SECO-ASSIST

2019 Research Seminar

When, how, and why mobile app developers update third-party libraries they rely on?

Pasquale Salza[1], Fabio Palomba[1], Dario Di Nucci[2], Andrea De Lucia[3], Filomena Ferrucci[3]

University of Zurich[UZH]

VRIJE UNIVERSITEIT BRUSSEL

UNIVERSITÀ DEGLI STUDI DI SALERNO

Salza, P., Palomba, F., Di Nucci, D., De Lucia, A. and Ferrucci, F., 2019. Third-party libraries in mobile apps. Springer EMSE (2019), pp.1-37

Third-party libraries

Crucial for the development of software

Save the effort related to the implementation of complex functions

Very popular for mobile apps

Libraries are software as well

Need to evolve

The updates aim at making them more stable and reliable

Why is updating important?

Apps have an intense and continuous release cycle

The user experience is fundamental

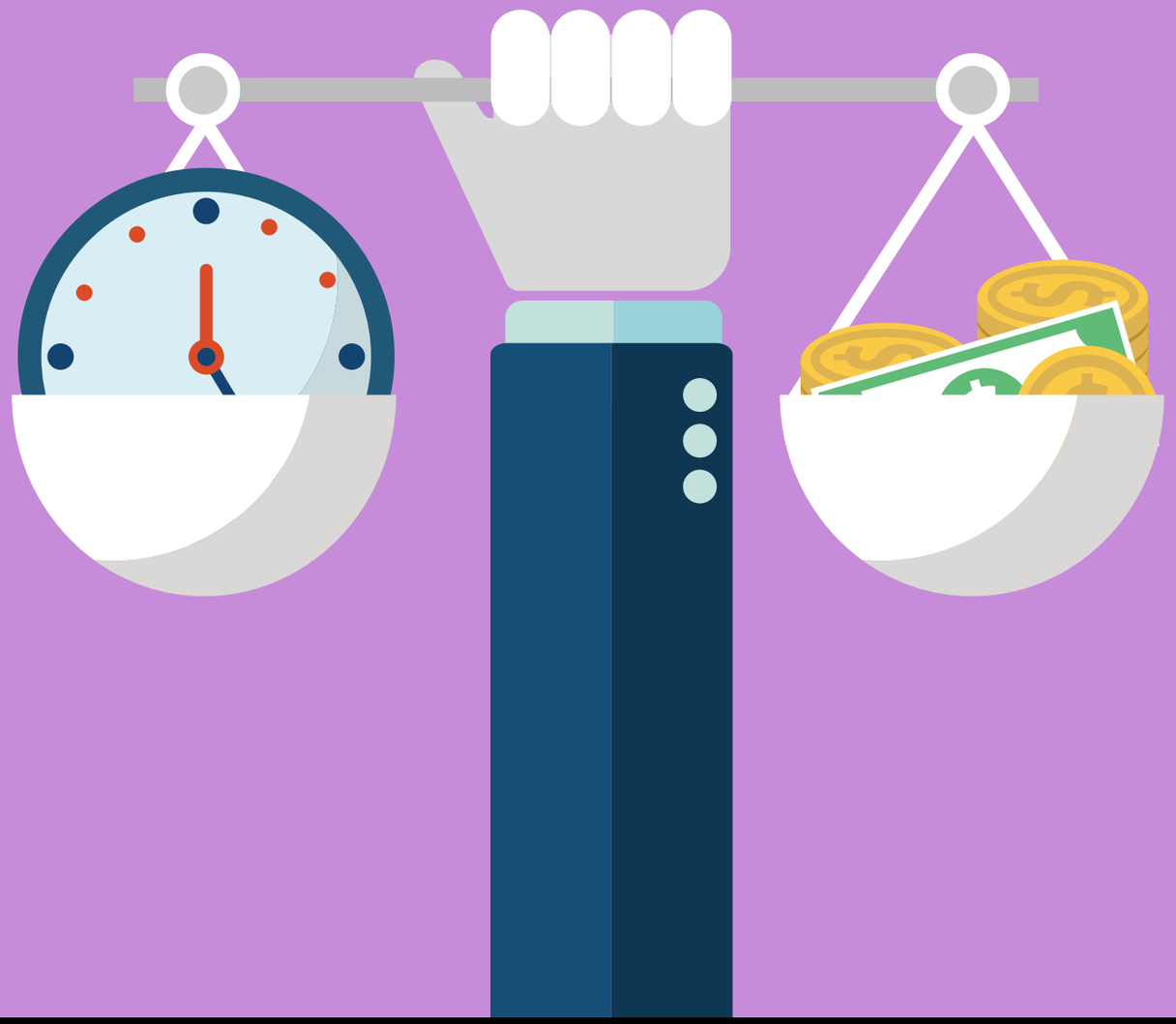
Users are the very testers and decide the success of an app

Bavota, Gabriele, et al. "The impact of api change-and fault-proneness on the user ratings of android apps." IEEE TSE (2014): 384-407.

Is it always worth updating?

The public API may change and require development effort before being updated

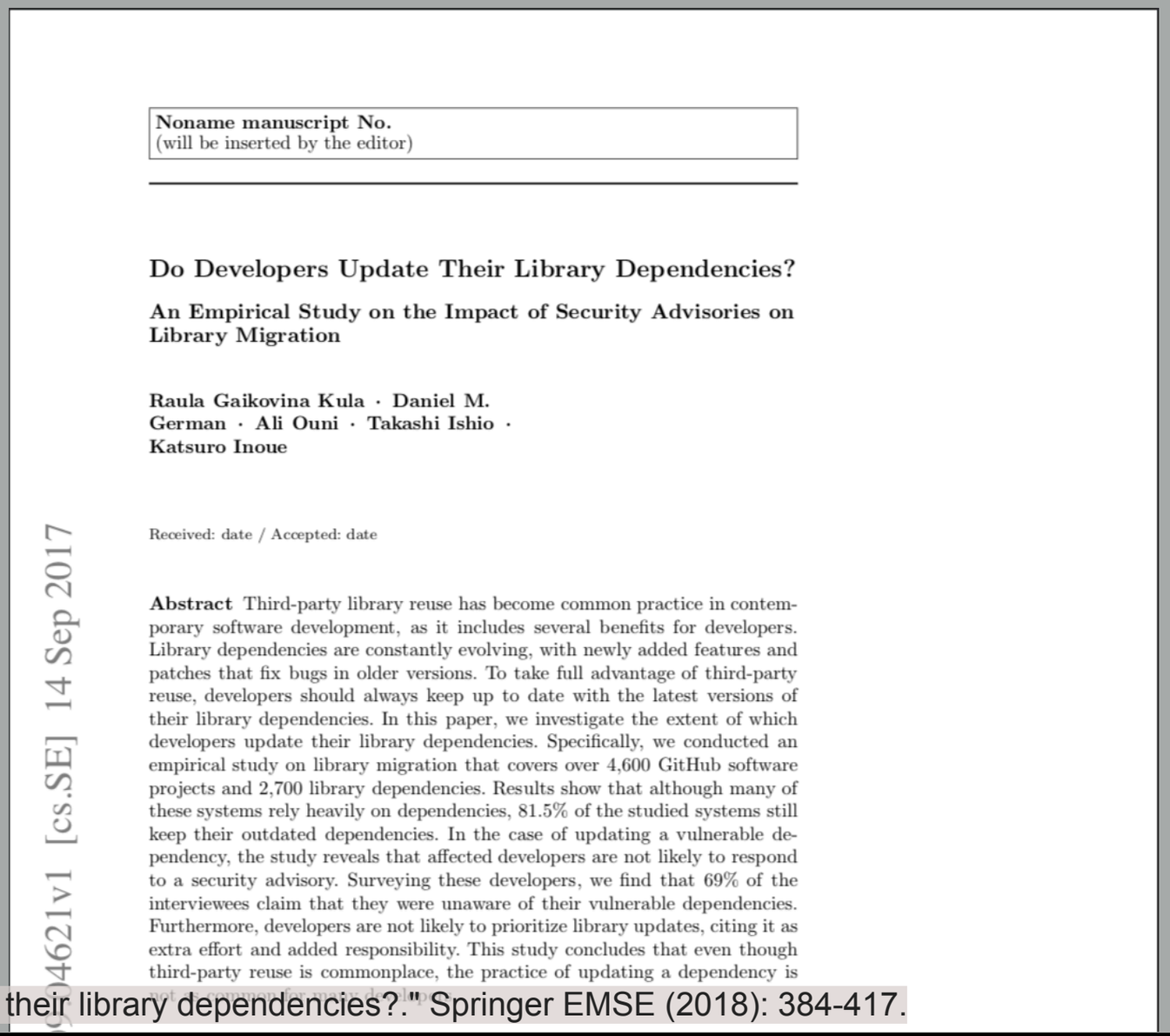
Stability and reliability are not truly guaranteed



Do developers update libraries?

“Developers are not likely to prioritize library updates, citing it as extra effort and added responsibility.”

“… even though third-party reuse is commonplace, the practice of updating a dependency is not as common for many developers.”



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Do Developers Update Their Library Dependencies?

An Empirical Study on the Impact of Security Advisories on Library Migration

Raula Gaikovina Kula · Daniel M. German · Ali Ouni · Takashi Ishio · Katsuro Inoue

Received: date / Accepted: date

Abstract Third-party library reuse has become common practice in contemporary software development, as it includes several benefits for developers. Library dependencies are constantly evolving, with newly added features and patches that fix bugs in older versions. To take full advantage of third-party reuse, developers should always keep up to date with the latest versions of their library dependencies. In this paper, we investigate the extent of which developers update their library dependencies. Specifically, we conducted an empirical study on library migration that covers over 4,600 GitHub software projects and 2,700 library dependencies. Results show that although many of these systems rely heavily on dependencies, 81.5% of the studied systems still keep their outdated dependencies. In the case of updating a vulnerable dependency, the study reveals that affected developers are not likely to respond to a security advisory. Surveying these developers, we find that 69% of the interviewees claim that they were unaware of their vulnerable dependencies. Furthermore, developers are not likely to prioritize library updates, citing it as extra effort and added responsibility. This study concludes that even though third-party reuse is commonplace, the practice of updating a dependency is

arXiv:1709.04621v1 [cs.SE] 14 Sep 2017

Kula, Raula Gaikovina, et al. "Do developers update their library dependencies?." Springer EMSE (2018): 384-417.

Goals

Goals

How much is common to update a library during app development?

Which category of libraries are updated the most?

Is there any common behaviour that developers have in updating libraries?

What factors lead developers to update libraries?

Large Empirical Study

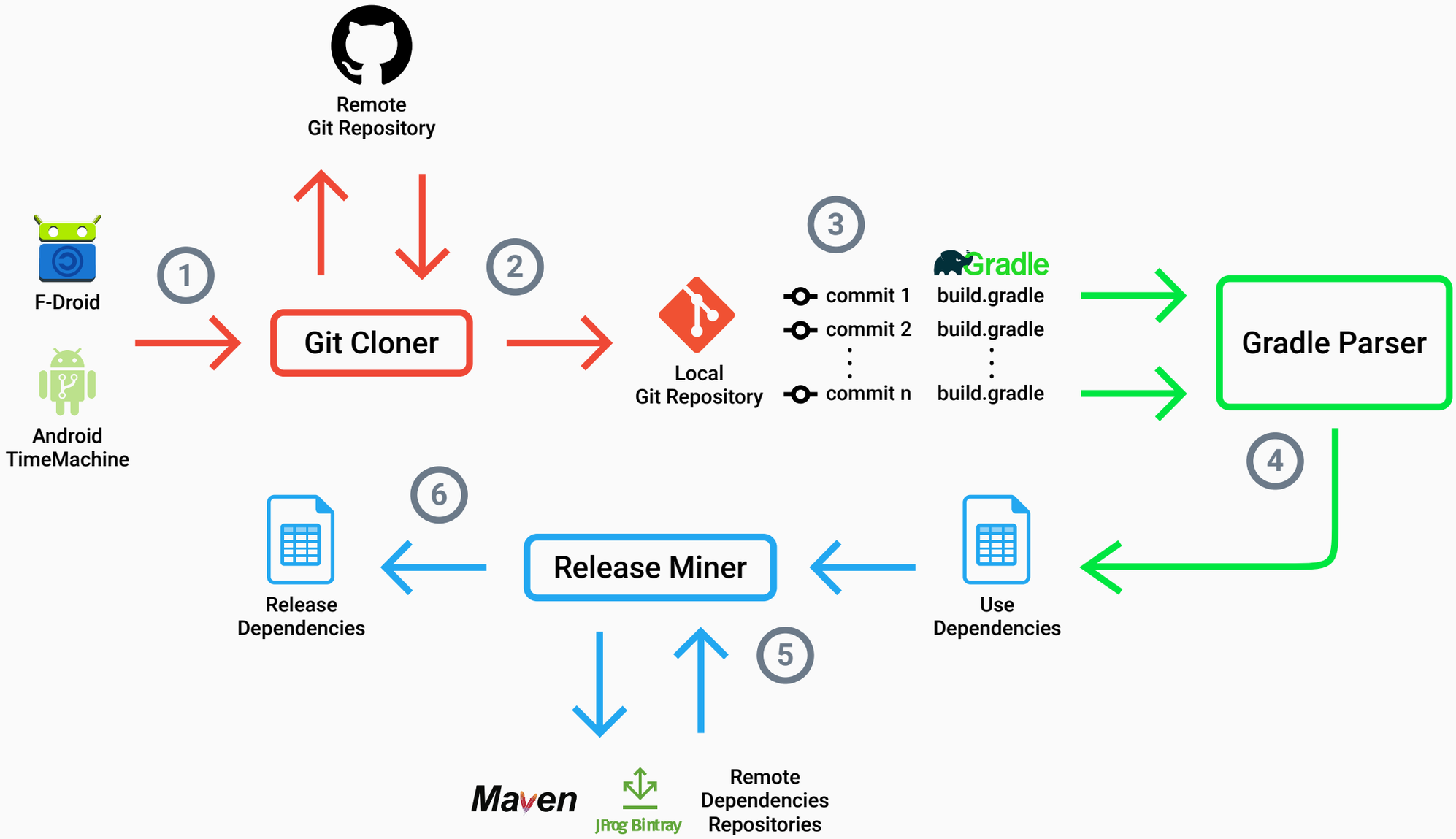
2,752 Android apps

291 apps from F-Droid

2,461 apps from Google Play Store[1]

[1] https://androidtimemachine.github.io/
Geiger, Franz-Xaver, et al. "A graph-based dataset of commit history of real-world android apps." MSR. 2018.

Mining Process



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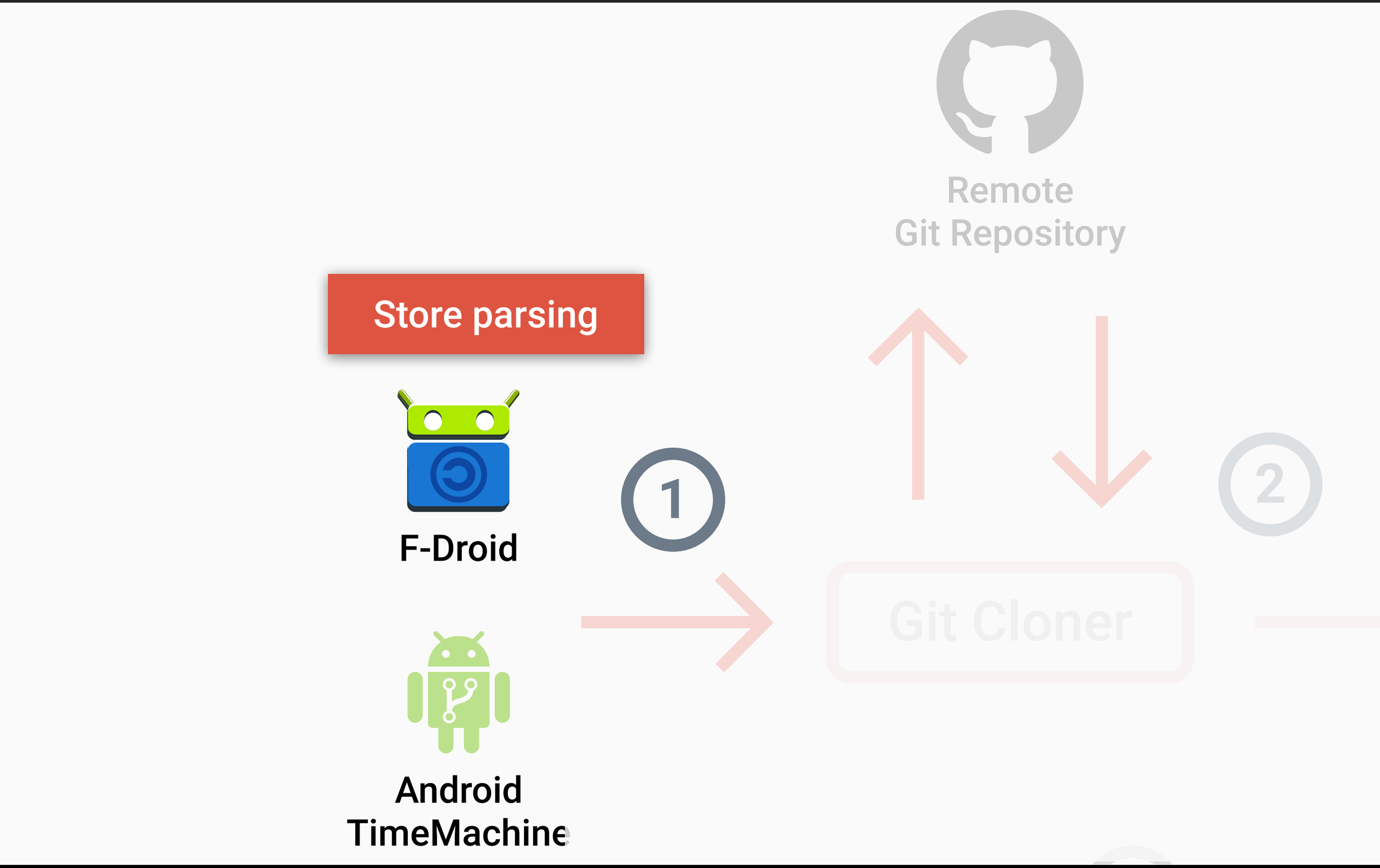

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Remote
Git Repository

Source code repository cloning

Git Cloner

Local
Git Repository

commit 1
commit 2
commit n

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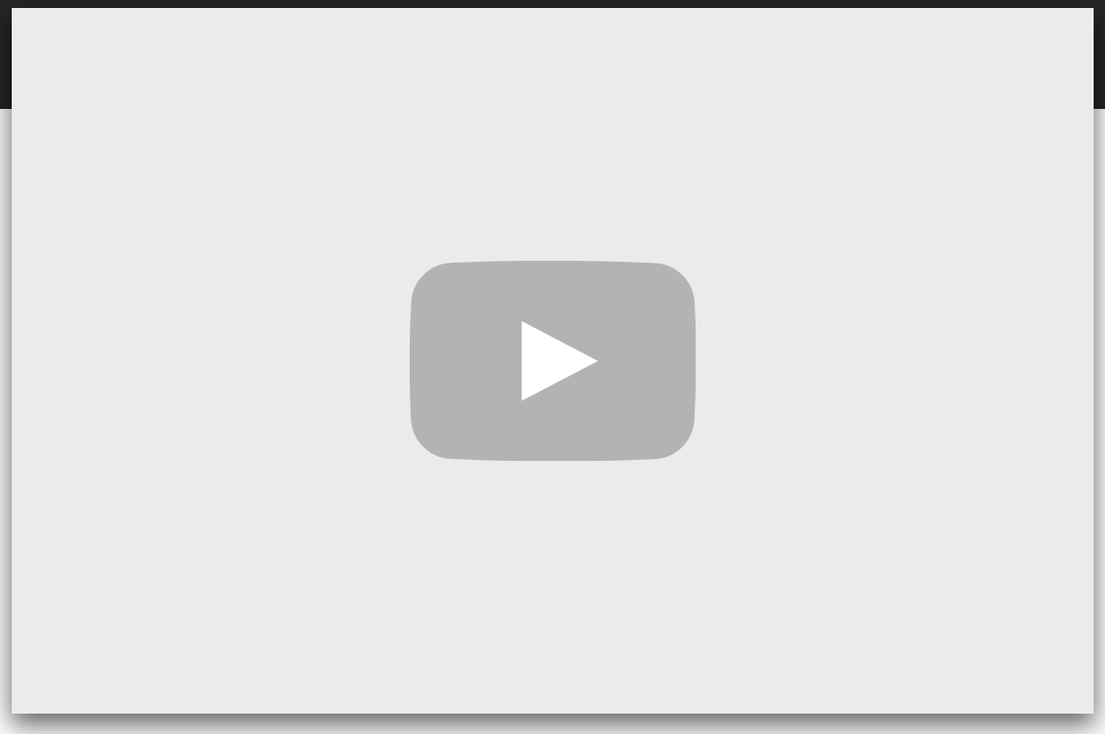

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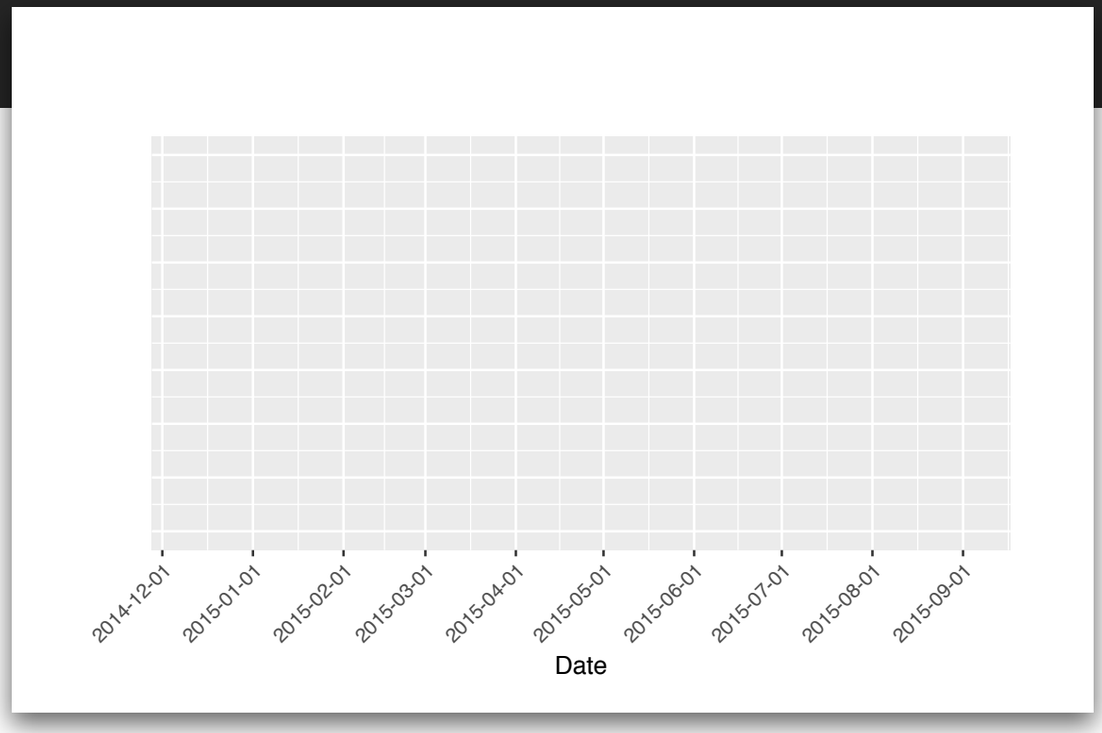

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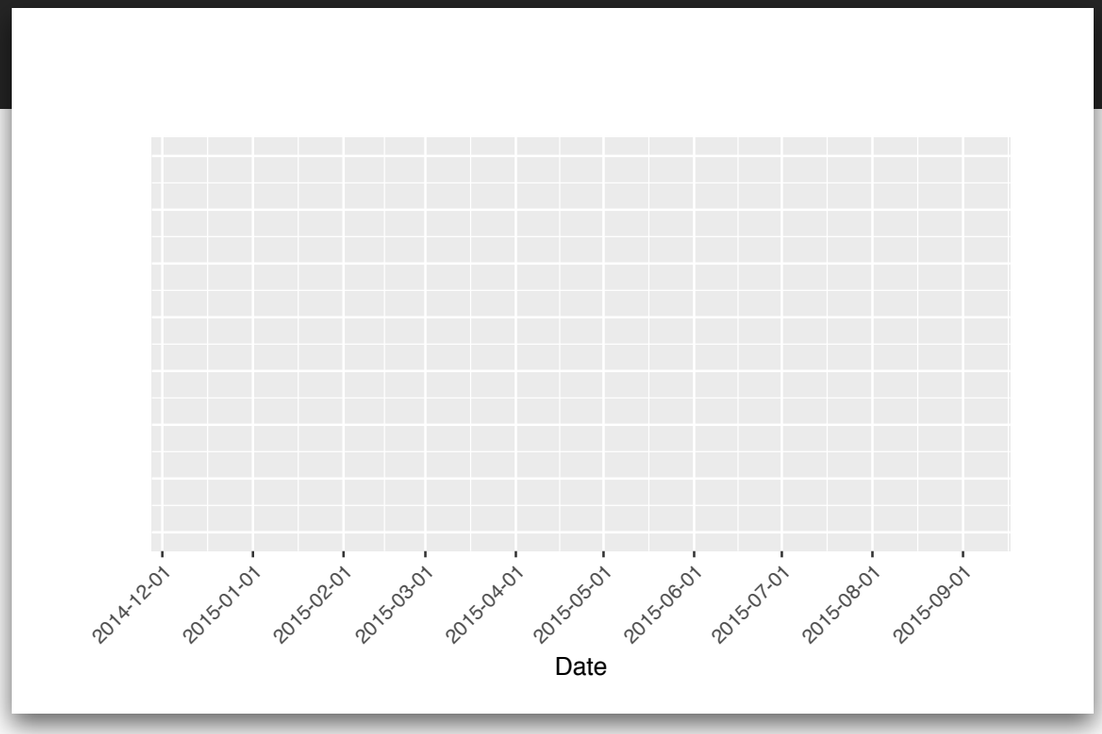
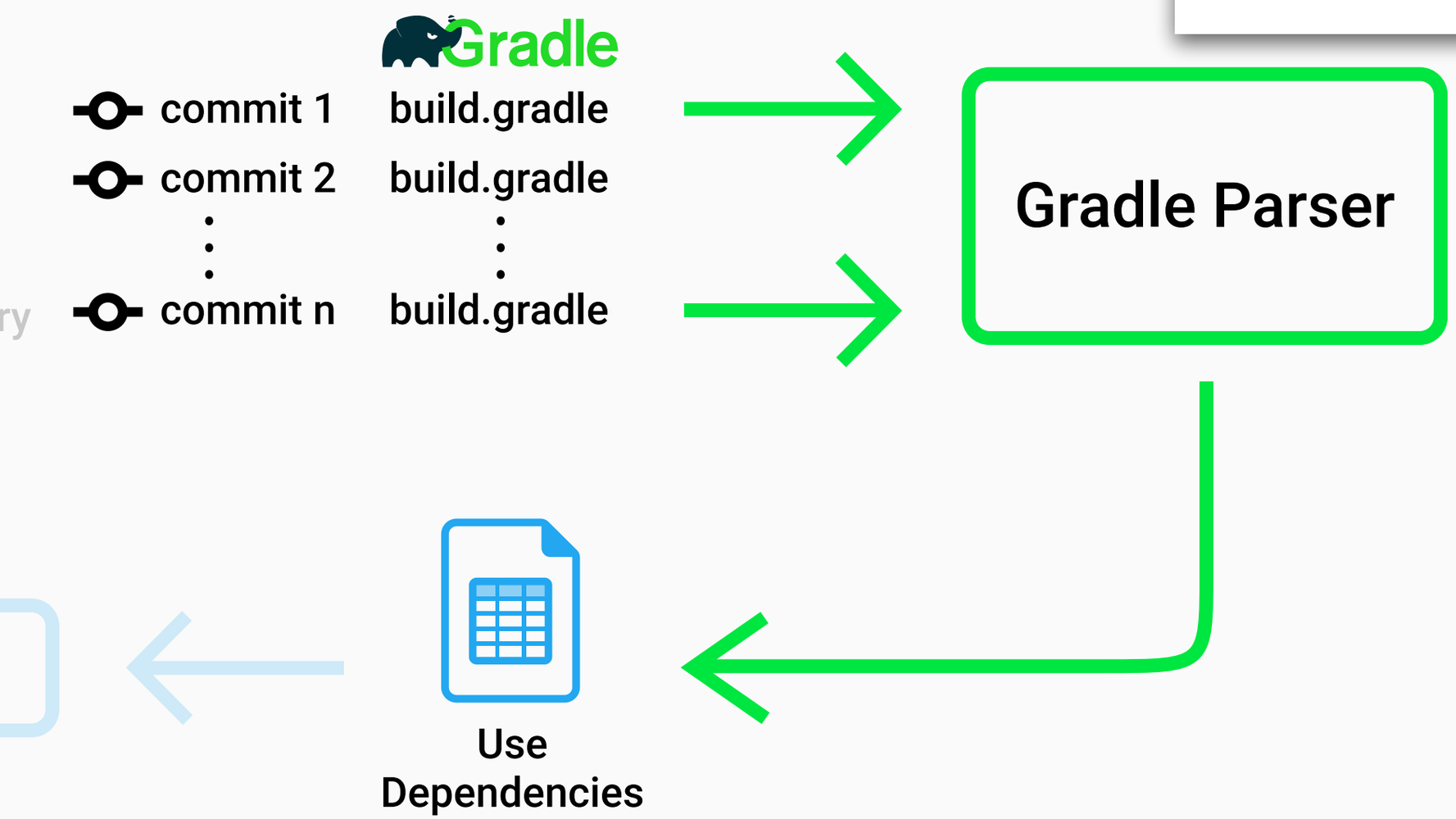


Gradle libraries parsing



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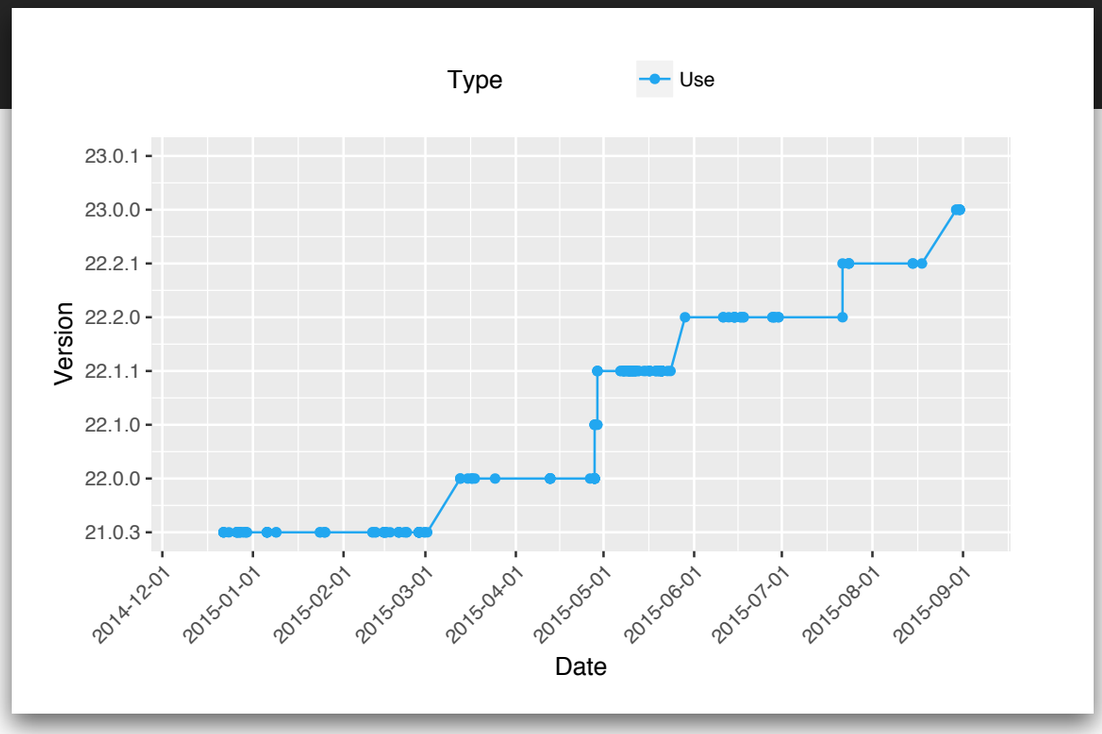

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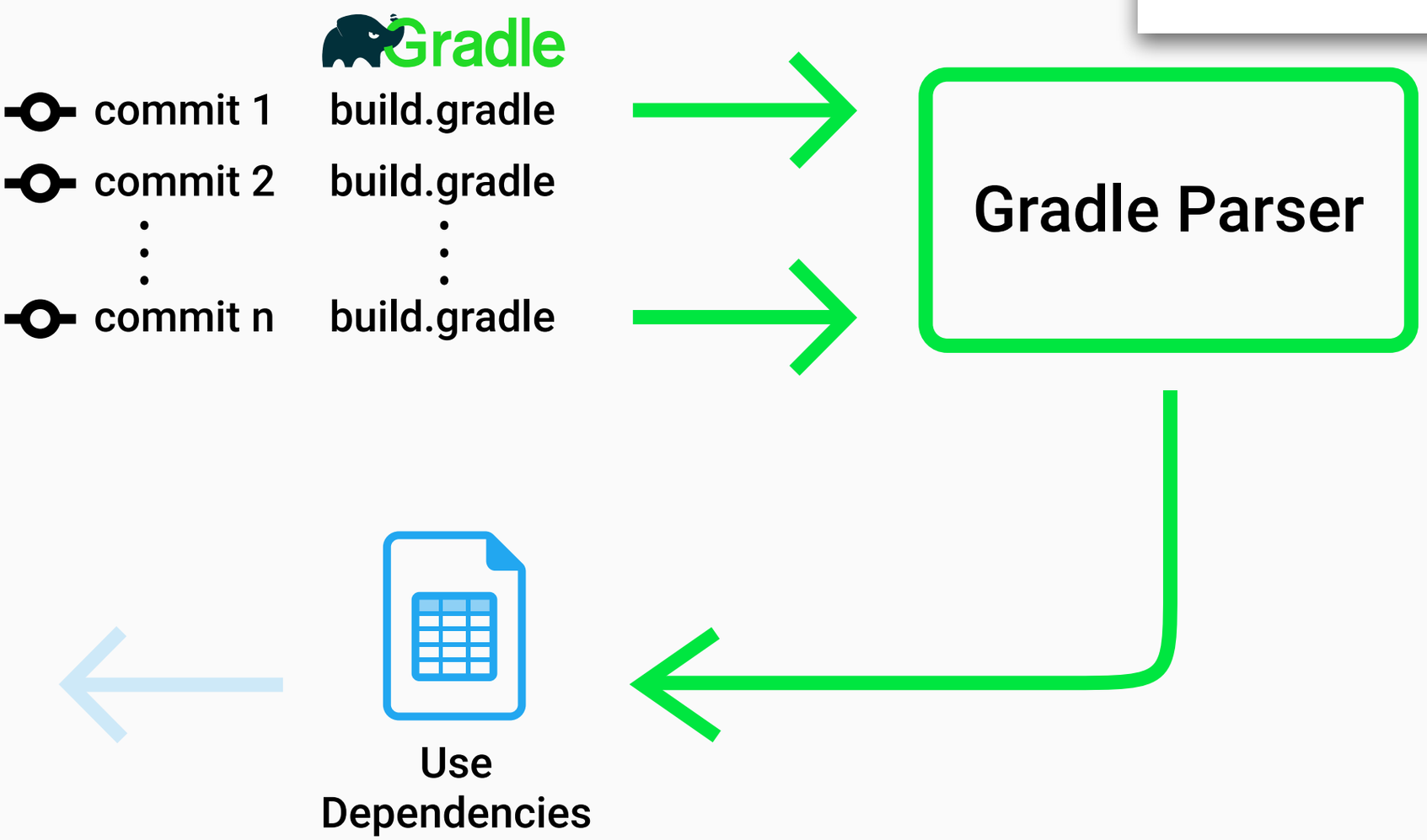

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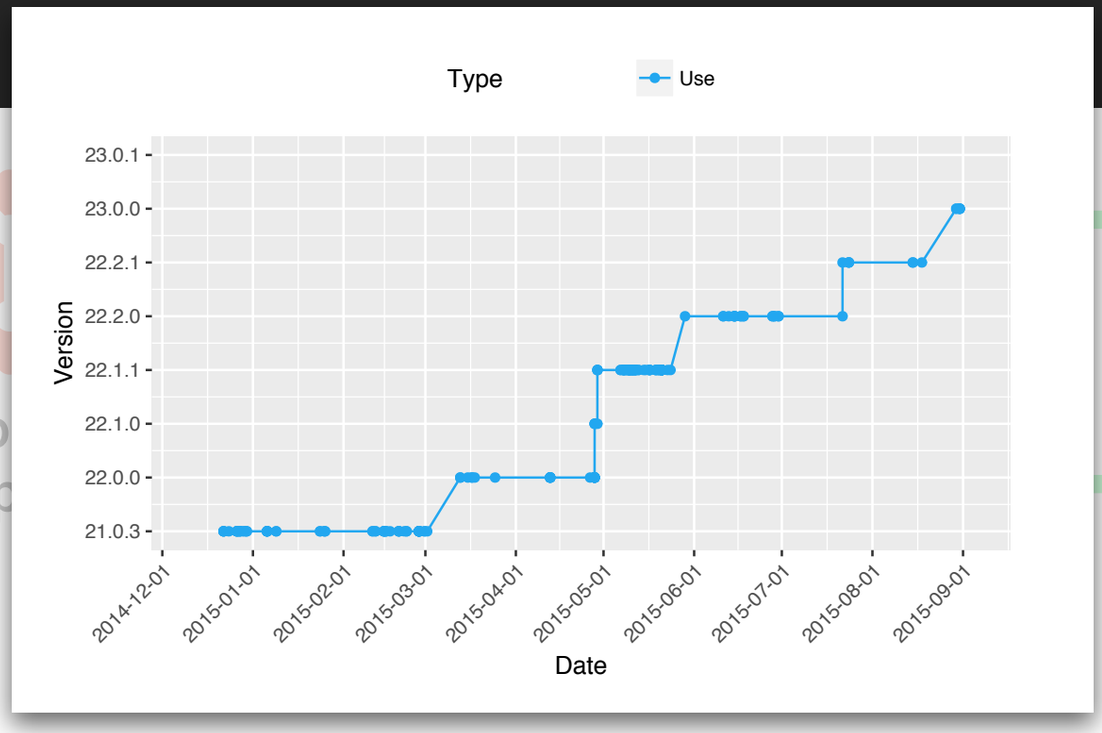

Git Cloner

Dependencies mining

Release Miner

Release Dependencies

Use Dependencies

Maven

JFrog Bintray

Remote Dependencies Repositories

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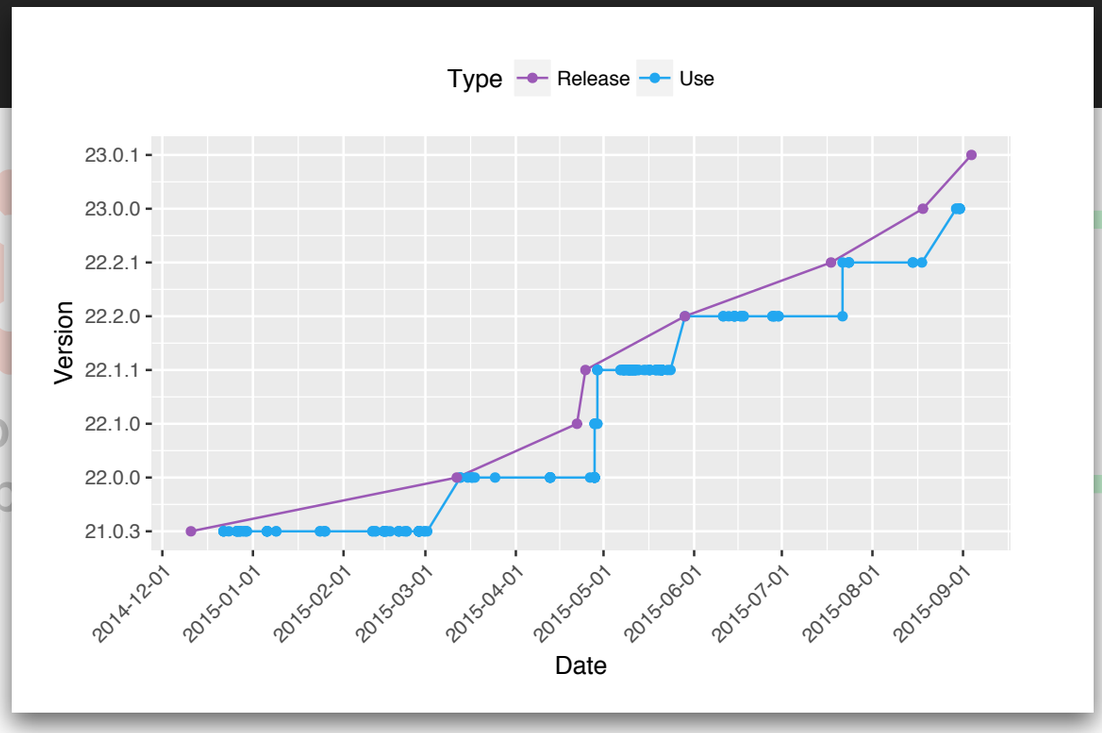

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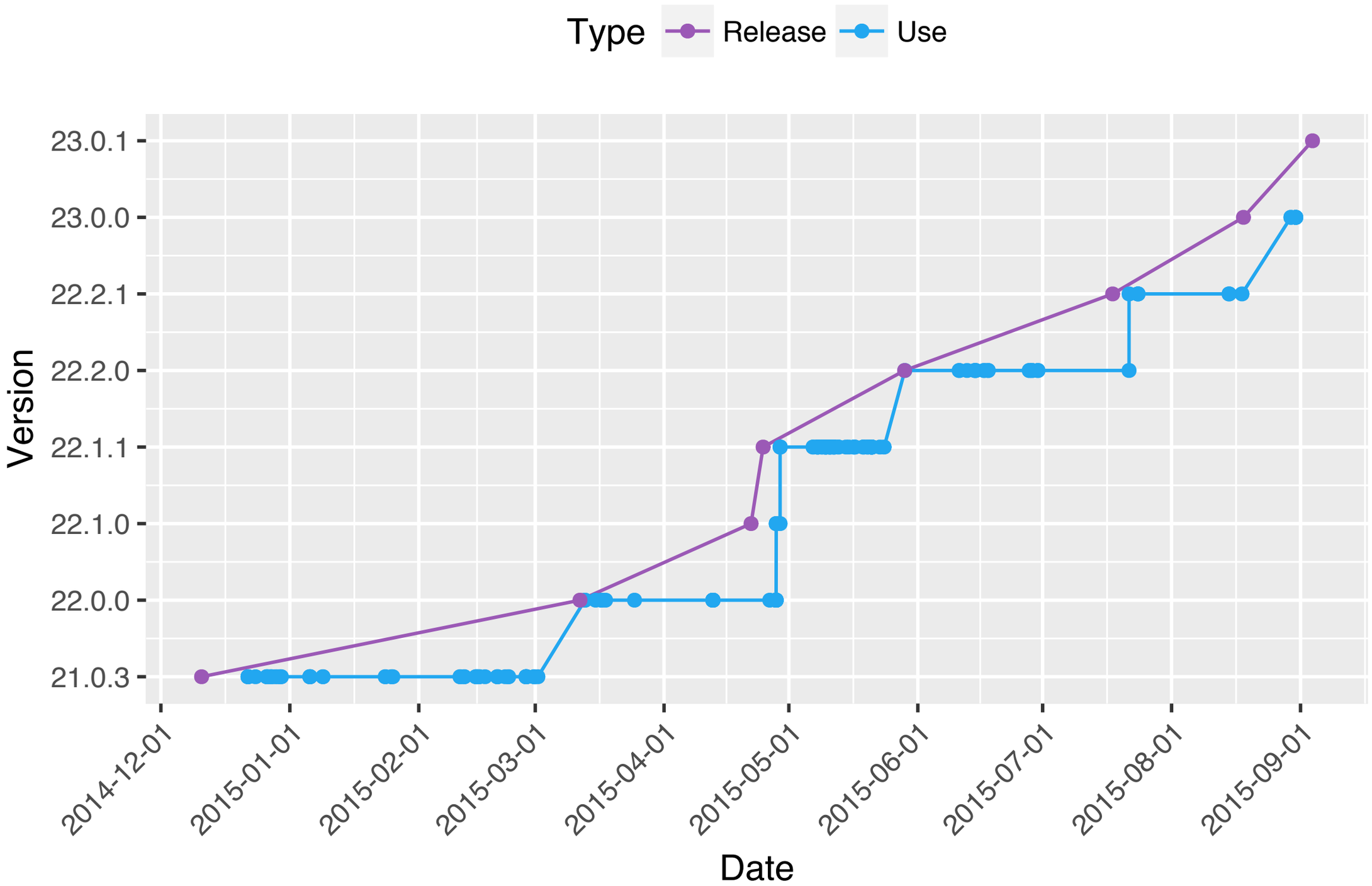


Libraries popularity

The apps relies from 1 use of third-party library to a maximum of 44

The mean is about 4 libraries per app

RQ1

When do mobile developers update third-party libraries?

RQ1.1

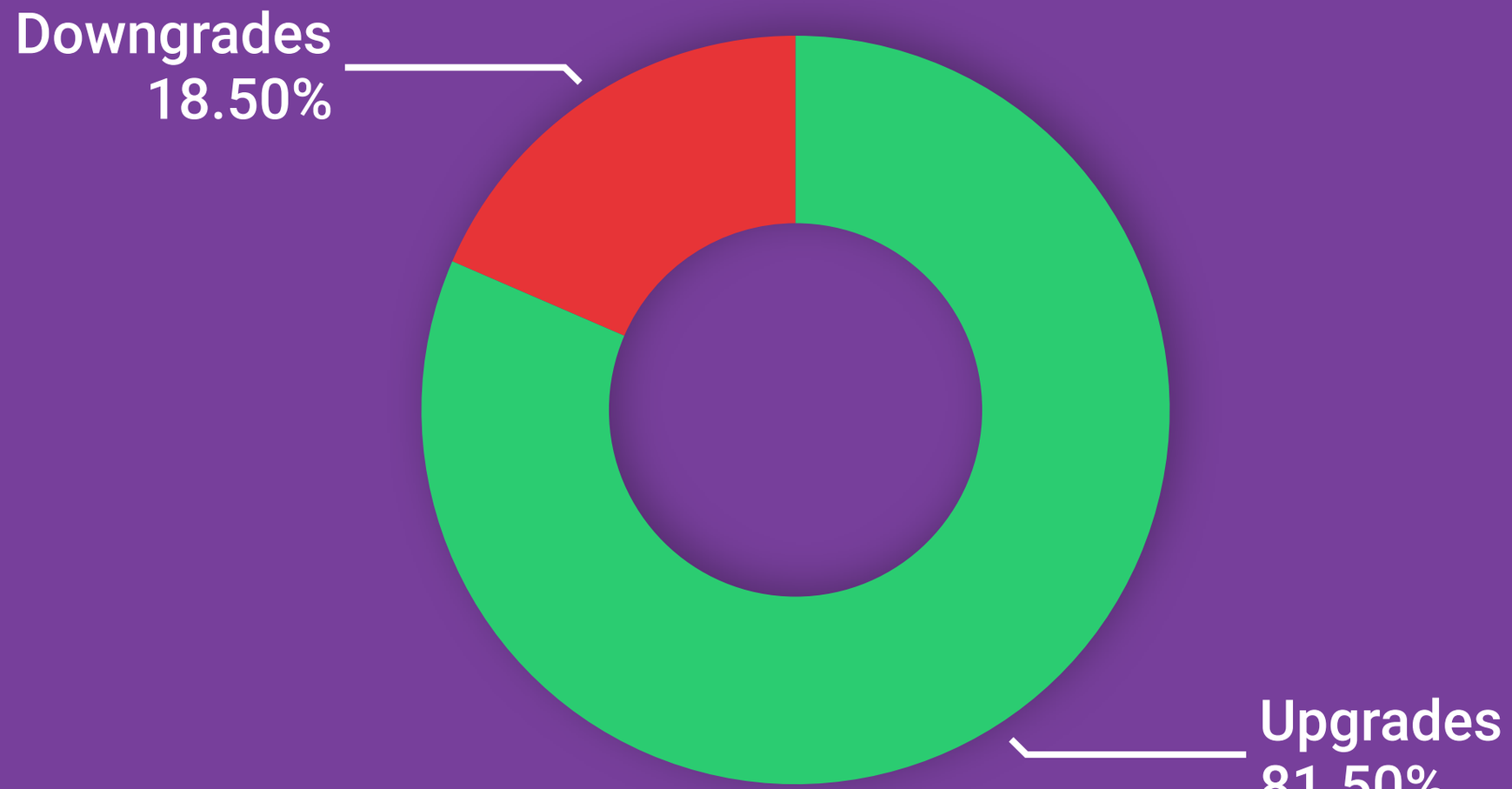
Do mobile developers update third-party libraries?

To update, or not to update

70% of libraries were used but never updated during the app development life

Only 1% of commits refers to a version change

Upgrade vs downgrade



Upgrade vs downgrade

Downgrades
18.50%

Anyone, any idea why the build fails […] does maven need to be updated too?!

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RQ1.2

How does the technical lag[1] of mobile apps vary over time?

[1]Zerouali, Ahmed, et al. "A formal framework for measuring technical lag in component repositories—and its application to npm." Wiley JSEP (2019).

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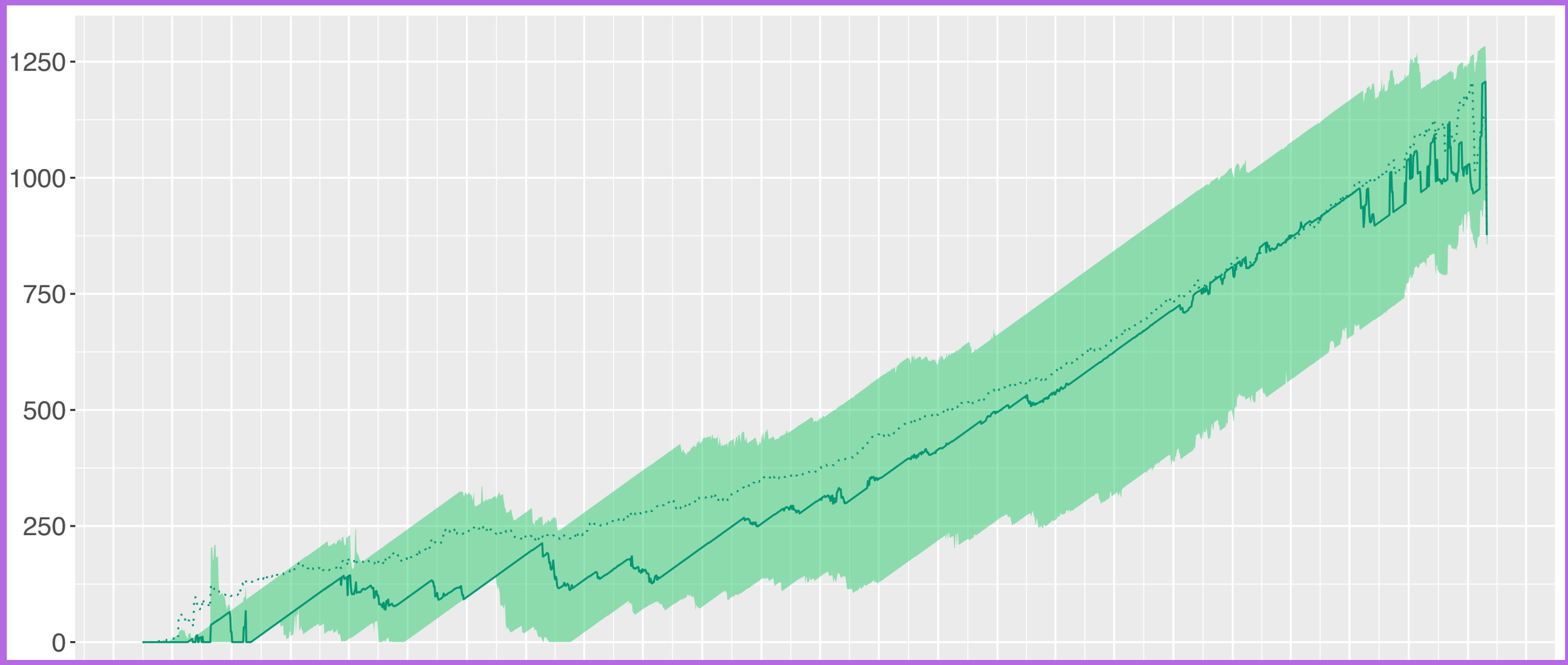
Technical Lag



The evolution seems to be worse with respect to what Zerouali et al. found in the npm package dependency network.

RQ2

How do developers update third-party libraries?

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RQ2.1

What types of third-party library uses are more prone to be updated?

RQ2.2

What types of third-party library uses are generally not updated?

Changed categories

Category	Changes	Upgrades	Downgrades
Graphical User Interface	7313	5923	1390
Frameworks	624	516	108
Networking	246	204	42
Cloud	196	142	54
Parsers	177	150	27
...	...	...	...
Sensors	9	9	0
Maintenance	8	8	0
Gaming	5	4	1
Templating	1	1	0

Changed categories

Update com.android.recyclerview-v7 to get new fancy icons.

Category		Upgrades	Downgrades
Graphical User Interface	[illegible]	5923	1390
Frameworks	624	516	108
Networking	246	204	42
Cloud	196	142	54
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Update com.android.recyclerview-v7 to get new fancy icons.

Update android.support to have an environment equivalent to the android platform.

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My 2 cents. This is an extreme case, and it doesn't justify the upgrade of the library.

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Update com.android.recyclerview-v7 to get new fancy icons.

Update android.support to have an environment equivalent to the android platform.

My 2 cents. This is an extreme case, and it doesn't justify the upgrade of the library.

This would require more changes to the Squeezer code, so I don't recommend working from that.

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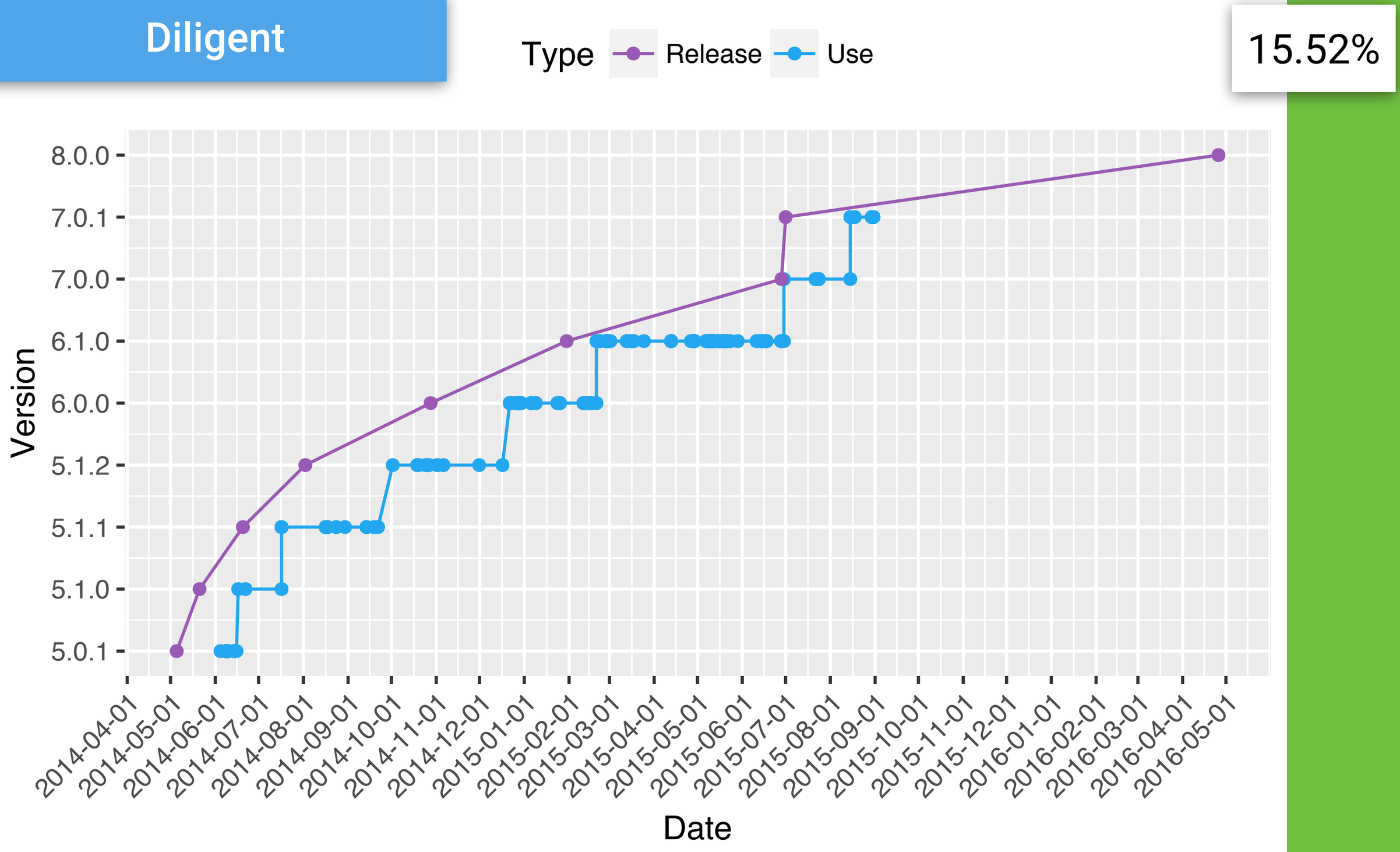
RQ2.3

What types of update patterns developers follow when updating third-party libraries?

Open coding process

We distributed a total of 11,626 library histories to 4 of the authors (2906 each) + 594 libraries also evaluated by one of the authors

Diligent


Type
Release
Use
15.52%
8.0.0
7.0.1
7.0.0
6.1.0
6.0.0
5.1.2
5.1.1
5.1.0
5.0.1
Version
2014-04-01
2014-05-01
2014-06-01
2014-07-01
2014-08-01
2014-09-01
2014-10-01
2014-11-01
2014-12-01
2015-01-01
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2015-07-01
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2015-10-01
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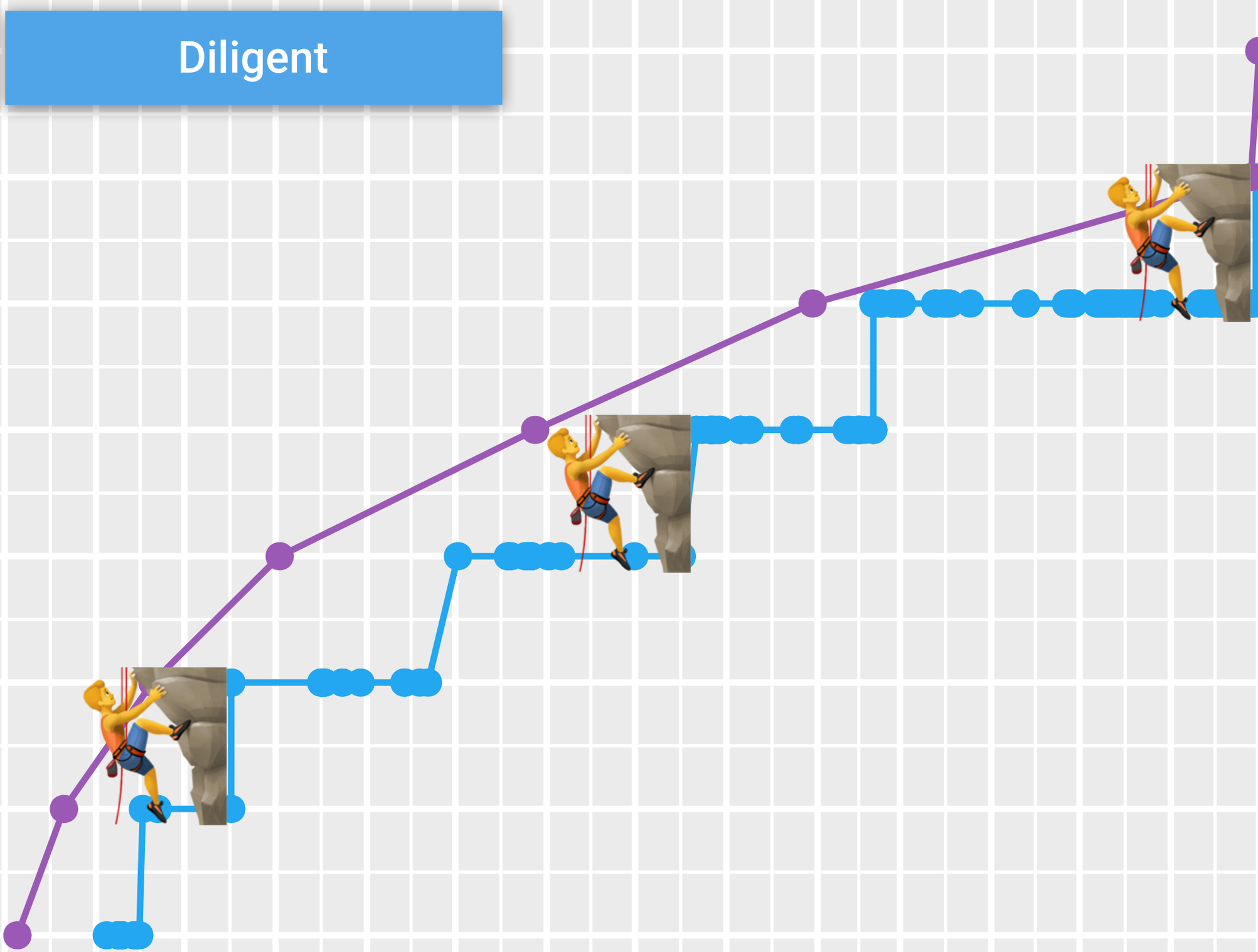
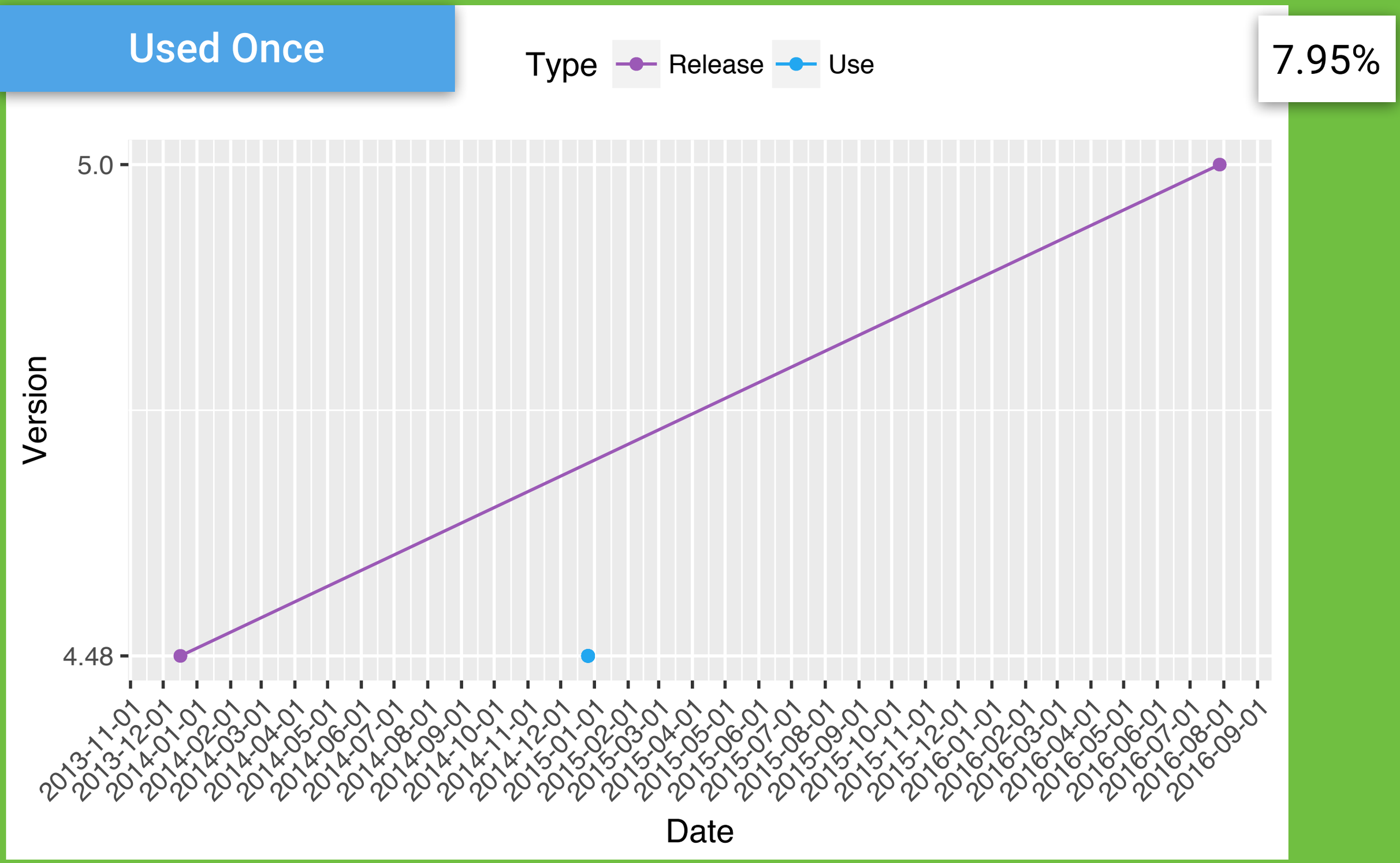
2016-04-01
2016-05-01
Date

Diligent

15.52%



Used Once


Type
Release
Use
7.95%
5.0
4.48
Version
2013-11-01
2013-12-01
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2014-06-01
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2016-02-01
2016-03-01
2016-04-01
2016-05-01
2016-06-01
2016-07-01
2016-08-01
2016-09-01
Date

Used Once

7.95%

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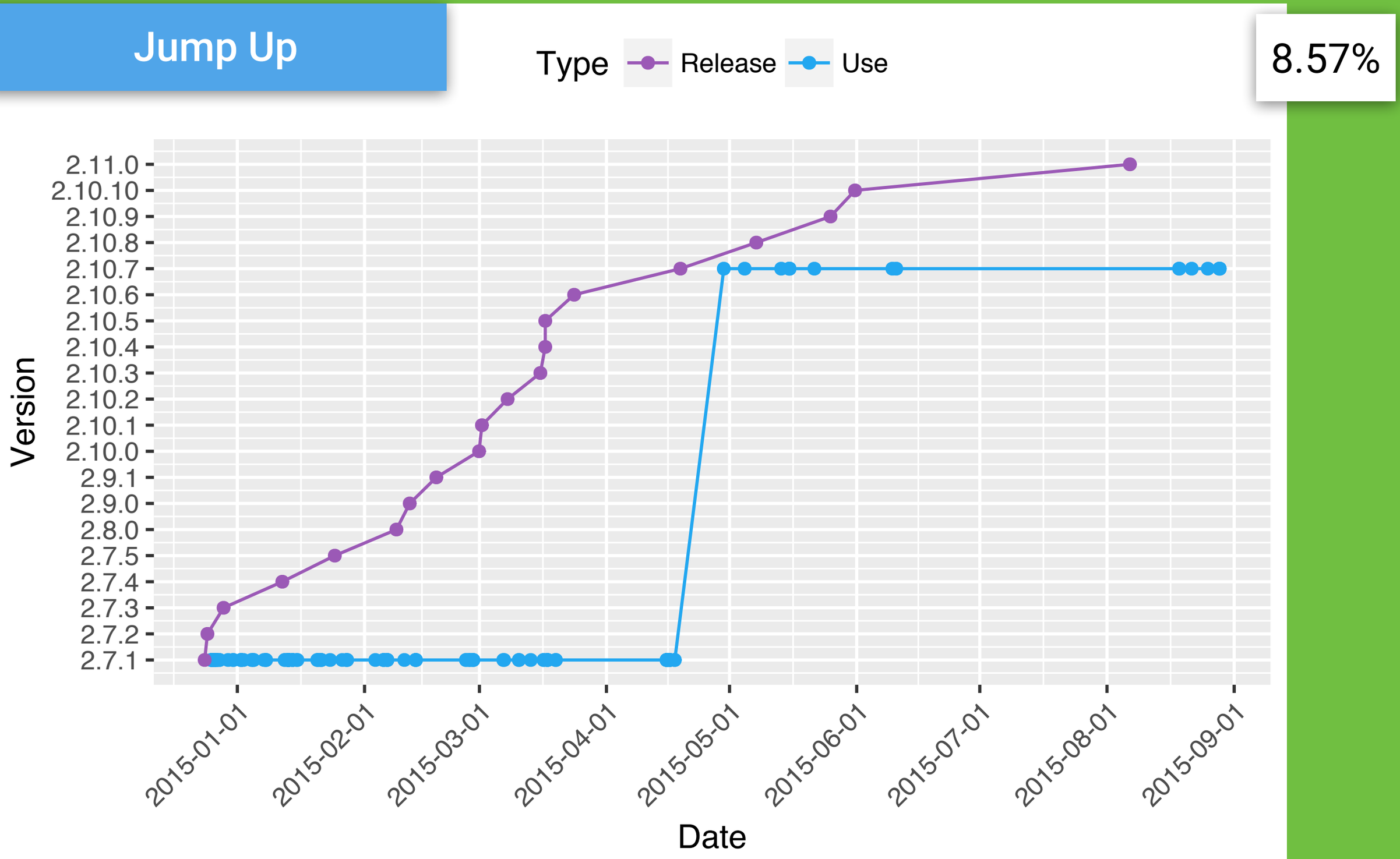
Jump Up



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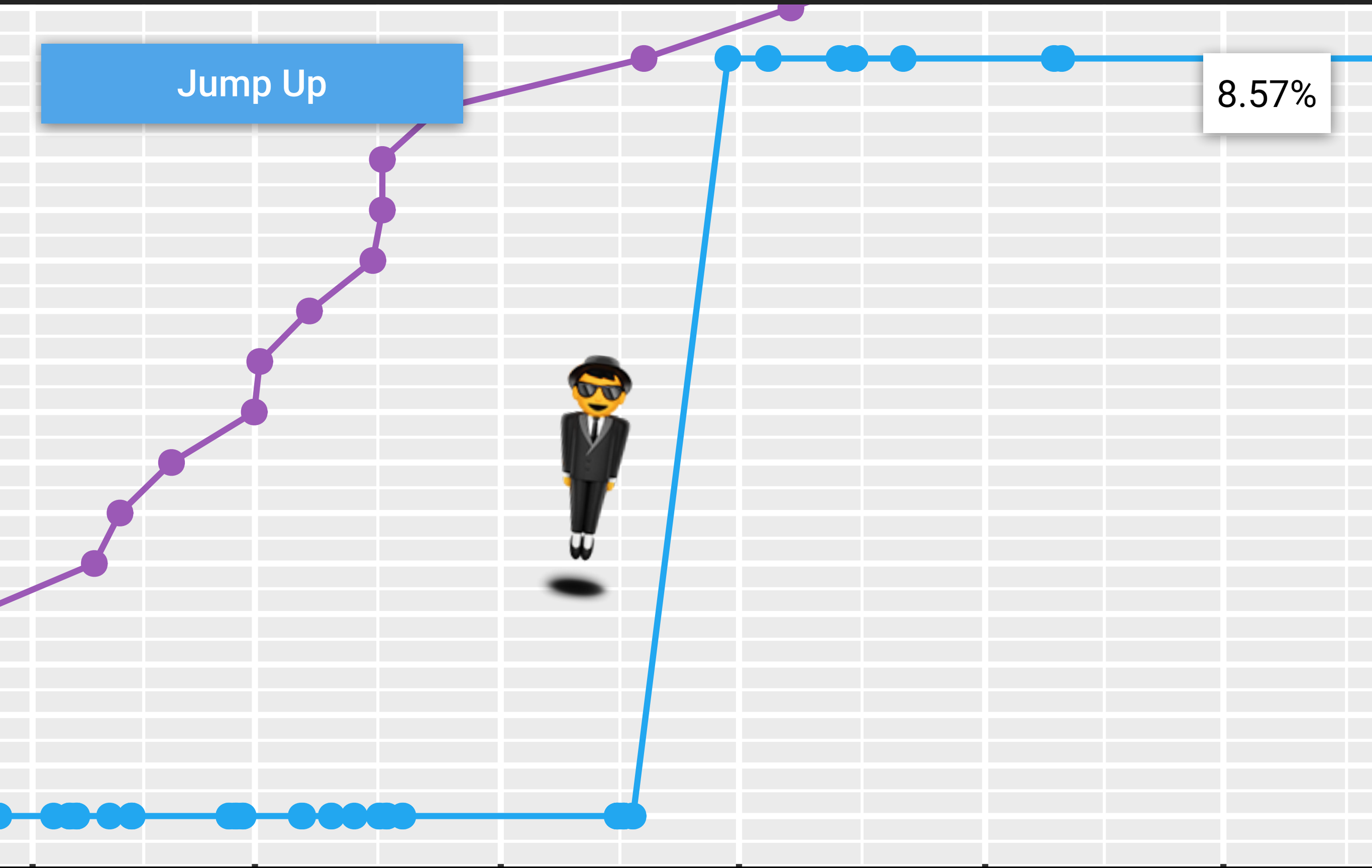

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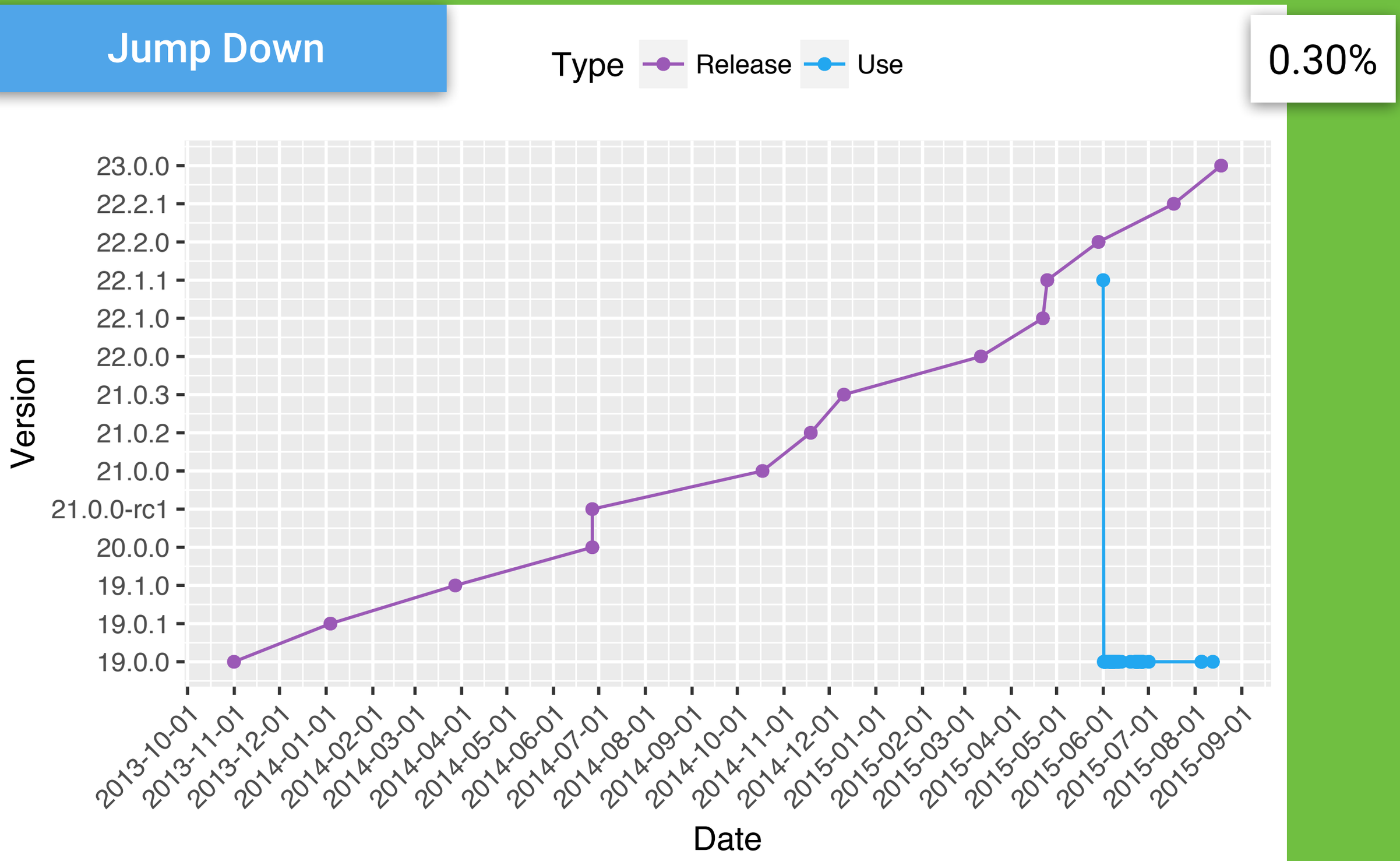
Jump Down



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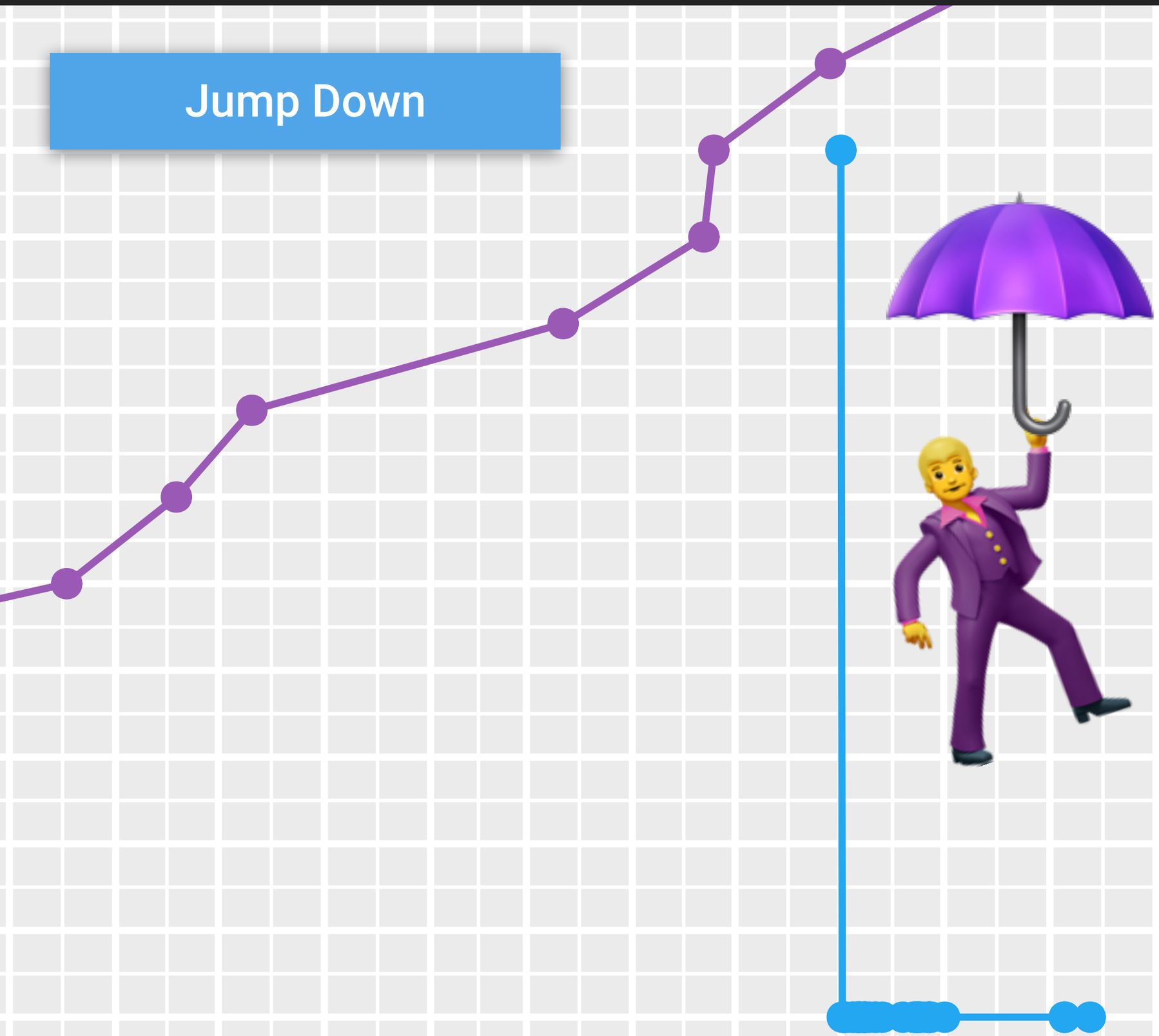
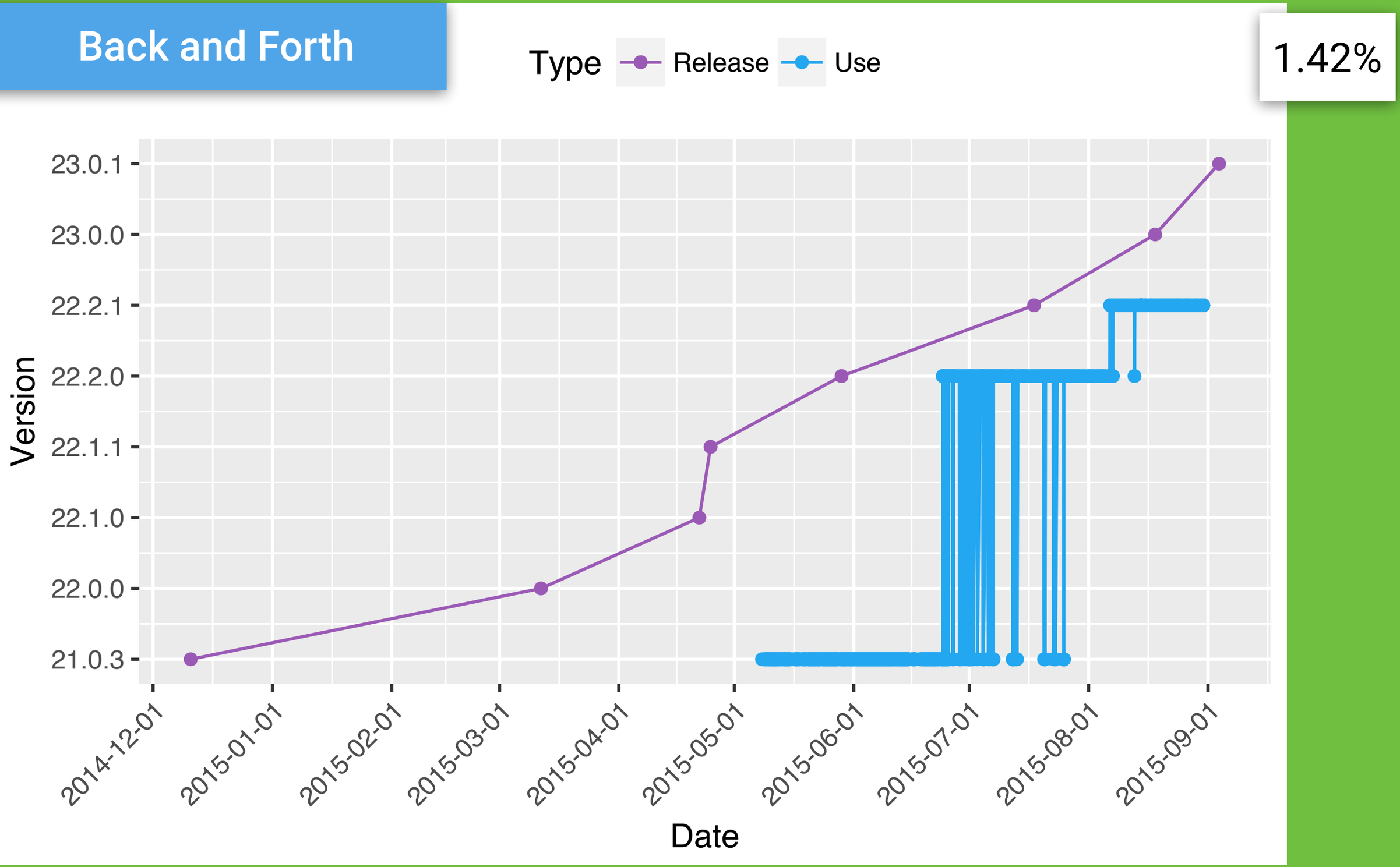
Jump Down

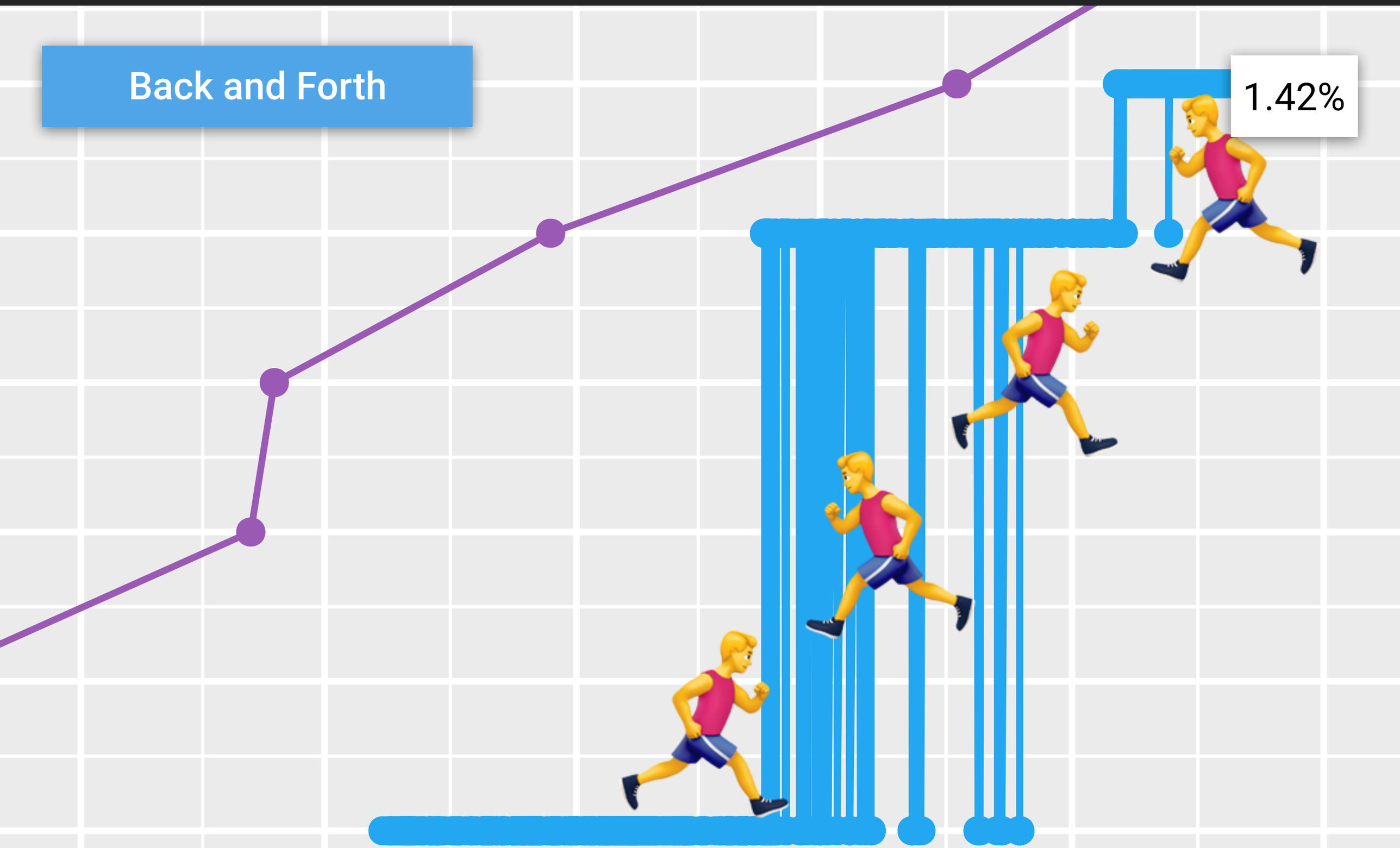


0.30%

Back and Forth



Back and Forth



Never Changed

66.24% of library uses were never changed during the development.

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RQ3

Why do mobile developers update third-party libraries?

High and low rated apps

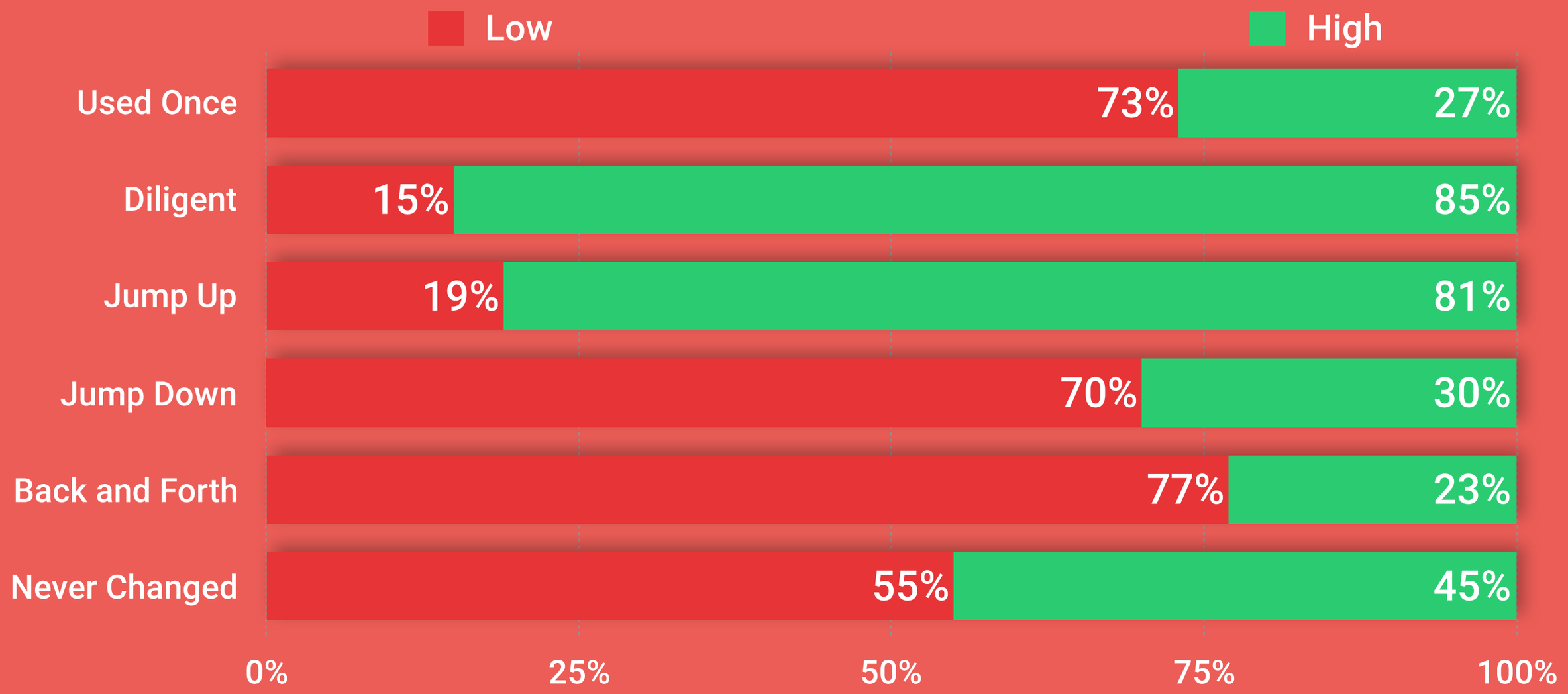
We classified the apps in two groups based on ratings

High rated: ≥ 3.5 ⭐

Low rated: < 3.5 ⭐

Khalid, Hammad, et al. "What do mobile app users complain about?." IEEE Software (2014): 70-77.

High and low rated apps



Developers Recruitment

Developers of the 2,752 Android apps with at least 5 commits

1,622 original developers

73 answers (4.5% response rate)

RQ3.1

Do developers frequently make use of third-party libraries when developing apps?

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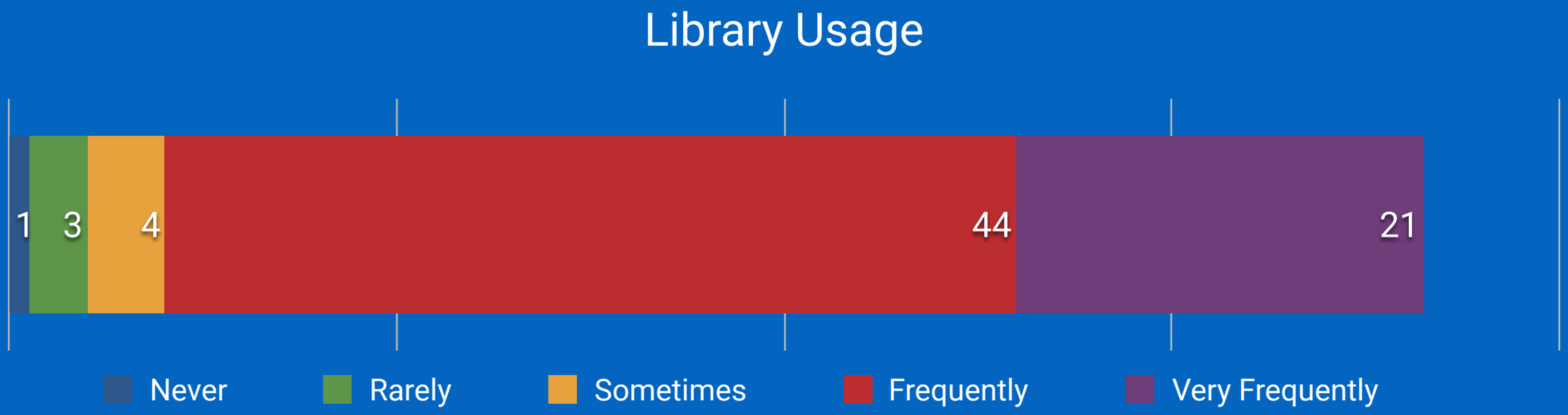

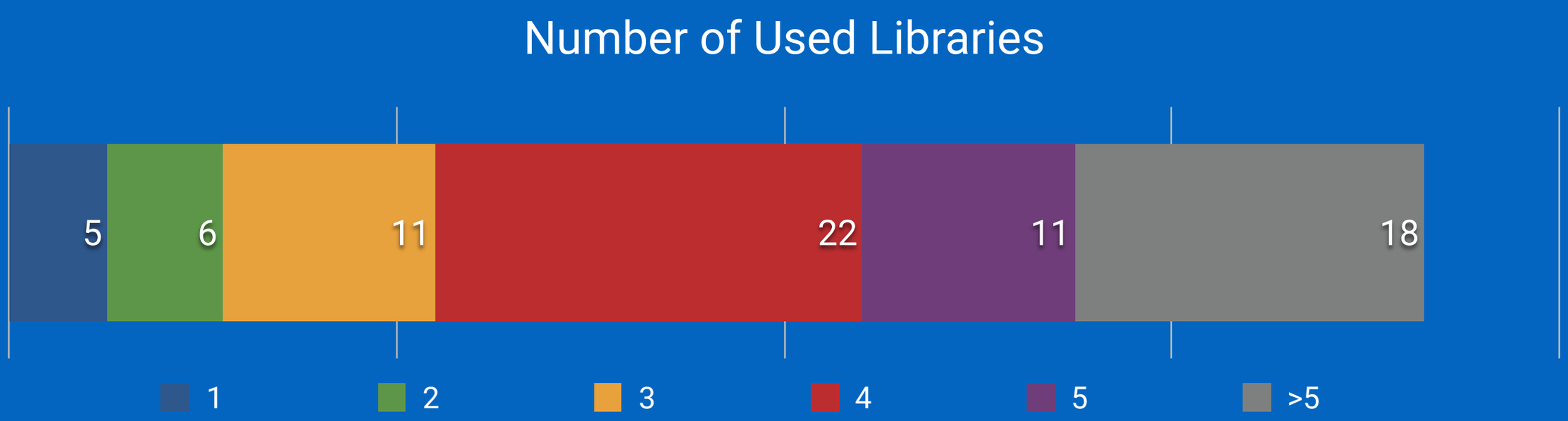

RQ3.2

What is the rationale behind the decisions of mobile developers when updating the third-Party libraries they use for their apps?

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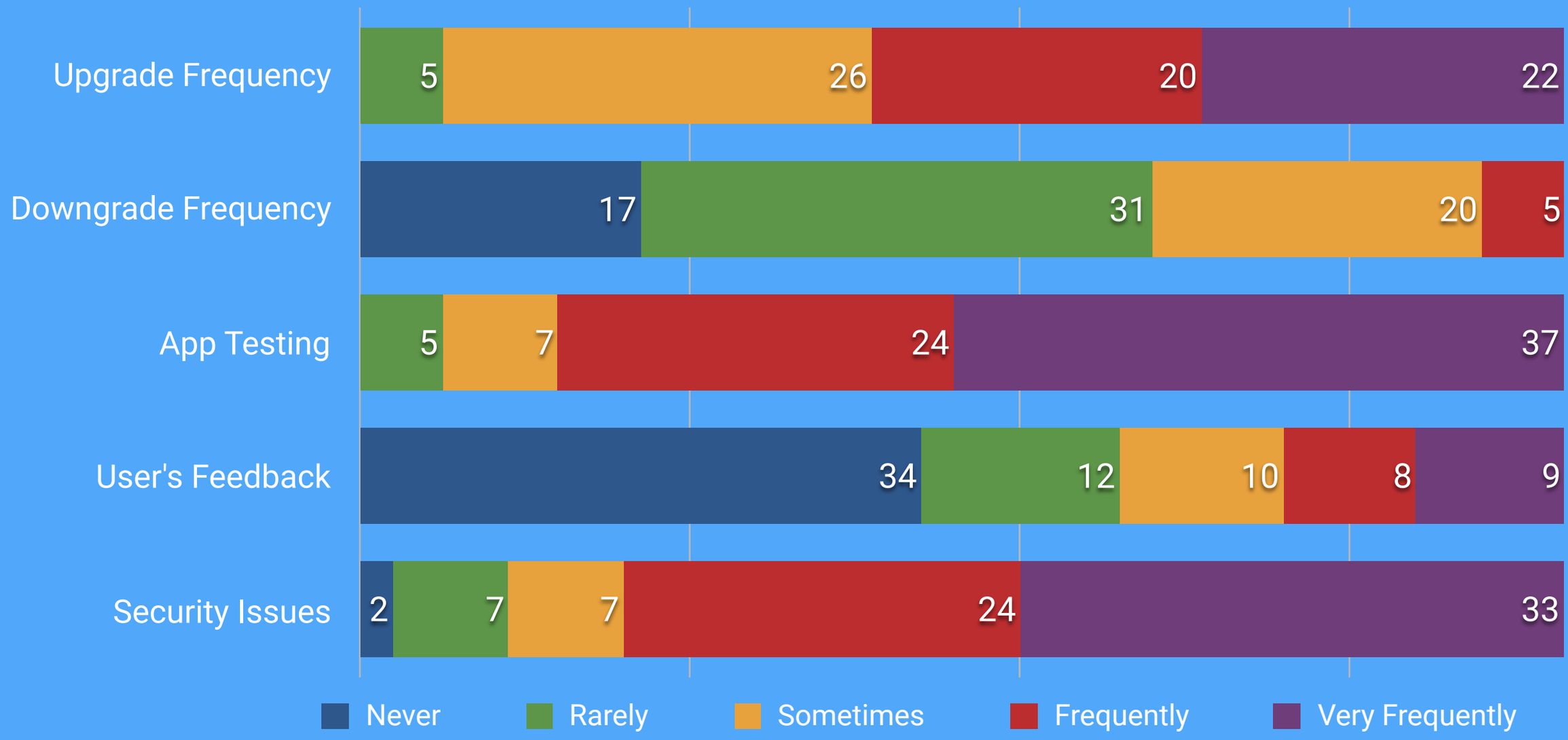

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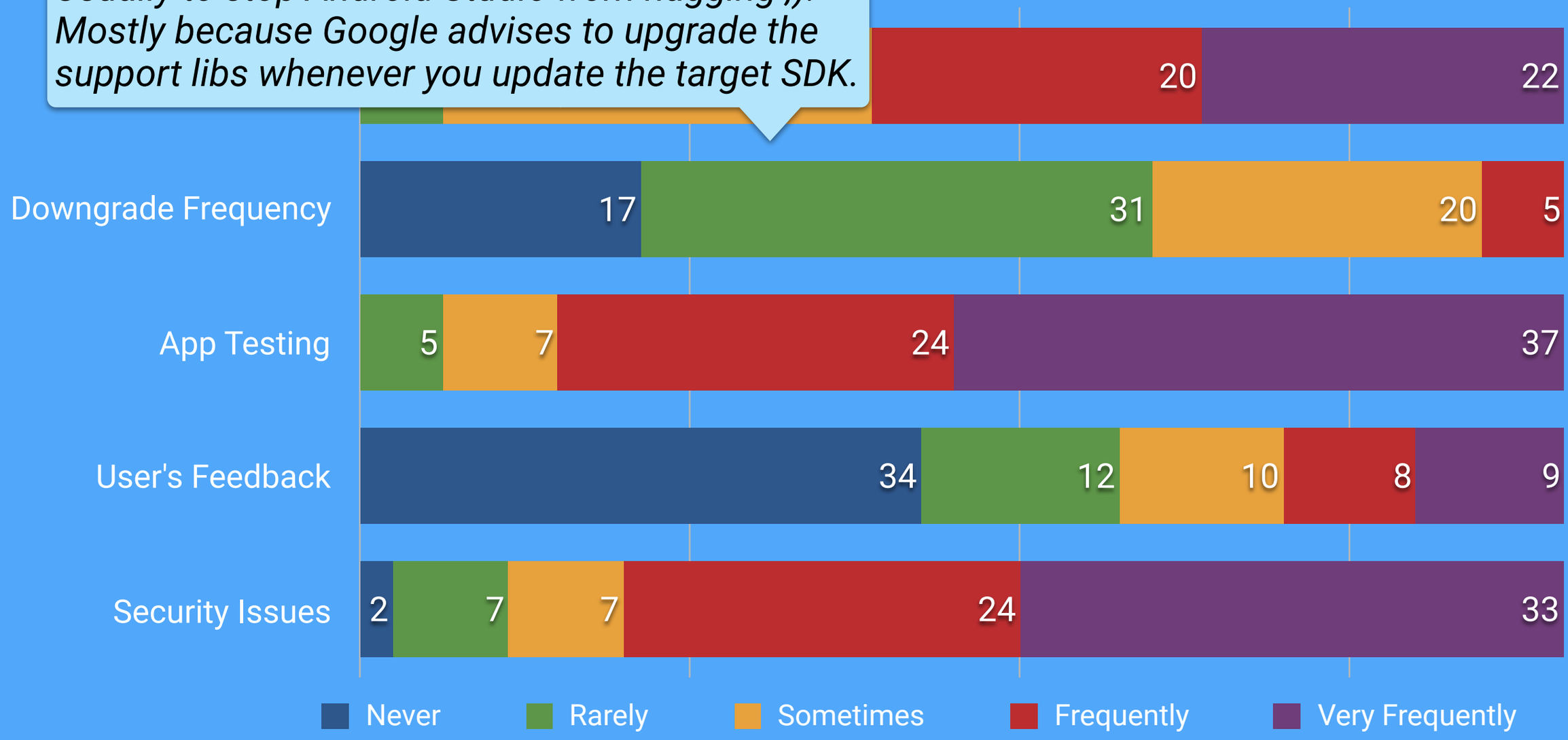
Usually to stop Android Studio from nagging ;). Mostly because Google advises to upgrade the support libs whenever you update the target SDK.



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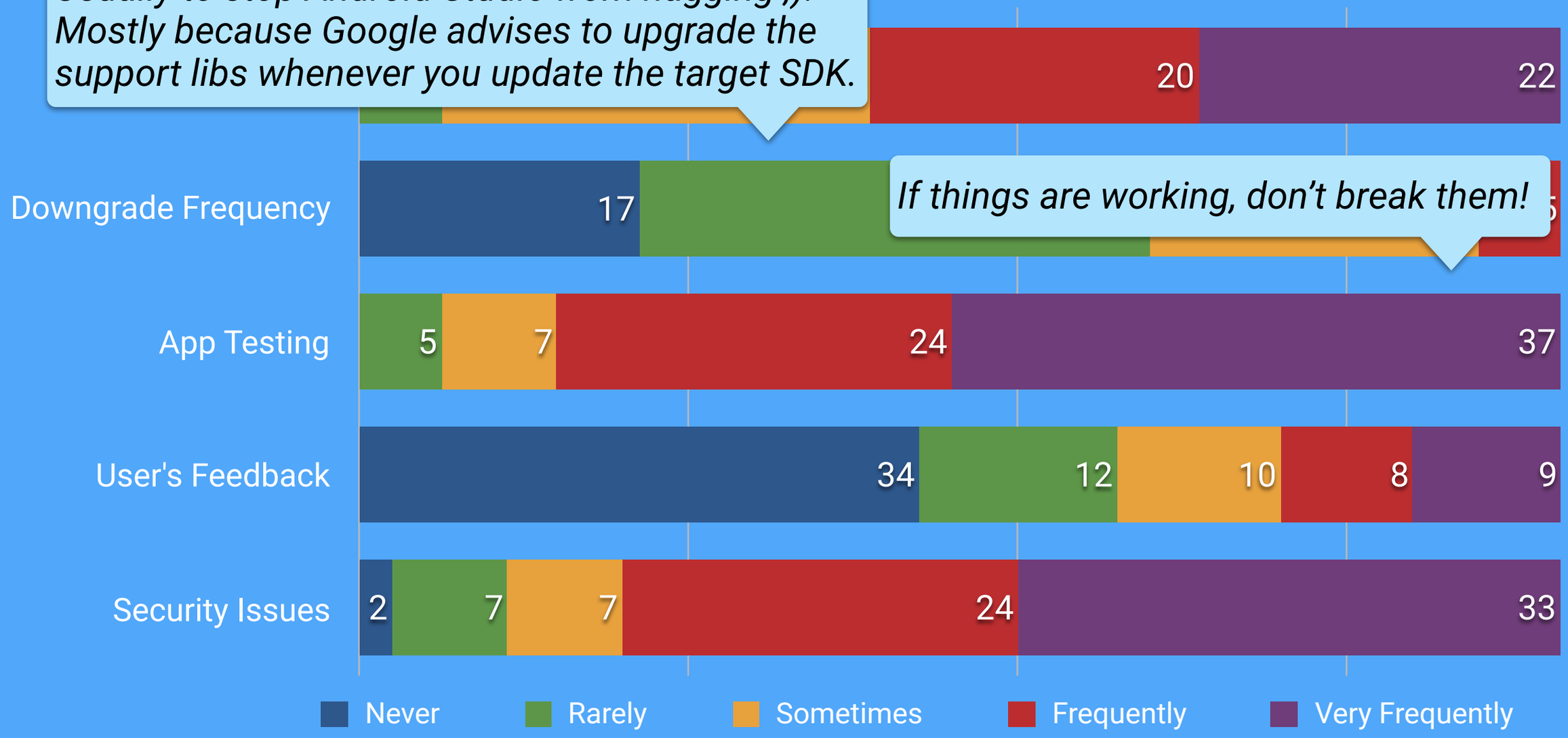
If things are working, don't break them!



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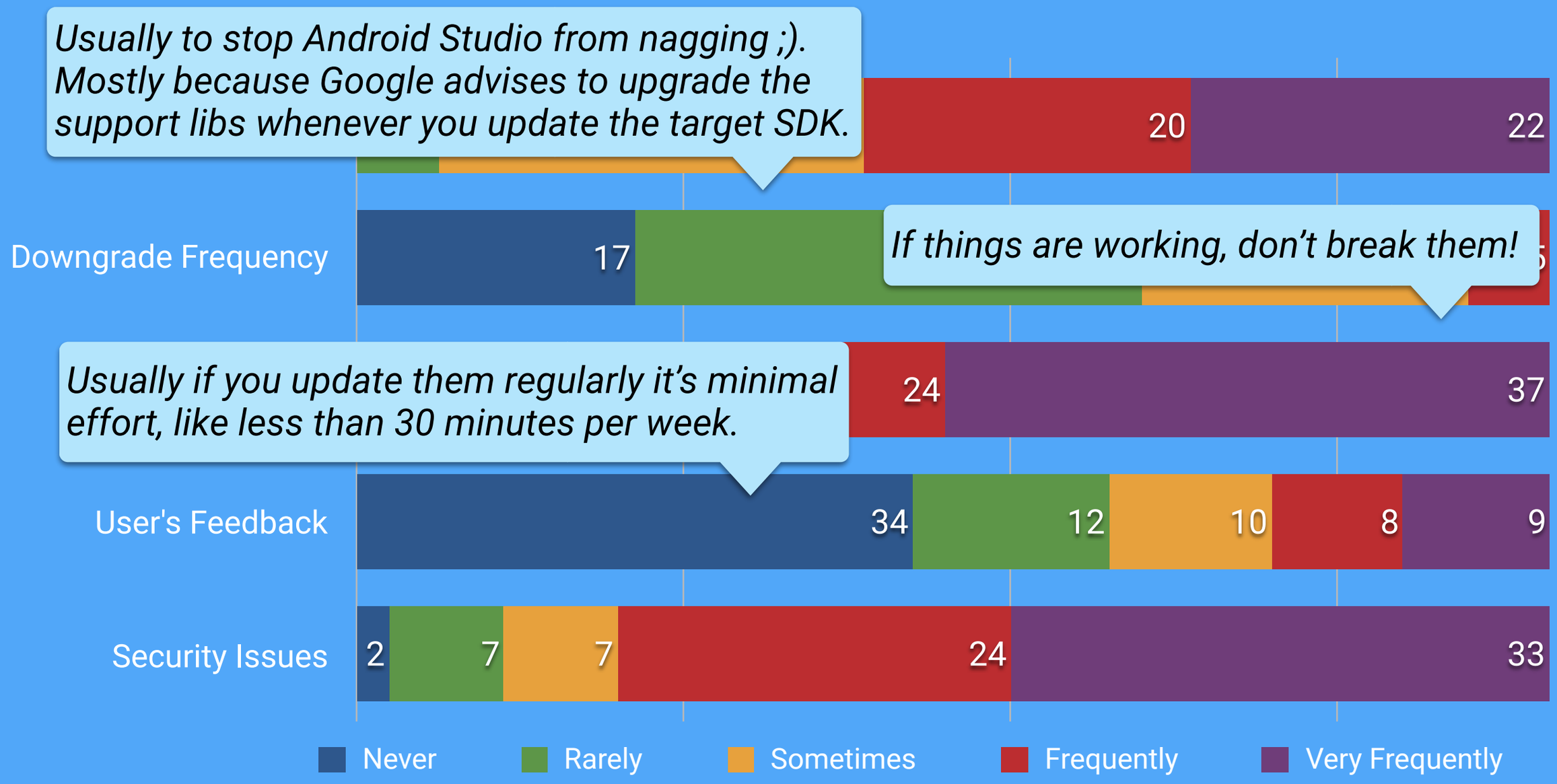
If things are working, don't break them!

Usually if you update them regularly it's minimal effort, like less than 30 minutes per week.



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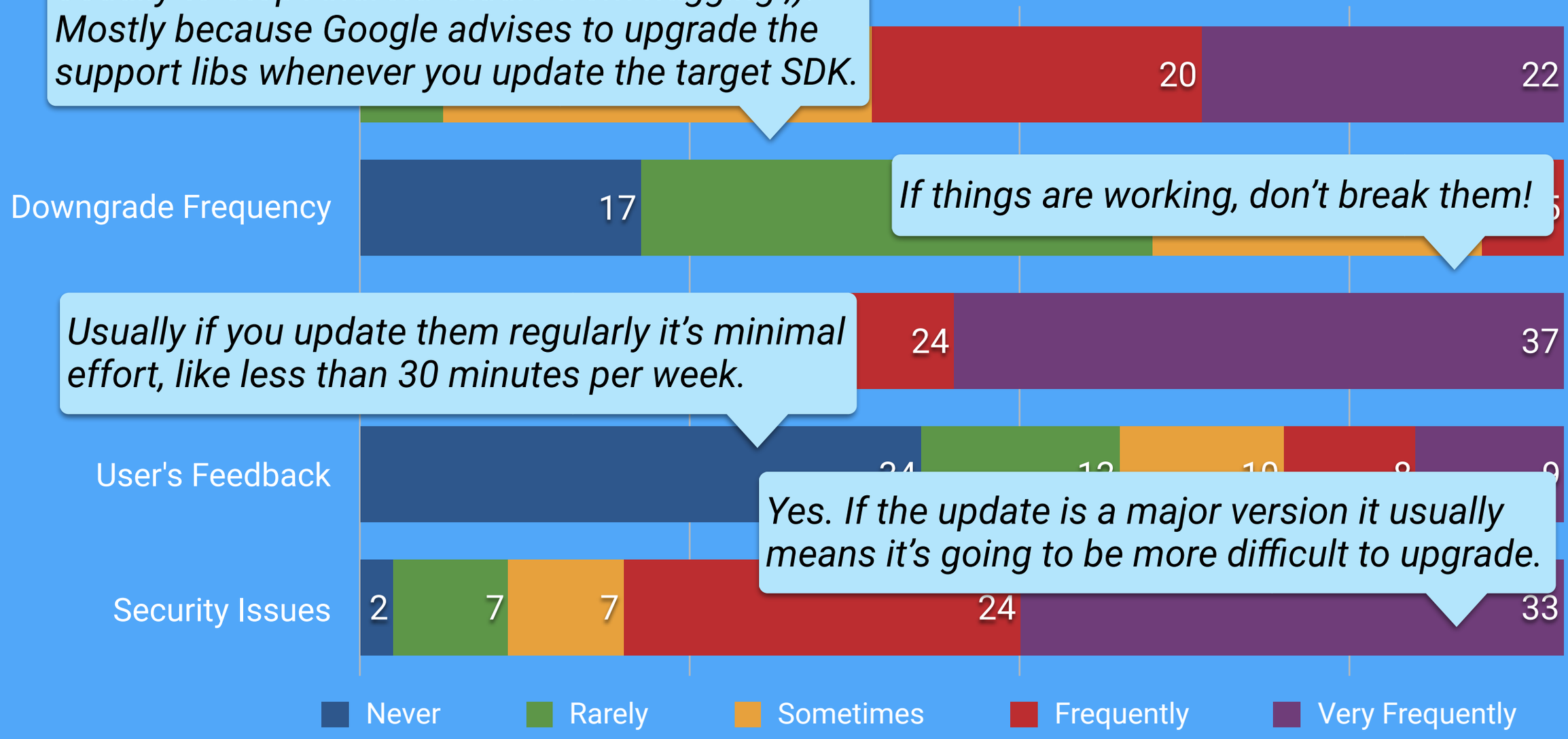
If things are working, don't break them!

Usually if you update them regularly it's minimal effort, like less than 30 minutes per week.

Yes. If the update is a major version it usually means it's going to be more difficult to upgrade.



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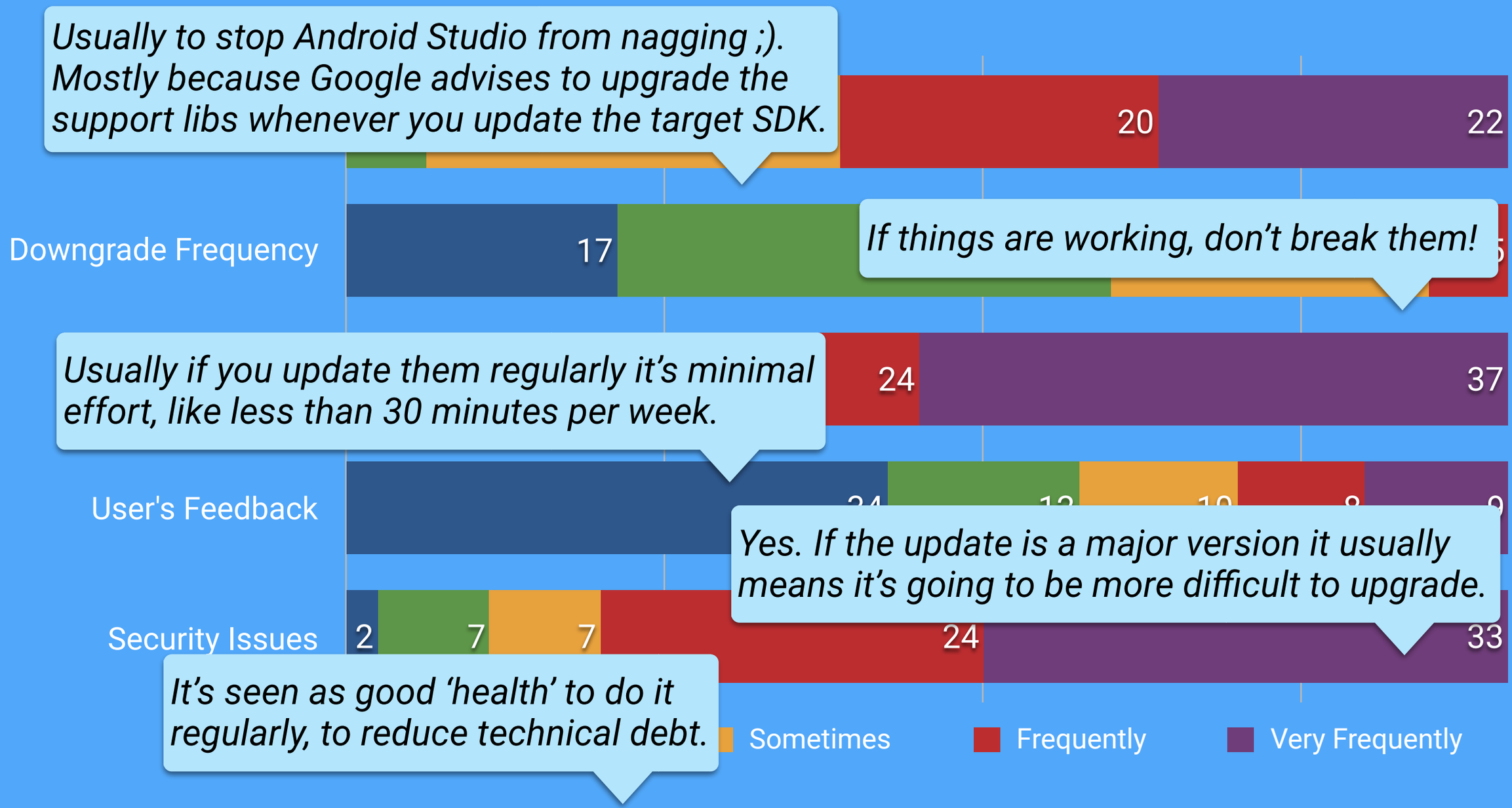
Usually to stop Android Studio from nagging ;). Mostly because Google advises to upgrade the support libs whenever you update the target SDK.

If things are working, don't break them!

Usually if you update them regularly it's minimal effort, like less than 30 minutes per week.

Yes. If the update is a major version it usually means it's going to be more difficult to upgrade.

It's seen as good 'health' to do it regularly, to reduce technical debt.



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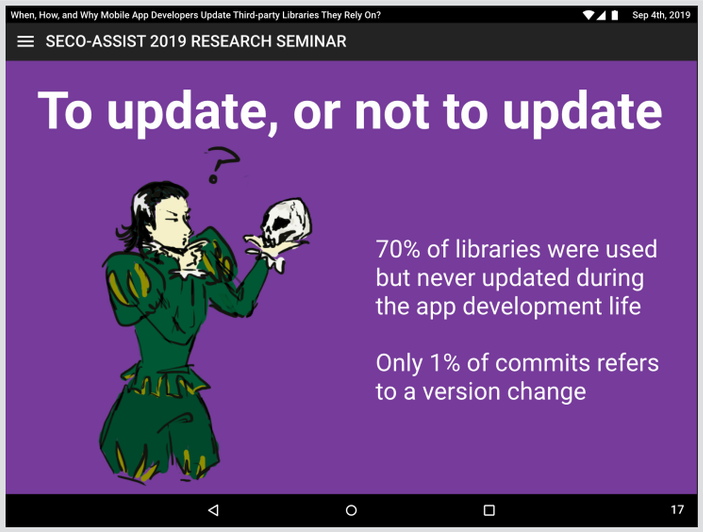

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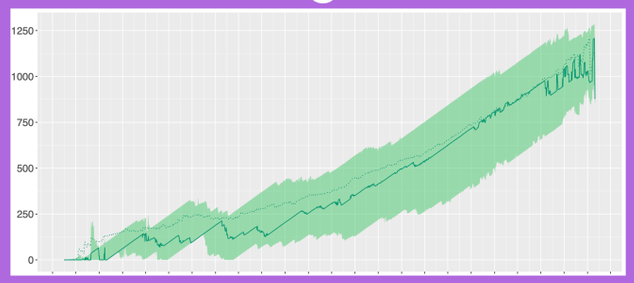

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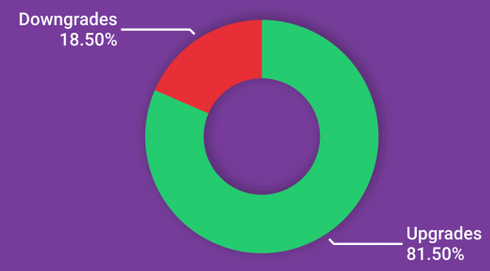

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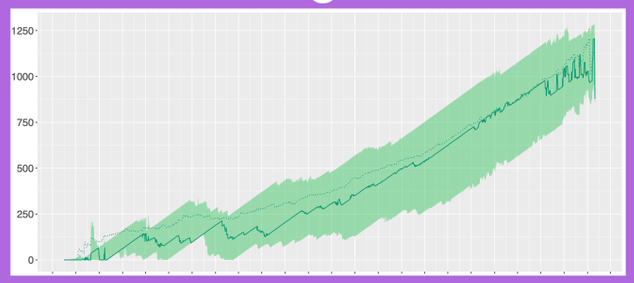

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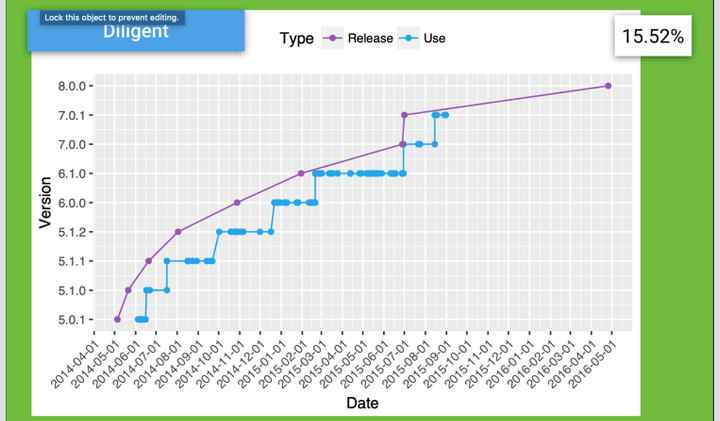

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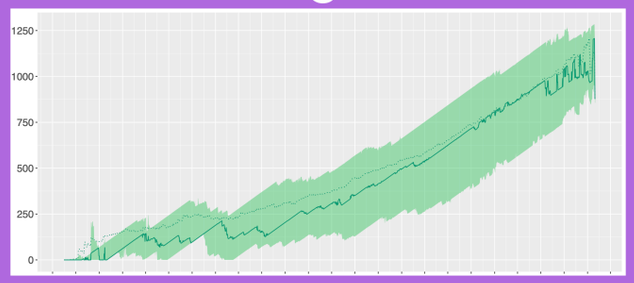

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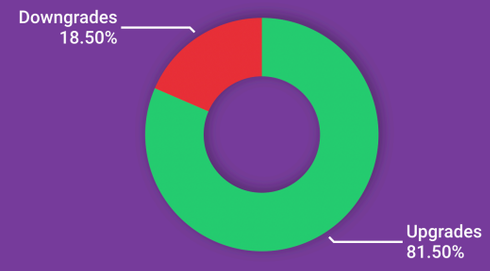

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Lock this object to prevent editing.

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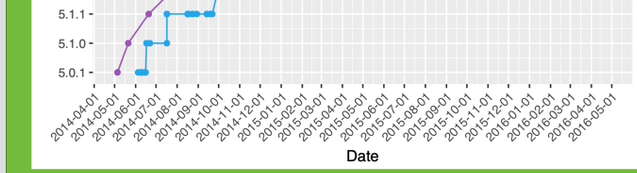
15.52%



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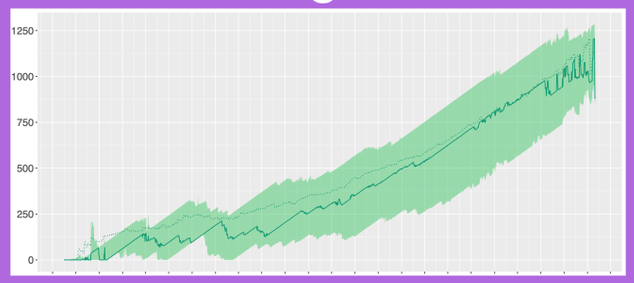

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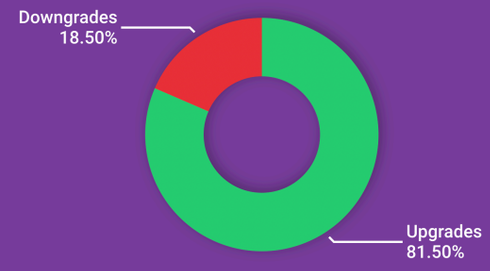

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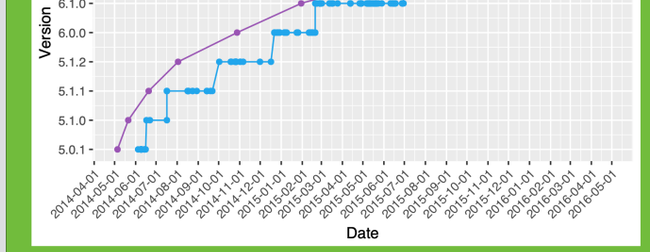

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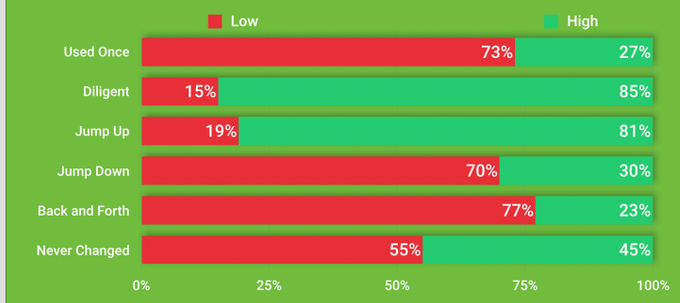

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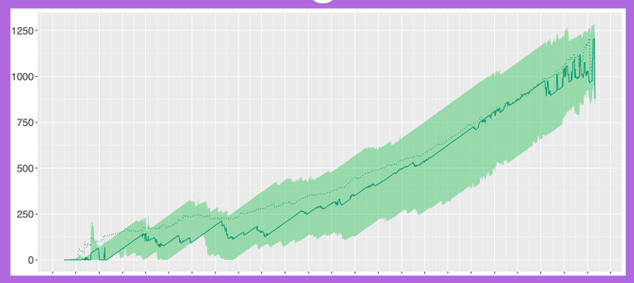

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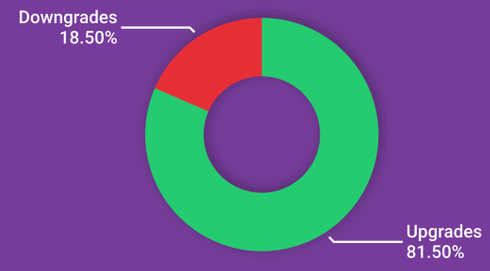

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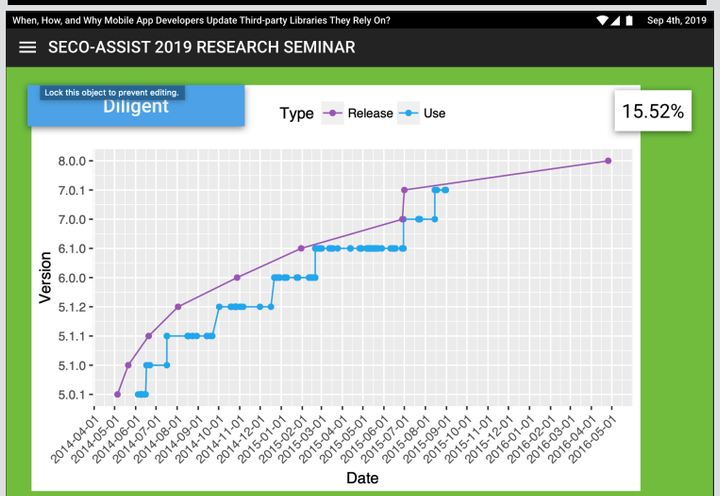

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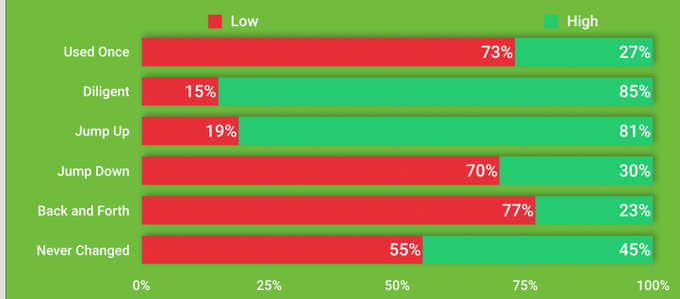

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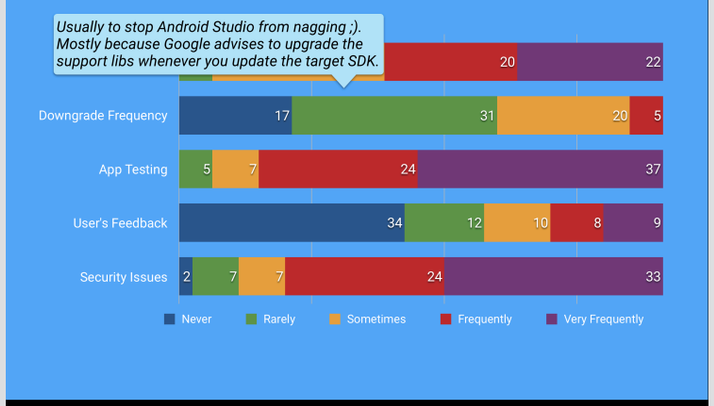

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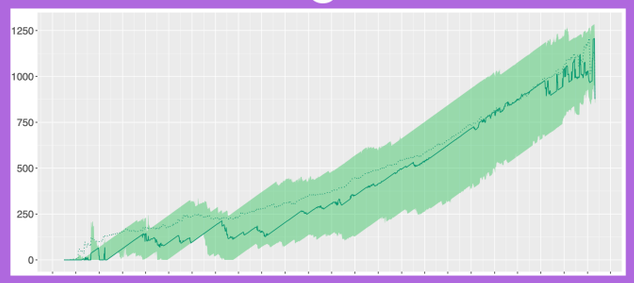

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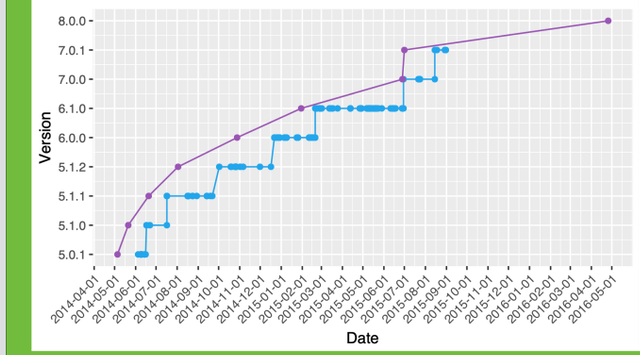

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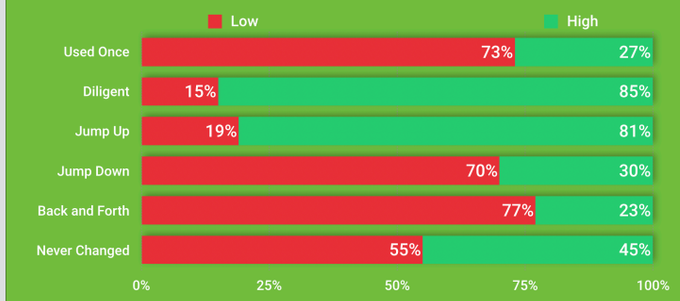

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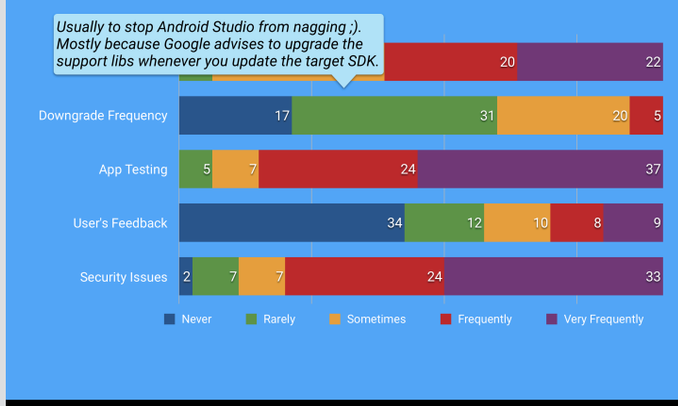

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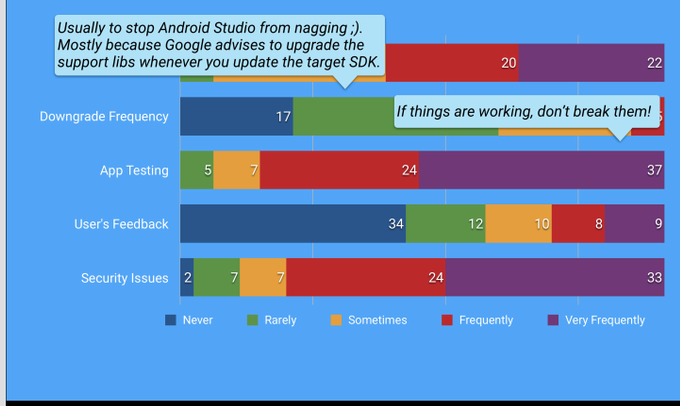

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So What?

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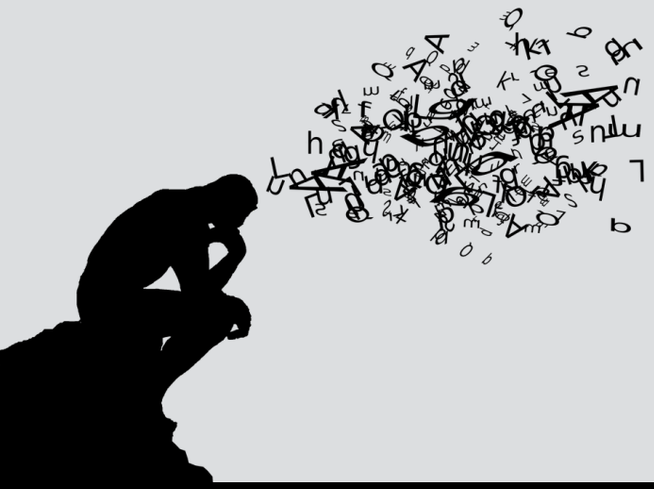

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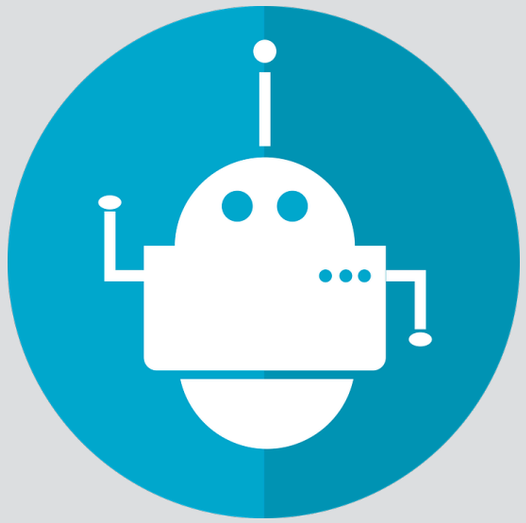

Enabling automated support

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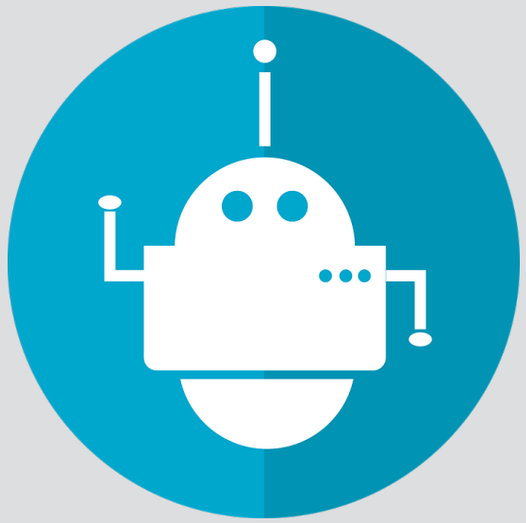

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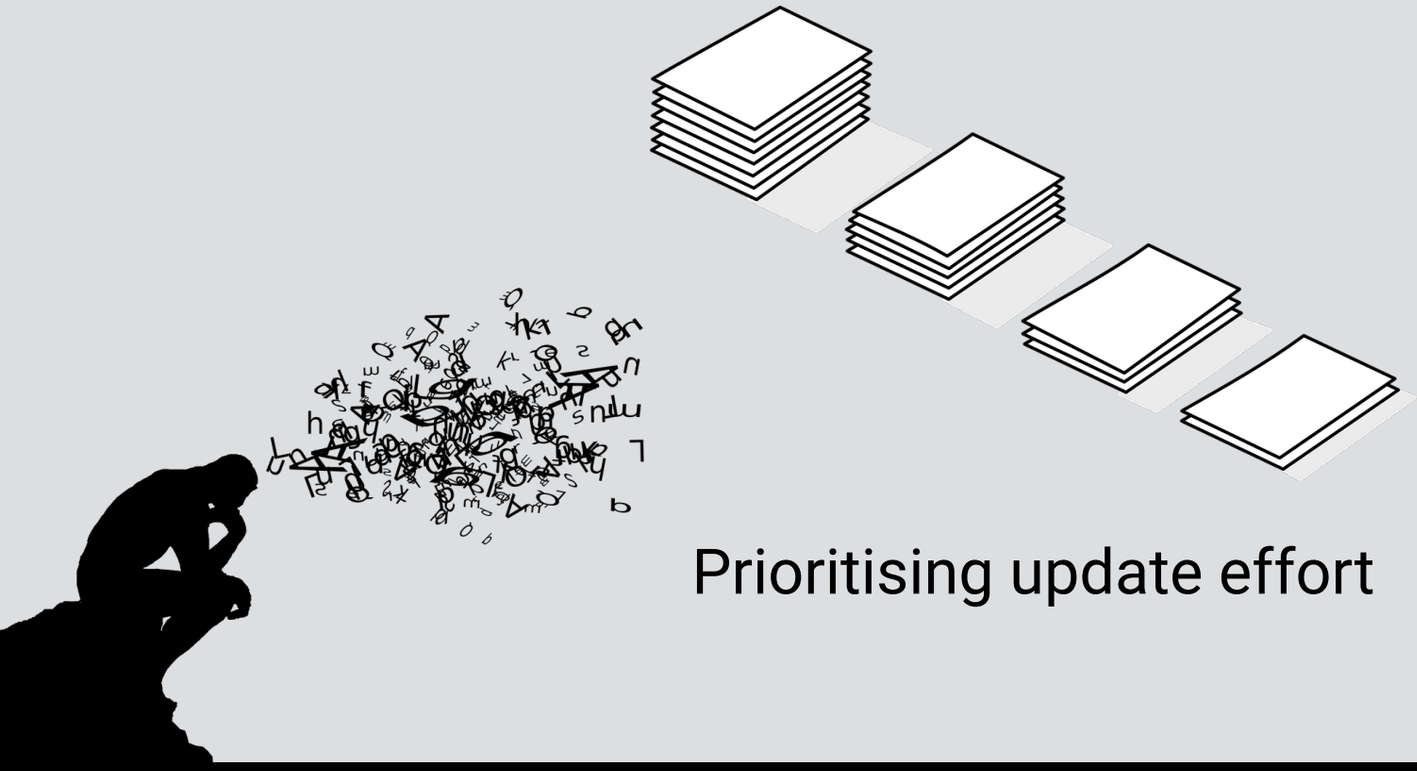

Prioritising update effort

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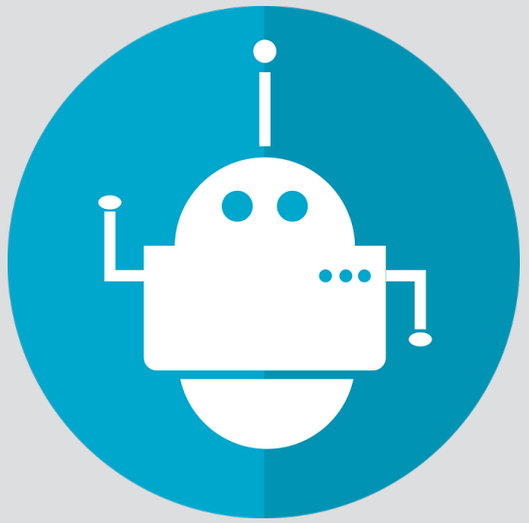

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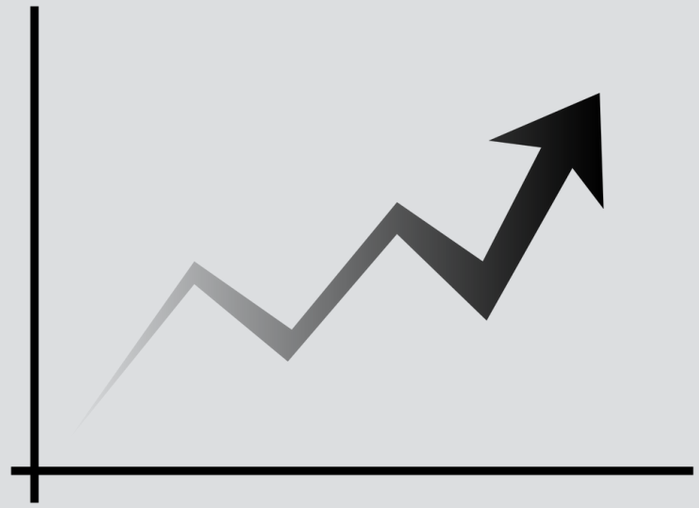

Predicting trends and impact on source code of missing updates