried also tried to keep the OpenMoko community through that

Freesmartphone.org: supported devices

- OpenMoko GTA01, GTA02
- GTA04
- Nexus S
- Nokia N900
- Palm Pre, Palm Pre Plus, Palm Pre 2
- Hp Veer
- HTC NexusOne
- HTC Dream, HTC Magic
- HTC Magician
- HTC HD2
- HTC Kaiser, Raphael, Diamond, Blackstone, etc
- OpenEZX smatphones
- E-Ten Goldfish M800, X800
- Motorola Milestone
- iphone 3g

Issues

- Software limitations
- Uncomplete ports

Software limitations

Xorg drivers for ARM devices were limited

- No rotation in most Xorg drivers
- xf86-video-omapfb
 - Had DRM planes support
 - Had XV: Video scaling, etc
 - No rotation
- xf86-video-omap
 - It may have had rotation (bad memory)
- xf86-video-glamo
 - Probably had rotation
- xf86-video-fbdev
 - It had static rotation (through Xorg configuration files)

The lack of free software 3D acceleration made several desktop environment unusable:

- Gnome-shell
- QT with Meego

Devices supported by SHR and freesmartphone.org

- OpenMoko GTA02: complete, also had rotation.
- GTA04: mostly complete.
- Nexus S: close to be usable: integration issues needed fixing
- Nokia N900: WIP: audio, telephony, power management, keyboard.
- Palm Pre, Palm Pre Plus, Palm Pre 2. WIP: Telephony, WiFi
- → HTC Dream: Audio issues, WiFi power management.
- HTC NexusOne: Audio issues, uncompleted

- September 2008: the HTC Dream is released



- Me and other people bought it and started porting it to SHR
- Some people from the Software Freedom Law center were also working on it from the Android side
- → We created Replicant to gather together all the efforts to make that phone usable with only free software (with both Android and GNU/Linux)

HTC Dream

- SHR: More than one year of free time effort by multiple people didn't make it usable
 - Audio didn't work well at all (The Qualcomm alsa drivers required fixed size buffer)
- Replicant: it took very few hours to make it usable
 - Audio: copy/paste example from playwav2 test code to replace nonfree dlopened libraries
 - Telephony: reuse of the reference-ril, patched some stuff here and there to fix things
 - Telephony: Tracing + GNU/Linux with SSH was used to debug it remotely to make it work in the USA

Result

- Result: Worked way better than the SHR and some other Openmoko distributions.

Why this huge gap?

- The abstraction is at the HAL level, and not in the Linux kernel...

Android Architecture

- Examples of the worst API changes:
 - Audio driver: Incompatible interface: Qualcomm DSP (MSM7K)
 - Modem driver: Out of tree driver, with changing interfaces (Samsung IPC)
 - Backlight driver: uses LED interfaces instead (HTC Dream)
 - WiFi driver: Has a highly modified Wext interface (Broadcom, TI, etc)
 - Display driver: Has a custom panel refresh interface (MSM7k, Optimus black)
 - Camera driver: uses custom ioctl to make it work
 - Accelerometer driver: output custom protocol + custom ioctl
 - Kernel core: has different power management API

HTC Dream

- Audio driver: Completely incompatible interface: Qualcomm DSP (MSM7K)
- Modem driver: virtual Serial port (over shared memory) with a mostly standard interface, had free software reference code
- Backlight driver: uses LED interfaces instead (HTC Dream)
- WiFi driver: OS independant and messy code with highly modified Wext interface: The code was used as documentation to rewrite the driver from scratch and upstreamed.
- Display driver: Has a custom panel refresh interface (MSM7k) but it can be disabled.
- Camera driver: Unknown (no free software implementation)
- Accelerometer driver: output custom protocol + custom ioctl
- Kernel core: has different power management API
- GPS: NMEA but required reverse engineered software to activate.

Similar issues in some GNU/Linux devices like the n900, but to a lesser extent

- Status when shipping (all that got fixed later):
 - Modem driver driver: Nonfree userspace protocol implementation
 - GPS: nonfree userspace protocol implementation
 - Battery charging: nonfree userspace
 - Camera driver: used custom then upstream interfaces to make it work
 - Accelerometer driver: output custom protocol + custom ioctl

Replicant founders

- Aaron Williamson: Initial builds and research, worked on a market alternative (SlideMe).
- Denis Carikli: work to make the hardware work without nonfree libraries.
- Bradley Kuhn: Infrastructure (OSUOSL, Domain name, etc) and project name.
- Graziano Sorbaioli: Testing, Community management.

Created in September 2009

```
$ git -c http.sslVerify=false clone \  
http://gitorious.org/replicant/manifest.git/  
$ cd manifest  
$ git checkout origin/replicant  
$ git show f1b1b7a28f114f6900c2d42e83af8c12bc81a421  
commit f1b1b7a28f114f6900c2d42e83af8c12bc81a421  
Author: Denis 'GNUtoo' Carikli <GNUtoo@no-log.org>  
Date: Tue Sep 29 22:15:06 2009 +0200
```

```
Manifest: added initial manifest
```

```
Note that we don't build the kernel and the wifi driver yet
```

Early times

- Mostly trivial
- Added support for the HTC Dream
 - Made it work in the USA through SSH with GNU/Linux
- Added support for the Nexus one
 - Display issues got fixed

What we found by working on Replicant

- The hardware was a nightmare: The modem was in control:
 - Shared memory between the modem and the CPU running Replicant
 - The sound card was in the modem → The microphone was probably under the control of the modem
 - The GPS was also in the modem
 - The modem booted the main CPU, had access to its storage, initialized its RAM, etc

Paul Kocialkowski

- Ported Replicant to the Nexus S
 - Partially unknown modem protocol
 - Some low layer available in code to port a GNU/Linux samsung phone to Android
 - The proprietary RIL logs were verbose
 - → He had SMS working in about 4 months of full time work equivalent
 - Added support for the rest of the hardware as well (camera, etc)
 - Also ported Replicant to most of the other Samsung devices

Several devices later...

Switching focus

- Devices with free software bootloader
 - GTA04
 - Optimus black

GTA04

- Some limited Replicant 4.2 support
- Got suspend issues with Replicant 6 (kernel)

Optimus black

- Long work to add support in upstream u-boot
- Very basic upstream Linux support (lacking a display driver etc)
- See Paul's blog for more details[?]

Wolfgang Weidermeier

- Ported Replicant from 4.2 to 6.0
- Also worked to reduce the amount of prebuilt binaries
 - Added support for new Samsung devices too

Extra readings

- OpenMoko History: <https://www.vanille.de/blog/openmoko-10-years-after-mickeys-story/>
- Paul's blog for on freeing the Optimus black[?]

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- HTC Dream:
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