

OpenEZX and  
OpenMoko, truly  
free software for  
mobile phones

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# OpenEZX and OpenMoko, truly free software for mobile phones

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# Today's Mobile Phone Market

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## The provider rules about the customer

- ▶ Branding
- ▶ Disabling from functions like bluetooth file transfer
- ▶ Only signed software packages
- ▶ Firmware updates over the air (FOTA)
- ▶ Even un-branded mobile phone are not much better
- ▶ Often Java SDK only, no access to the system libraries
- ▶ Only abstracted hardware access

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# Freedom

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# The user has **not** the full control over his own phone

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- ▶ In the last two years many projects started to change this
- ▶ This section gives you a short overview
- ▶ Frameworks first
- ▶ Linux kernel support for mobile phones afterwards

# GPE Phone

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- ▶ Implementation of Linux Phone Standards Forum (LiPS) standards
- ▶ Based on the popular GPE for handhelds
- ▶ Research project
- ▶ Work on many phones is in progress
- ▶ <http://gpephone.linuxtogo.org/>

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# The Hiker Project

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- ▶ Formerly know as ACCESS Linux Platform
- ▶ Avoid fragmentation
- ▶ Some kernel security modules and application under a free licence
- ▶ The biggest part of the software stack is ACCESS proprietary
- ▶ <http://www.hikerproject.org/>

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# OpenEZX

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- ▶ Linux kernel support for Motorola EZX devices
- ▶ Rewrite the 2.4 driver provided by Motorola in sane way for 2.6 mainline inclusion
- ▶ Support differs for hardware generations
- ▶ AT commands already working, but audio support for phone calls is still broken
- ▶ <http://www.openezx.org/>

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# Xanadux

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- ▶ Port the linux kernel on HTC based windows mobile devices
- ▶ Many different devices
- ▶ Hardware support differs from phone to phone
- ▶ Ongoing work with GPE Phone and OpenMoko
- ▶ <http://www.xda-developers.com/>

# Greenphone

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- ▶ Developer reference phone from Trolltech
- ▶ Should help developing applications for Qtopia
- ▶ Open source version from Qtopia core available
- ▶ Most of the telephony applications are not open source
- ▶ 2.4 kernel with binary modules

# OpenMoko

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- ▶ Truly open software stack for mobile devices
- ▶ Founded by Sean Moss-Pultz from FIC to scratch his own itch
- ▶ Development is sponsored by OpenMoko Inc. but driven by key developers of the FOSS community
- ▶ Not only software but also hardware
- ▶ First developer device, GTA01, is available since yesterday
- ▶ <http://www.openmoko.org/>

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# OpenEZX Introduction

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- ▶ Motorola sells Linux smartphones in Asia for quite some time
- ▶ They start selling the A780 in Europe end of 2005. Unfortunately they stopped it again in 2006
- ▶ October 2005 Harald Welte started the OpenEZX project
- ▶ Currently there are more then 10 different EZX devices
- ▶ Newer phones like A1200 and ROKR E6 already bootup a kernel but most of the drivers are not working

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# Pictures



Figure: E680



Figure: A780

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# Pictures



Figure: ROKR E2



Figure: A1200

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# EZX Hardware

- ▶ Quad Band GSM
- ▶ GPRS, sometimes EDGE but no UMTS
- ▶ Intel Xscale (PXA271) for the application CPU
- ▶ GSM/Baseband CPU Neptun LTE
- ▶ MicroSD or SD card slot
- ▶ Bluetooth
- ▶ 320x240 LCD with touchscreen
- ▶ Camera
- ▶ FM-Radio (E680, ROKR E2)
- ▶ GPS (European A780)
- ▶ Wlan (A910)
- ▶ Enhanced Mini USB

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# Enhanced Mini USB (EMU)

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- ▶ Mini USB plug
- ▶ The EMU can be changed between different modes:
  - ▶ USB device port
  - ▶ USB host port
  - ▶ Serial port
  - ▶ Stereo audio signal
  - ▶ 500mA charger
  - ▶ Carkit

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# Motorola and the GPL

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- ▶ No GPL license or source in the shipping box
- ▶ The guys from motorolafans forum requested the first kernel code
- ▶ Bootloader code followed
- ▶ <http://opensource.motorola.com/> was started as a place to store the code
- ▶ For A1200, ROKR E2 and A910 they started releases for more than one firmware release
- ▶ Still buggy kernel trees

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# Motorola and the community

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- ▶ Only contact about getting GPL compliant
- ▶ No contact to developers or engineers
- ▶ No submission of patches
- ▶ No documentation
- ▶ No SDK for native Linux applications
- ▶ It's a pity. :-)

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# Software

- ▶ 2.4.20 based kernel with many modifications from Montavista and Motorola
- ▶ Blob Bootloader
- ▶ gcc and glibc
- ▶ Userspace tools like modutils and findutils
- ▶ Closed parts:
  - ▶ The GUI is based on Qt Embedded. Motorola added own EZX libraries
  - ▶ PDA, PIM and dialer functions
  - ▶ Opera webbrowser
  - ▶ Real media player
  - ▶ CoPilot navigation software
  - ▶ Java VM

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# First own code

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- ▶ For fast development cycle an easy kernel test method was needed
- ▶ With the bootloader code as reference Harald Welte wrote boot\_usb
- ▶ Load zImage from host over usb into phone RAM and execute it
- ▶ Unfortunately phone stays in flash mode and no interaction with BP is possible

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# First own kernel

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- ▶ The released kernel code needed some fixes
- ▶ After the 2.4 kernel was running Harald started porting it over to 2.6
- ▶ The core platform is mostly ported
- ▶ Many chips can be used with the already in-tree kernel driver
- ▶ The mux\_cli for GSM modem functionality driver gave us a harder fight

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## 2.6 mux\_cli driver

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- ▶ 3GPP TS07.10 standard for multiplexing channels over a serial link
- ▶ Used for communication with baseband CPU
- ▶ Without this driver no phone functionality is available
- ▶ Only usable with a flashed kernel
- ▶ Phone turns off after 60 seconds with a non working mux\_cli driver
- ▶ It turned out that the mux devices needs to be opened within this 60s to turn off the BP watchdog

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# Voice call and audio handling

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- ▶ Audio handling on EZX mobiles is pretty complicated
- ▶ You have to route audio between many different codecs, chips and applications:
  - ▶ Baseband CPU
  - ▶ Bluetooth headset
  - ▶ Cable headset
  - ▶ Earphone speaker
  - ▶ Other speaker
  - ▶ Microphone
- ▶ On long term we would like to use the ASoC infrastructure for it
- ▶ For voice calls we will try a simple audio routing driver first

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# OpenEZX status

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- ▶ Port the architecture and driver from 2.4.20 to 2.6
- ▶ Biggest items left:
  - ▶ ASoC driver
  - ▶ Better handling of the BP (reset)
  - ▶ Power-management
  - ▶ Camera driver
  - ▶ Support newer phones
  - ▶ Many many fixes all over the place
  - ▶ Start submitting upstream
- ▶ We were already able to send a SMS with a 2.6 kernel and free software only

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# Future plans

- ▶ OpenEZX will focus on kernel level and OpenEmbedded integration
- ▶ Porting drivers and adding support for more phones
- ▶ Support for ROKR E2 and A1200 is on its way
- ▶ Submit code for review and mainline inclusion
- ▶ On top of our hardware support we need a free mobile phone framework

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# OpenMoko: The Mission

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## **OpenMoko the World's First Integrated Open Source Mobile Communications Platform**

- ▶ Open hardware drivers
- ▶ Open framework
- ▶ Open application

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# Backgrounds

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- ▶ Sean Moss-Pultz (FIC) has an itch, a mobile phone he can customize in all ways he like
- ▶ Many vendors run a linux kernel on there phones, but keep as most as possible closed
- ▶ From a free software stack not only costumers profit but also provider and handset maker

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# Pictures



Figure: FIC Neo1973

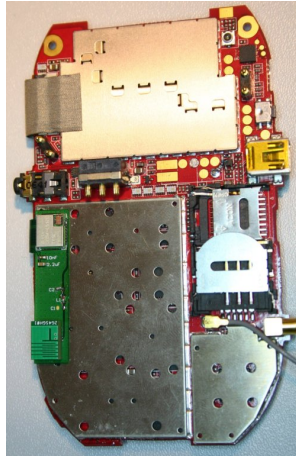


Figure: PCB down side

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## Configuration of the Neo1973 Phase 1

- ▶ Size: 120,7 x 62 x 18,5 (mm)
- ▶ 2,8 Zoll VGA (480x640) TFT Screen
- ▶ Samsung s3c2410 SoC (266MHz)
- ▶ Global Locate AGPS chip
- ▶ Ti Quadband GSM and GPRS (No EDGE or UMTS)
- ▶ USB 1.1 (Device and host powerless)
- ▶ Touchscreen
- ▶ MicroSD slot
- ▶ 2,5mm audio connector

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# Hardware

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...

- ▶ 2 keys
- ▶ 1200 mAh battery (Charging over USB)
- ▶ 128 MB SDRAM
- ▶ 64 MB NAND Flash
- ▶ Bluetooth 2.0 EDR

This is the hardware specification for the developer version.

**Available since yesterday on**

<http://www.openmoko.com/>

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The mass market version at the end of the year will be upgraded.

- ▶ Faster Soc (400MHz)
- ▶ Smedia graphics processor
- ▶ Wifi
- ▶ Accelerometers

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# Software

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- ▶ U-Boot as bootloader (Version 1.2/git)
- ▶ Linux kernel (version 2.6.21.1)
- ▶ Dbus, BlueZ, Udev
- ▶ New created libgsmd and gsmd
- ▶ Kdrive, Matchbox, GTK+
- ▶ libmoko{core,net,UI,PIM}
- ▶ Finger and Stylus applications

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# How to participate

- ▶ Standard tools used in free software projects: Wiki, maillinglists, IRC, OpenEmbedded, Bugzilla and SVN
- ▶ The complete source code is available in svn
- ▶ Libraries are LGPL and applications are GPL
- ▶ Metadata for building with OpenEmbedded are also available
- ▶ Applications can be compiled, tested and used on a normal PC
- ▶ A QEMU based emulator allows testing images build for the phone

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