Searching for Build Debt

Managing Technical Debt at Google

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Google's Build System Overview

- Single, Monolithic Source Repository 
- Single, Global Build System 
- Single Continuous Integration System 

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Google's Build System Debt

- Dependency Debt
- Visibility Debt
- Zombie Targets
- Dead Flags
- Other Discoveries

Dependency Debt

- Declared dependencies have to be manually kept in sync with source
- Over-declared dependencies waste resources
- Under-declared dependencies hinder progress

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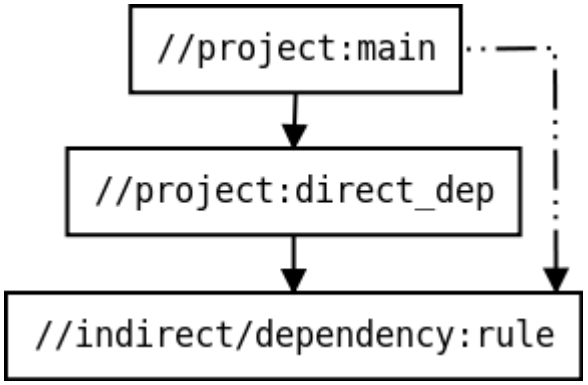
Example Under-Declared Dependency



calls Bar.getX()

uses Bar

defines Bar

```
/project/BUILD:

foo_binary(name = "main",
           deps = [":direct_dep"])

foo_library(name = "direct_dep",
            deps = ["//indirect/dependency:rule"])
```

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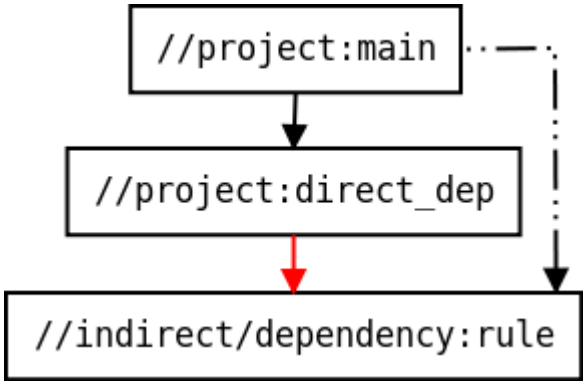
Example Over-Declared Dependency



calls Bar.getX()

stops using Bar

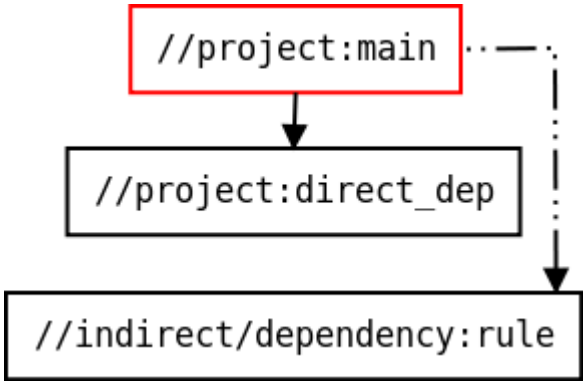
defines Bar

```
/project/BUILD:

foo_binary(name = "main",
           deps = [":direct_dep"])

foo_library(name = "direct_dep",
            deps = ["//indirect/dependency:rule"])
```

Remove Over-Declared Dependency



calls Bar.getX()

defines Bar

/project/BUILD:

```
foo_binary(name = "main",                ## BROKEN
           deps = [":direct_dep"])

foo_library(name = "direct_dep",
            deps = [])
```

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Treatment Philosophy

- Automate
- Make it easy to do the right thing
- Make it hard to do the wrong thing

Treatment of Under-Declared Dependencies

- Educate engineers
- Automate addition of under-declared dependencies
- Use build system to prevent reoccurrence

Results

- Tools adopted by several large projects
- Engineer pushback
- Uncovered additional technical debt

Visibility Debt Cleanup Results

- Changed default target visibility to private - 2011
- Poor education increased change aversion
- Engineer pushback overcome by management
- Remaining debt slowly being paid down

Zombie Target Cleanup Results

- Daily tracking of long-term broken targets (<1%)
- Identification in code search UI
- Semi-automated cleanup had little impact

Dependency Debt Removal Detail

- Language-specific solution (Java)
  - Build system partitions classpath elements (jars) into direct and indirect based on dependencies
  - Extend **`javac`** to determine the jar from which each referenced class was loaded
  - Issue warning when indirect jars referenced
  - Enforce: **`strict_java_deps`** build rule attribute