Integrating Red Hat Process Automation Manager with other products and components
Integrating Red Hat Process Automation Manager with other products and components
Abstract

This document describes how to integrate Red Hat Process Automation Manager with other products and components, such as Spring Boot, Red Hat Single Sign-On, and other supported products.
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# Red Hat Process Automation Manager 7.11

## Integrating Red Hat Process Automation Manager with other products and components

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As a developer or system administrator, you can integrate Red Hat Process Automation Manager with other products and components, such as Spring Boot, Red Hat Single Sign-On, and other supported products.
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.
PART I. CREATING RED HAT PROCESS AUTOMATION MANAGER BUSINESS APPLICATIONS WITH SPRING BOOT

As a developer, you can use Spring Boot starters through the business applications website to quickly create Red Hat Process Automation Manager business applications, configure those applications, and deploy them to an existing service or in the cloud.
CHAPTER 1. RED HAT PROCESS AUTOMATION MANAGER
SPRING BOOT BUSINESS APPLICATIONS

Spring Framework is a Java platform that provides comprehensive infrastructure support for developing Java applications. Spring Boot is a lightweight framework based on Spring Boot starters. Spring Boot starters are pom.xml files that contain a set of dependency descriptors that you can include in your Spring Boot project.

Red Hat Process Automation Manager Spring Boot business applications are flexible, UI-agnostic logical groupings of individual services that provide certain business capabilities. Business applications are based on Spring Boot starters. They are usually deployed separately and can be versioned individually. A complete business application enables a domain to achieve specific business goals, for example order management or accommodation management.

On the business application website you can create a Process Automation Manager, Decision Manager, or Red Hat build of OptaPlanner business application. After you create and configure your business application, you can deploy it to an existing service or to the cloud, through OpenShift.

Business applications can contain one or more of the following projects and more than one project of the same type:

- Business assets (KJAR): Contains business processes, rules, and forms and are easily imported into Business Central.

- Data model: Data model projects provide common data structures that are shared between the service projects and business assets projects. This enables proper encapsulation, promotes reuse, and reduces shortcuts. Each service project can expose its own public data model.

- Service: A deployable project that provides the actual service with various capabilities. It includes the business logic that operates your business. In most cases, a service project includes business assets and data model projects. A business application can split services into smaller component service projects for better manageability.
CHAPTER 2. CREATING A BUSINESS APPLICATION

You can use the business application website to quickly and easily create business applications using the Spring Boot framework. Doing this by-passes the need to install and configure Red Hat Process Automation Manager.

Procedure

1. Enter the following URL in a web browser:
   
   https://start.jbpm.org

2. Click Configure your business application

3. Click Business Automation and click Next.

4. Enter a package and application name.

5. Select Enterprise 7.11 from the Version menu and click Next.

   **NOTE**
   
   You must select Enterprise 7.11 to create a Red Hat Process Automation Manager business application.

6. Select the project types that you want to include in your project. You can include more than one project type.

   - **Business Assets**: Contains business processes, rules, and forms and are easily imported into Business Central. Select Dynamic Assets instead if you want to add adaptive and dynamic assets such as cases.

   - **Data Model**: Provides common data structures that are shared between the service projects and business assets projects. This enables proper encapsulation, promotes reuse, and reduces shortcuts. Each service project can expose its own public data model.

   - **Service**: Includes business logic that operates your business.

7. Click Generate business application
   
   The <BUSINESS-APPLICATION>.zip file downloads, where <BUSINESS-APPLICATION> is the name that you entered in the Application Name box.

CHAPTER 3. APACHE MAVEN AND RED HAT PROCESS AUTOMATION MANAGER SPRING BOOT APPLICATIONS

Apache Maven is a distributed build automation tool used in Java application development to create, manage, and build software projects. Maven uses standard configuration files called Project Object Model (POM) files to define projects and manage the build process. POM files describe the module and component dependencies, build order, and targets for the resulting project packaging and output using an XML file. This ensures that the project is built in a correct and uniform manner.

A Maven repository stores Java libraries, plug-ins, and other build artifacts. The default public repository is the Maven 2 Central Repository, but repositories can be private and internal within a company to share common artifacts among development teams. Repositories are also available from third parties.

You can use the online Maven repository with your Spring Boot projects or you can download the Red Hat Process Automation Manager Maven repository. The recommended approach is to use the online Maven repository with your Spring Boot projects. Maven settings used with a repository manager or repository on a shared server provide better control and manageability of projects.

3.1. CONFIGURING A RED HAT PROCESS AUTOMATION MANAGER SPRING BOOT PROJECT FOR THE ONLINE MAVEN REPOSITORY

After you create your Red Hat Process Automation Manager Spring Boot project, configure it with the online Maven Repository to store your application data.

Prerequisites

- You have created a Red Hat Process Automation Manager Spring Boot project.

Procedure

1. In the directory that contains your Red Hat Process Automation Manager Spring Boot application, open the `<BUSINESS-APPLICATION>-service/pom.xml` file in a text editor or IDE, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.

2. Add the following repository to the `repositories` element:

   ```xml
   <repository>
   <id>JBoss-enterprise-repository-group</id>
   <name>Red Hat JBoss Enterprise Maven Repository</name>
   <url>https://maven.repository.redhat.com/ga/</url>
   <layout>default</layout>
   <releases>
   <updatePolicy>never</updatePolicy>
   </releases>
   <snapshots>
   <updatePolicy>daily</updatePolicy>
   </snapshots>
   </repository>
   ```

3. Add the following plug-in repository to the `pluginRepositories` element:
NOTE

If your pom.xml file does not have the pluginRepositories element, add it as well.

```xml
<pluginRepository>
  <id>jboss-enterprise-repository-group</id>
  <name>Red Hat JBoss Enterprise Maven Repository</name>
  <url>https://maven.repository.redhat.com/ga/</url>
  <layout>default</layout>
  <releases>
    <updatePolicy>never</updatePolicy>
  </releases>
  <snapshots>
    <updatePolicy>daily</updatePolicy>
  </snapshots>
</pluginRepository>
```

Doing this adds the productized Maven repository to your business application.

3.2. DOWNLOADING AND CONFIGURING THE RED HAT PROCESS AUTOMATION MANAGER MAVEN REPOSITORY

If you do not want to use the online Maven repository, you can download and configure the Red Hat Process Automation Manager Maven repository. The Red Hat Process Automation Manager Maven repository contains many of the requirements that Java developers typically use to build their applications. This procedure describes how to edit the Maven settings.xml file to configure the Red Hat Process Automation Manager Maven repository.

NOTE

When you configure the repository by modifying the Maven settings.xml file, the changes apply to all of your Maven projects.

Prerequisites

- You have created a Red Hat Process Automation Manager Spring Boot project.

Procedure

1. Navigate to the Software Downloads page in the Red Hat Customer Portal (login required), and select the following product and version from the drop-down options:
   - Product: Process Automation Manager
   - Version: 7.11


3. Extract the downloaded archive.

4. Change to the ~/.m2/ directory and open the Maven settings.xml file in a text editor or integrated development environment (IDE).
5. Add the following lines to the `<profiles>` element of the Maven `settings.xml` file, where `<MAVEN_REPOSITORY>` is the path of the Maven repository that you downloaded. The format of `<MAVEN_REPOSITORY>` must be `file://$PATH`, for example `file:///home/userX/rhpam-7.11.0.GA-maven-repository/maven-repository`.

```xml
<profile>
  <id>red-hat-enterprise-maven-repository</id>
  <repositories>
    <repository>
      <id>red-hat-enterprise-maven-repository</id>
      <url>MAVEN_REPOSITORY</url>
      <releases>
        <enabled>true</enabled>
      </releases>
      <snapshots>
        <enabled>false</enabled>
      </snapshots>
    </repository>
  </repositories>
  <pluginRepositories>
    <pluginRepository>
      <id>red-hat-enterprise-maven-repository</id>
      <url>MAVEN_REPOSITORY</url>
      <releases>
        <enabled>true</enabled>
      </releases>
      <snapshots>
        <enabled>false</enabled>
      </snapshots>
    </pluginRepository>
  </pluginRepositories>
</profile>
```

6. Add the following lines to the `<activeProfiles>` element of the Maven `settings.xml` file and save the file.

```xml
<activeProfile>red-hat-enterprise-maven-repository</activeProfile>
```

**IMPORTANT**

If your Maven repository contains outdated artifacts, you might encounter one of the following Maven error messages when you build or deploy your project, where `<ARTIFACT_NAME>` is the name of a missing artifact and `<PROJECT_NAME>` is the name of the project you are trying to build:

- **Missing artifact `<PROJECT_NAME>`**
- **[ERROR] Failed to execute goal on project `<ARTIFACT_NAME>`; Could not resolve dependencies for `<PROJECT_NAME>`**

To resolve the issue, delete the cached version of your local repository located in the `~/.m2/repository` directory to force a download of the latest Maven artifacts.
CHAPTER 4. SPRING SECURITY WITH RED HAT PROCESS AUTOMATION MANAGER

Spring Security is provided by a collection of servlet filters that make up the Spring Security library. These filters provide authentication through user names and passwords and authorization through roles. The default Spring Security implementation generated in a Red Hat Process Automation Manager Spring Boot application provides authorization without authentication. This means that anyone with a user name and password valid for the application can access the application without a role.

The servlet filters protect your Spring Boot application against common exploits such as cross-site request forgery (CSRF) and cross-origin resource sharing (CORS). Spring Web relies on the DispatcherServlet to redirect incoming HTTP requests to your underlying java REST resources annotated with the @Controller annotation. The DispatchServlet is agnostic of elements such as security. It is good practice and more efficient to handle implementation details such a security outside of the business application logic. Therefore, Spring uses filters to intercept HTTP requests before routing them to the DispatchServlet.

A typical Spring Security implementation consists of the following steps that use multiple servlet filters:

1. Extract and decode or decrypt user credentials from the HTTP request.
2. Complete authentication by validating the credentials against the corporate identity provider, for example a database, a web service, or Red Hat Single Sign-On.
3. Complete authorization by determining whether the authorized user has access rights to perform the request.
4. If the user is authenticated and authorized, propagate the request to the DispatchServlet.

Spring breaks these steps down into individual filters and chains them together in a FilterChain. This chaining method provides the flexibility required to work with almost any identity provider and security framework. With Spring Security, you can define a FilterChain for your application programmatically. The following section is from the business-application-service/src/main/java/com/company/service/DefaultWebSecurityConfig.java file generated as part of a business application created on the https://start.jbpm.org web site.

```java
@Configuration("kieServerSecurity")
@EnableWebSecurity
public class DefaultWebSecurityConfig extends WebSecurityConfigurerAdapter {

    @Override (1)
    protected void configure(HttpSecurity http) throws Exception {
        http
            .cors().and()
            .csrf().disable()       (2)
            .authorizeRequests()    (3)
            .antMatchers("/rest/*").authenticated().and()
            .httpBasic().and()      (4)
            .headers().frameOptions().disable();    (5)
    }

    @Override (1)
    protected void configure(HttpSecurity http) throws Exception {
        http
            .cors().and()
            .csrf().disable()       (2)
            .authorizeRequests()    (3)
            .antMatchers("/rest/*").authenticated().and()
            .httpBasic().and()      (4)
            .headers().frameOptions().disable();    (5)
    }

    @Override (1)
    protected void configure(HttpSecurity http) throws Exception {
        http
            .cors().and()
            .csrf().disable()       (2)
            .authorizeRequests()    (3)
            .antMatchers("/rest/*").authenticated().and()
            .httpBasic().and()      (4)
            .headers().frameOptions().disable();    (5)
    }

    @Override (1)
    protected void configure(HttpSecurity http) throws Exception {
        http
            .cors().and()
            .csrf().disable()       (2)
            .authorizeRequests()    (3)
            .antMatchers("/rest/*").authenticated().and()
            .httpBasic().and()      (4)
            .headers().frameOptions().disable();    (5)
    }

    @Override (1)
    protected void configure(HttpSecurity http) throws Exception {
        http
            .cors().and()
            .csrf().disable()       (2)
            .authorizeRequests()    (3)
            .antMatchers("/rest/*").authenticated().and()
            .httpBasic().and()      (4)
            .headers().frameOptions().disable();    (5)
    }
```

- (1) Overrides the default configure(HttpSecurity http) method and defines a custom FilterChain using the Spring HttpClient fluent API/DSL
- (2) Disables common exploit filters for CORS and CSRF tokens for local testing
● (3) Requires authentication for any requests made to the pattern 'rest/*' but no roles are defined

● (4) Allows basic authentication through the authorization header, for example header 'Authorization: Basic dGVzdF9ic2VyOnBhc3N3b3Jk'

● (5) Removes the 'X-Frame-Options' header from request/response

This configuration allows any authenticated user to execute the KIE API.

Because the default implementation is not integrated into any external identity provider, users are defined in memory, in the same DefaultWebSecurityConfig class. The following section shows the users that are provided when you create a Red Hat Process Automation Manager Spring Boot business application:

```java
@Configuration("kieServerSecurity")
@EnableWebSecurity
public class DefaultWebSecurityConfig extends WebSecurityConfigurerAdapter {

    @Override
    protected void configure(HttpSecurity http) throws Exception {
        http
            .antMatchers("/rest/**").authenticated().and();
    }
}
```

4.1. USING SPRING SECURITY TO AUTHENTICATE WITH AUTHORIZATION

By default, anyone with a user name and password valid for the Red Hat Process Automation Manager Spring Boot application can access the application without requiring a role. Spring Security authentication and authorization are derived from the HTTPSecurity filter chain configuration. To protect the REST API from users that do not have a specific role mapping, use the Spring Security .authorizeRequests() method to match the URLs that you want to authorize.

Prerequisites

● You have a Red Hat Process Automation Manager Spring Boot application.

Procedure

1. In the directory that contains your Red Hat Process Automation Manager Spring Boot application, open the business-application-service/src/main/java/com/company/service/DefaultWebSecurityConfig.java file in a text editor or IDE.

2. To authorize requests for access by an authenticated user only if they have a specific role, edit the .antMatchers("/rest/**").authenticated().and() line in one of the following ways:

   ● To authorize for a single role, edit the antMatchers method as shown in the following example, where <role> is the role that the user must have for access:

```java
@Configuration("kieServerSecurity")
@EnableWebSecurity
public class DefaultWebSecurityConfig extends WebSecurityConfigurerAdapter {

    @Override
    protected void configure(HttpSecurity http) throws Exception {
        http
            .antMatchers("/rest/**").authenticated().and();
    }
}
```
To authorize a user that has one of a range of roles, edit the `antMatchers` method as shown in the following example, where `<role>` and `<role1>` are each roles the user can have for access:

```java
@Configuration("kieServerSecurity")
@EnableWebSecurity
public class DefaultWebSecurityConfig extends WebSecurityConfigurerAdapter {
    @Override
    protected void configure(HttpSecurity http) throws Exception {
        http
            .cors().and().csrf().disable()
            .authorizeRequests()
            .antMatchers("/**").hasAnyRole("<role>", "<role1>"
            .anyRequest().authenticated()
            .and().httpBasic()
            .and().headers().frameOptions().disable();
    }
}
```

The `authorizeRequests` method requires authorization of requests for a specific expression. All requests must be successfully authenticated. Authentication is performed using HTTP basic authentication. If an authenticated user tries to access a resource that is protected for a role that they do not have, the user receives an HTTP 403 (Forbidden) error.

## 4.2. DISABLING SPRING SECURITY IN A RED HAT PROCESS AUTOMATION MANAGER BUSINESS APPLICATION

You can configure Spring Security in a Red Hat Process Automation Manager business application to provide the security context without authentication.

### Prerequisites
- You have a Red Hat Process Automation Manager Spring Boot application.

### Procedure
1. In the directory that contains your Red Hat Process Automation Manager Spring Boot application, open the `business-application-service/src/main/java/com/company/service/DefaultWebSecurityConfig.java` file in a text editor or integrated development environment (IDE).
2. Edit the `.antMatchers` method as shown in the following example:
The *PermitAll* method allows any and all requests for the specified URL pattern.

**NOTE**

Because no security context is passed in the *HttpServletRequest*, Spring creates an *AnonymousAuthenticationToken* and populates the *SecurityContext* with the *anonymousUser* user with no designated roles other than the *ROLE_ANONYMOUS* role. The user will not have access to many of the features of the application, for example they will be unable to assign actions to group assigned tasks.

### 4.3. USING SPRING SECURITY WITH PREAUTHENTICATION

If you disable Spring Security authentication by using the *PermitAll* method, any user can log in to the application, but users will have limited access and functionality. However, you can preauthenticate a user, for example a designated service account, so a group of users can use the same login but have all of the permissions that they require. That way, you do not need to create credentials for each user.

The easiest way to implement preauthentication is to create a custom filter servlet and add it before the security FilterChain in the *DefaultWebSecurityConfig* class. This way, you can inject a customized, profile-based security context, control its contents, and keep it simple.

**Prerequisites**

- You have a Red Hat Process Automation Manager Spring Boot application and you have disabled Spring Security as Section 4.2, "Disabling Spring Security in a Red Hat Process Automation Manager business application".

**Procedure**

1. Create the following class that extends the *AnonymousAuthenticationFilter* class:

```java
protected void configure(HttpSecurity http) throws Exception {
    http
        .cors().and().csrf().disable()
        .authorizeRequests()
        .antMatchers("/**")
        .permitAll()
        .and().headers().frameOptions().disable();
}
```

The *PermitAll* method allows any and all requests for the specified URL pattern.

```java
import org.springframework.security.authentication.AnonymousAuthenticationToken;
import org.springframework.security.core.Authentication;
import org.springframework.security.core.AuthenticationException;
import org.springframework.security.core.GrantedAuthority;
import org.springframework.security.core.authority.SimpleGrantedAuthority;
import org.springframework.security.core.context.SecurityContextHolder;
import org.springframework.security.web.authentication.AnonymousAuthenticationFilter;
import javax.servlet.FilterChain;
import javax.servlet.ServletException;
import javax.servlet.ServletRequest;
import javax.servlet.ServletResponse;
import javax.servlet.http.HttpServletRequest;
```
2. Replace the following variables:

- Replace `<CLASS_NAME>` with a name for this class, for example `AnonymousAuthFilter`.
- Replace `<ANONYMOUS_USER>` with a user ID, for example `Service_Group`.
- Replace `<ROLE>` with the role that has the privileges that you want to give to `<ANONYMOUS_USER>`.

3. If you want to give `<ANONYMOUS_USER>` more than one role, add additional roles as shown in the following example:
4. Add `.anonymous().authenticationFilter(new <CLASS_NAME>()) .and()` to the `business-application-service/src/main/java/com/company/service/DefaultWebSecurityConfig.java` file, where `<CLASS_NAME>` is the name of the class that you created:

```java
@Override
protected void configure(HttpSecurity http) throws Exception {

    http
        .anonymous().authenticationFilter(new <CLASS_NAME>()) .and() // Override anonymousUser
    .cors().and().csrf().disable()
    .authorizeRequests()
    .antMatchers("/*").permitAll()
    .and().headers().frameOptions().disable();
}
```

### 4.4. CONFIGURING THE BUSINESS APPLICATION WITH RED HAT SINGLE SIGN-ON

Most organizations provide user and group details through single sign-on (SSO) tokens. You can use Red Hat Single Sign-On (RHSSO) to enable single sign-on between your services and to have a central place to configure and manage your users and roles.

**Prerequisites**

- You have a Spring Boot application ZIP file that you created using the business applications website.

**Procedure**

1. Download and install RHSSO. For instructions, see the [Red Hat Single Sign-On Getting Started Guide](#).

2. Configure RHSSO:
   a. Either use the default master realm or create a new realm.
      A realm manages a set of users, credentials, roles, and groups. A user belongs to and logs into a realm. Realms are isolated from one another and can only manage and authenticate the users that they control.

   b. Create the `springboot-app` client and set the `AccessType` to public.

   c. Set a valid redirect URI and web origin according to your local setup, as shown in the following example:

      - Valid redirect URIs: `http://localhost:8090/*`
      - Web origin: `http://localhost:8090`

   d. Create realm roles that are used in the application.
e. Create users that are used in the application and assign roles to them.

3. Add the following element and property to the Spring Boot project `pom.xml` file, where `<KEYCLOAK_VERSION>` is the version of Keycloak that you are using:

```xml
<properties>
  <version.org.keycloak><KEYCLOAK_VERSION></version.org.keycloak>
</properties>
```

4. Add the following dependencies to the Spring Boot project `pom.xml` file:

```xml
<dependencyManagement>
  <dependencies>
    <dependency>
      <groupId>org.keycloak.bom</groupId>
      <artifactId>keycloak-adapter-bom</artifactId>
      <version>${version.org.keycloak}</version>
      <type>pom</type>
      <scope>import</scope>
    </dependency>
  </dependencies>
</dependencyManagement>

....

<dependency>
  <groupId>org.keycloak</groupId>
  <artifactId>keycloak-spring-boot-starter</artifactId>
</dependency>
```

5. In your Spring Boot project directory, open the `business-application-service/src/main/resources/application.properties` file and add the following lines:

```
# keycloak security setup
keycloak.auth-server-url=http://localhost:8100/auth
keycloak.realm=master
keycloak.resource=springboot-app
keycloak.public-client=true
keycloak.principal-attribute=preferred_username
keycloak.enable-basic-auth=true
```

6. Modify the `business-application-service/src/main/java/com/company/service/DefaultWebSecurityConfig.java` file to ensure that Spring Security works correctly with RHSSO:

```java
import org.keycloak.adapters.KeycloakConfigResolver;
import org.keycloak.adapters.springboot.KeycloakSpringBootConfigResolver;
import org.keycloak.adapters.springsecurity.authentication.KeycloakAuthenticationProvider;
import org.keycloak.adapters.springsecurity.config.KeycloakWebSecurityConfigurerAdapter;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.context.annotation.Bean;
import org.springframework.context.annotation.Configuration;
import org.springframework.security.config.annotation.authentication.builders.AuthenticationManagerBuilder;
```
import org.springframework.security.config.annotation.web.builders.HttpSecurity;
import org.springframework.security.config.annotation.web.configuration.EnableWebSecurity;
import org.springframework.security.core.authority.mapping.SimpleAuthorityMapper;
import org.springframework.security.core.session.SessionRegistryImpl;
import org.springframework.security.web.authentication.session.RegisterSessionAuthenticationStrategy;
import org.springframework.security.web.authentication.session.SessionAuthenticationStrategy;

@Configuration("kieServerSecurity")
@EnableWebSecurity
public class DefaultWebSecurityConfig extends KeycloakWebSecurityConfigurerAdapter {

    @Override
    protected void configure(HttpSecurity http) throws Exception {
        super.configure(http);
        http.csrf().disable().authorizeRequests().anyRequest().authenticated().and().httpBasic();
    }

    @Autowired
    public void configureGlobal(AuthenticationManagerBuilder auth) throws Exception {
        KeycloakAuthenticationProvider keycloakAuthenticationProvider =
        keycloakAuthenticationProvider();
        SimpleAuthorityMapper mapper = new SimpleAuthorityMapper();
        mapper.setPrefix("");
        keycloakAuthenticationProvider.setGrantedAuthoritiesMapper(mapper);
        auth.authenticationProvider(keycloakAuthenticationProvider);
    }

    @Bean
    public KeycloakConfigResolver KeycloakConfigResolver() {
        return new KeycloakSpringBootConfigResolver();
    }

    @Override
    protected SessionAuthenticationStrategy sessionAuthenticationStrategy() {
        return new RegisterSessionAuthenticationStrategy(new SessionRegistryImpl());
    }
}
CHAPTER 5. RED HAT PROCESS AUTOMATION MANAGER
SPRING BOOT CONFIGURATION

After you create your Spring Boot project, you can configure several components to customize your application.

5.1. CONFIGURING REST ENDPOINTS FOR SPRING BOOT APPLICATIONS

After you create your Spring Boot project, you can configure the host, port, and path for the REST endpoint for your Spring Boot application.

Prerequisites

- You have a ZIP file that you created using the business application website.

Procedure

1. Extract the Spring Boot project ZIP file and navigate to the `<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service/src/main/resources` folder, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.

2. Open the `application.properties` file in a text editor.

3. Configure the host, port, and path for the REST endpoints, where `<ADDRESS>` is the server address and `<PORT>` is the server port:

   ```
   server.address=<ADDRESS>
   server.port=<PORT>
   cxf.path=/rest
   ```

   The following example adds the REST endpoint to the address `localhost` on port 8090.

   ```
   server.address=localhost
   server.port=8090
   cxf.path=/rest
   ```

5.2. CONFIGURING THE KIE SERVER IDENTITY

After you create your Spring Boot project, you can configure KIE Server so that it can be easily identified.

Prerequisites

- You have a Spring Boot business application ZIP file that you created using the business application website.

Procedure

1. Extract the Spring Boot project ZIP file and navigate to the `<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service/src/main/resources` folder, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.
2. Open the `application.properties` file in a text editor.

3. Configure the KIE Server parameters as shown in the following example:

   ```
   kieserver.serverId=<BUSINESS-APPLICATION>-service
   kieserver.serverName=<BUSINESS-APPLICATION>-service
   kieserver.location=http://localhost:8090/rest/server
   kieserver.controllers=http://localhost:8080/business-central/rest/controller
   ```

The following table describes the KIE Server parameters that you can configure in your business project:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>kieserver.serverId</td>
<td>string</td>
<td>The ID used to identify the business application when connecting to the Process Automation Manager controller.</td>
</tr>
<tr>
<td>kieserver.serverName</td>
<td>string</td>
<td>The name used to identify the business application when it connects to the Process Automation Manager controller. Can be the same string used for the <code>kieserver.serverId</code> parameter.</td>
</tr>
<tr>
<td>kieserver.location</td>
<td>URL</td>
<td>Used by other components that use the REST API to identify the location of this server. Do not use the location as defined by <code>server.address</code> and <code>server.port</code>.</td>
</tr>
<tr>
<td>kieserver.controllers</td>
<td>URLs</td>
<td>A comma-separated list of controller URLs.</td>
</tr>
</tbody>
</table>

### 5.3. INTEGRATING APACHE KAFKA WITH YOUR RED HAT PROCESS AUTOMATION MANAGER SPRING BOOT PROJECT

Apache Kafka is a distributed data streaming platform that can publish, subscribe to, store, and process streams of records in real time. It is designed to handle data streams from multiple sources and deliver them to multiple consumers. Apache Kafka is an alternative to a traditional enterprise messaging system.

You can integrate Apache Kafka with your Red Hat Process Automation Manager Spring Boot project.

**Prerequisites**

- You have an existing Red Hat Process Automation Manager Spring Boot project.

**Procedure**

1. In your Spring Boot project directory, open the `business-application-service/src/main/resources/application.properties` file.

2. Add the `kieserver.kafka.enabled` system property with value `true`:
Additional resources

- Integrating Red Hat Process Automation Manager with Red Hat AMQ Streams

5.4. CONFIGURING KIE SERVER COMPONENTS TO START AT RUNTIME

If you selected Business Automation when you created your Spring Boot business application, you can specify which KIE Server components must start at runtime.

Prerequisites

- You have a Spring Boot business application ZIP file that you created using the business application website.

Procedure

1. Extract the Spring Boot project ZIP file and navigate to the <BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service/src/main/resources folder, where <BUSINESS-APPLICATION> is the name of your Spring Boot project.

2. Open the application.properties file in a text editor.

3. To set a component to start at runtime, set the value of the component to **true**.

   The following table lists the components that you can set to start at runtime:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>kieserver.drools.enabled</td>
<td>true, false</td>
<td>Enables or disables the Decision Manager component.</td>
</tr>
<tr>
<td>kieserver.dmn.enabled</td>
<td>true, false</td>
<td>Enables or disables the Decision Model and Notation (DMN) component.</td>
</tr>
<tr>
<td>kieserver.jbpm.enabled</td>
<td>true, false</td>
<td>Enables or disables the Red Hat Process Automation Manager component.</td>
</tr>
<tr>
<td>kieserver.jbpmui.enabled</td>
<td>true, false</td>
<td>Enables or disables the Red Hat Process Automation Manager UI component.</td>
</tr>
<tr>
<td>kieserver.casemgmt.enabled</td>
<td>true, false</td>
<td>Enables or disables the case management component.</td>
</tr>
</tbody>
</table>

5.5. CONFIGURING YOUR SPRING BOOT APPLICATION FOR ASYNCHRONOUS EXECUTION
After you create your Spring Boot project, you can use the `jbpm.executor` parameters to enable asynchronous execution.

**Prerequisites**

- You have a Spring Boot business application ZIP file that you created using the [business application](#) website.

**Procedure**

1. Extract the Spring Boot project ZIP file and navigate to the `<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service/src/main/resources` folder, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.

2. Open the `application.properties` file in a text editor.

3. To enable asynchronous execution, set the value of the `jbpm.executor.enabled` parameter to `true`, uncomment the other `jbpm.executor` parameters, and change the values as required, as shown in the following example:

   ```properties
   jbpm.executor.enabled=true
   jbpm.executor.retries=5
   jbpm.executor.interval=0
   jbpm.executor.threadPoolSize=1
   jbpm.executor.timeUnit=SECONDS
   ```

The following table describes the executor parameters that you can configure in your business project:

**Table 5.3. Executor parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>jbpm.executor.enabled</code></td>
<td><code>true, false</code></td>
<td>Disables or enables the executor component.</td>
</tr>
<tr>
<td><code>jbpm.executor.retries</code></td>
<td>integer</td>
<td>Specifies the number of retries if errors occur while a job is running.</td>
</tr>
<tr>
<td><code>jbpm.executor.interval</code></td>
<td>integer</td>
<td>Specifies the length of time that the executor uses to synchronize with the database. The unit of time is specified by the <code>jbpm.executor.timeUnit</code> parameter. Disabled by default (value 0).</td>
</tr>
<tr>
<td><code>jbpm.executor.threadPoolSize</code></td>
<td>integer</td>
<td>Specifies the thread pool size.</td>
</tr>
<tr>
<td><code>jbpm.executor.timeUnit</code></td>
<td>string</td>
<td>Specifies the time unit used to calculate the interval that the executor uses to synchronize with the database. The value must be a valid constant of <code>java.util.concurrent.TimeUnit</code>. The default value is SECONDS.</td>
</tr>
</tbody>
</table>
5.6. CONFIGURING THE BUSINESS APPLICATION FOR A CLUSTER USING QUARTZ

If you plan to run your application in a cluster, you must configure the Quartz timer service.

Prerequisites

- You have a ZIP file that you created using the business application website, that you want to use in a cluster.

Procedure

1. Create the `quartz.properties` file and add the following content:

```properties
#==========================================================================
# Configure Main Scheduler Properties
#==========================================================================
==
org.quartz.scheduler.instanceName = SpringBootScheduler
org.quartz.scheduler.instanceId = AUTO
org.quartz.scheduler.skipUpdateCheck=true
org.quartz.scheduler.idleWaitTime=1000
#==========================================================================
# Configure ThreadPool
#==========================================================================
==
org.quartz.threadPool.class = org.quartz.simpl.SimpleThreadPool
org.quartz.threadPool.threadCount = 5
org.quartz.threadPool.threadPriority = 5
#==========================================================================
# Configure JobStore
#==========================================================================
==
org.quartz.jobStore.misfireThreshold = 60000
org.quartz.jobStore.class=org.quartz.impl.jdbcjobstore.JobStoreCMT
org.quartz.jobStore.driverDelegateClass=org.jbpm.process.core.timer.impl.quartz.DeploymentsAwareStdJDBCDelegate
org.quartz.jobStore.useProperties=false
org.quartz.jobStore.dataSource=myDS
org.quartz.jobStore.nonManagedTXDataSource=notManagedDS
org.quartz.jobStore.tablePrefix=QRTZ_
org.quartz.jobStore.isClustered=true
org.quartz.jobStore.clusterCheckinInterval = 5000
#==========================================================================
# Configure Datasources
#==========================================================================
==
org.quartz.dataSource.myDS.connectionProvider.class=org.jbpm.springboot.quartz.SpringConnectionProvider
org.quartz.dataSource.myDS.dataSourceName=quartzDataSource
```

Red Hat Process Automation Manager 7.11 Integrating Red Hat Process Automation Manager with other products
NOTE

Data source names in the Quartz configuration file refer to Spring beans. The connection provider must be set to
org.jbpm.springboot.quartz.SpringConnectionProvider to enable integration with Spring-based data sources.

2. To enable the Quartz clustered timers and set the path of the quartz.properties file that you created in the previous step, include the following properties in the <BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service/src/main/resources/application.properties file, where <BUSINESS-APPLICATION> is the name of your Spring Boot project.

   * jbpm.quartz.enabled=true
   * jbpm.quartz.configuration=quartz.properties

3. Create a managed and an unmanaged data source by adding the following content to the <BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service/src/main/resources/application.properties file:

   ```
   # enable to use database as storage
   jbpm.quartz.db=true

   quartz.datasource.name=quartz
   quartz.datasource.username=sa
   quartz.datasource.password=sa
   quartz.datasource.url=jdbc:h2:./target/spring-boot-jbpm;MVCC=true
   quartz.datasource.driver-class-name=org.h2.Driver

   # used to configure connection pool
   quartz.datasource.dbcp2.maxTotal=15

   # used to initialize quartz schema
   quartz.datasource.initialization=true
   spring.datasource.schema=classpath*:<QUARTZ_TABLES_H2>.sql
   spring.datasource.initialization-mode=always
   ```

   In the preceding example, replace `<QUARTZ_TABLES_H2>` with the name of a Quartz H2 database schema script. The last three lines of the preceding configuration initialize the database schema.

By default, Quartz requires two data sources:

- Managed data source to participate in the transaction of the decision engine or process engine
- Unmanaged data source to look up timers to trigger without any transaction handling

Red Hat Process Automation Manager business applications assume that the Quartz database (schema) will be co-located with Red Hat Process Automation Manager tables and therefore produce data sources used for transactional operations for Quartz.
The other (non transactional) data source must be configured but it should point to the same database as the main data source.

5.7. CONFIGURING BUSINESS APPLICATION USER GROUP PROVIDERS

With Red Hat Process Automation Manager, you can manage human-centric activities. To provide integration with user and group repositories, you can use two KIE API entry points:

- **UserGroupCallback**: Responsible for verifying whether a user or group exists and for collecting groups for a specific user
- **UserInfo**: Responsible for collecting additional information about users and groups, for example email addresses and preferred language

You can configure both of these components by providing alternative code, either code provided out of the box or custom developed code.

For the **UserGroupCallback** component, retain the default implementation because it is based on the security context of the application. For this reason, it does not matter which backend store is used for authentication and authorisation (for example, RH-SSO). It will be automatically used as a source of information for collecting user and group information.

The **UserInfo** component is a separate component because it collects more advanced information.

**Prerequisites**

- You have a ZIP file that you created using the business application website and that contains a business automation project.

**Procedure**

1. To provide an alternative implementation of **UserGroupCallback**, add the following code to the Application class or a separate class annotated with `@Configuration`:

   ```java
   @Bean(name = "userGroupCallback")
   public UserGroupCallback userGroupCallback(IdentityProvider identityProvider) throws IOException {
       return new MyCustomUserGroupCallback(identityProvider);
   }
   ```

2. To provide an alternative implementation of **UserInfo**, add the following code to the Application class or a separate class annotated with `@Configuration`:

   ```java
   @Bean(name = "userInfo")
   public UserInfo userInfo() throws IOException {
       return new MyCustomUserInfo();
   }
   ```

5.8. CONFIGURING A SPRING BOOT PROJECT WITH A MYSQL OR POSTGRESQL DATABASE
Red Hat Process Automation Manager business applications are generated with the default H2 database. You can change the database type to MySQL or PostgreSQL.

**Prerequisites**

- You have a Spring Boot application file that you created using the [business applications](https://example.com) website.

**Procedure**

1. Extract the Spring Boot project ZIP file and navigate to the `<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service/src/main/resources` folder, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.

2. Open the `application.properties` file in a text editor.

3. Configure your Spring Boot project to use a MySQL or PostgreSQL, complete one of the following set of steps:

   a. To configure your business application to use a MySQL database, locate the following parameters in the `application.properties` file and change the values as shown:

   ```
   spring.datasource.username=jbpm
   spring.datasource.password=jbpm
   spring.datasource.url=jdbc:mysql://localhost:3306/jbpm
   spring.datasource.driver-class-name=com.mysql.jdbc.jdbc2.optional.MysqlXADataSource
   spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.MySQL5InnoDBDialect
   
   spring.datasource.username=jbpm
   spring.datasource.password=jbpm
   spring.datasource.url=jdbc:postgresql://localhost:5432/jbpm
   spring.datasource.driver-class-name=org.postgresql.xa.PGXADatasource
   spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.PostgreSQLDialect
   
   NOTE
   To create a PostgreSQL schema that uses the `bytea` column type instead of the `oid` column type, set the value of the `org.kie.persistence.postgresql.useBytea` property to `true`:

   ```
   org.kie.persistence.postgresql.useBytea=true
   ```
   
   b. To configure your business application to use a PostgreSQL database, locate the following parameters in the `application.properties` file and change the values as shown:

   ```
   
   4. Save the `application.properties` file.

**5.9. CONFIGURING BUSINESS APPLICATIONS FOR JPA**
The Java Persistence API (JPA) is a standard technology that enables you to map objects to relational databases. You must configure JPA for your Red Hat Process Automation Manager business application.

Prerequisites

- You have a ZIP file that you created using the business applications website.

Procedure

1. Extract the `<BUSINESS-APPLICATION>.zip` file and navigate to the `<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service/src/main/resources` folder, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.

2. Open the `application.properties` file in a text editor.

3. Locate the following parameters in the `application.properties` file and verify that they have the values shown:

   ```
   spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.H2Dialect
   spring.jpa.properties.hibernate.show_sql=false
   spring.jpa.properties.hibernate.hbm2ddl.auto=update
   spring.jpa.hibernate.naming.physical-strategy=org.hibernate.boot.model.naming.PhysicalNamingStrategyStandardImpl
   ```

4. If your business application has business automation capabilities, you can add entities to the entity manager factory by adding a comma-separated list of packages:

   ```
   spring.jpa.properties.entity-scan-packages=org.jbpm.springboot.samples.entities
   ```

Business applications with business automation capabilities create an entity manager factory based on the `persistence.xml` file that comes with Red Hat Process Automation Manager. All entities found in the `org.jbpm.springboot.samples.entities` package are automatically added to the entity manager factory and used the same as any other JPA entity in the application.

Additional resources

For more information about configuring JPA, see the `Spring Boot Reference Guide`.

5.10. CONFIGURING PLUGGABLE VARIABLE PERSISTENCE

You can provide an arbitrary entity manager for configured process variable persistence in your Red Hat Process Automation Manager Spring Boot application. To do this, add named beans during the object marshalling strategy resolution. This enables you to configure a second entity manager factory based on a second data source qualifier. Note that this configuration will not interfere with the primary data source.

Prerequisites

- You have an existing Red Hat Process Automation Manager Spring Boot project.

Procedure

1. Add a customized entity manager JavaBean to your java class. The following example shows an

   ```
   spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.H2Dialect
   spring.jpa.properties.hibernate.show_sql=false
   spring.jpa.properties.hibernate.hbm2ddl.auto=update
   spring.jpa.hibernate.naming.physical-strategy=org.hibernate.boot.model.naming.PhysicalNamingStrategyStandardImpl
   ```

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1. Add a customized entity manager JavaBean to your java class. The following example shows an entity manager Java Bean called `auditEntityManager` for a Java Persistence API (JPA) data source:

```java
@Bean(name = "auditEntityManager")
@ConditionalOnMissingBean(name = "auditEntityManager")
public LocalContainerEntityManagerFactoryBean entityManagerFactory(@Qualifier("jpaAuditDataSource") DataSource dataSource,
                    JpaProperties jpaProperties) {
    return EntityManagerFactoryHelper.create(applicationContext,
                                               dataSource,
                                               jpaProperties,
                                               "custom-persistent-unit",
                                               "classpath:/META-INF/persistence.xml");
}
```

The `auditEntityManager` becomes an implicit context parameter when the parameters are resolved during MVFLEX Expression Language (MVEL) evaluation.

2. Add the following marshalling stragegy to the `kie-deployment-descriptor.xml` file:

```xml
<marshalling-strategy>
    <resolver>mvel</resolver>
    <identifier>new org.drools.persistence.jpa.marshaller.JPAPlaceholderResolverStrategy(auditEntityManager)</identifier>
    <parameters/>
</marshalling-strategy>
```

Additional resources

- For more information about persistence, see the "Persisting process variables in a separate database schema in Red Hat Process Automation Manager" section in *Managing and monitoring KIE Server*.

5.11. ENABLING SWAGGER DOCUMENTATION

You can enable Swagger-based documentation for all endpoints available in the service project of your Red Hat Process Automation Manager business application.

Prerequisites

- You have a Spring Boot application ZIP file that you created using the business applications website.

Procedure

1. Extract the `<BUSINESS-APPLICATION>.zip` file and navigate to the `<BUSINESS-APPLICATION>/service` folder, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.

2. Open the service project `pom.xml` file in a text editor.

3. Add the following dependencies to the service project `pom.xml` file and save the file.
4. To enable the Swagger UI (optional), add the following dependency to the pom.xml file and save the file.

```xml
<dependency>
    <groupId>org.apache.cxf</groupId>
    <artifactId>cxf-rt-rs-service-description-swagger</artifactId>
    <version>3.2.6</version>
</dependency>
<dependency>
    <groupId>io.swagger</groupId>
    <artifactId>swagger-jaxrs</artifactId>
    <version>1.5.15</version>
    <exclusions>
        <exclusion>
            <groupId>javax.ws.rs</groupId>
            <artifactId>jsr311-api</artifactId>
        </exclusion>
    </exclusions>
</dependency>
```

5. Open the <BUSINESS-APPLICATION>/service/src/main/resources/application.properties file in a text editor.

6. Add the following line to the application.properties file to enable Swagger support:

```properties
kieserver.swagger.enabled=true
```

You can create a single self-contained Red Hat Process Automation Manager Spring Boot JAR file that contains a complete service, including KIE Server and one or more KJAR files. The Red Hat Process Automation Manager Spring Boot JAR file does not depend on any KJAR files loading at runtime.

If necessary, the Red Hat Process Automation Manager Spring Boot JAR file can contain multiple versions of the same KJAR file, including modules. These KJAR files can have the same `artifactID` and `groupId` attribute values, but have different `version` values.

The included KJAR files are separated from any JAR files in the `BOOT-INF/lib` directory to avoid class loader collisions. Each KJAR classpath container file is isolated from other KJAR classpath container files and does not rely on the Spring Boot class loader.

### Prerequisites

- You have an existing Red Hat Process Automation Manager Spring Boot project.
- You have completed development of one or more KJAR files for the project.

### Procedure

1. Build all KJAR files for the project. In the default business application, the KJAR source is contained in the `<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-kjar` directory, where `BUSINESS-APPLICATION` is the name of the business application. Your project might include other KJAR source directories.

   To build the KJAR files, for every KJAR source directory, complete the following steps:
   
   a. Change to the KJAR source directory.
   
   b. Enter the following command:

   ```
   mvn install
   ```

   This command builds the KJAR file and places it into the local Maven repository. By default, this repository is located in the `~/.m2/repo` directory.

2. In the `<BUSINESS-APPLICATION>/service/src/main/resources` directory, add the following property to your Spring Boot application `application.properties` file:

   ```
   kieserver.classPathContainer=true
   ```

   When this property is set to `true`, KIE Server uses the class loader used by the container to load KJAR files and their dependencies.

3. Complete one of the following actions to ensure that KIE Server loads the necessary KJAR modules:

   - To configure KIE Server to scans and deploy all KJAR modules available in the Spring Boot application, add the following property to the `application.properties` file:

     ```
     kieserver.autoScanDeployments=true
     ```
When this property is set to **true**, KIE Server deploys all KJAR modules available in the application, whether they are declared programmatically or through the Maven plug-in.

This option is the simplest method to include all KJAR modules. However, it has two drawbacks:

- The application sets all container IDs and aliases automatically, based on the group, artifact, and version (GAV) of every KJAR module. You cannot set a custom container ID or alias for a KJAR module.
- At startup time, the application scans the JAR file and the class path for KJAR modules. Therefore, the duration of startup might be increased.

To avoid these drawbacks, you can configure every KJAR module individually using the **application.properties** file or using Java source code, as described in one of the following options.

- To configure every KJAR module individually using the **application.properties** file, for each of the KJAR modules that you want to include in the service, add the following properties to the **application.properties** file:

  ```
  kieserver.deployments[<n>].containerId=<container>
kieserver.deployments[<n>].alias=<alias>
kieserver.deployments[<n>].artifactId=<artifact>
kieserver.deployments[<n>].groupId=<group>
kieserver.deployments[<n>].version=<version>
  ```

Replace the following values:

- `<n>`: A sequential number: 0 for the first KJAR module, 1 for the second module, and so on
- `<container>`: The container ID for the KJAR module
- `<alias>`: The alias for the KJAR module
- `<artifact>`: The artifact ID for the KJAR module
- `<group>`: The group ID for the KJAR module
- `<version>`: The version ID for the KJAR module

The following example configures two versions of the **Evaluation** KJAR module:

```
  kieserver.deployments[0].alias=evaluation_v1
  kieserver.deployments[0].containerId=evaluation_v1
  kieserver.deployments[0].artifactId=Evaluation
  kieserver.deployments[0].groupId=com.myspace
  kieserver.deployments[0].version=1.0.0-SNAPSHOT

  kieserver.deployments[1].alias=evaluation_v2
  kieserver.deployments[1].containerId=evaluation_v2
  kieserver.deployments[1].artifactId=Evaluation
  kieserver.deployments[1].groupId=com.myspace
  kieserver.deployments[1].version=2.0.0-SNAPSHOT
```
To configure every KJAR module individually using Java source code, create a class in your business application service, similar to the following example:

```java
@Configuration
public class KieContainerDeployer {

    @Bean
    public KieContainerResource evaluation_v1() {
        KieContainerResource container = new KieContainerResource("evaluation_v1",
                new ReleaseId("com.myspace", "Evaluation", "1.0.0-SNAPSHOT"), STARTED);
                container.setConfigItems(Arrays.asList(new
                KieServerConfigItem(KieServerConstants.PCFG_RUNTIME_STRATEGY,
                "PER_PROCESS_INSTANCE", "String")));
        return container;
    }

    @Bean
    public KieContainerResource evaluation_v2() {
        KieContainerResource container = new KieContainerResource("evaluation_v2",
                new ReleaseId("com.myspace", "Evaluation", "2.0.0-SNAPSHOT"), STARTED);
                container.setConfigItems(Arrays.asList(new
                KieServerConfigItem(KieServerConstants.PCFG_RUNTIME_STRATEGY,
                "PER_PROCESS_INSTANCE", "String")));
        return container;
    }
}
```

For every KJAR module that you want to include, create a `KieContainerResource` bean in this class. The name of the bean is the container name, the first parameter of `KieContainerResource()` is the alias name, and the parameters of `ReleaseId()` are the group ID, artifact ID, and version ID of the KJAR module.

4. Optional: If your business application will run in a Red Hat OpenShift Container Platform pod or in any other environment where the current directory is not writable, add the `spring.jta.log-dir` property to the `application.properties` file and set it to a writable location. For example:

   ```properties
   spring.jta.log-dir=/tmp
   ```

   This parameter sets the location for the transaction log.

5. In the `<BUSINESS-APPLICATION>/service` directory, add the following Maven plug-in in the Spring Boot `pom.xml` file where `<GROUP_ID>`, `<ARTIFACT_ID>`, and `<VERSION>` are the group, artifact, and version (GAV) of a KJAR artifact that your project uses. You can find these values in the `pom.xml` file that is located in the KJAR source directory.

   ```xml
   <build>
       <plugins>
           <plugin>
               <groupId>org.kie</groupId>
               <artifactId>kie-maven-plugin</artifactId>
   ```

   **NOTE**

   You can add more than one version of an artifact.
The artifacts required to run the KJAR will be resolved at build time.

The following example adds two version of the **Evaluation** artifact:

```xml
<build>
  <plugins>
    <plugin>
      <groupId>org.kie</groupId>
      <artifactId>kie-maven-plugin</artifactId>
      <version>${version.org.kie}</version>
    </plugin>
    <executions>
      <execution>
        <id>copy</id>
        <phase>prepare-package</phase>
        <goals>
          <goal>package-dependencies-kjar</goal>
        </goals>
      </execution>
    </executions>
    <configuration>
      <artifactItems>
        <artifactItem>
          <groupId>com.myspace</groupId>
          <artifactId>Evaluation</artifactId>
          <version>1.0.0-SNAPSHOT</version>
        </artifactItem>
        <artifactItem>
          <groupId>com.myspace</groupId>
          <artifactId>Evaluation</artifactId>
          <version>2.0.0-SNAPSHOT</version>
        </artifactItem>
      </artifactItems>
    </configuration>
  </plugins>
</build>
```
6. Optional: if you want to be able to configure KIE Server to communicate with a Business Central monitoring instance using WebSockets, make the following changes:

   a. Add the following lines to the pom.xml file under the <dependencies> tag:

   ```xml
   <dependency>
     <groupId>org.kie.server</groupId>
     <artifactId>kie-server-controller-websocket-client</artifactId>
     <version>${version.org.kie}</version>
   </dependency>
   ```

   WebSockets communication with a Business Central monitoring instance is supported in all cases, including running the instance on Red Hat OpenShift Container Platform.

   b. In the <BUSINESS-APPLICATION>/service/src/main/resources/application.properties file, add or change the following properties:

   ```properties
   kieserver.location=${org.kie.server.location}
   kieserver.controllers=${org.kie.server.controller}
   ```

7. To build the self-contained Spring Boot image, enter the following command in the <BUSINESS-APPLICATION>/service directory:

   ```
   mvn install
   ```

8. Optional: to run the self-contained Spring Boot image, locate the JAR file in the target subdirectory and enter the following command:

   ```
   java -jar <FILENAME>.jar
   ```

   In this command, replace <FILENAME> with the name of the JAR file.

   To configure KIE Server to connect to a Business Central monitoring instance using WebSockets and run the image, enter the following command:

   ```
   ```

   In this command, replace the following values:

   - <LOCATION> with the fully qualified host name for accessing your service. Business Central monitoring accesses the service to retrieve process information and displays a URL for the service with this host name.

   - <PORT> with the port for accessing your service, for example, 8090.

   - <BC-HOSTNAME> with the fully qualified name of the Business Central monitoring instance.
• `<BC-PORT>` with the port of the Business Central Monitoring instance, for example, `8080`

• `<USER>` with the username of a user configured on the Business Central monitoring instance

• `<PASSWORD>` with the password of the user configured on the Business Central monitoring instance

• `<FILENAME>` with the name of the JAR file

**NOTE**

This configuration uses unsecured HTTP communication for your service. If you configure your Spring Boot business application with a valid SSL certificate, you can replace `http:` with `https:` to use secure HTTPS communication. For more information about configuring SSL on Spring Boot, see [Spring Boot documentation](#).

**NOTE**

If you want to view process information from Business Central monitoring, you must ensure that the user that is logged into Business Central can also be authenticated with your service using the same password.
CHAPTER 7. BUSINESS APPLICATION EXECUTION

By default, business applications contain a single executable project, the service project. You can execute the service project on Windows or Linux, in standalone (unmanaged) or development (managed) mode. Standalone mode enables you to start your application without additional requirements. Applications started in development mode require Business Central to be available as the Process Automation Manager controller.

7.1. RUNNING BUSINESS APPLICATIONS IN STANDALONE MODE

Standalone (unmanaged) mode enables you to start your business application without additional requirements.

Prerequisites

- You have a `<BUSINESS-APPLICATION>.zip` file that you created using the business applications website, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.
- The business application is configured.

Procedure

1. Navigate to the `<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service` folder.
2. Enter one of the following commands:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>.\launch.sh clean install</code></td>
<td>Launches in standalone mode on Linux or UNIX.</td>
</tr>
<tr>
<td><code>.\launch.bat clean install</code></td>
<td>Launches in standalone mode on Windows.</td>
</tr>
<tr>
<td><code>.\launch.sh clean install -Pmysql</code></td>
<td>Launches in standalone mode on Linux or UNIX if you have configured the application with a MySQL database.</td>
</tr>
<tr>
<td><code>.\launch.bat clean install -Pmysql</code></td>
<td>Launches in standalone mode on Windows if you have configured the application with a MySQL database.</td>
</tr>
<tr>
<td><code>.\launch.sh clean install -Ppostgres</code></td>
<td>Launches in standalone mode on Linux or UNIX if you have configured the application with a PostgreSQL database.</td>
</tr>
<tr>
<td><code>.\launch.bat clean install -Ppostgres</code></td>
<td>Launches in standalone mode on Windows if you have configured the application with a PostgreSQL database.</td>
</tr>
</tbody>
</table>
The \textit{clean install} argument directs Maven to build a fresh installation. The projects are then built in the following order:

- Data model
- Business assets
- Service

The first time that you run the script, it might take a while to build the project because all dependencies of the project are downloaded. At the end of the build, the application starts.

3. Enter the following command to access your business application:

```
http://localhost:8090/
```

4. Enter the credentials \texttt{user/user} or \texttt{kieserver/kieserver1}.

### 7.2. RUNNING BUSINESS APPLICATIONS IN DEVELOPMENT MODE

Development (managed) mode enables developers to work on a Red Hat Process Automation Manager business application business assets project and dynamically deploy changes to the business application without the need to restart it. In addition, development mode provides a complete monitoring environment for business automation capabilities, for example process instances, tasks, and jobs.

#### Prerequisites

- You have a Spring Boot application ZIP file that you created using the business applications website.
- You configured the business application.
- Business Central is installed and running.

#### Procedure

1. Navigate to the \texttt{<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-service} folder, where \texttt{<BUSINESS-APPLICATION>} is the name of your Spring Boot project.

2. Enter one of the following commands:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>\texttt{./launch-dev.sh clean install}</td>
<td>Launches in development mode on Linux or UNIX.</td>
</tr>
<tr>
<td>\texttt{./launch-dev.bat clean install}</td>
<td>Launches in development mode on Windows.</td>
</tr>
<tr>
<td>\texttt{./launch-dev.sh clean install -Pmysql}</td>
<td>Launches in development mode on Linux or UNIX if you have configured the application with a MySQL database.</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><code>./launch-dev.bat clean install -Pmysql</code></td>
<td>Launches in development mode on Windows if you have configured the application with a MySQL database.</td>
</tr>
<tr>
<td><code>./launch-dev.sh clean install -Ppostgres</code></td>
<td>Launches in development mode on Linux or UNIX if you have configured the application with a PostgreSQL database.</td>
</tr>
<tr>
<td><code>./launch-dev.bat clean install -Ppostgres</code></td>
<td>Launches in development mode on Windows if you have configured the application with a PostgreSQL database.</td>
</tr>
</tbody>
</table>

The **clean install** argument directs Maven to build a fresh installation. The projects are then built in the following order:

- **Data model**
- **Business assets**
- **Service**
  - The first time that you run the script, it might take a while to build the project because all dependencies of the project are downloaded. At the end of the build, the application starts.

3. Enter the following command to access your business application:

   ```
   http://localhost:8090/
   ```

4. Enter the credentials **user/user** or **kieserver/kieserver1**. After the business application starts, it connects to the Process Automation Manager controller and is visible in **Menu → Deploy → Execution Servers** in Business Central.
CHAPTER 8. RUNNING A SPRINGBOOT BUSINESS APPLICATION ON RED HAT OPENSIFIC CONTAINER PLATFORM

To run your Red Hat Process Automation Manager SpringBoot business application on Red Hat OpenShift Container Platform, create an immutable image and push this image to your Red Hat OpenShift Container Platform environment.

Optionally, you can also use Business Central Monitoring to monitor the execution of business processes in your application.

Prerequisites

- You have developed a Red Hat Process Automation Manager SpringBoot business application. For instructions about creating the application, see Chapter 2, Creating a business application.

- If necessary, you have configured Spring security for the application. For instructions about configuring Spring security, see Chapter 4, Spring Security with Red Hat Process Automation Manager.

- You have completed any necessary additional Spring configuration for the business application. For instructions about Spring configuration for your business application, see Chapter 5, Red Hat Process Automation Manager Spring Boot configuration.

- You created a single JAR file for the business application. For instructions about creating a single JAR file for your SpringBoot business application, see Chapter 6, Creating a self-contained Red Hat Process Automation Manager Spring Boot JAR file.

- You are logged on to your Red Hat OpenShift Container Platform environment using the oc command and the required project is active.

- If you want to use Business Central Monitoring, you have installed Business Central Monitoring using the operator. Use the same namespace to deploy Business Central Monitoring and your business application.

IMPORTANT

You must configure Business Central Monitoring to use the controller startup strategy. To enable the controller strategy on Business Central Monitoring, in the Console tab of the operator configuration, add a KIE_SERVER_CONTROLLER_OPENSIFIC_ENABLED environment variable and set it to false.

Procedure

1. Outside the business application project directories, create an ocp-image directory with the following subdirectories:

   ocp-image
   ├──/root
   │   └──/opt
   │       └──/spring-service
2. Copy the single JAR file for your business application into the `root/opt/spring-service` subdirectory. For example:

```bash
cd ../business-application-service
cp target/business-application-service-1.0-SNAPSHOT.jar ../ocp-image/root/opt/spring-service/
```

3. In the `ocp-image` directory, create a `Dockerfile` file with the following content:

```Dockerfile
FROM registry.access.redhat.com/ubi8/openjdk-11:latest
COPY root /
EXPOSE 8090
WORKDIR /opt/spring-service/
CMD ["sh","-c", "java ${JAVA_OPTIONS} -Dorg.kie.server.mode=PRODUCTION -jar /opt/spring-service/<FILENAME>.jar"]
```

Replace `<FILENAME>.jar` with the name of the single JAR file for your business application.

Alternatively, if you want to configure communication with Business Central Monitoring, use the following content for `Dockerfile`:

```Dockerfile
FROM registry.access.redhat.com/ubi8/openjdk-11:latest
COPY root /
EXPOSE 8090
WORKDIR /opt/spring-service/
CMD ["sh","-c", "java ${JAVA_OPTIONS} -Dorg.kie.server.location=${KIESERVER_LOCATION} -Dorg.kie.server.controller=${KIESERVER_CONTROLLERS} -Dorg.kie.server.controller.user=${KIE_SERVER_CONTROLLER_USER} -Dorg.kie.server.controller.pwd=${KIE_SERVER_CONTROLLER_PWD} -Dorg.kie.server.mode=PRODUCTION -jar /opt/spring-service/<FILENAME>.jar"]
```

Replace `<FILENAME>.jar` with the name of the single JAR file for your business application.

4. To build the initial image and deploy it in your Red Hat OpenShift Container Platform environment, complete the following steps:

   a. To build the image, run the following commands in the `ocp-image` directory:

   ```bash
   oc new-build --binary --strategy=docker --name openshift-kie-springboot
   oc start-build openshift-kie-springboot --from-dir=. --follow
   ```

   Optional: replace `openshift-kie-springboot` with a custom application name in these commands and all subsequent commands.

   b. To deploy the image in the Red Hat OpenShift Container Platform environment, run the following command:

   ```bash
   oc new-app openshift-kie-springboot
   ```

   Alternatively, to deploy the image and configure it to communicate with Business Central Monitoring, run the following command:

   ```bash
PORT>/websocket/controller -e KIE_SERVER_CONTROLLER_USER=USER -e KIE_SERVER_CONTROLLER_PWD=PASSWORD

In this command, replace the following values:

- `<LOCATION>` with the fully qualified host name for accessing your service. Business Central Monitoring accesses the service to retrieve process information and displays a URL for the service with this host name.

- `<PORT>` with the port for accessing your service, for example, `8090`.

- `<BC-HOSTNAME>` with the host name for accessing the Business Central Monitoring instance. If your application is deployed in the same project/namespace as the Business Central Monitoring instance, use the service name for Business Central Monitoring, for example, `myapp-rhpamcentrmon`. Otherwise, you can use the fully qualified host name of a route for the Business Central Monitoring instance.

- `<BC-PORT>` with the port of the Business Central Monitoring instance, for example, `8080`.

- `<USER>` with the username of a user configured on the Business Central Monitoring instance.

- `<PASSWORD>` with the password of the user configured on the Business Central Monitoring instance.

**NOTE**

This configuration uses unsecured HTTP communication for your service. If you configure your Spring Boot business application with a valid SSL certificate, you can replace `http:` with `https:` to use secure HTTPS communication. For more information about configuring SSL on Spring Boot, see Spring Boot documentation.

**NOTE**

If you want to view process information from Business Central Monitoring, you must ensure that the user that is logged into Business Central Monitoring can also be authenticated with your service using the same password.

c. Optional: To expose the route for the image, run the following command:

```
oc expose service/openshift-kie-springboot --port=8090
```

5. If you already built and deployed the image and need to update it, for example if you built the JAR file for a new version of Red Hat Process Automation Manager or of Spring Boot, run the following command in the `ocp-image` directory:

```
oc start-build openshift-kie-springboot --from-dir=. --follow
```
CHAPTER 9. IMPORTING AND DEPLOYING BUSINESS ASSETS PROJECTS IN BUSINESS CENTRAL

You can import a business assets project that is part of a Red Hat Process Automation Manager business application into Business Central and then deploy that project to a business application.

Prerequisites

- You have a business application project running in development mode.
- Red Hat Process Automation Manager Business Central is installed.

Procedure

1. Navigate to the `<BUSINESS-APPLICATION>/<BUSINESS-APPLICATION>-kjar` folder, where `<BUSINESS-APPLICATION>` is the name of your Spring Boot project.

2. Execute the following commands to initialize the Git repository for your project:

```bash
$ git init
$ git add -A
$ git commit -m "Initial project structure"
```

3. Log in to Business Central and go to **Menu → Design → Projects**.

4. Select **Import Project** and enter the following URL:

   ```
   file:///<business-application-path>/<business-application-name>-kjar
   ```

5. Click **Import** and confirm the project to be imported.

6. After the business assets project is imported into Business Central, open the project and click **Add Assets** to add assets such as business processes to your business assets project.

7. Click **Deploy** on your project page to deploy your project to a running business application.
NOTE

You can also select the **Build & Install** option to build the project and publish the KJAR file to the configured Maven repository without deploying to a KIE Server. In a development environment, you can click **Deploy** to deploy the built KJAR file to a KIE Server without stopping any running instances (if applicable), or click **Redeploy** to deploy the built KJAR file and replace all instances. The next time you deploy or redeploy the built KJAR, the previous deployment unit (KIE container) is automatically updated in the same target KIE Server. In a production environment, the **Redeploy** option is disabled and you can click **Deploy** only to deploy the built KJAR file to a new deployment unit (KIE container) on a KIE Server.

To configure the KIE Server environment mode, set the `org.kie.server.mode` system property to `org.kie.server.mode=development` or `org.kie.server.mode=production`. To configure the deployment behavior for a corresponding project in Business Central, go to project **Settings** → **General Settings** → **Version** and toggle the **Development Mode** option. By default, KIE Server and all new projects in Business Central are in development mode. You cannot deploy a project with **Development Mode** turned on or with a manually added **SNAPSHOT** version suffix to a KIE Server that is in production mode.

8. To review project deployment details, click **View deployment details** in the deployment banner at the top of the screen or in the **Deploy** drop-down menu. This option directs you to the **Menu** → **Deploy** → **Execution Servers** page.

9. To interact with your newly deployed business assets, go to **Menu** → **Manage** → **Process Definitions** and **Process Instances**.
CHAPTER 10. REPLICATING AUDIT DATA IN A JMS MESSAGE BROKER

You can replicate KIE Server audit data to a Java Message Service (JMS) message broker, for example ActiveMQ or Artemis, and then dump the data in an external database schema so that you can improve the performance of your Spring Boot application by deleting the audit data from your application schema.

If you configure your application to replicate data in a message broker, when an event occurs in KIE Server the record of that event is stored in the KIE Server database schema and it is sent to the message broker. You can then configure an external service to consume the message broker data into an exact replica of the application’s database schema. The data is appended in the message broker and the external database every time an event is produce by KIE Server.

NOTE

Only audit data is stored in the message broker. No other data is replicated.

Prerequisites

- You have an existing Red Hat Process Automation Manager Spring Boot project.

Procedure

1. Open the Spring Boot application’s pom.xml file in a text editor.

2. Add the KIE Server Spring Boot audit dependency to the pom.xml file:

   ```xml
   <dependency>
   <groupId>org.kie</groupId>
   <artifactId>kie-server-spring-boot-autoconfiguration-audit-replication</artifactId>
   <version>${version.org.kie}</version>
   </dependency>
   ```

3. Add the dependency for your JMS client. The following example adds the Advanced Message Queuing Protocol (AMQP) dependency:

   ```xml
   <dependency>
   <groupId>org.amqphub.spring</groupId>
   <artifactId>amqp-10-jms-spring-boot-starter</artifactId>
   <version>2.2.6</version>
   </dependency>
   ```

4. Add the JMS pool dependency:

   ```xml
   <dependency>
   <groupId>org.messaginghub</groupId>
   <artifactId>pooled-jms</artifactId>
   </dependency>
   ```

5. To configure KIE Server audit replication to use queues, complete the following tasks:

   a. Add the following lines to your Spring Boot application’s application.properties file:
kieserver.audit-replication.producer=true
kieserver.audit-replication.queue=audit-queue

b. Add the properties required for your message broker client. The following example shows how to configure KIE Server for AMPQ, where `<JMS_HOST_PORT>` is the port that the broker listens on and `<USERNAME>` and `<PASSWORD>` are the login credentials for the broker:

```
amqphub.amqp10jms.remote-url=amqp://<JMS_HOST_PORT>
amqphub.amqp10jms.username=<USERNAME>
amqphub.amqp10jms.password=<PASSWORD>
amqphub.amqp10jms.pool.enabled=true
```

c. Add the following lines to the `application.properties` file of the service that will consume the message broker data:

```
kieserver.audit-replication.consumer=true
kieserver.audit-replication.queue=audit-queue
```

d. Add the properties required for your message broker client to the `application.properties` file of the service that will consume the message broker data. The following example shows how to configure KIE Server for AMPQ, where `<JMS_HOST_PORT>` is the port that your message broker listens on and `<USERNAME>` and `<PASSWORD>` are the login credentials for the message broker:

```
spring.jms.pub-sub-domain=true
amqphub.amqp10jms.remote-url=amqp://<JMS_HOST_PORT>
amqphub.amqp10jms.username=<USERNAME>
amqphub.amqp10jms.password=<PASSWORD>
amqphub.amqp10jms.pool.enabled=true
```

6. To configure KIE Server audit replication to use topics, complete the following tasks:

a. Add the following lines to your Spring Boot application’s `application.properties` file:

```
kieserver.audit-replication.producer=true
kieserver.audit-replication.topic=audit-topic
```

b. Add the properties required for your message broker client to the `application.properties` file of the service that will consume the message broker data. The following example shows how to configure KIE Server for AMPQ, where `<JMS_HOST_PORT>` is the port that your message broker listens on and `<USERNAME>` and `<PASSWORD>` are the login credentials for the message broker:

```
spring.jms.pub-sub-domain=true
amqphub.amqp10jms.remote-url=amqp://<JMS_HOST_PORT>
amqphub.amqp10jms.username=<USERNAME>
amqphub.amqp10jms.password=<PASSWORD>
amqphub.amqp10jms.pool.enabled=true
```

c. Add the following lines to the `application.properties` file of the service that will consume the message broker data:

```
kieserver.audit-replication.consumer=true
kieserver.audit-replication.topic=audit-topic::jbpm
```
kieserver.audit-replication.topic.subscriber=jbpm
spring.jms.pub-sub-domain=true

d. Add the properties required for your message broker client to the application.properties file of the service that will consume the message broker data. The following example shows how to configure KIE Server for AMPQ, where <JMS_HOST_PORT> is the port that your message broker listens on and <USERNAME> and <PASSWORD> are the login credentials for the message broker:

```
amqphub.amqp10jms.remote-url=amqp://<JMS_HOST_PORT>
amqphub.amqp10jms.username=<USERNAME>
amqphub.amqp10jms.password=<PASSWORD>
amqphub.amqp10jms.pool.enabled=true
amqphub.amqp10jms.clientId=jbpm
```

7. Optional: To configure the KIE Server that contains the replicated data to be read only, set the org.kie.server.rest.mode.readonly property in the application.properties file to true:

```
org.kie.server.rest.mode.readonly=true
```

Additional resources

- Section 10.1, “Spring Boot JMS audit replication parameters”

### 10.1. SPRING BOOT JMS AUDIT REPLICATION PARAMETERS

The following table describes the parameters used to configure JMS audit replication for Red Hat Process Automation Manager applications on Spring Boot.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>kieserver.audit-replication.producer</td>
<td>true, false</td>
<td>Specifies whether the business application will act as a producer to replicate and send the JMS messages to either a queue or a topic.</td>
</tr>
<tr>
<td>kieserver.audit-replication.consumer</td>
<td>true, false</td>
<td>Specifies whether the business application will act as a consumer to receive the JMS messages from either a queue or a topic.</td>
</tr>
<tr>
<td>kieserver.audit-replication.queue</td>
<td>string</td>
<td>The name of the JMS queue to either send or consume messages.</td>
</tr>
<tr>
<td>kieserver.audit-replication.topic</td>
<td>string</td>
<td>The name of the JMS topic to either send or consume messages.</td>
</tr>
<tr>
<td>kieserver.audit-replication.topic.subscriber</td>
<td>string</td>
<td>The name of the topic subscriber.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Values</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>org.kie.server.rest.mode.readonly</td>
<td>true, false</td>
<td>Specifies read only mode for the business application.</td>
</tr>
</tbody>
</table>
As a system administrator, you can integrate Red Hat Single Sign-On with Red Hat Process Automation Manager to secure your Red Hat Process Automation Manager browser applications with a single authentication method.

Prerequisites

- Red Hat Process Automation Manager is installed on Red Hat JBoss EAP 7.3. For information, see *Installing and configuring Red Hat Process Automation Manager on Red Hat JBoss EAP 7.3*. 
CHAPTER 11. INTEGRATION OPTIONS

Red Hat Single Sign-On (RH-SSO) is a single sign-on solution that you can use to secure your browser applications with your REST web services and Git access.


The following chapters describe how you can integrate RH-SSO with Red Hat Process Automation Manager:

- **Chapter 14, Authenticating Business Central through RH-SSO**
  To authenticate Red Hat Process Automation Manager through an RH-SSO server, you must secure both the Red Hat Process Automation Manager web client (Business Central) and remote services through RH-SSO. This integration enables you to connect to Red Hat Process Automation Manager through RH-SSO using either Business Central or a remote service consumer.

- **Chapter 15, Authenticating KIE Server through RH-SSO**
  To authenticate KIE Server through an RH-SSO server, you must secure the remote services provided by KIE Server. Doing this enables any remote Red Hat Process Automation Manager service consumer (user or a service) to authenticate through RH-SSO. Note that KIE Server does not have a web interface.

- **Chapter 16, Authenticating third-party clients through RH-SSO**
  If Business Central or KIE Server are using RH-SSO, third-party clients must authenticate themselves using RH-SSO. After authentication, they can consume the remote service endpoints provided by Business Central and KIE Server, such as the REST API or remote file system services.

To facilitate LDAP integration with Red Hat Process Automation Manager, consider using RH-SSO with LDAP. For information, see the "LDAP and Active Directory" section of the *Red Hat Single Sign-On Server Administration Guide*. 
A realm is a security policy domain defined for a web or application server. Security realms are used to restrict access for different application resources. You should create a new realm whether your RH-SSO instance is private or shared with other products. You can keep the master realm as a place for super administrators to create and manage the realms in your system. If you are integrating with an RH-SSO instance that is shared with other product installations to achieve single sign-on with those applications, all of those applications must use the same realm. To create an RH-SSO realm, download, install, and configure RH-SSO 7.4.

**NOTE**

If Business Central and KIE Server are installed on different servers, complete this procedure on both servers.

**Procedure**

1. Navigate to the [Software Downloads](https://access.redhat.com/downloads) page in the Red Hat Customer Portal (login required), and select the product and version from the drop-down options:
   - **Product**: Red Hat Single Sign-On
   - **Version**: 7.4

2. Download Red Hat Single Sign-on 7.4.0 Server(\texttt{rh-sso-7.4.0.zip}) and the latest server patch.

3. To install and configure a basic RH-SSO standalone server, follow the instructions in the [Red Hat Single Sign On Getting Started Guide](https://access.redhat.com/documentation). For advanced settings for production environments, see the [Red Hat Single Sign On Server Administration Guide](https://access.redhat.com/documentation).

**NOTE**

If you want to run both RH-SSO and Red Hat Process Automation Manager servers on the same system, ensure that you avoid port conflicts by taking one of the following actions:

- Update the \texttt{RHSSO\_HOME/standalone/configuration/standalone-full.xml} file and set the port offset to 100. For example:

  ```xml
  <socket-binding-group name="standard-sockets" default-interface="public" port-offset="${jboss.socket.binding.port-offset:100}">
  </socket-binding-group>
  ```

- Use an environment variable to set the port offset when running the server:

  ```bash
  bin/standalone.sh -Djboss.socket.binding.port-offset=100
  ```
CHAPTER 13. RED HAT PROCESS AUTOMATION MANAGER
ROLES AND USERS

To access Business Central or KIE Server, you must create users and assign them appropriate roles before the servers are started. You can create users and roles when you install Business Central or KIE Server.

Business Central and KIE Server use the Java Authentication and Authorization Service (JAAS) login module to authenticate users. If both Business Central and KIE Server are running on a single instance, then they share the same JAAS subject and security domain. Therefore, a user who is authenticated for Business Central can also access KIE Server.

However, if Business Central and KIE Server are running on different instances, then the JAAS login module is triggered for both individually. Therefore, a user who is authenticated for Business Central must be authenticated separately to access KIE Server. For example, if a user who is authenticated on Business Central but not authenticated on KIE Server tries to view or manage process definitions in Business Central, a 401 error is logged in the log file and the Invalid credentials to load data from remote server. Contact your system administrator. message appears in Business Central.

This section describes Red Hat Process Automation Manager user roles.

NOTE

The admin, analyst, developer, manager, process-admin, user, and rest-all roles are reserved for Business Central. The kie-server role is reserved for KIE Server. For this reason, the available roles can differ depending on whether Business Central, KIE Server, or both are installed.

- **admin**: Users with the admin role are the Business Central administrators. They can manage users and create, clone, and manage repositories. They have full access to make required changes in the application. Users with the admin role have access to all areas within Red Hat Process Automation Manager.

- **analyst**: Users with the analyst role have access to all high-level features. They can model and execute their projects. However, these users cannot add contributors to spaces or delete spaces in the Design → Projects view. Access to the Deploy → Execution Servers view, which is intended for administrators, is not available to users with the analyst role. However, the Deploy button is available to these users when they access the Library perspective.

- **developer**: Users with the developer role have access to almost all features and can manage rules, models, process flows, forms, and dashboards. They can manage the asset repository, they can create, build, and deploy projects. Only certain administrative functions such as creating and cloning a new repository are hidden from users with the developer role.

- **manager**: Users with the manager role can view reports. These users are usually interested in statistics about the business processes and their performance, business indicators, and other business-related reporting. A user with this role has access only to process and task reports.

- **process-admin**: Users with the process-admin role are business process administrators. They have full access to business processes, business tasks, and execution errors. These users can also view business reports and have access to the Task Inbox list.

- **user**: Users with the user role can work on the Task Inbox list, which contains business tasks that are part of currently running processes. Users with this role can view process and task reports and manage processes.
• rest-all: Users with the rest-all role can access Business Central REST capabilities.

• kie-server: Users with the kie-server role can access KIE Server REST capabilities. This role is mandatory for users to have access to Manage and Track views in Business Central.

13.1. ADDING RED HAT PROCESS AUTOMATION MANAGER USERS

Before you can use RH-SSO to authenticate Business Central or KIE Server, you must add users to the realm that you created. To add new users and assign them a role to access Red Hat Process Automation Manager, complete the following steps:

1. Log in to the RH-SSO Admin Console and open the realm that you want to add a user to.

2. Click the Users menu item under the Manage section.
   An empty user list appears on the Users page.

3. Click the Add User button on the empty user list to start creating your new user.
   The Add User page opens.

4. On the Add User page, enter the user information and click Save.

5. Click the Credentials tab and create a password.

6. Assign the new user one of the roles that allows access to Red Hat Process Automation Manager. For example, assign the admin role to access Business Central or assign the kie-server role to access KIE Server.

   **NOTE**

   For projects that deploy from Business Central on OpenShift, create an RH-SSO user called mavenuser without any role assigned, then add this user to the BUSINESS_CENTRAL_MAVEN_USERNAME and BUSINESS_CENTRAL_MAVEN_PASSWORD in your OpenShift template.

7. Define the roles as realm roles in the Realm Roles tab under the Roles section.

   Alternatively, for roles used in Business Central, you can define the roles as client roles for the kie client. For instructions about configuring the kie client, see Section 14.1, “Creating the Business Central client for RH-SSO”. To use client roles, you must also configure additional settings for Business Central, as described in Section 14.2, “Installing the RH-SSO client adapter for Business Central”.

   You must define roles used in the KIE Server as realm roles.

8. Click the Role Mappings tab on the Users page to assign roles.
CHAPTER 14. AUTHENTICATING BUSINESS CENTRAL THROUGH RH-SSO

This chapter describes how to authenticate Business Central through RH-SSO. It includes the following sections:

- Section 14.1, “Creating the Business Central client for RH-SSO”
- Section 14.2, “Installing the RH-SSO client adapter for Business Central”

Prerequisites

- Business Central is installed in a Red Hat JBoss EAP 7.3 server, as described in Installing and configuring Red Hat Process Automation Manager on Red Hat JBoss EAP 7.3.
- RH-SSO is installed as described in Chapter 12, Installing and configuring RH-SSO.
- You added Business Central users to RH-SSO as described in Section 13.1, “Adding Red Hat Process Automation Manager users”.
- Optional: To manage RH-SSO users from Business Central, you added all realm-management client roles in RH-SSO to the Business Central administrator user.

NOTE


14.1. CREATING THE BUSINESS CENTRAL CLIENT FOR RH-SSO

After the RH-SSO server starts, use the RH-SSO Admin Console to create the Business Central client for RH-SSO.

Procedure

1. Enter `http://localhost:8180/auth/admin` in a web browser to open the RH-SSO Admin Console and log in using the admin credentials that you created while installing RH-SSO.

NOTE

If you are configuring RH-SSO with Red Hat OpenShift Container Platform, enter the URL that is exposed by the RH-SSO routes. Your OpenShift administrator can provide this URL if necessary.
When you login for the first time, you can set up the initial user on the new user registration form.

2. In the RH-SSO Admin Console, click the **Realm Settings** menu item.

3. On the **Realm Settings** page, click **Add Realm**. The Add realm page opens.

4. On the Add realm page, provide a name for the realm and click **Create**.

5. Click the **Clients** menu item and click **Create**. The Add Client page opens.

6. On the Add Client page, provide the required information to create a new client for your realm. For example:
   - **Client ID**: kie
   - **Client protocol**: openid-connect

   **NOTE**

   If you are configuring RH-SSO with Red Hat OpenShift Container Platform, enter the URL that is exposed by the KIE Server routes. Your OpenShift administrator can provide this URL if necessary.

7. Click **Save** to save your changes.

   After you create a new client, its **Access Type** is set to **public** by default. Change it to **confidential**.

The RH-SSO server is now configured with a realm with a client for Business Central applications and running and listening for HTTP connections at **localhost:8180**. This realm provides different users, roles, and sessions for Business Central applications.

### 14.2. INSTALLING THE RH-SSO CLIENT ADAPTER FOR BUSINESS CENTRAL

After you install RH-SSO, you must install the RH-SSO client adapter for Red Hat JBoss EAP and configure it for Business Central.

**Prerequisites**

- Business Central is installed in a Red Hat JBoss EAP 7.3 instance, as described in *Installing and configuring Red Hat Process Automation Manager on Red Hat JBoss EAP 7.3*.
- RH-SSO is installed as described in Chapter 12, *Installing and configuring RH-SSO*.
- A user with the **admin** role has been added to RH-SSO as described in Section 13.1, “Adding Red Hat Process Automation Manager users”.

**Procedure**
1. Navigate to the Software Downloads page in the Red Hat Customer Portal (login required), and select the product and version from the drop-down options:

   - **Product**: Red Hat Single Sign-On
   - **Version**: 7.4

2. Select the Patches tab.

3. Download Red Hat Single Sign-on 7.4 Client Adapter for EAP 7 (rh-sso-7.4.6-eap7-adapter.zip) or the latest version.

4. Extract and install the adapter zip file. For installation instructions, see the "JBoss EAP Adapter" section of the Red Hat Single Sign On Securing Applications and Applications Guide.

   **NOTE**

   Install the adapter with the `-Dserver.config=standalone-full.xml` property.

5. Navigate to the `EAP_HOME/standalone/configuration` directory in your Red Hat JBoss EAP installation and open the `standalone-full.xml` file in a text editor.

6. Add the system properties listed in the following example to `<system-properties>`:

   ```xml
   <system-properties>
   <property name="org.jbpm.workbench.kie_server.keycloak" value="true"/>
   <property name="org.uberfire.ext.security.management.api.userManagementServices" value="KCAdapterUserManagementService"/>
   <property name="org.uberfire.ext.security.management.keycloak.authServer" value="http://localhost:8180/auth"/>
   </system-properties>
   
   <system-properties>
   <property name="org.uberfire.ext.security.management.keycloak.use-resource-role-mappings" value="true"/>
   </system-properties>
   
   <property name="org.uberfire.ext.security.management.keycloak.resource" value="customClient"/>
   
   Replace `customClient` with the client resource name.

7. Optional: If you want to use client roles, add the following system property:

   ```xml
   <property name="org.uberfire.ext.security.management.keycloak.resource" value="customClient"/>
   
   Replace `customClient` with the client resource name.

8. Add the RH-SSO subsystem configuration. For example:

   ```xml
   <subsystem xmlns="urn:jboss:domain:keycloak:1.1">
   <secure-deployment name="business-central.war">
   <realm name="demo"/>
   
   <realm-public-key>MIGfMA0GCSqGSIb3DQEBAQUA4GNADCBiQKBgQCrVrCuTtArbgaZzL1vh0xtL5mc70OqPVnYXkLvwcIC3 BjLgw1tEGo4aXDuSaRllobmS3J Bjx33UNv+5zjUMG4kytBWxheNVKnL6GgolNabMaFlPLPCF8kAgKnsl79NM0+n6KnSYsYeUmecp2vjo2NjsSADVcWEQM VhJ31L
   ```
In this example:

- **secure-deployment name** is the name of your application’s WAR file.
- **realm** is the name of the realm that you created for the applications to use.
- **realm-public-key** is the public key of the realm you created. You can find the key in the Keys tab in the Realm settings page of the realm you created in the RH-SSO Admin Console. If you do not provide a value for realm-public-key, the server retrieves it automatically.
- **auth-server-url** is the URL for the RH-SSO authentication server.
- **enable-basic-auth** is the setting to enable basic authentication mechanism, so that the clients can use both token-based and basic authentication approaches to perform the requests.
- **resource** is the name for the client that you created. To use client roles, set the client resource name that you used when configuring the client in RH-SSO.
- **credential name** is the secret key for the client you created. You can find the key in the Credentials tab on the Clients page of the RH-SSO Admin Console.
- **principal-attribute** is the login name of the user. If you do not provide this value, your User Id is displayed in the application instead of your user name.

**NOTE**

The RH-SSO server converts the user names to lower case. Therefore, after integration with RH-SSO, your user name will appear in lower case in Red Hat Process Automation Manager. If you have user names in upper case hard coded in business processes, the application might not be able to identify the upper case user.

If you want to use client roles, also add the following setting under `<secure-deployment>`:

```
<use-resource-role-mappings>true</use-resource-role-mappings>
```

9. The Elytron subsystem provides a built-in policy provider based on JACC specification. To enable the JACC manually in the standalone.xml or in the file where Elytron is installed, do any of the following tasks:

- To create the policy provider, enter the following commands in the management command-line interface (CLI) of Red Hat JBoss EAP:
/subsystem=elytron/policy=jacc:add(jacc-policy={})
/subsystem=undertow/application-security-domain=other:remove
/subsystem=undertow/application-security-domain=other:add(http-authentication-factory=keycloak-http-authentication,enable-jacc=true)

For more information about the Red Hat JBoss EAP management CLI, see the Management CLI Guide for Red Hat JBoss EAP.

- Navigate to the $EAP_HOME/standalone/configuration$ directory in your Red Hat JBoss EAP installation. Locate the Elytron and undertow subsystem configurations in the $standalone.xml$ and $standalone-full.xml$ files and enable JACC. For example:

```xml
<subsystem xmlns="urn:wildfly:elytron:4.0" ...>
    ...
    <policy name="jacc">jacc-policy/</policy>
</subsystem>

<subsystem xmlns="urn:jboss:domain:undertow:7.0" ...>
    ...
    <application-security-domains>
        <application-security-domain name="other" http-authentication-factory="keycloak-http-authentication" enable-jacc="true"/>
    </application-security-domains>
</subsystem>
```

**NOTE**

To use the Elytron subsystem, you must disable JACC in the legacy security subsystem. To disable JACC in the legacy subsystem, enter the following command in the Red Hat JBoss EAP management CLI:

```
/subsystem=security:write-attribute(name=initialize-jacc, value=false)
```

For more information about disabling JACC in the legacy security subsystem, see the Development Guide for Red Hat JBoss EAP.

10. Navigate to $EAP_HOME/bin/$ and enter the following command to start the Red Hat JBoss EAP server:

```
./standalone.sh -c standalone-full.xml
```

**NOTE**

You can also configure the RH-SSO adapter for Business Central by updating your application’s WAR file to use the RH-SSO security subsystem. However, Red Hat recommends that you configure the adapter through the RH-SSO subsystem. Doing this updates the Red Hat JBoss EAP configuration instead of applying the configuration on each WAR file.

### 14.3. Securing Business Central File System Services Using RH-SSO
To consume other remote services such as file systems (for example, a remote GIT service), you must specify the correct RH-SSO login module.

**Procedure**

1. Generate a JSON configuration file:
   b. Click **Clients**.
   c. Create a new client with the following settings:
      - Set **Client ID** as **kie-git**.
      - Set **Access Type** as **confidential**.
      - Disable the **Standard Flow Enabled** option.
      - Enable the **Direct Access Grants Enabled** option.
   d. Click **Save**.
   e. Click the **Installation** tab at the top of the client configuration screen and choose **Keycloak OIDC JSON** as a **Format Option**.
   f. Click **Download**.

2. Move the downloaded JSON file to an accessible directory in the server’s file system or add it to the application class path.

3. Specify the correct RH-SSO login module in the `EAP_HOME/standalone/configuration/standalone-full.xml` file. By default, the security
domain in Red Hat Process Automation Manager is set to **other**. Replace the default values of the **login-module** in this security domain with the values in the following example:

```xml
<security-domain name="other" cache-type="default">
  <authentication>
    <login-module code="org.keycloak.adapters.jaas.DirectAccessGrantsLoginModule" flag="required">
      <module-option name="keycloak-config-file" value="$EAP_HOME/kie-git.json"/>
    </login-module>
  </authentication>
</security-domain>
```

4. The JSON file specified in the **module-option** element contains a client used for securing the remote services. Replace the $EAP_HOME/kie-git.json value of the **module-option** element with the absolute path or the class path (classpath://EXAMPLE_PATH/kie-git.json) to this JSON configuration file.

At this point, all users authenticated through the RH-SSO server can clone internal GIT repositories. In the following command, change **USER_NAME** to a RH-SSO user, for example **admin**:

```bash
git clone ssh://USER_NAME@localhost:8001/system
```
CHAPTER 15. AUTHENTICATING KIE SERVER THROUGH RH-SSO

KIE Server provides a REST API for third-party clients. If you integrate KIE Server with RH-SSO, you can delegate third-party client identity management to the RH-SSO server.

After you create a realm client for Red Hat Process Automation Manager and set up the RH-SSO client adapter for Red Hat JBoss EAP, you can set up RH-SSO authentication for KIE Server.

Prerequisites

- RH-SSO is installed as described in Chapter 12, Installing and configuring RH-SSO.
- At least one user with the kie-server role has been added to RH-SSO as described in Section 13.1, “Adding Red Hat Process Automation Manager users”.
- KIE Server is installed in a Red Hat JBoss EAP 7.3 instance, as described in Installing and configuring Red Hat Process Automation Manager on Red Hat JBoss EAP 7.3.

This chapter contains the following sections:

- Section 15.1, “Creating the KIE Server client on RH-SSO”
- Section 15.2, “Installing and configuring KIE Server with the client adapter”
- Section 15.3, “KIE Server token-based authentication”

NOTE

Except for Section 15.1, “Creating the KIE Server client on RH-SSO”, this section is intended for standalone installations. If you are integrating RH-SSO and Red Hat Process Automation Manager on Red Hat OpenShift Container Platform, complete the steps in Section 15.1, “Creating the KIE Server client on RH-SSO” and then deploy the Red Hat Process Automation Manager environment on Red Hat OpenShift Container Platform. For information about deploying Red Hat Process Automation Manager on Red Hat OpenShift Container Platform, see Deploying Red Hat Process Automation Manager on Red Hat OpenShift Container Platform.

15.1. CREATING THE KIE SERVER CLIENT ON RH-SSO

Use the RH-SSO Admin Console to create a KIE Server client in an existing realm.

Prerequisites

- KIE Server is installed in a Red Hat JBoss EAP 7.3 server, as described in Installing and configuring Red Hat Process Automation Manager on Red Hat JBoss EAP 7.3.
- RH-SSO is installed as described in Chapter 12, Installing and configuring RH-SSO.
- At least one user with the kie-server role has been added to RH-SSO as described in Section 13.1, “Adding Red Hat Process Automation Manager users”.

Procedure
1. In the RH-SSO Admin Console, open the security realm that you created in Chapter 12, *Installing and configuring RH-SSO*.

2. Click **Clients** and click **Create**. The **Add Client** page opens.

3. On the **Add Client** page, provide the required information to create a KIE Server client for your realm, then click **Save**. For example:
   - **Client ID**: kie-execution-server
   - **Root URL**: http://localhost:8080/kie-server
   - **Client protocol**: openid-connect

   **NOTE**
   If you are configuring RH-SSO with Red Hat OpenShift Container Platform, enter the URL that is exposed by the KIE Server routes. Your OpenShift administrator can provide this URL if necessary.

4. The new client **Access Type** is set to **public** by default. Change it to **confidential** and click **Save** again.

5. Navigate to the **Credentials** tab and copy the secret key. The secret key is required to configure the **kie-execution-server** client.

### 15.2. INSTALLING AND CONFIGURING KIE SERVER WITH THE CLIENT ADAPTER

After you install RH-SSO, you must install the RH-SSO client adapter for Red Hat JBoss EAP and configure it for KIE Server.

**Prerequisites**

- KIE Server is installed in a Red Hat JBoss EAP 7.3 server, as described in *Installing and configuring Red Hat Process Automation Manager on Red Hat JBoss EAP 7.3*.

- RH-SSO is installed as described in Chapter 12, *Installing and configuring RH-SSO*.

- At least one user with the **kie-server** role has been added to RH-SSO as described in Section 13.1, “Adding Red Hat Process Automation Manager users”.

**NOTE**

If you deployed KIE Server to a different application server than Business Central, install and configure RH-SSO on your second server as well.

**Procedure**

1. Navigate to the **Software Downloads** page in the Red Hat Customer Portal (login required), and select the product and version from the drop-down options:
   - **Product**: Red Hat Single Sign-On
• **Version:** 7.4

2. Download Red Hat Single Sign-on 7.4 Client Adapter for JBoss EAP 7 rh-sso-7.4.6-eap7-adapter.zip or the latest version).

3. Extract and install the adapter zip file. For installation instructions, see the "JBoss EAP Adapter" section of the Red Hat Single Sign On Securing Applications and Services Guide.

4. Go to **EAP_HOME*/standalone/configuration** and open the **standalone-full.xml** file.

5. Delete the `<single-sign-on/>` element from both of the files.

6. Navigate to **EAP_HOME*/standalone/configuration** directory in your Red Hat JBoss EAP installation and edit the **standalone-full.xml** file to add the RH-SSO subsystem configuration.

   For example:

7. Navigate to **EAP_HOME*/standalone/configuration** in your Red Hat JBoss EAP installation and edit the **standalone-full.xml** file to add the RH-SSO subsystem configuration. For example:

   ```xml
   <subsystem xmlns="urn:jboss:domain:kie:1.0">
     <secure-deployment name="kie-server.war">
       <realm>
         <realm></realm>
       </realm>
       <realm-public-key>MIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQKBgQCrVrCuTtArbgaZzL1hvh0xtL5mc7o0NqPVnYXkLvgcwiC3ByLGw1tGEGoJaXDuSaRllobm53JBhjx33UNv+5z/UMG4kylBWxheNVKnL6GgqlNabMaFiPPLPCF8kAgKnsi79NMo+n6KnSY8YeUmec/p2vjO2NjsSADcWEQMVhJ31LwIDAQAB</realm-public-key>
       <auth-server-url>http://localhost:8180/auth</auth-server-url>
       <ssl-required>external</ssl-required>
       <resource>kie-execution-server</resource>
       <enable-basic-auth>true</enable-basic-auth>
       <credential name="secret">03c2b267-7f64-4647-8566-572be673f5fa</credential>
       <principal-attribute>preferred_username</principal-attribute>
     </secure-deployment>
   </subsystem>

   `<system-properties>`
   `<property name="org.kie.server.sync.deploy" value="false"/>
   </system-properties>`

   In this example:

   - **secure-deployment name** is the name of your application WAR file.
   - **realm** is the name of the realm that you created for the applications to use.
   - **realm-public-key** is the public key of the realm you created. You can find the key in the **Keys** tab in the **Realm settings** page of the realm you created in the RH-SSO Admin Console. If you do not provide a value for this public key, the server retrieves it automatically.
   - **auth-server-url** is the URL for the RH-SSO authentication server.
   - **resource** is the name for the server client that you created.
**enable-basic-auth** is the setting to enable basic authentication mechanism, so that the clients can use both token-based and basic authentication approaches to perform the requests.

**credential name** is the secret key of the server client you created. You can find the key in the Credentials tab on the Clients page of the RH-SSO Admin Console.

**principal-attribute** is the login name of the user. If you do not provide this value, your UserId is displayed in the application instead of your user name.

8. Save your configuration changes.

9. Use the following command to restart the Red Hat JBoss EAP server and run KIE Server.

```
```

For example:

```
```

10. When KIE Server is running, enter the following command to check the server status, where `<KIE_SERVER_USER>` is a user with the kie-server role and `<PASSWORD>` is the password for that user:

```
curl http://<KIE_SERVER_USER>:<PASSWORD>@localhost:8080/kie-server/services/rest/server/
```

### 15.3. KIE SERVER TOKEN-BASED AUTHENTICATION

You can also use token-based authentication for communication between Red Hat Process Automation Manager and KIE Server. You can use the complete token as a system property of your application server, instead of the user name and password, for your applications. However, you must ensure that the token does not expire while the applications are interacting because the token is not automatically refreshed. To get the token, see Section 16.2, “Token-based authentication”.

**Procedure**

1. To configure Business Central to manage KIE Server using tokens:
   
   a. Set the **org.kie.server.token** property.
   
   b. Make sure that the **org.kie.server.user** and **org.kie.server.pwd** properties are not set. Red Hat Process Automation Manager will then use the **Authorization: Bearer $TOKEN** authentication method.

2. To use the REST API using the token-based authentication:
a. Set the `org.kie.server.controller.token` property.

b. Make sure that the `org.kie.server.controller.user` and `org.kie.server.controller.pwd` properties are not set.

**NOTE**

Because KIE Server is unable to refresh the token, use a high-lifespan token. A token’s lifespan must not exceed January 19, 2038. Check with your security best practices to see whether this is a suitable solution for your environment.
CHAPTER 16. AUTHENTICATING THIRD-PARTY CLIENTS THROUGH RH-SSO

To use the different remote services provided by Business Central or by KIE Server, your client, such as curl, wget, web browser, or a custom REST client, must authenticate through the RH-SSO server and have a valid token to perform the requests. To use the remote services, the authenticated user must have the following roles:

- rest-all for using Business Central remote services.
- kie-server for using the KIE Server remote services.

Use the RH-SSO Admin Console to create these roles and assign them to the users that will consume the remote services.

Your client can authenticate through RH-SSO using one of these options:

- Basic authentication, if it is supported by the client
- Token-based authentication

16.1. BASIC AUTHENTICATION

If you enabled basic authentication in the RH-SSO client adapter configuration for both Business Central and KIE Server, you can avoid the token grant and refresh calls and call the services as shown in the following examples:

- For web based remote repositories endpoint:
  
  curl http://admin:password@localhost:8080/business-central/rest/repositories

- For KIE Server:
  
  curl http://admin:password@localhost:8080/kie-server/services/rest/server/

16.2. TOKEN-BASED AUTHENTICATION

If you want a more secure option of authentication, you can consume the remote services from both Business Central and KIE Server by using a granted token provided by RH-SSO.

Procedure

1. In the RH-SSO Admin Console, click the Clients menu item and click Create to create a new client. The Add Client page opens.

2. On the Add Client page, provide the required information to create a new client for your realm. For example:
   - Client ID: kie-remote
   - Client protocol: openid-connect

3. Click Save to save your changes.
4. Change the token settings in **Realm Settings**:
   a. In the RH–SSO Admin Console, click the **Realm Settings** menu item.
   b. Click the **Tokens** tab.
   c. Change the value for **Access Token Lifespan** to **15 minutes**.
      This gives you enough time to get a token and invoke the service before it expires.
   d. Click **Save** to save your changes.

5. After a public client for your remote clients is created, you can now obtain the token by making an HTTP request to the RH–SSO server’s token endpoint using:

   ```sh
   RESULT=`curl --data "grant_type=password&client_id=kie-remote&username=admin&password=password"
                    http://localhost:8180/auth/realms/demo/protocol/openid-connect/token`
   
   The user in this command is a Business Central RH–SSO user. For more information, see Section 13.1, "Adding Red Hat Process Automation Manager users".

6. To view the token obtained from the RH–SSO server, use the following command:

   ```sh
   TOKEN=`echo $RESULT | sed 's/.*access_token"://g' | sed 's/".*/g'`
   
   You can now use this token to authorize the remote calls. For example, if you want to check the internal Red Hat Process Automation Manager repositories, use the token as shown below:

   ```sh
PART III. INTEGRATING RED HAT PROCESS AUTOMATION MANAGER WITH RED HAT AMQ STREAMS

As a developer, you can integrate Red Hat Process Automation Manager with Red Hat AMQ Streams or Apache Kafka. A business process can send and receive Kafka messages.
CHAPTER 17. KAFKA MESSAGES IN A BUSINESS PROCESS

Red Hat AMQ Streams, based on Apache Kafka, is a streaming platform. It acts as a message broker, passing messages, which are sorted into topics, between applications in a software environment.

Using Red Hat Process Automation Manager, you can create business processes that send and receive Kafka messages in the following ways:

- Create a start event, intermediate catch event, or boundary event (attached to a human task) of the type message. The KIE Server automatically subscribes to the Kafka topic that is defined in the message. A message triggers the event. The event node acts as the consumer of the message and can pass the content of the message to the subsequent node in the process.

- Create an end event or intermediate throw event of the type message. When the process triggers the event, the KIE Server sends a Kafka message in the topic that is defined in the message. The message contains the data that is configured in the event. The event node acts as the producer of the message.

- Add the KafkaPublishMessages custom task to the process. This task does not require the KIE Server Kafka capability but can be more complicated to configure than message events.

- Configure your service and the KIE Server to emit Kafka messages about every completed process, case, and task when transactions are committed.

17.1. CREATING AN EVENT THAT RECEIVES KAFKA MESSAGES

When designing your business process in Business Central, you can create an event that receives Kafka messages.

This event is triggered each time a message arrives in the configured topic. The message is expected to contain data that matches a predefined data object. The process engine parses the message and provides it as an output of the event.

Procedure

1. Open the project that contains your business process in Business Central.

2. Create a data object defining the data that the message will contain. For instructions about creating data objects, see Designing business processes using BPMN models.

3. Select the business process and open the business process designer.

4. Add a start event, an intermediate catch event, or a boundary event (attached to a human task) of the type message.

5. Open the properties of the event.

6. In the Message field, select New and then enter the name of the message. This name must be the same as the name of the topic from which the event is to receive Kafka messages, or else must be defined in an org.kie.server.jbpm-kafka.ext.topics.broker-topic-name system property of the KIE Server. For instructions about using org.kie.server.jbpm-kafka.ext.topics.* system properties to define topic names, see Chapter 18, Configuring a KIE Server to send and receive Kafka messages from the process.

7. Add an output data item. Select the data object that you created as its type.
8. Save the business process.

Next steps
To enable Red Hat AMQ Streams integration when running the process, you must configure the KIE Server according to instructions in Chapter 18, Configuring a KIE Server to send and receive Kafka messages from the process.

17.2. CREATING AN EVENT THAT SENDS KAFKA MESSAGES

When designing your business process in Business Central, you can create an event that sends Kafka messages.

The event can have a data object as an input data item. The process engine sends the content of a data object as a message in the configured topic.

Procedure

1. Open the project that contains your business process in Business Central.

2. Add the work item handler that is required for message-sending events:
   a. Select the Settings → Deployments → Work Item Handlers tab.
   b. Click Add Work Item Handler.
   c. Enter the following values in the new empty line:
      - Name: Send Task
      - Value: new org.jbpm.bpmn2.handler.SendTaskHandler()
      - Resolver type: MVEL

3. Create a data object defining the data that the message must contain. For instructions about creating data objects, see Designing business processes using BPMN models.

4. Select the business process and open the business process designer.

5. Add an intermediate throw event or an end event of the type message.

6. Open the properties of the event.

7. In the Message field, select New and then enter the name of the message. This name must be the same as the name of the topic to which the event is to send Kafka messages, or else must be defined in an org.kie.server.jboss-ext.topics.broker-topic-name system property of the KIE Server.
   For instructions about using org.kie.server.jboss-ext.topics.* system properties to define topic names, see Chapter 18, Configuring a KIE Server to send and receive Kafka messages from the process.

8. Add an input data item. Select the data object that you created as its type.

9. Save the business process.

Next steps
To enable Red Hat AMQ Streams integration when running the process, you must configure the KIE Server according to instructions in Chapter 18, Configuring a KIE Server to send and receive Kafka messages from the process.

## 17.3. ADDING A CUSTOM TASK THAT SENDS KAFKA MESSAGES

You can add a KafkaPublishMessages custom task to your process. This task sends Kafka messages. It does not use the KIE Server Kafka capability, so you can use this task in processes that do not run on a KIE Server. However, this task can be more complicated to configure than other Red Hat AMQ Streams integration options.

### Procedure

1. In the Business Central administrative settings menu, as the administrative user, select Custom Tasks Administration.

2. Ensure that KafkaPublishMessages is set to On.

3. In Business Central, select Menu → Design → Projects and then click the space name and the project name.

4. Select the Settings → Custom Tasks tab.

5. In the KafkaPublishMessages line, click Install.

6. Optional: Enter the following information. If you leave any of the fields empty, the process engine uses the default values for these fields.

   - **Bootstrap Servers**: The host and port of the Kafka broker. You can use a comma-separated list of multiple host:port pairs. The default value is localhost:9092.

   - **Client ID**: An identifier string to pass to the broker when making requests. Red Hat AMQ Streams uses this string for logging. The default value is

   - **Key Serializer class**: The class that provides the key serializer. The default value is org.apache.kafka.common.serialization.StringSerializer. You can enter a different value if you want to use your own custom serializer class.

   - **Value Serializer class**: The class that provides the value serializer. The default value is org.apache.kafka.common.serialization.StringSerializer. You can enter a different value if you want to use your own custom serializer class.

   In any of these fields, you can enter an env[property] value. In this case, the process engine reads the setting from a system property at runtime. For example, you can set Client ID to env[application.client.id] and then, before running the process service, set the client ID value in the application.client.id system property.

7. If you entered the name of a custom serializer class, complete the following additional configuration:

   a. Select the Settings → Deployments → Work Item Handlers tab.

   b. In the KafkaPublishMessages line, modify the Value field to add the classLoader parameter. For example, the initial value of this field can be the following string:

   ```java
   ```
In this example, change the value to the following string:

```java
new org.jbpm.process.workitem.kafka.KafkaWorkItemHandler("127.0.0.1:9092", "jbpm",
classLoader)
```

8. Select the **Assets** tab.

9. Select the business process and open the business process designer.

10. Add the **KafkaPublishMessages** custom task, available under **Custom Tasks** in the BPMN modeler palette.

11. In the properties of the custom task, open the data assignments.

12. Assign the **Key**, **Topic**, and **Value** inputs to define the message.

**Next steps**

If you entered a custom serializer class, you must provide this class to your business application. For instructions about providing custom classes to your business application, see *Chapter 20, Providing a custom class to your business application in Business Central*. 

CHAPTER 18. CONFIGURING A KIE SERVER TO SEND AND RECEIVE KAFKA MESSAGES FROM THE PROCESS

To run a process that sends or receives Kafka messages (except when using the custom task), you must use a KIE Server. You must configure this KIE Server to integrate with Red Hat AMQ Streams.

Procedure

1. To enable integration with Red Hat AMQ Streams, set the following system properties according to your environment:
   - If you are using the KIE Server on Red Hat JBoss EAP, set the `org.kie.kafka.server.ext.disabled` system property of the KIE Server to `false`.
   - If you are using Spring Boot, set the `kieserver.kafka.enabled` system property to `true`.

2. To configure the connection to the Kafka broker, set the `org.kie.server.jbpm-kafka.ext.bootstrap.servers` system property to the host and port of the broker. The default value is `localhost:9092`. You can use a comma-separated list of multiple host:port pairs.

3. Optional: Set any of the following system properties to configure sending and receiving Kafka messages:
   - `org.kie.server.jbpm-kafka.ext.client.id`: An identifier string to pass to the broker when making requests. Red Hat AMQ Streams uses this string for logging.
   - `org.kie.server.jbpm-kafka.ext.topics.*`: Mapping of message names to topic names. For example, if you want to send or receive a message in the `ExampleTopic` topic when `ExampleName` is the name of the message, set the `org.kie.server.jbpm-kafka.ext.topics.ExampleName` system property to `ExampleTopic`. You can set any number of such system properties. If a message name is not mapped using a system property, the process engine uses this name as the topic name.

4. Optional: Set any of the following system properties to configure receiving Kafka messages:
   - `org.kie.server.jbpm-kafka.ext.group.id`: A unique string that identifies the group to which this Kafka message consumer belongs. The default value is `jbpm-consumer`.

5. Optional: Set any of the following system properties to configure sending Kafka messages:
   - `org.kie.server.jbpm-kafka.ext.acks`: The number of acknowledgements that the Kafka leader must receive before marking the request as complete. The default value is `1`, which means the leader writes the record to its local log and then responds to the process engine, without waiting for full acknowledgement from all followers.
   - `org.kie.server.jbpm-kafka.ext.max.block.ms`: The number of milliseconds for which the publish method blocks. After this time, the process engine can resume execution of the business process. The default value is `2000` (2 seconds).

18.1. CONFIGURING THE USE A CUSTOM MESSAGE FORMAT

By default, when using message events, the process engine sends and receives messages in a format compliant with the CloudEvents specification version 1.0.
Optionally, you can configure the use of a raw JSON data format or a custom format for the messages. If you want to use a custom format, you need to implement and provide classes.

**Prerequisites**

- Your project uses message events to send or receive messages.

**Procedure**

1. If you want to use a custom format for sending or receiving messages, implement and provide custom classes:
   
   a. Develop the source code for the classes:
      
      - To send messages, develop a class that implements the `KafkaEventWriter` interface
      - To receive messages, develop a class that implements the `KafkaEventReader` interface
         
         You can download the interface definitions from the GitHub repository.
      
   b. Provide the classes to your business application. For instructions, see Chapter 20, *Providing a custom class to your business application in Business Central*.

2. Set the following KIE Server system properties to set the custom writer or reader:
   
   - `org.kie.server.jboss-kafka-ext.eventWriterClass`: the custom event writer class. Set this property to use a different format to send messages. If you want to use a custom format, set the property to the fully qualified name of your custom event writer class. If you want to use a raw JSON data format, set the property to `org.kie.server.services.jboss.kafka.RawJsonEventWriter`.
   
   - `org.kie.server.jboss-kafka-ext.eventReaderClass`: the custom event reader class. Set this property to use a different format to receive messages. If you want to use a custom format, set the property to the fully qualified name of your custom event reader class. If you want to use a raw JSON data format, set the property to `org.kie.server.services.jboss.kafka.RawJsonEventReader`. 
CHAPTER 19. CONFIGURING A SERVICE AND THE KIE SERVER TO EMIT KAFKA MESSAGES WHEN A TRANSACTION IS COMMITTED

You can configure the KIE Server to emit Kafka messages about every event when a process, case, or task is completed. The KIE Server sends the messages when it commits transactions.

You can use this functionality with any business process or case. You do not need to change anything in the process design.

This configuration is also available if you run your process service using SpringBoot.

By default, the KIE Server publishes the messages in the following topics:

- jbpm-processes-events for messages about completed processes
- jbpm-tasks-events for messages about completed tasks
- jbpm-cases-events for messages about completed cases

You can configure the topic names.

The published messages comply with the CloudEvents specification version 1.0. Each message contains the following fields:

- id: The unique identifier of the event
- type: The type of the event (process, task, or case)
- source: The event source as a URI
- time: The timestamp of the event, by default in the RFC3339 format
- data: Information about the process, case, or task, presented in a JSON format

Procedure

1. To enable emitting Kafka messages, complete one of the following steps:
   a. If you deployed the KIE Server on Red Hat JBoss EAP or another application server:
      i. Download the rhpam-7.11.0-maven-repository.zip product deliverable file from the Software Downloads page of the Red Hat Customer Portal.
      ii. Extract the contents of the file.
      iii. Copy the maven-repository/org/jbpm/jbpm-event-emitters-kafka/7.52.0.Final-redhat-00007/jbpm-event-emitters-kafka-7.52.0.Final-redhat-00007.jar file into the deployments/kie-server.war/WEB-INF/lib subdirectory of the application server.
   b. If you deployed the application using SpringBoot, add the following lines to the <dependencies> list in the pom.xml file of your service:

```xml
<dependency>
  <groupId>org.jbpm</groupId>
  <artifactId>jbpm-event-emitters-kafka</artifactId>
</dependency>
```
2. Configure any of the following system properties for the KIE Server as necessary:

- **org.kie.jbpm.event.emitters.kafka.bootstrap.servers**: The host and port of the Kafka broker. The default value is `localhost:9092`. You can use a comma-separated list of multiple host:port pairs.

- **org.kie.jbpm.event.emitters.kafka.date_format**: The timestamp format for the `time` field of the messages. The default value is `yyyy-MM-dd'T'HH:mm:ss.SSSZ`.

- **org.kie.jbpm.event.emitters.kafka.topic.processes**: The topic name for process event messages. The default value is `jbpm-processes-events`.

- **org.kie.jbpm.event.emitters.kafka.topic.cases**: The topic name for process event messages. The default value is `jbpm-cases-events`.

- **org.kie.jbpm.event.emitters.kafka.topic.tasks**: The topic name for process event messages. The default value is `jbpm-processes-tasks`.

- **org.kie.jbpm.event.emitters.kafka.client.id**: An identifier string to pass to the server when making requests. The server uses this string for logging.
CHAPTER 20. PROVIDING A CUSTOM CLASS TO YOUR BUSINESS APPLICATION IN BUSINESS CENTRAL

To interact with Red Hat AMQ Streams, your business application requires a custom class in the following cases:

- You want to use a custom message format for sending or receiving messages using message events.
- You want to use a custom serializer class for the KafkaPublishMessages custom task.

To use a custom class in your business application, use Business Central to upload the source code and configure the class.

Alternatively, if you deploy your application on SpringBoot, you can compile the classes separately and include them in the class path. In this case, do not complete this procedure.

Procedure

1. Prepare Java source files with the required custom classes, for example, MyCustomSerializer. Use the package name for your space and project, for example, com.myspace.test.

2. In Business Central, enter your project and select the Settings → Dependencies tab.

3. Add any dependencies that your custom classes require, for example, org.apache.kafka.kafka-clients.

4. Select the Assets tab.

5. For each of the class source files, complete the following steps:
   a. Click Import Asset.
   b. In the Please select a file to upload field, select the location of the Java source file for the custom serializer class.
   c. Click Ok to upload the file.
CHAPTER 21. ADDITIONAL RESOURCES

- Using AMQ Streams on OpenShift
- Using AMQ Streams on RHEL
As a developer, you can integrate Red Hat Process Automation Manager with ElasticSearch. The KIE Server can send process, task, and case information to ElasticSearch as JSON documents.
CHAPTER 22. CONFIGURING THE KIE SERVER TO SEND INFORMATION TO ELASTICSEARCH WHEN A TRANSACTION IS COMMITTED

You can configure the KIE Server to send information to ElasticSearch about every event when a process, case, or task is modified. The KIE Server sends the information when it commits transactions.

You can use this functionality with any business process or case. You do not need to change anything in the process design.

This configuration is also available if you run your process service using Spring Boot.

The KIE Server serializes the process, case, and task information as JSON documents. It uses the following ElasticSearch indexes:

- **processes** for process information
- **cases** for case information
- **tasks** for task information

Prerequisites

- You created a business process or a case. For more information about creating a business process or case, see [*Developing process services in Red Hat Process Automation Manager*](#).

Procedure

1. To enable sending information to ElasticSearch, complete one of the following steps:
   a. If you deployed the KIE Server on Red Hat JBoss EAP or another application server:
      i. Download the `rhpam-7.11.0-maven-repository.zip` product deliverable file from the Software Downloads page of the Red Hat Customer Portal.
      ii. Extract the contents of the file.
      iii. Copy the `maven-repository/org/jbpm/jbpm-event-emitters-elasticsearch/7.52.0.Final-redhat-00007/jbpm-event-emitters-elasticsearch-7.52.0.Final-redhat-00007.jar` file into the `deployments/kie-server.war/WEB-INF/lib` subdirectory of the application server.
   b. If you deployed the application using Spring Boot, add the following lines to the `<dependencies>` list in the `pom.xml` file of your service:

   ```xml
   <dependency>
     <groupId>org.jbpm</groupId>
     <artifactId>jbpm-event-emitters-elasticsearch</artifactId>
     <version>${version.org.kie}</version>
   </dependency>
   ```

2. Configure any of the following system properties for the KIE Server as necessary:

   - **org.jbpm.event.emitters.elasticsearch.url**: The URL of the ElasticSearch server. The default value is `http://localhost:9200`.

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• **org.jbpm.event.emitters.elasticsearch.date_format**: The timestamp format for the information. The default value is `yyyy-MM-dd'T'HH:mm:ss.SSSZ`.

• **org.jbpm.event.emitters.elasticsearch.user**: The user name for authenticating to the ElasticSearch server.

• **org.jbpm.event.emitters.elasticsearch.password**: The password for authenticating the user to the ElasticSearch server.
APPENDIX A. VERSIONING INFORMATION

Documentation last updated on Monday, July 5, 2021.
APPENDIX B. CONTACT INFORMATION

Red Hat Process Automation Manager documentation team: brms-docs@redhat.com