Oracle® Fusion Middleware

Developing Custom Jars and Custom Stages in Oracle Stream Analytics

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Contents

Preface

Developing Custom Stages and Functions describes the supported data types, limitations, and the procedure for adding custom stages and functions in Oracle Stream Analytics.

Topics:

Audience

This document is intended for developers who are looking to add custom stages and custom functions in Oracle Stream Analytics.

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Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Related Documents

Documentation for Oracle Stream Analytics is available on Oracle Help Center.

Also see the following documents for reference:

- *Understanding Oracle Stream Analytics*
- *Quick Installer for Oracle Stream Analytics*
- *Known Issues in Oracle Stream Analytics*
- *Spark Extensibility for CQL in Oracle Stream Analytics*
- *Using Oracle Stream Analytics*

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Developing Custom Stages and Custom Functions

Custom stage types or functions allow you to develop functionality that is not available in common stages and functions. For example, uncommon calculations, conversions, or algorithms.

As an example, you might want to calculate a message digest using the MD5 algorithm. This algorithm is not part of the in-built function library and it is not practical to implement it as an expression.

Custom stage types and functions are implemented in Java programming language using interfaces, classes, and annotations provided in the `osa.spark-cql.extensibility.api.jar` library. You can download this jar file from the installation folder: `osa-base/extensibility-api/osa.spark-cql.extensibility.api.jar`. For more information, see *Spark Extensibility for CQL in Oracle Stream Analytics*.

For a custom stage type, you need to implement the `EventProcessor` interface and apply the `@OsaStage` annotation to your class declaration. You must implement the `processEvent()` method that takes an input Event and returns an Output Event, both of which must be defined using the input and output spec respectively.

Topics:

Creating a Custom Jar

A custom jar is a user-supplied Jar archive containing Java classes for custom stage types or custom functions that will be used within a pipeline.

To create a custom jar:

1. In the **Create New Item** menu, select **Custom Jar**.

   The Import a jar for custom stages and functions wizard appears.

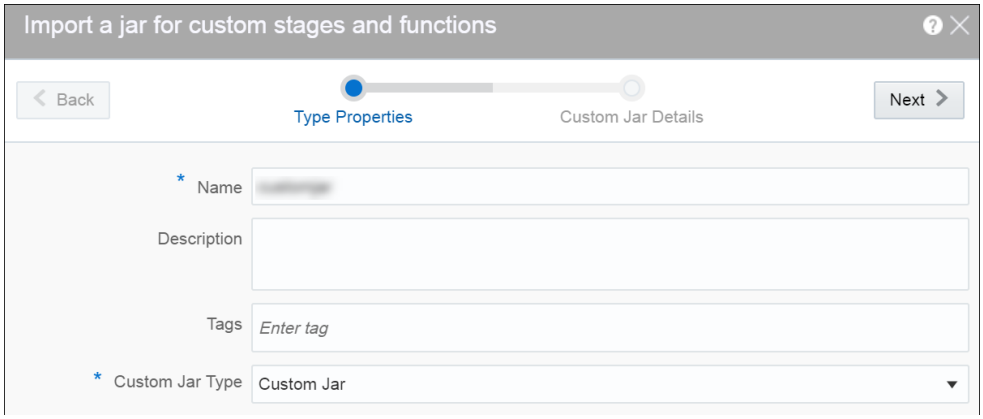
2. On the **Type Properties** page, enter/select suitable values and click Next:

   a. In the **Name** field, enter a meaningful name for the custom jar you are trying to import into the application.

   b. In the **Description** field, provide a suitable description.

   c. In the **Tags** field, select one or more of existing tags, or enter your own tags.

d. In the **Custom Jar Type** drop-down list, select **Custom Jar**.



3. On the **Custom Jar Details** page, click **Upload file**, select the jar file that you want to import into the application, and then click **Save**.

   Make sure that the jar file you select for uploading is a valid jar file and includes all the required dependencies.

Custom Stage Type

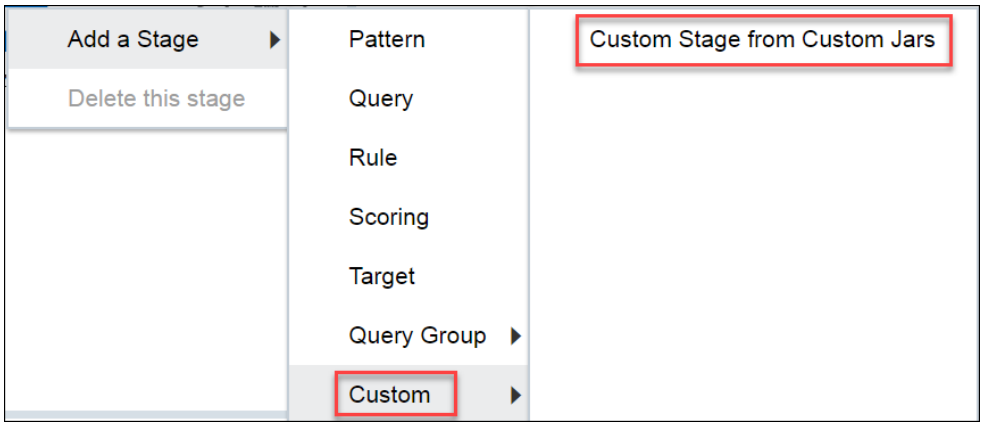
Custom Stage is a type of stage where you can apply your custom stage type to your streaming data in your pipeline. It behaves like any other type of stage with data flowing into and out of it. It is close to a pattern stage in the way that you are asked to configure a few parameters before its logic applies to the stream.

Adding a Custom Stage

You can add filters in a pipeline to obtain more accurate streaming data.

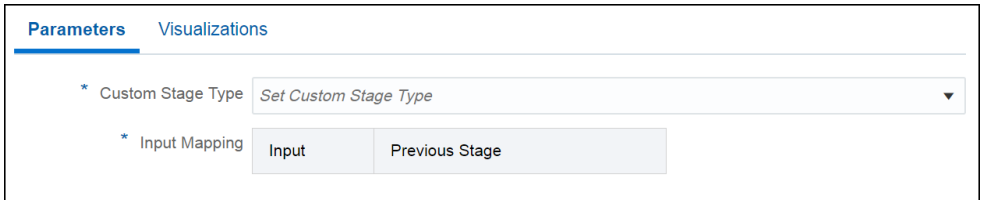
To add a custom stage:

1. Open the required pipeline in Pipeline Editor.
2. Right-click the stage after which you want to add a custom stage. Click **Add a Stage**, and **Custom** and then select **Custom Stage from Custom Jars**.



3. Enter a meaningful name and suitable description for the scoring stage and click **Save**.

4. In the stage editor, select appropriate values for the following:
   a. **Custom Stage Type** — the custom stage that was previously installed though a custom jar
   b. **Input Mapping** — the corresponding column from the previous stage for every input parameter



You can add multiple custom stages based on your use case.

Implementing a Custom Stage

For a custom stage type, you need to implement the `EventProcessor` interface and apply the `@OsaStage` annotation to your class declaration. You must implement the `processEvent()` method that takes an input Event and returns an Output Event, both of which must be defined using the input and output spec respectively.

Custom Functions

The functions that get installed when you add a custom jar are known as custom functions.

The custom functions will be available in the Expression Builder after they get installed. The custom functions will be listed under the *Custom* category. These functions are accessible like any other out of the box function within Oracle Stream Analytics.

Implementing Custom Functions

For a custom function, apply the `@OsaFunction` annotation to a method in any class, including a class implementing a custom stage type. For more information, see the Javadoc and the Samples.

> **Note:**
>
> Functions with same name within same package/class/method in same/ different jar are not supported.

Limitations

The limitations and restrictions of the custom stages and custom functions are listed in this section.

Custom stage type and custom functions must:

- only be used for stateless transformations. Access to state from previous calls to stage type or function methods cannot be guaranteed and might change based on optimizations.
- not use any blocking invocations.
- not start a new thread.
- not use any thread synchronization primitives, including the wait() method, which could potentially introduce deadlocks.
- have/be in a fully-qualified class name.

When you use the custom stages or custom functions, be careful about the heap space usage.

> **Note:**
>
> The resulting jar must include all the required dependencies and third-party classes and the size of the jar file must be less than 160 MB.

Mapping of Data Types

The following table lists the data types that can be used by custom stage types and custom functions.

Oracle Stream Analytics Data Type	Java Data Type	Comment
`BOOLEAN`	`boolean`	
`INT`	`int`	
`BIGINT`	`long`	
`FLOAT`	`float`	
`DOUBLE`	`double`	
`STRING`	`String`	
`BIGDECIMAL`	`BigDecimal`	
`TIMESTAMP`	`long` (in nanoseconds)	Can only be used in Custom Stage Types
`INTERVAL`	`long`	Can only be used in Custom Stage Types

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Samples

A sample custom stage type and sample function that you can use are provided.

Topics:

Sample Custom Stage Type

This sample class defines a custom stage that takes one textual field and produces an MD5 hash for it.

```
package com.oracle.osacs;

import com.oracle.cep.api.event.*;
import com.oracle.cep.api.annotations.OsaStage;
import com.oracle.cep.api.stage.EventProcessor;
import com.oracle.cep.api.stage.ProcessorContext;
import java.security.MessageDigest;
import java.security.NoSuchAlgorithmException;
import java.util.HashMap;
import java.util.Map;

@SuppressWarnings("serial")
@OsaStage(name = "md5", description = "Create an md5 hex from a string",
inputSpec = "input, message:string", outputSpec = "output, message:string,
md5:string")
public class CustomMD5Stage implements EventProcessor {

    EventFactory eventFactory;
    EventSpec outputSpec;

    @Override
    public void init(ProcessorContext ctx, Map<String, String> config) {
        eventFactory = ctx.getEventFactory();
        OsaStage meta = CustomMD5Stage.class.getAnnotation(OsaStage.class);
        String spec = meta.outputSpec();
        outputSpec = TupleEventSpec.fromAnnotation(spec);
    }

    @Override
    public void close() {
    }

    @Override
```

```
    public Event processEvent(Event event) {
        Attr attr = event.getAttr("message");
        Map<String, Object> values = new HashMap<String, Object>();
        if (!attr.isNull()) {
            String val = (String) attr.getObjectValue();
            String md5 = null;
            try {
                MessageDigest md = MessageDigest.getInstance("MD5");
                md.update(val.getBytes());
                byte[] digest = md.digest();
                md5 =
javax.xml.bind.DatatypeConverter.printHexBinary(digest);
            } catch (NoSuchAlgorithmException e) {
                e.printStackTrace();
            }
            values.put("message", val);
            values.put("md5", md5);
        } else {
            values.put("message", "empty");
            values.put("md5", "empty");
        }
        Event outputEvent = eventFactory.createEvent(outputSpec, values,
event.getTime());
        return outputEvent;
    }
}
```

Sample Custom Function

This sample class defines a custom function that takes one textual field and produces an MD5 hash for it.

```
package com.oracle.osacs;

import java.security.MessageDigest;
import java.security.NoSuchAlgorithmException;
import com.oracle.cep.api.annotations.OsaFunction;


public class CustomMD5Function {

        @OsaFunction(name = "md5", description = "Create an md5 hex from a
string")
        public static String md5(String message) {
               String result = null;

               try {
                       MessageDigest md = MessageDigest.getInstance("MD5");
                   md.update(message.getBytes());
                   byte[] digest = md.digest();
                   result =
javax.xml.bind.DatatypeConverter.printHexBinary(digest);
               } catch (NoSuchAlgorithmException e) {
```

```
                    e.printStackTrace();
                }

            return result;
        }

}
```