

ApacheCon



Enterprise Build & Test in the Cloud

Carlos Sanchez

March 27, 2009



Leading the Wave
of Open Source

About me



During the day

Sr. Solutions Architect at G2iX

At night

Member of Apache Maven PMC, Continuum, Archiva

Eclipse IAM co-lead

Apache
CON



Leading the Wave
of Open Source

Index

The tools

Maven Integration Tests

Maven & Selenium

Adding Continuum to the Mix

Testing in Different Environments

And Now in the Cloud

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The tools



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Build Apache Maven

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Maven

Build tool and more
Dependency management
Execution of unit /integration tests
Start/stop application server
Automatic application deployment

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How many?



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Test cases

TestNG



TestNG

Unit/integration tests
parameterized tests
parallel testing

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How many?



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Integration tests

Selenium



Selenium

UI and Integration testing

Tests run in the browser

support for multiple browsers

Tests can be recorded

no need for developers writing tests

Selenium IDE Firefox plugin

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How many?



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Continuous Integration

Apache Continuum



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Apache Continuum

Tight integration with Apache Maven
dependency handling

Trigger builds

when integration tests change

when the webapp changes

when the webapp dependencies change

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How many?



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Cloud Computing

Amazon Web Services



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Amazon Web Services

Amazon S3 storage

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Amazon Web Services

Amazon S3

storage

Amazon SQS

queue service

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Amazon Web Services

Amazon S3

storage

Amazon SQS

queue service

Amazon Mechanical Turk

manpower



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Amazon Web Services

Amazon S3

storage

Amazon SQS

queue service

Amazon Mechanical Turk

manpower

Amazon EC2

computation



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How many?



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Maven integration tests



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The webapp to
test
appfuse-struts



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A new Maven project *appfuse-selenium*

```
<groupId>org.appfuse</groupId>  
<artifactId>appfuse-selenium</artifactId>  
<version>2.0.2-SNAPSHOT</version>  
<packaging>war</packaging>  
<name>AppFuse Selenium testing</name>
```



that depends on
appfuse-struts

```
<dependency>  
  <groupId>org.appfuse</groupId>  
  <artifactId>appfuse-struts</artifactId>  
  <version>2.0.2</version>  
  <type>war</type>  
</dependency>
```

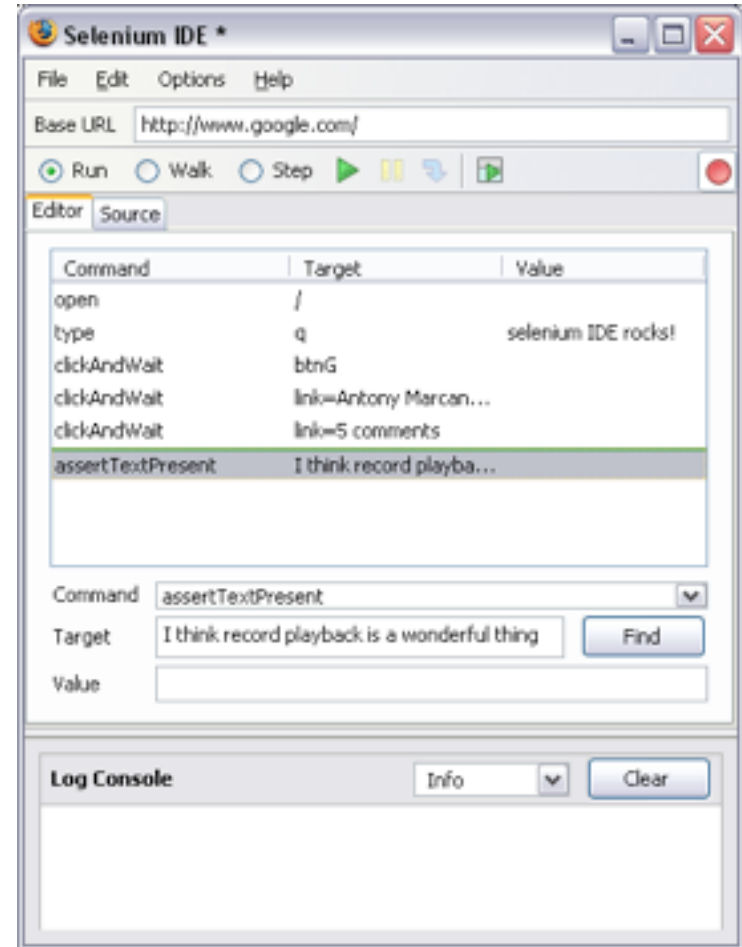


using Cargo to run it automatically

```
<plugin>  
  <groupId>org.codehaus.cargo</groupId>  
  <artifactId>cargo-maven2-plugin</artifactId>
```



Record Selenium tests SeleniumIDE





... as Java

The screenshot shows a Firefox browser window with the Selenium RC interface. The 'Options' menu is open, displaying a list of supported languages and their corresponding Selenium RC configurations. The 'Java - Selenium RC' option is selected. The main content area shows a Java test script for a Selenium RC test case.

```

package com.example.tests;

import com.thoughtworks.selenium.*;
import java.util.regex.Pattern;

public class NewTest extends SeleneTestCase {
    public void setUp() throws Exception {
        setUp("http://localhost:18880/", "chrome");
    }

    public void testNew() throws Exception {
        selenium.open("/mainMenu.html");
        selenium.click("link=Administration");
        selenium.waitForPageToLoad("30000");
        selenium.type("_password", "admin");
        selenium.click("rememberMe");
        selenium.click("/input[@name='login']");
        selenium.waitForPageToLoad("30000");
    }
}

```

The browser's address bar shows the base URL as `http://localhost:18880`. The Selenium RC interface includes a 'Log' section at the bottom, which is currently empty. The browser's status bar at the bottom indicates 'Logged in as: admin'.

test cases ...using Selenium API

```
public void setUp() throws Exception {
    setUp("http://localhost:18880/", "*chrome");
}
public void testNew() throws Exception {
    selenium.open("/mainMenu.html");
    selenium.click("link=Administration");
    selenium.waitForPageToLoad("30000");
    selenium.type("j_password", "admin");
    selenium.click("rememberMe");
    selenium.click("//input[@name='login']");
    selenium.waitForPageToLoad("30000");
    selenium.click("link=Edit Profile");
    selenium.waitForPageToLoad("30000");
    selenium.click("link=Main Menu");
    selenium.waitForPageToLoad("30000");
    selenium.click("link=Edit Profile");
    selenium.waitForPageToLoad("30000");
    selenium.click("document.forms[0].elements[24]");
    selenium.waitForPageToLoad("30000");
}
```

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breakpoint

we have

Selenium tests in Maven IT project

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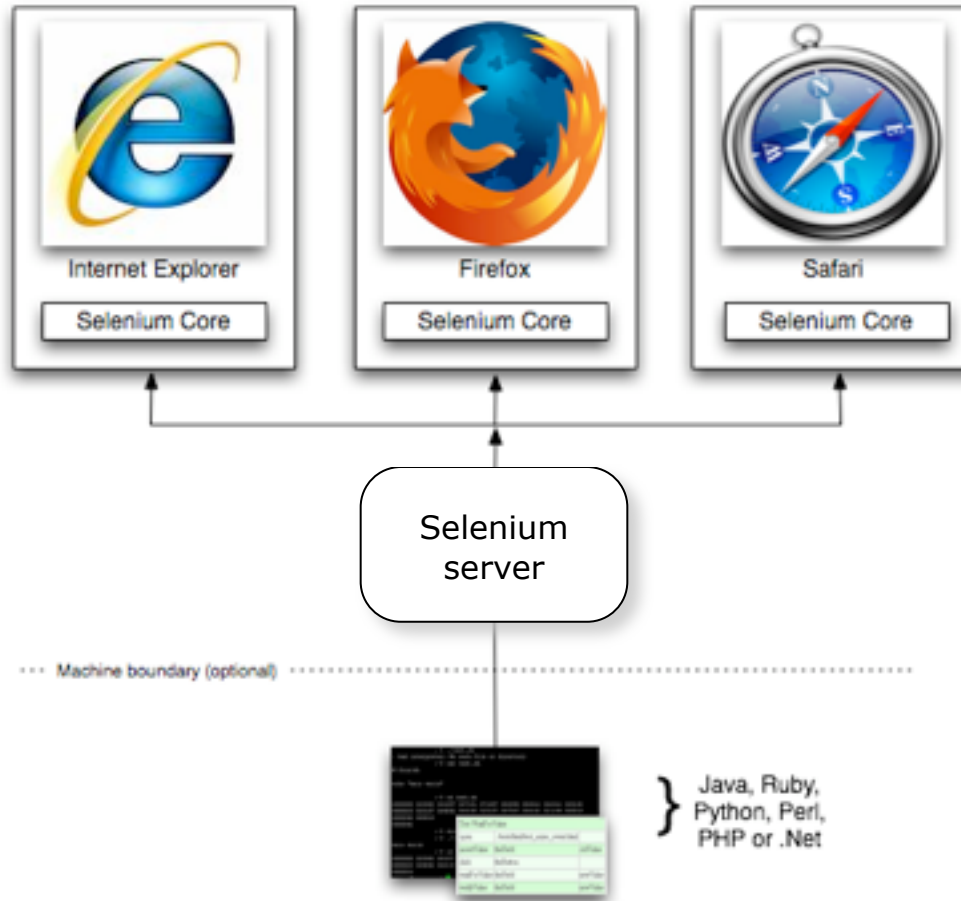
Maven & Selenium



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Selenium Architecture

Windows, Linux, or Mac (as appropriate)...



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Maven & Selenium

Start Selenium server locally

Run integration tests

Stop selenium server

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Selenium Maven plugin

<http://mojo.codehaus.org/selenium-maven-plugin>

selenium:start-server
selenium:stop-server

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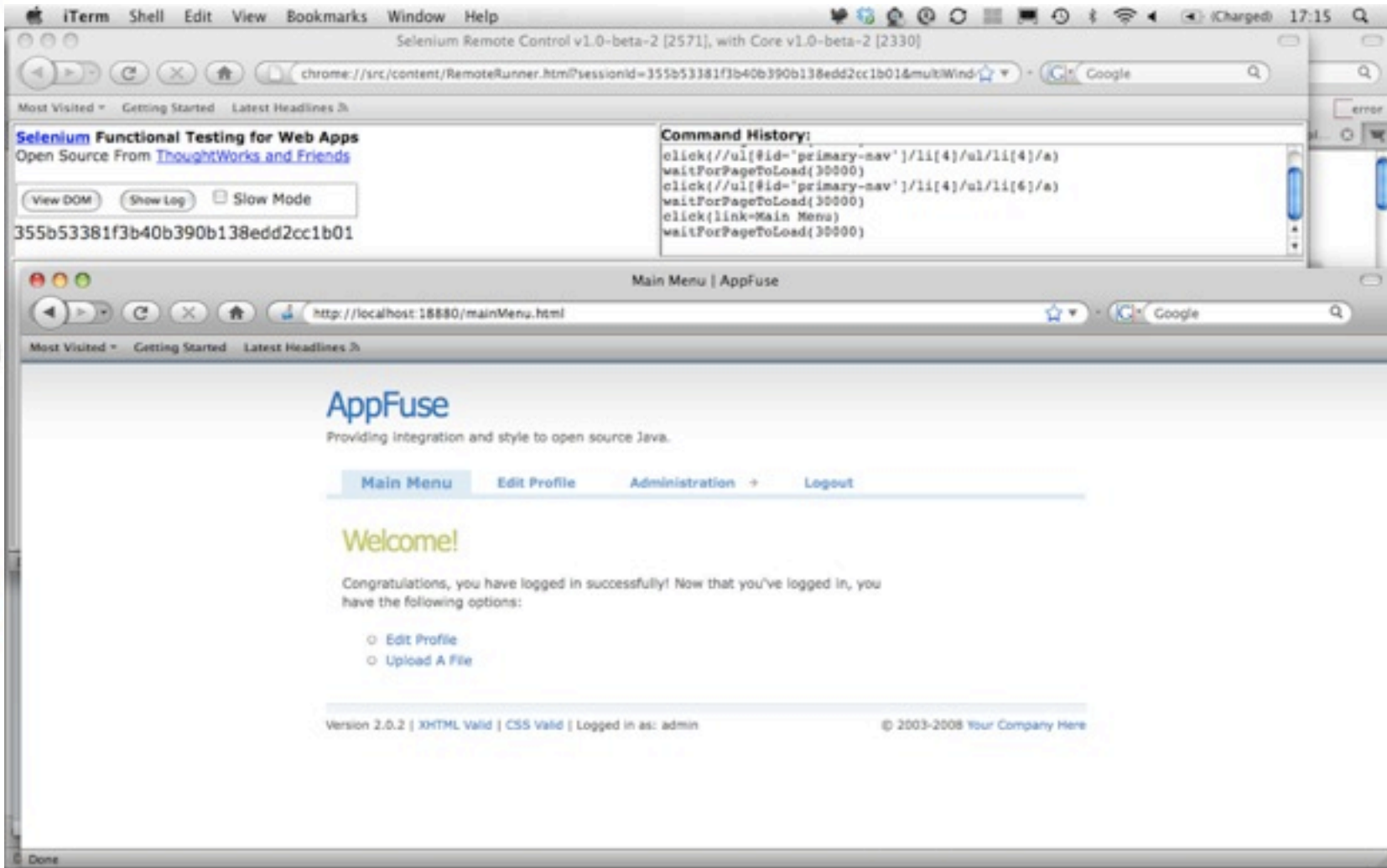


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configuration

```
<plugin>
  <groupId>org.codehaus.mojo</groupId>
  <artifactId>selenium-maven-plugin</artifactId>
  <version>1.0-rc-1</version>
  <executions>
    <execution>
      <id>start-selenium</id>
      <phase>pre-integration-test</phase>
      <goals>
        <goal>start-server</goal>
      </goals>
    </execution>
  </executions>
  <configuration>
    <background>${selenium.background}</background>
  </configuration>
</plugin>
```





The screenshot displays the Selenium Remote Control interface. The top window shows the Selenium Functional Testing for Web Apps page, which includes a "View DOM" button, a "Show Log" button, and a "Slow Mode" checkbox. The URL bar shows the Selenium Remote Control session ID: `chrome://src/content/RemoteRunner.htm?sessionId=355b53381f3b40b390b138edd2cc1b01&multWind`. The Command History window shows the following commands:

```
click(//ul[@id='primary-nav']/li[4]/ul/li[4]/a)
waitForPageToLoad(30000)
click(//ul[@id='primary-nav']/li[4]/ul/li[6]/a)
waitForPageToLoad(30000)
click(link=Main Menu)
waitForPageToLoad(30000)
```

The bottom window shows the AppFuse application running on `http://localhost:18880/mainMenu.html`. The page title is "Main Menu | AppFuse". The AppFuse logo is displayed, followed by the tagline "Providing Integration and style to open source Java." The navigation menu includes "Main Menu", "Edit Profile", "Administration", and "Logout". The main content area displays a "Welcome!" message and a congratulatory message: "Congratulations, you have logged in successfully! Now that you've logged in, you have the following options:". The options listed are "Edit Profile" and "Upload A File". The footer of the page shows "Version 2.0.2 | XHTML Valid | CSS Valid | Logged in as: admin" and "© 2003-2008 Your Company Here".

T E S T S

Running TestSuite

```
log4j:WARN No appenders could be found for logger
(com.thoughtworks.selenium.grid.tools.ThreadSafeSeleniumSessionStorage).
log4j:WARN Please initialize the log4j system properly.
DEBUG [btpool0-5] UserAction.edit(117) | checking for remember me login...
DEBUG [btpool0-8] LookupDaoHibernate.getRoles(20) | Retrieving all role names...
DEBUG [btpool0-8] StartupListener.setupContext(102) | Drop-down initialization complete [OK]
INFO [btpool0-8] ReloadAction.execute(34) | reload complete, reloading user back to: http://localhost:18880/admin/activeUsers.html
DEBUG [btpool0-3] UserAction.edit(117) | checking for remember me login...
DEBUG [btpool0-3] UserAction.edit(117) | checking for remember me login...
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 89.703 sec
```

Results :

Tests run: 1, Failures: 0, Errors: 0, Skipped: 0

```
[INFO] [cargo:stop {execution: stop-container}]
2009-03-23 16:41:42.176:/appfuse-selenium-2.0.2-SNAPSHOT:INFO: Closing Spring root WebApplicationContext
[INFO] [install:install]
[INFO] Installing /Users/csanchez/dev/maestro/appfuse-selenium/target/appfuse-selenium-2.0.2-SNAPSHOT.war
to /Users/csanchez/.m2/repository/org/appfuse/appfuse-selenium/2.0.2-SNAPSHOT/appfuse-selenium-2.0.2-
SNAPSHOT.war
[INFO] -----
[INFO] BUILD SUCCESSFUL
[INFO] -----
[INFO] Total time: 2 minutes 20 seconds
[INFO] Finished at: Mon Mar 23 16:41:45 CET 2009
[INFO] Final Memory: 43M/63M
[INFO] -----
2009-03-23 16:41:46.168::INFO: Shutdown hook executing
2009-03-23 16:41:46.169::INFO: Shutdown hook complete
```

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breakpoint

Selenium tests in Maven IT project
running locally in the browser

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Adding Continuum to the Mix



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Build the webapp if

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Build the webapp if
the webapp changes

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Continuum

Build the webapp if
the webapp changes
the dependencies change

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Continuum

Build the webapp if
the webapp changes
the dependencies change
Run the integration tests

Apache
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Continuum

Build the webapp if
the webapp changes
the dependencies change
Run the integration tests
if the ITs change

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Continuum

Build the webapp if
the webapp changes
the dependencies change
Run the integration tests
if the ITs change
if the webapp changes

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Continuum

Add *appfuse-struts*
Add *appfuse-selenium*

Project Group Last Build Result Overview

Success : 0  Errors : 0  Failed : 1 

Member Projects

<input type="checkbox"/>	Project Name	Version
<input type="checkbox"/>	 AppFuse Selenium testing	2.0.2-SNAPSHOT
<input type="checkbox"/>	AppFuse Struts 2 Module	2.0.2-SNAPSHOT

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Selenium headless

Most likely needed

Use *nix X Virtual Frame Buffer

In Maven

`selenium:xvfb`

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Selenium tests in Maven IT project
running locally in the browser
triggered by Continuum when there is
any change to webapp, tests or
dependencies

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Testing in different environments



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Multi environment

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Multi environment

Multiple Browsers



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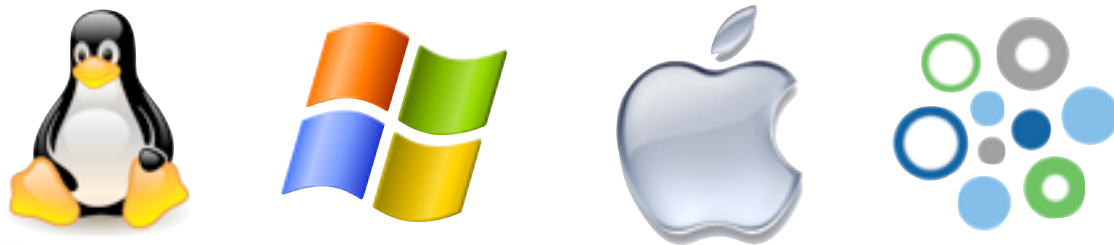
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Multi environment

Multiple Browsers



Multiple Operating Systems



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Parallel

Run tests in parallel
in each browser
several browsers per test

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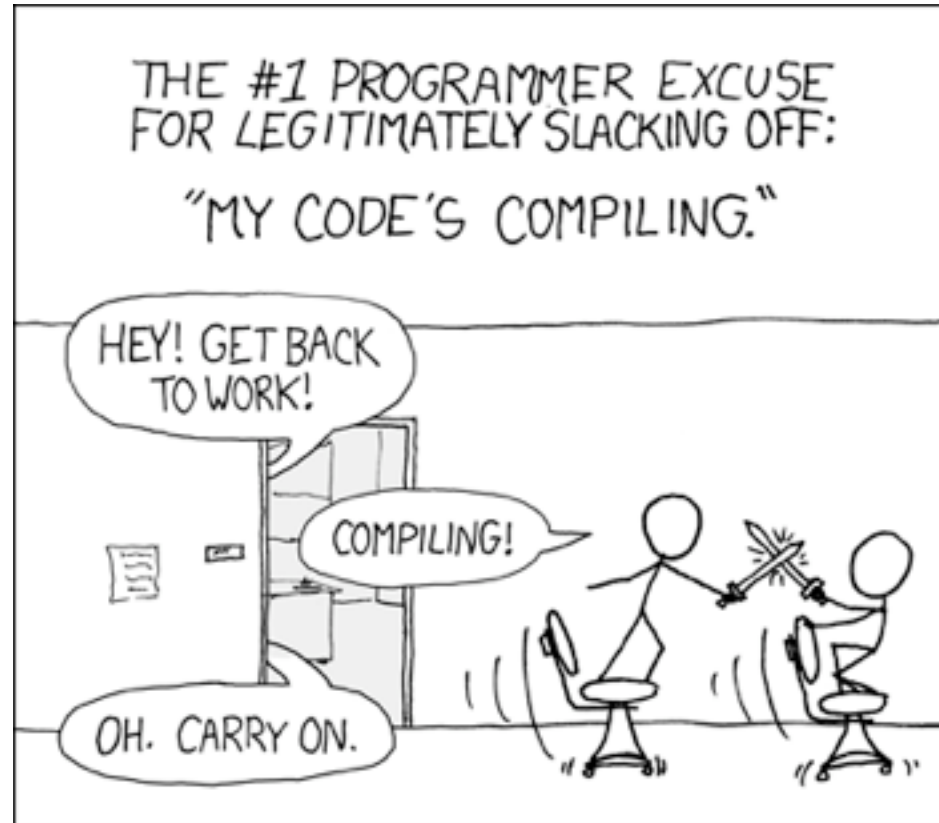


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Parallel

Faster testing

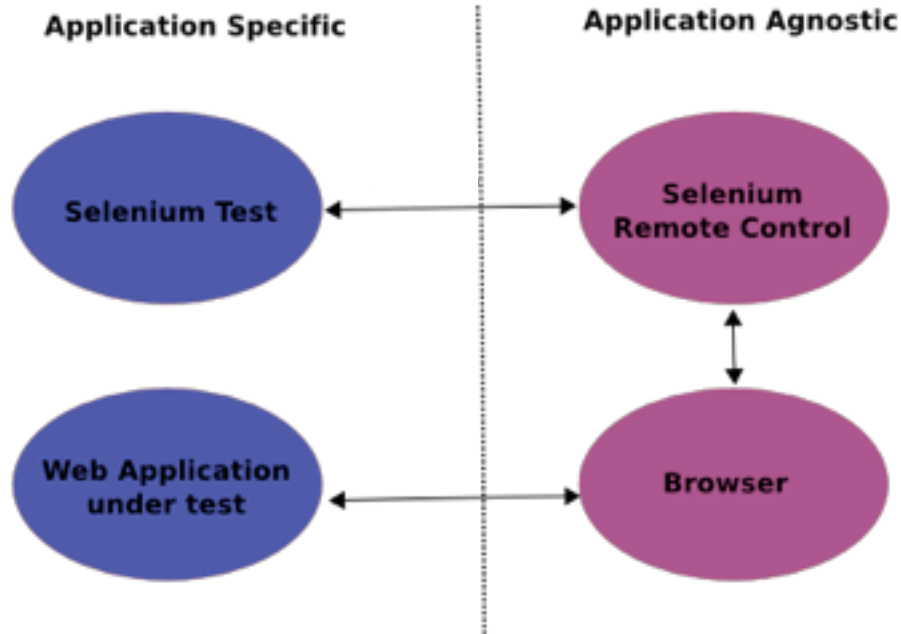
Load testing



Credits: XKCD

Selenium Grid

Traditional Selenium Setup



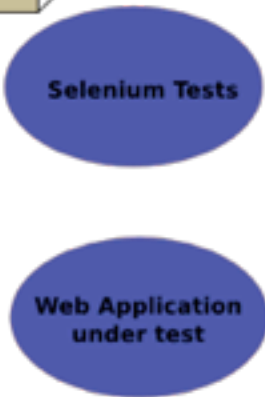
Slow. Usually the bottleneck of your Selenium Test Suite.



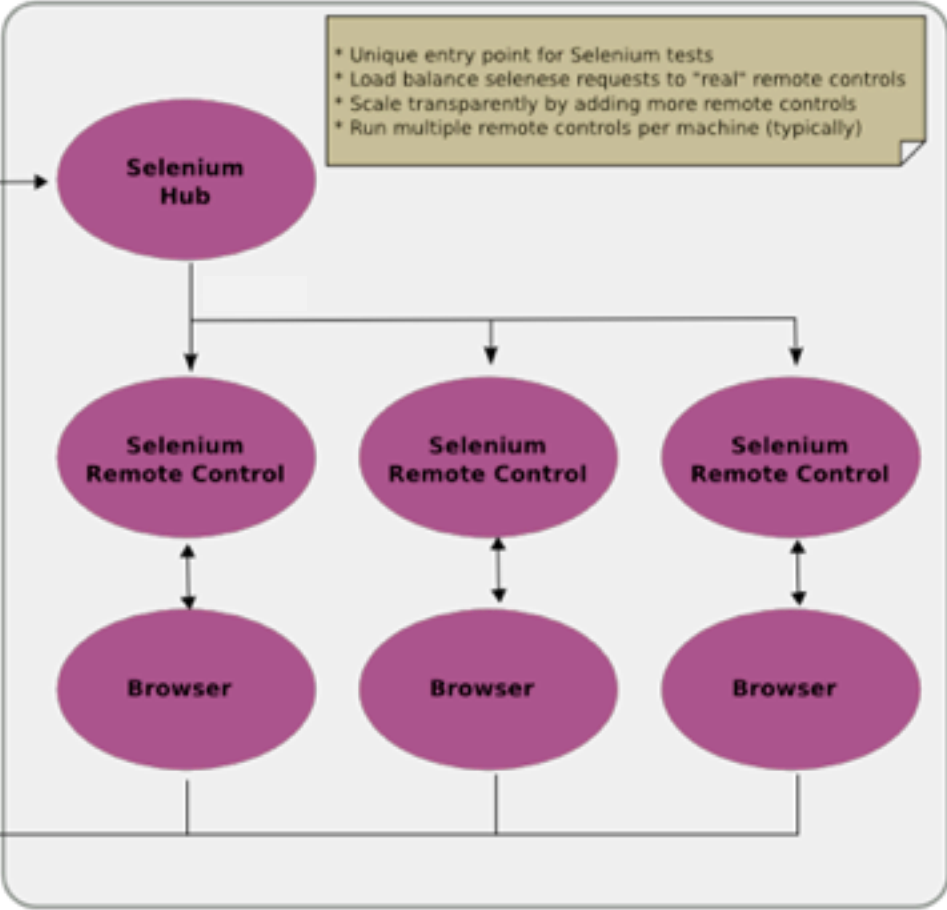
Selenium Grid Setup

* No change required
* Write them exactly as you would in the traditional setup
* Make them run in parallel to take advantage of the grid

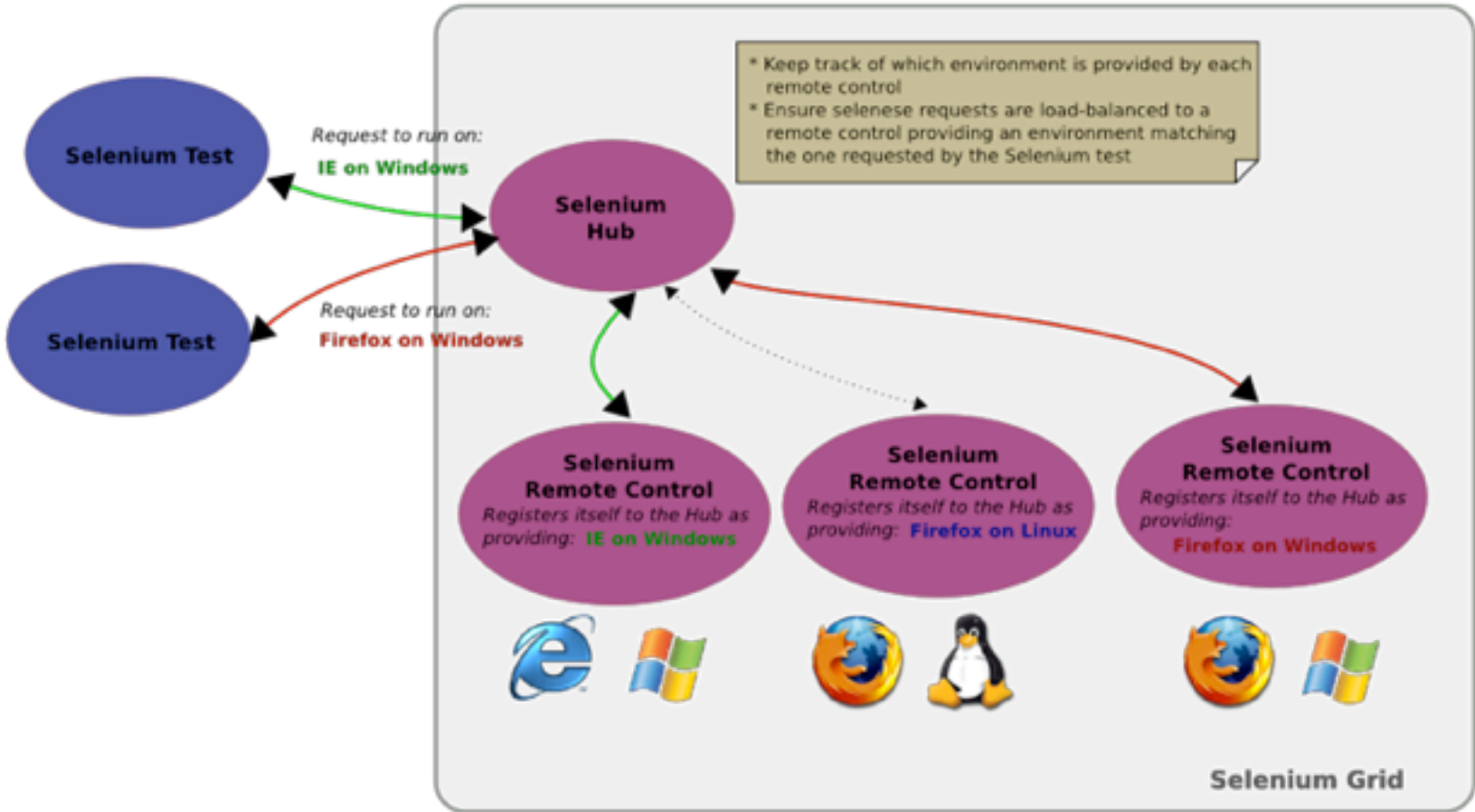
Application Specific



Selenium Grid - Application Agnostic



Selenium Grid : Requesting a Specific Environment



TestNG properties

Allows to run the same tests in
different environments

and in parallel

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TestNG properties

```
<suite name="Example" parallel="tests" thread-count="3">
  <test name="iexplore">
    <parameter name="browser" value="*iexplore"/>
    <packages>
      <package name="org.appfuse.webapp.selenium" />
    </packages>
  </test>
  <test name="firefox2">
    <parameter name="browser" value="*firefox2"/>
    <packages>
      <package name="org.appfuse.webapp.selenium" />
    </packages>
  </test>
  <test name="opera">
    <parameter name="browser" value="*opera"/>
    <packages>
      <package name="org.appfuse.webapp.selenium" />
    </packages>
  </test>
</suite>
```

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TestNG properties

```
<suite name="Example" parallel="tests" thread-count="3">
  <test name="iexplore">
    <parameter name="browser" value="*iexplore"/>
    <packages>
      <package name="org.appfuse.webapp.selenium" />
    </packages>
  </test>
  <test name="firefox2">
    <parameter name="browser" value="*firefox2"/>
    <packages>
      <package name="org.appfuse.webapp.selenium" />
    </packages>
  </test>
  <test name="opera">
    <parameter name="browser" value="*opera"/>
    <packages>
      <package name="org.appfuse.webapp.selenium" />
    </packages>
  </test>
</suite>
```

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breakpoint

Selenium tests in Maven IT project
running locally in several browsers

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and now in the Cloud



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Machines cost money

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Machines cost money
Bandwidth costs money



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Machines cost money
Bandwidth costs money
Electricity costs money





Machines cost money
Bandwidth costs money
Electricity costs money
Server administration costs money





Machines cost money
Bandwidth costs money
Electricity costs money
Server administration costs money



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Resource Optimization

test servers working 10-20% of the
time

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Predictions cost money

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Infrastructure
Cost \$



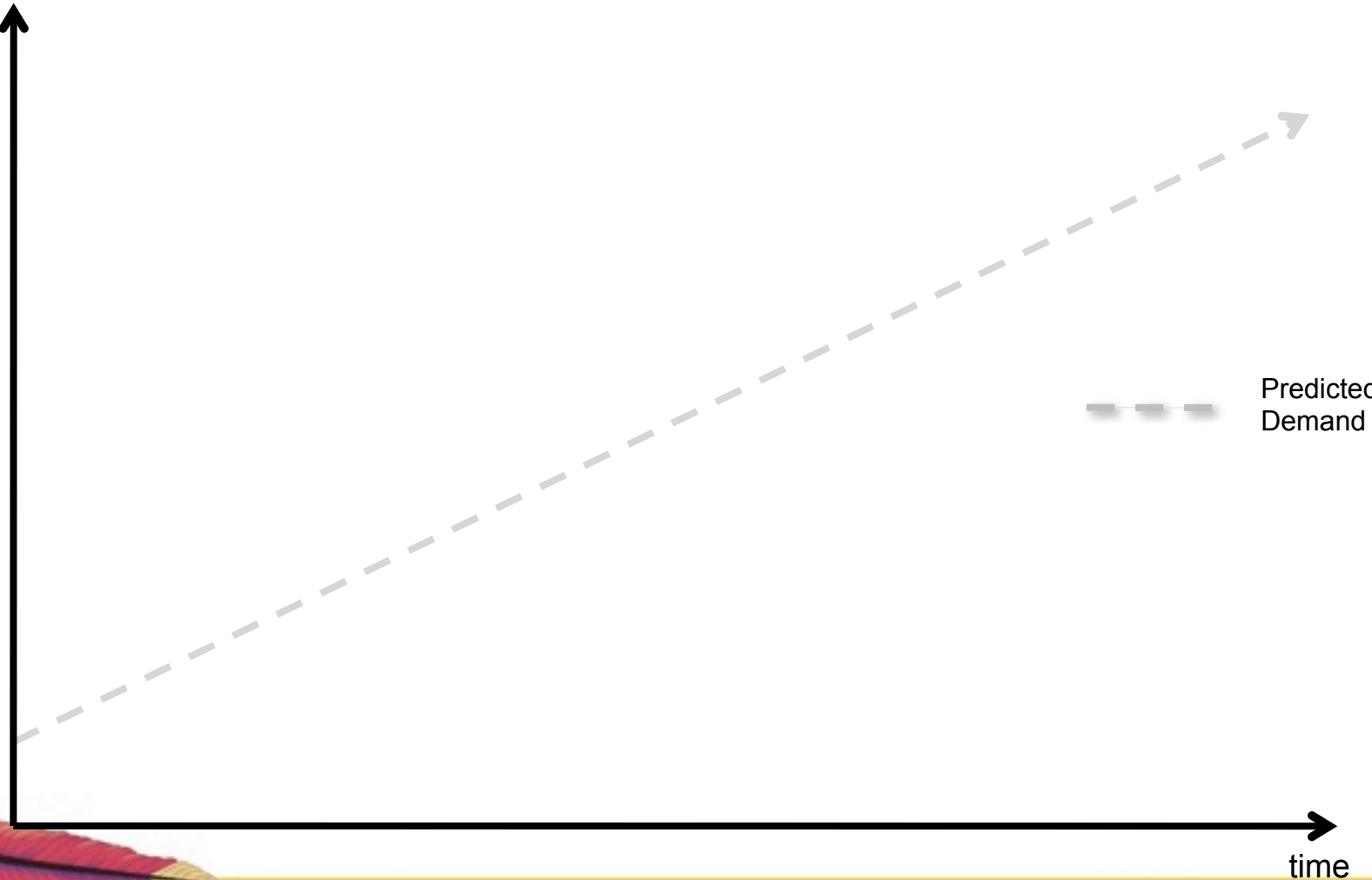
Leading the Wave
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Source: Amazon

Predictions cost money

ApacheCon

Infrastructure
Cost \$



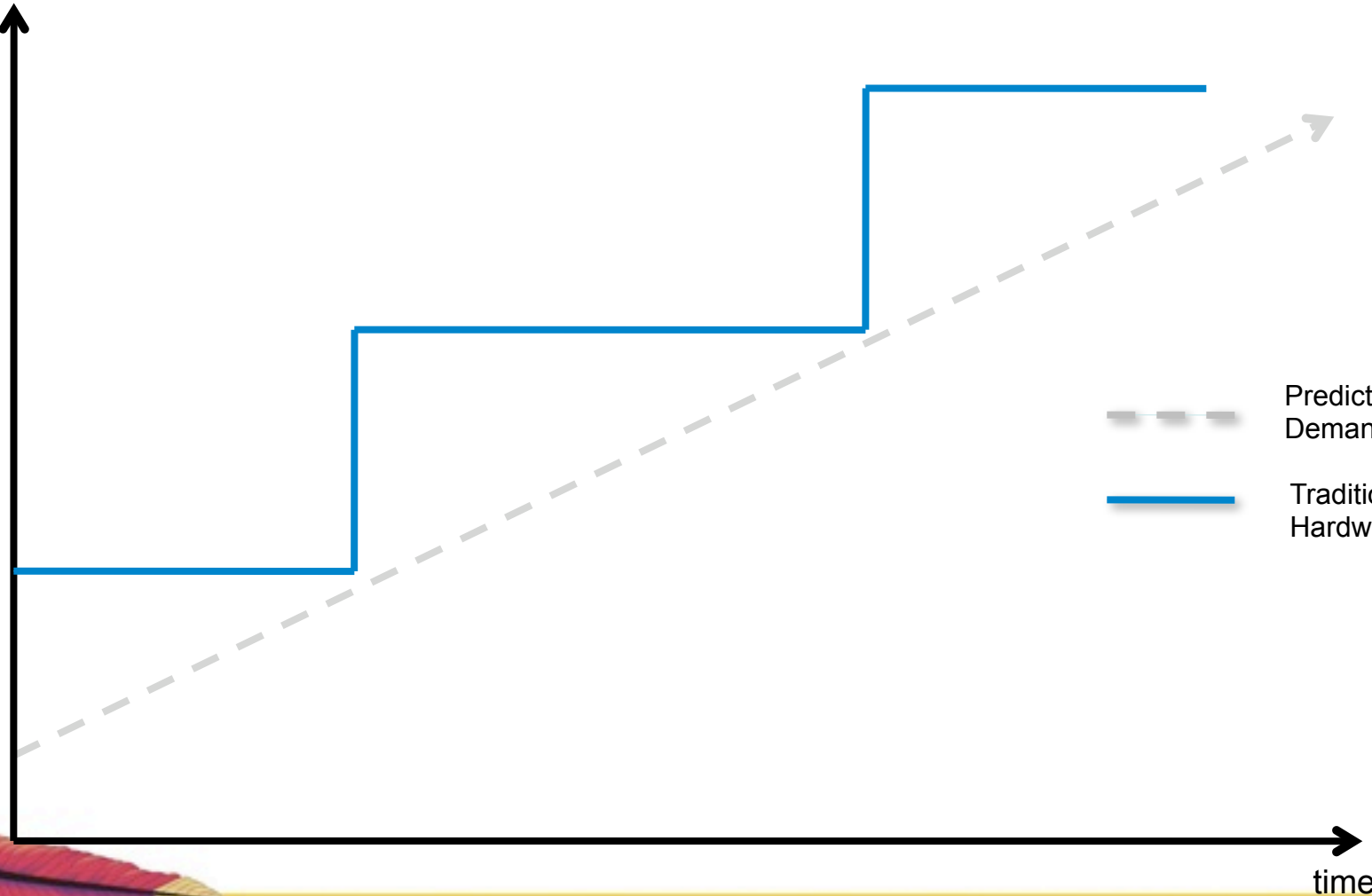
Leading the Wave
of Open Source

Source: Amazon

Predictions cost money

ApacheCon

Infrastructure Cost \$



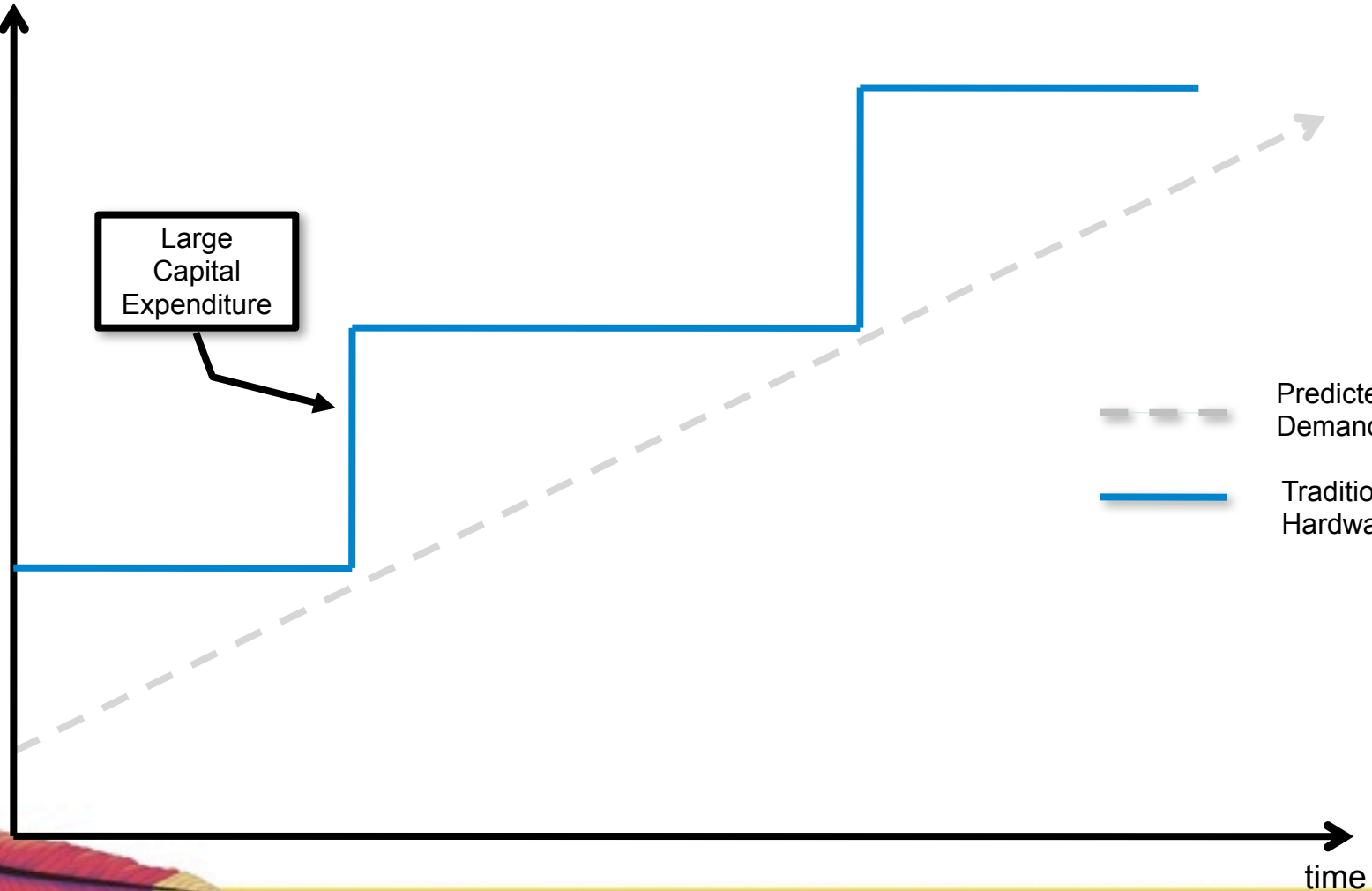
Leading the Wave of Open Source

Source: Amazon

Predictions cost money

ApacheCon

Infrastructure Cost \$



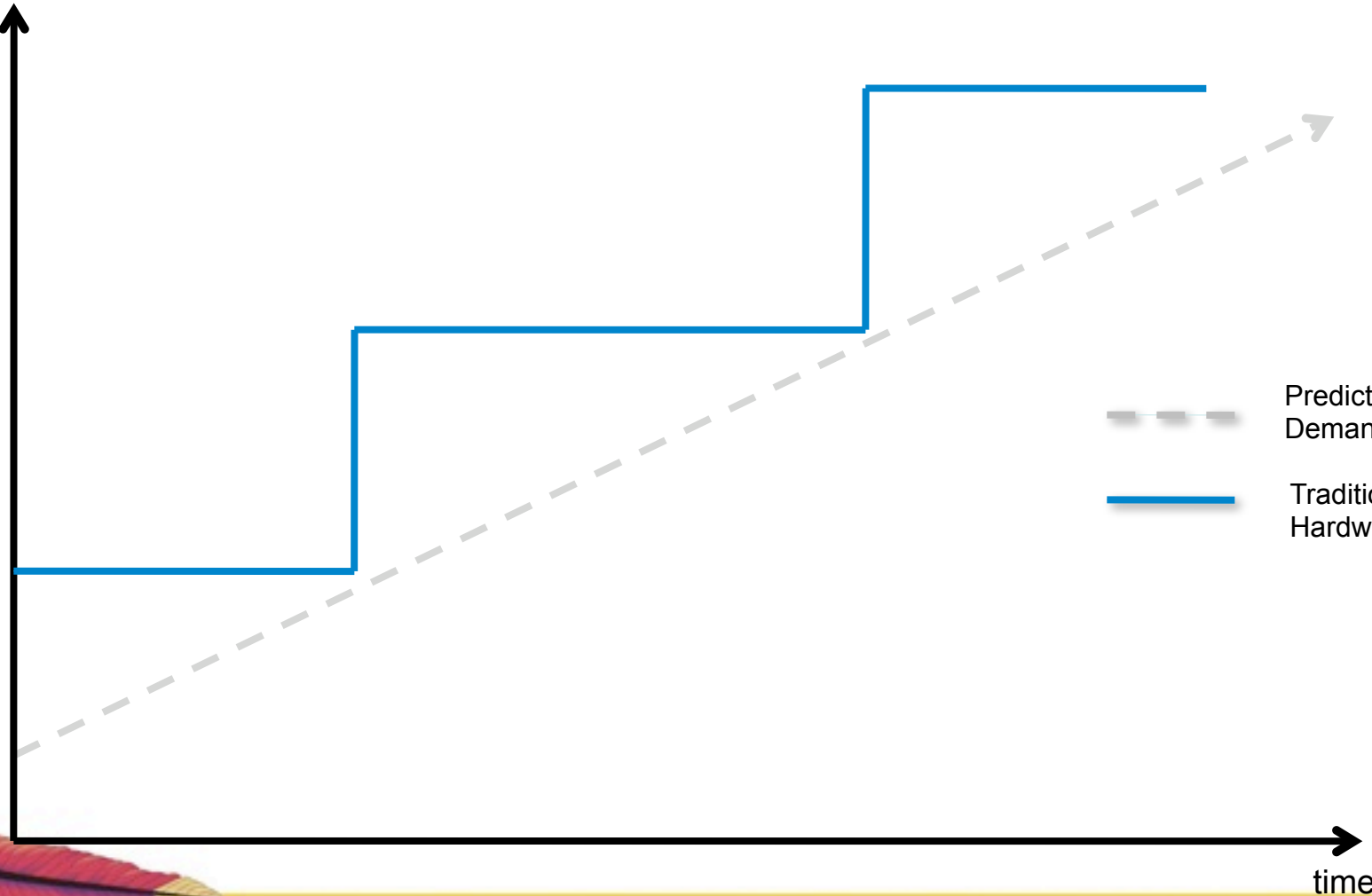
Leading the Wave of Open Source

Source: Amazon

Predictions cost money

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Infrastructure Cost \$



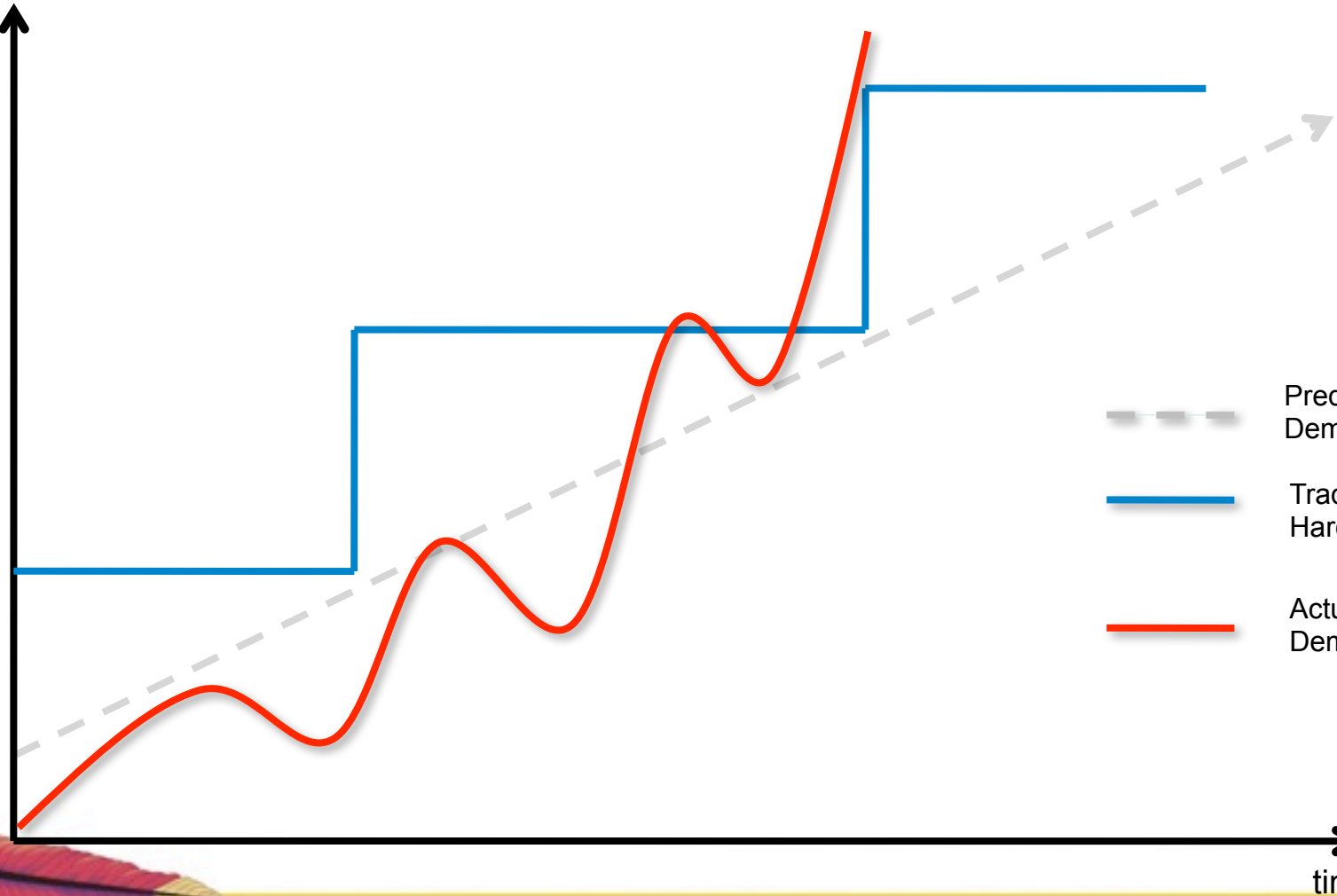
Leading the Wave of Open Source

Source: Amazon

Predictions cost money

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Infrastructure Cost \$



- Predicted Demand
- Traditional Hardware
- Actual Demand

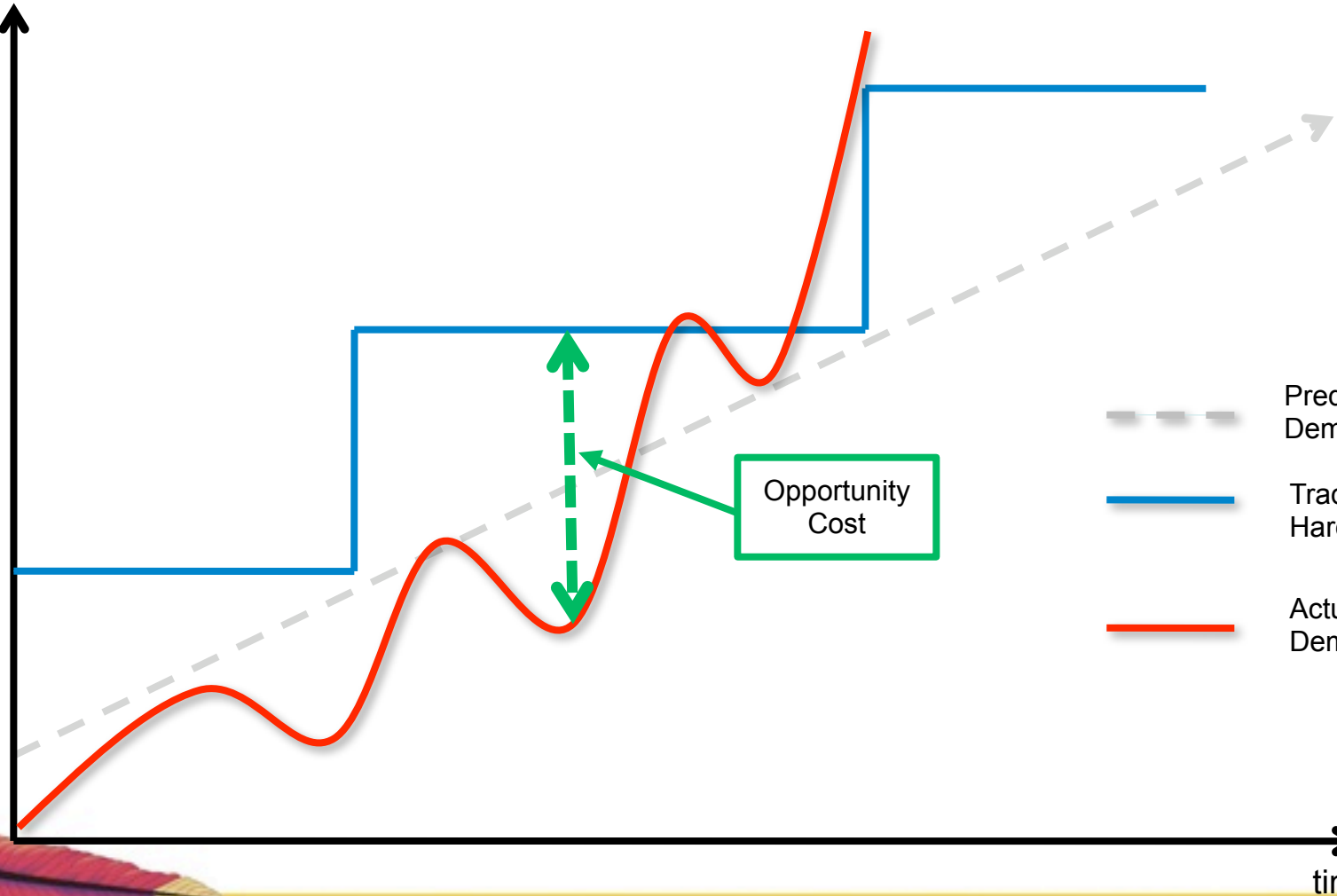
Leading the Wave of Open Source

Source: Amazon

Predictions cost money

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Infrastructure Cost \$



- Predicted Demand
- Traditional Hardware
- Actual Demand

Opportunity Cost

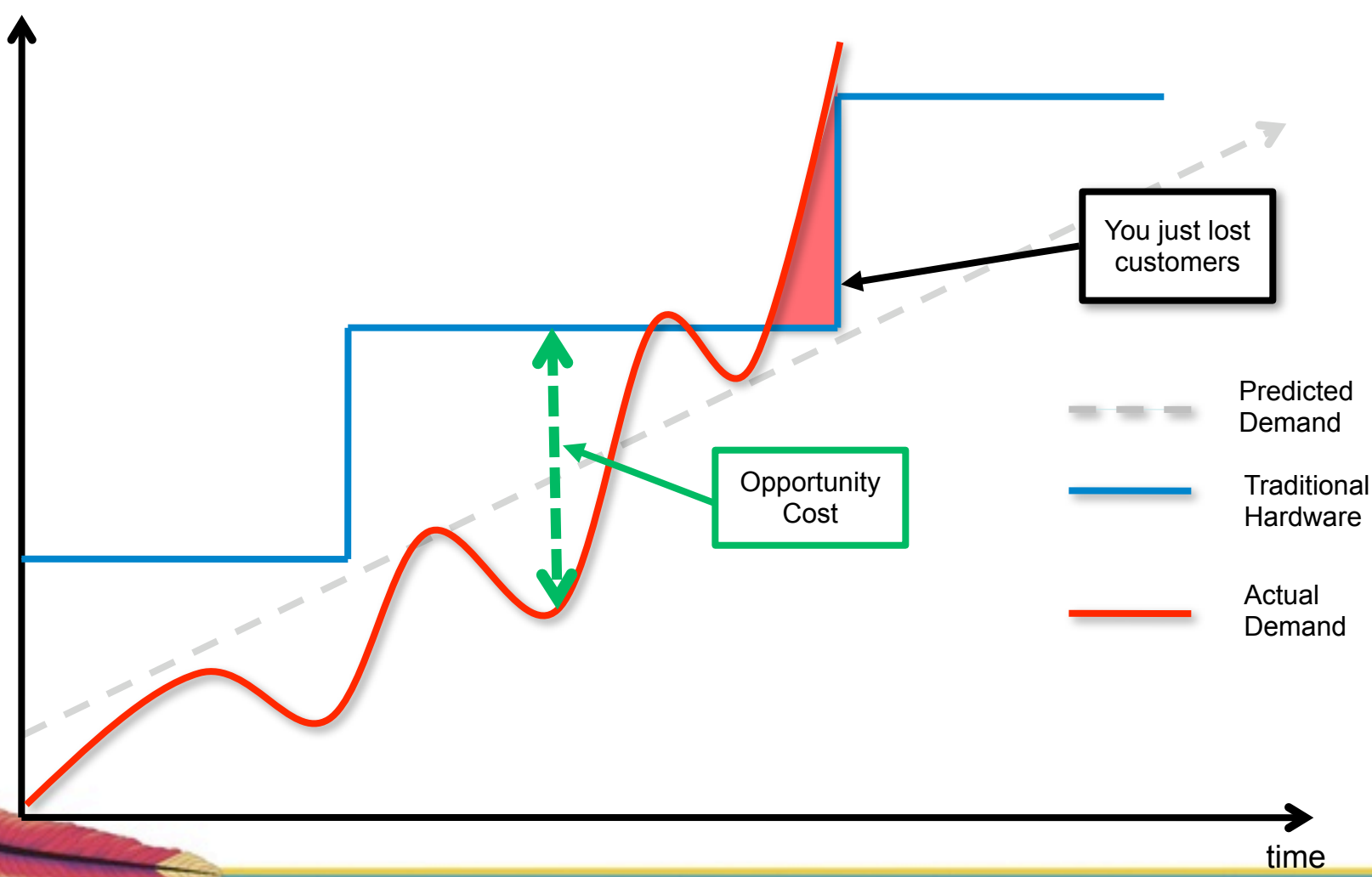
Leading the Wave of Open Source

Source: Amazon

Predictions cost money

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Infrastructure Cost \$



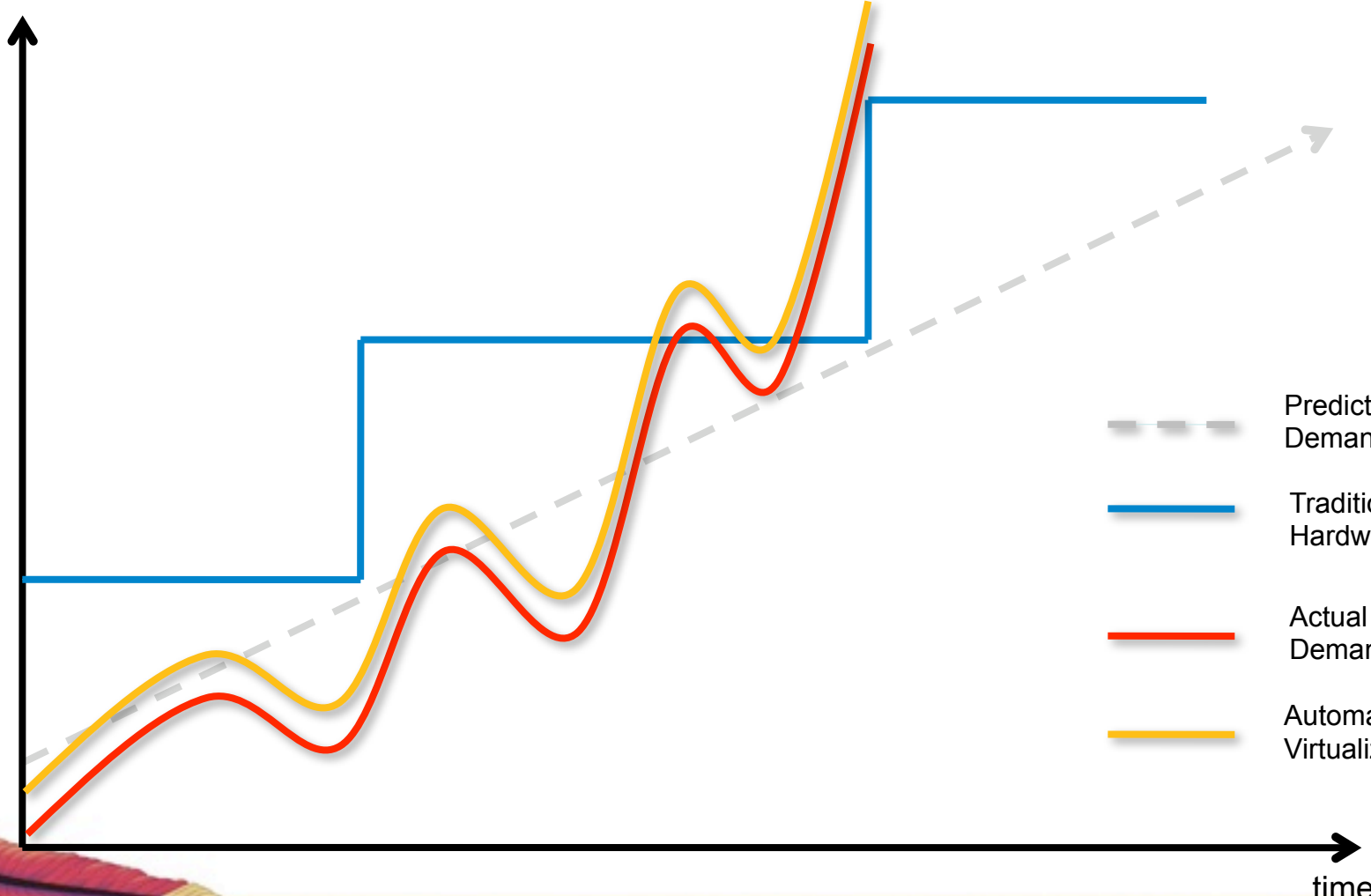
Leading the Wave of Open Source

Source: Amazon

Predictions cost money

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Infrastructure Cost \$



- Predicted Demand
- Traditional Hardware
- Actual Demand
- Automated Virtualization



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Source: Amazon

Availability

Can you get 3000 machines in 3 days?

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Amazon EC2

Elastic Compute Cloud

Machines on demand

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Amazon EC2

pay per hour

same price for

10 machines / 1 hour

1 machine / 10 hours

unlimited number of machines
start in couple minutes

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AMIs

Amazon Machine Images



Bundle your own



Countless possibilities

Internet Explorer



Firefox 2



Opera



Safari



Firefox 3



Firefox 2



no OS X :(

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Amazon AMIs

Create AMIs for different environments to test

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Amazon AMIs

Read user data to customize the
images at runtime
where is the Selenium Hub

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Maven EC2 plugin

in progress

<http://mojo.codehaus.org/maven-ec2-plugin>

start Amazon AMIs

stop at the end of the build

pass on user data

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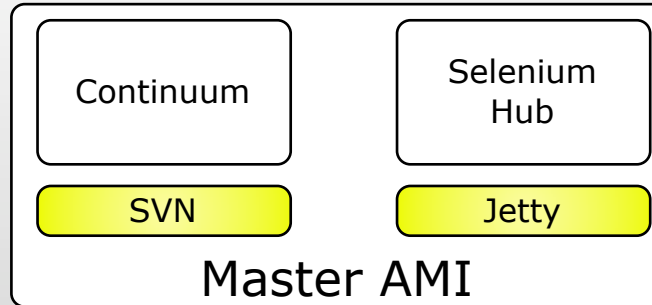
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Workflow



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Starting point



Amazon EC2

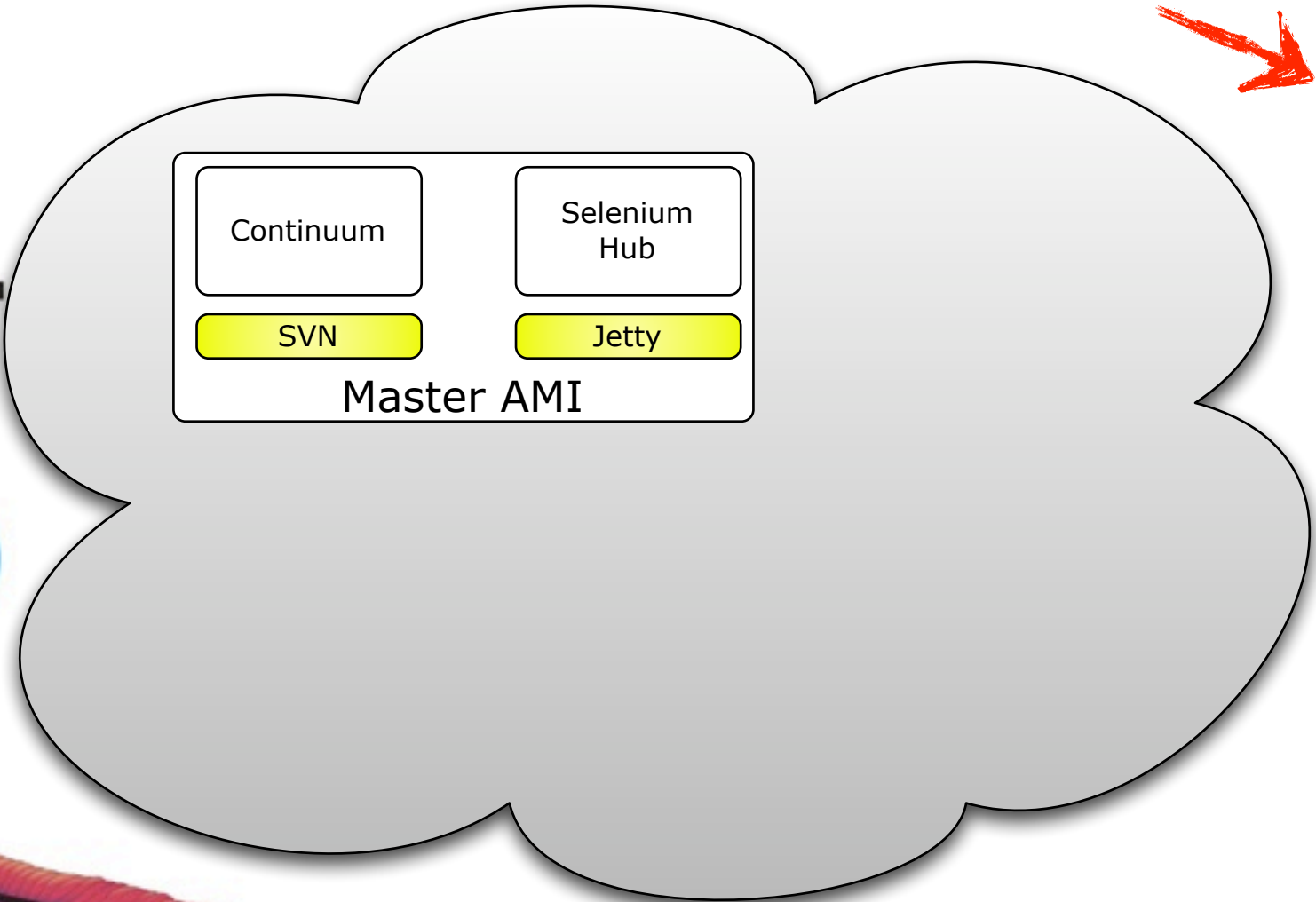
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Starting point

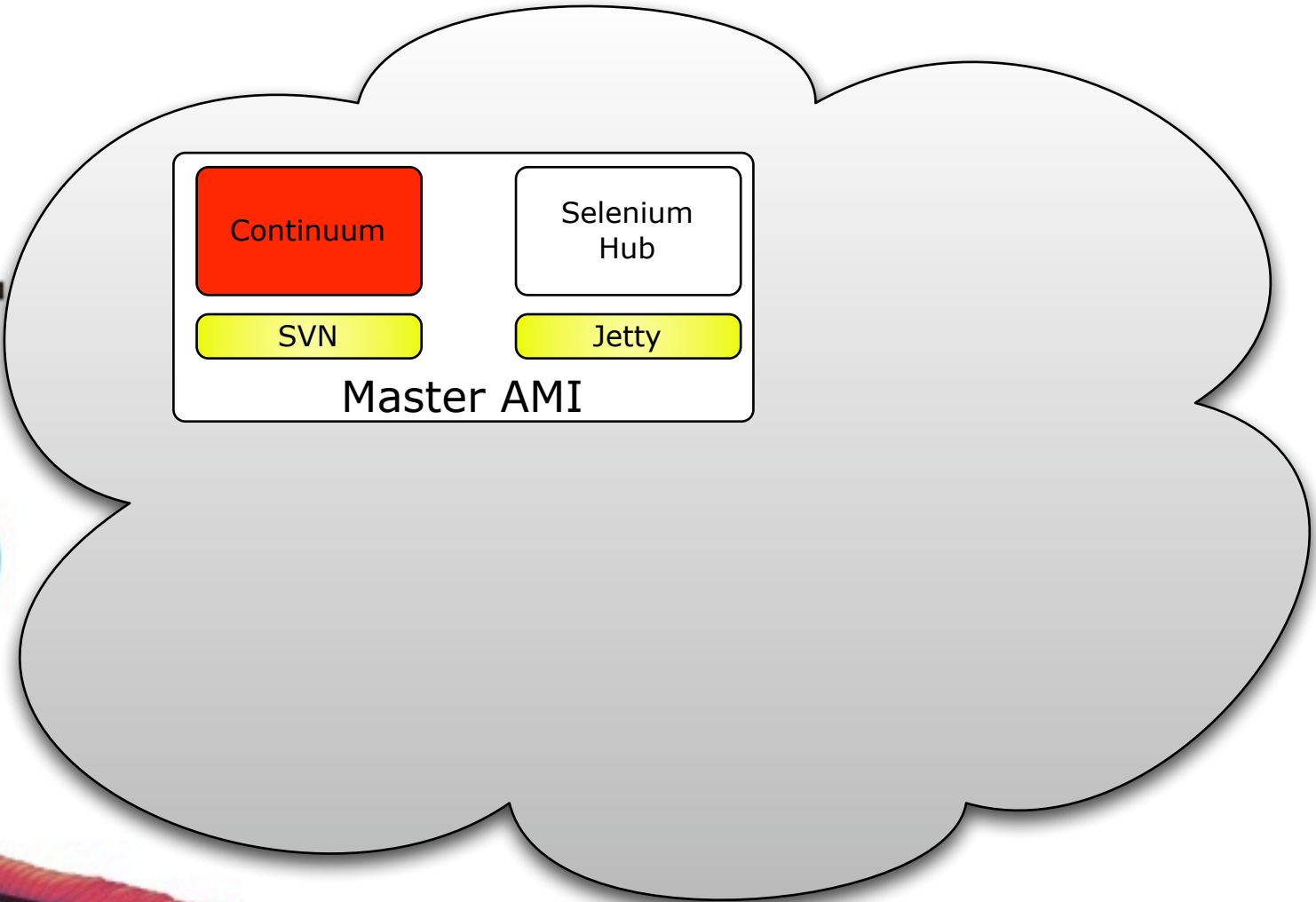
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Build is triggered

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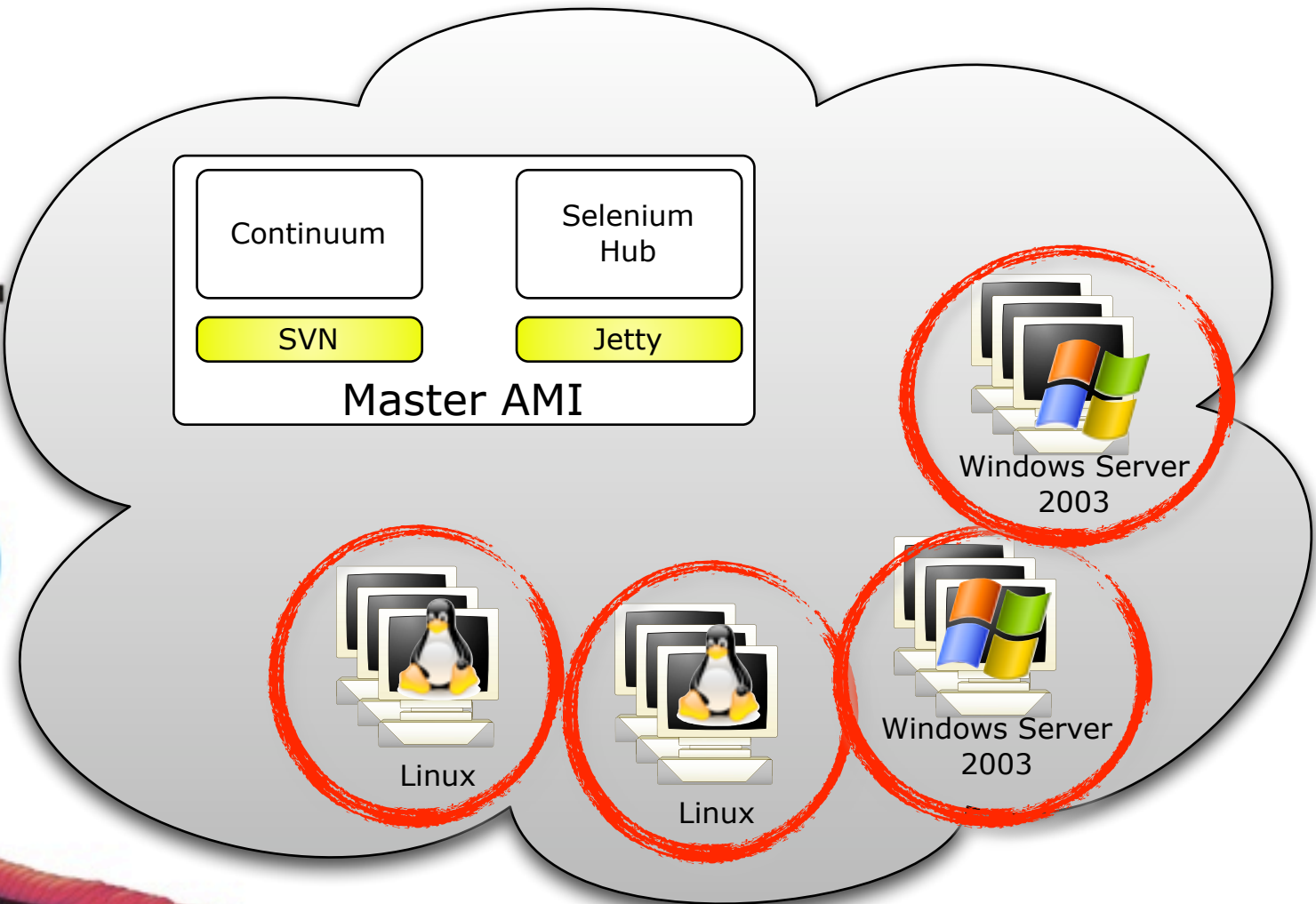


OS X

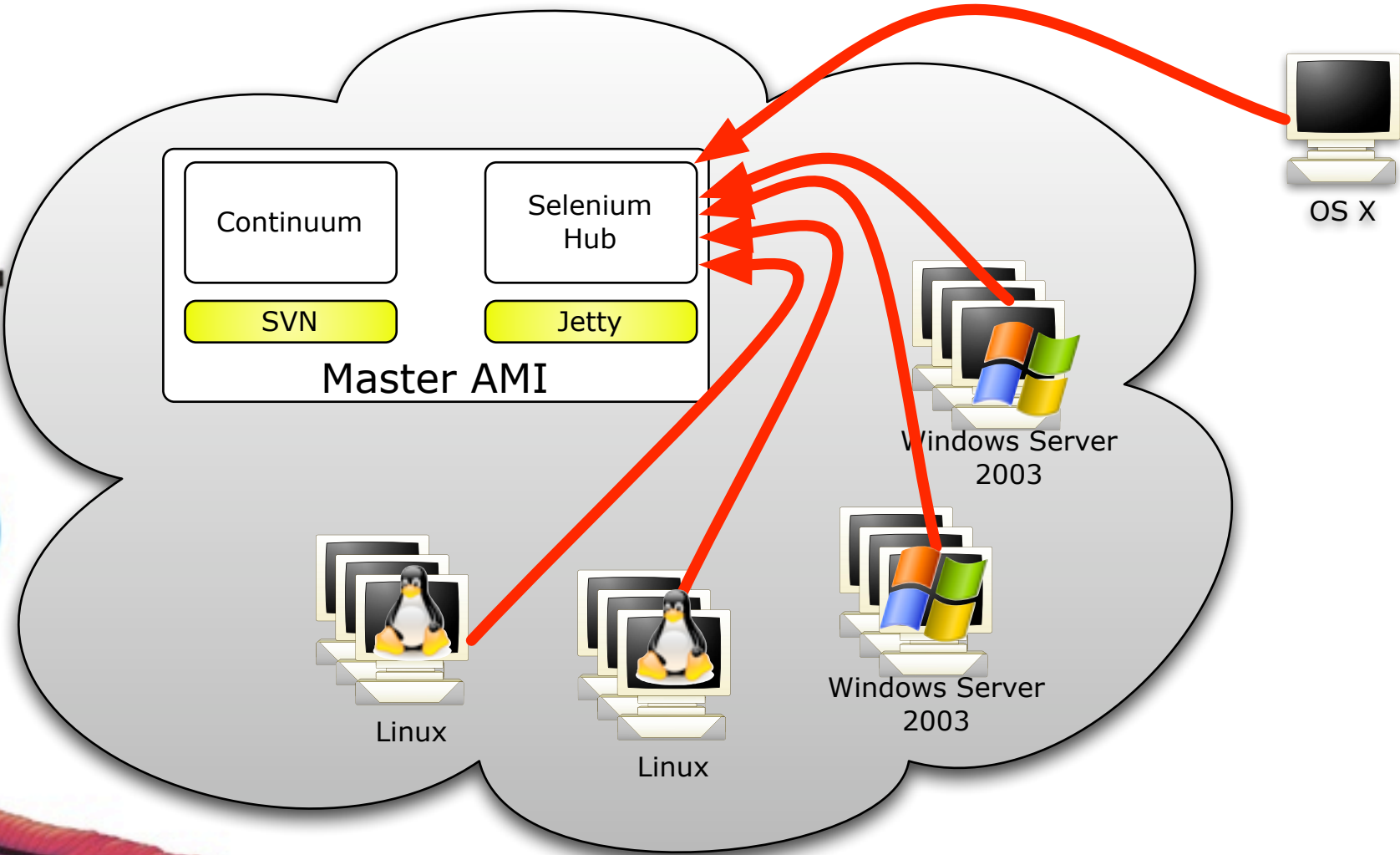


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Start Images

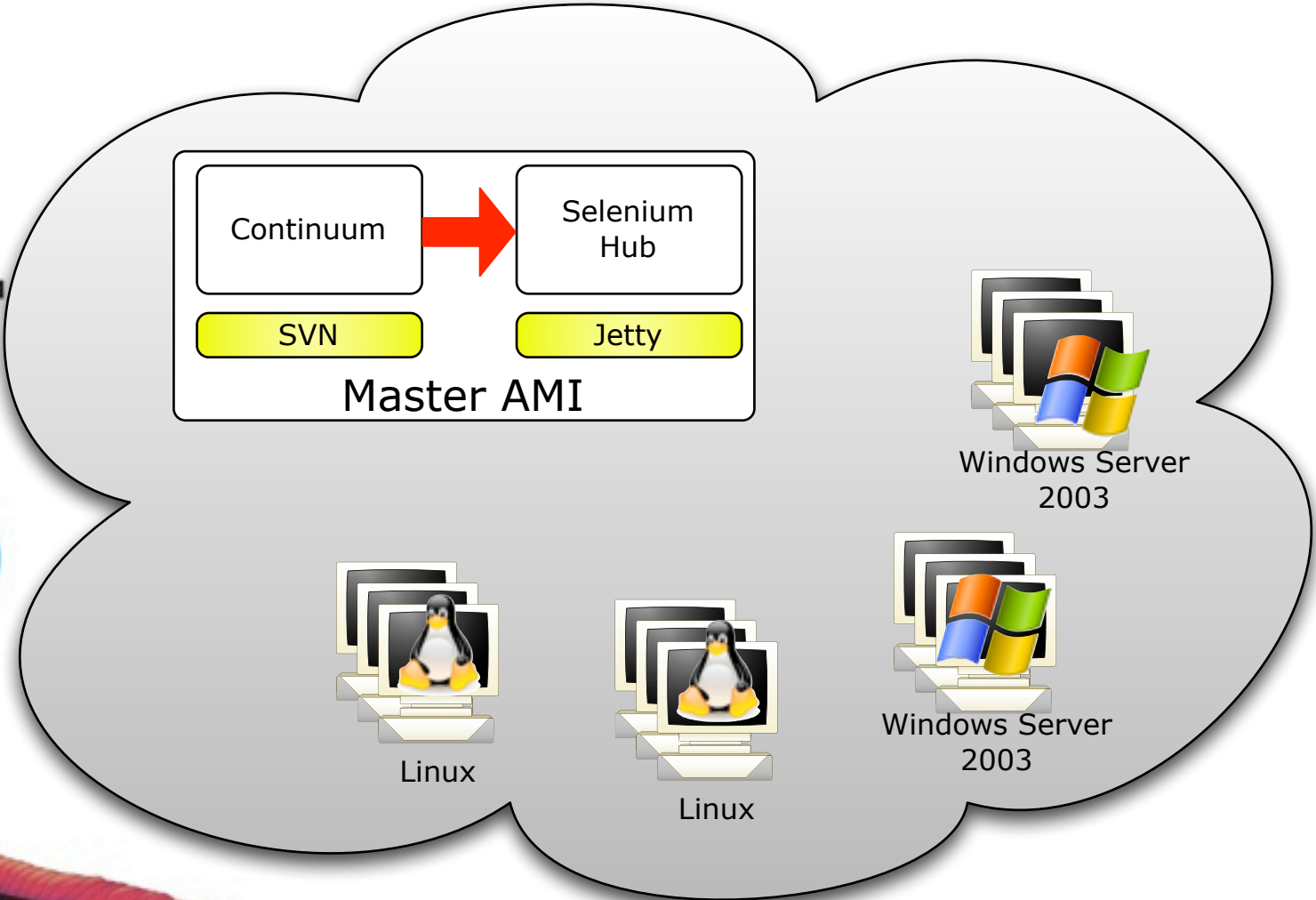


Register with Hub



Tests call Selenium

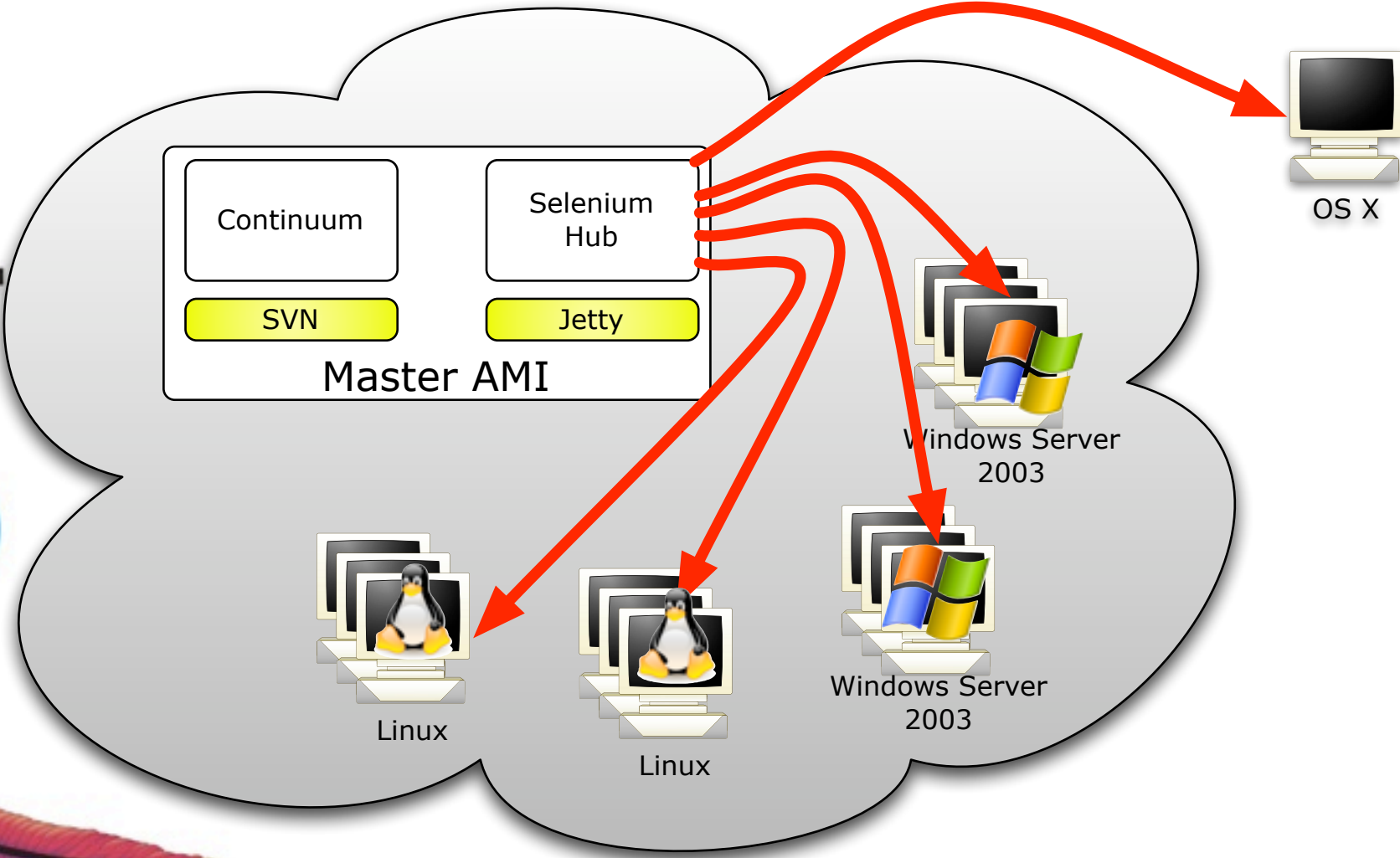
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Distribute tests

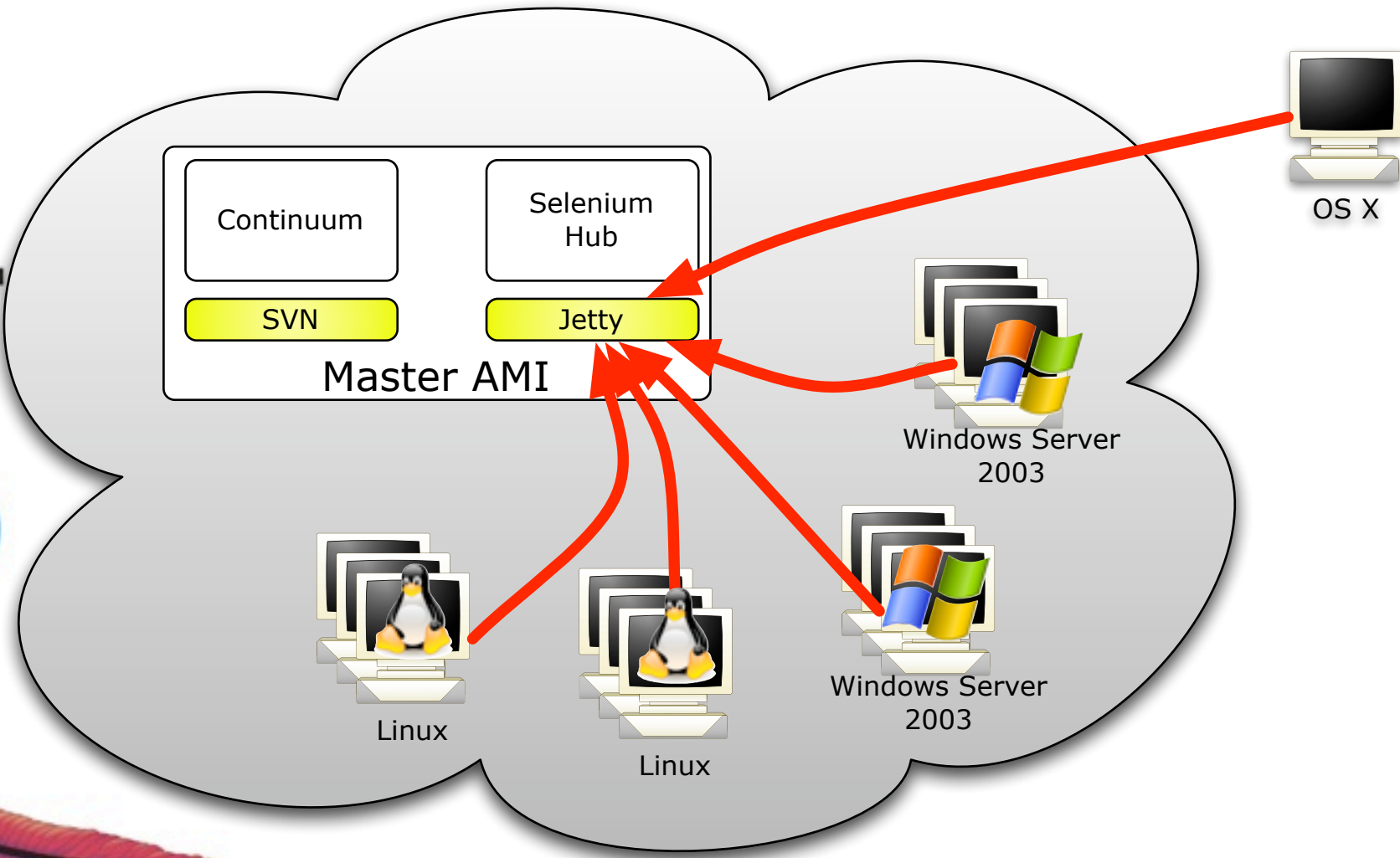
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Run tests against webapp

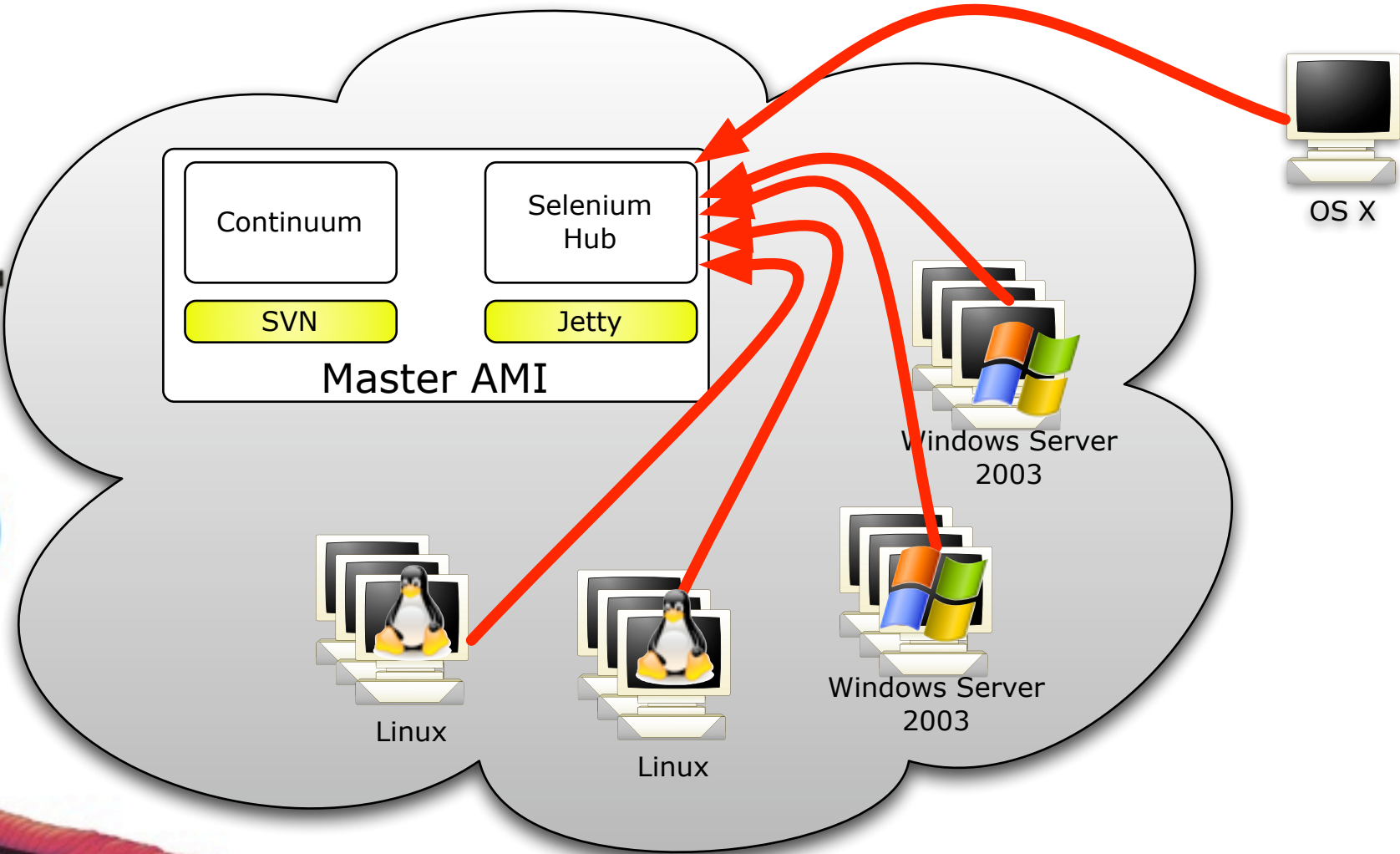
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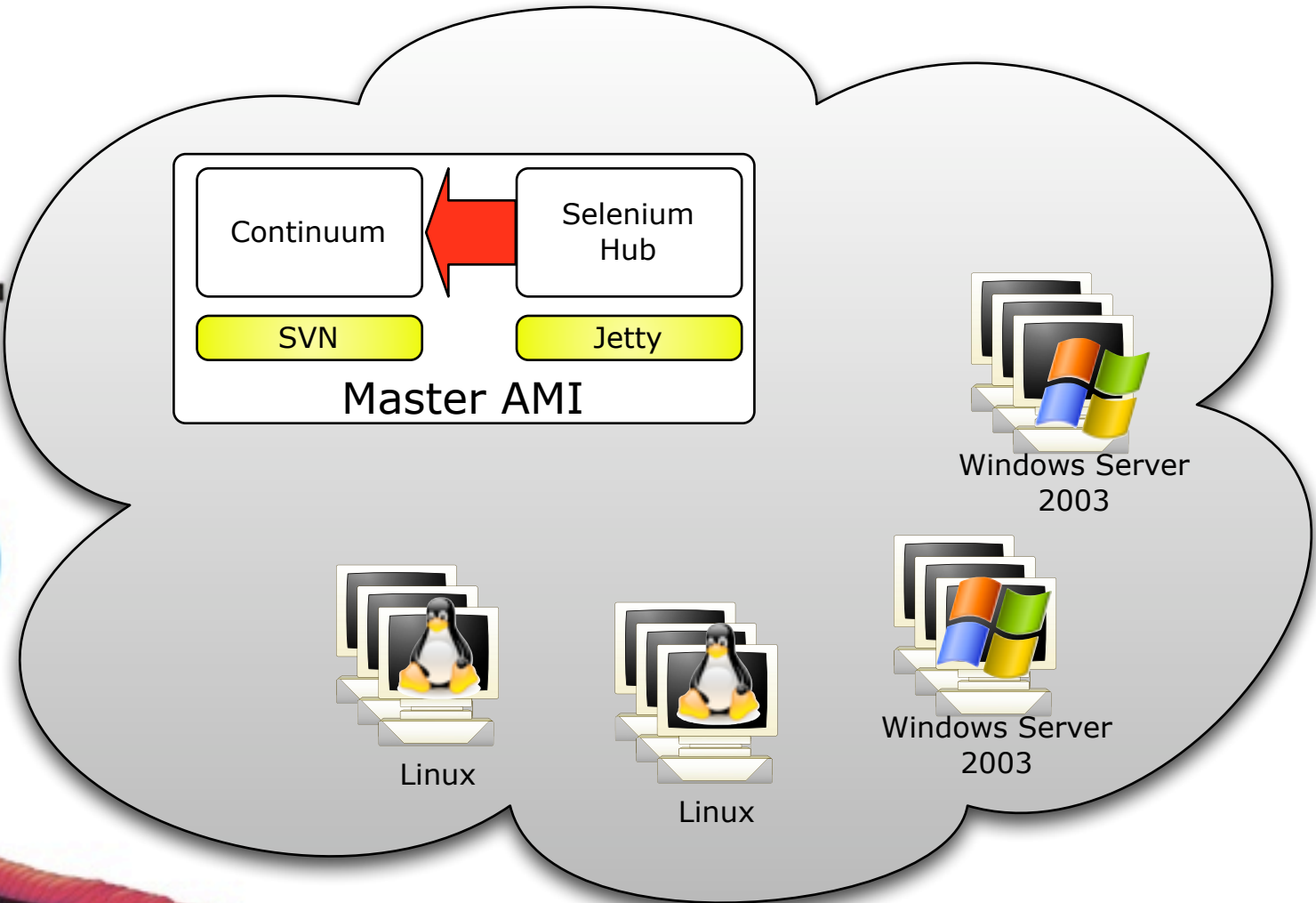
Return results to Hub

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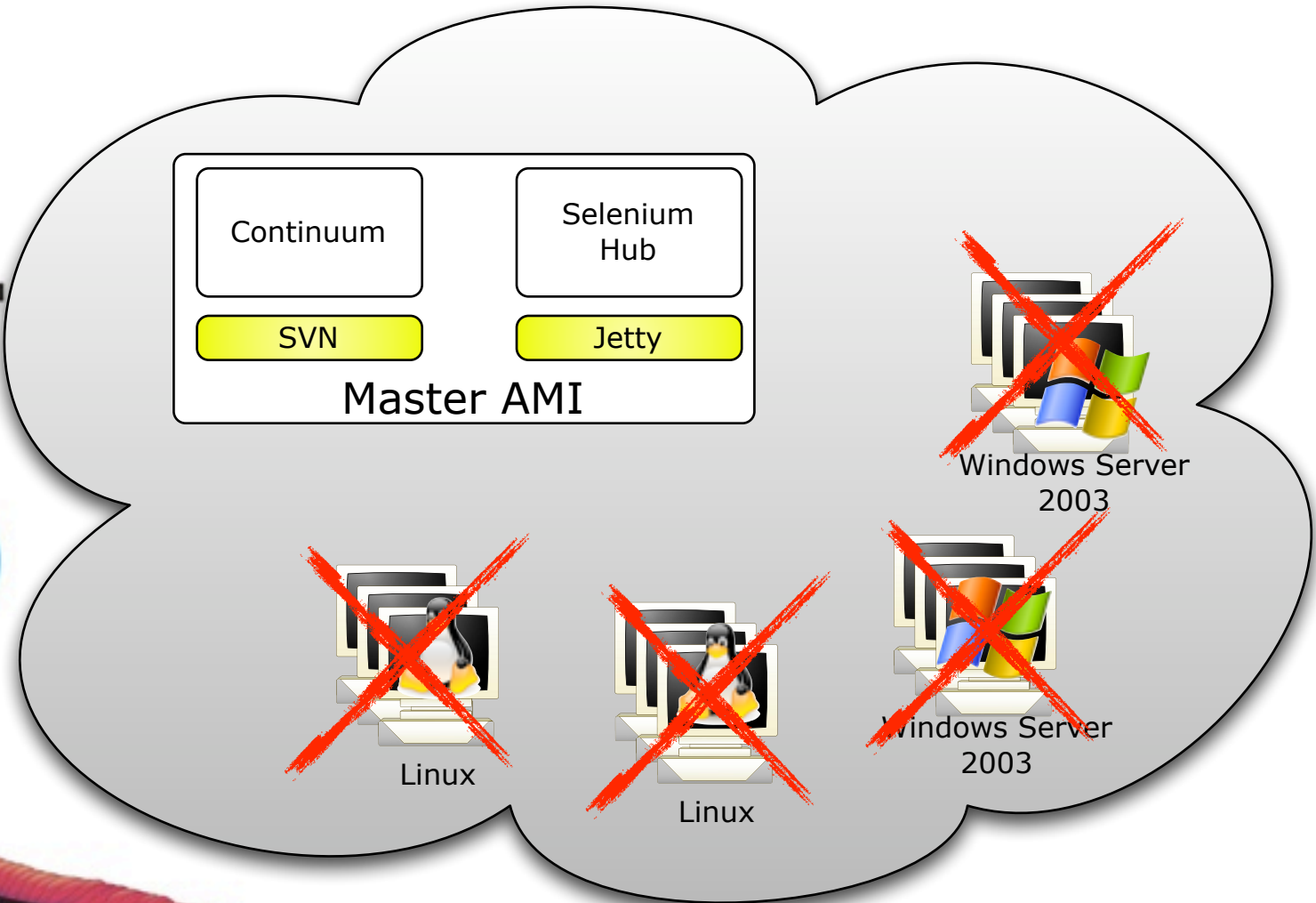


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Return results to builder



Kill Images



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.com



maestro dev
Release quality software and spend less building it.

The banner features the text 'maestro dev' in a light blue and grey font, with the tagline 'Release quality software and spend less building it.' below it. The background is a light blue gradient with faint gear patterns and a large, prominent blue gear on the right side.



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Questions?



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Thanks

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