

Chasing the Speed of Gradle Builds



Aurimas Liutikas

Software Engineer



Chasing the Speed of Gradle Builds

or how I learned you are never done

The Google logo is centered within a solid blue hexagon. The hexagon is positioned on the left side of the slide, overlapping a dark teal background that features a faint, wireframe-like pattern of a human figure. The word "Google" is written in its characteristic white, sans-serif font.

Google

About Google

A mom-and-pop search engine that also builds AndroidX libraries for Android App Developers

About Me



Aurimas Liutikas

Software Engineer

Where did it begin?

Project count
1

First checkin!

Change-Id: Ib09737c48a144dd778efe4750452d74ac8265a29

 hackbod@google.com (author)  Committed on 2011-02-07 6:47 PM

Parent: 8ef7ae3

files (22)

Type	Path	Change Summary	Expand All
------	------	----------------	------------



v4/Android.mk



-0, 0, +29



v4/java/android/support/v4/app/BackStackRecord.java



-0, 0, +664



v4/java/android/support/v4/app/DialogFragment.java



-0, 0, +394



v4/java/android/support/v4/app/Fragment.java



-0, 0, +1,162



v4/java/android/support/v4/app/FragmentActivity.java



-0, 0, +597



v4/java/android/support/v4/app/FragmentManager.java



-0, 0, +1,740



Jump to 2013 H2

Project count
5

gradle for support lib.

To build: 'gradle release'

This requires a local version of Gradle for now, until we figure out where we'll put the wrapper.

Change-Id: I8cf57fd97d5213dbc28d3bf68ea175348fe9a11b

 xav@android.com (author)  Committed on 2013-09-12 7:43 PM

Parent: 8764572

files (12)

Type	Path	Change Summary	Expand All
------	------	----------------	------------



build.gradle



-0, 0, +49



local.properties



-0, 0, +1



settings.gradle



-0, 0, +6



Fast forward to 2015 H2

Project count

18

Java LoC 171k

- make is the main build system
- Gradle 2.2.1 / AGP 1.3.1

Capabilities

- Gradle used for creating a maven zip
- No presubmit and only make postsubmit

[Commit used](#)

2016 H1

Project count

33

Java LoC 196k

- make is the main build system
- Gradle 2.10 / AGP 1.5.0

Capabilities

- Gradle can build tests and run them
- No presubmit and only make postsubmit

[Commit used](#)

2016 H2

Project count

36

Java LoC 283k

- Gradle 3.2 / AGP 2.2.1 is the main build system
- Still support make

Capabilities

- Using Doclava to build docs and run API checks
- Android Lint and Android Studio support
- Presubmit and postsubmit use Gradle and Make
- Automated device tests

Optimizations

- Gradle gets -Xmx3g

[Commit used](#)

2017 H1

Project count

41

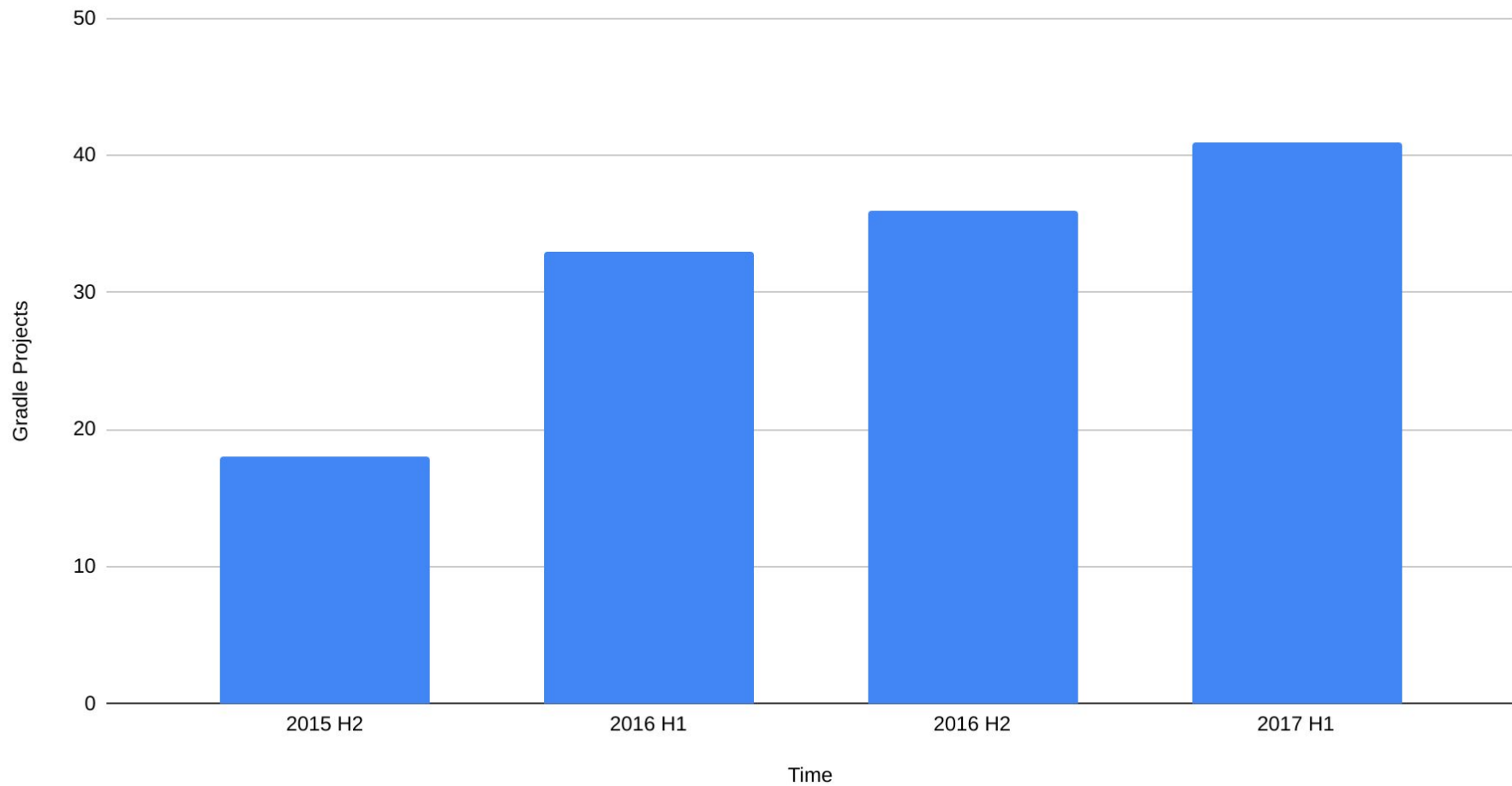
Java LoC 298k

- Gradle 3.3 / AGP 2.2.4
- Still support make

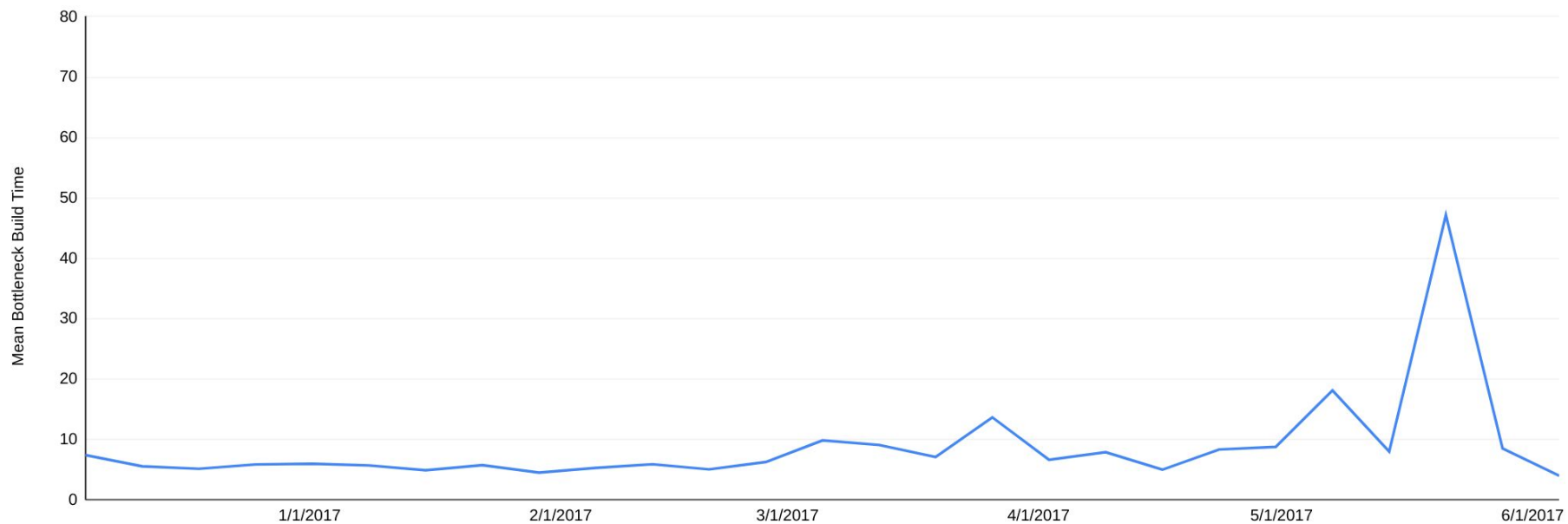
Optimizations

- Root build.gradle broken down into groovy scripts
- Enabled configuration on demand
- buildSrc with custom plugin in Groovy

[Commit used](#)



Mean Presubmit Build Time over time



2017 H2

- Gradle 4.3 / AGP 2.2.4
- Still support make

Capabilities

- Enhanced publishing (maven gradle plugin, version files, source jars)
- Error prone compiler
- **Started using Kotlin**

Optimizations

- Start using Kotlin/Java in buildSrc code
- Library groups, versions and dependencies in buildSrc
- -Xmx4g

Project count

76

(55 + 21)

Java LoC 379k

Kotlin LoC 20k

[Commit used](#)

2018 H1

- Gradle 4.5 / AGP 3.0.0
- Still support make

Capabilities

- Adding jetifier to our builds
- License checking for dependencies

Optimizations

- JVM tests as separate build target
- All buildSrc code in Kotlin
- Our plugins move to one per project type
- Standard directory layouts (src/main/...)

Project count

113

(86 + 27)

Java LoC 404k

Kotlin LoC 30k

2018 H2

Project count

185

Java LoC 557k

Kotlin LoC 60k

- Gradle 4.10.1 / AGP 3.3.0 (make removed!)

Capabilities

- Kotlin docs using a Dokka fork
- Kotlin API tracking using metalava
- Dependency version validation

Optimizations

- Enabled local build cache
- Build test APKs as separate target
- AffectedModuleDetector for device tests
- Dynamic docs publishing
- -Xmx8g

[Commit used](#)

2019 H1

- Gradle 5.1.1 / AGP 3.4.0

Capabilities

- Custom Android Lint checks
- Android Resource API tracking
- Library group versioning enforcement
- Max deps version testing

Optimizations

- Start migration to `tasks.register`
- `AffectedModuleDetector` for other tasks

Project count

198

Java LoC 573k

Kotlin LoC 83k

[Commit used](#)

2019 H2

- Gradle 6.0 / AGP 3.6.0

Capabilities

- ktlint
- Deeper integration with release tool
- Migrated to maven-publish
- Library metrics tracking

Optimizations

- -Xms8g -Xmx8g for CI
- buildSrc plugin restructured to one that reacts to plugins
- buildSrc tests moved out
- Task up-to-date / overlapping outputs enforcement
- First Gradle testkit test
- Gradle home and tmp to out directory
- Start using Gradle workers for Metalava tasks

Project count

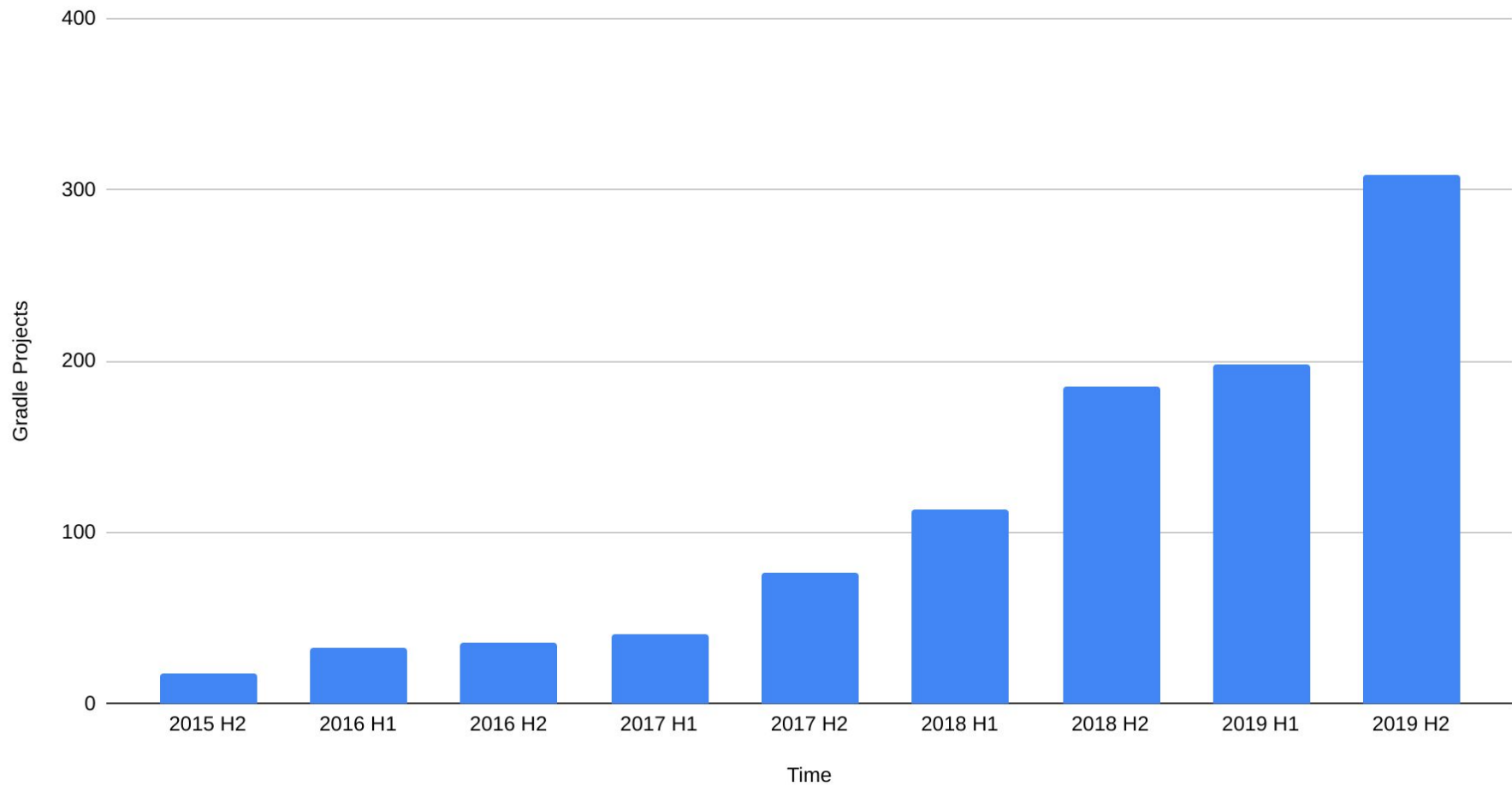
309

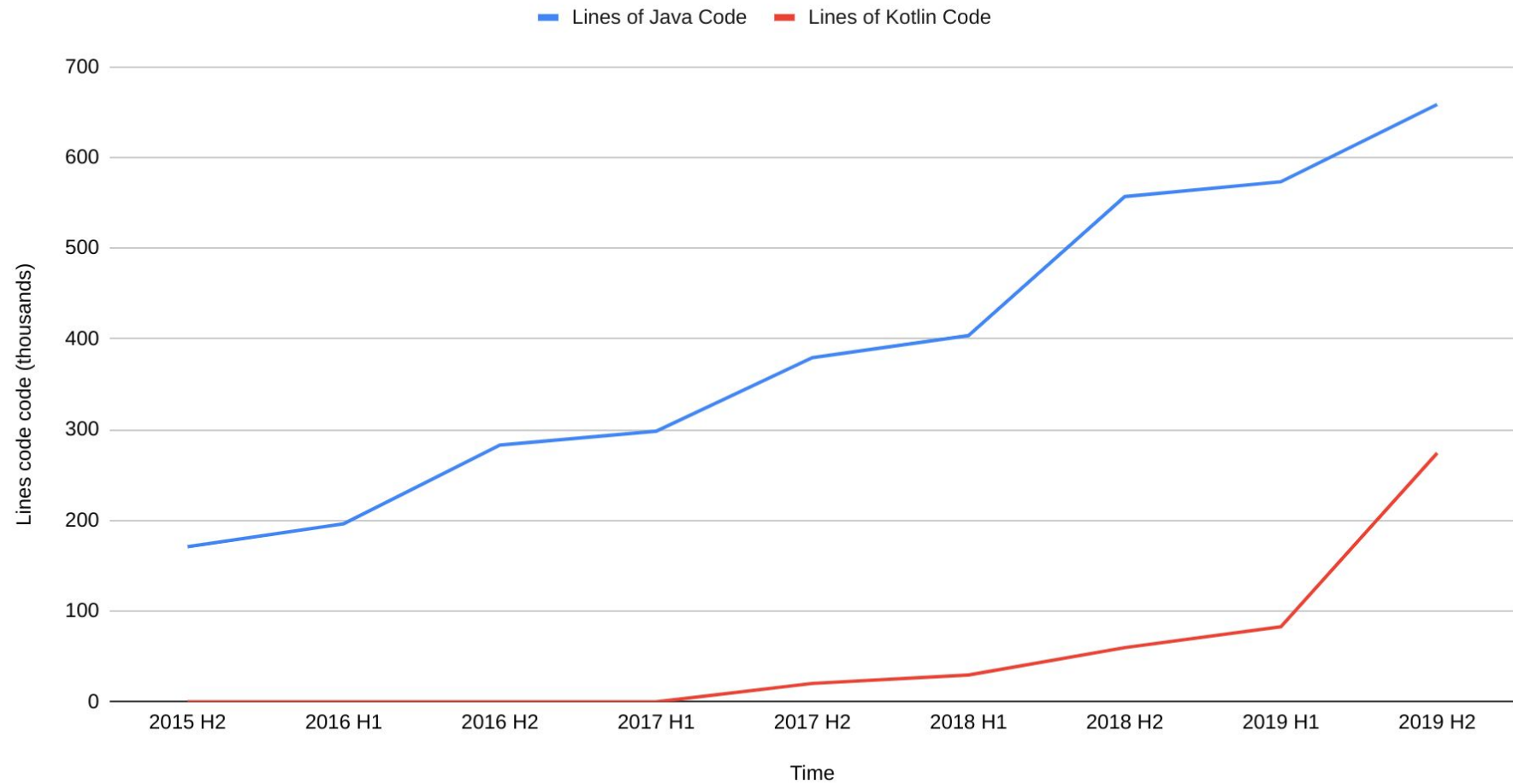
(268 + 41)

Java LoC 658k

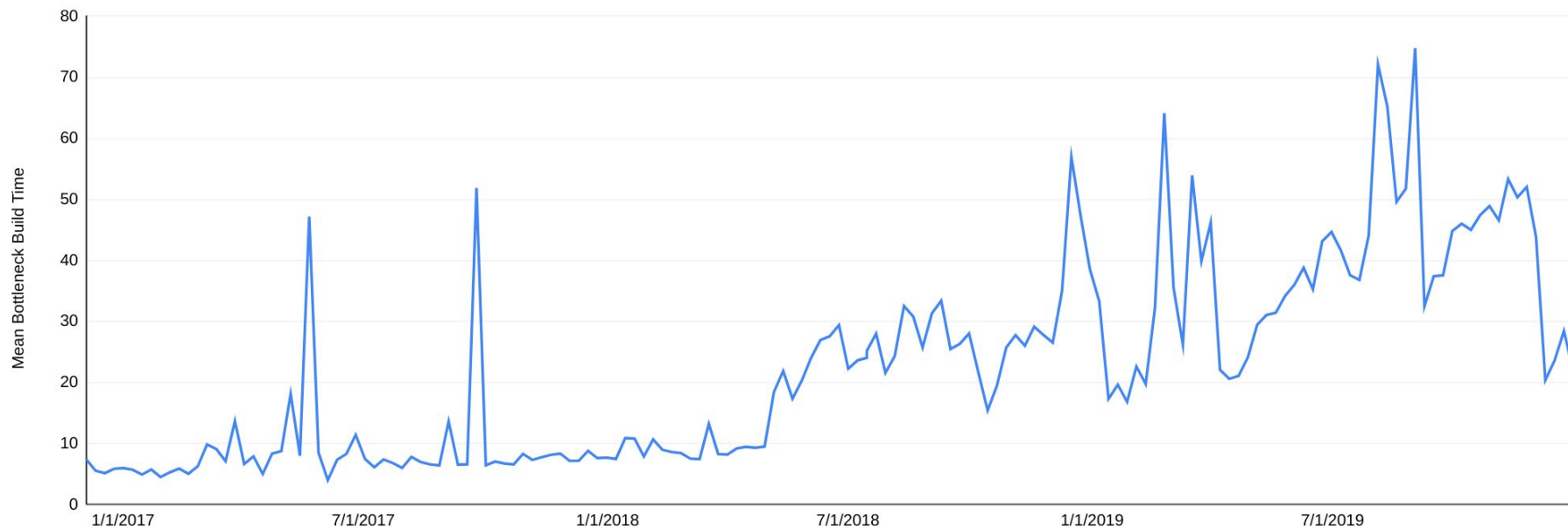
Kotlin LoC 274k

[Commit used](#)





Mean Presubmit Build Time over time



2020 H1

- Gradle 6.2.2 / AGP 4.0.0 (compose uses 4.1.0)

Capabilities

- Inspection integration with Android Studio
- Build against HEAD Android Gradle Plugin
- Support for Robolectric

Optimizations

- Remote build cache for local builds
- Task cacheability fixes
- JDK 11 upgrade
- Disable unused AGP features (aidl, BuildConfig)

Project count

365

(300 + 65)

Java LoC 677k

Kotlin LoC 339k

[Commit used](#)

2020 H2

- Gradle 6.7 / AGP 4.2.0

Capabilities

- Playground (GitHub mirror)

Optimizations

- Learning about input normalizers (fix compose invalidations)
- Rewrite docs integration with an explicit list of projects
- Project subgroups for Studio
- -XX:+UseParallelGC / split CI to -Xmx16g
- Build log output validation
- set no-parent

Project count

427

Java LoC 752k

Kotlin LoC 526k

[Commit used](#)

2021 H1

- Gradle 6.8.1 / AGP 4.2.0

Capabilities

- Bundling JarJared inside shipped artifacts

Optimizations

- Adopt libs.versions.toml
- CI -Xmx24g

Project count

473

Java LoC 786k

Kotlin LoC 577k

[Commit used](#)

2021 H2

- Gradle 7.3 / AGP 7.1.0

Capabilities

- Dependency signature verification
- Add 3rd docs tool Dackka

Optimizations

- Enabled configuration caching in warn mode / fix lots of issues
- Split buildSrc into public / private
- -Dkotlin.daemon.jvm.options=-XX:MaxMetaspaceSize=1g / JVM tests get 2g heap
- Gradle Enterprise for GitHub mirror / futher remote cache task restore fixes

Project count

575

Java LoC 853k

Kotlin LoC 866k

[Commit used](#)

2022 H1

- Gradle 7.4 / AGP 7.4

Capabilities

- Mac ARM support

Optimizations

- JVM test heap 3G
- Enable remote Gradle cache in CI
- Remove AffectedModuleDetector for everything except device tests
- Strong push for remote cache for local builds
- More remote cache restoration fixes

Project count

597

Java LoC 864k

Kotlin LoC 975k

[Commit used](#)

Today

- Gradle 7.5 / AGP 8.0.0

Capabilities

- JVM layoutlib based screenshot testing

Optimizations

- JDK 17
- Removed $\frac{2}{3}$ of documentation tools
- Profiling builds and filing upstream bugs

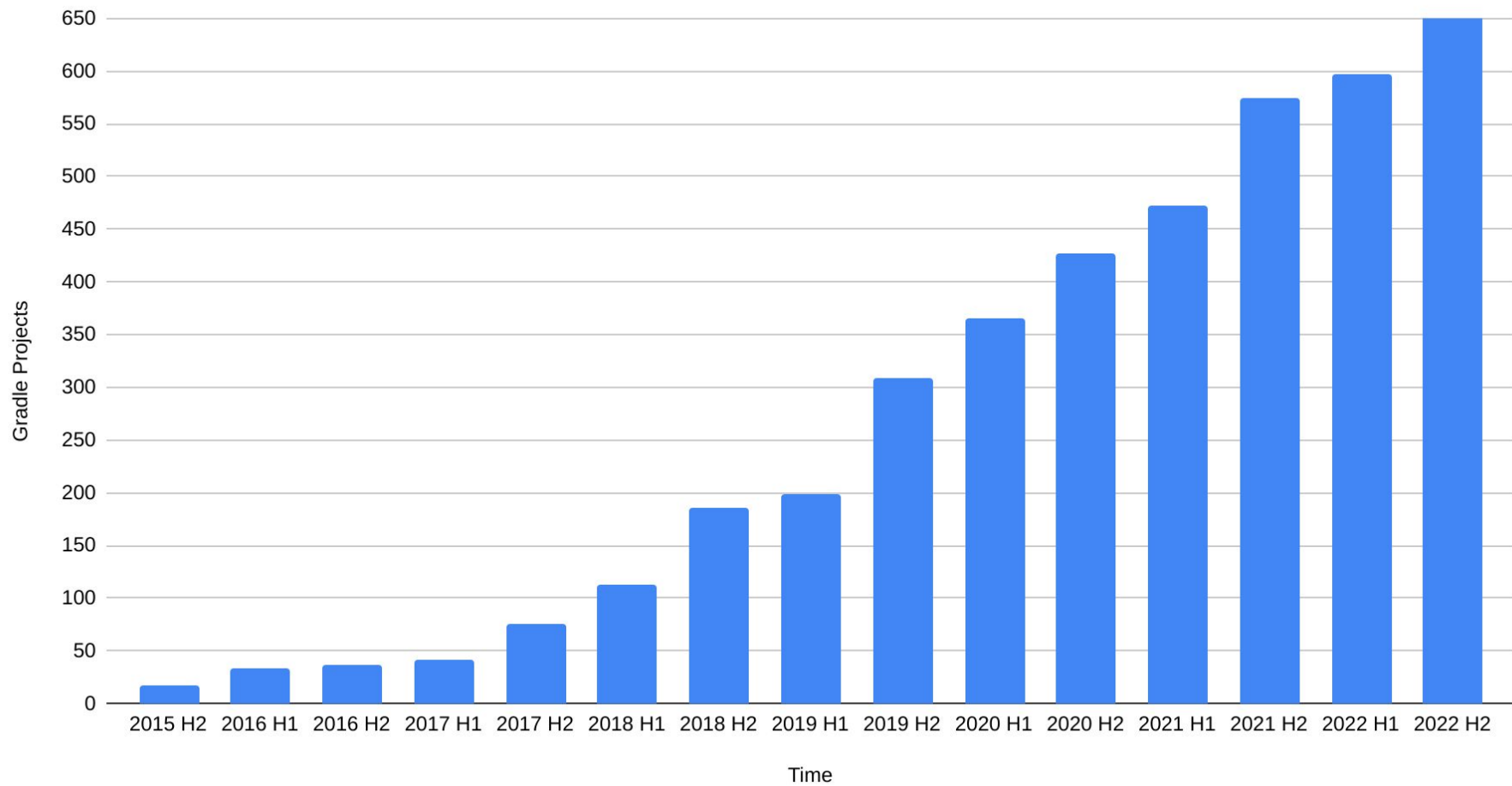
Project count

657

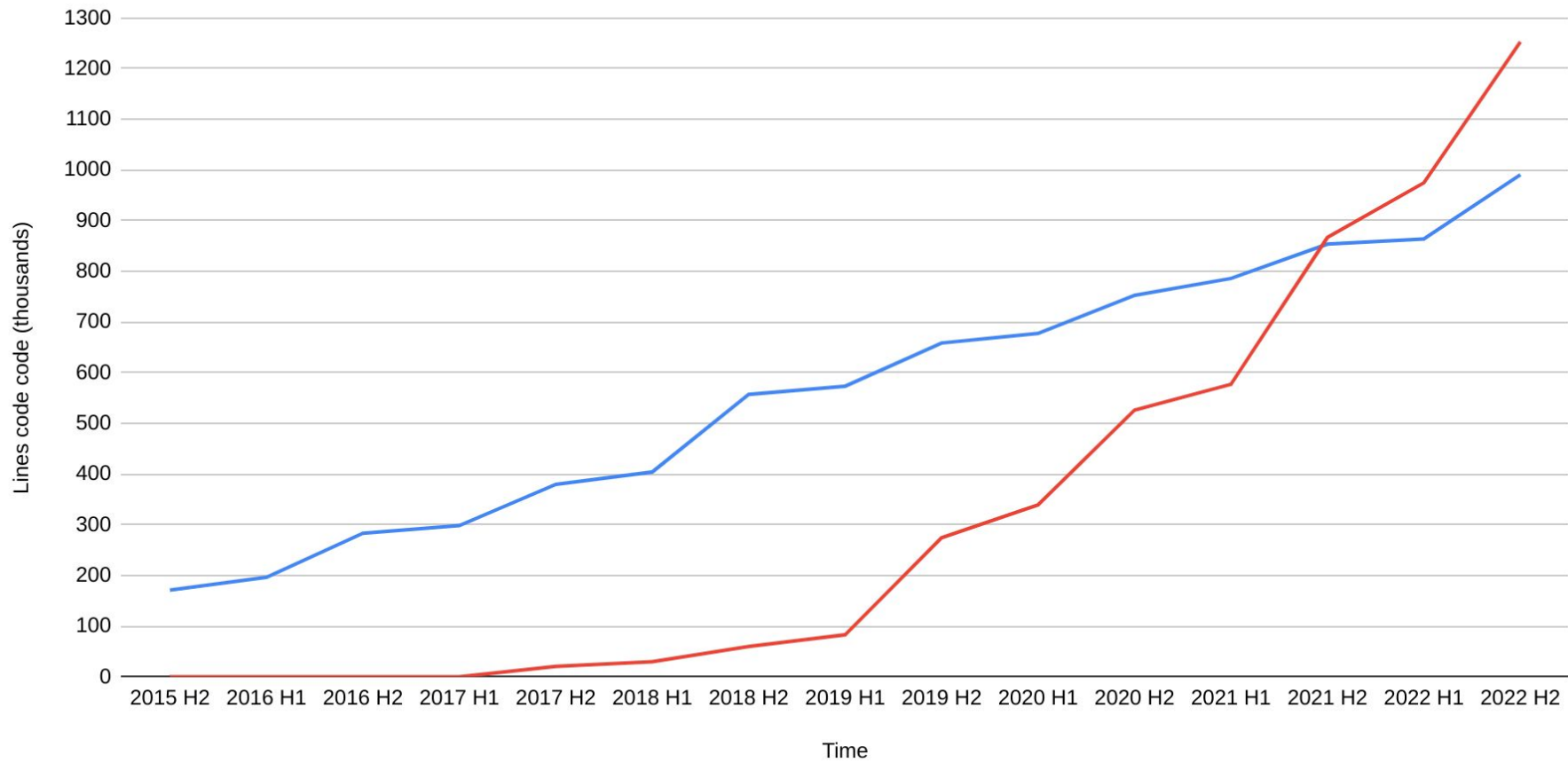
Java LoC 990k

Kotlin LoC 1.25M

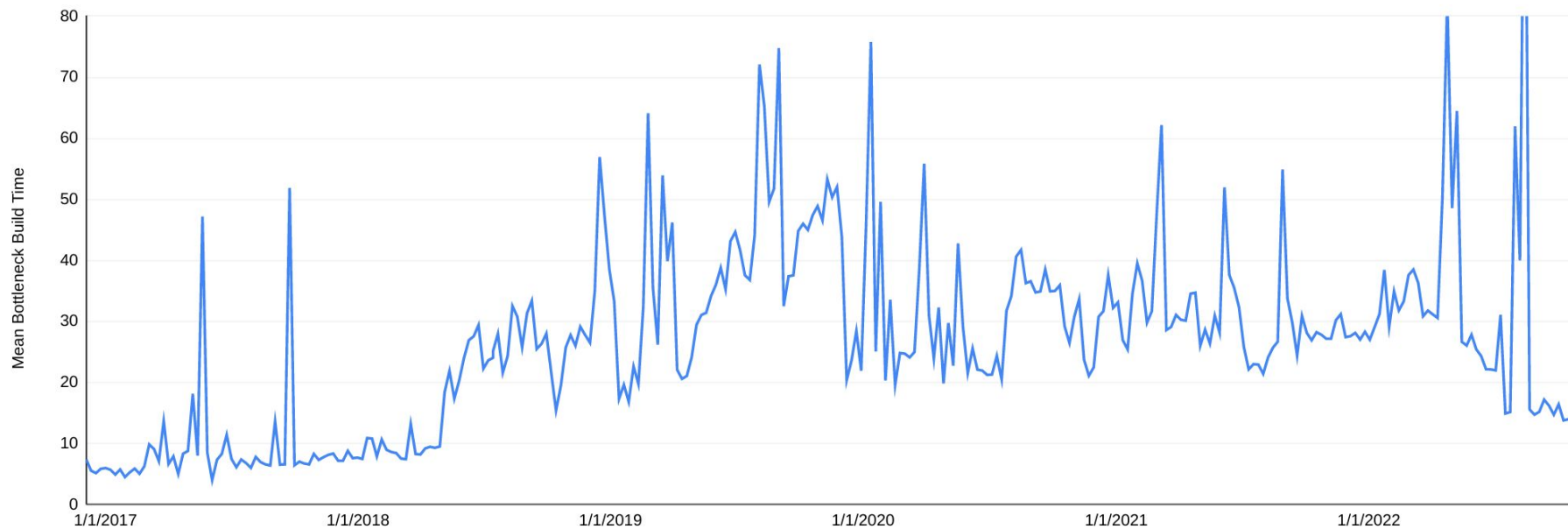
[Commit used](#)



Lines of Java Code Lines of Kotlin Code



Mean Presubmit Build Time over time



Future

- Gradle Project isolation
- Shadow builds
- JDK upgrades

Takeaways

- Keep your tools up to date
- Monitor monitor monitor
- Early feature adoption can be rough, but potentially worth it
- Project growth does not have to mean linear CI/build types

THANKS

Have any questions?

Twitter: @_aurimas
careers.google.com

<https://cs.android.com/androidx>