

GPL License Compliance

How to (not?) use Free Software

FreedomHEC Taipei 2009

by

Harald Welte <laforge@gpl-violations.org>

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Introduction

Who is speaking to you?

- an independent Free Software developer
- who earns his living off Free Software since 1997
- who is one of the authors of the Linux kernel firewall system called netfilter/iptables
- who spends a number of Free/Open software and hardware projects
- who has started gpl-violations.org to enforce license compliance
- who IS NOT A LAWYER

Disclaimer

Legal Disclaimer

- All information presented here is provided on an as-is basis
- There is no warranty for correctness of legal information
- The author is not a lawyer
- This does not comprise legal advice
- The authors' experience is limited to German copyright law

Ideas and Goals of the GNU GPL

- Free Software
- Software that has fundamental freedoms:
 - ▶ to use it for any purpose
 - ▶ to "help your neighbour" (i.e. make copies)
 - ▶ to study it's functionality (reading source code)
 - ▶ to fix it myself (make modifications and run them)
- Copyleft
- Is the legal idea to
 - ▶ exercising copyright to grant the above freedoms
 - ▶ assure that nobody can take away the freedom
- The GNU General Public License
- Is a legal instrument to apply they copyleft idea on software

The GNU GPL revisited

Revisiting the GNU General Public License

- Regulates distribution, not usage
- Allows distribution of source code and modified source code
 - The license itself is mentioned
 - A copy of the license accompanies every copy
- Allows distribution of binaries or modified binaries, if
 - The license itself is mentioned
 - A copy of the license accompanies every copy
 - The complete source code is either included with the copy (alternatively a written offer to send the source code on request to any 3rd party)

Complete Source Code

" ... complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the executable."

- For standard C-language programs, this means:
 - Source Code
 - Makefiles
 - compile-time Configuration (such as kernel .config)

- General Rule:
 - Intent of License is to enable user to run modified versions of the program.
 - Provide whatever is needed for that, and you will make them happy!

Derivative Works

- What is a derivative work?
 - Not dependent on any particular kind of technology (static/dynamic linking, dlopen, whatever)
 - Even while the modification can itself be a copyrightable work, the combination with GPL-licensed code is subject to GPL.
 - As soon as code is written for a specific non-standard API (such as the iptables plugin API), there is significant indication for a derivative work
 - This position has been successfully enforced out-of-court with two Vendors so far (iptables modules/plugins).

Derivative Works

- Binary-only kernel modules
 - In-kernel proprietary code (binary kernel modules) are hard to claim GPL compliant
 - Case-by-case analysis required, as the level of integration into the GPL licensed kernel code depends on particular case
 - There is no general acceptance or tolerance to binary-only kernel modules in the Linux (development) community. Not even Linus himself has ever granted an exception for such modules!
 - Create all kinds of technical problems, too - kernel API's and ABI's change all the time...

Derivative Works

- Glue Code
 - Acts as glue layer between GPL licensed code and proprietary code
 - Some Vendors think they can avoid the GPL by doing so
 - Is definitely not a bullet-proof legal solution, especially when it is clearly visible that the only purpose of this glue code is to "get rid" of the GPL.
 - So please, don't try it.

Derivative Works

■ Moral Issues

- Apart from what is legally possible, there are moral issues
- Even if in a particular case there is no legal way to claim a binary-only kernel module is a derivative work, you might still be acting against the authors' wishes
- By shipping binary-only kernel modules, you violate the "moral code of conduct" of the Free Software community
- But it is the work of this very community that enables you to build your product based on Free Software
- Such action might have long-term detrimental effects on the motivation of FOSS developers (dissatisfaction, demotivation, ...)

Collective Works

" ... it is not the intent .. to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works ... "

■ GPL controls "collective works"

" ... mere aggregation of another work ... with the program on a volume of a storage or distribution medium does not bring the other work und the scope of this license "

■ GPL allows "mere aggregation"

- like a general-purpose GNU/Linux distribution (SuSE, Red Hat, ...)

GPL And Embedded Systems

- Historical background:
 - The GPL was written for userspace programs running on existing operating systems
 - Covering a whole OS (and even userspace programs) is not an ideal match, but if you read it carefully it still makes sense

■ Toolchain:

"... the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable."

- Practical case:
 - ▶ You've modified gcc for a specific embedded platform
 - ▶ Therefore, this gcc is not "normally distributed with the operating system" and you have to distribute it together with the source code
 - ▶ gcc itself is covered under GPL, so you need to provide binaries and source code(!)

GPL And Embedded Systems

- The "Scripts"
 - (scripts to control compilation and installation, see earlier slide)
 - In case of embedded hardware, the "scripts" include:
 - ▶ Tools for generating the firmware binary from the source (even if they are technically no 'scripts')

- Embedded DRM
 - Intent of License is to enable user to run modified versions of the program. They need to be enabled to do so.
 - Result: Signing binaries and only accepting signed versions from the bootloader (without providing the signature key or a possibility to set a new key in the bootloader) is not acceptable!

Practical Source Code Offer

- Some Rules
 - The "complete corresponding source code" has to be made available
 - It has to be made available for each and every object-code version that was distributed
 - If you strip down the source code offer (e.g. remove proprietary source code), try to see whether the result actually compiles
 - If the product is mixed free / proprietary software, consider including the proprietary parts (as object code) in the "source code package", so the full firmware image can be rebuilt without having to tear apart an existing image and ripping out those proprietary programs from there.

The biggest myths about the GPL

The biggest myths about the GPL

- The GPL is not enforceable
- Software licensed under GPL has no copyright
- Unmodified distribution does not require source code availability
- The vendor can wait for a source code request (without offering it)

The most common mistakes

The most common mistakes

- not even once reading the GPL text and/or the FAQ from the FSF
- not including the GPL license text with the product
- not including a written offer with the product
- not considering that the GPL also applies to software updates
- only providing original source code (e.g. vanilla kernel.org kernel)
- not including the "scripts to control installation"
- only providing off-site hyperlinks to license and/or source code
- not responding to support requests for source code
- charging ridiculously high fees for physical shipping of source code

License Compatibility

- There's lots of Free Software available
- Different Software uses different Licenses:
 - ▶ Linux: GPL
 - ▶ glibc: LGPL
 - ▶ apache: Apache Software License
 - ▶ Perl: Artistic
 - ▶ ucd-snmp: BSD
- If you combine (i.e. link) differently-licensed software,
 - ▶ check license compatibility
 - ▶ in case of doubt, ask legal person and/or contact software authors
 - ▶ authors might give you an exception or consider making licenses compatible

Dual Licensing

- The copyright holder (often the original author) can provide alternative licensing
- Some projects do this as a business model (reiserfs, MySQL)
- In some projects it's impossible due to the extremely distributed copyright (e.g. Linux kernel)
- However, in smaller projects it never hurts to ask whether there would be interest in providing an alternative (non-copyleft) licensing

GPL Violations

- **When do I violate the license**
 - when one or more of the obligations are not fulfilled
- **What risk do I take if I violate the license?**
 - the GPL automatically revokes any usage right
 - any copyright holder can obtain a preliminary injunction banning distribution of the infringing product

Past GPL enforcement

Past GPL enforcement

- GPL violations are nothing new, as GPL licensed software is nothing new.
- However, the recent GNU/Linux hype made GPL licensed software used more often
- The FSF enforces GPL violations of code on which they hold the copyright
 - ▶ silently, without public notice
 - ▶ in lengthy negotiations

The Linksys case

- During 2003 the "Linksys" case drew a lot of attention
 - Linksys was selling 802.11 WLAN Acces Ponts / Routers
 - Lots of GPL licensed software embedded in the device (included Linux, uClibc, busybox, iptables, ...)
 - FSF led alliance took the usual "quiet" approach
 - Linksys bought itself a lot of time
 - Some source code was released two months later
 - About four months later, full GPL compliance was achieved

The Linksys case

- Some developers didn't agree with this approach
 - not enough publicity
 - violators don't loose anything by first not complying and wait for the FSF
 - four months delay is too much for low product lifecycles in WLAN world
- The netfilter/iptables project started to do their own enforcement in more cases that were coming up

Enforcement case timeline

- **In chronological order**
 - some user sends us a note he found our code somewhere
 - reverse engineering of firmware images
 - test purchase to verify device ships gpl-incompliant
 - sending the infringing organization a warning notice
 - wait for them to sign a statement to cease and desist
 - **if no statement is signed**
 - ▶ contract technical expert to do a study
 - ▶ apply for a preliminary injunction
 - **if statement was signed**
 - ▶ try to work out the details
 - ▶ grace period for boxes in stock possible
 - ▶ try to indicate that a donation would be good PR

Success so far

- Success so far
- amicable agreements in a number (100+) of cases
 - ▶ some of which made significant donations to charitable organizations of the free software community
- preliminary injunction against Sitecom, Sitecom also lost appeals case
- court decision of munich district court in Sitecom appealscase
- more preliminary injunctions (Siemens, Skype, Fortinet, D-Link)
- more settled cases (most of which not published)
- negotiating in more cases
- public awareness

Cases so far (1/4)

- Allnet GmbH
- Siemens AG
- Fujitsu-Siemens Computers GmbH
- Axis A.B.
- Securepoint GmbH
- U.S.Robotics Germany GmbH
- Netgear GmbH
- Belkin Components GmbH
- ASUS GmbH
- Gateprotect GmbH
- Sitecom GmbH / B.V.
- TomTom B.V.
- Gigabyte Technologies GmbH

Cases so far (2/4)

- Sun Deutschland GmbH
- Open-E GmbH
- Siemens AG (second case)
- Deutsche Telekom AG
- Hitachi Inc.
- Tecom Inc.
- ARP Datacon GmbH
- Conceptoronic B.V.
- D-Link GmbH
- Adaptec Deutschland GmbH
- Belkin Components GmbH (second case)

Cases so far (3/4)

- Siemens AG (third case)
- TARGA GmbH
- Medion AG
- naviflash GmbH
- Maxtor Inc.
- Cisco Deutschland GmbH
- Fortinet
- naviflash GmbH
- iRiver Europe GmbH
- Cisco Deutschland GmbH (second case)
- Acer Deutschland GmbH
- SMC Networks GmbH

Cases so far (4/4)

- Samsung, Thecus, Western Digital, Avocent, Canyon, Digital Data, Cowon, DGStation, Smartlink, Sphairon, DeviceVM, Kenwood, Telegent, Barracuda Networks, Ovislink, Assman, Gamepark Holdings, Hermstedt, Longshine, Motorola, Skype, Agfeo,...
- totally > 100 cases

What we've learned

- Copyleft-style licenses can be enforced!
- A lot of companies don't take Free Software licenses seriously
 - Even corporations with large legal departments who should know
 - Reasons unclear, probably the financial risk of infringement was considered less than the expected gains
- The FUD spread about "GPL not holding up in court" has disappeared

What can you do

- What companies can do
 - Education and training for engineers + managers
 - Think before copying/using/combining software
 - Use proper R&D process and revision control
 - Make sure you always have the complete source tree for every software release
 - Have the source code package ready when you ship a software release
 - Participate in the FSFE FTF Legal Network

- If you embrace the community and use an open source development process, your source code is released publicly before you even ship the product to the customer

Future GPL Enforcement

- GPL Enforcement
 - remains an important issue for Free Software
 - starts to happen within court in more countries
 - has to be made public in order to raise awareness
- What about Copylefted Content (Creative Commons)
 - probably just a matter of time until CC-licensed works of art are infringed

Problems of GPL Enforcement

- **Problems**
- **distributed copyright**
 - ▶ is an important safeguard
 - ▶ can make enforcement difficult, since copyright traditionally doesn't know cases with thousands of copyright holders
 - ▶ distribution of damages extremely difficult
- **the legal issue of having to do reverse engineering in order to prove copyright infringement(!)**
- **only the copyright holder (in most cases the author) can do it**
- **users discovering GPL'd software need to communicate those issues to all entitled parties (copyright holders)**
- **infringers obfuscating and/or encrypting fres software as disguis**

gpl-violations.org

- The <http://www.gpl-violations.org/> project was started ~ 5 years ago
 - as a platform where users can report alleged violations
 - to verify those violations and inform all copyright holders
 - to inform the public about ongoing enforcement efforts
-
- At the moment, project is still very small
 - it's Harald and Armijn, plus two lawyers
 - something like 270 reported (alleged) violations backlog
 - we only cherry-pick those that we consider important

Make later enforcement easy

- Practical rules for proof by reverse engineering
 - Don't fix typos in error messages and symbol names
 - Leave obscure error messages like 'Rusty needs more caffeine'
 - Make binary contain string of copyright message, not only source
- Practical rules for potential damages claims
 - Use revision control system
 - Document source of each copyrightable contribution
 - ▶ Name+Email address in CVS commit message
 - Consider something like FSFE FLA (Fiduciary License Agreement)
 - Make sure that employers are fine with contributions of their employees
- If you find out about violation
 - Don't make it public (has to be new/urgent for injunctive relief)

Finding GPL violations

Finding GPL violations in embedded systems

- Software based reverse engineering techniques
 - Analyze firmware update files
 - Exploit security bugs in firmware
 - Use existing "backdoors"
- Hardware based reverse engineering techniques
 - es
 - Take actual board apart, note major components
 - Find + use JTAG testpads
 - Find + use serial console

Finding GPL violations

Software based reverse engineering

- Analyzing firmware update files
 - Typically very easy, you don't even need the device to start with
 - Firmware updates available on the internet
 - Start with hex-editor, 'strings' and some pattern-matching
 - Find magic numbers of kernel image, cramfs/jffs2 rootfs image
 - extract kernel and/or rootfs by very easy means (dd, gzip/bzip2, ...)

Finding GPL violations

Software based reverse engineering

- Exploit security bugs in firmware
 - Typical CE embedded system vendor has
 - ▶ zero clue about Linux
 - ▶ zero clue about security
 - ▶ ages old software versions
 - Therefore, very easy to exploit years-old security problem
- ms
- ▶ buffer overflows, stack smashing
 - ▶ HTTP UI scripting problems (quoting problems)
- Goal
 - ▶ to get a [root] shell on the affected device

Finding GPL violations

Software based reverse engineering

- Use existing "backdoors"
- Sometimes, devices have existing backdoors from R&D
- e.g. special undocumented command in telnet or SSH UI for getting a shell
- very device-specific, no generic rule how to find it

Hardware based reverse engineering

Hardware based reverse engineering

- almost always successful
- amount of work differs from device to device
- see the next slides for an example
- BTW: the device in question is NOT a GPL violation

How to find GPL violations

JTAG pins

Find + use JTAG testpads



How to find GPL violations

JTAG pins

Find + use JTAG testpads



How to find GPL violations

JTAG pins

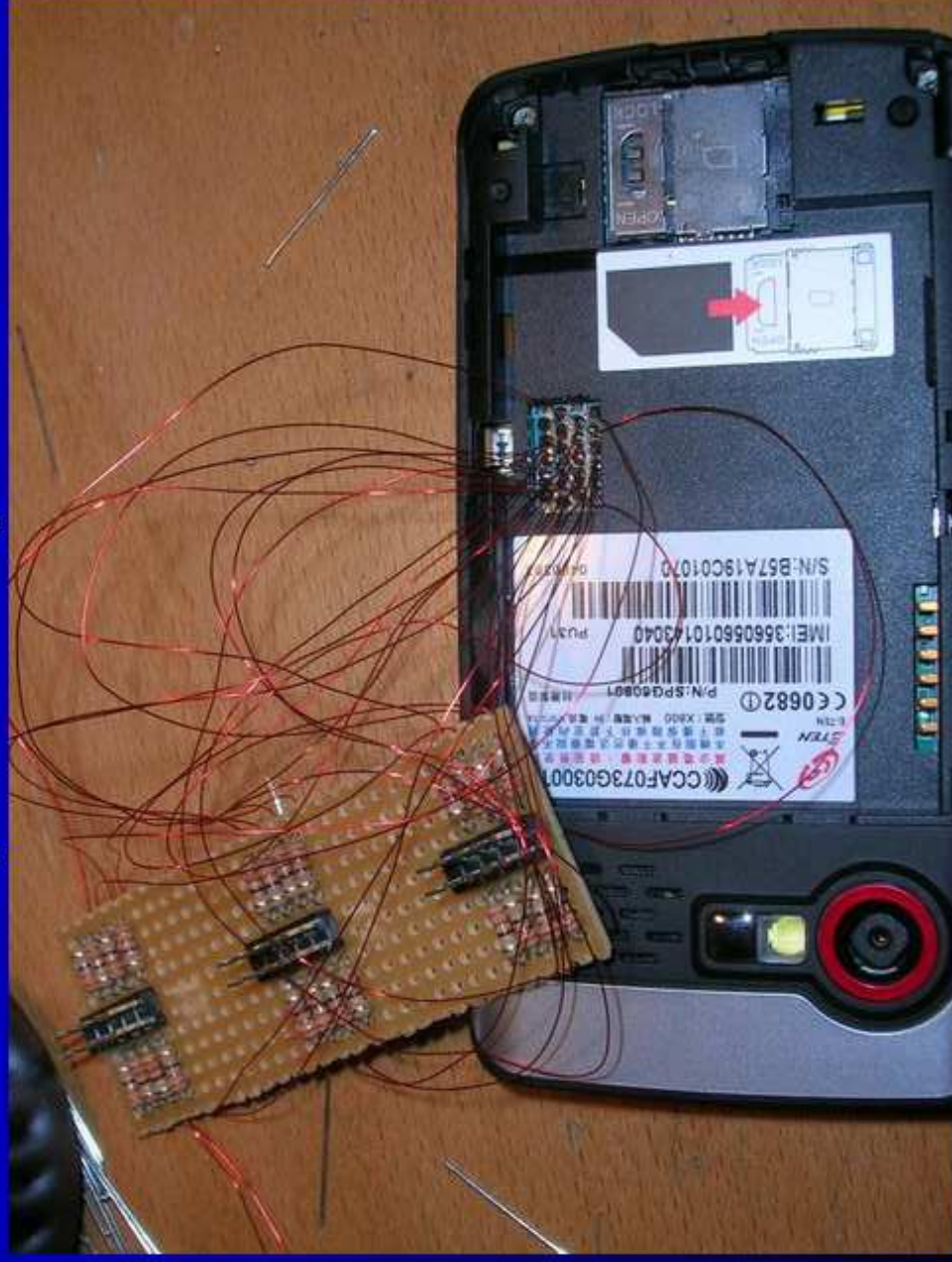
Find + use JTAG testpads



How to find GPL violations

JTAG pins

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How to find GPL violations

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How to find GPL violations

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Find + use JTAG testpads



JTAG pins

Found JTAG pins

- Chain 1
 - Samsung S3C2442 Application Processor
 - Has standard ARM JTAG ICE
- Chain 2
 - CPLD programming interface
- Remaining work
 - find the nTRST and nSRST pins

The End

- Further reading:
- The <http://gpl-violations.org/> project
- The Free Software Foundation <http://www.fsf.org/>, <http://www.fsf-europe.org/>
- The GNU Project <http://www.gnu.org/>
- The netfilter homepage <http://www.netfilter.org/>