LibSBML and Tomcat in highly concurrent Scenarios

This document describes how to use write a highly concurrent application that uses LibSBML and is hosted by Tomcat (or JBoss). For basic installation instructions see the introduction document on using LibSBML with Tomcat, which is available here: http://fbergmann.github.com/libsbml-tomcat-tutorial/.

The application

For this test case the SBML Validator (as available online: http://sbml.org/Facilities/Validator) has been ported to use Java. The actual application logic has been encoded in 'validator.jar'. The archive contains a collection of classes allowing configuring, and performing a validation run and returning the results. This archive is the only one referencing LibSBML. It can be run independently from the command line to perform validation there.

Our application to be hosted by the application server contains of one JSP file (see Figure 1) and one servlet (see Figure 2). The JSP file is there for the user to provide the input for the application. A user will select the file to be validated as well as the number of consistency checks. This file is dynamic in order to allow the user to provide either a File to be validated, or a URL. The information about the selected

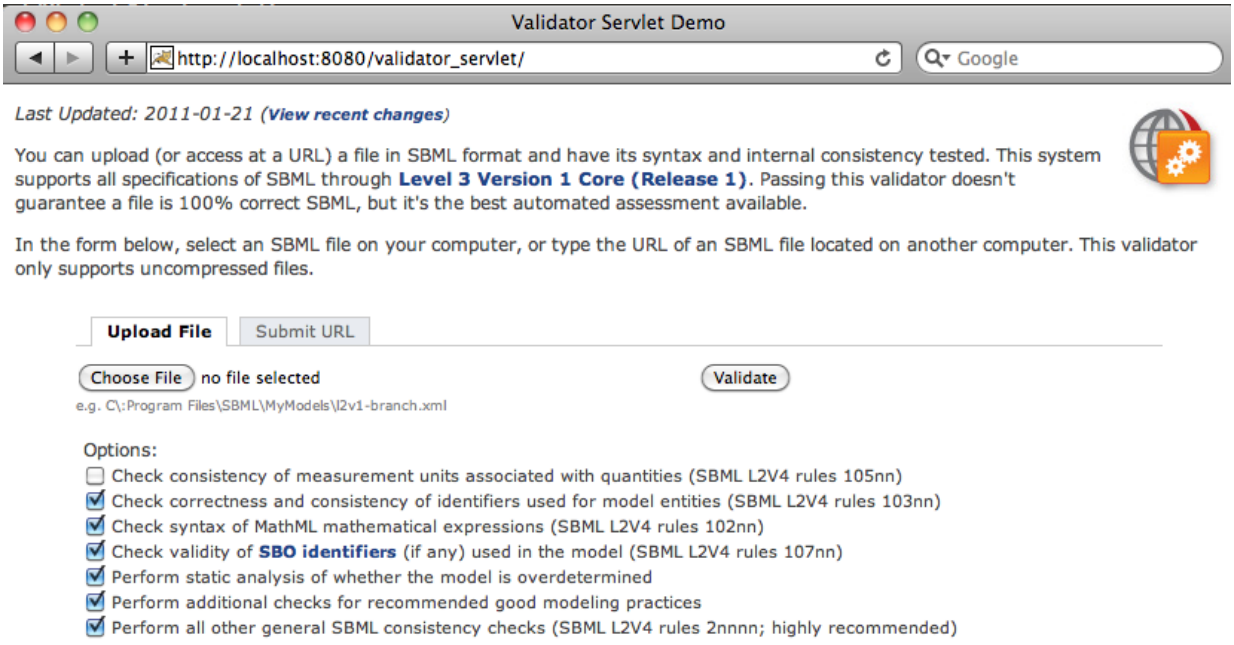


Figure 1: The JSP file, providing the validator input

consistency checks is kept in the User's current session. So if she were to validate another file the selection would be the same as before.

The servlet then:

- reads all the users input
    - in case of a specified URL, the document will be downloaded.
- calls the validation code in the 'validator.jar' to perform the validation.
- provides the result.

Both files together with a descriptor were then bundled into a standard web archive named 'validator_servlet.war'.

Installation

In order to verify that this application can be used by many users at the same time, it was installed using the application servers:

- Tomcat 7.0.5 on Win32, OSX and Linux (Fedora Core 14)
- as well as JBoss 6.0.0 Final (on Win32)

Deploying the application follows the same scheme as described previously (see http://cl.ly/3O2T3237391Q3W0V2m3y). The files 'errors2xhtml.xsl' and 'messages-en.xml' were placed in the bin directory of either Tomcat or JBoss. These files transform the XML result of the validator to HTML. The actual validation code 'validator.jar' along with the LibSBML Java bindings were placed in: Tomcat/lib or JBoss/common/lib. And then the Validator application was deployed by copying the

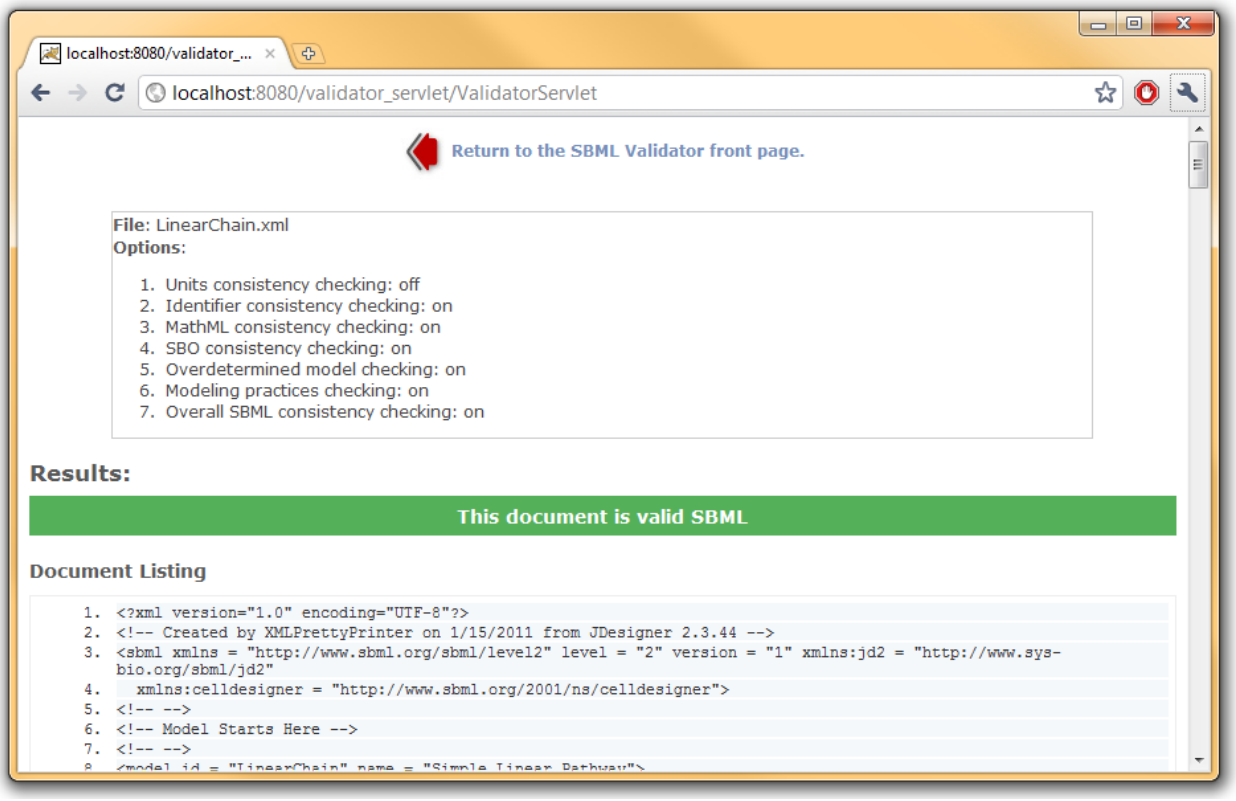


Figure 2: The servlet providing the validation result.

'validator_servlet.war' into tomcat/webapps or JBoss/server/default/deploy. Upon restating the application servers the servlet is available on: http://localhost:8080/validator_servlet/.

Testing

In order to test this web application in multi-user scenarios Visual Studio 2010 was used. Here a new Test project was created, and the following Web Test defined:

- navigate to http://localhost:8080/validator_servlet/ (when testing a non-Windows version the URL was adjusted according to the machines address)
- upload a first test file 'BorisEJB.xml'
- ensure that the result is 'document is valid SBML'
- navigate back
- upload a second test file 'brusselator.xml'

- ensure that the ‘document is valid SBML’
- navigate back
- upload the first file ‘BorisEJB.xml’ again, this time enabling the unit checking feature.
- Ensure that the result is ‘valid SBML with warnings’.

Once this test was defined two load test were created. Load Test 1:

- Runs WebTest 100 times
- With 250 parallel users.

Load Test 2:

- Runs WebTest for 30 minutes
- With a varying number of concurrent users between 10 and 200

Results

Running the Web Test worked fine from the start. However, when the Load Test was run the first time, the Java virtual machine crashed almost immediately. Analyzing the resulting dump (see page 9) showed clearly that there was an issue with using the 'xerces-c' parser. Presumably the xerces parser itself is not thread save. On that hunch the Java bindings were re-created using the expat and the libxml backend. With both of them the load tests ran without issues. Just as example here one result of the runs with the libxml2 backend:

Load Test 1

Overall Results

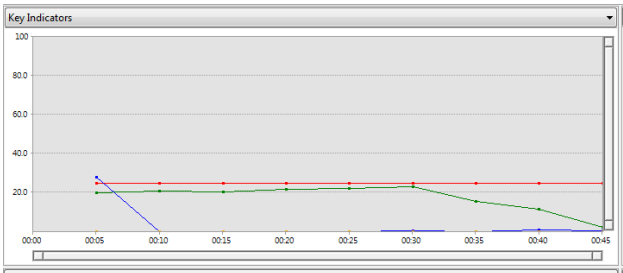
Max User Load	250
Tests/Sec	2.26
Tests Failed	0
Avg. Test Time (sec)	36.4
Transactions/Sec	0
Avg. Transaction Time (sec)	0
Pages/Sec	18.1
Avg. Page Time (sec)	0.39
Requests/Sec	22.6
Requests Failed	0
Requests Cached Percentage	37.5
Avg. Response Time (sec)	0.47
Avg. Content Length (bytes)	81,585

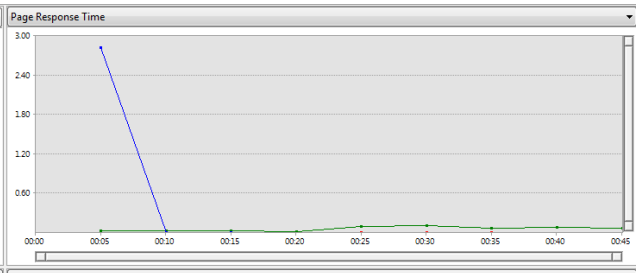
Test Results

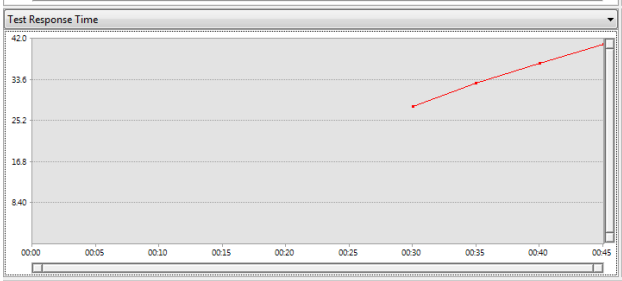
Name	Scenario	Total Tests	Failed Tests (% of total)	Avg. Test Time (sec)
WebTest	Scenario1	100	0 (0)	36.4

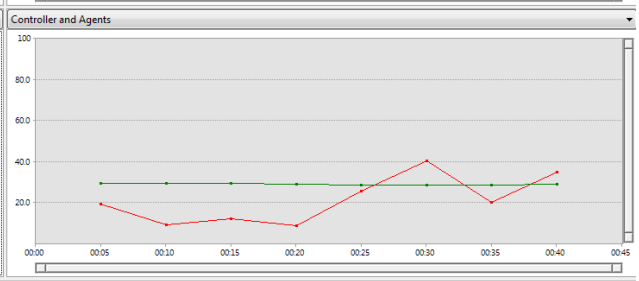
Page Results

URL (Link to More Details)	Scenario	Test	Avg. Page Time (sec)	Count
http://localhost:8080/validator_servlet/	Scenario1	WebTest	1.42	200
http://localhost:8080/validator_servlet/ValidatorServlet	Scenario1	WebTest	0.062	400
http://localhost:8080/validator_servlet/index.jsp	Scenario1	WebTest	0.00030	200









Counter	Instance	Category	Computer	Color	Range	Min	Max	Avg
Key Indicators								
User Load	_Total	LoadTest:Scenario	MINAKATA		1,000	250	250	250
Pages/Sec	_Total	LoadTest:Page	MINAKATA		100	2.57	23.2	18.1
Avg. Page Time	_Total	LoadTest:Page	MINAKATA		10	0.011	2.81	0.39
Errors/Sec	_Total	LoadTest:Errors	MINAKATA		0	0	0	0
Threshold Violations/Sec	_Total	LoadTest:Errors	MINAKATA		0	0	0	0
Page Response Time								
Avg. Page Time	index-jsp{GET}	LoadTest:Page	MINAKATA		3	0.00015	0.00047	0.00030
Avg. Page Time	ValidatorServlet{POST}	LoadTest:Page	MINAKATA		3	0.015	0.12	0.062
Avg. Page Time	validator_servlet{GET}	LoadTest:Page	MINAKATA		3	0.00014	2.84	1.42
Test Response Time								
Avg. Test Time	WebTest3	LoadTest:Test	MINAKATA		42	28.3	41.0	36.4
Controller and Agents								
% Processor Time	0	Processor	MINAKATA		100	8.86	40.5	21.6
Available MBytes	-	Memory	MINAKATA		10,000	2,875	2,989	2,934

Load Test 2

Overall Results

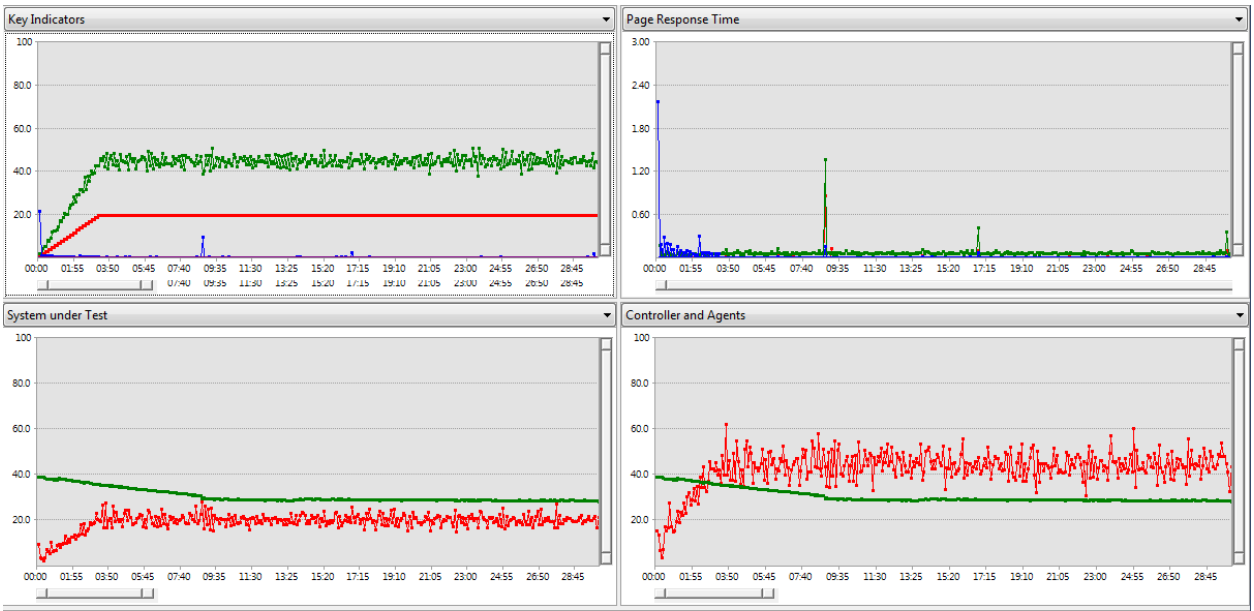
Max User Load	200
Tests/Sec	5.29
Tests Failed	0
Avg. Test Time (sec)	35.4
Transactions/Sec	0
Avg. Transaction Time (sec)	0
Pages/Sec	42.8
Avg. Page Time (sec)	0.040
Requests/Sec	43.0
Requests Failed	0
Requests Cached Percentage	49.8
Avg. Response Time (sec)	0.041
Avg. Content Length (bytes)	94,853

Test Results

Name	Scenario	Total Tests	Failed Tests (% of total)	Avg. Test Time (sec)
WebTest	Scenario1	9,528	0 (0)	35.4

Page Results

URL (Link to More Details)	Scenario	Test	Avg. Page Time (sec)	Count
http://localhost:8080/validator_servlet/ValidatorServlet	Scenario1	WebTest	0.075	38,468
http://localhost:8080/validator_servlet/	Scenario1	WebTest	0.0072	19,412
http://localhost:8080/validator_servlet/index.jsp	Scenario1	WebTest	0.0045	19,196



Counter	Instance	Category	Computer	Color	Range	Min	Max	Avg
Key Indicators								
User Load	_Total	LoadTest:Scenario	MINAKATA		1,000	10	200	189
Pages/Sec	_Total	LoadTest:Page	MINAKATA		100	1.40	51.0	42.8
Avg. Page Time	_Total	LoadTest:Page	MINAKATA		10	0.018	2.18	0.040
Errors/Sec	_Total	LoadTest:Errors	MINAKATA		0	0	0	0
Page Response Time								
Avg. Page Time	index-jsp{GET}	LoadTest:Page	MINAKATA		3	0.000100	0.88	0.0045
Avg. Page Time	ValidatorServlet{PO...	LoadTest:Page	MINAKATA		3	0.032	1.38	0.075
Avg. Page Time	validator_servlet{G...	LoadTest:Page	MINAKATA		3	0.00015	2.18	0.0072
System under Test								
% Processor Time	_Total	Processor	MINAKATA		100	2.52	28.5	19.7
Available MBytes	-	Memory	MINAKATA		10,000	2,862	3,941	3,095
Controller and Agents								
% Processor Time	0	Processor	MINAKATA		100	4.00	62.3	43.0
Available MBytes	-	Memory	MINAKATA		10,000	2,862	3,941	3,095

Conclusions

Looking at the test results it seems clear that currently the LibSBML Java bindings, if compiled against Xerces C, cannot be used in multi user or highly concurrent scenarios. However, using either LibXML or expat, the Java bindings can be successfully used. No stability issues were found even under high load (250 concurrent users). Applications relying on the Java bindings can be hosted on either Tomcat or JBoss with minimal efforts and work on all operating systems.

If it is vital for an application that the Xerces bindings are used additional measures should be taken to ensure that all calls are made synchronized and from the same thread. The recommended approach here would be to use the Executor Service or something of the like:

http://download.oracle.com/javase/1.5.0/docs/api/java/util/concurrent/ExecutorService.html

Appendix

Crash dump

```
#
# A fatal error has been detected by the Java Runtime Environment:
#
#  EXCEPTION_ACCESS_VIOLATION (0xc0000005) at pc=0x1204b780, pid=1600, tid=7864
#
# JRE version: 6.0_23-b05
# Java VM: Java HotSpot(TM) Client VM (19.0-b09 mixed mode, sharing windows-x86 )
# Problematic frame:
# C  [xerces-c_3_1.dll+0x4b780]
#
# If you would like to submit a bug report, please visit:
#   http://java.sun.com/webapps/bugreport/crash.jsp
# The crash happened outside the Java Virtual Machine in native code.
# See problematic frame for where to report the bug.
#

---------------  T H R E A D  ---------------

Current thread (0x01d19000):  JavaThread "http-8080-exec-15" daemon [_thread_in_native, id=7864, stack(0x06d30000,0x06d80000)]

siginfo: ExceptionCode=0xc0000005, reading address 0x00000000

Registers:
EAX=0x00000000, EBX=0x061f8f40, ECX=0x061f8f40, EDX=0x00000000
ESP=0x06d7efd0, EBP=0x06d7eff8, ESI=0x061f8f40, EDI=0x000003ff
EIP=0x1204b780, EFLAGS=0x00010206

Register to memory mapping:

EAX=0x00000000
0x00000000 is pointing to unknown location

EBX=0x061f8f40
0x061f8f40 is pointing to unknown location

ECX=0x061f8f40
0x061f8f40 is pointing to unknown location

EDX=0x00000000
0x00000000 is pointing to unknown location

ESP=0x06d7efd0
0x06d7efd0 is pointing into the stack for thread: 0x01d19000
"http-8080-exec-15" daemon prio=6 tid=0x01d19000 nid=0x1eb8 runnable [0x06d7f000]
   java.lang.Thread.State: RUNNABLE

EBP=0x06d7eff8
0x06d7eff8 is pointing into the stack for thread: 0x01d19000
"http-8080-exec-15" daemon prio=6 tid=0x01d19000 nid=0x1eb8 runnable [0x06d7f000]
   java.lang.Thread.State: RUNNABLE

ESI=0x061f8f40
0x061f8f40 is pointing to unknown location

EDI=0x000003ff
0x000003ff is pointing to unknown location


Top of Stack: (sp=0x06d7efd0)
0x06d7efd0:   370762b2 000003ff 061f8f40 00000000
0x06d7efe0:   1203e880 061f90f8 061f8f40 06d7f030
0x06d7eff0:   120b2ae3 ffffffff 06d7f03c 1204ad2b
0x06d7f000:   37077d76 00000000 061f8f40 05f7ec78
0x06d7f010:   00000000 061f8f40 6acf0289 1204b8a0
0x06d7f020:   00000000 000002a4 061f8f40 06d7f000
0x06d7f030:   06d7f080 120b44b4 0000000c 06d7f08c
0x06d7f040:   12035951 00000000 060fca60 0616aed0

Instructions: (pc=0x1204b780)
0x1204b770:   12 e8 5c 32 06 00 8b d9 89 5d f0 a1 f0 63 1b 12
0x1204b780:   ff 30 8b f0 e8 c4 a2 fb ff ff 05 ec 63 1b 12 a1


Stack: [0x06d30000,0x06d80000],  sp=0x06d7efd0,  free space=315k
Native frames: (J=compiled Java code, j=interpreted, Vv=VM code, C=native code)
C  [xerces-c_3_1.dll+0x4b780]
C  [xerces-c_3_1.dll+0x4ad2b]
C  [xerces-c_3_1.dll+0x35951]
C  [xerces-c_3_1.dll+0x4dda8]
C  [xerces-c_3_1.dll+0x5d3e9]
C  [xerces-c_3_1.dll+0x5d2ec]
C  [sbmlj.dll+0xdf6b3]

Java frames: (J=compiled Java code, j=interpreted, Vv=VM code)
j  org.sbml.libsbml.libsbmlJNI.readSBMLFromString(Ljava/lang/String;)J+0
```

```
j  org.sbml.libsbml.libsbml.readSBMLFromString(Ljava/lang/String;)Lorg/sbml/libsbml/SBMLDocument;+1
j  org.sbml.validator.Validate.<init>(Ljava/io/BufferedReader;Ljava/io/BufferedWriter;ZZ)V+31
j  org.sbml.validator.Validate.<init>(Lorg/sbml/validator/ValidatorOptions;)V+11
j  org.sbml.validator.ValidatorServlet.handleContent(Ljavax/servlet/http/HttpServletRequest;Ljavax/servlet/http/HttpServletResponse;)V+443
j  org.sbml.validator.ValidatorServlet.doPost(Ljavax/servlet/http/HttpServletRequest;Ljavax/servlet/http/HttpServletResponse;)V+3
j  javax.servlet.http.HttpServlet.service(Ljavax/servlet/http/HttpServletRequest;Ljavax/servlet/http/HttpServletResponse;)V+139
j  javax.servlet.http.HttpServlet.service(Ljavax/servlet/ServletRequest;Ljavax/servlet/ServletResponse;)V+30
j  org.apache.catalina.core.ApplicationFilterChain.internalDoFilter(Ljavax/servlet/ServletRequest;Ljavax/servlet/ServletResponse;)V+445
j  org.apache.catalina.core.ApplicationFilterChain.doFilter(Ljavax/servlet/ServletRequest;Ljavax/servlet/ServletResponse;)V+101
j  org.apache.catalina.core.StandardWrapperValve.invoke(Lorg/apache/catalina/connector/Request;Lorg/apache/catalina/connector/Response;)V+898
j  org.apache.catalina.core.StandardContextValve.invoke(Lorg/apache/catalina/connector/Request;Lorg/apache/catalina/connector/Response;)V+234
j  org.apache.catalina.core.StandardHostValve.invoke(Lorg/apache/catalina/connector/Request;Lorg/apache/catalina/connector/Response;)V+121
j  org.apache.catalina.valves.ErrorReportValve.invoke(Lorg/apache/catalina/connector/Request;Lorg/apache/catalina/connector/Response;)V+6
j  org.apache.catalina.valves.AccessLogValve.invoke(Lorg/apache/catalina/connector/Request;Lorg/apache/catalina/connector/Response;)V+78
j  org.apache.catalina.core.StandardEngineValve.invoke(Lorg/apache/catalina/connector/Request;Lorg/apache/catalina/connector/Response;)V+71
j  org.apache.catalina.connector.CoyoteAdapter.service(Lorg/apache/coyote/Request;Lorg/apache/coyote/Response;)V+192
j
org.apache.coyote.http11.Http11Processor.process(Lorg/apache/tomcat/util/net/SocketWrapper;)Lorg/apache/tomcat/util/net/AbstractEndpoint$Hand
ler$SocketState;+535
j
org.apache.coyote.http11.Http11Protocol$Http11ConnectionHandler.process(Lorg/apache/tomcat/util/net/SocketWrapper;Lorg/apache/tomcat/util/net
/SocketStatus;)Lorg/apache/tomcat/util/net/AbstractEndpoint$Handler$SocketState;+102
j  org.apache.tomcat.util.net.JIoEndpoint$SocketProcessor.run()V+124
j  java.util.concurrent.ThreadPoolExecutor$Worker.runTask(Ljava/lang/Runnable;)V+59
j  java.util.concurrent.ThreadPoolExecutor$Worker.run()V+28
j  java.lang.Thread.run()V+11
v  ~StubRoutines::call_stub

---------------  P R O C E S S  ---------------

Java Threads: ( => current thread )
  0x04872800 JavaThread "http-8080-exec-28" daemon [_thread_in_native, id=11076, stack(0x07680000,0x076d0000)]
  0x04872000 JavaThread "http-8080-exec-27" daemon [_thread_in_native, id=10960, stack(0x075f0000,0x07640000)]
  0x01d1d000 JavaThread "http-8080-exec-26" daemon [_thread_in_native, id=11060, stack(0x07560000,0x075b0000)]
  0x01d1cc00 JavaThread "http-8080-exec-25" daemon [_thread_in_native, id=10412, stack(0x074d0000,0x07520000)]
  0x01d1c400 JavaThread "http-8080-exec-24" daemon [_thread_in_native, id=10492, stack(0x07440000,0x07490000)]
  0x01d1c000 JavaThread "http-8080-exec-23" daemon [_thread_in_native, id=10992, stack(0x073b0000,0x07400000)]
  0x01d1b800 JavaThread "http-8080-exec-22" daemon [_thread_blocked, id=10424, stack(0x07320000,0x07370000)]
  0x01d1b400 JavaThread "http-8080-exec-21" daemon [_thread_in_native, id=10988, stack(0x07290000,0x072e0000)]
  0x01d1ac00 JavaThread "http-8080-exec-20" daemon [_thread_in_native, id=11260, stack(0x07200000,0x07250000)]
  0x01d1a800 JavaThread "http-8080-exec-19" daemon [_thread_in_native, id=10976, stack(0x07170000,0x071c0000)]
  0x01d1a000 JavaThread "http-8080-exec-18" daemon [_thread_in_native, id=10332, stack(0x070e0000,0x07130000)]
  0x01d19c00 JavaThread "http-8080-exec-17" daemon [_thread_in_native, id=10956, stack(0x07050000,0x070a0000)]
  0x01d19400 JavaThread "http-8080-exec-16" daemon [_thread_in_native, id=10952, stack(0x06dc0000,0x06e10000)]
=>0x01d19000 JavaThread "http-8080-exec-15" daemon [_thread_in_native, id=7864, stack(0x06d30000,0x06d80000)]
  0x01d18800 JavaThread "http-8080-exec-14" daemon [_thread_blocked, id=2060, stack(0x06ca0000,0x06cf0000)]
  0x01d18400 JavaThread "http-8080-exec-13" daemon [_thread_in_native, id=9836, stack(0x06b10000,0x06b60000)]
  0x01d17c00 JavaThread "http-8080-exec-12" daemon [_thread_in_native, id=8596, stack(0x06a80000,0x06ad0000)]
  0x01d17800 JavaThread "http-8080-exec-11" daemon [_thread_in_Java, id=5168, stack(0x069f0000,0x06a40000)]
  0x01d17000 JavaThread "http-8080-exec-10" daemon [_thread_in_native, id=3772, stack(0x05b60000,0x05bb0000)]
  0x01d16c00 JavaThread "http-8080-exec-9" daemon [_thread_in_native, id=10312, stack(0x052e0000,0x05330000)]
  0x01d16400 JavaThread "http-8080-exec-8" daemon [_thread_in_native, id=7824, stack(0x05ad0000,0x05b20000)]
  0x01d16000 JavaThread "http-8080-exec-7" daemon [_thread_in_native, id=4008, stack(0x05a40000,0x05a90000)]
  0x01d15800 JavaThread "http-8080-exec-6" daemon [_thread_in_native, id=7484, stack(0x05840000,0x05890000)]
  0x04a04800 JavaThread "http-8080-exec-5" daemon [_thread_blocked, id=6688, stack(0x05770000,0x057c0000)]
  0x04a04400 JavaThread "http-8080-exec-4" daemon [_thread_in_native, id=5608, stack(0x056e0000,0x05730000)]
  0x04a03c00 JavaThread "http-8080-exec-3" daemon [_thread_in_native, id=5680, stack(0x055f0000,0x05640000)]
  0x04a03800 JavaThread "http-8080-exec-2" daemon [_thread_in_native, id=3176, stack(0x05560000,0x055b0000)]
  0x049b0000 JavaThread "http-8080-exec-1" daemon [_thread_in_native, id=6532, stack(0x054d0000,0x05520000)]
  0x049ac800 JavaThread "ajp-8009-AsyncTimeout" daemon [_thread_blocked, id=1564, stack(0x05110000,0x05160000)]
  0x04a02800 JavaThread "ajp-8009-Acceptor-0" daemon [_thread_in_native, id=6572, stack(0x05080000,0x050d0000)]
  0x04a02000 JavaThread "http-8080-AsyncTimeout" daemon [_thread_blocked, id=5964, stack(0x04ff0000,0x05040000)]
  0x04a01c00 JavaThread "http-8080-Acceptor-0" daemon [_thread_in_native, id=9668, stack(0x04f20000,0x04f70000)]
  0x04a01000 JavaThread "ContainerBackgroundProcessor[StandardEngine[Catalina]]" daemon [_thread_blocked, id=3168, stack(0x04e90000,0x04ee0000)]
  0x0495d800 JavaThread "GC Daemon" daemon [_thread_blocked, id=6360, stack(0x04cf0000,0x04d40000)]
  0x01d02800 JavaThread "Low Memory Detector" daemon [_thread_blocked, id=2960, stack(0x045d0000,0x04620000)]
  0x01cf6c00 JavaThread "CompilerThread0" daemon [_thread_blocked, id=10104, stack(0x04540000,0x04590000)]
  0x01cf3800 JavaThread "Attach Listener" daemon [_thread_blocked, id=9440, stack(0x044b0000,0x04500000)]
  0x01cf0800 JavaThread "Signal Dispatcher" daemon [_thread_blocked, id=9220, stack(0x04420000,0x04470000)]
  0x01cea000 JavaThread "Finalizer" daemon [_thread_blocked, id=5616, stack(0x04390000,0x043e0000)]
  0x01ce8400 JavaThread "Reference Handler" daemon [_thread_blocked, id=6436, stack(0x04300000,0x04350000)]
  0x022b9400 JavaThread "main" [_thread_in_native, id=2528, stack(0x00380000,0x003d0000)]

Other Threads:
  0x01ce7000 VMThread [stack: 0x02240000,0x02290000] [id=8912]
  0x01d0c000 WatcherThread [stack: 0x04660000,0x046b0000] [id=9328]

VM state:not at safepoint (normal execution)

VM Mutex/Monitor currently owned by a thread: None

Heap
 def new generation   total 5568K, used 2844K [0x24670000, 0x24c70000, 0x29bc0000)
  eden space 4992K,  56% used [0x24670000, 0x24937170, 0x24b50000)
  from space 576K,   0% used [0x24b50000, 0x24b50000, 0x24be0000)
  to   space 576K,   0% used [0x24be0000, 0x24be0000, 0x24c70000)
 tenured generation   total 12268K, used 7359K [0x29bc0000, 0x2a7bb000, 0x34670000)
   the space 12268K,  59% used [0x29bc0000, 0x2a2efd40, 0x2a2efe00, 0x2a7bb000)
 compacting perm gen  total 12288K, used 10435K [0x34670000, 0x35270000, 0x38670000)
   the space 12288K,  84% used [0x34670000, 0x350a0d30, 0x350a0e00, 0x35270000)
    ro space 10240K,  51% used [0x38670000, 0x38b9bd20, 0x38b9be00, 0x39070000)
    rw space 12288K,  54% used [0x39070000, 0x39707d58, 0x39707e00, 0x39c70000)
```

```
Dynamic libraries:
0x00400000 - 0x00424000         C:\Program Files (x86)\Java\jre6\bin\javaw.exe
0x77d50000 - 0x77ed0000         C:\Windows\SysWOW64\ntdll.dll
0x76e80000 - 0x76f80000         C:\Windows\syswow64\kernel32.dll
0x77900000 - 0x77946000         C:\Windows\syswow64\KERNELBASE.dll
0x76f80000 - 0x77020000         C:\Windows\syswow64\ADVAPI32.dll
0x77140000 - 0x771ec000         C:\Windows\syswow64\msvcrt.dll
0x77560000 - 0x77579000         C:\Windows\SysWOW64\sechost.dll
0x76b80000 - 0x76c70000         C:\Windows\syswow64\RPCRT4.dll
0x758c0000 - 0x75920000         C:\Windows\syswow64\SspiCli.dll
0x758b0000 - 0x758bc000         C:\Windows\syswow64\CRYPTBASE.dll
0x777a0000 - 0x778a0000         C:\Windows\syswow64\USER32.dll
0x759b0000 - 0x75a40000         C:\Windows\syswow64\GDI32.dll
0x77d20000 - 0x77d2a000         C:\Windows\syswow64\LPK.dll
0x75bf0000 - 0x75c8d000         C:\Windows\syswow64\USP10.dll
0x77590000 - 0x775f0000         C:\Windows\system32\IMM32.DLL
0x76db0000 - 0x76e7c000         C:\Windows\syswow64\MSCTF.dll
0x7c340000 - 0x7c396000         C:\Program Files (x86)\Java\jre6\bin\msvcr71.dll
0x6d7f0000 - 0x6da9c000         C:\Program Files (x86)\Java\jre6\bin\client\jvm.dll
0x733f0000 - 0x73422000         C:\Windows\system32\WINMM.dll
0x71510000 - 0x7155b000         C:\Windows\system32\apphelp.dll
0x6d7a0000 - 0x6d7ac000         C:\Program Files (x86)\Java\jre6\bin\verify.dll
0x6d320000 - 0x6d33f000         C:\Program Files (x86)\Java\jre6\bin\java.dll
0x6d280000 - 0x6d288000         C:\Program Files (x86)\Java\jre6\bin\hpi.dll
0x77580000 - 0x77585000         C:\Windows\syswow64\PSAPI.DLL
0x6d7e0000 - 0x6d7ef000         C:\Program Files (x86)\Java\jre6\bin\zip.dll
0x6d550000 - 0x6d559000         C:\Program Files (x86)\Java\jre6\bin\management.dll
0x6d780000 - 0x6d788000         C:\Program Files (x86)\Java\jre6\bin\sunmscapi.dll
0x75a40000 - 0x75b5c000         C:\Windows\syswow64\CRYPT32.dll
0x75b60000 - 0x75b6c000         C:\Windows\syswow64\MSASN1.dll
0x6d600000 - 0x6d613000         C:\Program Files (x86)\Java\jre6\bin\net.dll
0x76c70000 - 0x76ca5000         C:\Windows\syswow64\WS2_32.dll
0x77360000 - 0x77366000         C:\Windows\syswow64\NSI.dll
0x753e0000 - 0x7541c000         C:\Windows\system32\mswsock.dll
0x751f0000 - 0x751f6000         C:\Windows\System32\wship6.dll
0x753d0000 - 0x753d5000         C:\Windows\System32\wshtcpip.dll
0x73e80000 - 0x73e96000         C:\Windows\system32\CRYPTSP.dll
0x73e40000 - 0x73e7b000         C:\Windows\system32\rsaenh.dll
0x74fc0000 - 0x74fd7000         C:\Windows\system32\USERENV.dll
0x753c0000 - 0x753cb000         C:\Windows\system32\profapi.dll
0x73df0000 - 0x73e34000         C:\Windows\system32\DNSAPI.dll
0x73940000 - 0x73965000         C:\Program Files (x86)\Bonjour\mdnsNSP.dll
0x75240000 - 0x7525c000         C:\Windows\system32\Iphlpapi.DLL
0x75230000 - 0x75237000         C:\Windows\system32\WINNSI.DLL
0x73900000 - 0x73927000         C:\Program Files (x86)\Common Files\Microsoft Shared\Windows Live\WLIDNSP.DLL
0x778a0000 - 0x778f7000         C:\Windows\syswow64\SHLWAPI.dll
0x738f0000 - 0x738f6000         C:\Windows\system32\rasadhlp.dll
0x751b0000 - 0x751e8000         C:\Windows\System32\fwpuclnt.dll
0x739b0000 - 0x739c0000         C:\Windows\system32\NLAapi.dll
0x739a0000 - 0x739a8000         C:\Windows\System32\winrnr.dll
0x73990000 - 0x739a0000         C:\Windows\system32\napinsp.dll
0x73970000 - 0x73982000         C:\Windows\system32\pnrpnsp.dll
0x73930000 - 0x7393d000         C:\Windows\system32\wshbth.dll
0x6a6b0000 - 0x6a8a6000         C:\Development\libsbml-5\_release\nm_java_xerces\bindings\java\sbmlj.dll
0x68440000 - 0x68457000         C:\Development\libsbml-5\_release\nm_java_xerces\bin\bzip2.dll
0x61b80000 - 0x61b98000         C:\Windows\system32\zlib1.dll
0x12000000 - 0x121dc000         C:\Development\libsbml-5\_release\nm_java_xerces\bin\xerces-c_3_1.dll
0x6ace0000 - 0x6ad9f000         C:\Windows\system32\MSVCR100.dll
0x6afb0000 - 0x6b019000         C:\Windows\system32\MSVCP100.dll

VM Arguments:
jvm_args:    -Dcatalina.base=C:\Development\EclipseWorkspace\.metadata\.plugins\org.eclipse.wst.server.core\tmp0    -Dcatalina.home=C:\apache-
tomcat-7.0.5           -Dwtp.deploy=C:\Development\EclipseWorkspace\.metadata\.plugins\org.eclipse.wst.server.core\tmp0\wtpwebapps           -
Djava.endorsed.dirs=C:\apache-tomcat-7.0.5\endorsed -Dfile.encoding=Cp1252
java_command: org.apache.catalina.startup.Bootstrap start
Launcher Type: SUN_STANDARD

Environment Variables:
CLASSPATH=.;C:\Program Files (x86)\Java\jre6\lib\ext\QTJava.zip
PATH=C:\Development\libsbml-5\_release\nm_java_xerces\bindings\java;C:\Development\libsbml-5\_release\nm_java_xerces\bin
USERNAME=fbergmann
OS=Windows_NT
PROCESSOR_IDENTIFIER=Intel64 Family 6 Model 30 Stepping 5, GenuineIntel



---------------  S Y S T E M  ---------------

OS: Windows 7 Build 7600

CPU:total 8 (4 cores per cpu, 2 threads per core) family 6 model 30 stepping 5, cmov, cx8, fxsr, mmx, sse, sse2, sse3, ssse3, sse4.1, sse4.2, popcnt,
ht

Memory: 4k page, physical 8346704k(1913836k free), swap 16691508k(9412232k free)

vm_info: Java HotSpot(TM) Client VM (19.0-b09) for windows-x86 JRE (1.6.0_23-b05), built on Nov 12 2010 15:00:43 by "java_re" with MS VC++ 7.1
(VS2003)

elapsed time: 3503 seconds
```