Research at Scale

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A Couple of Projects

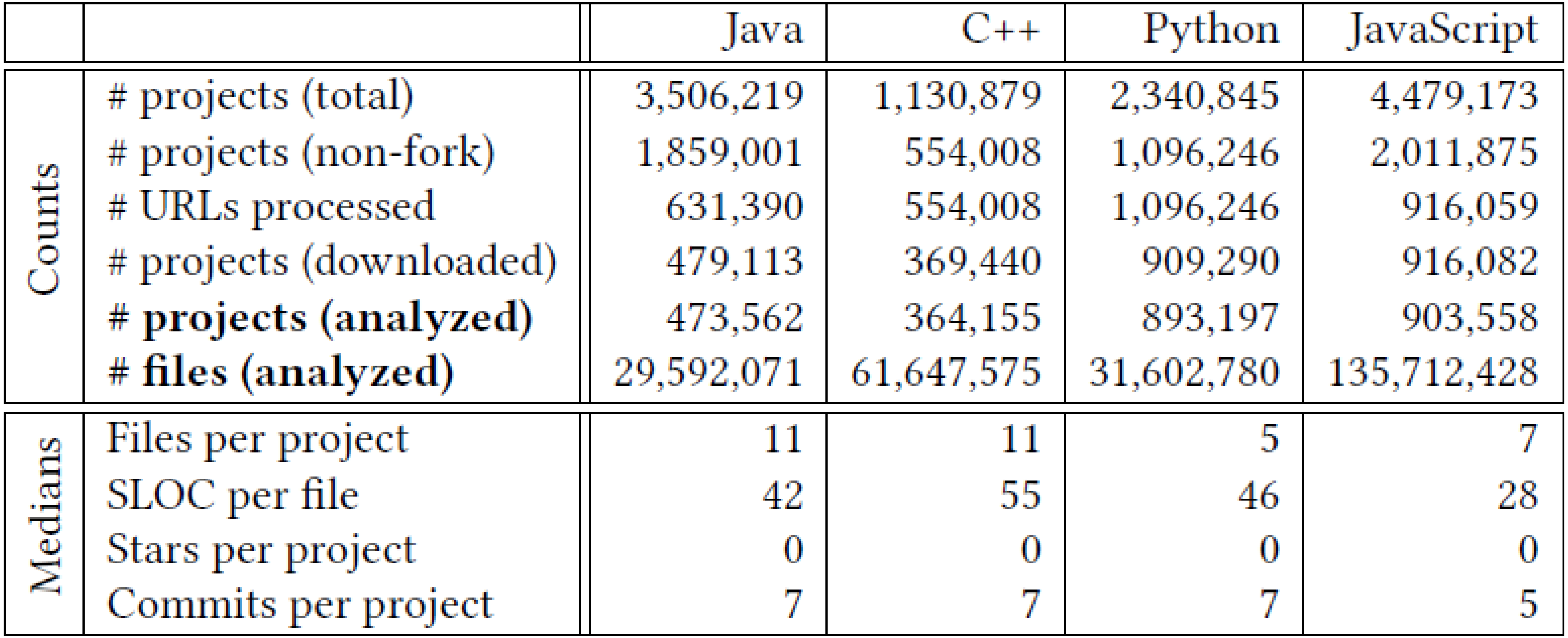
- Code cloning in Java, C++, Python, JavaScript (Collaboration with Jan Vitek, NEU)
- Sourcerer’s Java Build Framework
- [Is there gold in Stack Overflow data?]
  - Ask me offline!

Code Duplication

Understanding Natural Code Duplication

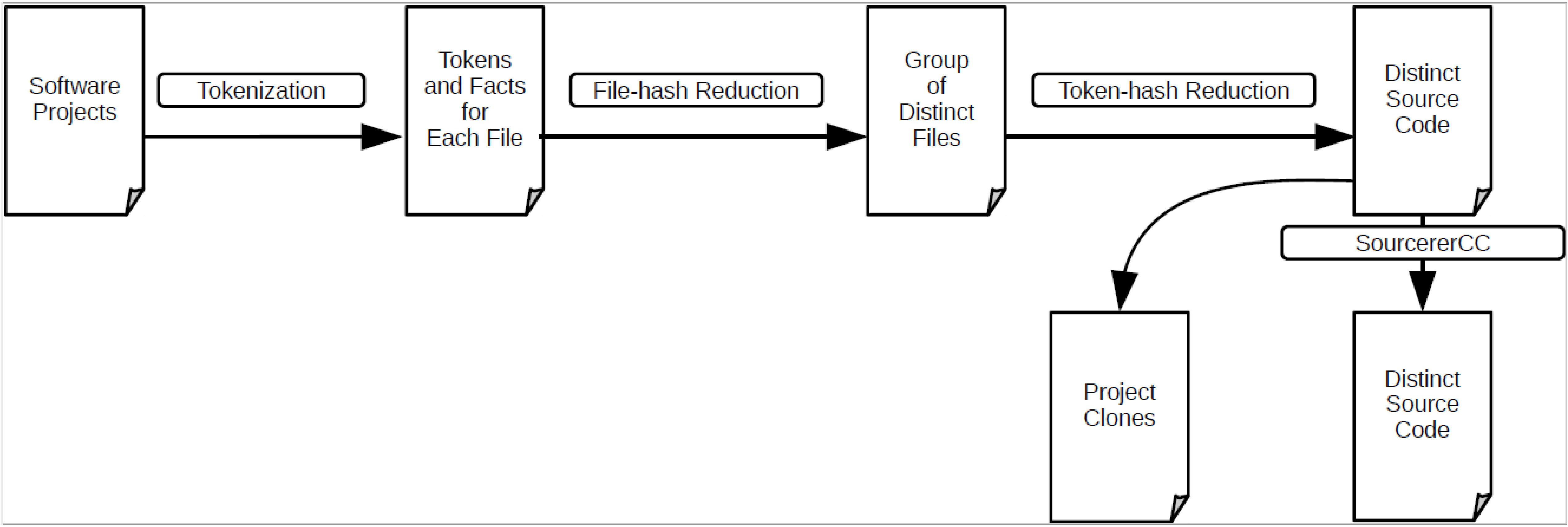
- Main objectives :
  - Measure it
  - Understand **what** is being cloned (qualitative analysis)
  - Understand main differences between different languages
  - Make duplication data available

Corpus

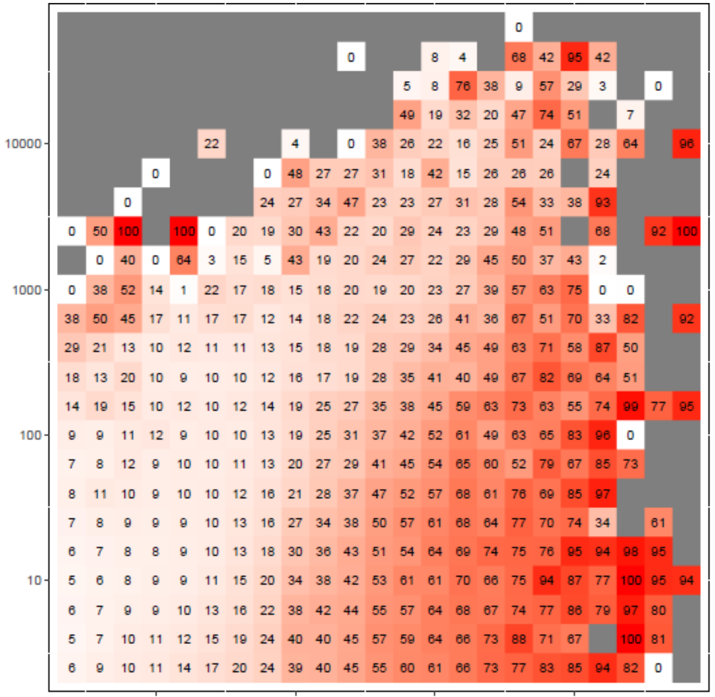


		Java	C++	Python	JavaScript
Counts	# projects (total)	3,506,219	1,130,879	2,340,845	4,479,173
	# projects (non-fork)	1,859,001	554,008	1,096,246	2,011,875
	# URLs processed	631,390	554,008	1,096,246	916,059
	# projects (downloaded)	479,113	369,440	909,290	916,082
	# projects (analyzed)	473,562	364,155	893,197	903,558
	# files (analyzed)	29,592,071	61,647,575	31,602,780	135,712,428
Medians	Files per project	11	11	5	7
	SLOC per file	42	55	46	28
	Stars per project	0	0	0	0
	Commits per project	7	7	7	5

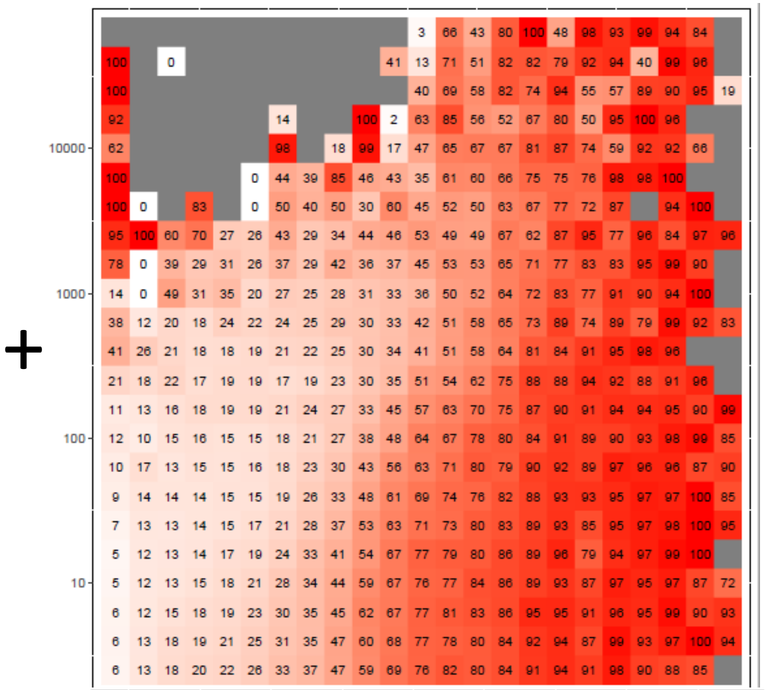
Data Processing Pipeline



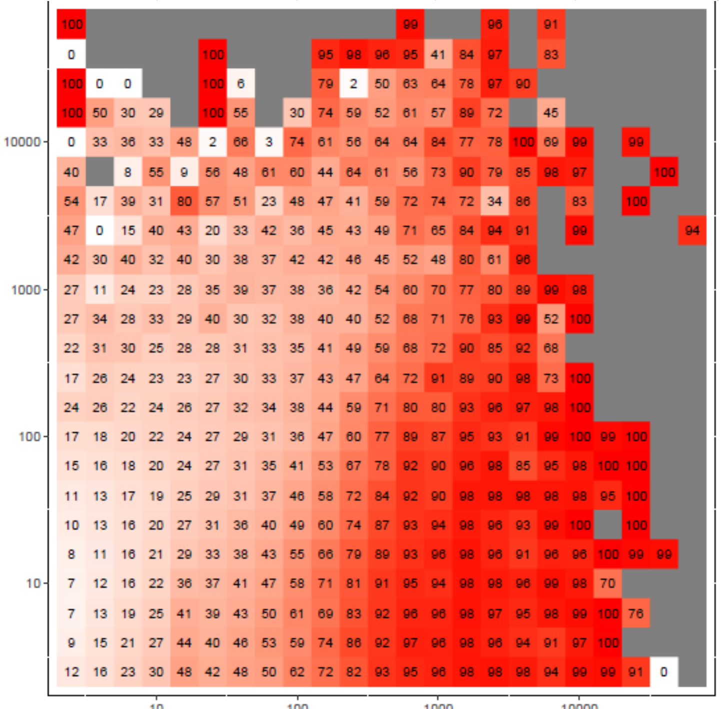
Duplication vs. # files, # commits



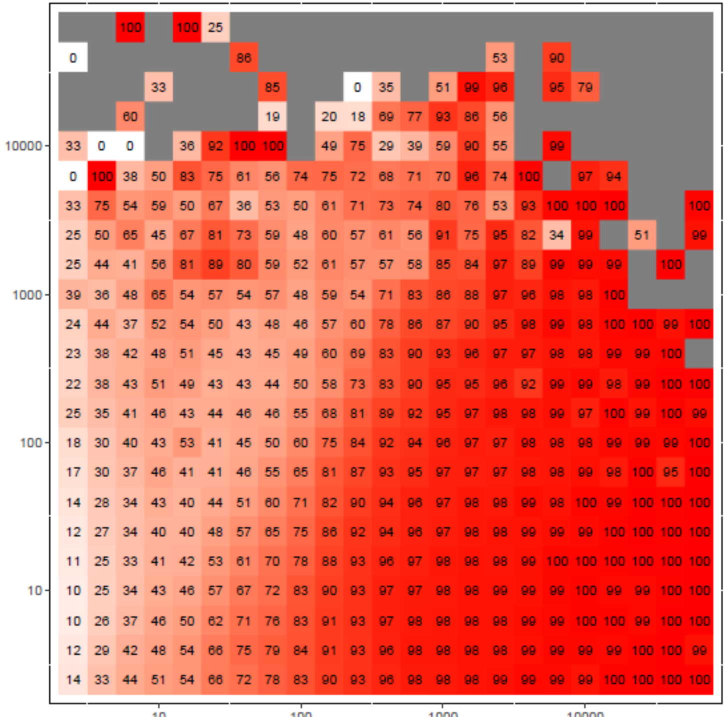
Java



C++

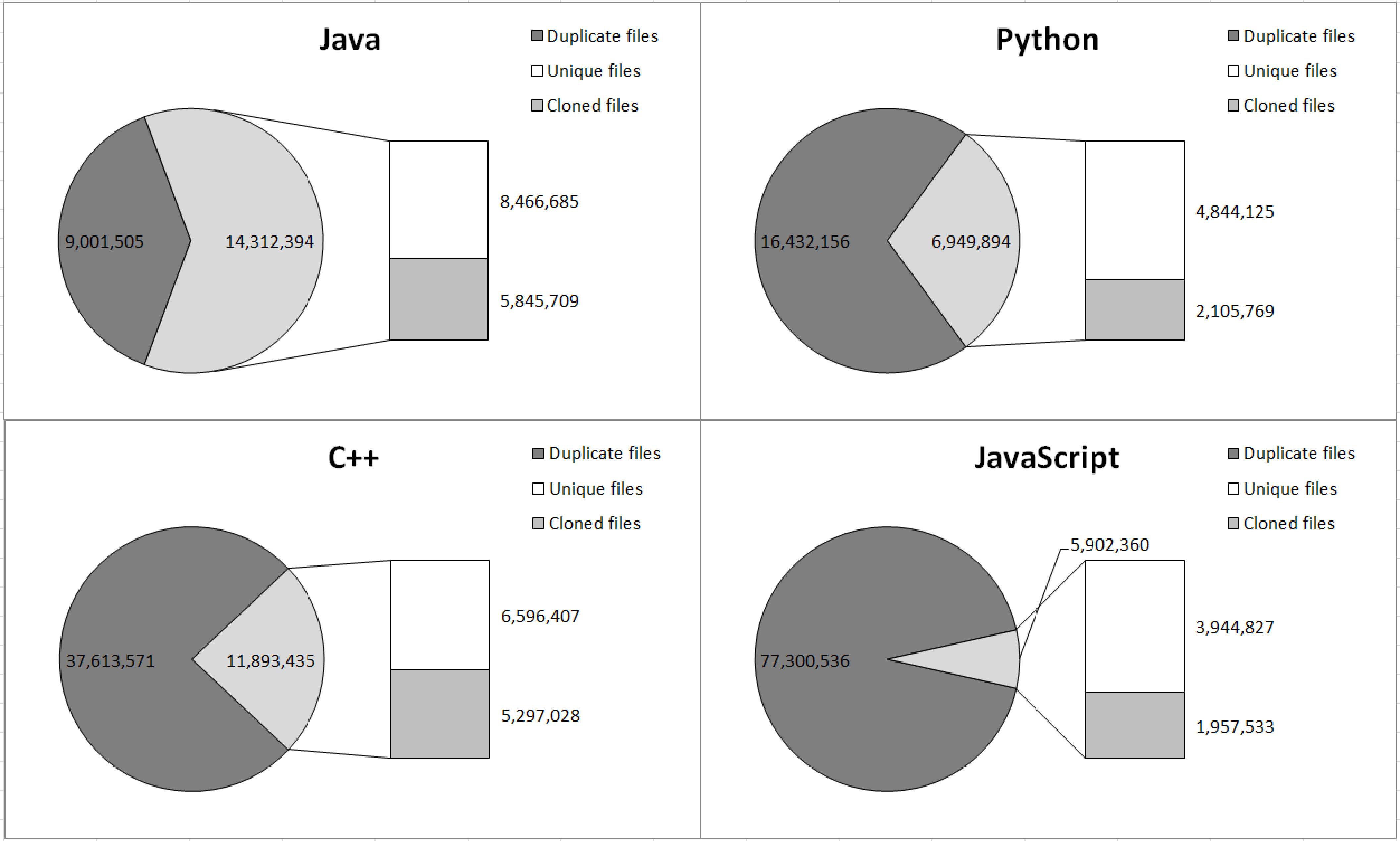


Python

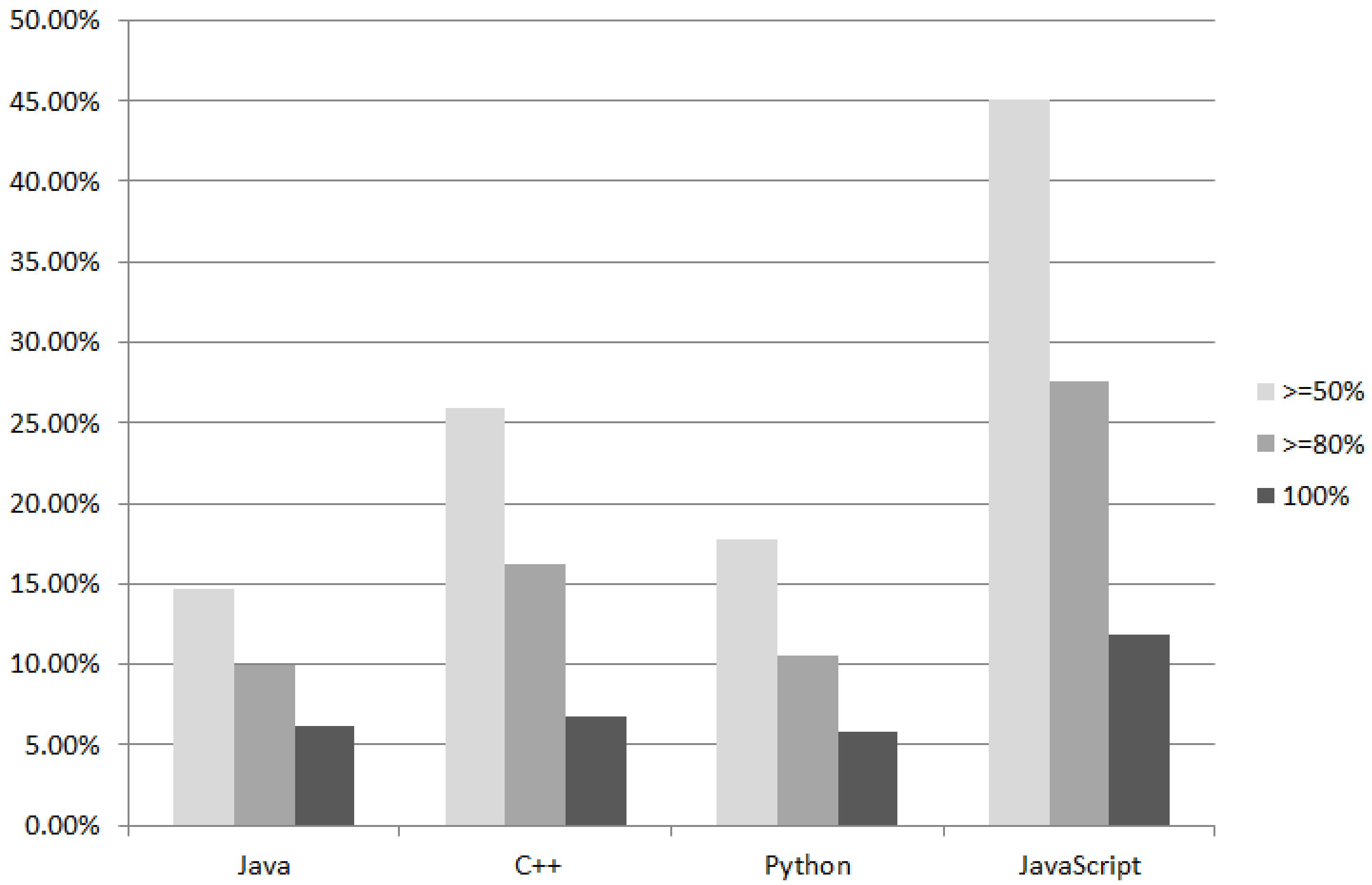


JS

Types and Amounts of Duplication



Project-Level Duplication



Current Work

- DejàVu: a Web service that returns all duplicates of a given file in GitHub
- Performance improvements to clone detection

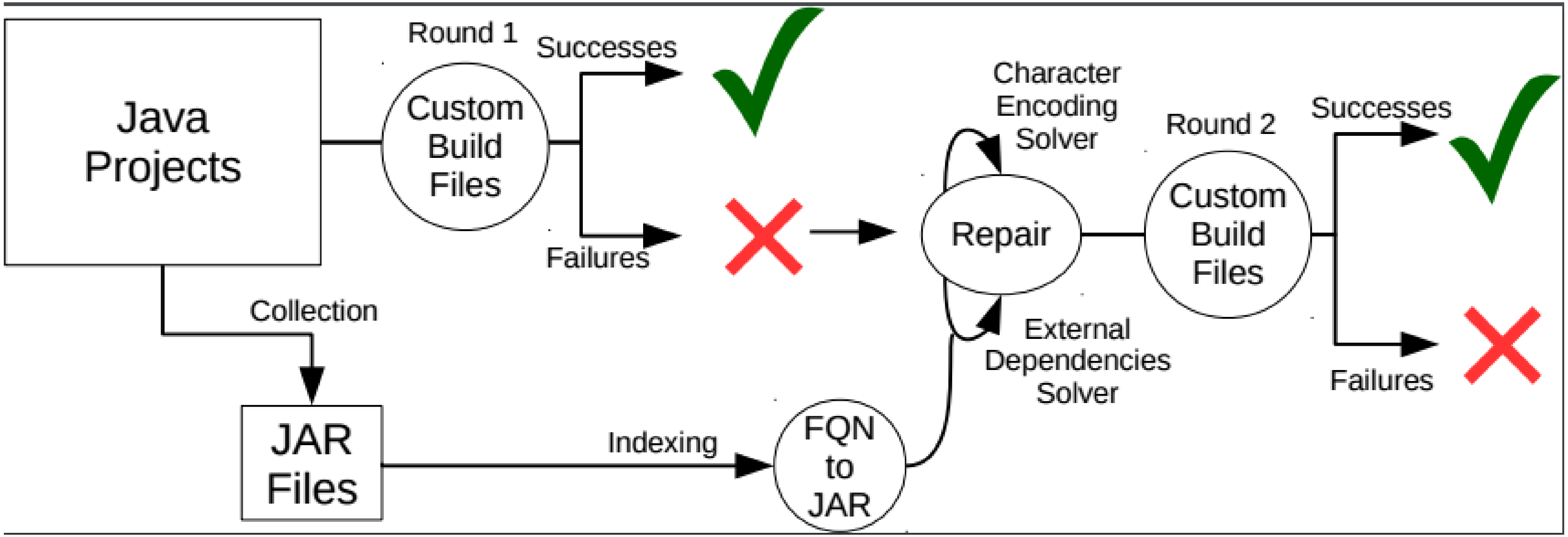
Sourcerer’s Java Build Framework

Goal

- Automatically build ALL of GitHub Java corpus

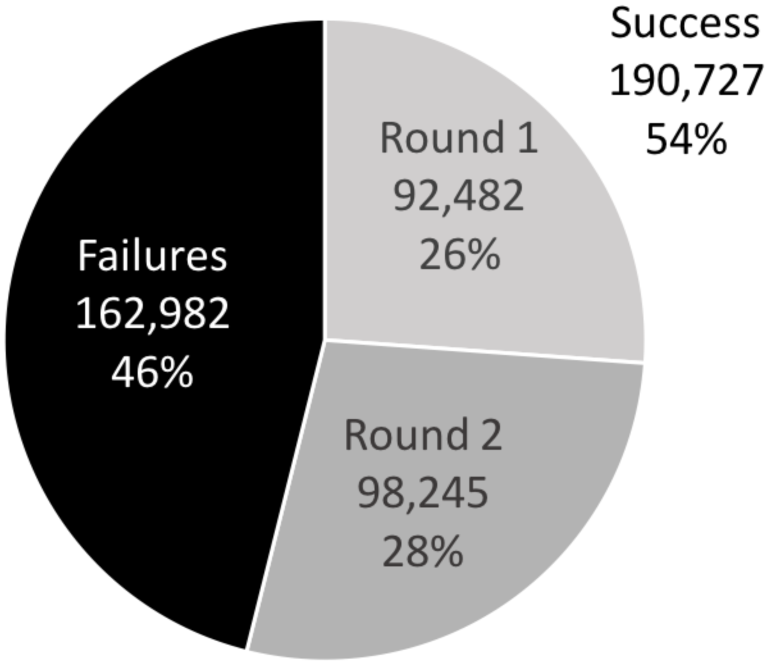
- Today:
  - **54% non-Android**

SourcererJBF



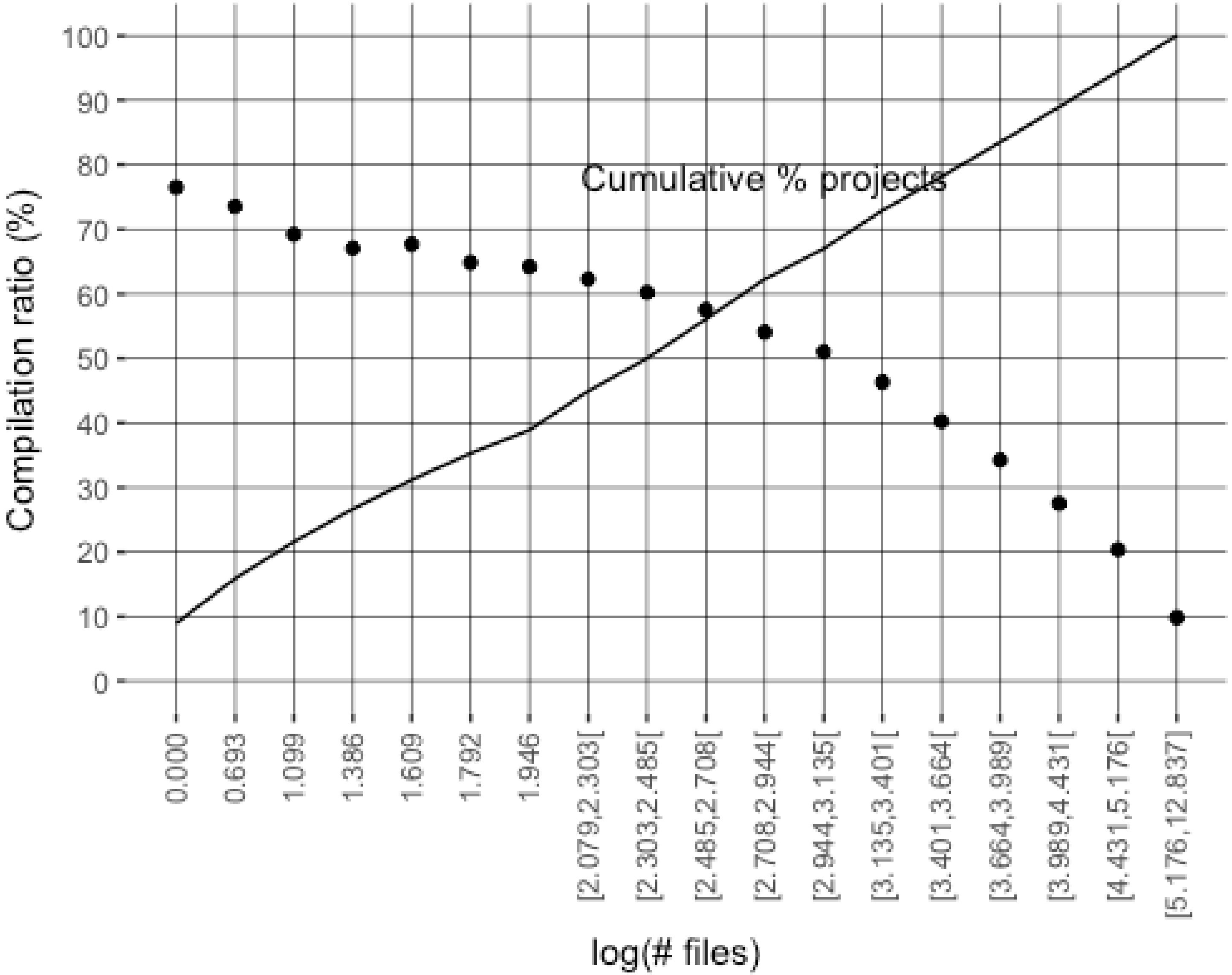
SourcererJBF Effectiveness

353,709 non-Android projects



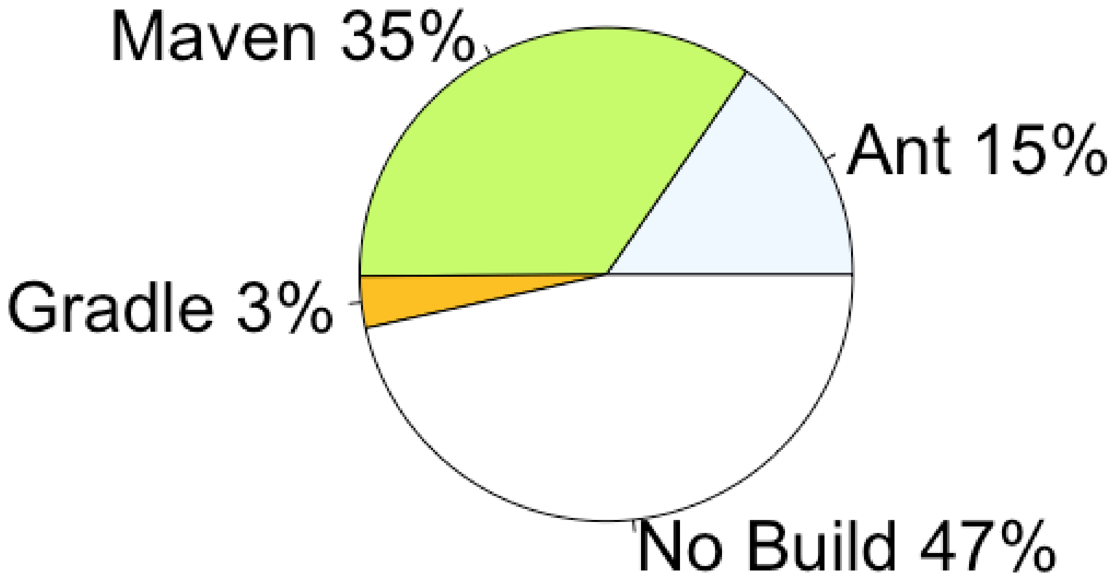
Success
54%

Correlation with Project Size?

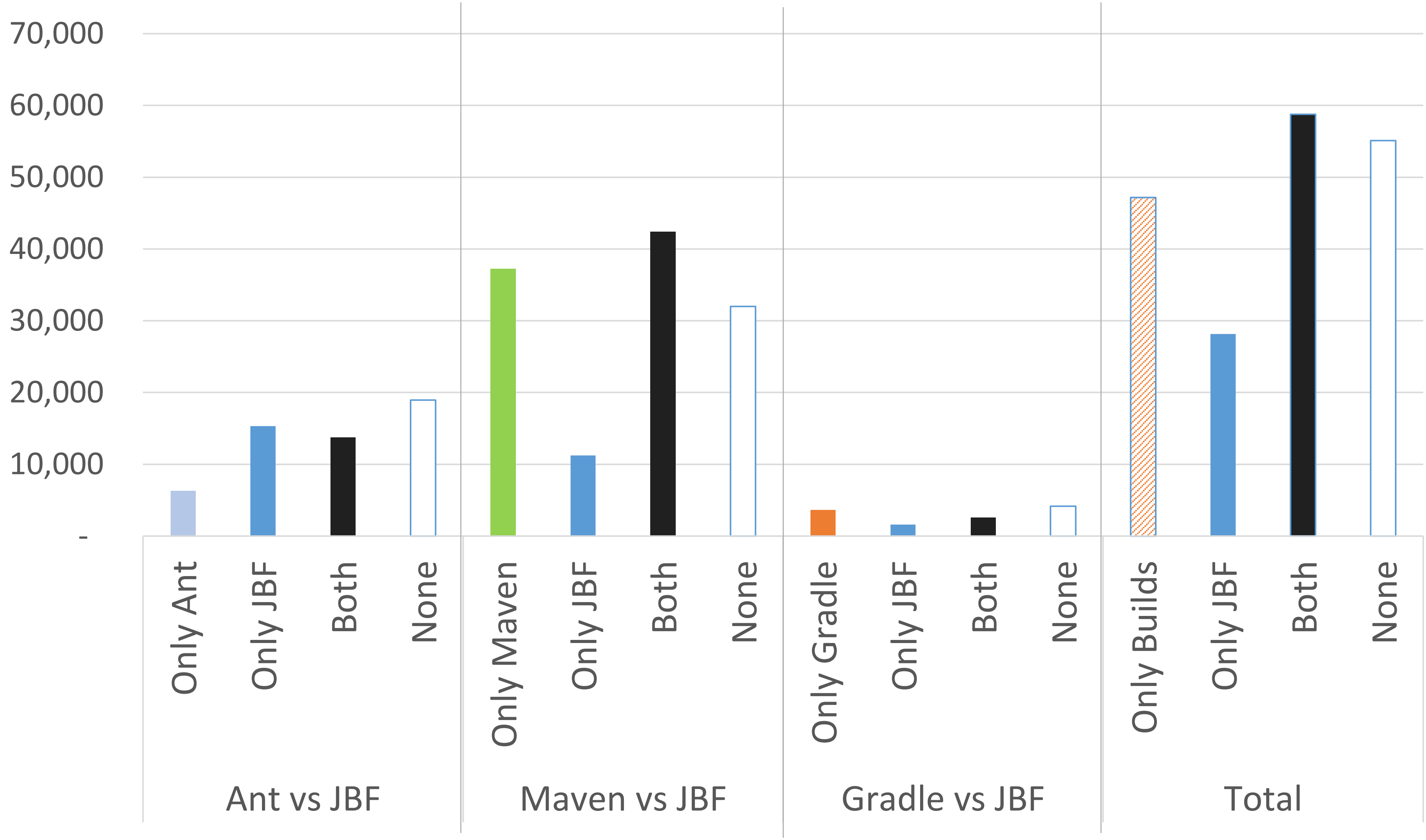


Could Own Build Scripts do Better?

189,220 out of 353,709 projects (53%)



Could Own Build Scripts do Better?



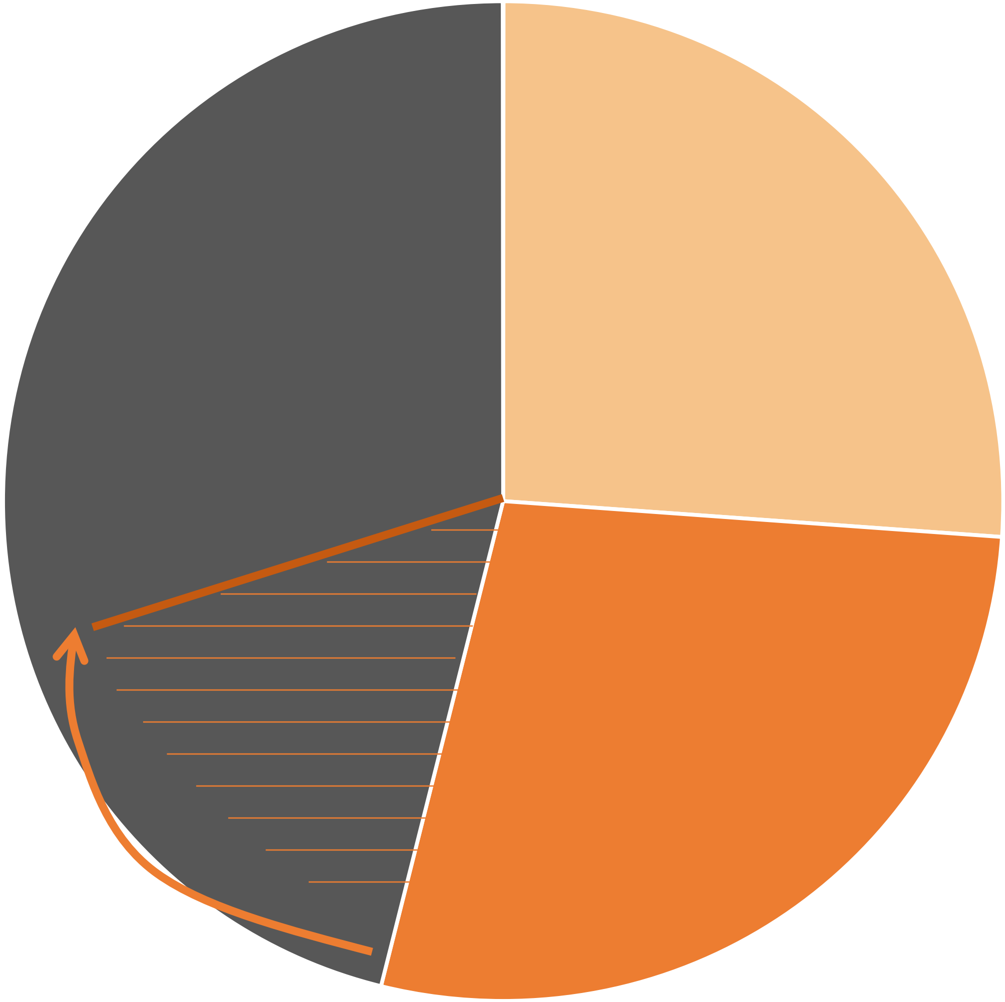
In **189,220** projects:
JBF: 86,926 (46%)
Own: 105,973 (56%)

In **353,709** projects:
JBF: 190,727 (**54%**) ←
Own: 105,973 (**30%**)

Problems with Own Builds

- Security and integrity of local build system
  - Crazy things happen!
- Unknown location of compiled code
  - Maybe jar’ed, may be moved into network, etc…
- Large variation of actions, not just compilation
  - “Success” means build script succeeded, not compilation succeeded
- Builds take much longer
  - JBF: 8 secs (median)
  - Own builds: 20 secs (median)

Improving SourcererJBF Effectiveness



Success now:
54%

↓

Success target:
67%

Doing Research with Big Data, the Bad

- Tera-byte sized datasets
  - Difficult to handle, share
- Requires $$ hardware
  - Currently: 112-core server, 512G RAM
- Processing can take weeks
  - Mistakes are expensive
- Scientific insights don’t necessarily need big data
  - Sampling

Doing Research with Big Data, the Good

- Useful applications require the whole data
- Scale presents new engineering challenges
  - Doctoral work worthy