Using JMeter for Testing a Data Center

Siegfried Goeschl
“Siegfried, do you want to do some performance testing?”

“Well, what would you like to test?”
“Some Data Centers with 300 servers, MSSQL clusters, Oracle RACs, large SAN storage, 1.5 million registered users, 750 call center agents, backup data center over dark fiber”
The Challenge Ahead

- Performance testing on critical path
  - Prohibitive contractual penalties
- Lots of politics and finger-pointing
  - “Your performance tests are broken”
- Complex test scenarios
  - Often broken by new deployment
Performance Test Scope

- End to end performance acceptance test
- Mandatory and client-witnessed test
- Strict acceptance criteria regarding
  - throughput
  - number of errors
  - severity of errors
Subsystems Under Test

- Transaction web service interface processing 10,5 million transactions per day
- CRM web service interfaces being used by 750 concurrent call center agents
- Public self-care web portal supporting 400 concurrent & active web user sessions
# Performance Test Types

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Test</td>
<td>One hour average load</td>
</tr>
<tr>
<td>Stress Test</td>
<td>One hour peak load</td>
</tr>
<tr>
<td>Endurance Test</td>
<td>24 hours maximum load</td>
</tr>
</tbody>
</table>
Performance Test Tools

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Planned</th>
<th>Delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRM Web Service</td>
<td><img src="#" alt="JMeter" /></td>
<td><img src="#" alt="JMeter" /></td>
</tr>
<tr>
<td>Public Web Portal</td>
<td><img src="#" alt="JMeter" /></td>
<td><img src="#" alt="WAPTPro" /></td>
</tr>
<tr>
<td>Transaction Interface</td>
<td><img src="#" alt="soapUIpro" /></td>
<td><img src="#" alt="JMeter" /></td>
</tr>
</tbody>
</table>
Testing Hardware

• Six dedicated load injectors
  ‣ Windows 2008 Server
  ‣ 3 physical and 3 virtual boxes
  ‣ Dual quad-cores with 8 GB RAM
• No direct access
  ‣ Citrix over RDP over RDP
What Is JMeter?

• Performance Test Tool
  ▶ Web Testing (HTTP/HTTPS)
  ▶ SOAP
  ▶ JDBC, LDAP, SMTP, JMS, ....
Why Using JMeter?

- It’s coming from the ASF
- Field-tested software
- No costs for virtual users
- Extensible using scripts and Java libraries
- Run from GUI, Ant task and command line
JMeter Goodies

- Proxy server to record script
- Save request and response on error
- Constant Throughput Timer
- Summarizer for non-GUI tests
- Remote shutdown of running tests
Speed Up JMeter

- Use SOAP/XML-RPC Request Sampler
  - faster than WebService(SOAP) Sampler
- Avoid HTTPS when possible
- BeanShell scripts work best
- Minimize scripting
- Move large junk of scripting into libraries
JMete Ant Integration

<jmeter
  jmeterhome="${jmeter.home}"
  testplan="${jmeter.test.script}"
  failureproperty="jmeter.test.failure"
  jmeterproperties="${jmeter.work.dir}/jmeter.properties"
  resultlog="${jmeter.test.result}">
  <jvmarg value="-Xmx${jmeter.memory.max}" />
  <jvmarg value="-Dsun.security.ssl.allowUnsafeRenegotiation=true" />
  <property name="jmeterengine.nongui.port" value="${nongui.port}" />
  <property name="log_file" value="${jmeter.report.dir}/jmeter.log" />
  <property name="user.language" value="en" />
</jmeter>
Things We Did To JMeter

• Three million WS requests over HTTPS requests where the server closes the socket after each request
• Sending up to 400 SOAP requests / sec
• Sending 400 KB SOAP requests
  ▸ 70 MByte/sec over the wire
• Using up to 750 worker threads per JVM
  ▸ 64-bit JVM with -Xmx=2048M
JMeter Reporting
ASP.NET Website
JMeter Reporting

- No “Service Level Agreement” reporting
- HTML reports done using XSLT
- XSLT does not scale
  - We have huge JMeter result files
  - Unable to create formal test report
JMeter Reporting

Load Test Results

Summary

<table>
<thead>
<tr>
<th>Tests</th>
<th>Failures</th>
<th>Success Rate</th>
<th>Average Time</th>
<th>Min Time</th>
<th>Max Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,997,465</td>
<td>58</td>
<td>99.9994 %</td>
<td>41 ms</td>
<td>2 ms</td>
<td>119,058 ms</td>
</tr>
</tbody>
</table>
JMeter SLA Report

- Merge multiple JTL files
- StAX parser to process large JTL file
- Statistic processing done by JAMon
- HTML export of JAMon model
### Summary

<table>
<thead>
<tr>
<th>Tests</th>
<th>Failures</th>
<th>Success Rate</th>
<th>Average Time</th>
<th>Min Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>435,410</td>
<td>0</td>
<td>100.0000 %</td>
<td>785 ms</td>
<td>8 ms</td>
</tr>
</tbody>
</table>

### Pages Overview (ms)

<table>
<thead>
<tr>
<th>Label</th>
<th>Tests</th>
<th>Avg</th>
<th>Total</th>
<th>StdDev</th>
<th>Min Time</th>
<th>Max Time</th>
<th>First Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initialize</td>
<td>1</td>
<td>213</td>
<td>213</td>
<td>0</td>
<td>213</td>
<td>213</td>
<td>22:12:02</td>
</tr>
<tr>
<td>Video:Insert</td>
<td>112,800</td>
<td>724</td>
<td>81,707,461</td>
<td>550</td>
<td>13</td>
<td>12,785</td>
<td>22:12:03</td>
</tr>
<tr>
<td>Video:InsertVe</td>
<td>112,800</td>
<td>820</td>
<td>92,491,768</td>
<td>627</td>
<td>15</td>
<td>12,875</td>
<td>22:12:03</td>
</tr>
<tr>
<td>Video:InsertIn</td>
<td>112,800</td>
<td>826</td>
<td>93,181,050</td>
<td>638</td>
<td>53</td>
<td>30,686</td>
<td>22:12:03</td>
</tr>
<tr>
<td>OBU:InsertTol</td>
<td>48,504</td>
<td>724</td>
<td>35,118,713</td>
<td>529</td>
<td>13</td>
<td>12,593</td>
<td>22:12:03</td>
</tr>
<tr>
<td>OBU:InsertVel</td>
<td>48,504</td>
<td>811</td>
<td>39,314,347</td>
<td>616</td>
<td>16</td>
<td>12,830</td>
<td>22:12:03</td>
</tr>
<tr>
<td>Dispose</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td>8</td>
<td>8</td>
<td>23:44:08</td>
</tr>
</tbody>
</table>

### Pages Detail Table (ms)

<table>
<thead>
<tr>
<th>Label</th>
<th>Tests</th>
<th>0-10</th>
<th>10-20</th>
<th>20-40</th>
<th>40-80</th>
<th>80-160</th>
<th>160-320</th>
<th>320-640</th>
<th>640-1280</th>
<th>1280-2560</th>
<th>2560-5120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initialize</td>
<td>1</td>
<td>536/17.4</td>
<td>6,011/29.8</td>
<td>11,272/59.1</td>
<td>8,173/106.8</td>
<td>2,057/213.4</td>
<td>5,381/556.4</td>
<td>73,641/868.6</td>
<td>4,246/1,777.3</td>
<td>1,444/3,179.1</td>
<td></td>
</tr>
<tr>
<td>Video:Insert</td>
<td>112,800</td>
<td>188/18.1</td>
<td>4,972/30.5</td>
<td>10,212/59.6</td>
<td>9,783/109.2</td>
<td>2,519/212.5</td>
<td>2,897/530.5</td>
<td>72,416/950.1</td>
<td>7,570/1,575.2</td>
<td>2,182/3,294.1</td>
<td></td>
</tr>
<tr>
<td>Video:InsertIn</td>
<td>112,800</td>
<td>564/71.5</td>
<td>11,979/125.6</td>
<td>13,441/212.9</td>
<td>3,293/474.6</td>
<td>76,237/939.8</td>
<td>5,855/1,666.7</td>
<td>1,294/3,286.6</td>
<td>577/3,165.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBU:InsertTol</td>
<td>48,504</td>
<td>226/17.5</td>
<td>2,510/30.3</td>
<td>4,702/59.1</td>
<td>3,632/107.8</td>
<td>979/211.9</td>
<td>2,258/555.7</td>
<td>31,754/870.8</td>
<td>1,856/1,787.5</td>
<td>577/3,165.1</td>
<td></td>
</tr>
<tr>
<td>OBU:InsertVel</td>
<td>48,504</td>
<td>73/18.3</td>
<td>2,267/30.1</td>
<td>4,708/59.5</td>
<td>3,898/108</td>
<td>984/211.6</td>
<td>1,328/533</td>
<td>31,362/945.6</td>
<td>2,978/1,618.8</td>
<td>882/3,275</td>
<td></td>
</tr>
<tr>
<td>Dispose</td>
<td>1</td>
<td>1/8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Report Properties

<table>
<thead>
<tr>
<th>Key</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Start Date</td>
<td>Sun Sep 25 22:12:02 UTC 2011</td>
</tr>
<tr>
<td>Test End Date</td>
<td>Sun Sep 25 23:44:08 UTC 2011</td>
</tr>
<tr>
<td>Test Duration (sec)</td>
<td>5,526</td>
</tr>
</tbody>
</table>
JMeter SLA Report

<java
classname="org.apache.jmeter.extra.report.sla.Main"
classpathref="jmeter.class.path">
<sysproperty key="jmeter.thread.count" value="..."/>
<sysproperty key="jmeter.thread.rampup" value="..."/>
<sysproperty key="jmeter.thread.loops" value="..."/>
<sysproperty key="jmeter.server.endpoint" value="..."/>
<arg value="${jmeter.test.summary-report}"/>
<arg value="${jmeter.test.result}"/>
</java>
ASP.NET Web Sites

Server Error in '/Test' Application.

Validation of viewstate MAC failed. If this application is hosted by a Web Farm or cluster, ensure that <machineKey> configuration specifies the same validationKey and validation algorithm. AutoGenerate cannot be used in a cluster.

Description: An unhandled exception occurred during the execution of the current web request. Please review the stack trace for more information about the error and where it originated in the code.

Exception Details: System.Web.HttpException: Validation of viewstate MAC failed. If this application is hosted by a Web Farm or cluster, ensure that <machineKey> configuration specifies the same validationKey and validation algorithm. AutoGenerate cannot be used in a cluster.
ASP.NET Web Sites

- Hidden fields and JavaScript parameters
  - ViewState
  - EventValidation
  - EventTarget
- ASP.NET security features
- Ajax calls
ASP.NET Web Sites

• Customer registration increased from 8 to 32 HTTP requests over a few weeks

• “ViewState Errors” were popping up after each and every release

• Impossible to fix broken scripts under pressure
Switched from JMeter to WAPT Pro with ASP.NET module

- 4-6 hours to write new script
- Disabled security ASP.NET feature since we still got errors under heavy load
Some More Thoughts

- Test your test tools
- No software installation
- Take two (or more)
- Automation is your friend
- Performance test for everyone
Test Your Test Tools

• Tests tools are buggy
  ▶ Multi-threading issues with soapUI Pro
  ▶ Multi-threading issues with WAPT Pro
  ▶ Replaced soapUI Pro with JMeter
No Software Installation

- Portable Apps on USB Stick
  - Run JMeter directly from USB Stick
  - Clone USB Stick to hard disk
- Have all your tools on the USB stick
  - Editor, Portable Git, ...
Take Two (or more)

• A minimum of two share-nothing load injectors are required to prove that the servers is causing the performance bottleneck (and not your test tool)

• We used a maximum of five share-nothing load injectors simultaneously
Automation Is Your Friend

- Testing at night and over the weekend
- Test execution managed by Hudson
- Test failures triggers email notification
- Test protocols are copied to FTP server
Performance Tests for Everyone

- All test scenarios are configured as Hudson jobs
  - Baseline, stress & endurance test
- Everyone can start and monitor a performance test scenario over the web browser
- Even developers can run performance tests
Performance Tests for Everyone
The few things you should take home
Lessons Learned

• Tests tools are buggy
  ▶ Make sure that they work for you

• JMeter is perfectly able to run large performance tests reliably

• JMeter might not be handy for complex web sites
  ▶ Switched from JMeter to WAPT Pro
Lessons Learned

- Performance tests are a valuable asset
  - Testing database failover
  - Testing data center replication & failover
  - Testing different server setups
- Creation and maintenance of complex performance test suite is a project on its own
Questions & Answers
### Resources

<table>
<thead>
<tr>
<th>Name</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAMon API</td>
<td><a href="http://jamonapi.sourceforge.net/">http://jamonapi.sourceforge.net/</a></td>
</tr>
<tr>
<td>JMeter ANT Tasks</td>
<td><a href="http://www.programmerplanet.org/pages/projects/jmeter-ant-task.php">http://www.programmerplanet.org/pages/projects/jmeter-ant-task.php</a></td>
</tr>
<tr>
<td>WAPT Pro</td>
<td><a href="http://www.loadtestingtool.com">http://www.loadtestingtool.com</a></td>
</tr>
<tr>
<td>soapUI</td>
<td><a href="http://www.soapui.org/">http://www.soapui.org/</a></td>
</tr>
</tbody>
</table>
The Software Stack

- JMeter
- ANT
- Git
- soapUI Pro
- Hudson
- Groovy
- WAPT Pro
- Portable Apps
- JavaScript