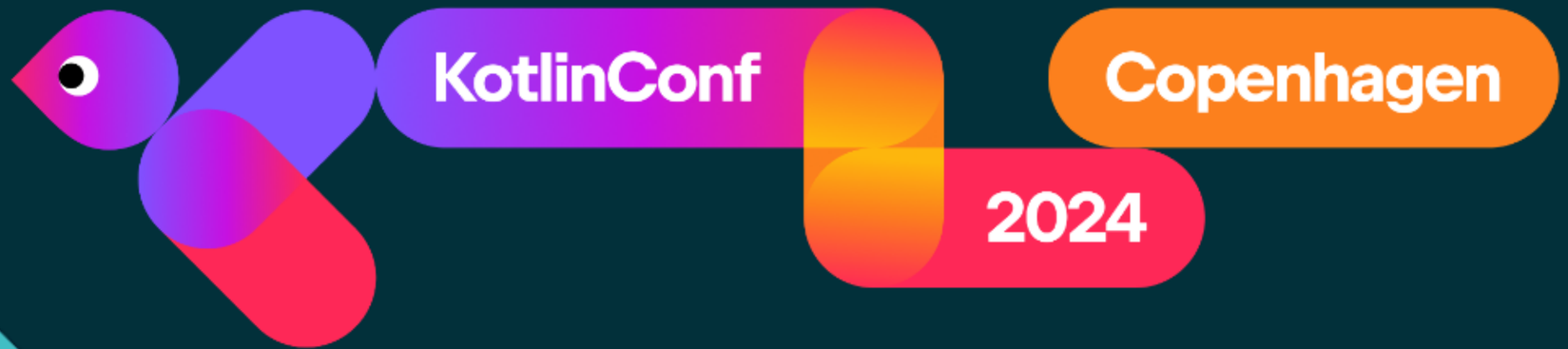
Developer-first Gradle builds

Sterling Greene & Paul Merlin



Gradle

Agenda

Challenges

Maintenance and understanding

Developer first builds

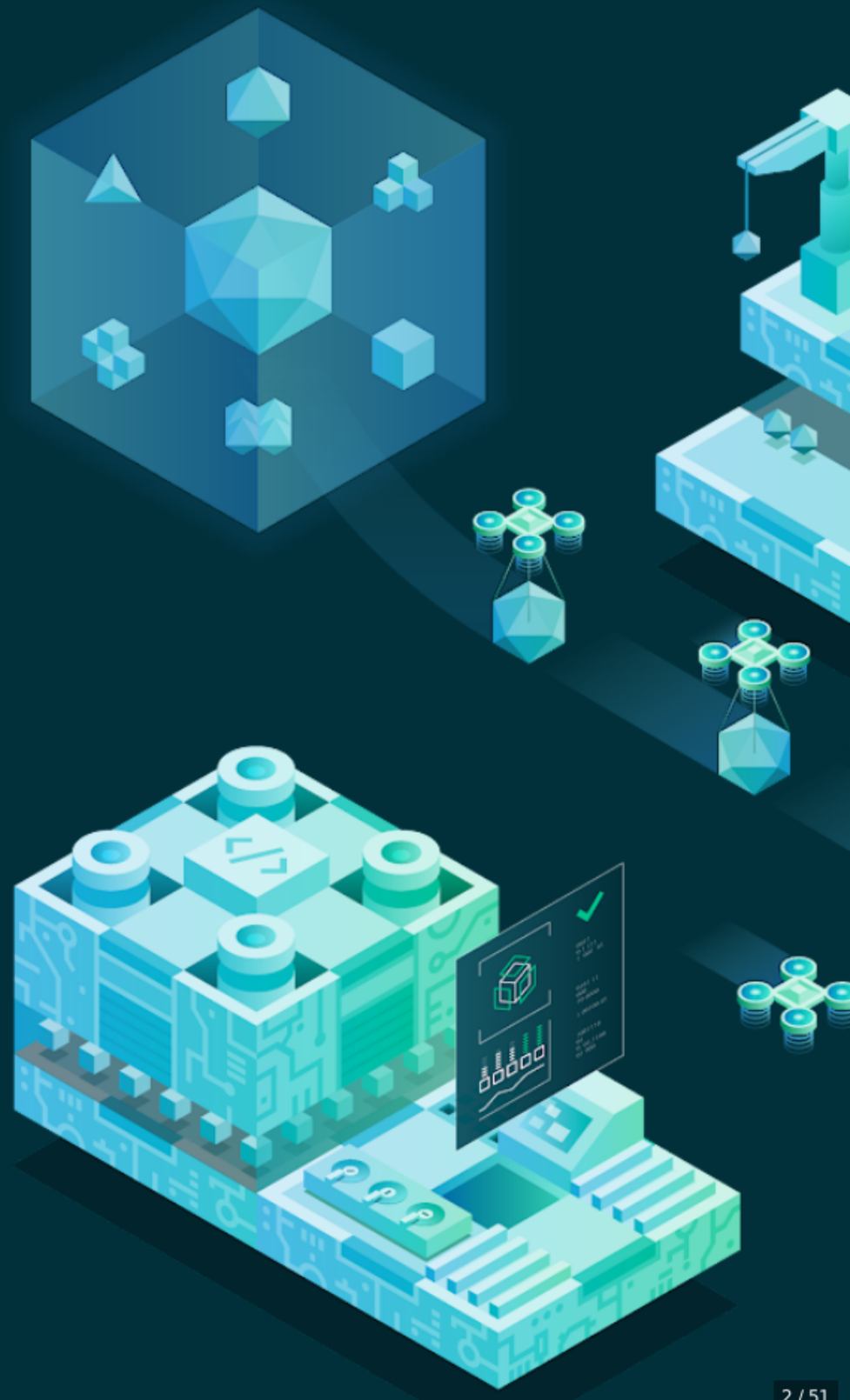
Vision and current state

Demos

Don’t say it, declare it

What’s next?

A peak into the future



Who are we?

```
speaker {
  name = "Paul Merlin"
  company = "Gradle"
  joined = 2015
  currently = "Declarative Gradle"
  previously = "Performance, Kotlin DSL, Configuration Cache"
  github = "eskatos"
  mastodon = "@eskatos@mastodon.social"
}
```

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  x = "@argfile"
}
```

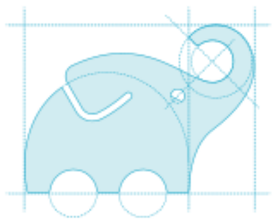
Gradle

gradleware

gradle

Gradle

Since 2008, our mission is to accelerate developer productivity.



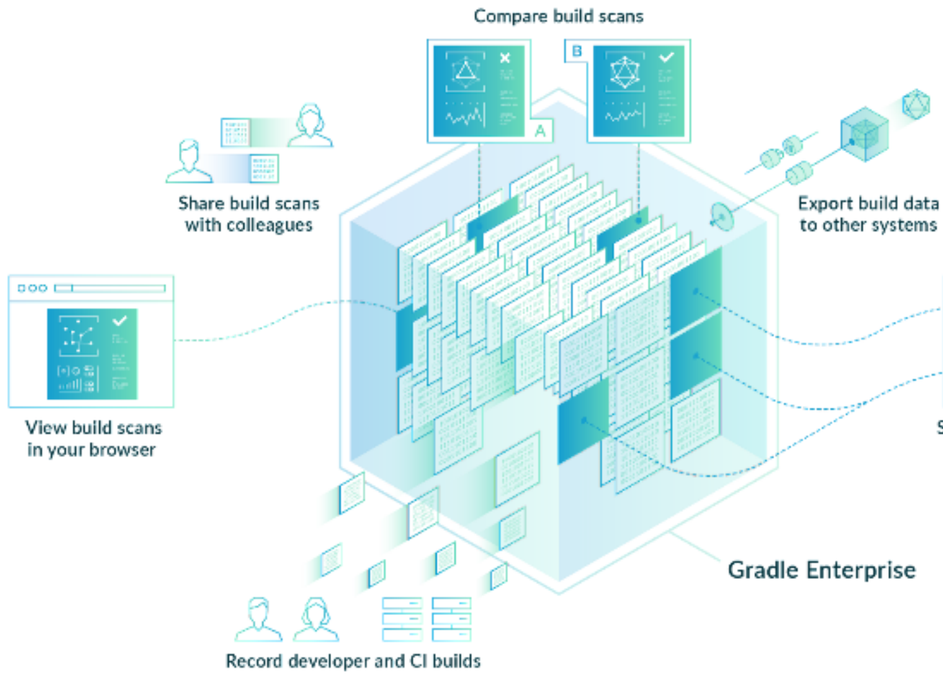
Gradle Build Tool

Apache licenced sofware build tool

With 50M+ monthly downloads and one of the top 20 popular open source projects according to TechCrunch.

DEVELOCITY

Develocity, commercial product, is the first Developer Productivity Engineering (DPE) integrated solution.



Gradle

Android

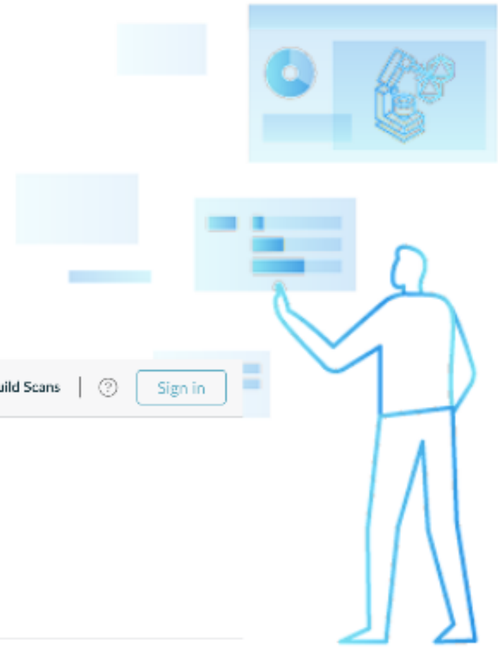
Maven

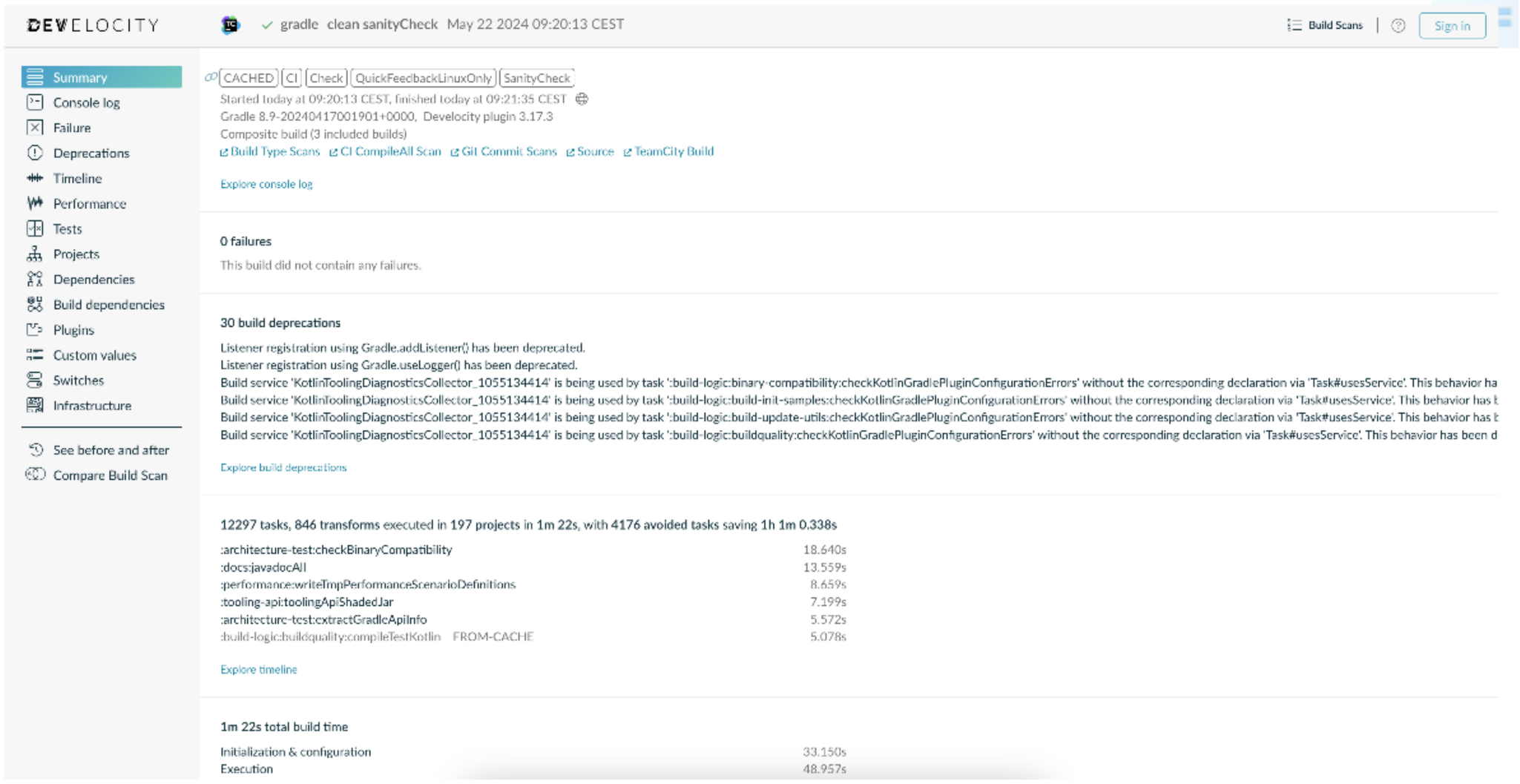
Bazel

Scala

Build Scan®

A permanent record of what happens during a build.

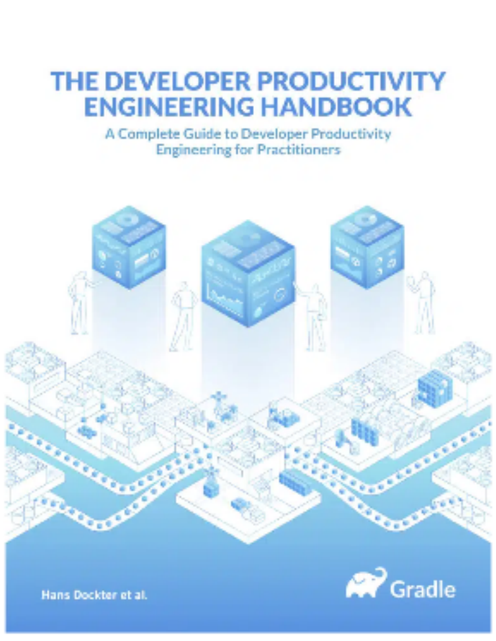


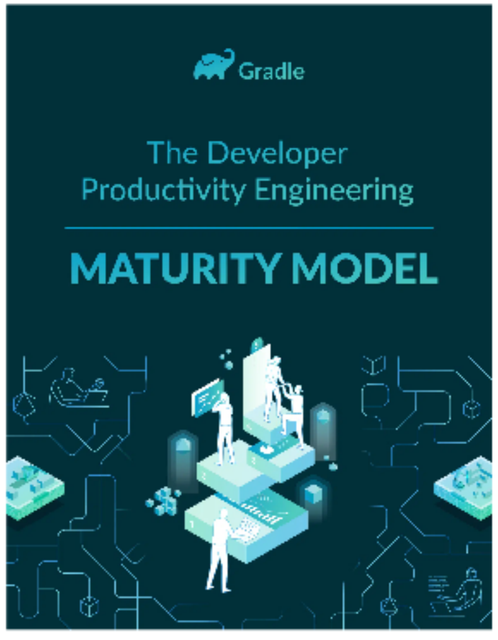


build scan

Developer Productivity Engineering

DPE is an emerging software practice that relies on acceleration technologies and data analysis to improve developer productivity.





gradle.com/developer-productivity-engineering

dpe.org

DPE Lowdown - Youtube Playlist
DPE Showdown - Youtube Playlist

NEW: DPE University

- Free courses at dpeuniversity.gradle.com
- 6 Gradle courses - from Beginner to Advanced levels
- More courses on Maven, Develocity etc…

Challenges

Gradle is flexible and extensible

Drawbacks

Challenges

Gradle is flexible and extensible
Drawbacks

- Build scripts speak Gradle and not your domain.
- Build scripts can be a mess.
- Tooling can only help so much.

Challenges - Jeg taler Gradle

`build.gradle.kts`

```
plugins {
    java
}

repositories {
    mavenCentral()
}

dependencies {
    testImplementation(libs.junit.jupiter)

    testRuntimeOnly("org.junit.platform:junit-platform-launcher")

    api(libs.commons.math3)

    implementation(libs.guava)
}

tasks.named<Test>("test") {
    useJUnitPlatform()
}
```

Challenges - ☢

`build.gradle.kts`

```
plugins {
    id("my-conventions")
}

apply {
    from("dependencies.gradle.kts")
}

tasks.named<Test>("test") {
    useJUnitPlatform()
    jvmArgs "-Dsamples=${projectDir.absolutePath}/samples"
}

... 500 lines ...

tasks.named<Test>("test") {
    useJUnitPlatform {
        includeTags("Fast")
    }
}
```

Challenges - Gauntlet for toolability

`build.gradle.kts`

```
android {
    namespace = "com.example.${project.name}"
}

dependencies {
    testImplementation(libs.junit.jupiter)
    testRuntimeOnly("org.junit.platform:junit-platform-launcher")

    api(libs.commons.math3)

    if (!buildingForJava17()) {
        implementation(libs.java17CompatibilityShim)
    }

    implementation(libs.guava)

    listOf("foo", "bar").forEach { name ->
        implementation("org:${name}:1.0")
    }

}

fun buildingForJava17() = JavaVersion.current() == JavaVersion.VERSION_17
```

Questions

- Who has needed a flexible and extensible build system?
- Who has seen a complex build?

Overcoming challenges

Overcoming challenges - Definitions

- Software Definition
  - *What* needs to be built
  - Kind of software, languages, target platforms
  - Dependencies, toolchains, quality checks etc…
- Build Logic
  - *How* the software will be built
  - Adds new capabilities, integrate tools
  - Supplies convention to the software definition

Overcoming challenges - Recommendations

Gradle can look declarative

- Keep build logic in plugins
- Give your convention plugins meaningful names
- Keep your build scripts simple - condition and loop free

Overcoming challenges -

`build.gradle.kts`

```
plugins {
    id("backend-library-conventions")
}

dependencies {
    api(libs.commons.math3)
    implementation(libs.guava)
}
```

But this might not be enough.

Developer-first builds

Vision

Developer-first builds - Vision

> *Elegant and extensible declarative build language that allows developers to describe any kind of software in a clear and understandable way.*

- Extensible, flexible
- Declarative 😟
- Clear and understandable 😫

Software Developers & Build Engineers

- Software Developers - Majority in most teams
  - Improve software by shipping features, fixing bugs …
- Build Engineers - Frequent in larger teams
  - Maintain the build, make developers productive
- Frequent in smaller teams
  - Who’s the Gradle expert?

Software Definition vs Build Logic

- Software Definition - *What* needs to be built
  - Meant to be read and modified by Software Developers
  - Resides in settings and projects definitions
- Build Logic - *How* the software will be built
  - Meant to be read and modified by Build Engineers
  - Resides in plugins (local or external)

Developer-first builds - Tactical goals

- Separate software definition and build logic with a declarative DSL
- Match the software definition to the software domain
- Excellent Tooling and IDE Integration

Developer-first builds

Current state

Developer-first builds - Teams

We work on this together

- Multiple teams at Gradle (DSL, Software, IDE)
- Android Studio team at Google
- IntelliJ, Kotlin & Amper teams at JetBrains

Developer-first builds - Disclaimers

- These are experiments.
- Prototypes require a Gradle nightly.
- IDE features require an Android Studio nightly.
- Prototypes are changing all the time and are not ready for production use.

Developer-first builds - Declarative Configuration Language

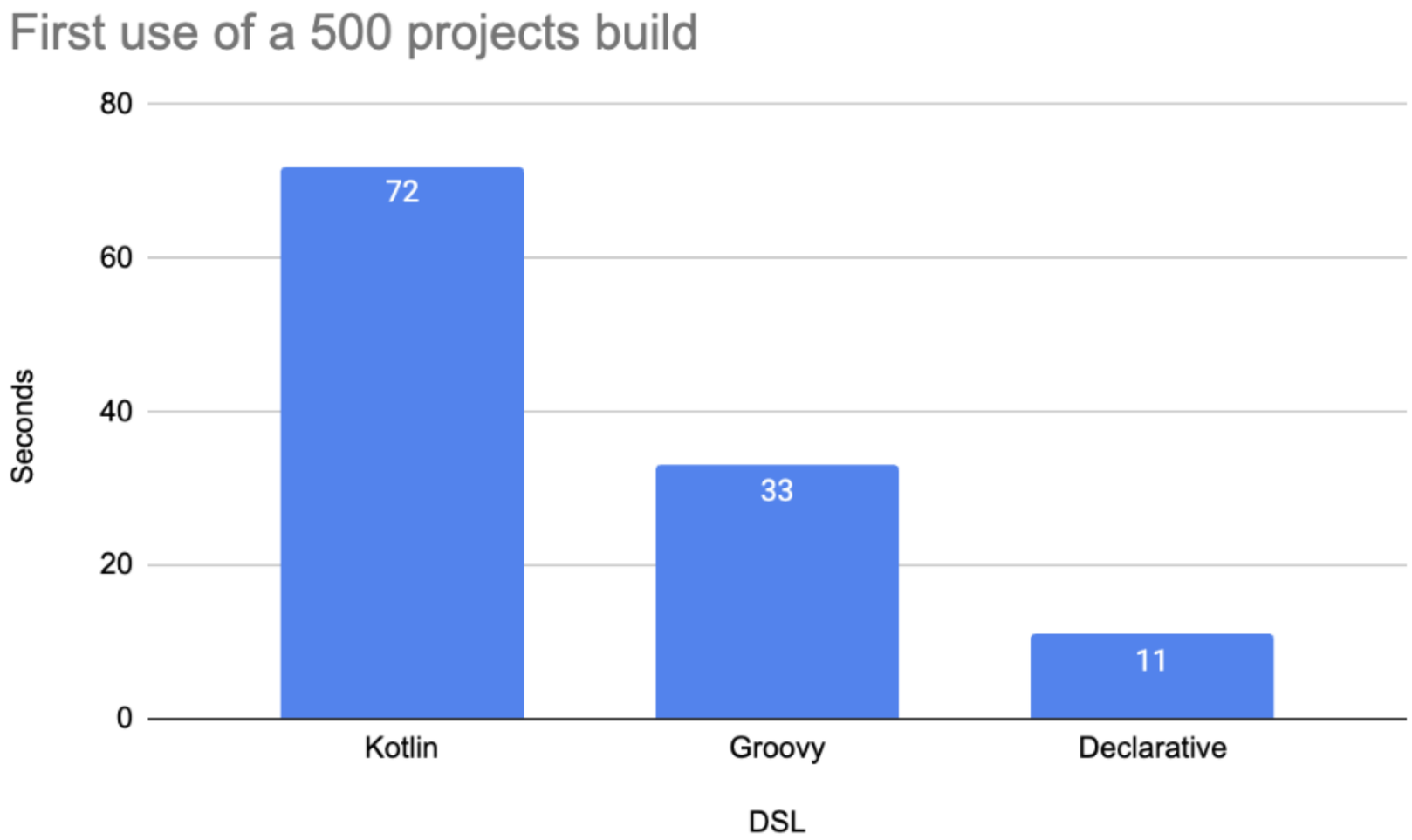
- Purely declarative
- Small subset of the Kotlin language
- Fast and resilient parser
- Schemas & Documents

Developer-first builds - Tooling

- Get projects schemas via Gradle's Tooling API
  - After build settings are evaluated
  - Before configuring any project
- Load documents for project definitions
  - Validate using the schema
  - DOM-like API
- This is data!
  - JSON Serialization

Developer-first builds - Performance

```
./gradlew assemble
```



Current prototypes - Software definition

- Software types for Kotlin (KMP), JVM (Kotlin, Java) & Android
    - Software type is a high level model for the ecosystem
- Wraps around existing plugins
- Limited configurability just to explore/experiment
- No plugin application in project DCL files

Current prototypes - Reusable conventions

- Reusable conventions support sharing common configuration
  - Properties
  - Dependencies
- Declared at the top-level settings DCL file

Current prototypes - Software types - Demo

`settings.gradle.dcl`

```
conventions {
    kotlinJvmLibrary {
        javaVersion = 21
    }
}
```

`build.gradle.dcl`

```
kotlinJvmLibrary {
    // javaVersion comes from convention

    dependencies {
        api(project(":core:common"))
    }
}
```

Demo

Questions

- Who has tried to automate changing the build definition?
- Who would like to clicky-click in a UI to understand a build and change it?

What's next?

A peak into the future

What's next? - Mutations / Refactorings

- Gradle guided changes available from tooling and command-line
- Integrated with IDE workflow (preview/diff, undo)
- Provided out of the box by Gradle or registered by plugins

What's next? - Mutations / Refactorings

Examples

- Upgrade an external dependency
- Add Compose to this project
- Update Gradle from 9.0 → 9.1
- Refactor this project to use non-deprecated properties

What's next? - Quick and resilient IDE sync

- Progressively provide more context
  instead of a monolithic sync step.
- Avoid slow recompilation of build scripts when build logic changes.
  Reparsing declarative files is fast.
- Errors in a declarative file don't need to be fatal to sync
  Best effort: know what "kind" of project it is at least.

What's next? - Other IDEs

- We want all features to be available to most IDEs
- We're working with JetBrains and Google for their IDEs
- Our IDE team is exploring
  - LSP language server & BSP build server
  - plugins for both Eclipse/Buildship and Visual Studio Code
- LSP & BSP should allow to add support in many other IDEs

What's next? - Defining new Software types

- Multiple conventions for the same software type
- Restricted configurability for a software type
- Entirely new software types/ecosystems

What's next? - Multiple Software type conventions

For example, a build with two different KMP libraries.

settings.gradle.dcl

```
softwareTypes {
    legacyLibrary {
        ...
    }
    nextGenerationLibrary {
        compose {
            ...
        }
    }
}
```

What's next? - Software type conventions

Some reusable conventions cross software type boundaries.

For example, Compose can be used by KMP or Android.

`settings.gradle.dcl`

```
conventions {
    compose {
        kotlinCompilerExtensionVersion = "1.5.12"
    }
}
softwareTypes {
    kmpLibrary {
        compose = conventions.compose
    }
    androidLibrary {
        compose = conventions.compose
    }
}
```

Where do we want to go?

Where do we want to go?

> *Elegant and extensible declarative build language that allows developers to describe any kind of software in a clear and understandable way.*

and more …

- Pluggable mutations/refactorings
- Excellent IDE support

Transition

- You can mix imperative and declarative in a build
- Gradle imperative DSLs don’t go away
- Software-types will be usable from imperative DSLs
- We are exploring ways and tooling for incremental migration

Roadmap - Highly speculative

- First EAP this summer
  - Demonstrating what we just talked about
  - Early feedback from the community
- 2024-H2
  - More EAPs towards the end of the year
  - More features
  - Addressing collected feedback
  - Further feedback from the community

Call to action

We need your help and feedback

- Visit declarative.gradle.org site
- Explore gradle/declarative-gradle repository
- Join Gradle's Community Slack
  `#declarative-gradle`
- Share your thoughts and use cases with us

Thank you!

Don’t forget to vote!

Come talk with us at our booth

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