

# Linux Kernel Development

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[github.com/gregkh/kernel-development](https://github.com/gregkh/kernel-development)

69,970 files  
29,460,000 lines

4,645 developers  
450+ companies

Kernel releases 5.3.0 – 5.8.0  
September 2019 – August 2020

8,900 lines added

2,700 lines removed

2,100 lines modified

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2,100 lines modified

Every day

Kernel releases 5.3.0 – 5.8.0  
September 2019 – August 2020

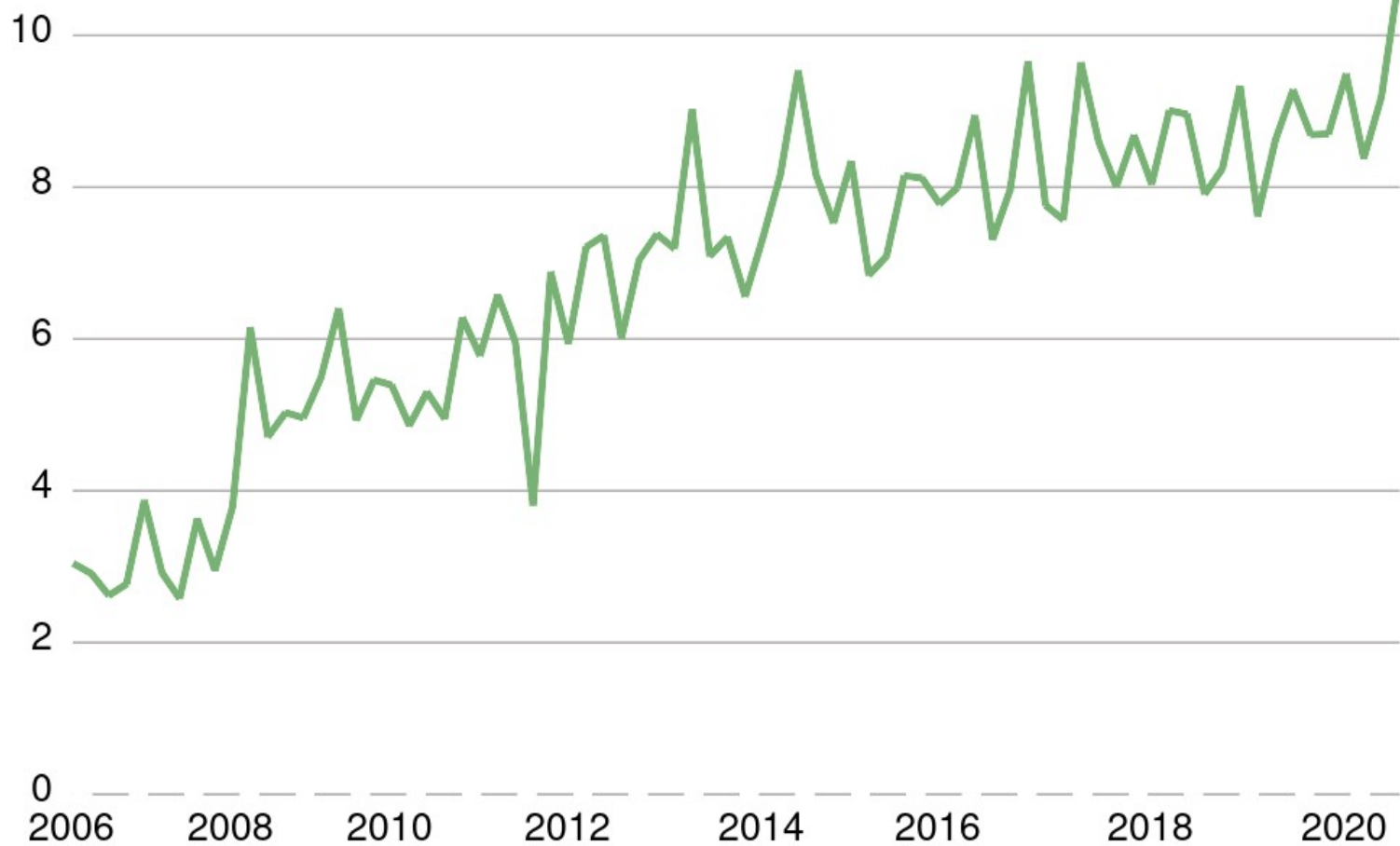
# 9.2 changes per hour

Kernel releases 5.3.0 – 5.8.0  
September 2019 – August 2020

10.8 changes per hour

5.8 release

# Patches merged per hour





# How we stay sane

Time based releases

Incremental changes

# Old release model

2.2 – January 1999

2.4 – January 2001

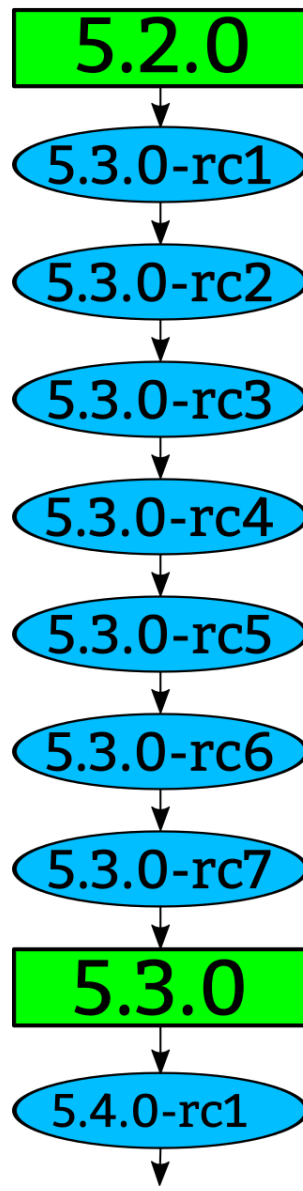
2.6 – December 2003



**New release every  
2½ months**

**Every release is stable**

Version numbers  
mean nothing





# “Longterm kernels”

One picked per year

Maintained for at least 2 years

4.4    4.9    4.14    4.19    5.4

[kernel.org/category/releases.html](https://kernel.org/category/releases.html)

4.4      9 changes / day

4.9      13 changes / day

4.14     18 changes / day

4.19     23 changes / day

5.4      28 changes / day

5.8      30 changes / day



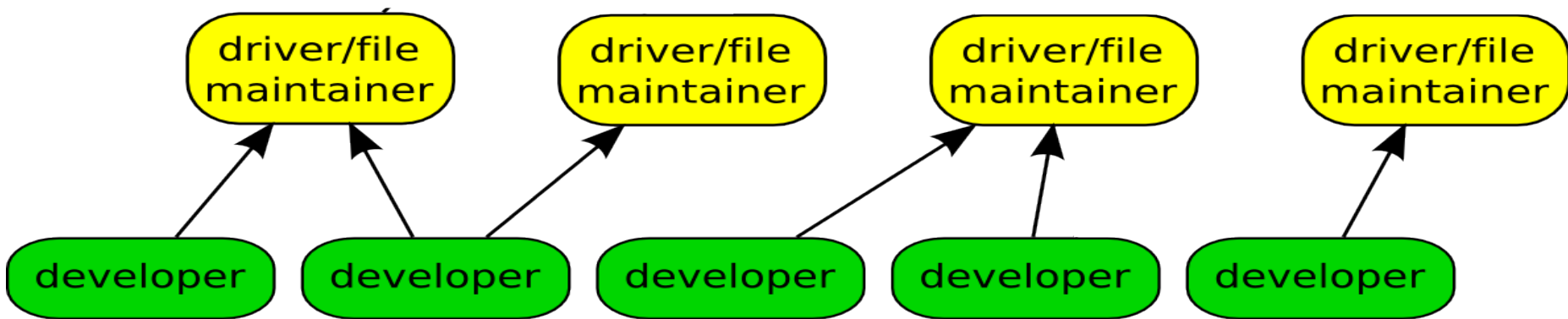
developer

developer

developer

developer

developer



```
commit ecf85e481a716cfe07406439fdc7ba9526bbfaeb
Author:      Robert Jarzmik <robert.jarzmik@free.fr>
AuthorDate:  Tue Apr 21 20:33:10 2009 -0700
Commit:      Greg Kroah-Hartman <gregkh@suse.de>
CommitDate:  Thu Apr 23 14:15:31 2009 -0700
```

USB: otg: Fix bug on remove path without transceiver

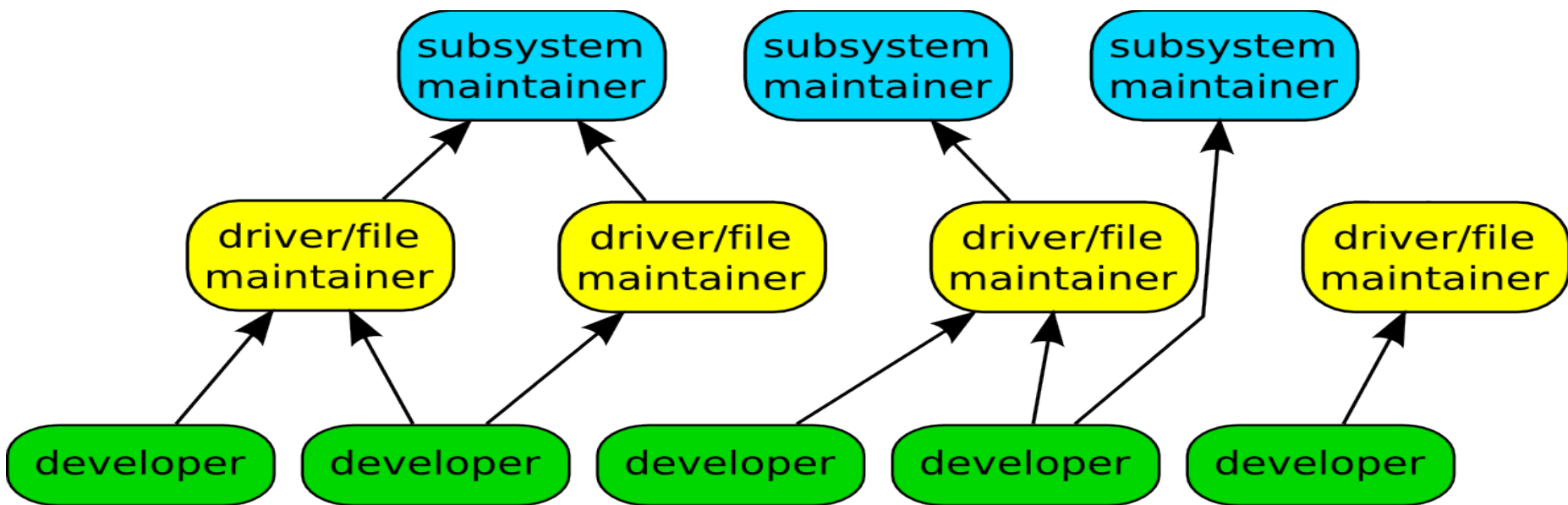
In the case where a gadget driver is removed while no transceiver was found at probe time, a bug in `otg_put_transceiver()` will trigger.

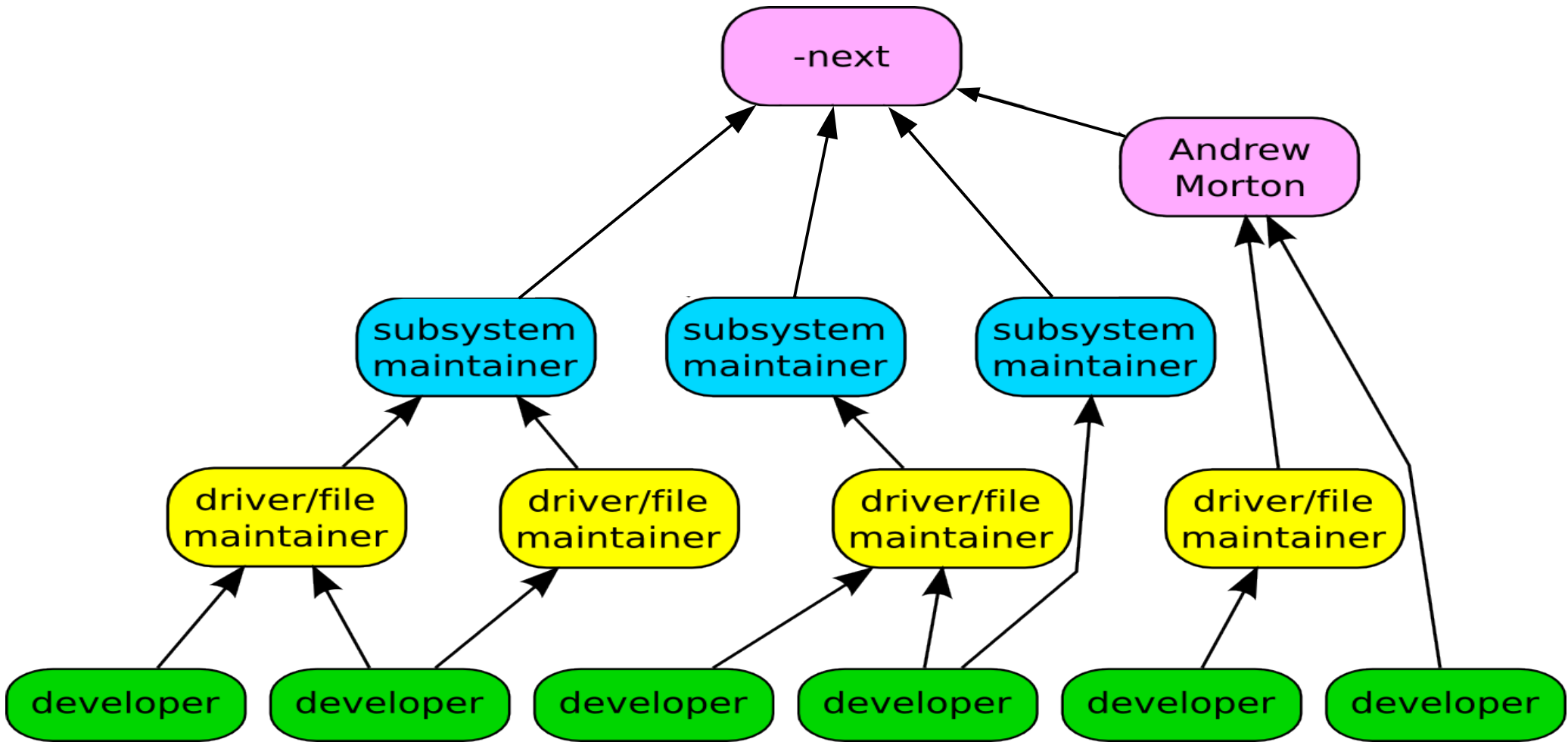
Signed-off-by: Robert Jarzmik <robert.jarzmik@free.fr>  
Acked-by: David Brownell <dbrownell@users.sourceforge.net>  
Signed-off-by: Greg Kroah-Hartman <gregkh@suse.de>

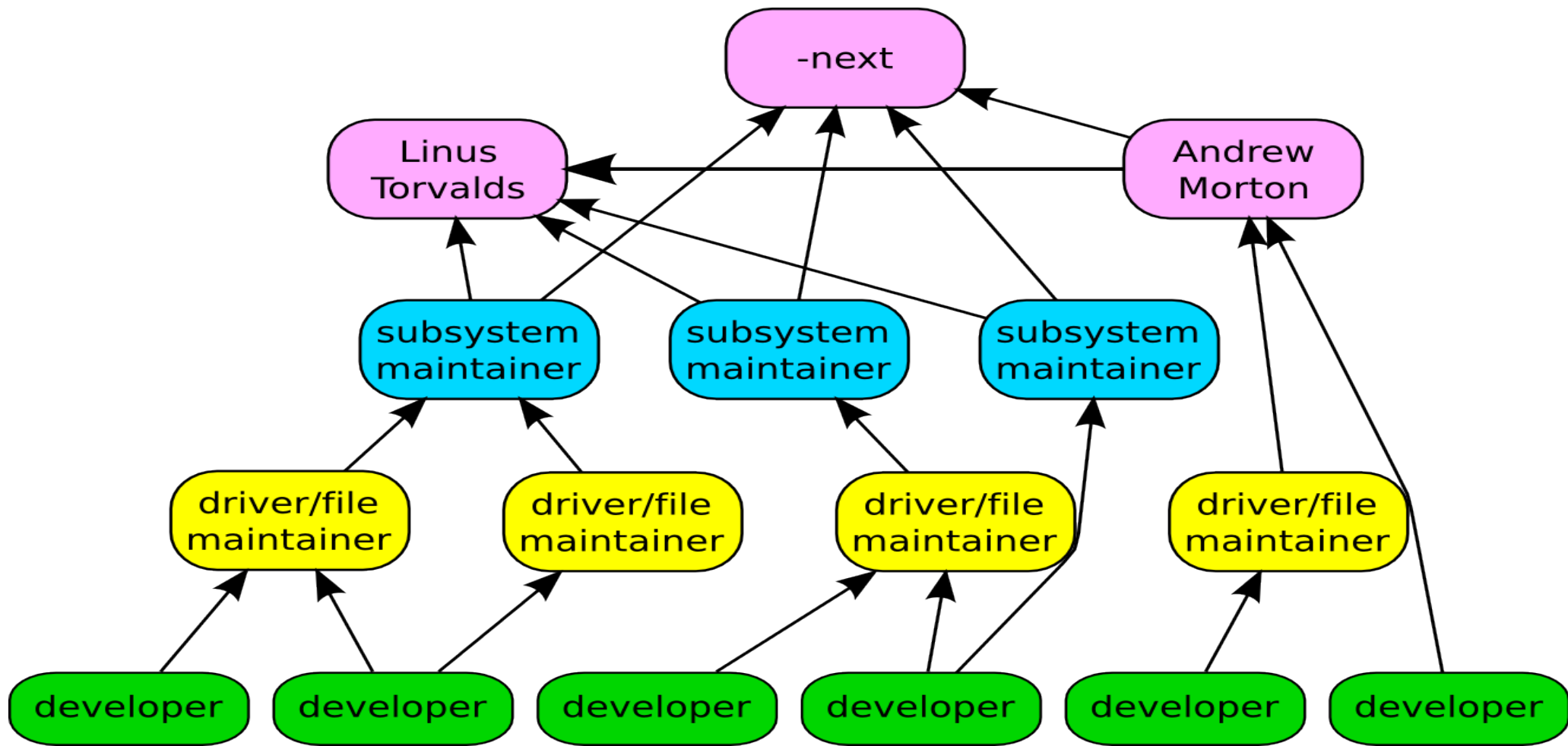
```
--- a/drivers/usb/otg/otg.c
+++ b/drivers/usb/otg/otg.c
@@ -43,7 +43,8 @@ EXPORT_SYMBOL(otg_get_transceiver);
 void otg_put_transceiver(struct otg_transceiver *x)
 {
-    put_device(x->dev);
+    if (x)
+        put_device(x->dev);
 }
```

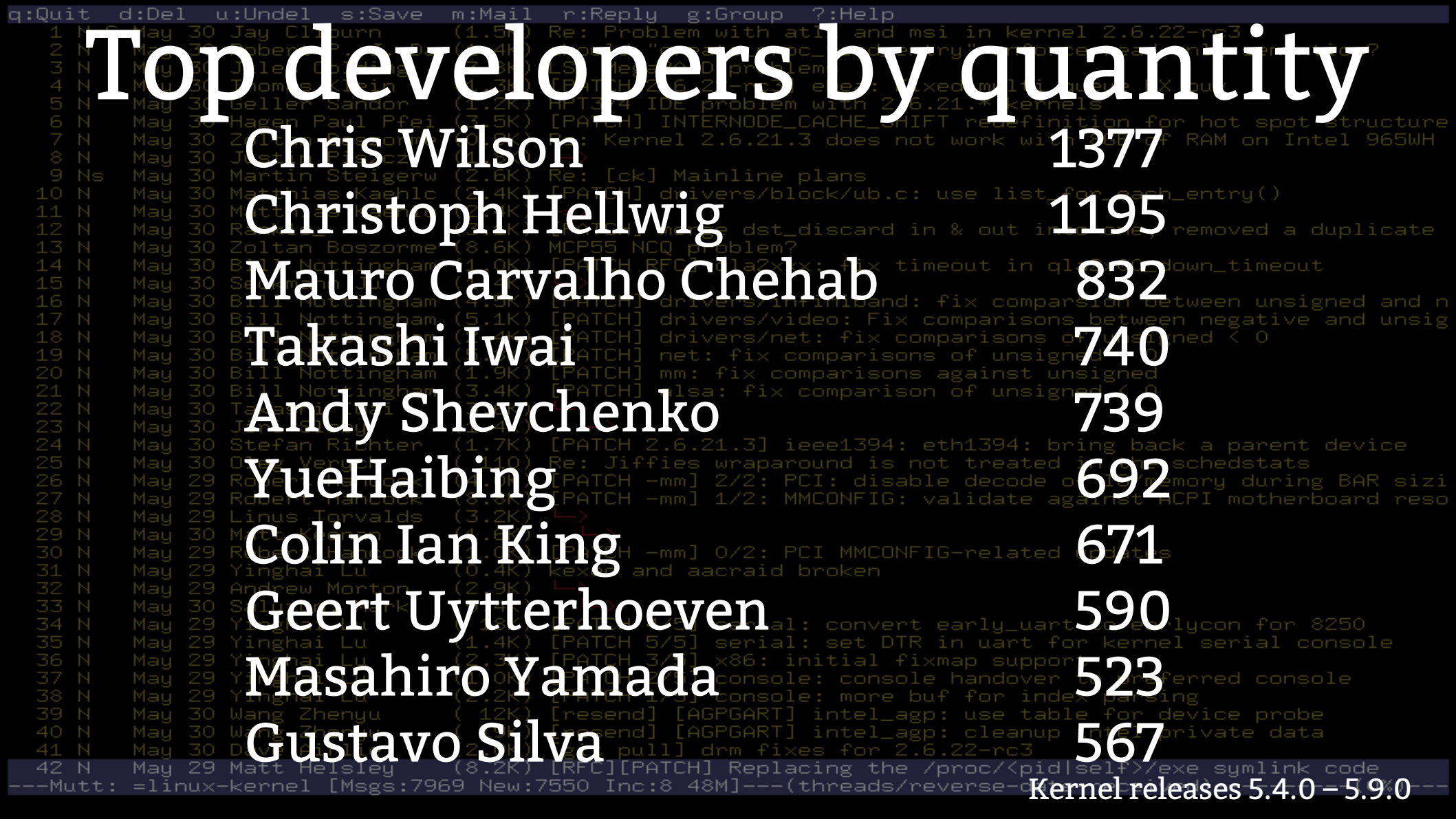
# Developer's Certificate of Origin

- (a) I created this change; or
- (b) Based this on a previous work with a compatible license; or
- (c) Provided to me by (a), (b), or (c) and not modified
- (d) This contribution is public.









# Top developers by quantity

Chris Wilson 1377

Christoph Hellwig 1195

Mauro Carvalho Chehab 832

Takashi Iwai 740

Andy Shevchenko 739

YueHaibing 692

Colin Ian King 671

Geert Uytterhoeven 590

Masahiro Yamada 523

Gustavo Silva 567



# Top Signed-off-by:

David S. Miller 8446

Greg Kroah-Hartman 5028

Alex Deucher 4323

Mark Brown 3565

Mauro Carvalho Chehab 2596

Linus Torvalds 2446

Andrew Morton 2218

Chris Wilson 1884

Jens Axboe 1787

Martin Petersen 1639

Kernel releases 5.4.0-5.9.0

# Who is funding this work?

1. “Amateurs”	13.5%
2. Intel	11.6%
3. Red Hat	6.6%
4. AMD	4.9%
5. Huawei	4.8%
6. Google	4.7%
7. Linaro	3.8%
8. SUSE	3.6%
9. IBM	3.1%
10. “Consultants”	2.7%

# Who is funding this work?

11. Mellanox	2.5%
12. NXP Semiconductors	2.2%
13. Renesas Electronics	2.2%
14. Facebook	2.0%
15. ARM	1.8%
16. Oracle	1.3%
17. Texas Instruments	1.2%
18. Code Aurora (Qualcomm)	1.2%
19. Linux Foundation	1.2%
20. Canonical	1.1%

# Kernel Security

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How the Kernel Security team works

# Linux security fixes

- Happen at least once a week
- Look like any other bugfix
- Rarely called out as a security fix
- Most fixes not known to be security related until much later
- Very few CVEs ever get assigned



# Linux security fixes $\neq$ CVEs

- Small fraction of kernel fixes get CVEs
- 2006-2018 had 1005 CVEs for Linux
  - 41% (414) had negative “fix date”
  - 12 never fixed
  - Average fix date, -100 days
  - Longest fix dates, -3897 and 2348
  - 88 fixed within 1 week
  - Standard deviation 405 days

# CVEs mean nothing for Linux

[More details](#) for the curious

“If you are not using a stable /  
longterm kernel, your machine  
is insecure”

– me

# “The kernel needs airbags” – Konstantin Ryabitsev

[`slides.com/mricon/giant-bags-of-mostly-water#`](https://slides.com/mricon/giant-bags-of-mostly-water#/)

**“We will always have bugs,  
we must stop their exploitation”  
– Kees Cook**

[outflux.net/slides/2015/ks/security.pdf](https://outflux.net/slides/2015/ks/security.pdf)

# Kernel Hardening

[kernsec.org/wiki/index.php/Kernel\\_Self\\_Protection\\_Project](http://kernsec.org/wiki/index.php/Kernel_Self_Protection_Project)



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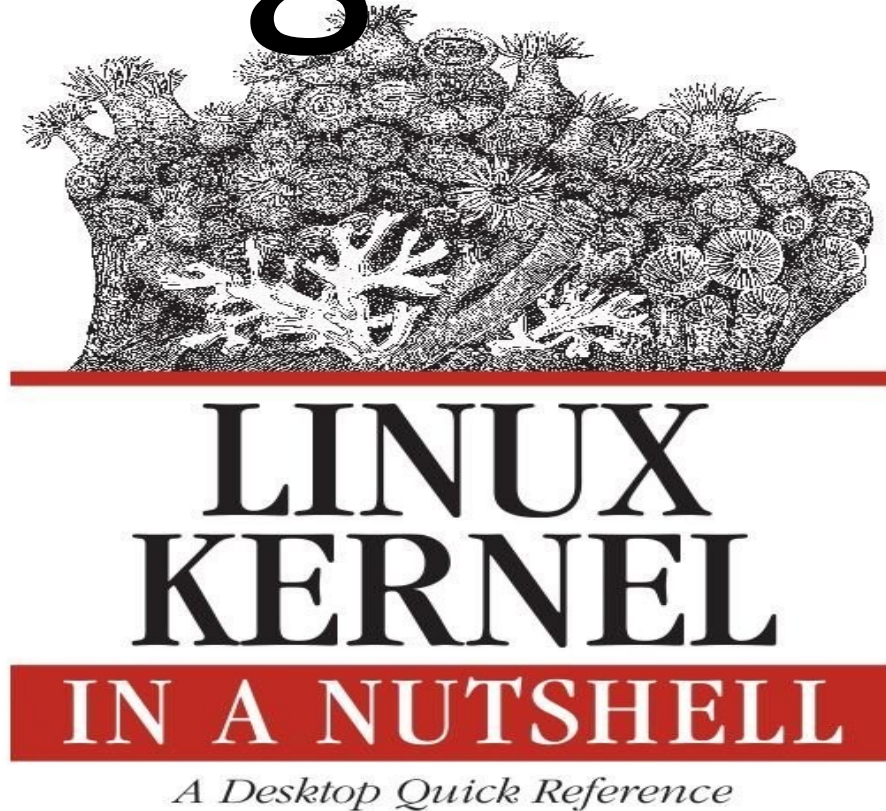




# Getting involved

Run the `kernel.org` release on your machine

# Getting involved



# Getting involved

[Documentation/process/howto.rst](#)

[Documentation/process/development-process.rst](#)

# Getting involved

[kernelnewbies.org](https://kernelnewbies.org)



# Getting involved

Google “write your first kernel patch”

# Getting involved

Linux Driver Project

`drivers/staging/*/TODO`

# Getting involved

Eudyptula Challenge  
(little penguin)

[eudyptula-challenge.org](https://eudyptula-challenge.org)