Hadoop:
Big Data Stacks Validation w/ iTest
How to tame the elephant?

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Agenda

(in no particular order)

- Problem we are facing
  - Big Data Stacks
  - Why validation
- Solutions
  - Ops testing
  - Platform certification
  - Application testing
- Stack on stack
  - Test artifacts are First Class Citizen
  - Assembling validation stack (vstack)
  - Tailoring vstack for target clusters
  - D^3: Deployment/Dependencies/Determinism

Not on Agenda

- Development cycles
  - Features, fixes, commits, patch testing
- Release engineering
  - Release process
  - Package preparations
  - Release notes
  - RE deployments
  - Artifact management
  - Branching strategies
- Application deployment
  - Cluster update strategies (rolling vs. offline)
  - Cluster upgrades
  - Monitoring
  - Statistics collection
- We aren't done yet, but...

What's a Big Data Stack anyway?

Just a base layer!

What is Big Data Stack?

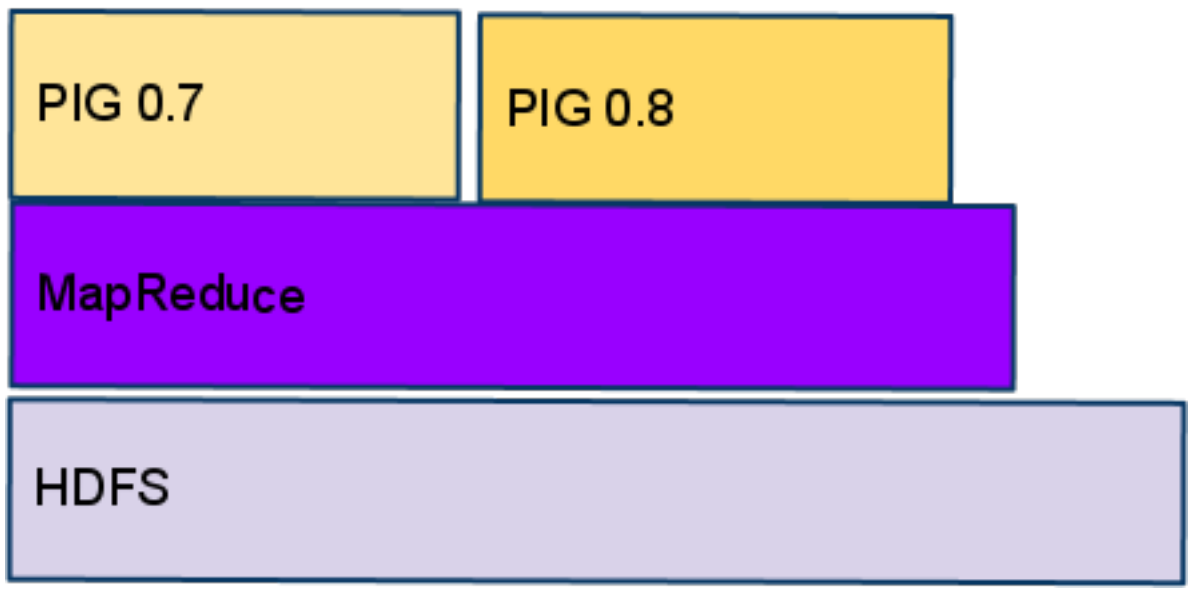
Guess again...

What is Big Data Stack?

A bit more...

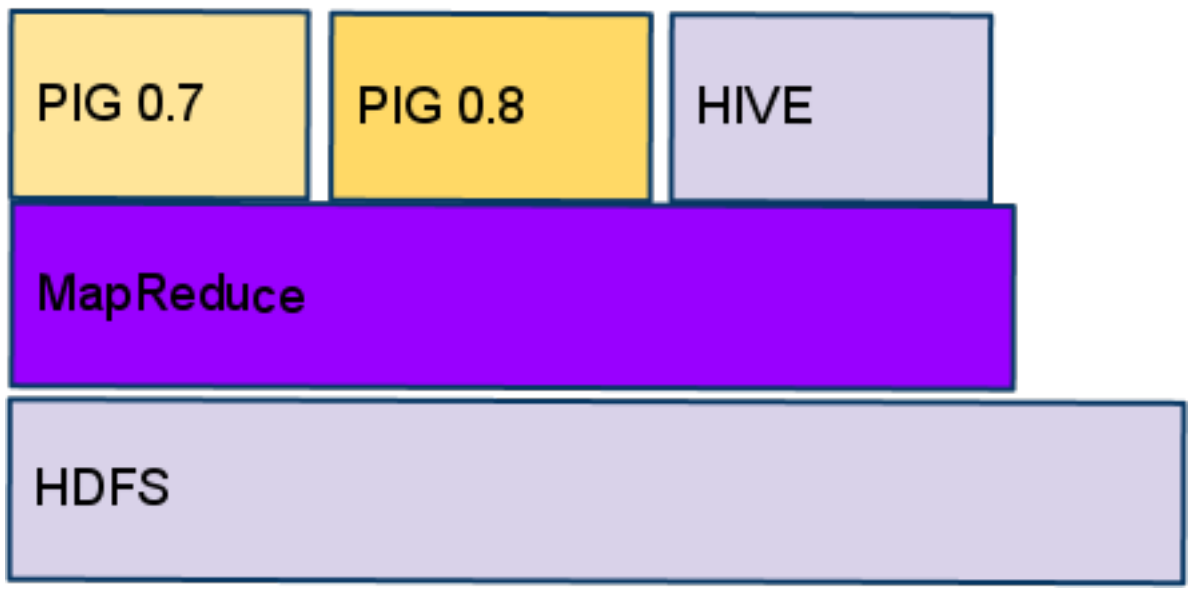
What is Big Data Stack?

A bit or two more...

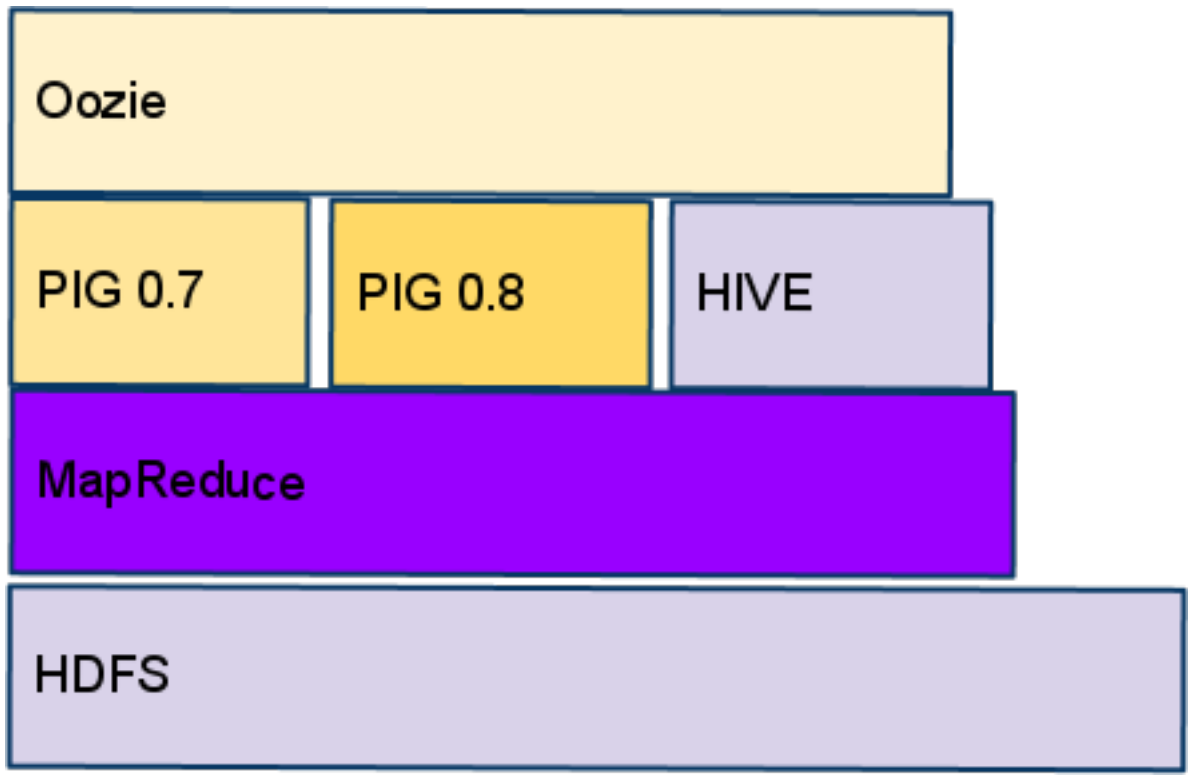


What is Big Data Stack?

A bit or two more + a bit = HIVE

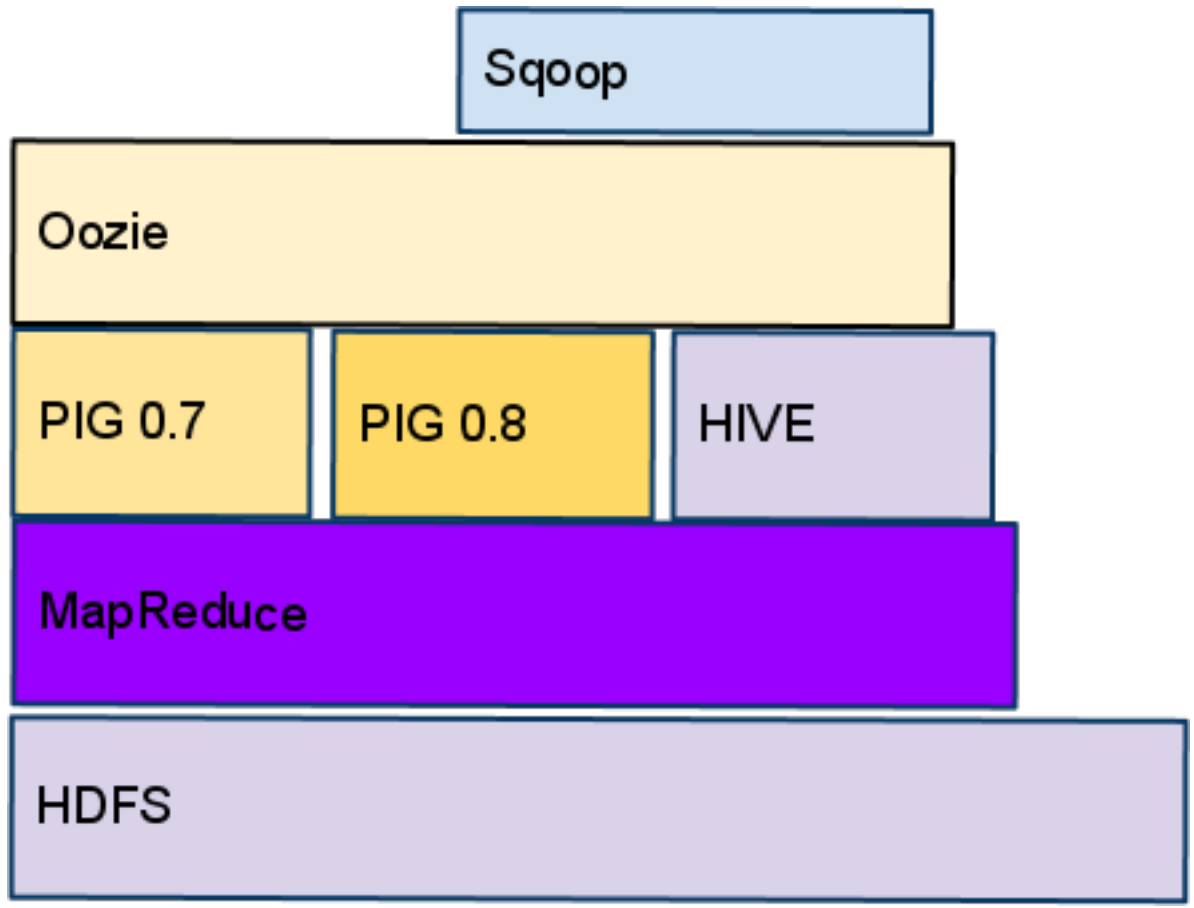


What is Big Data Stack?



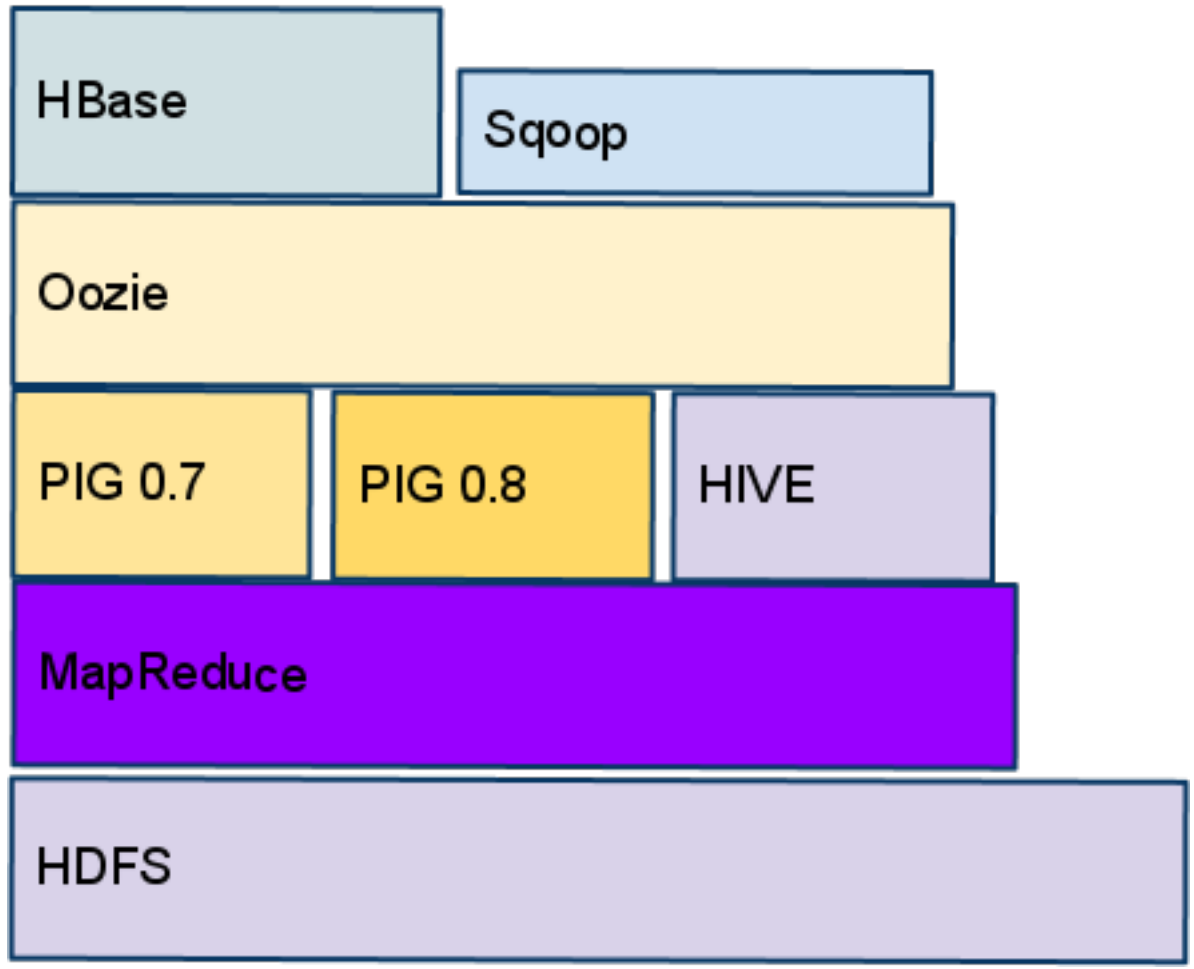
What is Big Data Stack?

And a Sqoop of flavor...



What is Big Data Stack?

A Babylon tower?



What is the glue that holds the bricks?

- Packaging
  - RPM, DEB, YINST, EINST?
  - Not the best fit for Java
- Maven
  - Part of the Java ecosystem
  - Not the best tool for non-Java artifacts
- Common APIs we will assume
  - Versioned artifacts
  - Dependencies
  - BOMs

How can you possibly guarantee that everything is right?

Development & Deployment
Discipline !

Is it enough really?

Of course not...

Components:

- I want Pig 0.7
- You need Pig 0.8

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Configurations:

- Have I put in 5th data volume to DN's conf of my 6TB nodes?
- Have I _not_ copied it accidently to my 4TB nodes?

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- You need Pig 0.8

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Auxiliary services:

- Does my Sqoop has Oracle connector?

Honestly:

- Can anyone remember all these details?

What if you've missed some?

How would you like your 10th re-spin of a release?
Make it bloody this time, please...

Redeployments...

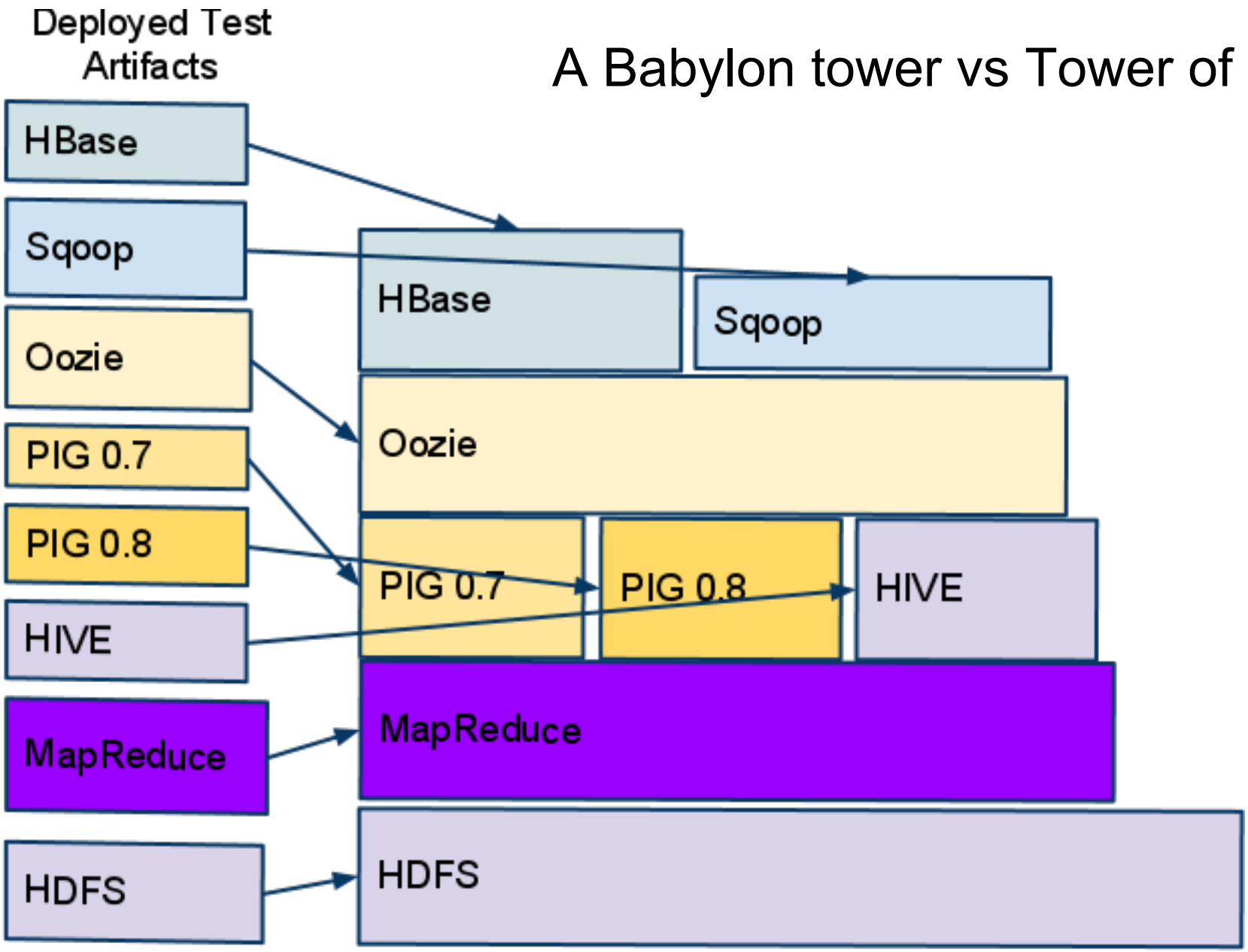
Angry customers...

LOST REVENUE ;(

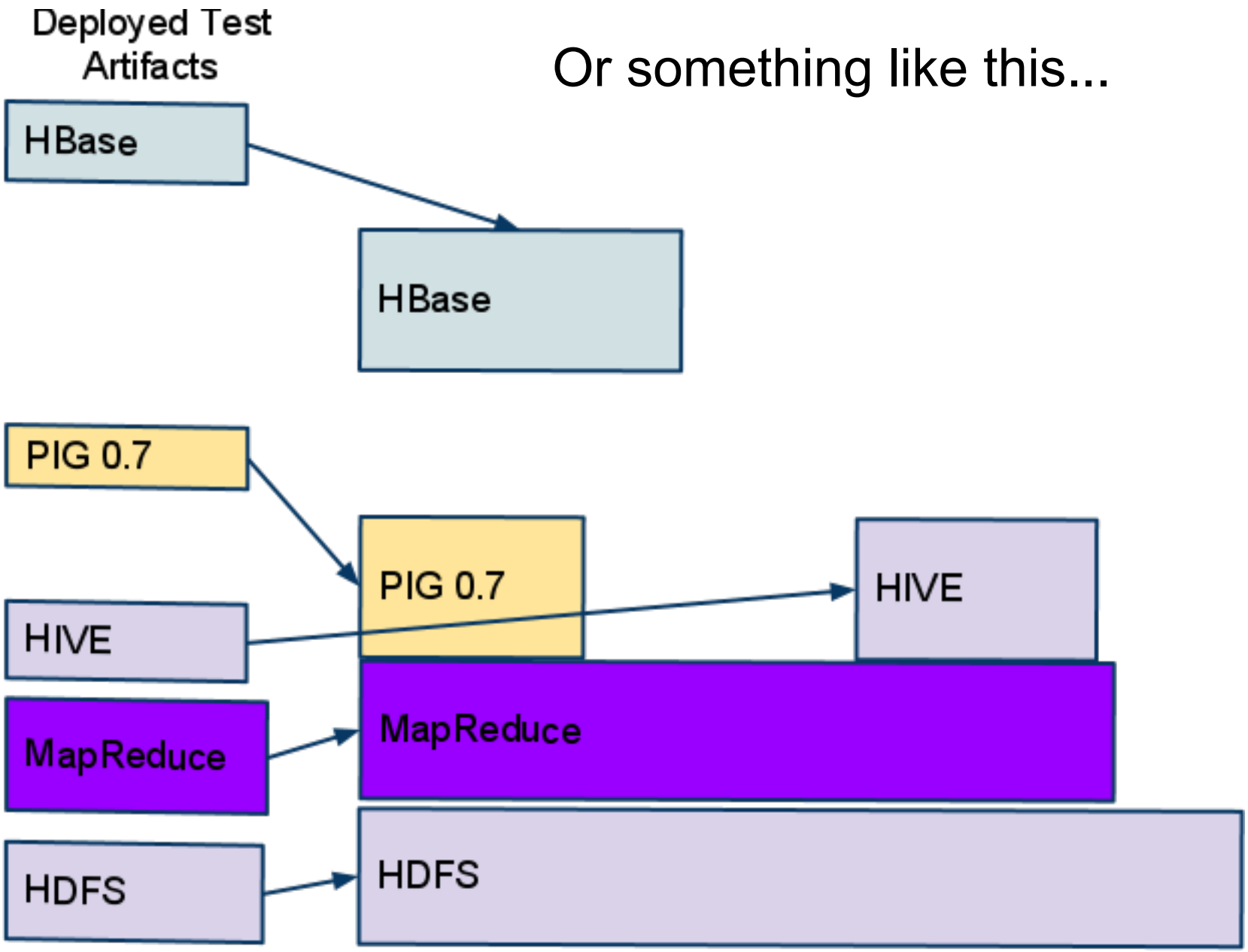
And don't you have anything better to do with that life of yours?

You need
AUTOMATIC VALIDATION!!!

Validation Stack for Big Data



Validation Stack (tailored)



Or something like this...

Use accepted platform, tools, practices

- JVM is simply The Best
  - Disclaimer: not to start religious war
- Yet, Java isn't dynamic enough (as in JDK6)
  - But we don't care what's your implementation language
  - Groovy, Scala, Clojure, JPython (?)
- Everyone knows JUnit/TestNG
  - alas not everyone can use it effectively
- Dependency tracking and packaging
  - Maven
- Information radiators facilitate data comprehension and sharing
  - TeamCity
  - Jenkins

Few more pieces

- Tests/workloads have to be artifact'ed
  - It's not good to go fishing for test classes
- Artifacts have to be self-contained
  - Reading 20 pages to find a URL to copy a file from? "Forget about it" (C)
- Standard execution interface
  - JUnit's Runner is as good as any custom one
- A recognizable reporting format
  - XML sucks, but at least it has a structure

A test artifact (PigSmoke 0.9-SNAPSHOT)

```
<project>
  <groupId>org.apache.pig</groupId>
  <artifactId>pigsmoke</artifactId>
  <packaging>jar</packaging>
  <version>0.9.0-SNAPSHOT</version>
  <dependencies>
    <dependency>
      <groupId>org.apache.pig</groupId>
      <artifactId>pigunit</artifactId>
      <version>0.9.0-SNAPSHOT</version>
    </dependency>
    <dependency>
      <groupId>org.apache.pig</groupId>
      <artifactId>pig</artifactId>
      <version>0.9.0-SNAPSHOT</version>
    </dependency>
  </dependencies>
</project>
```

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  <dependencies>
    <dependency>
      <groupId>org.apache.pig</groupId>
      <artifactId>pigunit</artifactId>
      <version>0.9.0-SNAPSHOT</version>
    </dependency>
    <dependency>
      <groupId>org.apache.pig</groupId>
      <artifactId>pig</artifactId>
      <version>0.9.0-SNAPSHOT</version>
    </dependency>
  </dependencies>
</project>
```

What wrong with it?

A test artifact (PigSmoke 0.9-SNAPSHOT)

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  <artifactId>pigsmoke</artifactId>
  <packaging>jar</packaging>
  <version>0.9.0-SNAPSHOT</version>
  <dependencies>
    <dependency>
      <groupId>org.apache.pig</groupId>
      <artifactId>pigunit</artifactId>
      <version>0.9.0-SNAPSHOT</version>
    </dependency>
    <dependency>
      <groupId>org.apache.pig</groupId>
      <artifactId>pig</artifactId>
      <version>0.9.0-SNAPSHOT</version>
    </dependency>
<!-- OMG: Hadoop dependency is missed -->
  </dependencies>
</project>
```

Before you start!

Add suitable dependencies (if desired)

```
<project>
  ...
    <dependency>
      <groupId>org.apache.pig</groupId>
      <artifactId>pigsmoke</artifactId>
      <version>0.9-SNAPSHOT</version>
      <scope>test</scope>
    </dependency>
    <!-- OMG: Hadoop dependency _WAS_ missed -->
    <dependency>
      <groupId>org.apache.hadoop</groupId>
      <artifactId>hadoop-core</artifactId>
      <version>0.20.2-CDH3B4-SNAPSHOT</version>
    </dependency>
  ...
```

Unpack data (if needed)

```
...
        <execution>
            <id>unpack-testartifact-jar</id>
          <phase>generate-test-resources</phase>
          <goals>
            <goal>unpack</goal>
          </goals>
          <configuration>
            <artifactItems>
              <artifactItem>
                <groupId>org.apache.pig</groupId>
                <artifactId>pigsmoke</artifactId>
                <version>0.9-SNAPSHOT</version>
                <type>jar</type>
                <outputDirectory>${project.build.directory}</outputDirectory>
                <includes>test/data/**/*</includes>
              </artifactItem>
            </artifactItems>
          </configuration>
        </execution>
...
```

Find runtime libraries (if required)

```
...
        <execution>
          <id>find-lzo-jar</id>
          <phase>pre-integration-test</phase>
          <goals> <goal>execute</goal>  </goals>
          <configuration>
            <source>
              try {
                project.properties['lzo.jar'] = new File("${HADOOP_HOME}/lib").list(
                  [accept:{d, f-> f ==~ /hadoop.*lzo.*.jar/ }] as FilenameFilter
                ).toList().get(0);
              } catch (java.lang.IndexOutOfBoundsException ioob) {
                log.error "No lzo.jar has been found under ${HADOOP_HOME}/lib. Check your
installation.";
                throw ioob;
              }
            </source>
          </configuration>
        </execution>
  </project>
```

Take it easy: iTest will do the rest

```
...
      <execution>
        <id>check-testslist</id>
        <phase>pre-integration-test</phase>
        <goals> <goal>execute</goal> </goals>
        <configuration>
          <source><![CDATA[
            import org.apache.itest.*

            if (project.properties['org.codehaus.groovy.maven.destination'] &&
                project.properties['org.codehaus.groovy.maven.jar']) {
                 def prefix = project.properties['org.codehaus.groovy.maven.destination'];
                JarContent.listContent(project.properties['org.codehaus.groovy.maven.jar']).
                   each {
                     TestListUtils.touchTestFiles(prefix, it);
                   };
            }]]>
          </source>
        </configuration>
      </execution>
...
```

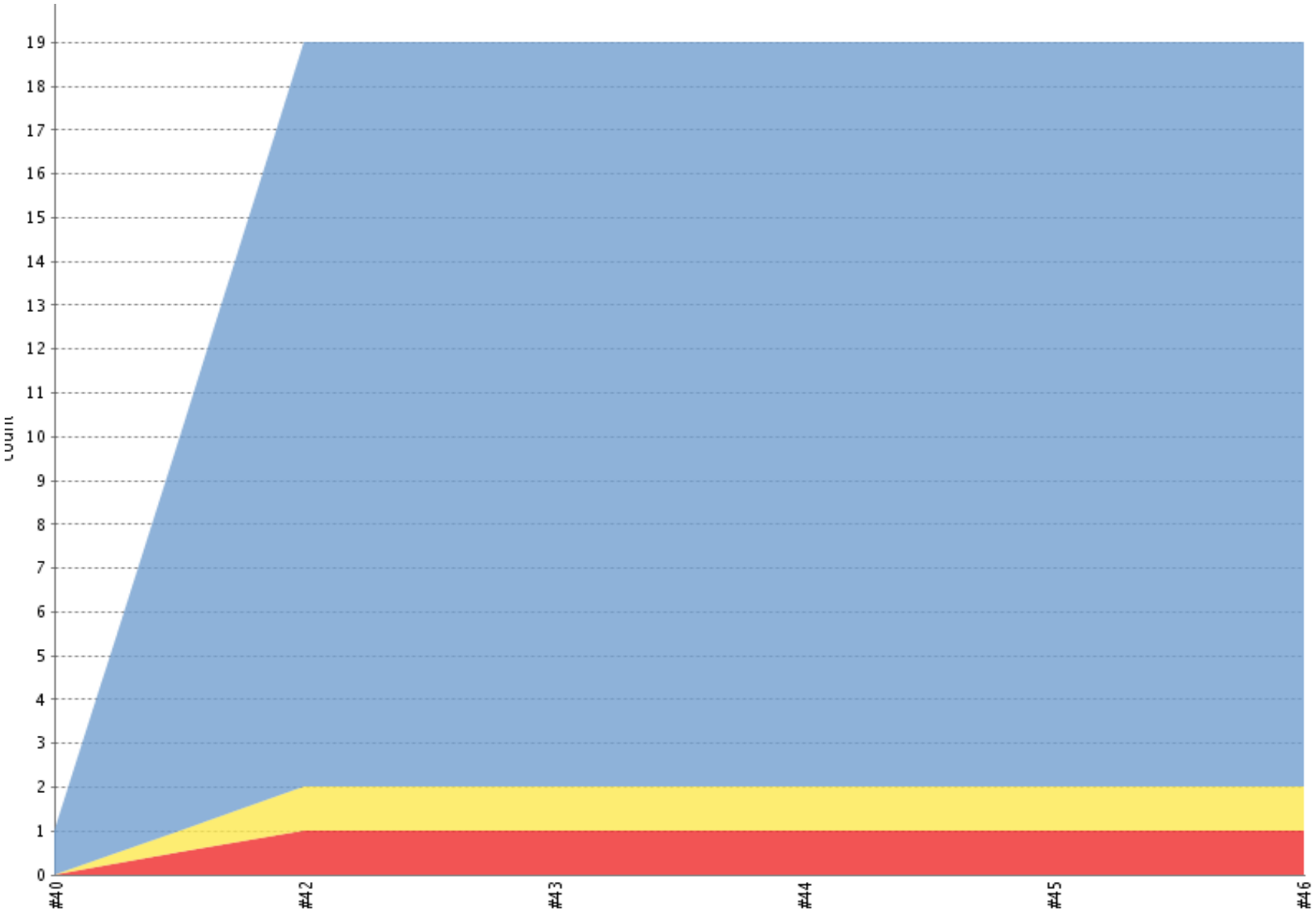
Tailoring validation stack

```
<project>
  <groupId>com.cloudera.itest</groupId>
  <artifactId>smoke-tests</artifactId>
  <packaging>pom</packaging>
  <version>1.0-SNAPSHOT</version>
  <name>hadoop-stack-validation</name>
 ...

  <!--  List of modules which should be executed as a part of stack testing run -->
  <modules>
    <module>pig</module>
    <module>hive</module>
    <module>hadoop</module>
  </modules>

 ...
</project>
```

How do we write iTest artifacts

```
$ cat TestHadoopTinySmoke.groovy
        class TestHadoopTinySmoke {
                ....
                 @BeforeClass
                  static void  setUp() throws IOException {
                          String pattern = null; //Let's unpack everything
                          JarContent.unpackJarContainer(TestHadoopSmoke.class, '.' , pattern);
                           .....
                  }

                  @Test
                   void testCacheArchive() {
                         def conf = (new Configuration()).get("fs.default.name");
                         ....
                         sh.exec("hadoop fs -rmr ${testDir}/cachefile/out",
                                   "hadoop ....
```

Just let Jenkins do its job



Just let Jenkins do its job

Test Result

1 failures (+1) , 1 skipped (+1)

19 tests (+18)
Took 12 min.
add description

All Failed Tests

Test Name	Duration	Age
>>> com.cloudera.itest.hadoopsmoke.TestHadoopSmoke.testArchives	14.544	2

All Tests

Package	Duration	Fail	(diff)	Skip	(diff)	Total	(diff)
com.cloudera.itest.hadoopsmoke	43 sec	1	+1	0		2	+2
com.cloudera.itest.hivesmoke	48 sec	0		0		1	
org.apache.pig.test.pigunit	10 min	0		1	+1	12	+12
org.apache.pig.test.pigunit.pig	0.54 sec	0		0		4	+4

What else needs to be taken care of?

- Packaged deployment
  - packaged artifact verification
  - stack validation

Think little bit of Puppet implemented on top of JVM:

```
static PackageManager pm;

@BeforeClass
  static void setUp() {
  ....
  pm = PackageManager.getPackageManager()
  pm.addBinRepo("default", "http://archive.canonical.com/", key)
  pm.refresh()
  pm.install("hadoop-0.20")
```

The coolest thing about single platform:

```
void commonPackageTest(String[] gpkgs, Closure smoke, ...) {
    pkgs.each { pm.install(it) }
    pkgs.each { assertTrue("package ${it.name} is
notinstalled",
                                    pm.isInstalled(it)) }
    pkgs.each { pm.svc_do(it, "start")}
    smoke.call(args)
}
@Test
void testHadoop() {
   commonPackageTest(["hadoop-0.20", ...],
                                this.&commonSmokeTestsuiteRun,
                                TestHadoopSmoke.class)
   commonPackageTest(["hadoop-0.20", ...],
                                { sh.exec("hadoop fs -ls /") })
}
```

Putting it all together:

- Puppet, iTest, Whirr:
  1. Change hits a SCM repo
  2. Hudson build produces Maven + Packaged artifacts
  3. Automatic deployment of modified stacks
  4. Automatic validation using corresponding stack of integration tests
  5. Rinse and repeat
- Challenges:
  - Maven versions vs. packaged versions vs. source
  - Strict, draconian discipline in test creation
  - Battling combinatoric explosion of stacks
  - Size of the cluster (pseudo-distributed <-> 500 nodes)
  - Self contained dependencies (JDK to the rescue!)
  - Sure, but does it brew espresso?

iTest: current status

- is in Alpha state
- all work is under Apache2.0 license
- to be available from github.com/cloudera/iTest shortly

Demo

Q & A