Production-Driven Patch Generation

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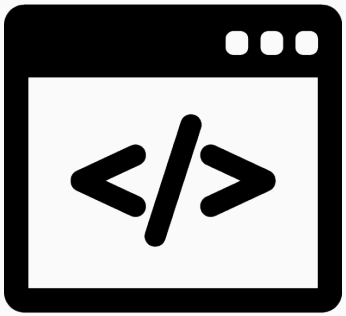
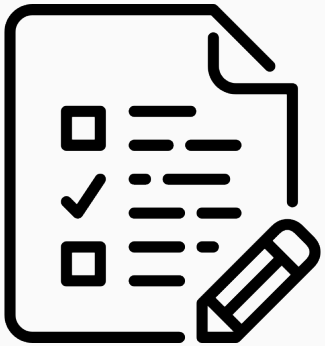
Firefox 52 crashes 63892 per day!

Automatic Program Repair



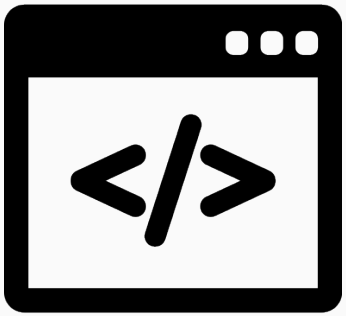
Firefox

Repair Strategy



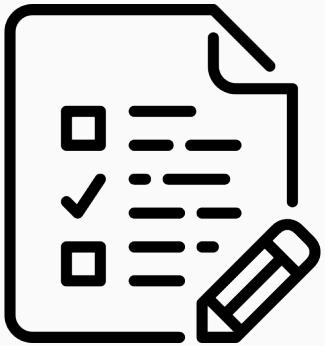
Presence of a Crash

Offline - Automatic Program Repair



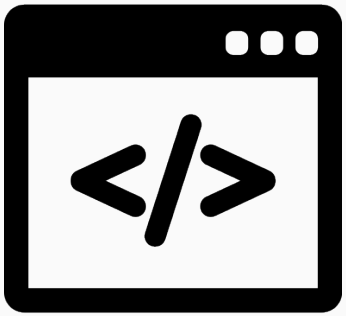
Buggy Program

GenProg,
Nopol, ...



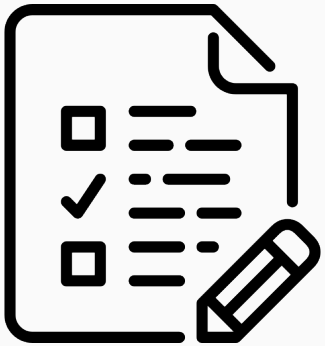
Test Suite

Online - Automatic Program Repair



Running Program

Repair Strategy



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Itzal Concept

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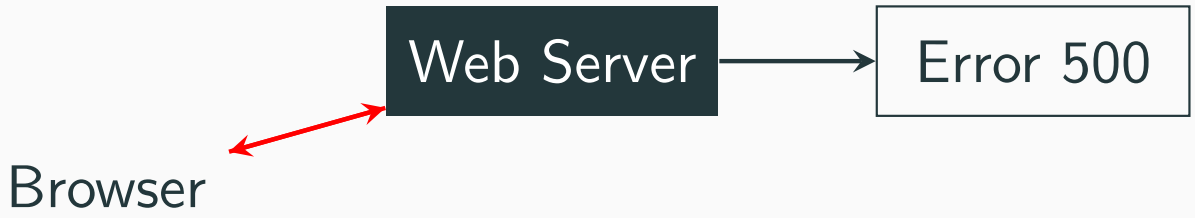
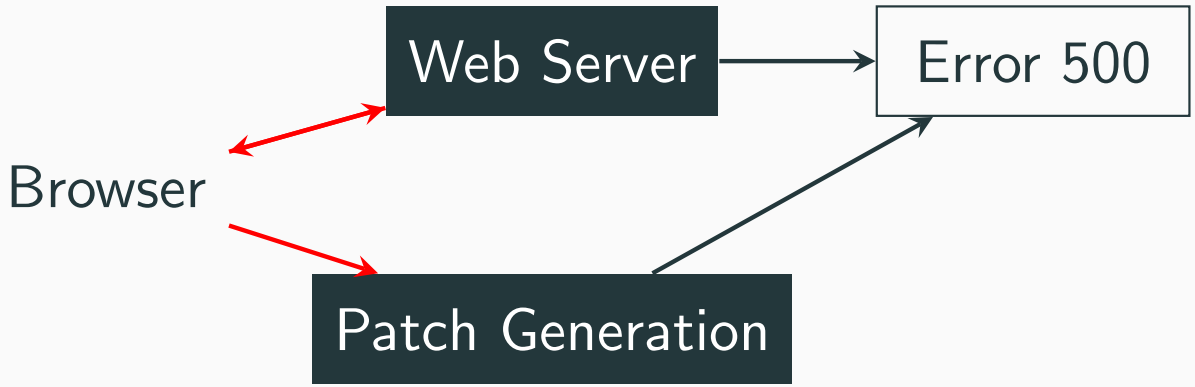


Itzal Concept



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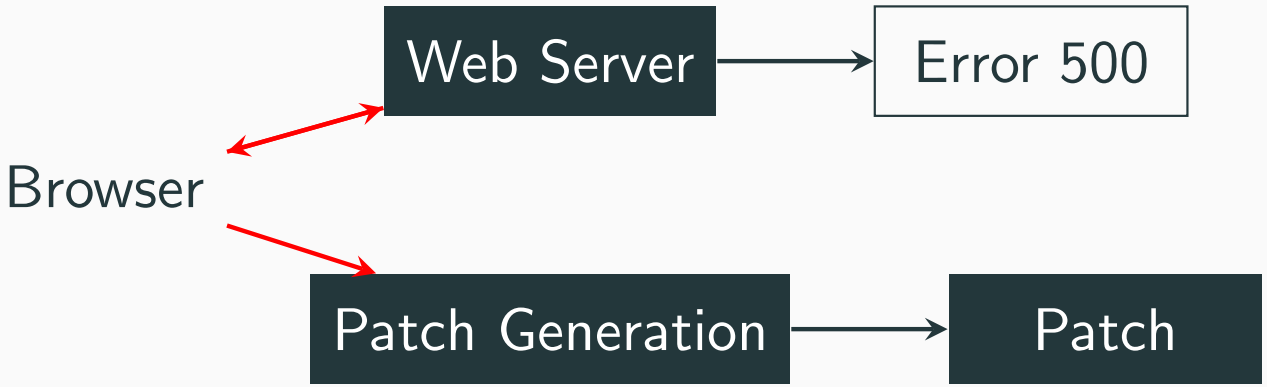
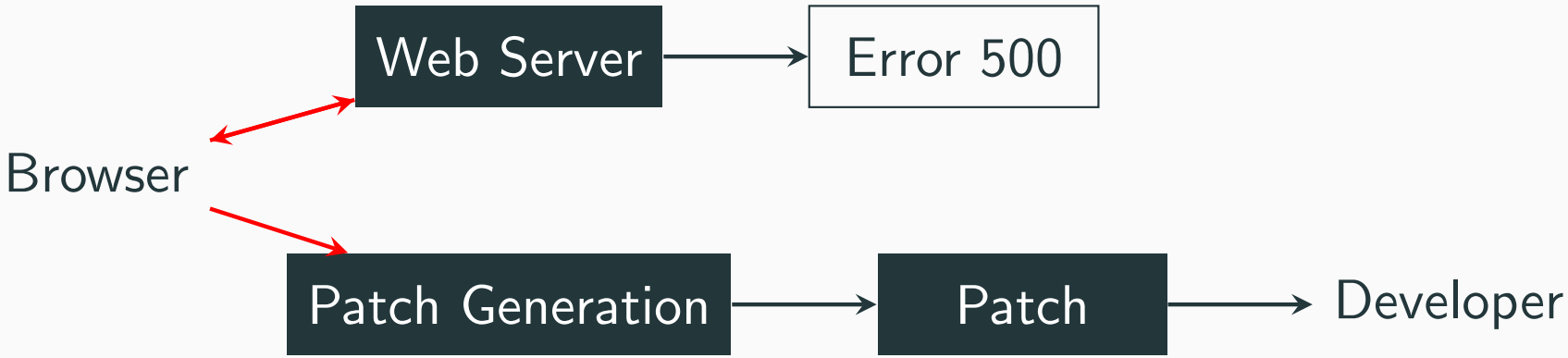


Itzal Concept



Itzal Architecture

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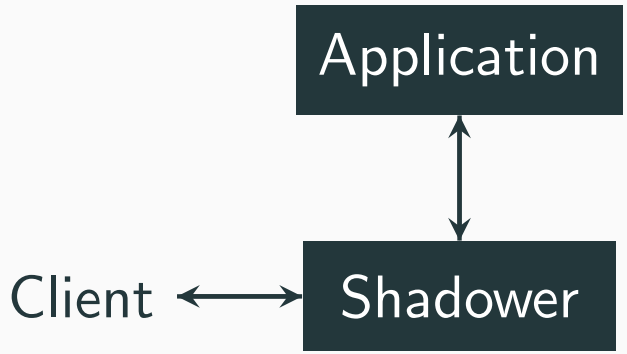
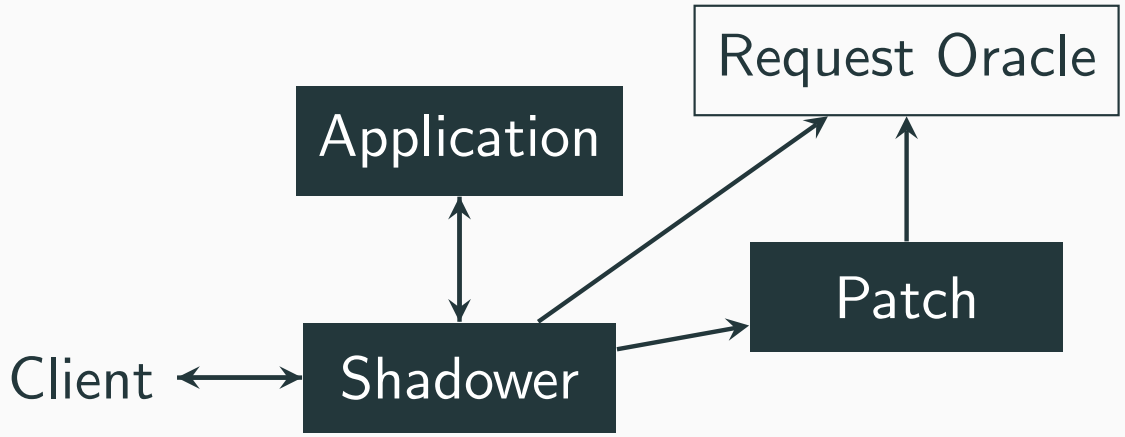


Shadower: intercepts and duplicates the requests

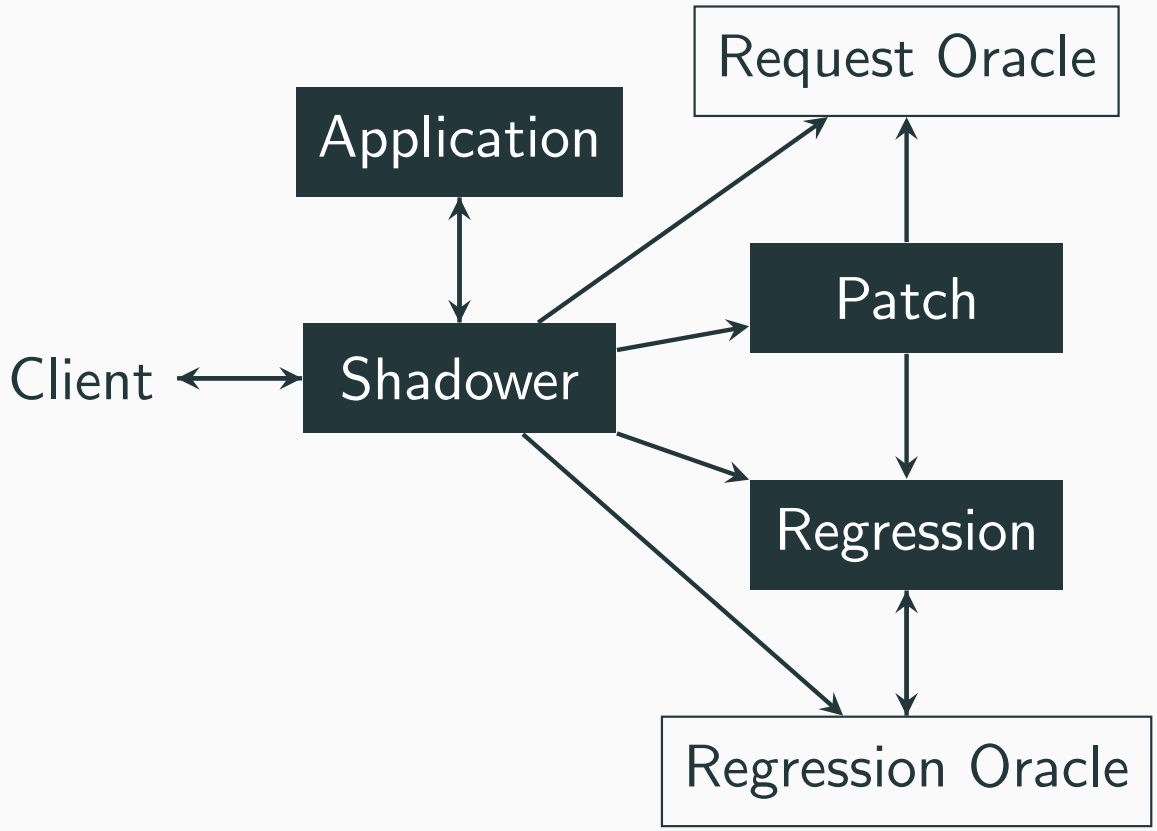
Itzal Architecture



Patch: generates patches that fix the requests

Request Oracle: detects if a request is passing or failing

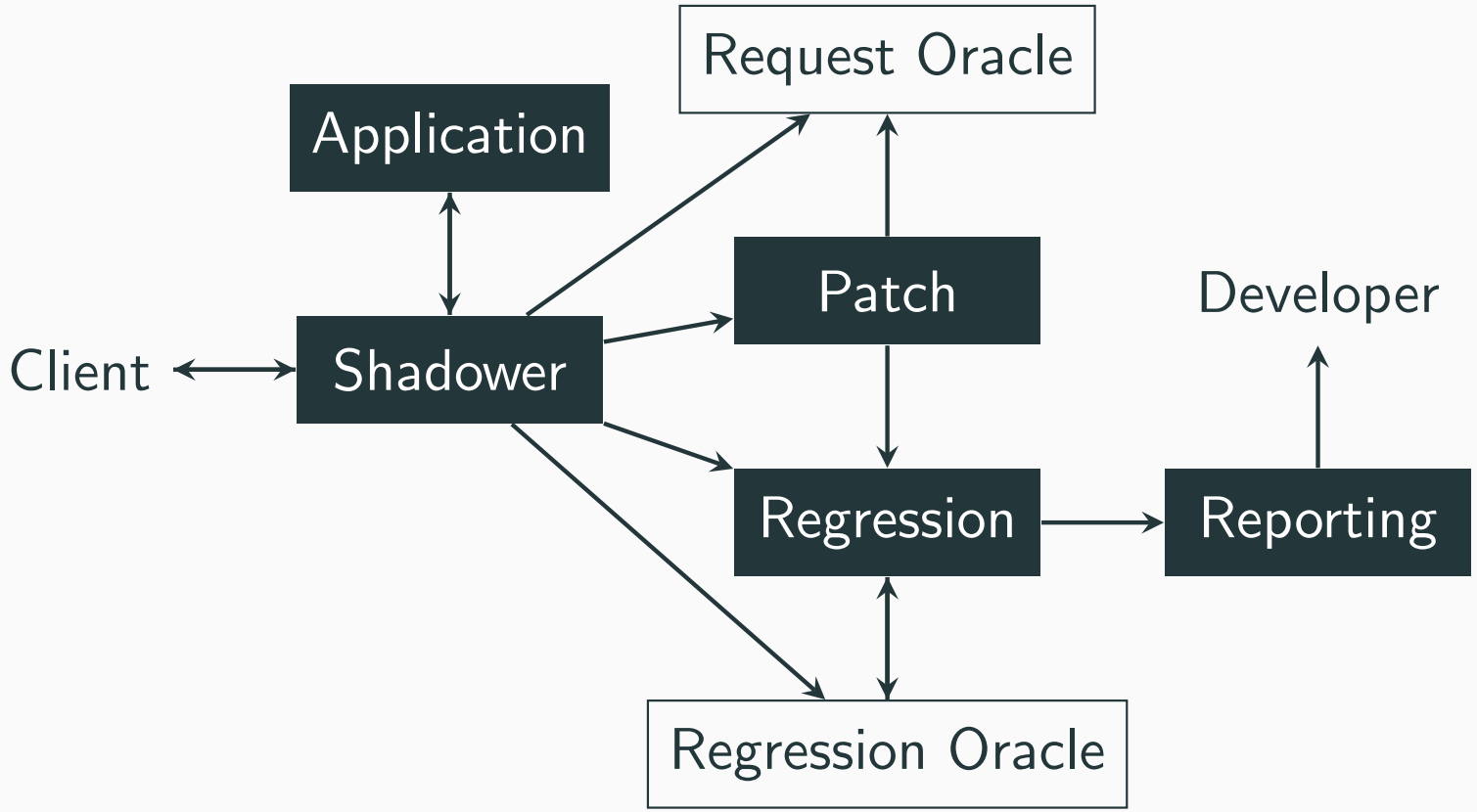
Itzal Architecture



Regression: executes passing request on patched application

Regression Oracle: compares the output of the application and the patched application

Itzal Architecture



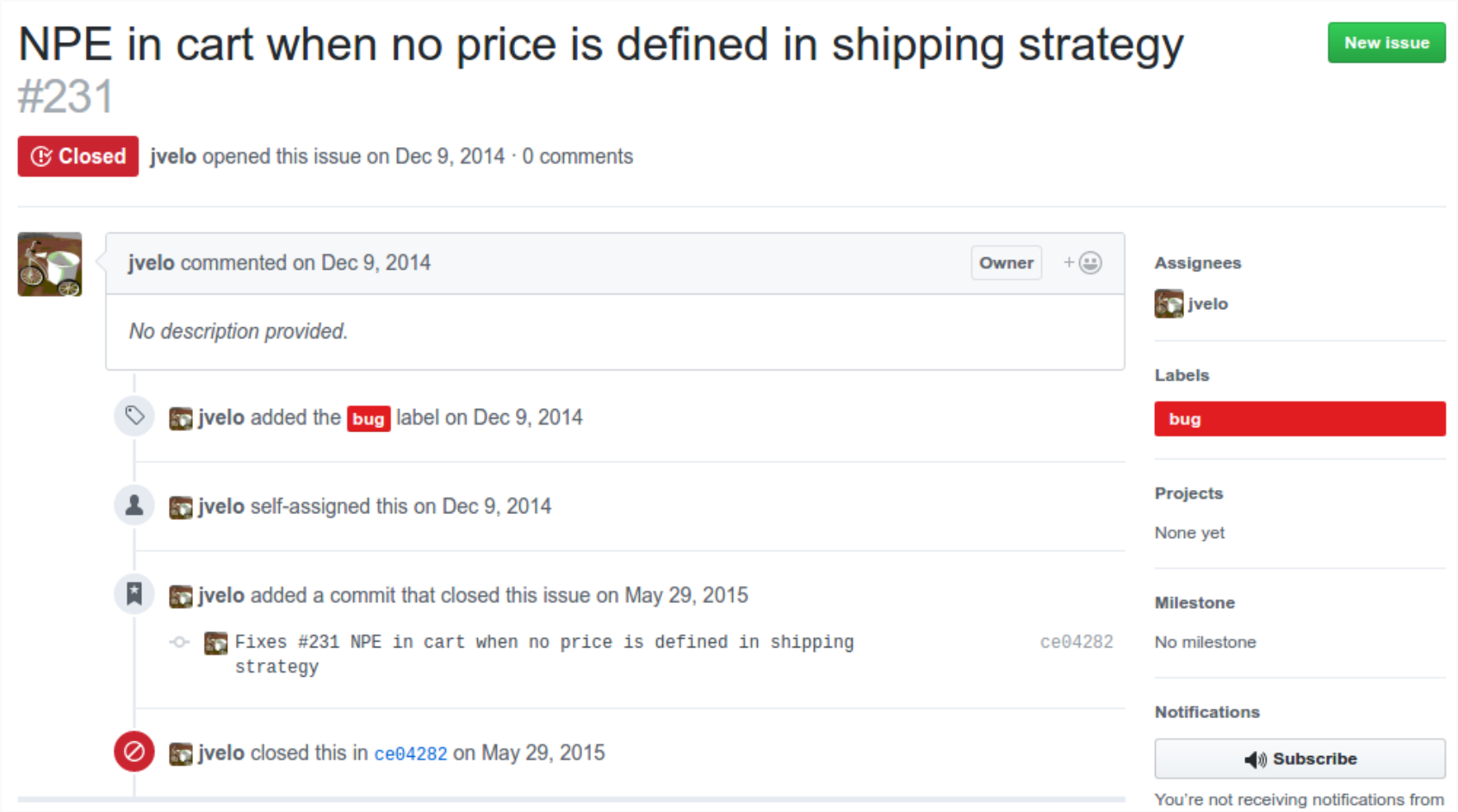
Reporting: communicates the patches to the developers (Dashboard, Pull Request, ...)

Itzal Oracle

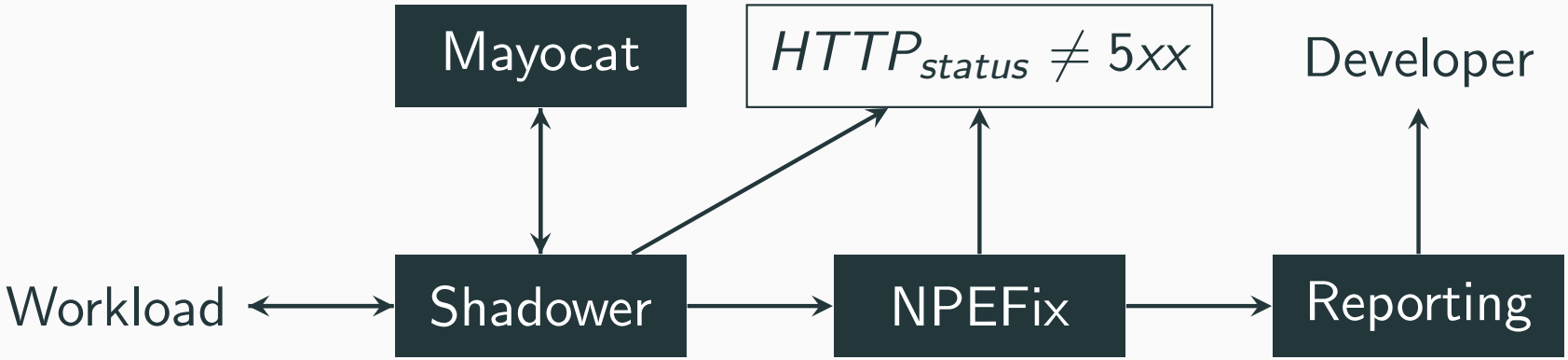
- Request Oracle: decides if a request is valid or not (e.g. $HTTP_{status} \neq 5xx$)
- Regression Oracle: decides if a patch has the good behavior for a specific request (e.g. Output Application = Output Patched Application)

Itzal Evaluation

Itzal Evaluation



Itzal Evaluation



Mayocat of Patch

```
@@ FlatStrategyPriceCalculator.java
@@ -37,2 +37,5 @@
+    if (carrier.getPerItem() == null) {
+        return null;
+    }
     price = price.add(carrier.getPerItem().
         multiply(BigDecimal.valueOf(
         numberOfItems)));
```

How to create scenario?

How to create scenario?

- Reproduce the nominal scenario: nobody communicates production workload
- Reproduce the buggy scenario: very hard to create a scenario that reproduces an issue

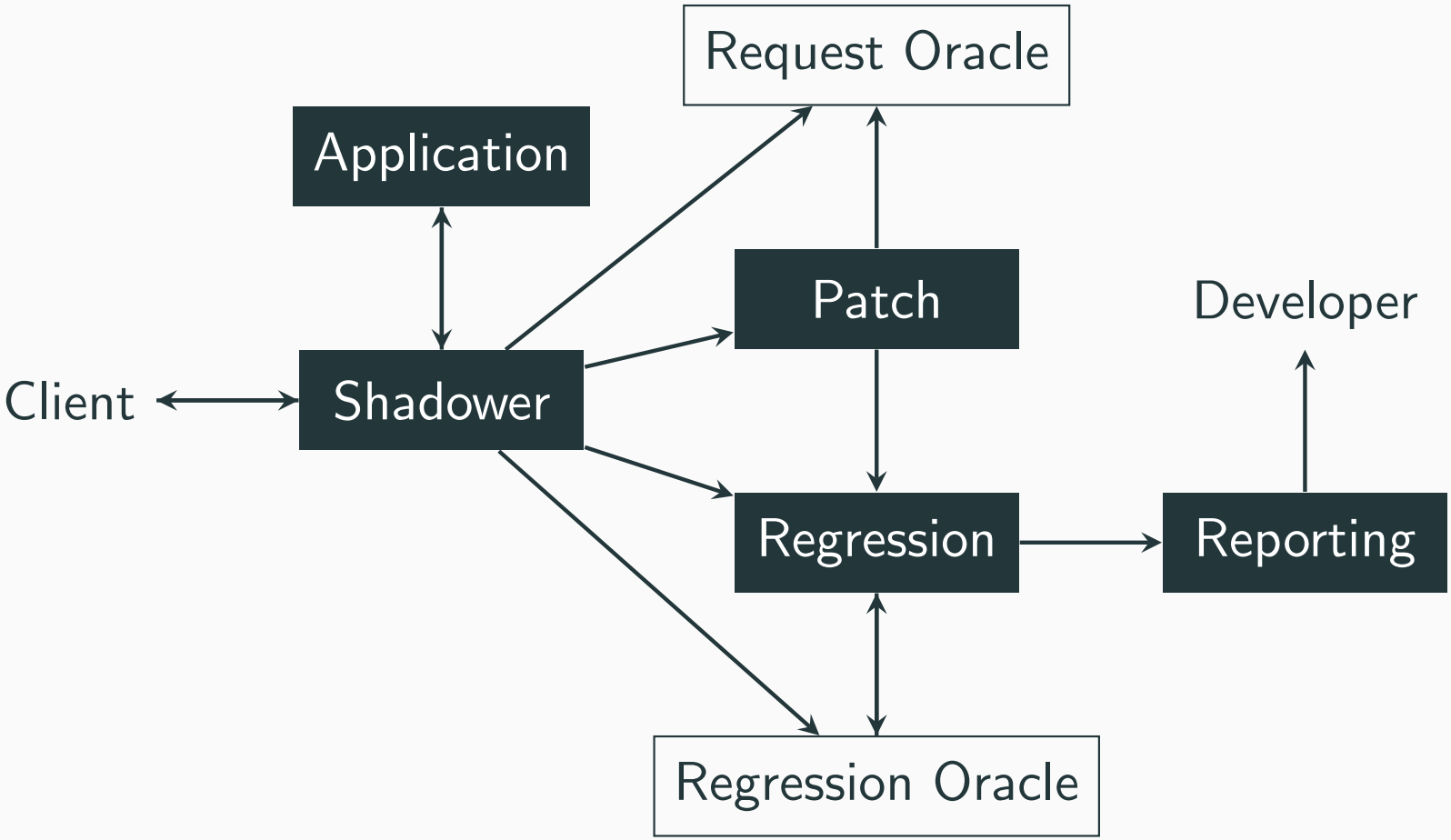
Conclusion

Take Away

It is possible to use Runtime Contracts instead of Test Contracts for Automatic Program Repair

The reproduction of real workload and buggy scenario is really hard

Summary


Request Oracle
Application
Patch
Developer
Client
Shadower
Regression
Reporting
Regression Oracle