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JBoss Cookbook: Secret Recipes

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Secret Recipes

- Byteman
- Cluster and Load Balancing Configuration Generator
- Troubleshooting High CPU
- Mocking a JBoss “Hang” State

Byte (code) Man (ipulation)

- Tool that simplifies tracing and testing of Java programs
- Inject code almost anywhere without recompiling, repackaging or redeployment of your application
- Works by modifying the bytecode of your application at runtime (can modify codes whose sources are not available)
- Injected codes are reversible (load/unload scripts)

Driving Byteman

- Install as “Java agent” through java options
  - `-javaagent:$BYTEMAN_HOME}/lib/byteman.jar=agentoptions`
  - Can start as listener on a port (allows upload/unload/reload of rules while program still running)
  - agentoptions are comma separated name:value pairs
    - e.g. script:./rules.btm,script:./morerules.btm,boot:byteman.jar
    - **script:script.btm** install rules from script.btm at agent startup
    - **boot:my.jar** add my.jar to bootstrap classpath
    - **sys:my.jar** add my.jar to system classpath
    - **listener:true** start up agent listener
    - **port:999** use listener port 999
    - **address:192.168.0.1** use listener host 192.168.0.1

Driving Byteman

- Install agent into already running program
  - **bminstall process_id**
  - Always starts listener
  - **bmsubmit [-l | -u] [script1 . . . scriptN]**
    - Load or unload rule scripts to listener
    - e.g.: bmsubmit -l /path/to/myscript.btm
  - **bmcheck [-cp path|jar]* [-p prefix]* script1 ... scriptN**
    - e.g.: bmcheck -cp /path/to/my.jar -p org.example myscript.btm

Driving Byteman

- Start your java program with the agent
  - Use in place of java command
    - **bmjava javaargs**
  - e.g.: bmjava org.my.App
    - Then install script: bmsubmit -l myscript.btm

Sample Byteman Rule Script

```
RULE trace HelloWorld methods
CLASS org.jboss.samples.webservices.Echo
METHOD echo(String)
AT ENTRY
IF TRUE
DO
trace("Byteman Entering")
ENDRULE
```

Sample Byteman Rule Script

```
[RULE trace HelloWorld methods]
CLASS org.jboss.samples.webservices.Echo
METHOD echo(String)
AT ENTRY
IF TRUE
DO
trace("Byteman Entering")
ENDRULE
```

Rule name

Sample Byteman Rule Script

```
RULE trace HelloWorld methods
[CLASS org.jboss.samples.webservices.Echo]
[METHOD echo(String)]
[AT ENTRY]
IF TRUE
DO
trace("Byteman Entering")
ENDRULE
```

Event (Trigger point)

Sample Byteman Rule Script

```
RULE trace HelloWorld methods
CLASS org.jboss.samples.webservices.Echo
METHOD echo(String)
AT ENTRY
[IF TRUE]
[DO]
trace("Byteman Entering")
ENDRULE
```

Condition

Sample Byteman Rule Script

```
RULE trace HelloWorld methods
CLASS org.jboss.samples.webservices.Echo
METHOD echo(String)
AT ENTRY
IF TRUE
DO
[trace("Byteman Entering")]
ENDRULE
```

Action

in Action (Demo)

Byteman

Byteman Built In Methods

- Tracing
  - traceOpen, traceClose, traceln, traceStack, ...
- Managing Shared Rule State
  - flag, clear, countDown, incrementCounter, ...
- Timing
  - createTimer, getElapsedTime, resetTimer
- Checking Caller Stack
  - callerEquals, callerMatches
- **Check out the Programmer's Guide**

Byteman Helper Classes

- You can use any POJO as Helper

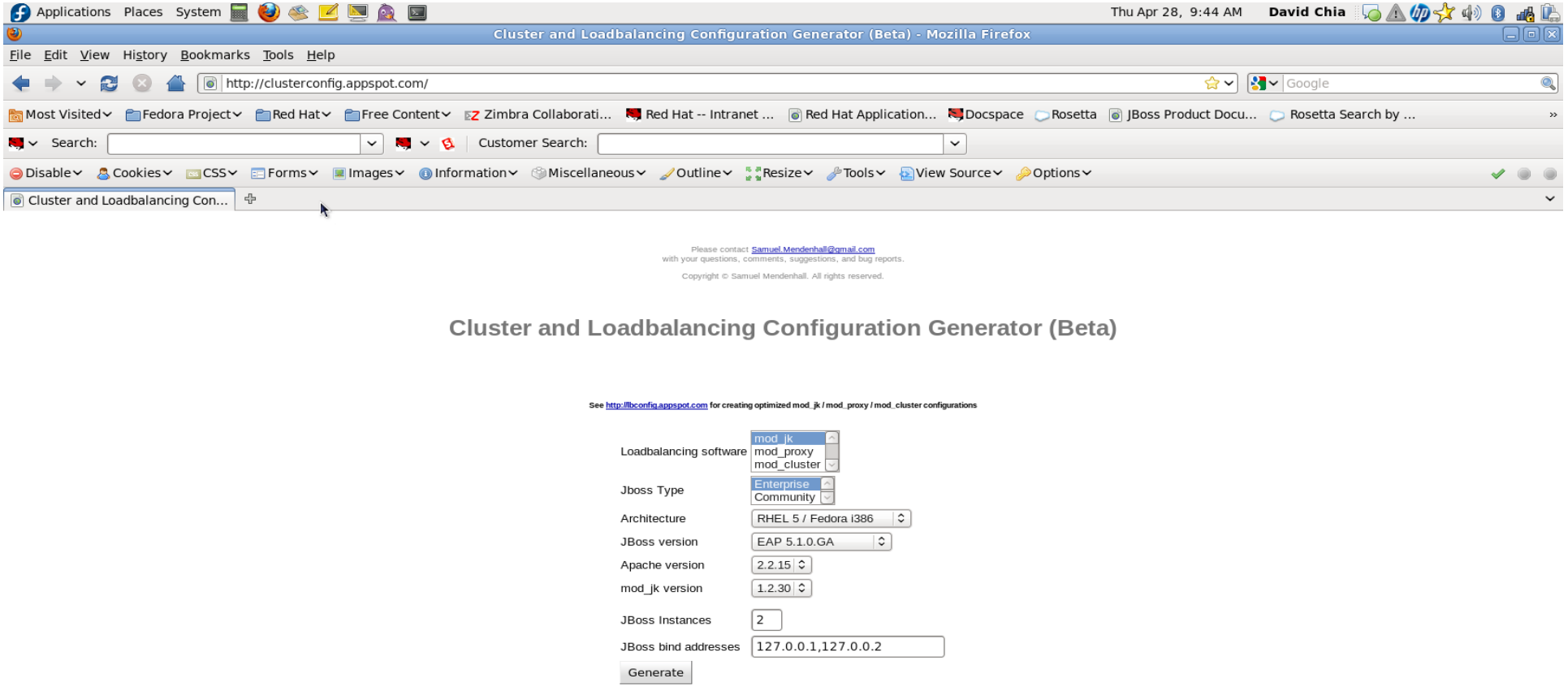
```
class DBHelper {
public void trace(String msg, Record rec) { . . . }
. . . }
```

```
RULE use my own trace method
CLASS org.my.db.DBManager
METHOD update(Record)
AT CALL setName(String)
HELPER org.my.bmutil.DBHelper
IF $@[1] == "David”
DO trace("found interesting record update ", $1)
ENDRULE
```

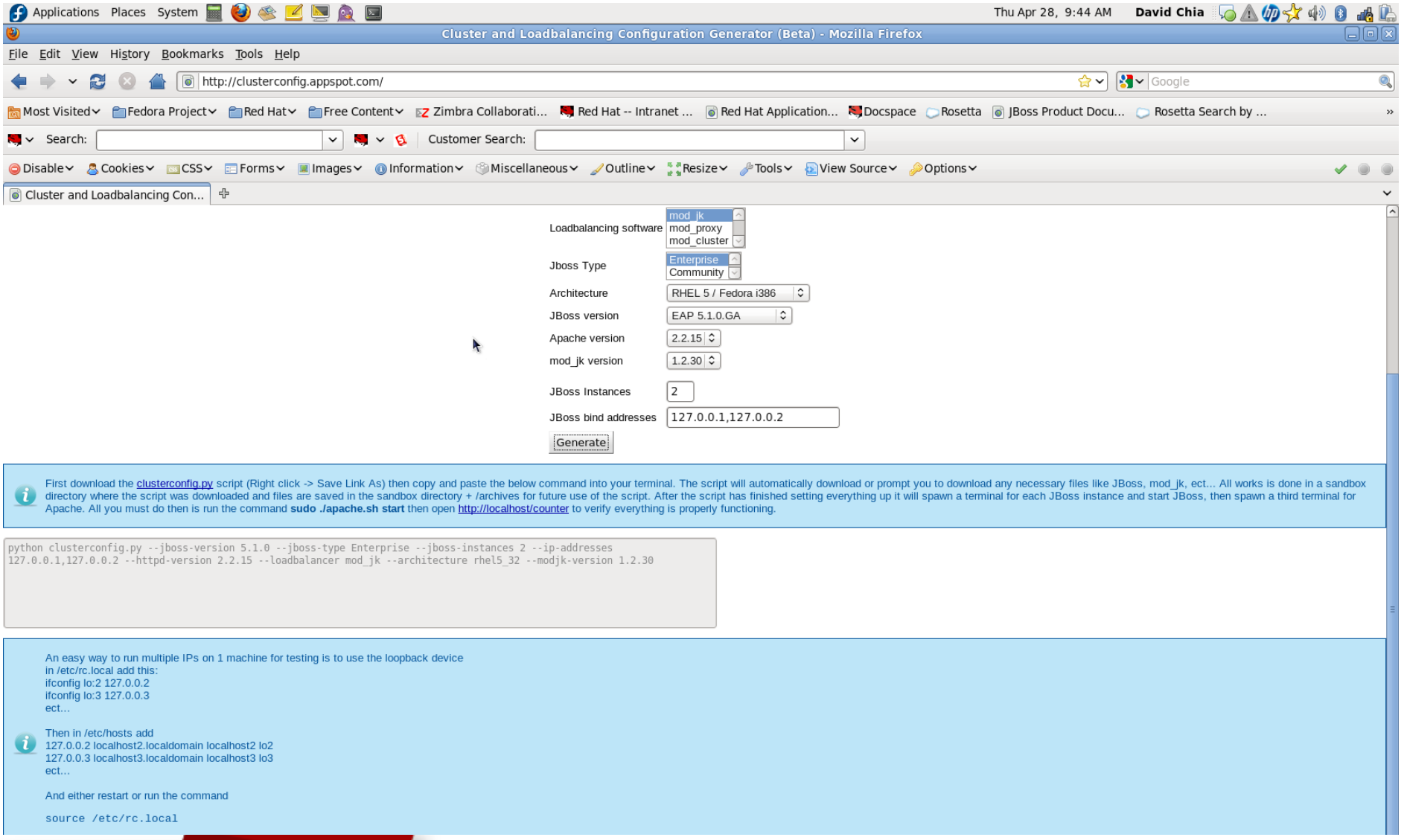
Cluster and Load Balancing Configuration Generator

- Automatically generates the optimal configuration for your cluster and load balancer based on your server setup
- Cluster and load balancing configuration generator:
  - http://clusterconfig.appspot.com/
- Load balancer configuration generator:
  - http://lbconfig.appspot.com/

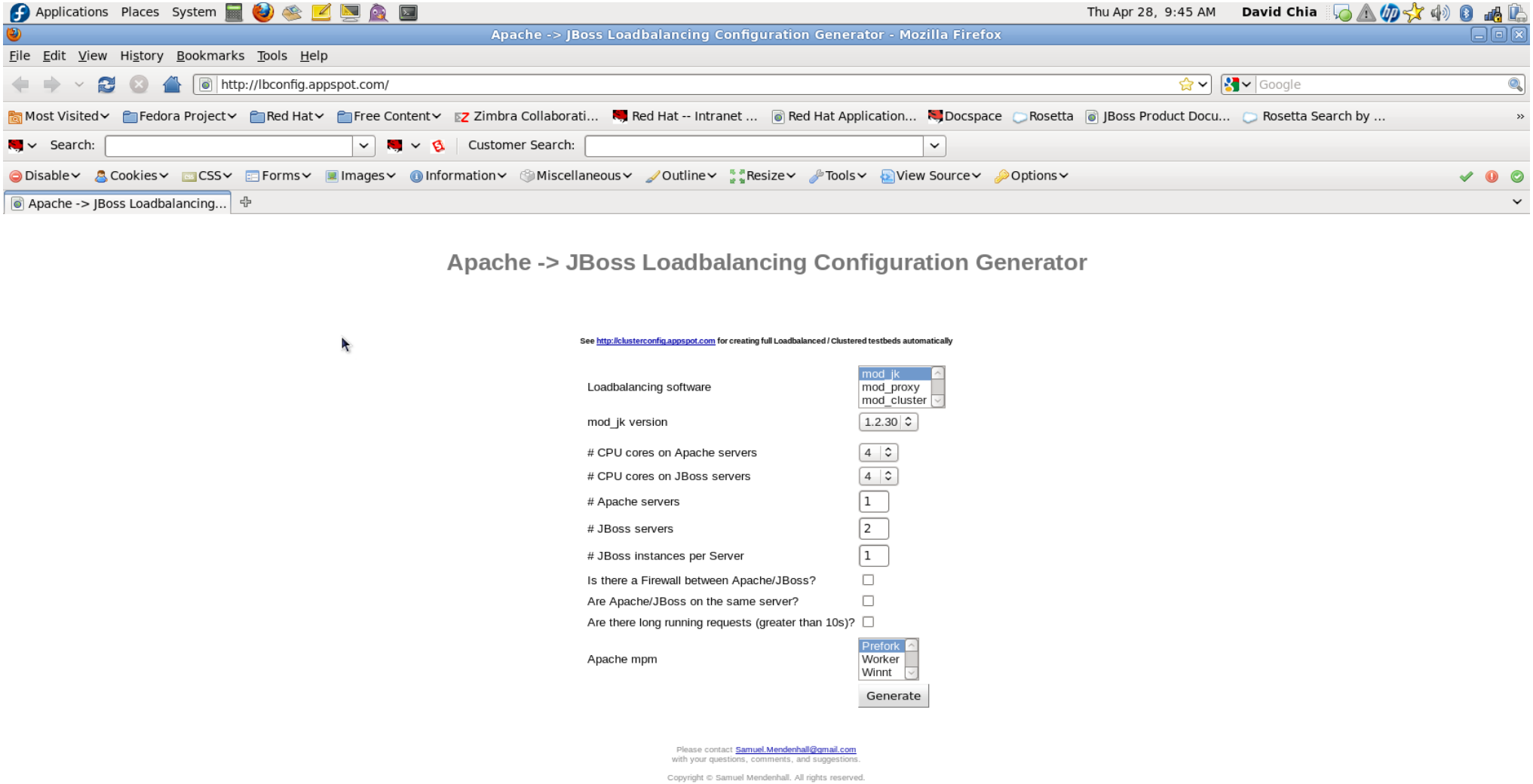
http://clusterconfig.appspot.com/



http://clusterconfig.appspot.com/



http://lbconfig.appspot.com/



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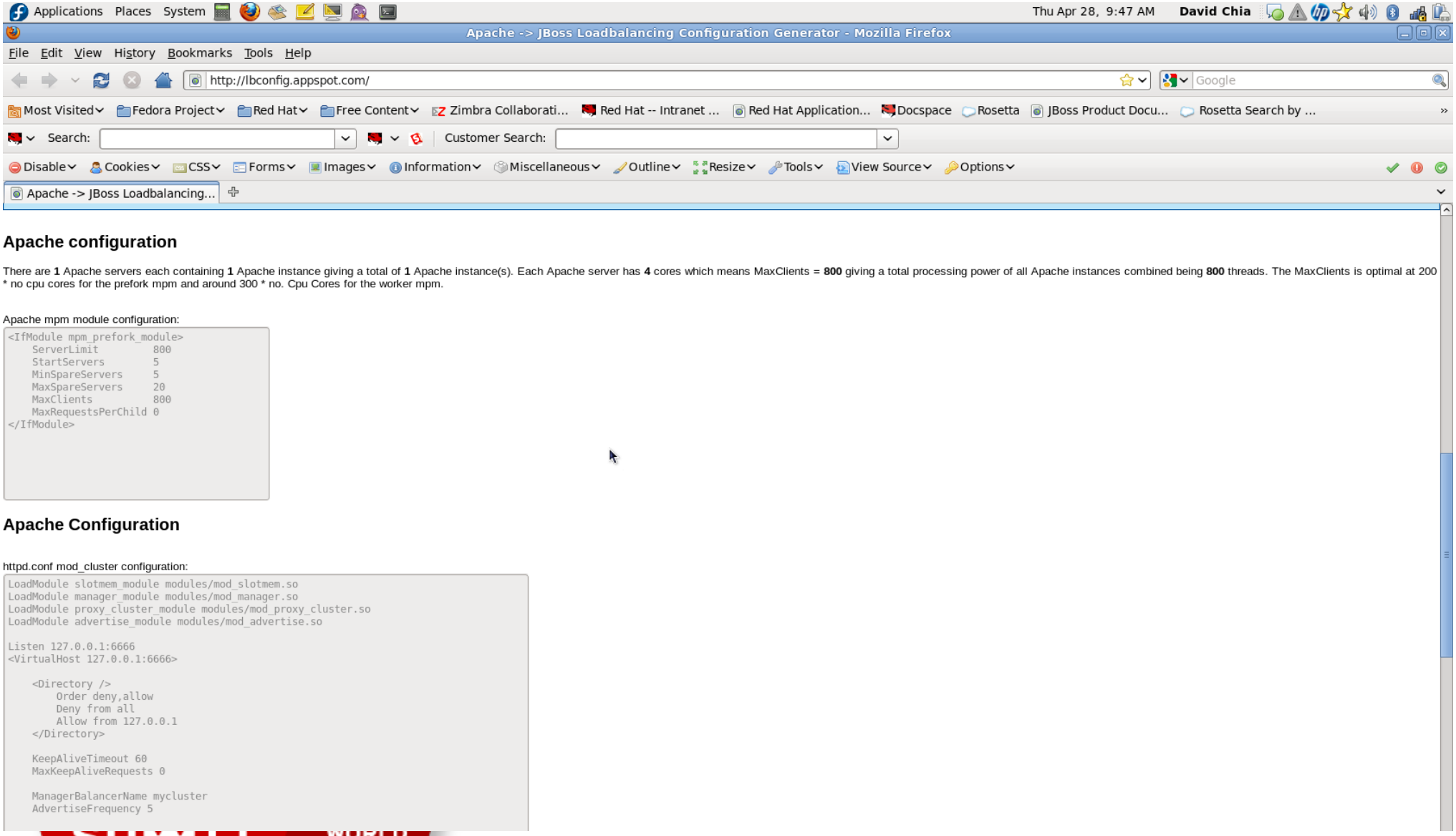

Troubleshooting High CPU

- Identify the cause:
  - Garbage collection logs (rule out GC issues first)
  - Thread dumps
- For application servers, gather logs:
  - JBoss EAP
    - $JBOSS_HOME/server/$PROFILE/log/server.log
    - $JBOSS_HOME/server/$PROFILE/log/boot.log
  - Tomcat
    - catalina.out

Troubleshooting High CPU (cont.)

- Garbage collection basics
  - OpenJDK, SunOracle JDK, and IBM JDK all use generation collectors, meaning there are two distinct regions within the heap: one for new objects (young generation space) and one for objects that have been around a while (old generation space).
  - When a generation fills up, the JVM may stop all threads in the JVM to do garbage collection.
  - The JVM uses different collectors, some with multiple phases to do collections.
  - Not every phase of a collector is blocking. Some phases are concurrent, meaning threads in the JVM are running at the same time.

Troubleshooting High CPU (cont.)

- Garbage collection basics
  - 2 Main GC Issues: long pauses and bad throughput
  - Throughput is the percentage of time spent not doing garbage collection vs. total time. So 100% means no GC was happening, all time was spent running application threads. 0% means all time spent doing GC.
  - Throughput of 95% and above is generally considered "good".
  - Acceptable max pause depends on system requirements, but 10 seconds seems to be a dividing line for many customers.
  - It is generally not a close call. Generally it's quite clear when the real issue is GC, not a threading problem. Max pauses will be very high or throughput will be very low (one collection after another w/ very little time in between)

Troubleshooting High CPU (cont.)

- Garbage collection logs
  - To enable when using OpenJDK/Sun JDK
    - `-verbose:gc -Xloggc:gc.log -XX:+PrintGCDetails -XX:+PrintGCTimeStamps`
  - Analyze logs for long pauses times and/or low throughput
    - http://code.google.com/a/eclipselabs.org/p/garbagecat/
    - http://www.alphaworks.ibm.com/tech/pmat

Troubleshooting High CPU (cont.)

- Analyzing Sample Report

Troubleshooting High CPU (cont.)

- GC Tuning
  - Long pauses (long full GC)
    - Change from the parallel throughput collector to the CMS low pause collector
      - -XX:+UseConcMarkSweepGC)
    - Enable large page support
      - (SunJDK/OpenJDK) -XX:+UseLargePages -XX:LargePageSizeInBytes=4m
      - (IBM JDK) -lp
      - (Jrockit JDK) -XXlargePages

Troubleshooting High CPU (cont.)

- GC Tuning
  - Long pauses (long full GC)
    - Check to see if the JVM is running in a virtual or physical environment. If running in a virtual environment, explicitly set -XX:ParallelGCThreads based on the number of CPUs assigned to the guest OS

Troubleshooting High CPU (cont.)

- How do thread dumps help?
  - Show deadlocks
  - Show monitor contention for a point in time
  - Show thread progression

Troubleshooting High CPU (cont.)

- Producing thread dumps
  - `kill -3 JAVA_PID`
    - Output sent to std out
    - Redirect std out to a file
  - `jstack -l JAVA_PID > jstack.out`
    - JDK 1.6 and later
  - Script that takes a series of thread dumps given an interval

Troubleshooting High CPU (cont.)

- Thread Dump Analysis Tools
  - Thread Dump Analyzer (TDA)
  - Samurai

Troubleshooting High CPU (cont.)

- Thread Dump Analysis Tools Demo

Mocking a JBoss “Hang” State

- Useful in cluster setup – test load balancing functionality
- To “pause” the JBoss process
  - Press “CTRL-Z”
  - If run as a service, “kill -STOP <pid>”
- To “resume” JBoss in foreground
  - Press “fg”
  - If run as a service, “kill -STOP <pid>”

Resources

- Byteman
  - http://www.jboss.org/byteman
- Cluster and load balancing configuration generator:
  - http://clusterconfig.appspot.com/
- Load balancer configuration generator:
  - http://lbconfig.appspot.com/
- Thread Dump Analyzer (TDA)
  - http://java.net/projects/tda
- Samurai
  - http://yusuke.homeip.net/samurai/en/index.html

Resources

- GarbageCat
  - http://code.google.com/a/eclipselabs.org/p/garbagecat/
- IBM Thread and Monitor Dump Analyzer
  - http://www.alphaworks.ibm.com/tech/jca
- EAP 5 Performance Tuning White Paper
  - http://www.jboss.com/pdf/JB_JEAP5_PerformanceTuning_wp_web.pdf

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