# EKumi Documentation

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# Getting Started

EKumi is a workflow management system licensed under the Eclipse Public License 2.0.

EKumi allows to automate the execution of a chain of tasks. Its bigger strength is its extensibility as it allows anyone to provide and share new:

- workflow editors,
- scripting languages,
- datatypes.

Please follow **Getting Started** chapters to learn how to create and execute a workflow using EKumi's built-in features.

CHAPTER 1

# Table of Contents

## 1.1 Main Concepts

The following glossary sums up EKumi's main concepts and define the terms used throughout this documentation.

**Task** A single unit of work. A task takes inputs, performs some operation and then produces outputs. A task may neither take any input nor produce any output.

**Activity** A collection of tasks, which is also considered as a task. The terms "workflow" and "activity" are equivalent.

**Input** A typed value that is given to a task before it is executed.

**Output** A typed value that is produced by the execution of a task.

**Datatype** A type that determines the values that can be associated to an input or an output.

## 1.2 Install EKumi

**Todo:** No download available at the moment, please wait for the first release.

EKumi can be installed in to different ways:

- either on the top of an existing Eclipse IDE installation
- or as a standalone product.

Depending on your needs you may choose one or the other.

### 1.2.1 On top of an existing Eclipse IDE installation

EKumi can be installed as a set of plug-ins directly within Eclipse IDE.

To this end, open the IDE, click on `Help` > `Install new software...` then paste the following URL in the dialog:

- <URL not available yet>

Check the following features:

- EKumi IDE Integration
- EKumi IDE UI Integration
- EKumi Java Scripting Language

Click on `Finish`, accept the licenses then `Finish`.

Wait for the installation to end then restart the IDE.

### 1.2.2 As a standalone product

To use EKumi as a standalone product you have to download the archive corresponding to your OS at the following address:

- <URL not available yet>

You can then decompress it, and run the `ekumi` executable.

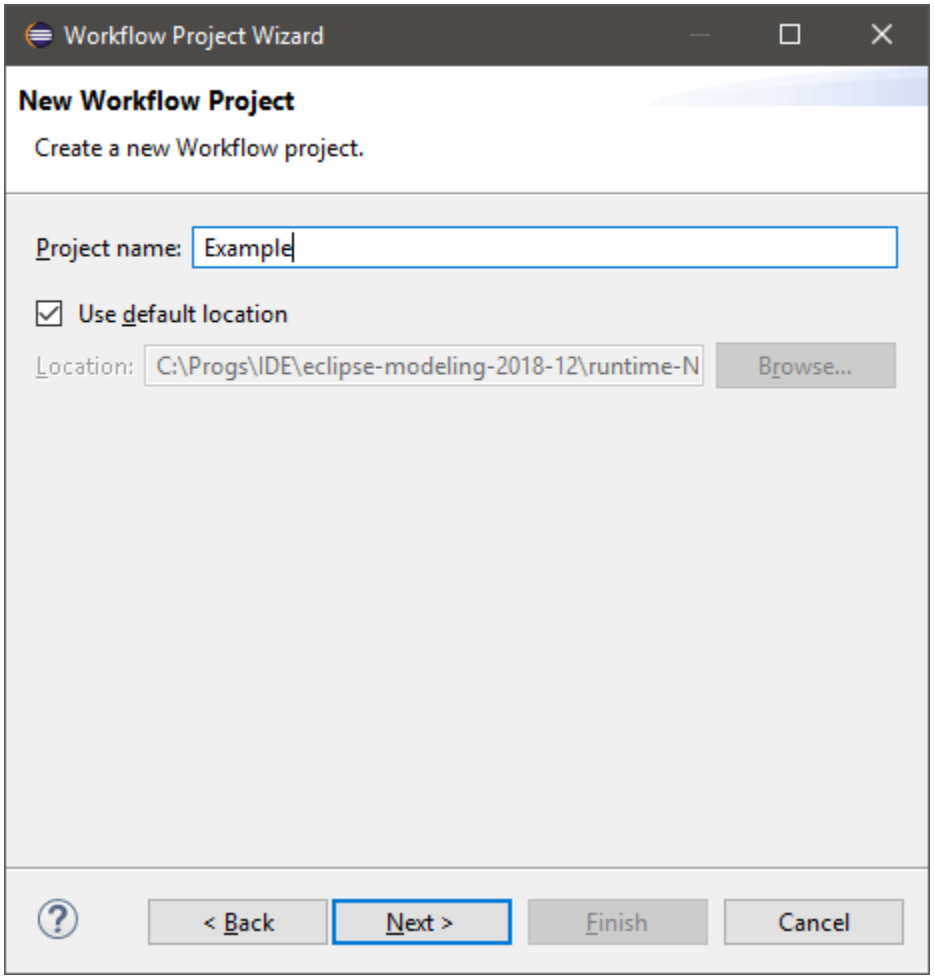
You are now ready to create a first workflow project.

## 1.3 Create a new Workflow project

### 1.3.1 Use the *New Workflow Project* wizard

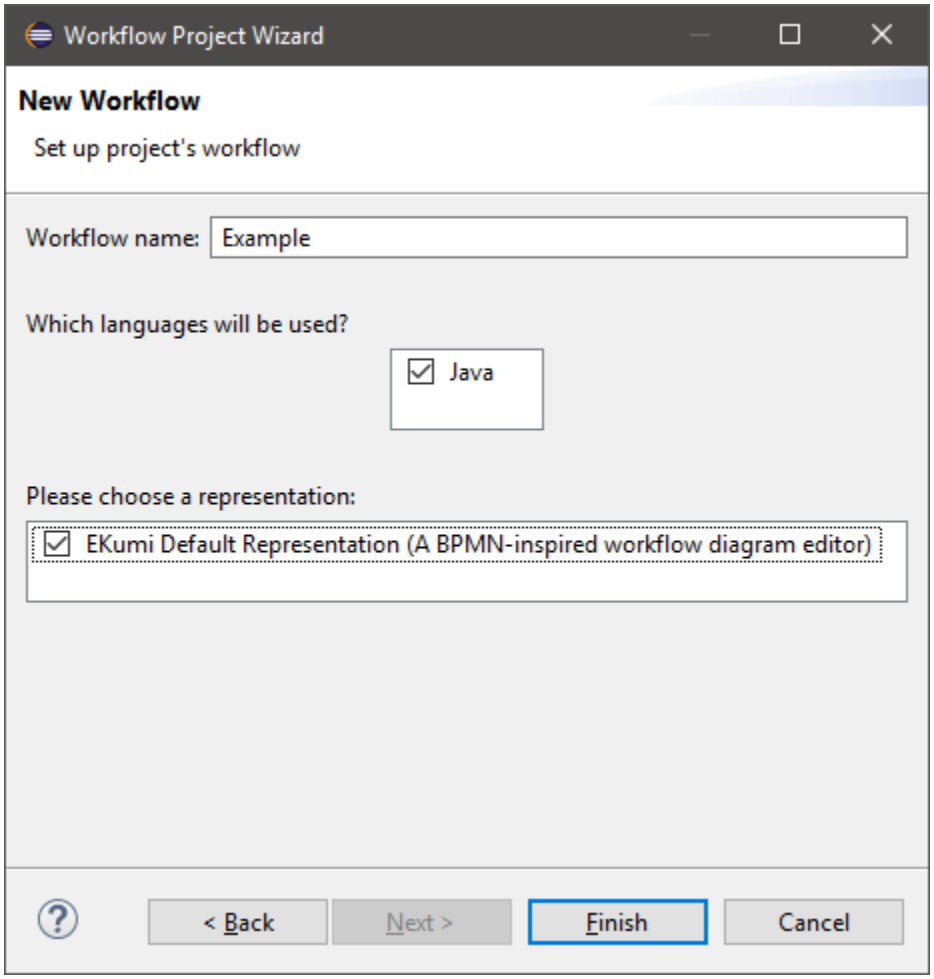
The simplest way to create a new Workflow project is to use the dedicated wizard. It can be opened from `File` > `New...` > `Workflow Project`.

The wizard first asks for the name of the new project. Fill in the text field then press `Next`.




The second page asks the user to choose:

- the name of the workflow (which, by default, is the same as the name of the project),
- the scripting languages enabled for this workflow,
- the representation.




### 1.3.2 Enable scripting languages

Scripting languages are used to specify the behaviour of a task at runtime. A scripting language is typically kind of an interpreter able to execute a script associated with a task.

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**Tip:** See **Available Scripting Languages** for an overview of available scripting languages.

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Several scripting languages can be selected at once for a project. In the context of this tutorial just select `Java`; if Java is not available, please see *Install EKumi*.

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**Important:** It is currently impossible to enable new scripting languages in an existing project. Take care to the languages you select during the creation of the projects.

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### 1.3.3 Choose a representation

A representation defines the way an activity can be seen. A representation is usually associated with an editor providing tools to modify the activity.

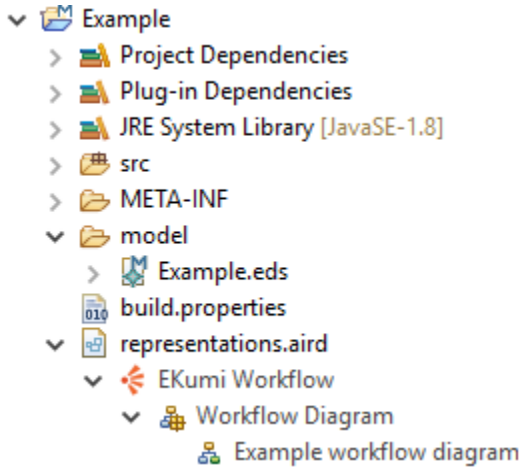
These editors can take any shape: it can be a diagram editor, a textual DSL or even a GUI with text fields and buttons. It is important to pick a representation which is relevant to your goal because it will define the way you design the activity.

**Tip:** See **Available Representations** for an overview of available representations.

Currently only one representation is allowed per project. Select `EKumi Default Representation`.

### 1.3.4 Create the project

When the setup is done, click on `Finish`. Wait a few seconds to see the project being added to the Explorer.




**Tip:** See the *Java* and *EKumi Default Representation* for a detailed presentation of the project's content.

You are now ready to design your first activity.

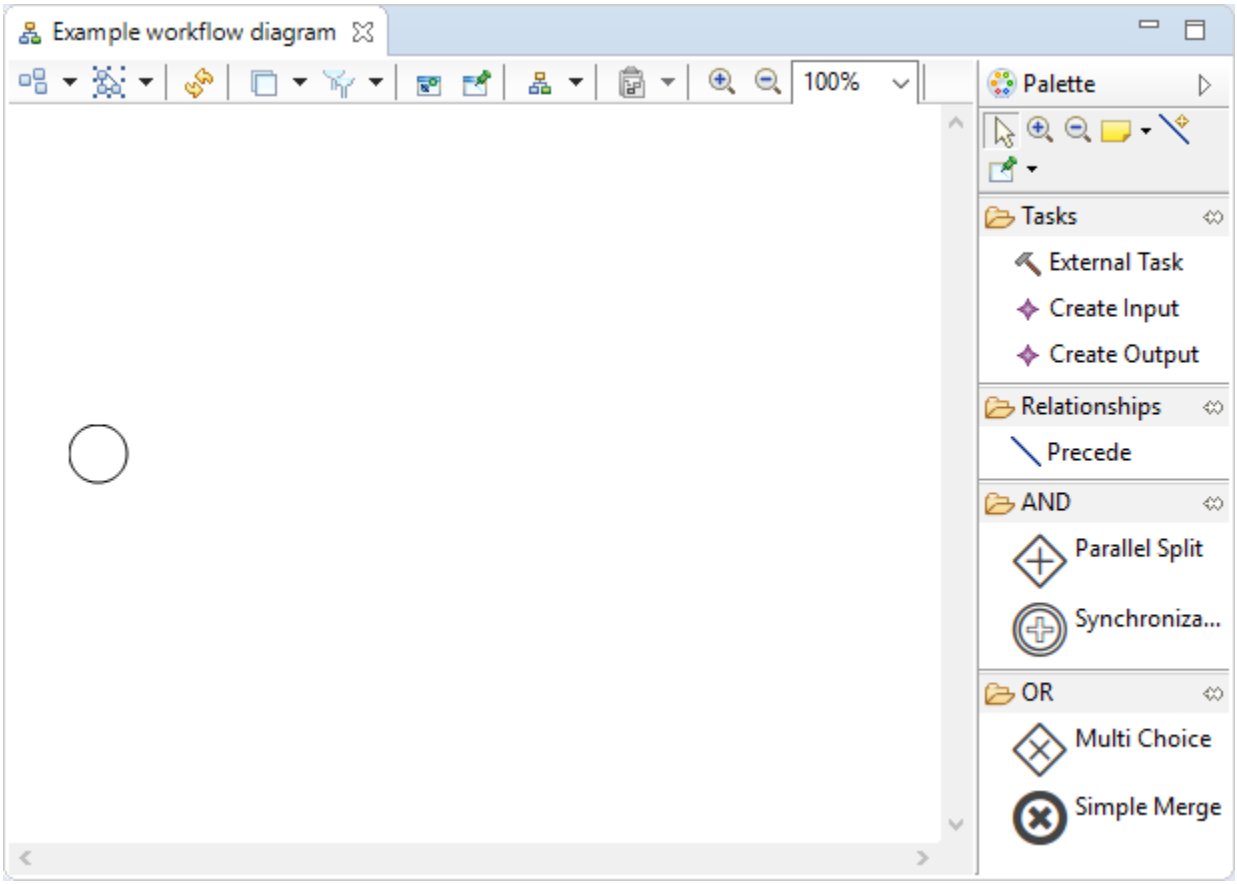
## 1.4 Design an activity

### 1.4.1 Open the diagram editor

In order to open the diagram editor:

1. Unfold the *representations.aird* file
2. Double-click on *Example workflow diagram*

The following view should open:




### 1.4.2 Understand the diagram editor

The workflow diagram editor is made of two parts:

- the edition area, which is the blank area on the left,
- the palette, which is the section on the right.

The edition area provides a visual representation of the workflow. Tools can be applied on it in order to modify the representation.

The circle represents the start node, which is the entry point of the workflow when it is executed.

The palette provides access to the different tools that can be used to modify the workflow. A tool can be used by:

1. Clicking on the tool in the palette
2. Clicking on the edition area

**Tip:** See *EKumi Default Representation* for an in-depth presentation of available tools.

### 1.4.3 Create a Greeting task

A new Task can be created thanks to the External Task tool:

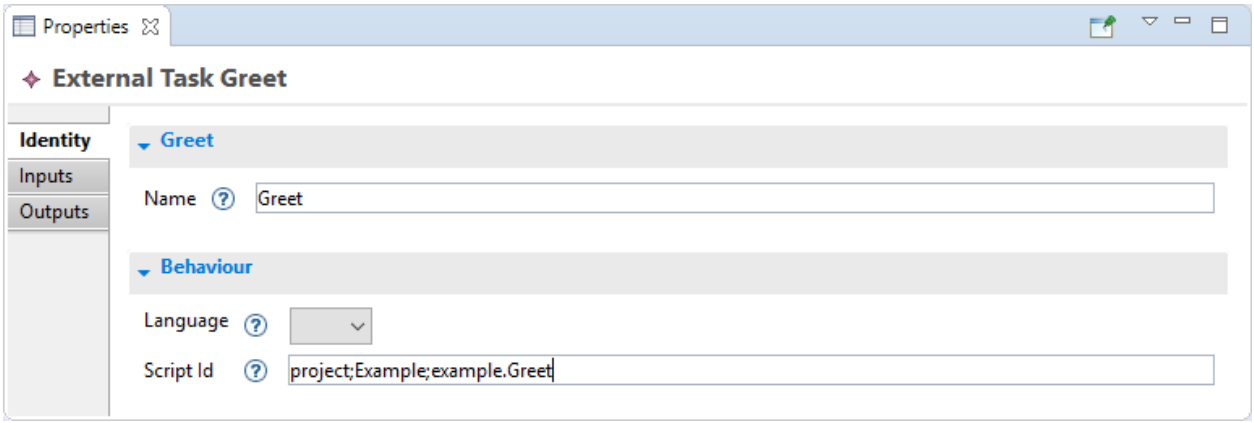
1. Click on the tool
2. Click somewhere in the edition area

A new box appears on the editor, representing the new task.

Open the `Properties` view, select the task, then type “Greet” in the *Name* text field.

In order to add behavior to this task we have to link it to a Java script. To this end:

1. Select `Java` in the *Languages* drop-down menu
2. Type “project;<the_name_of_your_project>;example.Greet” in the *Script Id* text field




**Note:** The *Script Id* fields allows EKumi to resolve the script to run. The UI will evolve in the future so that users won’t have to type it by hand anymore.

Then create a new Java class called `Greet` in the *example* package that prints something to the console.

```
1  package example;
2
3  import fr.kazejiyu.ekumi.core.workflow.Context;
4  import fr.kazejiyu.ekumi.core.workflow.gen.impl.RunnerImpl;
5
6  public class Greet extends RunnerImpl {
7
8          @Override
9          public void run(Context context) {
10                 System.out.println("Hello!");
11         }
12
13 }
```

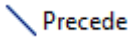
**Todo:** Build a more complex activity with two tasks, one producing outputs and another consuming them.

Now that the activity is ready, it can be executed.

## 1.5 Execute an activity

### 1.5.1 Link the task to the start node

First of all, the `Greet` task must be linked to the start node, otherwise it won't be considered as a runnable task.

To this end, use the 

tool:

1. Click on the tool
2. Click on the start node
3. Click on the task

### 1.5.2 Launch the execution

Then you can create a new Run configuration:

1. `Run` > `Run Configurations...`
2. Double-click on *Workflow*
3. Click on *Browse*
4. Select *model/Example.eds*
5. Click on *Run*

**Hello!** should be printed to the console.

## 1.6 Good Practices

### 1.6.1 Use meaningful names

When naming a task it is important to use a clear and easy to understand name.

Since tasks represent computations, it is relevant to use **verbs** to name them. For instance:

- Compute X
- Merge data
- Write to file

When a task is only used to extract data, naming it after the name of the data can make its purpose clearer. For instance, a task used to compute the length of a String may be called Length.

Exceptions are tasks representing mathematical operations. In such cases it may be clearer to use the mathematical expression as name:

- a + b
- y = f(x) + 2b

## 1.7 EKumi Default Representation

**Important:** Section under construction

### 1.7.1 A BPMN-inspired editor

This is the default built-in representation of an activity. It provides a BPMN-inspired diagram workflow editor.

### 1.7.2 Use Cases

This representation should be used when a graphical representation makes easier to design an activity.

### 1.7.3 Features

This representation allows anyone to:

- Design an activity made of multiple tasks,
- Add inputs and outputs to a task,
- Associate a script to a task,
- Specify that several tasks must be executed concurrently.

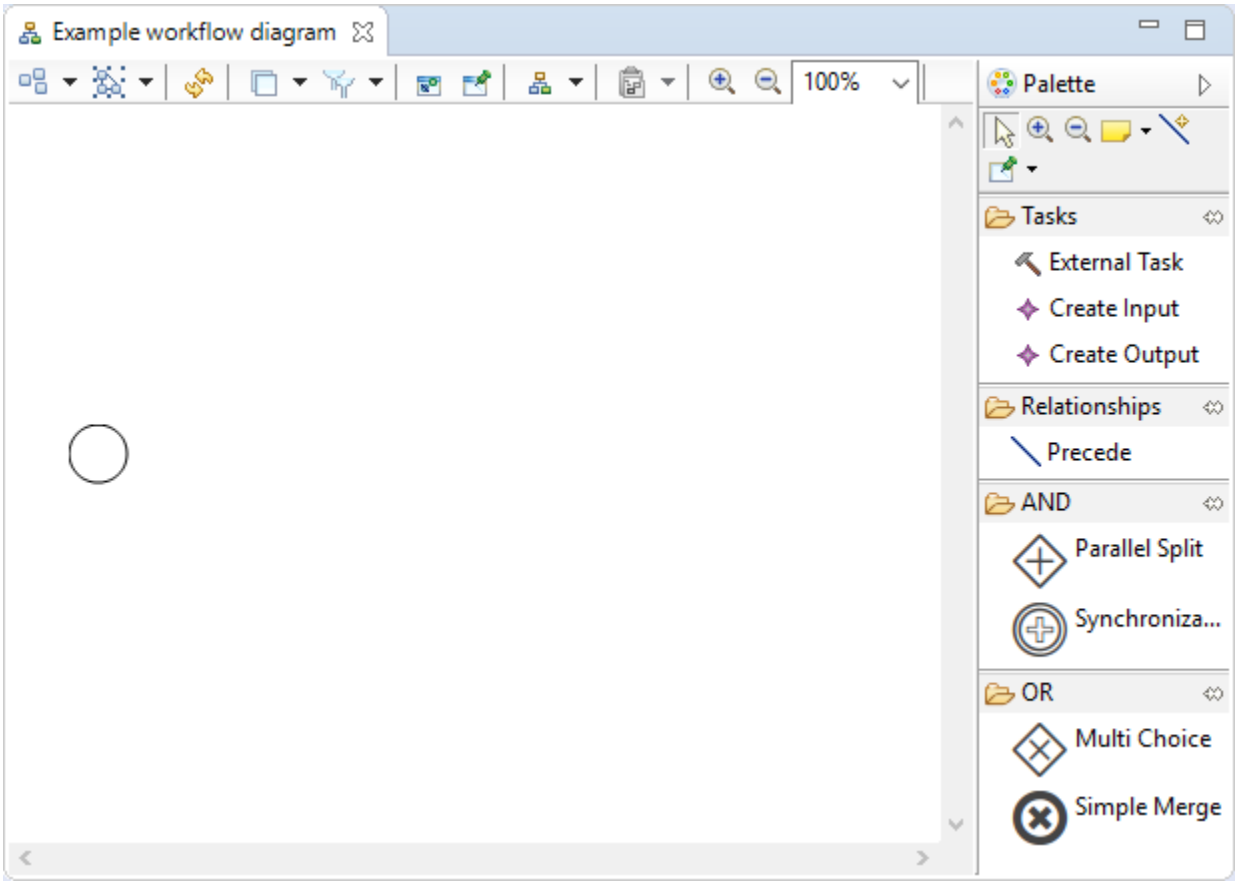
### 1.7.4 Impacts on project

When this representation is chosen for a project, it creates the following files:

| File | Purpose |
|---|---|
| `representations.aird` | Describes the workflow diagram. |
| `model/<activity-name>.eds` | Describes the activity, defining the different tasks it is made of. |

It also adds the `Modeling` nature to the project.

### 1.7.5 Understand the diagram editor




The workflow diagram editor is made of two parts:

- the edition area, which is the blank area on the left,
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The palette provides access to the different tools that can be used to modify the workflow. A tool can be used by:

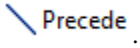
1. Clicking on the tool in the palette
2. Clicking on the edition area

Available tools are described in the following chapters.

### 1.7.6 Create a new task

A new Task can be created thanks to the External Task tool.

### 1.7.7 Link two tasks

Two task can be linked in order to specify which one should be executed first. This can be achieved thanks to the 

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### 1.7.8 Launch an activity

Once the activity is ready, it can be executed. An execution can be launched in two ways.

#### Create a dedicated launch configuration

1. `Run` > `Run Configurations...`
2. Double-click on *Workflow*
3. Click on *Browse*
4. Select the *.eds* file located under the *model/* folder
5. Click on *Run*

#### Use the context menu shortcut

In the file explorer:

1. Right-click on the *.eds* file located under the *model/* folder
2. Select `Run As` > `EKumi Activity`

## 1.8 Java

**Important:** Section under construction

Currently, Java is the only available scripting language. It allows to specify the behaviour of tasks by writting Java scripts. Each script is a class that extends the `RunnerImpl` class.

### 1.8.1 Impacts on project

When Java is enabled on a Workflow Project, it creates the following files:

| File | Purpose |
|---|---|
| `src/` | Directory containing Java source files. |
| `META-INF/MANIFEST.MF` | Defines project's dependencies, including EKumi's API. |
| `build.properties` | Defines the files to include when the project is packaged as a binary. |

The `Java` and `Plugin` natures are also added to the project. That enables the Java builder to compile the sources and allows the dependencies toward EKumi API to be resolved.

### 1.8.2 Script implementation

A new script can be added to a task by specifying the class' canonical name as script id. The class must extend the `RunnerImpl` class as in the example below:

```
/**
 * A script that prints 'Hello' when the corresponding task is executed.
 */
public class SayHello extends RunnerImpl {

    @Override
    public void run(Context context) {
        System.out.println("Hello!");
    }

}
```

### 1.8.3 Dependency Injection

Java scripts can be injected with some environment objects. Currently two objects can be injected:

- `Events`: allows to send specific events and to register new listener
- `ExecutionStatus`: allows to check the current status of the execution (failed, cancelled, etc.)

```
/**
 * A script that waits until the execution is cancelled.
 */
public class WaitCancellation extends RunnerImpl {

    @Inject
    private final ExecutionStatus execution;

    @Override
    public void run(Context context) {
        while (! execution.isCancelled()) {
            // wait
        }
    }

}
```

## 1.9 Add a new Scripting Language

**Important:** This section requires some knowledge about Eclipse Extension Points.

### 1.9.1 What is a scripting language?

A scripting language is a language that can be used to specify the behaviour of a task. Concretely, a language is a parser that can:

1. Instantiate an `Activity` from a given String

2. Create a String from an existing `Activity`.

It is hence responsible of serializing and deserializing Activities so that they can both be persisted and executed.

### 1.9.2 How to add a new scripting language?

A new one can be defined by contributing to the `fr.kazejiyu.ekumi.core.languages` extension point.

It requires one class that implements the `ScriptingLanguage` interface.

The interface is defined as follows:

```
public interface ScriptingLanguage {

    /**
     * Returns a unique id identifying the language.
     * @return a unique id identifying the language
     */
    String id();

    /**
     * Returns a human-readable name of the language.
     * @return a human-readable name of the language
     */
    String name();

    /**
     * Turns a runner written with the language into a EKumi {@link Runner}.
     *
     * @param identifier
     *                      Uniquely identifies the runner to resolve.
     *                      Must not be {@code null}.
     * @param context
     *                      The context of the {@link Execution}. Can be null if the execution
     *                      does not provide any context, or if the Runner is not resolved in
     *                      the context of an execution.
     *
     * @return a runner that can be handled by EKumi.
     *
     * @throws ScriptLoadingFailureException if the script cannot be loaded.
     * @throws IllegalScriptIdentifierException if the given identifier is not properly formatted.
     */
    Runner resolveRunner(String identifier, Context context);
}
```

### 1.9.3 How to use the new scripting language within the workflow diagram editor?

**Important:** Feature not implemented yet.

## 1.10 Add a new Data Type

**Important:** This section requires some knowledge about Eclipse Extension Points.

### 1.10.1 What is a data type?

A data type is a language that can be used to specify the format of a data. The term data represents both inputs and outputs. Concretely, a datatype is a parser that can:

1. Instantiate an `Object` from a given String
2. Create a String from an existing `Object`.

It is hence responsible of serializing and deserializing data so that they can both be persisted and used during the execution.

### 1.10.2 How to add a new datatype?

A new one can be defined by contributing to the `fr.kazejiyu.ekumi.core.datatypes` extension point.

It requires one class that implements the `DataType<T>` interface.

The interface is defined as follows:

```
public interface DataType<T> {

    /**
    * Returns an identifier for this type.
    * @return an identifier for this type.
    */
    String getId();

    /**
    * Returns the name of the type.
    * @return the name of the type.
    */
    String getName();

    /**
    * Returns the Java class corresponding to this type.
    * @return the Java class corresponding to this type.
    */
    Class<T> getJavaClass();

    /**
    * Returns the default value of a new instance of this type.
    * @return the default value of a new instance of this type.
    */
    T getDefaultValue();

    /**
    * Returns a String representation of the type.<br>
    * <br>
    * For any type {@code type}, the following assertion must be {@code true}:
```

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```
31      * <pre>{@code instance.equals( type.unserialize(type.serialize(instance)) );}</
    ↪pre>
32      *
33      * @return a String representation of the type.
34      *
35      * @throws DataTypeSerializationException if T cannot be turned into a String
36      *
37      * @see #unserialize(String)
38      */
39     String serialize(T instance);
40
41     /**
42      * Returns a new instance of the type from a given representation.<br>
43      * <br>
44      * For any type {@code type}, the following assertion must be {@code true}:
45      * <pre>{@code instance.equals( type.unserialize(type.serialize(instance)) );}</
    ↪pre>
46      *
47      * @param representation
48      *                        The string representation of the type.
49      *
50      * @throws DataTypeUnserializationException if representation cannot be turned␣
    ↪into an instance of T
51      *
52      * @see #serialize()
53      */
54     T unserialize(String representation);
55 }
```

### 1.10.3 How to use the new datatype within the workflow diagram editor?

**Important:** Feature not implemented yet.

## 1.11 Add a new Specification

**Important:** This section requires some knowledge about Eclipse Extension Points.

### 1.11.1 What is a specification?

A specification is a definition of how a workflow is structured; as such, it can be affiliated to a concrete grammar.

A specification can be used to customize the way workflows are persisted, but are mainly aimed at supporting new editors (see *Add a new Representation*).

### 1.11.2 How to add a new specification?

A new one can be defined by contributing to the `fr.kazejiyu.ekumi.core.specs` extension point which requires one class that implements the `ActivityAdapter` interface.

The interface to implement is defined as follows:

```
1  public interface ActivityAdapter {
2
3      /**
4       * Returns whether the adapter can turn the given specification into an Activity.
5       *
6       * @param specification
7       *                      The specification to adapt, may be null.
8       *
9       * @return whether the adapter can turn the given specification into an Activity
10      */
11     boolean canAdapt(Object specification);
12
13     /**
14      * Creates an Activity from the given specification.
15      *
16      * @param specification
17      *                      The specification to adapt.
18      * @param datatypes
19      *                      The factory used to instantiate available datatypes.
20      * @param languages
21      *                      The factory used to instantiate available scripting␣
↪languages.
22      *
23      * @return a new Activity
24      */
25     Optional<Activity> adapt(Object specification, DataTypeFactory datatypes,␣
↪ScriptingLanguageFactory languages);
26
27  }
```

An `ActivityAdapter` is responsible of turning your own specification model into an `Activity` so that the framework can execute it.

### 1.11.3 How to integrate the new specification within the IDE?

**Important:** Feature not implemented yet.

## 1.12 Add a new Representation

**Important:** This section requires some knowledge about Eclipse Extension Points.

### 1.12.1 What is a representation?

A specification describes a possible representation of a workflow. The main purposes of represenations is allowing new workflow editors (which can visual, textual or even in-memory).

### 1.12.2 How to add a new representation?

A new one can be defined by contributing to the `fr.kazejiyu.ekumi.ide.project_customization` extension point.

It requires a contribution to the *representations* attribute.

### 1.12.3 How to integrate the new representation within the IDE?

The representation is automatically proposed to the user in the *New Workflow Project* wizard as soon as the new extension is completed.

## 1.13 Share an Activity

**Important:** This section requires some knowledge about Eclipse Extension Points.

**Todo:** Explain usage of the `categories` extension point.