Automated runtime software repair

Benoit Cornu, Martin Monperrus

Automated Runtime Software Repair

Improving resilience in presence of exceptions

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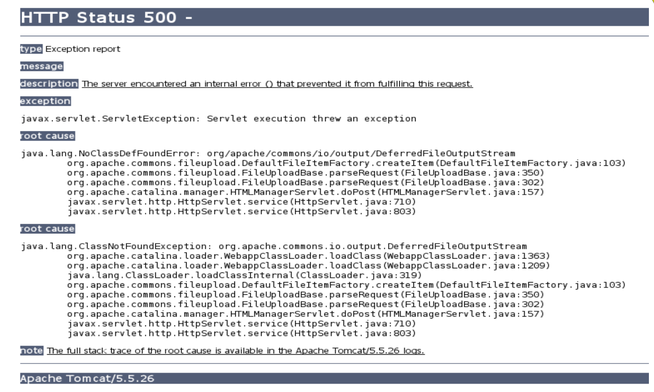
Context

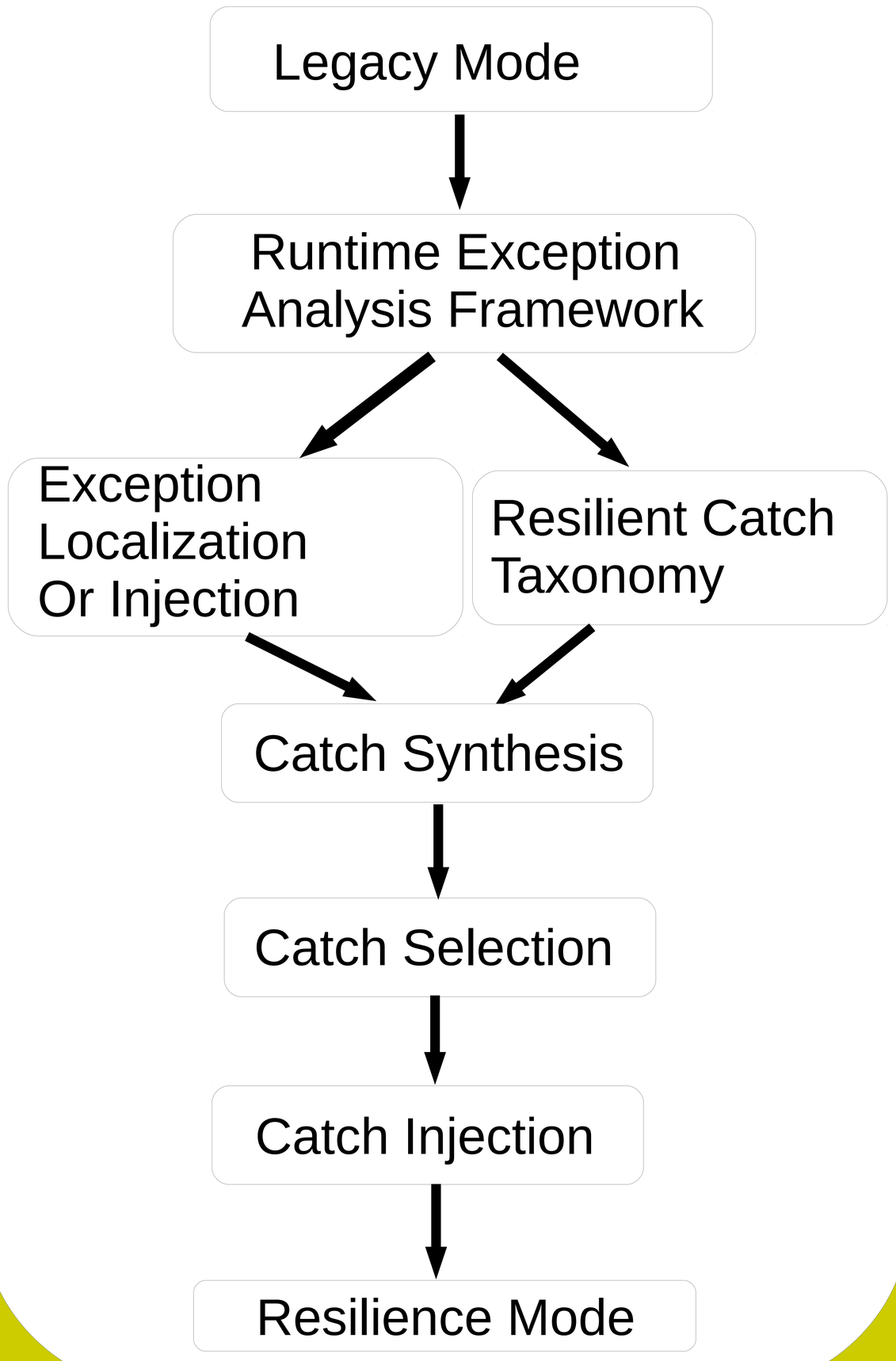
The server encountered an internal error ...



> Observation: m*any applications crash due to unexpected exceptions*
> Goal: *catch those exceptions* in an automated manner with synthesized catch blocks to prevent crashing the application*
> Techniques: code transformation, empirical analysis, code synthesis, data-mining

* whether checked or unchecked/runtime exceptions

Thesis Overview



Runtime Exception Analysis

Applicative Goals

-analyze the exception behavior specification
-isolate the catch blocks needed to perform an action
-isolate the catch blocks which are not (or cannot be) used

Technical Goals

-detection of exception sources and their context
-capture of catch block execution and their interplay
-analyze the relationship between causes and treatments

The Spoon library is used to instrument source code

```
try{
     Framework.learn("try-start");
     //developper code
     Framework.learn("try-end");
}catch(RuntimeException re){
     Framework.learn("catch-start", re);
     //developper code
     Framework.learn("catch-end");
}
```

Results

Run org.apache.commons.lang Test Suite skipping the catch treatments: (2051 tests)

4 failures --> bad assert result
125 errors --> unexpected Exception
1 crash --> non-ending required Thread

Number of used catch blocks / thrown exceptions to boot

Vuze: 24 catch – 413 exceptions
Jabref : 5 catch – 50 exceptions
Bluej : 0 catch – 1 exceptions

Ongoing Work

Exception injection of appropriate types at relevant place.

-select the place according to execution traces
-for a given place choose the type according to the static and dynamic context
-minimize artificiality / maximize learning

Evaluation

-How many “manually” fixed exception bugs from bug repositories can be automatically repaired by the framework?
-How much can the framework avoid crashing from fault injection?