

STARTS: STAtic Regression Test Selection

Owolabi Legunsen, August Shi, Darko Marinov

ASE 2017

Urbana-Champaign, Illinois

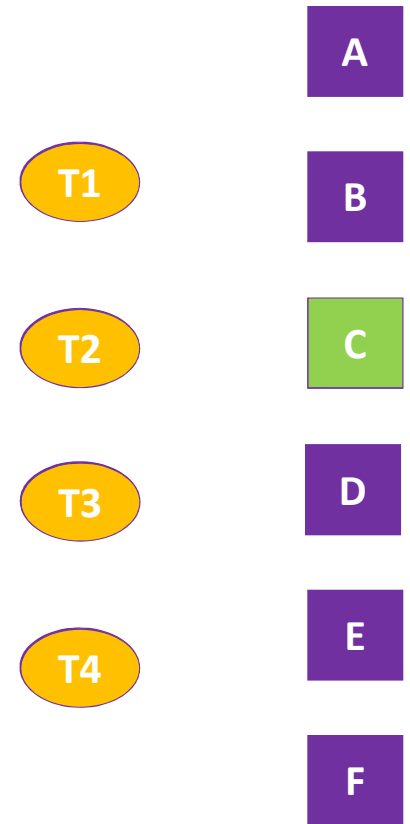
November 1, 2017



Regression Testing

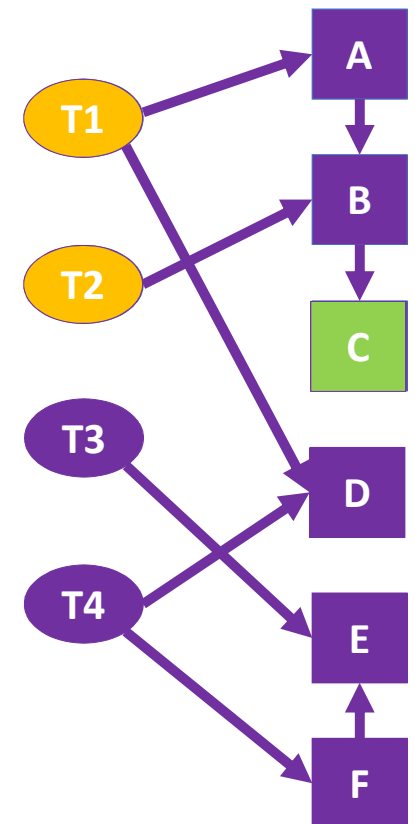
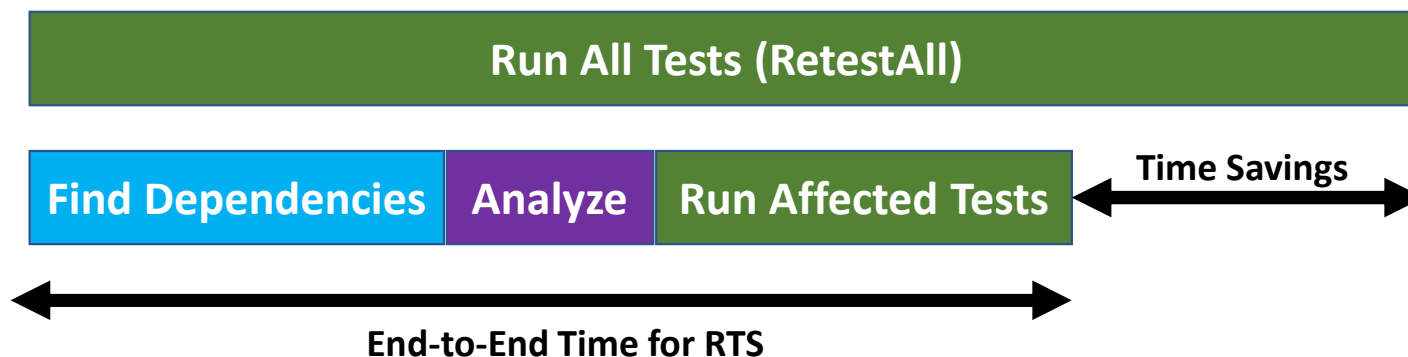
- Rerun tests after every change to check that existing functionality is not broken
- RetestAll: run all tests after each change

Problem: RetestAll can be slow especially when there are many tests!



Regression Test Selection (RTS)

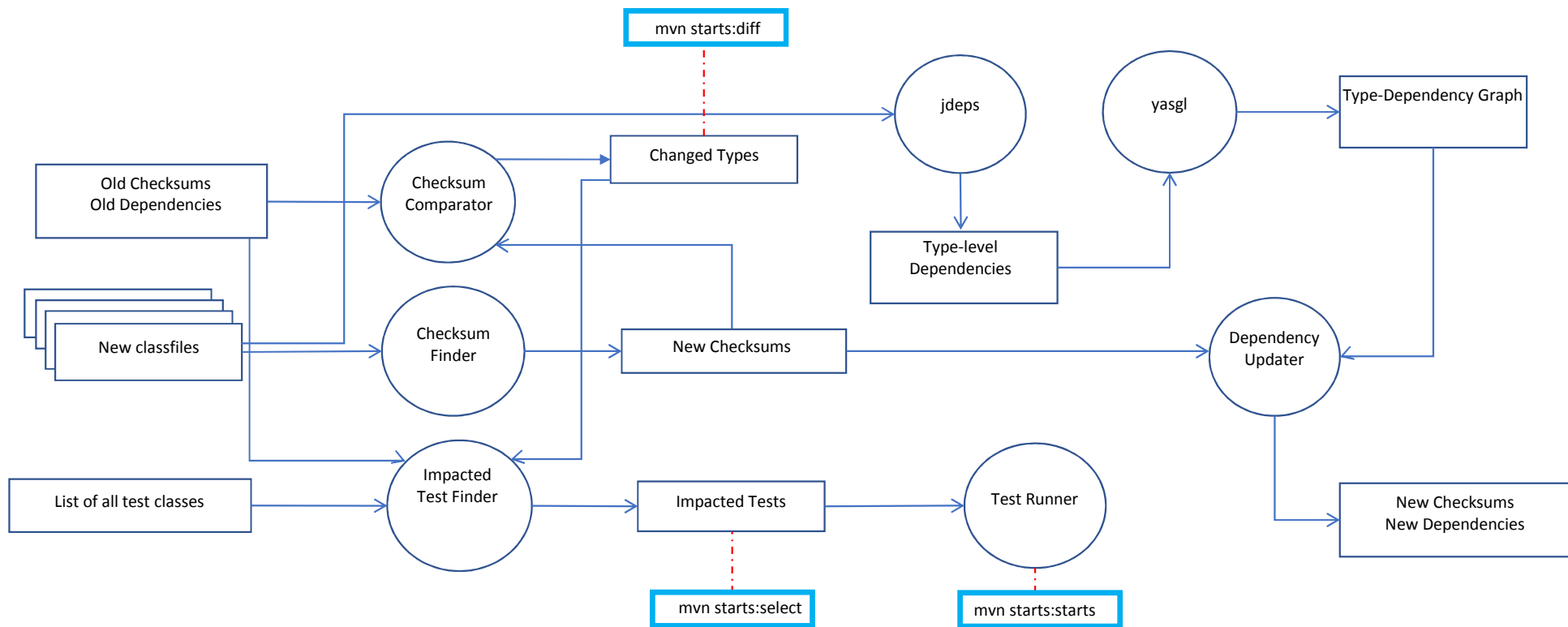
- RTS speeds up regression testing by rerunning only tests that are affected by the code changes
- End-to-end time for RTS steps must be less than time to rerun all tests



STARTS

- STARTS is an RTS tool that finds dependencies **statically**
 - Dynamic may be too slow, or infeasible in some settings
- We implemented STARTS as a Maven plugin
- STARTS source code is publicly-available on GitHub:
 - <https://github.com/TestingResearchIllinois/starts>

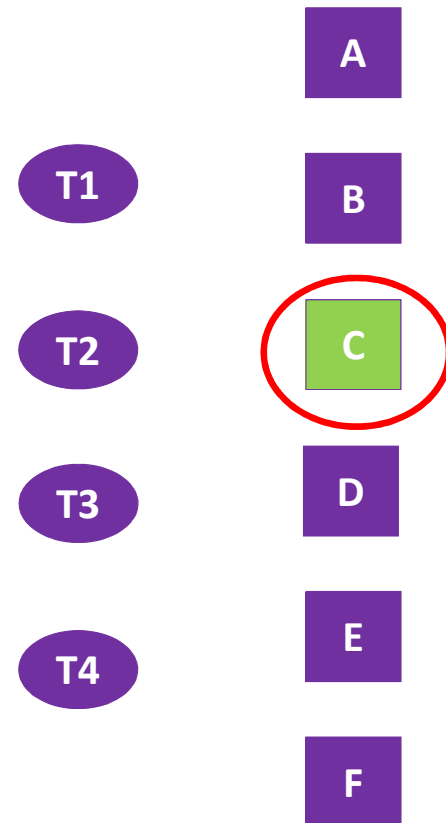
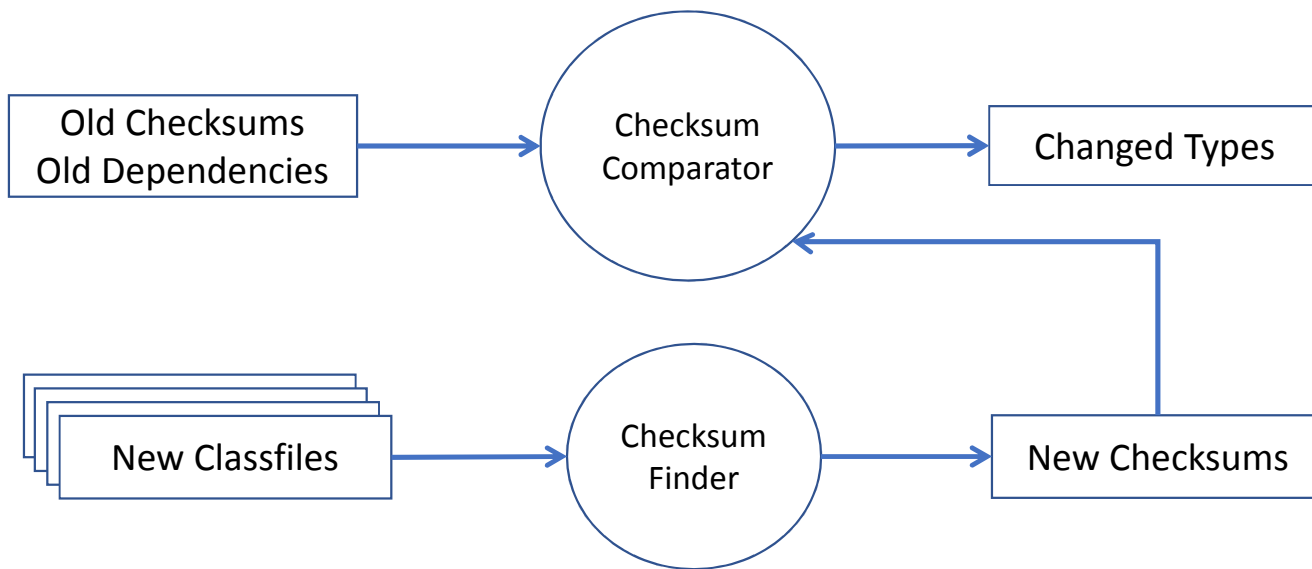
STARTS Architecture



STARTS: Finding Changes

`mvn starts:diff`

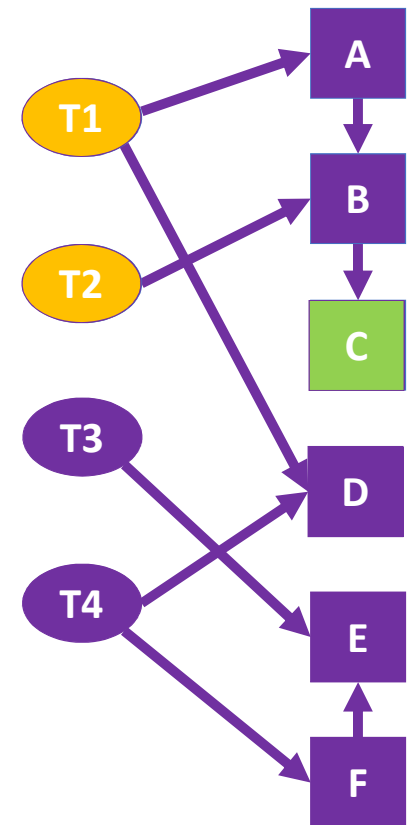
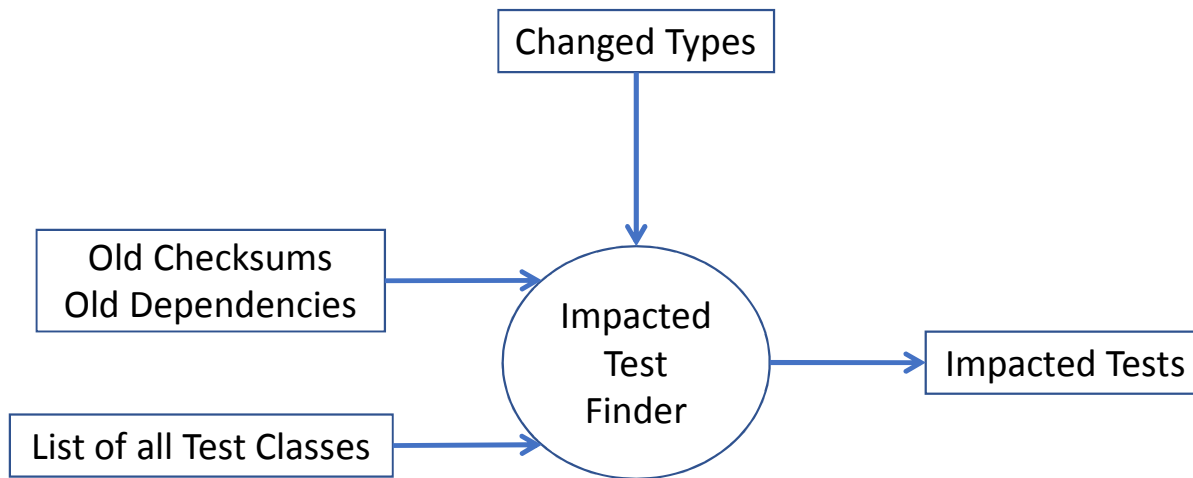
Find changes since last time STARTS was run



STARTS: Selecting Impacted Tests

`mvn starts:select`

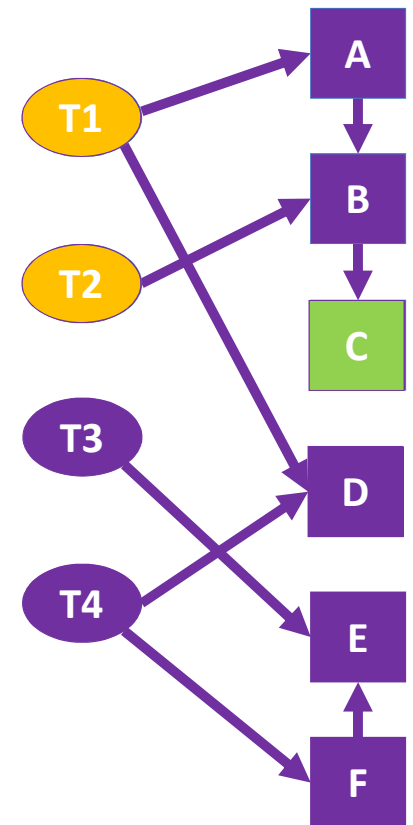
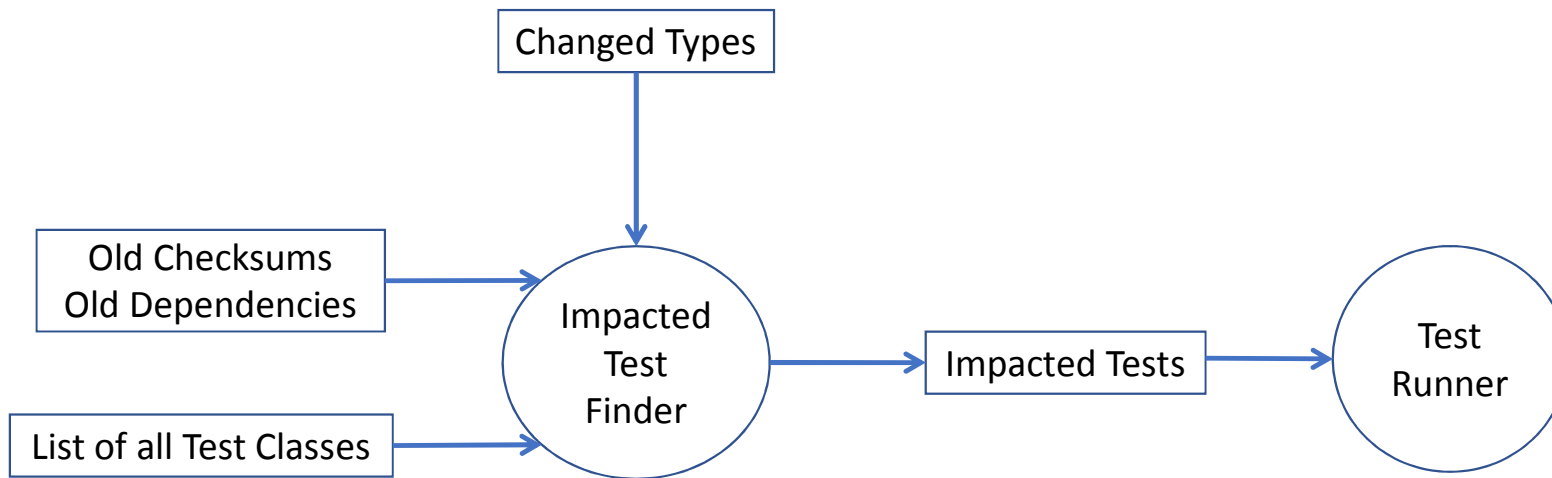
Select impacted tests without running them



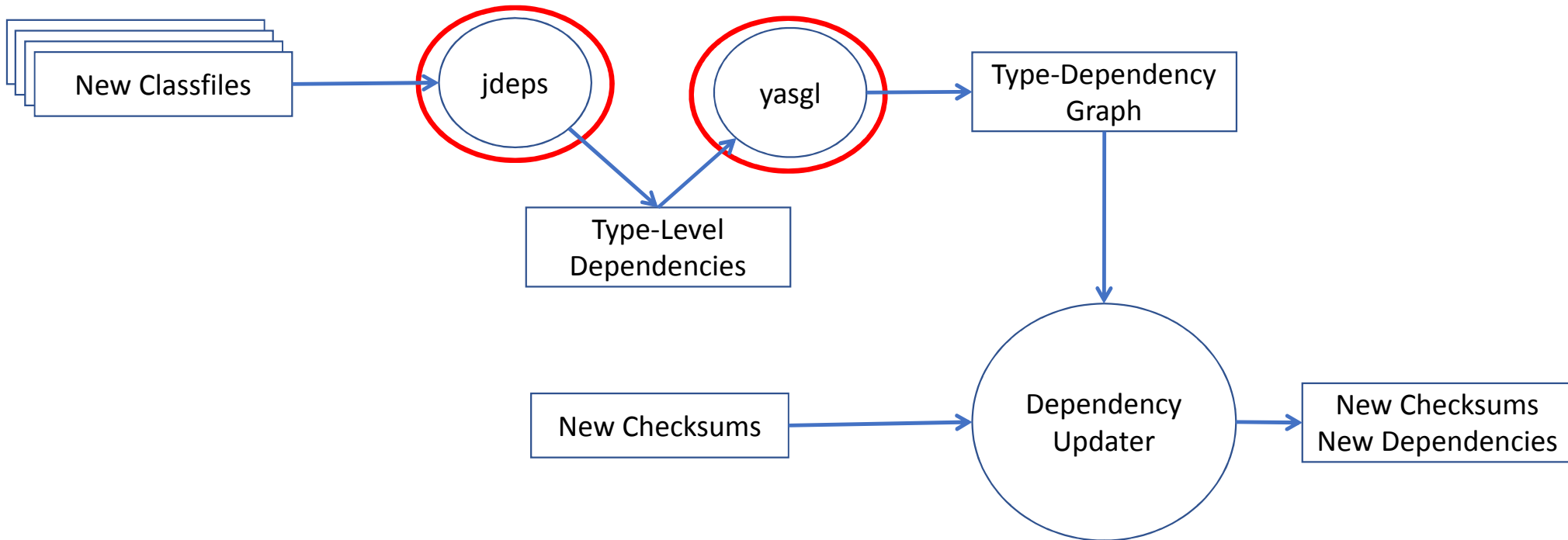
STARTS: Running Impacted Tests

`mvn starts:starts`

Select and run impacted tests



STARTS: Updating for the Next Run



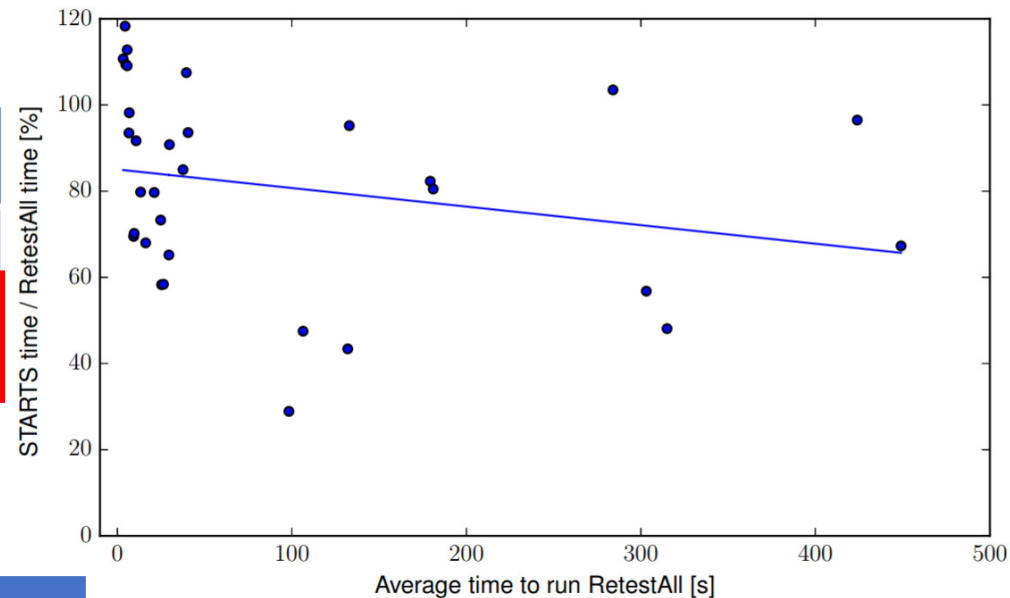
jdeps is part of the standard JDK and quickly finds direct class dependencies

yasgl is our custom graph library for computing the transitive closure

Results on 840 versions of 32 GitHub projects

| | Tests (#) | Selected Tests (#) | Selected Tests (%) | RetestAll Time (s) | STARTS Time (%) |
|---------------|-----------|--------------------|--------------------|--------------------|-----------------|
| Avg (SHORT) | 58.0 | 16.4 | 32.4 | 17.6 | 87.8 |
| Avg (LONG) | 155.9 | 54.1 | 40.5 | 236.8 | 68.2 |
| Avg (OVERALL) | 91.7 | 29.4 | 35.2 | 93.0 | 81.0 |

STARTS is more effective for longer-running projects



| | STARTS Breakdown (%) | | | |
|---------------|----------------------|------------------|----------------------|-------------|
| | <i>analysis</i> | <i>execution</i> | <i>graph constr.</i> | Compilation |
| Avg (SHORT) | 1.0 | 25.9 | 8.7 | 64.4 |
| Avg (LONG) | 0.8 | 70.8 | 2.3 | 26.2 |
| Avg (OVERALL) | 0.9 | 41.3 | 6.5 | 51.3 |

STARTS analysis and graph construction time is relatively efficient

Conclusions

- STARTS is a publicly-available, purely static, class-level regression test selection tool
- We are investigating ways to make STARTS safer
 - Maybe also more precise?
- STARTS is available on GitHub
 - <https://github.com/TestingResearchIllinois/starts>

legunse2@illinois.edu