Apache Tomcat: Enabling Scripting Languages in JSPs

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Overview

- Motivation

- Goals

- Teaser

- Implementation

- Nutshell examples

- Small utiltity samples

- Roundup

Motivation

- Business administration students, who just learned programming

  - *ooRexx*: easy syntax, dynamically typed, caseless, message based

    - Within a four hour lecture (for four months) they become empowered from zero to creating programs that exploit *MS Office*, *OpenOffice*, socket programming and *JavaFX* GUIs

  - *ooRexx-Java* bridge: *BSF4ooRexx* camouflages *Java* as *ooRexx*

- Becoming able to create web server applications in the next step

  - *Java* or *Jakarta EE* (enterprise edition)

  - *Tomcat*: popular, easy to setup and to maintain, yet acquired knowledge can be applied to other *Java/Jakarta EE* web servers!

Goals

- Easy to use, hence *JSP* (Java server pages) hosted

- Infrastructure should be made available to other scripting languages

  – Employing the Java scripting framework (*javax.script*, a.k.a. „JSR-223")

  – Any scripting language can be used that implements j*avax.script.ScriptEngine*

  – Programmers not acquainted with Java can still use all of Java/Jakarta EE

  – „End-user programmers" can implement their own server apps, if need be

- Make it easy to debug and explore the infrastructure (JSR-223, EE)

- Programs in scripting languages should be invocable as if they were *Servlets*, allow them to be stored externally as well

sql_add_data.jsp - Java-less Interaction with a SQLite Database

Using ooRexx to get a SQLite connection object, save it as a *request* attribute named *sql_con* to allow other programs on the page to use it. Then using ooRexx to insert a record ...

Using JavaScript to insert a record ...

Using Groovy to insert a record ...

Using Jython to insert a record ...

Using PHP to insert a record ...

Using ooRexx to display current records in database:

ID	Name	Message	Date
1	ooRexx	Recreated database	2021-09-20 19:19:46
2	ooRexx	Hello, from ooRexx	2021-09-20 19:24:03
3	JavaScript	Hello, from Nashorn	2021-09-20 19:24:03
4	Groovy	Hello, from Groovy	2021-09-20 19:24:03
5	Jython	Hello, from Jython	2021-09-20 19:24:03
6	PHP	Hello, from PHP	2021-09-20 19:24:03

Implementation

- Exploiting *JSPs*, creating a tag library

- Support *Java EE* (<=TC9, *javax.ScriptTagLibs.jar*) and *Jakarta EE* (>=TC10, *jakarta.ScriptTagLibs.jar*)

- Supports *JSR-223* (*javax.script*) and Apache *BSF* (*apache.org.bsf*)

- Two tags

  - *script*: create output text by using the *JSP* implicit *out* object

  - *expr*: return a string value that will be printed to *out*

- By default any script invocation will supply as arguments the three implicit *JSP* objects *request, response* and *out* in this order, unless the attribute *arguments* is set to *false*

Implementation

- Exploiting *JSPs*, creating a tag library (continued)

  - Attributes available to each tag

    - **type***: mandatory, denotes scripting language, e.g. *rexx, javascript, groovy, ...*

    - *arguments* (*true*)

    - *cacheSrc* (*true*): if *false* then external scripts will not get cached

    - *compile* (*true*): *JSR-223* only, controls whether script code gets compiled or not

    - *debug* (*false*)

    - *name* (optional): any script element can be named to ease debugging

    - *reflect* (*false*): controls whether script code can access its attribute values

    - *slot* (optional): if present, script code can access this value for further processing

    - *src* (optional URL to external program)

    - *throwException* (*false*)

Implementation (JSR-223)

- Exploiting *JSPs*, creating a tag library (continued)

  – Each JSP invocation uses a single instance of *javax.script.ScriptEngineManager*

    - *getBindings()* returns the global scope *Bindings* that ges also shared among *ScriptEngine*s

    - For each page a single instance of the script language's *javax.script.ScriptEngine* gets loaded and used to run the script code

  – Add all implicit *JSP* objects to *ScriptContext*'s engine scope *Bindings* (scope index: 100):

    - *application, config, exception, out, page, pageContext, request, response, session*

    - Script engines may make the *Bindings* entries implicitly available as well or supply other means to access them

    - Other *Java* objects may also be shared among *Java* and scripting engines using the *ScriptContext*'s global scope *Bindings* (scope index: 200)

Implementation (JSR-223), JSP Skeleton

```
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>

 …

<s:script type="rexx">
    … Rexx code …
</s:script>

…

<s:expr type="javascript"> … JavaScript code … </s:expr>
```

Implementation (JSR-223), Nutshell Samples

- *xxx_helloWorld.jsp*, where *xxx* denotes a scripting language

  - Demonstrates the *s:script* tag to execute script code without any attributes and a *s:script* tag with the same script code, but with the *debug* attribute set to *"true"* which displays debug information related to the taglib usage, the *ScriptEngine* and its *ScriptEngineFactory*

- *xxx_request_object.jsp*, where *xxx* denotes a scripting language

  - Demonstrates accessing and using the implicit JSP object *request* to retrieve the request's url and the corresponding uri

Implementation (JSR-223)
Nutshell: ooRexx_helloWorld.jsp

```
<%@ page session="false" pageEncoding="UTF-8" contentType="text/html; charset=UTF-8" %>
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
    <meta charset="UTF-8" />
    <style>
        body { background-color: ivory; }
    </style>
    <title>Hello World from ooRexx (Title)</title>
</head>
<body>
    <div style="float: left; padding: 10px">
        <img src="images/bsf4oorexx_064.png" alt="" />
    </div>

    <h1>&quot;Hello, world ...&quot; by ooRexx</h1>
    <s:script type="rexx">
        say '<p style="background-color: gold;">Hello, world, this is ooRexx speaking at:' .dateTime~new '</p>'
    </s:script>

    <hr width="75%" style="color: green;">

    <h1>&quot;Hello, world ...&quot; by ooRexx, this time attribute &quot;<code>debug</code>&quot; Set to True</h1>
    <s:script type="rexx" debug="true">
        say '<p style="background-color: gold;">Hello, world, this is ooRexx speaking at:' .dateTime~new '</p>'
    </s:script>

    <hr width="75%" style="color: green;">
    <p>Done.<p>
</body>
</html>
```

"Hello, world ..." by ooRexx

Hello, world, this is ooRexx speaking at: 2021-09-18T12:02:19.687907

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"Hello, world ..." by ooRexx, this time attribute "debug" Set to True

Debug Information	
request.getContextPath()	/demoASF2021
request.getRequestURL()	http://localhost:8080/demoASF2021/ooRexx_helloWorld.jsp
request.getRequestURI()	/demoASF2021/ooRexx_helloWorld.jsp
virtualPath (without contextPath)	/ooRexx_helloWorld.jsp
application.getRealPath(virtualPath)	/opt/tomcat9/apache-tomcat-9.0.52/webapps/demoASF2021/ooRexx_helloWorld.jsp *exists? (true)*

Debug Information (Taglib Invocation Related)	
Current thread	id=[22]: name=[http-nio-8080-exec-3], threadGroup=[java.lang.ThreadGroup[name=main,maxpri=10]], priority=[5], state=[RUNNABLE]
Script manager	javax.script.ScriptEngineManager@6b051757
Script engine	org.rexxla.bsf.engines.rexx.jsr223.RexxScriptEngine@3b11f16e
scriptCode	say '<p style="background-color: gold;">Hello, world…
Attribute "arguments"	true
Attribute "cacheScr"	true

Inst

macports.upgrade — -zsh

Attribute "arguments"	true
Attribute "cacheSrc"	true
Attribute "compile"	true
Attribute "debug"	true
Attribute "name"	null
Attribute "reflect"	false
Attribute "slot"	null
Attribute "src"	null
Attribute "throwException"	false
Attribute "type"	rexx
cachedSrcScripts.size()	0
compiledScript	null
compiledCachedSrcScripts.size()	0
filename	/opt/tomcat9/apache-tomcat-9.0.52/webapps/demoASF2021/ooRexx_helloWorld.jsp!(unknown) *exists? (false)*
getTagName()	script
isExpression()	false
scriptTagLib	Jsr223TagLib
srcRealPath	null
srcVirtualPath	null

Debug Information (Implicit Objects)

Debug Information (Implicit Objects)	
application	org.apache.catalina.core.ApplicationContextFacade@14421b9c
config	org.apache.catalina.core.StandardWrapperFacade@65df0830
exception	null
out	org.apache.jasper.runtime.JspWriterImpl@6a416163
page	org.apache.jsp.ooRexx_005fhelloWorld_jsp@5aef78a
pageContext	org.apache.jasper.runtime.PageContextImpl@123d04ae
request	org.apache.catalina.connector.RequestFacade@608970b
response	org.apache.catalina.connector.ResponseFacade@1e26ce21
session	null
scriptTagLibTag	Jsr223TagLib.script

Debug Information (ScriptEngine)	
Script manager	javax.script.ScriptEngineManager@6b051757

SCRIPTENGINE RELATED:

Script engine	org.rexxla.bsf.engines.rexx.jsr223.RexxScriptEngine@3b11f16e
ScriptEngine.ARGV="javax.script.argv" ScriptEngine.get(ARGV)	`[org.apache.catalina.connector.RequestFacade@608970b, org.apache.catalina.connector.ResponseFacade@1e26ce21, org.apache.jasper.runtime.JspWriterImpl@6a416163]`
ScriptEngine.ENGINE="javax.script.engine" ScriptEngine.get(ENGINE)	`Open Object Rexx (ooRexx)`
ScriptEngine.ENGINE_VERSION="javax.script.engine_version" ScriptEngine.get(ENGINE_VERSION)	`100.20210705`

ScriptEngine.ENGINE_VERSION="javax.script.engine_version" ScriptEngine.get(ENGINE_VERSION)	`100.20210705`
ScriptEngine.FILENAME="javax.script.filename" ScriptEngine.get(FILENAME)	`/opt/tomcat9/apache-tomcat-9.0.52/webapps/demoASF2021/oo`
ScriptEngine.LANGUAGE="javax.script.language" ScriptEngine.get(LANGUAGE)	`ooRexx`
ScriptEngine.LANGUAGE_VERSION="javax.script.language_version" ScriptEngine.get(LANGUAGE_VERSION)	`REXX-ooRexx_5.0.0(MT)_64-bit 6.05 18 Jul 2021`
ScriptEngine.NAME="javax.script.name" ScriptEngine.get(NAME)	`rexx`

<div align="center">

SCRIPTENGINEFACTORY RELATED:

</div>

ScriptEngineFactory	org.rexxla.bsf.engines.rexx.jsr223.RexxScriptEngineFactory@31f5
ScriptEngineFactory.getEngineName()	Open Object Rexx (ooRexx)
ScriptEngineFactory.getEngineVersion()	100.20210705
ScriptEngineFactory.getExtensions()	`[rex, rexx, orx, cls, rxj, rexxj, jrexx, rxo]`
ScriptEngineFactory.getLanguageName()	ooRexx
ScriptEngineFactory.getLanguageVersion()	REXX-ooRexx_5.0.0(MT)_64-bit 6.05 18 Jul 2021
ScriptEngineFactory.getMethodCallSyntax(String obj, String m, String... args)	`obj~m(arg1,arg2,arg...)`
ScriptEngineFactory.getMimeTypes()	`[text/rexx, text/oorexx, application/rexx, application/` `rexx-java, text/x-rexx-java-ooo]`
ScriptEngineFactory.getNames()	`[rexx, Rexx, REXX, oorexx, ooRexx, OOREXX, orexx, oRexx,`
toDisplay: Some "double-quoted" and some 'single-quoted' string. ScriptEngineFactory.getOutputStatement(toDisplay)	`SAY "Some ""double-quoted"" and some 'single-quoted' st`
ScriptEngine.ENGINE="javax.script.engine" ScriptEngineFactory.getParameter(ENGINE)	`Open Object Rexx (ooRexx)`

ScriptEngineFactory.getMimeTypes()	`[text/rexx, text/oorexx, application/rexx, application/` `rexx-java, text/x-rexx-java-ooo]`
ScriptEngineFactory.getNames()	`[rexx, Rexx, REXX, oorexx, ooRexx, OOREXX, orexx, oRexx,`
toDisplay: `Some "double-quoted" and some 'single-quoted' string.` ScriptEngineFactory.getOutputStatement(toDisplay)	`SAY "Some ""double-quoted"" and some 'single-quoted' st`
ScriptEngine.ENGINE=`"javax.script.engine"` ScriptEngineFactory.getParameter(ENGINE)	`Open Object Rexx (ooRexx)`
ScriptEngine.ENGINE_VERSION=`"javax.script.engine_version"` ScriptEngineFactory.getParameter(ENGINE_VERSION)	`100.20210705`
ScriptEngine.LANGUAGE=`"javax.script.language"` ScriptEngineFactory.getParameter(LANGUAGE)	`ooRexx`
ScriptEngine.LANGUAGE_VERSION=`"javax.script.language_version"` ScriptEngineFactory.getParameter(LANGUAGE_VERSION)	`REXX-ooRexx_5.0.0(MT)_64-bit 6.05 18 Jul 2021`
ScriptEngine.NAME=`"javax.script.name"` ScriptEngineFactory.getParameter(NAME)	`rexx`
ScriptEngineFactory.getParameter("THREADING")	`MULTITHREADED`

strings:
   `Hello, world`
   `this is "Jsr223TagLib".'script"`
	output statements:
	   `SAY "Hello, world"`
	   `SAY "this is ""Jsr223TagLib".'script"""`

ScriptEngineFactory.getProgram(statements)	`/* --> begin of .RexxScriptEngineFactory@31f5107b --> 2(`
	`        SAY "Hello, world";`
	`        SAY "this is ""Jsr223TagLib".'script""";`
	`/* <-- end   of .RexxScriptEngineFactory@31f5107b <-- 2(`

Hello, world, this is ooRexx speaking at: 2021-09-18T12:02:19.693385

Done.

Implementation (JSR-223)
Nutshell: ooRexx_request_object.jsp

```
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
<style>
    body { background-color: ivory; }
</style>
<title>ooRexx_request_object.jsp (Title)</title>
</head>

<h1>Hello, world (JSP with ooRexx)</h1>
<p>This JSP was executed, because of the following URL:
<ul><li>URL <em>request~getRequestURL</em>: <br><code>
<body>
<s:script type="rexx">
   use arg request
   say request~getRequestURL~toString "</code>"
   say "<li>its URI being <em>request~getRequestURI</em>: <br><code>"
   say request~getRequestURI
</s:script>
</code></ul></p>
</body>
</html>
```

ooRexx_request_object.jsp

Hello, world (JSP with ooRexx)

This JSP was executed, because of the following URL:

- URL *request~getRequestURL*:
  `http://localhost:8080/demoASF2021/ooRexx_request_object.jsp`
- its URI being *request~getRequestURI*:
  `/demoASF2021/ooRexx_request_object.jsp`

Implementation (JSR-223) Nutshell: JavaScript_helloWorld.jsp

```jsp
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
    <meta charset="UTF-8" />
    <style>
        body { background-color: ivory; }
    </style>
    <title>Hello World from JavaScript/Nashorn (Title)</title>
</head>
<body>
    <h1>&quot;Hello, world ...&quot; by JavaScript/Nashorn</h1>
    <s:script type="nashorn">
        // Date and formatting is a problem in JavaScript, using Java directly
        df = new java.text.SimpleDateFormat("yyyy-MM-dd'T'HH:mm:ss.SSS");
        strISO = df.format( new java.util.Date());
        out.println('<p style="background-color: gold;">Hello, world, this is JavaScript/Nashorn speaking at: ' + strISO + '</p>');
    </s:script>

    <hr width="75%" style="color: green;">

    <h1>&quot;Hello, world ...&quot; by JavaScript/Nashorn, this time attribute &quot;<code>debug</code>&quot; Set to True</h1>
    <s:script type="javascript" debug="true">
        // Date and formatting is a problem in JavaScript, using Java directly
        df = new java.text.SimpleDateFormat("yyyy-MM-dd'T'HH:mm:ss.SSS");
        strISO = df.format( new java.util.Date());
        out.println('<p style="background-color: gold;">Hello, world, this is JavaScript/Nashorn speaking at: ' + strISO + '</p>');
    </s:script>
    <hr width="75%" style="color: green;">

    <p>Done.<p>
</body>
</html>
```

Implementation (JSR-223)
Nutshell: JavaScript_request_object.jsp

```
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
<style>
    body { background-color: ivory; }
</style>
<title>JavaScript_request_object.jsp (Title)</title>
</head>

<h1>Hello, world (JSP with JavaScript/Nashorn)</h1>
<p>This JSP was executed, because of the following URL:
<ul><li>URL <em>request.getRequestURL()</em>: <br><code>
<body>
<s:script type="javascript">
    out.println( request.getRequestURL() + "</code>" );
    out.println( "<li>its URI being <em>request.getRequestURI()</em>: <br><code>" );
    out.println( request.getRequestURI() );
</s:script>
</code></ul></p>

</html>
```

"Hello, world ..." by JavaScript/Nashorn

Hello, world, this is JavaScript/Nashorn speaking at: 2021-09-18T12:50:16.738

"Hello, world ..." by JavaScript/Nashorn, this time attribute "`debug`" Set to True

Debug Information

request.getContextPath()	/demoASF2021
request.getRequestURL()	
request.getRequestURI()	
virtualPath (without contextPa	
application.getRealPath(virtua	

Hello, world (JSP with JavaScript/Nashorn)

This JSP was executed, because of the following URL:

- URL *request.getRequestURL()*:
  `http://localhost:8080/demoASF2021/JavaScript_request_object.jsp`
- its URI being *request.getRequestURI()*:
  `/demoASF2021/JavaScript_request_object.jsp`

Current thread	id=[prio
Script manager	javax.script.ScriptEngineManager@4b11e0a7
Script engine	jdk.nashorn.api.scripting.NashornScriptEngine@351f5fe8

scriptCode	`// Date and formatting is a problem in JavaScript, u…`
	`df = new java.text.SimpleDateFormat("yyyy-MM-dd'T'HH…`
	`strISO = df.format( new java.util.Date());`

Implementation (JSR-223)
Nutshell: Groovy_helloWorld.jsp

```
<%@ page session="false" pageEncoding="UTF-8" contentType="text/html; charset=UTF-8" %>
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8" />
<style>
    body { background-color: ivory; }
</style>
<title>Groovy_helloWorld.jsp (Title)</title>
</head>
<body>

<div style="float: left; padding: 10px;">
<img src="images/Groovy-logo.svg" width="200px" alt="" />
</div>

<h1>&quot;Hello, world ...&quot; by Groovy</h1>

<s:script type="groovy" >
  df = new java.text.SimpleDateFormat("yyyy-MM-dd'T'HH:mm:ss.SSS")
  strISO = df.format( new java.util.Date())
  println "<p style='background-color: gold;'>Hello, world this is Groovy speaking at: " + strISO + "</p>"
</s:script>

<hr width="75%" style="color: green;">

<h1>&quot;Hello, world ...&quot; by Groovy, this time attribute &quot;<code>debug</code>&quot; Set to True</h1>
<s:script type="groovy" debug="true">
  df = new java.text.SimpleDateFormat("yyyy-MM-dd'T'HH:mm:ss.SSS")
  strISO = df.format( new java.util.Date())
  println "<p style='background-color: gold;'>Hello, world this is Groovy speaking at: " + strISO + "</p>"
</s:script>

<hr width="75%" style="color: green;">
<p>Done.<p>
</body>
</html>
```

Implementation (JSR-223)
Nutshell: Groovy_request_object.jsp

```
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
<style>
    body { background-color: ivory; }
</style>
<title>Groovy_request_object.jsp (Title)</title>
</head>

<h1>Hello, world (JSP with Groovy)</h1>
<p>This JSP was executed, because of the following URL:
<ul><li>URL <em>request.getRequestURL()</em>: <br><code>
<body>
<s:script type="groovy">
    println request.getRequestURL() + "</code>"
    println "<li>its URI being <em>request.getRequestURI()</em>: <br><code>"
    println request.getRequestURI()
</s:script>
</code></ul></p>

</body>
</html>
```

"Hello, world ..." by Groovy

Hello, world this is Groovy speaking at: 2021-09-18T12:59:43.354

"Hello, world ..." by Groovy, this time attribute "debug" Set to True

request.getContextPath()	/demoASF202...
request.getRequestURL()	http://localhos...
request.getRequestURI()	/demoASF202...
virtualPath (without contextPath)	/Groovy_hello...
application.getRealPath(virtualPath)	/opt/tomcat9/a... exists? (true)

Hello, world (JSP with Groovy)

This JSP was executed, because of the following URL:

- URL *request.getRequestURL()*:
  `http://localhost:8080/demoASF2021/Groovy_request_object.jsp`
- its URI being *request.getRequestURI()*:
  `/demoASF2021/Groovy_request_object.jsp`

Debug Informa

Current thread	id=[23]: name=[http-nio-8080-exec-4], threadGroup=[java.lang.ThreadGroup[name=main,maxpri=10]], priority=[5], state=[RUNNABLE]
Script manager	javax.script.ScriptEngineManager@4149f41d
Script engine	org.codehaus.groovy.jsr223.GroovyScriptEngineImpl@4392f75b
scriptCode	``` df = new java.text.SimpleDateFormat("yyyy-MM-dd'T'HH:mm:ss… strISO = df.format(new java.util.Date()) println "<p style='background-color: gold;'>Hello, world t… ```

Implementation (JSR-223)
Nutshell: Jython_helloWorld.jsp

```jsp
<%@ page contentType="text/html" %>
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8" />
<style>
    body { background-color: ivory; }
</style>
<title>Jython_helloWorld.jsp (Title)</title>
</head>
<body>
<div style="float: left; padding: 10px;">
<img src="images/jython-log.png" width="200px" alt="" />
</div>
<h1>&quot;Hello, world ...&quot; by Jython</h1>
<s:script type="python" arguments="false" >
from java.text import SimpleDateFormat
df = SimpleDateFormat("yyyy-MM-dd'T'HH:mm:ss.SSS")
from java.util import Date
now = Date()
strISO = df.format( now )
print( "<p style='background-color: gold;'>Hello, world this is Jython speaking at: " + strISO + "</p>")
</s:script>
<hr width="75%" style="color: green;">
<h1>&quot;Hello, world ...&quot; by Jython, this time attribute &quot;<code>debug</code>&quot; Set to True</h1>
<s:script type="jython" arguments="false" debug="true">
from java.text import SimpleDateFormat
df = SimpleDateFormat("yyyy-MM-dd'T'HH:mm:ss.SSS")
from java.util import Date
now = Date()
strISO = df.format( now )
print( "<p style='background-color: gold;'>Hello, world this is Jython speaking at: " + strISO + "</p>")
</s:script>
<hr width="75%" style="color: green;">
<p>Done.<p>
</body>
```

Implementation (JSR-223)
Nutshell: Jython_request_object.jsp

```
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
<style>
    body { background-color: ivory; }
</style>
<title>Jython_request_object.jsp (Title)</title>
</head>

<body>
<s:script type="jython" arguments="false" >
print("<h1>Hello, world (JSP with Jython)</h1>")

print("<p>This JSP was executed, because of the following URL:"  \
     + "<ul><li>URL <em>request.getRequestURL()</em>: <br><code>"  \
     + request.getRequestURL().toString() + "</code>")

print("<li>its URI being <em>request.getRequestURI()</em>: <br><code>" \
     + request.getRequestURI() + "</code></ul></p>")
</s:script>
</body>
</html>
```

"Hello, world ..." by Jython

Hello, world this is Jython speaking at: 2021-09-18T13:26:02.949

"Hello, world ..." by Jython, this time attribute "`debug`" Set to True

Debug Information	
request.getContextPath()	/demoASF2021
request.getRequestURL()	http://localhost:8080/demoASF2021/Jyt...
request.getRequestURI()	/demoASF2021/Jython_helloWorld.jsp
virtualPath (without contextPath)	/Jython_helloWorld.jsp
application.getRealPath(virtualPath)	/opt/tomcat9/apache-tomcat-9.0.52/web... *exists? (true)*

Hello, world (JSP with Jython)

This JSP was executed, because of the following URL:

- URL *request.getRequestURL()*:
  `http://localhost:8080/demoASF2021/Jython_request_object.jsp`
- its URI being *request.getRequestURI()*:
  `/demoASF2021/Jython_request_object.jsp`

Debug Information (Taglib Invocation F...	
Current thread	id=[29]: name=[http-nio-8080-exec-9], threadGroup=[java.lang.ThreadGroup[name=main,maxpri=10]], priority=[5], state=[RUNNABLE]
Script manager	javax.script.ScriptEngineManager@1546c17a
Script engine	org.python.jsr223.PyScriptEngine@5454c645
| scriptCode | ```
from java.text import SimpleDateFormat
df = SimpleDateFormat("yyyy-MM-dd'T'HH:mm:ss.SSS")
from java.util import Date
now = Date()
``` |

Implementation (JSR-223) Nutshell: PHP_helloWorld.jsp

```
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
    <meta charset="UTF-8" />
    <style> body { background-color: ivory; } </style>
    <title>PHP_helloWorld.jsp (Title)</title>
</head>
<body>
    <div style="float: left; padding: 10px;">
    <img src="images/resin-logo-small.jpg" width="200px" alt="" />
    </div>
    <h1>&quot;Hello, world ...&quot; by PHP/Resin (Quercus)</h1>
    <s:script type="php">
    <?php
        // microseconds 'u' not supported on Resin?  // $now = new DateTime('NOW');
        // $strISO = $now->format('Y-m-d\TH:i:s.u'); // 'u' not supported? 'c' will use ISO with GMT offset
        $df = new Java("java.text.SimpleDateFormat", "yyyy-MM-dd'T'HH:mm:ss.SSS");
        $now = new Java("java.util.Date");
        $strISO = $df->format($now);
        echo "<p style=\"background-color: gold;\">Hello, world, this is PHP/Resin (Quercus) speaking at: " , $strISO , "</p>" ;
     ?>
    </s:script>
    <hr width="75%" style="color: green;">
    <h1>&quot;Hello, world ...&quot; by PHP/Resin (Quercus), this time attribute &quot;<code>debug</code>&quot; Set to True</h1>
    <s:script type="php" debug="true">
    <?ph
        $df = new Java("java.text.SimpleDateFormat", "yyyy-MM-dd'T'HH:mm:ss.SSS");
        $now = new Java("java.util.Date");
        $strISO = $df->format($now);
        echo "<p style=\"background-color: gold;\">Hello, world, this is PHP/Resin (Quercus) speaking at: " , $strISO , "</p>" ;
     ?>
    </s:script>
    <hr width="75%" style="color: green;">
    <p>Done.<p>
</body>
</html>
```

Implementation (JSR-223) Nutshell: PHP_request_object.jsp

```jsp
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>
<html>
<head>
<style>
    body { background-color: ivory; }
</style>
<title>PHP_request_object.jsp (Title)</title>
</head>

<h1>Hello, world (JSP with PHP/Resin (Quercus))</h1>
<p>This JSP was executed, because of the following URL:
<ul><li>URL <em>$request-&gt;getRequestURL()</em>: <br><code>
<body>
<s:script type="php">
    <?
    echo $request->getRequestURL() , "</code>" ;
    echo "<li>its URI being <em>\$request-&gt;getRequestURI()</em>: <br><code>" ;
    echo $request->getRequestURI() ;
    ?>
</s:script>
</code></ul></p>

</html>
```

"Hello, world ..." by PHP/Resin (Quercus)

"Hello, world ..." by PHP/Resin (Quercus), this time attribute "`debug`" Set to True

Debug Information

request.getContextPath()	/demoASF...
request.getRequestURL()	http://loca...
request.getRequestURI()	/demoASF...
virtualPath (without contextPath)	/PHP_hell...
application.getRealPath(virtualPath)	/opt/tomca... exists? (tr...

Hello, world (JSP with PHP/Resin (Quercus))

This JSP was executed, because of the following URL:

- URL *$request->getRequestURL()*:
  `http://localhost:8080/demoASF2021/PHP_request_object.jsp`
- its URI being *$request->getRequestURI()*:
  `/demoASF2021/PHP_request_object.jsp`

Debug Information (Taglib Invocation Related)

Current thread	id=[24]: name=[http-nio-8080-exec-5], threadGroup=[java.lang.ThreadGroup[name=main,maxpri=10]], priority=[5], state=[RUNNABLE]
Script manager	javax.script.ScriptEngineManager@5c0ba4f3
Script engine	QuercusScriptEngine[isUnicodeSemantics=true]
	```<?php // $now = new DateTime('NOW'); // $strISO = $now->format('Y-m-d\TH:i:s.u'); // 'u' …```

Small Utiltity Samples
server_infos.jsp

- *server_infos.jsp*

    – Invokes ooRexx servlet *server_infos.rex* which creates debug information for *ooRexx*, *BSF4ooRexx* and *Java*

    – Use in a proper *JSP* or include it temporarily in one of your *JSPs* for debugging

```
<%@ page session="false" pageEncoding="UTF-8" contentType="text/html; charset=UTF-8" %>
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<s:script type="rexx" src="code/server_infos.rex" cacheSrc="false" />
```

BSF4ooRexx Setup Information
(2021-09-18T13:55:56.745520)

This was created with ooRexx at the server employing the JSP (Java Server Pages) infrastructure. In effect this particular Rexx program can be regarded as a "Rexx Servlet (RSL)".

`.bsf4rexx~display.version: [ooRexx 5.0.0 r12266 (18 Jul 2021) / BSF 641.20210829 / Java 1.8.0_162, 64-bit (x86_64) / Darwin 20.6.0]`

TagLib Invocation Information

This Rexx script was invoked via:

- typelib: [`Jsr223TagLib`]
- tag: [`script`]
- Total number of received arguments: [4]
    - arg(1): [`org.apache.catalina.connector.RequestFacade@332bc84`]
    - arg(2): [`org.apache.catalina.connector.ResponseFacade@523ddb35`]
    - arg(3): [`org.apache.jasper.runtime.JspWriterImpl@690a0b38`]
    - arg(4): [`a Slot.Argument`]

Rexx Information

- version: [`REXX-ooRexx_5.0.0(MT)_64-bit 6.05 18 Jul 2021`]
- source: [`DARWIN SUBROUTINE /opt/tomcat9/apache-tomcat-9.0.52/webapps/demoASF2021 /code/server_infos.rex`]

Information Supplied By .RexxInfo	
1	architecture	64
2	caseSensitiveFiles	0
3	date	18 Jul 2021
4	digits	9
5	directorySeparator	/
6	endofline	"0A"x
7	executable	/Library/Java/JavaVirtualMachines/jdk1.8.0_162.jdk/Contents/Home/bin/java
8	form	SCIENTIFIC
9	fuzz	0
10	internalDigits	18
11	internalMaxNumber	999999999999999999
12	internalMinNumber	-999999999999999999
13	languageLevel	6.05
14	libraryPath	/Library/Frameworks/ooRexx.framework/Versions/A/Libraries
15	majorVersion	5
16	maxArraySize	100000000000000000
17	maxExponent	999999999
18	maxPathLength	1024
19	minExponent	-999999999
20	modification	0
21	name	REXX-ooRexx_5.0.0(MT)_64-bit 6.05 18 Jul 2021
22	package	The REXX Package
23	pathSeparator	:
24	platform	DARWIN
25	release	0
26	revision	12266
27	version	5.0.0

BSF4ooRexx Information

BSF4ooRexx Version Information	
1 BSF4Rexx (DLL/so)	`600.20210804 org/rexxla/bsf/engines/rexx 64-bit`
2 Java Rexx engine	`600.20210805 org.rexxla.bsf.engines.rexx` `(org.apache.bsf)`
3 BSF.CLS	`641.20210829`
4 org.rexxla.bsf.engines.rexx.ArrayWrapper	`106.20210205`
5 org.apache.bsf.BSFManager	`245.20130629`
6 org.rexxla.bsf.engines.rexx.EnumerationWrapper	`102.20060101`
7 org.rexxla.bsf.engines.rexx.Java4Rexx	`452.20150804`
8 org.rexxla.bsf.engines.rexx.RexxAndJava	`600.20210805`
9 org.rexxla.bsf.engines.rexx.RexxEngine	`600.20191211`
10 org.rexxla.bsf.engines.rexx.Supplier	`106.20210209`

BSF4ooRexx External Functions
1 BSF
2 BsfContextVariables
3 BsfCreateRexxProxy
4 BsfDoUnregisterRexxObject
5 BsfDropFuncs
6 BsfGetRIID
7 BsfGetRTC
8 BsfGetTID
9 BsfInvokedBy
10 BsfJavaException
11 BsfLoadFuncs
12 BsfQueryAllFunctions
13 BsfQueryRegisteredFunctions
14 BsfRawBytes
15 BsfRexxProxy
16 BsfShowErrorMessage
17 BsfUninit4JavaBean
18 BsfVersion

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Java System Properties

1	awt.toolkit	`sun.lwawt.macosx.LWCToolkit`
2	catalina.base	`/opt/tomcat9/apache-tomcat-9.0.52`
3	catalina.home	`/opt/tomcat9/apache-tomcat-9.0.52`
4	catalina.useNaming	`true`

5	common.loader	`"${catalina.base}/lib",`
		`"${catalina.base}/lib/*.jar",`
		`"${catalina.home}/lib",`
		`"${catalina.home}/lib/*.jar"`

6	file.encoding	`UTF-8`
7	file.encoding.pkg	`sun.io`
8	file.separator	`/`
9	ftp.nonProxyHosts	`local|*.local|169.254/16|*.169.254/16`
10	gopherProxySet	`false`
11	http.nonProxyHosts	`local|*.local|169.254/16|*.169.254/16`
12	ignore.endorsed.dirs	
13	java.awt.graphicsenv	`sun.awt.CGraphicsEnvironment`
14	java.awt.printerjob	`sun.lwawt.macosx.CPrinterJob`
15	java.class.path	`/opt/tomcat9/latest/bin/bootstrap.jar:` `/opt/tomcat9/latest/bin/tomcat-juli.jar`
16	java.class.version	`52.0`
17	java.endorsed.dirs	`/Library/Java/JavaVirtualMachines/jdk1.8.0_162.jdk/Contents` `/Home/jre/lib/endorsed`

18	java.ext.dirs	`/Users/rony/Library/Java/Extensions:`
		`/Library/Java/JavaVirtualMachines/jdk1.8.0_162.jdk/Contents`
		`/Home/jre/lib/ext:`
		`/Library/Java/Extensions:`
		`/Network/Library/Java/Extensions:`
		`/System/Library/Java/Extensions:`
		`/usr/lib/java`

19	java.home	`/Library/Java/JavaVirtualMachines/jdk1.8.0_162.jdk/Contents` `/Home/jre`
20	java.io.tmpdir	`/opt/tomcat9/latest/temp`
21	java.library.path	`/usr/local/lib`
22	java.naming.factory.initial	`org.apache.naming.java.javaURLContextFactory`
23	java.naming.factory.url.pkgs	`org.apache.naming`

Small Utiltity Samples invocation_infos.jsp

- *invocation_infos.jsp*

    - Invokes ooRexx servlet *invocation_infos.rex* which creates debug information for the implicit JSP objects

    - Helpful for peeking around the current invocation information

```jsp
<%@ page session="true" pageEncoding="UTF-8" contentType="text/html; charset=UTF-8" %>
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>
<!DOCTYPE html>

<html>
<head>
    <meta charset="UTF-8" />
        <link rel="stylesheet" href="css/script.css">
        <title>Sample Application JSP Page Using Rexx Via Script/JSR-223 (Title)</title>
</head>
<body>
    <s:script type="rexx" src="code/invocation_infos.rex" cacheSrc="false"throwException="true" />
    <p>Done.</p>
</body>
</html>
```

TagLib Invocation Information (2021-09-18T13:56:00.758921)

`.bsf4rexx~display.version:`[ooRexx 5.0.0 r12266 (18 Jul 2021) / BSF 641.20210829 / Java 1.8.0_162, 64-bit (x86_64) / Darwin 20.6.0]

Dumping information about the following implicit objects with the attribute names:

1. *application* (`org.apache.catalina.core.ApplicationContextFacade@14421b9c`)
2. *config* (`org.apache.catalina.core.StandardWrapperFacade@65df0830`)
3. *exception* (`The NIL object`)
4. *out* (`org.apache.jasper.runtime.JspWriterImpl@137d1f0c`)
5. *page* (`org.apache.jsp.invocation_005finfos_jsp@7ed5ddc1`)
6. *pageContext* (`org.apache.jasper.runtime.PageContextImpl@5c03972e`)
7. *request* (`org.apache.catalina.connector.RequestFacade@332bc84`)
8. *response* (`org.apache.catalina.connector.ResponseFacade@523ddb35`)
9. *session* (`org.apache.catalina.session.StandardSessionFacade@c038de7`)

TagLib Implicit Attribute Information (2021-09-18T13:56:00.759945)

1. Accessible Methods for [*application*]

The following table has four columns: nr, name, `superclass level`, and method's `full name` at that level. If the method is a getter method (starts with 'get' or 'is' and has no parameters), then it gets executed and the resulting value or exception gets shown in the next line.

Accessible methods of [class org.apache.catalina.core.ApplicationContextFacade]			
1	addFilter	1	public javax.servlet.FilterRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addFilter(java.lang.String,ja
		1	public javax.servlet.FilterRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addFilter(java.lang.String,ja
		1	public javax.servlet.FilterRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addFilter(java.lang.String,ja

1. Accessible Methods for [*application*]

The following table has four columns: `nr`, `name`, `superclass level`, and method's `full name` at that level. If the method is a getter method (starts with 'get' or 'is' and has no parameters), then it gets executed and the resulting value or exception gets shown in the next line.

			Accessible methods of [class org.apache.catalina.core.ApplicationContextFacade]
1	addFilter	1	public javax.servlet.FilterRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addFilter(java.lang.String,ja...
		1	public javax.servlet.FilterRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addFilter(java.lang.String,ja...
		1	public javax.servlet.FilterRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addFilter(java.lang.String,ja...
2	addJspFile	1	public javax.servlet.ServletRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addJspFile(java.lang.Stri...
3	addListener	1	public void org.apache.catalina.core.ApplicationContextFacade.addListener(java.lang.Class)
		1	public void org.apache.catalina.core.ApplicationContextFacade.addListener(java.lang.String)
		1	public void org.apache.catalina.core.ApplicationContextFacade.addListener(java.util.EventListener)
4	addServlet	1	public javax.servlet.ServletRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addServlet(java.lang.Stri...
		1	public javax.servlet.ServletRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addServlet(java.lang.Stri...
		1	public javax.servlet.ServletRegistration$Dynamic org.apache.catalina.core.ApplicationContextFacade.addServlet(java.lang.Stri...
5	clone	2	protected native java.lang.Object java.lang.Object.clone() throws java.lang.CloneNotSupportedException
6	createFilter	1	public javax.servlet.Filter org.apache.catalina.core.ApplicationContextFacade.createFilter(java.lang.Class) throws javax.servlet....
7	createListener	1	public java.util.EventListener org.apache.catalina.core.ApplicationContextFacade.createListener(java.lang.Class) throws javax.s...
8	createServlet	1	public javax.servlet.Servlet org.apache.catalina.core.ApplicationContextFacade.createServlet(java.lang.Class) throws javax.ser...
9	declareRoles	1	public void org.apache.catalina.core.ApplicationContextFacade.declareRoles(java.lang.String[])
10	equals	2	public boolean java.lang.Object.equals(java.lang.Object)
11	finalize	2	protected void java.lang.Object.finalize() throws java.lang.Throwable
12	getAttribute	1	public java.lang.Object org.apache.catalina.core.ApplicationContextFacade.getAttribute(java.lang.String)
13	getAttributeNames	1	public java.util.Enumeration org.apache.catalina.core.ApplicationContextFacade.getAttributeNames()

```
a getter, value: [java.util.Collections$3@2e8df39c]
```

1	javax.servlet.context.tempdir	java.io.File@1dd81a4d
2	javax.websocket.server.ServerContainer	org.apache.tomcat.websocket.server.WsServerContainer@7e80934f
3	org.apache.catalina.jsp_classpath	/opt/tomcat9/apache-tomcat-9.0.52/lib/:
		/opt/tomcat9/apache-tomcat-9.0.52/lib/tomcat-i18n-ko.jar:
		/opt/tomcat9/apache-tomcat-9.0.52/lib/el-api.jar:
		/opt/tomcat9/apache-tomcat-9.0.52/lib/tomcat-i18n-es.jar:
		/opt/tomcat9/apache-tomcat-9.0.52/lib/tomcat-websocket.jar:

Roundup

- Taglib library to allow scripting languages to be used in JSPs

  - *Java EE*: <= Tomcat 9 use ***javax***.*ScriptTagLibs.jar*

  - *Jakarta EE*: >= Tomcat 10 use ***jakarta***.*ScriptTagLibs.jar*

- Any JSR-223 or BSF scripting language can be used

  - Either a *javax.script.ScriptEngine* or an *org.apache.bsf.BSFEngine* implementation

- Java objects can be shared among Java and scripting languages

  - Use the *request*'s *setAttribute(...)*, *getAttribute(...)*, *removeAttribute(...)*, or the global scope (scope number: 200) *Bindings* to store, to change or to remove objects

- It becomes possible for non-Java programmers to create web server applications with Tomcat and take advantage of all the features and supported infrastructures of Tomcat!

Some Links

- Taglibs: *https://sourceforge.net/projects/bsf4oorexx/files/Sandbox/rgf/taglibs/*

  - Includes the web application for this presentation: *demoASF2021.war*

  - Article that introduces servlets, JSPs and *ScriptTagLibs.jar* (*https://epub.wu.ac.at/8117/*)

  - Bachelor thesis: WebShop with cart et al: *http://wi.wu.ac.at/rgf/diplomarbeiten/#bakk_202102*

- Tomcat: *http://tomcat.apache.org*

- ooRexx: *https://sourceforge.net/projects/oorexx/files/oorexx/5.0.0beta/*

- BSF4ooRexx: *https://sourceforge.net/projects/bsf4oorexx/files/beta/20200928/*

- Nashorn Java > 14: *https://github.com/openjdk/nashorn*

- Groovy: *https://groovy.apache.org/download.html*

- Jython: *https://www.jython.org/download.html*

- PHP: *https://caucho.com/products/resin/download/gpl*

Teaser (sql_add_data.jsp)

```
<%@ taglib uri="http://rexxla.org/taglibs/jsr223" prefix="s" %>

<html>
<head>
    <title>sql_add_data.jsp</title>
    <link rel="stylesheet" href="css/mystyle.css">
</head>

<body>
<h1>sql_add_data.jsp - Java-less Interaction with a SQLite Database</h1>

<div class="rexx">
<p>Using ooRexx to get a SQLite connection object, save it as a <em>request</em>
attribute named <em>sql_con</em> to allow other programs on the page to use it.
Then using ooRexx to insert a record ...

<p>
<s:script type="rexx" name="sql_add_data.rex">
    use arg request
    con=.nil                -- no connection as of yet
    signal on syntax    -- create debug infos in case of an error
    name = "java:/comp/env/jdbc/TomcatTestDB" -- JNDI name of our database
    ctxt = .bsf~new("javax.naming.InitialContext")  -- get JNDI initial context
    ds   = ctxt~lookup(name)            -- get access to our datasource
    if ds~isNil then
    do
      say "<br>PROBLEM: cannot get access to our datasource:" pp(name)
      say "<br>ctxt~getNameInNamespace:" pp(ctxt~getNameInNamespace) "<br>" -- "java:"
      exit -1
    end
    con = ds~getConnection   -- get a connection
    request~setAttribute("sql_con", con)    -- save connection for others to use

    -- insert a record
    stmt  = con~createStatement     -- create statement
```

Teaser (sql_add_data.jsp)

```
    -- insert a record
    stmt  = con~createStatement     -- create statement
    sql = "INSERT INTO tomcat (name, message, datetime) VALUES" -
          "('ooRexx', 'Hello, from ooRexx', datetime(""NOW""))"
    rows = stmt~executeUpdate(sql)
    exit

syntax:                 -- label Rexx jumps to in case of an error
    co = condition('o') -- get condition information
    say '<br><pre style="text-align: left; color:maroon;">'esc(ppJavaExceptionChain(co, .true)) "</pre>"
    say '<p style="color: maroon;">No connection available, aborting!</p>'
    if con<>.nil then
    do
        con~close       -- make sure we close the connection
        request~removeAttribute("sql_con")
    end
    raise propagate     -- now let ooRexx get the condition

::routine esc public -- escape &, <, >
  return arg(1)~changeStr("&","&amp;")~changeStr("<","&lt;")~changeStr(">","&gt;")
</s:script>
</div>


<hr>
<div class="javascript">
<p>Using JavaScript to insert a record ...
<s:script type="javascript" name="sql_add_data.js">
con=request.getAttribute("sql_con") // get connection object
if (con==null) exit;
stmt=con.createStatement();
sql = "INSERT INTO tomcat (name, message, datetime) VALUES" +
      "('JavaScript', 'Hello, from Nashorn', datetime(\"NOW\"))";
rows = stmt.executeUpdate(sql);
</s:script>
</div>
```

Teaser (sql_add_data.jsp)

```html
<hr>
<div class="groovy">
<p>Using Groovy to insert a record ...
<s:script type="Groovy" name="sql_add_data.groovy">
con=request.getAttribute("sql_con") // get connection object
if (con==null) return;
stmt=con.createStatement();
sql = "INSERT INTO tomcat (name, message, datetime) VALUES" +
      "('Groovy', 'Hello, from Groovy', datetime(\"NOW\"))";
rows = stmt.executeUpdate(sql);
</s:script>
</div>
<hr>
<div class="jython">
<p>Using Jython to insert a record ...
<s:script type="jython" name="sql_add_data.py" arguments="false">
con=request.getAttribute("sql_con")
if con: # if not null insert record
    stmt=con.createStatement()
    sql = "INSERT INTO tomcat (name, message, datetime) VALUES" + \
          "('Jython', 'Hello, from Jython', datetime(\"NOW\"))"
    rows = stmt.executeUpdate(sql)
</s:script>
</div>
<hr>
<div class="php">
<p>Using PHP to insert a record ...
<s:script type="php" name="sql_add_data.php">
<?
$con=$request->getAttribute("sql_con"); // get connection object
if (is_null($con)) return;
$stmt=$con->createStatement();
$sql = "INSERT INTO tomcat (name, message, datetime) VALUES
        ('PHP', 'Hello, from PHP', datetime(\"NOW\"))";
$rows = $stmt->executeUpdate($sql);
?>
</s:script>
</div>
```

Teaser (sql_add_data.jsp)

```
<div class="rexx">
<p>Using ooRexx to display current records in database:
<p> <table>
        <tr>
            <th>ID</th>
            <th>Name</th>
            <th>Message</th>
            <th>Date</th>
        </tr>
<s:script type="rexx" name="sql_show_data.rex">
    use arg request
    con=request~getAttribute("sql_con") -- fetch connection
    if con~isNil then return
    signal on syntax     -- create debug infos in case of an error
    stmt  = con~createStatement     -- create statement
                                    -- define sql statement:
    query = "select id, name, message, datetime from tomcat"
    rs    = stmt~executeQuery(query)  -- run query, fetch result set
    loop while rs~next               -- loop over all rows
        say "           <tr>"
        say "              <td class='nr'>" rs~getString("id")  "</td>"
        say "              <td>" esc(rs~getString("name"     )) "</td>"
        say "              <td>" esc(rs~getString("message"  )) "</td>"
        say "              <td class='date'>" rs~getString("datetime")  "</td>"
        say "           </tr>"
    end
    exit
syntax:                  -- label Rexx jumps to in case of an error
    co = condition('o') -- get condition information
    say '<br><pre style="text-align: left; color:maroon;">'esc(ppJavaExceptionChain(co, .true)) "</pre>"
    say '<p style="color: maroon;">No connection available, aborting!</p>'
    if con<>.nil then
    do
        con~close        -- make sure we close the connection
        request~removeAttribute("sql_con")
    end
    raise propagate      -- now let ooRexx get the condition
</s:script>
```

Teaser (sql_add_data.jsp)

```html
        </table>
</div>
<br>
<hr>
<p>Information regarding the current database using <code>java.sql.DatabaseMetaData</code>
on this connection object (ooRexx):
<br>
<div style="text-align: center;" class="rexx">
    <table style="font-size: smaller; color: maroon;">
        <tr>
            <th>Name</th>
            <th>Value</th>
        </tr>
```

```rexx
<s:script type="rexx" name="showMetaData.rex">
    use arg request
    con=request~getAttribute("sql_con")
    if con~isNil then return        -- no connection available
    signal on syntax    -- create debug infos in case of an error
    metaData = con~getMetaData
    infos = ("getUserName", "getURL",                                   -
             "getDatabaseProductName", "getDatabaseProductVersion",         -
             "getDatabaseMajorVersion", "getDatabaseMinorVersion",          -
             "getDriverName", "getDriverVersion",                           -
             "getJDBCMajorVersion", "getJDBCMinorVersion",                  -
             "getExtraNameCharacters",                                      -
             "getSQLKeywords",                                              -
             "getTimeDateFunctions", "getNumericFunctions", "getStringFunctions", "getSystemFunctions", -
             "supportsCoreSQLGrammar", "supportsExtendedSQLGrammar",        -
             "supportsANSI92EntryLevelSQL", "supportsANSI92IntermediateSQL", "supportsANSI92FullSQL", -
             "supportsStoredProcedures",                                    -
             "usesLocalFiles"                                               )
```

Teaser (sql_add_data.jsp)

```
    do methName over infos      -- iterate over the array
        say "              <tr>"
        say "                 <td>" methName "</td>"
        value=metaData~send(methName)   -- execute Java method, fetch result
        if value<>.nil, value~pos(",")>0 then value=value~changeStr(",", ", ")   -- insert blank to allow table cell to break line
        say "                 <td>" value "</td>"
        say "              </tr>"
    end
    con~close             -- make sure we close the connection to release the resources,
                          -- otherwise we will hang the web app eventually
    exit

syntax:                  -- label Rexx jumps to in case of an error
    co = condition('o') -- get condition information
    say '<br><pre style="text-align: left; color:maroon;">'esc(ppJavaExceptionChain(co, .true)) "</pre>"
    if con<>.nil then con~close   -- make sure we close the connection
    raise propagate       -- now let ooRexx get the condition
</s:script>
</table>
</div>

</body>
</html>
```

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