Introduction to Terracotta

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Agenda

1. Introduction
2. Main Parts
3. Terracotta Integration Modules
4. Hello World
5. Lessons Learned using Terracotta
6. Different Uses for Terracotta
7. Resources

Introduction

Introduction

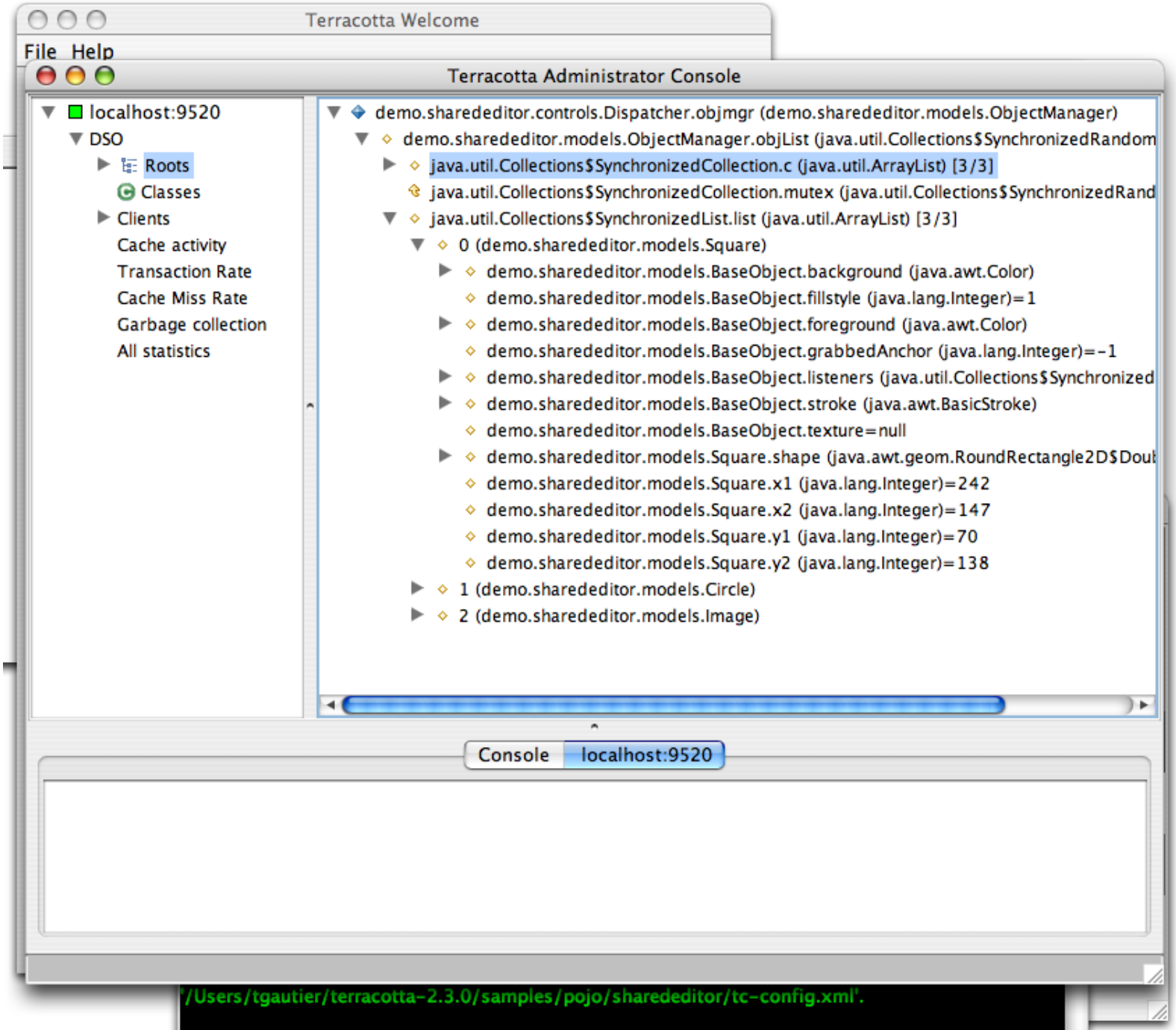
- Terracotta is...
  - A Distributed Cache
  - A Distributed Session Server
  - Network Attached Memory

- Terracotta is...
  - Open Source
  - Java
  - Client / Server

Main Parts

Main Parts

- Terracotta Server
  - tc-config.xml
- Terracotta Enabled Application
  - tc-config.xml
  - JAVA_OPTS
- Terracotta Administration Console


Terracotta Welcome
File Help
Terracotta Administrator Console
localhost:9520
DSO
Roots
Classes
Clients
Cache activity
Transaction Rate
Cache Miss Rate
Garbage collection
All statistics
demo.sharededitor.controls.Dispatcher.objmgr (demo.sharededitor.models.ObjectManager)
demo.sharededitor.models.ObjectManager.objList (java.util.Collections$SynchronizedRandom
java.util.Collections$SynchronizedCollection.c (java.util.ArrayList) [3/3]
java.util.Collections$SynchronizedCollection.mutex (java.util.Collections$SynchronizedRand
java.util.Collections$SynchronizedList.list (java.util.ArrayList) [3/3]
0 (demo.sharededitor.models.Square)
demo.sharededitor.models.BaseObject.background (java.awt.Color)
demo.sharededitor.models.BaseObject.fillstyle (java.lang.Integer)=1
demo.sharededitor.models.BaseObject.foreground (java.awt.Color)
demo.sharededitor.models.BaseObject.grabbedAnchor (java.lang.Integer)=-1
demo.sharededitor.models.BaseObject.listeners (java.util.Collections$Synchronized
demo.sharededitor.models.BaseObject.stroke (java.awt.BasicStroke)
demo.sharededitor.models.BaseObject.texture=null
demo.sharededitor.models.Square.shape (java.awt.geom.RoundRectangle2D$Doub
demo.sharededitor.models.Square.x1 (java.lang.Integer)=242
demo.sharededitor.models.Square.x2 (java.lang.Integer)=147
demo.sharededitor.models.Square.y1 (java.lang.Integer)=70
demo.sharededitor.models.Square.y2 (java.lang.Integer)=138
1 (demo.sharededitor.models.Circle)
2 (demo.sharededitor.models.Image)
Console
localhost:9520
'/Users/tgautier/terracotta-2.3.0/samples/pojo/sharededitor/tc-config.xml'.

tc-config.xml

- Roots
- Locks
- Instrumented Classes
- Transient Fields
  - Marking
  - Resolving

Configuring Roots in tc-config.xml

```
<roots>
  <root>
    <field-name>org.pkg.MyClass.aField</field-name>
  </root>
  <root>
    <field-name>org.pkg.MyClass.field2</field-name>
  </root>
</roots>
```

Terracotta Locks

- Four types of locks
  - One
  - Two
  - Three
  - Four
- All changes to a Terracotta managed object must be done in the scope of a lock
- You do not need a lock on the object you are changing
- Locks are the *Transactions* of Terracotta

Configuring Locks in tc-config.xml

```
<locks>
  <autolock auto-synchronized="false">
    <method-expression>*
org.pkg.MyClass.method(..)</method-expression>
    <lock-level>write</lock-level>
  </autolock>
  <autolock auto-synchronized="false">
    <method-expression>* org.pkg.SomeClass$Inny.run(..)</
method-expression>
    <lock-level>write</lock-level>
  </autolock>
</locks>
```

Instrumented Classes

- Each instrumented class can or must configure the following section
  - class-expression (required)
  - honor-transient (optional)
  - on-load (optional)
- Optional instrumented-classes section
  - exclude (optional)

Configuring Instrumented Classes in tc-config.xml

```
<instrumented-classes>
  <include>
      <class-expression>org.pkg.MyClass</class-expression>
      <honor-transient>true</honor-transient>
      <on-load><execute><![CDATA[self.log =
org.apache.commons.logging.LogFactory.getLog(org.pkg.MyClass.class);
]]></execute></on-load>
  </include>
  <include>
      <class-expression>org.pkg.YourClass</class-expression>
      <honor-transient>true</honor-transient>
      <on-load>
        <method>resolveTransientFields</method>
      </on-load>
  </include>
</instrumented-classes>
```

Resolving Transient Fields

- Transient Fields may be specified 2 ways
  - Transient keyword in the Java source file and corresponding property to honor transient keyword in tc-config.xml
  - Explicitly declaring a field as transient in the tc-config.xml file
- Transient Fields may be resolved in 2 ways
  - BeanShell script in tc-config.xml
  - Calling a method on the resolved object

Resolving a Transient Field with BeanShell

```
<instrumented-classes>
  <include>
      <class-expression>org.pkg.MyClass</class-expression>
      <honor-transient>true</honor-transient>
      <on-load>
        <execute><![CDATA[self.log =
org.apache.commons.logging.LogFactory.getLog(org.pkg.MyClass.cla
ss);]]></execute>
      </on-load>
  </include>
</instrumented-classes>
```

Resolving a Transient Field with Java

```
<instrumented-classes>
  <include>
      <class-expression>org.pkg.YourClass</class-expression>
      <honor-transient>true</honor-transient>
      <on-load>
        <method>resolveTransientFields</method>
      </on-load>
  </include>
</instrumented-classes>
```

Terracotta Integration Modules

Terracotta Integration Modules

- TIM (Terracotta Integration Module)
  - OSGi bundle
  - Maven artifact

- Use to decompose your tc-config.xml
- Let different application components manage their own tc-config.xml configuration bits
- Maven support for building a TIM

Using a TIM in tc-config.xml

```
<clients>
   <logs>/var/logs/terracotta/client/</logs>
   <statistics>/var/logs/terracotta/clientstats</statistics>
   <modules>
      <repository>/opt/local/tc-repo/</repository>
      <module name="tim-mytim" version="1.2.3" group-
id="org.pkg"/>
      <module name="tim-yourtim" version="2.0.7" group-
id="org.pkg"/>
   </modules>
</clients>
```

Creating a TIM with Maven

```
<plugins>
  <plugin>
    <groupId>org.terracotta.maven.plugins</groupId>
    <artifactId>tc-maven-plugin</artifactId>
  </plugin>
  <plugin>
    <groupId>org.apache.maven.plugins</groupId>
    <artifactId>maven-jar-plugin</artifactId>
  </plugin>
</plugins>
```

For a complete example look at the following pom.xml file
https://source.sakaiproject.org/svn/kernel/trunk/kernel-tim/pom.xml

Hello World

(in Terracotta)

Code Sample

```
Insert Code Here
```

Lessons Learned

Lessons Learned

- Serializable, Transient, Synchronization
- Course Grained Locking versus Fine Grained Locking
- Cluster-wide Locking
- TIMs

Lessons Learned

- Partitioning your data
  - Avoiding iterating over all objects in a Root collection
- Minor field updates vs Full object replacements
- Instrumenting ALL classes that access shared objects
- Avoid direct field access (use setters instead)
- Avoid non-static inner classes (they require storage of the outer class)

Different Uses for Terracotta

Different Uses for Terracotta

- Clustering your application for server failover
  - Transparent session migration
- Hibernate second level cache mirroring
- General purpose cache mirroring
- Pseudo Object Database

Resources

Resources

- *Cluster-enabling Sakai with Terracotta*
  - Tuesday, 10:15 am
- Websites
  - Open Source http://www.terracotta.org/
  - Commercial http://www.terracottatech.com/
- Website Resources
  - Downloads
  - Documentation
  - Forums
- Book
  - *The Definitive Guide to Terracotta*, ISBN-13: 978-1590599860

Questions & Answers

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