

OpenEZX – unleashing the full potential of Motorola EZX mobile phones

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Outline

Introduction

Hardware

Motorola

EZX Software

OpenEZX

Community PoV

Future plans

Summarize

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OpenEZK –
unleashing the full
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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 OpenEZK project
- ▶ Currently there are more than 10 different EZK devices

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Why choose EZX mobile phones for hacking?

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- ▶ They already run linux
- ▶ Motorola sells millions of them
- ▶ They look nice :-)

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Core components

- ▶ 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

- ▶ No GPL license or source in the shipping box
- ▶ The guys from motorolafans 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
- ▶ If Motorola is interested in community efforts about the EZX platform, just should drop me a line

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- ▶ 2.4.20 based kernel with many modifications from Montavista and Motorola
 - ▶ EZx ARM subarchitecture
 - ▶ Touchscreen
 - ▶ SD / MMC / Transflash
 - ▶ mux_cli
 - ▶ GPRS
 - ▶ Bootloader
 - ▶ gcc and glibc
 - ▶ Userspace tools like modutils and findutils

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Closed software

- ▶ 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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OpenEZX goals

- ▶ The goal is a complete free software stack on the application CPU
- ▶ Linux kernel with complete hardware support
- ▶ Cellphone suited GUI
- ▶ Firmware updates
- ▶ Documentation of the hardware

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User benefits

- ▶ Firmware images to flash the phone at home
- ▶ Security updates
- ▶ Updates for new software version
- ▶ **The possibility to change the system to their own needs**

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First own code

- ▶ For fast development cycle an easy kernel test method is needed
- ▶ Bootloader based on Blob (GPL)
- ▶ With this 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

- ▶ 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 driver for GSM modem functionality gave us a harder fight

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2.6 mux_cli driver

- ▶ 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 useable 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
- ▶ Hard to debug

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

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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:
 - ▶ 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 SMS and do voicecalls with a 2.6 kernel and free software only.

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Current situation

- ▶ Most of the GPL code is available
- ▶ Still some license issues on some parts
- ▶ Driver porting is hard due to missing documentation and code quality

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Future wishes

- ▶ Publish per-feature patches instead of all-in-one tarballs
- ▶ Consider to release some hardware data sheets. (PCAP2)
- ▶ Contacts to engineers or developers
- ▶ Clarify licenses for some drivers

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Future plans

- ▶ OpenEZX should focus on system level and OpenEmbedded integration
- ▶ Porting drivers and adding support for more phones
- ▶ Write plugin for gsmd
- ▶ Support for E2, E6 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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- ▶ <http://www.openmoko.org/>
- ▶ FIC sponsored free mobile phone software stack
- ▶ Already tied up with OpenEZX as they share some core developers
- ▶ They also work on a clean TS07.10 kernel infrastructure with EZX phones in mind

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GPE Phone

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- ▶ <http://gpephone.linuxtogo.org/>
- ▶ Implementation of Linux Phone Standards Forum (LiPS) standards
- ▶ Work on A780 and A1200 is in progress
- ▶ Needs work for touchscreen based mobile phones

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- ▶ Still much work to be done, but we expect something useable at the end of the year
- ▶ <http://www.openezx.org/>
- ▶ Some parts of this slides base on slides from Harald Welte. Thank you.
- ▶ You can find the slides later on <http://www.datenfreihafen.org/paper.html>

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