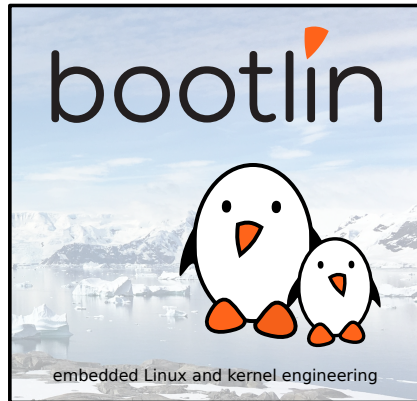




Being a Linux kernel maintainer

Miquèl Raynal
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Corrections, suggestions, contributions and translations are welcome!





- ▶ Embedded Linux engineer at Bootlin
 - Embedded Linux **expertise**
 - **Development**, consulting and training
 - Strong open-source focus
- ▶ Open-source contributor
 - Maintainer of the NAND subsystem
 - Co-maintainer of the MTD subsystem
 - Co-maintainer of the IEEE 802.15.4 subsystem
 - Contributor to Linux, U-Boot, Zephyr, Buildroot
- ▶ Living in **Toulouse**, France

<https://bootlin.com/company/staff/miquel-raynal/>



Why this talk?

- ▶ Going beyond famous people rants
 - Insights from inside
 - Will I loose my position/job if I make a mistake? (normally, no)
- ▶ Encourage people to help with reviews and maintainance (in general)?



Linux kernel 101

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Where to find Linux kernels in the nature?

Literally everywhere

- ▶ satellites, ovens, washing machine, bikes, phones, servers, routers, rovers, cars, cameras,...

SpaceX Falcon 9 and
Falcon Heavy rockets



Image credits: Wikipedia

Mars Ingenuity Helicopter



Image credits:

<https://commons.wikimedia.org/wiki/File:Chromecast-2015.jpg>

Image credits: Evan Amos
(<https://bit.ly/2JzDIkv>)

- ▶ Does it feature media capabilities? networking capabilities? multi-tasking?
(Then, likely yes)



Who contributes?

- ▶ Started in 1991 as a student project
- ▶ Mostly hobbyists during the first decade
- ▶ "Most" contributions today are paid/sponsored
 - Main global tech companies
 - Hardware manufacturers
 - Foundations and associations
 - Smaller independent actors, like Bootlin o/
- ▶ No major company should take over governance
- ▶ Variety of maintainers is key
- ▶ The Linux Foundation pays "fellows"

Total patch sets of this kernel release: 1213048
906 companies contribute their works to this kernel release.
Averagely, every company committed 1338 patch sets.

❑ No.1	Unknown	222317(18.33%)
❑ No.2	Intel	126152(10.40%)
❑ No.3	Red Hat	94782(7.81%)
❑ No.4	Hobbyists	78575(6.48%)
❑ No.5	Novell	47480(3.91%)
❑ No.6	Linaro	44032(3.63%)
❑ No.7	IBM	40056(3.30%)
❑ No.8	AMD	37633(3.10%)
❑ No.9	Google	35062(2.89%)
❑ No.10	Huawei	25618(2.11%)
❑ No.11	Renesas Electronics	23408(1.93%)
❑ No.12	Oracle	22320(1.84%)
❑ No.13	Samsung	18446(1.52%)
❑ No.14	Texas Instruments	18268(1.51%)
❑ No.15	NVIDIA	14514(1.20%)
❑ No.16	ARM	12032(0.99%)
❑ No.17	Pengutronix	11731(0.97%)
❑ No.18	NXP	11633(0.96%)
❑ No.19	Mellanox Technologies	11521(0.95%)
❑ No.20	Academics	9531(0.79%)
❑ No.21	Broadcom	9399(0.77%)
❑ No.22	Linutronix	9383(0.77%)
❑ No.23	Canonical	8762(0.72%)
❑ No.24	QUALCOMM	8481(0.70%)
❑ No.25	Consultants	8194(0.68%)
❑ No.26	Bootlin	7751(0.64%)
❑ No.27	Linux Foundation	7586(0.63%)
❑ No.28	Code Aurora Forum	7079(0.58%)
❑ No.29	Analog Devices	6637(0.55%)
❑ No.30	VISION Engraving and Routing Systems	6045(0.50%)
❑ No.31	MediaTek	5407(0.45%)
❑ No.32	Marvell	5172(0.43%)
❑ No.33	Fujitsu	5163(0.43%)
❑ No.34	Collabora	4931(0.41%)
❑ No.35	Freescale	4698(0.39%)
❑ No.36	Facebook	4227(0.35%)
❑ No.37	Wolfson Microelectronics	4180(0.34%)
❑ No.38	Nokia	4151(0.34%)
❑ No.39	Microchip Technology Inc.	4141(0.34%)
❑ No.40	Cisco	4124(0.34%)
—		

Source: http://www.remword.com/kps_result/



The role of maintainer

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What people expect from you? From: Linus Torvalds

- ▶ One Git pull-request the first week of the merge window with features
 - An e-mail with Subject: `[GIT PULL] <subsystem> changes for...`
 - A signed tag `<subsystem>/for-<version>`
 - A summary of the main changes
- ▶ As less as possible of fixes pull-requests the rest of the time



What people expect from you? From: contributors

- ▶ Fast answers to their patches (ideally, acks)
- ▶ Collecting the changes in some public branch (eg. on `git.kernel.org`)
- ▶ Problem 1: contributions never stop
 - Contributors live all over the globe in different TZ
 - You cannot keep a mailbox tidy
 - Constantly handle context switching (I suck at it)
- ▶ Problem 2: we must give feedback
 - Sometimes it's hard to have an opinion, but people expect you to



What people expect from you? From: The rest of the world

- ▶ Carefully review and test what gets in
 - Spoiler: this is impossible
- ▶ Avoid bugs and security bugs
 - Spoiler again: this is also impossible
- ▶ But we get help!
 - A single maintainer cannot be blamed if the community fails
 - People are invited to review, test, give feedback
 - Official reviewers (in the MAINTAINERS file)



The tools

- ▶ To track, review, apply patches: mailing-lists, Patchwork, Git, B4
- ▶ Robots report warnings/failures (kernel test robot, 0-day, syzkaller,...)
 - Parse all mailing-lists and our maintainer's repositories
 - Compile with extra warnings, random configurations
 - perform random injection from userspace
- ▶ People take over these reports and send fixes
- ▶ linux-next



Security concerns

- ▶ Must sign tags for upstream
- ▶ Encouraged to use physical medium for 2FA authentication
- ▶ GPG key signed by at least 3 existing maintainers to get a kernel.org account
- ▶ Sensible software wrt. security
 - cf. the xz 2024 breach which involved technical skills and social engineering



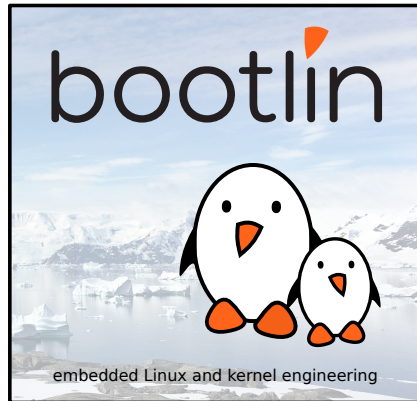
Source: <https://www.nitrokey.com/products/nitrokeys>



Being a Linux kernel maintainer

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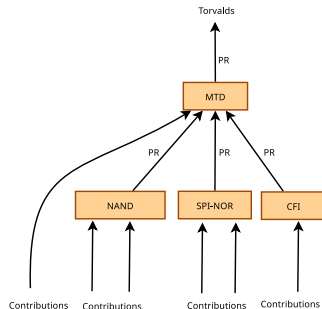
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My journey to become a maintainer

- ▶ Former employer experiences NAND corruptions
- ▶ I contact the worldwide NAND expert and kernel maintainer (who happen to live in Colomiers), Boris
- ▶ Rework of the Freescale NAND controller driver
- ▶ Rework/upstream of the Marvell NAND controller driver
- ▶ With Boris we engineer and contribute a new API
 - First MAINTAINERS entry: driver maintainer
- ▶ Collaboration works well, I help him with reviews
- ▶ At some point I step-up as NAND Co-maintainer
 - I make Pull-Requests to my upstream MTD maintainer
- ▶ Boris quits the maintainance
- ▶ I step-up as MTD co-maintainer
 - I now make Pull-Requests to myself and then to Linus

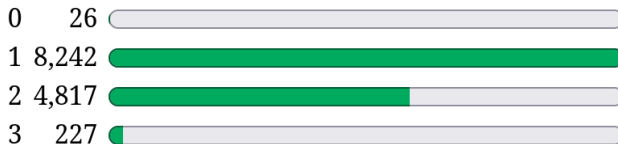




Usual patch flow between trees

Trees transited by each commit

Trees Commits



Source: <https://lwn.net/Articles/981559/>



Louis experience in DRM

- ▶ He tries to make significant improvements
- ▶ He does not get enough reviews
- ▶ He gains knowledge but he remains a newcomer
- ▶ He pings, pings, pings
- ▶ The maintainer steps-down and invites him to step-up
 - His problems are unsolved, but maintainance is moving on



Maxime situation in net

- ▶ He contributes to a subsystem for years
- ▶ He makes significant and substantial contributions
- ▶ He knows everyone in place
- ▶ Maintainers complain there is not enough reviews from peers
- ▶ He starts reviewing patches on the mailing list
- ▶ He needs to prove his reviewing capabilities and could become an official reviewer



What is the feeling?

- ▶ I can say yes or no to MTD kernel changes
 - Do not abuse this
- ▶ I must "teach" new contributors with the same respect I initially received
- ▶ Repeating myself, a lot, is part of the job
- ▶ Easy to just focus on nitpicks
- ▶ Understanding the API and spotting abuses is much harder



Careful moments

► Handling failures rapidly

```
From: Linus Torvalds <torvalds@linux-foundation.org>  
To: Miquel Raynal <miquel.raynal@bootlin.com>  
Cc: Linux Kernel Mailing List <linux-kernel@vger.kernel.org>...
```

```
On Sun, Aug 15, 2021 at 4:47 PM Guenter Roeck <linux@roeck-us.net> wrote:
```

```
>
```

```
> Failed tests:
```

```
> arm:z2:pxa_defconfig:nodebug:nocd:nofs:nonvme:noscsi:notests:novirt:nofdt:flash8,384k,2:rootfs
```

Miquel? Guenter has been reporting this failure since -rc1. It's rc6 now. The fix has been discussed, and is available since early July - so why isn't this getting sent to me, and why do we still have that known failure going on?

Linus

<https://lore.kernel.org/linux-kernel/CAHk-=wiWo3sRhEm69XprffzNpvcD0iK=X56G1H5A40f4LdwaKQ@mail.gmail.com/>



Careful moments

- ▶ Solving or hinting solutions when there is a breakage
 - Fortunately, I am often the guilty contributor

```
From: Linus Torvalds <torvalds@linux-foundation.org>  
To: Miquel Raynal <miquel.raynal@bootlin.com>  
Cc: linux-mtd@lists.infradead.org...
```

I'm about to release rc7, and I still don't have the build fix for MTD that has been pending in the mtd tree since Feb 19.

[...]

This is getting quite frustrating. These are basic errors that fail some very basic issues, have fixes, and the fixes for some inexplicable reason aren't actually propagated up.

Why?

Linus

<https://lore.kernel.org/linux-mtd/CAHk-=wjweAonv54h4rxFPVReKS5qZkVCGfB80GUDPNKbo-uEqQ@mail.gmail.com/>



Careful moments

► And being in time for pull-requests

[...]

The rule is that things that get sent to me should be ready **before** the merge window opens, not be made ready during the merge window. With some slack for "life happens", of course, but I really get the feeling that a few people treat the end of the merge window as a deadline, missing the whole "it was supposed to be ready before the merge window".

You know who you are.

[...]

Linus

https://lore.kernel.org/all/CAHk-=wj6y5fipM2A5kEu009qm5PBzUY=-m9viEahhtxT09KR_g@mail.gmail.com/



The good, the bad and the ugly

Mauro, SHUT THE FUCK UP!

It's a bug alright - in the kernel. How long have you been a maintainer? And you **still** haven't learnt the first rule of kernel maintenance?

[...]
To make matters worse, commit f0ed2ce840b3 is clearly total and utter CRAP even if it didn't break applications. ENOENT is not a valid error return from an ioctl. Never has been, never will be. ENOENT means "No such file and directory", and is for path operations. ioctl's are done on files that have already been opened, there's no way in hell that ENOENT would ever be valid.

> So, on a first glance, this doesn't sound like a regression,
> but, instead, it looks the pulseaudio/tumbleweed has some serious
> bugs and/or regressions.

Shut up, Mauro. And I don't *_ever_* want to hear that kind of obvious garbage and idiocy from a kernel maintainer again. Seriously.

[...]

Fix your f*cking "compliance tool", because it is obviously broken. And fix your approach to kernel programming.

Linus

<https://lkml.org/lkml/2012/12/23/75>

- ▶ More fun on wikiquote
 - https://en.wikiquote.org/wiki/Linus_Torvalds#2024
- ▶ Most people never get in touch with him directly
- ▶ He since agreed to abide with the (new) kernel Code of Conduct.



Benevolent Dictator for Life (dictateur bienveillant à vie)



Fanboy picture taken in Vienna this Autumn



Socializing

- ▶ Most interactions are done through e-mail
 - Learn who you are talking to (MAINTAINERS, statistics, talks)
 - Negative answers should be on code, not against people
 - Feedback can be felt harsh when there is a strong technical focus
- ▶ International conferences (one/year in Europe, a couple in France)
 - Ideal places to meet your peers
- ▶ Many people from the kernel community around Toulouse, including kernel maintainers (DRM, thermal, MTD)

<https://www.kernel.org/doc/ksmap/>



Co-presenting with Boris in Austrian alpine lodge at ALPSS, the Alpine Linux Persistent Storage Summit



Most people are just nice

- ▶ Varied approaches and strong personalities
- ▶ Very neutral tone (Binding maintainers)
- ▶ Others are welcoming, nice, patients
 - Mark Brown (`spi`), Jonathan Cameron (`IIO`), Andrew Lunn (`net`)...



Conclusion

The maintainer role is critical, rewarding, and challenging.

- ▶ Do not only consume open-source
- ▶ Contribute
- ▶ Help with the maintainance (regardless of the project)
- ▶ Speak about it to your employer?

Questions?

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Bootlin is hiring !
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More on [bootlin.com](#) and at our booth

Slides under CC-BY-SA 3.0
<https://bootlin.com/pub/conferences/>