X4 ADK

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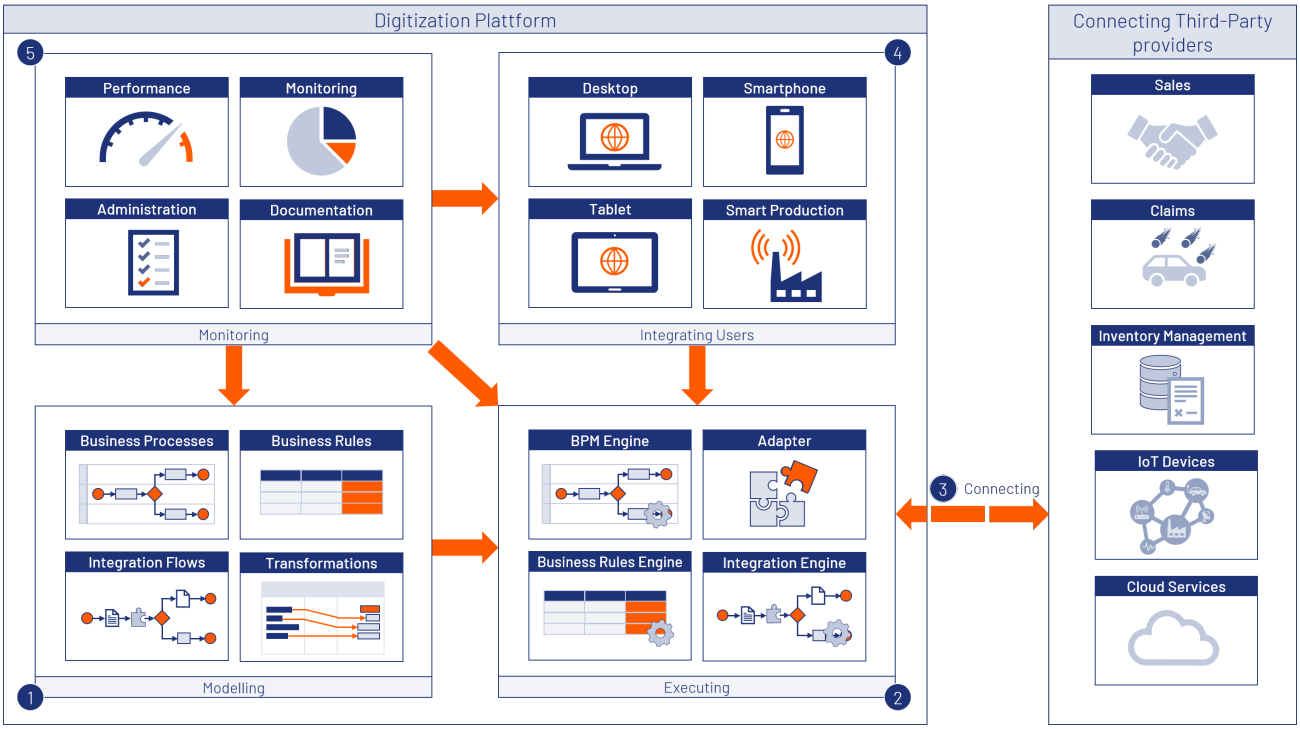
About the X4 Suite

Digitalization requires a holistic approach, which presupposes that also the used solution has to reflect that. X4 Suite supports you as a central platform in solving these challenges. The focus is on modeling, implementing and monitoring your business processes. Therefore, the X4 Suite contains all necessary tools and is compatible with a variety of interfaces and formats. That helps to avoid isolated information silos and media breaks that inhibit productivity, and accelerate digitization at the same time.

Implementing business processes without programming effort enables a large number of users to enter into the management of business processes. That's important, since employees of the specialist department usually know best what is important in the respective business processes. Therefore, you should rely on the X4 Suite as a platform whose tools reduce complexity to such an extent that business processes can be analyzed, optimized, modeled, as well as controlled and documented even without programming knowledge. All tools support integrated, graphical process modeling and implementation and generate processes that are executed by the X4 Suite with high performance.

1. **X4 Designer:** Modelling processes and rules graphically
2. **X4 Server:** Simulating and executing processes and rules
3. **X4 Adapter:** Integrating third-party systems into processes
4. **X4 Activities**: Providing web apps for employees and customers
5. **X4 Control Center:** Monitoring and managing all processes and apps



Target Audience of this Documentation

This documentation aims to Java developers who want to develop project or system-specific adapters for the X4 Suite. Java knowledge in the JEE application development, basic knowledge

about XML, XSLT and XPath and especially detailed technical knowledge of the data and the workflows are important requirements for this purpose.

The documentation gives an overview of the framework for the adapter development (ADK) and explains how to develop your own adapters.

1 Developing Adapters with the X4 Suite

Adapter projects allow to develop new adapters for the X4 Suite using the various tools provided within the X4 Suite.

> To use this X4 Suite feature an ADK license is required.

1.1 The Structure of Adapter Projects

Adapter projects have a predefined and unchangeable folder structure, which is created automatically when a new Adapter project is created.

> The automatically created folders and subfolders cannot be deleted, moved or renamed.

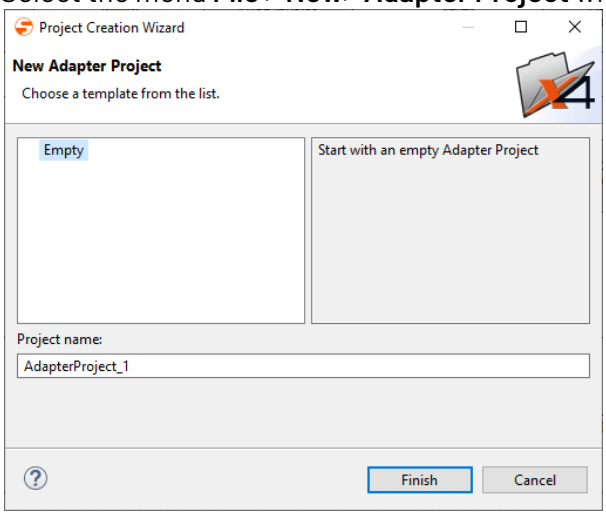
`Adapters`	Adapters, which are used within technical processes, are stored here.
`Icons`	The different adapter icons are stored here.
`Operations`	Any number of technical processes (`.wrf`) can be created here. Each process provides an adapter operation thereby.
`Resources`	Folders, resources such as images, text and XML documents and other files can be stored here.
`TemporaryFiles`	Temporarily used files are stored here.
`Transformations`	Transformations (`.xsl`) and reports (`.rep`) are stored here.
`<Projekt>.nad`	Adapter definition, which is created and named after the project automatically when creating a new adapter project, e.g. *`AdapterProject_Documentation.nad`*. > A project can contain only one adapter definition.

1.2 Creating Adapter Projects

There are different options to create adapter projects:

- Via **New Adapter** on the X4 Designer Welcome page
- Via the context menu **New > Adapter Project** within the Repository Navigator
- Via the menu **File > New > Adapter Project**

1. Select the menu **File > New> Adapter Project** within the X4 Designer.



2. Select an empty project template or an already existing template.
3. Enter the project's name in **Project name**.
4. Click **Finish** to create the project.
   An empty adapter project with the predefined structure is created within the Repository Navigator.

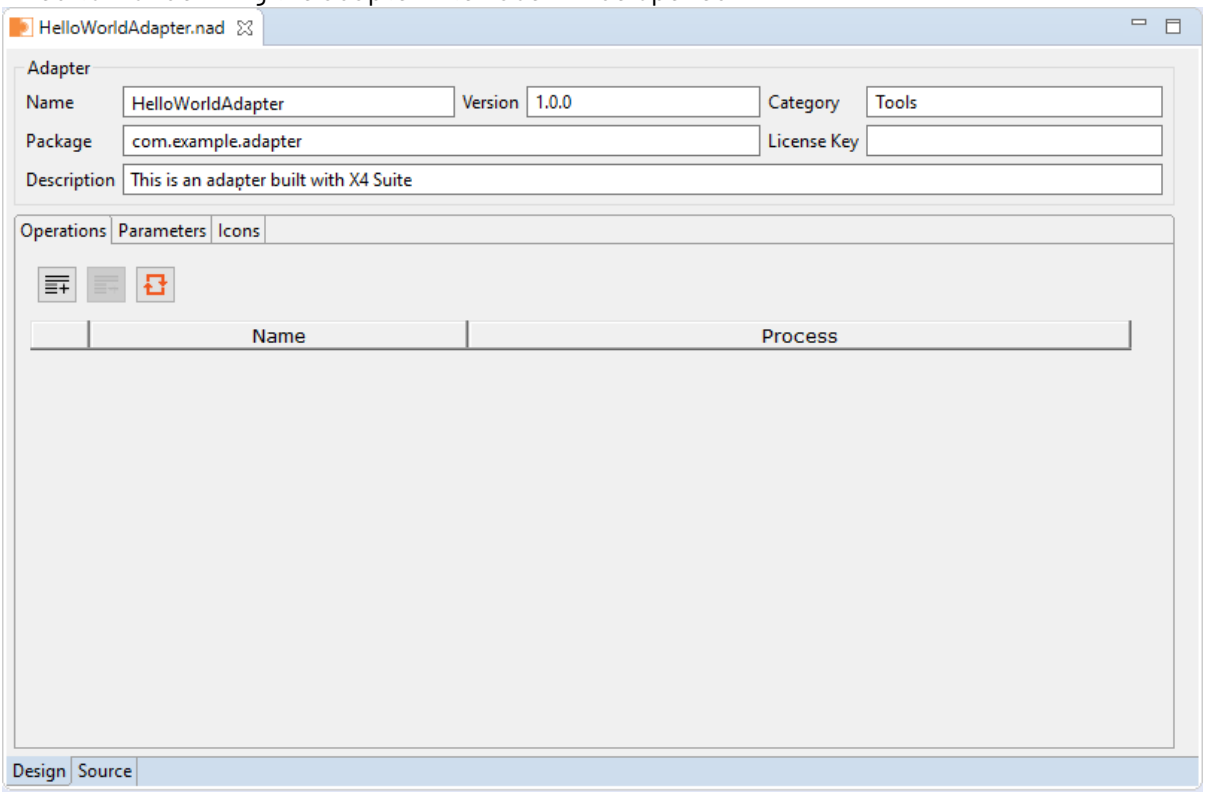
   > The various elements of an ESB project can now be created via the context menu. The available options change depending on where in the tree structure the context menu is opened.

1.3 Defining the Adapter Interface

The adapter interface can be defined within the adapter definition file (`.nad`). The available adapter operations are specified using technical processes.

1. Create an adapter project, see Creating Adapter Projects.

2. Open the adapter definition file `<Projectname>.nad` by double-clicking it.
   An editor for defining the adapter interface will be opened.



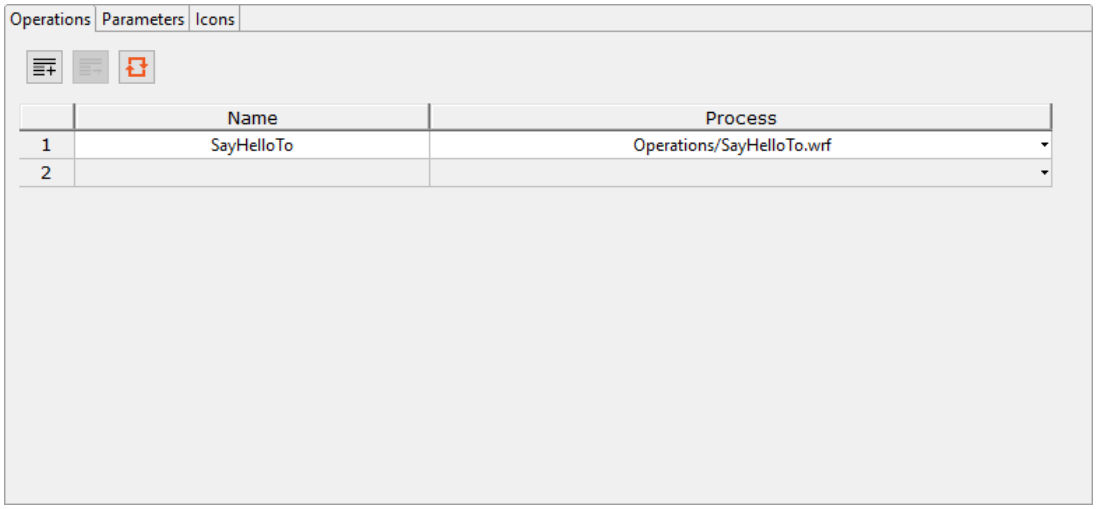
3. Define the general adapter settings within the **Adapter** area. The following settings can be made:
   - **Name:** Adapter name
   - **Version:** Adapter version
   - **Category:** Adapter category, e.g. Tools
   - **Package:** Name of the WildFly module to be provided.

     > This setting is relevant when using the option **Package as Adapter**.

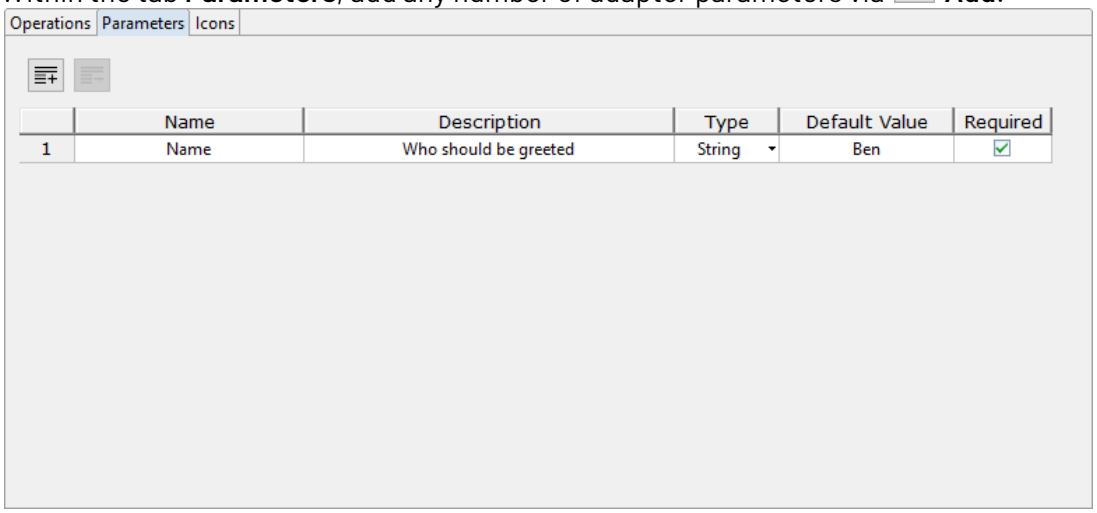
   - **License Key**: Adapter license key
   - **Description:** Adapter description
4. Within the tab **Operations**, add any number of adapter operations via **Add**.
   Each operation has to be linked to a technical process.

> - To delete an operation select the row and click **Remove**.
> - To load newly created processes click **Refresh operations**.

5. Select for each operation the corresponding technical process from the folder **`Operations`**.



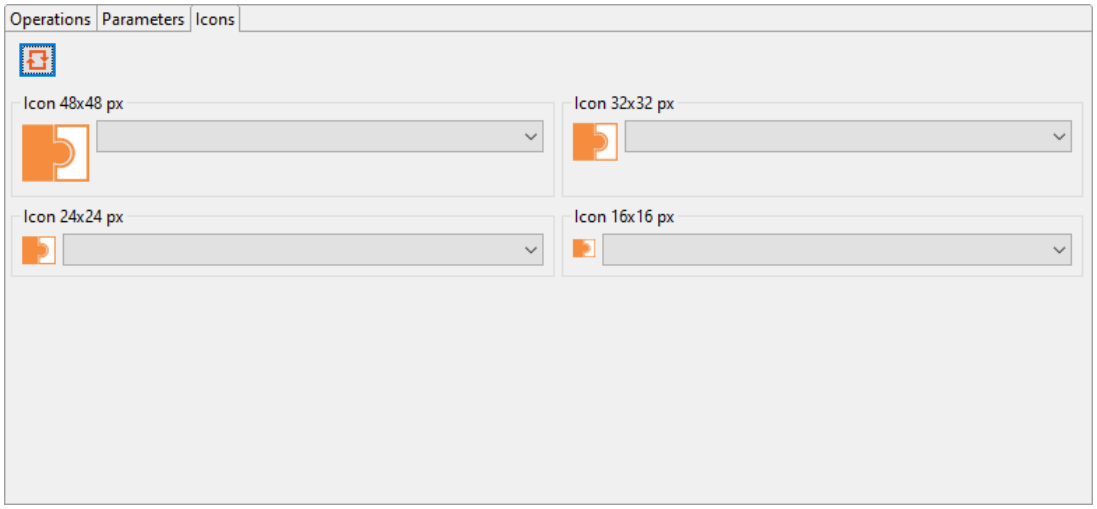
6. Within the tab **Parameters**, add any number of adapter parameters via  **Add**.



7. Define the adapter parameters. The following settings can be made:
   - **Name**: Parameter name
   - **Description:** Parameter description
   - **Type:** Parameter type
     - **String:** For strings
     - **Number:** For numbers
     - **Boolean:** For Boolean values
   - **Default Value**: Default value of the parameter
   - **Required:** Information, whether a parameter is mandatory or optional

   > The parameters will be available within technical processes as placeholder `PARAM_INPUT_<Name>`.

8. Within the tab **Icons**, define images from the folder **`Icons`** as adapter icons.



To load newly added icons click **Refresh icons**.

9. Save the adapter definition.

1.4 Providing the Adapter Project as Module

Adapters created with the X4 Suite can be packaged like Java adapters and provided as module in WildFly. The function `Package as a Wildfly Module` is available via the context menu of the adapter project.

1. Make the adapter definition as required, see Defining the Adapter Interface.
2. Open the context menu on the top project level (project name) and select **Package as Adapter**. A dialog for exporting the project is now opened.
3. Select the desired storage location and enter the adapter name.
4. Click **Save** to export the adapter project as a ZIP folder.
5. Provide the adapter on the Server, seeProviding Adapters on the X4 Server.

1.5 Providing Adapters on the X4 Server

To include the finished adapter package into the X4 Server configuration the compiled adapter classes and required external libraries are provided as Java archive (`.jar` file) on the application server.
The sample project within the ADK package already contains the corresponding Maven build, which generates the JAR file and descriptors already with the expected folder structure.

1. Unpack the generated ZIP file under `C:\X4\Server\<wildfly>\modules\system\layers\base`.
2. Add a reference to the adapter's own module within the *`X4-Extensions`* module.
3. Restart the X4 Server.
   The adapter will be available within the X4 Designer after the next connection with the X4 Server and can be then used in processes.

⚠ Note that the adapter project and the provided adapter module cannot be used simultaneously on the same X4 Server.

2 Developing Own Adapters in Java

How to develop your own adapter using the adapter framework of X4 ADK.

2.1 Adapter Basics

X4 adapters are process components providing basic functions such as data conversions or document processing or allowing the access to complex enterprise systems. Since the X4 ESB mainly works with XML data, adapters within technical processes usually create or modify XML documents. An adapter usually requires an input and outputs an XML document, which is further processed in the next process step.

Implementing custom adapters is the fastest and easiest way to integrate various applications into the X4 Suite and to extend its functionality. The X4 Suite provides a framework that simplifies the adapter development in many ways.

2.2 Configuring the ADK Environment

Learn about the development environment is required and how to configure it.
In order to develop an adapter for the X4 Suite, you first need to provide the necessary classes and configure the Java development environment (e.g. *Eclipse*) with a Java Runtime Environment (JRE) in version 1.8 or later.

> You can request the ADK package with the needed X4 Java classes and examples from SoftProject support via support@softproject.de.

Unpack the `adk-example.zip` and import it as already existing Maven project into your Java IDE.

The Java project now contains the folder `src/main/java` (code examples).

2.3 Implementing the Adapter Interface

How to create the basic framework for the adapter implementation using the standardized adapter interface

2.3.1 Interface and Constructor

All adapters use the interface `de.softproject.integration.adapter.core.Adapter` and the default constructor (without parameters) to create the main class. The abstract class `de.softproject.integration.adapter.core.BaseAdapter` contains a base implementation to get the adapter status and to access the project directory.

2.3.2 Defining Adapter Metadata

To define adapter metadata the annotation `@AdapterDescription` is used. The following fields must be set:

Field	Description	Mandatory
`category`	Technical adapter category	yes
`description`	Description of the adapter's purpose	yes
`displayName`	Displayed adapter name	yes
`version`	Adapter version with the format `major.minor.patch` (e.g. *`1.0.0`*)	yes
`configurationBeanClass`	Type of the `ConfigurationBean`, if the adapter requires parameters. If the adapter class contains the configuration, no values have to be set here.	no

2.3.3 Using BaseAdapter

This base class contains protected methods for accessing the adapter status and the ProjectExplorer. The basic implementation assumes that the configuration is made within the adapter class, which means that the adapter parameters are defined in the class itself. If you want to use your own class for the adapter configuration, the method `getConfigurationBean` must be overwrite as described in the section *Defining Adapter Metadata*.

2.3.4 Using the Adapter Interface

1. Create a new adapter class that implements the interface `de.softproject.integration.adapter.core.Adapter`.
2. Use the default constructor. This X4 class will be instantiated via default constructor at runtime of the X4 ESB.
   The methods `init()`, `cleanup()` and `getConfigurationBean()` are created and the required packages are imported. With this constructor, the following elements are created:
   - `public void cleanup()`: This method *always* cleans up after the execution of the `operation` method and closes resources that have been allocated by the adapter instance.
   - `public void init(Status arg0, long arg1)`: After creating the adapter instance, a status instance will be created and will be handed over to the adapter with the `init()` method call. Parameter `arg0` specifies an object's adapter instance to set a status; parameter `arg1` specifies the adapter instance (within the code).
     When executed, the adapter can manipulate its status instance within its `do...` methods, and this state will be evaluated by the X4 ESB.
   - `public Object getConfigurationBean()`: Returns an instance of the configuration bean containing setter methods for setting configuration parameters. Adapter instances can access configuration parameters via the configuration bean object.
3. Create a status variable and assign an instance status.
4. Create a configuration bean object (see Creating the Configuration Bean), and use in`getConfigurationBean()` as return value.
   The basic framework for the adapter main class is now ready.

2.3.5 Example

```
import java.nio.charset.StandardCharsets;
import de.softproject.integration.adapter.annotations.AdapterDescription;
import de.softproject.integration.adapter.annotations.AdapterOperation;
import de.softproject.integration.adapter.annotations.AdapterParameter;
import de.softproject.integration.adapter.core.AdapterException;
import de.softproject.integration.adapter.core.AdapterParameterDataType;
import de.softproject.integration.adapter.core.BaseAdapter;
import de.softproject.integration.util.x4documents.MimeTypeUtils;
import de.softproject.integration.util.x4documents.X4Document;
import de.softproject.integration.util.x4documents.X4DocumentFactory;

/**
 * This is a simple Adapter showing how Adapters are declared in the
 * X4-Suite.<br>
 * An adapter needs some Annotation to be recognized by the X4-System:<br>
 * <ul>
 * <li>{@link AdapterDescription}: Mandatory for making an Adapter visible. It
 * describes the metadata of the adapter</li>
 * <li>{@link AdapterParameter}: Mandatory for Parameters. They will be mapped
 * to the corresponding setter Method. It must match the parameter name.
 * <li>{@link AdapterOperation}: Mandatory for Operations. It describes the
 * metadata for an adapter operation
 * </ul>
 */
@AdapterDescription(category = "Demo", description = "Say Hello...", displayName =
"HelloWorld", version = "1.0.0")
public class HelloWorldAdapter extends BaseAdapter {

    @AdapterParameter(dataType = AdapterParameterDataType.STRING, description = "say
hello to", optional = true)
    private String name = "default";

    @AdapterOperation(name = "HelloWorld")
    public X4Document sayHelloWorld(X4Document input) {
        return X4DocumentFactory.createX4Document("Hello World",
StandardCharsets.UTF_8.name(),
                MimeTypeUtils.TEXTPLAIN);
    }

    @AdapterOperation(name = "HelloTo")
    public X4Document sayHelloTo(X4Document input) throws AdapterException {
        if (name == null || "".equals(name)) {
            throw new AdapterException(123, "Parameter \"name\" ist nicht
gesetzt...");
        }
        getStatus().setOk();
        return X4DocumentFactory.createX4Document("Hello " + name,
StandardCharsets.UTF_8.name(),
                MimeTypeUtils.TEXTPLAIN);
    }

    public void setName(String name) {
```

```
        this.name = name;
    }
}
```

2.4 Creating the Configuration Bean

How to create the basic framework for a configuration bean

2.4.1 Purpose of a Configuration Bean

A configuration bean is used to bundle configuration parameters of an adapter instance and contains methods for setting the configuration parameters. Adapter instances can access the configuration bean object using the method `getConfigurationBean()`.

2.4.2 Creating a Configuration Bean

1. Create a new configuration bean class within the package.
2. Define variables which serve as configuration parameters (only of the type `String`).
3. The annotation `@AdapterParameter` specifies a field as adapter configuration. There can either be a Configuration Bean class in which all parameters are defined, or the definition can be made in the adapter class itself (a mixture is not possible!).
4. Define set/get methods for each configuration parameter. They have to be named following the pattern `set<Parameter name>(<value>)` or `get<Parameter name>()`.
   The basic frame of the configuration bean is now ready.

2.4.3 Defining Metadata for Adapter Parameters

To define metadata for adapter parameters the annotation `@AdapterParameter` is used:

Field	Description	Mandatory
`description`	Textual description of the parameter's purpose	yes
`dataType`	Parameter type *Possible values*: `PASSWORD`, `BOOLEAN`, `STRING`, `ARRAY`, `DOUBLE`, `INTEGER`	yes
`displayName`	The parameter's display name. The field's name is default.	no
`optional`	Specifies whether the parameter is mandatory or not *Possible values*: • *`true`*: the parameter is not mandatory • *`false`*: the parameter is mandatory (default)	no
`defaultValue`	Sets an initial parameter value	no

The annotation `@AllowedPropertyValue` has to be used additionally, if `dataType` is set to *ARRAY* in order to set the possible values.

Field	Description
`displayName`	Specifies the value's display name
`value`	Technical identifier that is written to the field during selection

2.4.4 Example

```
import de.softproject.integration.adapter.annotations.AdapterParameter;
import de.softproject.integration.adapter.core.AdapterParameterDataType;

public class SimpleChartConfiguration {

    @AdapterParameter(dataType = AdapterParameterDataType.STRING, description = "set
the title of the chart")
    private String chartTitle;
    @AdapterParameter(dataType = AdapterParameterDataType.INTEGER, description = "set
the width of the chart", defaultValue = "300")
    private int chartWidth = 300;

    public String getChartTitle() {
        return chartTitle;
    }

    public void setChartTitle(String chartTitle) {
        this.chartTitle = chartTitle;
    }

    public int getChartWidth() {
        return chartWidth;
    }

    public void setChartWidth(int chartWidth) {
        this.chartWidth = chartWidth;
    }
}
```

2.5 Specifying Operations

How to define one or more operations for an adapter

2.5.1 Operations for Adapters

Adapters offer certain functions that can be selected within the *X4 Designer* using the property `Operation` in the Properties view. Each list entry of this selection menu corresponds to an operation method within the adapter.

An adapter needs at least one operation. If the adapter offers only a single operation, it will be automatically selected in the Process Designer.

2.5.2 Assigning Methods to Operations

1. Specify for each operation the annotation `@AdapterOperation` for declaring to a public method in the adapter class.
2. Define the parameters.

   - Each method can define a parameter, which corresponds to the adapter input.
   - The method's return type can be `X4Document` or a JAXB-conform Java bean. If the return type is `void`, the input is considered as output.
   - To use Java beans, the input has to be XML and conform to the Java bean definition. Otherwise, the adapter execution will be aborted with the status *-1*.

   The basic frame of an Operation method is now ready.

2.5.3 Defining Metadata for Adapter Operations

To define metadata for adapter operations the annotation `@AdapterOperation` is used:

Field	Description
`name`	Specifies the operation's name and can be freely selected. However, it has to be unique for each adapter.

2.6 Providing Adapters on the X4 Server

To include the finished adapter package into the X4 Server configuration the compiled adapter classes and required external libraries are provided as Java archive (`.jar` file) on the application server.
The sample project within the ADK package already contains the corresponding Maven build, which generates the JAR file and descriptors already with the expected folder structure.

1. Execute *Maven clean install*.
2. Unpack the generated ZIP file `target/adk-examples-1.0.0-SNAPSHOT-wildfly-module.zip` under `C:\X4\Server\<wildfly>\modules\system\layers\base`.
3. Add a reference to the adapter's own module within the *`X4-Extensions`* module.
4. Restart the X4 Server.
   The adapter will be available within the X4 Designer after the next connection with the X4 Server and can be then used in processes.

2.7 Defining the Adapter Icon

You can define custom icons for already existing and self-developed adapters. They are loaded from the X4 Repository and displayed within the process diagram instead of the standard adapter icon.

You can either define icons for single adapters or for the different adapter types.

2.7.1 Default Icons

For default icons, annotations are available that can be annotated to the adapter class.

Adapter type	Symbol	Annotation
Converter		@ConverterIcon
Transfer		@TransferAdapterIcon
Connector		@ConnectorIcon

If no annotation is specified, the function adapter icon  is used.

2.7.2 Providing the Icon

The adapter symbol is provided using the annotation `@AdapterIcon`, which can be written to the adapter class.

Icon sizes of 16x16, 24x24, 32x32 and 48x48 can be defined. At least one size can be specified, and all other sizes are then calculated from the largest image size. The specified value must be a classpath to the image resource in `src/main/resources`.

Example: The directory `src/main/resources/HelloWorld/icons` contains the image `icon_16.png` which is to be used as adapter icon. The corresponding path is */HelloWorld/icons/icon_16.png*.

3 Adapter Framework Reference

Which components of the *X4 ADK* are available for adapter developers

3.1 Adapter Interface

How the adapter interface, the constructor and the methods are used

All adapters use the interface `de.softproject.integration.adapter.core.Adapter` and the default constructor (without parameters) to create the main class. Each adapter instance has a `status` object in order to set a status after the adapter component's execution, and a unique identifier.

3.1.1 Adapter Interface Methods

de.softproject.integration.adapter.core.Adapter	
`public void cleanup()`	Always cleans up after the execution of the `operation` method and closes resources having been occupied by the adapter instance.
`public void init(Status arg0, long arg1)`	Will be called after creating the adapter instance. The parameter `arg0` names the object for whose adapter instance a status is to be set, the parameter `arg1` specifies the adapter instance (within the code).
`public Object getConfigurationBean()`	Returns an instance of the configuration bean containing setter methods for setting configuration parameters. Adapter instances can access configuration parameters via the configuration bean object.

3.2 X4Document Interfaces

Which methods are available to access input documents, process documents and create documents within adapters

Process components, i. e. instances of an adapter for example, can read and output many document types: XML documents, as well as text or binary data. With the `X4Document` interface, adapters can access documents or generate with `X4DocumentFactory` an output document as result of the adapter operation. This can be an `X4Document` instance of a *dom4j* tree, a `java.io.InputStream` or a byte array.

> ⓘ Character encoding problems can be avoided, if XSL transformations get a DOM-based input within X4 processes. For byte-based documents the byte array is passed to the XML parser without additional information.

3.2.1 X4Document Methods

de.softproject.integration.util.x4documents.X4Document	
public byte[ ] getAsByteArray()	Returns the content as byte array
public byte[ ] getAsByteArray(String encoding)	Returns the content as byte array with the encoding specified within `encoding`
public java.io.InputStream getAsInputStream()	Returns the InputStream of the access to the document content
public org.dom4j.Document getAsDocument() throws org.dom4j.DocumentException	Returns the content as *dom4J* DOM tree
public org.dom4j.Document getAsDocument(String encoding) throws org.dom4j.DocumentException, java.io.UnsupportedEncodingException	Returns the content as *dom4J* DOM tree with the encoding specified within `encoding`
public void parseWithHandler (ContentHandler chandler) throws SAXException, IOException	Passes the content to the provided *org.sax.ContentHandler* instance (flush)
public String getMimeType()	Returns the MIME type of the document
public String getEncoding()	Returns the encoding of the document
public void setMimeType(String mimeType)	Sets the MIME type of the document
public void setEncoding(String encoding)	Sets the encoding of the document

3.2.2 X4DocumentFactory Methods

de.softproject.integration.util.x4documents.X4DocumentFactory	
public static X4Document createX4Document(byte[ ] bytes, String encoding, String mimeType)	Outputs the `X4Document` instance with the byte array content `bytes`, which has the encoding `encoding` and the MIME type `mimeType`
public static X4Document createDocument(Document doc, String encoding, String mimeType)	Outputs the `X4Document` instance with the *dom4J* tree content `doc`, which has the encoding `encoding` and the MIME type `mimeType`

de.softproject.integration.util.x4documents.X4DocumentFactory	
public static X4Document createX4Document(InputStream is, String encoding, String mimeType) throws X4DocumentException	Outputs the `X4Document` instance with the `java.io.InputStream` content `is`, which has the encoding `encoding` and the MIME type `mimeType`

3.2.3 Example

```
public class X4DocumentTest {
    public static void main(String[] args) {
        InputStream is = null;
        try {
            is = new FileInputStream("Sample.xml");
            // create a new X4Document
            X4Document x4doc = X4DocumentFactory.createX4Document(is,
                    "cp-1252", "text/xml");
            // get content as a dom4j document
            System.out.println(x4doc.getAsDocument().asXML() + "\n");
            // get content as a byte array
            System.out.println(new String(x4doc.getAsByteArray())
                    + "\n");
            // parse the x4document's content
            SAXContentHandler chandler = new SAXContentHandler();
            x4doc.parseWithHandler(chandler);
            System.out.println(chandler.getDocument().asXML() + "\n");
        } catch (Exception ex) {
            ex.printStackTrace();
        } finally {
            if (is != null)
                try {
                    is.close();
                } catch (IOException ioex) {
                }
        }
    }
}
```

3.3 ProjectExplorer API for the Project Access

The ProjectExplorer API allows to access project files using the adapter.

Method	Description
`String getProjectName()`	Returns the project name
`LocalDateTime getLastModifiedTime(ProjectPath path)`	Returns the file's last modification date
`InputStream read(ProjectPath path)`	Returns the files content as input stream

Method	Description
`List<ProjectPath> getProjectContent()`	Returns all files as project paths
`void write(ProjectPath path, InputStream inputStream)`	Writes the data stream to the specified position and creates a new file, if the project type's rules allow it
`boolean exists(ProjectPath path)`	Checks whether the file or folder exists
`void create(ProjectPath path)`	Creates a directory
`void delete(ProjectPath path)`	Deletes a directory or a file
`void move(ProjectPath sourcePath, ProjectPath targetPath)`	Moves a file or directory to the specified location according to the project type's rules
`void copy(ProjectPath sourcePath, ProjectPath targetPath)`	Copies a file or directory to the specified location according to the project type's rules
`List<ProjectPath> getFolderContent(ProjectPath folderPath)`	Returns all paths within the folder and all subfolders

3.4 Developing Adapters

For all adapters status values can be set via the class `de.softproject.integration.adapter.core.Status`. These status values can be interpreted within *X4* processes using `Condition` process components. Each executed operation method of an adapters can set a corresponding status. Thereby, the three default status values `OK (1)`, `ERROR (-1)` and `TIMEOUT_EXCEEDED (0)`, or a custom integer status value can be set. If no status is set in the adapter, occurring exceptions while executing the operation method will be treated as `ERROR (-1)`, otherwise the status `OK (1)` will be returned.

3.4.1 Status Methods

`de.softproject.integration.adapter.core.Status`	
public void setOk()	Sets the status of the operation method to *executed successfully*
public void setError()	Sets the status of the operation method to *executed incorrectly*
public void setTimeoutExceed()	Sets the status of the operation method to *not executed within the defined time*
public void setStatus(int Status)	Sets the status code Not allowed values are: *-999*, *-2* and *999*!
public boolean isOk()	Checks if the status is set to *executed successfully (1)*

de.softproject.integration.adapter.core.Status	
public boolean isError()	Checks if the status is set to *executed incorrectly (-1)*
public boolean isTimeoutExceed()	Checks if the status is set to *not executed within the defined time*
public int getStatus()	Reads the status value as integer number
public static final int OK=1	Associates the status `OK` with the value *1*
public static final int ERROR=-1	Associates the status `ERROR` with the value *-1*
public static final int TIMEOUT_EXCEED=0	Associates the status `TIMEOUT_EXCEED` with the value *0*

3.5 Logging Framework

Logging methods of the adapter framework that extend the *log4j* functional range is described here. To assign logger context information to clients, the X4 Suite's logging framework provides class `de.softproject.integration.logging.MDC`. This class is a *Mapped Diagnostic Context* (MDC) wrapper for *log4j* .

> You can find a reference for the *log4j* API under http://logging.apache.org/log4j/1.2/apidocs/org/apache/log4j/package-summary.html.

3.5.1 Methods for Mapped Diagnostic Context

de.softproject.integration.logging.MDC	
public static void setActionLabel(String label)	Sets the label within the MDC to `label`
public static String getActionLabel()	Returns the label stored within the MDC
public static void SetWorkflowName(String name)	Sets the process name stored within the MDC to `name`
public static String getWorkflowName()	Returns the process name stored within the MDC
public static void setProcessId(Stringid)	Sets the process ID stored within the MDC to `id`
public static void setProcessId(long id)	Sets the process ID stored within the MDC to `id`
public static String getProcessId()	Returns the process ID stored within the MDC

de.softproject.integration.logging.MDC	
public static void setUserId(String id)	Sets the user ID within the MDC to `id` If the *X4 Server* uses SNMP, only user IDs of the type `long` are allowed
public static void setUserId(long id)	Sets the user ID stored within the MDC to `id`
public static String getUserId()	Returns the user ID stored within the MDC
public static void put(String id, Object o)	Adds the object `o` with the ID `id` to the MDC
public static Object get( )	Returns the object `key` stored within the MDC
public static void remove(String id)	Deletes the object `id` stored within the MDC
public static Map getContext()	Returns the content of the MDC
public static void setMessageId(String id)	Sets the message ID in the MDC to `id`
public static void removeMessageId()	Deletes the message ID stored within the MDC
public static String getMessageId()	Returns the message ID stored within the MDC
public static void setModuleId(String id)	Sets the process component ID stored within the MDC (`ACTION_ID` within the *X4* process) to `id`
public static String getModuleId()	Returns the process component ID stored within the MDC (`ACTION_ID` within the *X4* process)

3.5.2 Example

```
package examples.xlog;
import org.apache.log4j.Logger;
import examples.xlog.test.XlogTest2;

public class XlogTest {
    // logger associated with the class, not with the instance
    private static final Logger logger = Logger
            .getLogger(XlogTest.class);
    public void f() {
        try {
            //log a debug message
            logger.debug("method XlogTest.f() - entry");
            //log 10 info messages
            for (int i = 0; i &lt; 10; i++ )
                logger.info("counter state: " + i);
            //log a warning
            logger.warn("a test warning");
            XlogTest2 test2 = new XlogTest2();
            //this method throws an exception
            test2.f();
            //log a debug message
            logger.debug("method XlogTest.f() - exit");
        }
        catch (Exception ex) {
            //do not use System.err to log the exception
            //ex.printStackTrace();
            //use the logging framework to log the exception
            logger.error("error", ex);
        }
    }
    public static void main(String[] args) {
        XlogTest test = new XlogTest();
        test.f();
    }
}
```

3.6 Exceptions and Error Handling

An easy possibility to handle errors within adapters, is throwing exceptions. The class `de.softproject.integration.adapter.core.AdapterException` allows an error code and a message to be assigned to the root exception.
If the adapter misses parameter values, which can happen during the process modeling, they can throw a `de.softproject.integration.adapter.core.MissingParameterException`.

Configuration problems should be signalizes by adapters by throwing an `de.softproject.integration.adapter.core.AdapterConfigurationException`.

3.6.1 AdapterException Methods

de.softproject.integration.adapter.core.AdapterException	
public AdapterException(int reasonCode, String msg)	Constructor for an adapter exception with `reasonCode` (numeric code to identify fault cases) and `msg` (to describe the fault case)
public AdapterExeception(String msg, Exception ex)	Constructor for an adapter exception with `msg` (to describe the fault case) and `ex` (root exception)
public AdapterException(int reasonCode, String msg,Exception ex)	Constructor for an adapter exception with `reasonCode` (numeric code to identify fault cases), `msg` (to describe the fault case), and `ex` (root exception)

3.6.2 MissingParameterException Methods

de.softproject.integration.adapter.core.MissingParameterException	
public MissingParameterException(int reasonCode, String msg)	Constructor for a MissingParameter exception with `reasonCode` (numeric code to identify fault cases) and `msg` (to describe the fault case)

3.6.3 AdapterConfigurationException Methods

de.softproject.integration.adapter.core.AdapterConfigurationException	
public AdapterConfigurationException(int reasonCode, String msg)	Constructor for an AdapterConfiguration exception with `reasonCode` (numeric code to identify fault cases) and `msg` (to describe the fault case)