

Apache

Apache TomEE, Java EE 6 Web Profile on Tomcat

TomEE
OpenEJB
OpenJPA
OpenWB
MyFaces
Tomcat

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@dblevins
#TomEE



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What is Apache TomEE?



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Tomcat + JavaEE = TomEE

- Java EE 6 Web Profile certified stack, pronounced “Tommy”
- Tomcat
- All Apache components
 - OpenJPA
 - OpenWebBeans
 - OpenEJB
 - MyFaces
 - BeanVal
 - CXF & ActiveMQ
- Core Values
 - Be small
 - Be certified
 - Be Tomcat

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What is a “Web Profile”?



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The Web Profile

- Introduced in Java EE 6
- About half the specs as the Full Profile
 - 12~ in the Web Profile
 - 24~ in the Full Profile
- Legacy-free, contains no
 - CMP EntityBeans
 - CORBA
 - JAX-RPC
- Missing some good stuff
 - JAX-RS
 - JAX-WS
 - JMS
 - Connectors (surprisingly useful)



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Flavors of TomEE

- Apache TomEE **Web Profile** (Java EE 6 Certified)
 - JPA
 - CDI
 - EJB
 - JSF
 - Bean Validation
 - JavaMail *
- Apache TomEE **JAX-RS** (Java EE 6 Certified) *NEW*
 - JAX-RS
- Apache TomEE **Plus** (NOT Java EE 6 Certified)
 - JAX-WS
 - Connector
 - JMS



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Happy Birthday, TomEE!



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Apache TomEE Releases

- 1.0.0 Beta 1
 - JavaOne 2011
 - Entering the show
- 1.0.0 Beta 2
 - January 2012
 - Closing gaps
- 1.0.0 Final
 - April 2012
 - Nailed it
 - Flood of feedback
- 1.5.0
 - October 2012

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“There is also one point to note. TomEE is insanely fast!”

-- Łukasz Budnik, CXF JAX-RS on Apache TomEE @ DZone, May 23rd 2012

“From an architect that switched from <XXX> to Tomee. I can tell you Tomee kicks <XXX>'s ass in every way. Memory, speed, reliability, validation, you name it.”

-- Zeeman, User List, July 3rd 2012

“If you are concerned about performance and footprint, but can accept that you'll have to solve problems yourself, go TomEE. (TomEE seems to be much faster than <XXX>)”

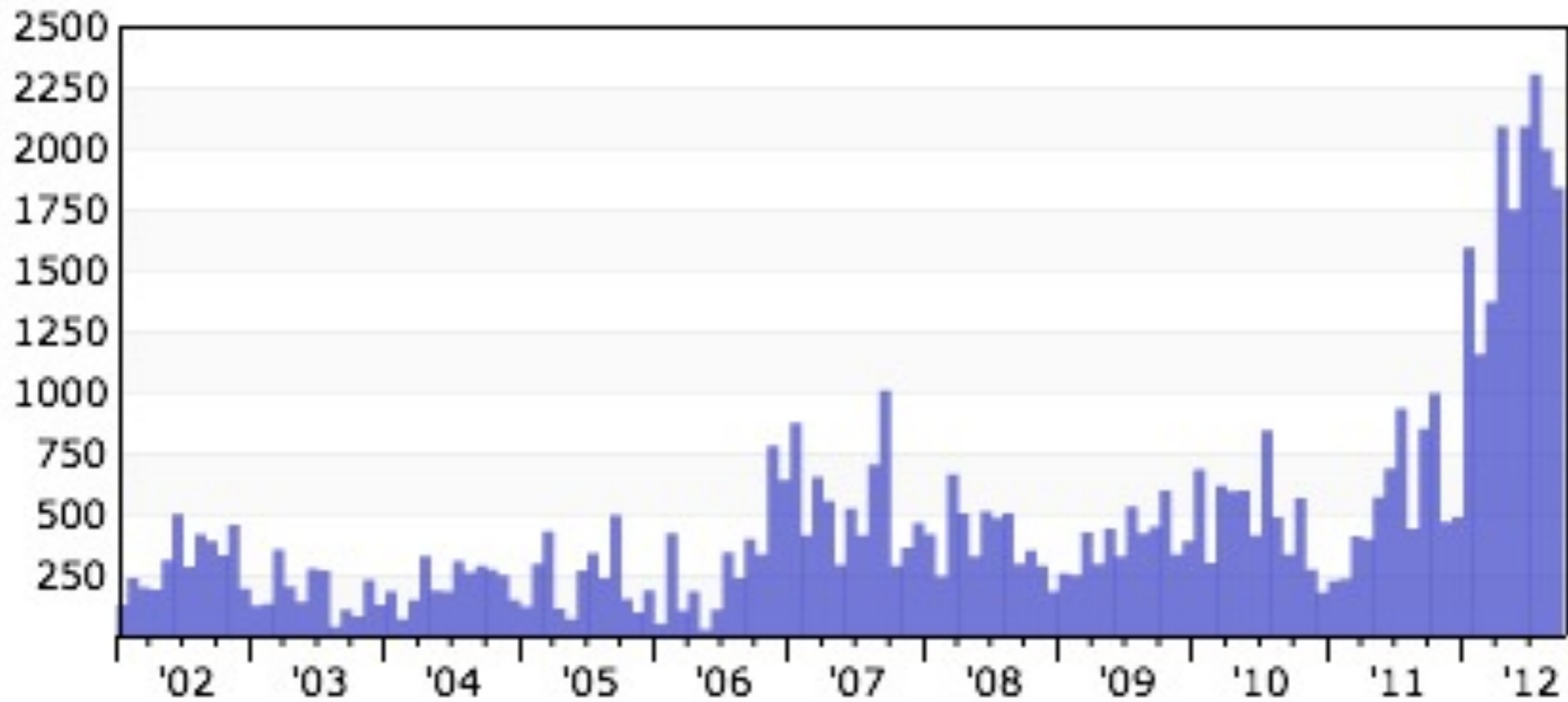
-- Jonathan Fisher, User List, July 3rd 2012

Website Traffic



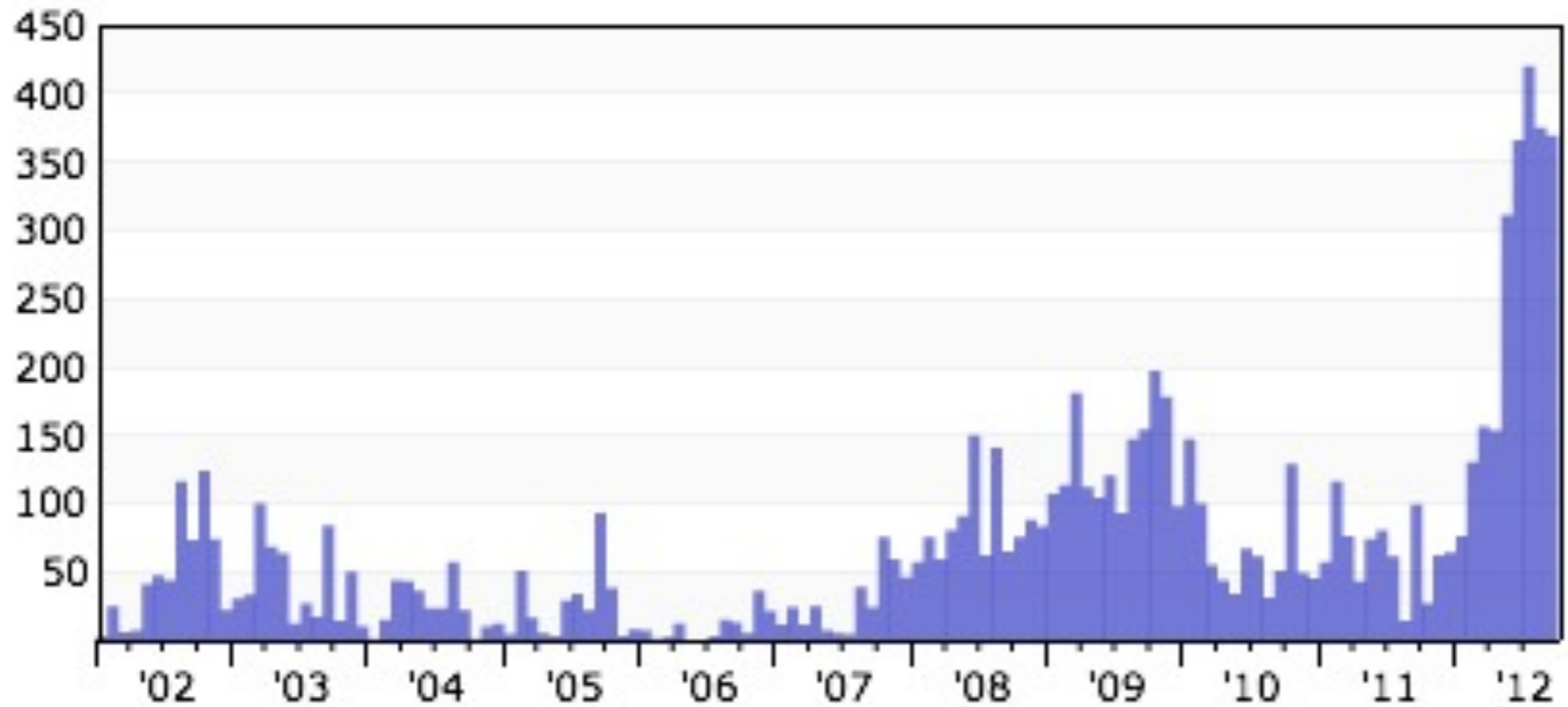
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Mailing List Traffic



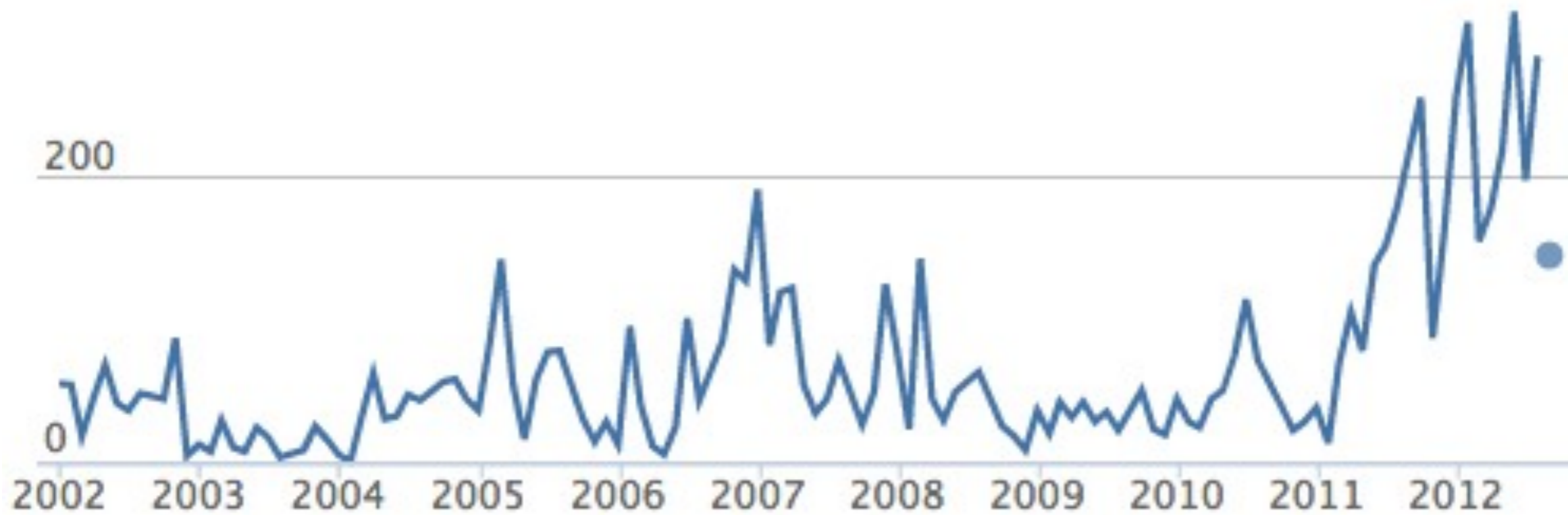
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User List Traffic



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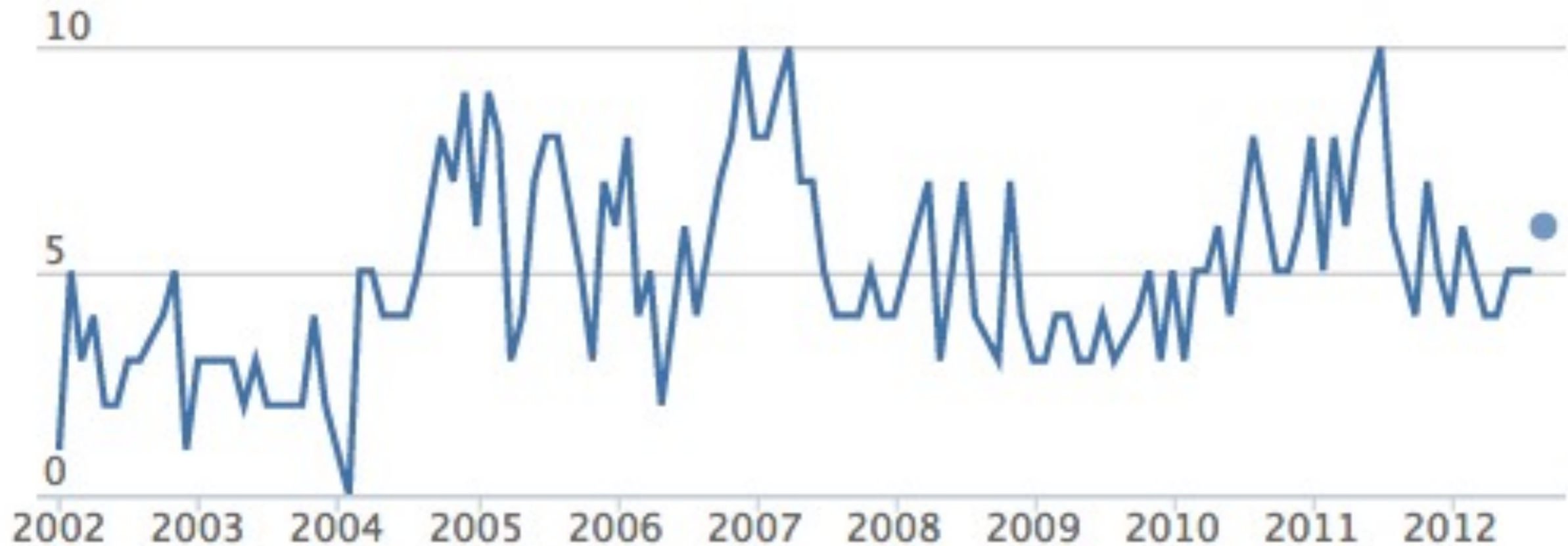
Commits Per Month



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Contributors Per Month

(help needed)



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How to Help

- Contribute
 - Code
 - **Documentation**
 - Help on User List
- Evangelize
 - Tweet
 - **Blog**
 - **Articles**
- Say Thank You
 - Like on Facebook
 - Circle on Google Plus
 - Follow on Twitter
 - Add 'TomEE' to LinkedIn 'Skills & Experiences'

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Demo

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Making TomEE

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We do it like you do it
-- *Burger King*

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Files Added

conf/

system.properties tomee.xml

bin/

TomEE.*.exe service*.bat tomee.sh

endorsed/

annotation-api.jar jaxb-impl.jar
jaxb-api.jar

lib/

bval-*.jar	myfaces-*.jar
commons-*.jar	openejb-*.jar
geronimo-javamail.jar	openjpa-*.jar
geronimo-transaction.jar	openwebbeans-*.jar
gson.jar	quartz.jar
howl.jar	serp.jar
hsqldb.jar	slf4j-*.jar
jansi.jar	swizzle-stream.jar
javaee-api.jar	tomee-*.jar
javassist.jar	wsdl4j.jar
mbean-annotation-api.jar	xbean-*.jar

Files Modified

- conf/server.xml

```
conf server.xml.diff # embed raw
1 --- conf/server.xml
2 +++ conf/server.xml
3 @@ -20,6 +20,8 @@
4     Documentation at /docs/config/server.html
5     -->
6     <Server port="8005" shutdown="SHUTDOWN">
7 +   <!-- TomEE plugin for Tomcat -->
8 +   <Listener className="org.apache.tomee.catalina.ServerListener" />
9     <!-- Security listener. Documentation at /docs/config/listeners.html
10    <Listener className="org.apache.catalina.security.SecurityListener" />
11    -->
```


Files Modified

- bin/catalina.sh
 - optional - only needed if using OpenJPA or EclipseLink and no build-time enhancement

```
bin catalina.sh.diff # embed raw  
1 --- bin/catalina.sh  
2 +++ bin/catalina.sh  
3 @@ -237,6 +237,11 @@  
4 # org.apache.catalina.security.SecurityListener  
5 #JAVA_OPTS="$JAVA_OPTS -Dorg.apache.catalina.security.SecurityListener.UMASK=`umask`"  
6  
7 +# Add OpenEJB javaagent  
8 +if [ -r "$CATALINA_HOME/lib/openejb-javaagent.jar" ]; then  
9 +  JAVA_OPTS="$JAVA_OPTS -javaagent:$CATALINA_HOME/lib/openejb-javaagent.jar" $JAVA_OPTS"  
10 +fi  
11 +  
12 # ----- Execute The Requested Command -----  
13  
14 # Bugzilla 37848: only output this if we have a TTY
```

Files Removed

- lib/annotations-api.jar
 - non-compliant, replaced by *endorsed/annotations-api.jar*
- lib/el-api.jar
 - not needed, replaced by *lib/javaee-api.jar*
- webapps/examples/
 - whim, could have easily been left there

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Testing

- Our own tests (hour+)
 - Arquillian based
 - Each test run 4 to 5 times
- Certification Tests on Amazon EC2 (hundred+ machine hours)
 - t1.micro linux images, lot's of them
 - 100 spot instances going at once!
 - Each has 613MB memory max
 - Pass complete Web Profile TCK with default jvm memory (tiny!)
- Current certified OSs
 - Amazon Linux AMI 2011.09, EBS boot, 32-bit EC2 t1.micro
 - Amazon Linux AMI 2011.09, EBS boot, 32-bit EC2 m1.small
 - Amazon Linux AMI 2011.09, EBS boot, 32-bit EC2 c1.medium



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Results

- Small
 - 27MB zip
 - 64MB memory
- Works with Tomcat tools (it is Tomcat)
 - Eclipse, Netbeans, IntelliJ
 - YourKit, JRebel, NewRelic, etc.....
- Tightly integrated
 - All about the code you don't write
- Hundreds of hours of testing
 - Unit, Integration, Compliance
- Certified
 - Java EE 6 Web Profile portability



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Doing it Yourself

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Perils of doing it yourself

- Wasted time you could spend coding
- Actually slower, not faster
 - Tomcat will scan all your jars
 - ... so will your JSF implementation
 - ... so will your CDI implementation
 - ... so will your JAX-RS implementation
 - ... so will your JPA implementation... and so on
- Bloated memory from duplicate classes
- Incomplete parts
 - OpenJPA missing JTA/EXTENDED EntityManagers
 - OpenWebBeans runs 60% of CDI TCK
 - Tomcat has no “java:global/” JNDI, @DataSourceDefinition, and more



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Perils of doing it yourself

- Incomplete integration
 - connection, transaction, security propagation
 - increased cohesion in specifications
- Get by with a little help from friends
 - No way to share bug fixes
 - If only there was community for Tomcat integration....
- Under Tested
 - 1000s of integration tests required
 - Each upgrade is a mystery
 - If only there was a community for sharing tests....
- No portability
 - Hard changing parts
 - Even harder changing servers



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Arquillian

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All your bugs
are belong to us



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Arquillian Adapters

- TomEE Remote Adapter
 - For separate running TomEE process
 - Managed and Unmanaged
- TomEE Embedded Adapter
 - Runs TomEE in the test, embedded
- Tomcat + TomEE.war file
 - Start with a Tomcat install
 - Deploys the TomEE.war
- OpenEJB Embedded Adapter
 - Everything but Servlet, JSP, JSF
 - Much Faster



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Maven

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All programs evolve until
they can send email
-- Letts' Law



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tomEE-maven-plugin

- Configure and setup servers from scratch
- Start/stop servers
- Deploy/undeploy apps

```
<plugin>
  <groupId>org.apache.openejb.maven</groupId>
  <artifactId>tomEE-maven-plugin</artifactId>
  <version>1.0.0</version>
  <configuration>
    <tomEEVersion>1.5.0</tomEEVersion>
    <tomEEClassifier>plus</tomEEClassifier>
    <debug>>false</debug>
    <debugPort>5005</debugPort>
    <args>-Dfoo=bar</args>
    <config>${project.basedir}/src/test/tomEE/conf</config>
    <libs>
      <lib>mysql:mysql-connector-java:5.1.20</lib>
    </libs>
    <webapps>
      <webapp>org.superbiz:myapp:4.3:war?name=ROOT</webapp>
      <webapp>org.superbiz:api:1.2:war</webapp>
    </webapps>
  </configuration>
</plugin>
```



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Validation

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OverworkedBean

```
@EJB(beanName = "NoSleep")
@Resource(name = "my/DataSource")
@Stateless
public class OverworkedBean implements Overworked {

    @Resource
    private EntityManager myEntityManager;

    @Resource
    private EntityManagerFactory myEntityManagerFactory;

    @Init
    public void comeInEarly() {
    }

    @Remove
    public void stayLater() {
    }

    public void doThisRealQuick(Object task) {
    }

    public boolean isItDoneYet() {
        return false;
    }
}
```



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Business Interface

```
@Local
public interface Overworked {

    @PostConstruct
    public void comeInEarly();

    @TransactionAttribute(SUPPORTS)
    public boolean isItDoneYet();

    @RolesAllowed("Manager")
    @TransactionAttribute(MANDATORY)
    public void doThisRealQuick(Object task);

    @PreDestroy
    public void stayLater();
}
```

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Validation Results

```
FAIL ... OverworkedBean: Missing required "name" attribute on class-level @EJB usage
FAIL ... OverworkedBean: Missing required "beanInterface" attribute on class-level @EJB usage
FAIL ... OverworkedBean: Missing required "type" attribute on class-level @Resource usage
FAIL ... OverworkedBean: Mistaken use of @Resource on an EntityManager reference. Use @PersistenceContext
FAIL ... OverworkedBean: Mistaken use of @Resource on an EntityManagerFactory reference. Use @PersistenceUnit
WARN ... OverworkedBean: Ignoring @PostConstruct used on interface org.superbiz.Overworked method comeInEarly
WARN ... OverworkedBean: Ignoring @PreDestroy used on interface org.superbiz.Overworked method stayLater
WARN ... OverworkedBean: Ignoring @RolesAllowed used on interface org.superbiz.Overworked method doThisReally
WARN ... OverworkedBean: Ignoring @TransactionAttribute used on interface org.superbiz.Overworked method doThisReally
WARN ... OverworkedBean: Ignoring @TransactionAttribute used on interface org.superbiz.Overworked method doThisReally
WARN ... OverworkedBean: @Remove is ignored for beans of type Stateless. Method: stayLater
WARN ... OverworkedBean: @Init is ignored for beans of type Stateless. Method: comeInEarly
WARN ... OverworkedBean: Corrected invalid injection-target-name: setMyNumber
```



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Configuration

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Tomcat Options

- **No rip and replace**
- System Level
 - `conf/server.xml`
- App Level
 - `META-INF/context.xml`
- Standard configuration options still work
 - Resources available too all components: EJBs, CDI, JSF
- Connection pooling still **not** JTA aware!
- All Security done with Tomcat Realms
 - EJB security
 - WebService Security
 - Use your custom Realm implementation

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Additional Options

- System Level
 - `conf/tomee.xml`
 - `conf/system.properties`
- Process Level
 - `plain -D properties`
- App Level
 - `META-INF/context.xml`
 - `META-INF/resources.xml`
 - `META-INF/application.properties`



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conf/tomee.xml

```
<tomee>
  <TransactionManager id="myTransactionManager">
    DefaultTransactionTimeout = 10 minutes
  </TransactionManager>

  <SecurityService id="mySecurityService">
    DefaultUser = guest
  </SecurityService>

  <Container id="myStatelessContainer" type="STATELESS">
    StrictPooling = true
    MaxSize      = 11
    MinSize      = 5
    ReplaceAged  = true
    MaxAge       = 1 day
    IdleTimeout  = 30 minutes
    SweepInterval = 3 minutes
  </Container>

  <Resource id="myDataSource" type="DataSource">
    UserName      = joe
    Password      = cool
    JdbcDriver     = org.hsqldb.jdbcDriver
    JdbcUrl        = jdbc:hsqldb:mem:hsqldb
    MaxActive      = 10
    MaxIdle        = 5
    JtaManaged    = true
    MinEvictableIdleTime = 15 minutes
    TimeBetweenEvictionRuns = 5 minutes
  </Resource>
</tomee>
```

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Not Case-Sensitive

```
<tomee>

<TransactionManager id="myTransactionManager">
  defaultTRANSACTIONtimeout = 10 minutes
</TransactionManager>

<SecurityService id="mySecurityService">
  DEFAULTuser = guest
</SecurityService>

<Container id="myStatelessContainer" type="STATELESS">
  STRICTpooling = true
  maXSize      = 11
  minSIZE     = 5
  REPLACEAGED = true
  MAXAGE      = 1 day
  IDLEtimeOUT = 30 minutes
  sweepINTERVAL = 3 minutes
</Container>

<Resource id="myDataSource" type="DataSource">
  username = joe
  Password = cool
  jdbcDriver = org.hsqldb.jdbcDriver
  JDBCURL = jdbc:hsqldb:mem:hsqldb
  maXActive = 10
  MAXIDLE = 5
  JTAMANAGED = true
  MINEVICTABLEIDLETIME = 15 minutes
  timebetweenevictionruns = 5 minutes
</Resource>
```

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Be as Brief as you Want

```
<tomee>  
  
  <TransactionManager id="myTransactionManager" />  
  
  <SecurityService id="mySecurityService" />  
  
  <Container id="myStatelessContainer" type="STATELESS">  
    ReplaceAged    = true  
    MaxAge         = 1 day  
  </Container>  
  
  <Resource id="myDataSource" type="DataSource">  
    Username       = joe  
    Password       = cool  
    MinEvictableIdleTime = 15 minutes  
    TimeBetweenEvictionRuns = 5 minutes  
  </Resource>  
  
</tomee>
```

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...really

```
<tomee>  
  <Resource id="myDataSource" type="DataSource">  
    Username = joe  
    Password = cool  
  </Resource>  
</tomee>
```

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...really brief

```
<tomEE>
```

```
</tomEE>
```

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Human Readable Durations

```
<tomee>  
  
  <TransactionManager id="myTransactionManager">  
    DefaultTransactionTimeout = 2 minutes and 2 seconds  
  </TransactionManager>  
  
  <Container id="myStatelessContainer" type="STATELESS">  
    MaxAge          = 1 day, 5 hours, 42 minutes, 3 seconds  
    IdleTimeout     = 5 hours and 15 minutes and 9 seconds  
    SweepInterval  = 2 minute  
  </Container>  
  
  <Resource id="myDataSource" type="DataSource">  
    MinEvictableIdleTime = 15 min  
    TimeBetweenEvictionRuns = 5 m  
  </Resource>  
  
</tomee>
```

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Comments Welcome

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```
<tomee>  
  <TransactionManager id="myTransactionManager">  
    # NEVER change this ...  
    # unless you want to carry the beeper for a month  
    DefaultTransactionTimeout = 2 minutes and 2 seconds  
  </TransactionManager>  
</tomee>
```



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Do it in the App

- META-INF/resources.xml

```
<resources>  
  <Container id="myStatelessContainer" type="STATELESS">  
    StrictPooling = true  
    MaxSize       = 11  
    MinSize       = 5  
    ReplaceAged   = true  
    MaxAge        = 1 day  
    IdleTimeout   = 30 minutes  
    SweepInterval = 3 minutes  
  </Container>  
  <Resource id="myDataSource" type="DataSource">  
    UserName      = joe  
    Password       = cool  
    JdbcDriver     = org.hsqldb.jdbcDriver  
    JdbcUrl        = jdbc:hsqldb:mem:hsqldb  
    MaxActive      = 10  
    MaxIdle        = 5  
    JtaManaged    = true  
    MinEvictableIdleTime = 15 minutes  
    TimeBetweenEvictionRuns = 5 minutes  
  </Resource>  
</resources>
```



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Hate XML?

conf/system.properties

```
myTransactionManager = new://TransactionManager  
myTransactionManager.defaultTransactionTimeout = 10 minutes
```

```
mySecurityService = new://SecurityService  
mySecurityService.defaultUser = guest
```

```
myStatelessContainer = new://Container?type=STATELESS  
myStatelessContainer.StrictPooling = true  
myStatelessContainer.MaxSize = 11  
myStatelessContainer.MinSize = 5  
myStatelessContainer.ReplaceAged = true  
myStatelessContainer.MaxAge = 1 day  
myStatelessContainer.IdleTimeout = 30 minutes  
myStatelessContainer.SweepInterval = 3 minutes
```

```
myDataSource = new://Resource?type=DataSource  
myDataSource.UserName = joe  
myDataSource.Password = cool  
myDataSource.JdbcDriver = org.hsqldb.jdbcDriver  
myDataSource.JdbcUrl = jdbc:hsqldb:mem:hsqldb  
myDataSource.MaxActive = 10  
myDataSource.MaxIdle = 5  
myDataSource.JtaManaged = true  
myDataSource.MinEvictableIdleTime = 15 minutes  
myDataSource.TimeBetweenEvictionRuns = 5 minutes
```



Plain Java Properties

- JAVA_OPTS in a script

```
set JAVA_OPTS="-DmyDataSource=new://Resource?type=DataSource \  
-DmyDataSource.UserName=total \  
-DmyDataSource.Password=awesomeness \  
-DmyDataSource.jdbcDriver=org.hsqldb.jdbcDriver \  
-DmyDataSource.jdbcUrl=jdbc:hsqldb:mem:hsqldb"
```



Mixed

- conf/tomee.xml

```
<tomee>  
  <TransactionManager id="myTransactionManager">  
    DefaultTransactionTimeout = 10 minutes  
  </TransactionManager>  
</tomee>
```

- META-INF/resources.xml

```
<resources>  
  <Resource id="myDataSource" type="DataSource">  
    Username      = joe  
    JdbcDriver    = org.hsqldb.jdbcDriver  
    JdbcUrl       = jdbc:hsqldb:mem:hsqldb  
  </Resource>  
</resources>
```

- JAVA_OPTS in a script

```
set JAVA_OPTS=" \  
  -DmyDataSource.Username=total \  
  -DmyDataSource.Password=awesomeness \  
  -DmyTransactionManager.DefaultTransactionTimeout=1hour"
```



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Extending

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Extending (configuration)

- META-INF/resources.xml via <Resource class-name="">

```

<resources>

  <Resource id="shade" class-name="org.superbiz.Color">
    red = 255
    green = 0
    blue = 0
  </Resource>

  <Resource id="twitter" class-name="org.superbiz.Twitter">
    apiKey = %jliYNDjasdjkfhjhaf
    consumerKey = %jliYNDjasdjkfhjhaf
    consumerSecretKey = d9%^hjdHJKLF78wHJKLlhdfafiuywdjauyh
    requestTokenUrl = https://api.twitter.com/oauth/request_token
    authorizeUrl = https://api.twitter.com/oauth/authorize
  </Resource>

</resources>

```

- Injectable via @Resource

```

@Resource
private Twitter twitter;

@Resource(name = "shade")
private Color color;

```



Extending (runtime events)

- CDI-style @Observes

```
public void myCode(@Observes AssemblerAfterApplicationCreated event) {  
    //...  
}
```

- Registered via <Service> in META-INF/resources.xml

```
<resources>  
    <Service id="myEventLogger" class-name="org.superbiz.EventLogger"/>  
</resources>
```

- Not quite CDI (yet)
- 27 client-side events
- 12 server-side events
- more events coming...



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```
public class EventLogger {  
  
    public void log(@Observes ClusterMetaDataUpdated event) {  
        final Logger logger = Logger.getLogger(event.getClass().getName());  
  
        final ClusterMetaData cluster = event.getClusterMetaData();  
  
        final String msg = event.toString();  
  
        if (logger.isLoggable(Level.FINE)) {  
            logger.log(Level.FINE, msg);  
        }  
  
        if (logger.isLoggable(Level.FINER)) {  
            int i = 0;  
            for (URI uri : cluster.getLocations()) {  
                final String format = String.format("%s # %s %s", msg, ++i, uri.toASCIIString());  
                logger.log(Level.FINER, format);  
            }  
        }  
    }  
  
    public void log(@Observes Object event) {  
        final Log log = event.getClass().getAnnotation(Log.class);  
  
        if (log == null) return;  
  
        final Logger logger = Logger.getLogger(event.getClass().getName());  
  
        try {  
            final Level level = Level.parse(log.value().name());  
  
            if (logger.isLoggable(level)) {  
                logger.log(level, event.toString());  
            }  
        } catch (IllegalArgumentException e) {  
            logger.log(Level.WARNING, event.toString());  
        }  
    }  
}
```

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Failover Client-Side Events

```

public void observe(@Observes RemoteInitialContextCreated event);

public void observe(@Observes ServerAdded event);
public void observe(@Observes ServerRemoved event);

public void observe(@Observes ConnectionPoolCreated event);
public void observe(@Observes ConnectionPoolTimeout event);

public void observe(@Observes ConnectionOpened event);
public void observe(@Observes ConnectionFailed event);

public void observe(@Observes RequestFailed event);
public void observe(@Observes RetryingRequest event);

public void observe(@Observes FailoverSelection event);
public void observe(@Observes RandomFailoverSelection event);
public void observe(@Observes RoundRobinFailoverSelection event);
public void observe(@Observes StickyFailoverSelection event);
    
```



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Management and Monitoring

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OpenJPA
OpenWB
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Tomcat



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Management and Monitoring

- JMX
 - Webapp JMX deployment / apps (Tomcat)
 - EJB Servers / Containers / Invocation stats (OpenEJB)
 - JMS Topic / Queue / Subscriber / Broker (ActiveMQ)
 - PersistenceUnit redeploy
 - Database Pools
 - Discovered servers / peers
 - more coming...
- REST (soon)
 - Just idea at this point
 - Tiny bit available via 'tomee' console
 - Would be great to have REST equivalents of all JMX beans



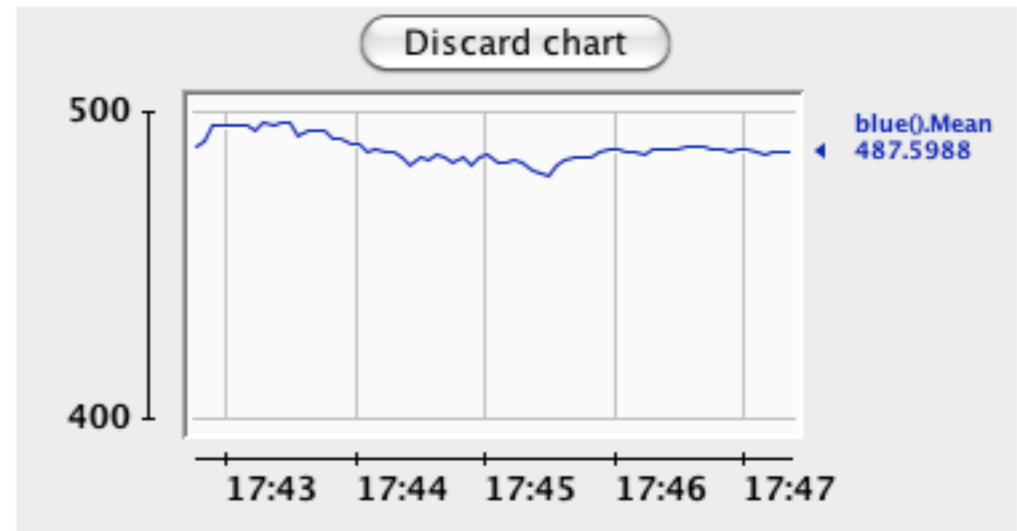
pid: 15117 org.apache.openejb.monitoring.MethodScratchPad

Overview Memory Threads Classes VM Summary **MBeans**

- JMImplementation
- com.sun.management
- java.lang
- java.util.logging
- something
- Invocations
 - Attributes**
 - Operations

Attribute values

Name	Value
Invocations	1171
MonitoredMethods	4
blue().Count	339
blue().GeometricMean	348.00617452679546
blue().Kurtosis	-1.3341898656067332
blue().Max	997.0
blue().Mean	487.5988
blue().Min	2.0
blue().Percentile01	8.799999999999999
blue().Percentile10	88.0
blue().Percentile25	217.0
blue().Percentile50	466.0
blue().Percentile75	769.0
blue().Percentile90	894.0
blue().Percentile99	983.0000000000001
blue().SampleSize	2000
blue().Skewness	0.04827245186828253
blue().StandardDeviation	298.8332609808119
blue().Sum	165296.0
blue().Sumsq	1.1078198E8
blue().Variance	89301.317868426
green().Count	215
green().GeometricMean	0.0
green().Kurtosis	-1.093680063077513
green().Max	999.0
green().Mean	525.6093023255813
green().Min	0.0



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Tuning

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Scanning

- META-INF/scan.xml
- Usable in any jar
- Speeds loading of large jars
- Match packages

```
<scan>  
  <packages>  
    <package>org.superjava</package>  
  </packages>  
</scan>
```

- Match classes

```
<scan>  
  <classes>  
    <class>org.superbiz.color.Red</class>  
    <class>org.superbiz.color.Green</class>  
    <class>org.superbiz.kind.of.Blue</class>  
  </classes>  
</scan>
```



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Clust...^H...
Cloud Features

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Cloud

- Existing
 - Super tiny size
 - Certified on EC2 t1.micro, m1.small, c1.medium
 - TCP and UDP server discovery
 - Standard Tomcat clustering... er... *cloudstering*
 - EJB client load-balancing and failover (stateless)
 - Maven based provisioning
- Desired
 - Multi-server console w/ monitoring and deployment
 - Queue based auto-scaling (add/remove nodes)
 - Cloud scoped @Singletons
 - Cloud-wide @Observers and Events
 - Cloud-wide Timers and @Schedule methods
 - Amazon BeanStalk w/ TomEE

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Cloud Feature Requests?

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