

JSP & Struts Cheat Sheet

Jakarta Pages 4.0 · EL 6.0 · JSTL 3.0 · Servlet 6.1 · Tomcat 11.0.26 · Struts 7.4.0 · Java 21
Versions verified 2026-10-08 · albertoirueta.github.io/docs → Web Development → JSP & Struts

1 Setup: Maven, WAR, web.xml

provided:
jakarta.servlet:jakarta.servlet-api 6.1.0,
jakarta.servlet.jsp:jakarta.servlet.jsp-api 4.0.0, jakarta.el:jakarta.el-api 6.0.1
in the WAR (Tomcat has no JSTL):
jakarta.tomcat:jsp.jstl:jakarta.servlet.jsp.jstl-api 3.0.2+
org.glassfish.web:jakarta.servlet.jsp.jstl 3.0.1
Struts: import org.apache.struts:struts2-bom:7.4.0 (type pom, scope import); then struts2-core and struts2-**<name>**-plugin without versions. Java 17+, Servlet 6+.
Layout: src/main/webapp/ → WEB-INF/web.xml, WEB-INF/jsp/ (views, never served directly), WEB-INF/tags/, WEB-INF/lib/, WEB-INF/classes/ (incl. struts.xml). Deploy: webapps/ROOT.war or Manager.

```
<web-app version="6.1"
xmlns="https://jakarta.ee/xml/ns/jakartaee">
  <filter><filter-name>struts2</filter-name>
    <filter-class>org.apache.struts2.dispatcher.filter
  </filter>
  <StrutsPrepareAndExecuteFilter</filter>
</class></filter>
  <filter-mapping><filter-name>struts2</filter-name>
    <url-pattern>*/</url-pattern>
  </filter-mapping>
</web-app>
```

2 Servlet essentials

Lifecycle: init once → service → doGet/doPost per request (one instance, many threads: no mutable fields) → destroy.
Scopes: page < request < session < application (ServletContext). Session = cookie JSESSIONID; set HttpOnly, Secure, SameSite (Cookie.setAttribute()).

forward	server side, same request, URL unchanged
redirect	302/303 to a new request; use after a POST (PostRedirect/Get); 6.1 lets you pick the status
include	other resource's output inline, response stays yours

Components: @WebServlet, @WebFilter (chain.doFilter), @WebListener, @MultipartConfig + Part; web.xml overrides. Error pages: error-page; dispatch via RequestDispatcher.

3 JSP syntax

Directives: <%@ page contentType pageEncoding import session buffer autoFlush errorPage isErrorPage extends info language isELIgnored errorOnELNotfound trimDirectiveWhitespaces deferredSyntaxAllowedAsLiteral %>; <%@ include file="..." %> (translation time); <%@ taglib prefix uri %>.

Implicit objects (9): request response session application config out page pageContext exception (error pages only).

Comments: <!-- JSP --> (never sent) vs <!-- HTML --> (sent). **Legacy scripting:** <% %> scriptlet, <%= %> declaration, <%= %> expression; avoid; scripting=invalid turns them off.

Actions: jsp:include (request time) jsp:forward jsp:param jsp:useBean jsp:setProperty jsp:getProperty jsp:attribute jsp:body jsp:element jsp:text jsp:root (XML syntax, .jspx).

Lifecycle: translate → compile → jspInit → jspService per request → jspDestroy; recompiled when the file changes (development mode).

4 Expression Language 6.0

#{expr} immediate; **#(expr)** deferred. Unqualified name searches page, request, session, application.
Objects: pageContext pageScope requestScope sessionScope applicationScope param paramValues header headerValues cookie initParam.
Precedence (high→low): [] · () · unary - ! not empty * / div % mod + - · += (concat) · < > <= >= lt gt le ge == != eq ne && and · || or ? : · → · → · ;
empty: null, "", empty collection, map or array. Array Length property (6.0).
Lambdas/collections: (a,b) → a+b; set {1,2}, list [1,2], map {'k':1}; streams: books.stream().filter(b → b.price lt 20).map(b → b.title.toList()).
Static & types: Integer.MAX_VALUE, Math.max(1,2) (java.lang imported); records read by component name; Optional needs the opt-in resolver; ELProcessor standalone. Missing identifier: PropertyNotFoundException only with errorOnELNotFound.

5 JSTL 3.0 (Jakarta Tags)

prefix	URI
c	jakarta.tags.core
fmt	jakarta.tags.fmt
fn	jakarta.tags.functions
sql / x	jakarta.tags.sql / jakarta.tags.xml (legacy)

core: out (escapeXml true) set remove catch if choose when otherwise forEach forTokens import url param redirect
fmt: setLocale requestEncoding bundle setBundle message param formatNumber parseNumber formatDate parseDate setTimeZone timeZone
varStatus (LoopTagStatus): index (0-based, absolute) count (1-based) first last current begin end step.
fn (16): contains containsIgnoreCase endsWith escapeXml indexOf join length replace split startsWith substring substringAfter substringBefore toLowerCase toUpperCase trim

```
<%@ taglib prefix="c"
uri="jakarta.tags.core" %>
<c:forEach var="b" items="{books}"
varStatus="s">
  <c:out value="{s.count}.
  ${b.title}" />
</c:forEach>
```

6 Custom tags

SimpleTag: extend SimpleTagSupport; attributes are setters; doTag() writes via getJspContext().getOut(); body: getJspBody().invoke(null); stop the page with SkipPageException.

Classic: doStartTag → SKIP_BODY | EVAL_BODY_INCLUDE | EVAL_BODY_BUFFERED (BodyTag); doAfterBody → EVAL_BODY_AGAIN | SKIP_BODY; doEndTag → EVAL_PAGE | SKIP_PAGE. Handlers may be pooled (enablePooling).

```
<taglib
xmlns="https://jakarta.ee/xml/ns/jakartaee" version="4.0">
  <tlb-version>1.0</tlb-version>
  <short-name>ui</short-name>
  <uri>https://example.org/ui</uri>
  <tag->name>badge</name><tag-class>...
</tag-class>
  <body-content>scriptless</body-content>
  <attribute->name>text</name>
  <required>true</required>
  <rtexprvalue>true</rtexprvalue>
</attribute></tag>
  <function>...</function></taglib>
```

body-content: empty scriptless tagdependent JSP. **Tag files** (WEB-INF/tags/*.tag, taglib tagdir): directives tag attribute variable taglib include; <jsp:doBody/> renders the body, <jsp:invoke fragment="f"/> a fragment attribute; layouts via fragment attributes.

7 jsp-property-group & Jasper

jsp-config → jsp-property-group: url-pattern el-ignored error-on-el-not-found page-encoding scripting-invalid is-xml include-include-coda deferred-syntax-allowed-as-literal trim-directive-whitespaces default-content-type buffer error-on-undeclared-namespace.

Jasper (init params of the jsp servlet in conf/web.xml or web.xml):

parameter	default	production
development	true	false
modificationTestInterval	4 s	(unused)
trimSpaces	false	single
maxStringAsCharArray	false	true
keepgenerated	true	false
compilerSourceVM/Targ etVM	17	21

Also checkInterval enablePooling maxLoadedJspss jspIdleTimeout scratchdir mappedfile suppressSmap javaEncoding. Precompile with JspC; generated source in work/.

8 Struts lifecycle & struts.xml

Request → StrutsPrepareAndExecuteFilter → ActionMapper → ActionProxy/ActionInvocation → interceptors (in) → action method → Result → interceptors (out, reverse) → response. Default extension action,, (/books and /books.action).

```
<struts>
  <constant name="struts.devMode"
value="false"/>
  <package name="shelf"
extends="struts-default"
namespace="/">
    <global-results><result
name="login"/></WEB-INF/jsp/login.jsp
</result></global-results>
    <action name="books"
class="org.example.BooksAction"
method="list">
      <allowed-methods>list,add</allowed-methods>
      <interceptor-ref
name="defaultStack"/>
      <result></WEB-INF/jsp/books.jsp</result>
      <result name="added"
type="redirectAction">books
</result></action>
    </package>
  </struts>
```

Default result name success, default type dispatcher. Packages: name extends namespace abstract. Wildcards {1} and strict method invocation (allowed-methods). exception-mapping / global-exception-mappings. An action with its own interceptor-ref loses defaultStack unless it lists it.

9 Result types & defaultStack

Result types: success input error login none (null = none).

type	key parameter
dispatcher (default)	location
redirect	location, statusCode
redirectAction	actionName, namespace
chain	actionName
stream	inputName
httpheader plainText postback freemarker	location, headers
plugins: json tiles velocity xslt.jasperreports7	

defaultStack (24, in order): 1 exception 2 alias 3 servletConfig 4 httpMethod 5 i18n 6 csp 7 prepare 8 chain 9 scopedModelDriven 10 modelDriven 11 actionFileUpload 12 checkbox 13 datetime 14 multiselect 15 staticParams 16 actionMappingParams 17 params 18 conversionError 19 coep 20 coop 21 fetchMetadata 22 validation 23 workflow 24 debugging.

Others: basicStack paramsPrepareParamsStack executeAndWaitStack emptyStack token tokenSession timer logger. Own interceptor: AbstractInterceptor.intercept(inv) → inv.invoke().

10 OGNL, ValueStack, @StrutsParameter

ValueStack: object stack (action on top, then model) + applicationContext map. <%=property value="name"/> searches the stack top down; [1].name skips the top.

Named objects: #session #application #request #attr #parameters #action #this. %{expr} forces evaluation in a string attribute; \${expr} in result locations (parse). Projection #books.[title], selection #books.{? #this.price > 10}, literals {1,2}, # {'a':'b'}.

@StrutsParameter (struts.parameters.requireAnnotations=true): only annotated setters/fields (depth=0) and nested paths (@StrutsParameter(depth = 1)) receive request parameters.

OGNL limits: struts.allowlist.enable=true (+ struts.allowlist.packageNames/classes), struts.ognl.expressionMaxLength=256, excluded classes/packages, no static field access, no proxy access. Never build an expression from request input.

11 Validation, i18n, type conversion

Validators (*-validation.xml): required requiredString int long short double date expression fieldExpression email creditcard url visitor conditionalVisitor conversion stringLength regex; short-circuit stops later ones.

```
<validators><field name="title">
  <field-validator
type="requiredString" short-
circuit="true">
    <message key="title.required"/>
  </field-validator>
</field></validators>
```

File: BooksAction-validation.xml (or - alias-validation.xml) next to the class. Also validate(), validateXxx(), annotations @Validations @RequiredStringValidator @IntRangeFieldValidator @StringLengthFieldValidator @EmailValidator @ExpressionValidator @CustomValidator, Bean Validation plugin. validation + workflow return input on errors (excludeMethods input, back, cancel, browse).

i18n: locale from request_locale (i18n), session, cookie, Accept-Language. Bundle search: 1 Action, properties 2 interfaces 3 superclasses 4 model 5 package.properties (up the tree) 6 key hierarchy 7 global (struts.custom.i18n.resources). getText, <s:text name="k"/>.

Conversion: built-in locale aware converters; conversionError → field error. xwork.default.invalid.fieldvalue; xwork-conversion.properties, @Conversion; ModelDriven, Preparable.

12 Tags, themes, Convention, JSON, REST, upload

Tags (<%@ taglib prefix="s" uri="/struts-tags" %>): control if else if else iterator append generator merge sort subset; data a action bean date debug i18n include param property push set text url; UI form textField textarea password hidden checkbox checkboxList radio select combobox doubleselect optgroup file submit reset label token fielderror actionerror actionmessage head.

Themes (struts.ui.theme, default xhtml): simple, xhtml, css_xhtml, html5 (7.2.0); FreeMarker templates; themes="simple" per tag.

Convention: packages ending action actions struts struts2; class BookListAction → /book-list; view /WEB-INF/content/book-list.jsp or book-list-input.jsp; @Action @Namespace @Result @ParentPackage.

JSON: struts2-json-plugin, package extends json-default, result json (root includeProperties excludeProperties), json interceptor.

REST: struts2-rest-plugin, rest-default: GET /books index, /books/2 show, /books/new editNew, POST create, PUT update, DELETE destroy; .json/.xml.

Upload: actionFileUpload (6.4+) + UploadedFilesAware, withUploadedFiles (List<UploadedFile>); limits struts.multipart.maxSize maxFileSize maxFiles; check type and name, store outside the web app.

Security strip

- Escape on output: c:out, fn:escapeXml, <s:property> (escapes by default); never unescaped request data in \${} in scripts/attributes; keep JSPs under WEB-INF.
- struts.devMode=false in production; allowlist on; @StrutsParameter only where needed; strict method invocation (allowed-methods); DMI and action: prefix off (defaults).
- State changes by POST + CSRF/token interceptor; csp, coop, coep, fetchMetadata interceptors; upload limits; no OGNL/EL built from input.
- Run Struts 7.4.0 (or 6.12.0): S2-075 to S2-078 are fixed there; Tomcat 11.0.26 current; remove default webapps.

Changed since older tutorials

- javax.* → jakarta.* (EE 9); http://java.sun.com/jsp/jstl/* → jakarta.tags.* (Tags 3.0).
- jsp:plugin, isThreadSafe removed (Pages 4.0); SingleThreadModel removed (Servlet 6.0).
- FilterDispatcher → StrutsPrepareAndExecuteFilter; com.opensymphony.xwork2 → org.apache.struts2 (7.0); @StrutsParameter mandatory (7.0).
- fileUpload → actionFileUpload (6.4); Dojo/ajax theme, SiteMesh, Codebehind plugin removed.
- Struts 1 EOL 2013-04-05; 2.3 EOL 2019; 2.5 EOL 2023-10-30; no 7.x Maven archetype.