Linux Kernel Release Model

(and security stuff)

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github.com/gregkh/presentation-release-model

68,000 files
28,443,000 lines

Kernel release 5.7.0

4,537 developers
450+ companies

Kernel releases 5.2.0 – 5.7.0
May 2019 – May 2020

10,000 lines added

2,500 lines removed

2,100 lines modified

Kernel releases 4.8.0 – 4.13.0
August 2016 – September 2017

10,000 lines added
2,500 lines removed
2,100 lines modified

Every day

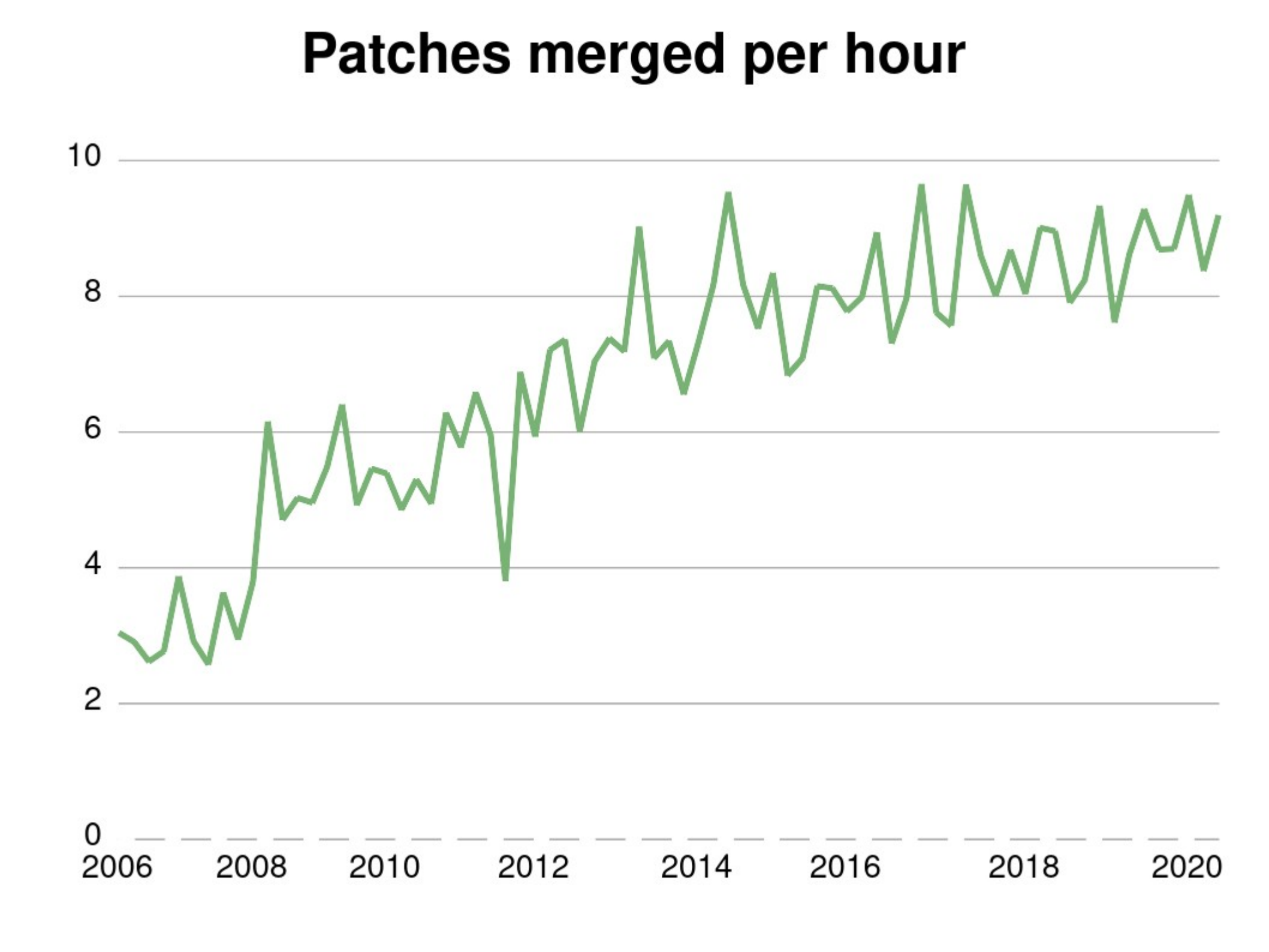
Kernel releases 4.8.0 – 4.13.0
August 2016 – September 2017

8.5 changes per hour

Kernel releases 4.8.0 – 4.13.0
August 2016 – September 2017

9.5 changes per hour

5.5 release


Patches merged per hour
10
8
6
4
2
0
2006
2008
2010
2012
2014
2016
2018
2020

Old release model

2.2 – January 1999
2.4 – January 2001
2.6 – December 2003

“New” release model

Release every 2-3 months
All releases are stable

“Cambridge Promise”

Will not break userspace.

“Cambridge Promise”

Will not break userspace,
on purpose.

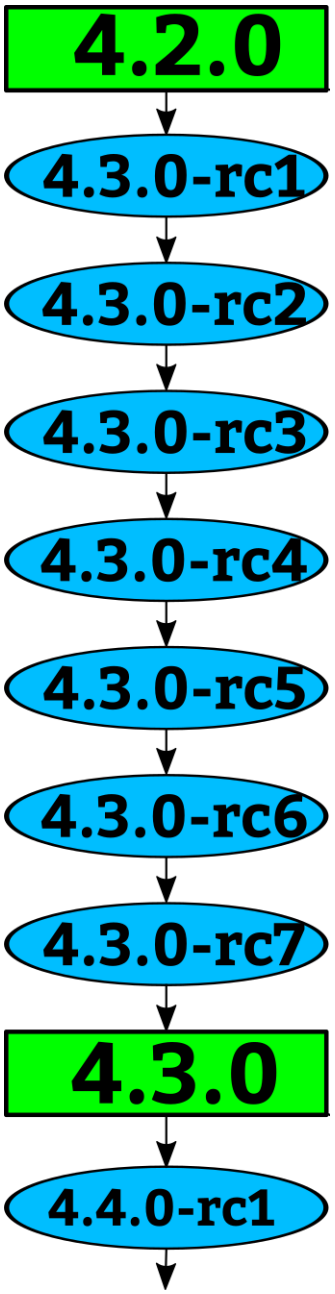
– July 2007

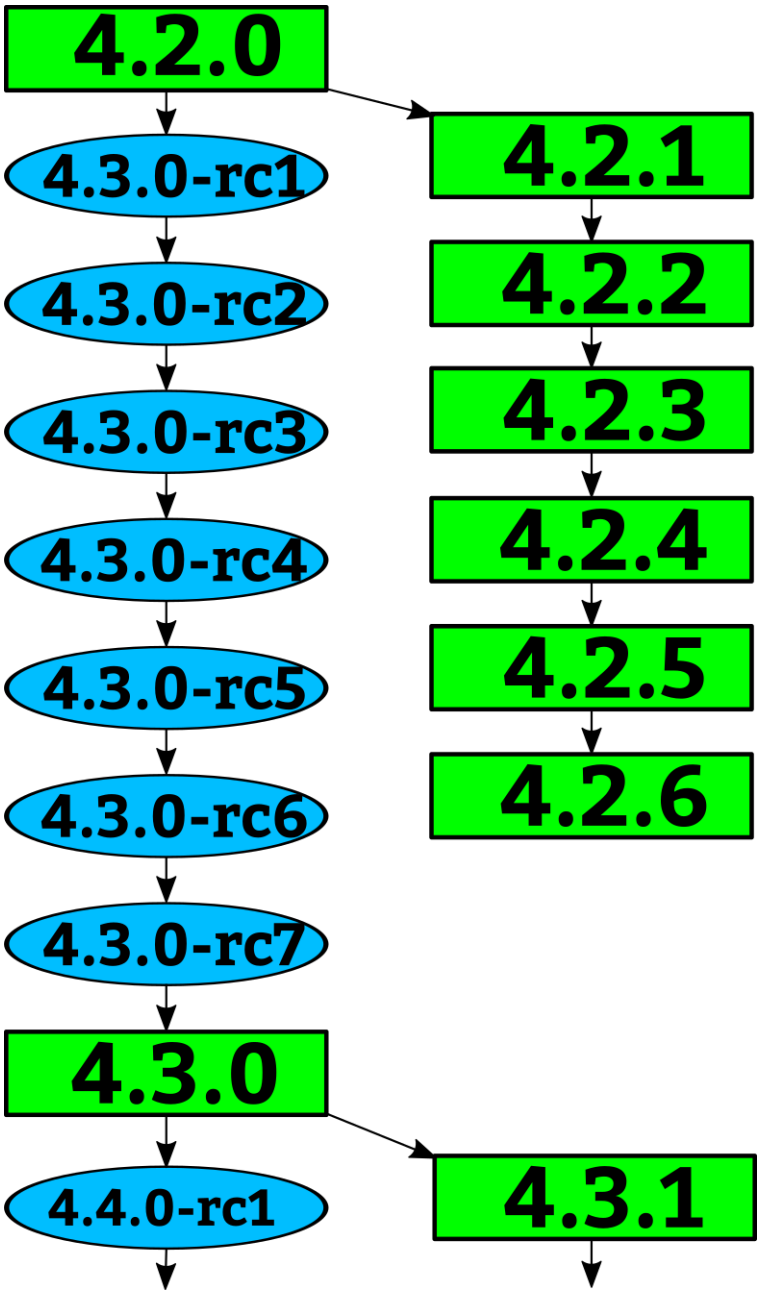
Version numbers mean nothing

2.6.x → 3.x 2011

3.x → 4.x 2015

4.x → 5.x 2019


4.2.0
4.3.0-rc1
4.3.0-rc2
4.3.0-rc3
4.3.0-rc4
4.3.0-rc5
4.3.0-rc6
4.3.0-rc7
4.3.0
4.4.0-rc1


4.2.0
4.3.0-rc1
4.3.0-rc2
4.3.0-rc3
4.3.0-rc4
4.3.0-rc5
4.3.0-rc6
4.3.0-rc7
4.3.0
4.4.0-rc1
4.2.1
4.2.2
4.2.3
4.2.4
4.2.5
4.2.6
4.3.1

Stable rules

- Bugfix
- Less than 100 lines
- New ids or quirks
- Must be in Linus's tree

https://www.kernel.org/doc/html/latest/process/stable-kernel-rules.html

“Longterm kernels”

One picked per year
Maintained for at least 2 years

4.4 4.9 4.14 4.19 5.4

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
5.7	33 changes / day

Every release is stable

Decade old guarantee

Always update your kernel

Can’t update your kernel?

Blame your SoC provider…

“Popular” SoC kernel tree

```
6171 files changed 2837180 insertions(+), 42568 deletions(-)
```

“Popular” SoC kernel tree

```
6171 files changed 2837180 insertions(+), 42568 deletions(-)
```

`Image.lz4` – 3.2 million lines

Linux “like”

Kernel Security

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Almost all bugs can be a “security” issue.

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Fix them as soon as possible.

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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
- Cherry-picking CVEs result in insecure system
- Some CVEs have follow-on fixes not listed

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

Linux Longterm kernels fix problems

- Bugs are fixed before you realize it
- Google security team requests in 2018:
  - 92% (201/218) problems already fixed in LTS release
  - No need for cherry-picking
  - Remaining issues were due to out-of-tree code

Linux Longterm kernels fix problems

- Bugs are fixed before you realize it
- Google security team requests in 2019:
  - 90% problems already fixed in LTS release
  - 950+ criticial non-security bugs also fixed

Linux Longterm kernels fix problems

Android now requires LTS kernel updates

Keeping a Secure System

Take **all** stable kernel updates

Enable hardening features

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

– me

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