Fast Track to Struts
: What it does and how

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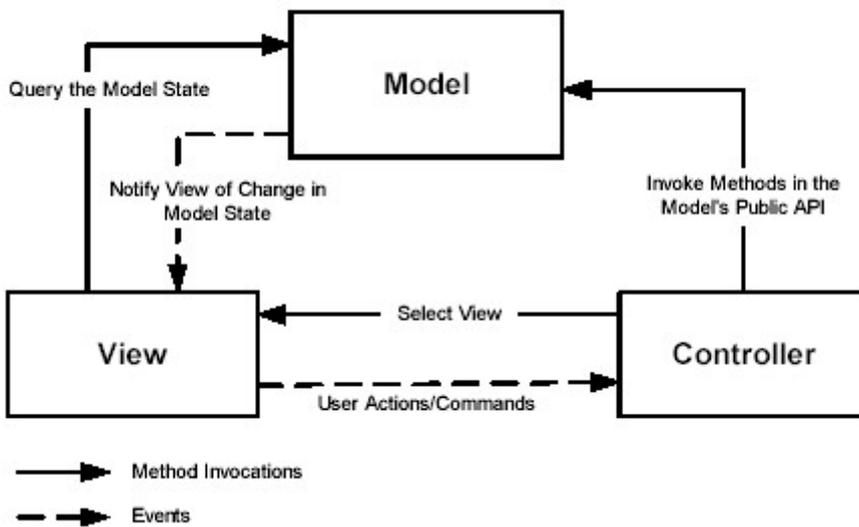
:

: Bizcom Java Article Center

[Intermediate level java developer]

1

, (configuration) (usage semantics)

. (robust presentation framework)

. (controller)

(semantics) (helper component)

.

.

http://jakarta.apache.org/struts .

MVC (MVC Architecture)

MVC (Model-View-Controller) (model), (view), (controller)

. ,

(graphical user interaction) .

(Model) :

1

.

．   (persistent state)

．

．

(public)   ,

．   ,

;

．   ,   ,

．

．

,   ．

(View) :   ．

．   ,

．   ,   ．

(forward).

(Controller) :   ,

．

．

J2EE   , MVC
JSP( )   (presentation layer)   JavaBean
EJB(   )   (business layer)
．   HTTP   ,
WML   XML   ,
． HTTP   /   ,
HTTP   ,   ,   ,
(request handler)   (delegate).   MVC Type-II
(Model 2)   ．   ,
(hook)[2]   ．

,

．

---

[2] hook   hook   ．
interface   abstract
．   hook
．

MVC   (Struts MVC Semantics)

MVC   .

Service to Worker   [Core]   MVC   .
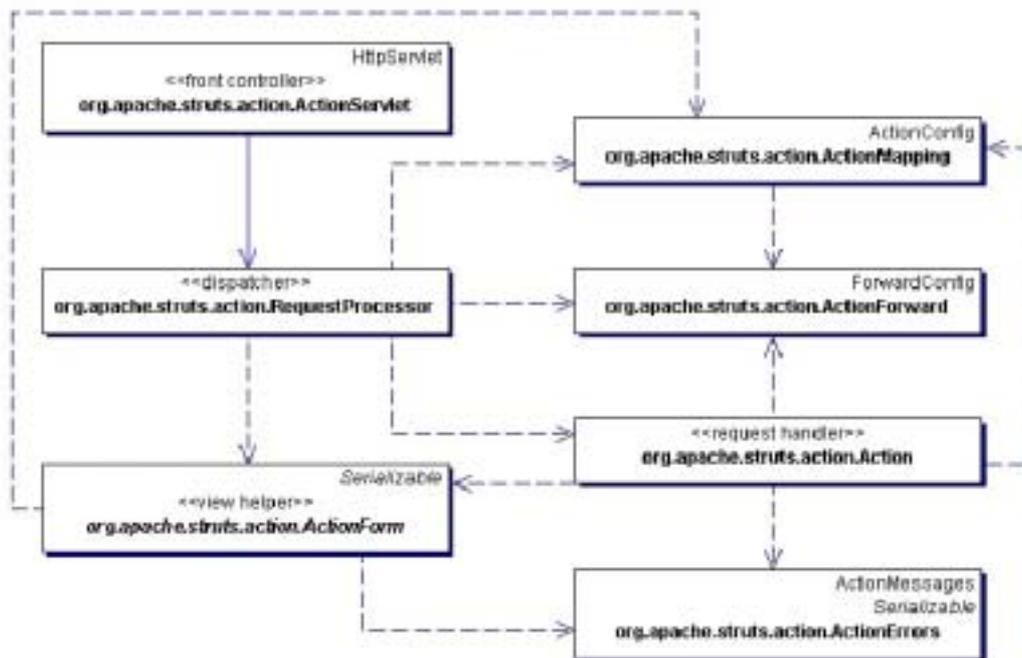
(The Controller Object)

ActionServlet   .

.   ,

,

.   (deployment descriptor)   .

<servlet>
<servlet- name>action</servlet- name>
<servlet- class>org.apache.struts.action.ActionServlet</servlet- class>
</servlet>

*.do   URI   .

```
<servlet- mapping>
<servlet- name>action</servlet- name>
<url- pattern>*.do</url- pattern>
</servlet- mapping>
```

URI   .

http://www.my_site_name.com/mycontext/actionName.do

(extension mapping)   .   ,   (path mapping)
,   /*   .

```
<servlet- mapping>
<servlet- name>action</servlet- name>
<url- pattern>/do/*</url- pattern>
</servlet- mapping>
```

URI   .

http://www.my_site_name.com/mycontext/do/action_Name

,   ,
;   (mapping scheme)
Multiplexed Resource Mapping   .
(centralized access point)   .
RequestProcessor   . RequestProcessor   ,   (form bean)
(dispatcher)   ,
.   RequestProcessor
.   ,   ,
,   ,
,   ,   ,
.

1.1   ,   init()
.   , ActionMapping
URI   ,   ,

.   ,

RequestProcessor   ,   ActionServlet

RequestProcessor   .

(The Dispatcher Object)

RequestProcessor   ,   (form

bean)   ,   .

RequestProcessor   ,

RequestProcessor   .   (/   )

RequestProcessor   .

RequestProcessor   , struts-config.xml   <action>

,   .

```
<action-mappings>
<action path="/editCustomerProfile"
type="packageName.EditCustomerProfileAction"
name="customerProfileForm"
scope="request"/>
</action-mappings>
<form-bean name="customerProfileForm"
type="packageName.customerProfileForm"/>
```

, RequestProcessor

. RequestProcessor   (action identifier)   URI   ,

(   ) ActionMapping

, requesthandler.execute(…)   .   execute(…)

.   ,

ActionForward   RequestProcessor   (ActionForward

<forward>   (run time)   , "ActionForward   (Navigation

using ActionForward)"   ). RequestProcessor   RequestDispatcher.forward(…)

response.sendRedirect(…)   ,

ActionFoward   .

ActionMapping   (Command Pattern using ActionMapping)

XML   ,   URI

.   (Gof)

.   struts-config.xml   ;   ActionMapping
                              ,   <action>   .

```
<action-mappings>
<action path="/editCustomerProfile"
type="packageName.EditCustomerProfileAction"
name="customerProfileForm"
scope="request"/>
</action-mappings>
```

                                                          .

path   HTTP   (context)
type
name   (JavaBean)   .

                              ,   .

scope

                              HTML <form>   action   .
                                                                          , HTML

                          .   ,   ,
                                          .   Action
                  .

HTML <form>   ,   org.apache.struts.taglib.html.FormTag
action   URL   ,   <url-pattern>
                                          HTML   . *.do* url
                              FormTag   <html:form
action="/editCustomerProfile?customerType=preferred">   ,   ,
                              HTML <form>   .
<form action="*/contextPath*/editCustomerProfile.do?customerType=preferred"/>

---

name   ,   HTTP

.   ActionForm

.   name   ,   ActionForm

. ActionForm

<form- beans>   struts- config.xml   .

<form- bean name="customerProfileForm"

type="*packageName*.customerProfileForm"/>

<form- bean>   ActionForm

   (Capturing Form Data)   .

(Model Interaction with Request Handlers)

Action   (adaptor)   .

                        Action   .

RequestProcessor   ,   RequestProcessor

                        .   Action   *(The Dispatcher Objects)*

                ,   .   [Gof]

        .   ,   URI   ,

(RequestProcessor)   .   UI

(decouple).

        Action   Action

        execute(…)   .

        ,   , *ErrorsTag*   *(Displaying Errors with ErrorsTag)*

                                    org.apache.struts.taglib.html.ErrorsTag

HTML   .   execute(…)

        ActionForm   ,

              ,   .

                        , RequestProcessor   (cache)   ,

        .   ,   .

        (serialized)

    .

                            ,   EJB

                                        ,   *Business Delegate*[Core]

            .   ,

        .

.

.

'

.   '

.   '

(*Data Access Object* [Core])   ,

. DAO   '

(integration tier)   .

Action   .

ActionForward   *(Navigation using ActionForward)*

ActionForward   .   'success', 'failure'

lookup   .

ActionForward   (forwarding) URL   (target view)

. ActionForward   struts- config.xml

<forward>   .   <action>

<forward>   .


```
<action path="/editCustomerProfile"
type="packageName.EditCustomerProfileAction"
name="customerProfileForm"
scope="request">
<forward name="success" path="/MainMenu.jsp"/>
<forward name="failure" path="/CustomerService.jsp"/>
</action>
```

(global) <forward>   ,

.


```
<global- forwards>
<forward name="success" path="/MainMenu.jsp"/>
<forward name="failure" path="/CustomerService.jsp"/>
</global- forwards>
```

execute(...)   ,   <forward>   name

org.apache.struts.action.ActionMapping.findForward(…)   ,
            . ActionMapping.findForward(…)
ActionForward   ,   response.sendRedirect(…)
RequestDispatcher.forward(…)   ,
ActionForward   RequestProcessor   .
RequestDispatcher.forward(…)   <forward>   redirect="false"
                    ,   redirect   . redirect="true"
sendRedirect(…)   .   redirect   .

```
<forward name="success" path="/Catalog.jsp" redirect="true"/>
```

struts-config.xml   <controller>   <forward>   name
                                                    . <controller>
        , <action>   input   .

```
<action path="/editCustomerProfile"
type="packageName.EditCustomerProfileAction"
name="customerProfileForm"
scope="request"
input="profile">
<forward name="profile" path="/CustomerProfile.jsp"/>
<forward name="success" path="/MainMenu.jsp"/>
</action>
<controller>
<set-property property="inputForward" value="true"/>
</controller>
```

        <action>   input   .
    <forward>   .   <controller>
    , ActionForm.validate(…)   ActionErrors   null   ActionErrors
        , RequestProcessor   <forward>   name   <action>
input   <forward>   .
RequestProcessor   ,
                ,   .   <controller>   ,
ActionForm.validate(…)   ActionErrors   null   ActionErrors

, input   ActionForward   URL
. inputForward   ,   .

```
<controller>
<set- property property="inputForward" value="false"/>
</controller>
```

path   ,   '/'
              .   ,   URL
              RequestProcessor   .

redirect=true   , URL   /contextPath/path   .
        HttpServletResponse.sendRedirect(...)   ,
                          ,   '/'   URL   .
redirect=false   , /path   URI   .
        ServletContext.getRequestDisptacher(...)   URL
        .

(Internationalization and Localization Support)

I18N[3]   ,
                                          .
        ,   .

GUI   ,
              .   ,
        ..
        ,   ,   ,   ,
        .

              ,   .
              , I18N
                          . JDK   ,
                          Locale   . Locale   ,

---

[3] I18N   "internalization"   .   I   N   18   .

.   I18N

(The Locale Object)

I18N   getAttribute(Action.LOCALE_KEY)

, HttpSession   .

HtmlTag   (Using HtmlTag)

org.apache.struts.taglib.html.HtmlTag   <html:html locale="true">

JSP   .   .

locale=true   ,   HttpServletRequest.getLocale()

Locale   . getLocale()   .

Accept-Language

.   Accept-Language   ,

.   ,   ,

Action.LOCALE_KEY   ,   Locale   .   ,

lang   ,   HTML   .

.   locale=true

.

.

(Using The Action Object)

, Action   Action.LOCALE_KEY

setLocale(…)   .

,   UI   , HTML

.   ,   ,

,

.   ,   ,

,   .

<controller>   (Using <controller> Element)

, *struts-config.xml*   <controller>   , HttpServletRequest

Action.LOCALE_KEY

RequestProcessor   .   .

```
<controller>
<set- property property="locale" value="true"/>
</controller>
```

value=true   ,   request.getLocale()   Locale   ,

          ,   .

(Internationalized Messaging and Labeling)

I18   ,   ,   ,   ,   GUI

                            .   JDK   ResourceBundle

                    MessageResources   .

                                        .   .

                    (base name)   ,

                                                .

                                                                ,

              ,   .   ,

                                        .   .

                                MyApplicationResources   ,

                            .

    MyApplicationResources_en   .
    MyApplicationResources_fr   .
    MyApplicationResources_fr_FR   .
    MyApplicationResources_fr_CA   .

                        fr_FR   en_US   ,

                                        .

              .

1. MyApplicationResources_fr_FR –

2. MyApplicationResources_fr –

3. MyApplicationResources_en_US –

4. MyApplicationResources_en –

5. MyApplicationResources –

MessageResources

. MessageResources   4   /

. ResourceBundle(s)

,   , MessageResources

struts- config.xml   .   struts-

config.xml   .

<message- resources parameter="packageName.MyApplicationResources"
key="MyResources"/>

parameter   .

MyApplicationResources.properties   ,

MyApplicationResources_*localeSpecificExtension*.properties

.   ,   .

,   , ActionServlet   MessageResources   ,

MessageResources   ,   Action.MESSAGE_KEY

Globals.MESSAGE_KEY   ,   MessageResources   , <message-

resource>   key   MessageResources

, ServletContext   .

, Action   MessageResources

,   ServletContext

, Action.getResources(…)   .   MessageResources

,

.   ,   <message- resource>

parameter   MessageResources   .

, MessageResources.getMessage(…)   .

. Action.LOCALE_KEY

. Object[]   MessageResources.getMessage(…)

,   , MessageFormat

.   MessageFormat

MessageFormat.format(…)

. MessageFormat   ,

Object[]   . MessageResources API

.   Javadoc

---

http://jakarta.apache.org/struts/api/index.html   .

    (Error Handling)

                                                                          .

       .   *(Internationalized Messaging and Labeling)*
           ,   MessageResources   .
MessageResources   /   .
     (lookup)   ,   ,
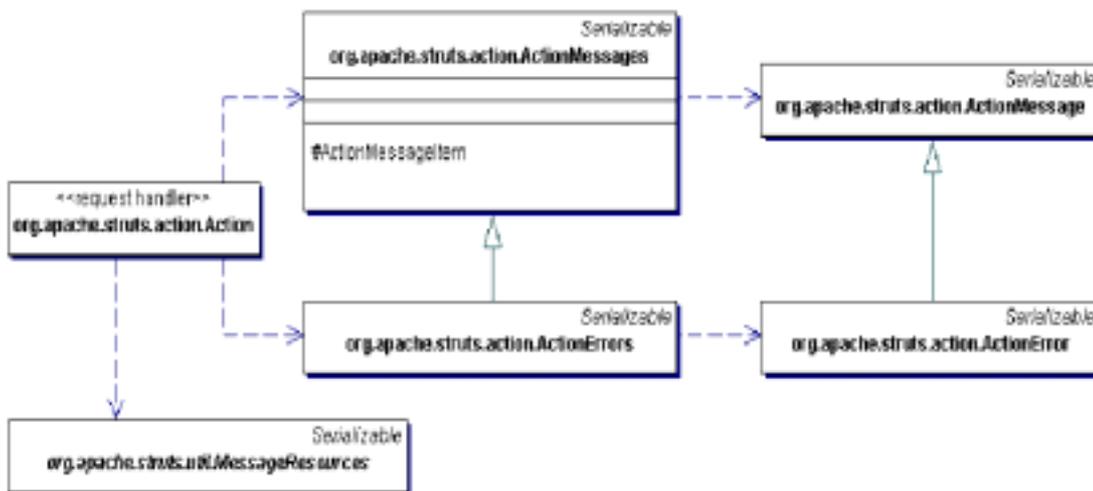(precursor)   ,   ActionErrors

            .

                   .

                                                              .

     ,

                                                        .

JSP   .

ActionError   *(Identifying Errors with ActionError)*
Action.execute(…)   ActionForm.validate(…)   ActionErrors

, ActionErrors

ActionError   . ActionError

object[]⁵   .

(Internationalized   Messaging   and   Labeling)   .

ActionError   .

ActionError   , I18N   . ActionError

, ActionError API   .

ActionError   ,   ActionError.add(…)

ActionErrors⁶   . ActionError

.   ,

ActionErrors.GLOBAL_ERROR⁷   ActionError.add(…)

. ActionErrors   *ActionErrors*

. ActionError   ActionMessage   .

1.1   , ActionError   ActionMessage   .

ActionErrors   *(Compiling Errors with ActionErrors)*

ActionErrors   HashMap   ActionError   . HashMap

,   ActionMessageItem   .

ActionMessageItem   ActionMessages   (inner class)   .

ActionMessageItem

ArrayList   .

ActionMessageItem   .

. ActionErrors .get()   ActionError

ArrayList   Iterator   .   Iterator

ErrorsTag   ,   *ErrorsTag*   .

,   , Action.execute(…)   , ActionErrors   Action.ERROR_KEY

HttpServletRequest   .   ActionErrors

Action   saveErrors(…)   .

ActionForm.validate(…)   ActionErrors   Action.ERROR_KEY

RequestProcessor   .   ActionErrors

ErrorsTag   . ErrorsTag   JSP

---

⁵ ActionError(String key, Object value0), ActionError(String key, Object value0, Object
value1), ActionError(String key, Object value0, Object value1, Object value2)
⁶ ActionErrors errors = new ActionErrors();
  errors.add("xx", new ActionError("yy"));
⁷ errors.add(ActionErrors.GLOBAL_ERROR, new ActionError("yy"));

.

```
<%@  taglib uri="/WEB-INF/struts-html.tld" prefix="html" %>
<html:errors/>
```

ActionErrors   ActionMessages   .   ActionErrors
GLOBAL_ERROR   ,   ActionMessages   GLOBAL_MESSAGE
                        .   ,
                    .   ActionMessages   ,
ActionMessages   Action.saveMessages(…)
    . Action.MESSAGE_KEY   ,   ActionMessages   .

                                                                      , String   ,
String   ,   ErrorMessages   (   )   ActionErrors
              org.apache.struts.util.RequestUtils.getActionErrors(…)   .
                              ,   getActionErrors(…)
ActionErrors.GLOBAL_ERROR   .

ErrorsTag   (Displaying Errors with ErrorsTag)
                          HTML   .   Action.ERROR_KEY
    , HttpServletRequest   ActionErrors   ,   ActionErrors.get()
                ,   ActionError   ArrayList   Iterator   .
ArrayList   ActionError   ,
                    .   .   ,
      locale   .   ,   Action.MESSAGE_KEY
                                      bundle
      .   ,   ,
                                                  .   1.1   ,   ErrorsTag
          (,   )   .   ,   ActionErrors
                                                                                                    .

ActionErrors   ActionError
                ,   ErrorsTag   property   ,
                    . ErrorsTag   ,   ,
                    "errors.header"   "errors.footer"   .

errors.header=<h3><font color="red">Please review following message(s)
```

before proceeding:</font></h3><ul>

errors.footer=</ul>


### (Exception Handling)


,


.


,


. JSP

JSP 1.2                              , errorPage                              .

,                                    web.xml                              <error-

page>                              .              , JSP

.              struts-config.xml

.


```
<action path="/editCustomerProfile"
type="packageName.EditCustomerProfileAction"
name="customerProfileForm"
scope="request"
input="profile">
<forward name="profile" path="/CustomerProfile.jsp"/>
<forward name="success" path="/MainMenu.jsp"/>
<exception
key="profile.inaccessible"
type=" packageName.ProfileAccessException"
path="/logon.jsp"/>
</action>
```


,

MessageResources   .

.

```
<<dispatcher>>                              <<request handler>>
org.apache.struts.action.RequestProcessor   org.apache.struts.action.Action

                    ActionConfig                              ForwardConfig
org.apache.struts.action.ActionMapping       org.apache.struts.action.ActionForward

                                            org.apache.struts.action.ExceptionHandler

                    Serializable
org.apache.struts.config.ExceptionConfig

                                                          ActionMessage
                    Exception                             Serializable
org.apache.struts.util.AppException          org.apache.struts.action.ActionError
```

(Role of Dispatcher)

RequetProcessor   , RequestProcessor   execute(..)
                         .   RequestProcessor

struts- config.xml   <exception>   .

RequetProcessor , type   ExceptionConfig

(<exception>   )

ActionMapping.findException(…)   .   <exception>

                                  , findException(…)   (chain)

                    ,   .

ActionMapping.findException(…)   ActionMapping

    <exception>   .

                              ,   <exception>

                    .

<global- exceptions>

<exception

key="profile. inaccessible"

type=" *packageName*. ProfileAccessException"

path="/logon.jsp"/>

</global- exceptions>

ExceptionConfig   , RequestProcessor

,   execute(…)   .

"   ActionErrors   (Converting an Exception into ActionErrors)"

. RequestProcessor   ActionForward

URL   .

AppException   (Exception Handling with AppException)

AppException   .

(   )   ActionError   . AppException

,   ,

,

.   ExceptionConfig

. AppException

AppException   API   . AppException

ExceptionHandler.execute(…)   .

ActionErrors   (Converting Exception into ActionErrors)

RequestProcessor   ExceptionConfig   .

RequestProcessor   ExceptionHandler   ,   create(…)

,   AppException   .

org.apache.struts.action.ExceptionHandler   ExceptionConfig

. ExceptionHandler   AppException   ActionError[8]

ErrorTag   ActionErrors   .   AppException

, AppException   , ExceptionHandler

<exception>   ActinErrors[9]   .

.   ,

ActionError

.   ,   <exception>

handler   . ExceptionHandler

ExceptionConfig   path   ActionForward   .

, ActionMapping   input

---

[8] Action, ActionForm

.   .

[9] ActionError   HashMap   ActionError
collection   .

. ExceptionHandler   Action.EXCEPTION_KEY[10]

Action.EXCEPTION_KEY   ,   error- page
,   .

(Once- Only Form Submission)

,
.   (e- Commerce)
.   ,   Action

generateToken(…)   ,
.   (integrity)
(atomicity)   , ActionForward
saveToken(…)   .   generateToken(…)
, Action.TRANSACTION_TOKEN_KEY   ,
.   FormTag
Constants.TOKEN_KEY   .

,   Action   isValid(…)
.   false   ,
.

.

```
if (!isTokenValid(request)) {
errors.add(ActionErrors.GLOBAL_ERROR,
new ActionError("transaction.token.invalid"));
//errors object is of type ActionErrors
}
```

, isTokenValid(…)
.   ,   , isTokenValid()
resetToken(…)   .
isTokenValid(…)   false   ,
.

saveToken(…)   .

---

[3]   JSP   Throwable
.

(Capturing Form Data)

JSP   ,   <jsp:useBean>   <jsp:setProperty>

                                                             .   ,
                                                      (coupling)   .   , HTML

                                                                                                        .

        <jsp:useBean>

                    ,
                    .

            .   ,   <jsp:useBean>   <jsp:setProperty>

    .

        <action>   <form-bean>   .

<form-bean name="customerProfileForm"
type="*packageName*.customerProfileForm"/>
<action path="/editCustomerProfile"
type="*packageName*.EditCustomerProfileAction"
name="customerProfileForm"
scope="request"/>

                    name="customerProfileForm(   )
packageName.customerProfileForm   name="customerProfileForm"
<action>   .   /editCustomerProfile

                            .
            .

ActionForm   .   ,

DynaAcitonForm   .

FormTag   ActionForm   *(Initializing ActionForm objects with FormTag)*

, HTML   URL action   <action>

,   <form- bean>   . FormTag   action

URL   FormTag   ,   <url- pattern>

URL   .   ,   <url- pattern>

.   ,   URL

/editCustomerProfile?customerType=preferred

/editCustomerProfile.do?customerType   .

FormTag   RequestUtils.createActionForm(...)   ,

<action>   ActionFormBean

(ActionFormBean   <form- bean>   ).

ActionForm   <form- bean>   type   .

ActionForm   ,   .   ,

FormTag   ,   ActionForm.reset(...)

.   <action>   scope   .

ActionForm   name

.

ActionForm   *(Storing Form Data using ActionForm)*

ActionForm   ,

. ActionForm   HttpServletRequest

.

ActionForm   (FormTag   ) FormTag   ,

FormTag   , RequestProcessor

.   ,

RequestProcessor   ,   ,

validate(...)

. validate(...)   , ActionMapping   validate

true   .   .

request.getParameter(parameterName)   String[]

.   (*Request Parameter*

Type-Conversion)   .   (Error Handling)

                ActionErrors   ,

                org.apache.struts.taglib.html.ErrorsTag   . ActionForm

        ,   (JSP)

                .

ActionForm   , RequestProcessor   .   JSP

                        URL   ,

                    .   , RequestProcessor   ,

            ActionForm   ,   ActionForm

    . <action>   name   ActionForm

                    .   RequestProcessor   ,

        execute(…)   . ActionForm

                    .

JSP   (request scope)

            .   ,   .

            .   ,   .

                                        .   ,

                    .

        (best practice)   ,

                .   ,   .

                                    .

            (   )   .   ,

                                        .

                                .

        ,   ,   .

ActionForm   *(Creating ActionForm with Dynamic Properties)*

DynaActionForm   . DynaActionForm

ActionForm   .   ,   struts-config.xml

                .

```
<form-bean name="logonForm"
type="org.apache.struts.action.DynaActionForm">
<form-property name="username" type="java.lang.String"/>
<form-property name="password" type="java.lang.String"/>
</form-bean>
```

RequestProcessor   ActionForm   DynaActionForm
              ,   .   ,   <form-
bean>   DynaActionForm   .
                                    .

(Request Parameter Type- Conversion)
                        request.getParameterValues(parameterName)
String[]
            .

java.lang.BigDecimal

java.lang.BigInteger

boolean   java.lang.Boolean

byte   java.lang.Byte

char   java.lang.Character

double   java.lang.Double

float   java.lang.Float

int   java.lang.Integer

long   java.lang.Long

short   java.lang.Short

java.lang.String

java.sql.Date

java.sql.Time

java.sql.Timestamp

            ,   (introspection)
                        .   DynaActionForm
                    .   ,
parameterName[n]   .   n   0   .
                        ,
                    .
                                                                .

public <PropertyType>[] get<PropertyName>();
public void set<PropertyName>(<PropertyType>[] value);

.

public <PropertyType> get<PropertyName>(int index);
public void set<PropertyName>(int index, <PropertyType> value);

.

1.   ,
parameterNames[n]   , request.getParameterValues(parameterName)
            String[]   . DynaActionForm
                                            .

ActionForm   .

public void set<PropertyName>(<PropertyType>[] value);
public <PropertyType> [] get<PropertyName>();

2.   ,
parameterNames[n]   , request.getParameterValues(parameterName)
        String[]   .   ,
String[0]   . DynaActionForm
                                  .

    ActionForm   .

public void set<PropertyName>(int index, <PropertyType>[] value);
public <PropertyType> [] get<PropertyName>(int index);

        .   ,   ,   ,
                    .

public <PropertyType> [] get<PropertyName>();

            ,   ,   ,
        get   set   .

3.   , request.getParameterValues(parameterName)

String[ ]   .   String[0]

                            . DynaActionForm

                    .   ActionForm

                    .

public void set<PropertyName>(<PropertyType> value);
public <PropertyType> get<PropertyName>();

                            .   , org.apache.struts.taglib.nested

                                                                            .

                                    , http://jakarta.apache.org/struts/userGuide/index.html

                    .

http://jakarta.apache.org/struts/resources/index.html   .

            JavaServer Pages Standard Library (JSTL)   JavaServer Faces

                            .

(Custom Extensions with Plug-ins)[11]

                                    (seamlessly)

(plugging)   ,   (extension)

      .   ,   (, init(), destroy())

                                    (extension point)   .

                                    ,   ,   ,

      ,

                                    .

                    Validator   .

struts-config.xml   .

```
<plug-in className="org.apache.struts.validator.ValidatorPlugIn">
<set-property property="pathnames"
value="/WEB-INF/validator-rules.xml,/WEB-INF/validation.xml"/>
</plug-in>
```

11
                                                                            .
                    , JNDI   .

ValidatorPlugIn

.   <plug-in>

className   .   <plug-in>

,

.   ,

init(…)   .   ,

Validator.init(…)   , ValidatorPlugIn.VALIDATOR_KEY

.   ,

org.apache.commons.validator.Validator

.   Action.PLUG_INS_KEY

, org.apache.struts.action.PlugIn   .   ,

destroy()   ,

destroy()   .

(Summary)

HTTP   /   MVC

.

,

.   Validator

Tiles   .

,   .

http://jakarta.apache.org/struts/userGuide/index.html   .

,

.   ,   http://jakarta.apache.org/struts

(release notes)   .

(References)

[Core] Core J2EE Patterns by Deepak Alur et. al. (Prentice Hall, 2001)

[Gof]   Design Patterns by Erich Gamma et. Al. (Addison-Wesley, 1995)