Linux Kernel Development

Greg Kroah-Hartman
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github.com/gregkh/kernel-development

71,240 files
30,340,000 lines

4,660 developers
450+ companies

8,900 lines added

2,500 lines removed

2,100 lines modified

8,900 lines added
2,500 lines removed
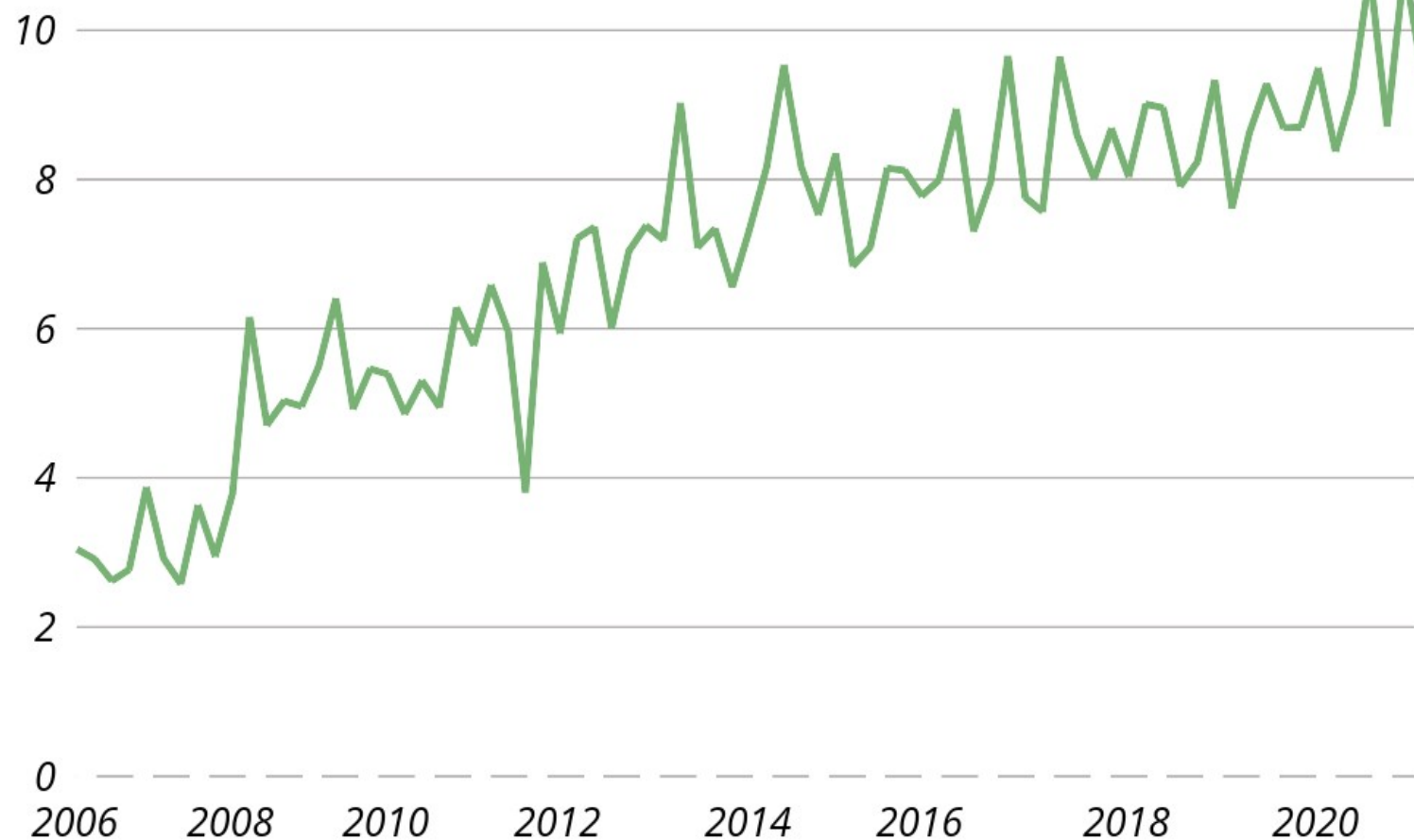2,100 lines modified
Every day

9.6 changes per hour

Kernel releases 5.3.0 – 5.8.0
September 2019 – August 2020

10.8 changes per hour

5.8 and 5.10 release

Patches merged per hour

How we stay sane

Time based releases
Incremental changes

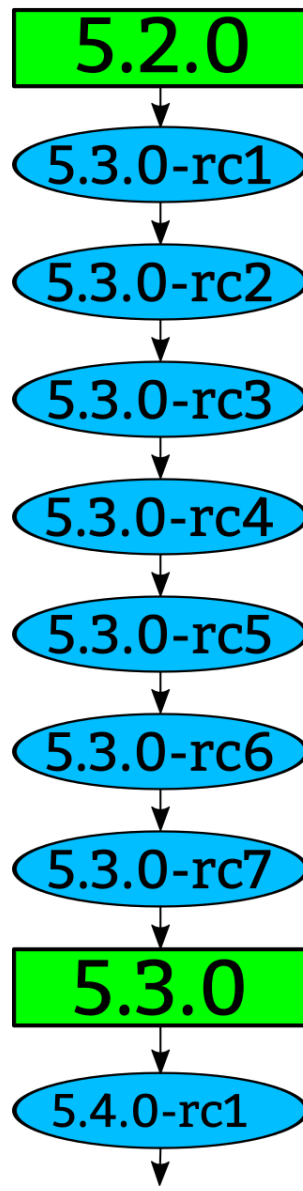# Old release model

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

```
5.2.0 ──────────┐
  │             ▼
  ▼           5.2.1
5.3.0-rc1       │
  │             ▼
  ▼           5.2.2
5.3.0-rc2       │
  │             ▼
  ▼           5.2.3
5.3.0-rc3       │
  │             ▼
  ▼           5.2.4
5.3.0-rc4       │
  │             ▼
  ▼           5.2.5
5.3.0-rc5       │
  │             ▼
  ▼           5.2.6
5.3.0-rc6
  │
  ▼
5.3.0-rc7
  │
  ▼
5.3.0 ──────────┐
  │             ▼
  ▼           5.3.1
5.4.0-rc1
  │
  ▼
```

"Longterm kernels"

One picked per year
Maintained for at least 2 years

4.4   4.9   4.14   4.19   5.4   5.10

"Longterm kernels"

What about 6 years?

kroah.com/log/blog/2021/02/03/helping-out-with-lts-kernel-releases/

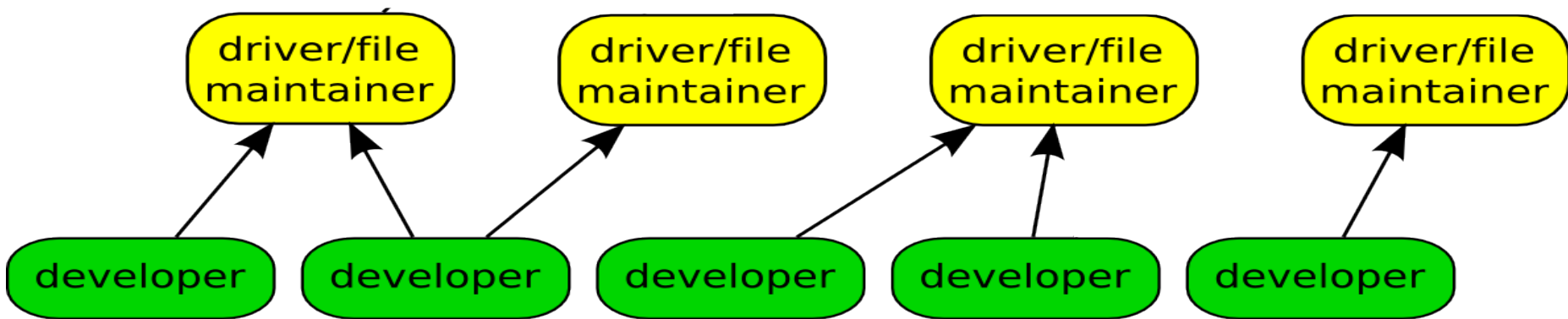|	
4.4	9 changes / day
4.9	12 changes / day
4.14	16 changes / day
4.19	20 changes / day
5.4	25 changes / day
5.10	33 changes / day

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);
 }
```
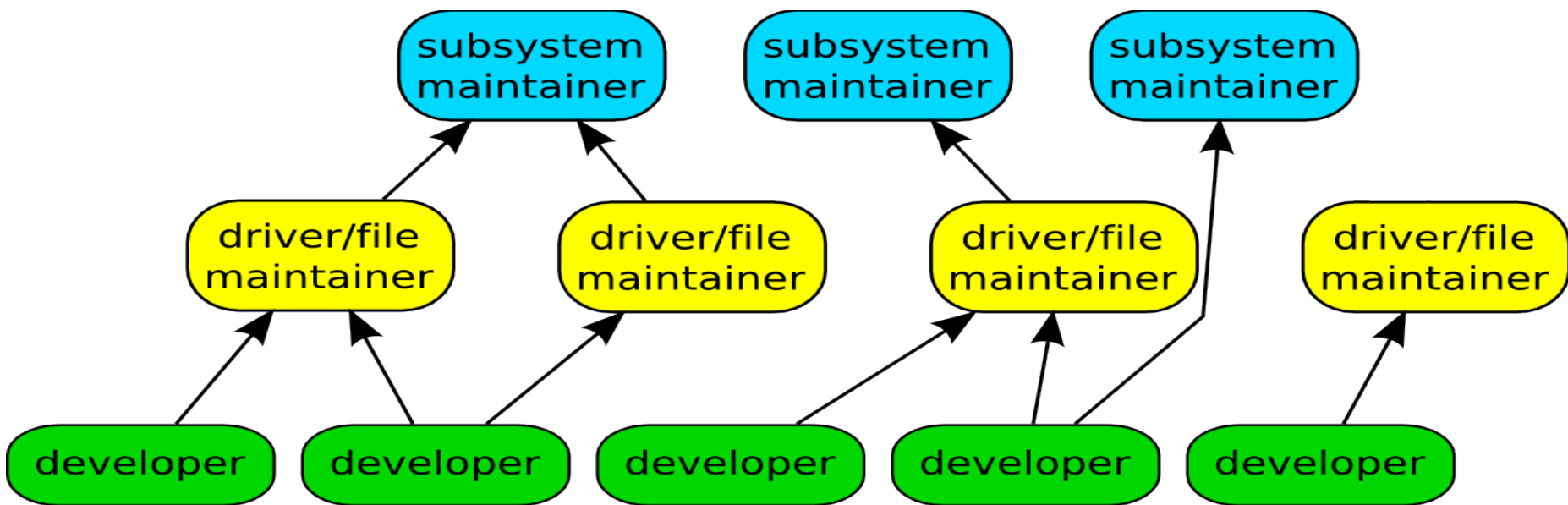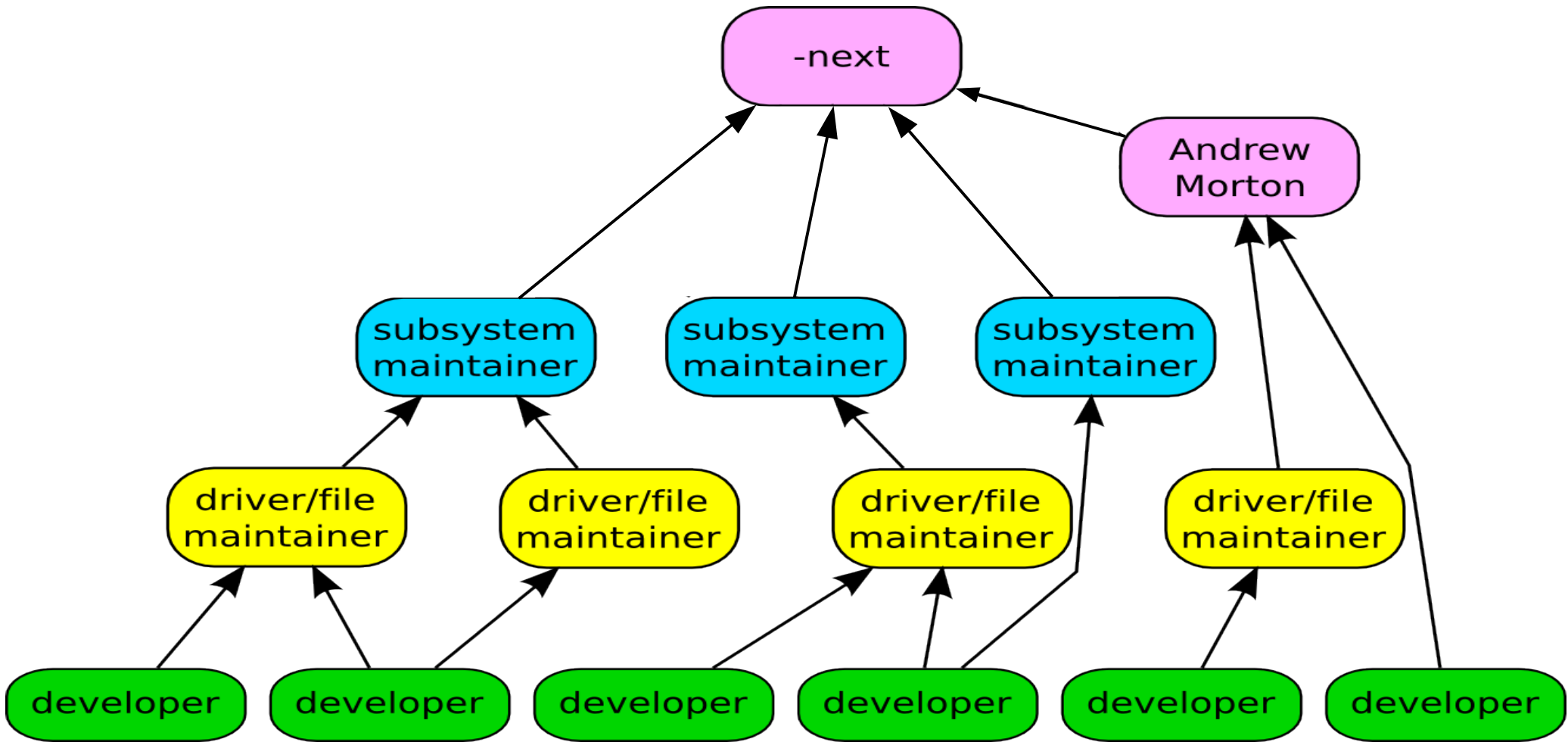
Developer's Certificate of Origin

(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

Developer	Count
Mauro Carvalho Chehab	1217
Christoph Hellwig	1206
Lee Jones	1134
Chris Wilson	1026
Krzysztof Kozlowski	897
Takashi Iwai	726
Andy Shevchenko	679
Gustavo Silva	660
Geert Uytterhoeven	567
Colin Ian King	546

Kernel releases 5.6.0 – 5.11.0
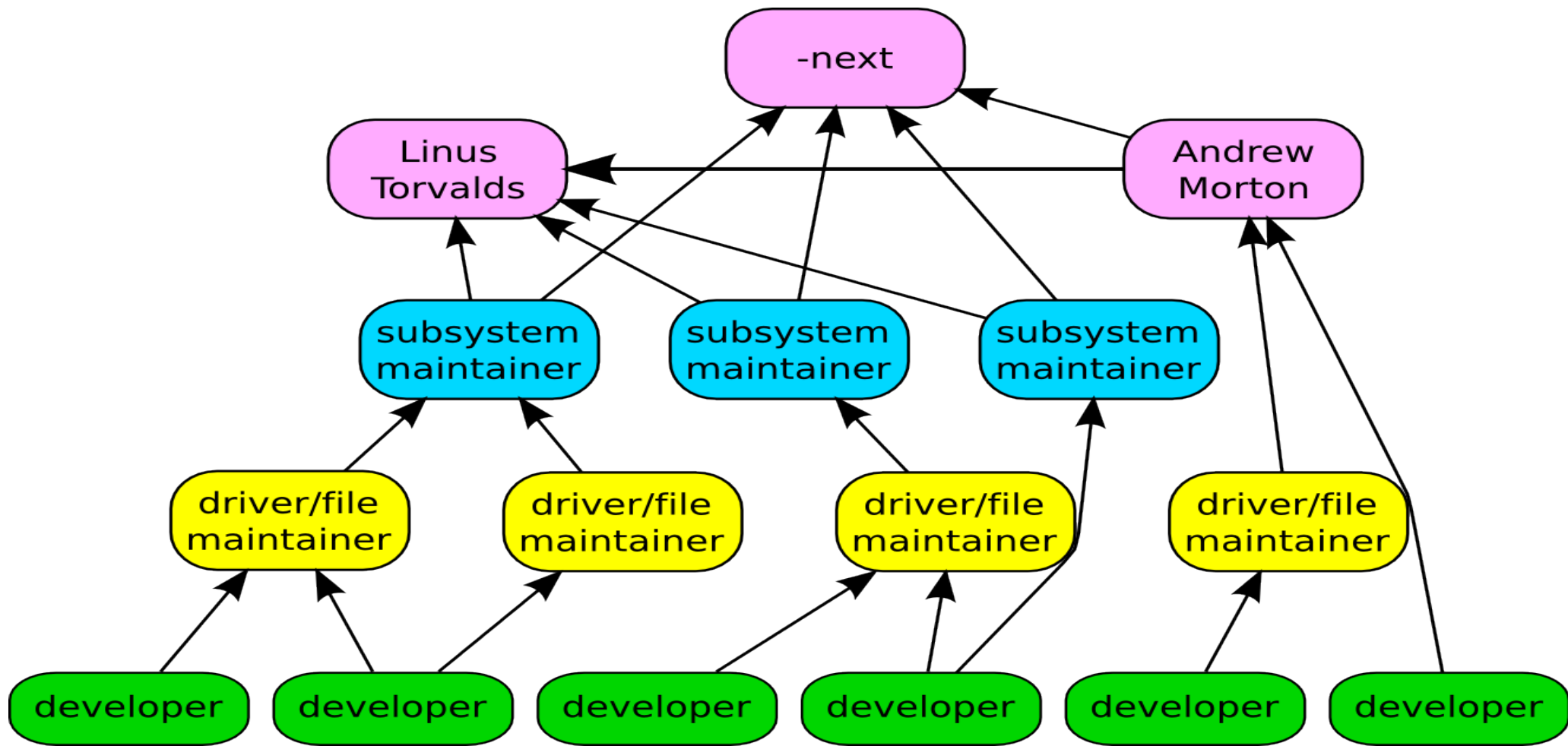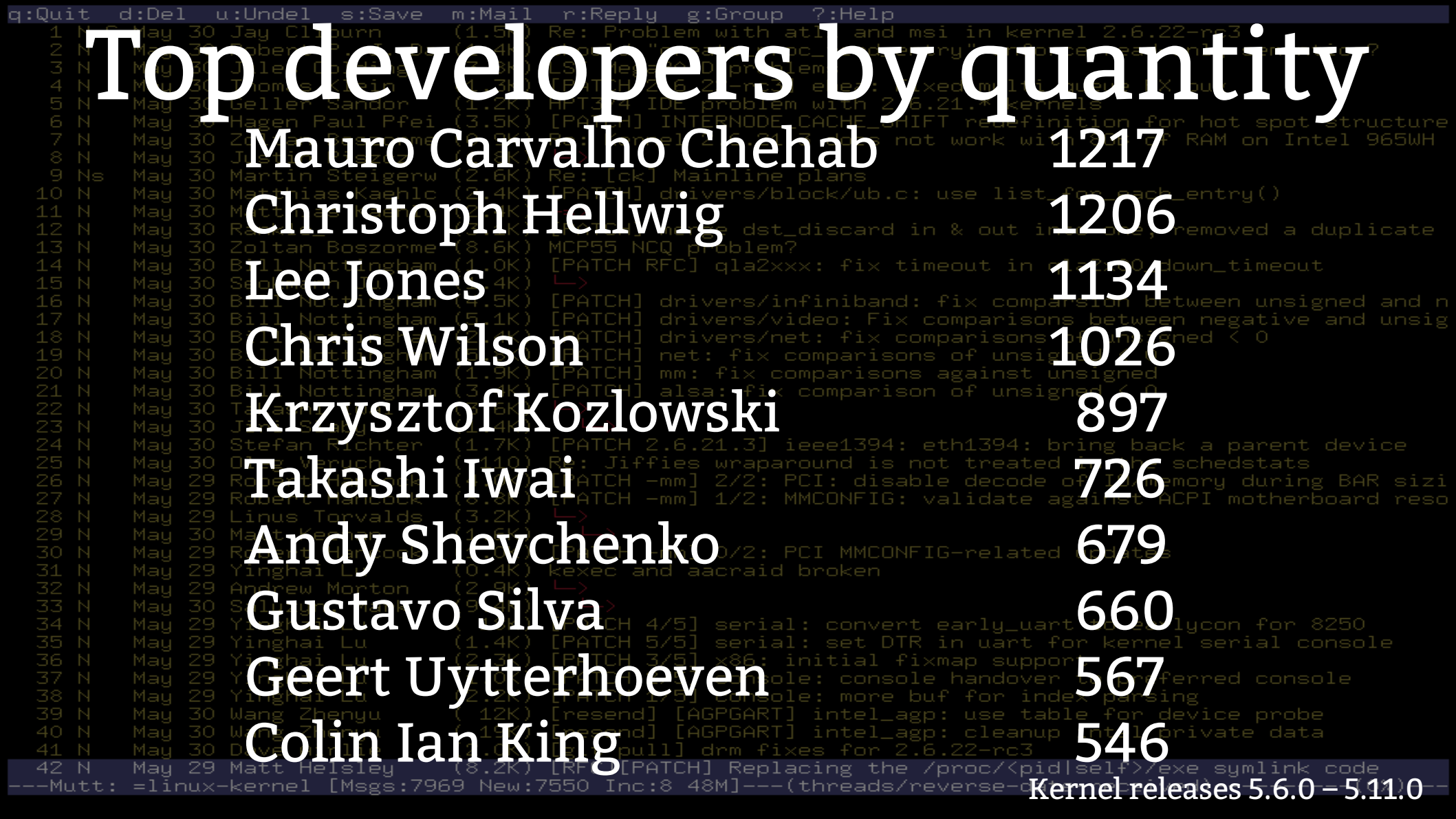
Top Signed-off-by:

David S. Miller	7160
Greg Kroah-Hartman	4606
Alex Deucher	4397
Mark Brown	3613
Mauro Carvalho Chehab	3252
Linus Torvalds	2773
Andrew Morton	2546
Jakub Kicinski	2126
Jens Axboe	1958
Michael Ellerman	1655

Kernel releases 5.6.0 − 5.11.0

Who is funding this work?

1. "Amateurs"   11.9%
2. Intel   10.7%
3. Red Hat   6.5%
4. Huawei   5.8%
5. AMD   4.7%
6. Google   4.5%
7. Linaro   4.5%
8. SUSE   3.6%
9. IBM   2.9%
10. Facebook   2.7%

Kernel releases 5.6.0 – 5.11.0

Who is funding this work?

11.	"Consultants"	2.6%
12.	NXP Semiconductors	2.2%
13.	Renesas Electronics	1.9%
14.	Mellanox	1.9%
15.	ARM	1.9%
16.	Oracle	1.7%
17.	Code Aurora (Qualcomm)	1.6%
18.	NVIDIA	1.5%
19.	Samsung	1.5%
20.	Texas Instruments	1.3%

Kernel releases 5.6.0 – 5.11.0

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 ≠ 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

LTS kernels fix problems

- Bugs are fixed before you realize it
- Google security team requests for pixel phones in 2018:
  - 92% (201/218) problems were already fixed in an LTS released kernel
  - No need for cherry-picking at all
  - Remaining issues were for out-of-tree code

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

– me

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