SAVE:

Testing static analyzers and compilers

HUAWEI

TestCon MOSCOW

Can you hear me?

Disclaimer:

No testing «philosophy»
No marketing
No boring reading from the list
Only personal experience
And some PR of open-source projects

01

Intro

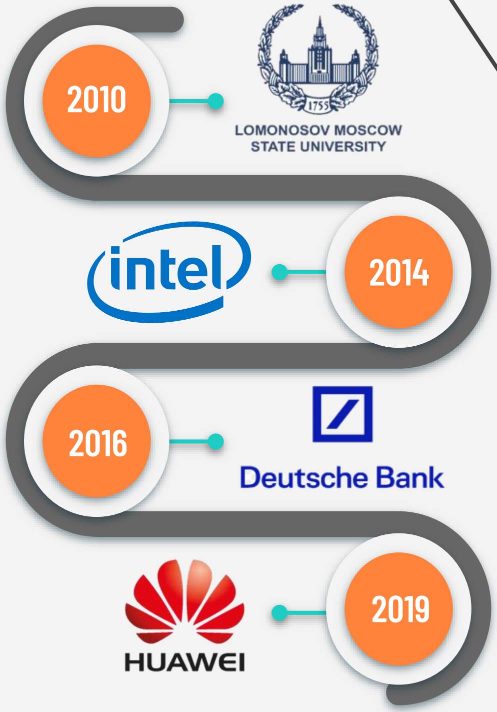
About the problem and us

$ whoami

Andrey Kuleshov, R&D at Huawei RRI

https://github.com/**akuleshov7**

#static analysis, #open-source, #kotlin



Problem

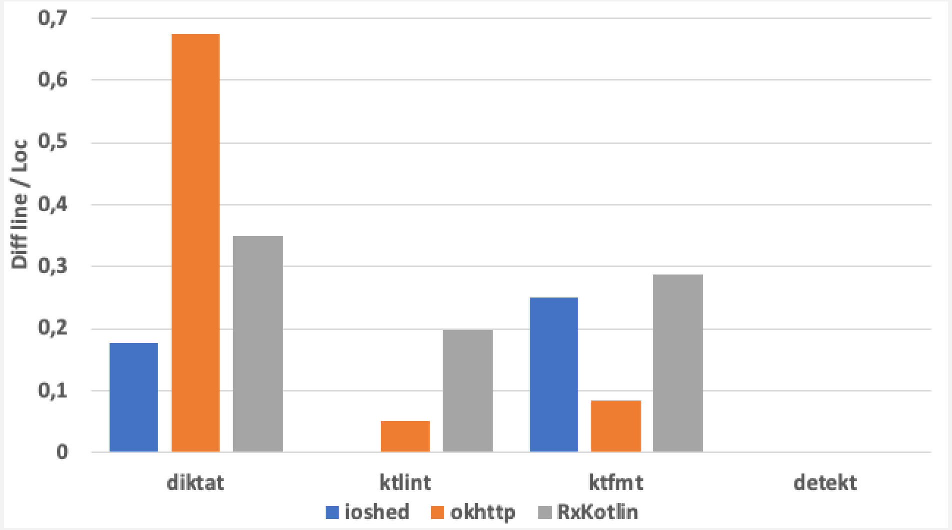
We are creating and using:

- Vendor tools and Internal Systems for Static Analysis

We see the lack of tools and frameworks in open-source for:

- Measuring of capabilities, functional testing
- Quick and easy regression testing
- Standardization and benchmarking

Need some evaluation and comparisson mechanism



A figure from our paper for ISSRE conference comparing code fixers for Kotlin

For example:

We created static analyzer for Kotlin: https://github.com/cqfn/diKTat

We integrated to: https://github.com/diffplug/spotless

But what if we want to find and evaluate existing tool instead of creating a brand new one?

Our inspiration and existing works

lit – LLVM Integrated Tester

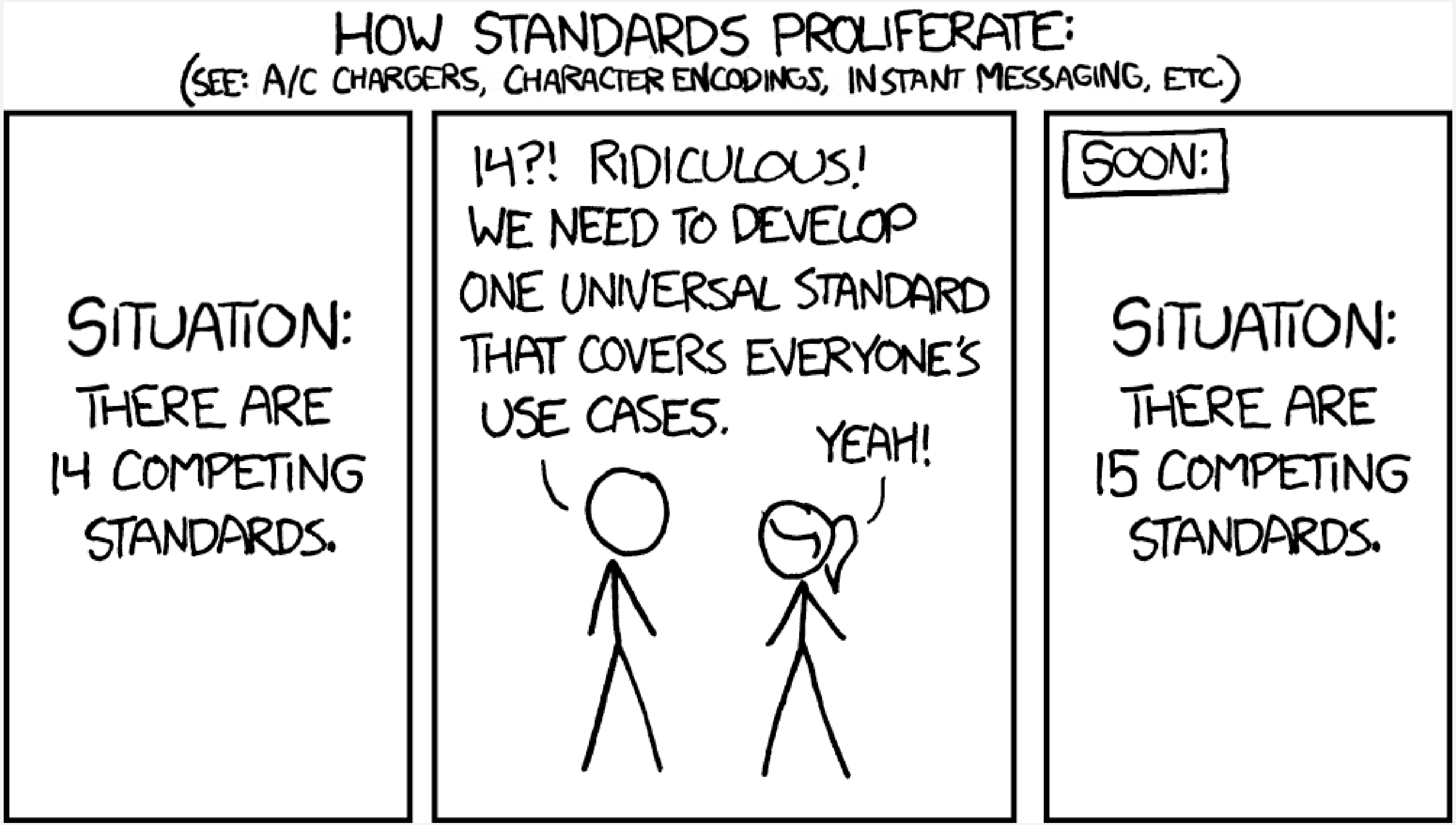
spec.org - Standard Performance Evaluation Corporation

MISRA - Motor Industry Software Reliability Association

Industial Compilers and Static Analyzers

350,000+

This is how many functional tests are there in GCC. LLVM and Clang have mostly same huge test packages. Industrial compilers, like ICC, can have **1 mln+** tests


HOW STANDARDS PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)
SITUATION: THERE ARE 14 COMPETING STANDARDS.
14?! RIDICULOUS! WE NEED TO DEVELOP ONE UNIVERSAL STANDARD THAT COVERS EVERYONE'S USE CASES.
YEAH!
SOON:
SITUATION: THERE ARE 15 COMPETING STANDARDS.

02

SAVE

Static Analysis Verification and Evaluation,
CLI application, core framework

How to close these gaps

https://github.com/cqfn/save

01

Native CLI application that can process readable tests with different plugins

Some specific CI/CD service, that has standard benchmarks and executes tests on flexible cluster

02

https://github.com/cqfn/save-cloud

3 active contributors with the most active **@petertrr**

Concept points

What did we want (and still want) to achieve?

01

Native application

Kotlin Native Multiplatform
Win/Linux/MacOS

02

Plugins and reporters for test logic (processing)

Plugins and reporters should have a common interface

03

Configuration mechanism

Hierarchical inheritance
Logic via config DSL (~~TOML~~)

https://github.com/cqfn/save

Config and default plugins

save.toml (https://github.com/akuleshov7/**ktoml**)

```
[general]
   tags = ["documentation", "custom tag", “other tags"]
   description = "Test for diktat - linter and formatter for Kotlin"
   suiteName = "warnings"
   execCmd = "java -jar ktlint -R diktat.jar"
   expectedWarningsPattern = "// ;warn:(.+):(\\d+): (.+)"

[warn]
   testNameSuffix = "Test.kt"
   actualWarningsPattern="(\\w+\\..+):(\\d+):(\\d+): (\\[.*\\].*)$"
   exactWarningsMatchHasColumn = true
   warningTextHasLine = true

[fix]
   execFlags = "-F"
```

Common section with the main info

Plugins (test execution logic). Optional

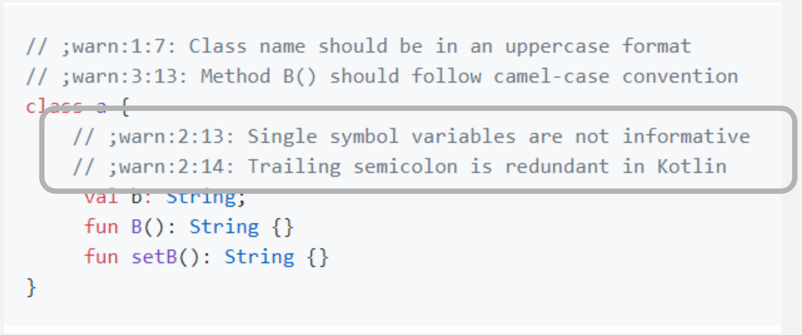
Default plugins

[FIX] plugin

1. **Execute** tested tool that should be tested on the test resource with Test suffix in the name
2. **Compare** the result with the resource with Expected suffix in the name

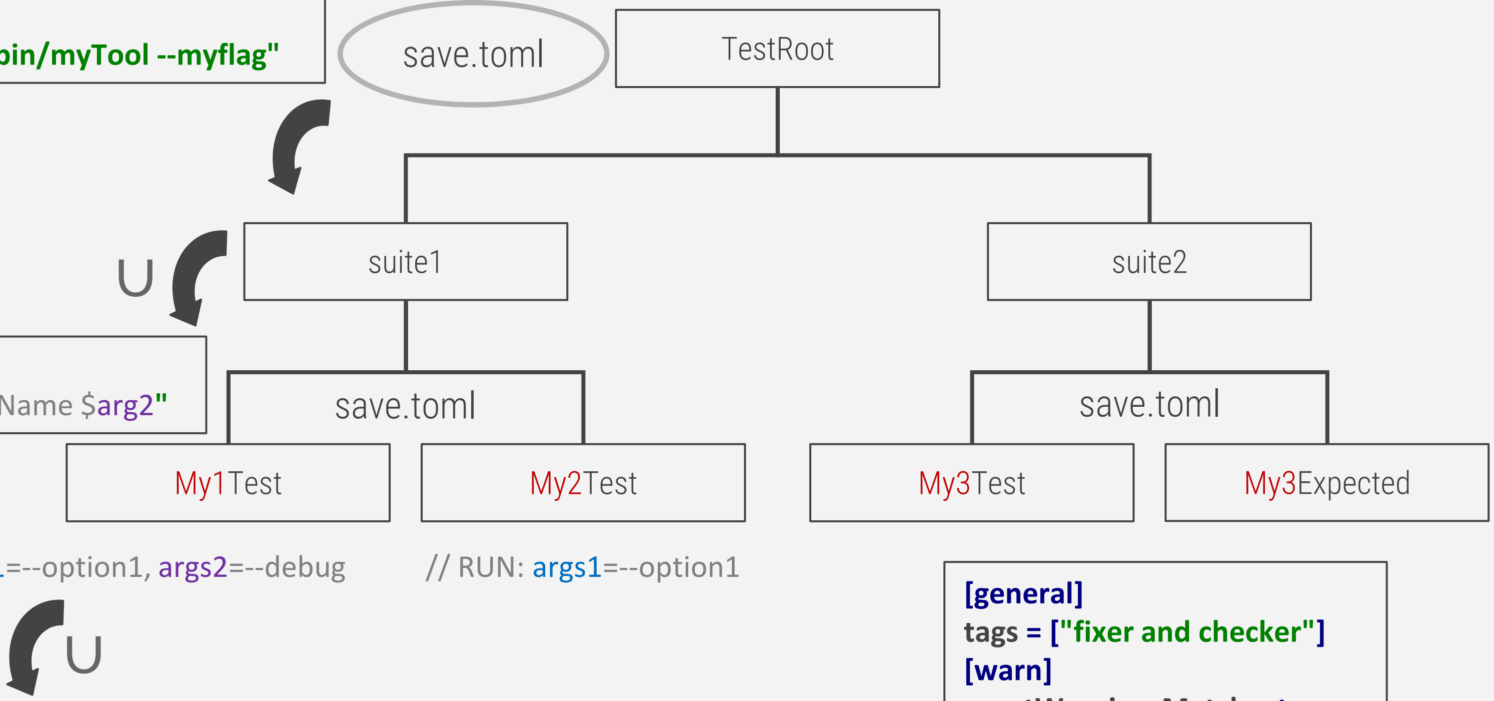
[WARN] plugin

1. **Execute** tested tool that should be tested on the test resource with Test suffix in the name
2. Map and **Compare** the output with special metadata



```
// ;warn:1:7: Class name should be in an uppercase format
// ;warn:3:13: Method B() should follow camel-case convention
class a {
    // ;warn:2:13: Single symbol variables are not informative
    // ;warn:2:14: Trailing semicolon is redundant in Kotlin
     val b: String;
     fun B(): String {}
     fun setB(): String {}
}
```

Less code duplication with configs



```
[general]
execCmd = "/usr/bin/myTool --myflag"
```

```
[warn]
execFlags = "$arg1 $fileName $arg2"
```

// RUN: args1=--option1, args2=--debug

// RUN: args1=--option1

```
[general]
tags = ["fixer and checker"]
[warn]
exactWarningsMatch = true
[fix]
execFlags = --fix
```

/usr/bin/myTool --myflag --option1 My1Test --debug

In-file test setup

https://github.com/cqfn/save/tree/main/**examples/kotlin-diktat**

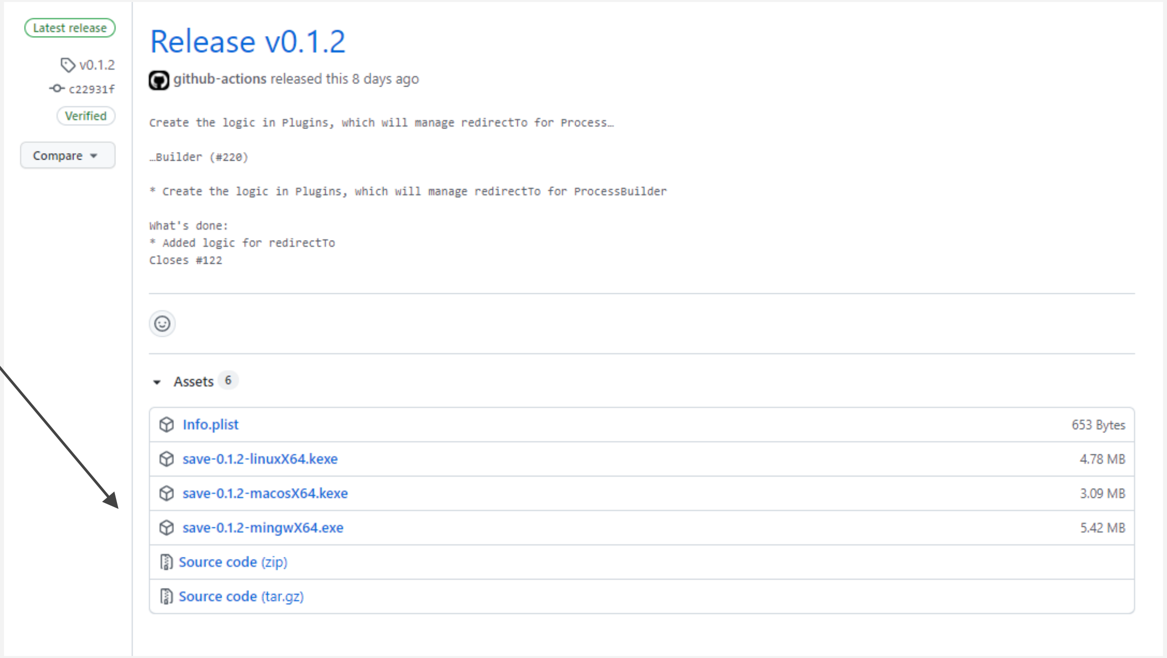
```
// RUN: args2=--debug
enum class EnumValueSnakeCaseTest {
   // ;warn:10:5: [ENUM_VALUE] enum values should be in selected UPPER_CASE format: paSC_SAl_l
   paSC_SAl_l,
}
```

Setup and run

1. Download SAVE executable (native binary) from GitHub. No additional SDK runtime required; everything runs out of the box.

2. Execute
   $ ./save --help
   $ ./save test/root/location

3. Get results in your **favourite** format: JSON/PLAIN/YML


Latest release
v0.1.2
c22931f
Verified
Compare

Release v0.1.2

github-actions released this 8 days ago

```
Create the logic in Plugins, which will manage redirectTo for Process…

…Builder (#220)

* Create the logic in Plugins, which will manage redirectTo for ProcessBuilder

What's done:
* Added logic for redirectTo
Closes #122
```

Assets 6

Info.plist	653 Bytes
save-0.1.2-linuxX64.kexe	4.78 MB
save-0.1.2-macosX64.kexe	3.09 MB
save-0.1.2-mingwX64.exe	5.42 MB
Source code (zip)	
Source code (tar.gz)	

03

SAVE CI/CD in Cloud

Let’s make it look like enterprise with SAVE-cloud service

Concept points

What did we want (and still want) to achieve?

01

Parallel execution of a large number of tests

Flexible execution of several SAVE-cli frameworks in **Docker** containers

02

User-friendly **dashboard** with test results

Historical results, regression testing

03

Benchmarking and Comparisson

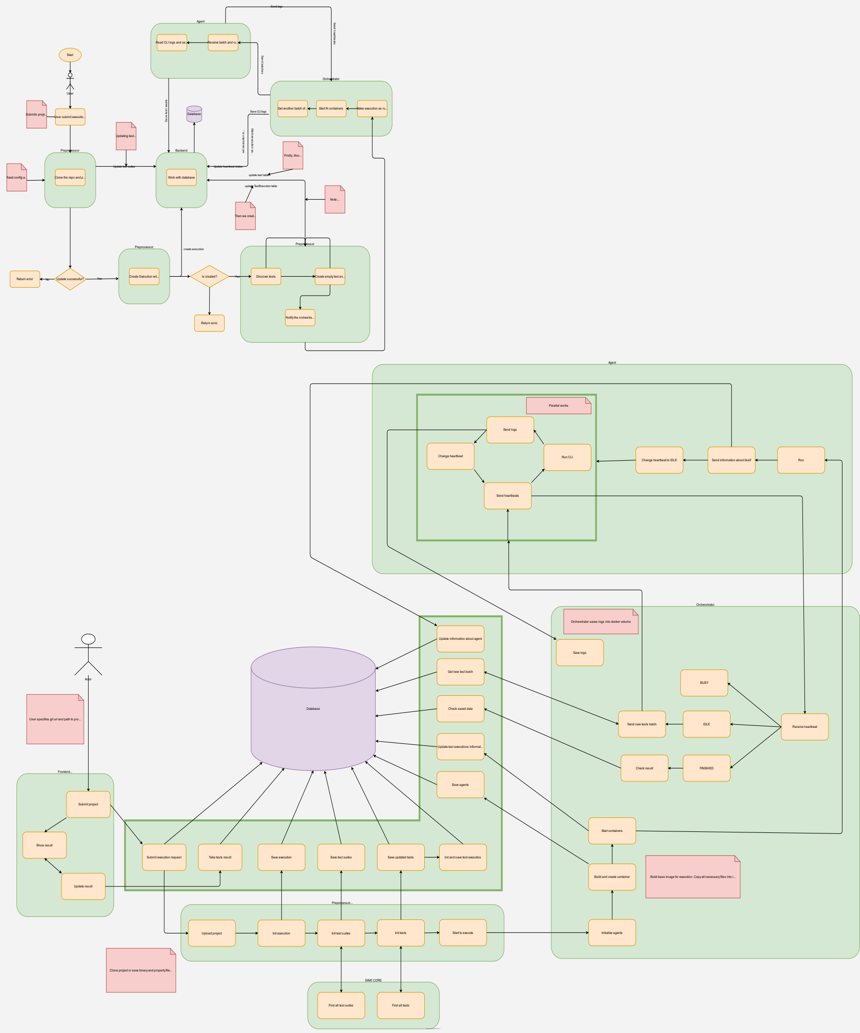
Standard test suites, benchmarks, comparison of community-made static analyzers

https://github.com/cqfn/save-cloud

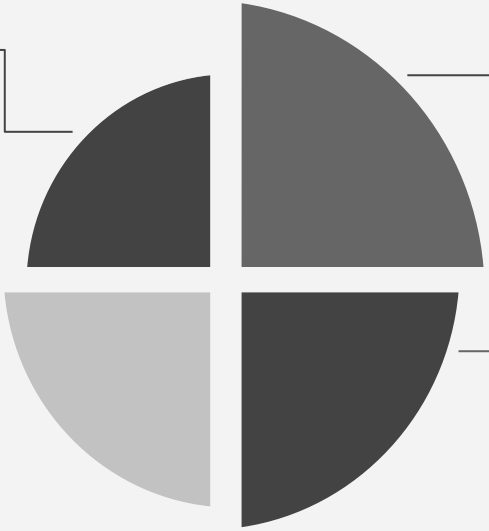
SOS: Save Our Souls

SOT: http://SaveOurTool.com/

But you can **build** it and **deploy** easily by yourself



Save-cloud main components



Orchestrator

Agent and processing management

Agent

Save (cli) running in the Ubuntu docker container

Backend

All related work with the database (processing of results)

Preprocessor

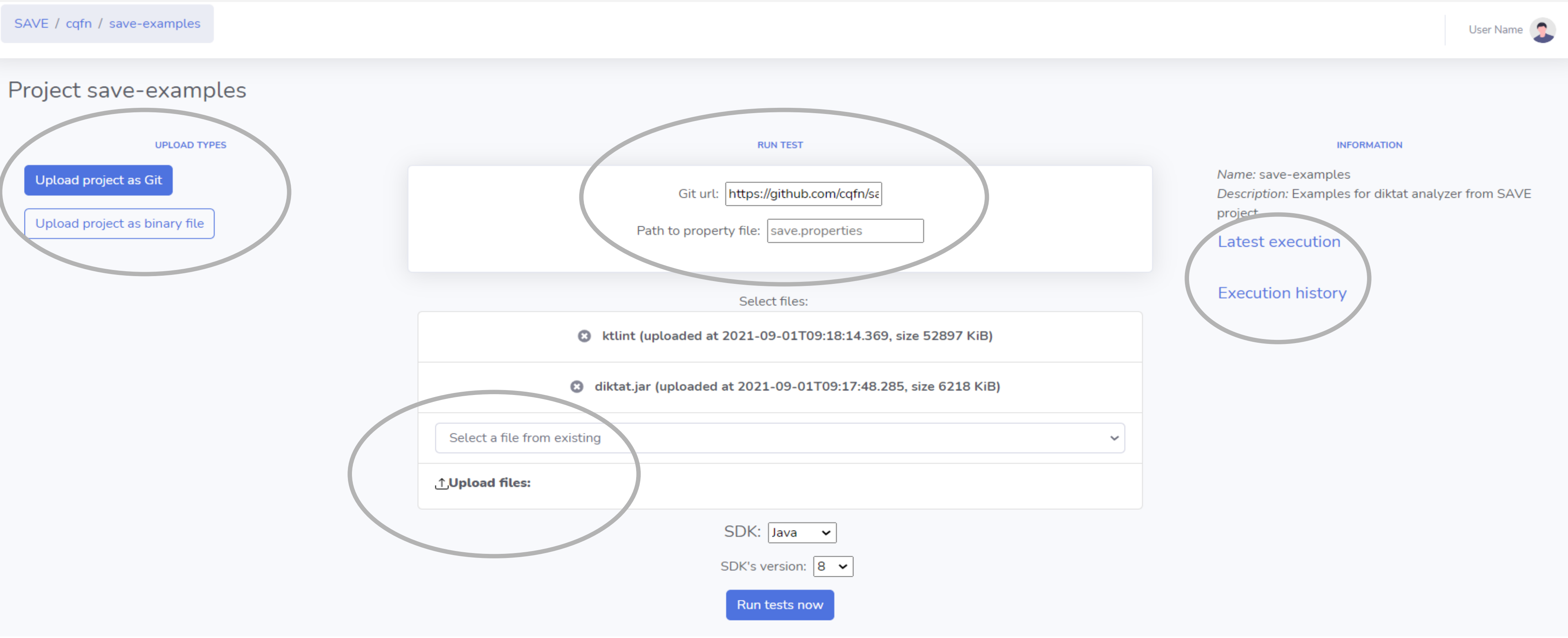
Work with the test-repository (loading, checking, test-discovery)

Components are using **JVM and Kotlin**

Technology stack

	Technology stack
Orchestrator	Docker, Prometheus, Graphana, testcontainers
Agent	Kotlin Native, KTOR (communication via heartbeats)
Preprocessor	Spring Boot 2.5, Spring Security
Backend	Spring Boot 2.5 WebFlux (Project Reactor stack), Hibernate/JPA, Mysql, Liquibase

Upload your custom git test repository or select existing suites



SAVE / cqfn / save-examples

User Name

Project save-examples

UPLOAD TYPES

Upload project as Git

Upload project as binary file

RUN TEST

Git url: https://github.com/cqfn/sa

Path to property file: save.properties

Select files:

ktlint (uploaded at 2021-09-01T09:18:14.369, size 52897 KiB)

diktat.jar (uploaded at 2021-09-01T09:17:48.285, size 6218 KiB)

Select a file from existing

Upload files:

SDK: Java

SDK's version: 8

Run tests now

INFORMATION

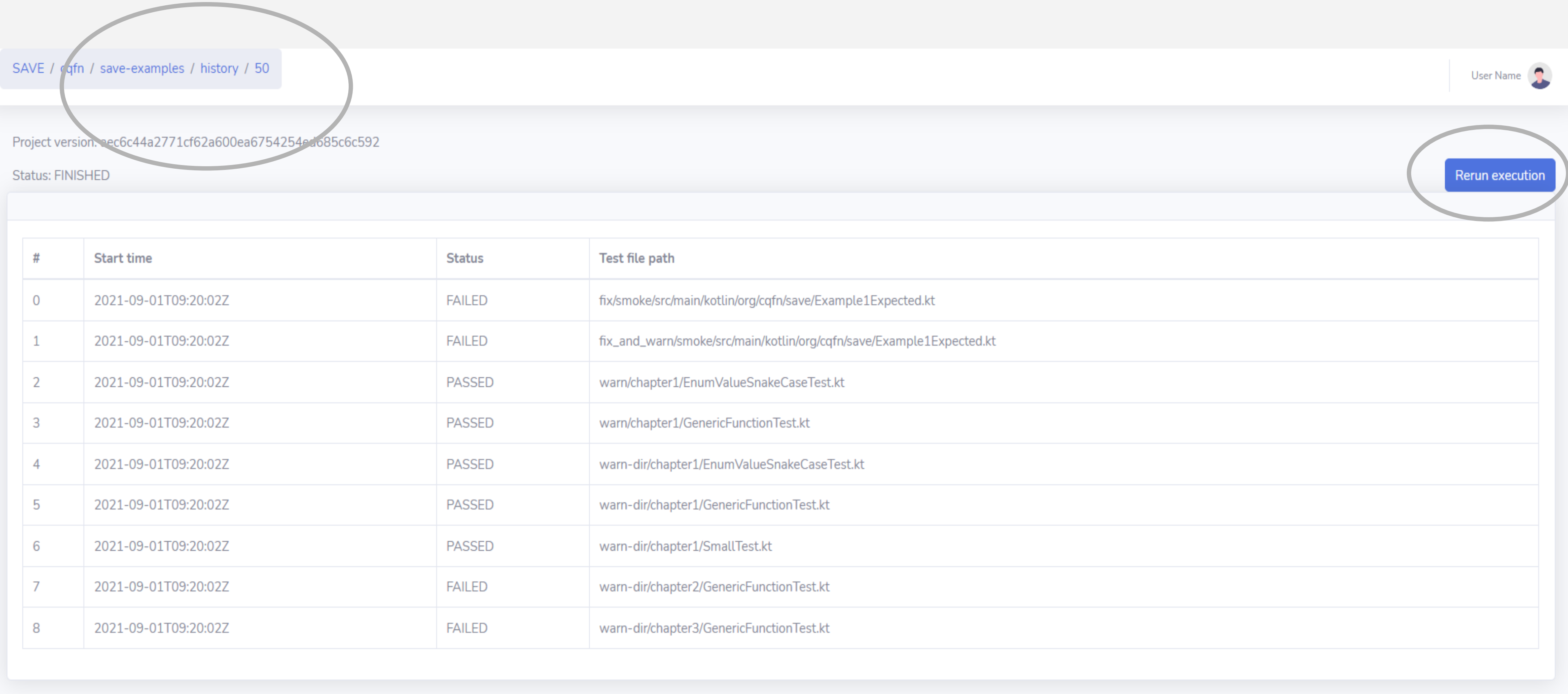
Name: save-examples

Description: Examples for diktat analyzer from SAVE project

Latest execution

Execution history

Simply get test results with the history



SAVE / cqfn / save-examples / history / 50

User Name

Project version: aec6c44a2771cf62a600ea6754254ed685c6c592

Status: FINISHED

Rerun execution

#	Start time	Status	Test file path
0	2021-09-01T09:20:02Z	FAILED	fix/smoke/src/main/kotlin/org/cqfn/save/Example1Expected.kt
1	2021-09-01T09:20:02Z	FAILED	fix_and_warn/smoke/src/main/kotlin/org/cqfn/save/Example1Expected.kt
2	2021-09-01T09:20:02Z	PASSED	warn/chapter1/EnumValueSnakeCaseTest.kt
3	2021-09-01T09:20:02Z	PASSED	warn/chapter1/GenericFunctionTest.kt
4	2021-09-01T09:20:02Z	PASSED	warn-dir/chapter1/EnumValueSnakeCaseTest.kt
5	2021-09-01T09:20:02Z	PASSED	warn-dir/chapter1/GenericFunctionTest.kt
6	2021-09-01T09:20:02Z	PASSED	warn-dir/chapter1/SmallTest.kt
7	2021-09-01T09:20:02Z	FAILED	warn-dir/chapter2/GenericFunctionTest.kt
8	2021-09-01T09:20:02Z	FAILED	warn-dir/chapter3/GenericFunctionTest.kt

04

Conclusion

Let’s summarize

Where SAVE could be used

Static analyzers and auto-fixers

- Checking warnings in the code
- Checking auto-fixed code

Compilers and their parts

- Testing generated IR and generated final code
- Expected behaviour of compiled programm
- Warnings and errors in the front-end (parser)

Plans

- Benchmarks for popular programming languages
- Comparison of different tools, contests
- SAVE own standard for static analysis
- User-friendly frontend with test history
- R~~eplace LIT~~. Usage of the framework by the most popular analyzers
- External API and plugins for external build systems (like GitHub Actions)
- Mechanism for easy detection of regressions

THANKS!

Q&A

https://github.com/akuleshov7
https://github.com/cqfn/save