Windup User Guide

Overview

This guide is for engineers, consultants, and others who plan to use Windup 2 to migrate Java applications or other components.

What is Windup?

JBoss Windup is a rule-based tool to simplify application migrations.

Running from a Forge environment, the tool examines EAR, WAR, and JAR deployments (or a project source directory) and produces an HTML report detailing the inner workings of the Java application to simplify migration efforts. It seeks to make migrating from other containers to JBoss EAP a piece of cake.

Windup 2 vs. Windup 0.7.x

Windup 2 aims to deliver the same functionality as legacy Windup, however, the internal architecture and rule structure is very different and allows for the creation of much more complex rules.

How Does Windup Simplify Migration?

Windup looks for common resources and highlight technologies and known “trouble spots” in migrating applications. The goal of Windup is to provide a high level view into relevant technologies in use within the application, and provide a consumable report for organizations to estimate, document, and migrate enterprise applications to Java EE and JBoss EAP.

These are some of the of the areas targetted by current core Windup rulesets:

Ruleset	Description
Java code	Reads compiled Java files, determines if blacklisted classes are imported, and if so, continues to profile the resource.
JSP code	Reads JSP files, extracts the JSP imports and taglibs, and continues to profile the resource
XML configuration	Reads XML files into a DOM objects and continues to profile the resource.

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Features of Windup 2

Shared Data Model

Windup 2 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 2 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 2 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 2 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 2 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.

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

Install Windup

Minimum System Requirements

- Java Platform, Enterprise Edition 7
- A minimum of 4 GB RAM. For better performance, a 4-core processor with 8 GB RAM is recommended. This allows 3 - 4 GB RAM for use by the JVM.
- A minimum of 4 GB of free disk space. A fast disk, especially a Solid State Drive (SSD), will improve performance.
- Windup is tested on Linux (Fedora), Mac OS X, and Windows. Other Operating Systems with Java 7 support should work equally well.

Download and Install Windup

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

> **NOTE** If you used 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*

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, see About 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_HOME/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, see Review 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 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
```

Windup Command Examples

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

Source Code Example

The following command runs against the 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 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 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 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:

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

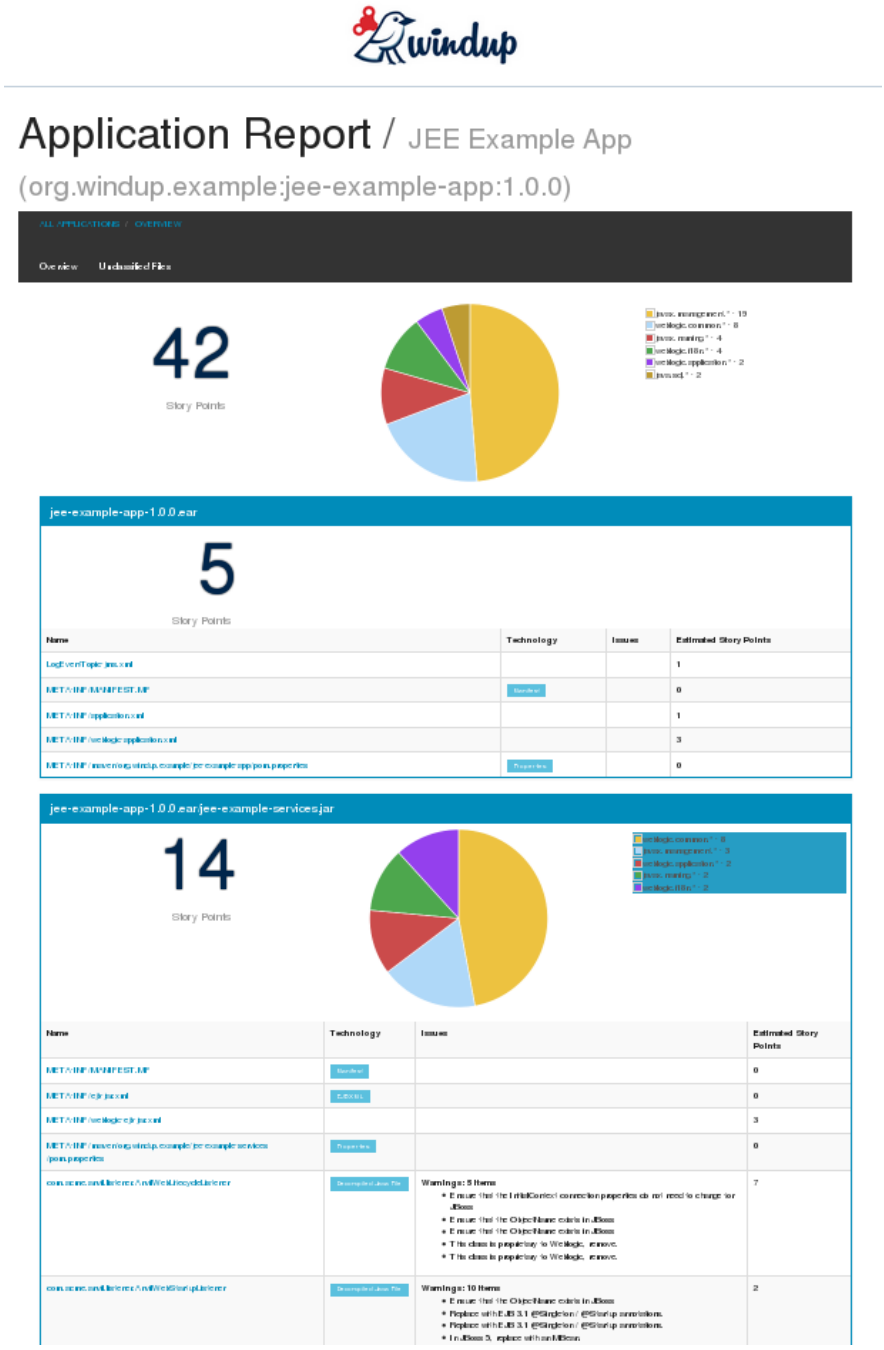
Report Sections

Application Report Page

The first section of the application report page summarizes the migration effort. It provides the total *Story Points* and a graphically displays the effort by technology. 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.

- 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.

The following is an example of a Windup Application Report.



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

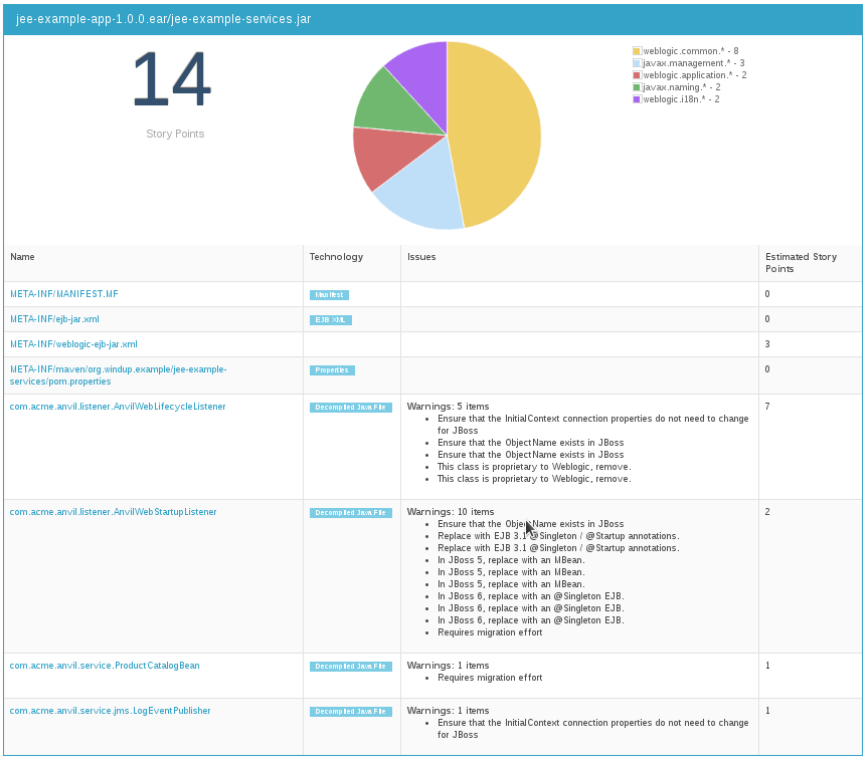
Issues

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`.



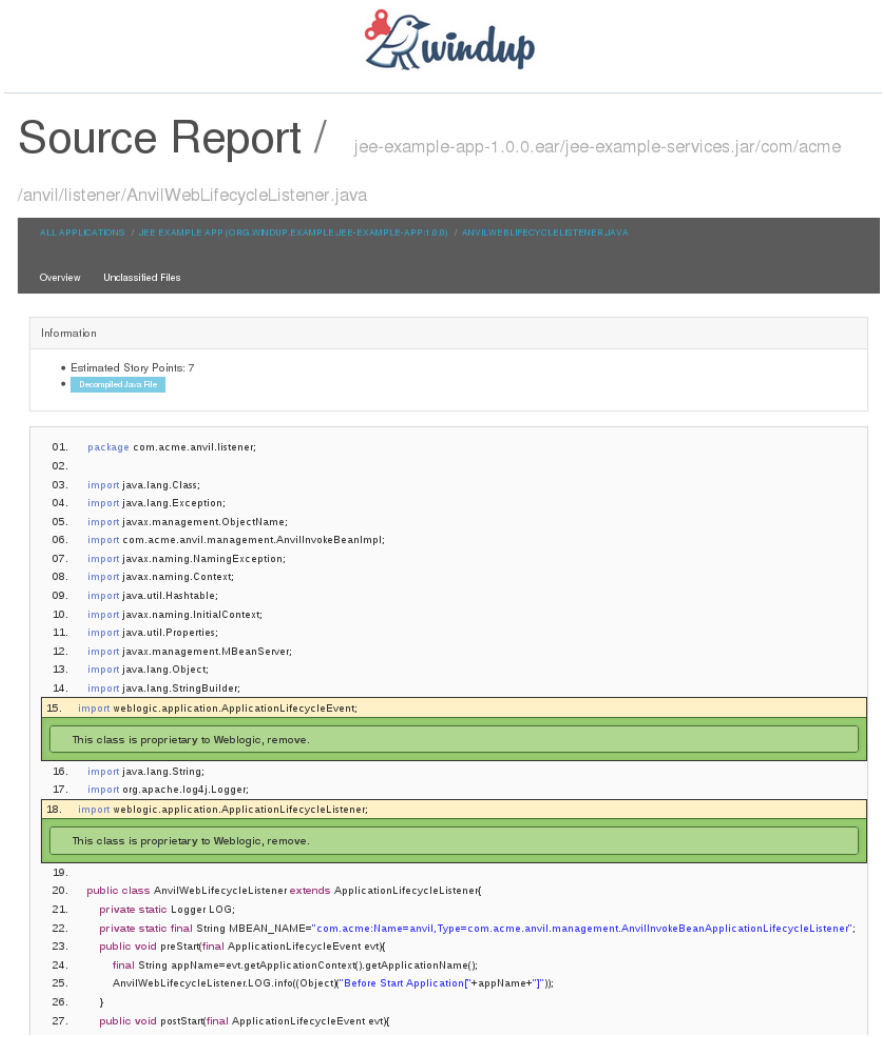
File Analysis Pages

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

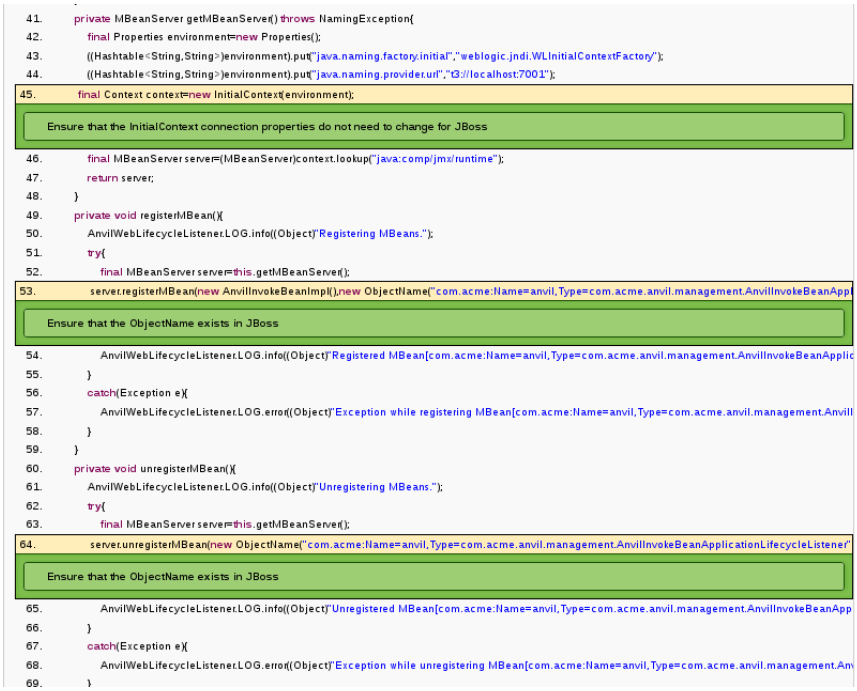
`com.acme.anvil.listener.AnvilWebLifecycleListener` file has 5 warnings and is assigned 7 story points. Click on the file to see the detail.

- 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.



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

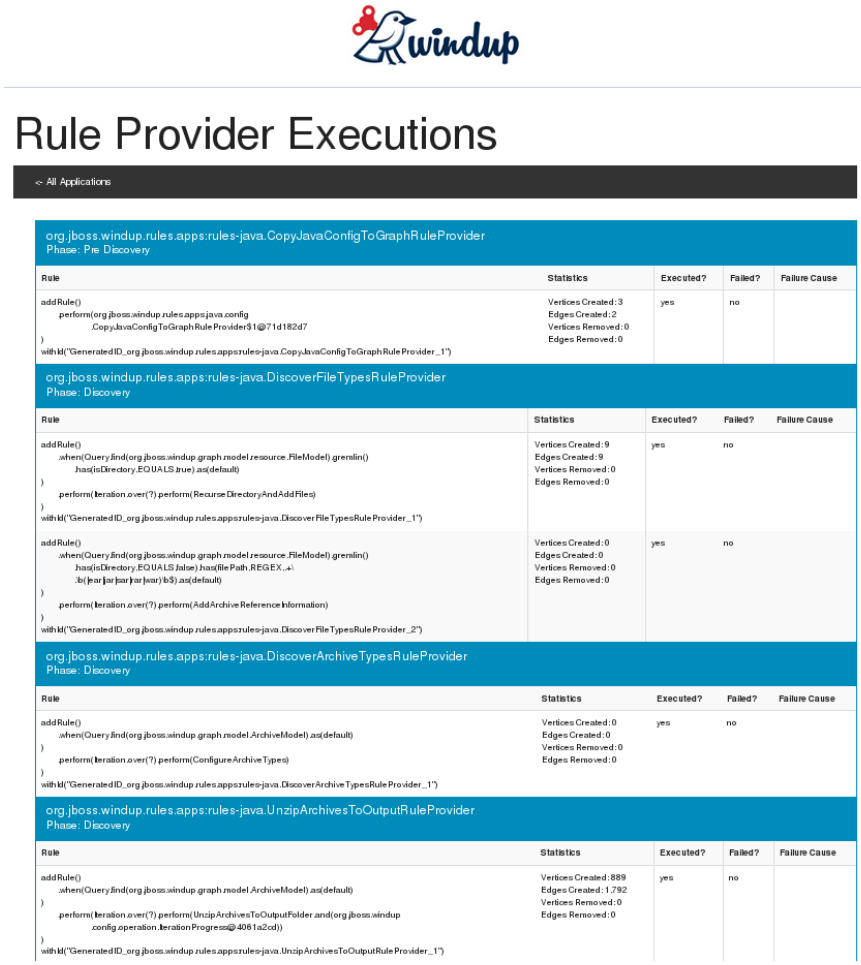


Additional Reports

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 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.

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 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 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. Some items require only a few minutes of your time!

- 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 Windup rules.
  - Write a Windup rule add-on to automate a migration process.
  - Create a test for the new rule.
  - For details, see the *Windup Rules Development Guide*.

- You can also contribute to the project source code.
  - Create a core rule.
  - Improve 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!

Helpful links

- Windup Wiki: https://github.com/windup/windup/wiki
- Windup documentation (generated from the Wiki documentation at the link above):
  - http://windup.github.io/windup/docs/latest/html/WindupUserGuide.html
  - http://windup.github.io/windup/docs/latest/html/WindupRulesDevelopmentGuide.html
  - http://windup.github.io/windup/docs/latest/html/WindupCoreDevelopmentGuide.html
- Windup Forums: https://community.jboss.org/en/windup
- Windup Forums: https://developer.jboss.org/en/windup (inherited from Windup 0.x)
- 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

You can also follow us on this IRC channel: `irc.freenode.net#windup`.

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 Windup 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 `Confirmaddress` 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

A class that implements one or more rules using the `.addRule()` method. The following are examples of legacy Java RulesProviders that are defined in `rules-java-ee` ruleset.

- EjbConfig
- JDKConfig
- SeamToCDI

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

Lift and Shift (Level of effort)

The code or file is standards-based and can be ported to the new environment with no changes.

Mapped (Level of effort)

There is a standard mapping algorithm to port the code or file to the new environment.

Custom (Level of effort)

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 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.

Discovery Phase

Wnen you run the `windup-migrate-app` command, Windup executes its own core rules to extract files from archives, decompile classes, and analyze the application. In this phase Windup 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, see Rule Phases.

For more information about the graph database components, see Windup 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's architecture allows 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, or story 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.

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 2 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.

Windup includes several Frames extensions, which are documented here: Frames Extensions.

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.

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.
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.

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