

Linux on the Xbox



A Lecture by Jens Kühnel

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author of the german book
„Samba 3 – Wanderer zwischen den Welten“



meets



Linux on the Xbox content

- What's inside!
 - Hardware
 - Software
- Install Linux
 - Mod-Chip
 - Cromwell
 - Software Hack
- free Software
- Thanks

Hardware

- 733 Mhz Intel Celeron CPU (PIII -based)
- 64 MB RAM (expandable to 128M,soldering!)
- 10/100MBit Network card (Nvidia)
- NVidia GForce 3,5 graphic card with TV-Out – only 2D XV Acceleration available, no 3D
- 8 or 10 GB Hard disc (ATAPI-Lock)
- 4 USB-1.1 Ports with special Connector
- DVD Rom Drives (Problems reading some CD-R/RW)

Versions

- 7 known Versions at the moment:
1.0 1.1 1.2 1.3 1.4 1.5 1.6
- Not Identifiable by production date, because of different factories and assembly lines
- Xbox-Linux-Team has a Version-Howto
http://www.xbox-linux.org/Xbox_Versions_HOWTO

The Birth date

XBOX Microsoft

Games sold separately. | Jeux vendus séparément. | Spiele separat erhältlich. | Giochi venduti separatamente. | Los juegos se venden por separado. | Games worden apart verkocht.

2002 FIFA World Cup™ - Electronic Arts

Oddworld: Munch's Oddysee™

MotoGP™ - THQ

Halo™

Project Gotham Racing™

Amped™ Freestyle Snowboarding

Buffy the Vampire Slayer™ - Fox Interactive/ Electronic Arts

Medal of Honor™ - Electronic Arts

VIDEO GAME SYSTEM
Technical Specifications
Central processing unit (CPU)
Graphics processing unit (GPU)
64 MB memory
Hard disk
Supports Dolby® Digital and Dolby® Surround audio (Games must support Dolby technologies)
Advanced SCART cable and sound system with Dolby Digital required for Dolby Digital audio. Sold separately.
256 audio channels, including 64 3-D audio channels
Four controller ports
Ethernet connectivity via the Xbox™ System Link cable (sold separately)
DVD movie playback capability (DVD Movie Playback Kit required. Sold separately. See bottom panel for details.)

This unit is designed to be used with:
1) Games that have the Xbox logo and the (TM) designation.
2) Audio CDs that have the Compact Disc logo.
3) DVD movies with the (TM) designation. Refer to required DVD Movie Playback Kit for region specifications.

IMPORTANT!
Le manuel d'utilisation dans lequel vous trouverez des informations importantes sur la sécurité se trouve à l'intérieur.

WICHTIG!
Leze de handleiding met belangrijke informatie over de veiligheid en de correcte gebruikswijze in de doos, het spel of de Xbox Productinformatie.

PREMIUMAVVERTING!
Aankomende de handleiding en de instructievideo's zorgvuldig lezen om belangrijke informatie over de veiligheid en de correcte gebruikswijze te verkrijgen.

IMPORTANTE!
Antes de utilizar este producto, lea el Manual de Instrucciones para obtener información importante sobre salud y seguridad.

TECHNISCHE SPECIFICATIES:
Centrale verwerkingseenheid (CPU)
Grafische verwerkingseenheid (GPU)
64 MB geheugen
Hard schijf
Ondersteunt Dolby® Digital- en Dolby® Surround- (spellen moeten Dolby-technologieën ondersteunen)
Geavanceerde SCART- en geluidssysteem met Dolby Digital vereist voor Dolby Digital- (afzonderlijk te koop)
256 geluidskanalen, inclusief 64 3-D-geluidskanalen
Vier controllerpoorten
Verbinding met het ethernet via de systeemlinkkabel voor Xbox™ (afzonderlijk te koop)
DVD-filmweergave (DVD-filmweergavekit vereist. Afzonderlijk te koop. Zie de onderkant van de doos voor details.)

Dit apparaat is ontworpen om te worden gebruikt met:
1) Spellen met het Xbox- (TM) logo.
2) Audio-CD's met het Compact Disc- (TM) logo.
3) DVD-films met het (TM) logo. Zie de vereiste DVD-filmweergavekit voor regionale specificaties.

Wichtige informatie:
Lezen de gebruiksaanwijzing en de instructievideo's zorgvuldig voor belangrijke informatie over de veiligheid en de correcte gebruikswijze.

Atenção:
Antes de utilizar este produto, leia o Manual de Instruções para obter informações importantes sobre saúde e segurança.

54471 **SILVER** **2002-03-03 MFG. DATE**
1166356 20903 SERIAL NO.
713 1166356 20903 PRODUCT ID

SERIAL NUMBER / NUMÉRO DE SÉRIE / SERIENNOMMER / NÚMERO DE SÉRIE / NÚMERO DE SÉRIE / SERIENNUMMER / NÚMERO DE SÉRIE

www.xbox.com 3602 Part No. 300-000001

Microsoft XBOX

Xbox - Versions

- 1.0 Boxes
 - extra fan on the Graphic card
 - TV-Chip Conexant
 - TSOP (1024KB) and AT-like power connector
- 1.1 Boxes
 - New MCPX (Chipset)
- 1.2 Boxes
 - smaller TSOP (256KB)
 - New ATX-like power connector

Xbox - Versions

- 1.3 Boxes
 - one Signal is removed from the LPC-Port
- 1.4 Boxes
 - New TV-Chip FOCUS
- 1.5 Boxes
 - Removing of the 3.3 V and GND from the LPC-Port
 - There is no proof of real 1.5-Boxes
- 1.6 Boxes
 - New Boxes with TV-Chip xcalibur
 - LPC-Port is hidden, but still on the board
 - No Flash any more, Kernel is now in ROM

Hard disc

- Hard disc is not version depended
- Hard discs are swappable Mind the Lock!
- Key/Serial of the ATAPI-Lock is in the EEPROM
- Two Manufacturers 4 Drives:

Seagate 10GB



Western Digital 8GB



Hard disc partitioning

- Normal no real Partition table
- String BRFR is used to detect Xbox-HDD
- 5 „Partitions“ at predefined Positions
 - 3*750MB (X: Y: Z:) Temp FS
 - 500MB (C:) System
 - 4.7GB (E:) Save-Games and Audio-CD-Rips
- FATX-Filesystem (cleaned FAT-Derivat)

DVD-Drives

- DVD-Drives are not Version dependent
- special Power connector with Eject detection
- 3 known Manufactures:

- Thomson

- Problems: CD-R and CD-RW

- Philips

- Problems: CD-R
 - New Versions looks OK

- Samsung

- can read anything
 - hard to get



TV – OUT and other

- normally only TV-OUT (1 + 2 Audio Cinch with Scart-Adapter) or Scart directly
- Xbox supports HD-TV up to 1080i
- VGA-adapter with SDIF 5.1 for all Boxes and many Games/Linux available (80€)
- Owner Conexant-Chip-boxes can make a self-made Cable for Linux only

Memory-Module

- original Memory-Module
 - 8MB USB-Stick with special Connector
 - very expensive (40€)
- Many USB-Sticks working with a simple Adapter
 - Compatibility only recognisable by testing
 - The Try of a Compatibility list is available at:<http://unmodded.mine.nu/docs/XboxUsbCompatibilityList>



LPC - Port

- Open Bus-System as the successor of ISA
- Available in every Xbox.
- The signals are scattered over the board at 1.6-Boxes
- In case of an error in the flash the LPC-port is used as the booting device
- An error can be created by grounding the Signal D0, this is used by the mod-Chips

Original Software / Firmware

- special Windows 2000–Kernel
 - very small ~ 500 KB
 - no User-Mode
 - no Memory protection
 - no Caching
 - no Swapping
 - no dynamic linking
 - no NTFS, but FATX, GDF and UDF
 - flashed into the TSOP (write protected)

Dash

- Dash
 - The Dash-Board is the User interface shown when no Game is put into the DVD-Drive
 - It's possible to to rip Audio-CDs and to manage Save games



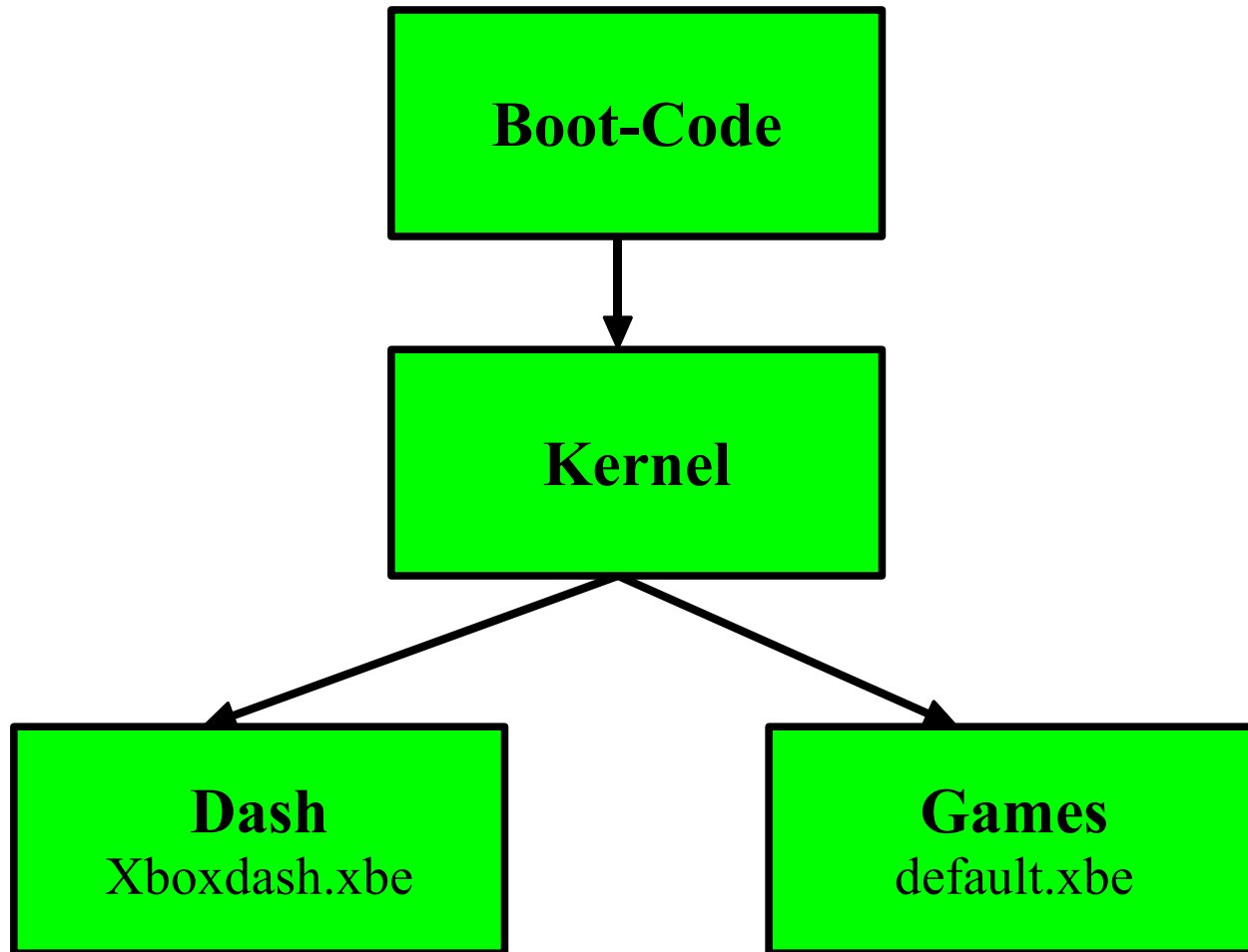
Xbox Live

- Xbox-Live
 - Online-Game-System
 - Tries to send the Xbox-ID to Microsoft and updates the Dash whenever the menu item xbox-live is selected.
 - Makes it possible to connect the Xbox-ID and the .NET-ID
 - Xbox-Live uses Kerberos (Port 88) and the Ports 3074 upd and tcp.
 - When the Progressbar is under 90% you can still reset the box.

Anti-Linux Protection

- The Boot code is inside the MCPX (Chipset)
- The Boot code starts the Kernel
- Kernel tests the ATAPI-Lock and the digital Signature(RSA-2048Bit) of the binaries (XBE)
- When a game is in the DVD-Drive the default.xbe is tested and started.
- When no game is available the Xboxdash.xbe is used.
- The XBE-Binary-Format defines, if a Program can be run from HDD or DVD.

Trust-Path



Software-Bugs 1

- Game:
 - Buffer overflow in the Loader of the Save games
 - We need a special prepared Save game
 - Microsoft has started to fix Games.
- Available Games :
 - 007 Agent in Crossfire (Kreuzfeuer)
 - Mechassault (Game of the Year Edition is fixed !)
 - Splinter Cell (still Beta)

Save games available for

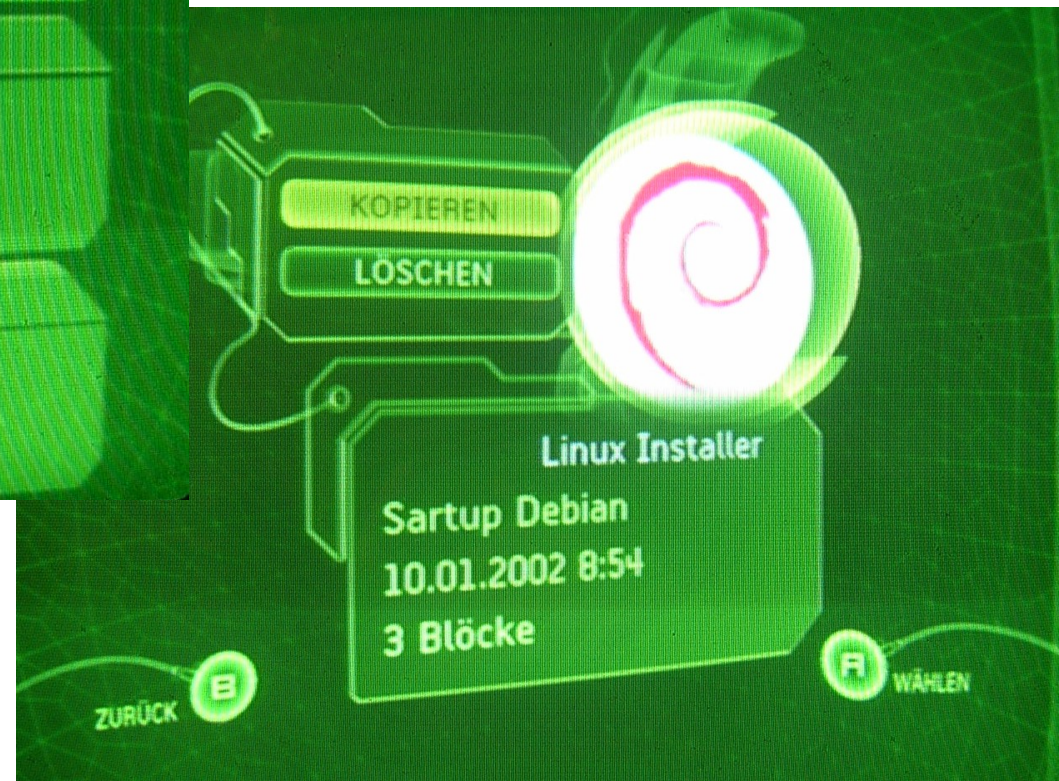


Installation of the Save games

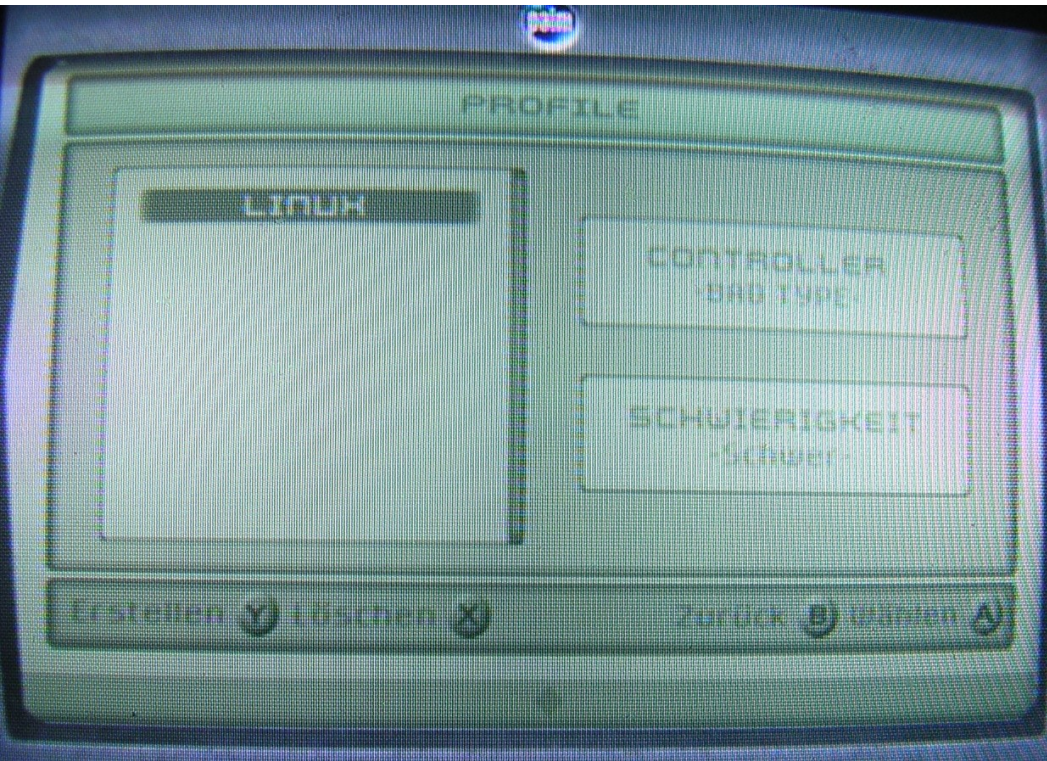
- USB-Cabel
 - special USB cable and „normal“ USB-Stick (not all models work)
- Original 8MB-USB-Stick with the special Xbox-Connector is used on a already modded Xbox.
- HDD
 - The Hard disc is unlocked during the boot of the Xbox. After the boot the still running HDD is removed from the Xbox and connected to a Linux-PC with FATX-Support! !!! DANGEROUS!!!

Copying of the Save games

Copy all Savegames from
USB-Memory to Harddisc



Loading the Save games

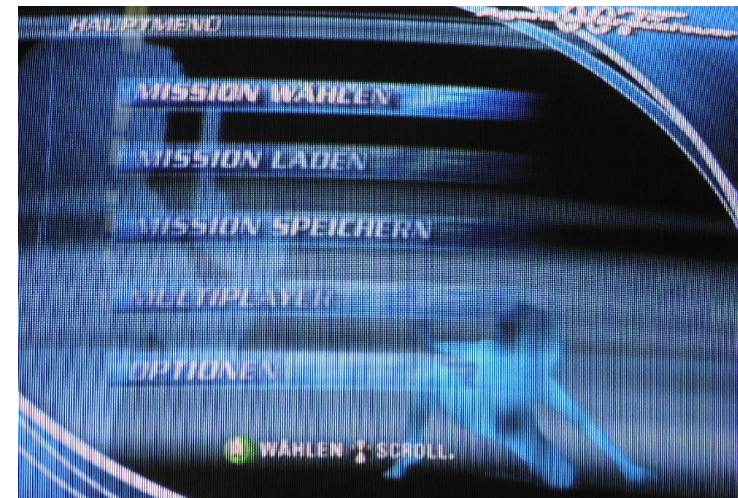


Splinter Cell



Mechassault

007

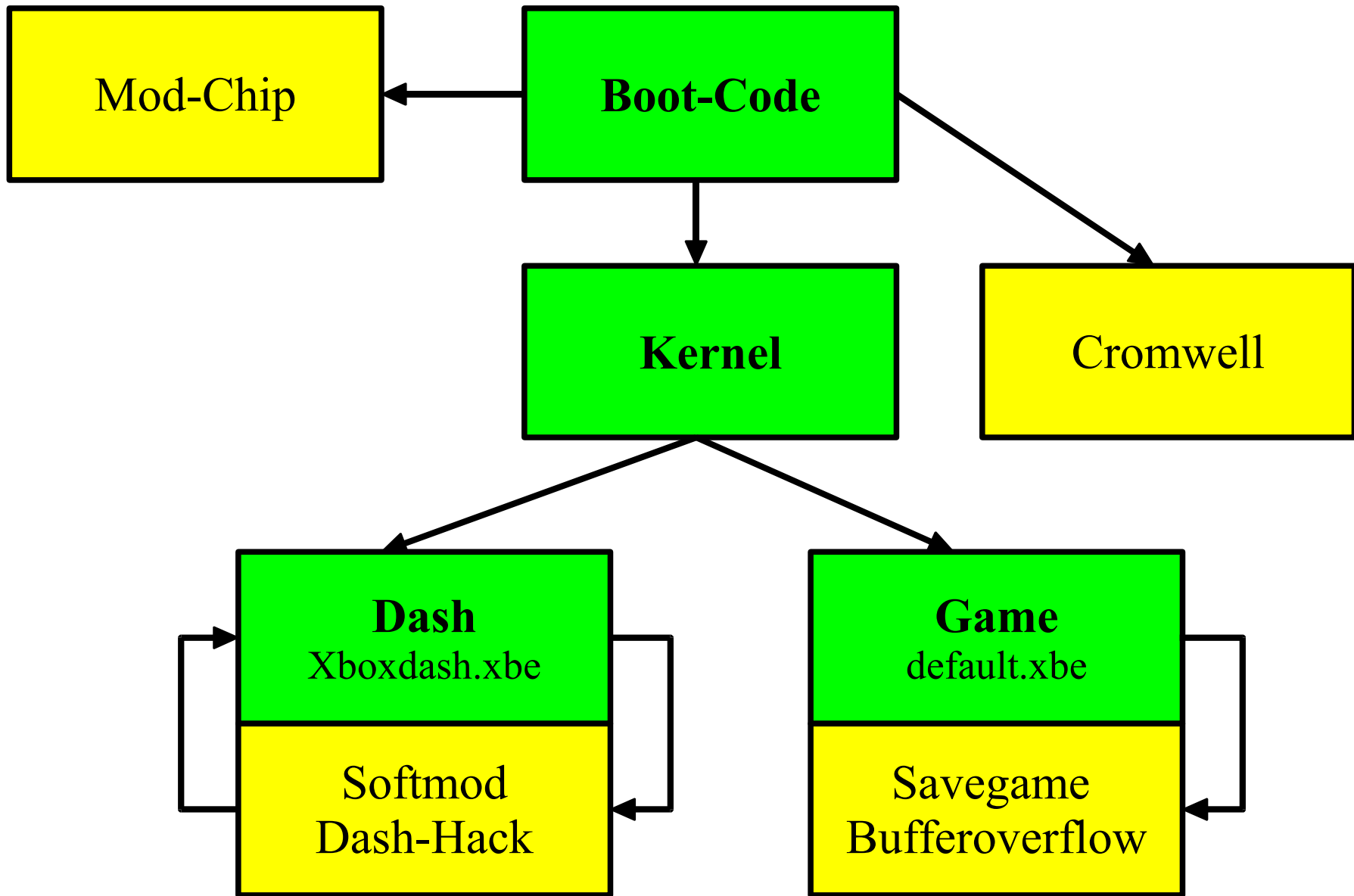


and Linux is booting!
The root password is xbox

Possibilities for a permanent installation

- Mod-Chip
 - everything is possible
- Cromwell
 - Linux-Only
- Software-Hack
 - Games are still possible

Our new Trust-Path :-)



Modchip

- Only empty Mod-Chips or loaded with Cromwell are legal!
- Xbox has to be opened
- No Warranty
- Expensive (20-50€)
- too complicated for the average User
 - solder or insecure Piggy-Packs
- Available for all Boxes

Cromwell

- Override the Microsoft-Kernel with the Linux-Boot loader Cromwell.
- You have to open your Xbox
- HDD- and DVD-Drive can be swapped very easy.
- No Xbox games possible any more
- 100% open (own) Code, therefore 100% legal!

Cromwell Install

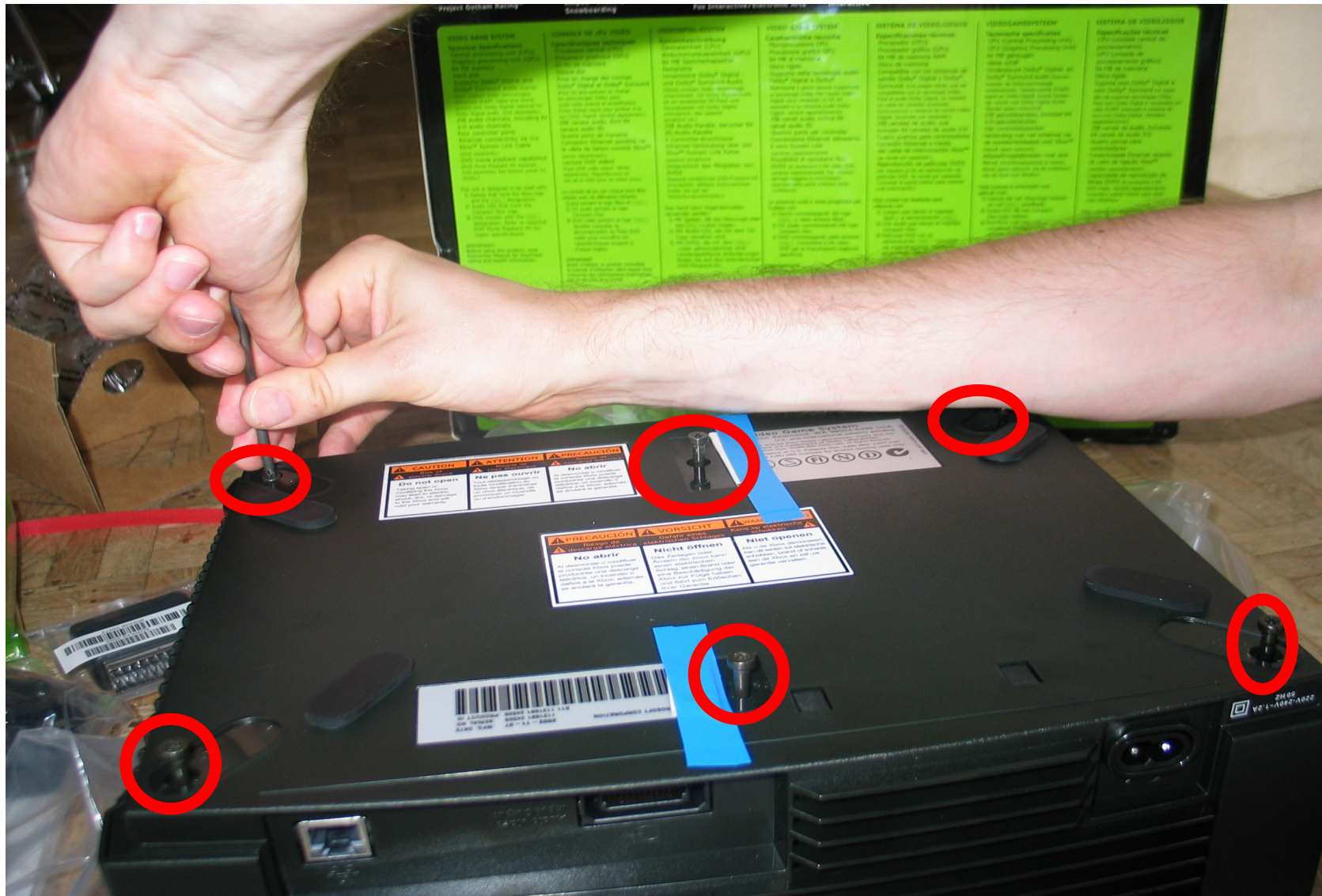
- Take you Xbox apart
- Take out your Motherboard
- remove TSOP write protection
- Boot Linux with buggy game
- write new TSOP flash with raincoat

Opening the Xbox

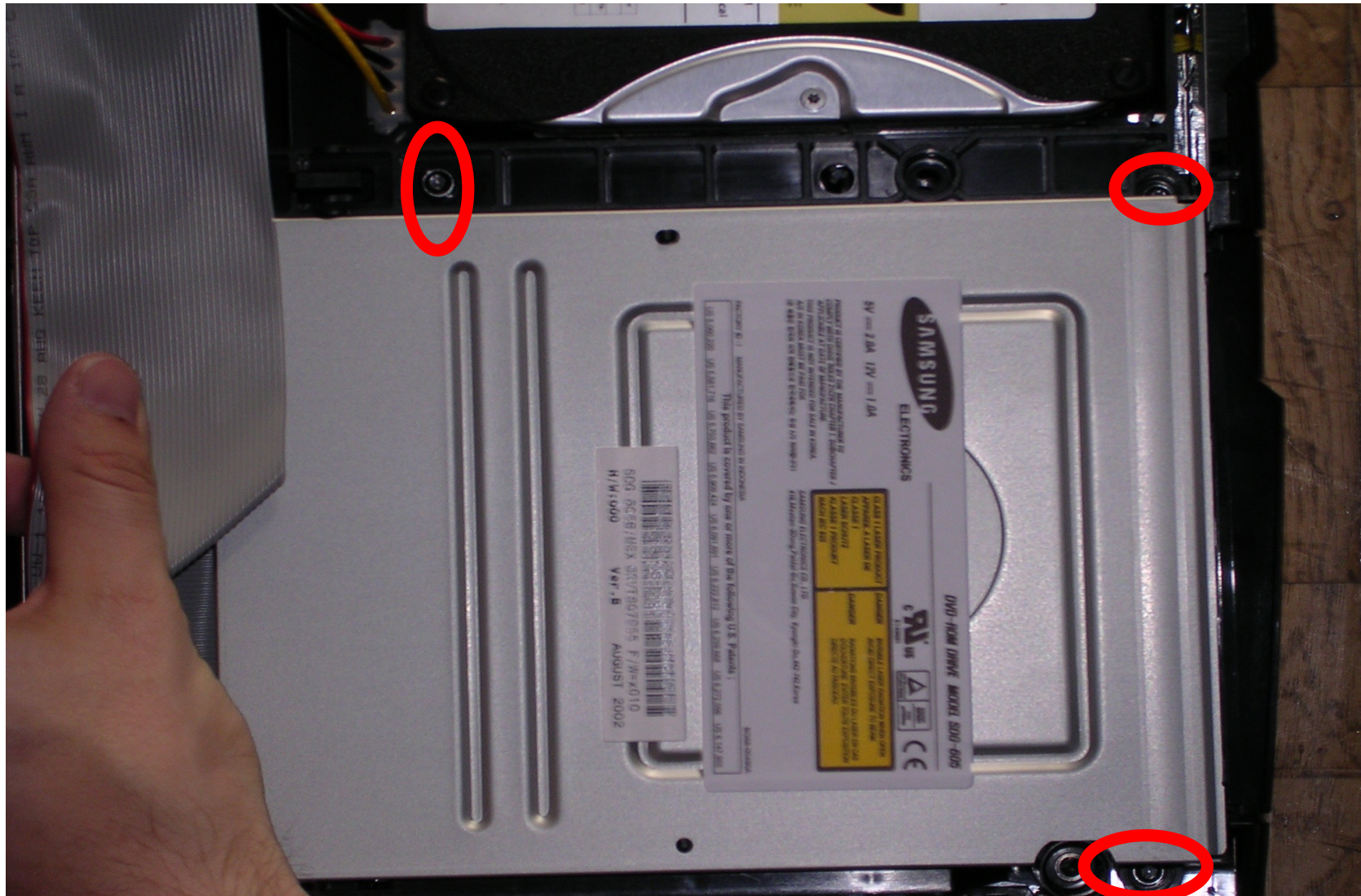


There are 6 Torx-Screws.

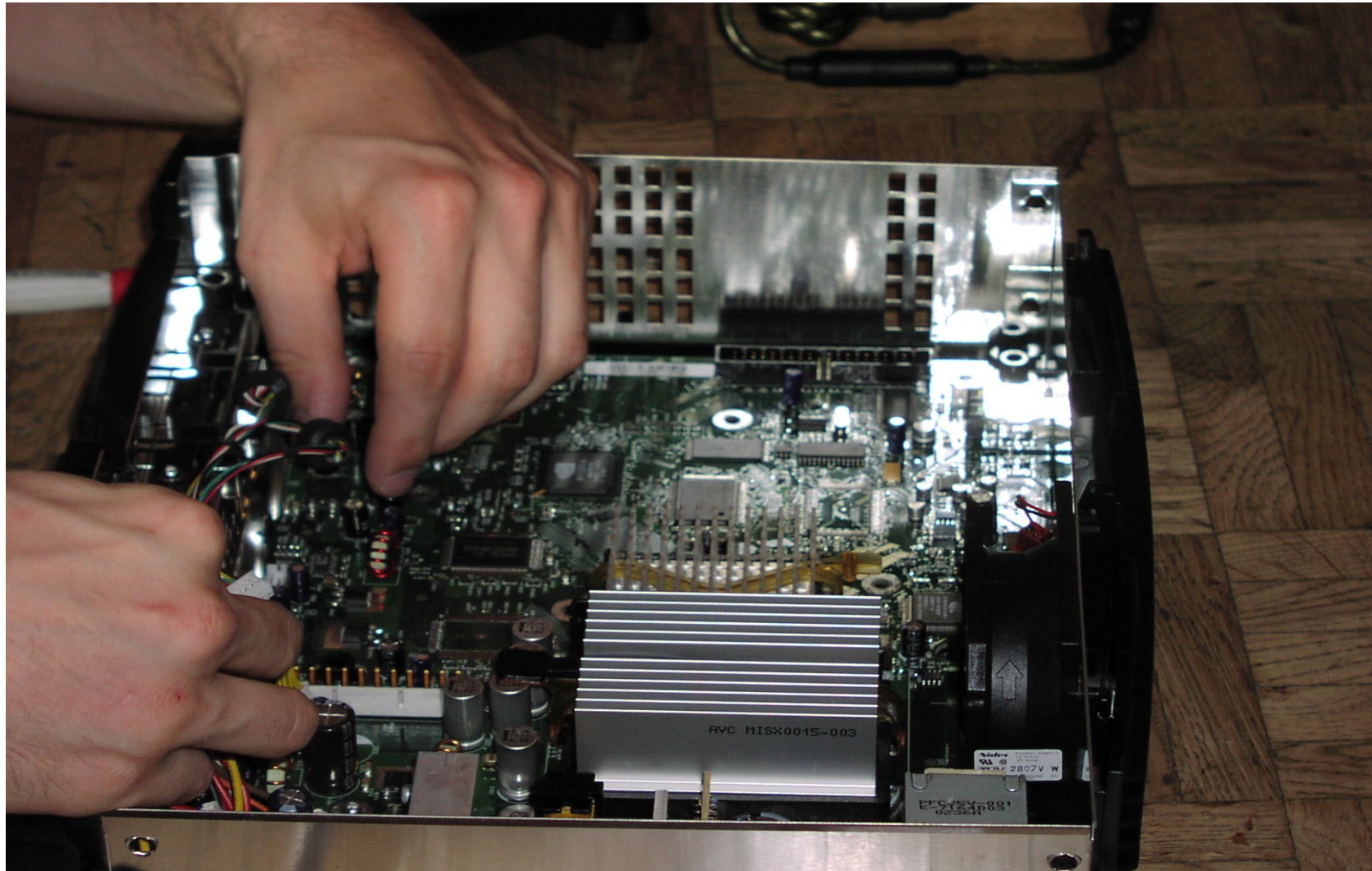
Opening the Xbox



Remove the Drives (HDD and DVD)

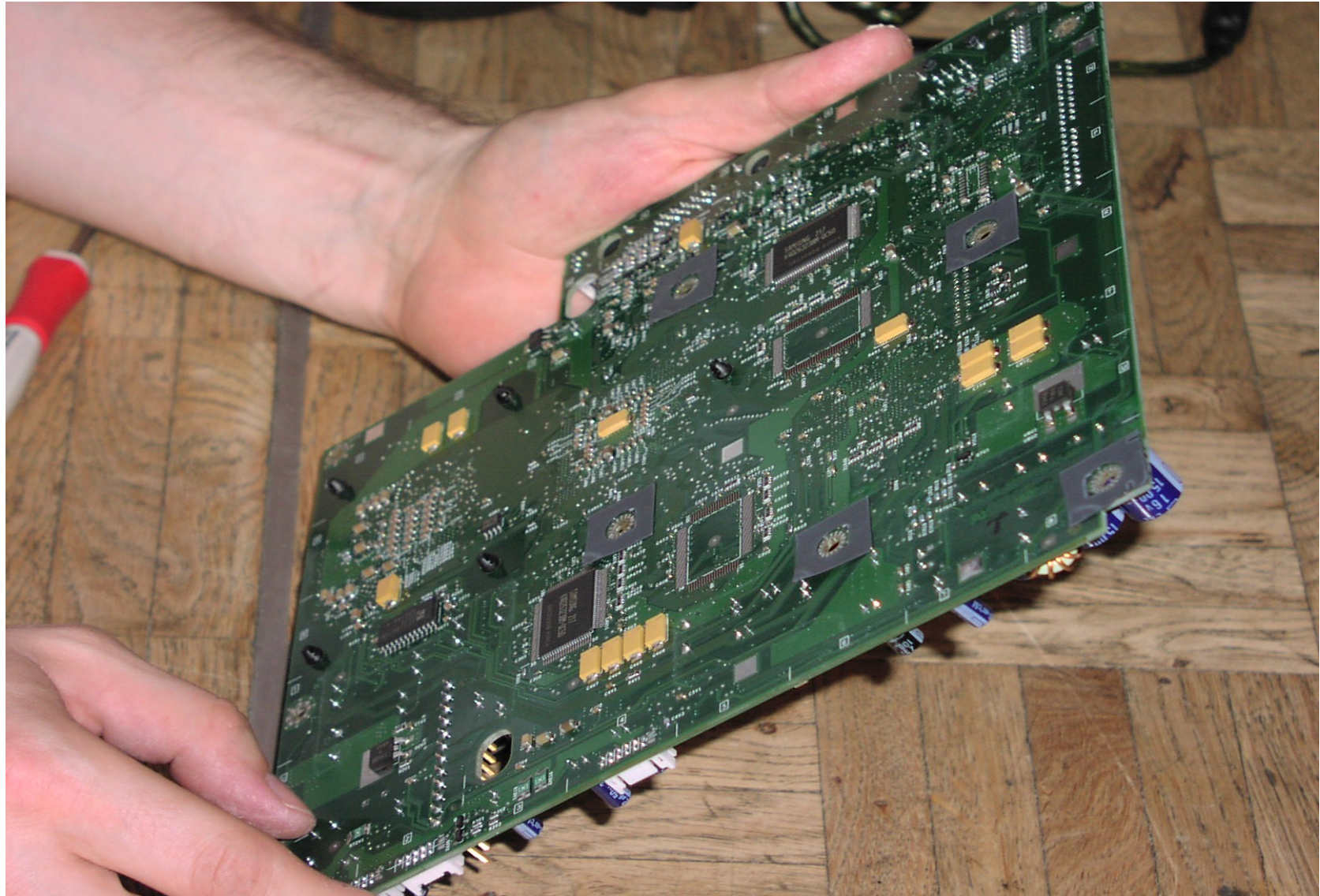


take Motherboard out

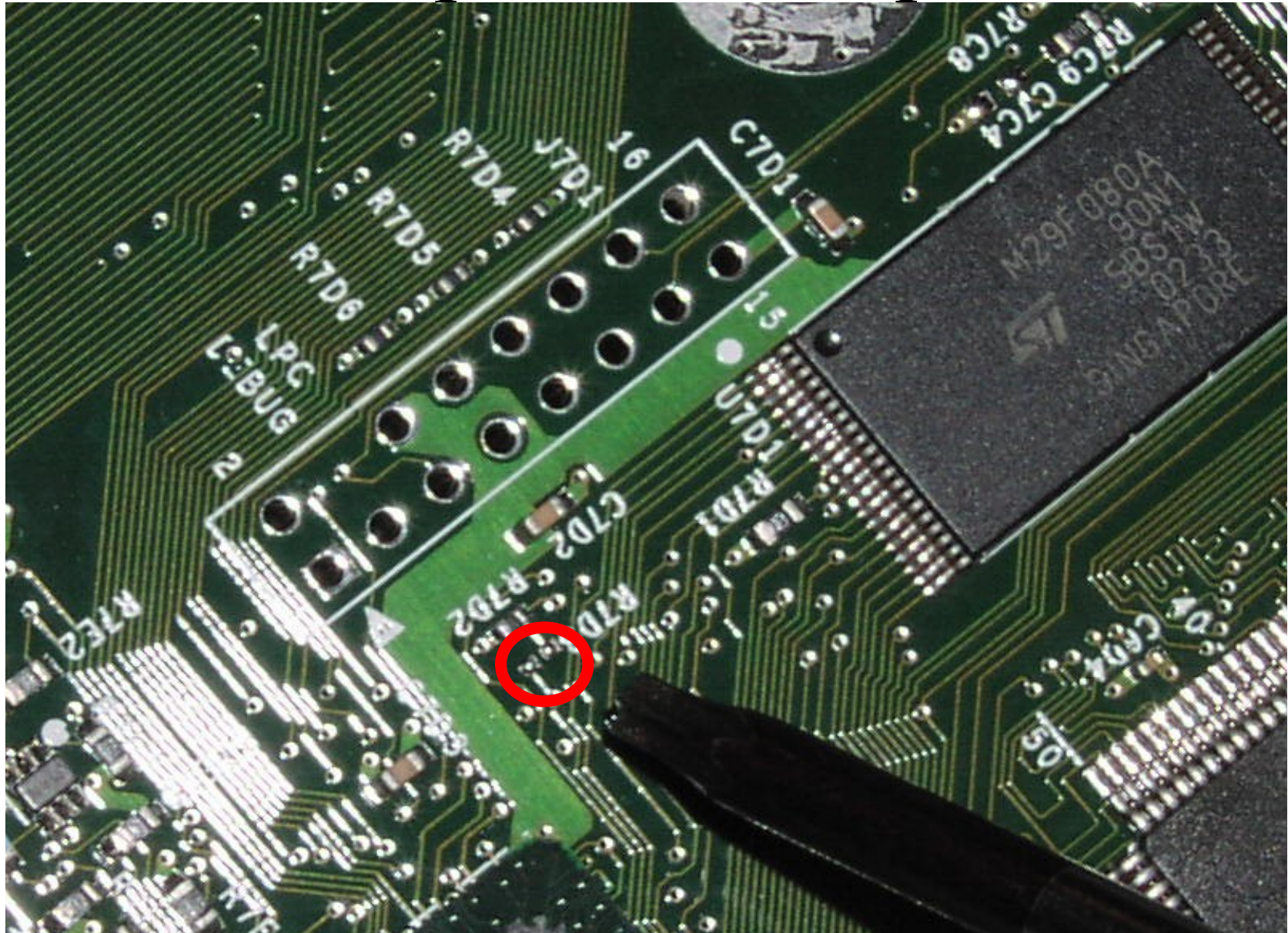


- Remove all Screws (13) and Connectors (5)
- Take motherboard out

The Motherboard

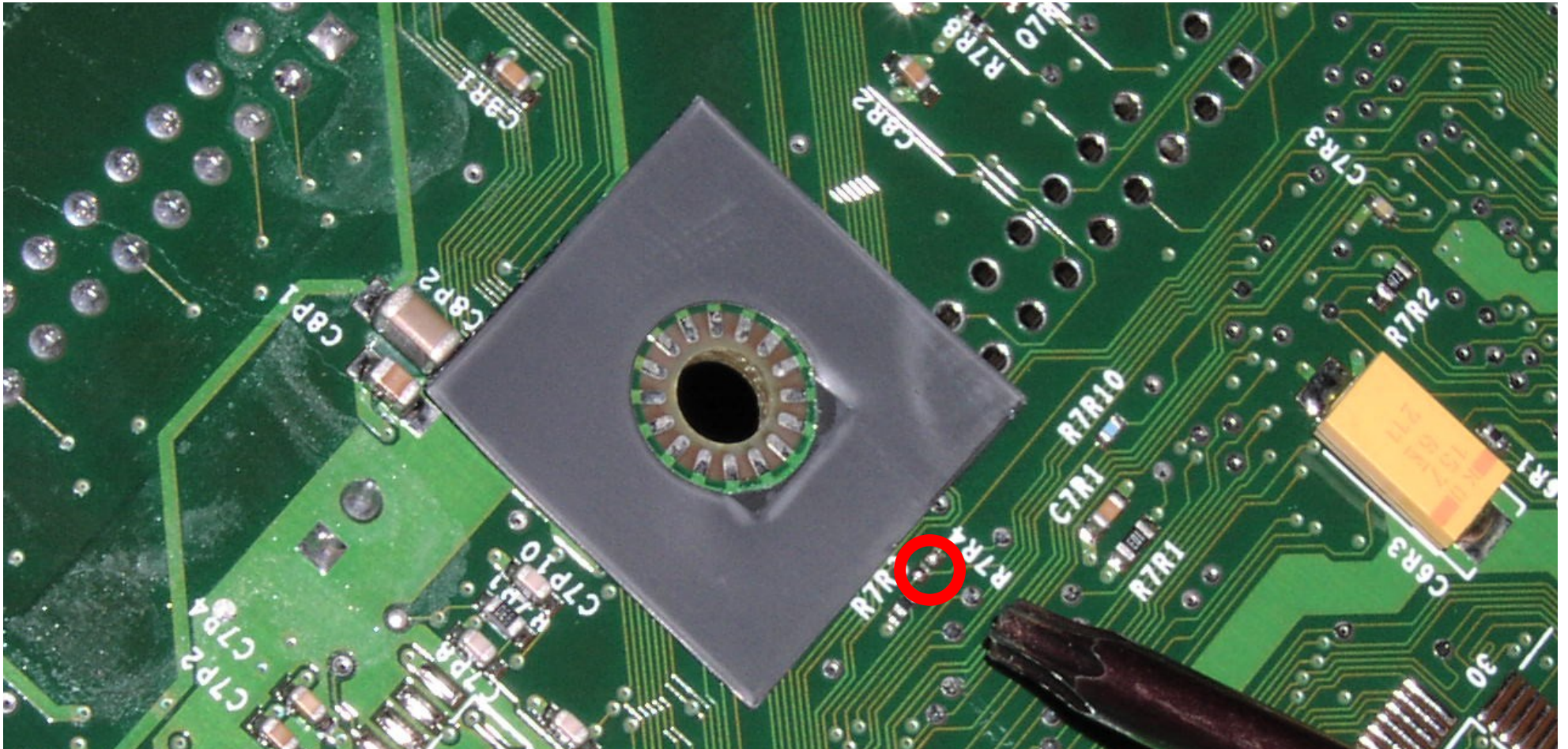


Write protection topside



The solderpoints are crossed.

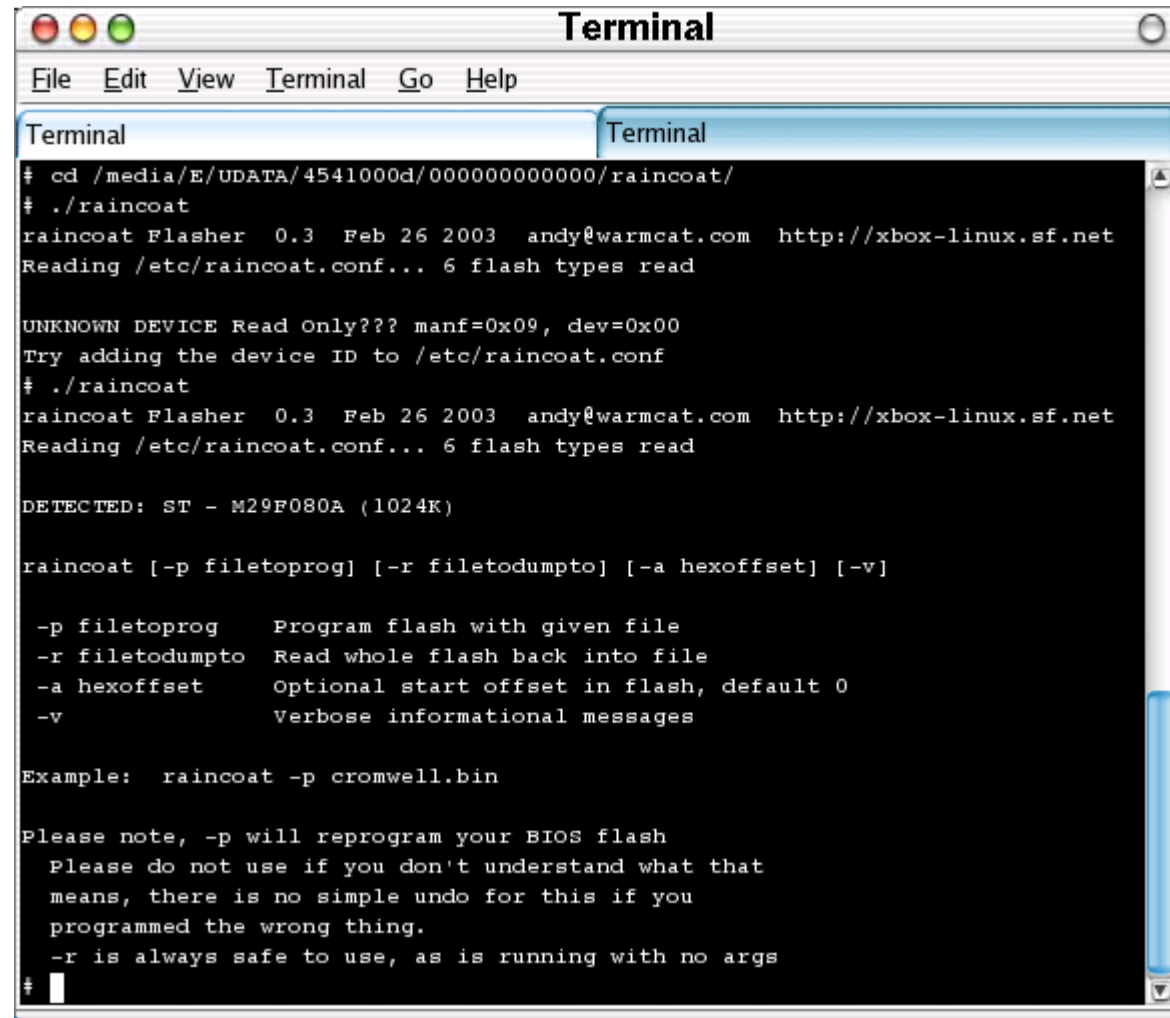
Solder points button



Samething on the button.

Installing Cromwell

- Start buggy Game
- load Linux-Sagegame
- Flashing with raincoat
- Watch the size of the TSOP
- reboot



```
Terminal
File Edit View Terminal Go Help

Terminal
Terminal
# cd /media/E/UDATA/4541000d/000000000000/raincoat/
# ./raincoat
raincoat Flasher 0.3 Feb 26 2003 andy@warmcat.com http://xbox-linux.sf.net
Reading /etc/raincoat.conf... 6 flash types read

UNKNOWN DEVICE Read Only??? manf=0x09, dev=0x00
Try adding the device ID to /etc/raincoat.conf
# ./raincoat
raincoat Flasher 0.3 Feb 26 2003 andy@warmcat.com http://xbox-linux.sf.net
Reading /etc/raincoat.conf... 6 flash types read

DETECTED: ST - M29F080A (1024K)

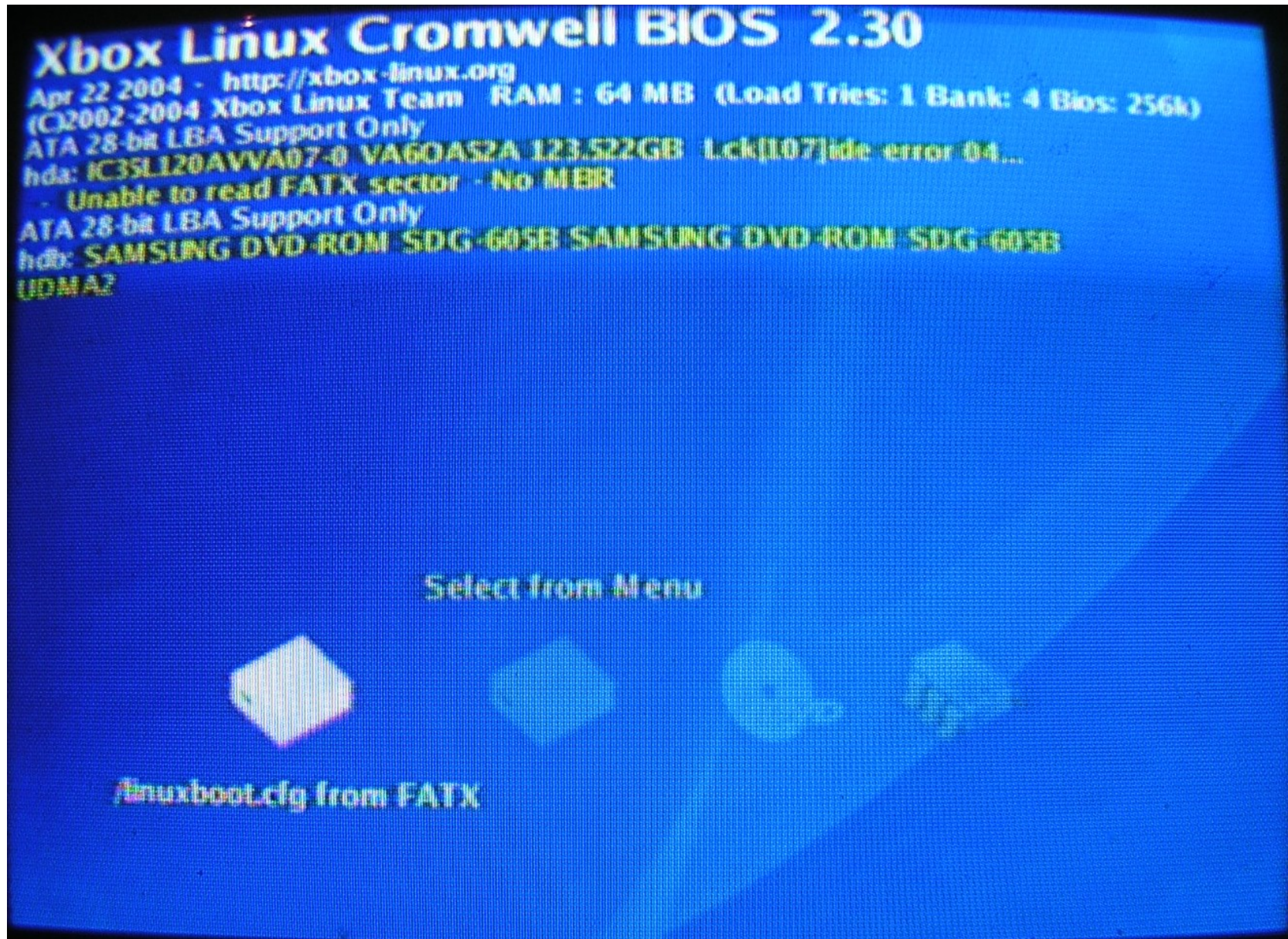
raincoat [-p filetoprog] [-r filetodumpto] [-a hexoffset] [-v]

-p filetoprog      Program flash with given file
-r filetodumpto   Read whole flash back into file
-a hexoffset      Optional start offset in flash, default 0
-v                Verbose informational messages

Example: raincoat -p cromwell.bin

Please note, -p will reprogram your BIOS flash
Please do not use if you don't understand what that
means, there is no simple undo for this if you
programmed the wrong thing.
-r is always safe to use, as is running with no args
#
```

Cromwell



Software Hack

- Software-Hack (aka Mechinstaller)
- No opening the Xbox
- Warranty ??
- Uses a Error in the Microsoft Dash and the Game Mechassault
- New Version for Splinter Cell is in Beta-Status

Software Bug 2

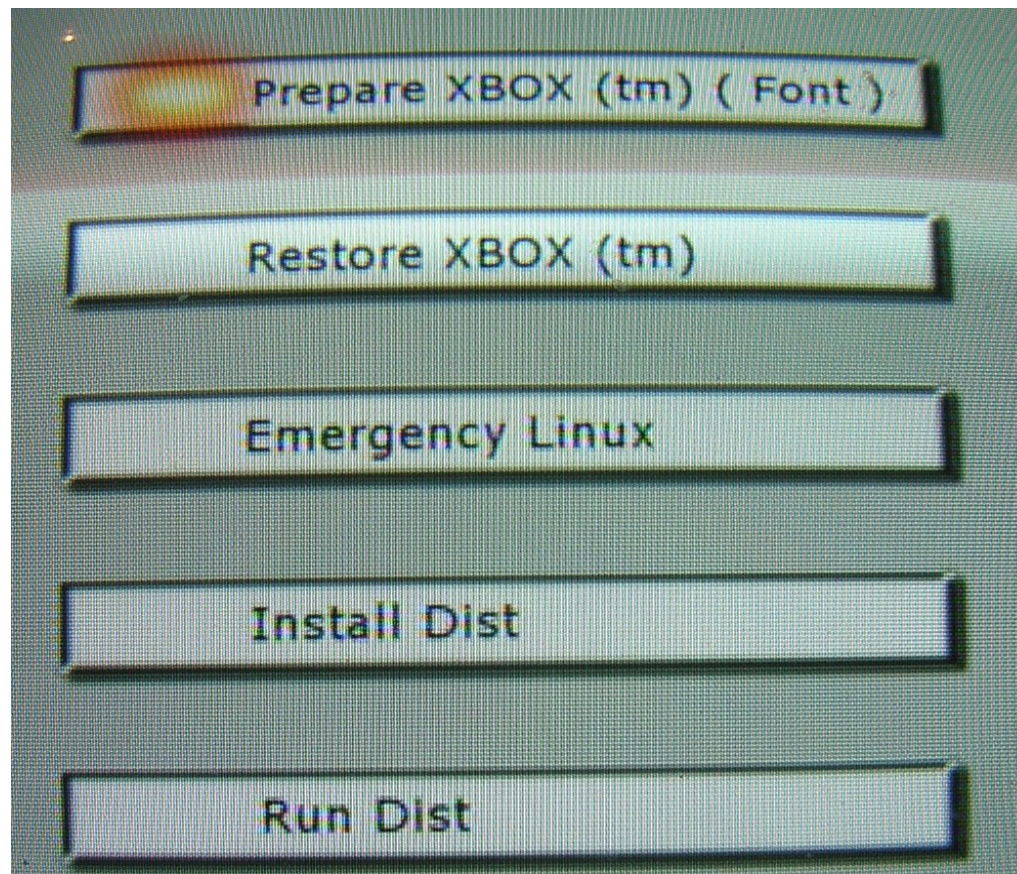
- Dash:
 - Font-Bug
 - The Font files are not digital signed and there is a HEAP-Overflow in the Font-System
 - Audio-Bug
 - Integer-Overflow in the Index-File of the self ripped Audio-CDs-Database

Software Hacks Problems

- New Dashes are fixed
 - Microsoft Xbox-Live updates the Dash automatically
 - A downgrade to an older Version should be legal
- Newer Kernels (since 5713) down allow downgrading
 - Chose other installation Method
 - A new Hack is under Development (UDE/UDE2/UDX)

Installation

- Chose before loading by Mechinstaller
- Use the new Select menu by Splinter Cell



Before



before:
The new select menu



Xebian install

- CD install and boot
- open terminal
- su -
- XBOXLinuxInstall
 - Select the installation target
 - 1 Save game (e) partition
 - 2 unused Space with HDD bigger than 8 GB
 - 3 use HDD completely (not for Soft-Mod!)

The Xbox-Linux Project

- The official Website of the Xbox-Linux-Project:
 - <http://www.xbox-linux.org/>
 - Xbox-Linux Version database:
 - <http://www.xbox-linux.org/docs/versionsentry.html>
 - <http://www.xbox-linux.org/docs/versionsdb.html>
 - Chocolate-List: Users help users
 - <http://www.xbox-linux.org/docs/usershelpusers.html>
- Other interesting websites:
 - <http://www.xbox-scene.com/>
 - <http://hackingthexbox.com/>

Software for the Xbox

•**Xebian**

- Debian for the Xbox
- <http://www.xbox-linux.org/debian/>

•**freevo**

- Frontend to watch Movies

•**Gentoox**

- <http://gentoox.shallax.com/>

•**Cromwell** the Open-Source Xbox-Bios

- <http://www.xbox-linux.org/download.html>

Building new Distributions

- TODO list for new Distributions
 - Kernel
 - i2c
 - alsa
 - X-Server

home-brew-Software (xbins)

- open source -Software some legal problems.
- needed the Microsoft-XDK for compilation
- The XDK is only available for official Xbox-Developers inside limited guideline
- **The Binaries are illegal.**
- Well known Examples: XBMC / XBMP
- **The Xbox-Linux-Project is not related at all with these Projects.**

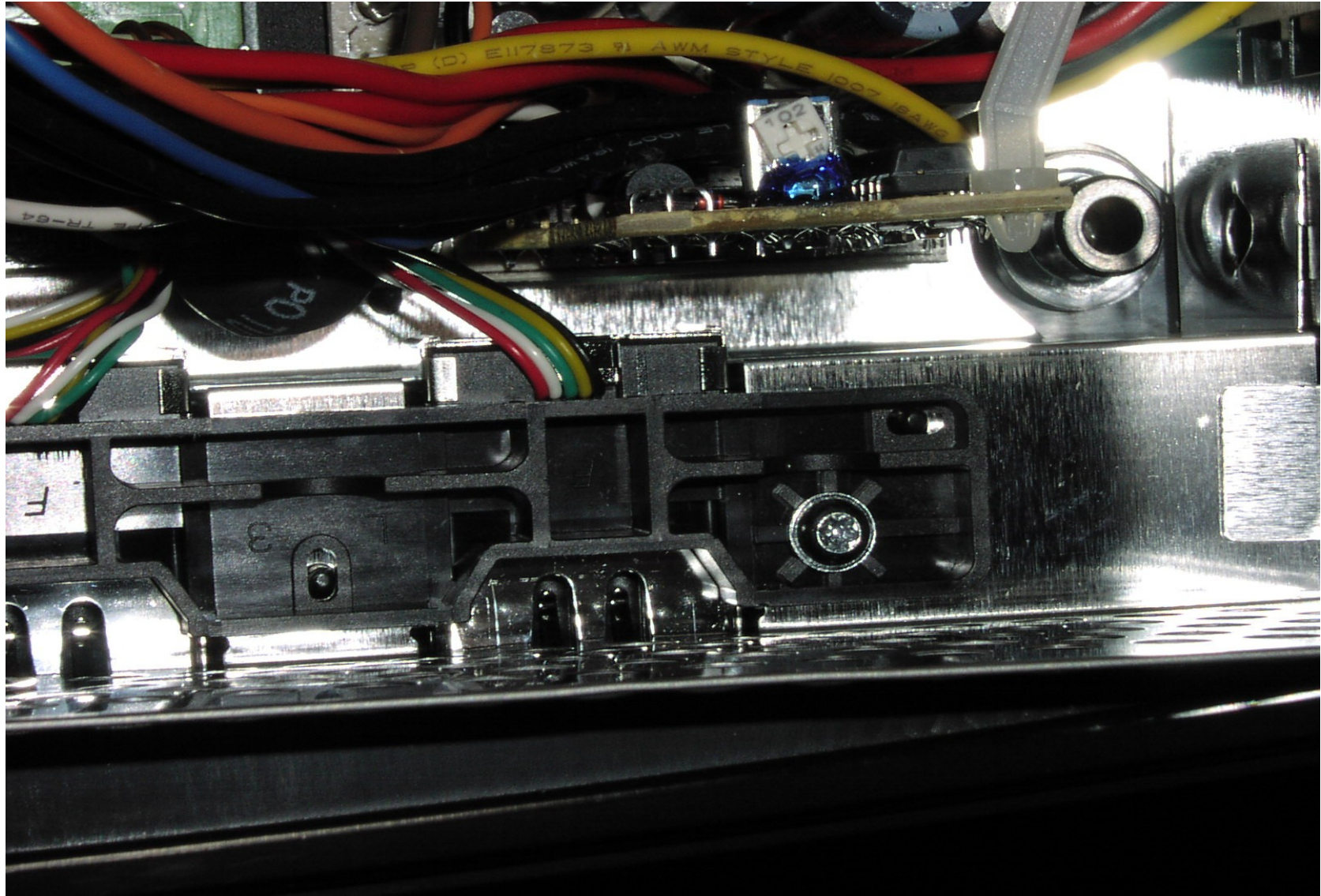
Thanks goes to:

- Michael Steil:
 - Who started the Xbox-Linux-project
- Marvin (Lug-AL)
 - For his slide as a starting point
- The whole Xbox-Linux-Team
 - otherwise I had nothing to play with
- and Microsoft for generously sponsoring the Hardware :-)

Appendix:

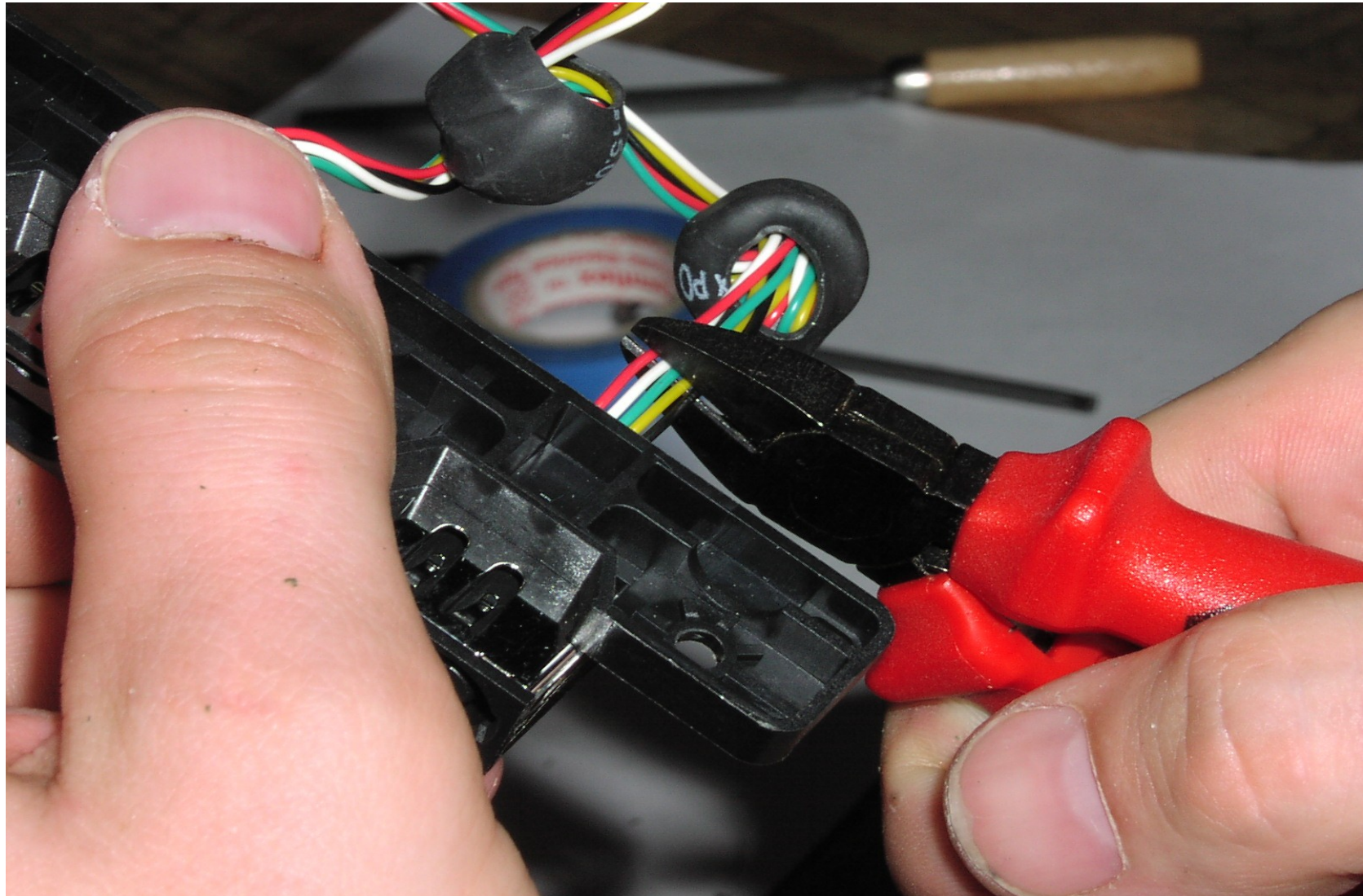
USB-Modding

Replaces the right USB-Connector



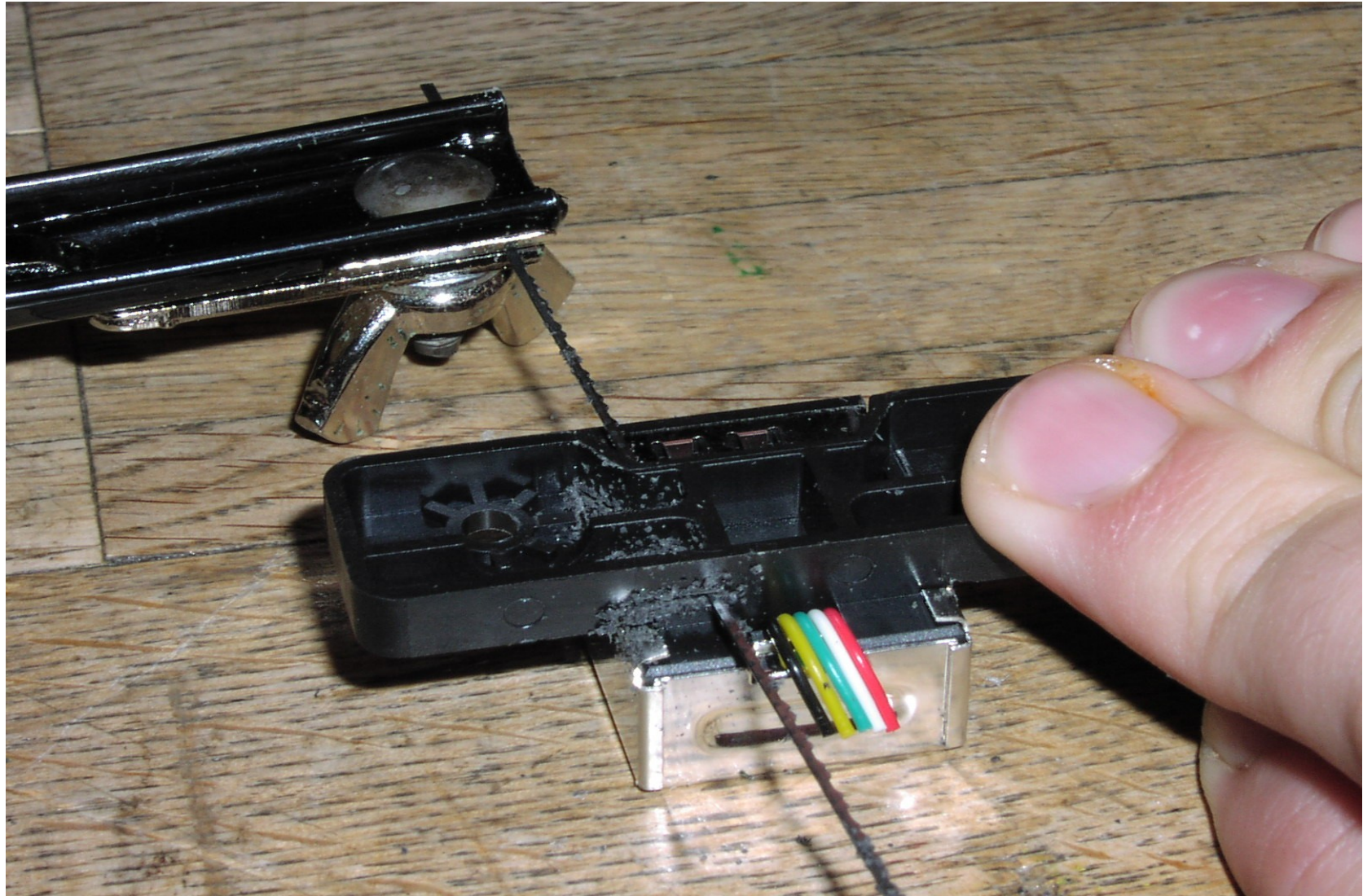
Remove the right bracket

Disconnect the USB-Connector



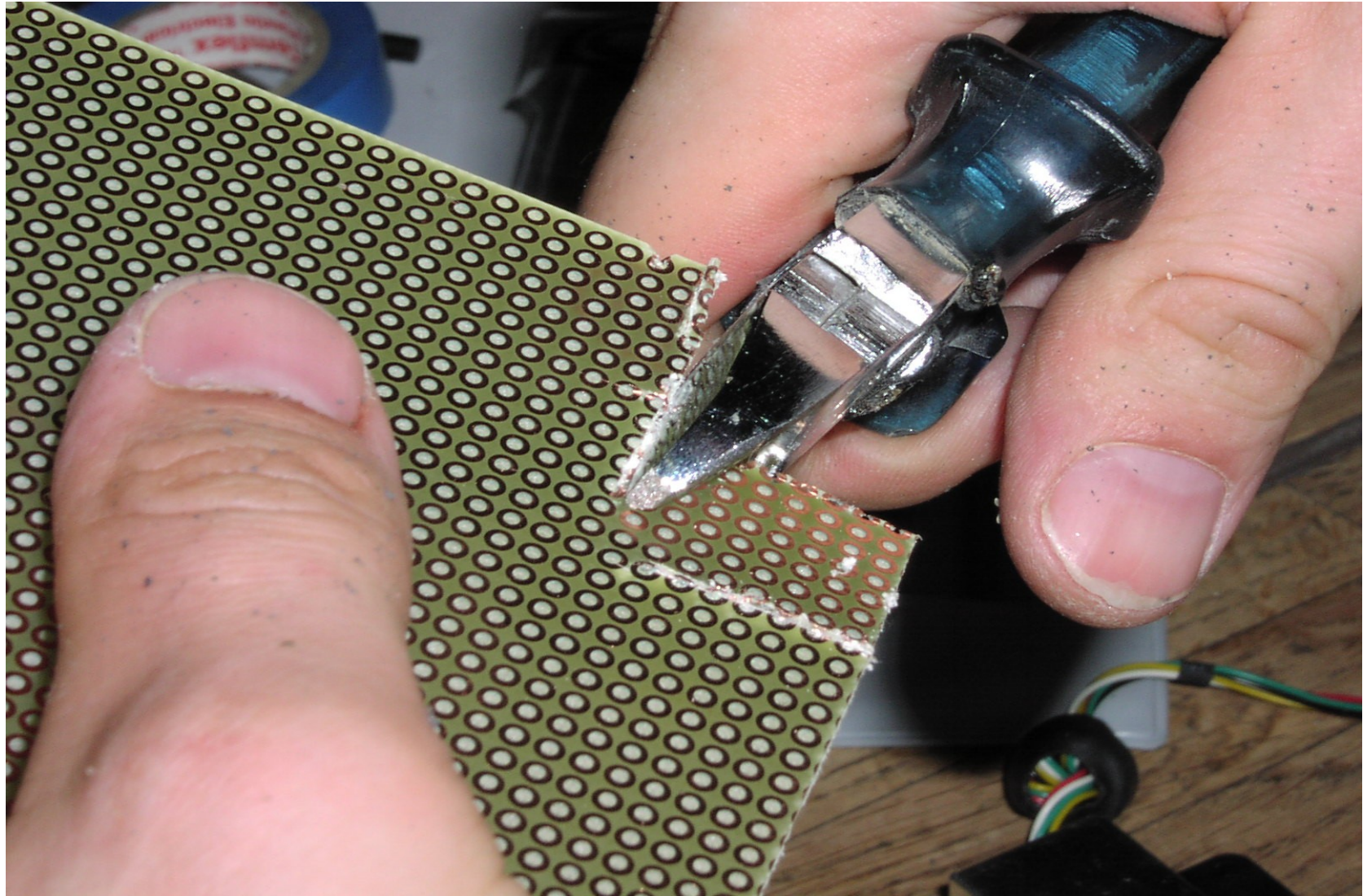
Cut the cable nearby the female USB
leave some room if you want to connect the female USB to your PC

Remove the Connector



Cut the old one out

Building a new bracket



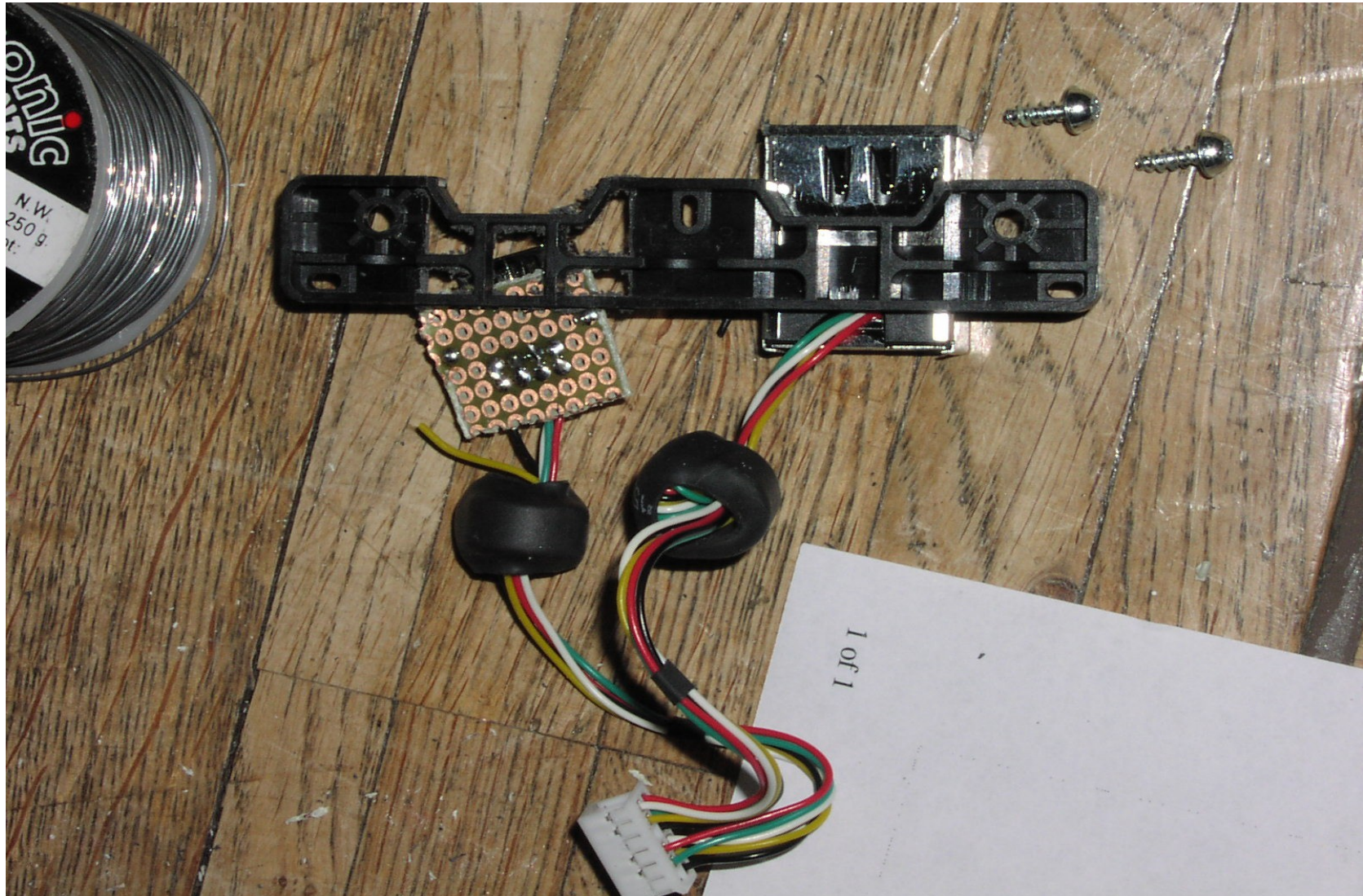
Cut a small piece circuitboard

Building a bracket for the female USB



Solder the female USB to the circuitboard

Connect the female USB



connect the cable with the Help of the colorcoding.
Details see next side.

Connect the female USB

front view



1 2 3 4

- 1 – VBUS / +5V – Red**
- 2 – D- / Data - – White**
- 3 – D+ / Data + – Green**
- 4 – GND / Ground – Black**

fixating the female USB



A little bit of hot glue and every things adherence
Try to fit in befor glueing

Everything is finished

