Migration Toolkit for Applications 7.0

CLI Guide

Learn how to use the Migration Toolkit for Applications CLI to migrate your applications.

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Legal Notice

Abstract

This guide describes how to use the Migration Toolkit for Applications CLI to simplify migration of Java applications.

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MAKING OPEN SOURCE MORE INCLUSIVE

Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see our CTO Chris Wright's message.

CHAPTER 1. INTRODUCTION

1.1. ABOUT THE CLI GUIDE

This guide is for engineers, consultants, and others who want to use the Migration Toolkit for Applications (MTA) to migrate Java applications or other components. It describes how to install and run the CLI, review the generated reports, and take advantage of additional features.

1.2. ABOUT THE MIGRATION TOOLKIT FOR APPLICATIONS

What is the Migration Toolkit for Applications?
Migration Toolkit for Applications (MTA) accelerates large-scale application modernization efforts across hybrid cloud environments on Red Hat OpenShift. This solution provides insight throughout the adoption process, at both the portfolio and application levels: inventory, assess, analyze, and manage applications for faster migration to OpenShift via the user interface.

MTA uses an extensive default questionnaire as the basis for assessing your applications, or you can create your own custom questionnaire, enabling you to estimate the difficulty, time, and other resources needed to prepare an application for containerization. You can use the results of an assessment as the basis for discussions between stakeholders to determine which applications are good candidates for containerization, which require significant work first, and which are not suitable for containerization.

MTA analyzes applications by applying one or more rulesets to each application considered to determine which specific lines of that application must be modified before it can be modernized.

MTA examines application artifacts, including project source directories and application archives, and then produces an HTML report highlighting areas needing changes.

How does the Migration Toolkit for Applications simplify migration?
The Migration Toolkit for Applications looks for common resources and known trouble spots when migrating applications. It provides a high-level view of the technologies used by the application.

MTA generates a detailed report evaluating a migration or modernization path. This report can help you to estimate the effort required for large-scale projects and to reduce the work involved.

1.2.1. Supported migration paths

The Migration Toolkit for Applications (MTA) supports migrations from third-party enterprise application servers, such as Oracle WebLogic Server, to JBoss Enterprise Application Platform (JBoss EAP) and upgrades to the latest release of JBoss EAP.

MTA provides a comprehensive set of rules to assess the suitability of your applications for containerization and deployment on Red Hat OpenShift Container Platform (RHOCP). You can run an MTA analysis to assess your applications' suitability for migration to multiple target platforms.

The following table describes the migration paths most commonly supported.

Table 1.1. Supported migration paths: Source platform ⇒ target

Source platform ⇒	Migration to JBoss EAP 7 & 8	OpenShift (cloud readiness)	OpenJDK 11, 17, and 21	Jakarta EE 9	Camel 3 & 4	Spring Boot in Red Hat Runtimes	Quarkus	Open Liberty
Oracle WebLogic Server	✔	✔	✔	-	-	-	-	-
IBM WebSphere Application Server	✔	✔	✔	-	-	-	-	✔
JBoss EAP 4	✘ [a]	✔	✔	-	-	-	-	-
JBoss EAP 5	✔	✔	✔	-	-	-	-	-
JBoss EAP 6	✔	✔	✔	-	-	-	-	-
JBoss EAP 7	✔	✔	✔	-	-	-	✔	-
Thorntail	✔ [b]	-	-	-	-	-	-	-
Oracle JDK	-	✔	✔	-	-	-	-	-
Camel 2	-	✔	✔	-	✔	-	-	-
Spring Boot	-	✔	✔	✔	-	✔	✔	-
Any Java application	-	✔	✔	-	-	-	-	-
Any Java EE application	-	-	-	✔	-	-	-	-

[a] Although MTA does not currently provide rules for this migration path, Red Hat Consulting can assist with migration from any source platform to JBoss EAP 7.

[b] Requires JBoss Enterprise Application Platform expansion pack 2 (EAP XP 2)

For more information about use cases and migration paths, see the MTA for developers web page.

1.3. ABOUT THE CLI

The CLI is a command-line tool in the Migration Toolkit for Applications that allows you to assess and prioritize migration and modernization efforts for applications. It provides numerous reports that highlight the analysis without the overhead of the other tools. The CLI includes a wide array of

customization options, and allows you to finely tune MTA analysis options or integrate with external automation tools.

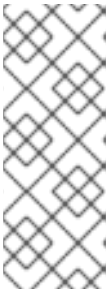
CHAPTER 2. INSTALLING AND RUNNING THE CLI

2.1. INSTALLING THE CLI

You can install the CLI on Linux, Windows, or macOS operating systems.

Prerequisites

- Red Hat Container Registry Authentication for **registry.redhat.io**. Red Hat distributes container images from registry.redhat.io, which requires authentication. For more details, see Red Hat Container Registry Authentication.
- Podman must be installed



PODMAN

Podman is a daemonless, open source, Linux native tool designed to make it easy to find, run, build, share and deploy applications using Open Containers Initiative (OCI) Containers and Container Images. Podman provides a command line interface (CLI) familiar to anyone who has used the Docker Container Engine. For more information on installing and using Podman, see Podman installation instructions.

2.1.1. Installing the CLI .zip file

Procedure

To install using the downloadable **.zip** file:

1. Navigate to the MTA Download page and download the OS specific CLI file or the **src** file:
   - mta-7.0.0-cli-linux.zip
   - mta-7.0.0-cli-macos.zip
   - mta-7.0.0-cli-windows.zip
   - mta-7.0.0-cli-src.zip
2. Extract the **.zip** file to a directory of your choice. The **.zip** file extracts a single binary, called **mta-cli**.
   When you encounter **<MTA_HOME>** in this guide, replace it with the actual path to your MTA installation.

2.1.2. Installing the CLI using Podman

Prerequisites

- Red Hat Container Registry Authentication for **registry.redhat.io**. Red Hat distributes container images from registry.redhat.io, which requires authentication. For more details, see Red Hat Container Registry Authentication.

Procedure

To install using **podman pull**:

1. To use Podman to authenticate to registry.redhat.io:

```
podman login registry.redhat.io
Username: <username>
Password: <**********>
```

2. Issue:

```
podman cp $(podman create registry.redhat.com/mta-toolkit/mta-mta-cli-rhel9:
{ProductVersion}):/usr/local/bin/mta-cli ./
```

This command will copy the binary **PATH** for system-wide use.

WARNING

Although installation using Podman is possible, downloading installing the **.zip** file is the preferred installation.

2.2. RUNNING THE CLI

You can run MTA against your application.

Procedure

1. Open a terminal and navigate to the **<MTA_HOME>**/ directory.
2. Execute the **mta-cli** script, or **mta-cli.exe** for Windows, and specify the appropriate arguments:

```
$ ./mta-cli analyze --input /path/to/jee-example-app-1.0.0.ear \
    --output /path/to/output --source weblogic --target eap6 \
```

- **--input**: The application to be evaluated.
- **--output**: The output directory for the generated reports.
- **--source**: The source technology for the application migration.

3. Access the report.

2.2.1. MTA command examples

Running MTA on an application archive
The following command analyzes the jee-example-app-1.0.0.ear example EAR archive for migrating from JBoss EAP 5 to JBoss EAP 7:

```
$ <MTA_HOME>/mta-cli analyze \
    --input /path/to/jee-example-app-1.0.0.ear \
    --output /path/to/report-output/ --source eap5 --target eap7 \
```

Running MTA on source code
The following command analyzes the seam-booking-5.2 example source code for migrating to JBoss EAP 6.

```
$ <MTA_HOME>/mta-cli analyze --mode source-only --input /path/to/seam-booking-5.2/ \
    --output /path/to/report-output/ --target eap6 --packages org.jboss.seam
```

Running cloud-readiness rules
The following command analyzes the jee-example-app-1.0.0.ear example EAR archive for migrating to JBoss EAP 7. It also evaluates for cloud readiness:

```
$ <MTA_HOME>/mta-cli analyze --input /path/to/jee-example-app-1.0.0.ear \
    --output /path/to/report-output/ \
    --target eap7
```

2.2.2. Performing analysis using the command line

Analyze allows running source code and binary analysis using **analyzer-lsp**.

To run analysis on application source code, run the following command:

```
mta-cli analyze --input=<path/to/source/code> --output=<path/to/output/dir>
```

All flags:

```
Analyze application source code

Usage:
  mta-cli analyze [flags]

Flags:
      --analyze-known-libraries   analyze known open-source libraries
  -h, --help                      help for analyze
  -i, --input string              path to application source code or a binary
      --json-output               create analysis and dependency output as json
      --list-sources              list rules for available migration sources
      --list-targets              list rules for available migration targets
  -l, --label-selector string     run rules based on specified label selector expression
      --maven-settings string     path to a custom maven settings file to use
      --overwrite                 overwrite output directory
      --skip-static-report        do not generate static report
  -m, --mode string               analysis mode. Must be one of 'full' or 'source-only' (default "full")
  -o, --output string             path to the directory for analysis output
      --rules stringArray         filename or directory containing rule files
      --skip-static-report        do not generate static report
  -s, --source string             source technology to consider for analysis. To specify multiple sources,
repeat the parameter: --source <source_1> --source <source_2> etc.
  -t, --target string             target technology to consider for analysis. To specify multiple targets,
repeat the parameter: --target <target_1> --target <target_2> etc.
```

```
Global Flags:
      --log-level uint32   log level (default 4)
      --no-cleanup         do not cleanup temporary resources
```

Usage example

1. Get an example application to run analysis on.
2. List available target technologies.

```
mta-cli analyze --list-targets
```

3. Run an analysis with a specified target technology, for example **cloud-readiness**.

```
mta-cli analyze --input=<path-to/example-applications/example-1> --output=<path-to-output-dir> --target=cloud-readiness
```

4. Several analysis reports are created in your specified output path:

```
$ ls ./output/ -1
analysis.log
dependencies.yaml
dependency.log
output.yaml
static-report
```

output.yaml is the file that contains the issues report.

static-report contains the static HTML report.

dependencies.yaml contains a dependencies report.

2.2.3. Performing transformation using the command line

Transform has two sub commands - **openrewrite** and **rules**.

```
Transform application source code or mta XML rules

Usage:
  mta-cli transform [flags]
  mta-cli transform [command]

Available Commands:
  openrewrite Transform application source code using OpenRewrite recipes
  rules       Convert XML rules to YAML

Flags:
  -h, --help   help for transform

Global Flags:
      --log-level uint32   log level (default 4)
```

```
      --no-cleanup         do not cleanup temporary resources

Use "mta-cli transform [command] --help" for more information about a command.
```

2.2.3.1. OpenRewrite

The **openrewrite** sub command allows running **OpenRewrite** recipes on source code.

```
Transform application source code using OpenRewrite recipes

Usage:
  mta-cli transform openrewrite [flags]

Flags:
  -g, --goal string     target goal (default "dryRun")
  -h, --help            help for openrewrite
  -i, --input string    path to application source code directory
  -l, --list-targets    list all available OpenRewrite recipes
  -s, --maven-settings string   path to a custom maven settings file to use
  -t, --target string   target openrewrite recipe to use. Run --list-targets to get a list of packaged
recipes.

Global Flags:
      --log-level uint32   log level (default 4)
      --no-cleanup         do not cleanup temporary resources
```

To run transform openrewrite on application source code, run the following command:

```
mta-cli transform openrewrite --input=<path/to/source/code> --target=
<exactly_one_target_from_the_list>
```

NOTE

You can only use a single target to run the **transform overwrite** command.

2.2.3.2. Rules

The **rules** sub command allows converting mta XML rules to analyzer-lsp YAML rules using **windup-shim**.

```
Convert XML rules to YAML

Usage:
  mta-cli transform rules [flags]

Flags:
  -h, --help               help for rules
  -i, --input stringArray   path to XML rule file(s) or directory
  -o, --output string       path to output directory

Global Flags:
      --log-level int   log level (default 5)
```

To run **transform rules** on application source code, run the following:

```
mta-cli transform rules --input=<path/to/xmlrules> --output=<path/to/output/dir>
```

Usage example

1. Get an example application to transform source code.
2. View the available OpenRewrite recipes.

   ```
   mta-cli transform openrewrite --list-targets
   ```

3. Run a recipe on the example application.

   ```
   mta-cli transform openrewrite --input=<path-to/jakartaee-duke> --target=jakarta-imports
   ```

   Inspect the **jakartaee-duke** application source code diff to see the transformation

2.2.3.3. Available OpenRewrite recipes

Table 2.1. Available OpenRewrite recipes

Migration path	Purpose	rewrite.configLocation	activeRecipes
Java EE to Jakarta EE	Replace import of **javax** packages with equivalent **jakarta** packages Replace **javax** artifacts, declared within **pom.xml** files, with the **jakarta** equivalents	**<MTA_HOME>/rules/openrewrite/jakarta \ /javax/imports/rewrite.yml**	**org.jboss.windup.JavaxToJakarta**
Java EE to Jakarta EE	Rename bootstrapping files	**<MTA_HOME>/rules/openrewrite/jakarta \ /javax/bootstrapping/rewrite.yml**	**org.jboss.windup.jakarta.javax. \ BootstrappingFiles**
Java EE to Jakarta EE	Transform **persistence.xml** configuration	**<MTA_HOME>/rules/openrewrite/jakarta \ /javax/xml/rewrite.yml**	**org.jboss.windup.javax-jakarta. \ PersistenceXML**
Spring Boot to Quarkus	Replace **spring.jpa.hibernate.ddl-auto** property within files matching **application*.properties**	**<MTA_HOME>/rules/openrewrite/quarkus \ /springboot/properties/rewrite.yml**	**org.jboss.windup.sb-quarkus.Properties**

2.3. ACCESSING REPORTS

When you run the Migration Toolkit for Applications, a report is generated in the **<OUTPUT_REPORT_DIRECTORY>** that you specify using the **--output** argument in the command line.

The output directory contains the following files and subdirectories:

```
<OUTPUT_REPORT_DIRECTORY>/
├── index.html          // Landing page for the report
├── <EXPORT_FILE>.csv   // Optional export of data in CSV format
├── archives/           // Archives extracted from the application
├── mavenized/          // Optional Maven project structure
├── reports/            // Generated HTML reports
├── stats/              // Performance statistics
```

Procedure

1. Obtain the path of the **index.html** file of your report from the output that appears after you run MTA:

```
Report created: <OUTPUT_REPORT_DIRECTORY>/index.html
        Access it at this URL: file:///<OUTPUT_REPORT_DIRECTORY>/index.html
```

2. Open the **index.html** file by using a browser.
   The generated report is displayed.

CHAPTER 3. REVIEWING THE REPORTS

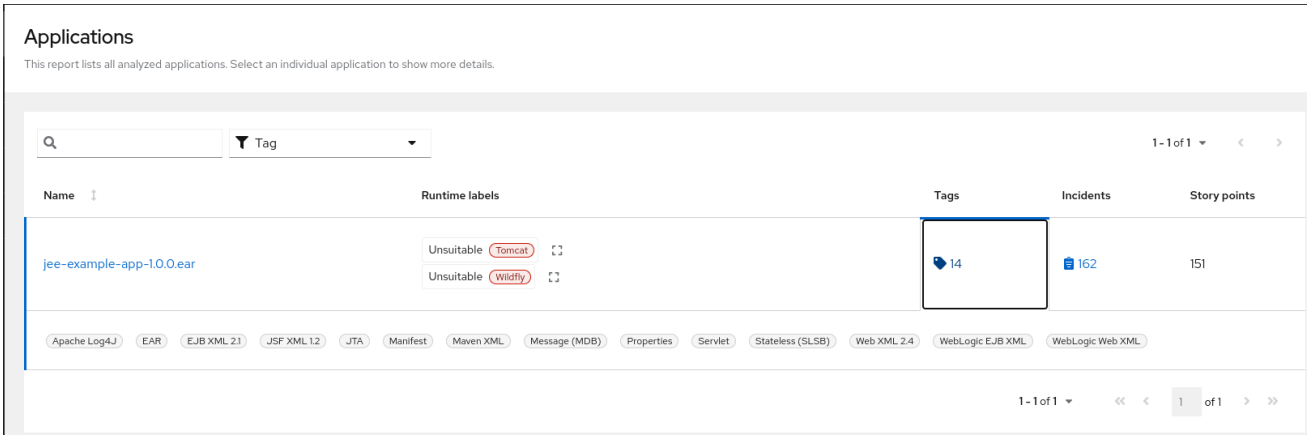
The report examples shown in the following sections are a result of analyzing the **com.acme** and **org.apache** packages in the jee-example-app-1.0.0.ear example application, which is located in the MTA GitHub source repository.

The report was generated using the following command.

```
$ <MTA_HOME>/bin/mta-cli --input /home/username/mta-cli-source/test-files/jee-example-app-1.0.0.ear/ --output /home/username/mta-cli-reports/jee-example-app-1.0.0.ear-report --target eap6 --packages com.acme org.apache
```

Use a browser to open the **index.html** file located in the report output directory. This opens a landing page that lists the applications that were processed. Each row contains a high-level overview of the story points, number of incidents, and technologies encountered in that application.

Figure 3.1. Application list



NOTE

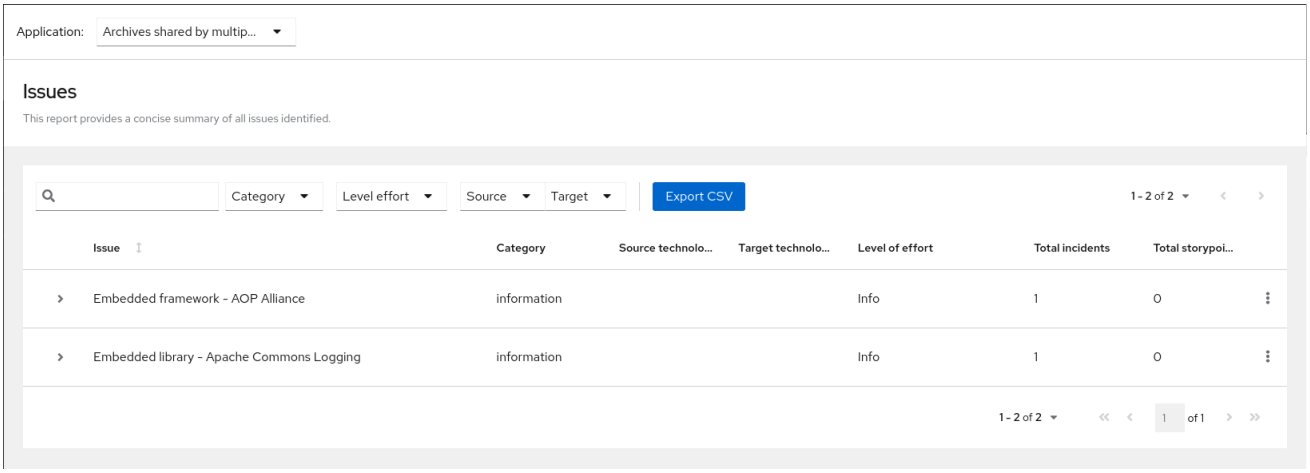
The incidents and estimated story points change as new rules are added to MTA. The values here may not match what you see when you test this application.

The following table lists all of the reports and pages that can be accessed from this main MTA landing page. Click the name of the application, **jee-example-app-1.0.0.ear**, to view the application report.

Page	How to Access
Application	Click the name of the application.
Technologies report	Click the **Technologies** link at the top of the page.
Archives shared by multiple applications	Click the **Archives shared by multiple applications** link. Note that this link is only available when there are shared archives across multiple applications.
Rule providers execution overview	Click the **Rule providers execution overview** link at the bottom of the page.

Note that if an application shares archives with other analyzed applications, you will see a breakdown of how many story points are from shared archives and how many are unique to this application.

Figure 3.2. Shared archives



Information about the archives that are shared among applications can be found in the Archives Shared by Multiple Applications reports.

3.1. APPLICATION REPORT

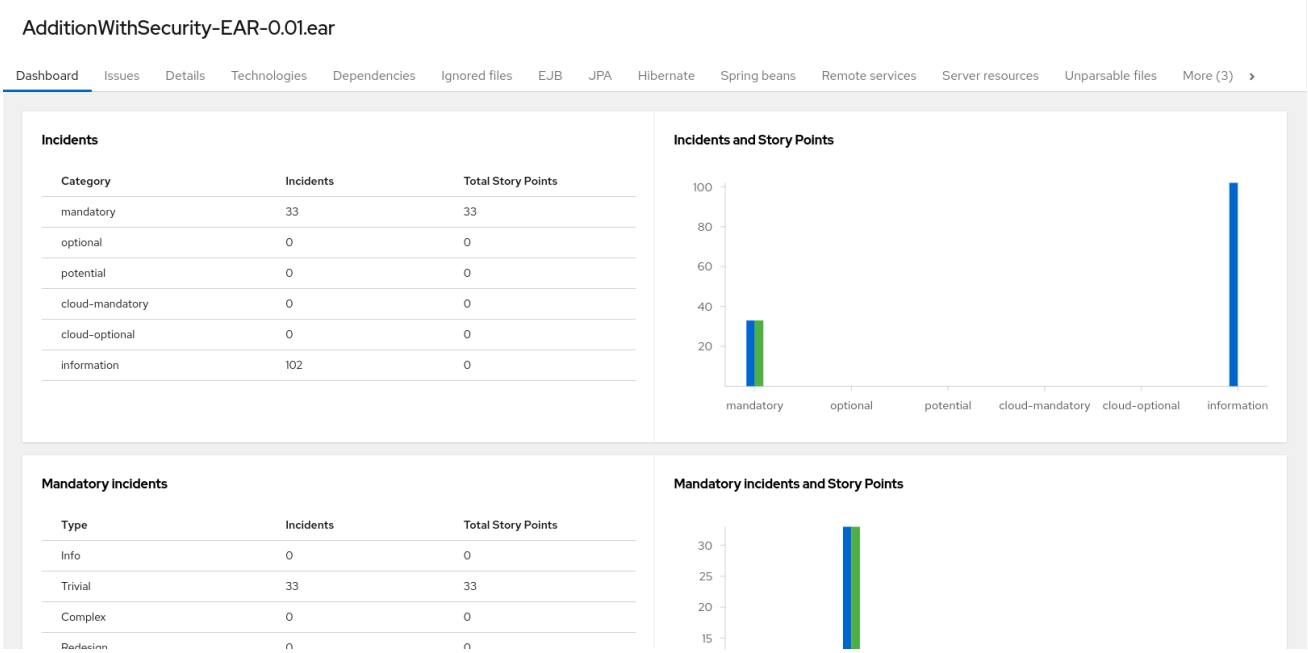
3.1.1. Dashboard

Access this report from the report landing page by clicking on the application name in the **Application List**.

The dashboard gives an overview of the entire application migration effort. It summarizes:

- The incidents and story points by category
- The incidents and story points by level of effort of the suggested changes
- The incidents by package

Figure 3.3. Dashboard



The top navigation bar lists the various reports that contain additional details about the migration of this application. Note that only those reports that are applicable to the current application will be available.

Report	Description
Issues	Provides a concise summary of all issues that require attention.
Application details	Provides a detailed overview of all resources found within the application that may need attention during the migration.
Technologies	Displays all embedded libraries grouped by functionality, allowing you to quickly view the technologies used in each application.
Dependencies	Displays all Java-packaged dependencies found within the application.
Unparsable	Shows all files that MTA could not parse in the expected format. For instance, a file with a **.xml** or **.wsdl** suffix is assumed to be an XML file. If the XML parser fails, the issue is reported here and also where the individual file is listed.
Remote services	Displays all remote services references that were found within the application.
EJBs	Contains a list of EJBs found within the application.
JBPM	Contains all of the JBPM-related resources that were discovered during analysis.
JPA	Contains details on all JPA-related resources that were found in the application.

Report	Description
Hibernate	Contains details on all Hibernate-related resources that were found in the application.
Server resources	Displays all server resources (for example, JNDI resources) in the input application.
Spring Beans	Contains a list of Spring Beans found during the analysis.
Hard-coded IP addresses	Provides a list of all hard-coded IP addresses that were found in the application.
Ignored files	Lists the files found in the application that, based on certain rules and MTA configuration, were not processed. See the **--userIgnorePath** option for more information.
About	Describes the current version of MTA and provides helpful links for further assistance.

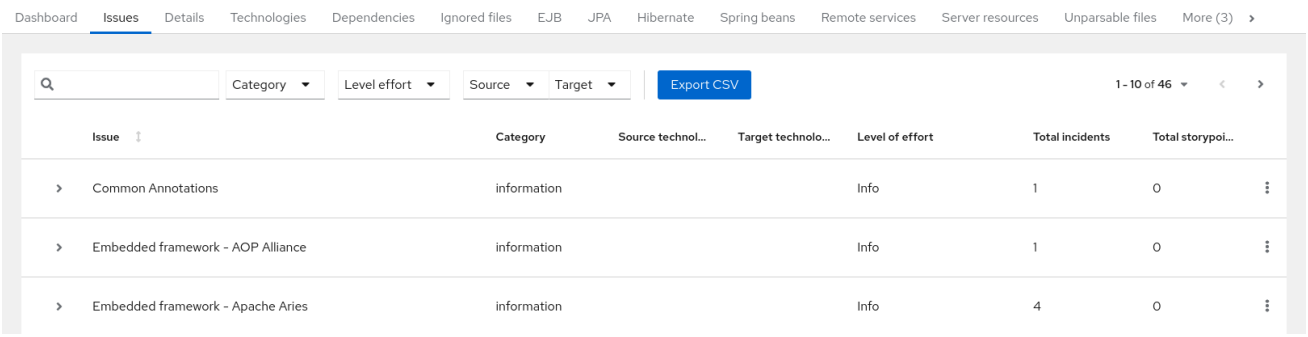
3.1.2. Issues report

Access this report from the dashboard by clicking the **Issues** link.

This report includes details about every issue that was raised by the selected migration paths. The following information is provided for each issue encountered:

- A title to summarize the issue.
- The total number of incidents, or times the issue was encountered.
- The rule story points to resolve a single instance of the issue.
- The estimated level of effort to resolve the issue.
- The total story points to resolve every instance encountered. This is calculated by multiplying the number of incidents found by the story points per incident.

Figure 3.4. Issues report



Each reported issue may be expanded, by clicking on the title, to obtain additional details. The following information is provided.

- A list of files where the incidents occurred, along with the number of incidents within each file. If the file is a Java source file, then clicking the filename will direct you to the corresponding Source report.
- A detailed description of the issue. This description outlines the problem, provides any known solutions, and references supporting documentation regarding either the issue or resolution.
- A direct link, entitled **Show Rule**, to the rule that generated the issue.

Figure 3.5. Expanded issue

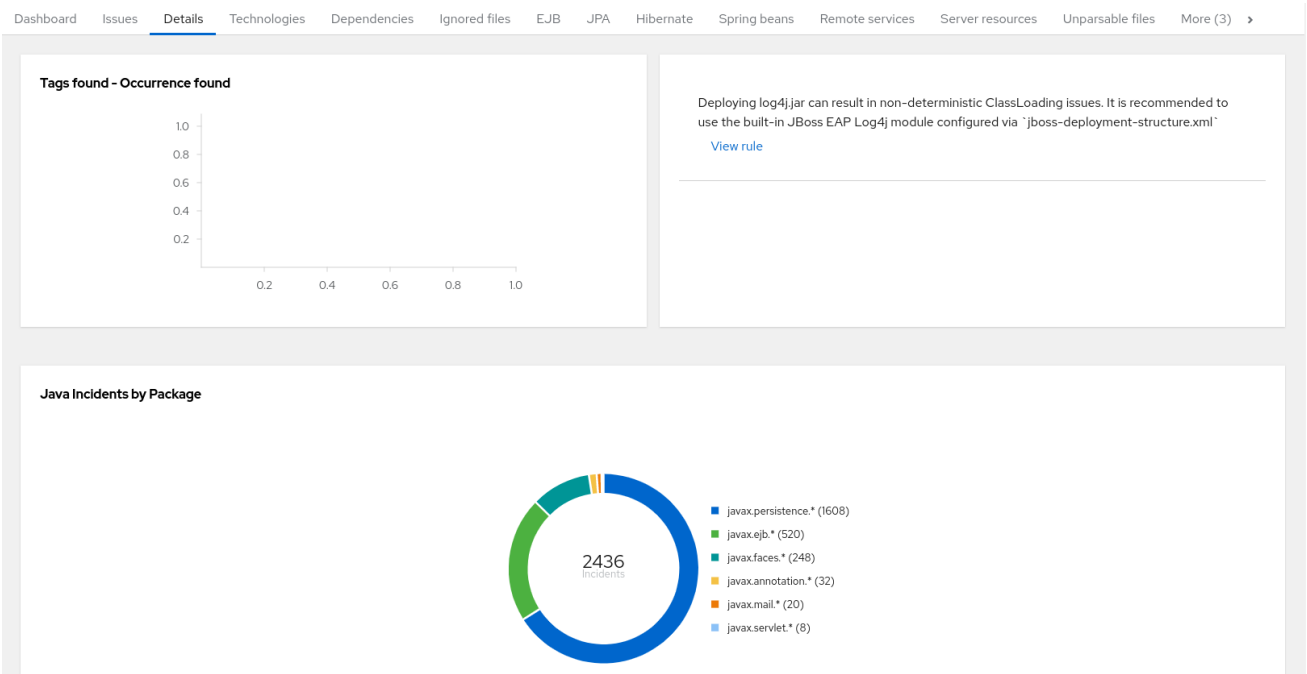
Issues are sorted into four categories by default. Information on these categories is available at ask Category.

3.1.3. Application details report

Access this report from the dashboard by clicking the **Application Details** link.

The report lists the story points, the Java incidents by package, and a count of the occurrences of the technologies found in the application. Next is a display of application messages generated during the migration process. Finally, there is a breakdown of this information for each archive analyzed during the process.

Figure 3.6. Application Details report

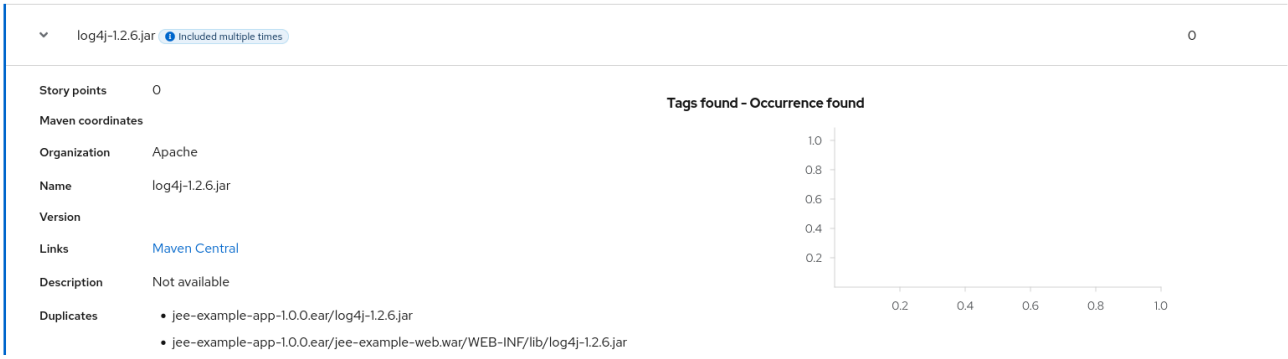


Expand the **jee-example-app-1.0.0.ear/jee-example-services.jar** to review the story points, Java incidents by package, and a count of the occurrences of the technologies found in this archive. This summary begins with a total of the story points assigned to its migration, followed by a table detailing the changes required for each file in the archive. The report contains the following columns.

Column Name	Description
Name	The name of the file being analyzed.
Technology	The type of file being analyzed, for example, **Decompiled Java File** or **Properties**.
Issues	Warnings about areas of code that need review or changes.
Story Points	Level of effort required to migrate the file.

Note that if an archive is duplicated several times in an application, it will be listed just once in the report and will be tagged with **[Included multiple times]**.

Figure 3.7. Duplicate archive in an application



The story points for archives that are duplicated within an application will be counted only once in the total story point count for that application.

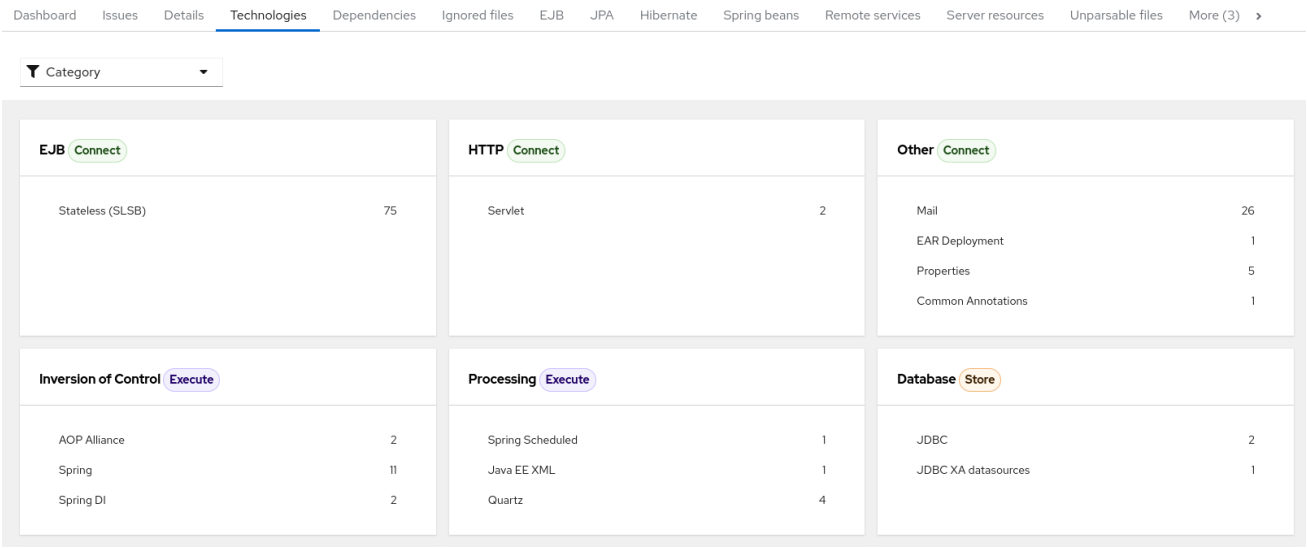
3.1.4. Technologies report

Access this report from the dashboard by clicking the **Technologies** link.

The report lists the occurrences of technologies, grouped by function, in the analyzed application. It is an overview of the technologies found in the application, and is designed to assist users in quickly understanding each application's purpose.

The image below shows the technologies used in the **jee-example-app**.

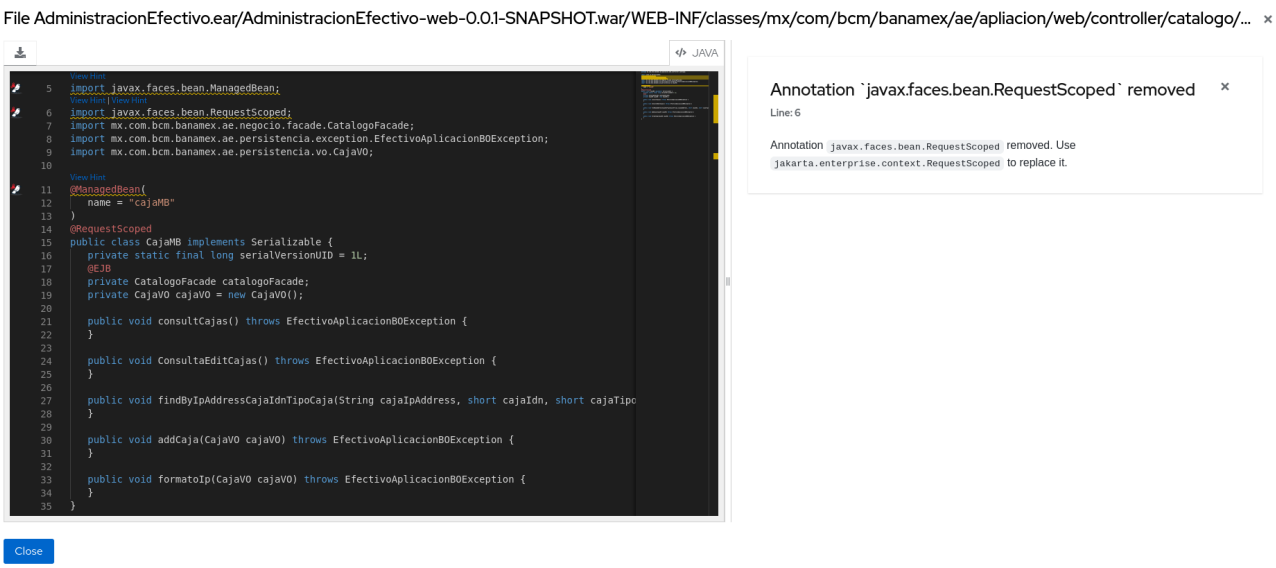
Figure 3.8. Technologies in an application



3.1.5. Source report

The Source report displays the migration issues in the context of the source file in which they were discovered.

Figure 3.9. Source report



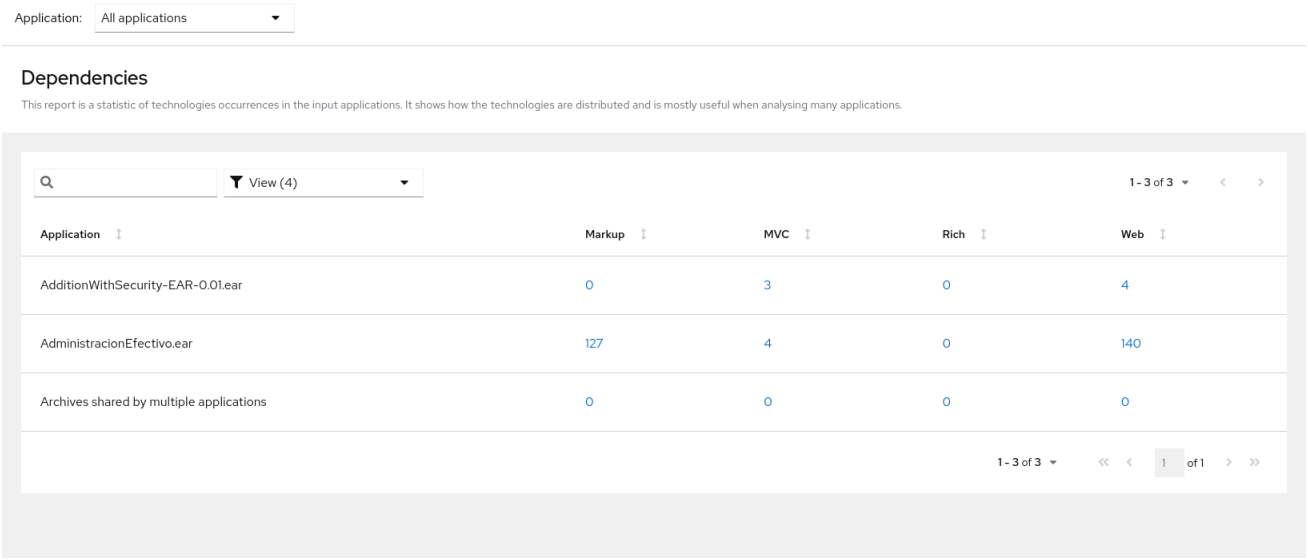
3.2. TECHNOLOGIES REPORT

Access this report from the report landing page by clicking the **Technologies** link.

This report provides an aggregate listing of the technologies used, grouped by function, for the analyzed applications. It shows how the technologies are distributed, and is typically reviewed after analyzing a large number of applications to group the applications and identify patterns. It also shows the size, number of libraries, and story point totals of each application.

Clicking any of the headers, such as **Markup**, sorts the results in descending order. Selecting the same header again will resort the results in ascending order. The currently selected header is identified in bold, next to a directional arrow, indicating the direction of the sort.

Figure 3.10. Technologies used across multiple applications



3.3. SELECTING PACKAGES

A space-delimited list of the packages to be evaluated by MTA. It is highly recommended to use this argument.

Usage

- In most cases, you are interested only in evaluating custom application class packages and not standard Java EE or third party packages. The **<PACKAGE_N>** argument is a package prefix; all subpackages will be scanned. For example, to scan the packages **com.mycustomapp** and **com.myotherapp**, use **--packages com.mycustomapp com.myotherapp** argument on the command line.

- While you can provide package names for standard Java EE third party software like **org.apache**, it is usually best not to include them as they should not impact the migration effort.