

# Optimising **CI** using **Test Case Prioritisation**

**June 19, 2020**

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# Overview

## 1. Problem

# Overview

1. Problem
2. Solutions

# Overview

1. Problem
2. Solutions
3. Implementation

# Overview

1. Problem
2. Solutions
3. Implementation
4. Results

# Overview

1. Problem
2. Solutions
3. Implementation
4. Results
5. (Demo)

**But first**

# Just what is **CI**?

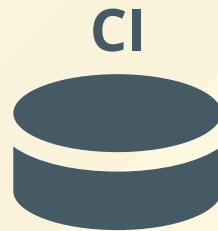
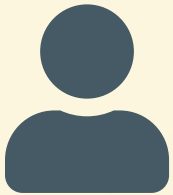


# Continuous Integration

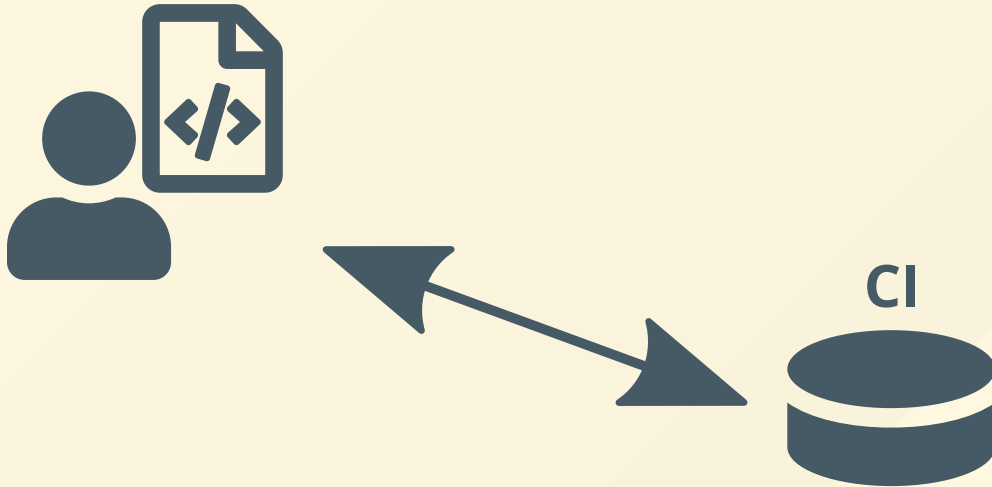


**Example:** Android app

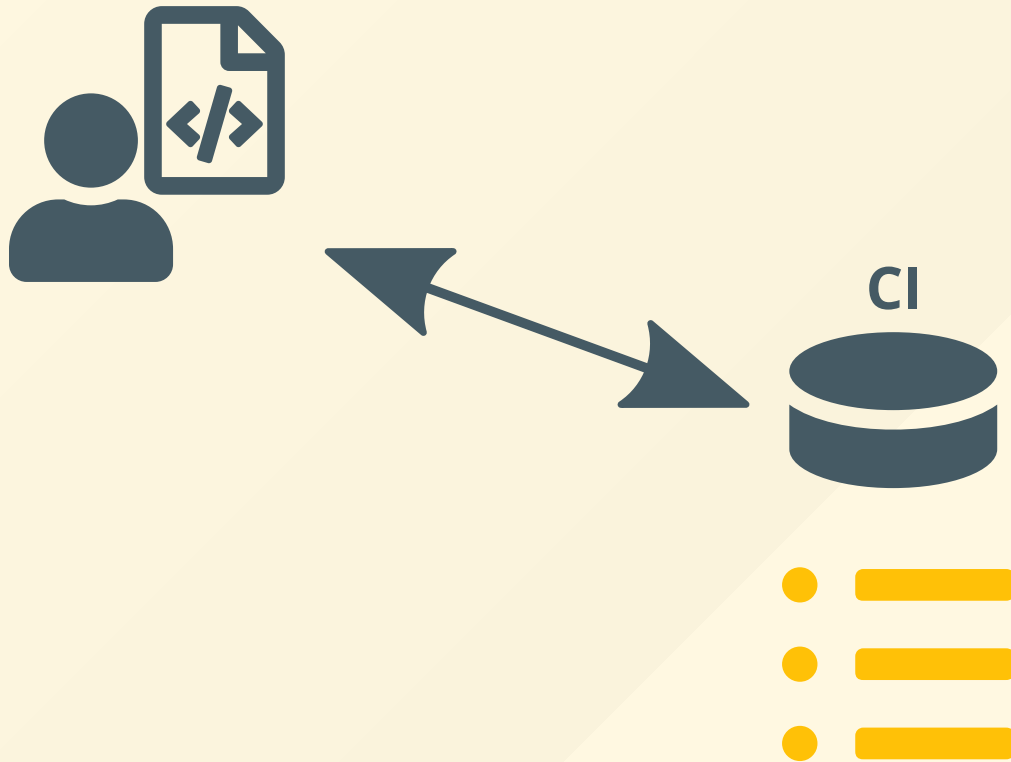
# Continuous Integration



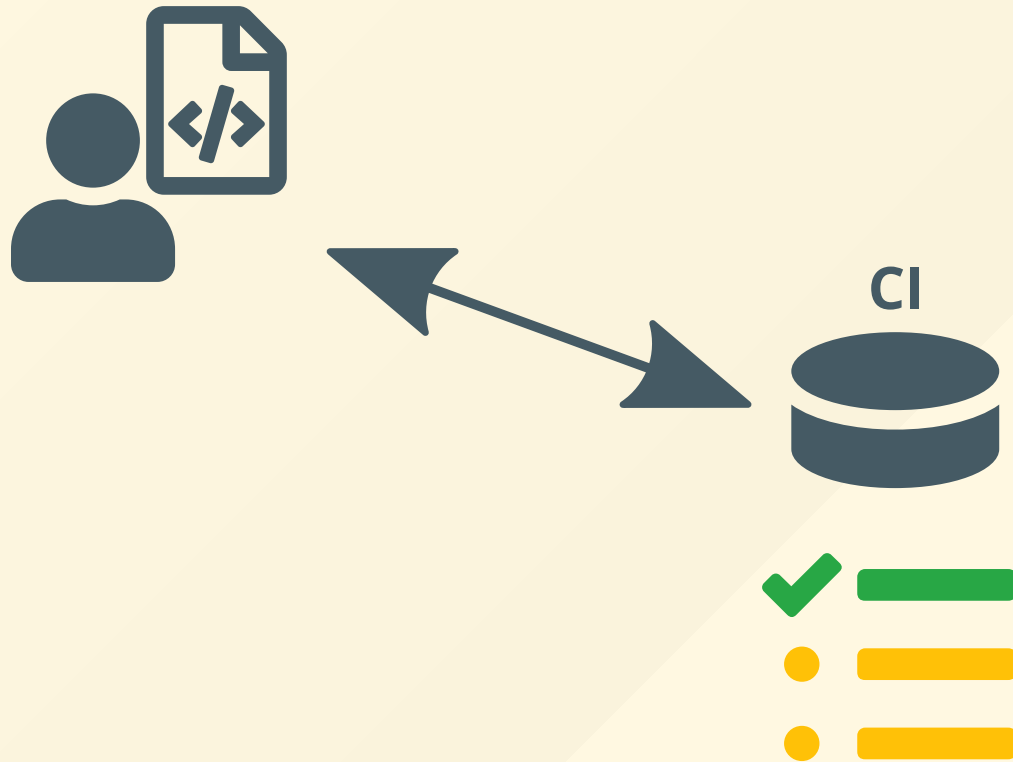
# Continuous Integration



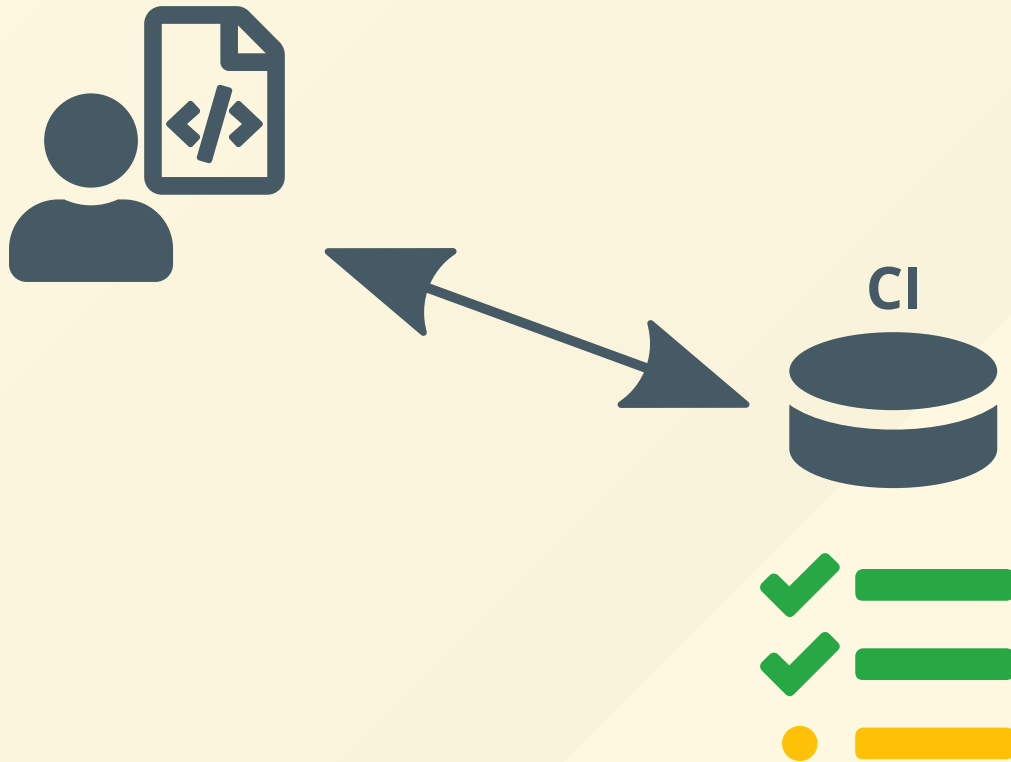
# Continuous Integration



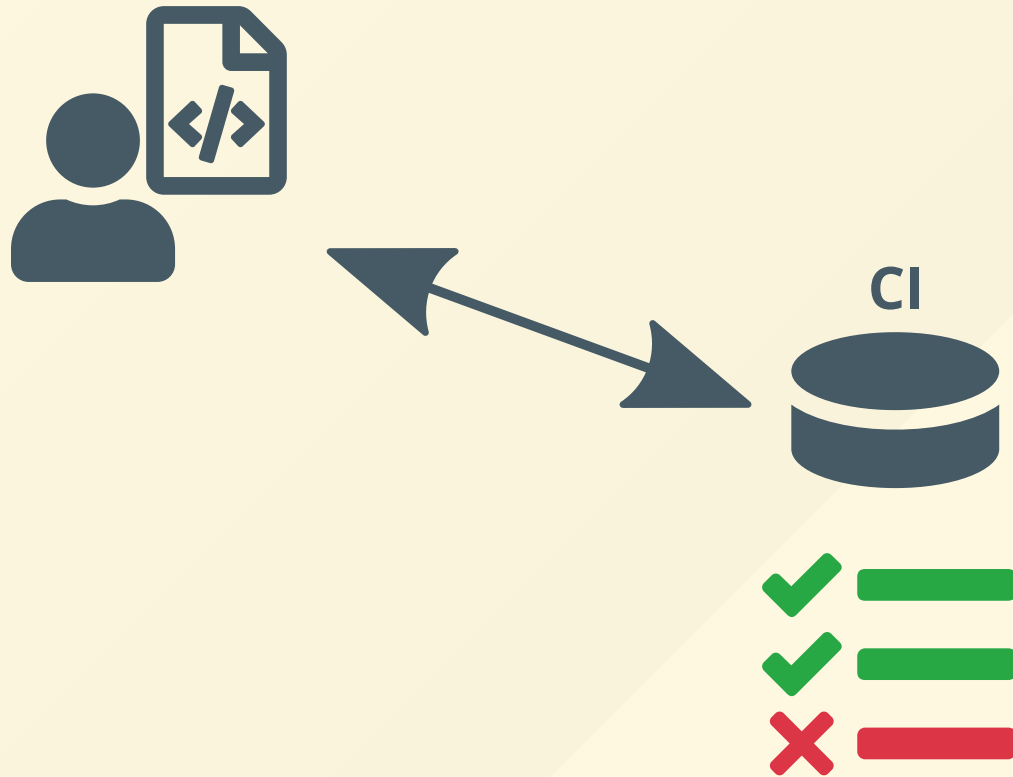
# Continuous Integration



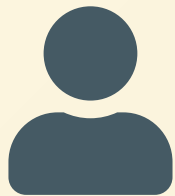
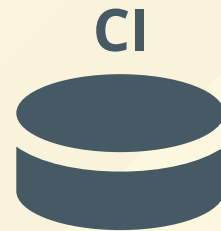
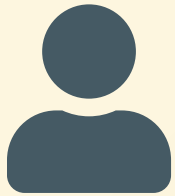
# Continuous Integration



# Continuous Integration

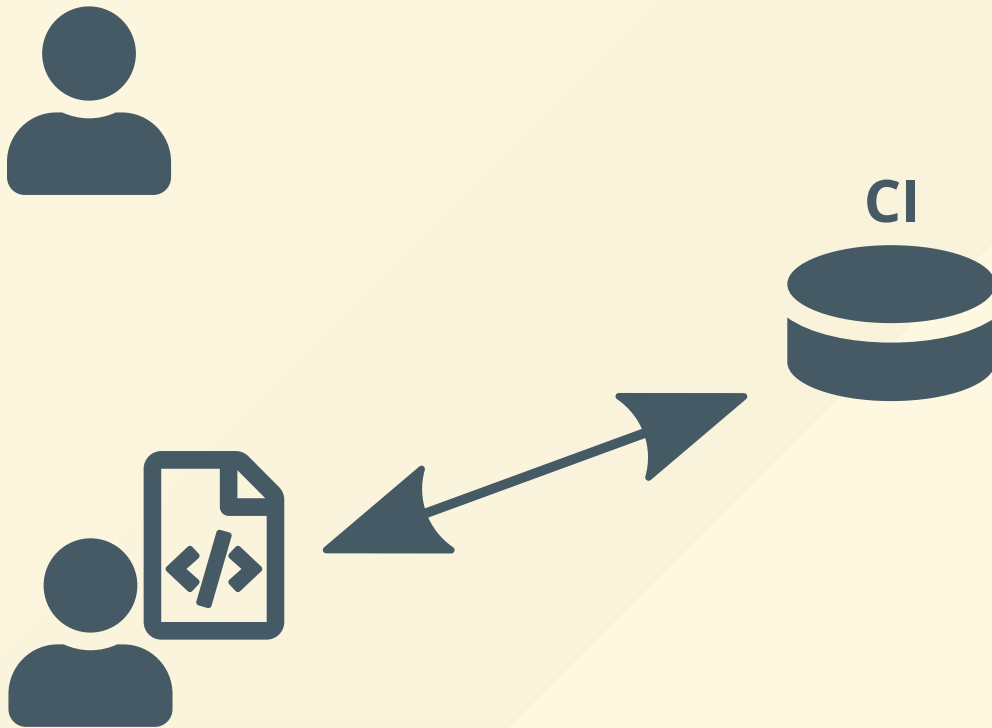


# Continuous Integration

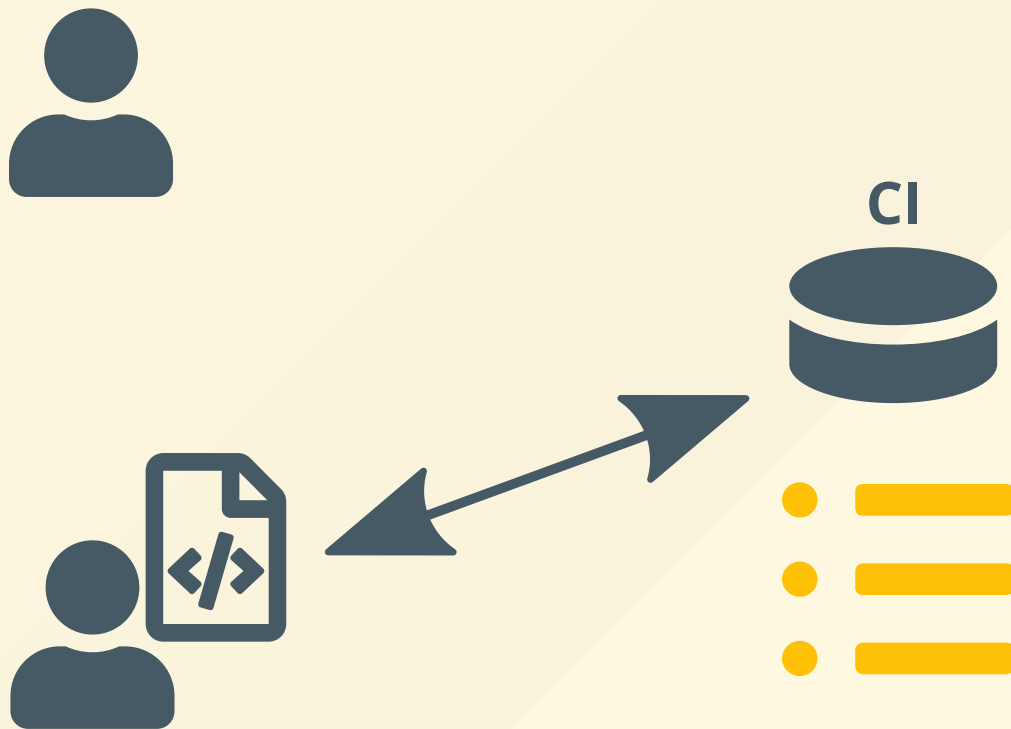




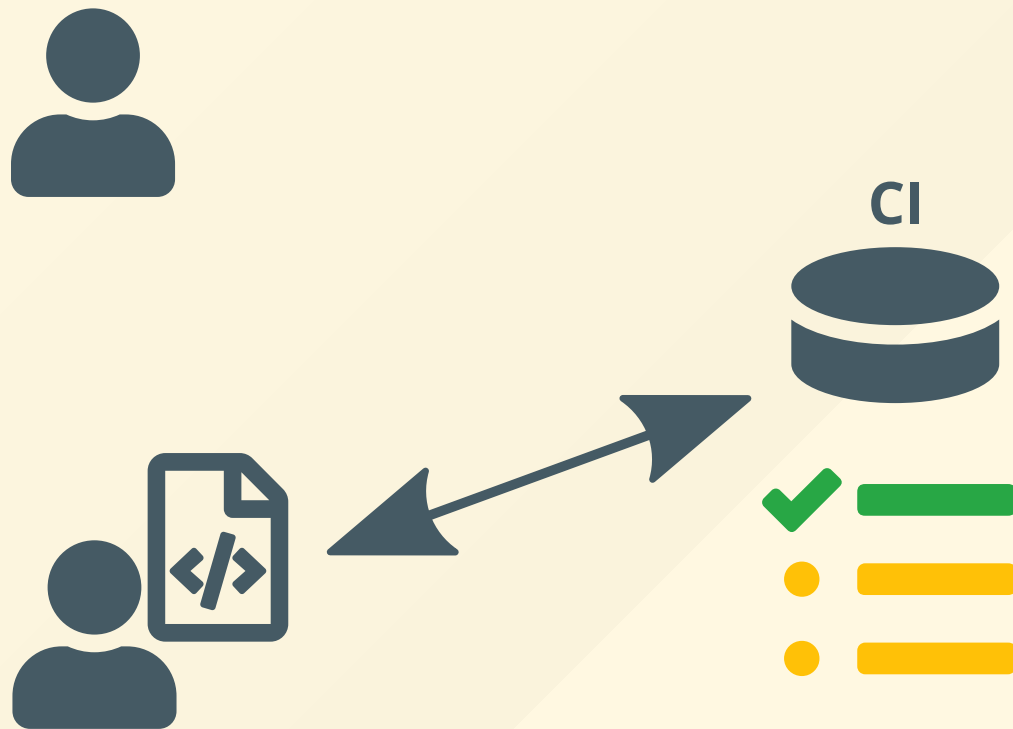
# Continuous Integration



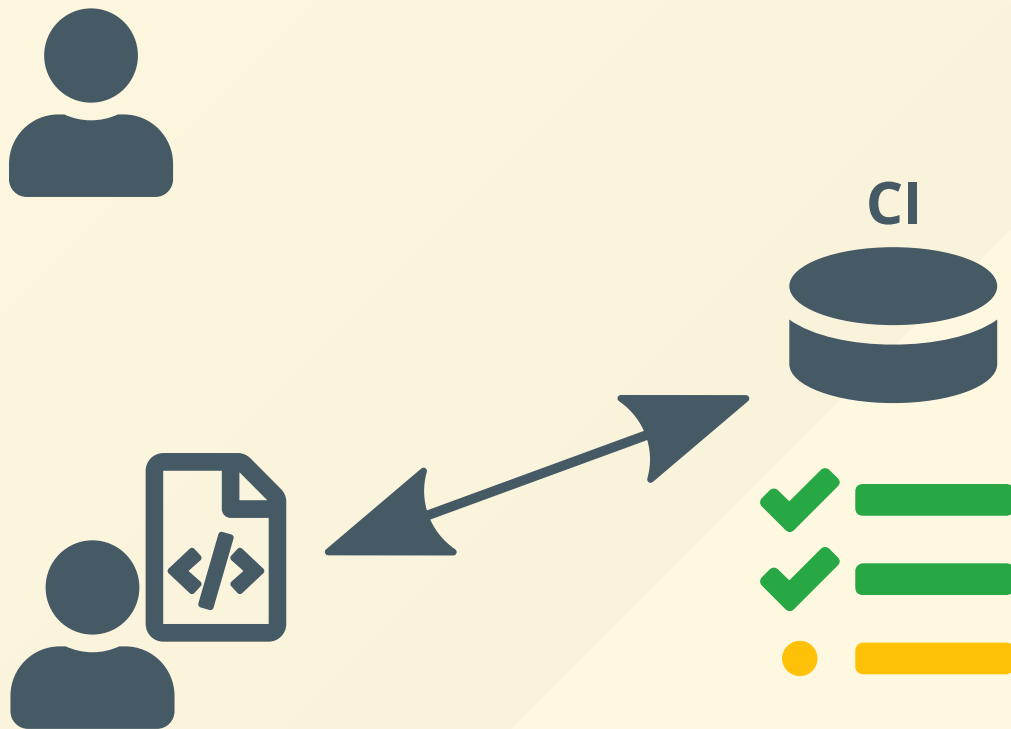
# Continuous Integration



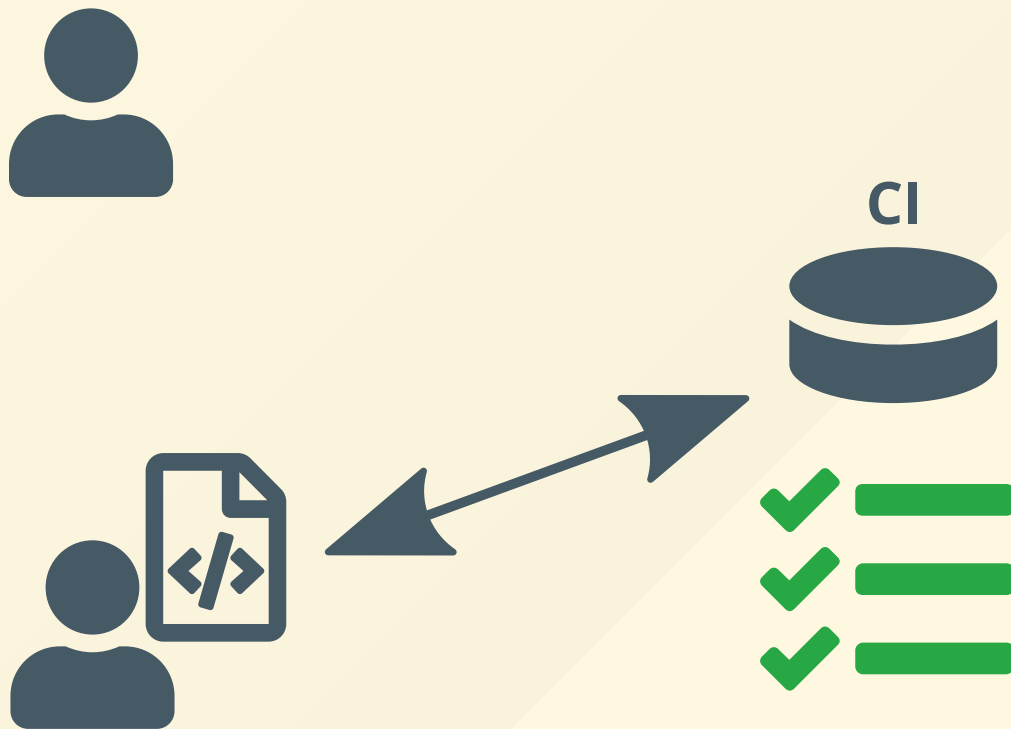
# Continuous Integration



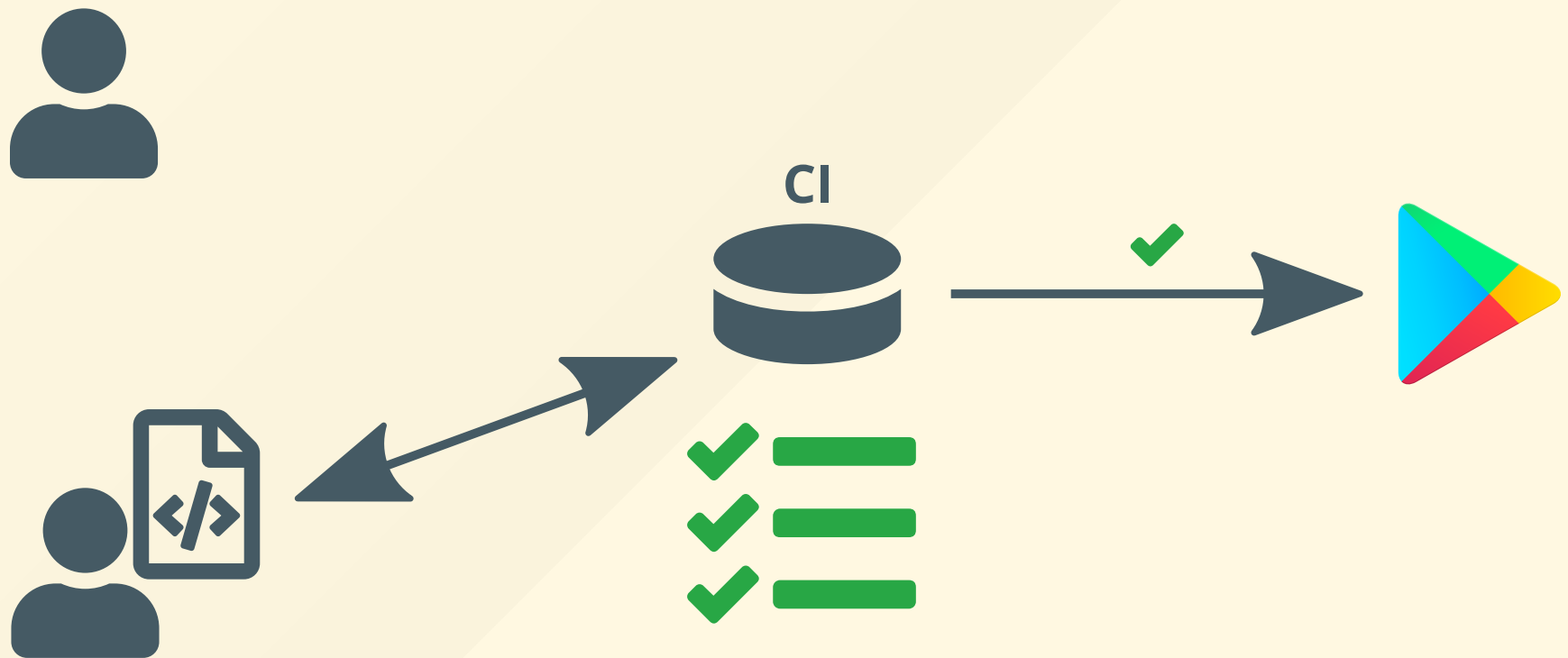
# Continuous Integration



# Continuous Integration



# Continuous Integration



# Problem?

# Tests!



# Tests



# Tests



# Tests

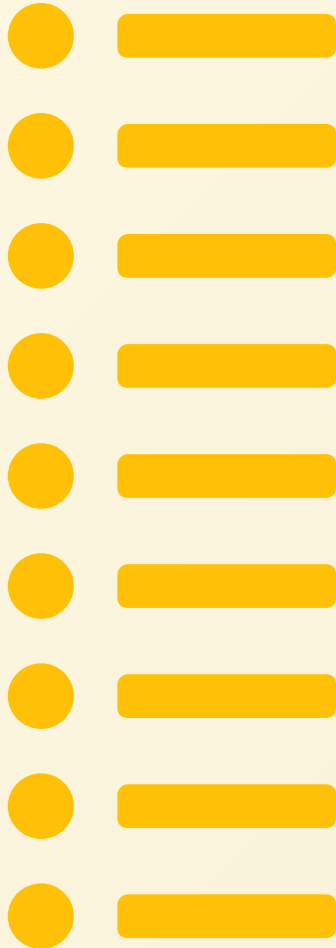


# Solutions

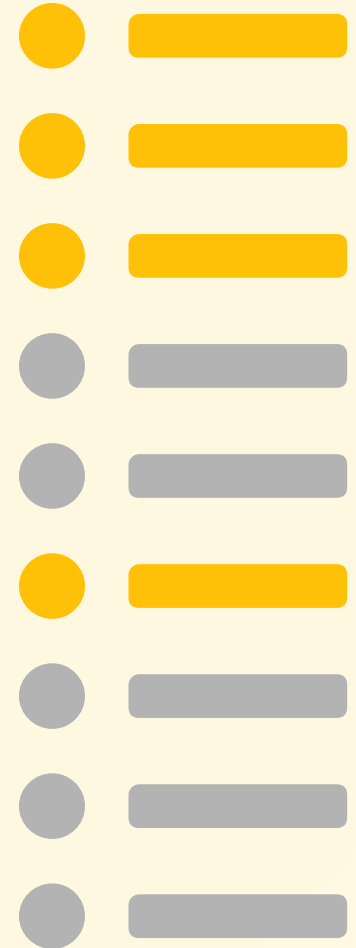
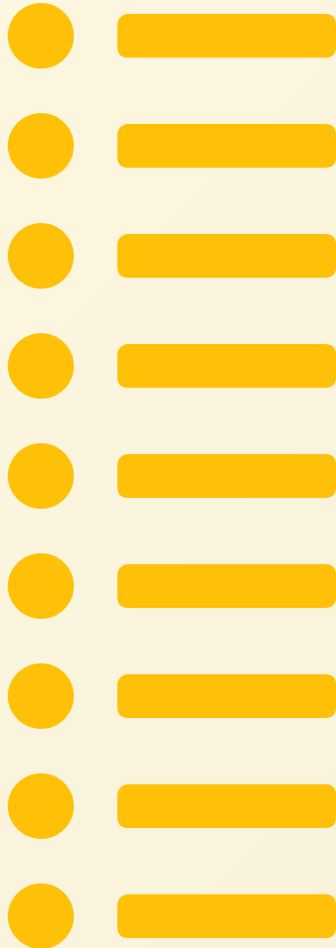
# **Solutions**

## **Test Case Selection**

# Solutions / Test Case Selection



# Solutions / Test Case Selection

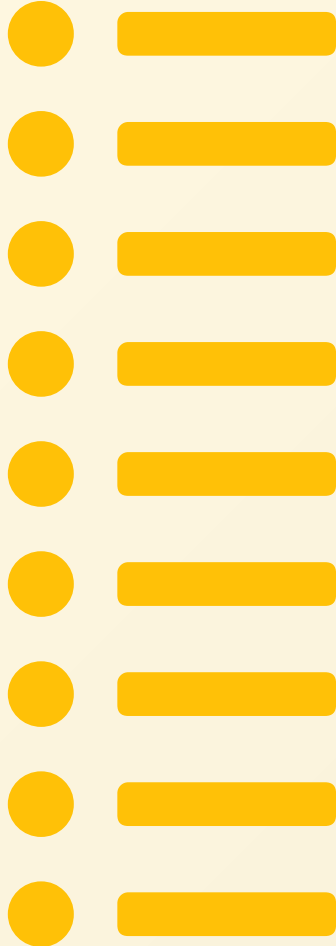


# **Solutions**

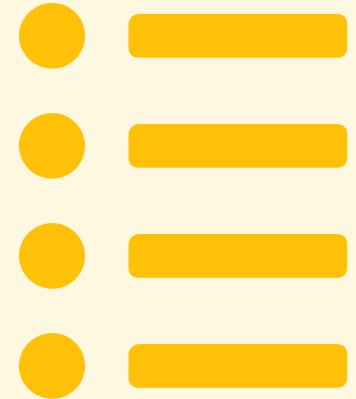
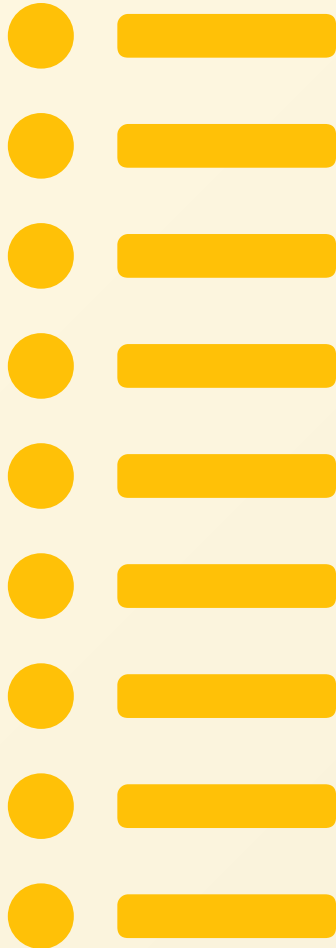
## **Test Suite Minimisation**



# Solutions / Test Suite **Minimisation**



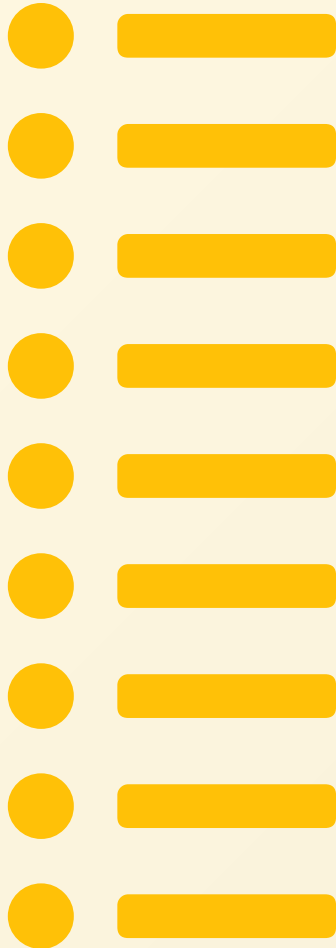
# Solutions / Test Suite **Minimisation**



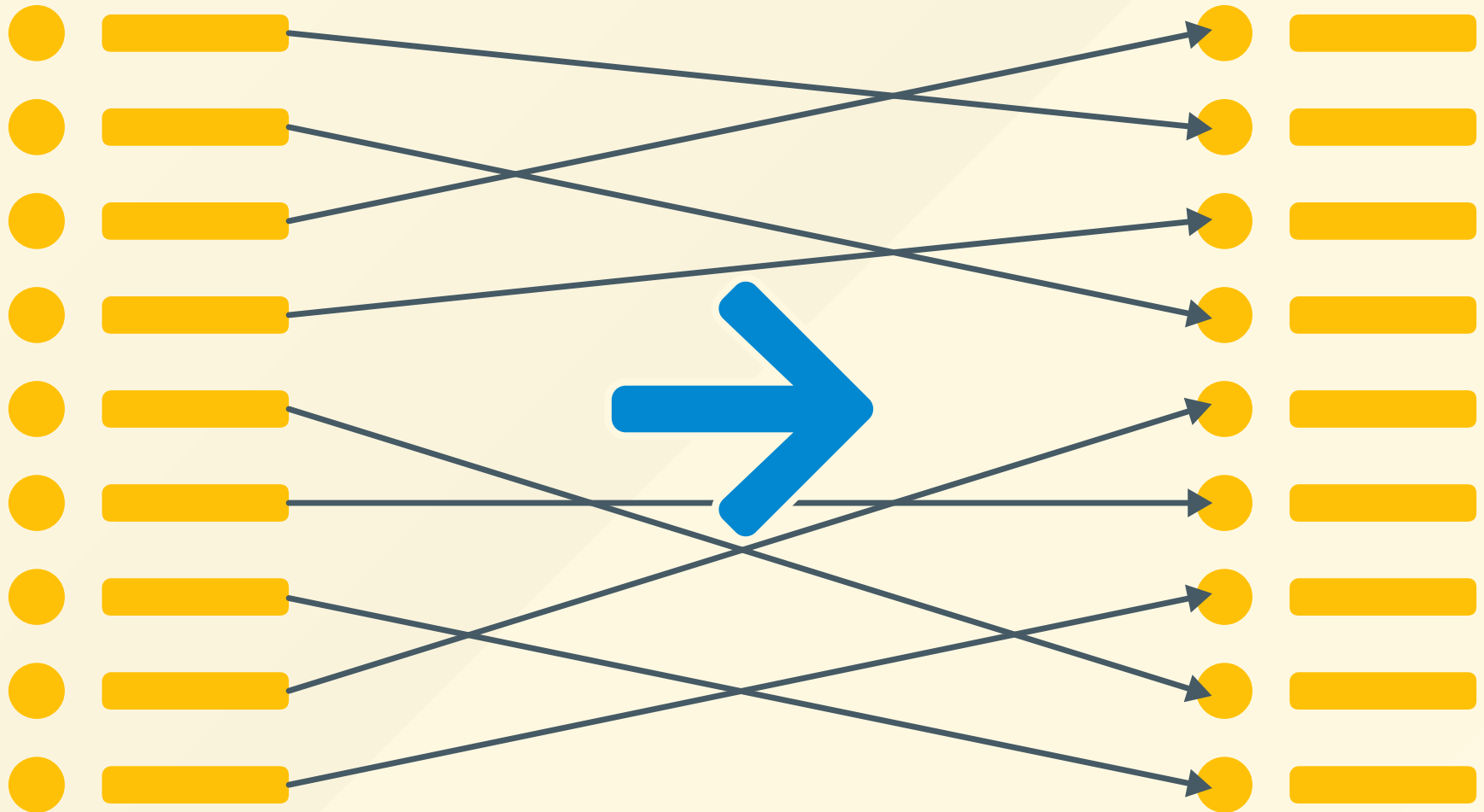
# **Solutions**

## **Test Case Prioritisation**

# Solutions / Test Case Prioritisation



# Solutions / Test Case Prioritisation



**So.. problem solved!**

**..right?**





# State of the art

# State of the art



Java

# State of the art



Java



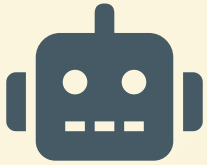
Other  
languages

# Implementation

# Implementation

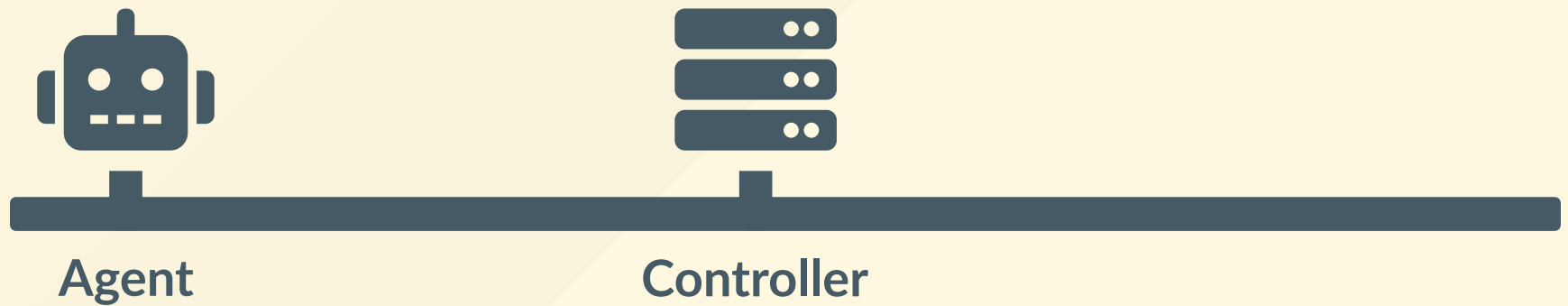
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# Implementation

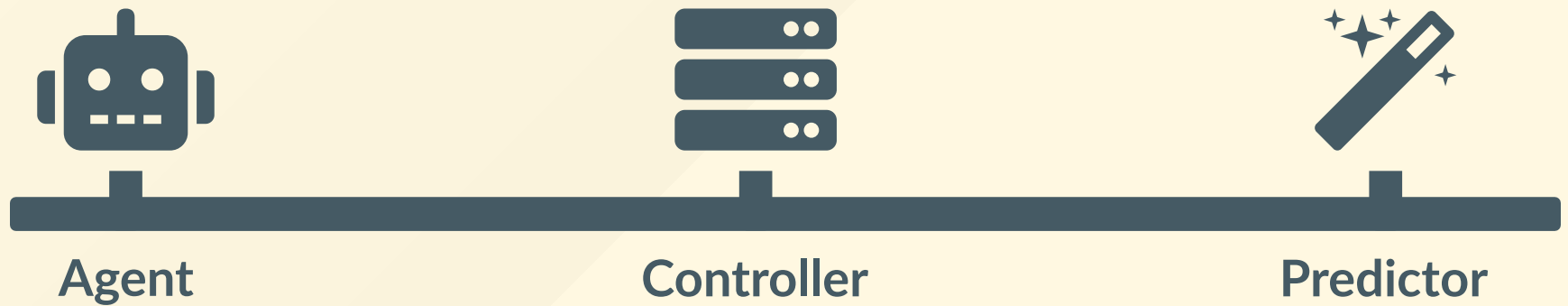


Agent

# Implementation

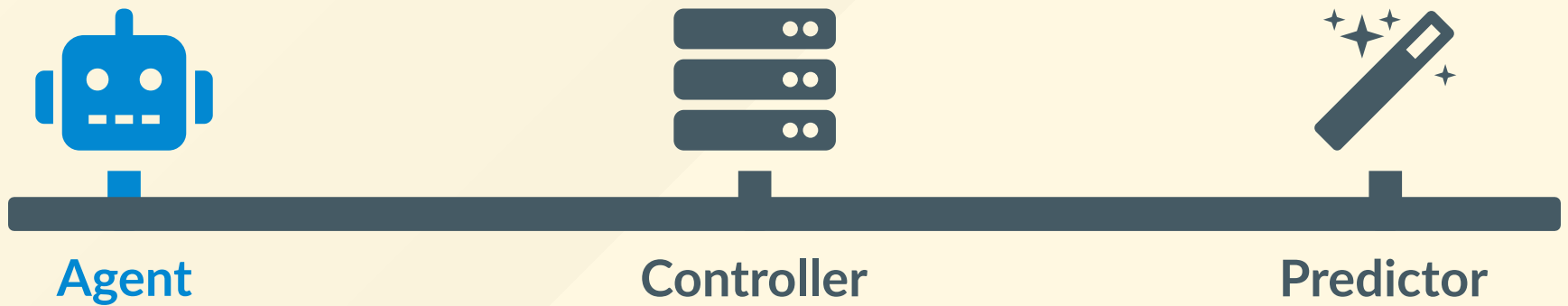


# Implementation





# Implementation



# Implementation / Agent



Execute tests



Feedback

# Implementation / Agent



Execute tests



Feedback

# Implementation



# Implementation / Controller



Routing

# Implementation / Controller

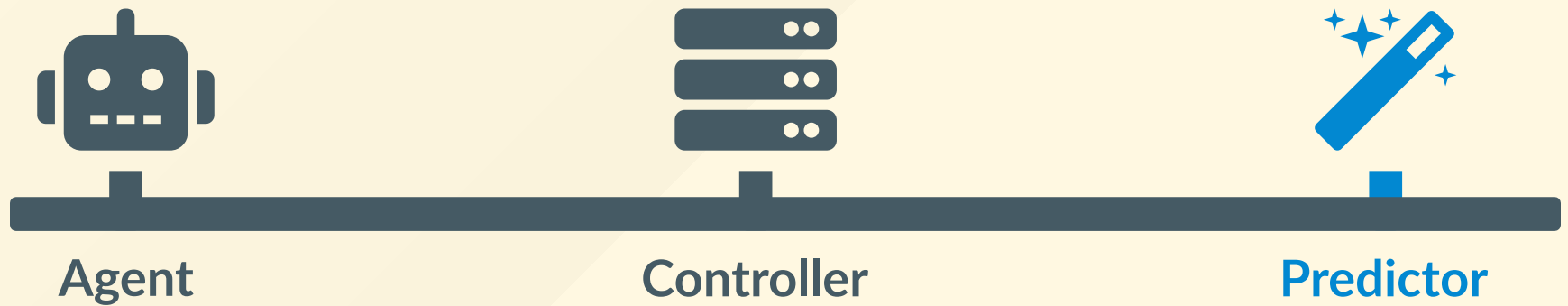


Routing



Analysis

# Implementation



# Implementation / Predictor

**1**   
**2**   
**3** 

Determine  
order



# Implementation / Predictor



Determine  
order



10 algorithms

# Implementation / Predictor



Determine  
order



10 algorithms



Extensible

```
# Generate a random order.  
def predict(test_cases, coverage, results, duration):  
    return shuffle(test_cases)
```

# Implementation / Alpha-algorithm

# Implementation / Alpha-algorithm

1. Unstable, affected test cases (by duration)

# Implementation / Alpha-algorithm

1. Unstable, affected test cases (by duration)
2. Affected test cases (by duration)

# Implementation / Alpha-algorithm

1. Unstable, affected test cases (by duration)
2. Affected test cases (by duration)
3. Test cases based on additional coverage

# Implementation / Alpha-algorithm

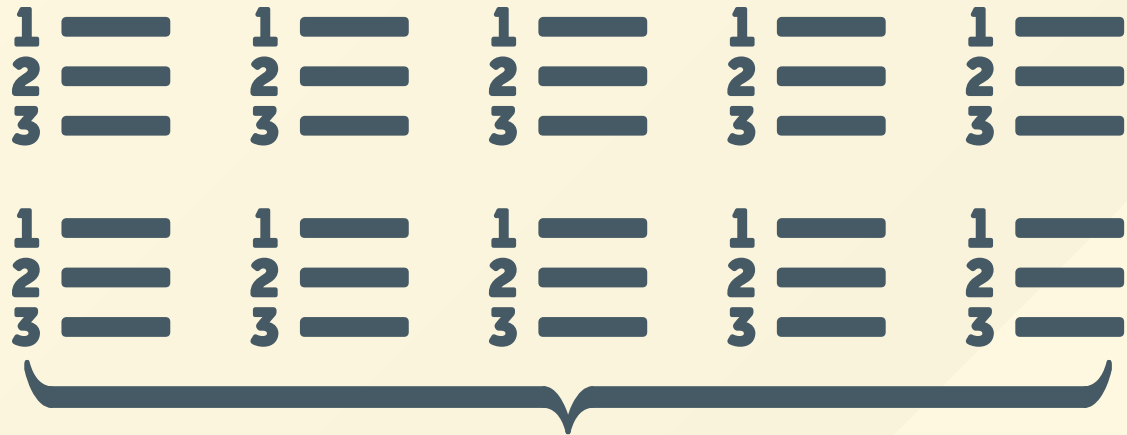
1. Unstable, affected test cases (by duration)
2. Affected test cases (by duration)
3. Test cases based on additional coverage
4. Other test cases

# Implementation / Alpha-algorithm

1. Unstable, affected test cases (by duration)
2. Affected test cases (by duration)
3. Test cases based on additional coverage
4. Other test cases [redundant]



# Implementation / Meta predictor



# Implementation / Meta predictor

1 — 1 — 1 — 1 — 1 —  
2 — 2 — 2 — 2 — 2 —  
3 — 3 — 3 — 3 — 3 —

1 — 1 — 1 — 1 — 1 —  
2 — 2 — 2 — 2 — 2 —  
3 — 3 — 3 — 3 — 3 —



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2 — 2 — 2 — 2 — 2 —  
3 — 3 — 3 — 3 — 3 —

1 — 1 — 1 — 1 — 1 —  
2 — 2 — 2 — 2 — 2 —  
3 — 3 — 3 — 3 — 3 —

# Implementation / Meta predictor

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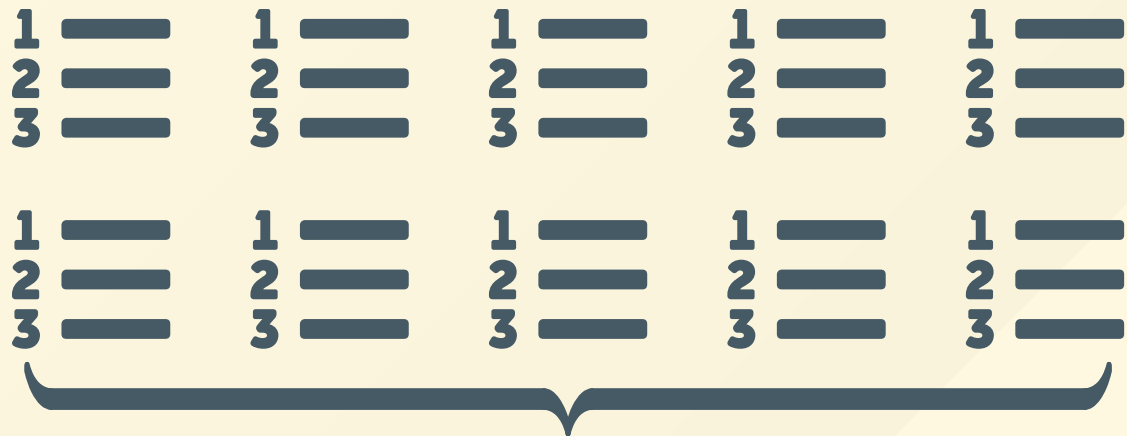
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3 —

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2 —  
3 —

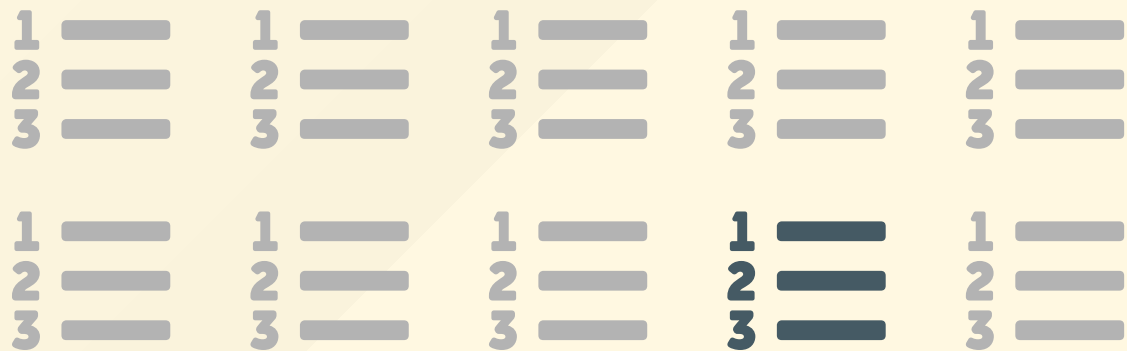
1 —  
2 —  
3 —

1 —  
2 —  
3 —

# Implementation / Meta predictor



=



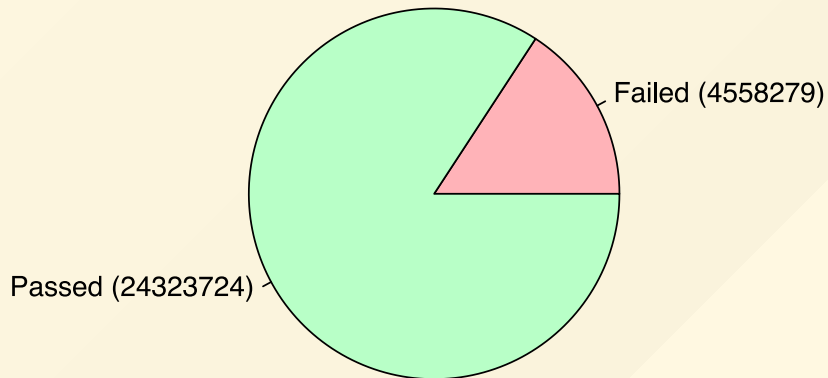
ALGORITHM	SCORE
Alpha	20
Greedy	10
HGS	-3

# Results

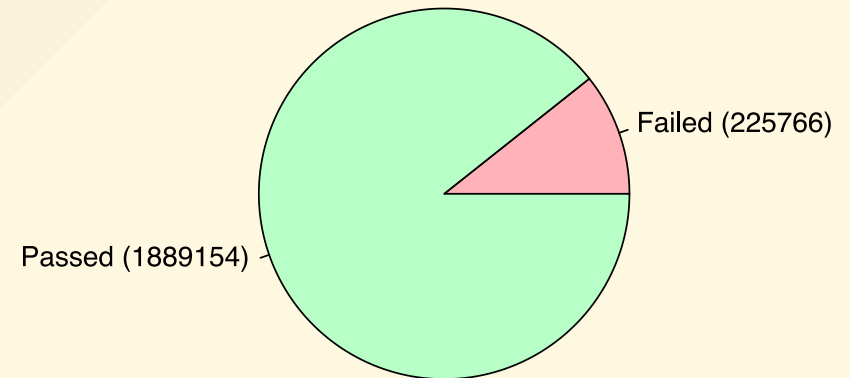
# Results

## RQ1: Failure probability

Durieux et al.



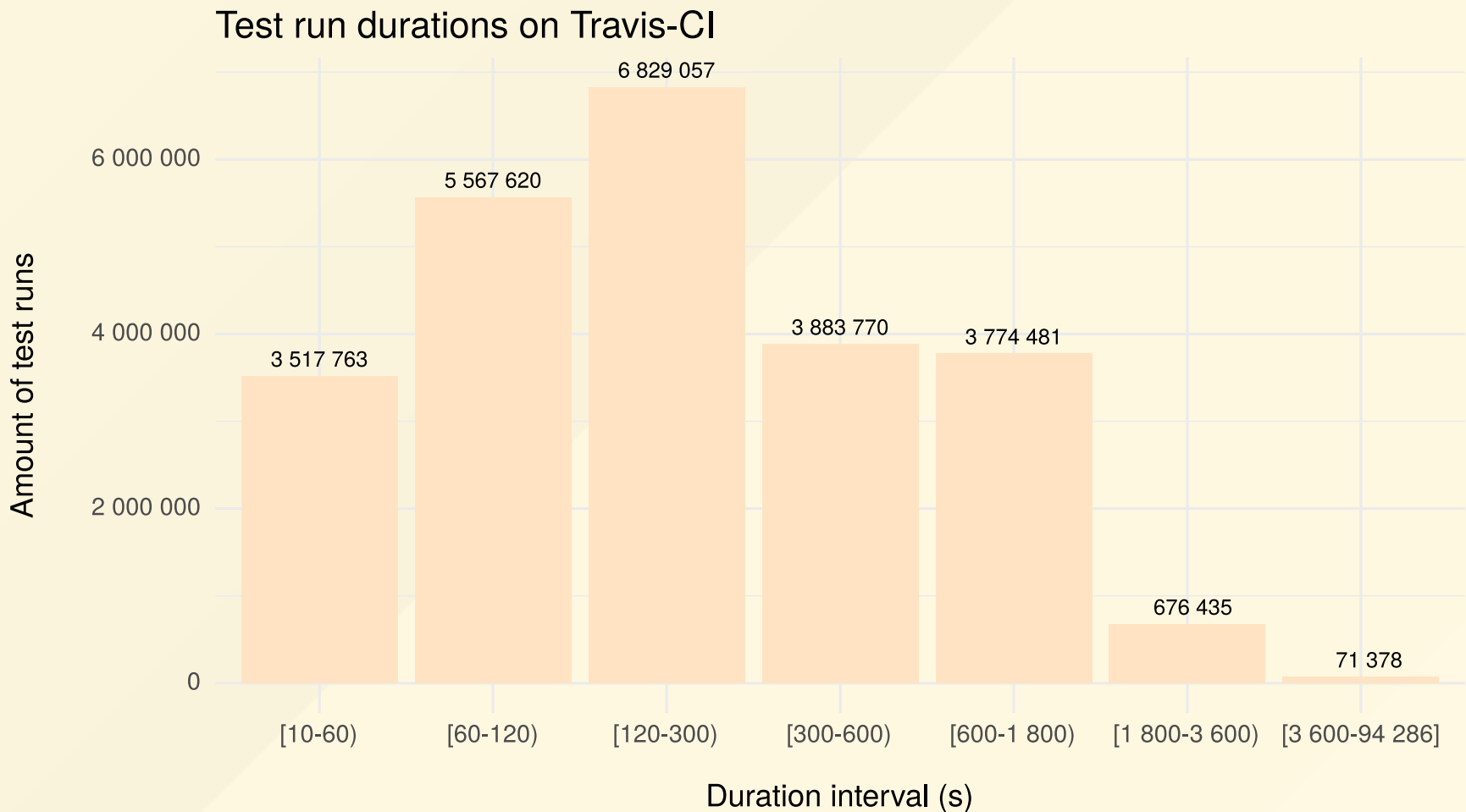
TravisTorrent



11% - 19%

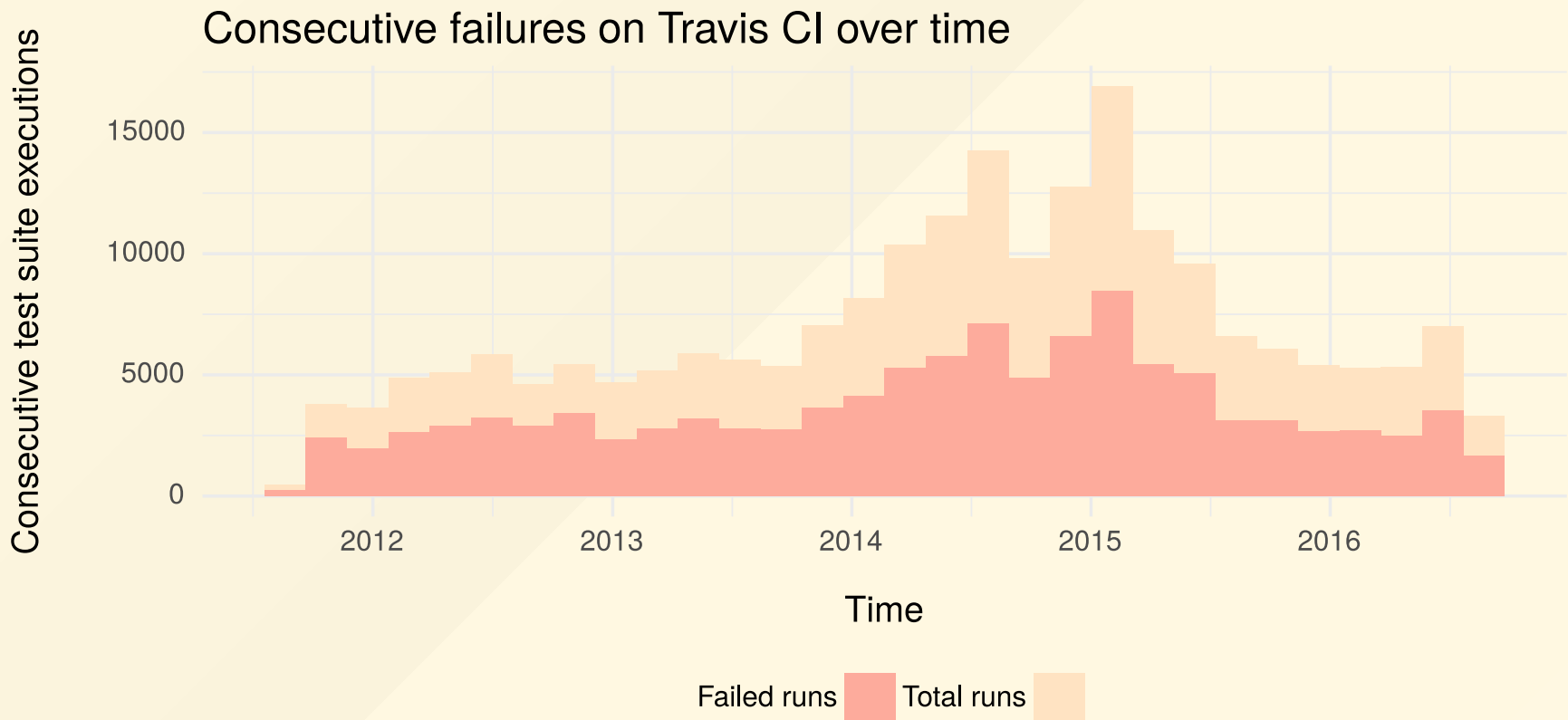
# Results

## RQ2: Average test run duration



# Results

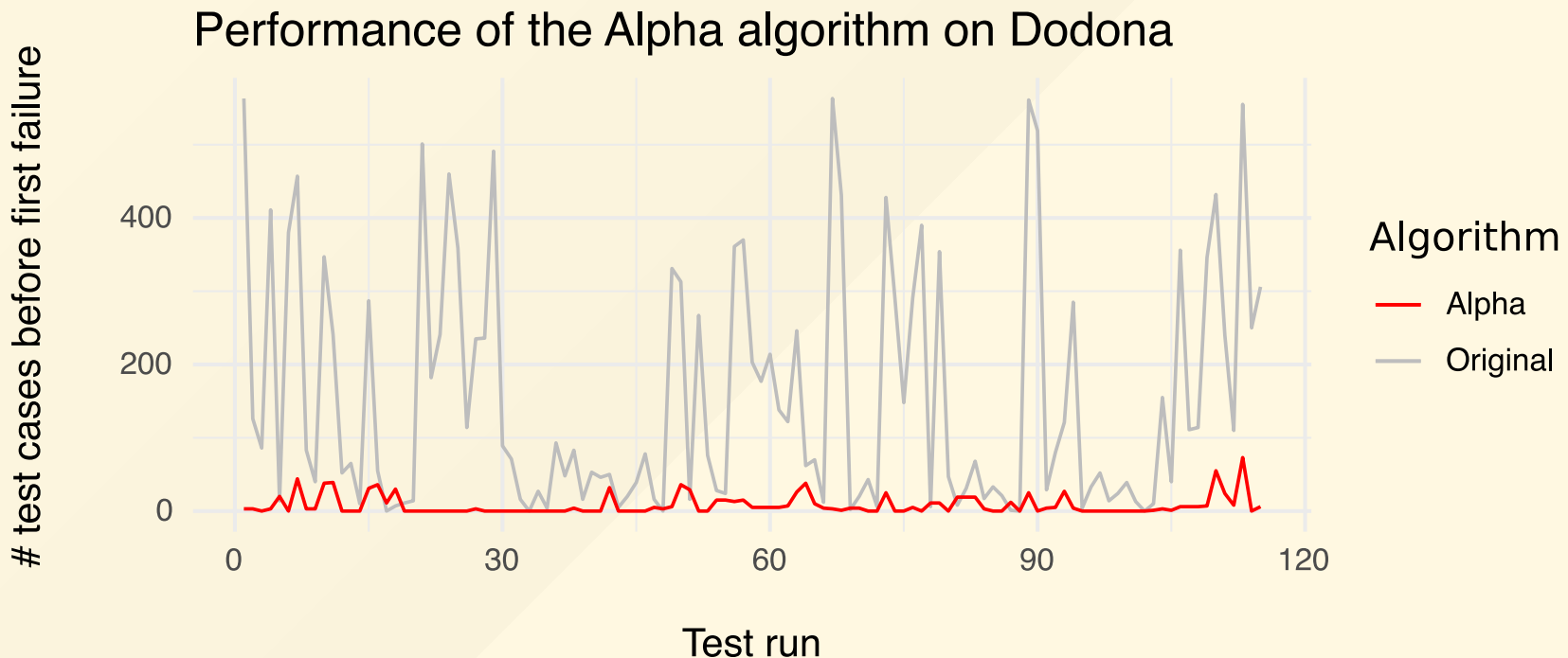
## RQ3: Consecutive failure probability





# Results

## RQ4: Performance on Dodona



**# test cases: < 25x | duration: < 40x**

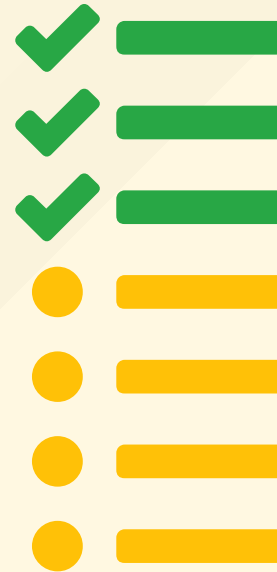
# Demo

# Wrapping up

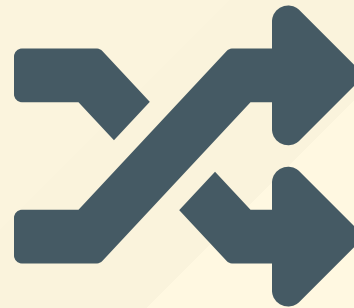
# Conclusion



# Conclusion



# Conclusion



TCP

# Conclusion



# Questions?



# References

- Slides created using [Marp](#).
- Icons are property of [FontAwesome](#).