Linux Kernel Development

Greg Kroah-Hartman
gregkh@linux.com

github.com/gregkh/kernel-development

37,617 files

14,998,000 lines

2,823 developers
379 companies

Kernel releases 2.6.37 – 3.2.0
January 2011 – January 2012

12,300 lines added

8,800 lines removed

2,300 lines modified

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per day for all of 2011

Kernel releases 2.6.37 – 3.2.0
January 2011 – January 2012

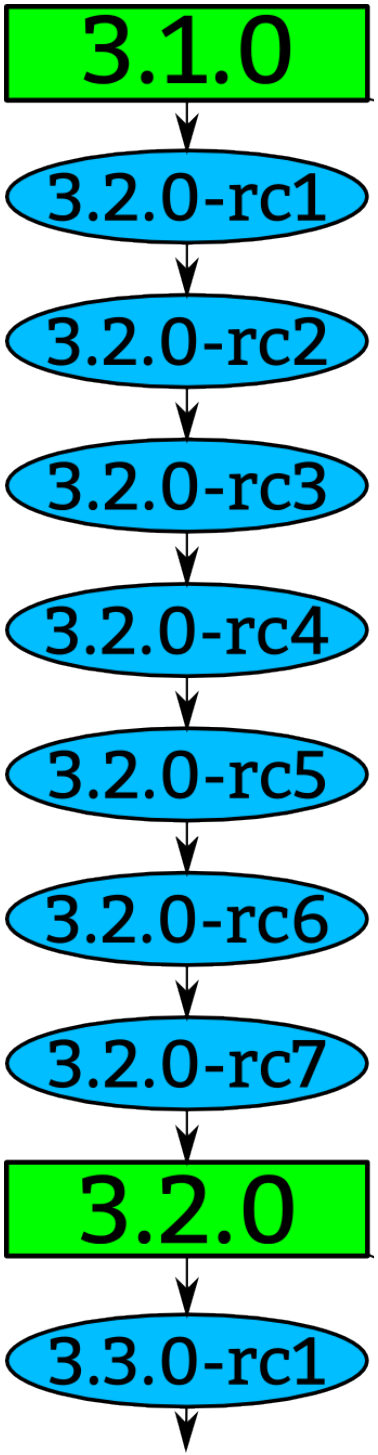
5.77 changes per hour

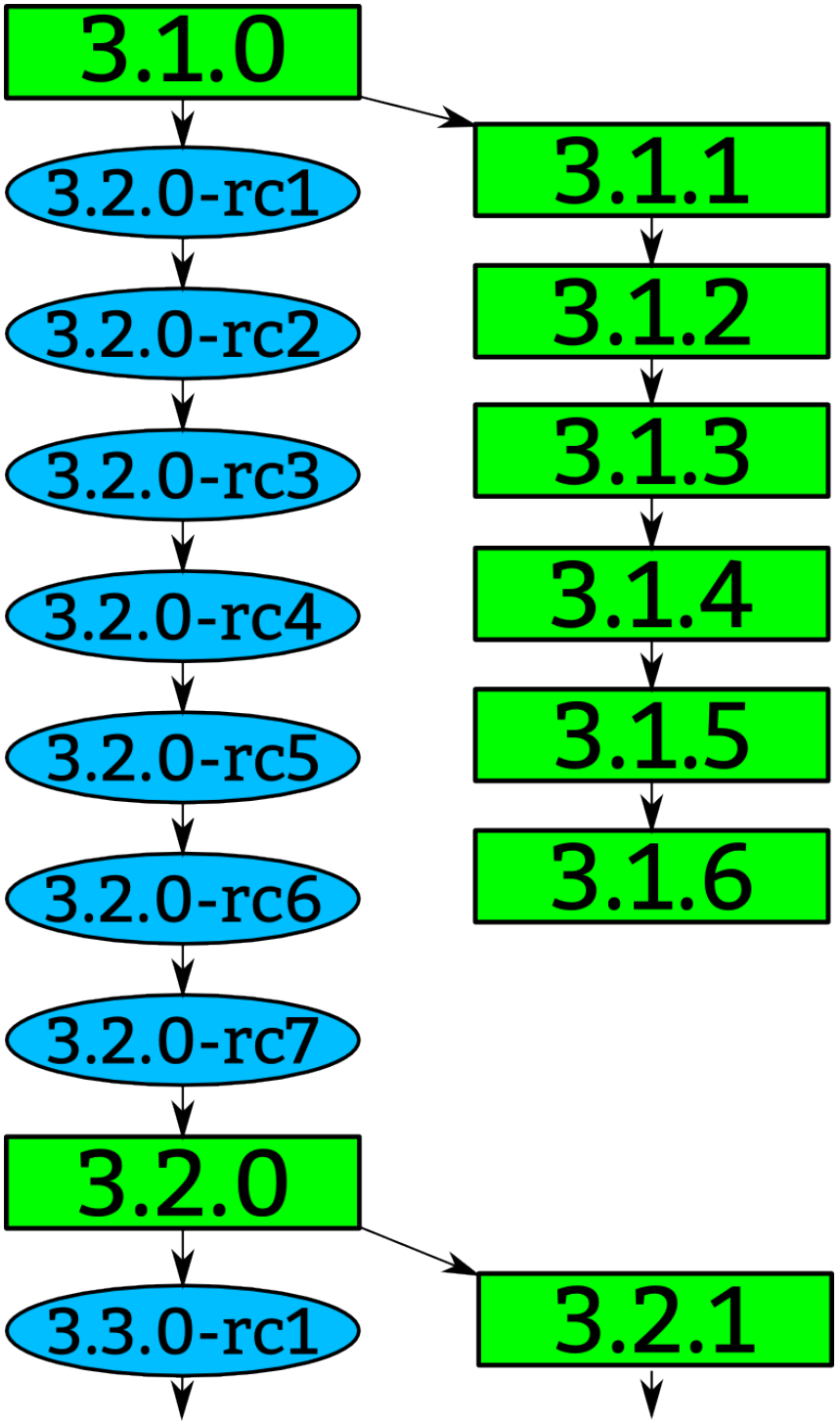
Kernel releases 2.6.37 – 3.2.0
January 2011 – January 2012

How we stay sane

Time based releases
Incremental changes


New release every
2¾ months
Kernel releases 2.6.20 – 3.2.0


3.1.0
3.2.0-rc1
3.2.0-rc2
3.2.0-rc3
3.2.0-rc4
3.2.0-rc5
3.2.0-rc6
3.2.0-rc7
3.2.0
3.3.0-rc1


3.1.0
3.2.0-rc1
3.2.0-rc2
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3.2.0-rc4
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3.2.0-rc6
3.2.0-rc7
3.2.0
3.3.0-rc1
3.1.1
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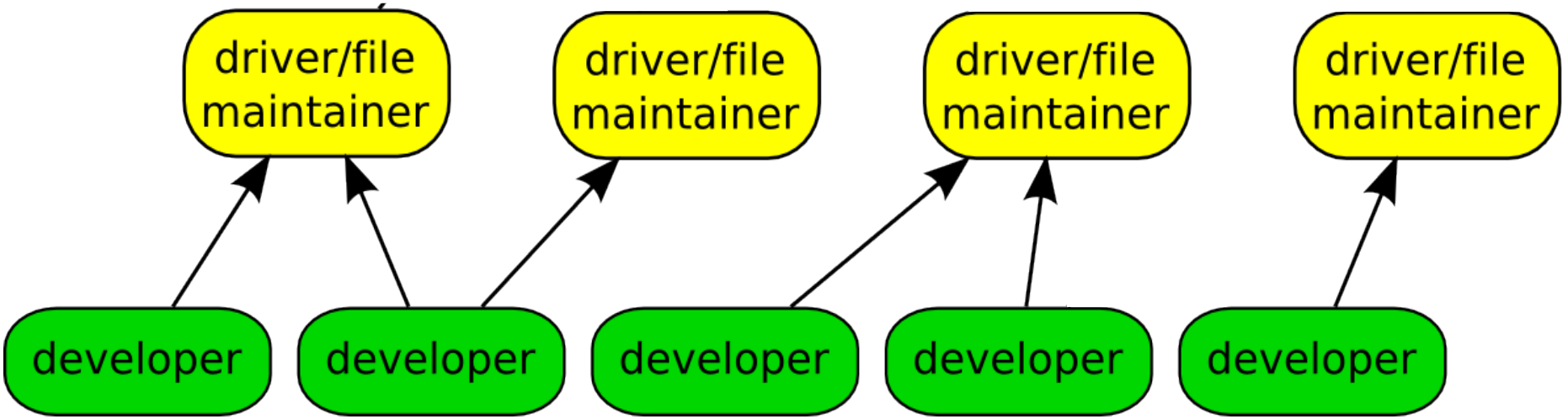
3.1.4
3.1.5
3.1.6
3.2.1


developer
developer
developer
developer
developer


driver/file maintainer
driver/file maintainer
driver/file maintainer
driver/file maintainer
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);
 }
```

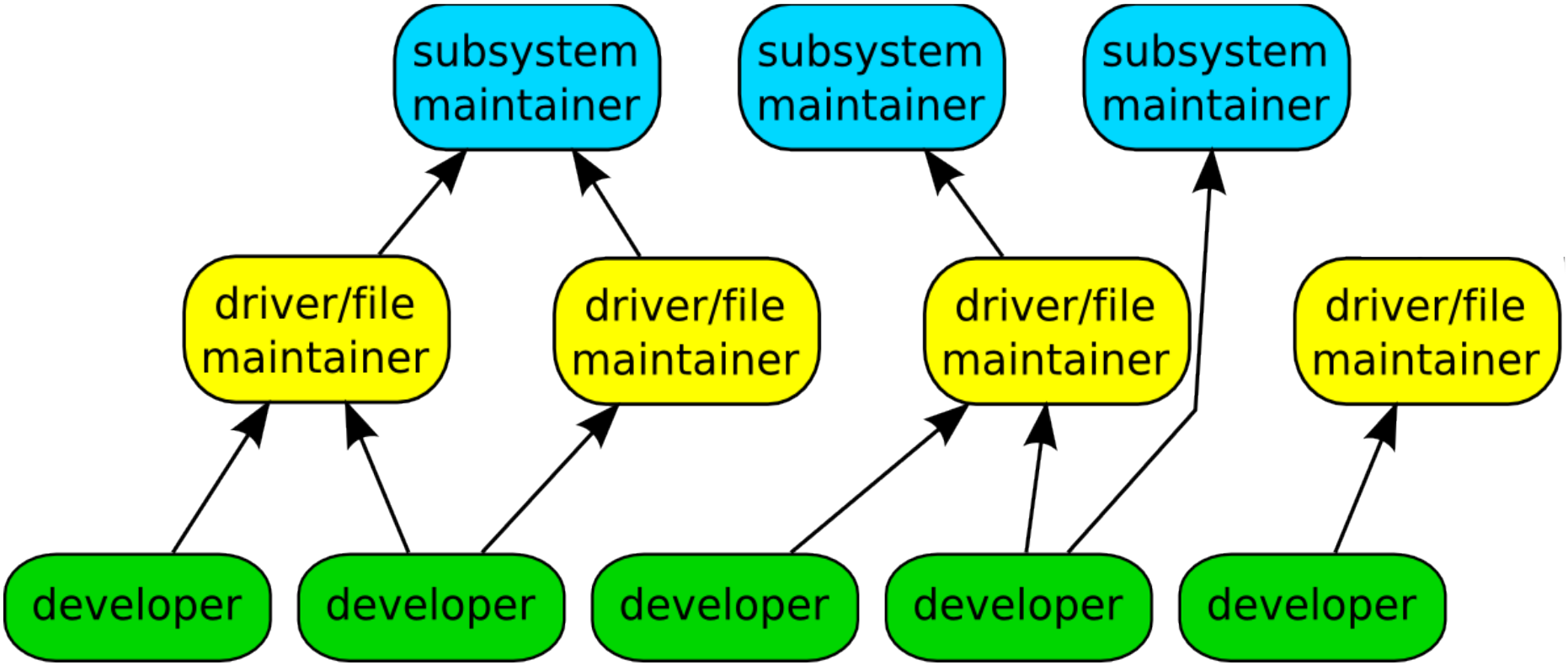
Developer's Certificate of Origin

(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.


subsystem maintainer
subsystem maintainer
subsystem maintainer
driver/file maintainer
driver/file maintainer
driver/file maintainer
driver/file maintainer
developer
developer
developer
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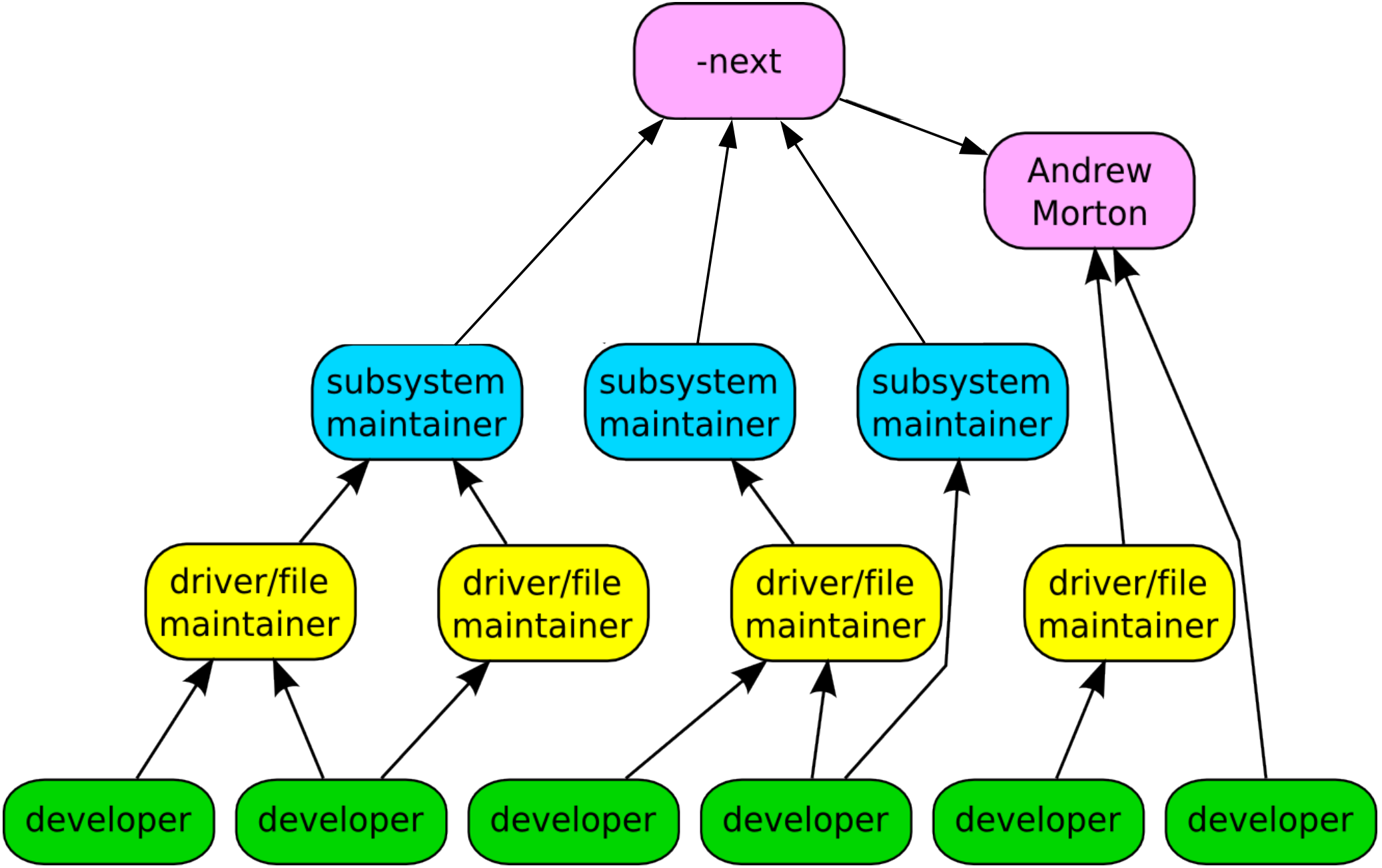
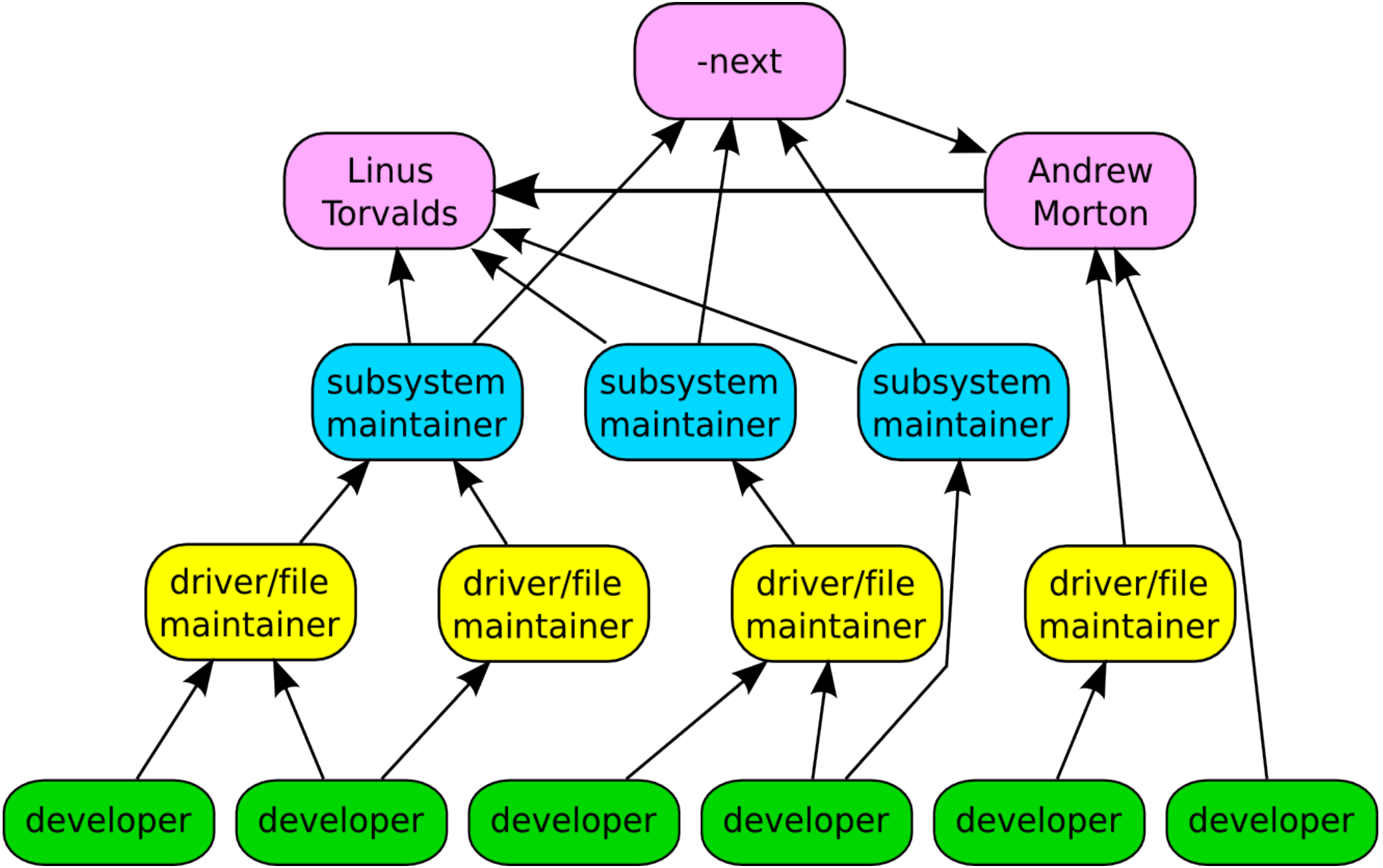
developer


-next
Andrew Morton
subsystem maintainer
subsystem maintainer
subsystem maintainer
driver/file maintainer
driver/file maintainer
driver/file maintainer
driver/file maintainer
developer
developer
developer
developer
developer
developer


-next
Linus Torvalds
Andrew Morton
subsystem maintainer
subsystem maintainer
subsystem maintainer
driver/file maintainer
driver/file maintainer
driver/file maintainer
driver/file maintainer
developer
developer
developer
developer
developer
developer

Top developers by quantity

Mark Brown	743
Thomas Gleixner	643
K. Y. Srinivasan	588
David Miller	533
Joe Perches	493
Axel Lin	444
Al Viro	426
Russell King	426
Takashi Iwai	409
Ben Skeggs	408

Kernel releases 2.6.37 – 3.2.0

Top Signed-off-by:

Greg Kroah-Hartman	5807
David S. Miller	4047
John Linville	3024
Mauro Carvalho Chehab	2237
Linus Torvalds	2120
Mark Brown	1704
Andrew Morton	1642
James Bottomley	1110
Takashi Iwai	957
Russell King	934

Kernel releases 2.6.37 – 3.2.0

Who is funding this work?

1.		
2.	Red Hat	10.3%
3.	Intel	7.3%
4.		
5.	Novell	4.0%
6.	IBM	3.6%
7.	Texas Instruments	3.4%
8.	Broadcom	2.9%
9.	Consultants	2.4%
10.	Nokia	1.8%

Kernel releases 2.6.37 – 3.2.0

Who is funding this work?

1. “Amateurs”	15.9%
2. Red Hat	10.3%
3. Intel	7.3%
4. Unknown Individuals	4.4%
5. Novell	4.0%
6. IBM	3.6%
7. Texas Instruments	3.4%
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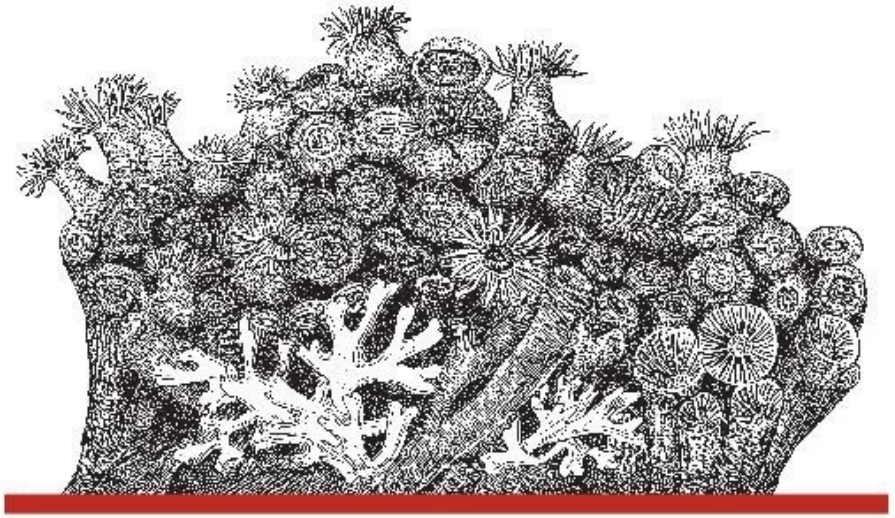
Kernel releases 2.6.37 – 3.2.0

Getting involved

Run the kernel.org release on your machine

Getting involved



LINUX
KERNEL
IN A NUTSHELL
A Desktop Quick Reference

Getting involved

`Documentation/HOWTO`

`Documentation/development-process`

Getting involved

kernelnewbies.org

Getting involved

Google “write your first kernel patch”

Getting involved

kernelnewbies.org/KernelJanitors/Todo

Getting involved

Linux Driver Project

`drivers/staging/*/TODO`

Linux Kernel Development

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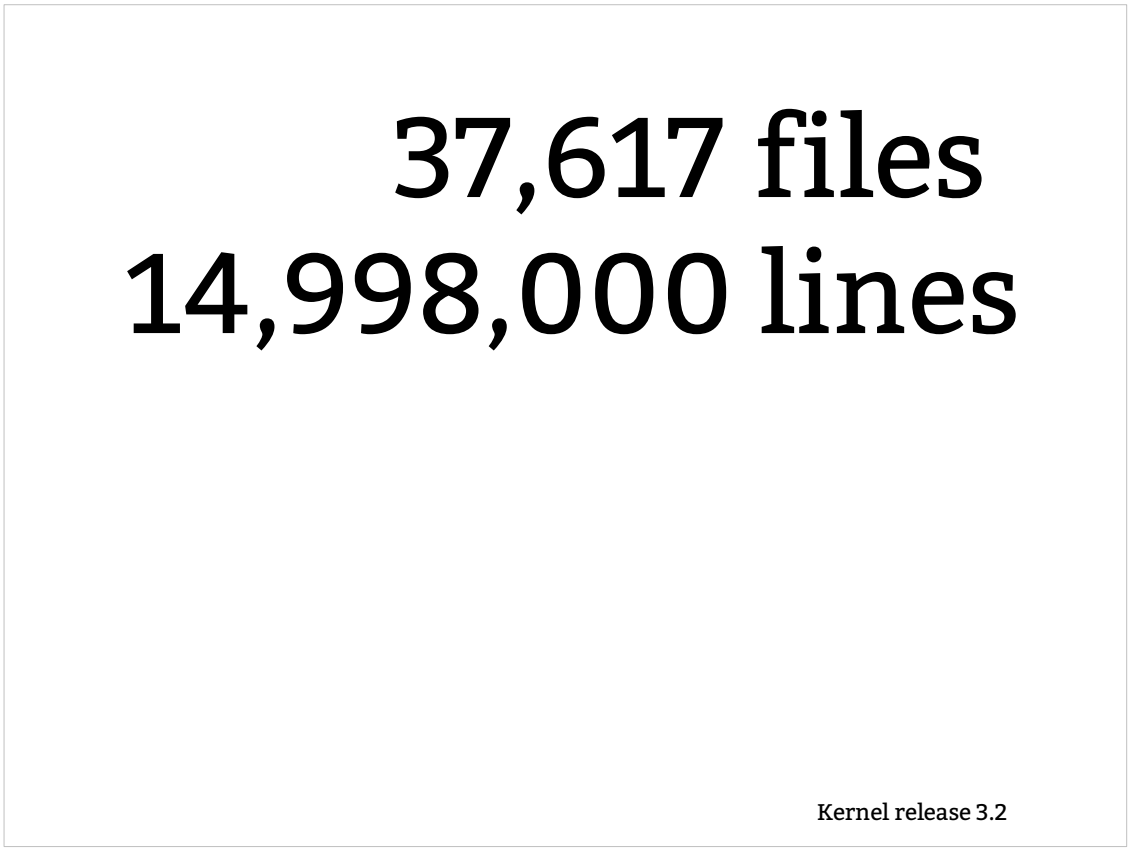
I'm going to discuss the how fast the kernel is moving, how we do it all, and how you can get involved.



This was for the 3.2 kernel release, which happened January 4, 2012.

2,823 developers
379 companies

Kernel releases 2.6.37 – 3.2.0
January 2011 – January 2012

This makes the Linux kernel the largest contributed body of software out there that we know of.

This is just the number of companies that we know about, there are more that we do not, and as the responses to our inquiries come in, this number will go up.

12,300 lines added
8,800 lines removed
2,300 lines modified

Kernel releases 2.6.37 – 3.2.0
January 2011 – January 2012

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Kernel releases 2.6.37 – 3.2.0
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5.77 changes per hour

Kernel releases 2.6.37 – 3.2.0
January 2011 – January 2012

This is 24 hours a day, 7 days a week, for a full year.

We went this fast the year before this as well, this is an amazing rate of change.

Interesting note, all of these changes are all through the whole kernel.

For example, the core kernel is only 5% of the code, and 5% of the change was to the core kernel. Drivers are 55%, and 55% was done to them, it's completely proportional all across the whole kernel.

How we stay sane

Time based releases
Incremental changes

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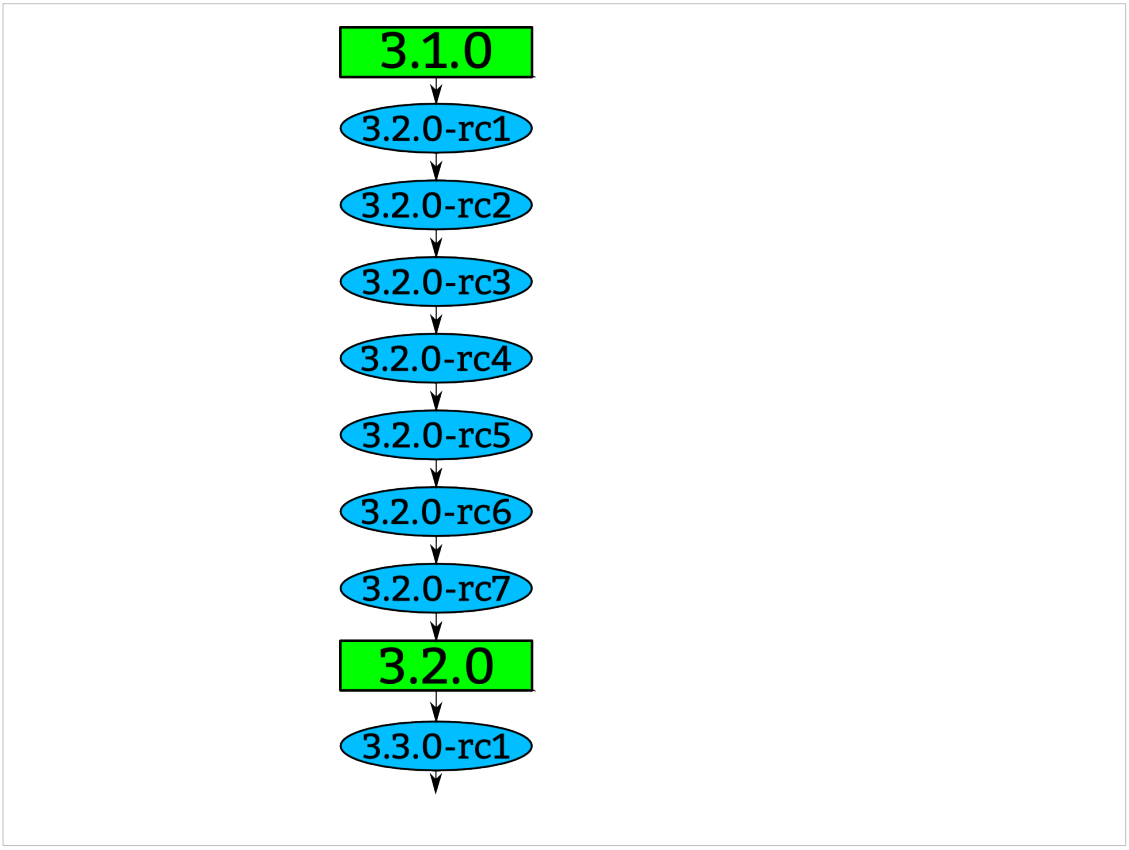
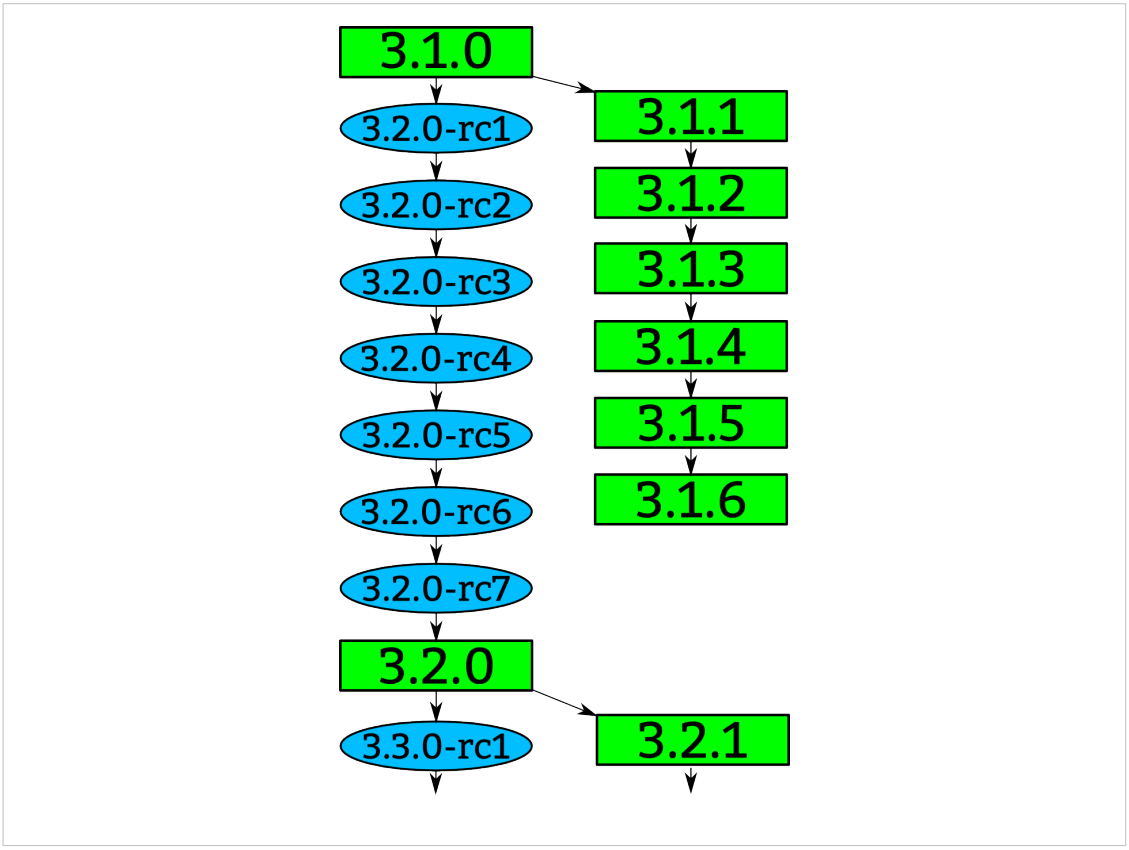
For example, the core kernel is only 5% of the code, and 5% of the change was to the core kernel. Drivers are 55%, and 55% was done to them, it's completely proportional all across the whole kernel.

84 days to be exact, very regular experience.



How a kernel is developed.
Linus releases a stable kernel
- 2 week merge window from subsystem maintainers
- rc1 is released
- bugfixes only now
- 2 weeks later, rc2
- bugfixes and regressions
- 2 weeks later,rc3

And so on until all major bugfixes and regressions are resolved and then the cycle starts over again.

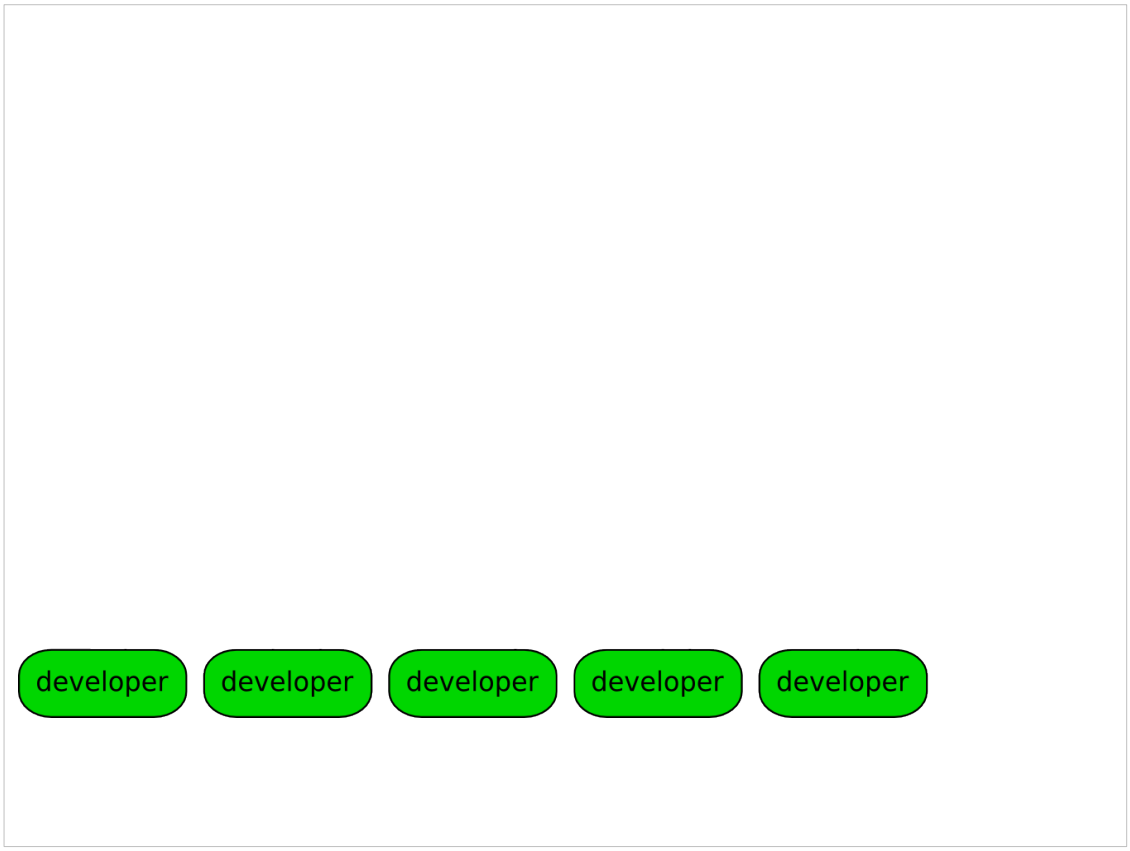


Greg takes the stable releases from Linus, and does stable releases with them, applying only fixes that are already in Linus's tree.

Requiring fixes to be in Linus's tree first ensures that there is no divergence in the development model.

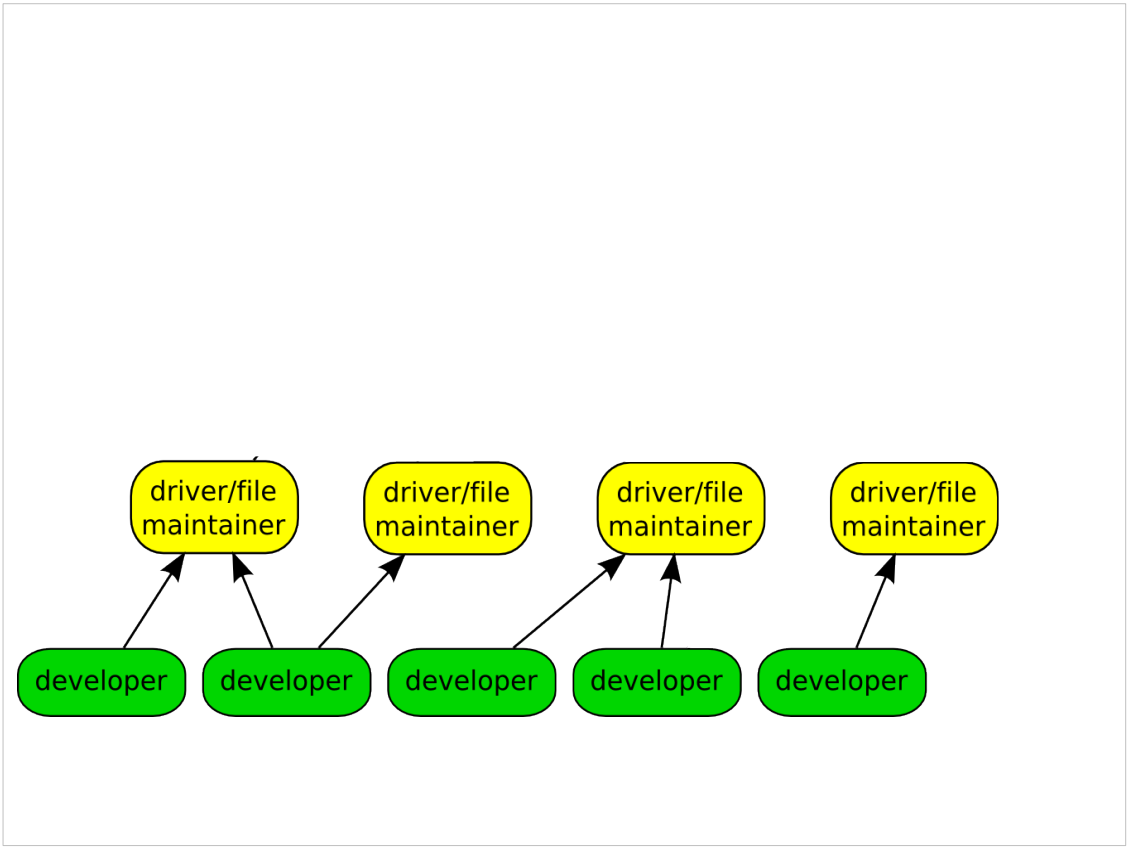
After Linus releases a new stable release, the old stable series is dropped.

With the exception of “longterm” stable releases, those are special, the stick around for much longer...



Like mentioned before, we have almost 2900 individual contributors. They all create a patch, a single change to the Linux kernel. This change could be something small, like a spelling correction, or something larger, like a whole new driver.

Every patch that is created only does one thing, and it can not break the build, complex changes to the kernel get broken up into smaller pieces.



The developers send their patch to the maintainer of the file(s) that they have modified.

We have about 700 different driver/file/subsystem maintainers

```
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>
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    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.

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--- 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);
 }
```

This is an example of a patch.

It came from Robert, was acked by David, the maintainer at the time of the usb on-the-go subsystem, and then signed off by by me before it was commited to the kernel tree.

The change did one thing, it checked the value of the pointer before it was dereferenced, fixing a bug that would have crashed the kernel if it had been hit.

This is also a “blame” trail, showing who changed each line in the kernel, and who agreed with that change.

If a problem is found, these are the developers that you can ask about it.

Because of this, every line in the Linux kernel can be traced back to at least two developers who are responsible for it.

This is better than any other body of code.

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.

This is what “Signed-off-by:” means.
All contributions to the Linux kernel have to agree to this, and every single patch has at least one signed-off-by line, usually all have at least two.

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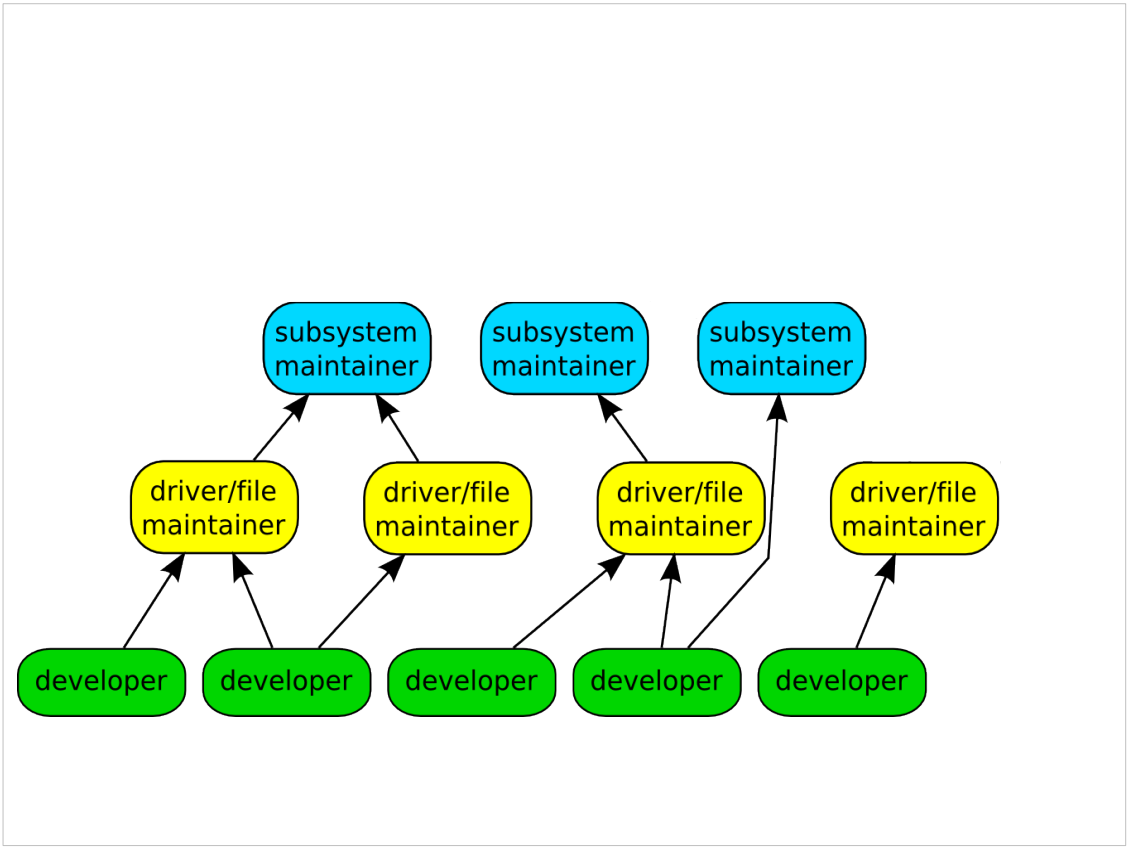
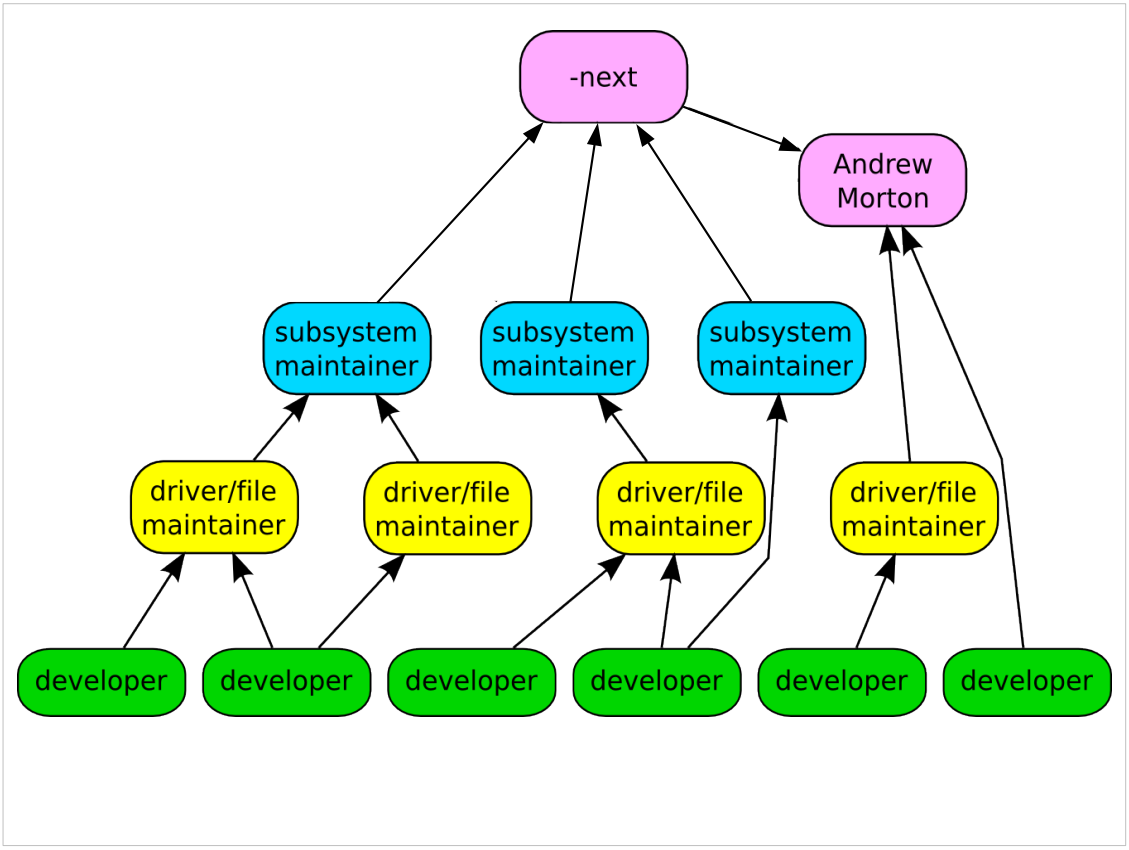


After reviewing the code, and adding their own signed-off-by to the patch, the file/driver maintainer sends the patch to the subsystem maintainer responsible for that portion of the kernel.

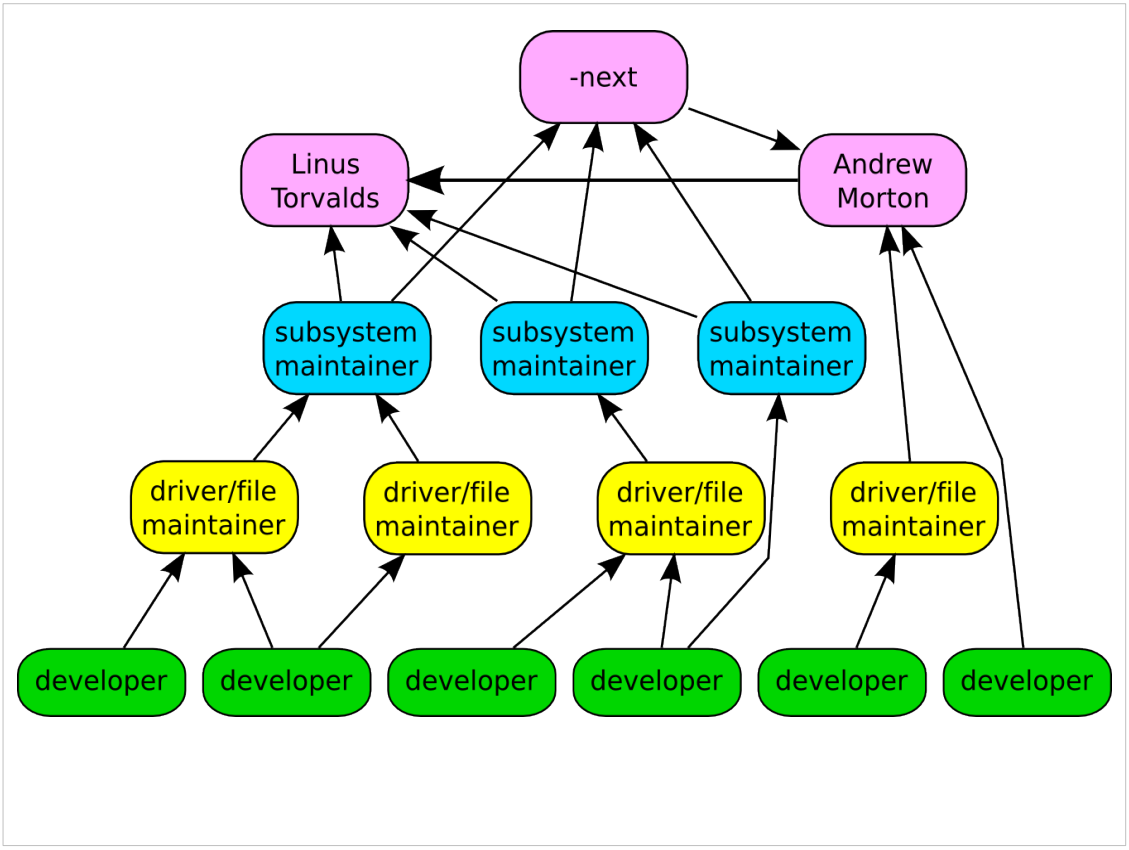
We have around 150 subsystem maintainers



Linux-next gets created every night from all of the different subsystem trees and build tested on a wide range of different platforms.

We have about 150 different trees in the linux-next release.

Andrew Morton picks up patches that cross subsystems, or are missed by others, and releases his -mm kernels every few weeks. This includes the linux-next release at that time.

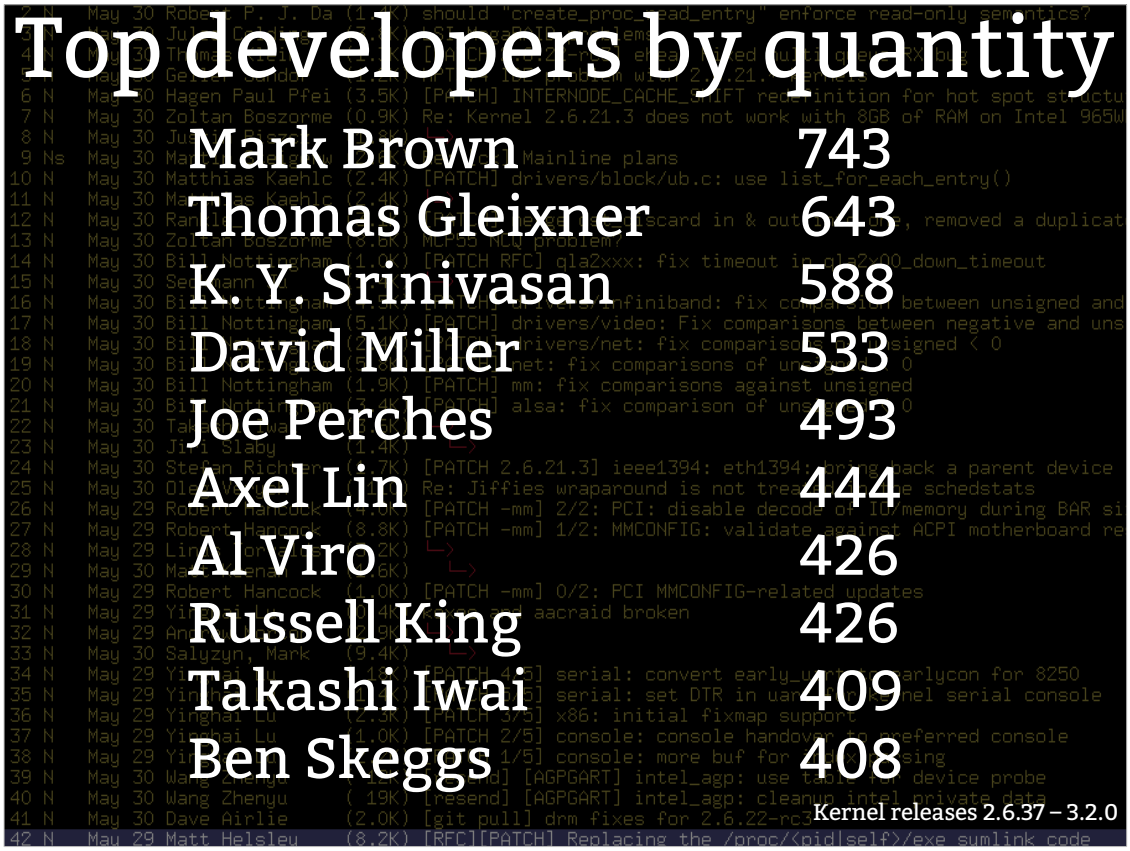


Every 3 months, when the merge window opens up, everything gets sent to Linus from the subsystem maintainers and Andrew Morton.

The merge window is 2 weeks long, and thousands of patches get merged in that short time.

All of the patches merged to Linus should have been in the linux-next release, but that isn't always the case for various reasons.

Linux-next can not just be sent to Linus as there are things in there that sometimes are not good enough to be merged just yet, it is up to the individual subsystem maintainer to decide what to merge.



Mark – embedded sound
Thomas – x86 maintainer
KY – hyperv
David – networking
Joe – janitorial
Alexl – janitorial
Al – vfs and filesystem
Russell – ARM maintainer
Takashi – sound maintainer
Ben – nouveau developer

Top Signed-off-by:

Greg Kroah-Hartman	5807
David S. Miller	4047
John Linville	3024
Mauro Carvalho Chehab	2237
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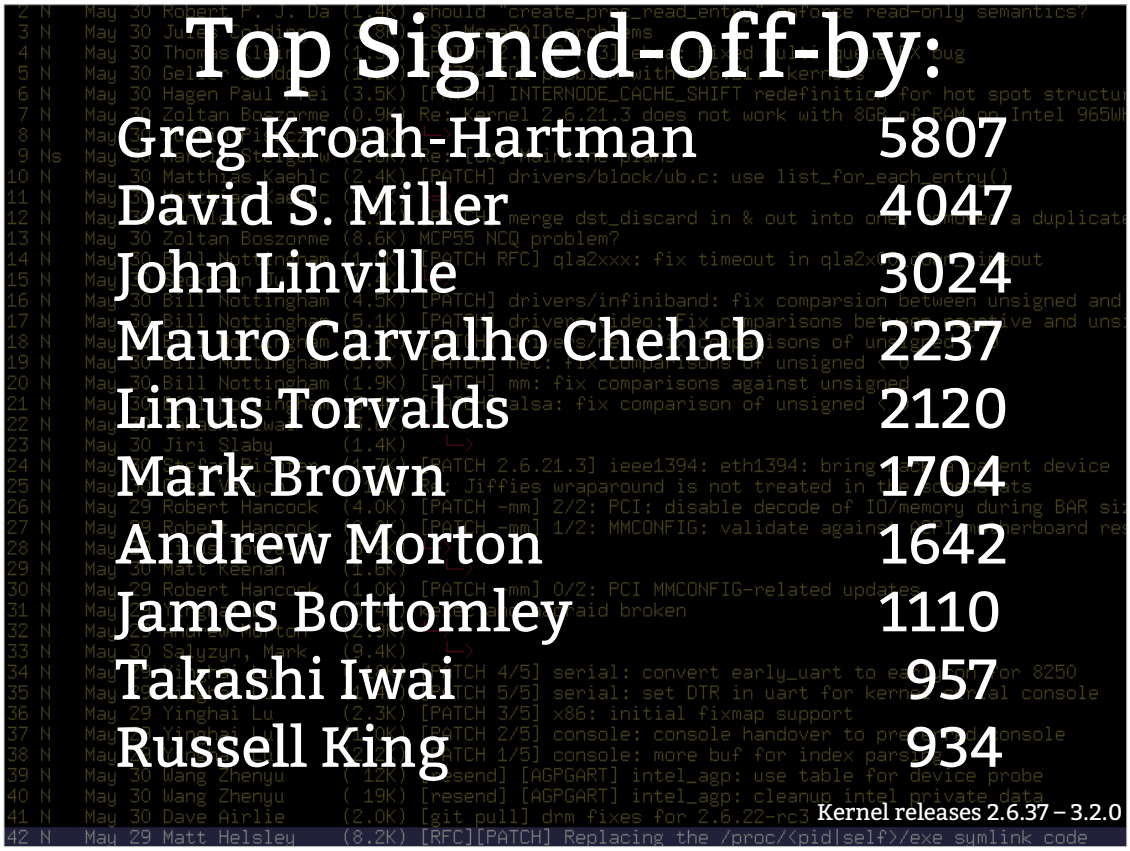
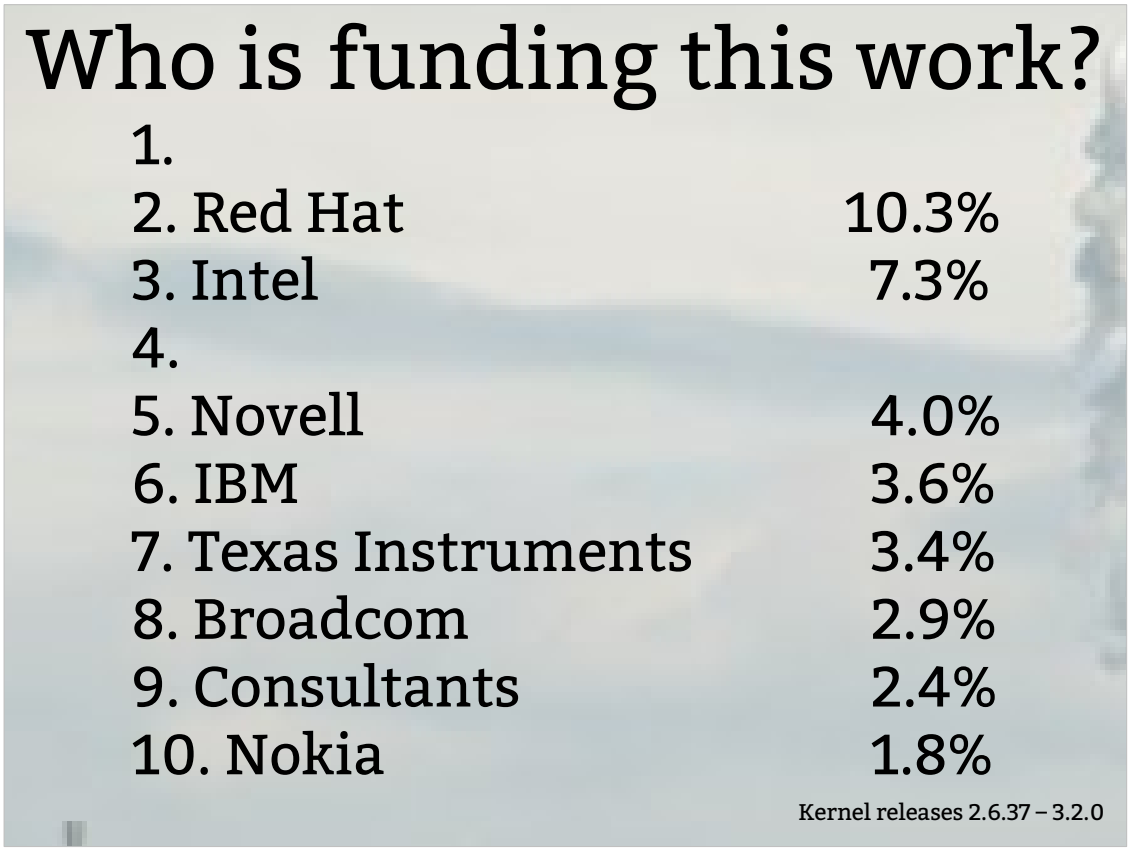
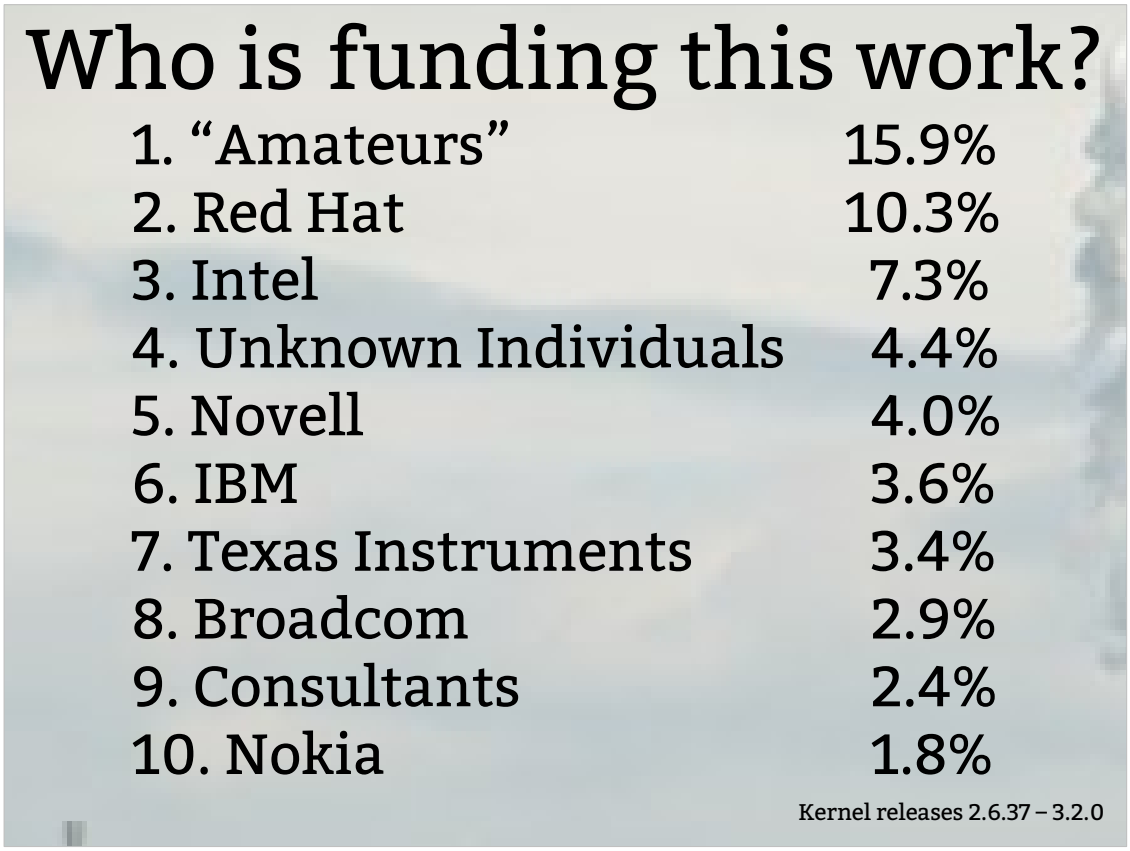


Kernel releases 2.6.37 – 3.2.0

Greg – driver core, usb, staging
David – networking
John – wireless networking
Mauro - v4l
Linus – everything
Mark - embedded
Andrew – everything
James – SCSI
Takashi – sound
Russell - ARM



11 Wolfson Microelectronics 830 (1.7%)
12 Google 794 (1.6%)
13 Samsung 778 (1.6%)
14 Oracle 728 (1.5%)
15 Microsoft 672 (1.4%)
16 AMD 669 (1.3%)
17 Freescale 625 (1.3%)
18 tglx PITA 591 (1.2%)
19 Fujitsu 564 (1.1%)
20 Atheros Communications 543 (1.1%)
21 (Academia) 534 (1.1%)
22 Wind River 513 (1.0%)
23 Linaro 503 (1.0%)
24 ST Ericsson 457 (0.9%)
25 MiTAC 444 (0.9%)
26 Pengutronix 428 (0.9%)
27 Analog Devices 418 (0.8%)
28 Marvell 383 (0.8%)
29 University of Cambridge 360 (0.7%)
30 Societe Francaise de Radiotelephone 334 (0.7%)



So you can view this as either 20% is done by non-affiliated people, or 80% is done by companies.

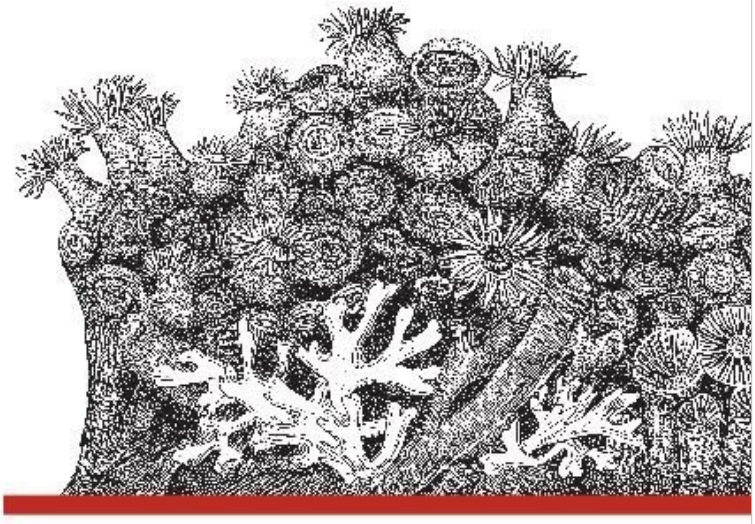
Now to be fair, if you show any skill in kernel development you are instantly hired.

Why this all matters: If your company relies on Linux, and it depends on the future of Linux supporting your needs, then you either trust these other companies are developing Linux in ways that will benefit you, or you need to get involved to make sure Linux works properly for your workloads and needs.

Getting involved

Run the kernel.org release on your machine

Getting involved



This book tells you how to build and install a kernel on your machine.

Free online

Getting involved

`Documentation/HOWTO`

`Documentation/development-process`

These documents in the kernel source directory are the best place to start if you want to understand how the development process works, and how to get involved.

The HOWTO file has links to almost everything else you ever wanted..

Getting involved

kernelnewbies.org

http://www.kernelnewbies.org

Getting involved

Google “write your first kernel patch”

This is a video of a talk I gave at FOSDEM, going through the steps, showing exactly how to create, build, and send a kernel patch.

Getting involved

kernelnewbies.org/KernelJanitors/Todo

So you know how to create a patch, but what should you do? The kernel janitors has a great list of tasks to start with in cleaning up the kernel and making easy patches to be accepted.

Getting involved

Linux Driver Project

`drivers/staging/*/TODO`

The staging tree also needs a lot of help, here are lists of things to do in the kernel for the drivers to be able to move out of the staging area.

Please always work off of the linux-next tree if you want to do these tasks, as sometimes they are already done by others by the time you see them in Linus's tree.

Obligatory Penguin Picture