

# Technical Debt in Start-ups / Scale-Ups

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Technical Debt for Variability-intensive Systems (TD4Vis)  
13 September 2022, Graz, Austria



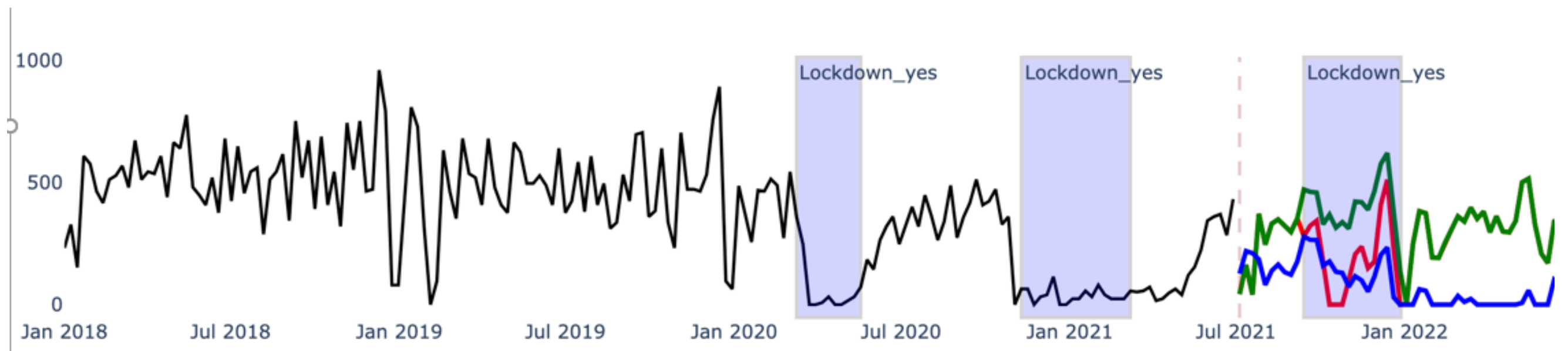
# garvis

+

AI

The planner

Data



Filters

Forecast Version  
16/08/2021

SalesOrgText  
BRE

L4 Brand  
Pack Format  
101101  
GR

Unit of measure  
Quantity

Forecast Version  
16/08/2021

PRODUCT HIERARCHY

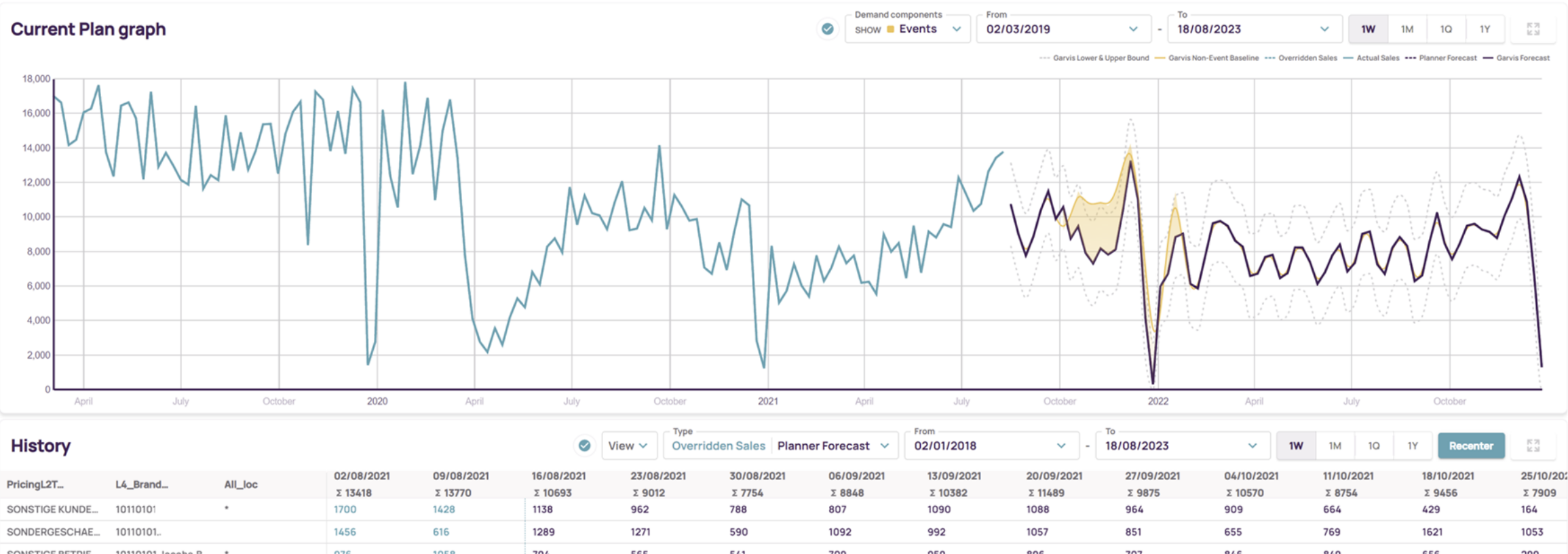
Is\_kit\_or\_Display  
Not assigned

RU\_Unit  
kg

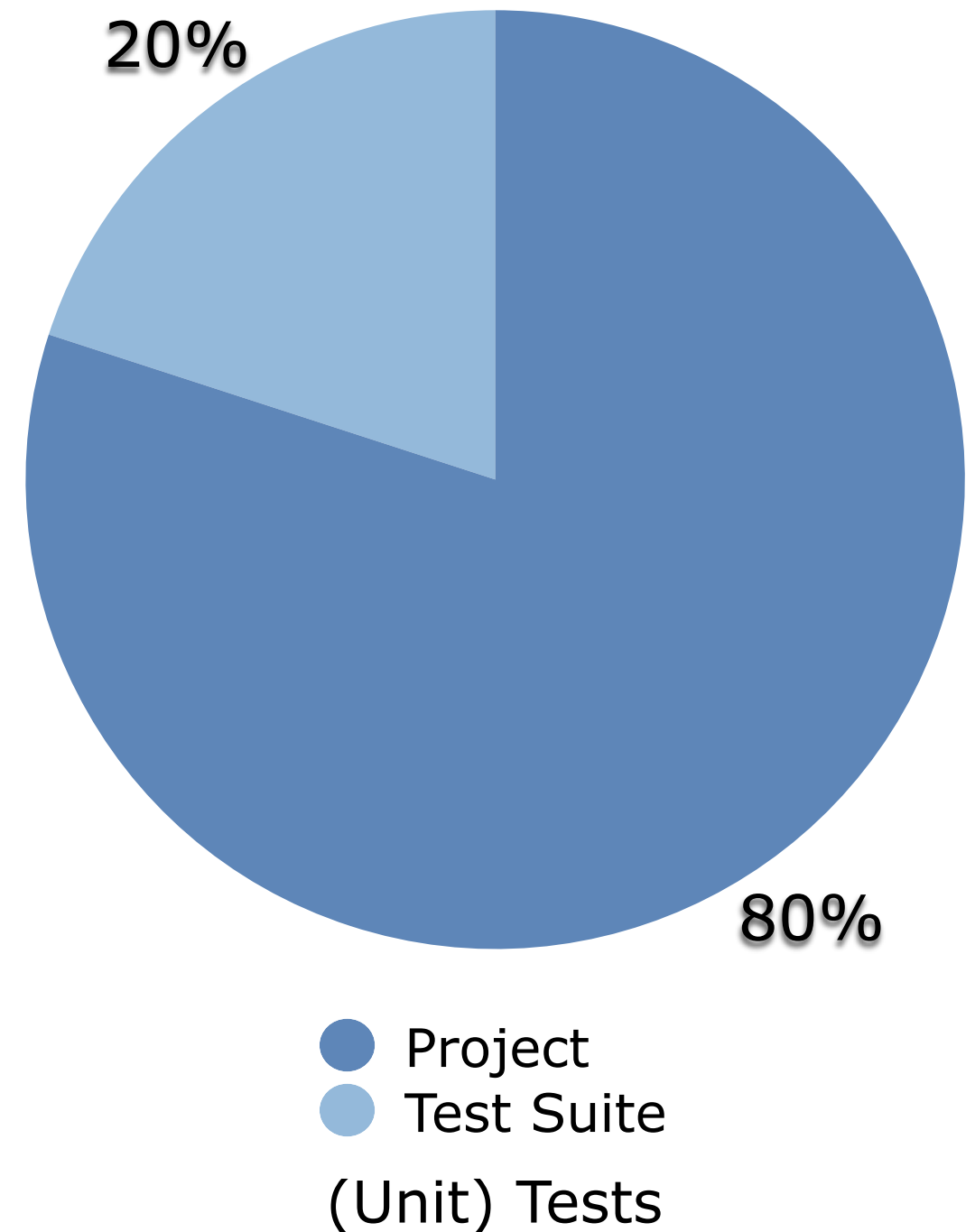
Market\_Segmentation  
Not assigned

IBP\_L1\_Category  
MultiServe

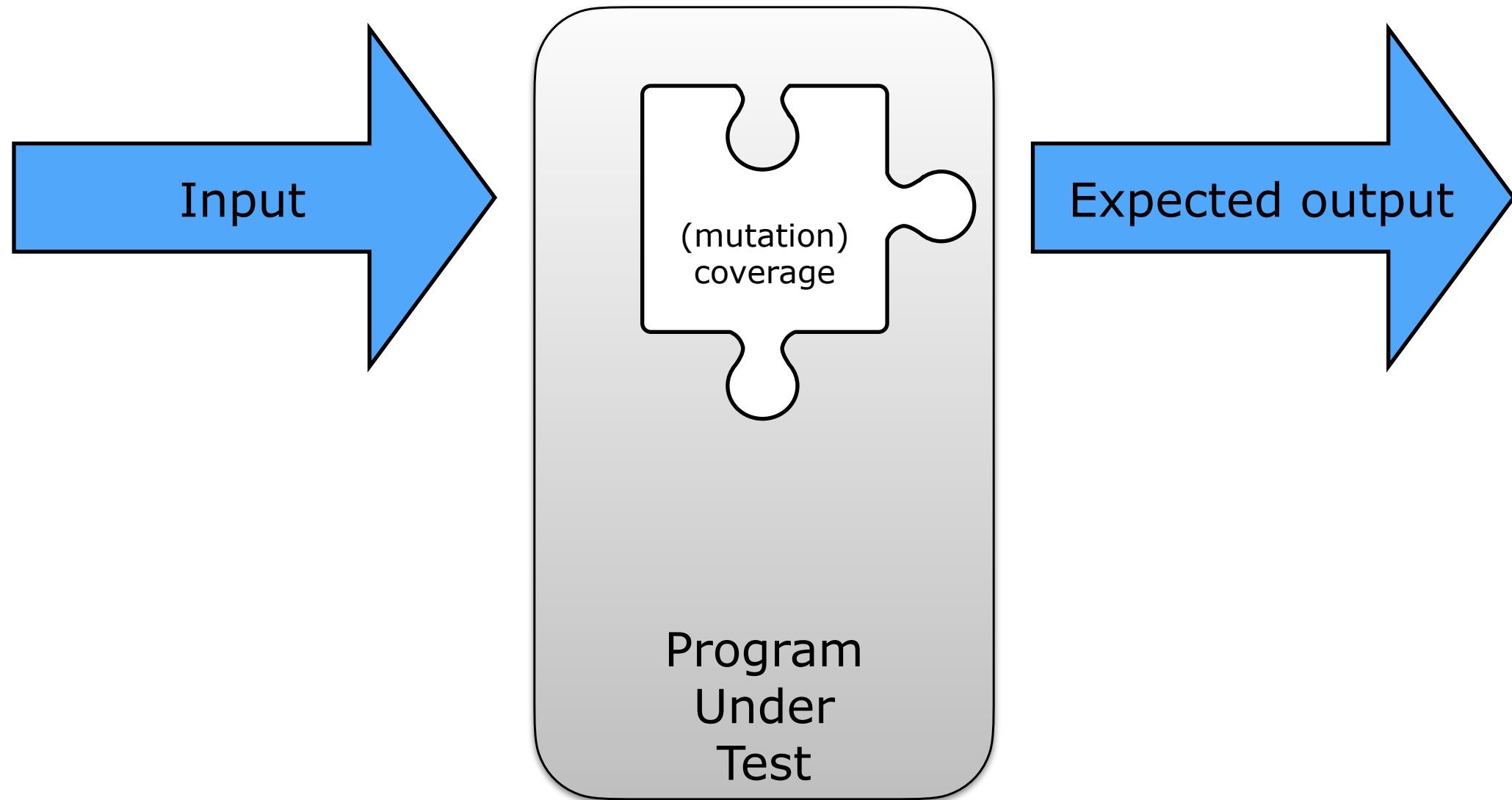
SKU\_Variant  
STD



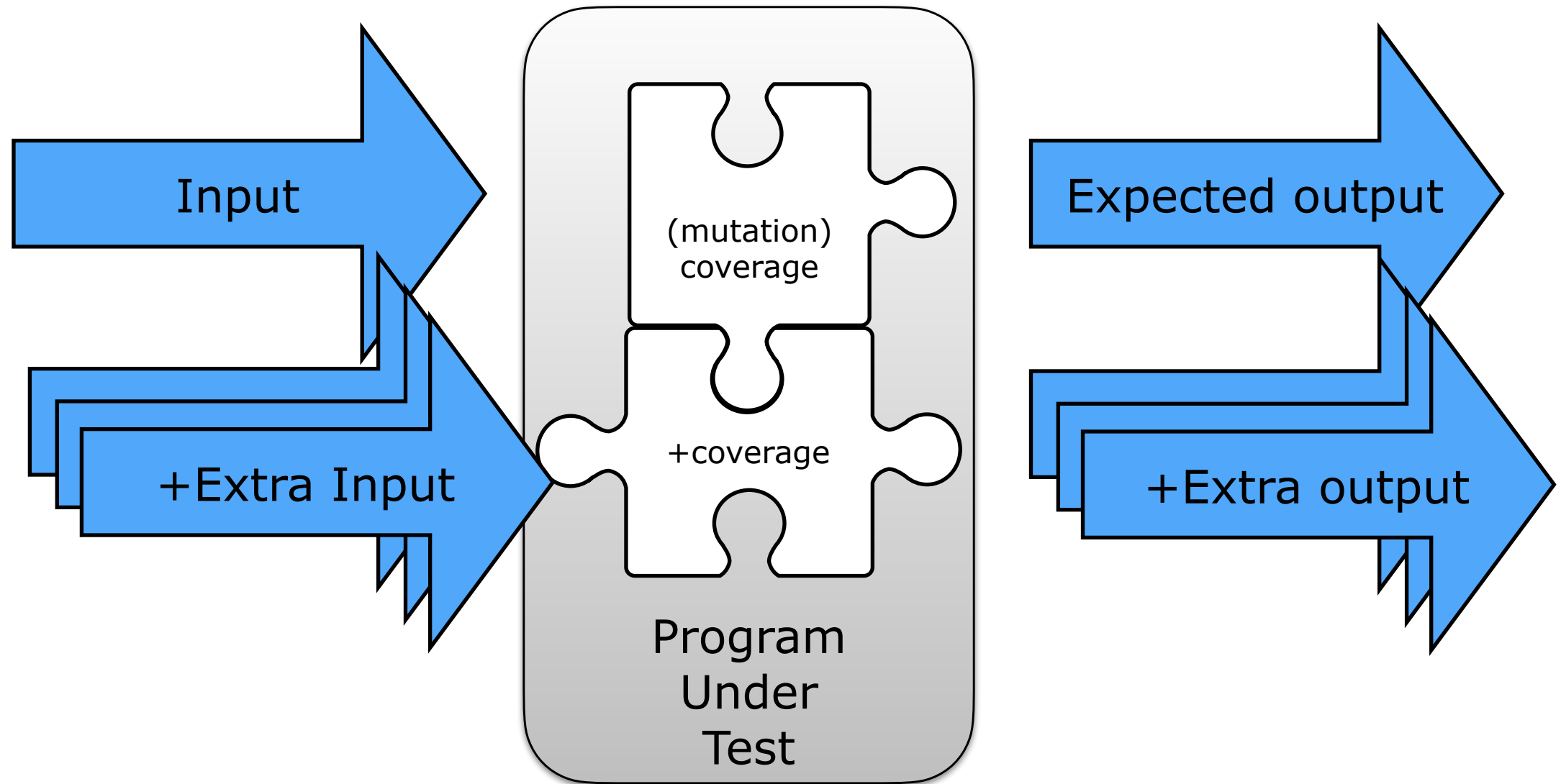
- Start-up established in 2020
- Fast-growing
  - more customers
  - more investors
  - *Single variant*
- AI engine is vital



# Coverage



# Test Amplification

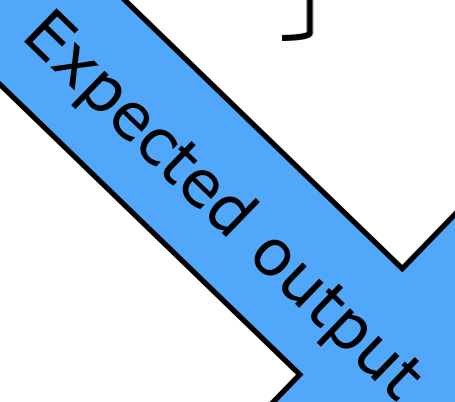


# Example - testDeposit



Input

```
1 def testDeposit ( self ) :  
2     self.b.set_owner('Iwena Kroka')  
3     self.b.deposit(10)  
4     self.assertEqual(self.b.get_balance(), 10) }  
5     self.b.deposit(100)  
6     self.b.deposit(100)  
7     self . assertEquals ( self .b. get_balance ( ) 210) }
```



Expected output



# Example - testDeposit\_amplified (1/2)

Assertion Amplification

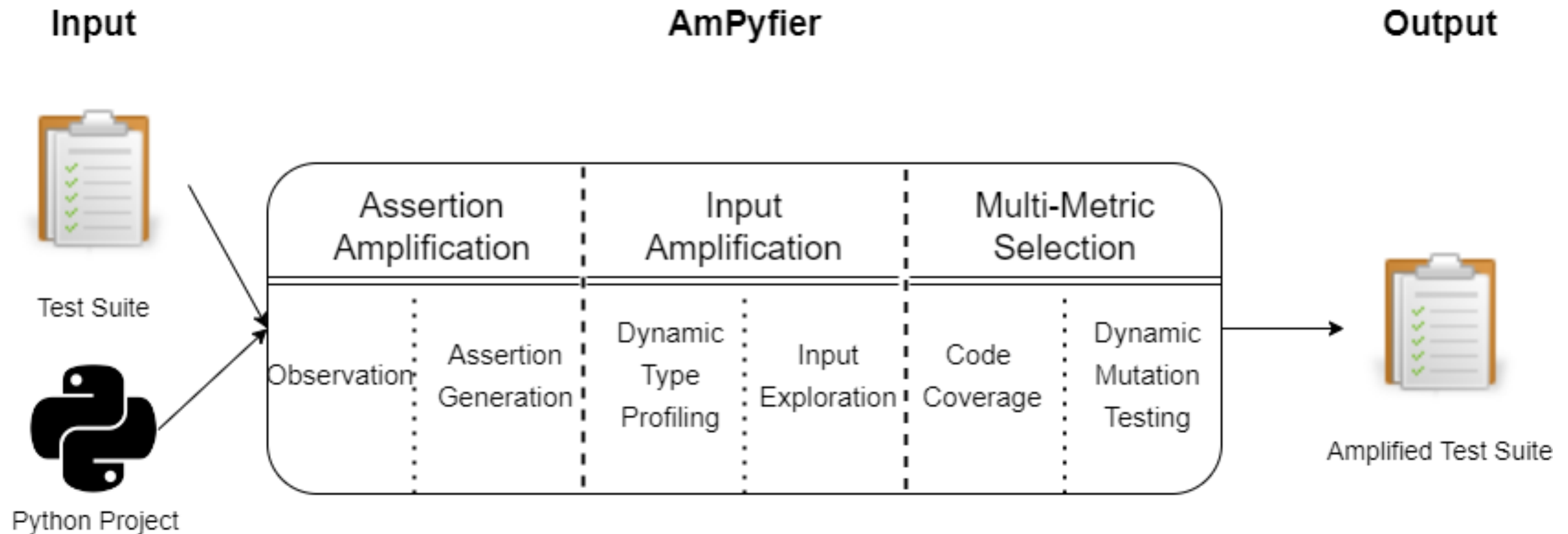
```
1 def testDeposit_amplified ( self ) :  
2     self.b.set_owner('Iwena Kroka')  
3     self.b.deposit(10)  
4     self.assertEqual(self.b.  
5         get_transactions(), [10])  
6     self.assertFalse (self .b. is_empty () )  
7     self.assertEqual(self.b.owner, 'Iwena Kroka')  
8     self.assertEqual(self.b.get_balance(), 10)  
    ...
```

# Example - testDeposit\_amplified (2/2)

Input Amplification

```
1 def testDeposit_amplified ( self ) :
2     self.b.set_owner('Iwena Kroka')
3     self.b.deposit(10)
4     self.assertEqual(self.b.
5         get_transactions(), [10])
6     self.assertFalse (self .b. is_empty () )
7     self.assertEqual(self.b.owner, 'Iwena Kroka')
8     self.assertEqual(self.b.get_balance(), 10)
9     with self.assertRaises(Exception):
10         self .b. deposit(-56313)
11         self.b.deposit(100)
12         self.b.set_owner('Guido van Rossum')
13         self.assertEqual(self.b.
14             get_transactions(), [10])
15     ...
```

# AmPyfier: Main Idea



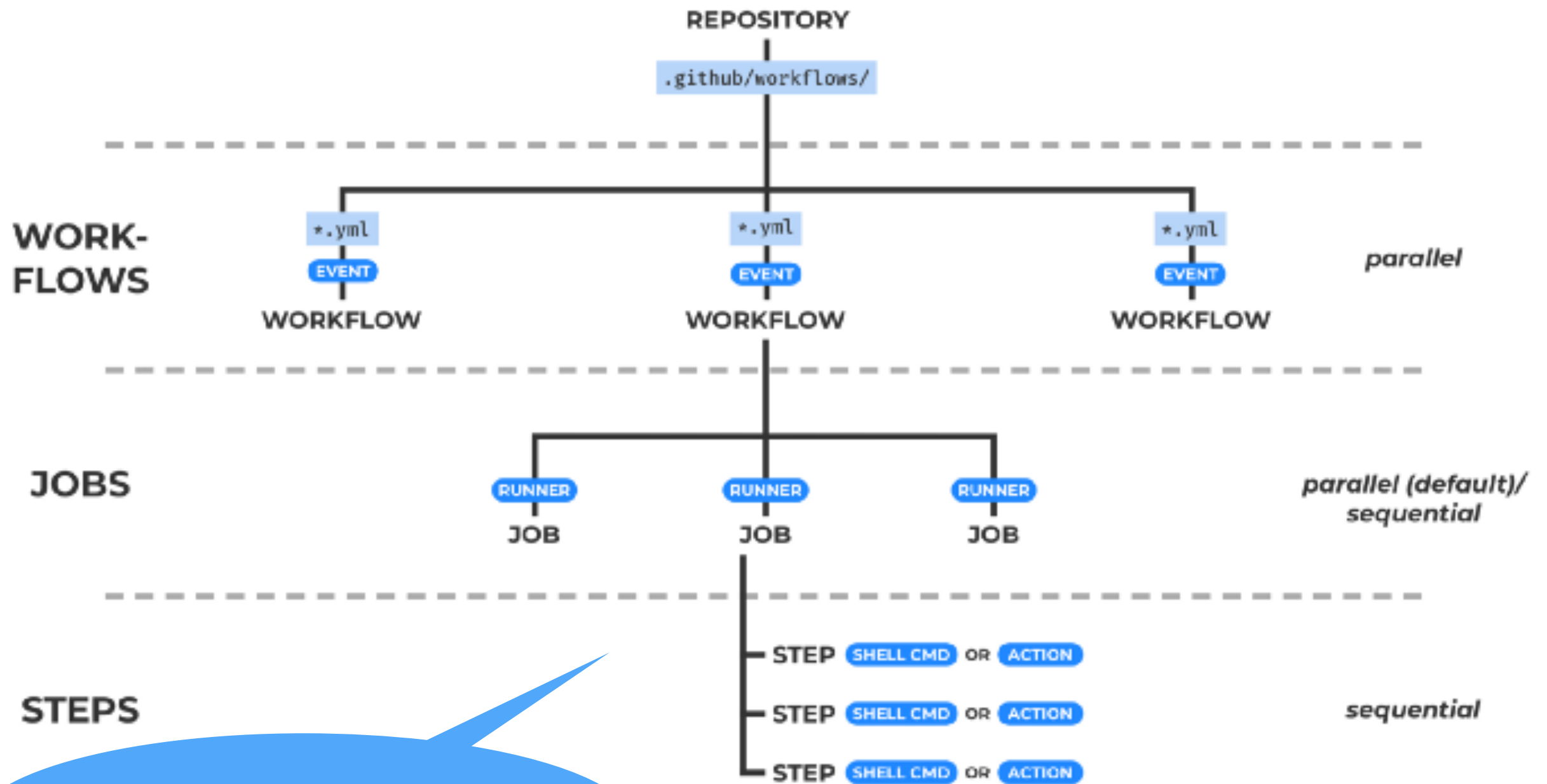
AmPyfier: Test amplification in Python

Journal of Software Evolution and Process 2022

<https://doi.org/10.1002/smr.2490>

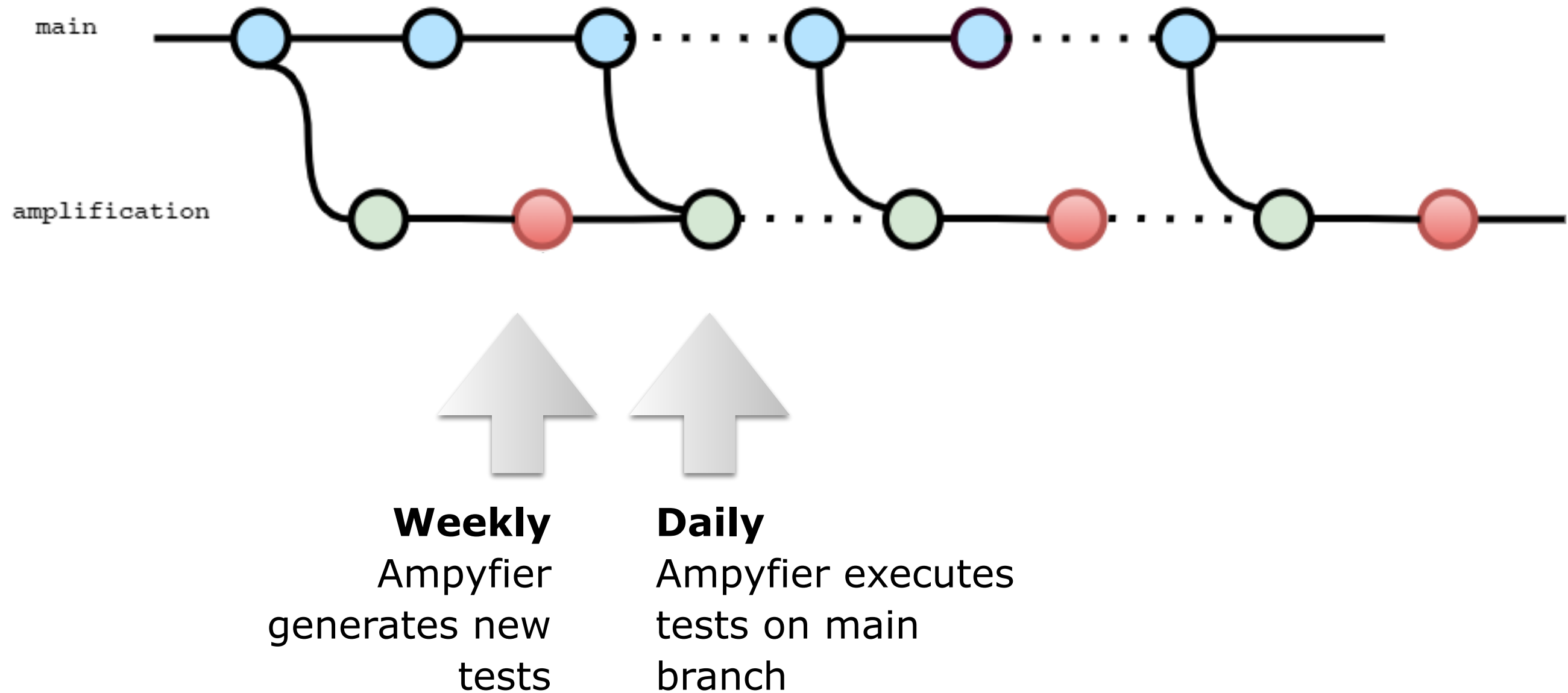


# GitHub Actions

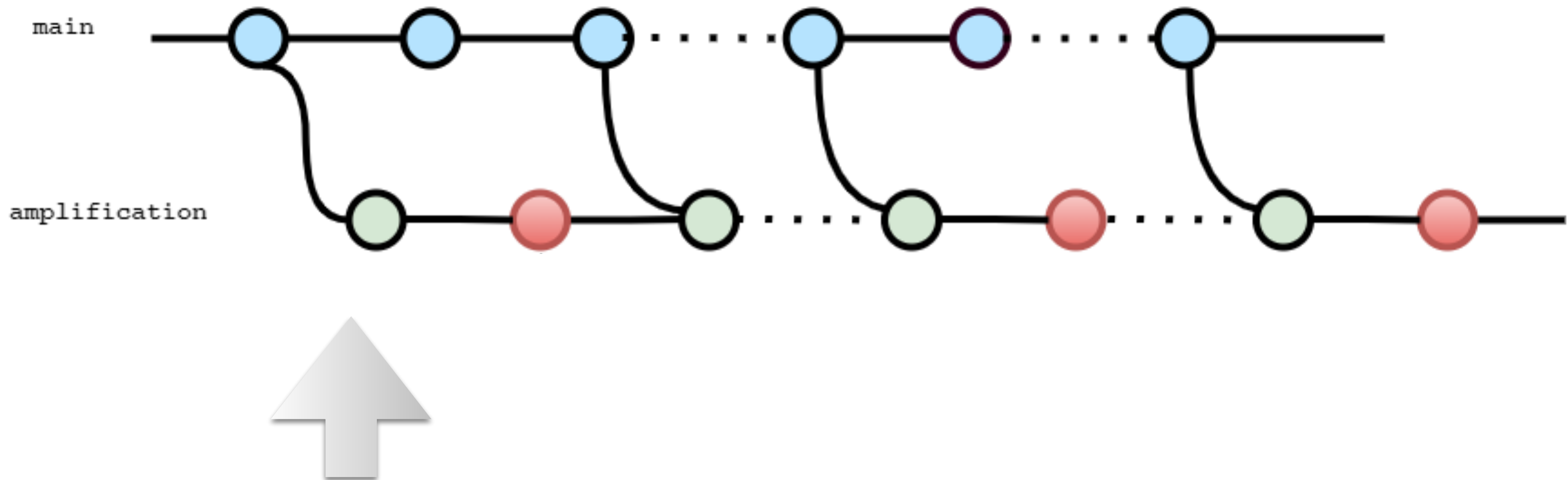


360 minutes

# Experimental Set-Up



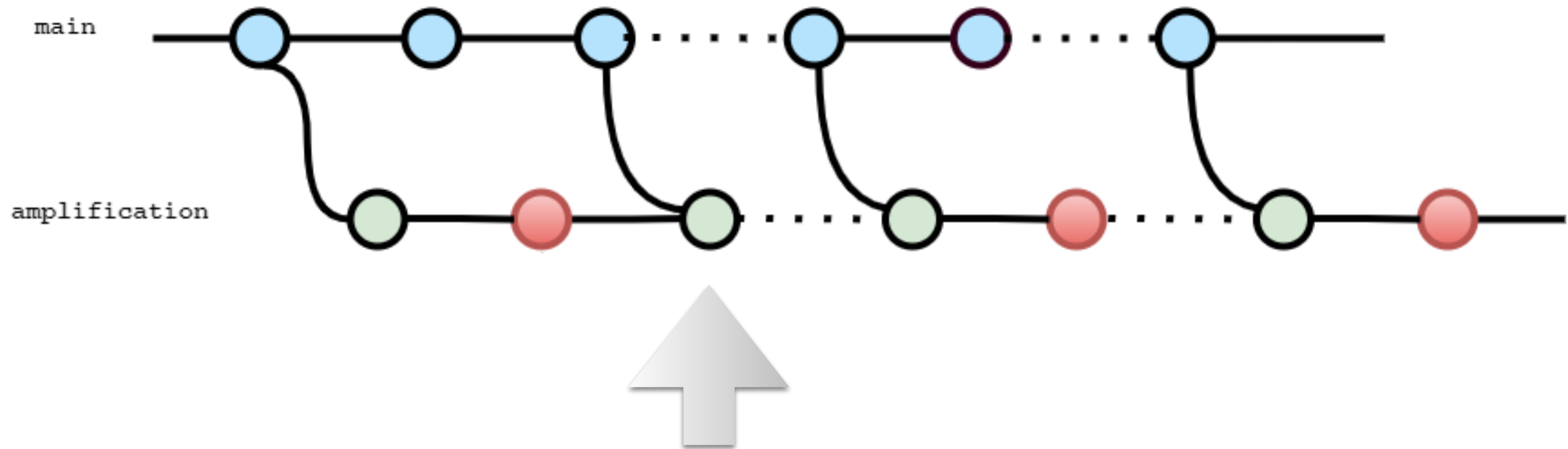
# Initial Amplification



Improvement for 13/25 files

- Mutation Score: 20.29%
- Code Coverage: 41.39%

# Continuous Amplification



Improvement for all

- Mutation score:  $7/8 \approx 87\%$
- Code coverage:  $5/8 \approx 63\%$
- Both:  $4/8 \approx 50\%$

