# Insights and statistics about the Android Open Source Project

Deep dive AOSP

Stefan Lengfeld, FOSDEM’26

# About me: Stefan Lengfeld

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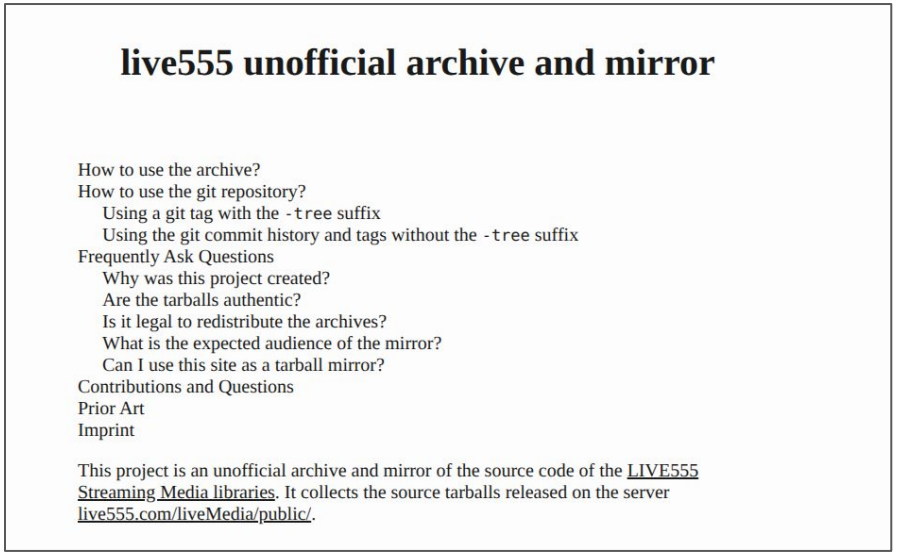
*“I like to collect and order things!”*

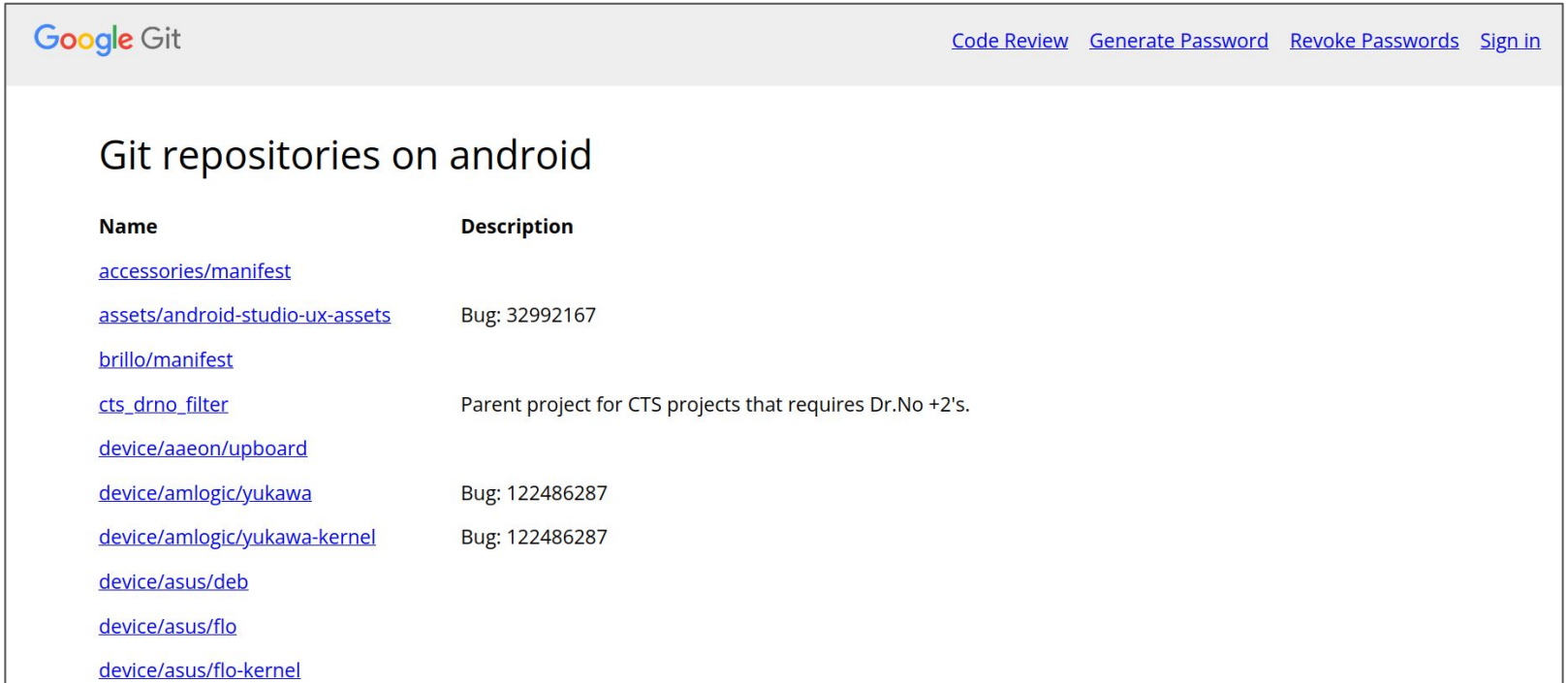



Example: Collecting tarballs of live555

https://lengfeld.github.io/live555-unofficial-archive/

# What was my goal?

Watch and inspect all repos on [https://android.googlesource.com/](https://android.googlesource.com/)



# What do you need?

Requirements:

- Good downstream bandwidth
- Enough storage
- Some compute power
- Basic Linux distro for scripting and tools

Solution: Shopping on the Hetzner Serverbörse

- 62GB RAM
- 2x 7.3 TB disk (used with mirror raid)
- 12 Core 3.x Ghz Intel something
- Debian 13
- Using btrfs for repository clone (features: checksums and mirroring)
- Tooling: Make, python, ninja, shell, gnuplot
- Cost: 44€/month

# How to get the source code in the first place?

You normally execute a command like

```
$ repo init --partial-clone \
   -u https://android.googlesource.com/platform/manifest \
   -b android-16.0.0_r4

$ repo sync -c -j8
```

The different parts

- Base URL: `https://android.googlesource.com/`
- Manifest repository: `platform/manifest`
- group of releases: `android`
- version of release: `16.0.0_r4`

(A bit of)

# Caution!

I tried to be accurate with the graphs, but …

# What do you find in 3040 git repositories and 1.7 TB of data* ?

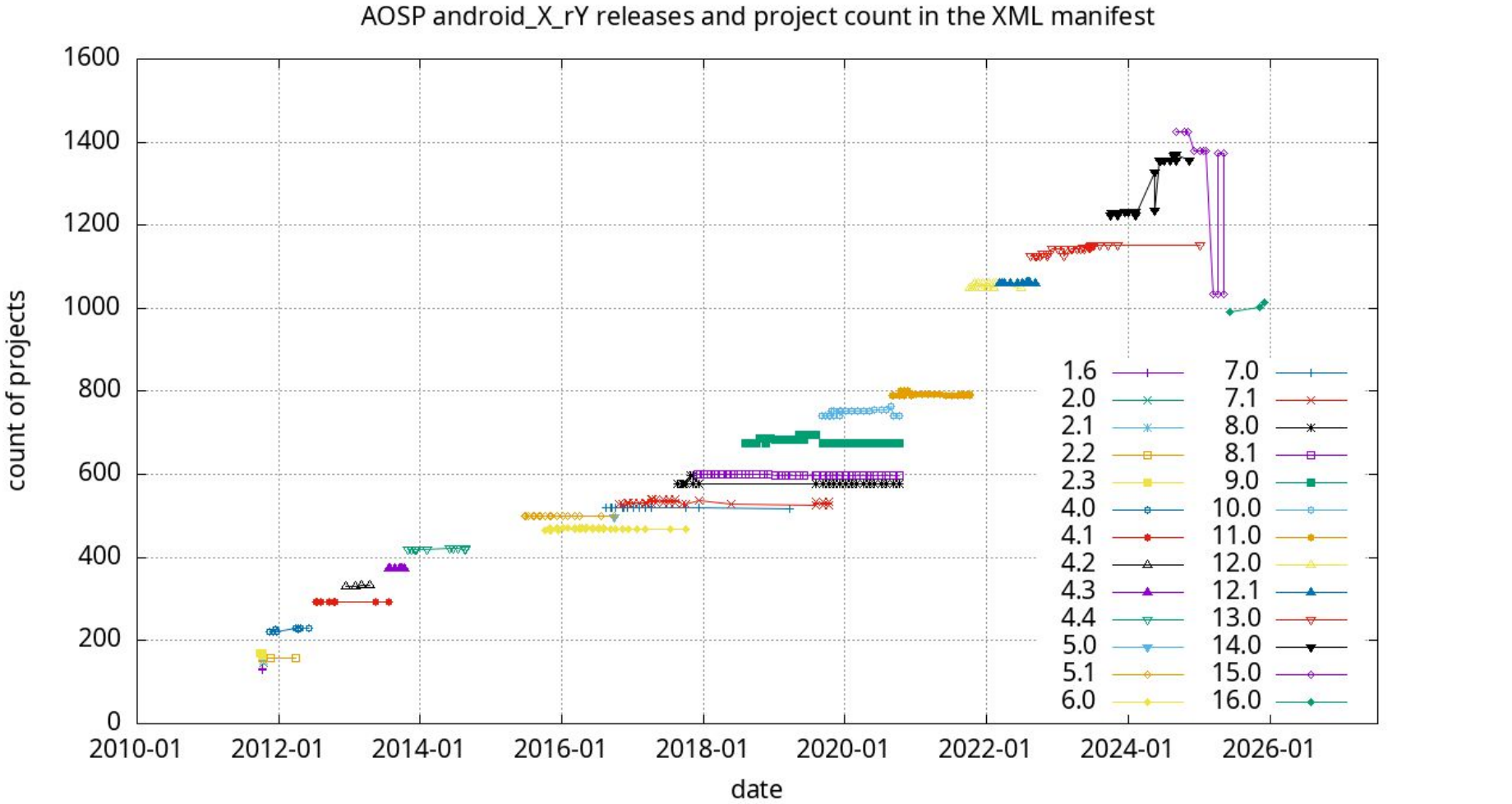
* without refs refs/cache-automerge/* refs/changes/* refs/notes/* refs/users/*

# Multiple manifest repositories for the repo tool

| repo_name | count_tags | count_branches | latest_update |
|---|---|---|---|
| accessories/manifest | 0 | 2 | 2012-06-28 20:22:38 UTC |
| brillo/manifest | 0 | 11 | 2016-09-16 19:05:25 UTC |
| **kernel/manifest** | 6 | 492 | **2026-01-07 10:39:44 UTC** |
| **mirror/manifest** | 0 | 2 | **2026-01-23 19:03:53 UTC** |
| **platform/manifest** | 2975 | 3483 | **2026-01-24 00:30:09 UTC** |
| toolchain/manifest | 0 | 5 | 2015-07-16 22:44:02 UTC |
| tools/manifest | 0 | 3 | 2024-11-20 20:10:03 UTC |
| trusty/manifest | 0 | 2 | 2025-03-14 01:27:46 UTC |

# Manifest repo: platform/manifest (only tags, no branches!)

| main_group | count | first manifest date | last manifest date |
|---|---|---|---|
| **android** | 911 | 2011-09-29 | 2025-12-02 |
| android-mainline | 764 | 2019-09-04 | 2025-03-18 |
| android-cts | 299 | 2011-12-22 | 2025-11-04 |
| android-security | 202 | 2020-10-07 | 2025-12-01 |
| android-platform | 191 | 2020-10-06 | 2025-12-02 |
| android-vts | 134 | 2017-10-05 | 2025-11-05 |
| **studio** | 131 | 2014-08-12 | 2026-01-15 |
| **ndk** | 87 | 2016-03-14 | 2025-10-06 |
| android-wear | 64 | 2015-05-28 | 2025-04-09 |
| iot | 37 | 2017-02-28 | 2022-01-10 |
| platform-tools | 29 | 2019-07-15 | 2024-08-05 |
| ub-automotive-master | 20 | 2023-03-06 | 2025-11-19 |
| android-automotiveos | 10 | 2024-07-29 | 2025-11-25 |
| [...] | | | |


AOSP android_X_rY releases and project count in the XML manifest
count of projects
date
0
200
400
600
800
1000
1200
1400
1600
2010-01
2012-01
2014-01
2016-01
2018-01
2020-01
2022-01
2024-01
2026-01
1.6
2.0
2.1
2.2
2.3
4.0
4.1
4.2
4.3
4.4
5.0
5.1
6.0
7.0
7.1
8.0
8.1
9.0
10.0
11.0
12.0
12.1
13.0
14.0
15.0
16.0

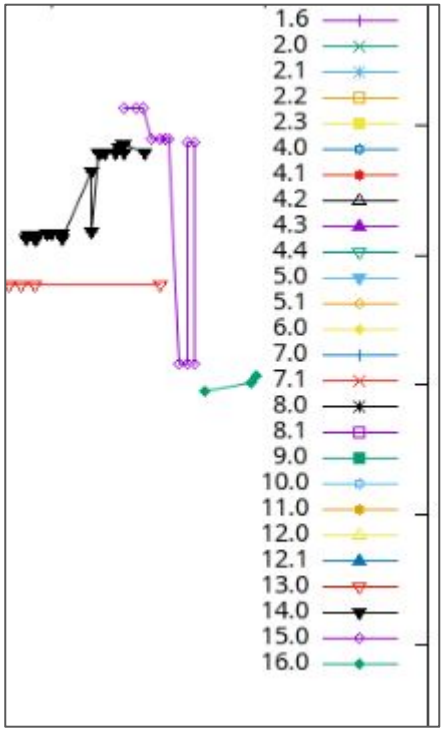
# Why does Android 16 has less projects?

First answer: rust

- The (super) repo external/rust/android-crates-io/ was added: “This repository contains Rust crates imported from crates.io for use by the Android platform.”
- See commit (2025-05-04) that removes the individual rust dependency repos

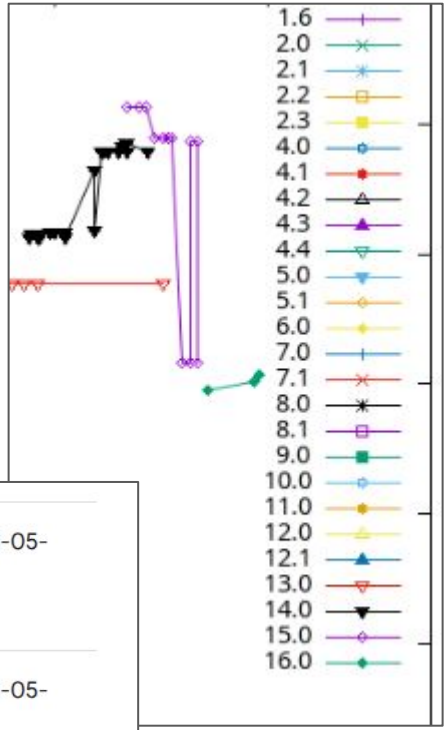
Also a lot of google devices were removed:

- See commit (2025-06-09)

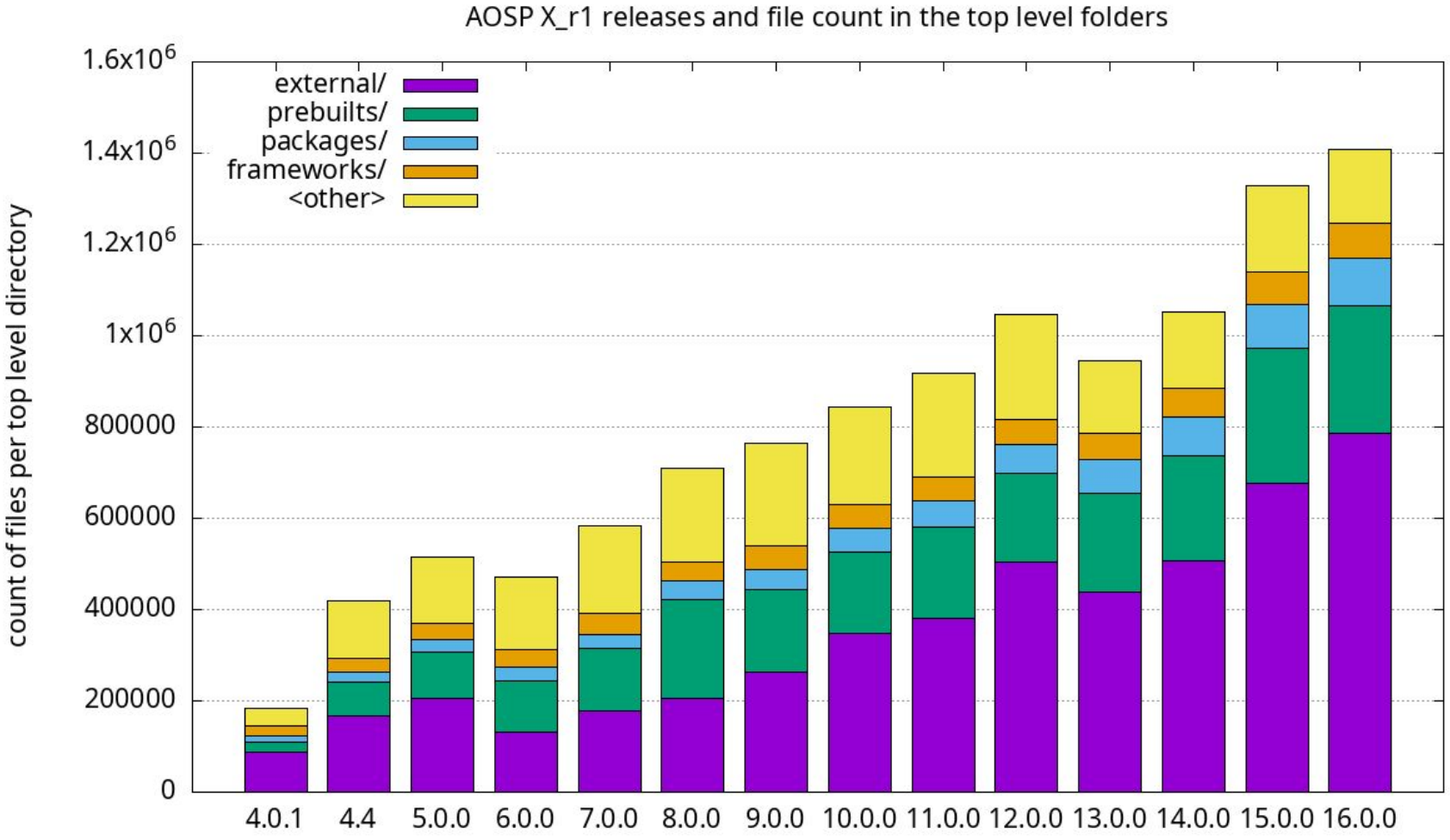


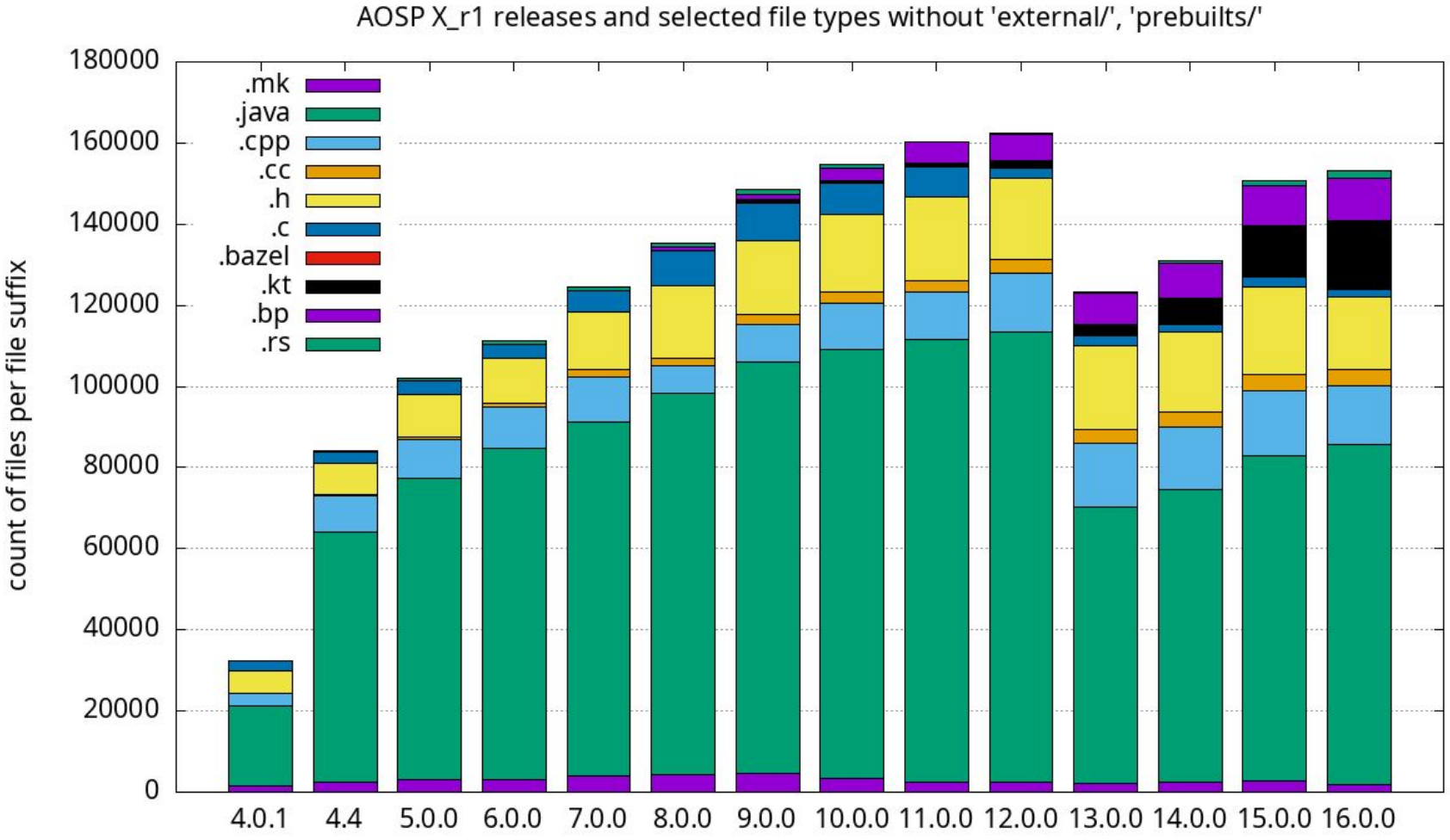
# Why are sometimes the commits going sideways?

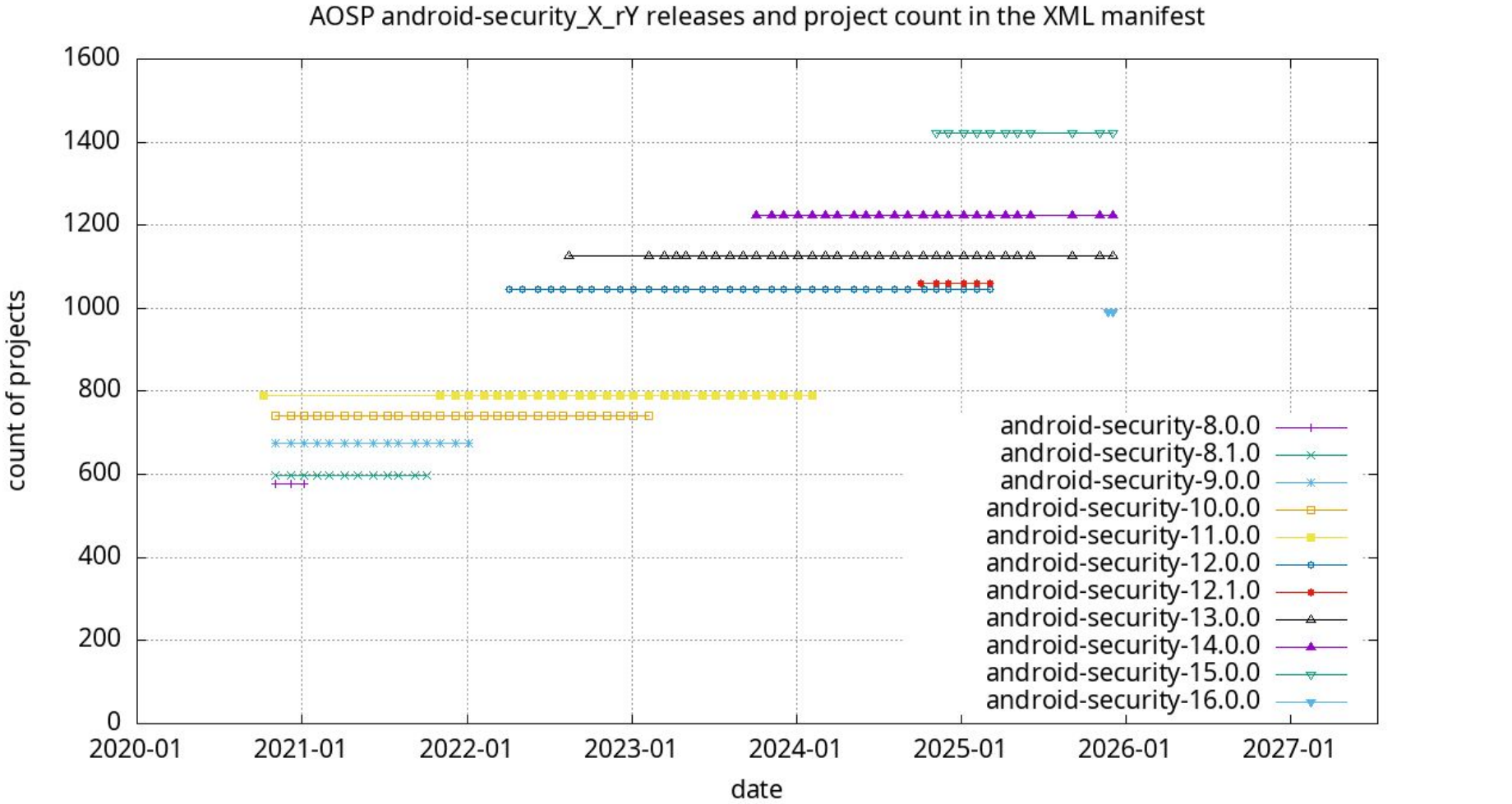
- The android_X_rY releases are **not linear** in Y.
- There are different “families” of Y releases,
  - Releases of different phones models
  - Then android-security-X_rY releases were android-X_rY previously
- See [Codenames, tags, and build numbers]




| | | | | |
|---|---|---|---|---|
| BP1A.250505.005 | android-15.0.0_r32 | Android15 | Pixel 6, Pixel 6 Pro, Pixel 6a, Pixel 9, Pixel 9 Pro, Pixel 9 Pro Fold, Pixel 9 Pro XL, Pixel Tablet | 2025-05-05 |
| BD4A.250505.003 | android-15.0.0_r31 | Android15 | Pixel 9a | 2025-05-05 |
| BP1A.250405.007.D1 | android-15.0.0_r30 | Android15 | Pixel 9, Pixel 9 Pro, Pixel 9 Pro Fold, Pixel 9 Pro XL | 2025-04-05 |


AOSP X_r1 releases and file count in the top level folders
count of files per top level directory
1.6x10^6
1.4x10^6
1.2x10^6
1x10^6
800000
600000
400000
200000
0
external/
prebuilts/
packages/
frameworks/
<other>
4.0.1
4.4
5.0.0
6.0.0
7.0.0
8.0.0
9.0.0
10.0.0
11.0.0
12.0.0
13.0.0
14.0.0
15.0.0
16.0.0


AOSP X_r1 releases and selected file types without 'external/', 'prebuilts/'
count of files per file suffix
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
.mk
.java
.cpp
.cc
.h
.c
.bazel
.kt
.bp
.rs
4.0.1
4.4
5.0.0
6.0.0
7.0.0
8.0.0
9.0.0
10.0.0
11.0.0
12.0.0
13.0.0
14.0.0
15.0.0
16.0.0


AOSP android-security_X_rY releases and project count in the XML manifest
count of projects
date
0
200
400
600
800
1000
1200
1400
1600
2020-01
2021-01
2022-01
2023-01
2024-01
2025-01
2026-01
2027-01
android-security-8.0.0
android-security-8.1.0
android-security-9.0.0
android-security-10.0.0
android-security-11.0.0
android-security-12.0.0
android-security-12.1.0
android-security-13.0.0
android-security-14.0.0
android-security-15.0.0
android-security-16.0.0

# Brillo and Android Things

Brillo:

- announced in 2015
- Android-based IoT OS for resource constrained devices (32MB)
  “Android without the Java-parts”
- Building Brillo: first impressions | 2net.co.uk (Chris Simmonds)
- Source code in manifest/brillo manifest repository. Just 10 branches!
- Last update there in Sep. 2016 and official discontinued in Dec 2016
- Replaced by Android Things

# Android Things

Android “with Java” for (bigger) IoT devices, e.g. Smart Speakers:

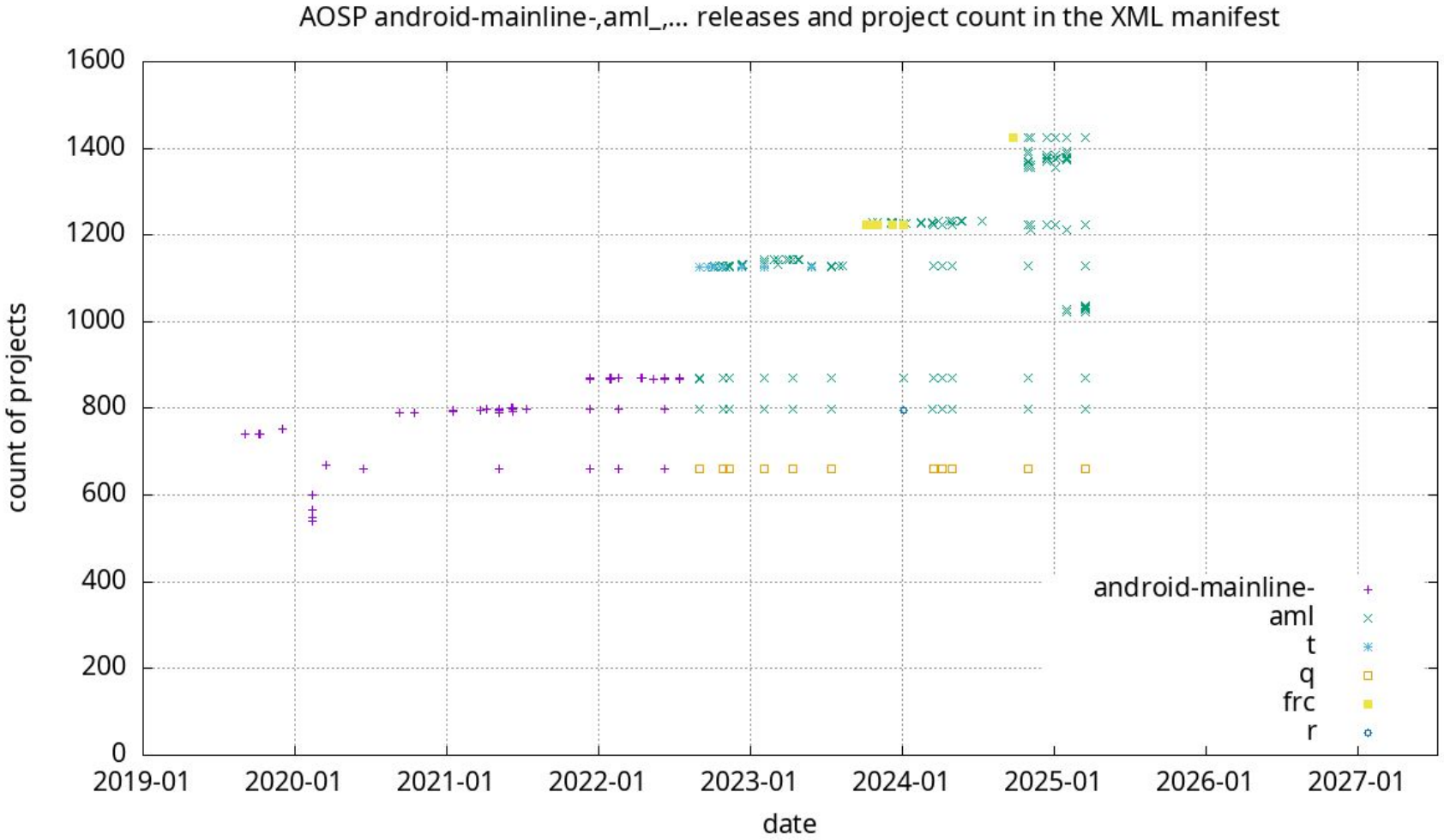
- Source code in the platform/manifest manifest repository on tags/branches with “iot” in the name!
- First source code release on Feb. 2017 and last source code release on Jan. 2022.
- 1.0 release in 2018
- Shutdown announcement in 2020
- Final shutdown in January 2022

Tag examples:

| | |
|---|---|
| android-n-iot-release-lg-thinq-wk7 | Nougat IOT Release (ThinQ Speaker) |
| android-o-mr1-iot-release-1.0.0 | Android Things LTS v1.0.0 (4760714) |
| android-o-mr1-iot-release-1.0.1 | Android Things LTS v1.0.1 (4795405) |

# Android Mainline

- Android Mainline (Modules)
- Also called “Google Play System Updates”
- Started around Android 10
- Uses the APEX (Android Phoney EXpress) container format
- There are ~30 different modules, e.g. tzdata, media, wifi, statsd, …
- Released as different types of manifests (tag names):
  - ~183x e.g. android-mainline-12.0.0_r116
  - ~529x e.g. aml_tz2_306503000, aml_wif_341610000, aml_med_341513600
  - ~60x other tags, e.g. t_frc_med_330443030, q_tzdata_aml_294400310


AOSP android-mainline-,aml_,... releases and project count in the XML manifest
count of projects
date
0
200
400
600
800
1000
1200
1400
1600
2019-01
2020-01
2021-01
2022-01
2023-01
2024-01
2025-01
2026-01
2027-01
android-mainline-
aml
t
q
frc
r

# Android Automotive: AAOS

[Android Automotive OS releases]

Started at 2024-07-29

“14.0.0_lts1” is missing!

[Unbundled apps release notes]

Started at 2023-03-06

And released two previous versions: 2022-11-02, 2022-12-15

android-automotiveos-14.0.0_lts2
android-automotiveos-14.0.0_lts3
android-automotiveos-14.0.0_lts4
android-automotiveos-14.0.0_lts5
android-automotiveos-14.0.0_lts6
android-automotiveos-14.0.0_lts7
android-automotiveos-15.0.0_lts1
android-automotiveos-15.0.0_lts2
android-automotiveos-15.0.0_lts3
android-automotiveos-15.0.0_lts4

ub-automotive-master
ub-automotive-master-20221102
ub-automotive-master-20221215
ub-automotive-master-20230303
ub-automotive-master-20230427
ub-automotive-master-20230622
ub-automotive-master-20231011
ub-automotive-master-20231102
ub-automotive-master-20240125
ub-automotive-master-20240314
ub-automotive-master-20240521
ub-automotive-master-20240731
ub-automotive-master-20240924
ub-automotive-master-20241205
ub-automotive-master-20250219
ub-automotive-master-20250402
ub-automotive-master-20250418
ub-automotive-master-20250609
ub-automotive-master-20250722
ub-automotive-master-20250910
ub-automotive-master-20251118

# Lighting talk at 14:25 in the this devroom

Stay tuned for a talk by Chris Simmonds:

## A quick look at Android release names, tags and build numbers

links: Schedule slides

# Thank you!
# Questions?
# Comments!
# Ideas?

https://aosp-devs.org

Data and graphs on
https://codeberg.org/lengfeld/talk-aosp-stats

# Abstract: Deep dive AOSP: Insights and statistics about the Android Open Source Project

The Android Open Source Project (AOSP) is more than just the yearly and now half-yearly releases of the Android platform source code. It consists of 3000+ git repositories, 1500+ repo XML manifests, and 1.8+TB of (compressed) source code data.

In this talk I want to give a detailed tour of the AOSP releases, the code, and everything that can be found in the AOSP repositories: How are the _rXXX releases assembled? And why do the git tags sometimes go backward? Where do I find the source code for my Pixel devices (until 2025)? What are the Build IDs? What are Brillo manifests, and why are they also in the AOSP? How are security patches released? Why is the number of git repos increasing with every release? And why is it decreasing with Android 16? How did the amount of rust and other code evolve over time? What is Project mainline and apex's? And where do I find the source code for these "Google Play system updates"? Where do I find the AAOS (Android Automotive Operating System) code and its releases?

These and other questions I want to answer in my talk.

https://fosdem.org/2026/schedule/event/9DRDS7-deep-dive-aosp/