

JUDCon

JBoss Users & Developers Conference

2012: Boston

The Dark Sides of Integration

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JRebel, ZeroTurnaround
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Observe
results



Make a
change





Build,
deploy,
wait





Where the time goes?

Where the time goes?

	
Build	Just don't
Container start	Light containers
Deployment	?
Navigation	Persist sessions

Where the time goes?

	
Build	Just don't
Container start	Light containers
Deployment	JRebel
Navigation	Persist sessions

```
@Path("/")  
public String foo() {  
    return "FooBar";  
}
```

```
@Path("/")
public String foo() {
    return "FooBar";
}
```



```
@Path("/")
public FooBar foo() {
    return new FooBar();
}
```



```
@Path("/")  
public String foo() {  
    return "FooBar";  
}
```



```
@Path("/foobar")  
public FooBar foo() {  
    return new FooBar();  
}
```

JRebel






Project Explorer

- jboss-as-kitchensink
 - JAX-RS REST Web Services
 - Deployment Descriptor: jboss-as-ki
 - Web Resources
 - JAX-WS Web Services
 - JPA Content
 - Java Resources
 - JavaScript Resources
 - Deployed Resources
 - pom.xml
 - README.md
 - src
 - target
 - m2e-wtp

rebel.xml | jboss-as-7.1.1.Final | Java EE 6 Starter Application

http://localhost:8080/jboss-as-kitchensink/index.jsf



JBoss Application Server 7

Welcome to JBoss AS 7!

You have successfully deployed Kitchensink, a Java EE 6 web application on JBoss AS 7.

Register (Bean Validation example)

Enforces annotation-based constraints defined on the model class.

Name:

Email:

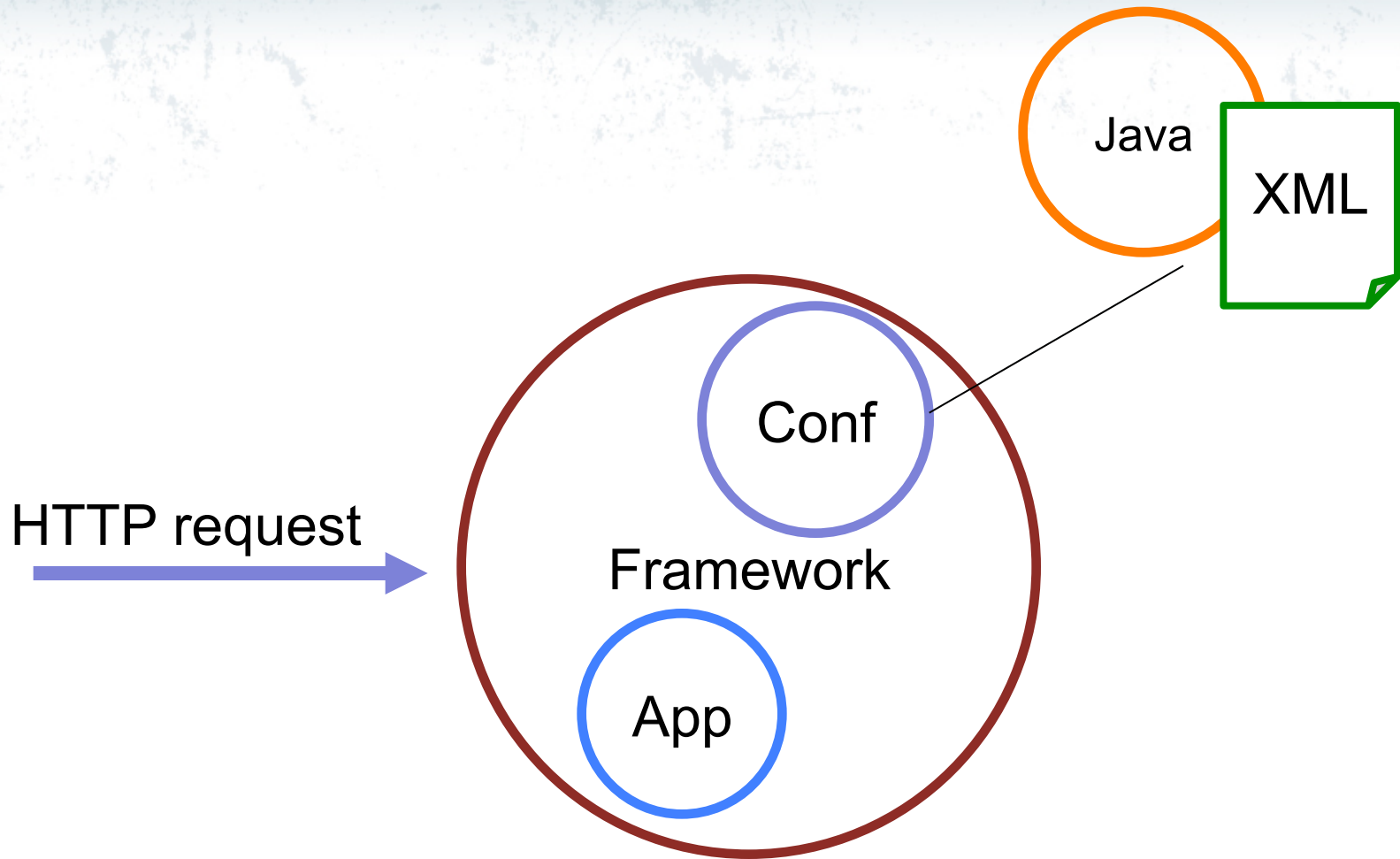
Markers | Properties | Servers | Data Source Explorer | Snippets | Console

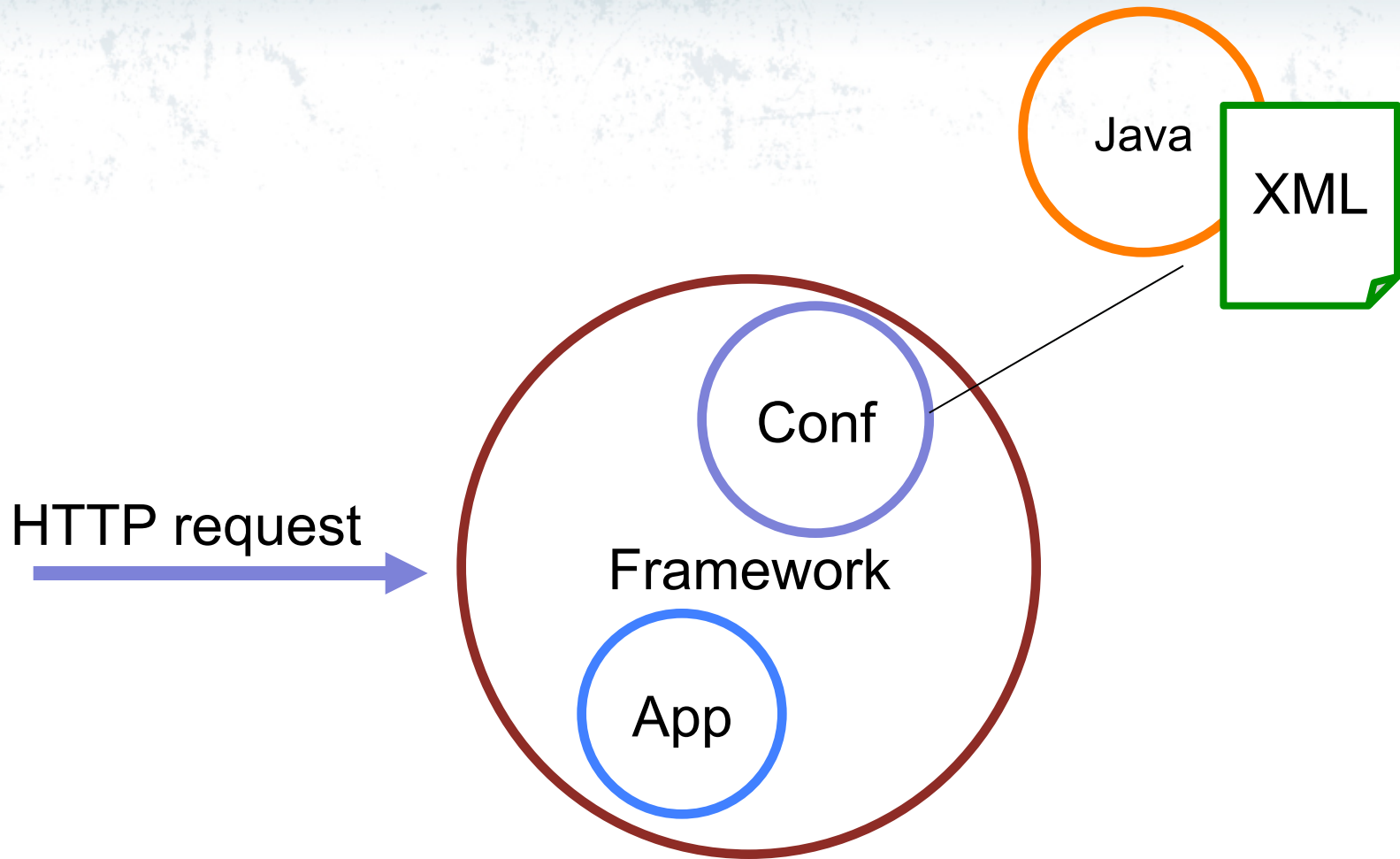
- jboss-as-7.1.1.Final [Started, Republish]
 - jboss-as-kitchensink [Republish]
 - XML Configuration
 - Filesets
 - Server Details

Come To The Dark Side

We have cookies

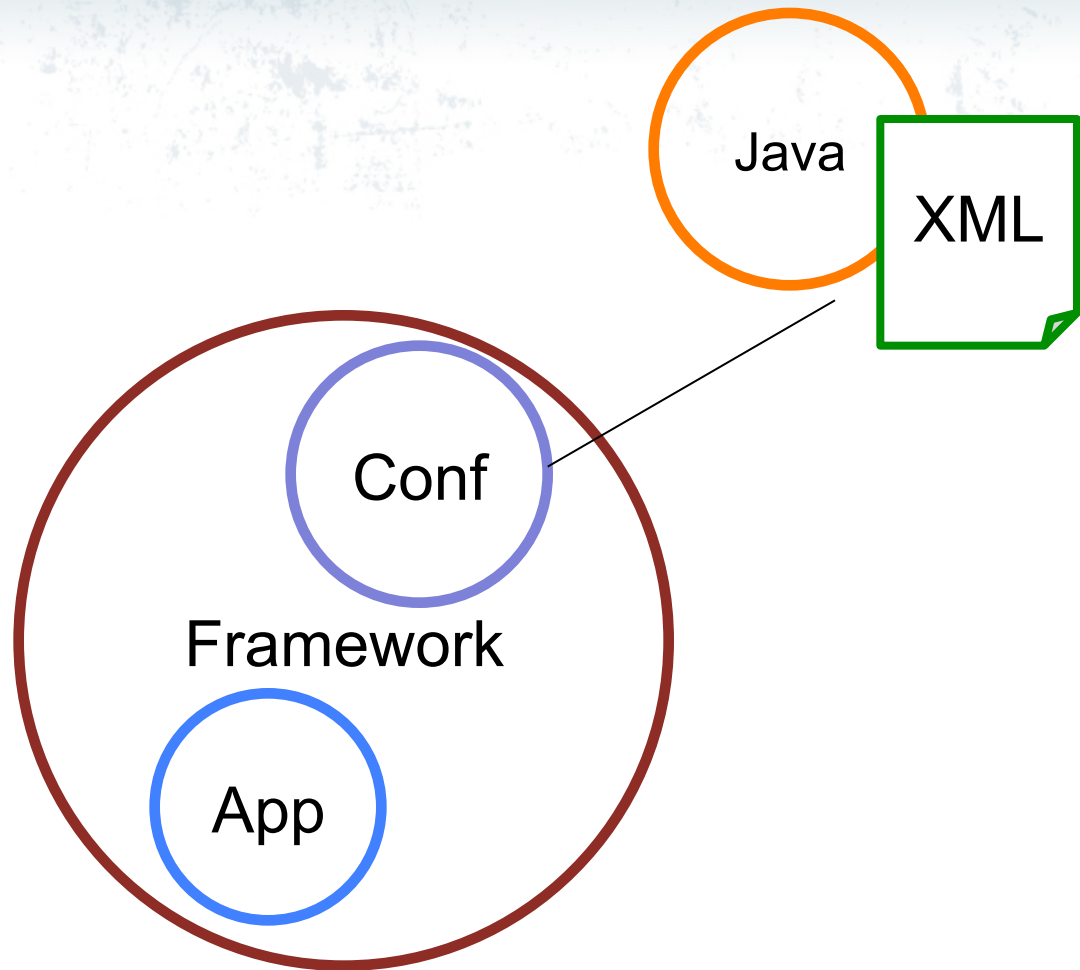






JRebel

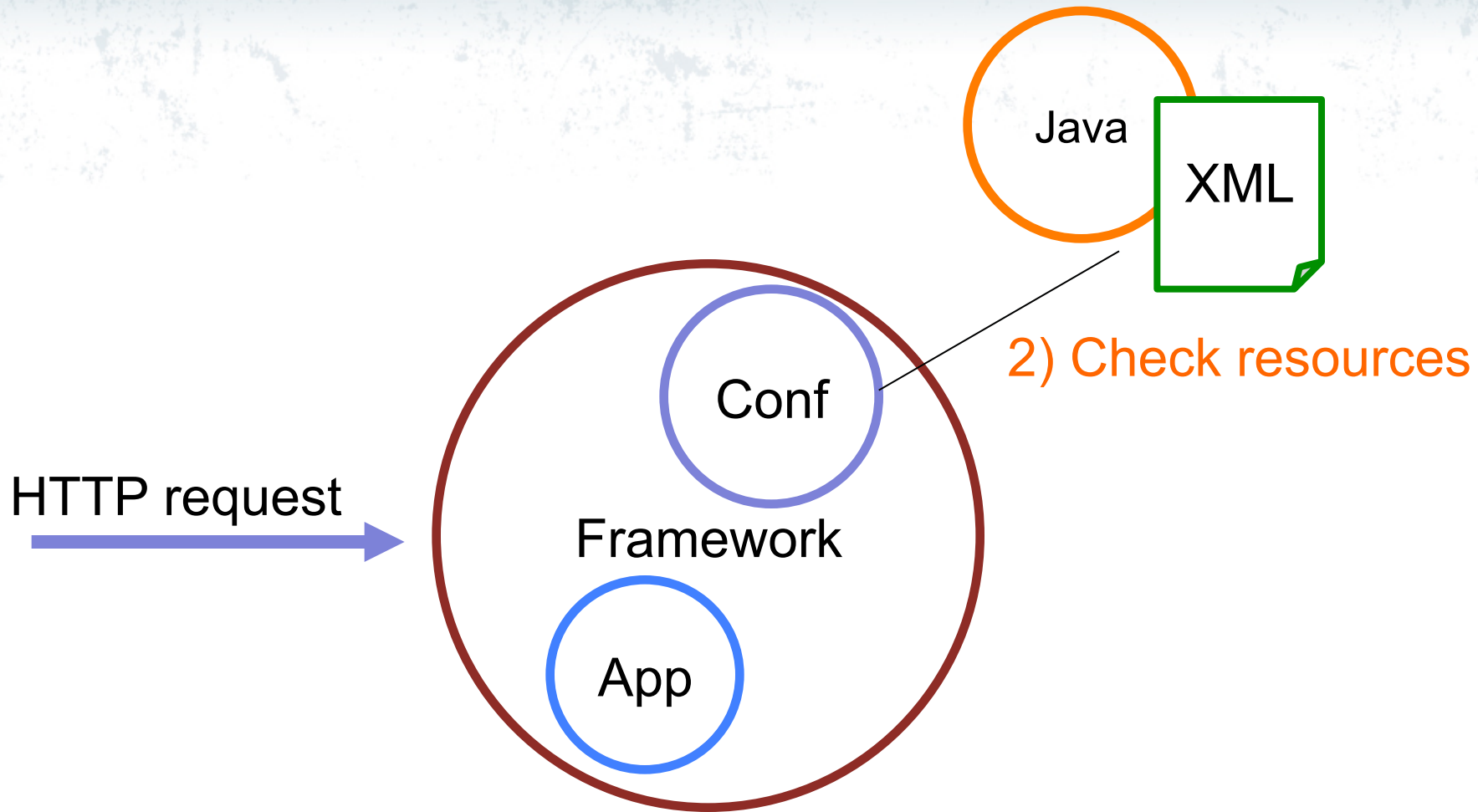
HTTP request
→
1) Stop request



JRebel

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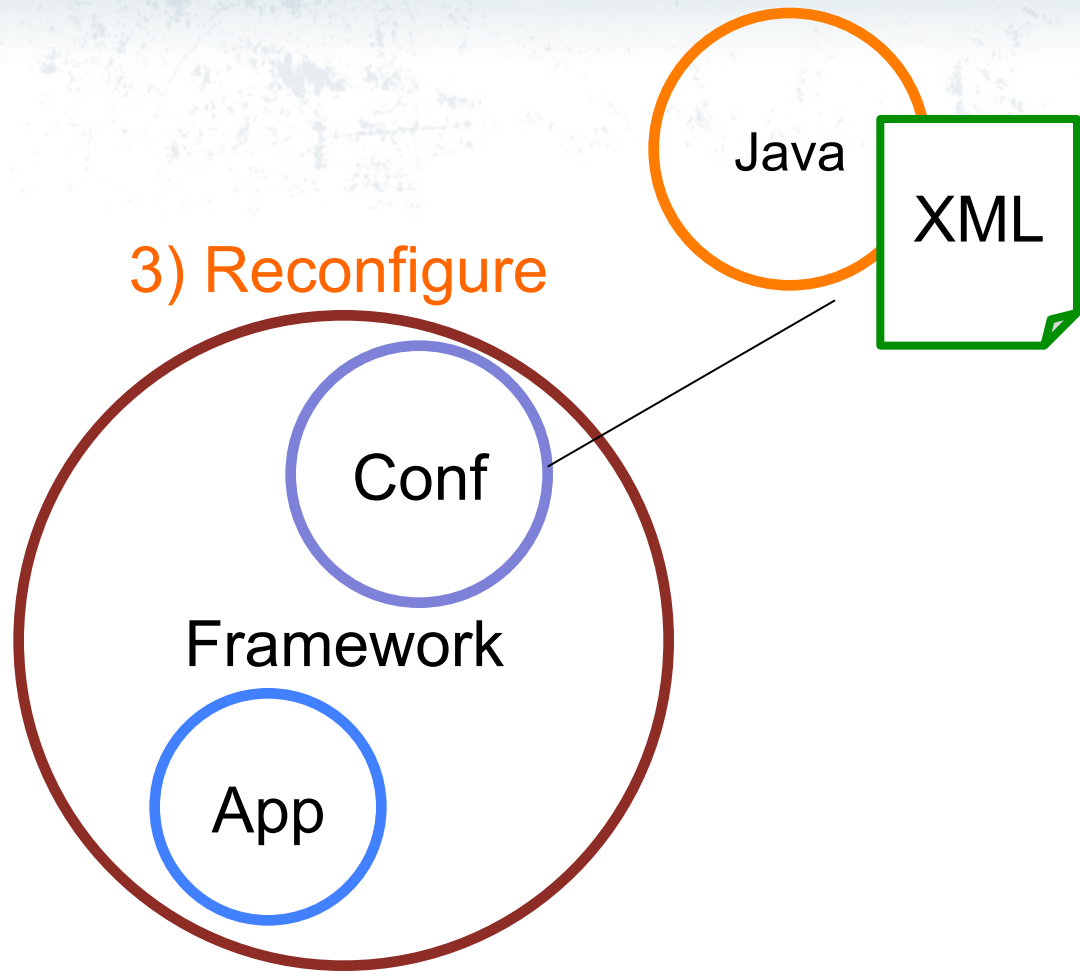


JRebel

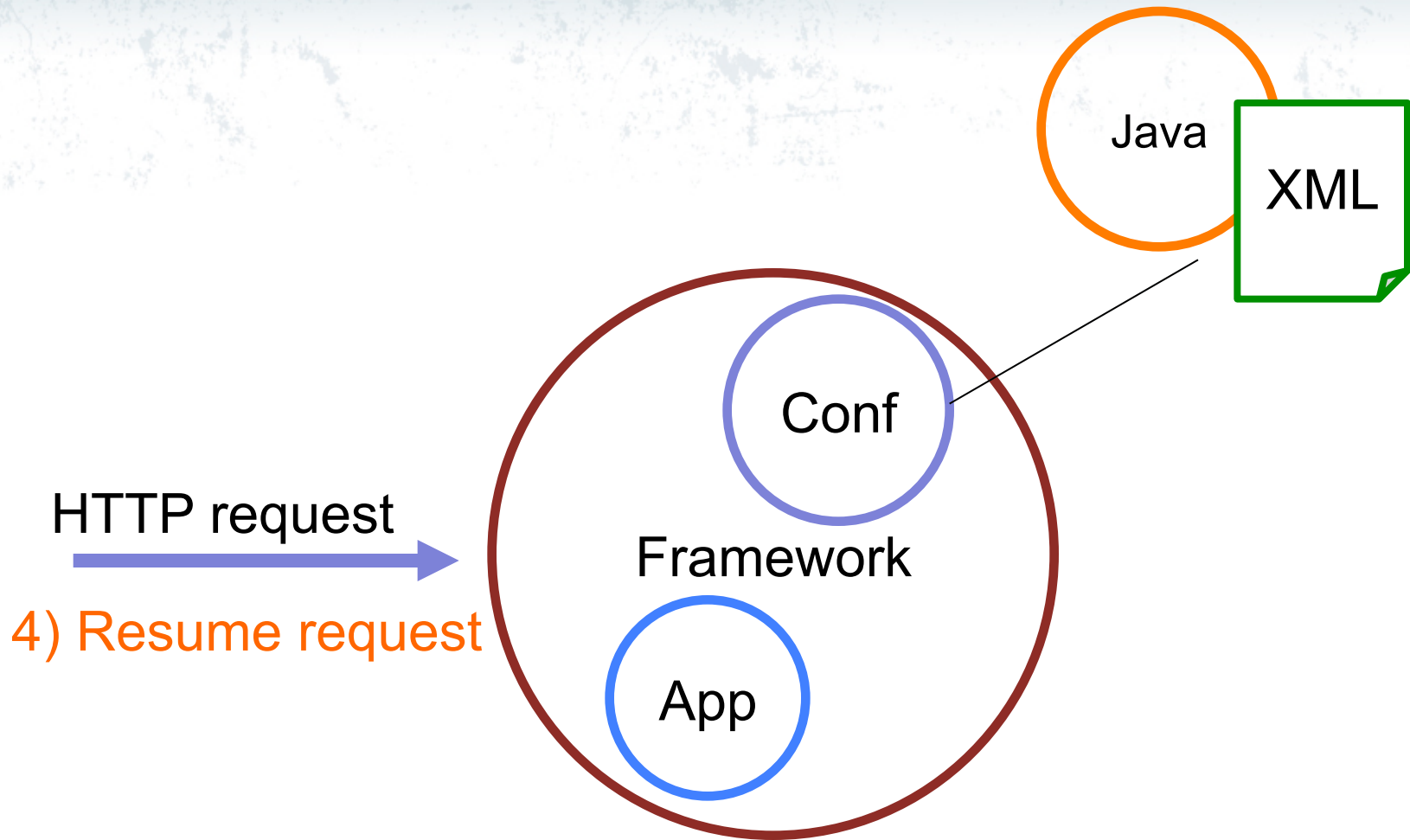
HTTP request



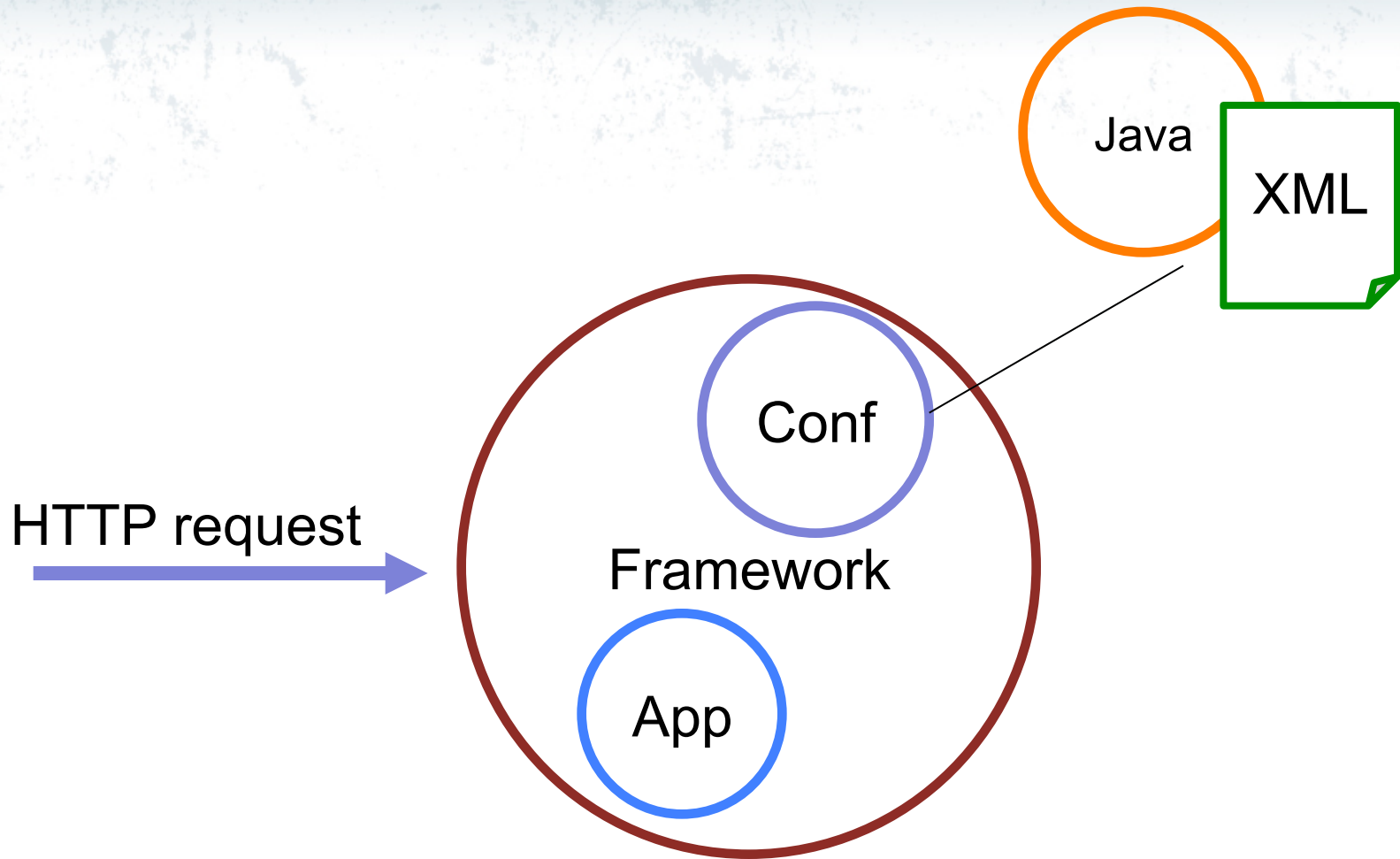
3) Reconfigure



JRebel



JRebel



PROFIT! 😊

How?

- Load time weaving, e.g. binary patching

o_O Isn't it dangerous??

- Well, you have to be careful 😊

How?

- Add **-javaagent** to hook into class loading process
- Implement **ClassFileTransformer**
- Use bytecode manipulation libraries (**Javassist**, **cglib**, **asm**) to add any custom logic

java.lang.instrument

java.lang.instrument

```
import java.lang.instrument.ClassFileTransformer;
```

```
import java.lang.instrument.Instrumentation;
```

```
public class Agent {
```

```
    public static void premain(String args, Instrumentation inst)
```

```
        throws Exception {
```

```
        inst.addTransformer(new ClassFileTransformer { ... });
```

```
    }
```

```
}
```

```
META-INF/MANIFEST.MF  
Premain-Class: Agent
```

```
java -javaagent:agent.jar ...
```

java.lang.instrument

```
import java.lang.instrument.ClassFileTransformer;
```

```
import java.lang.instrument.Instrumentation;
```

```
public class Agent {
```

```
    public static void premain(String args, Instrumentation inst)
```

```
        throws Exception {
```

```
        inst.addTransformer(new ClassFileTransformer { ... });
```

```
    }
```

```
}
```

```
META-INF/MANIFEST.MF  
Premain-Class: Agent
```

```
java -javaagent:agent.jar ...
```

ClassFileTransformer

```
new ClassFileTransformer() {  
    public byte[] transform(ClassLoader loader,  
                            String className,  
                            Class<?>classBeingRedefined,  
                            ProtectionDomain protectionDomain,  
                            byte[] classfileBuffer){
```

```
    ClassPool cp = ClassPool.getDefault();  
    CtClass ct = cp.makeClass(new ByteArrayInputStream(classfileBuffer));  
    transformClass(ct, cp);  
    return ct.toBytecode();  
}  
}
```


ClassFileTransformer

```
new ClassFileTransformer() {  
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```

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    }  
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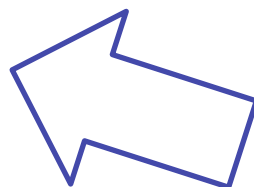
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```

```
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```

```
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```

```
}
```

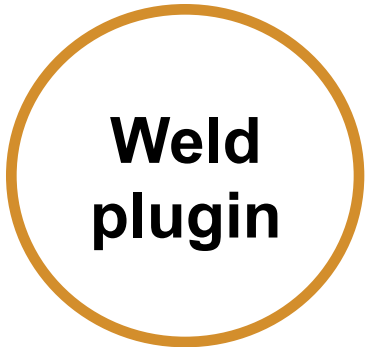
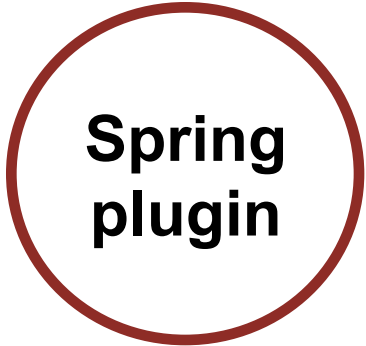
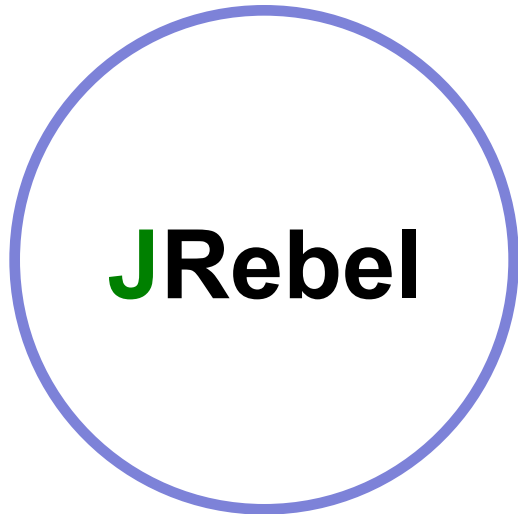
```
}
```



Enter JRebel SDK

IntegrationFactory #addIntegrationProcessor (Processor)

ReloaderFactory #addClassReloadListener (Listener)



JRebel SDK

```
class MyPlugin implements Plugin {  
    public void preinit() {  
        IntegrationFactory.getInstance().  
            addIntegrationProcessor(  
                getClass().getClassLoader(),  
                "org.jboss.Registry",  
                new RegistryCBP());  
    }  
}
```

JRebel SDK

```
class MyPlugin implements Plugin {  
    public void preinit() {  
        ReloaderFactory.getInstance().  
        addClassReloadListener(  
            new ClassEventListener() {  
                public void onClassEvent(int type, Class c) {  
                }  
            }  
        }  
    }  
}
```

JRebel SDK

```
public class RegistryCBP extends
    JavassistClassBytecodeProcessor {

    public void process(ClassPool cp, ClassLoader cl,
        CtClass ctClass) throws Exception {

        cp.importPackage("org.zereturnaround.javarebel");
    }
}
```

JRebel SDK

```
public class RegistryCBP extends  
    JavassistClassBytecodeProcessor {  
  
    public void process(ClassPool cp, ClassLoader cl,  
        CtClass ctClass) throws Exception {  
  
        cp.importPackage("org.zereturnaround.javarebel");  
    }  
}
```


JRebel SDK

```
public class RegistryCBP extends
    JavassistClassBytecodeProcessor {

    public void process(ClassPool cp, ClassLoader cl,
        CtClass ctClass) throws Exception {

        for (CtConstructor c : ctClass.getConstructors()) {
            if (c.callsSuper())
                c.insertAfter("ReloaderFactory.getInstance()." +
                    "addClassReloadListener($0);");
        }
    }
}
```

JRebel SDK

```
public class RegistryCBP extends
    JavassistClassBytecodeProcessor {

    public void process(ClassPool cp, ClassLoader cl,
        CtClass ctClass) throws Exception {
        ctClass.addInterface(cp.get(
            ClassEventListener.class.getName()));

        ctClass.addMethod(CtNewMethod.make(
            "public void onClassEvent(int type, Class clazz) {"
```

Javassist

- Bytecode manipulation made easy
- Source-level and bytecode-level API
- Uses the vocabulary of Java language
- On-the-fly compilation of the injected code
- <http://www.jboss.org/javassist>

Insert Before

```
CtClass clazz = ...
```

```
CtMethod method = clazz.getMethod("dispatch", "(V)V");
```

```
m.insertBefore(
```

```
    "{ Reloader reloader = " +
```

```
        "ReloaderFactory.getInstance();" +
```

```
        "reloader.checkAndReload(SomeClass.class); " +
```

```
        "Config.init(); }" );
```

Adding Interfaces

```
ClassPool cp = ClassPool.getDefault();
```

```
CtClass ct = cp.get("org.judcon.Alarm");
```

```
ct.addInterface(cp.get(Listener.class.getName()));
```

```
ct.addMethod(CtNewMethod.make("public void fire()  
{ alert(); }", ct));
```

```
public class Alarm {  
  
    void alert() {}  
  
}
```

```
public interface Listener {  
  
    void fire();  
  
}
```

Adding Interfaces

```
ClassPool cp = ClassPool.getDefault();
```

```
CtClass ct = cp.get("org.judcon.Alarm");
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Adding Interfaces

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```
ct.addMethod(CtNewMethod.make("public void fire()  
{ alert(); }", ct));
```

```
public class Alarm {  
  
    void alert() {}  
  
}
```

```
public interface Listener {  
  
    void fire();  
  
}
```

Intercept Statements

```
ClassPool pool = ClassPool.getDefault();  
  
CtClass ct = pool.get("org.judcon.Config");  
  
ct.getDeclaredMethod("process")  
  .instrument(new ExprEditor() {  
    public void edit(NewExpr e)  
      throws CannotCompileException {  
      e.replace("$_ = $proceed($$);");  
    }  
  });
```


Intercept Statements

```
ClassPool pool = ClassPool.getDefault();  
  
CtClass ct = pool.get("org.judcon.Config");  
  
ct.getDeclaredMethod("process")  
  .instrument(new ExprEditor() {  
    public void edit(NewExpr e)  
      throws CannotCompileException {  
        e.replace("$_ = $proceed($$);");  
      }  
  });
```

Copy Methods

```
CtClass clazz = ...
```

```
CtMethod m = clazz.getMethod("configure", "(V)V");
```

```
CtMethod copy = CtNewMethod.copy(  
    m, "__configure", clazz, null);  
    ...
```

```
clazz.addMethod(CtNewMethod.make(  
    "public void onClassEvent(int type, Class clazz) {" +  
    "    __configure();" +  
    "}");
```

Copy Methods

```
CtClass clazz = ...  
CtMethod m = clazz.getMethod("configure", "(V)V");  
CtMethod copy = CtNewMethod.copy(  
    m, "__configure", clazz, null);  
    ...  
clazz.addMethod(CtNewMethod.make(  
    "public void onClassEvent(int type, Class clazz) {" +  
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```

Copy Methods

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CtClass clazz = ...  
CtMethod m = clazz.getMethod("configure", "(V)V");  
CtMethod copy = CtNewMethod.copy(  
    m, "__configure", clazz, null);  
    ...  
clazz.addMethod(CtNewMethod.make(  
    "public void onClassEvent(int type, Class clazz) {" +  
    "    __configure();" +  
    "}");
```

How To Test?

- Unit tests are (almost) no use here
- Requires integration testing across all platforms:
 - Containers / versions
 - JDK / versions
 - Framework / versions

[Refresh](#)

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[Run](#)
[Rerun](#)
[Hudson](#)

[Servlet Tests](#)
[Start](#)
[Clean](#)
[Cancel](#)
[Hudson](#)

[EJB Tests](#)
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[Cloud Tests](#)
[Restart](#)
[Build](#)
[Cancel queue](#)
[All](#)
[Stop Hudson](#)

[Get diff](#)

[Save diff snapshot](#)

[New window](#)
[Compact view](#)
[Show test versions](#)

Legend:
■ SUCCESS - test passed
■ ERROR - 1st version of the test failed
■ FAILURE - 2nd version of the test failed
■ WARNING - unimportant FAILURE
■ N/A - test not supported on this server or deploy mode test was not run

Select	ALL	TC4	TC50	TC55	TC6	TC7	TCAT	TCAT6R3	JBOSS326	JBOSS4	JBOSS405	JBOSS5	JBOSS6	WLS10	WLS8	WLS9	WAS60	WAS61	WAS70	GFISH2	GFISH3	GFISH3P	JETTY6	JETTY7C	JETTY7E	GAE	OC410	OC49	RESIN30	RESIN31	RESIN32	RESIN40	GERONIMO		
Container Status																																			
Job Running																																			
Job		Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X		
Last Tested																																			
View Logs		Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Error Rebel	Test Server Error Rebel	Test Server Error Rebel	Test Server Error Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel	Test Server Rebel		
Build no.		123	8	122	282	5	3	3	11	139	7	177	10	144	96	134	45	46	35	142	131	2	148	20	16	13	81	89	70	64	55	57	7		

Overview of the test results

ALL	TC4	TC50	TC55	TC6	TC7	TCAT	TCAT6R3	JBOSS326	JBOSS4	JBOSS405	JBOSS5	JBOSS6	WLS10	WLS8	WLS9	WAS60	WAS61	WAS70	GFISH2	GFISH3	GFISH3P	JETTY6	JETTY7C	JETTY7E	GAE	OC410	OC49	RESIN30	RESIN31	RESIN32	RESIN40	GERONIMO		
exploded																																		
classPathTests																																		
click22Tests																																		
eclipseLinkJpa1Tests																																		
eclipseLinkJpa2Tests																																		
faceletTests																																		
freemarker2Tests																																		
guice1Tests																																		
guice2Tests																																		
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lift21Tests																																		
log4jTests																																		
logback09Tests																																		
mojarra12Tests																																		
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openJpaTests																																		
resteasyJacksonTests																																		
resteasyTests																																		
sdkRequestTests																																		
seam20Tests																																		
seam21Tests																																		
seam22Tests																																		
servletContextTests																																		
springBean20Tests																																		
springBean25Tests																																		

Thank You!

Questions?

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<http://www.jrebel.com>