Windup Core Development Guide

Introduction

This guide is for developers who plan to contribute source code updates or core rule add-ons to the Windup project.

What is Windup?

Overview

Windup is an extensible and customizable rule-based tool that helps simplify migration of Java applications.

Windup can be run as a standalone application or as a plug-in to Red Hat JBoss Developer Studio. Running from a Forge environment, it examines application artifacts, including project source directories and applications archives, then produces an HTML report highlighting areas that need changes. Windup can be used to migrate Java applications from previous versions of *Red Hat JBoss Enterprise Application Platform* or from other containers, such as *Oracle WebLogic Server* or *IBM® WebSphere® Application Server*.

How Does Windup Simplify Migration?

Windup looks for common resources and highlights technologies and known “trouble spots” when migrating applications. The goal is to provide a high level view into the technologies used by the application and provide a detailed report organizations can use to estimate, document, and migrate enterprise applications to Java EE and JBoss EAP.

Features of Windup

Shared Data Model

Windup creates a shared data model graph that provides the following benefits.

- It enables complex rule interaction, allowing rules to pass findings to other rules.
- It enables 3rd-party plug-ins to interact with other plugins, rules and reports.
- The data graph organizes the findings to be searchable and queryable.

Extensibility

Windup can be extended by developers, users, and 3rd-parties.

- It provides a plug-in API to inject other applications into Windup.
- It enables 3rd-parties to create simple POJO plug-ins that can interact with the data graph.
- Means we don’t have to invent everything. Users with domain knowledge can implement their own rules.

Better Rules

Windup provides more powerful and complex rules.

- XML-based rules are simple to write and and easy to implement.
- Java-based rule add-ons are based on OCPsoft Rewrite and provide greater flexibility and power creating when rules.
- Rules can now be nested to handle more complex situations. This means you can nest simple statements rather than use complex XPATH or REGEX expressions. *Rules can be linked using and/or statements

Automation

Windup has the ability to automate some of the migration processes.

- Windup is integrated with Forge 2, meaning it can generate projects, libraries, and configuration files.
- Rules can create Forge inputs and put them into the data graph.
- During the automation phase, the data graph inputs can be processed to generate a new project.

Work Estimation

Estimates for the level of effort is based on the skills required and the classification of migration work needed.

- Lift and Shift - The code or file is standards-based and can be ported to the new environment with no changes.
- Mapped - There is a standard mapping algorithm to port the code or file to the new environment.
- Custom – The code or file must be rewritten or modified to work in the new environment.

Better Reporting

Windup reports are now targeted for specific audiences.

- IT Management - Applications are ranked by cost of migration.
- Project Management - Reports detail the type of work and estimation of effort to complete the tasks.
- Developers - An Eclipse plug-in provides hints and suggested code changes within the IDE.

Unresolved directive in Windup-Core-Development-Guide-Topics.adoc - include::System-Requirements[tabsize=4]

About the WINDUP_HOME Variable

This documentation uses the **WINDUP_HOME** *replaceable* value to denote the path to the Windup distribution. When you encounter this value in the documentation, be sure to replace it with the actual path to your Windup installation.

- If you download and install the latest distribution of Windup from the JBoss Nexus repository, WINDUP_HOME refers to the windup-distribution-2.2.0-Final folder extracted from the downloaded ZIP file.
- If you build Windup from GitHub source, WINDUP_HOME refers to the windup-distribution-2.2.0-Final folder extracted from the Windup source dist/target/windup-distribution-2.2.0-Final.zip file.

Get Started

Before you begin to contribute to Windup, take a quick tour to see how to use it.

Install Windup

1. If you installed previous versions of Windup, delete the `${user.home}/.windup/` directory. Otherwise you may see errors like the following when you execute Windup.

```
Command: windup-migrate-app was not found
```

2. Download the latest Windup ZIP distribution.
3. Extract the ZIP file in to a directory of your choice.

Execute Windup

Prerequisites

Before you begin, you must gather the following information.

1. The fully qualified path of the application archive or folder you plan to migrate.
2. The fully qualified path to a folder that will contain the resulting report information.
   - If the folder does not exist, it is created by Windup.
   - If the folder exists, you are prompted with the message:

     ```
     Overwrite all contents of <OUTPUT_DIRECTORY> (anything already in the directory will be deleted)? [y/N]
     ```

     Choose "y" if you want Windup to delete and recreate the directory.
   - If you are confident you want to overwrite the output directory, you can specify `--overwrite` on the command line to automatically delete and recreate the directory.

     NOTE Be careful not to specify a directory that contains important information!
3. You must also provide a list of the application packages to be evaluated.
   - In most cases, you are interested only in evaluating the custom application class packages and not the standard Java EE or 3rd party packages. For example, if the *MyCustomApp* application uses the package `com.mycustomapp`, you provide that package using the `--packages` argument on the command line. It is not necessary to provide the standard Java EE packages, like `java.util` or `javax.ejb`.
   - While you can provide package names for standard Java EE 3rd party software like `org.apache`, it is usually best not to include them as they should not impact the migration effort.
   - If you omit the `--packages` argument, every package in the application is scanned, resulting in very slow performance. It is best to provide the argument with one or more packages.

Start Windup

For information about the use of WINDUP_HOME in the instructions below, seeAbout the WINDUP_HOME Variable.

1. Open a terminal and navigate to the WINDUP_HOME/bin directory
2. Type the following command to start Windup:

   ```
   For Linux:    windup/bin $ ./windup
   For Windows:  C:\WINDUP_HOME\bin> windup
   ```
3. You are presented with the following prompt.

   ```
   Using Windup at WINDUP_HOME

    _       ___           __
   | |     / (_)___  ____/ /_  ______
   | | /| / / / __ \/ __  / / / / __ \
   | |/ |/ / / / / / /_/ / /_/ / /_/ /
   |__/|__/_/_/ /_/\__,_/\__,_/ .___/
                             /_/

   JBoss Windup, version [ 2.2.0.Final ] - JBoss, by Red Hat, Inc. [ http://windup.jboss.org ]

   [windup-distribution-2.2.0.Final]$
   ```

Run Windup

1. The command to run Windup is `windup-migrate-app`.
2. This command can take arbitrary options processed by different addons. The list of options in the core Windup distribution can be found in Javadoc. Most commonly used command line arguments are:

--input **INPUT_ARCHIVE_OR_FOLDER**

This is the fully qualified application archive or source path.

--output OUTPUT_REPORT_DIRECTORY

The fully qualified path to the folder that will contain the the report information produced by Windup.

NOTE

If the **OUTPUT_REPORT_DIRECTORY** directory exists and you do not specify the `--overwrite` argument, you are prompted to overwrite the contents. If you respond "y", it is deleted and recreated by Windup, so be careful not to specify an output directory that contains important information!

--overwrite (optional)

Specify this optional argument only if you are certain you want to force Windup to delete the existing **OUTPUT_REPORT_DIRECTORY**. The default value is `false`.

--userRulesDirectory

Points to a directory to load XML rules from. (Search pattern: *.windup.groovy and *.windup.xml)

--packages PACKAGE_1, PACKAGE_2, PACKAGE_N (optional)

This is a comma-delimited list of the packages to be evaluated by Windup.

--excludePackages **PACKAGE_1, PACKAGE_2, PACKAGE_N (optional)**

This is a comma-delimited list of the packages to be excluded by Windup.

--source-mode true (optional)

This argument is optional and is only required if the application to be evaluated contains source files rather than compiled binaries. The default value is `false`.

3. To evaluate an application archive, use the following syntax:

```
windup-migrate-app --input INPUT_ARCHIVE_OR_FOLDER --output OUTPUT_REPORT_DIRECTORY --packages PACKAGE_1 PACKAGE_2
PACKAGE_N
```

To run Windup against application source code, you must add the `--sourceMode true` argument:

```
windup-migrate-app --sourceMode true --input INPUT_ARCHIVE_OR_FOLDER --output OUTPUT_REPORT_DIRECTORY --packages
PACKAGE_1 PACKAGE_2 PACKAGE_N
```

See Windup Command Examples below for concrete examples of commands that use source code directories and archives located in the Windup GitHub repository.

4. You should see the following result upon completion of the command:

```
***SUCCESS*** Windup execution successful!
```

5. To exit Windup, type:

```
exit
```

6. Open the `OUTPUT_REPORT_DIRECTORY/index.html` file in a browser to access the report. The following subdirectories in the `OUTPUT_REPORT_DIRECTORY` contain the supporting information for the report:

```
OUTPUT_REPORT_DIRECTORY/
    graph/
    renderedGraph/
    reports/
    stats/
    index.html
```

7. For details on how to evaluate the report data, seeReview the Report.

Run Windup in Batch Mode

Windup can be also executed in batch mode within a shell or batch script using the `--evaluate` argument as follows.

1. Open a terminal and navigate to the WINDUP_HOME directory.
2. Type the following command to run Windup in batch mode:

   ```
   For Linux:     $ bin/windup --evaluate "windup-migrate-app --input INPUT_ARCHIVE --output OUTPUT_REPORT --packages
   PACKAGE_1 PACKAGE_2 PACKAGE_N"
   For Windows:   > bin\windup.bat --evaluate "windup-migrate-app --input INPUT_ARCHIVE --output OUTPUT_REPORT --
   packages PACKAGE_1 PACKAGE_2 PACKAGE_N"
   ```

Windup Command Line Help

To see the complete list of available arguments for the `windup-migrate-app` command, execute the following command in the Windup prompt:

```
man windup-migrate-app
```

Command Examples

The following command examples report against applications located in the Windup source[test-files](test-files) directory.

Source Code Example

The following command runs against the[seam-booking-5.2](seam-booking-5.2) application source code. It evaluates all `org.jboss.seam` packages and creates a folder named 'seam-booking-report' in the `/home/username/windup-reports/` directory to contain the reporting output.

```
windup-migrate-app --sourceMode true --input /home/username/windup-source/test-files/seam-booking-5.2/ --output
/home/username/windup-reports/seam-booking-report --packages org.jboss.seam
```

Archive Example

The following command runs against the[jee-example-app-1.0.0.ear](jee-example-app-1.0.0.ear) EAR archive. It evaluates all `com.acme` and `org.apache` packages and creates a folder named 'jee-example-app-1.0.0.ear-report' in the `/home/username/windup-reports/` directory to contain the reporting output.

```
windup-migrate-app --input /home/username/windup-source/test-files/jee-example-app-1.0.0.ear/ --output
/home/username/windup-reports/jee-example-app-1.0.0.ear-report --packages com.acme org.apache
```

Windup Batch Example

The following Windup batch command runs against the[jee-example-app-1.0.0.ear](jee-example-app-1.0.0.ear) EAR archive. It evaluates all `com.acme` and `org.apache` packages and creates a folder named 'jee-example-app-1.0.0.ear-report' in the `/home/username/windup-reports/` directory to contain the reporting output.

```
For Linux: $ bin/windup --evaluate "windup-migrate-app --input /home/username/windup-source/test-files/jee-example-app-
1.0.0.ear/ --output /home/username/windup-reports/jee-example-app-1.0.0.ear-report --packages com.acme org.apache"
For Windows: > bin\windup.bat --evaluate "windup-migrate-app --input \windup-source\test-files\jee-example-app-1.0.0.ear
--output \windup-reports\jee-example-app-1.0.0.ear-report --packages com.acme org.apache
```

Windup Quickstart Examples

For more concrete examples, see the Windup quickstarts located on GitHub here:https://github.com/windup/windup-quickstarts. If you prefer, you can download the[latest release](latest release) ZIP or TAR distribution of the quickstarts.

The quickstarts provide examples of Java-based and XML-based rules you can run and test using Windup. The README instructions provide a step-by-step guide to run the quickstart example. You can also look through the code examples and use them as a starting point for creating your own rules.

Review the Report

About the Report

When you execute Windup, the report is generated in the`OUTPUT_REPORT_DIRECTORY` you specify for the `--output` argument in the command line. This output directory contains the following files and subdirectories:

- `index.html` : This is the landing page for the report.
- `archives/` : Contains the archives extracted from the application

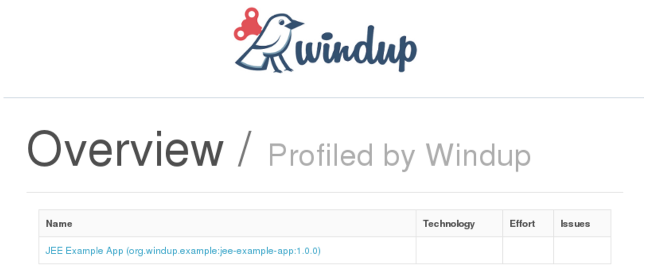
- `graph/` : Contains binary graph database files
- `reports/` : This directory contains the generated HTML report files
- `stats/` : Contains Windup performance statistics

The examples below use the test-files/jee-example-app-1.0.0.ear located in the Windup GitHub source repository for input and specify the `com.acme` and `org.apache` package name prefixes to scan. For example:

```
windup-migrate-app --input /home/username/windup-source/test-files/jee-example-app-1.0.0.ear/ --output
/home/username/windup-reports/jee-example-app-1.0.0.ear-report --packages com.acme org.apache
```

Open the Report

Use your favorite browser to open the `index.html` file located in the output report directory. You should see something like the following:



Name	Technology	Effort	Issues
JEE Example App (org.windup.example:jee-example-app:1.0.0)			

Click on the link under the **Name** column to view the Windup application report page.

Report Sections

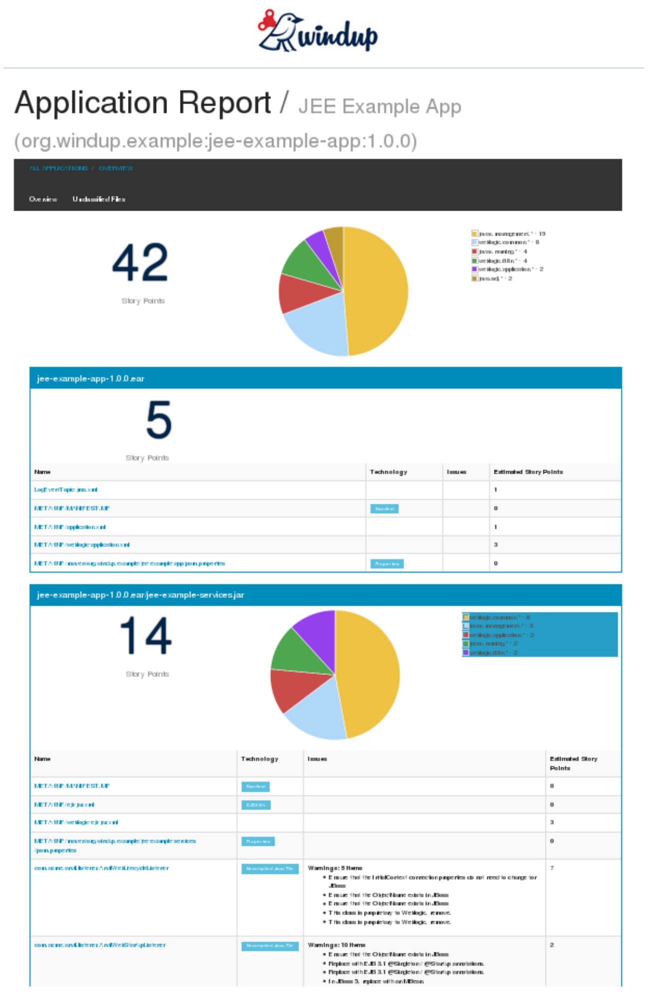
Application Report Page

The first section of the application report page summarizes the migration effort. It displays the following information both graphically and in list form by application artifact for each file that is analyzed.

- The file name
- The file type
- A list of issues, if any, that were found in the file
- The estimated total *Story Points* to migrate the file. A *Story Point* is a term commonly used in Scrum Agile software development methodology to estimate the level of effort needed to implement a feature or change. It does not necessarily translate to man-hours, but the value should be consistent across tasks.

In the following Windup Application Report example, the migration of the **JEE Example App** EAR is assigned a total of 42 story points. A pie chart shows the breakdown of story points by package. This is followed by a section for each of the archives contained in the EAR. It provides the total of the story points assigned to the archive and lists the files contained in archive along with the warnings and story point assigned to each file.

Example of a Windup Application Report



Application Report / JEE Example App
(org.windup.example:jee-example-app:1.0.0)

42
Story Points

jee-example-app-1.0.0.ear

5
Story Points

Name	Technology	Issues	Estimated Story Points
LogEventTopic-jms.xml			1
META-INF/MANIFEST.MF	Manifest		0
META-INF/application.xml			1
META-INF/weblogic-application.xml			3
META-INF/maven/org.windup.example/jee-example-app/pom.properties	Properties		0

jee-example-app-1.0.0.ear/jee-example-services.jar

14
Story Points

Name	Technology	Issues	Estimated Story Points
META-INF/MANIFEST.MF	Manifest		0
META-INF/ejb-jar.xml	EJB XML		0
META-INF/weblogic-ejb-jar.xml			3
META-INF/maven/org.windup.example/jee-example-services/pom.properties	Properties		0
com.acme.anvil.listener.AnvilWebLifecycleListener	Decompiled Java File	Warnings: 5 items • Ensure that the InitialContext connection properties do not need to change for JBoss • Ensure that the ObjectName exists in JBoss • Ensure that the ObjectName exists in JBoss • This class is proprietary to Weblogic, remove. • This class is proprietary to Weblogic, remove.	7
com.acme.anvil.listener.AnvilWebStartupListener	Decompiled Java File	Warnings: 10 items • Ensure that the ObjectName exists in JBoss • Replace with EJB 3.1 @Singleton / @Startup annotations. • Replace with EJB 3.1 @Singleton / @Startup annotations. • In JBoss 5, replace with an MBean.	2

Archive Analysis Sections

Each archive summary begins with a total of the story points assigned to its migration, followed by a table detailing the changes required for each file in the archive. The report contains the following columns.

Name

The name of the file being analyzed

Technology

The type of file being analyzed. For example:

- Java Source
- Decompiled Java File
- Manifest
- Properties
- EJB XML
- Spring XML
- Web XML
- Hibernate Cfg
- Hibernate Mapping

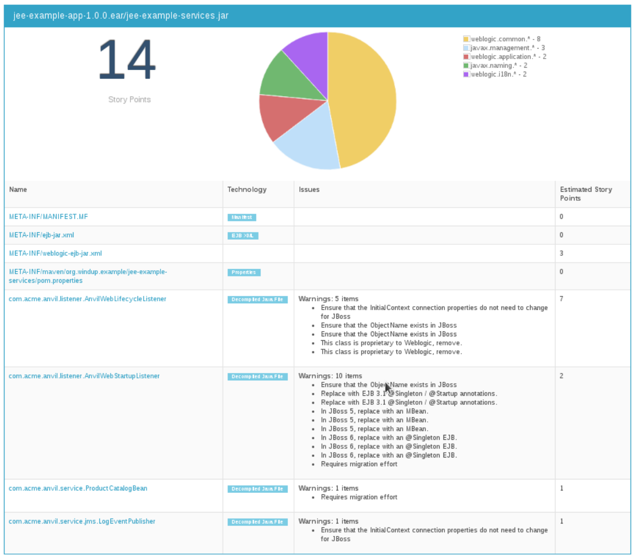
Issues

Warnings about areas of code that need review or changes.

Estimated Story Points

Level of effort required for migrating the file.

The following is an example of the archive analysis summary section of a Windup Report. In this example, it's the analysis of the `WINDUP_SOURCE/test-files/jee-example-app-1.0.0.ear/jee-example-services.jar`.



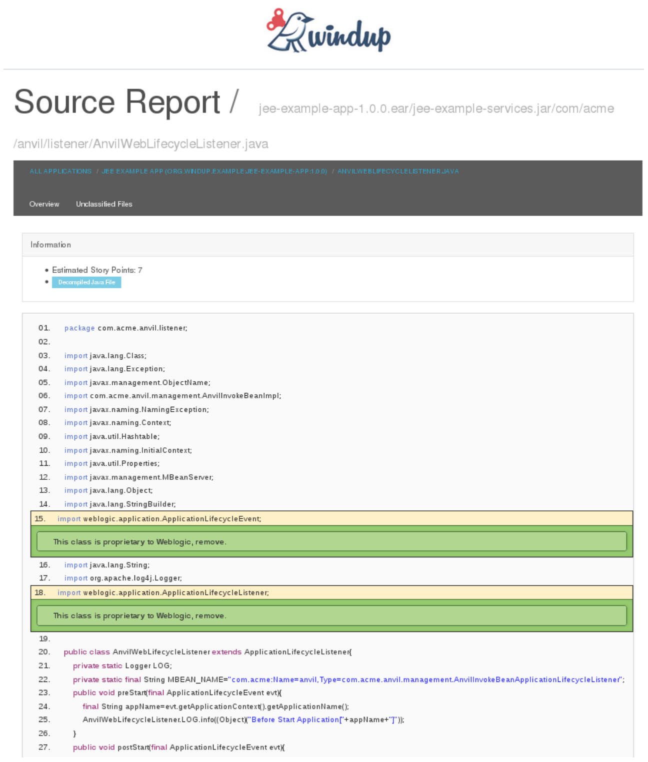
Name	Technology	Issues	Estimated Story Points
META-INF/MANIFEST.MF	Manifest		0
META-INF/ejb-jar.xml	EJB XML		0
META-INF/weblogic-ejb-jar.xml			3
META-INF/maven/org.windup.example/jee-example-services/pom.properties	Properties		0
com.acme.anvil.listener.AnvilWebLifecycleListener	Decompiled Java File	Warnings: 5 items • Ensure that the InitialContext connection properties do not need to change for JBoss • Ensure that the ObjectName exists in JBoss • Ensure that the ObjectName exists in JBoss • This class is proprietary to Weblogic, remove. • This class is proprietary to Weblogic, remove.	7
com.acme.anvil.listener.AnvilWebStartupListener	Decompiled Java File	Warnings: 10 items • Ensure that the ObjectName exists in JBoss • Replace with EJB 3.1 @Singleton / @Startup annotations. • Replace with EJB 3.1 @Singleton / @Startup annotations. • In JBoss 5, replace with an MBean. • In JBoss 5, replace with an MBean. • In JBoss 5, replace with an MBean. • In JBoss 6, replace with an @Singleton EJB. • In JBoss 6, replace with an @Singleton EJB. • In JBoss 6, replace with an @Singleton EJB. • Requires migration effort	2
com.acme.anvil.service.ProductCatalogBean	Decompiled Java File	Warnings: 1 items • Requires migration effort	1
com.acme.anvil.service.jms.LogEventPublisher	Decompiled Java File	Warnings: 1 items • Ensure that the InitialContext connection properties do not need to change for JBoss	1

File Analysis Pages

The analysis of the `jee-example-services.jar` lists the files in the JAR and the warnings and story points assigned to each one. Notice the `com.acme.anvil.listener.AnvilWebLifecycleListener` file has 5 warnings and is assigned 7 story points. Click on the file to see the detail.

- The **Information** section provides a summary of the story points and notes that the file was decompiled by Windup.
- This is followed by the file source code listing. Warnings appear in the file at the point where migration is required.

In this example, warnings appear at the import of `weblogic.application.ApplicationLifecycleEvent` and report that the class is proprietary to WebLogic and must be removed.


windup
Source Report / jee-example-app-1.0.0.ear/jee-example-services.jar/com/acme/anvil/listener/AnvilWebLifecycleListener.java
ALL APPLICATIONS / JEE EXAMPLE APP (ORG.WINDUP.EXAMPLE:JEE-EXAMPLE-APP:1.0.0) / ANVILWEBLIFECYCLELISTENER.JAVA
Overview
Unclassified Files
Information

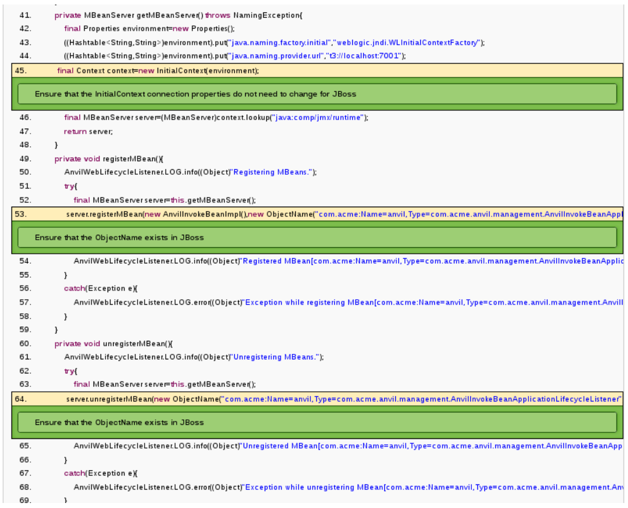
- Estimated Story Points: 7
- Decompiled Java File

```java
package com.acme.anvil.listener;

import java.lang.Class;
import java.lang.Exception;
import javax.management.ObjectName;
import com.acme.anvil.management.AnvilInvokeBeanImpl;
import javax.naming.NamingException;
import javax.naming.Context;
import java.util.Hashtable;
import javax.naming.InitialContext;
import java.util.Properties;
import javax.management.MBeanServer;
import java.lang.Object;
import java.lang.StringBuilder;
import weblogic.application.ApplicationLifecycleEvent;
    This class is proprietary to Weblogic, remove.
import java.lang.String;
import org.apache.log4j.Logger;
import weblogic.application.ApplicationLifecycleListener;
    This class is proprietary to Weblogic, remove.

public class AnvilWebLifecycleListener extends ApplicationLifecycleListener{
    private static Logger LOG;
    private static final String MBEAN_NAME="com.acme:Name=anvil,Type=com.acme.anvil.management.AnvilInvokeBeanApplicationLifecycleListener";
    public void preStart(final ApplicationLifecycleEvent evt){
        final String appName=evt.getApplicationContext().getApplicationName();
        AnvilWebLifecycleListener.LOG.info((Object)("Before Start Application["+appName+"]"));
    }
    public void postStart(final ApplicationLifecycleEvent evt){
```

Later in the code, warnings appear for the creation of the InitialContext and for the object name when registering and unregistering an MBeans



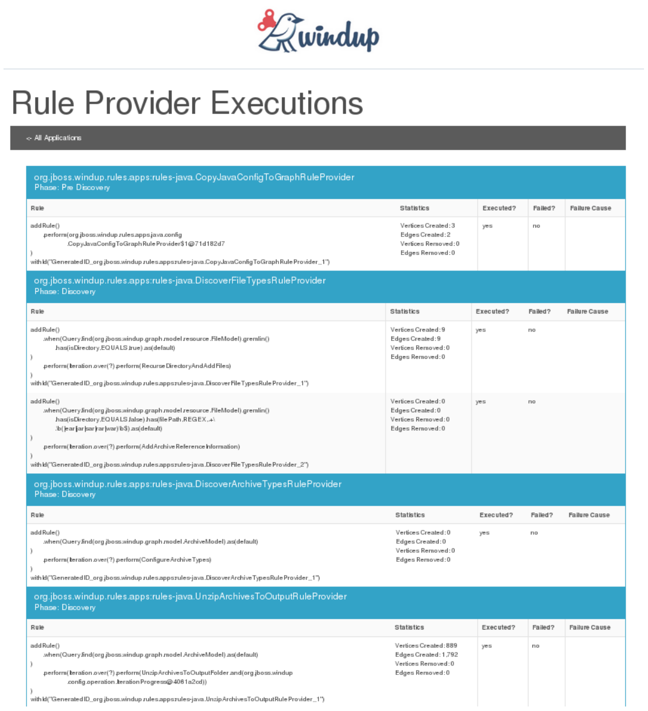
```
    private MBeanServer getMBeanServer() throws NamingException{
        final Properties environment=new Properties();
        ((Hashtable<String,String>)environment).put("java.naming.factory.initial","weblogic.jndi.WLInitialContextFactory");
        ((Hashtable<String,String>)environment).put("java.naming.provider.url","t3://localhost:7001");
        final Context context=new InitialContext(environment);
    Ensure that the InitialContext connection properties do not need to change for JBoss
        final MBeanServer server=(MBeanServer)context.lookup("java:comp/jmx/runtime");
        return server;
    }
    private void registerMBean(){
        AnvilWebLifecycleListener.LOG.info((Object)"Registering MBeans.");
        try{
            final MBeanServer server=this.getMBeanServer();
            server.registerMBean(new AnvilInvokeBeanImpl(),new ObjectName("com.acme:Name=anvil,Type=com.acme.anvil.management.AnvilInvokeBeanAppl
    Ensure that the ObjectName exists in JBoss
            AnvilWebLifecycleListener.LOG.info((Object)"Registered MBean[com.acme:Name=anvil,Type=com.acme.anvil.management.AnvilInvokeBeanApplic
        }
        catch(Exception e){
            AnvilWebLifecycleListener.LOG.error((Object)"Exception while registering MBean[com.acme:Name=anvil,Type=com.acme.anvil.management.Anvill
        }
    }
    private void unregisterMBean(){
        AnvilWebLifecycleListener.LOG.info((Object)"Unregistering MBeans.");
        try{
            final MBeanServer server=this.getMBeanServer();
            server.unregisterMBean(new ObjectName("com.acme:Name=anvil,Type=com.acme.anvil.management.AnvilInvokeBeanApplicationLifecycleListener"
    Ensure that the ObjectName exists in JBoss
            AnvilWebLifecycleListener.LOG.info((Object)"Unregistered MBean[com.acme:Name=anvil,Type=com.acme.anvil.management.AnvilInvokeBeanApp
        }
        catch(Exception e){
            AnvilWebLifecycleListener.LOG.error((Object)"Exception while unregistering MBean[com.acme:Name=anvil,Type=com.acme.anvil.management.Anv
        }
```

Additional Reports

Explore the Windup `OUTPUT_REPORT_DIRECTORY/reports` folder to find additional reporting information.

Rule Provider Execution Report

The `OUTPUT_REPORT_DIRECTORY/reports/windup_ruleproviders.html` page provides the list of rule providers that executed when running the Windup migration command against the application.



Rule Provider Executions

<- All Applications

org.jboss.windup.rules.apps:rules-java.CopyJavaConfigToGraphRuleProvider
Phase: Pre Discovery

Rule	Statistics	Executed?	Failed?	Failure Cause
addRule() .perform(org.jboss.windup.rules.apps.java.config .CopyJavaConfigToGraphRuleProvider$1@71d182d7) withId("GeneratedID_org.jboss.windup.rules.apps:rules-java.CopyJavaConfigToGraphRuleProvider_1")	Vertices Created: 3 Edges Created: 2 Vertices Removed: 0 Edges Removed: 0	yes	no	

org.jboss.windup.rules.apps:rules-java.DiscoverFileTypesRuleProvider
Phase: Discovery

Rule	Statistics	Executed?	Failed?	Failure Cause

addRule()
.when(Query.find(org.jboss.windup.graph.model.resource.FileModel).gremlin()
.has(isDirectory.EQUALS.true).as(default)
)
.perform(Iteration.over(?).perform(RecurseDirectoryAndAddFiles)
)
withId("GeneratedID_org.jboss.windup.rules.apps:rules-java.DiscoverFileTypesRuleProvider_1")
	Vertices Created: 9
	Edges Created: 9
	Vertices Removed: 0
	Edges Removed: 0
		yes	no	

addRule()
.when(Query.find(org.jboss.windup.graph.model.resource.FileModel).gremlin()
.has(isDirectory.EQUALS.false).has(filePath.REGEX..+\
.\b(|ear|jar|sar|rar|war)\b$).as(default)
)
.perform(Iteration.over(?).perform(AddArchiveReferenceInformation)
)
withId("GeneratedID_org.jboss.windup.rules.apps:rules-java.DiscoverFileTypesRuleProvider_2")
	Vertices Created: 0
	Edges Created: 0
	Vertices Removed: 0
	Edges Removed: 0
		yes	no	

org.jboss.windup.rules.apps:rules-java.DiscoverArchiveTypesRuleProvider
Phase: Discovery

Rule	Statistics	Executed?	Failed?	Failure Cause

addRule()
.when(Query.find(org.jboss.windup.graph.model.ArchiveModel).as(default)
)
.perform(Iteration.over(?).perform(ConfigureArchiveTypes)
)
withId("GeneratedID_org.jboss.windup.rules.apps:rules-java.DiscoverArchiveTypesRuleProvider_1")
	Vertices Created: 0
	Edges Created: 0
	Vertices Removed: 0
	Edges Removed: 0
		yes	no	

org.jboss.windup.rules.apps:rules-java.UnzipArchivesToOutputRuleProvider
Phase: Discovery

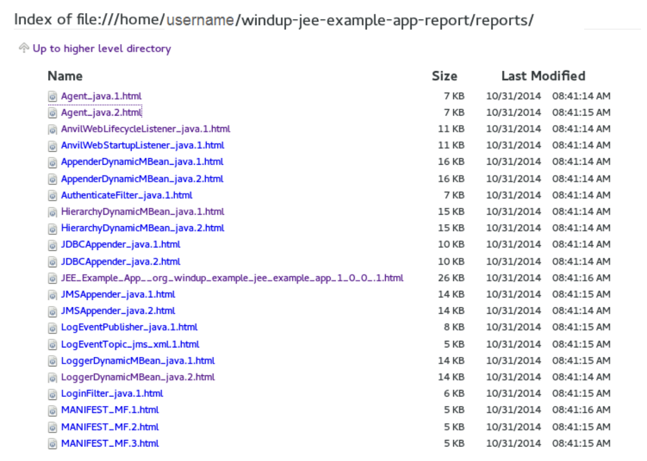
Rule	Statistics	Executed?	Failed?	Failure Cause
addRule() .when(Query.find(org.jboss.windup.graph.model.ArchiveModel).as(default)) .perform(Iteration.over(?).perform(UnzipArchivesToOutputFolder.and(org.jboss.windup .config.operation.IterationProgress@4061a2cd))) withId("GeneratedID_org.jboss.windup.rules.apps:rules-java.UnzipArchivesToOutputRuleProvider_1")	Vertices Created: 889 Edges Created: 1,792 Vertices Removed: 0 Edges Removed: 0	yes	no	

Rule Provider Execution Report

The `OUTPUT_REPORT_DIRECTORY/reports/windup_ruleproviders.html` page provides the list of rule providers that executed when running the Windup migration command against the application.

Individual File Analysis Reports

You can directly access the the file analysis report pages described above by browsing for them by name in the `OUTPUT_REPORT_DIRECTORY/reports/` directory. Because the same common file names can exist in multiple archives, for example "manifest.mf" or "web.xml", Windup adds a unique numeric suffix to each report file name.



Index of file:///home/username/windup-jee-example-app-report/reports/

Up to higher level directory

Name	Size	Last Modified	
Agent_java.1.html	7 KB	10/31/2014	08:41:14 AM
Agent_java.2.html	7 KB	10/31/2014	08:41:15 AM
AnvilWebLifecycleListener_java.1.html	11 KB	10/31/2014	08:41:14 AM
AnvilWebStartupListener_java.1.html	11 KB	10/31/2014	08:41:14 AM
AppenderDynamicMBean_java.1.html	16 KB	10/31/2014	08:41:14 AM
AppenderDynamicMBean_java.2.html	16 KB	10/31/2014	08:41:14 AM
AuthenticateFilter_java.1.html	7 KB	10/31/2014	08:41:14 AM
HierarchyDynamicMBean_java.1.html	15 KB	10/31/2014	08:41:14 AM
HierarchyDynamicMBean_java.2.html	15 KB	10/31/2014	08:41:14 AM
JDBCAppender_java.1.html	10 KB	10/31/2014	08:41:14 AM
JDBCAppender_java.2.html	10 KB	10/31/2014	08:41:14 AM
JEE_Example_App__org_windup_example_jee_example_app_1_0_0_.1.html	26 KB	10/31/2014	08:41:16 AM
JMSAppender_java.1.html	14 KB	10/31/2014	08:41:15 AM
JMSAppender_java.2.html	14 KB	10/31/2014	08:41:14 AM
LogEventPublisher_java.1.html	8 KB	10/31/2014	08:41:15 AM
LogEventTopic_jms_xml.1.html	5 KB	10/31/2014	08:41:15 AM
LoggerDynamicMBean_java.1.html	14 KB	10/31/2014	08:41:15 AM
LoggerDynamicMBean_java.2.html	14 KB	10/31/2014	08:41:14 AM
LoginFilter_java.1.html	6 KB	10/31/2014	08:41:15 AM
MANIFEST_MF.1.html	5 KB	10/31/2014	08:41:16 AM
MANIFEST_MF.2.html	5 KB	10/31/2014	08:41:15 AM
MANIFEST_MF.3.html	5 KB	10/31/2014	08:41:15 AM

Prepare Your Development Environment

Now that you’ve seen Windup in action, prepare your development environment.

Install and Configure Maven

Overview

If you plan to contribute to the core code base or create Java-based rule add-ons, you must first configure Maven to build Windup from source.The procedure you follow depends on whether you plan to build Windup using an IDE or Maven Command line.

Download and Install Maven

If you plan to use Eclipse Luna (4.4) to build Windup, you can skip this step and go directly to the section entitled Configure Maven to Build Using Your IDE. This version of Eclipse embeds Maven 3.2.1 so you do not need to install it separately.

If you plan to run Maven using the command line or plan to use Red Hat JBoss Developer Studio 7.1.1 or an older version of Eclipse, you must install Maven 3.1.1. or later.

1. Go to Apache Maven Project - Download Maven and download the latest distribution for your operating system.
2. See the Maven documentation for information on how to download and install Apache Maven for your operating system.

Configure Maven to Build Using Your IDE

Follow this procedure if you plan to build Windup using an IDE.

JBoss Developer Studio 7.1.1 is built upon Eclipse Kepler (4.3), which embeds Maven 3.0.4. If you plan to use JBoss Developer Studio 7.1.1 or an Eclipse version earlier than Eclipse Luna (4.4), you must replace the embedded 3.0.4 version of Maven with this newer version.

1. From the menu, choose `Window` -→ `Preferences`.
2. Expand `Maven` and click on `Installations`.
3. Uncheck `Embedded (3.0.4/1.4.0.20130531-2315)`
4. Click `Add` and navigate to your Maven install directory. Select it and click `OK`.
5. Make sure the new external Maven installation is checked and click `OK` to return to JBoss Developer Studio.

Note: If you use another IDE, refer to the product documentation to update the Maven installation.

Configure Maven to Build Using Command Line

Follow this procedure to configure the Maven settings if you plan to build Windup using the command line.

Windup uses artifacts located in the JBoss Nexus repository. You must configure Maven to use this repository before you build Windup.

1. Open your `${user.home}/.m2/settings.xml` file for editing.
2. Copy the following `jboss-nexus-repository` profile XML prior to the ending `</profiles>` element.

   ```
   <profile>
     <id>jboss-nexus-repository</id>
     <repositories>
       <repository>
         <id>jboss-nexus-repository</id>
         <url>http://repository.jboss.org/nexus/content/groups/public/</url>
         <releases>
           <enabled>true</enabled>
         </releases>
         <snapshots>
           <enabled>true</enabled>
         </snapshots>
       </repository>
     </repositories>
     <pluginRepositories>
       <pluginRepository>
         <id>jboss-nexus-plugin-repository</id>
         <url>http://repository.jboss.org/nexus/content/groups/public/</url>
         <releases>
           <enabled>true</enabled>
         </releases>
         <snapshots>
           <enabled>true</enabled>
         </snapshots>
       </pluginRepository>
     </pluginRepositories>
   </profile>
   ```

3. Copy the following XML prior to the ending `</activeprofiles>` element to make the profile active.

   ```
   <activeProfile>jboss-nexus-repository</activeProfile>
   ```

You are now configured to build Windup.

Get the Windup Source Code

The source code for the Windup project is located in 2 repositories:

- Windup core code base: https://github.com/windup/windup
- Windup XML-based rulesets: https://github.com/windup/windup-rulesets
- Windup distribution: https://github.com/windup/windup-distribution

To contribute to the Windup project source code, you must fork the Windup, Windup ruleset, and Windup distribution repositories to your own Git, clone your forks, commit your work on topic branches, and make pull requests back to the corresponding repository.

Install the Git Client

If you don't have the Git client (`git`), get it from: http://git-scm.com/

- Be sure to generate an SSH key and add the public key to your GitHub account: https://help.github.com/articles/generating-ssh-keys. You can verify the key using the following command:

  ```
  ssh -T git@github.com
  ```

  You should see a message indicating your ID has successfully authenticated.

- You should also configure your name and email identity using the following commands:

  ```
  git config --global user_name "FIRST_NAME LAST_NAME"
  git config --global user_email "YOUR_EMAIL_ADDRESS"
  ```

Fork and Clone the Windup Repository

1. Fork the Windup project. This creates the `windup` project in your own Git with the default remote name 'origin'.

2. Clone your fork. This creates and populates a directory in your local file system.

   ```
   git clone https://github.com/<your-username>/windup.git
   ```

3. Change to the `windup` directory.
4. Add the remote `upstream` repository so you can fetch any changes to the original forked repository.

   ```
   git remote add upstream git@github.com:windup/windup.git
   ```

5. Get the latest files from the `upstream` repository.

   ```
   git fetch upstream
   ```

Fork and Clone the Windup Rulesets Repository

The Windup XML rulesets now live in a separate repository. Follow these instructions to fork and clone them.

1. Fork the Windup Rulesets project. This creates the `windup-rulesets` project in your own Git with the default remote name 'origin'.
2. Clone your fork. This creates and populates a directory in your local file system.

   ```
   git clone https://github.com/<your-username>/windup-rulesets.git
   ```

3. Change to the `windup-rulesets` directory.
4. Add the remote `upstream` repository so you can fetch any changes to the original forked repository.

   ```
   git remote add upstream git@github.com:windup/windup-rulesets.git
   ```

5. Get the latest files from the `upstream` repository.

   ```
   git fetch upstream
   ```

Fork and Clone the Windup Distribution Repository

1. Fork the Windup distribution project. This creates the `windup-distribution` project in your own Git with the default remote name 'origin'.
2. Clone your fork. This creates and populates a directory in your local file system.

   ```
   git clone https://github.com/<your-username>/windup-distribution.git
   ```

3. Change to the `windup-distribution` directory.
4. Add the remote `upstream` repository so you can fetch any changes to the original forked repository.

   ```
   git remote add upstream git@github.com:windup/windup-distribution.git
   ```

5. Get the latest files from the `upstream` repository.

   ```
   git fetch upstream
   ```

Build Windup from Source

Overview

This information is provided for new developers who plan to contribute code to the Windup open source project. It describes how to build Windup from source using an IDE or command line and to extract the Windup distribution that is created during the build process.

If you use Linux and are an experienced Windup developer looking for a quick refresher, jump to:Quick Build Review for Experienced Developers.

System Requirements

1. Java 1.7.

   You can choose from the following:

   ```
   OpenJDK
   Oracle Java SE
   ```

2. Maven 3.1.1 or newer

   If you have not yet installed or configured Maven, see Install and Configure Maven for details.

   If you have installed Maven, you can check the version by typing the following in a command prompt:

   ```
   mvn --version
   ```

3. IDE requirements

   If you prefer, you can work within an IDE. The following IDEs are recommended.

   - Red Hat JBoss Developer Studio 7.1.1 or newer
   - Eclipse 4.3 (Kepler) or newer

   You must also make sure the IDE embeds Maven 3.1.1 or later. See Install and Configure Maven for details.

Prerequisites

- Make sure you have configured Maven as described here: Install and Configure Maven.
- Windup source code is located in 3 GitHub projects. Follow the instructions to Get the Windup Source Code.

Build Using Red Hat JBoss Developer Studio or Eclipse

If you prefer, you can use an IDE to build Windup.

1. Make sure you have configured the Maven installation in your IDE as described here: Install and Configure Maven.
2. Start JBoss Developer Studio or Eclipse.
3. Import the `windup-ruleset` project.
   - From the menu, select `File` → `Import`.
   - In the selection list, choose `Maven` → `Existing Maven Projects`, then click Next.
   - Click `Browse` and navigate to the root of the `windup-ruleset` project directory, then click `OK`.
   - After all projects are listed, click `Next`. Ignore any Maven build or dependency errors and click `Finish`. If you get a dialog titled *Incomplete Maven Goal Execution*, ignore it and click `OK` to continue.
   - In the Project Explorer tab, right-click on the `windup-ruleset` project and choose `Run As` -→ `Maven install`.
4. Import the `windup` project.
   - From the menu, select `File` → `Import`.
   - In the selection list, choose `Maven` → `Existing Maven Projects`, then click Next.
   - Click `Browse` and navigate to the root of the `windup` project directory, then click `OK`.
   - After all projects are listed, click `Next`. Ignore any Maven build or dependency errors and click `Finish`. If you get a dialog titled *Incomplete Maven Goal Execution*, ignore it and click `OK` to continue.
   - In the Project Explorer tab, find the `windup_parent` project in the list, right-click, and choose `Run As` -→ `Maven install`.
5. Import the `windup-distribution` project.
   - From the menu, select `File` → `Import`.
   - In the selection list, choose `Maven` → `Existing Maven Projects`, then click Next.
   - Click `Browse` and navigate to the root of the `windup-distribution` project directory, then click `OK`.
   - After all projects are listed, click `Next`. Ignore any Maven build or dependency errors and click `Finish`. If you get a dialog titled *Incomplete Maven Goal Execution*, ignore it and click `OK` to continue.

- In the Project Explorer tab, right-click on the `windup-distribution` project and choose `Run As` -→ `Maven install`.

Build Using Maven Command Line

Windup source code consists of 3 projects:

- windup-ruleset
- windup
- windup-distribution

The `windup-distribution` project has dependencies on the other 2 projects, so you must build the `windup-ruleset` and `windup` projects first. Use the following steps to build the Windup distribution.

1. Build the windup-ruleset project.
   - Open a command terminal and navigate to the root of the Windup Ruleset project directory.

     ```
         cd windup-ruleset/
     ```

   - Build the project.

     ```
     mvn clean install
     ```

2. Build the windup project.
   - Open a command terminal and navigate to the root of the windup project directory.

     ```
         cd windup/
     ```

   - Build the project.

     ```
     mvn clean install
     ```

   - You can also build the project without the tests.

     ```
     mvn clean install -DskipTests
     ```

3. Build the windup-distribution project.
   - Open a command terminal and navigate to the root of the Windup distribution project directory.

     ```
         cd windup-distribution/
     ```

   - Build the project.

     ```
     mvn clean install
     ```

   - This creates a `windup-distribution-<VERSION>-offline.zip` file in the `windup-distribution/target/` directory.

Build Using Red Hat JBoss Developer Studio or Eclipse

If you prefer, you can use an IDE to build Windup.

1. Make sure you have configured the Maven installation in your IDE as described here:Install and Configure Maven.
2. Start JBoss Developer Studio or Eclipse.
3. Import the `windup-ruleset` project.
   - From the menu, select `File` → `Import`.
   - In the selection list, choose `Maven` → `Existing Maven Projects`, then click Next.
   - Click `Browse` and navigate to the root of the `windup-ruleset` project directory, then click `OK`.

   - After all projects are listed, click `Next`. Ignore any Maven build or dependency errors and click `Finish`. If you get a dialog titled *Incomplete Maven Goal Execution*, ignore it and click `OK` to continue.
   - In the Project Explorer tab, right-click on the `windup-ruleset` project and choose `Run As` -→ `Maven install`.
4. Import the `windup` project.
   - From the menu, select `File` → `Import`.
   - In the selection list, choose `Maven` → `Existing Maven Projects`, then click Next.
   - Click `Browse` and navigate to the root of the `windup` project directory, then click `OK`.
   - After all projects are listed, click `Next`. Ignore any Maven build or dependency errors and click `Finish`. If you get a dialog titled *Incomplete Maven Goal Execution*, ignore it and click `OK` to continue.
   - In the Project Explorer tab, find the `windup_parent` project in the list, right-click, and choose `Run As` -→ `Maven install`.
5. Import the `windup-distribution` project.
   - From the menu, select `File` → `Import`.
   - In the selection list, choose `Maven` → `Existing Maven Projects`, then click Next.
   - Click `Browse` and navigate to the root of the `windup-distribution` project directory, then click `OK`.
   - After all projects are listed, click `Next`. Ignore any Maven build or dependency errors and click `Finish`. If you get a dialog titled *Incomplete Maven Goal Execution*, ignore it and click `OK` to continue.
   - In the Project Explorer tab, right-click on the `windup-distribution` project and choose `Run As` -→ `Maven install`.

Extract the Distribution Source File

The build process creates a `windup-distribution-<VERSION>-offline.zip file` in the `windup-distribution/target/` directory.

Unzip the file into a directory of your choice.

Quick Build Review for Experienced Developers

```
git clone git@github.com:windup/windup-ruleset.git windup
cd windup-ruleset
mvn clean install
git clone git@github.com:windup/windup.git windup
cd windup
mvn clean install -DskipTests
git clone git@github.com:windup/windup-distribution.git windup
cd windup-distribution
mvn clean install
unzip target/windup-distribution-<VERSION-offline.zip -d <WINDUP-DIRECTORY>
```

Execute Windup (Built from Windup Source)

These instructions are for Windup core developers who plan to build Windup from source to test code updates.

- If you are new to the project and not familiar with the procedures to execute Windup, seeExecute Windup. It contains complete step-by-step instructions to execute Windup and also provides command line examples.
- Experienced users who need a refresher can follow the steps below.

  ```
  mkdir tmp
  cd tmp
  unzip -q ../dist/target/windup-*.zip
  cd windup-*
  rm -rf ~/.forge/addons/
  bin/windup.sh

  ## Execute
  $ windup-migrate-app --input /home/username/work/Migration/TestApps/_apps/BradApp --output Report --packages org com
  net

  ## Exit
  $ exit
  ```

```
## View the Report
firefox Report/index.html
```

Developer Contributing Information

Development Guidelines and Conventions

- Project Source Code Formatting
- Source Code Naming Conventions
- Maven Project Naming Conventions

Project Source Code Formatting

All project source code contributed to Windup should be formatted using the settings defined in the `Eclipse_Code_Format_Profile.xml` file located in the root directory of the Windup project.

Eclipse IDE

1. In Eclipse, choose Windows → Preferences.
2. Expand Java → Code Style → Formatter
3. Click Import
4. Browse to the `Eclipse_Code_Format_Profile.xml` located in the root of the Windup project directory, then click 'OK'.

Netbeans IDE

Use this file to format Windup source code:

http://plugins.netbeans.org/plugin/50877/eclipse-code-formatter-for-java

IntelliJ IDEA

Use this file to format Windup source code:

http://plugins.jetbrains.com/plugin/?id=6546

Source Code Naming Conventions

Class Interface and Implementation Names

- Do not name interfaces using the prefix 'I' for interface names. Instead, use a descriptive term for the interface, like `Module.java`.
- The implementation class name should begin with a descriptive name, followed by the interface name, for example, for example `JavaHandlerModule.java`

Standard Prefixes and Suffixes

- Append all RuleProvider class names with `RuleProvider`.
- Append all XML rule file names with `.windup.xml`
- Append all Model class names with `Model`.
- All test names should be prefixed with 'Test'.
- Property constants: TBD

Maven Project Naming Conventions

Maven Module Names

The following are not really accurate at this time. This is still TBD!

- Lowercase with dashes. Start with `windup-`.
- Ruleset add-ons start with `windup-rules-`.

Submit Code Updates to the Windup Project

To get the Windup Source Code, see Get the Source Code for instructions.

1. Open a command terminal and navigate to the root of the Windup project directory.
2. Create a new topic branch to contain your features, changes, or fixes using the `git checkout` command:

   ```
    git checkout -b  <topic-branch-name> upstream/master
   ```

   If you are fixing a JIRA, it is a good practice to use the number in the branch name. For example:

   ```
   git checkout -b WINDUP-225 upstream/master
   ```

3. Make changes or updates to the source files. Be sure to test the changes thoroughly!
4. When you are sure your updates are ready and working, use the `git add` command to add new or changed file contents to the staging area.

   ```
   git add <folder-name>/
   git add <file-name>
   ```

5. Use the `git status` command to view the status of the files in the directory and in the staging area and ensure that all modified files are properly staged:

   ```
   git status
   ```

6. Commit your changes to your local topic branch. For example:

   ```
   git commit -m 'WINDUP-225: Description of change...'
   ```

7. Push your local topic branch to your GitHub forked repository. This will create a branch on your GitHub fork repository with the same name as your local topic branch name.

   ```
   git push origin HEAD
   ```

   Note: The above command assumes your remote repository is named 'origin'. You can verify your forked remote repository name using the command `git remote -v`.
8. Browse to the newly created branch on your forked GitHub repository.

   ```
   https://github.com/<your-username>/windup/tree/<topic-branch-name>
   ```

9. Open a Pull Request. For details, see Using Pull Requests.
   - Give the pull request a clear title and description.
   - Review the modifications that are to be submitted in the pull to be sure it contains only the changes you expect.
10. The pull request will be reviewed and merged by a Windup project administrator.

Understand the Windup Architecture and Structure

Windup Architectural Components

The following open source software, tools, and APIs are used within Windup to analyze and provide migration information. If you plan to contribute source code to the core Windup project, you should be familiar with them.

Forge

Forge is an open source, extendable, rapid application development tool for creating Java EE applications using Maven. For more information about Forge 2, see: JBoss Forge.

Forge Furnace

Forge Furnace is a modular runtime container behind Forge that provides the ability to run Forge add-ons in an embedded application. For more information about Forge Furnace, see: Run Forge Embedded.

TinkerPop

TinkerPop is an open source graph computing framework. For more information, see:TinkerPop.

Titan

Titan is a scalable graph database optimized for storing and querying graphs. For more information, see:Titan Distributed Graph Database and Titan Beginner's Guide.

Frames

Frames represents graph data in the form of interrelated Java Objects or a collection of annotated Java Interfaces. For more information, see: TinkerPop Frames.

Gremlin

Gremlin is a graph traversal language that allows you to query, analyze, and manipulate property graphs that implement the Blueprints property graph data model. For more information, see: TinkerPop Gremlin Wiki.

Blueprints

Blueprints is an industry standard API used to access graph databases. For more information about Blueprints, see: TinkerPop Blueprints Wiki.

Pipes

Pipes is a dataflow framework used to process graph data. It for the transformation of data from input to output. For more information, see: Tinkerpop Pipes Wiki.

Rexster

Rexster is a graph server that exposes any Blueprints graph through HTTP/REST and a binary protocol called RexPro. Rexster makes extensive use of Blueprints, Pipes, and Gremlin. For more information, see: TinkerPop Rexster Wiki.

OCPsoft Rewrite

OCPsoft Rewrite is an open source routing and URL rewriting solution for Servlets, Java Web Frameworks, and Java EE. For more information about Ocpsoft Rewrite, see: OCPsoft Rewrite.

Frames Extensions

Windup has several Frames extensions to satisfy its needs.

Multiple Types in a Vertex

The upstream frames project only stores one type in the*type* property by default. Windup extends this default type resolver behavior to support multiple types. The values themselves are stored in a multi-valued Titan property on each Vertex.

Map Handler

To store a map in a single vertexes properties:

```
@TypeValue("MapModelMain")
public interface MapMainModel extends WindupVertexFrame
{
    @MapInProperties void setMap(Map<String, MapValueModel> map);
    @MapInProperties Map<String, MapValueModel> getMap();
}
```

Map

To store a map in as adjacent vertices.

```
@TypeValue("MapModelMain")
public interface MapMainModel extends WindupVertexFrame
{
    @MapInAdjacentProperties(label = "map") void setMap(Map<String, MapValueModel> map);
    @MapInAdjacentProperties(label = "map") Map<String, MapValueModel> getMap();
}
```

See the FrameMapHandlerTest.

List

`WindupVertexListModel` offers a generic model for lists of other models, which are stored as adjacent vertices.

Windup Core Project Structure

Windup source code consists of 3 projects:

- windup-ruleset
- windup core
- windup-distribution

The Windup core project contains the executable source code and consists of the following subprojects.

config/
: This project is for the engine that runs the rules and abstracts the graph operations.

decompiler/
: This subproject contains an API that wraps calls to the decompiler. Windup currently uses only one decompiler: *Procyon*

exec/
: This subproject contains the bootstrap code to run the Windup application.

ext/
: This subproject is for code extensions. It currently only contains the Groovy rules syntax. Eventually it will contain any code that is not related to the rules or the core code base.

graph/
: This subproject contains the datastore and Frames extensions.

logging/
: This is the logging subproject. This subproject may be removed, depending on the outcome of this JIRA:WINDUP-49.

reporting/
: This subproject contains code that does reporting.

rules/
: This subproject contains all the rules.

test-files/
: This subproject contains the demo applications that are used for test input.

tests/
: This subproject contains the integration test suite.

tinkerpop/
: This subproject contains a code fix for Titan NPE issues.

ui/
: This subproject contains experimental Forge UI code.

utils/
: This subproject contains all utility code.

Rules and Rulesets

Windup Processing Overview

Windup is a rule-based migration tool that allows you to write customized rules to analyze the APIs, technologies, and architectures used by the applications you plan to migrate. The Windup tool also executes its own core rules through all phases of the migration process.

The following is a high level conceptual overview of what happens within Windup when you execute the tool against your application or archive.

Run Windup Against Your Application

Wnen you run the `windup-migrate-app` command against your application, Windup executes its own core rules to process the following types of application input artifacts:

- Archive files such as EARs, WARs, JARs
- Java classes
- JSP files
- Manifest files
- XML files

Windup extracts files from archives, decompiles classes, and analyzes the application code. In this phase, it builds a data model and stores component data and relationships in a graph database, which can then be queried and updated as needed by the migration rules and for reporting purposes.

For more information about the phases of rule execution, seeRule Phases.

For more information about the graph database components, seeWindup Architectural Components.

Application Migration

The next step in the process is the execution of the migration rules. In this phase, the rules typically do not execute against the application input files. Instead, they execute against the graph database model. Windup rules are independent and decoupled and they communicate with each other using the graph database model. Rules query the graph database to obtain information needed to test the rule condition. They also update the data model with information based on the result of the rule execution. This allows rules to easily interact with other rules and enables the creation of very complex rules.

The Windup distribution contains a large number of migration rules, but in some cases, you may need to create additional custom rules for your specific implementation. Windup is architected to allow you to create Java-based rule addons or XML rules and add easily add them to Windup. Custom rule creation is covered in the *Windup Rules Development Guide*.

Generate Findings Based on the Rule Execution Results

The final step in the process is to pull data from the graph database model to generate of reports and optionally generate scripts. Again, Windup uses rules to generate the final output.

By default, Windup generates the following reports at the end of the application migration process. The reports are located in the `reports/` subdirectory of the output report path specified when you execute Windup:

- Application Report: This report provides a summary of the total estimated effort, orstory points, that are required for the migration. It also provides a detailed list of issues and suggested changes, broken down by archive or folder.
- RuleProvider report: This is a detailed listing of the rule providers that fired when running Windup and whether any errors occurred.
- Additional reports are generated that provide detailed line-by-line migration tips for individual files.

Windup can also generate scripts to automate migration processes based on the findings. For example, some configuration files are easily mapped and can be automatically generated as part of the migration process.

Rule Execution Lifecycle

Rule phases provide a way for rule authors to control the rule lifecycle by specifying the phase in which the rule should execute. Windup executes rules sequentially within rule phases, however, you can also provide more fine-grained control over the order of rule execution within a phase. A rule may specify that one or more rules must be executed before it this rule is run. All named rules will be fired in the order specified before executing the the current rule. A rule may also specify that one or more rules must be executed after it is run. In this case, all named rules will be fired in the order specified after executing the the current rule.

The rule phase and execution order is stored in the associated rule'sRuleMetadata.

For a detailed description of Windup rule phases and the order of their execution, see:Rule Phases

Set the Rule Execution Phase

You can set the phase in which the rule executes in one of the following ways.

- Add the `@RuleMetadata(phase = RulePhase)` annotation to the rule.
- Code the `setPhase(RulePhase)` method in the constructor of the rule.

Control the Execution Order Within the Rule Phase

You can also provide more fine-grained control over the order of rule execution within a phase. A rule may specify that one or more rules must be executed before it this rule is run. All named rules will be fired in the order specified before executing the the current rule. A rule may also specify that one or more rules must be executed after it is run. In this case, all named rules will be fired in the order specified after executing the the current rule.

This is done in one of the following ways.

- Add the `@RuleMetadata(after = PreviousRuleProvider, before = NextRuleProvider)` annotation to the rule.
- Use the `addExecuteAfter(NextRuleProvider)` or `addExecuteBefore(PreviousRuleProvider)` methods in the constructor, specifying the rules that should precede or follow this rule.

Code Example Using the Annotation Method

The following is an example of a rule that overrides the rule phase and sets the ordering using the`@RuleMetaData` annotation.

```
@RuleMetadata(id = "MyCustomRuleProvider",
            phase = DependentPhase.class,
            after = { MyFirstRuleProvider.class, MySecondRuleProvider.class },
            before = { MyFinalRuleProvider1.class })
public class MyCustomRuleProvider extends AbstractRuleProvider
{
```

Code Example Using the Constructor Method

The following example provides the same results using constructor methods.

```
public MyCustomRuleProvider extends AbstractRuleProvider
{
    super(MetadataBuilder.forProvider(MyCustomRuleProvider.class)
                .setPhase(DiscoveryPhase.class)
                .addExecuteAfter({ MyFirstRuleProvider.class, MySecondRuleProvider.class }),
                .addExecuteBefore({MyLastRuleProvider.class}));
}
```

Additional Information

For more information about what can be specified in the `@RuleMetadata` annotation, see the RuleMetadata JavaDoc.

For more information about RuleProvider constructor MetadataBuilder methods, see theMetadataBuilder JavaDoc.

For a graphical overview of rule processing, see this diagram.

Rule Phases

Rule phases provide a way for rule authors to control the rule lifecycle by specifying the phase in which the rule should execute. Windup executes rules sequentially within rule phases, however, the order of rule execution within a phase can be controlled by specifying other rules that should be run before or after the rule.

By default, rules run in the MigrationRulesPhase. However, a rule may require certain processing or actions to occur before it executes, such as the extraction of archives and scanning of java or XML files, so a rule can specify that it is run during another phase in the process.

The rule phases below are listed in the order in which they are executed by Windup. The exception is the last phase, which can occur during any phase of the execution lifecycle.

InitializationPhase

This is the first phase of Windup Execution. Initialization related tasks, such as copying configuration data to the graph, should occur during this phase.

DiscoveryPhase

This resource discovery phase immediately follows the InitializationPhase. During this phase, input files are identified by the name, extension, location, and fully qualified Java class names. Typically, any rule that only puts data into the graph is executed during this phase.

ArchiveExtractionPhase

This phase immediately follows the DiscoveryPhase. During this phase, input files such and EARs, WARs, JARs, and other zipped files are unzipped during this phase.

ArchiveMetadataExtractionPhase

This phase occurs immediately after ArchiveExtractionPhase. It calculates checksums for archives and determines whether the archive is an EAR, WAR, JAR, or some other type of compressed file.

ClassifyFileTypesPhase

This phase follows the ArchiveMetadataExtractionPhase. During this phase, files are scanned and metadata is created for them.For example, this phase may find all of the Java files in an application and mark them as Java, or it may find all of the bash scripts in an input and identify them appropriately.

DiscoverProjectStructurePhase

This phase, which follows ClassifyFileTypesPhase, identifies the project structure of the input application. This includes identification of project files, any subprojects, and the type of project, for example Maven or Ant.

DecompilationPhase

This phase follows the DiscoverProjectStructurePhase. This phase is responsible for identifying and decompiling classes included in the input application.

InitialAnalysisPhase

This phase follows the DecompilationPhase and is called to perform a basic analysis of file content. It extracts all method names from class files and extracts metadata, such as the XML namespace and root element, from XML files.

MigrationRulesPhase

This phase, which follows the InitialAnalysisPhase, is the default phase for all rules unless it is specifically overridden. During this phase, migration rules attach data to the graph associated with migration. This can include hints to migrators for manual migration, automated migration of schemas or source segments, blacklists to indicate vendor specific APIs.

PostMigrationRulesPhase

This phase occurs immediately after MigrationRulesPhase. This phase can be used to execute a rule that must follow all other migration rules. The primary use case at the moment involves unit tests.

PreReportGenerationPhase

This phase occurs after the PostMigrationRulesPhase and immediately before the ReportGenerationPhase. It can be used for initialization tasks that will be needed by all reports during that phase.

ReportGenerationPhase

During this phase, reporting visitors produce report data in the graph that is used later by the report rendering phase.

PostReportGenerationPhase

This phase occurs immediately after the main tasks of report generation. It can be used to generate reports that need data from all of the previously generated reports.

ReportRenderingPhase

This is the phase that renders the report.

PostReportRenderingPhase

This phase occurs immediately after reports have been rendered. It can be used to render any reports that need to execute last. One possible use is to render all the entire contents of the graph itself.

FinalizePhase

This phase is called to clean up resources and close streams. This phase occurs at the end of execution. Rules in this phase are responsible for any cleanup of resources and closing any streams that may have been opened.

PostFinalizePhase

This occurs immediately after the FinalizePhase. This is an ideal place to put Rules that would like to be the absolute last things to fire, for example reporting on the execution time of previous rules or reporting on all of the rules that have executed and which AbstractRuleProviders executed them.

DependentPhase

This phase can occur during any phase of the execution lifecycle. It’s exact placement is determine by the code within the rule.

Rule Story Points

What are Story Points?

Story points are an abstract metric commonly used in Scrum Agile software development methodology to estimate the level of effort needed to implement a feature or change. They are based on a modified Fibonacci sequence.

In a similar manner, Windup uses story points to express the level of effort needed to migrate particular application constructs, and in a sum, the application as a whole. It does not necessarily translate to man-hours, but the value should be consistent across tasks.

How Story Points are Estimated in Rules

Estimating story points for a rule can be tricky. The following are the general guidelines Windup uses when estimating the level of effort required for a rule.

Level of Effort	Story Points	Description
Lift and Shift	0	The code or file is standards-based and requires no effort.
Mapped	1- 2 per file	There is a standard mapping algorithm to port the code or file. The number of story points required is small, but is dependent on the number of files to port.

Level of Effort	Story Points	Description
Custom	5 - 20 per change or component	The number of story points required to modify and rewrite code depends on the complexity of the change, the number of unknown imports, the size of the files, and the number of components. The following are examples of how to estimate story points. • Port MyBatis to JPA: '20' story points per query. • Port a web page from one web framework to another depends on the complexity and the number of components involved in the migration. You could estimate '20' story points per component.

Difference Between XML-based and Java-based Rules

Summary

As mentioned before, Windup provides a core and a default set of rules to analyze and report on migration of application code. Windup also allows you to write your own custom rules. These rules can be written using either XML or Java. Rules written using XML are referred to as *XML-based* rules. Rules written using the Java API are referred to as *Java-based* rule add-ons. Both *XML-based* and *Java-based* rule add-ons can be used to inspect (classify) and report on Java source, XML, properties, archives, and other types of files,

Which one to choose?

XML-based rules provide a quick, simple way to create rules to analyze Java, XML, and properties files. If you simply need to highlight a specific section of Java code or XML file content and provide migration hints for it, creation of *XML-based* rules is the recommended approach. Creation of custom*XML-based* rules is covered in the *Windup Rules Development Guide*.

Java-based rule add-ons provide the ability to create very complex rules, manipulate the shared data model graph, and customize the resulting reports. If you need to test or perform complex conditions and operations or want to manipulate the shared data model graph, create custom reports, or extend the functionality in any other way beyond what the *XML-based* rules provide, you must create*Java-based* rules. Creation of custom *Java-based* rules is covered in the *Windup Core Development Guide*.

Pros and Cons of XML-based Rules

Pros:

- XML rules are fairly easy to write and require less code.
- XML rules are not compiled so you do not need to configure Maven to build from source.
- XML rules are simple to deploy. You simply drop the rule into the appropriate path and Windup automatically scans the new rule.

Cons:

- XML rules only support a simple subset of conditions and operations.
- XML rules do not provide for direct custom graph data manipulation.
- XML rules do not support the ability to create custom reports.

Pros and Cons - Java

Pros:

- Java rule add-ons allow you to write custom conditions and operations and provide a lot of flexibility.
- Java rule add-ons allow you to access and manipulate the shared data model graph and to customize reports.
- You can set breakpoints and test Java rule add-ons using a debugger.
- IDEs provide code completion for the Windup API.

Cons:

- You must configure Maven to compile Java rule add-ons.
- Java rule add-ons that are not included in the Windup core code base must be a full Forge add-on.
- Java rule add-ons require that you write Java code.
- Writing Java rule add-ons can be complex and require knowledge of Windup internals.

Examples

The following is an example of a rule written in XML that classifies Java code:

```xml
<?xml version="1.0"?>
<ruleset xmlns="http://windup.jboss.org/v1/xml" id="EjbRules">
    <rules>
        <rule id="EjbRules_2fmb">
            <when>
                <javaclass references="javax.persistence.Entity" as="default">
                    <location>TYPE</location>
                </javaclass>
            </when>
            <perform>
                <iteration>
                    <classification classification="JPA Entity" effort="0"/>
                </iteration>
            </perform>
        </rule>
    </rules>
</ruleset>
```

The following is an example of a rule written in Java that classifies Java code:

```java
/**
 * Scans for classes with EJB related annotations, and adds EJB related metadata for these.
 */
public class DiscoverEjbAnnotationsRuleProvider extends AbstractRuleProvider
{
    @Override
    public Configuration getConfiguration(GraphContext context) {
        return ConfigurationBuilder.begin()
        .addRule()
        .when(JavaClass.references("javax.ejb.{annotationType}").at(TypeReferenceLocation.ANNOTATION))
        .perform(new AbstractIterationOperation<JavaTypeReferenceModel>()
        {
            public void perform(GraphRewrite event, EvaluationContext context, JavaTypeReferenceModel payload)
            {
                extractEJBMetadata(event, payload);
            };
        })
        .where("annotationType").matches("Stateless|Stateful")
        .withId(ruleIDPrefix + "_StatelessAndStatefulRule")
        .addRule()
        .when(JavaClass.references("javax.ejb.MessageDriven").at(TypeReferenceLocation.ANNOTATION))
        .perform(new AbstractIterationOperation<JavaTypeReferenceModel>() {
            @Override
            public void perform(GraphRewrite event, EvaluationContext context, JavaTypeReferenceModel payload) {
                extractMessageDrivenMetadata(event, payload);
            }
        })
        .withId(ruleIDPrefix + "_MessageDrivenRule")
        .addRule()

.when(JavaClass.references("javax.persistence.Entity").at(TypeReferenceLocation.ANNOTATION).as(ENTITY_ANNOTATIONS)

.or(JavaClass.references("javax.persistence.Table").at(TypeReferenceLocation.ANNOTATION).as(TABLE_ANNOTATIONS_LIST)))
```

```
        .perform(Iteration.over(ENTITY_ANNOTATIONS).perform(new AbstractIterationOperation<JavaTypeReferenceModel>() {
            @Override public void perform(GraphRewrite event, EvaluationContext context, JavaTypeReferenceModel payload)
{
                extractEntityBeanMetadata(event, payload);
            }
        }).endIteration())
        .withId(ruleIDPrefix + "_EntityBeanRule");
    }
    ...
}
```

Quick Comparison Summary

Requirement	XML Rule	Java Rule Add-on
Easy to write?	Yes	Depends on the complexity of the rule
Requires that you configure Maven?	No	Yes
Requires that you compile the rule?	No	Yes
Simple deployment?	No	Yes
Supports custom reports?	No	Yes
Ability to create complex conditions and operations?	No	Yes
Ability to directly manipulate the graph data?	No	Yes

Create and Test Java Rule Add-ons

Java-based Rule Structure

RuleProvider

Windup rules are based on OCPsoft Rewrite, an open source routing and URL rewriting solution for Servlets, Java Web Frameworks, and Java EE. The **rewrite** framework allows you to create rule providers and rules in an easy to read format.

Windup rule add-ons can implement the RuleProvider interface or they can extend the AbstractRuleProvider class, the SingleRuleProvider class, or the IteratingRuleProvider class.

- If the rule should run in a phase other than the default MIGRATION_PHASE, you must implement the getPhase() method and specify in which Windup lifecycle phase the rule should be executed. For more information about rule phases, see Rule Execution Lifecycle.
- Rules are added in the getConfiguration(GraphContext context) method. This method is inherited from the OCPsoft Rewrite interface org.ocpsoft.rewrite.config.ConfigurationProvider. Rules are discussed in more detail below under Add Rule Code Structure
- If other rules must execute after or before the rules in this provider, you must provide the list of RuleProvider classes using the getExecuteBefore() or http://windup.github.io/windup/docs/javadoc/latest/org/jboss/windup/config/RuleProvider.html#getExecuteAfter%28%29getExecu methods.

The following is an example of a simple Java-based rule add-on.

```
public class ExampleRuleProvider extends AbstractRuleProvider
{
    @Override public RulePhase getPhase(){
        return RulePhase.DISCOVERY;
    }

    // @formatter:off
    @Override
    public Configuration getConfiguration(GraphContext context)
    {
        return ConfigurationBuilder.begin()
        .addRule()
        .when(
            // Some implementation of GraphCondition.
            Query.find(...)....
        )
       .perform(
            ...
       );
    }
    // @formatter:on
    // (@formatter:off/on prevents Eclipse from formatting the rules.)
}
```

Add Rule Code Structure

As mentioned above, individual rules are added to a ruleset in the getConfiguration(GraphContext context) method using the OCPsoft Rewrite ConfigurationBuilder class.

Like most rule-based frameworks, Windup rules consist of the following:

- Condition: This is the **when(condition)** that determines if the rule should execute.
- Operation: This defines what to **perform()** if the condition is met.
- Otherwise: The **when(condition)** is not met
- Operation: This defines what to **perform()** if the condition is not met.

Rules must define the condition, or *when*, and an operation, or *perform*. However, the otherwise and remainder are optional.

when()

```
.when(Query.fromType(XmlMetaFacetModel.class))
```

The `.when()` clause of a rule typically queries the graph using the Query API. Results of the query are put on variables stack (`Variables`), many times indirectly through the querying API.

The `.when()` clause can also subclass GraphCondition. The Query class extends GraphCondition and is a convenient way to create a condition. You can also use multiple conditions within one when() call using and().

Example:

```
.when(Query.fromType(XmlMetaFacetModel.class).and(Query...))
```

One last but important feature is the ability to use Gremlin queries. See the Gremlin Documentation reference manual for more information.

perform()

```
.perform(
   new AbstractIterationOperation<XmlMetaFacetModel>(XmlMetaFacetModel.class, "xml")
   {
      public void perform(GraphRewrite event, EvaluationContext context, XmlMetaFacetModel model)
      {
         // for each model, do something
      }
   }
)
```

The `.perform()` clause of the rule typically iterates over the items of interest, such as Java and XML files and querying services, processes them, and writes the findings into the graph.

For that, various operations are available, which are subclasses of GraphOperation. You can also implement your own operations.

There are several convenient implementations for constructs like iteration (`Iteration`).

Iteration

```
.perform(
    Iteration.over(XmlMetaFacetModel.class, "xmlModels").as("xml")
    .when(...)
    .perform(
        new AbstractIterationOperation<XmlMetaFacetModel>(XmlMetaFacetModel.class, "xml"){
            public void perform(GraphRewrite event, EvaluationContext context, XmlMetaFacetModel xmlFacetModel)
            {
            }
        })
    .otherwise(
        new AbstractIterationOperation<XmlMetaFacetModel>(XmlMetaFacetModel.class, "xml"){
            public void perform(GraphRewrite event, EvaluationContext context, XmlMetaFacetModel payload)
                { ... }
        })
    .endIteration()
```

Nested iterations

An iteration is also an operation, so anywhere an operation is expected, you can use the Iteration. If the Iteration is placed within the perform method of another Iteration, it is called nested iteration.

The following is an example of a nested iteration.

```
.addRule()
     .when(...)
     .perform(
     Iteration.over("list_variable").as("single_var")
       .perform(
         Iteration.over("single_var") //second iteration
           .perform(...).endIteration()
     )
     .endIteration()
);
```

otherwise

As previously mentioned, Windup rules are based on OCPsoft Rewrite. The `.otherwise()` clause allows you to perform something if the condition specified in `.when()` clause is not matched. For more information, see OCP Rewrite web.

The following is an example of an otherwise operation.

```
.otherwise(
   new AbstractIterationOperation<XmlMetaFacetModel>(XmlMetaFacetModel.class, "xml")
   {
      public void perform(GraphRewrite event, EvaluationContext context, XmlMetaFacetModel model)
      {
         // for each model, do something altenate
      }
   }
)
```

Where

The `where()` clause is used to provide information about used parameters within the rule. So for example if you have used a parameter in some condition like for example `JavaClass.references("{myMatch}")`, you may use the where clause to specify what the `myMatch` is like `.where("myMatch").matches("java.lang.String.toString\(.*\)")`.

The following is an example

```
.when(JavaClass.references("{myMatch}").at(TypeReferenceLocation.METHOD))
.perform(...)
.where("myMatch").matches("java.lang.String.toString\(.*\)")
```

+ Please note that within the where clause the regex is used in contrast to JavaClass.references() where a windup specific syntax is expected.

Metadata

Rules can specify metadata. Currently, the only appearing in some rules, and not actually used, is

`RuleMetadata.CATEGORY`.

```
.withMetadata(RuleMetadata.CATEGORY, "Basic")
```

`.withMetadata()` is basically putting key/value to a `Map<Object, Object>`.

Available utilities

For a list of what key services and constructs can be used in the rule, seeAvailable Rules Utilities.

Variable stack

The communication between the conditions and operations is done using the variable stack that is filled with the output of the condition/s and then given to the Iteration to be processed. Within conditions, you can specify the name of the result iterable that is saved in the stack using `as()` method, the iteration can specify the iterable to iterate over using the `over()` method and even specify the name of for each processed single model of the result being processed. Example:

```
.addRule()
     .when(Query...as("result_list"))
     .perform(
     Iteration.over("result_list").as("single_var")
          ...
     )
);
```

The varstack may be accesed even from the second condition in order to narrow the result of the previous one. After that the iteration may choose which result it wants to iterate over (it is even possible to have multiple iterations listed in the perform, each of which may access different result saved in the variable stack).

```
.addRule()
     .when(Query...as("result_list").and(Query.from("result_list")....as("second_result_list")))
     .perform(
     Iteration.over("second_result_list")
          ...
     )
);
```

Basic Rule Execution Flow Patterns

Single Operation - operation();

No condition or iteration is needed. The following is an example of a single operation.

```
return ConfigurationBuilder.begin()
    .addRule()
    .perform(new GraphOperation(){
        @Override
        public void perform(GraphRewrite event, EvaluationContext context){
            ...
        }
    });
```

Windup source code example: https://github.com/windup/windup/blob/master/rules-java/impl/src/main/java/org/jboss/windup/rules/apps/java/config/CopyJavaConfigToGraphRuleProvider.java#L99-L101

The `copyConfigToGraph` GraphOperation used in the perform() above is defined before the rule.

Single Conditional Operation - if(...){ operation()}

A single condition must be met. The following is an example of a single conditional operation.

```
return ConfigurationBuilder.begin()
    .addRule()
    .when( ... )
    .perform(new GraphOperation(){
        @Override
        public void perform(GraphRewrite event, EvaluationContext context){
            ...
        }
    });
```

Windup source code example:
https://github.com/windup/windup/blob/master/reporting/api/src/main/java/org/jboss/windup/reporting/rules/AttachApplicationRep
L41

Single Iteration - for(FooModel.class){ … }

For simple iterations, you can extend the `IteratingRuleProvider` class to simplify the `perform` code.

```
public class ComputeArchivesSHA512 extends IteratingRuleProvider<ArchiveModel>
{
    public ConditionBuilder when() {
        return Query.find(ArchiveModel.class);
    }

    // @formatter:off
    public void perform( GraphRewrite event, EvaluationContext context, ArchiveModel archive ){
        try( InputStream is = archive.asInputStream() ){
            String hash = DigestUtils.sha512Hex(is);
            archive.asVertex().setProperty(KEY_SHA512, hash);
        }
        catch( IOException e ){
            throw new WindupException("Failed to read archive: " + archive.getFilePath() +
                "\n    Due to: " + e.getMessage(), e);
        }
    }
    // @formatter:on

    @Override public String toStringPerform() { return this.getClass().getSimpleName(); }
}
```

Windup source code example: https://github.com/windup/windup/blob/master/rules-java/api/src/main/java/org/jboss/windup/rules/apps/java/scan/provider/DiscoverArchiveManifestFilesRuleProvider.java

Conditional Iteration - if(…){ for(…) }

```
return ConfigurationBuilder.begin()
    .addRule()
    .when(
        new GraphCondition(){ ... }
    ).perform(
        Iteration.over(ArchiveModel.class)
            .perform( ... )
    )
```

Windup source code example: https://github.com/windup/windup/blob/master/rules-java-ee/addon/src/main/java/org/jboss/windup/rules/apps/javaee/rules/DiscoverEjbAnnotationsRuleProvider.java#L82-L93

Iteration With a Condition - for(…){ if(…){ … } }

```
return ConfigurationBuilder.begin()
.addRule()
    .when(
        // Stores all ArchiveModel's into variables stack, under that type.
        Query.find(ArchiveModel.class)
    ).perform(
        Iteration.over(ArchiveModel.class) // Picks up ArchiveModel's from the varstack.
            .when(new AbstractIterationFilter<ArchiveModel>(){
                @Override
                public boolean evaluate(GraphRewrite event, EvaluationContext context, ArchiveModel payload)
                {
                    return payload.getProjectModel() == null;
                }
                @Override
                public String toString()
                {
                    return "ProjectModel == null";
                }
            })
            .perform( ... )
```

Windup source code example:
https://github.com/windup/windup/blob/master/reporting/impl/src/main/java/org/jboss/windup/reporting/rules/rendering/RenderRe

L66

Nested Iterations - for(...){ for(...) { ... } }

```
.addRule()
     .when(...)
     .perform(Iteration //first iteration
     .over("list_variable").as("single_var")
     .perform(
         Iteration.over("single_var") //second iteration
         .perform(...).endIteration()
     )
     .endIteration()
);
```

Windup source code example:
https://github.com/windup/windup/blob/master/config/tests/src/test/java/org/jboss/windup/config/iteration/payload/IterationPayLoa
L202

Create a Basic Java-based Rule Add-on

You can create a Windup rule using Java or XML. This topic describes how to create a rule add-on using Java.

Prerequisites

- You must Install Windup.
- Be sure you Install and Configure Maven.
- Before you begin, may want also want to be familiar with the following documentation:
  - Windup rules are based on the ocpsoft **rewrite** project. You can find more information about ocpsoft **rewrite** here: http://ocpsoft.org/rewrite/
  - The JavaDoc for the Windup API is located here: http://windup.github.io/windup/docs/javadoc/latest/

Working examples of Java-based rules can be found in the Windup quickstarts and Windup source code repositories.

Create the Maven Project

Create a new Maven Java Project. These instructions will refer to the project folder location with the **replaceable** variable 'RULE_PROJECT_HOME'. Modify the project `pom.xml` file as follows

1. Add the following properties. Be sure to replace `WINDUP_VERSION` with the current version of Windup, for example: `2.2.0.Final`.

   ```
   <properties>
       <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
       <maven.compiler.source>1.7</maven.compiler.source>
       <maven.compiler.target>1.7</maven.compiler.target>
       <version.windup>WINDUP_VERSION</version.windup>
   </properties>
   ```

2. Add a dependency management section for the Windup BOM.

   ```
   <dependencyManagement>
       <dependencies>
           <!-- BOM -->
           <dependency>
               <groupId>org.jboss.windup</groupId>
               <artifactId>windup-bom</artifactId>
               <version>${version.windup}</version>
               <type>pom</type>
                  <scope>import</scope>
            </dependency>
       </dependencies>
   </dependencyManagement>
   ```

3. Add a `<dependencies>` section to include Windup, rulesets, and test dependencies required by your rule add-on. Windup is a Forge/Furnace based application and has a modular design, so the dependencies will vary depending on the Windup APIs used by the rule.

   The following are examples of some dependencies you may need for your rule add-on.

```
<!-- API dependencies -->
<dependency>
    <groupId>org.jboss.windup.graph</groupId>
    <artifactId>windup-graph</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.jboss.windup.config</groupId>
    <artifactId>windup-config</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.jboss.windup.config</groupId>
    <artifactId>windup-config-xml</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.jboss.windup.config</groupId>
    <artifactId>windup-config-groovy</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.jboss.windup.utils</groupId>
    <artifactId>windup-utils</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.jboss.windup.reporting</groupId>
    <artifactId>windup-reporting</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>

<!-- Dependencies on other rulesets -->
<dependency>
    <groupId>org.jboss.windup.rules.apps</groupId>
    <artifactId>windup-rules-java</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.jboss.windup.rules.apps</groupId>
    <artifactId>windup-rules-java-ee</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.jboss.forge.furnace.container</groupId>
    <artifactId>cdi-api</artifactId>
    <scope>provided</scope>
</dependency>
<dependency>
    <groupId>org.jboss.forge.furnace.container</groupId>
    <artifactId>cdi</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>

<!-- Test dependencies -->
<dependency>
    <groupId>org.jboss.forge.furnace.test</groupId>
    <artifactId>furnace-test-harness</artifactId>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.jboss.forge.furnace.test</groupId>
    <artifactId>arquillian-furnace-classpath</artifactId>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <type>jar</type>
</dependency>

<dependency>
    <groupId>org.jboss.windup.exec</groupId>
    <artifactId>windup-exec</artifactId>
    <classifier>forge-addon</classifier>
    <scope>test</scope>
</dependency>
```

4. Add the `<plugins>` section to make it a Forge add-on.

   ```
   <build>
       <plugins>
           <!-- This plugin makes this artifact a Forge add-on. -->
           <plugin>
               <artifactId>maven-jar-plugin</artifactId>
               <executions>
                   <execution>
                       <id>create-forge-addon</id>
                       <phase>package</phase>
                       <goals>
                           <goal>jar</goal>
                       </goals>
                       <configuration>
                           <classifier>forge-addon</classifier>
                       </configuration>
                   </execution>
               </executions>
           </plugin>
       </plugins>
   <build>
   ```

Create the Java RuleProvider Class

1. Within your Maven project, create the Java RuleProvider class.
   - This class can extend AbstractRuleProvider or one of the following helper classes: SingleRuleProvider or IteratingRuleProvider.
   - If you prefer not to extend one of these classes, you can implement theRuleProvider interface.
   - It is recommended that you end the name of the class with `RuleProvider`. For example:

     ```
     public class MyCustomRuleProvider extends AbstractRuleProvider
     {
     }
     ```

2. Provide a constructor for your rule class.
   - In the constructor, you can create a new RuleProviderMetadata builder instance for thisn RuleProvider type, using the provided parameters and RulesetMetadata.
   - By default, rules run in the MigrationRulesPhase. If your rule should run earlier during the initial DiscoveryPhase, this can be overridden in the constructor using the `setPhase()` method.
   - Use the `addExecuteAfter()` or `addExecuteBefore()` method to control the order in which the rule is executed,

     ```
     public MyCustomRuleProvider()
     {
         super(MetadataBuilder.forProvider(MyCustomRuleProvider.class)
                     .setPhase(DiscoveryPhase.class)
                     .addExecuteBefore(MyOtherRuleProvider.class));
     }
     ```

     For more information about rule phases, see Rules Execution Lifecycles.

3. Finally, add rules to the rule provider. Rules are added in the `getConfiguration()` method using the `ConfigurationBuilder.begin().addRule()` code construct.
   - Java rules consist of *conditions* and *actions* and follow the familiar "if/then/else" construct:

     ```
     when(condition)
         perform(action)
     otherwise
         perform(action
     ```

     - Conditions are specified using `.when()`.
     - Actions are performed using `.perform()`.

- High-level Conditions and Operations

  The following is a specific high-level rule which uses high-level conditions (`JavaClass`) and operations (`Classification`). See the documentation of those conditions and operations for the details.

  ```
  @Override
  public Configuration getConfiguration(GraphContext context)
  {
      return ConfigurationBuilder.begin()
          .addRule()
          .when(JavaClass.references("weblogic.servlet.annotation.WLServlet").at(TypeReferenceLocation.ANNOTATION)
          )
          .perform(
              Classification.as("WebLogic @WLServlet")
                  .with(Link.to("Java EE 6 @WebServlet", "https://access.redhat.com/documentation/en-
  US/JBoss_Enterprise_Application_Platform/index.html"))
                  .withEffort(0)
                  .and(Hint.withText("Migrate to Java EE 6 @WebServlet.").withEffort(8))
          );
  }
  ```

  Working examples of Java-based rules can be found in theWindup quickstarts and Windup source code repositories.

- Low-level Conditions and Operations

  As you can see, the conditions and operations above are Java-specific. They come with the `Java Basic` ruleset. The list of existing rulesets will be part of the project documentation. Each ruleset will be accompanied with a documentation for its `Condition`s and `Operation`s (and also `Model`s).

  These high-level elements provided by rulesets may cover majority of cases, but not all. Then, you will need to dive into the mid-level Windup building elements.

- Mid-level Conditions and Operations

4. Create a `beans.xml` file in the project `META-INF/` directory, for example:

   ```
   PROJECT_DIRECTORY/src/main/resources/META-INF/beans.xml
   ```

   This file tells CDI to scan your add-on for CDI beans. The file can be empty, but it is a good practice to include the basic schema information.

   ```
   <!-- Marker file indicating CDI 1.0 should be enabled -->
   <beans xmlns="http://java.sun.com/xml/ns/javaee"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:schemaLocation="
         http://java.sun.com/xml/ns/javaee
         http://java.sun.com/xml/ns/javaee/beans_1_0.xsd">
   </beans>
   ```

Install the Java-based Rule Add-on

The easiest and fastest way to build the rule add-on, install it into the local Maven repository, and install it into Windup as a rule add-on is to use the Windup `addon-build-and-install` command.

- If you have not started Windup, follow the instructions toExecute Windup.
- At the Windup console prompt, enter the `addon-build-and-install` command:

  ```
  addon-build-and-install --projectRoot RULE_PROJECT_HOME
  ```

- You should see a result similar to the following.

  ```
  ***SUCCESS*** Addon MyCustomRuleProvider:::2.2.0.Final was installed successfully.
  ```

Test the Java-based Rule Add-on

Test the Java-based rule add-on against your application file by running the`windup-migrate-app` command in the Windup console prompt.

The command uses this syntax:

```
windup-migrate-app [--sourceMode true] --input INPUT_ARCHIVE_OR_FOLDER --output OUTPUT_REPORT_DIRECTORY --packages
PACKAGE_1 PACKAGE_2 PACKAGE_N
```

You should see the following result:

```
***SUCCESS*** Windup report created: QUICKSTART_HOME/windup-reports-java/index.html
```

For more information and examples of how to run Windup, see:Execute Windup

Review the Output Report

1. Open OUTPUT_REPORT_DIRECTORY /index.html file in a browser.
2. You are presented with an Overview page containing the application profiles.
3. Click on the application link to review the detail page. Check to be sure the warning messages, links, and story points match what you expect to see.

Create and Test XML Rules

Create a Basic XML Rule

You can create a Windup rule using Java, XML, or Groovy. This topic describes how to create a rule using XML.

Prerequisites

- You should have already installed Windup.
- Before you begin, you may also want to be familiar with the following documentation:
  - Windup rules are based on the ocpsoft **rewrite** project. You can find more information about ocpsoft **rewrite** here: http://ocpsoft.org/rewrite/
  - The JavaDoc for the Windup API is located here:http://windup.github.io/windup/docs/javadoc/latest/
  - The XML rule schema is located here:https://github.com/windup/windup/blob/master/config-xml/rule-schema.xsd.

File Naming Convention for XML Rules

You must name the file containing an XML rule with the `.windup.xml` extension. Windup identifies files with this extension as XML-base rules, so be sure to use this naming convention, otherwise the rule will not be evaluated!

Basic XML Rule Template

XML rules consist of *conditions* and *actions* and follow the familiar "if/then/else" construct:

```
when(condition)
    perform(action)
otherwise
    perform(action)
```

The following is the basic syntax for XML rules.

```
<?xml version="1.0"?>
<ruleset xmlns="http://windup.jboss.org/v1/xml" id="XmlFileMappings">
    <phase>
        <!-- The phase in which to run the rules -->
    </phase>
    <rules>
        <rule>
            <when>
                <!-- Test a condition... -->
            </when>
            <perform>
                <!-- Perform this action when condition is satisfied -->
            </perform>
            <otherwise>
                <!-- Perform this action when condition is not satisfied -->
            </otherwise>
        </rule>
      <rules>
    </ruleset>
```

Create the Rule When Condition

The syntax is dependent on whether you are creating a rule to evaluate Java class, an XML file, a project, or file content and is described in more detail here: XML Rule - When Condition Syntax

Create the Rule Perform Action

Operations allowed in the `perform` section of the rule include the classification of application resources, in-line hints for migration steps, links to migration information, and project lineitem reporting. The syntax is described in detail here: XML Rule - Perform Action Syntax.

Test multiple XML rulesets with .xsd schema

To test all the xml rules with the .xsd schema, follow this steps

- Download https://github.com/amouat/xsd-validator and unzip it into your selected folder (referred to as $XSD_VAL)
- prepare ruleset directory as $RULESET_DIRECTORY and assume the xsd file is placed in $XSD_SCHEMA path
- run the command

  ```
  find $RULESET_DIRECTORY -type f -iname "*windup.xml" -exec $XSD_VAL./xsdv.sh $XSD_SCHEMA {} \;
  ```

XML Rule - When Condition Syntax

Conditions allowed in the `when` portion of a rule must extendGraphOperation and currently include evaluation of Java classes, XML files, projects, and file content. Because XML rules are modeled after the Java-based rule add-ons, links to JavaDocs for the related Java classes are provided for a better understanding of how they behave.

The complete XML rule schema is located here:https://github.com/windup/windup/blob/master/config-xml/rule-schema.xsd.

The following sections describe the more common XML `when` rule conditions.

- javaclass Syntax
- xmlfile Syntax
- project Syntax
- filecontent Syntax

javaclass Syntax

Summary

Use the `javaclass` element to find imports, methods, variable declarations, annotations, class implementations, and other items related to Java classes. For a better understanding of the `javaclass` condition, see the JavaDoc for the JavaClass class.

The following is an example of a rule that tests for a `javaclass`.

```
<rule>
    <when>
        <javaclass references="org.jboss.ws.api.annotation.WebContext" in="org/jboss/{*}" as="webcontextclasses">
            <location>IMPORT</location>
            <location>TYPE</location>
        </javaclass>
    </when>
    <perform>
        <hint message="WebContext is deprecated." effort="0"/>
    </perform>
</rule>
```

Construct a javaclass Element

javaclass Element Attributes

references="CLASS_NAME"

The package or class name to match on. Wildcard characters can be used.

Example:

```
references="org.apache.commons.{*}"
```

as="VARIABLE_NAME"

A variable name assigned to the rule so that it can be used as a reference in later processing. See the `from` attribute below.

Example:

```
as="MyEjbRule"
```

in="PATH_FILTER"

Used to filter input files matching this regex (regular expression) naming pattern. Wildcard characters can be used.

Example:

```
in="{*}File1"
```

from="VARIABLE_NAME"

Begin the search query with the filtered result from a previous search identified by its `as` VARIABLE_NAME.

Example:

```
from="MyEjbRule"
```

JavaClass Element Child Elements

location

The location where the reference was found in a Java class. Location can refer to annotations, field and variable declarations, imports, and methods. For the complete list of valid values, see the JavaDoc for TypeReferenceLocation.

Example:

```
<location>IMPORT</location>
```

xmlfile Syntax

Summary

Use the `xmlfile` element to find information in XML files. For a better understanding of the `xmlfile` condition, see the XmlFile JavaDoc.

The following is an example of a rule that tests for an `xmlfile`.

```
<rule>
    <when>
        <xmlfile matches="/w:web-app/w:resource-ref/w:res-auth[text() = 'Container']">
            <namespace prefix="w" uri="http://java.sun.com/xml/ns/javaee"/>
        </xmlfile>
    </when>
    <perform>
        <hint title="Title for Hint from XML">
            <message>Container Auth</message>
        </hint>
        <xslt description="Example XSLT Conversion" extension="-converted-example.xml"
              template="/exampleconversion.xsl"/>
    </perform>
</rule>
```

Construct an xmlfile Element

xmlfile Element: Attributes

matches="XPATH"

Match on an XML file condition.

Example:

```
matches="/w:web-app/w:resource-ref/w:res-auth[text() = 'Container']"
```

xpathResultMatch="XPATH_RESULT_STRING"

Return results that match the given regex.

Example:

```
xpathResultMatch=""
```

as="VARIABLE_NAME"

A variable name assigned to the rule so that it can be used as a reference in later processing. See the `from` attribute below.

Example:

```
as="MyEjbRule"
```

in="PATH_FILTER"

Used to filter input files matching this regex (regular expression) naming pattern. Wildcard characters can be used.

Example:

```
in="{*}File1"
```

from="VARIABLE_NAME"

Begin the search query with the filtered result from a previous search identified by its `as` VARIABLE_NAME.

Example:

```
from="MyEjbRule"
```

public-id="PUBLIC_ID"

The DTD public-id regex.

Example:

```
public-id="public"
```

xmlfile Element: Child Elements

namespace

The namespace to referenced in XML files. This element contains 2 attributes: The `prefix` and the `uri`.

Example:

```
<namespace prefix="abc" uri="http://maven.apache.org/POM/4.0.0"/>
```

project Syntax

Summary

Use the `project` element to query for the project charateristics. For a better understanding of the `project` condition, see the JavaDoc for the Project class.

The following is an example of a rule that checks a rule is dependent on the junit in the version between 2.0.0.Final and 2.2.0.Final.

```
<rule>
    <when>
        <project>
            <artifact groupId="junit" artifactId="junit" from="2.0.0.Final" to="2.2.0.Final"/>
        </project>
    </when>
    <perform>
        <lineitem message="The project uses junit with the version between 2.0.0.Final and 2.2.0.Final"/>
    </perform>
</rule>
```

Construct a project Element

project Element Attributes

The `project` element is used to match against the project as a whole. You can use this condition to query for dependencies of the project. It does not have any attributes itself.

project Element Child Elements

artifact

Subcondition used within `project` to query against project dependencies. This element contains the following attributes:

- groupId="PROJECT_GROUP_ID"

  Match on the project `<groupId>` of the dependency
- artifactId="PROJECT_ARTIFACT_ID" Match on the project `<artifactId>` of the dependency
- fromVersion="FROM_VERSION"

  Specify the lower version bound of the artifact. For example `2.0.0.Final`
- toVersion="TO_VERSION"

  Specify the upper version bound of the artifact. For example `2.2.0.Final`

filecontent Syntax

Use the `filecontent` element to find strings or text within files, for example, a line in a Properties file. For a better understanding of the `filecontent` condition, see the JavaDoc for the FileContent class.

XML Rule - Perform Action Syntax

Operations available in the `perform` section of the rule include the classification of application resources, in-line hints for migration steps, links to migration information, and project lineitem reporting. Because XML rules are modeled after the Java-based rule add-ons, links to JavaDocs for the related Java classes are provided for a better understanding of how they behave.

The complete XML rule schema is located here:https://github.com/windup/windup/blob/master/config-xml/rule-schema.xsd.

The following sections describe the more common XML rule perform actions.

- Classification Syntax
- Link Syntax
- Hint Syntax
- XSLT Syntax
- Lineitem Syntax
- Iteration Syntax

Classification Syntax

Summary

The `classification` element is used to identify or classify application resources. It provides a level of effort and can also provide links to additional information about how to migrate this resource classification. For a better understanding of the `classification` action, see the JavaDoc for the Classification class.

The following is an example of a rule that classifies a resource as a WebLogic EAR application deployment descriptor file.

Example:

```
<rule id="XmlWebLogicRules_10vvyf">
    <when>
        <xmlfile as="default" matches="/*[local-name()='weblogic-application']"></xmlfile>
    </when>
    <perform>
        <iteration>
            <classification classification="Weblogic EAR Application Descriptor" effort="3"/>
        </iteration>
    </perform>
</rule>
```

`classification` Element: Attributes

classification="STRING"

Classify the resource as the specified string.

Example:

```
classification="JBoss Seam Components"
```

effort="NUMBER"

The level of effort assigned to this resource.

Example:

```
effort="2"
```

`classification` Element: Child Elements

xref

Provides a link URI and text description for additional information.

Example:

```
<classification classification="Websphere Startup Service" effort="4">
   <link href="http://docs.oracle.com/javaee/6/api/javax/ejb/Singleton.html" description="EJB3.1 Singleton Bean"/>
   <link href="http://docs.oracle.com/javaee/6/api/javax/ejb/Startup.html" description="EJB3.1 Startup Bean"/>
</classification>
```

Link Syntax

Summary

The `link` element is used in classifications or hints to identify or classify links to informational content. For a better understanding of the `link` action, see the JavaDoc for the Link class.

The following is an example of a rule that creates links to additional information.

Example:

```
<rule id="SeamToCDIRules_2fmb">
    <when>
        <javaclass references="org.jboss.seam.{*}" as="default"/>
    </when>
    <perform>
        <iteration>
```

```
            <classification classification="SEAM Component" effort="1">
                <link href="http://www.seamframework.org/Seam3/Seam2ToSeam3MigrationNotes" description="Seam 2 to Seam 3 
Migration Notes"/>
                <link href="http://docs.jboss.org/weld/reference/latest/en-US/html/example.html" description="JSF Web 
Application Example"/>
                <link href="http://docs.jboss.org/weld/reference/latest/en-US/html/contexts.html" description="JBoss 
Context Documentation"/>
                <link href="http://www.andygibson.net/blog/tutorial/cdi-conversations-part-2/" description="CDI 
Conversations Blog Post"/>
            </classification>
        </iteration>
    </perform>
</rule>
```

`link` Element: Attributes

href="URI"

The URI for the referenced link/.

Example:

```
href="https://access.redhat.com/articles/1249423"
```

description="URI_DESCRIPTION"

A description for the link.

Example:

```
description="Migrate WebLogic Proprietary Servlet Annotations"
```

Hint Syntax

Summary

The `hint` element is used to provide a hint or inline information about how to migrate a section of code. For a better understanding of the `hint` action, see the JavaDoc for the Hint class.

The following is an example of a rule that creates a hint.

Example:

```
<rule id="WebLogicWebServiceRules_8jyqn">
    <when>
        <javaclass references="weblogic.wsee.connection.transport.http.HttpTransportInfo.setUsername({*})" as="default">
            <location>METHOD</location>
        </javaclass>
    </when>
    <perform>
        <iteration>
            <hint message="Replace proprietary web-service authentication with JAX-WS standards." effort="0">
                <link href="http://java-x.blogspot.com/2009/03/invoking-web-services-through-proxy.html" 
description="JAX-WS Proxy Password Example"/>
            </hint>
        </iteration>
    </perform>
</rule>
```

`hint` Element: Attributes

message="MESSAGE"

A message describing the migration hint

Example:

```
message="See this KnowledgeBase article on the Customer Portal: <some-url>"
```

effort="NUMBER"

The level of effort assigned to this resource.

Example:

```
effort="2"
```

`hint` Element: Child Elements

xref

Identify or classify links to informational content. See the section onLink Syntax for details.

Example:

```
link href="http://java-x.blogspot.com/2009/03/invoking-web-services-through-proxy.html" description="JAX-WS Proxy
Password Example"/>
```

XSLT Syntax

Summary

The `xslt` element specifies how to transform an XML file. For a better understanding of the `xslt` action, see the JavaDoc for the XSLTTransformation class.

The following is an example of rule that defines an XSLT action.

Example:

```
<rule id="XmlWebLogicRules_6bcvk">
    <when>
        <xmlfile as="default" matches="/weblogic-ejb-jar"/>
    </when>
    <perform>
        <iteration>
            <classification classification="Weblogic EJB XML" effort="3"/>
            <xslt description="JBoss EJB Descriptor (Windup-Generated)" template="transformations/xslt/weblogic-ejb-to-
jboss.xsl" extension="-jboss.xml"/>
        </iteration>
    </perform>
</rule>
```

`xslt` Element: Attributes

of="STRING"

Create a new transformation for the given reference.

Example:

```
of="testVariable_instance"
```

description="String"

Sets the description of this XSLTTransformation.

Example:

```
description="XSLT Transformed Output"
```

extension="String"

Sets the extension for this XSLTTransformation.

Example:

```
extension="-result.html"
```

template=String

Sets the XSL template.

Example:

```
template="simpleXSLT.xsl"
```

`xslt` Element: Child Elements

xslt-parameter=Map<String,String>

Specify XSLTTransformation parameters as property value pairs

Example:

```
<xslt-parameter property="title" value="EJB Transformation"/>
```

Lineitem Syntax

Summary

The `lineitem` element is used to provide line item information about a hint on the project or application overview page. For a better understanding of the `lineitem` action, see the JavaDoc for the Lineitem class.

The following is an example of a rule that creates a lineitem message.

Example:

```
<rule>
    <when>
        <javaclass references="weblogic.servlet.annotation.WLServlet" as="default">
            <location>ANNOTATION</location>
        </javaclass>
    </when>
    <perform>
        <hint message="Replace the proprietary WebLogic @WLServlet annotation with the Java EE 6 standard @WebServlet
annotation." effort="1">
            <link href="https://access.redhat.com/articles/1249423" description="Migrate WebLogic Proprietary Servlet
Annotations" />
            <lineitem message="Proprietary WebLogic @WLServlet annotation found in file."/>
        </hint>
    </perform>
</rule>
```

`lineitem` Element: Attributes

message="MESSAGE"

A lineitem message

Example:

```
message="Proprietary code found."
```

Iteration Syntax

Summary

The `iteration` element specifies to iterate over an implicit or explicit variable defined within the rule. For a better understanding of the `iteration` action, see the JavaDoc for the Iteration class.

The following is an example of a rule that preforms an iteration.

Example:

```
<rule id="XmlWebLogicRules_14wscy">
    <when>
        <xmlfile as="1" matches="/wl:weblogic-webservices | /wl9:weblogic-webservices">
            <namespace prefix="wl9" uri="http://www.bea.com/ns/weblogic/90"/>
            <namespace prefix="wl" uri="http://www.bea.com/ns/weblogic/weblogic-webservices"/>
        </xmlfile>
        <xmlfile as="2" matches="//wl:webservice-type | //wl9:webservice-type" from="1">
            <namespace prefix="wl9" uri="http://www.bea.com/ns/weblogic/90"/>
            <namespace prefix="wl" uri="http://www.bea.com/ns/weblogic/weblogic-webservices"/>
        </xmlfile>
    </when>
    <perform>
        <iteration over="1">
            <classification classification="Weblogic Webservice Descriptor" effort="0"/>
        </iteration>
        <iteration over="2">
            <hint message="Webservice Type" effort="0"/>
        </iteration>
    </perform>
</rule>
```

`iteration` Element: Attributes

over="VARIABLE_NAME"

Iterate over the condition identified by this VARIABLE_NAME.

Example:

```
over="2"
```

`iteration` Element: Child Elements

iteration child elements include a `when` condition, along with the actions `iteration`, `classification`, `hint`, `xslt`, `lineitem`, and `otherwise`.

Test an XML Rule in Windup

Add the Rule to Windup

A Windup rule is installed simply by copying the rule to the appropriate Windup folder. Windup scans for rules, which are files that end with either `*.windup.groovy` or `.windup.xml`, in the following locations:

- In the directory specified on the `windup-migrate-app` using the `--userRulesDirectory` argument.
- In the WINDUP_HOME/rules/ directory.

  WINDUP_HOME is the directory where you install and run the Windup executable.
- In the `${user.home}/.windup/rules/` directory.

  The `${user.home}/.windup` is a directory created by Windup at first run and contains rules, add-ons, and the Windup log.

  ```
  For Linux or Mac:   ~/.windup/rules/
  For Windows: "\Documents and Settings\USER_NAME\.windup\rules\"  -or-  "\Users\USER_NAME\.windup\rules\"
  ```

Test the XML Rule

1. If you have not started Windup, follow the instructions toExecute Windup.
2. Test the XML rule against your application file by running the`windup-migrate-app` command in the Windup console prompt.

   The command uses this syntax:

   ```
   windup-migrate-app [--sourceMode true] --input INPUT_ARCHIVE_OR_FOLDER --output OUTPUT_REPORT_DIRECTORY --packages
   PACKAGE_1 PACKAGE_2 PACKAGE_N
   ```

   You should see the following result:

   ```
   ***SUCCESS*** Windup report created: OUTPUT_REPORT_DIRECTORY/index.html
   ```

Additional Resources

- For more information and examples of how to run Windup, see:Execute Windup
- Working examples of XML-based rules can be found on GitHub in theWindup source code GitHub repository and the Windup quickstarts GitHub repository or latest release ZIP download.

Core Developer topics

Windup Bootstrap Process

DRAFT

This section describes how Windup starts up, finds the resources, loads the rules, and executes them.

Boot

1. `@Inject WindupProcessor`

   ```
   CDI instantiates `WindupProcessorImpl`
   ```

2. Create `WindupProcessorConfig`
3. WindupProcessorImpl.execute(WindupProcessorConfig)

   ```
   WindupProcessorImpl instantiates `@Inject GraphContext graphContext`, which holds
   graph-related objects.
   ```

4. `GraphContextFactoryImpl`:

   ```
   `create()`
   `@Produces GraphContext produceGraphContext()`
   ```

GraphContext

RuleSubset

Frames creation

In the `GraphContextImpl` constructor. For additonal method Handlers, see

```
final Module addModules = new Module()
{
    @Override
    public Graph configure(Graph baseGraph, FramedGraphConfiguration config)
    {
        config.setFrameClassLoaderResolver(fclr);
        // Java Handlers
        config.addMethodHandler(new FrameMapHandler());
        config.addMethodHandler(new MapInPropertiesHandler());
        config.addMethodHandler(new MapInAdjacentPropertiesHandler());
        return baseGraph;
     }
};
```

Classloading Notes

DRAFT

Page contains temporary notes, to be edited.

This covers the specific situations when the Windup core developer needs to look up certain runtime classes. Does not relate to rules authoring.

Forge add-ons transitive dependencies

Let A depend on B depend on C. Depending on scope of C in B's POM:

```
<scope>provided</scope>
```

`provided` will NOT export C, so A depending on B won't see C's classes. Only `compile` scope is exported. `compile` will export C, so A depending on B will also see C's classes.

- `provided` == import
- `compile` == import & export

- `optional` == optional, not installed automatically
- `runtime` == export only

Finding classes

```
AddonRegistry.getServices(MyServiceInterface.class)

// Use the FurnaceHolder class to access the AddonRegistry
FurnaceHolder.getFurnace().getAddonRegistry().getServices(MyServiceInterface.class);
```

or

```
@Inject Imported<MyServiceInterface.class) imported;
```

Instantiating

If you want something from the current add-on, you can simply @Inject the type you wish to use. Alternately you can @Inject an Imported<T> instance, or also @Inject the AddonRegistry itself.

Which ClassLoader is used? Always the one of the current code?

Depends, if you are in a Furnace Service, then yes, it will use the current code's add-on ClassLoader.

Reading annotations from classes

Since classes can be proxied by Forge/Furnace, it's safer to read annotations using `Annotations API`:

```
Rules annotation = Annotations.getAnnotation(this.getClass(), Rules.class);
```

Supposedly, Furnace proxies should also be able to handle such call:

```
Rules annotation1 = ((FurnaceProxy) proxy).getOriginalClass().getAnnotation(Rules.class);
```

TO_DO: Find out how exactly this is done.

How do I know if I am in a Furnace service?

Every furnace service is wrapped in a proxy. If it came from another add-on (not your current add-on) and was not instantiated with new Blah(), you are in a furnace service. So if it was `@Inject`ed or retrieved via `addonRegistry.getServices(…)`

```
(16:32:40) jsightler: ozizka: I do like a Resource.open(...) type API -- that sounds like a good idea.
(16:32:57) LincolnBaxter: ozizka: unless you use the TCCL (which you shouldn't in a modular environment), then using the
class's own classloader is the best solution for that situation
(16:33:41) LincolnBaxter: ozizka: using a shared Resource.open() APi will actually be sort of a no-op, and just introduce
another layer, since you generally need to be able to specify a classloader anyway
(16:33:53) jsightler: lincolnthree: Well...
(16:34:09) LincolnBaxter: ozizka: unless I'm misunderstanding the point of this
(16:34:10) jsightler: lincolnthree: In windup we frequently need resources from the caller's add-on
(16:34:18) LincolnBaxter: ozizka: ah wait
(16:34:27) LincolnBaxter: ozizka: the *caller*'s classloader
(16:34:35) LincolnBaxter: ozizka: not the CL of the current operation
(16:34:44) LincolnBaxter: ozizka: that's different. hmm
(16:35:11) ozizka-FN: Right
(16:35:18) ozizka-FN: Actually that's what I wanted to ask -
(16:35:21) jsightler: We deal with this in an ad-hoc way at the moment... it might be nice to have a centralized service
that does it.
(16:35:25) ozizka-FN: which classloader is used?
(16:35:33) ozizka-FN: Always the one of the current code?
(16:35:44) ozizka-FN: Implicitly
(16:35:54) LincolnBaxter: ozizka: depends, if you are in a Furnace Service, then yes, it will use the current code's add-
on's classloader
(16:36:00) ozizka-FN: Ah
(16:36:11) ozizka-FN: How do I know if I am in a Furnace service?
(16:36:14) LincolnBaxter: ozizka: because every furnace service is wrapped in a proxy
(16:36:31) LincolnBaxter: ozizka: basically if it came from another add-on (not your current add-on), you are in a
furnace service
(16:36:43) LincolnBaxter: ozizka: and if you didn't instantiate with new Blah()
(16:37:00) LincolnBaxter: ozizka: so if it was @Injected or retrieved via addonRegistry.getServices(...)
(16:37:43) LincolnBaxter: jsightler: ozizka: mbriskar: why do we need the classloader of the calling add-on? just curious
(16:37:54) ozizka-FN: So here we would use TCCL right?
LincolnBaxter lincolnthree
```

```
(16:38:28) ozizka-FN: lincolnthree:  To load it's resources
(16:38:31) ozizka-FN: from other add-on
(16:38:32) ozizka-FN: .
(16:38:35) ozizka-FN: Or is there other way?
(16:38:42) LincolnBaxter: ozizka: that's a vague statement ;)
(16:38:48) LincolnBaxter: ozizka: where is *here*?
(16:38:56) LincolnBaxter: ozizka: the best way is to pass the actual classloader you want to use
(16:39:01) ozizka-FN: For this use case. For the Resource.open()
LincolnBaxter lincolnthree
(16:39:21) ozizka-FN: lincolnthree, right, but well, putting classloading code into rules...
(16:39:25) ozizka-FN: Not user friendly
```

Resources loading

```
(16:48:30) ozizka-FN: lincolnthree:  Just a note - the potential collisions caused  by add-on's CL span is not considered
as a risk?
(16:49:25) ozizka-FN: I mean, it could load the file from it's deps.
(16:49:36) ozizka-FN: * file = resource
(16:49:50) LincolnBaxter: ozizka1: so the way it works is actually very controlled
(16:50:06) LincolnBaxter: ozizka1: classloader will always attempt to load its own resources before loading from another
add-on
(16:50:23) LincolnBaxter: ozizka1: at which point the order is determined by the order of the add-on dependency in the
POM

(16:53:26) ozizka-FN: Q: Unwrapping proxies caused the code in invoke() not actually being called?
(16:53:32) ozizka-FN: Since the method calls were not intercepted?
(16:54:09) LincolnBaxter: ozizka1: exactly :)

(16:54:10) ozizka-FN: lincolnthree, Is that impl a real TCCL or just TCCL-like concept?
(16:54:29) LincolnBaxter: ozizka1: what do you mean "real" ?
(16:54:51) ozizka-FN: Not sure about how TCCL is implemented, I thought you'd need to call something like
(16:54:52) ozizka-FN: Thread.currentThread().setContextClassLoader(classLoader);
(16:54:56) LincolnBaxter: ozizka1: also if you are interested in where the resource loading / ordering is controlled ->
https://github.com/forge/furnace/blob/master/container/src/main/java/org/jboss/forge/furnace/impl/modules/AddonModuleLoad
er.java#L194
(16:55:01) jsightler: lincolnthree: I wondered that too :)
(16:55:30) LincolnBaxter: ozizka1: jsightler, actually it does:
https://github.com/forge/furnace/blob/master/proxy/src/main/java/org/jboss/forge/furnace/proxy/ClassLoaderInterceptor.jav
a#L103
(16:55:55) LincolnBaxter: ozizka1: jsightler: https://github.com/forge/furnace/blob/master/container-
api/src/main/java/org/jboss/forge/furnace/util/ClassLoaders.java#L27

(16:56:57) ozizka-FN: Hm, ok so I guess if we dug deeper, it would eventually come to
Thread.currentThread().setContextClassLoader(classLoader); ?
(16:57:15) LincolnBaxter: ozizka1: yep: https://github.com/forge/furnace/blob/master/container-
api/src/main/java/org/jboss/forge/furnace/util/SecurityActions.java#L71
```

Furnace Proxies:

https://github.com/forge/furnace/blob/master/proxy/src/main/java/org/jboss/forge/furnace/proxy/Proxies.java#L15

What classloader is used by Freemarker to load resources?

`org.jboss.windup.reporting.freemarker.FurnaceFreeMarkerTemplateLoader`

Connect to the Graph via Rexster

There is a specific add-on for running Rexster along your graph with groupId**org.jboss.windup.rexster** and **artifactId** Rexster.

Running Rexster Within Your Test

Deploy the Rexster add-on by adding the Rexster add-on to the dependencies.

```
@Deployment
    @Dependencies({
                ....
                @AddonDependency(name = "org.jboss.windup.rexster:windup-rexster", version = "2.3.0-SNAPSHOT"),
                ....
    })
```

Then put some debug breakpoint in the specific phase of graph you are interested in and browsehttp://localhost:8182/ to enjoy the graph! Username and password: rexster

Run Rexster within Windup

Make sure the Rexster add-on is deployed in Furnace and is accessible onhttp://localhost:8182/.

```
username: rexster
password: rexster
```

Decompiling

The **Decompiler** API

DRAFT : Needs work!

Windup provides a decompiler API to process the following application artifacts.

- Directories
- JARS or Archives
- Class files
- The `DecompilerConfig` should also contain `Filter<String>` (or maybe `Filter<TypeReference>`) to decide whether to decompile the class or not.
- `windup.ProcyonConfiguration` should extend abstract windup.DecompilerConfig<T>, which would contain the configurables common to all decompilers. In case of Procyon, `outputDir` would be delegated to `procyon.DecompilerSettings`.

Procyon

Windup includes the Procyon decompiler as the default decompiler, but other decompilers can be swapped in if preferred.

Config

- `windup.ProcyonConfiguration` contains `procyon.DecompilerSettings`.
- `procyon.DecompilerSettings` contains `outputDir` (the others are not much important). TO_DO: Make that a parameter to method call?

TypeReference

TO_DO: Check how we get info about Java files; perhaps cache the `TypeReference` results - if worth it?

ITypeLoader

- `JarTypeLoader` - iterates a `JarFile`, expects a .jar `File` as input.
- `ClasspathTypeLoader` - loads classes from a list of classes.
- `ClasspathTypeLoader("some/path:other/path")`
- `ClasspathTypeLoader()` → sysprop("java.class.path") : sysprop("sun.boot.class.path")
- `InputTypeLoader`
- `CompoundTypeLoader` - 2 typeloaders, queried in succession

TO_DO: Create a simple `FileSystemTypeLoader`.

Dependencies (Forge add-ons)

DRAFT

Based on this discussion.

Maven Add-on Structure

The following is the typical structure of Maven `add-on` modules.

```
my-add-on-parent
+--- my-add-on - jar, classifier: forge-addon
+--- my-add-on-api - jar
+--- my-add-on-impl - jar
+--- my-add-on-tests - jar
```

The `add-on` POM file can declare dependencies on other forge-addons. To prevent exporting the add-on to dependent modules, use `<optional>true</optional>`.

```
<dependency>
    <groupId>org.jboss.forge.furnace.container</groupId>
    <artifactId>cdi</artifactId>
    <classifier>forge-addon</classifier>
    <optional>true</optional>
</dependency>
```

The `add-on` POM files may also declare a dependency on typical Maven artifacts. To prevent exporting the add-on to dependent modules, use `<optional>true</optional>`.

```
<dependency>
    <groupId>com.thinkaurelius.titan</groupId>
    <artifactId>titan-lucene</artifactId>
    <version>${version.titangraph.lucene}</version>
</dependency>
```

One more question regarding dependencies. Is it advisable to depend on the `forge-addon` artifact from add-on's subparts?

Add-ons should reference the `<classifier>forge-addon</classifier>` artifact from other add-ons.

Add-on sub-parts

Add-on sub-parts declare dependency preferably on forge add-on APIs, not on the add-ons themselves, wherever possible (wherever an add-on has an explicit API). These dependencies must be marked as `provided` scope.

```
<dependency>
    <groupId>org.jboss.forge.furnace.container</groupId>
    <artifactId>cdi-api</artifactId>
    <classifier>forge-addon</classifier>
    <scope>provided</scope>
</dependency>
```

They may instead depend on the primary add-on dependency, e.g. `forge-addon`. The latter makes the POM files simpler, but can be confusing, because the add-on dependency still needs to be declared in the depending add-on's POM.

```
<dependency>
    <groupId>org.jboss.forge.furnace.container</groupId>
    <artifactId>cdi-api</artifactId>
</dependency>
```

Declaring a `forge-addon` depencendy anywhere else than the `forge-addon` pom doesn't actually cause Furnace to establish an add-on dependency. I.e. classes from the dep won't be available unless you declare it in the `forge-addon's pom.

Add-on's sub-parts may also declare dependencies on other normal maven dependencies, and these are treated as normal.

NOTE Add-on depends on API , scope `compile` > Add-on depends on Impl , scope `compile` with `<optional>true</optional>` - prevents exporting this dependency to consumers of the add-on.

Test dependencies

For test dependencies on add-ons: Any add-on/sub-part requiring an add-on for testing purposes should use `<scope>test</scope>`.

```
<dependency>
    <groupId>org.jboss.windup.graph</groupId>
    <artifactId>windup-graph</artifactId>
    <version>${project.version}</version>
    <classifier>forge-addon</classifier>
    <scope>test</scope>
</dependency>
```

Dependencies between sub-parts within the same add-on

Subpart may declare dependency on other subpart. E.g. `impl` typically depends on `api`. In that case, the scope should be set appropriately for the given situation - typically `provided` or `compile` scope.

```
<dependency>
    <groupId>org.jboss.windup.graph</groupId>
    <artifactId>windup-graph-api</artifactId>
    <scope>compile</scope>
</dependency>
```

Internal API Features

Find the RuleProvider that provided a Rule

A `Rule` implements `Context`, which stores metadata. The following example gets the RuleProvider from the Rule context.

```
RuleProvider ruleProvider =
     (RuleProvider) context.get(RuleMetadata.RULE_PROVIDER);
```

For more information about the metadata stored in the context, seeRule Metadata

In-memory Frames

```
GraphService<FooModel> fooModelService = context.getService(FooModel.class);
FooModel inMemoryModel = fooModelService.create();
```

Performance measurement

```
ExecutionStatistics.get().begin("Process-01");
// ... your code to be timed goes here
ExecutionStatistics.get().end("Process-01");
```

The results goes to `stats/detailed_stats.csv`.

Logging

DRAFT

This section describes how to use logging from the Java-based rules in Windup.

Textual logging

Windup uses `java.util.logging`. The following is a convenient way to get access to the logger.

```
private static final Logger LOG = Logging.get(MyClass.class);
```

Displaying Progress

IterationProgress

```
return ConfigurationBuilder.begin().addRule()
            .when(Query.find(ArchiveModel.class))
            .perform(UnzipArchiveToOutputFolder.unzip()
            .and(IterationProgress.monitoring("Unzipped archive: ", 1))
            .and(Commit.every(1))
            );
```

Variables Stack

DRAFT

The `Variables` class stores the variables which are available in rules, EL expressions, and FreeMarker and XSLT templates.

Accessing variables

From a Java-based rule

TO_DO: Describe how to access variables from a Java-based rule.

From a Groovy-based rule

TO_DO: Describe how to access variables from a Groovy-based rule.

From an EL expression

TO_DO: Describe how to access variables from an EL expression.

From a FreeMarker

TO_DO: Describe how to access variables from a FreeMarker.

From XSLT template

TO_DO: Describe how to access variables from an XSLT template.

Accessing variables as a flat `Map`

TO_DO: Describe how to access variables from a Map.

Git Rebasing

This section describes a few ways you can pull in the code to rebase to the latest code base.

Approach Suggested on GitHub

This is the approach suggested on GitHub.

1. Checkout the source:

   ```
   git checkout -b lincolnthree-WINDUP-133 master
   git pull https://github.com/lincolnthree/windup.git WINDUP-133
   ```

2. Run the tests to make sure it builds.

   ```
   mvn clean install
   ```

3. If they pass, merge and push them to your repository.

   ```
   git checkout master
   git merge --no-ff lincolnthree-WINDUP-133
   git push origin master
   ```

Script Provided by the Windup Development Team

Ondra Zizka wrote the following script to bring down a series of pull requests into a single branch. It then pushes that branch to upstream master-ignore.

1. Bring down the pulls into a single branch.

   ```
   pull() {
     cmd="git fetch upstream master "
     for PR in "$@"
     do
       cmd="$cmd pull/$PR/head:pullRequest$PR"
     done

     $cmd

     git branch -D pulls
     git checkout master
     git rebase upstream/master
     git checkout -b pulls

     for PR in "$@"
       do
       git checkout pullRequest$PR
       git rebase pulls
       git checkout pulls
       git merge pullRequest$PR
       git branch -D pullRequest$PR
     done
   }
   ```

2. Fetch using the one pull request.

   ```
   git fetch upstream master pull/$PR/head:pullRequest$PR
   ```

3. The branch is now updated with the latest source.

Rules topics

Available Rule Utilities

Programmatically Access the Graph

Note: Needs update. This is out of date!

(Lower Level API, to cover cases not provided by high level API)

This topic describes how to to programmatically access or update graph data when you create a Java-based rule add-on.

Query the graph

There are several ways - including Query API, Gremlin support, or GraphService methods.

Query the Graph Within the .when() method

Building a rule contains the method when(), which is used to create a**condition**. Vertices that fulfill the condition, are passed to the perform() method.

For the queries in the when() method, class Query is used. There are several methods which you can use to specify the condition. For example: * **find()** specifies the Model type of the vertex ***as()** method specifies the name of the final list, that is passed to the perform() method * **from(String name)** starts the query not on the all vertices, but only on the vertices already stored in the the given **name** (used to begin query on the result of the other one) ***withProperty()** specify the property value of the given vertex

The following are examples of simple queries.

Return a list of archives

```
Query.find(ArchiveModel.class)
```

```
Query.find(ApplicationReportModel.class).as(VAR_APPLICATION_REPORTS)
```

Iteration

```
ConfigurationBuilder.begin().addRule()
    .when(
        GraphSearchConditionBuilderGremlin.create("javaFiles", new ArrayList())
        .V().framedType( JavaFileModel.class ).has("analyze")
    )
    .perform(
        // For all java files...
        Iteration.over("javaFiles").var("javaFile").perform(
```

Nested Iteration

```
code,java
// For all java files...
Iteration.over("javaFiles").var("javaFile").perform(
    // A nested rule.
    RuleSubset.evaluate(
        ConfigurationBuilder.begin().addRule()
        .when(...)
        .perform(
            Iteration.over("regexes").var(RegexModel.class, "regex").perform(
                new AbstractIterationOperator<RegexModel>( RegexModel.class, "regex" ) {
                    public void perform( GraphRewrite event, EvaluationContext context, RegexModel regex ) {
                        //...
                    }
```

```
                }
            )
            .endIteration()
        )// perform()
    )
)
```

Modify Graph Data

For more custom operations dealing with Graph data that are not covered by the `Query` mechanism, use the GraphService.

```
GraphService<FooModel> fooService = new GraphService<FooModel>(graph,FooModel.class);

List<FooModel> = fooService.findAll();
FooModel = fooService.create();

// etc ...
```

GraphService<> can also be used to query the graph for models of the specified type:

```
FooModel foo = new GraphService<>(graphContext, FooModel.class).getUnique();
```

```
FooModel foo = new GraphService<>(graphContext, FooModel.class).getUniqueByProperty("size", 1);
```

Concepts & Philosophy

TO_DO: - OZIZKA: Can this topic be marked obsolete and be replaced by this one:Windup Processing Overview ?_

Windup is a rule-based tool that allows users to write customized rules based on the needs, constructs, and custom APIs used in their applications.

Individual rules should be decoupled, only expressing what rules should precede and follow, and "communicate" through the graph. Each rule will query the graph database, use the results for locating the candidates of it's interests, process them, and then write the results to the graph database.

Graph database and Models (Frames)

As a graph db implementation, we use TinkerPop backed by Titan backed by BerkeleyDB. For explanation of graph database concepts, see Titan.

Like there's ORM (like JPA) for JDBC, TinkerPop's BluePrints hasFrames. This allows you to access the graph data in form of your custom Java models (implemented as Java Proxies to the querying).

We use this concept heavily. Each ruleset will likely have it's own models. (But you can opt to use Blueprints API if you like).

See also the list ofWindup Models.

Examples of breaking non-trivial workflows into rules

1. Finding all `@Entity`s which use `org.hibernate` extensions.

   TO_DO

2. Finding *MyBatis* DAOs and classes using them.

   TO_DO

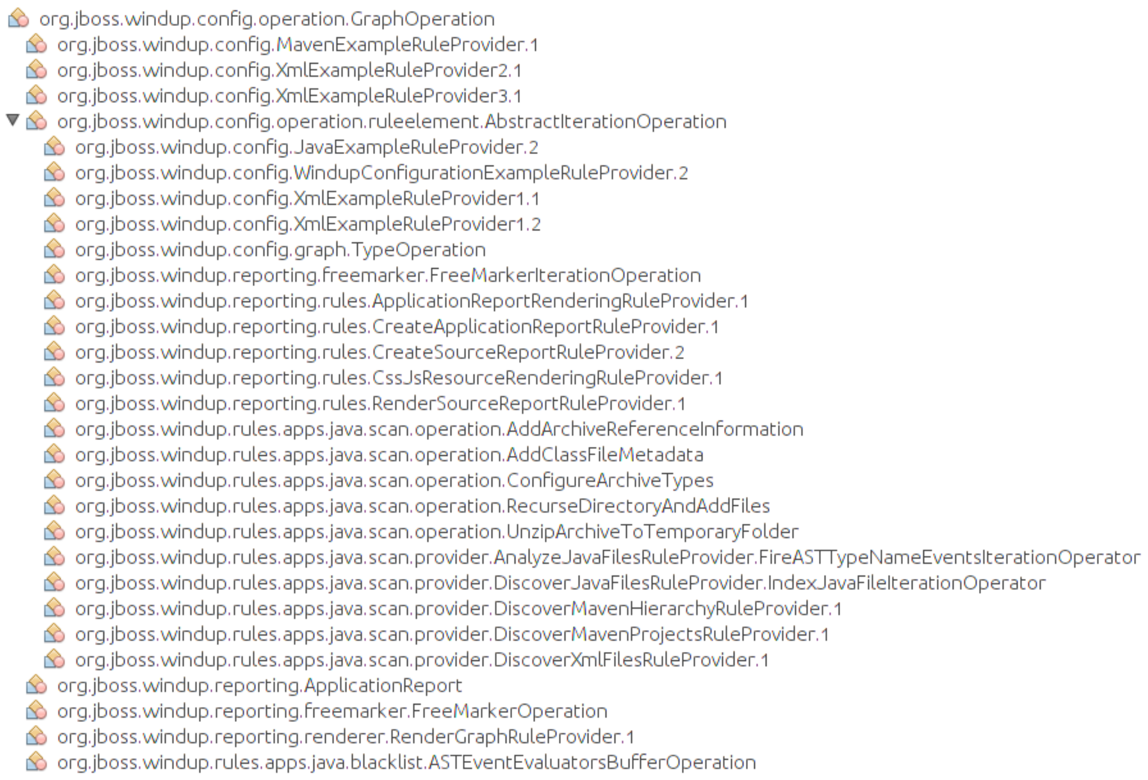
Creating Rule Operations

An operation is a task which can be invoked from within a rule.

It is created by extending GraphOperation.

```
public class FooOperation extends GraphOperation
{
    @Override
    public void perform(GraphRewrite event, EvaluationContext context)
    {
        ...
    }
}
```

Existing operations:



```
org.jboss.windup.config.operation.GraphOperation
  org.jboss.windup.config.MavenExampleRuleProvider.1
  org.jboss.windup.config.XmlExampleRuleProvider2.1
  org.jboss.windup.config.XmlExampleRuleProvider3.1
  org.jboss.windup.config.operation.ruleelement.AbstractIterationOperation
    org.jboss.windup.config.JavaExampleRuleProvider.2
    org.jboss.windup.config.WindupConfigurationExampleRuleProvider.2
    org.jboss.windup.config.XmlExampleRuleProvider1.1
    org.jboss.windup.config.XmlExampleRuleProvider1.2
    org.jboss.windup.config.graph.TypeOperation
    org.jboss.windup.reporting.freemarker.FreeMarkerIterationOperation
    org.jboss.windup.reporting.rules.ApplicationReportRenderingRuleProvider.1
    org.jboss.windup.reporting.rules.CreateApplicationReportRuleProvider.1
    org.jboss.windup.reporting.rules.CreateSourceReportRuleProvider.2
    org.jboss.windup.reporting.rules.CssJsResourceRenderingRuleProvider.1
    org.jboss.windup.reporting.rules.RenderSourceReportRuleProvider.1
    org.jboss.windup.rules.apps.java.scan.operation.AddArchiveReferenceInformation
    org.jboss.windup.rules.apps.java.scan.operation.AddClassFileMetadata
    org.jboss.windup.rules.apps.java.scan.operation.ConfigureArchiveTypes
    org.jboss.windup.rules.apps.java.scan.operation.RecurseDirectoryAndAddFiles
    org.jboss.windup.rules.apps.java.scan.operation.UnzipArchiveToTemporaryFolder
    org.jboss.windup.rules.apps.java.scan.provider.AnalyzeJavaFilesRuleProvider.FireASTTypeNameEventsIterationOperator
    org.jboss.windup.rules.apps.java.scan.provider.DiscoverJavaFilesRuleProvider.IndexJavaFileIterationOperator
    org.jboss.windup.rules.apps.java.scan.provider.DiscoverMavenHierarchyRuleProvider.1
    org.jboss.windup.rules.apps.java.scan.provider.DiscoverMavenProjectsRuleProvider.1
    org.jboss.windup.rules.apps.java.scan.provider.DiscoverXmlFilesRuleProvider.1
  org.jboss.windup.reporting.ApplicationReport
  org.jboss.windup.reporting.freemarker.FreeMarkerOperation
  org.jboss.windup.reporting.renderer.RenderGraphRuleProvider.1
  org.jboss.windup.rules.apps.java.blacklist.ASTEventEvaluatorsBufferOperation
```

Rulesets

DRAFT

Example page for design decisions. Could be generated automatically in the future.

What is a Ruleset?

A ruleset is a Windup "plug-in" targeting a specific area of migration, for example, migration from Spring to Java EE 6 . Under the hood, it is a set of rules, and everything they might need: Operations and Conditions, Report templates (if needed), and static files (e.g. images, XML or CSV files, etc.). A ruleset may also declare metadata, like ruleset ID, dependencies on other rulesets, etc.

xref:Ruleset-Java-Basic-Ruleset Forge add-on (i.e. a `.jar` file).

Groovy-based ruleset is a directory with `.windup.groovy` script(s) and its static files, possibly in a `.zip` file.

See ? to read about how to create your own Ruleset.

Basic tags

- app - denotes the rules which help migrating applications.
- server - denotes the rules which help migrating server configuration.
- java - denotes the rules treating Java source code.
- java-ee - denotes the rules treating Java EE applications or Java EE containers.

Besides that, you may use any custom tag.

Rulesets

Core rulesets

Rulesets distributed with Windup and maintained by the development team.

- Java Basic Ruleset
- Tags: java, app
- Java EE Applications
- java-ee, app
- Java EE Servers
- java-ee, server
- Reporting
  - CreateApplicationReportIndexRuleProvider
  - CreateJavaApplicationOverviewReportRuleProvider
  - RenderSourceReportRuleProvider

Community rulesets

Rulesets contributed by Windup users.

Java Basic Ruleset

DRAFT
This is an example page. Content serves for design decision.

Purpose of this ruleset.

Metadata

ID: myRuleset **Graph prefix:** myRuleset

Rule providers

A definition list (dl/dt/dd) of RuleProviders of given Ruleset.

- **JDKconfigRuleProvider** - Targeted towards the classes distributed with JDK, like `java.lang.*`, `java.security.*`, `org.xml.*`, etc.
- **FooRuleProvider** - blah
- **BarRuleProvider** - blah
- **Maven Project analysis**
- **Seam 2.0 to CDI**

Models

- JavaClassModel
- AmbiguousJavaClassModel
- AmbiguousReferenceModel<REFERENCETYPE>
- ClassificationModel
- EjbBeanBaseModel
- EjbEntityBeanModel
- EjbMessageDrivenModel
- EjbSessionBeanModel
- HibernateConfigurationFileModel
- HibernateEntityModel
- HibernateMappingFileModel
- HibernateSessionFactoryModel

- InlineHintModel
- JarArchiveModel
- JarManifestModel
- JavaClassFileModel
- JavaClassModel
- JavaMethodModel
- JavaParameterModel
- JavaSourceFileModel
- JavaTypeReferenceModel
- LinkModel
- MavenProjectModel
- PackageModel
- ProjectDependencyModel
- ProjectModel
- PropertiesModel
- SourceFileModel
- SpringBeanModel
- SpringConfigurationFileModel
- WarArchiveModel
- WebXmlModel

Configuration

- **--packages** - Which packages to scan.

Reports

Ruleset Java Classifications and Inline Hints

DRAFT

Some of the most important rules are**classifications** and **inline hints**.

Classifications

Classifications are important because they tell developers very quickly***what*** the resource is, so that they can quickly identify resources of importance. For example, say you are responsible for migrating an application from Weblogic to JBoss… wouldn't it be nice to know that project is a Spring project? Wouldn't it be nice to have the Weblogic descriptors identified and called out to us? This is what classifiers do. They identify resources, and add a classification to the resource.

Classifications are displayed both at the 10,000 foot view, main report and also at the resource report level.

- Java Classifications TO_DO: link
- XML Classifications TO_DO: link

Inline Hints

Windup takes the approach of profiling resources and providing syntactically highlighted resource reports. The resource report will show the resource with potentially highlighted lines that may contain inline hints to help the developers migrate a piece of code.

Adding inline hints for Java and XML are as simple as adding Regular Expressions or XPath Expressions to the Windup rules.

Ruleset Java EE Apps

DRAFT

TBD?

Ruleset Java EE Servers

DRAFT

TBD ?

Ruleset Reporting

DRAFT

TBD?

XML Ruleset

DRAFT

- XPathMatch
- XsltTransformation

A core ruleset to provide support for XML files.

Metadata

ID: xml **Graph prefix:** xml

Rule providers

A definition list (dl/dt/dd) of RuleProviders of given Ruleset with brief descriptions.

TO_DO: Not sure if all the `Xml*` really belong here - maybe rather to Java or Java EE?

- **DiscoverXmlFilesRuleProvider** -
- **XmlBaseConfig** -
- **XmlGlassfishConfig** -
- **XmlJbossConfig** -
- **XmlJbossEsbConfig** -
- **XmlJonasConfig** -
- **XmlJppConfig** -
- **XmlJrunConfig** -
- **XmlKnowHowConfig** -
- **XmlOrionConfig** -
- **XmlPersistanceConfig** -
- **XmlResinConfig** -
- **XmlSoa5Config** -
- **XmlSonicEsbConfig** -
- **XmlSpringConfig** -
- **XmlWeblogicConfig** -
- **XmlWebserviceConfig** -
- **XmlWebsphereConfig** -

Models

_Subclasses of `WindupVertexFrame`.

- DoctypeMetaModel
- XmlFileModel

- XmlTypeReferenceModel
- XsltTransformationModel

Configuration

_Subclasses of `TO_DO`

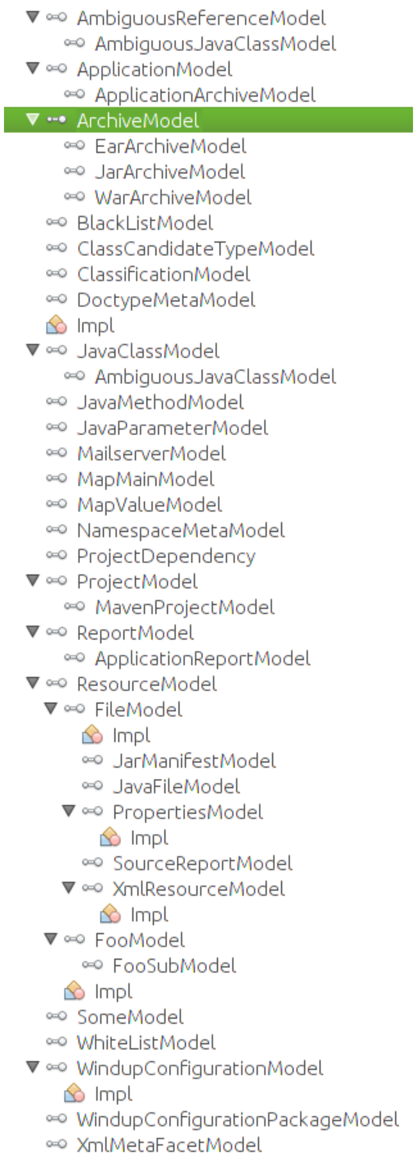
Reports

Report files or report parts created by this ruleset.

Windup Models

Windup models are the classes extending WindupVertexFrame. They are used to model the data in the graph database to Java objects.

This is an overview of the most important models. The complete and up-to-date list of models is located in theWindup JavaDoc.



```
AmbiguousReferenceModel
  AmbiguousJavaClassModel
ApplicationModel
  ApplicationArchiveModel
ArchiveModel
  EarArchiveModel
  JarArchiveModel
  WarArchiveModel
BlackListModel
ClassCandidateTypeModel
ClassificationModel
DoctypeMetaModel
Impl
JavaClassModel
  AmbiguousJavaClassModel
JavaMethodModel
JavaParameterModel
MailserverModel
MapMainModel
MapValueModel
NamespaceMetaModel
ProjectDependency
ProjectModel
  MavenProjectModel
ReportModel
  ApplicationReportModel
ResourceModel
  FileModel
    Impl
    JarManifestModel
    JavaFileModel
    PropertiesModel
      Impl
    SourceReportModel
    XmlResourceModel
      Impl
  FooModel
    FooSubModel
  Impl
SomeModel
WhiteListModel
WindupConfigurationModel
  Impl
WindupConfigurationPackageModel
XmlMetaFacetModel
```

Meta Models

- User input
- Rules and Rule Providers metadata

Core Models

FileModel ArchiveModel

Reporting Models

Custom Models (coming from add-ons)

See respective ruleset's documentation.

Create Java Queries

Query for all frames of some Model

```
Query.find(FileModel.class).as("result")
```

Query by property

```
Query.find(FileModel.class)
    .withProperty(FileModel.PROPERTY_IS_DIRECTORY, true)
    .as("res")
```

Gremlin query

```
code,java
Query.find(FileModel.class).piped(new QueryGremlinCriterion() {
    public void query( GraphRewrite event, GremlinPipeline<Vertex, Vertex> pipeline ) {
       throw new UnsupportedOperationException( "Not supported yet." ); //To change body of generated methods, choose
Tools | Templates.
    }
})
.withProperty(FileModel.PROPERTY_IS_DIRECTORY, true)
.as("res")
```

Custom query

The `Query` API is just a convenience implementation. For a custom query, implement your own `GraphCondition`:

```
.when(
    new GraphCondition() {
        public boolean evaluate( GraphRewrite event, EvaluationContext context ) {
            event.getGraphContext(); //...
        }
    }
)
```

Rule Metadata

Overview

DRAFT

Windup uses rule metadata to store and track information such as the rule ID, origin, and required add-ons. It is also used to apply tags to the rule related for ordering, filtering, debugging and performance reasons.

Metadata used by Windup

NOTE | The ruleset metadata will be set using annotations in the future.

```
@Rules(id="", after=[...], ...)
```

To control **ordering**, override `getExecuteAfter()` and `getExecuteBefore()`.

```
public class MyRules extends AbstractRuleProvider
{
    public List<Class<? extends AbstractRuleProvider>> getExecuteAfter() {
        return asClassList(UpdateVictimsDbRules.class, ComputeArchivesSHA512.class);
    }
```

NOTE | The order is set for whole `RuleProvider`. There's no way to set it for individual rules.

To specify the **rule ID**, use `.withId("...")`.

```
            .addRule()
            .perform(...)
            .withId("CheckArchivesWithVictims")
```

For **other metadata**, either use `.withMetadata()` or override `enhanceMetadata()`. To provide categorization for filtering, use `CATEGORY`.

For its metadata, Windup uses the keys defined in `RuleMetadata`:

- CATEGORY (String): Define which category the rule belongs to, which can be then used to filter the rules to execute (plus all those they depend on). Not implemented yet.
- ORIGIN (String): The rule origin. Typically a class name.
- AUTO_COMMIT (boolean): Whether to call database `commit()` after the rule executes.
- TREAT_EXCEPTIONS_AS_FATAL (boolean): Whether all Exceptions from this Rule are to be treated as fatal. The default is non-fatal.
- RULE_PROVIDER: The `RuleProvider` that originated the rule. This is used internally, not to be specified by rule author.

You can find out more information about rule metadata here:RuleMetadata Javadoc.

How to define rule metadata

The `RuleMetadata` is defined using the `.withMetadata(Object key, Object value)`.

```
            .addRule()
            .when(...)
            .perform(...)
            .withId("CheckArchivesWithVictims")
            .withMetadata(RuleMetadata.CATEGORY, ...)
```

In case you want to apply the same metadata to all rules in some`RuleProvider`, override it's `enhanceMetadata()` method. The default implementations sets `CATEGORY` to "Uncategorized", `ORIGIN` to it's class'es name, and `RULE_PROVIDER` to the `RuleProvider` object:

```
public class MyRules extends AbstractRuleProvider
{
    public void enhanceMetadata(Context context) {
        if( ! context.containsKey(RuleMetadata.CATEGORY) )
            context.put(RuleMetadata.CATEGORY, "Uncategorized");
        if( ! context.containsKey(RuleMetadata.ORIGIN) )
            context.put(RuleMetadata.ORIGIN, this.getClass().getName());
        if( ! context.containsKey(RuleMetadata.RULE_PROVIDER) )
            context.put(RuleMetadata.RULE_PROVIDER, this);
    }
```

Why a Map?

For the rules definition, Windup uses the OCPsoft Rewrite library. Whenever there is something Windup specific which can't be pulled to the upstream implementation, Windup resorts to putting data into a metadata map.

This map is typically not used by rule authors, unless they use a custom Windup extension (don't confuse that with custom Ruleset).

Ruleset metadata

Ruleset metadata cover the whole Ruleset, not individual rules. For ruleset metadata, unlike rules, Windup uses a type-safe interface RulesetMetadata.

Currently, it only defines Ruleset ID.

Debugging and Troubleshooting

Debugging and Profiling

Debug the Windup Distribution Runtime

You can debug the Windup distribution using one of the following approaches.

1. Pass the `--debug` argument on the command line when you execute Windup.

   ```
   For Linux:    WINDUP_HOME/bin $ ./windup --debug
   For Windows:  C:\WINDUP_HOME\bin> windup --debug
   ```

2. Configure the `FORGE_OPTS` for debugging.

   ```
   export FORGE_OPTS="-Xdebug -Xnoagent -Djava.compiler=NONE -
   Xrunjdwp:transport=dt_socket,server=y,suspend=y,address=8000"
   ```

Debug a Test Using NetBeans

Click the `Debug Test File` button, or choose `Menu` → `Debug` → `Debug Test File`.

Profile a Test Using NetBeans

1. Profiling requires a lot of memory, so be sure to increase the NetBeans memory settings.
   - Open the `NETBEANS_HOME/etc/netbeans.conf` file
   - Find the line with `netbeans_default_options=`
   - Add the following option

     ```
     -J-Xmx5200m -J-XX:MaxPermSize=1024m
     ```

   - Restart NetBeans.
2. Click `Menu > Profile > Profile Test File`.
3. In the resulting dialog, enter the following.

   ```
   exec.args=-Djboss.modules.system.pkgs=org.netbeans
   ```

Profile Forge Runtime Using YourKit

1. Download and unzip YourKit. Be sure to get the trial license.
2. Configure the `FORGE_OPTS` for Yourkit:

   ```
   export YOURKIT_HOME=/home/ondra/sw/prog/YourKit-b14092
   export FORGE_OPTS="-Djboss.modules.system.pkgs=com.yourkit -agentpath:$YOURKIT_HOME/bin/linux-x86-
   64/libyjpagent.so=sampling,onexit=snapshot,delay=0"
   ```

3. Run `forge`. For details, see Profiling Forge, but skip the first 2 points that direct you to copy the YourKit module and JAR into the Forge installation. Forge 2 already contains the YourKit module and JAR>.
4. Run `windup-analyze-app`.

   ```
   forge -e windup-migrate-app
   ```

Troubleshoot Windup Issues

Logging

Logging is currently broken and will not be fixed any time soon.

See Known Issues and WINDUP-73 for the current status.

Debugging Exceptions

Exceptions in Surefire reports are broken due to the way Forge wraps exceptions and the way Surefire handles them. You need to debug or rewrap exceptions using `TestUtil.rewrap(ex)`.

See Known Issues and WINDUP-197 for the current status..

Classloading Problems

Configuring dependencies in a Forge-based project can be a little tricky.

```
Caused by: java.lang.IllegalArgumentException: Type value for model
'org.jboss.windup.rules.files.model.FileReferenceModel' is already registered with model
org.jboss.windup.rules.files.model.FileReferenceModel
```

This means that the model class is loaded twice. I.e. the module containing it is loaded twice. Or, in tests, you may be (accidentally) adding the class to the deployment. This may especially happen after Maven coordinates of some module are changed.

Wiki Information

About the Windup Wiki

Purpose

This wiki is a place to create Windup documentation in a collaborative manner, a bit wildly, and on the fly. It is intended to reflect the state of the Windup source code master branch, however pages may become obsolete as the master changes quickly.

Areas of Interest

The Wiki pages are divided into the following main areas of interest, which may often overlap. The page names use these prefixes:

- **Dev-: ...**: These pages are of interest to Windup core developers.
- **Rules- ...**: These pages are of interest to rules developers.
- **User- ...**: These pages that are of interest to Windup users.
- no prefix: These pages that are also of interest to all users.

AsciiDoc

This Wiki uses AsciiDoc because it is capable of handling the publishing requirements and structural elements needed to create technical books. If you would like to contribute to the documentation, feel free to use your favorite Wiki language, however, it will ultimately be converted to AsciiDoc.

Contributor Guidelines

Please see the Contributing Guidelines for details about how to name pages and use the correct AsciiDoc syntax to make the transition to the final documentation go more smoothly.

The following is a brief overview.

- Name wiki pages using only letters, numbers and dashes. Do not include spaces, colons, or other special characters in page names.
- Always use the `ProductName` or `ProductShortName` variables when referring to the product name.
- Do not use the product name in page names or in headers. This is because you should always use the variables when referring to the product names and the variables do not work in generated anchors.
- Use the following variables instead of hard-coded values

  ```
  {ProductName} - The full product name
  {ProductShortName} - The abbreviated product name
  {ProductVersion} - The current product version
  {ProductDistribution} - The distribution file name
  {ProductHomeVar} - The installation home variable
  {ProductDocHomeVar} - The documentation home variable
  {ProductSrcHomeVar} - The source home variable
  {ProductReleaseVar} - The product release variable
  ```

- Be sure to add a level 3 page heading (===) at the top of each page. When compiled in a book, the Guide name is the top level, chapters are level 2, and the page is level 3. This is the title that appears in the table of contents for the page.

```
=== Review the Quickstarts
```

- At the beginning of each new Wiki page, add an anchor with the exact page name, including the dashes. This generates the correct anchors that are needed when the pages are combined into a book.

  ```
  [[Page-Name]]
  === Page Name
  ```

- Wiki generates anchors using dashes for spaces. AsciiDoctor generates a leading underscore and underscores for spaces. When referring to another section within the same page, do not use the `<<section-title-anchor>>` syntax. Instead, create an anchor and use the 'xref:' syntax to provide the link. Replace spaces in the section title with dashes.
  - Create the anchor at the top of the section using double brackets to force the generation of dashes instead of underscores.

    ```
    [[section-header]]
    ==== Section Header
    ```

  - Then use the `xref` to create the link.

    ```
    See xref:section-header[Section Header] for more information.
    ```

- In Asciidoctor 1.5.0, the backtick is no longer an inline monospaced literal. This means that the wildcard character (*) within backticks renders as an emphasis tag, resulting in the following build error.

  ```
  parser error : Opening and ending tag mismatch
  ```

  Wildcard characters (*) within tick marks must be preceded by `[x-]`, for example"

  ```
  [x-]`org.apache.commons.{*}`
  ```

  This is described in further detail here:https://github.com/asciidoctor/asciidoctor/issues/1045

Add Images to the Windup Wiki

- Fork https://github.com/windup/windup/wiki
- Clone the Windup Wiki into a `windup.wiki/` directory using the SSH clone URL:

  ```
  git clone git@github.com:USER_NAME/windup.git windup.wiki
  ```

- Navigate to the new `windup.wiki/` directory.
- Add the upstream repository.

  ```
  git remote add -f upstream git@github.com:windup/windup.wiki.git
  ```

- Check out a branch to work in.

  ```
  git checkout -b BRANCH_NAME upstream/master
  ```

- Copy the image into the `windup.wiki/images` directory

  ```
  cp IMAGE_NAME.png images/
  ```

- Add the new image to Git

  ```
  git add images/IMAGE_NAME.png
  ```

- Commit the change

  ```
  git commit -m "Add new image"
  ```

- Push the change to your Windup Wiki repository.

  ```
  git push origin HEAD:master
  ```

- Test the new image in a page on your own Wiki. Don't forget to add the `:imagesdir: images` directive to the beginning of the page to point to the images directory.

  ```
  image:IMAGE_NAME.png[New Image]
  ```

  For example:

  My Image

- If it works, push the image to the upstream repository

  ```
  git push upstream HEAD:master
  ```

Windup Product Release and Documentation Process

Windup Release Process

Windup consists of artifacts from multiple GitHub repositories. Use the following procedure to create a Windup release.

1. Release http://github.com/windup/nexus-indexer

   ```
   mvn release:prepare release:perform -DreleaseVersion=X -Dtag=Y -DdevelopmentVersion=Z
   ```

2. Release http://github.com/windup/windup *primary reactor*
3. Release http://github.com/windup/windup-rulesets
4. Release http://github.com/windup/windup-distribution

Create Windup JavaDoc

The most recent Windup JavaDoc build is located here:http://windup.github.io/windup/docs/javadoc/latest/index.html

If you want to build an updated version, use the following procedure to create JavaDoc for Windup.

1. In Windup project root directory, type the following Maven command:

   ```
   mvn validate -PjavadocDist
   ```

2. The JavaDoc is created in the Windup `target/apidocs` subdirectory.

NOTE To cross-link with 3rd-party libraries, see https://issues.jboss.org/browse/WINDUP-422[WINDUP-422} and http://stackoverflow.com/questions/27392535/javadoc-how-to-make-it-link-the-dependencies-maven-project.

Windup Documentation Process

Wiki Documentation

- Name wiki pages using only letters, numbers and dashes. Do not include spaces, colons, or other special characters in page names.
- Use AsciiDoc rather than Markdown for the syntax.

Windup JavaDoc

Instructions to build the Windup JavaDoc are located here: Create Windup JavaDoc.

Product Documentation

Windup product documentation is stored here: https://github.com/windup/windup-documentation

See the CONTRIBUTING guide for AsciiDoc syntax rules regarding headers and links to make this process easier.

Update the Windup Documentation with the Latest Wiki Changes

Summary

The Windup guides are located in the windup-documentation/docs directory. They are named the same as the guides in the Wiki but have a 'Windup-' prefix. The windup-documentation/docs guides should kept synchronized with the versions in the windup.wiki.

Wiki Guide	Windup Docs Guide
User-Guide.asciidoc	Windup-User-Guide.adoc
Rules-Development-Guide.asciidoc	Windup-Rules-Development-Guide.adoc
Core-Development-Guide.asciidoc	Windup-Core-Development-Guide.adoc
Migration-Planning-Guide	Windup-Migration-Planning-Guide.adoc

Documentation Update Scripts

The https://github.com/windup/windup-documentation/tree/master/scripts/windupDocUpdate.sh script copies the pages from the Windup wiki to the windup-documentation repository, makes minor modifications, and generates each guide in a single HTML page book format. The resulting guides are created in the *WINDUP_DOCUMENTATION_HOME/html/* directory.

The script performs the following steps.

1. Copies the Windup wiki pages to the *WINDUP_DOCUMENTATION_HOME/docs/* directory, renaming them with the `.adoc` extension.
2. Makes sure each guide includes all pages that are referenced by pages within it. Scripts are provided to search for links within each individual guide. They navigate to the *WINDUP_DOCUMENTATION_HOME/docs/* directory and search using the following command:

   ```
   grep 'xref:[A-Z]' `find . -name '*.adoc'`.
   ```

3. Replaces each `xref:` to external pages with an `xref:` using the following command.

   ```
   find . -name '*.adoc' -print | xargs sed -i 's/xref:/xref:/g'
   ```

4. Navigates to the *WINDUP_DOCUMENTATION_HOME/* directory and builds the books. The single page HTML files are created in the *WINDUP_DOCUMENTATION_HOME/html/* directory.

Windup Guide	Command
Windup User Guide	asciidoctor -t -dbook -a toc -o html/WindupUserGuide.html docs/Windup-User-Guide.adoc

Windup Guide	**Command**
Windup Rules Development Guide	asciidoctor -t -dbook -a toc -o html/WindupRulesDevelopmentGuide.html docs/Windup-Rules-Development-Guide.adoc
Windup Core Development Guide	asciidoctor -t -dbook -a toc -o html/WindupCoreDevelopmentGuide.html docs/Windup-Core-Development-Guide.adoc

5. Navigates to the *WINDUP_DOCUMENTATION_HOME/* directory and builds the DocBook Customer Portal books. The files are created in the *WINDUP_DOCUMENTATION_HOME/build/* directory.

Windup Guide	**Command**
Windup User Guide	ccutil compile --lang en_US --main-file ~/windup-documentation/docs/Windup-User-Guide.adoc
Windup Rules Development Guide	ccutil compile --lang en_US --main-file ~/windup-documentation/docs/Windup-Rules-Development-Guide.adoc
Windup Core Development Guide	ccutil compile --lang en_US --main-file ~/windup-documentation/docs/Windup-Core-Development-Guide.adoc

Publish the HTML Docs for Access at GitHub IO

The https://github.com/windup/windup-documentation/tree/master/scripts/windupPublish.sh script copies the pages from the Windup wiki to the windup-documentation repository, makes minor modifications, and generates each guide in a single HTML page book format. The resulting guides are created in the *WINDUP_SOURCE_HOME/html/* directory.

The script performs the following steps.

- The first time, you must fork and clone the windup GitHub repository. After that, just fetch the latest upstream.

```
git clone https://github.com/windup/windup.git
git fetch upstream
```

- Navigate to the local *WINDUP_SOURCE_HOME/* directory.

```
cd windup
```

- Checkout the `gh-pages` from the Windup repository

```
git checkout -b gh-pages windup/gh-pages
```

- If the *WINDUP_SOURCE_HOME/docs/WINDUP_RELEASE/* directory does not yet exist, create a *docs/WINDUP_RELEASE/html/images/* directory.

```
mkdir -p docs/2.2.0-Final/html/images (if it doesn't exist!)
```

- Copy any the images, stylesheets, and html files from windup-documentation:

```
cp windup-documentation/html/*.html windup/docs/2.2.0-Final/html/
cp windup-documentation/*.css windup/docs/2.2.0-Final/html/
cp windup-documentation/images/* windup/docs/2.2.0-Final/html/images/
```

- Add the updated files to GitHub.

```
git add docs
```

- Commit the changes.

```
git commit -m "Update message..."
```

- Push the changes to GitHub.

  ```
  git push upstream gh-pages
  ```

- View the documentation at http://windup.github.io/windup/docs/WINDUP_RELEASE/html/WindupUserGuide.html
- Update the symlink for `latest` to point to the new version.
  - Navigate to the `WINDUP_HOME/docs` directory.
  - Remove the existing symlink for "latest".

    ```
    unlink latest
    ```

  - Create a symlink to the new documentation.

    ```
    Syntax: ln -s WINDUP_RELEASE latest
    Example: ln -s 2.2.0-Final latest
    ```

  - Add the modified "latest" directory to Git.

    ```
    git add latest
    ```

  - Commit the change.

    ```
    git commit -m 'Replace symlink for latest to point to 2.2.0-Final'
    ```

  - Push the changes to your own git repository, verify and issue a pull.

    ```
    git push origin HEAD
    ```

  - Push the changes upstream

    ```
    git push upstream gh-pages
    ```

  - View the documentation at http://windup.github.io/windup/docs/latest/html/WindupUserGuide.html

---

Additional Resources

Review the Windup Quickstarts

The Windup quickstarts provide working examples of how to create custom Java-based rule add-ons and XML rules. You can use them as a starting point for creating your own custom rules. The quickstarts are available on GitHub here: https://github.com/windup/windup-quickstarts

You can fork and clone the project to have access to regular updates or you can download a ZIP file of the latest version.

Download the Latest Quickstart ZIP

To download the latest quickstart ZIP file, browse to: https://github.com/windup/windup-quickstarts/releases

Click on the most recent release to download the ZIP to your local file system.

Fork and Clone the Quickstart GitHub Project

If you don't have the GitHub client (`git`), download it from: http://git-scm.com/

1. Click the `Fork` link on the Windup quickstart GitHub page to create the project in your own Git. The forked GitHub repository URL created by the fork should look like this: https://github.com/YOUR_USER_NAME/windup-quickstarts.git

2. Clone your Windup quickstart repository to your local file system:

   ```
   git clone https://github.com/YOUR_USER_NAME/windup-quickstarts.git
   ```

3. This creates and populates a `windup-quickstarts` directory on your local file system. Navigate to the newly created directory, for example

   ```
   cd windup-quickstarts/
   ```

4. If you want to be able to retrieve the lates code updates, add the remote `upstream` repository so you can fetch any changes to the original forked repository.

   ```
   git remote add upstream https://github.com/windup/windup-quickstarts.git
   ```

5. To get the latest files from the `upstream` repository.

   ```
   git reset --hard upstream/master
   ```

Get Involved

How can you help?

To help us make Windup cover most application constructs and server configurations, including yours, you can help with any of the following items. Many require only a few minutes of your time!

- Send an email to windup-users@lists.jboss.org and let us know what Windup migration rules should cover.
- Provide example applications to test migration rules.
- Identify application components and problem areas that may be difficult to migrate.
  - Write a short description of these problem migration areas.
  - Write a brief overview describing how to solve the problem migration areas.
- Try Windup on your application. Be sure to report any issues you encounter.
- You can contribute to the Windup rules repository.
  - Write a Windup rule to identify or automate a migration process.
  - Create a test for the new rule.
  - Details are provided in the *Windup Rules Development Guide*.
- You can also contribute to the project source code.
  - Create a core rule.
  - Improve Windup performance or efficiency.
  - See the_Windup Core Development Guide_ for information about how to configure your environment and set up the project.

Any level of involvement is greatly appreciated!

Important links

See the list of links to Windup resources.

Important Links

- Windup wiki: https://github.com/windup/windup/wiki
- Windup documentation (generated from the Wiki documentation at the link above):
  - Windup User Guide
  - Windup Rules Development Guide
  - Windup Core Development Guide

    - Windup Javadoc

- Windup forums: https://community.jboss.org/en/windup
    - Windup 0.x legacy forums: https://developer.jboss.org/en/windup
- Windup issue tracker: https://issues.jboss.org/browse/WINDUP
- Windup users mailing List: windup-users@lists.jboss.org
- Windup developers mailing list: windup-dev@lists.jboss.org
- Windup commits mailing list: windup-commits@lists.jboss.org
- Windup on Twitter: @JBossWindup
- Windup IRC channel: Server FreeNode (`irc.freenode.net`), channel `#windup`.
    - Windup IRC Chat transcripts: http://bit.ly/windup-transcripts
    - Windup meeting IRC Chat transcripts: transcripts: http://bit.ly/windup-meetings

Known Windup Issues

Windup known issues are tracked here: Open Windup issues

Report Issues with Windup

Windup uses JIRA as its issue tracking system. If you encounter an issue executing Windup, please file a JIRA Issue.

Create a JIRA Account

If you do not yet have a JIRA account, create one using the following procedure.

1. Open a browser to the following URL: https://issues.jboss.org/secure/Dashboard.jspa
2. Click the *Sign Up* link in the top right side of the page.
3. Enter your email address and click the `Confirm address` button.
4. Follow the instructions sent to your email address.

Create a JIRA Issue

1. Open a browser to the following URL: https://issues.jboss.org/secure/CreateIssue!default.jspa.
    - If you have not yet logged in, click the *Log In* link at the top right side of the page.
    - Enter your credentials and click the `LOGIN` button.
    - You are then redirected back to the **Create Issue** page.
2. Choose the following options and click the `Next` button.
    - **Project**: *Windup*
    - **Issue Type**: *Bug*
3. On the next screen complete the following fields:
    - **Summary**: Enter a brief description of the problem or issue.
    - **Environment**: Provide the details of your operating system, version of Java, and any other pertinent information.
    - **Description**: Provide a detailed description of the issue. Be sure to include logs and exceptions traces.
4. Click the `Create` button to create the JIRA issue.
5. If the application or archive causing the issue does not contain sensitive information and you are comfortable sharing it with the Windup development team, attach it to the issue by choosing `More → Attach Files`. You are provided with an option to restrict visibility to JBoss employees.

Appendix

Glossary of Terms Used in Windup

Rules Terms

Rule

A piece of code that performs a single unit of work during the migration process. Depending on the complexity of the rule, it may or may not include configuration data. Extensive configuration information may be externalized into external configuration, for example, a custom XML file. The following is an example of a Java-based rule added to the `JDKConfig` RuleProvider class.

```
.addRule()
    .when(JavaClass.references("java.lang.ClassLoader$").at(TypeReferenceLocation.TYPE))
    .perform(Classification.as("Java Classloader, must be migrated.")
    .with(Link.to("Red Hat Customer Portal: How to get resources via the ClassLoader in a JavaEE application in JBoss
EAP",  "https://access.redhat.com/knowledge/solutions/239033"))
     .withEffort(1))
```

RuleProvider

An implementation of OCPSoft ConfigurationProvider class specifically for Windup. It provides Rule instances and the relevant RuleProviderMetadata for those Java-based and XML-based Rule instances.

Ruleset

A ruleset is a group of one or more RuleProviders that targets a specific area of migration, for example, `Spring → Java EE 6` or `WebLogic → JBoss EAP`. A ruleset is packaged as a JAR and contains additional information needed for the migration, such as operations, conditions, report templates, static files, metadata, and relationships to other rulesets. The following Windup projects are rulesets.

- rules-java-ee
- rules-xml

Rules Metadata

Information about whether a particular ruleset applies to a given situation. The metadata can include the source and target platform and frameworks.

Rules Pipeline

A collection of rules that feed information into the knowledge graph.

Reporting Terms

Level of effort

The level of effort required for the migration task. The following values are used in the reports.

- *Lift and Shift*: The code or file is standards-based and can be ported to the new environment with no changes.
- *Known Solution*: There is a standard mapping algorithm to port the code or file to the new environment.
- *Custom*: The code or file must be rewritten or modified to work in the new environment.

Story Point

A term commonly used in Scrum Agile software development methodology to estimate the level of effort needed to implement a feature or change. It does not necessarily translate to man-hours, but the value should be consistent across tasks.

Windup Project Information

Github Repository

The Windup project github repository is located at https://github.com/windup/windup/.

See the *Core-Developer-Guide* for details on how to contribute to the Windup project source code.

Documentation

The Windup documentation is currently located here in the Windup project Wiki.

For additional information, refer to the Windup Javadoc.

Website

There is currently no website for Windup.

The windup.jboss.org website currently provides information primarily for legacy Windup 1.x (legacy).

IRC chat

Server: irc.freenode.net
Channel: #windup

Mailing lists

Subscribe to the JBoss mailing lists at https://lists.jboss.org/mailman/listinfo/windup-dev.

- Core development discussion: windup-dev@redhat.com
- Rules development discussion, usage: windup-users@redhat.com

Core development team (and IRC nicks)

Lead: Lincoln Baxter (lincolnthree)
Members: Jess Sightler (jsightler), Matej Briskar (mbriskar), Ondrej Zizka (ozizka)

IRC meeting bot commands (hint for the moderator)

```
#startmeeting
#chair lincolnthree, ozizka, jsightler, mbriskar
#addtopic Status Reports
#addtopic Next steps
#nexttopic
#info ...
#endmeeting
Useful Commands: #action #agreed #help #info #idea #link #topic.
```