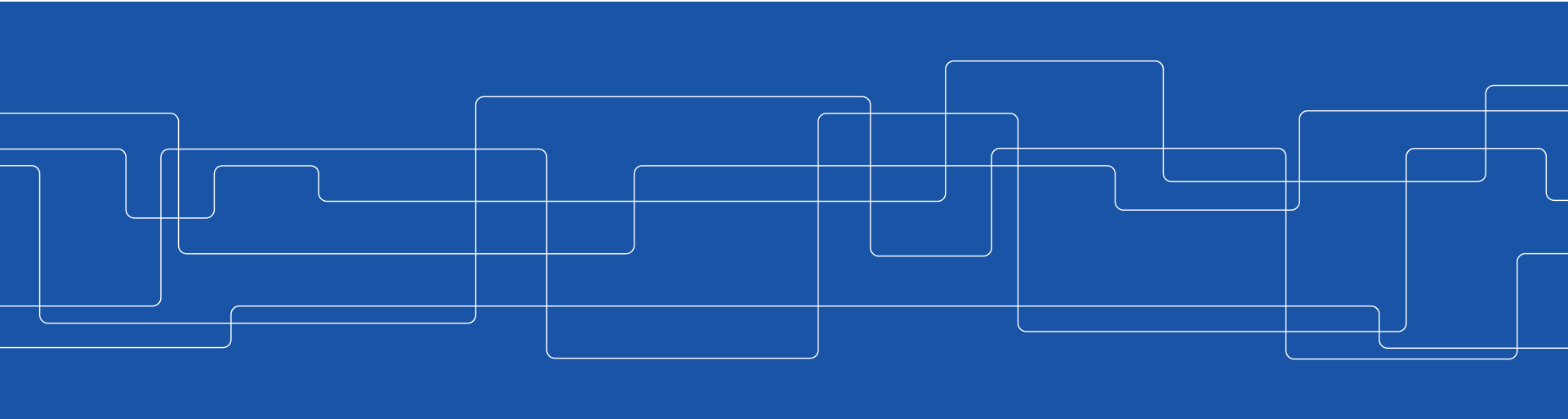
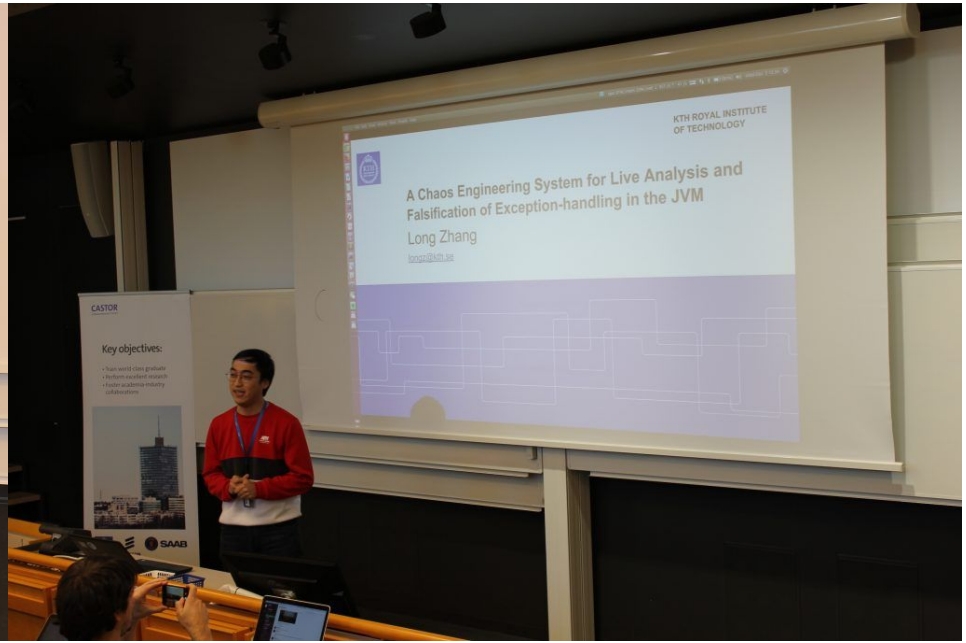
KTH ROYAL INSTITUTE
OF TECHNOLOGY

Introduction to Royal Chaos

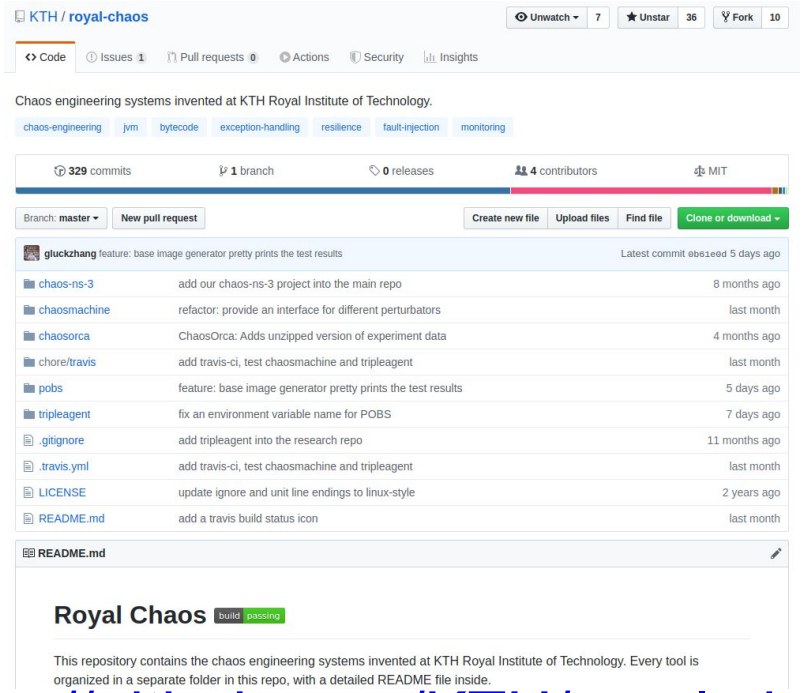
Long Zhang, KTH Royal Institute of Technology
longz@kth.se



Our ChaosDay 2018



Royal-Chaos @ GitHub



https://github.com/KTH/royal-chaos

TripleAgent

Monitoring, Perturbation and Failure-obliviousness for Automated Resilience Improvement in Java Applications

A Chinese Kungfu in Chaos Engineering

Technique of Ambidexterity, Zhou Botong, The Legend of the Condor Heroes

https://en.wikipedia.org/wiki/Zhou_Botong

TripleAgent - Example

- An invocation chain: m2 → m1 → m0

```
Class2 {
    public void m2() {
        try {
            new Class1().m1();
        } catch (EA a) {
            ...
        } catch (EB b) {
            ...
        }
    }
}
```

```
Class1 {
    public void m1() throws EA, EB {
        new Class0().m0();
    }
}
```

```
Class0 {
    public void m0() throws EA, EB {
        // a statement
        ...
    }
}
```

TripleAgent - Example

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Class1 {
    public void m1() throws EA, EB {
        new Class0().m0();
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}
```

```
Class0 {
    public void m0() throws EA, EB {
        // code injected with code transformation
        PAgent.throwExceptionPerturbation(key1);
        PAgent.throwExceptionPerturbation(key2);
        // a statement
        ...
        ...
    }
}
```

TripleAgent - Example

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}
```

```
Class1 {
    public void foo() throws EA, EB {
        try {
            new Class0().m0();
        } catch (Exception e) {
            if (FOAgent.modelsOn(key)) {
                // the exception is silenced
            } else { throw e; }
        }
    }
}
```

```
Class0 {
    public void m0() throws EA, EB {
        // code injected with code transformation
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```
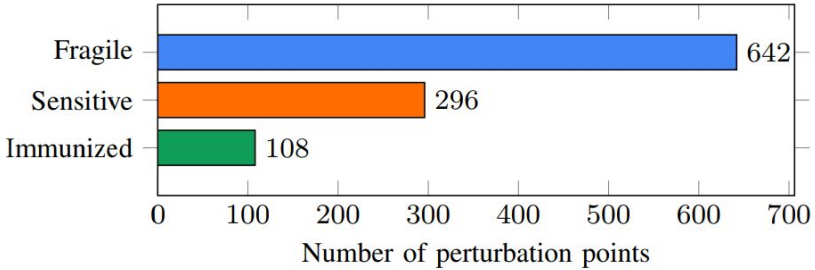
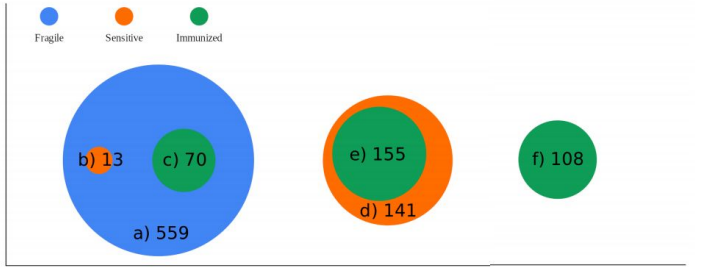

TripleAgent - Evaluation



Category of perturbation points



a) Fragile stays fragile, b) Fragile to sensitive, c) Fragile to immunized
d) Sensitive stays sensitive, e) Sensitive to immunized, f) Immunized stays immunized

Resilience improvement

TripleAgent identifies 238 perturbation points whose resilience could be improved by failure-oblivious methods.

TripleAgent - Overhead

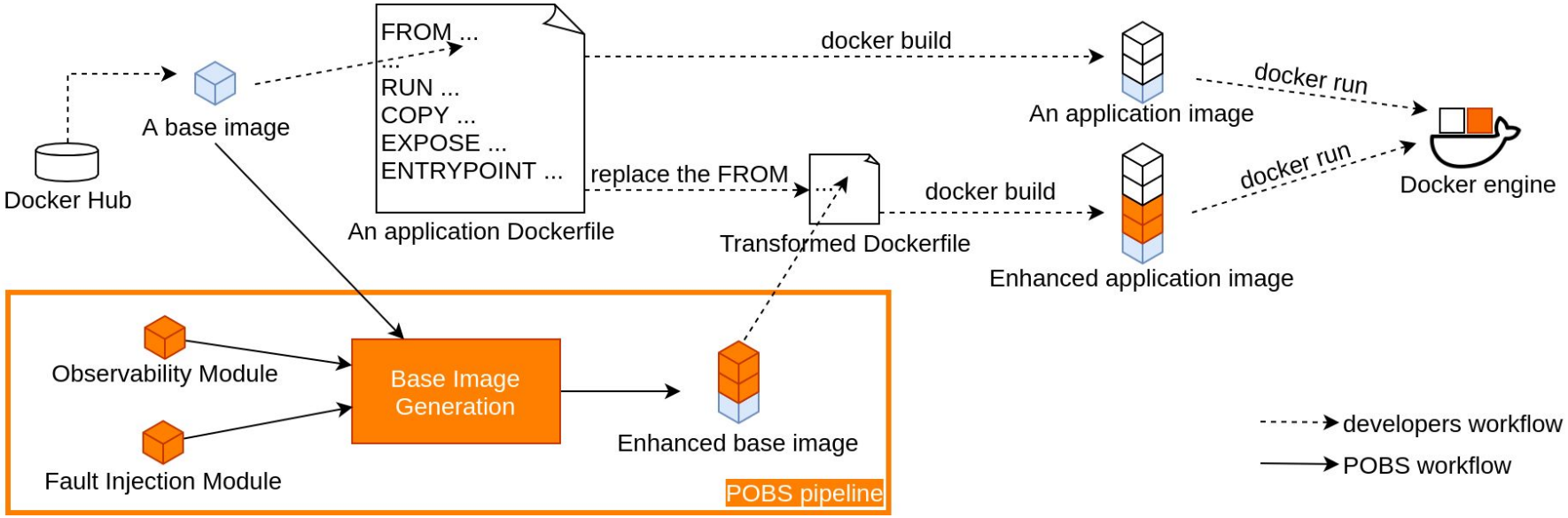
- Application level: the execution time
- Operating system level: CPU usage etc.
- Binary code level: the code bloat

THE OVERHEAD OF AN EXPERIMENT ON TTORRENT

Evaluation Aspects	Original Version	Instrumented Version	Variation
Downloading time	20.4s	21.1s	3.5%
CPU time	15.0s	18.3	22.2%
Memory usage	47M	49M	4.3%
Peak thread count	30	32	6.7%
Relevant class files size	16.7KB	16.8KB	0.6%

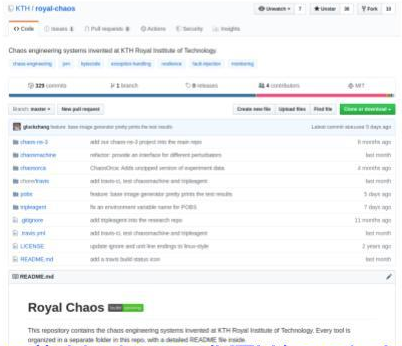
DEMO Time!

POBS - Design


FROM ...
...
RUN ...
COPY ...
EXPOSE ...
ENTRYPOINT ...
An application Dockerfile
docker build
An application image
docker run
Docker engine
A base image
Docker Hub
replace the FROM
Transformed Dockerfile
docker build
Enhanced application image
docker run
Observability Module
Fault Injection Module
Base Image Generation
Enhanced base image
POBS pipeline
developers workflow
POBS workflow

DEMO Time!

Royal-Chaos @ GitHub



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Class1 {
   public void foo() throws EA, EB {
      try {
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      } catch (Exception e) {
         if (FOAgent.modeIsOn(key)) {
            // the exception is silenced
         } else { throw e; }
      }
   }
}
```

```
Class0 {
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      PAgent.throwExceptionPerturbation(key1);
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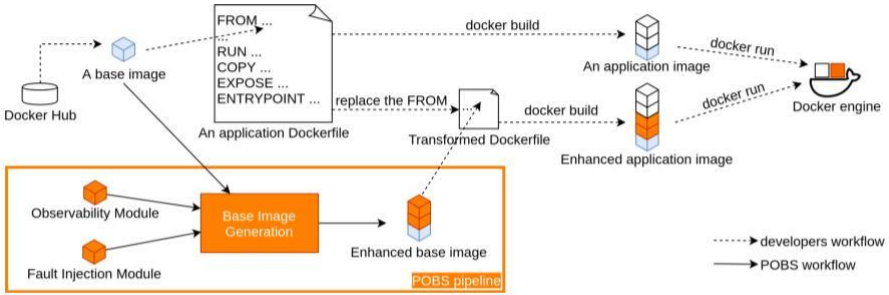
POBS - Design



DEMO Time!

Thanks for listening!

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