# A Quick-Start Tutorial on Struts 2

## Introduction

Structs, an open-source Apache project at http://struts.apache.org, is a MVC (Model-View-Controller) framework for creating user interfaces for Java web application. Struts is an extension of Java Servlets and JSP. Struts is in direct competition with JSF (Java Server Faces).

[TODO] struts functions, comparison of struts and JSF.

## Develop and Deploy Struts Application on Tomcat

Before writing our first Struts program, I shall assume that you have installed and configured Tomcat server. I shall also assume that Tomcat is running on port 8080 and denote the Tomcat's installed directory as `$CATALINA_HOME`. (Otherwise, read "How to install Tomcat".)

I also assume that you understand basic Java server-side technologies such as Java Servlets, JSP (JavaServer Pages), and Java Web Applications.

### Download the Struts Runtime Libraries

1. Download the Struts runtime libraries from http://struts.apache.org. Select "Downloads" ⇒ "Releases" ⇒ Select the latest General Availability (GA) release, e.g., "Struts 2.1.8.1" ⇒ "Full Distribution" ⇒ "`struts-2.1.8.1-all.zip`".
2. Unzip.
3. The runtime libraries are kept in sub-directory "`lib`", which includes 71 jar-files. To deploy Struts application in Tomcat, these libraries must be available to Tomcat. You could copy the selected jar-files into Tomccat's "`lib`" directory (i.e., `$CATALINA_HOME\lib`), which will be available to all the web applications. You could also place the jar-files into a specific web context's "`lib`" directory, which will be available to only the particular web application.

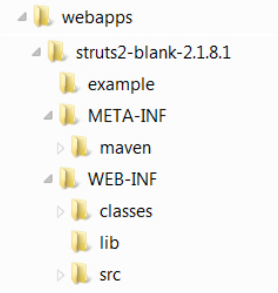
### Deploy and Run the Sample Applications Provided

The downloaded Struts package contains a few ready-to-deploy sample applications in directory "`apps`", in the form of war-files. In particular, a "blank" application template for which you can use to start writing your own codes. War-file (Web Application Archive) uses ZIP algorithm to compress and group files. You can extract the contents of war-file using WINZIP, WINRAR, or any other ZIP programs.

To deploy a sample application, simply copy the war-file into Tomcat's "`webapps`" directory (`$CATALINA_HOME\webapps`). Let's copy the "blank" sample application `struts2-blank-2.1.8.1.war` into Tomcat's "`webapps`". Start your Tomcat. The war-file will be unzipped and deployed automatically. Observer the following message in the Tomcat's console:

```
INFO: Deploying web application archive struts2-blank-2.1.8.1.war
May 1, 2010 11:32:41 AM com.opensymphony.xwork2.util.logging.jdk.JdkLogger info
INFO: Parsing configuration file [struts-default.xml]
May 1, 2010 11:32:41 AM com.opensymphony.xwork2.util.logging.jdk.JdkLogger info
INFO: Parsing configuration file [struts-plugin.xml]
May 1, 2010 11:32:41 AM com.opensymphony.xwork2.util.logging.jdk.JdkLogger info
INFO: Parsing configuration file [struts.xml]
```

The following directories are extracted from the war-file under "`webapps`":



```
webapps
  struts2-blank-2.1.8.1
    example
    META-INF
      maven
    WEB-INF
      classes
      lib
      src
```

A Java web application has a *standard* directory for storing various type of files:

- "`$CATALINA_HOME\webapps\struts2-blank-2.1.8.1`": This directory is known as *context root* of the web application "`struts2-blank-2.1.8.1`", which keeps the "`html`", "`jsp`" files accessible by the users. In this example, the home page "`index.html`".
- "`$CATALINA_HOME\webapps\struts2-blank-2.1.8.1\WEB-INF`": This directory is hidden from user and keeps the configuration files. You keep the configuration file in this directory and program codes in its sub-directories. In this example, it contains a configuration file "`web.xml`" for configuring this web application.
- "`$CATALINA_HOME\webapps\struts2-blank-2.1.8.1\WEB-INF\src`": Keep the java program source files (optional).
- "`$CATALINA_HOME\webapps\struts2-blank-2.1.8.1\WEB-INF\classes`": Keep the java classes.
- "`$CATALINA_HOME\webapps\struts2-blank-2.1.8.1\WEB-INF\lib`": keep the runtime libraries (jar-files) for this application.
- "`$CATALINA_HOME\webapps\struts2-blank-2.1.8.1\META-INF`":

Start Tomcat. Observe these message in the Tomcat's console:

```
May 1, 2010 4:18:56 PM org.apache.catalina.startup.HostConfig deployWAR
INFO: Deploying web application archive struts2-blank-2.1.8.1.war
May 1, 2010 4:18:56 PM com.opensymphony.xwork2.util.logging.jdk.JdkLogger info
INFO: Parsing configuration file [struts-default.xml]
May 1, 2010 4:18:57 PM com.opensymphony.xwork2.util.logging.jdk.JdkLogger info
INFO: Parsing configuration file [struts-plugin.xml]
May 1, 2010 4:18:57 PM com.opensymphony.xwork2.util.logging.jdk.JdkLogger info
INFO: Parsing configuration file [struts.xml]
```

To access the sample struts application, issue URL `http://loaclhost:8080/struts2-blank-2.1.8.1` from a web browser. The home page "`index.html`" redirect to "`example\Helloworld.jsp`". Browse thru the source code of these pages.

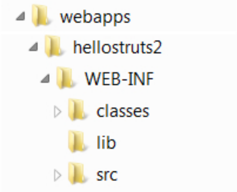
Try `http://loaclhost:8080/struts2-blank-2.1.8.1/example/Welcome.jsp`, and browse thru the source codes for these pages in "`example`" sub-directory.

## First Example: Hello-world

Let's write a Hello-world Struts application.

### Define a new Web Context "hellostructs2" in Tomcat

- First of all, define a new *web context* (*web application*) called "`hellostruts2`" in Tomcat for our Struts Hello-world application, by creating the standard directory structure for the web context (as shown in the figure below). Create a directory called "`hellostruts2`", under the Tomcat's `webapps` directory (`$CATALINA_HOME\webapps`). Create a sub-directory "`WEB-INF`" under "`hellostruts2`". Create sub-directories: "`classes`", "`lib`" and "`src`" under "`WEB-INF`". Take note that the directory names are case-sensitive.



- Copy the struts runtime jar-file into "`lib`": `commons-fileupload-1.2.1.jar`, `commons-io-1.3.2.jar`, `freemarker-2.3.15.jar`, `ognl-2.7.3.jar`, `struts2-core-2.1.8.1.jar`, `xwork-core-2.1.6.jar`.

### Configure "hellostruts2" - "web.xml" and "struts.xml"

Create the following web configuration file "`web.xml`". Save in "`$CATALINA_HOME\webapps\hellostruts2\WEB-INF`". The `<filter>` tag sets up the struts's dispatcher. The `<filter-mapping>` maps URL pattern "`/*`" (all requests under the root) to struts.

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app version="2.5" xmlns="http://java.sun.com/xml/ns/javaee"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation="http://java.sun.com/xml/ns/javaee http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd">
  <filter>
    <filter-name>struts2</filter-name>
    <filter-class>org.apache.struts2.dispatcher.FilterDispatcher</filter-class>
  </filter>
  <filter-mapping>
    <filter-name>struts2</filter-name>
    <url-pattern>/*</url-pattern>
  </filter-mapping>
</web-app>
```

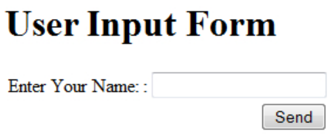
Create the following configuration file for struts "`struts.xml`". Save in "`$CATALINA_HOME\webapps\hellostruts2\WEB-INF\classes`". An *action* called `HelloWorld` is declared, which is mapped to `hello.HelloWorld` class. If the action returns a string "`Success`", invoke "`/response.jsp`".

```
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE struts PUBLIC
    "-//Apache Software Foundation//DTD Struts Configuration 2.0//EN"
    "http://struts.apache.org/dtds/struts-2.0.dtd">

<struts>
  <package name="default" extends="struts-default">
    <action name="HelloWorld" class="hello.HelloWorld">
      <result name="Success">/response.jsp</result>
    </action>
  </package>
</struts>
```

### Write the Hello-world Struts 2 Application

**"`input.jsp`"**: save under the context root "`$CATALINA_HOME\webapps\hellostruts2`". This page is used to produce the following form:



```
<%@page contentType="text/html" pageEncoding="UTF-8"%>
<%@taglib uri="/struts-tags" prefix="s" %>

<html>
<head>
  <title>Hello World</title>
</head>
<body>
  <h1>User Input Form</h1>
  <s:form action="HelloWorld" >
    <s:textfield name="name" label="Enter Your Name: " />
    <s:submit value="Send" />
  </s:form>
</body>
</html>
```

- The taglib directive declares the struts 2 tags, with prefix `'s'`.
- The `<s:form>` defines a HTML form, with processing action of "`HelloWorld`". The "`HelloWorld`" action is mapped to "`hello.HelloWorld`" class (in "`struts.xml`").
- The `<s:textfield>` define a text field element. The value will be captured in a field "`name`" of the "`hello.HelloWorld`" class.

**Class "`hello.HelloWorld`"**: save as "`hellostruts2\WEB-INF\src\hello\HelloWorld.java`"

```
package hello;

public class HelloWorld {
    private String message;
    private String name;
    private String name;

    public String execute() {
        setMessage("Hello, " + getName());
        return "Success";
    }

    public String getMessage() {
        return message;
    }

    public void setMessage(String message) {
        this.message = message;
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }
}
```

- To compile this Java source code using JDK, change the current directory to "`hellostruts2\WEB-INF`", and use `-d` option to set the output directory:

  ```
  > javac -d classes src\hello\HelloWorld.java
  ```

- We need to define a `execute()` method, which returns a string. From "`struts.xml`", if the return result is "`Success`", forward to "`\response.jsp`".
- Two properties, `name` and `message`, are defined together with the public getters and setters.

"**`response.jsp`**": saved as "`hellostruts2\response.jsp`". This page accesses the "`message`" property of the class "`hello.HelloWorld`", and has a "Back" button to return to "`/input.jsp`".

```
<%@page contentType="text/html" pageEncoding="UTF-8"%>
<%@taglib uri="/struts-tags" prefix="s" %>

<html>
<head>
  <title>Response Page</title>
</head>
<body>
  <h1><s:property value="message" /></h1>
  <s:form action="/input.jsp" >
    <s:submit value="Back" />
  </s:form>

</body>
</html>
```

### Start Tomcat

Start the Tomcat server. Check for the following messages to confirm that web context "`hellostruts2`" has been started.

```
May 1, 2010 4:18:59 PM org.apache.catalina.startup.HostConfig deployDirectory
INFO: Deploying web application directory hellostruts2
May 1, 2010 4:18:59 PM com.opensymphony.xwork2.util.logging.commons.CommonsLogger info
INFO: Parsing configuration file [struts-default.xml]
May 1, 2010 4:18:59 PM com.opensymphony.xwork2.util.logging.commons.CommonsLogger info
INFO: Parsing configuration file [struts-plugin.xml]
May 1, 2010 4:18:59 PM com.opensymphony.xwork2.util.logging.commons.CommonsLogger info
INFO: Parsing configuration file [struts.xml]
```

### Run the Struts Application

Issue URL:

```
http://localhost:8080/hellostruts2/input.jsp
```

Try "View Source" the see the output produced by "`input.jsp`" and "`response.jsp`".

## REFERENCES & RESOURCES

- Apache Tomcat @ http://tomcat.apache.org.
- Struts @ http://struts.apache.org.
- JavaServer Pages (JSP) Home Page @ http://java.sun.com/products/jsp, and Developer Site @ https://jsp.dev.java.net.

Latest version tested: JDK 1.6, Tomcat 6.0.26, Struts 2.1.8.1
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