

# Keycloak Authentication and Spring Boot Application

## **Installation and Setup:**

- Download the Keycloak server from the official website and install it on your preferred platform (Windows, Linux, Mac etc.).
- Set up a database for Keycloak (Keycloak supports various databases like PostgreSQL, MySQL, etc.). Install and configure the database if it is necessary.
- Configure Keycloak by editing the standalone.xml or standalone-ha.xml file located in the Keycloak server installation directory. Update the database settings and other configurations as needed with db-name, db-username, db-password.

## **Start Keycloak Server:**

- Start the Keycloak server by running the appropriate command use (./kc.sh start-dev) for Mac or script for your operating system.
- Keycloak will start and be accessible via a web interface in <http://localhost:8080/>.

## **Create a Realm:**

- Log in to the Keycloak Admin Console using the default credentials (admin/admin).
- Create a new realm, which is a security domain where your applications and users will reside.
- Configure the realm settings such as name, themes, email settings, etc.
- Add Clients:
- Create a client within the realm to represent your application. Configure the client settings such as client ID, access type, and redirect URIs.
- Specify the authentication flow, which defines how users will be authenticated (e.g., username/password, social login, etc.).

## **Manage Users and Roles:**

- Create user accounts within the realm or allow users to self-register.
- Define roles and assign them to users. Roles control the permissions and access levels within your application.
- Integrate Authentication into Your Application:
- Integrate Keycloak's authentication into your application by utilizing Keycloak's client adapters. Keycloak provides adapters for various programming languages and frameworks like Java, Node.js, etc.
- Configure the adapter with the necessary settings such as Keycloak server URL, realm name, client ID, etc.

## **Implement Authentication and Authorization:**

- In your application, use the Keycloak adapter to initiate the authentication flow and handle user login and logout.
- Validate tokens received from Keycloak to ensure the user's authenticity and extract user information for authorization purposes.
- Use Keycloak's APIs or libraries to implement fine-grained authorization based on user roles and permissions.

# **how keycloak works for access control and Where do the messages go and how does it control an users access to a call?**

Keycloak is an open-source identity and access management solution that provides centralized authentication, authorization, and user management for applications and services. It's built on top of the OAuth 2.0 and OpenID Connect (OIDC) protocols, which are industry-standard mechanisms for secure authentication and authorization.

## **Here's an overview of how Keycloak works for access control:**

**User Authentication:** When a user wants to access a protected resource (e.g., a web application, API, or service), the application redirects the user to Keycloak for authentication. Keycloak provides a login page and supports various authentication methods, such as username/password, social login (e.g., Google, Facebook), or multi-factor authentication.

## **Authorization and Access Control Policies:**

After successful authentication, Keycloak issues an access token and an optional refresh token to the user. The access token contains information about the user and their permissions. Keycloak's access control mechanism is based on the concept of policies, which define what a user can or cannot do. Policies can be based on user roles, user attributes, group membership, time of day, client application, etc.

## **Resource Server Protection:**

The application or service that hosts the protected resource is referred to as the Resource Server. When a user tries to access a specific endpoint or perform an action within the Resource Server, the server validates the access token presented by the user. The Resource Server then sends a request to Keycloak to validate the token's authenticity and check the user's permissions based on defined policies.

## **Token Verification:**

To validate the access token, the Resource Server communicates with Keycloak's Token Validation endpoint. This endpoint verifies the signature and expiration of the token and ensures that the user has the required permissions to access the requested resource.

## **Token-Based Access Decision:**

Keycloak uses the information stored in the access token to make an access control decision. The token contains information about the user, such as their ID, roles, and other attributes, which are used to evaluate the policies associated with the requested resource.

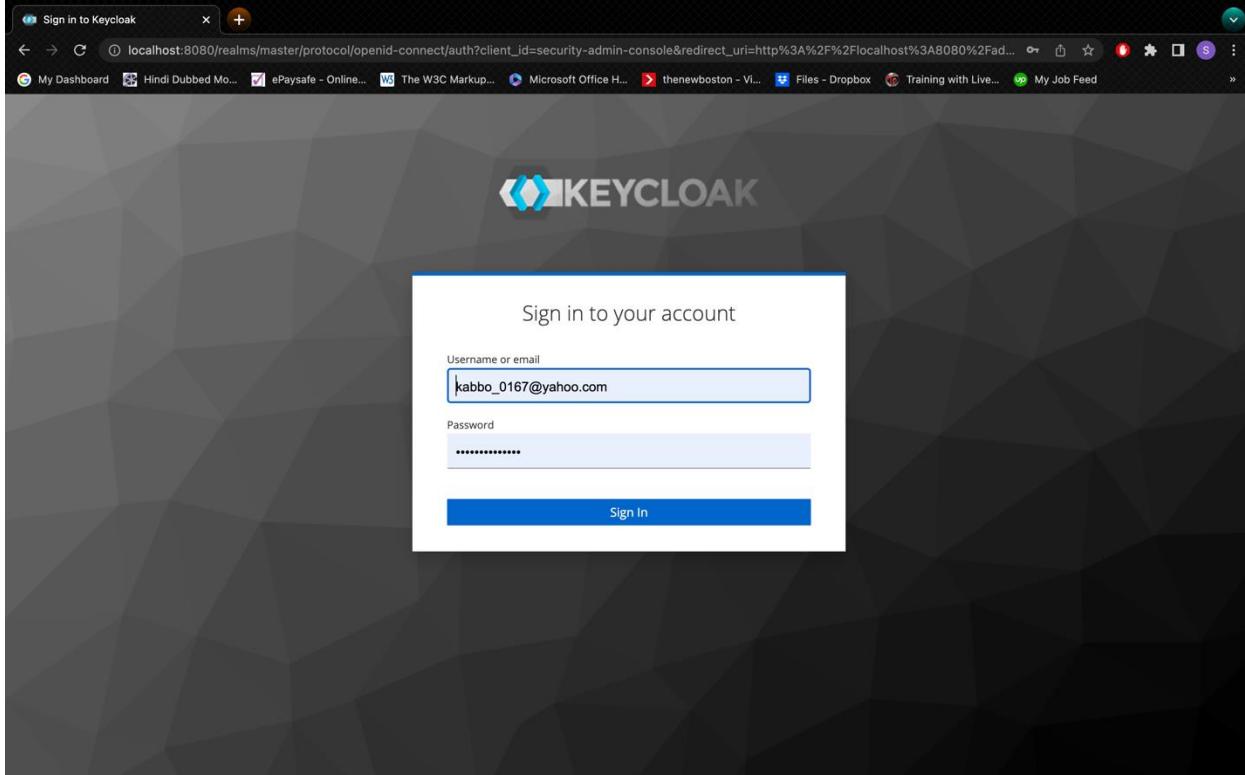
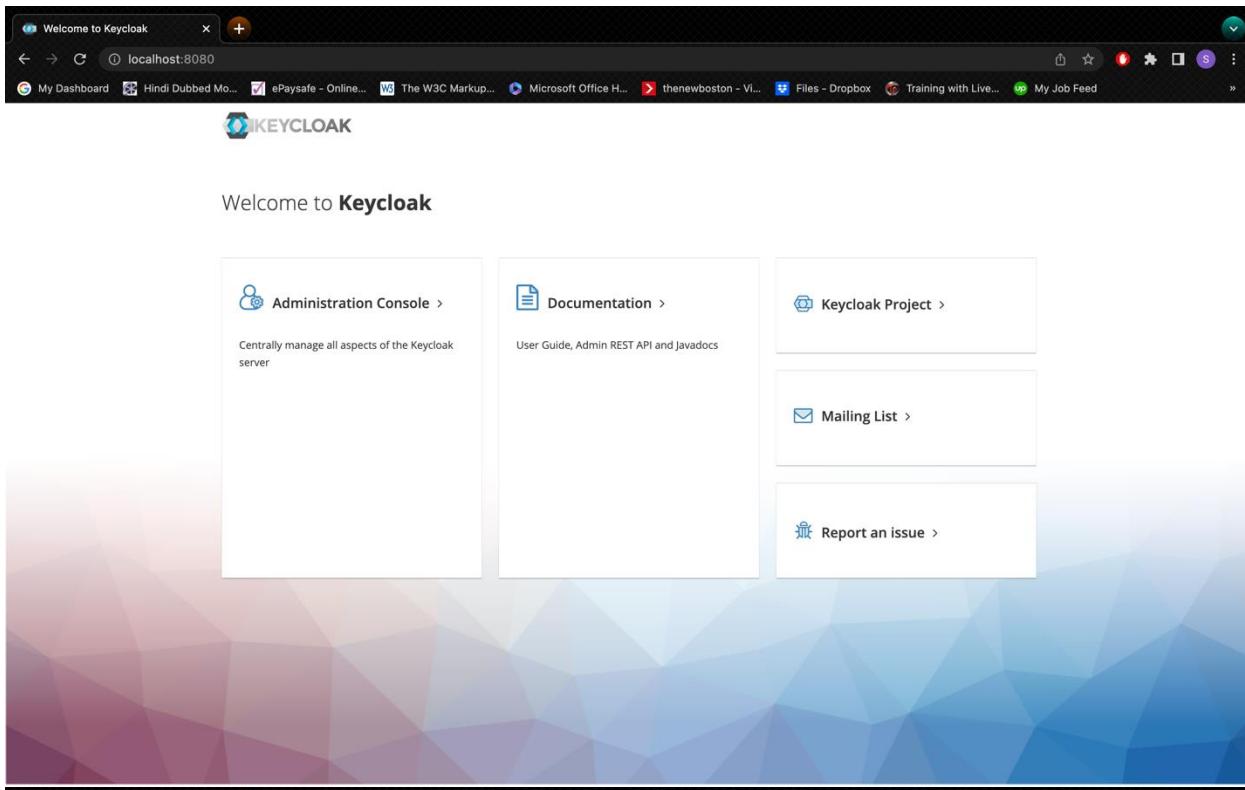
## **Token Lifespan and Refresh:**

Access tokens have a limited lifespan to enhance security. If the token expires, the user must re-authenticate with Keycloak to obtain a new token. Alternatively, if the application has been granted the necessary permissions, it can use the refresh token to request a new access token without requiring the user to re-enter their credentials.

## **Summary of enables Keycloak access:**

Enables access control by providing a central authentication and authorization service. It issues access tokens to authenticated users containing their permissions and attributes. Resource Servers validate these tokens with Keycloak to determine whether a user is allowed to access specific resources or perform particular actions within the application or service. This approach ensures secure and fine-grained access control across different components of an application or multiple interconnected services.





Keycloak Administration UI

localhost:8080/admin/master/console/

My Dashboard Hindi Dubbed Mo... ePaysafe - Online... The W3C Markup... Microsoft Office H... thenewboston - Vi... Files - Dropbox Training with Live... My Job Feed

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## master realm

Server info Provider info

Server info		Profile	
Version	21.1.1	Enabled features	ACCOUNT3 (Experimental) ADMIN_FINE_GRAINED_AUTHZ (Preview)
Product	Default	Disabled features	CLIENT_SECRET_ROTATION (Preview) DECLARATIVE_USER_PROFILE (Preview)
Memory		DOCKER (Supported)	DYNAMIC_SCOPES (Experimental) FIPS (Supported)
Total memory	512 MB	MAP_STORAGE (Experimental)	OPENSHIFT_INTEGRATION (Preview)
Free memory	351 MB	RECOVERY_CODES (Preview)	SCRIPTS (Preview) TOKEN_EXCHANGE (Preview)
Used memory	160 MB	UPDATE_EMAIL (Preview)	

Create Realm

Events

Configure

Realm settings

Authentication

Identity providers

localhost:8080/admin/master/console/#/master/add-realm

Keycloak Administration UI

localhost:8080/admin/master/console/#/master/add-realm

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## Create 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.

Resource file  Drag a file here or browse to upload

Upload a JSON file

Realm name \*

Enabled  On

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/clients/add-client

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Clients > Create client

SpringBootKeycloakCon...

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Create client

Clients are applications and services that can request authentication of a user.

1 General Settings 2 Capability config 3 Login settings

Client type: OpenID Connect

Client ID: springboot-and-keycloak-config-test-app

Name:

Description:

Always display in UI: Off

Next Back Cancel

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/clients/add-client

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Clients > Create client

SpringBootKeycloakCon...

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Create client

Clients are applications and services that can request authentication of a user.

1 General Settings 2 Capability config 3 Login settings

Client authentication: Off

Authorization: Off

Authentication flow:

- Standard flow
- Direct access grants
- Implicit flow
- Service accounts roles
- OAuth 2.0 Device Authorization Grant
- OIDC CIBA Grant

Next Back Cancel

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/clients/add-client

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Clients > Create client

SpringBootKeycloakCon...

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Create client

Clients are applications and services that can request authentication of a user.

1 General Settings Root URL

2 Capability config

3 Login settings Home URL

Valid redirect URIs http://localhost:8082/\* Add valid redirect URIs

Valid post logout redirect URIs Add valid post logout redirect URIs

Web origins Add web origins

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/clients/89d60c5a-0ebd-4098-be67-488ec1cb2a58/roles

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Clients > Client details

SpringBootKeycloakCon...

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

springboot-and-keycloak-config-test-app OpenID Connect Enabled Action

Clients are applications and services that can request authentication of a user.

Settings Roles Client scopes Sessions Advanced

No roles for this client

You haven't created any roles for this client. Create a role to get started.

Create role

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/clients/89d60c5a-0ebd-4098-be67-488ec1cb2a58/roles/new

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Clients > Client details > Create role

### Create role

Role name \* app\_member

Description member of the application

Save Cancel

SpringBootKeycloakCon...

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/clients/89d60c5a-0ebd-4098-be67-488ec1cb2a58/roles/new

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Clients > Client details > Create role

### Create role

Role name \* app\_librarian

Description Librarian of the application

Save Cancel

SpringBootKeycloakCon...

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/clients/89d60c5a-0ebd-4098-be67-488ec1cb2a58/roles

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Role created

Clients > Client details

springboot-and-keycloak-config-test-app (OpenID Connect)

Clients are applications and services that can request authentication of a user.

Enabled Action

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Settings Roles Client scopes Sessions Advanced

Search role by name Create role

Role name	Composite	Description
app_librarian	False	Librarian of the application
app_member	False	member of the application

1-2

Role name: Member

Description:

Save Cancel

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/roles/new

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Realm roles > Create role

Create role

Role name \* Member

Description:

Save Cancel

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/roles/363d9119-ab2d-43d9-ba30-d3fb3d44b66c/details

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SpringBootKeycloakCon...

Realm roles > Role details

## Librarian

Action ▾

- Add associated roles
- Delete this role

Details Attributes Users in role

Role name Librarian

Description

Save Cancel

Manage

Clients

Client scopes

Realm roles

Users

Groups

Sessions

Events

Configure

Realm settings

Authentication

Identity providers

User federation

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/roles

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SpringBootKeycloakCon...

## Realm roles

Realm roles are the roles that you define for use in the current realm. [Learn more](#)

Search role by name Create role

1-5

Role name	Composite	Description	⋮
default-roles-springbootkeycloakconfig	True	\${role_default-roles}	⋮
Librarian	False	-	⋮
Member	False	-	⋮
offline_access	False	\${role_offline-access}	⋮
uma_authorization	False	\${role_uma_authorization}	⋮

1-5

Manage

Clients

Client scopes

Realm roles

Users

Groups

Sessions

Events

Configure

Realm settings

Authentication

Identity providers

User federation

Keycloak Administration UI    +

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/roles/363d9119-ab2d-43d9-ba30-d3fb3d44b66c/details

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Assign roles to Librarian

Filter by clients app Description

Name	Description
account view-applications	\${role_view-applications}
<input checked="" type="checkbox"/> springboot-and-keycloak-config-test-app app_librarian	Librarian of the application
<input type="checkbox"/> springboot-and-keycloak-config-test-app app_member	member of the application

Assign Cancel

Authentication Identity providers User federation

Keycloak Administration UI    +

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/roles/078e99a9-2f8b-4e4a-8f84-07dd4c304b6f/details

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Assign roles to Member

Filter by clients app Description

Name	Description
account view-applications	\${role_view-applications}
<input type="checkbox"/> springboot-and-keycloak-config-test-app app_librarian	Librarian of the application
<input checked="" type="checkbox"/> springboot-and-keycloak-config-test-app app_member	member of the application

Assign Cancel

Authentication Identity providers User federation

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/users

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SpringBootKeycloakCon...

Manage

Clients

Client scopes

Realm roles

**Users**

Groups

Sessions

Events

Configure

Realm settings

Authentication

Identity providers

User federation

## Users

Users are the users in the current realm. [Learn more](#)

User list

No users found

Change your search criteria or add a user

Create new user

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/users/add-user

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SpringBootKeycloakCon...

Manage

Clients

Client scopes

Realm roles

**Users**

Groups

Sessions

Events

Configure

Realm settings

Authentication

Identity providers

User federation

## Create user

Required user actions Select action

Username \* user1

Email user1@gmail.com

Email verified Yes

First name user1

Last name

Groups Join Groups

Create Cancel

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/users/0a1eda26-7b0f-40e7-827e-c1799a399ff9/credentials

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KEYCLOAK

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SpringBootKeycloakCon... ▾

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Users > User details user1

Enabled Action

Identity provider links Sessions Credential Reset

Set password for user1

Password \* ..... Password confirmation \* .....

Temporary  Off

Save Cancel

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/users/0a1eda26-7b0f-40e7-827e-c1799a399ff9/role-mapping

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KEYCLOAK

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Spring

Manage Clients Client scopes Realm roles Users Groups Sessions Events Configure Realm settings Authentication Identity providers User federation

Assign roles to user1

Filter by realm roles ▾ Search by role name → 1 - 4 ▾

Name	Description
<input type="checkbox"/> Librarian	
<input checked="" type="checkbox"/> Member	
<input type="checkbox"/> offline_access	#[role_offline-access]
<input type="checkbox"/> uma_authorization	#[role_uma_authorization]

Assign Cancel

Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/users/add-user

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KEYCLOAK Shamim Hasan

Create user

SpringBootKeycloakCon...

Manage

Clients

Client scopes

Realm roles

**Users**

Groups

Sessions

Events

Configure

Realm settings

Authentication

Identity providers

User federation

Required user actions Select action

Username \* user2

Email user2@gmail.com

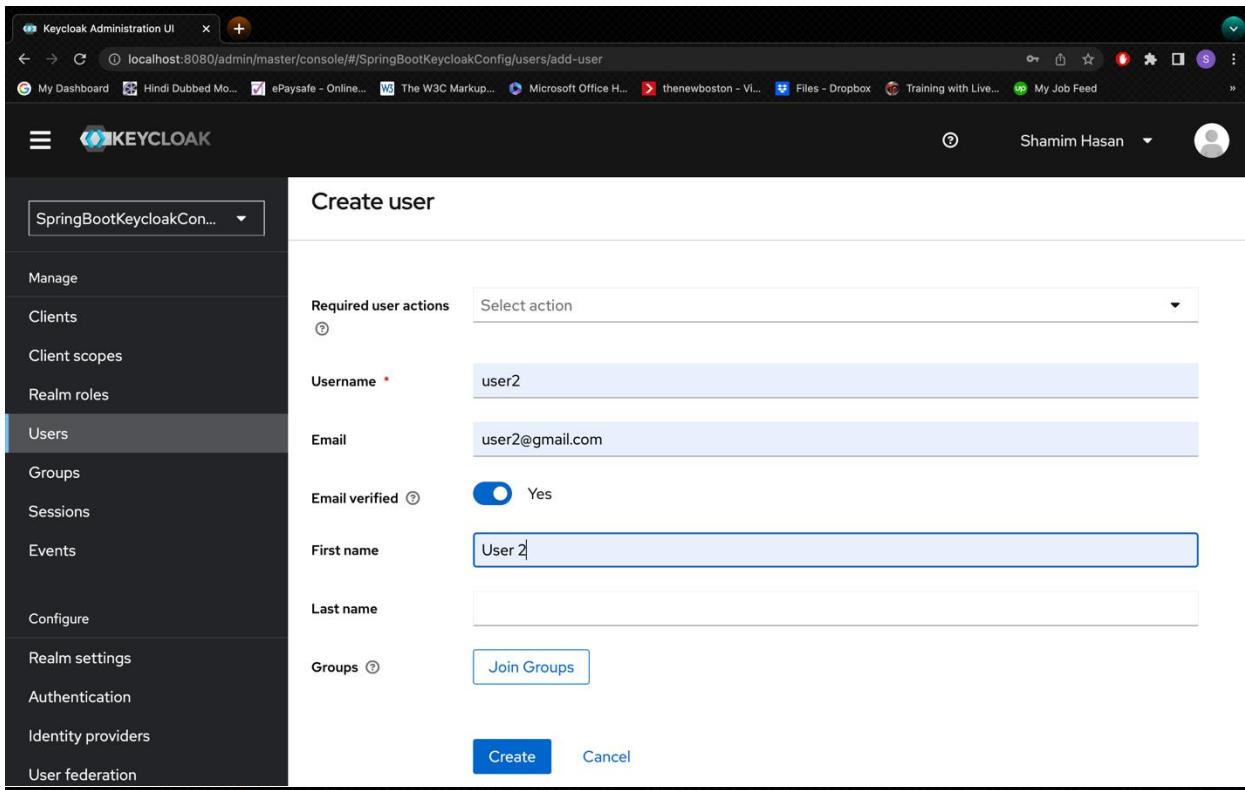
Email verified Yes

First name User 2

Last name

Groups Join Groups

Create Cancel



Keycloak Administration UI

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/users/c426359c-f9c7-4603-83c8-34fa9c3eacf0/credentials

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Users > User details

SpringBootKeycloakCon...

Manage

Clients

Client scopes

Realm roles

**Users**

Groups

Sessions

Events

Configure

Realm settings

Authentication

Identity providers

User federation

user2

Enabled Action

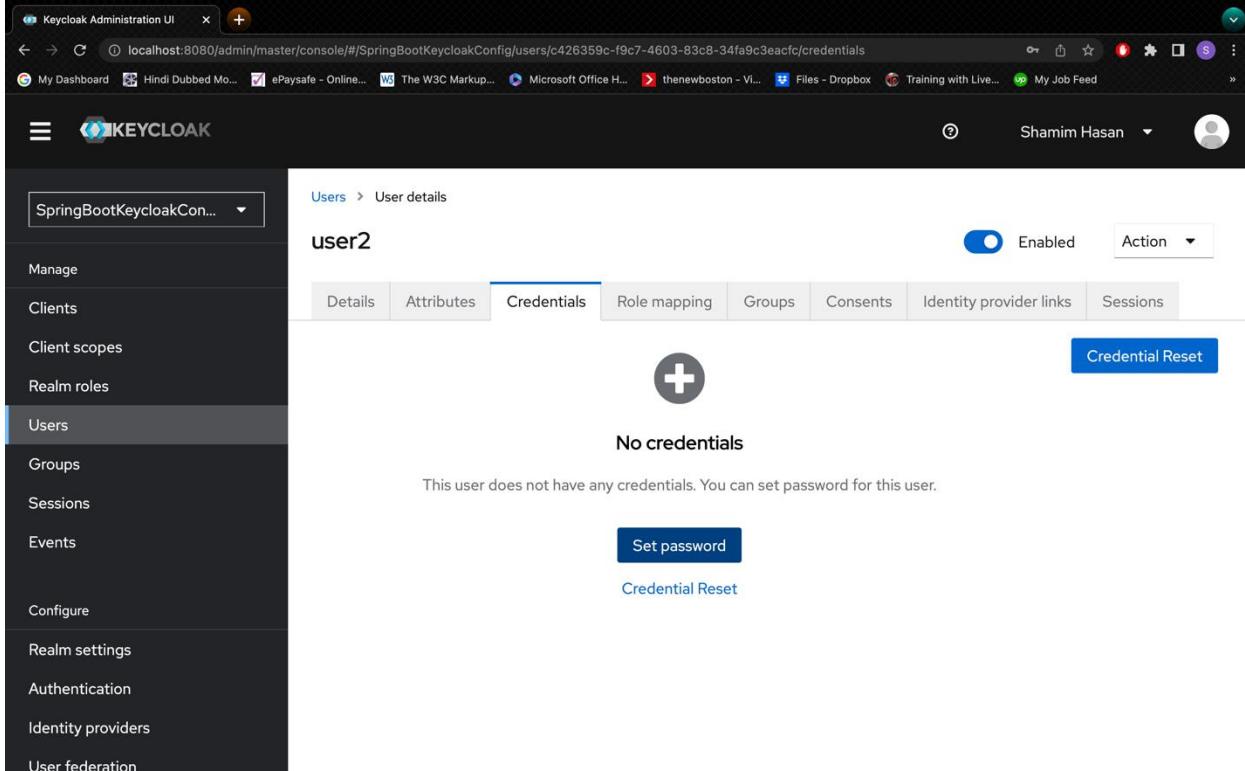
Details Attributes Credentials Role mapping Groups Consents Identity provider links Sessions

Credential Reset

No credentials

This user does not have any credentials. You can set password for this user.

Set password Credential Reset



Keycloak Administration UI    403 | Forbidden

localhost:8080/admin/master/console/#/SpringBootKeycloakConfig/users/c426359c-f9c7-4603-83c8-34fa9c3eacf0/role-mapping

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## Assign roles to user2

Filter by realm roles ▾ Search by role name → 1-4 ▾

Name	Description
<input checked="" type="checkbox"/> Librarian	
<input checked="" type="checkbox"/> Member	
<input type="checkbox"/> offline_access	\${role_offline-access}
<input type="checkbox"/> uma_authorization	\${role_uma_authorization}

1-4 ▾

Assign Cancel

Manage Clients Client realms Realm resources Users Groups Sessions Events Configuration Realm settings Authentication Identity providers User federation

Keycloak Administration UI    Spring Initializr

start.spring.io

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Spring Initializr

Project Language Dependencies

No dependency selected ADD DEPENDENCIES... ⌘ + B

Gradle - Groovy Java Kotlin Groovy

Gradle - Kotlin Maven

Spring Boot

3.1.1 (SNAPSHOT) 3.1.0 3.0.8 (SNAPSHOT) 3.0.7

2.7.13 (SNAPSHOT) 2.7.12

Project Metadata

Group com.example

Artifact demo

Name demo

Description Demo project for Spring Boot

Package name com.example.demo

Packaging Jar War

Java 20 17 11 8

GENERATE ⌘ + ↵ EXPLORE CTRL + SPACE SHARE...

The image shows two vertically stacked code editors within an IDE interface. Both editors have a dark theme and display Java code.

**Top Editor:**

```
spring_boot_and_keycloak_config_test_app src main java com.cyberskills.spring_boot_and_keycloak
  SpringBootAndKeycloakApplication.java application.properties BookRepository.java KeycloakConfig.java SecurityConfig.java

  package com.cyberskills.spring_boot_and_keycloak;
  import ...
  @SpringBootApplication(exclude={DataSourceAutoConfiguration.class, SecurityAutoConfiguration.class})
  public class SpringBootAndKeycloakApplication {
    public static void main(String[] args) { SpringApplication.run(SpringBootAndKeycloakApplication.class, args);
  }
```

**Bottom Editor:**

```
spring_boot_and_keycloak_config_test_app src main resources application.properties
  SpringBootAndKeycloakApplication.java application.properties BookRepository.java KeycloakConfig.java SecurityConfig.java

  server.port=8082
  keycloak.realm=
  keycloak.resource=
  keycloak.auth-server-url=http://localhost:8080
  keycloak.ssl-required=external
  keycloak.public-client=true
  keycloak.principal-attribute=preferred_username
```

The bottom editor's status bar shows the following information: 8:101 (101 chars, 1 line break) LF UTF-8 Tab\*. The top editor's status bar shows the current time as 4:19 and other system details.

spring\_boot\_and\_keycloak\_config\_test\_app src main resources application.properties

```

server.port=8082

keycloak.realm=SpringBootKeycloakConfig
keycloak.resource=springboot-and-keycloak-config-test-app
keycloak.auth-server-url=http://localhost:8080
keycloak.ssl-required=external
keycloak.public-client=true
keycloak.principal-attribute=preferred_username

```

Version Control    TODO    Problems    Terminal    Services    Profiler    Build    Dependencies

4:58 LF ISO-8859-1 4 spaces

Run: SpringBootAndKeycloakApplication

Console Actuator

```

:: Spring Boot ::      (v2.7.12)

2023-06-16 11:43:56.376 INFO 7413 --- [           main] c.c.s.SpringBootAndKeycloakApplication : Starting SpringBootAndKeycloakApplication using Java 20.0.1 on Sha
2023-06-16 11:43:56.376 INFO 7413 --- [           main] c.c.s.SpringBootAndKeycloakApplication : No active profile set, falling back to 1 default profile: "default"
2023-06-16 11:43:58.016 INFO 7413 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer : Tomcat initialized with port(s): 8082 (http)
2023-06-16 11:43:58.027 INFO 7413 --- [           main] o.apache.catalina.core.StandardService : Starting service [Tomcat]
2023-06-16 11:43:58.028 INFO 7413 --- [           main] org.apache.catalina.core.StandardEngine : Starting Servlet engine: [Apache Tomcat/9.0.75]
2023-06-16 11:43:58.156 INFO 7413 --- [           main] o.a.c.c.C.[Tomcat].[localhost].[/] : Initializing Spring embedded WebApplicationContext
2023-06-16 11:43:58.156 INFO 7413 --- [           main] w.s.c.WebServerApplicationContext : Root WebApplicationContext: initialization completed in 1710 ms
2023-06-16 11:43:58.491 INFO 7413 --- [           main] o.s.s.web.DefaultSecurityFilterChain : Will secure any request with [org.springframework.security.web.ses
2023-06-16 11:43:58.647 INFO 7413 --- [           main] o.s.b.a.w.s.WelcomePageHandlerMapping : Adding welcome page template: index
2023-06-16 11:43:58.879 INFO 7413 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer : Tomcat started on port(s): 8082 (http) with context path ''
2023-06-16 11:43:58.894 INFO 7413 --- [           main] c.c.s.SpringBootAndKeycloakApplication : Started SpringBootAndKeycloakApplication in 3.252 seconds (JVM run

```

Version Control    Run    TODO    Problems    Terminal    Services    Profiler    Build    Dependencies

Build completed successfully in 5 sec, 607 ms (moments ago)

LF ISO-8859-1 4 spaces

A screenshot of a web browser window. The address bar shows 'localhost:8082'. The page title is 'Home | Public Library'. The navigation bar includes 'Public Library', 'Home', 'Browse Books', and 'Manage Library'. The main content area displays the heading 'Public Library' and the message 'Welcome to the public library. You are free to visit this page since it is not protected.'

## Public Library

Welcome to the public library. You are free to visit this page since it is not protected.

A screenshot of a web browser window. The address bar shows 'localhost:8080/realms/SpringBootKeycloakConfig/protocol/openid-connect/auth?response\_type=code&client\_id=springboot-and-keycloak-config-t...'. The page title is 'Sign in to SpringBootKeycloak'. The main content area displays a sign-in form with fields for 'Username or email' (containing 'user1') and 'Password' (containing '\*\*\*\*\*'). A 'Sign In' button is at the bottom of the form. The background of the page features a dark, geometric pattern.

Public Library Home Browse Books Manage Library Logout

#	Title	Author
B01	Harry Potter and the Deathly Hallows	J.K. Rowling
B02	The Lord of the Rings	J.R.R. Tolkien
B03	War and Peace	Leo Tolstoy

localhost:8082/logout

Public Library Home Browse Books Manage Library

#	Title	Author
B01	Harry Potter and the Deathly Hallows	J.K. Rowling
B02	The Lord of the Rings	J.R.R. Tolkien
B03	War and Peace	Leo Tolstoy

## Hello user 1

This page is protected. You have member privileges, so you can browse the books.

#	Title	Author
B01	Harry Potter and the Deathly Hallows	J.K. Rowling
B02	The Lord of the Rings	J.R.R. Tolkien
B03	War and Peace	Leo Tolstoy

## Forbidden

You don't have the right privileges to access this area.



Keycloak Administration UI

Sign in to SpringBootKeycloakConfig

localhost:8080/realm/BootstrapKeycloakConfig/protocol/openid-connect/auth?response\_type=code&client\_id=springboot-and-keycloak-config-t...

My Dashboard Hindi Dubbed Mo... ePaysafe - Online... The W3C Markup... Microsoft Office H... thenewboston - Vi... Files - Dropbox Training with Live... My Job Feed

SPRINGBOOTKEYCLOAKCONFIG

Sign in to your account

Username or email

user2

Password

\*\*\*\*\*

Sign In

Keycloak Administration UI

Browse Books

localhost:8082/books

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Public Library Home Browse Books Manage Library Logout

## Hello User 2

This page is protected. You have member privileges, so you can browse the books.

#	Title	Author
B01	Harry Potter and the Deathly Hallows	J.K. Rowling
B02	The Lord of the Rings	J.R.R. Tolkien
B03	War and Peace	Leo Tolstoy

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Keycloak Administration UI × Manage Library × +

localhost:8082/manager

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Public Library Home Browse Books Manage Library Logout

## Hello User 2

This page is protected. You have librarian privileges, so you can manage the library.



# Git Comment

- Add file or folder to git repository:
  1. Check the status: - git status
  2. Add the file or folder to git repository: - git add (file or folder name)
  3. Add all file or folder to git repository: - git add .
  4. Add commit for folder or file: - git commit -m "your commit here"
- Download the branch and sw

## **Configuration for the User globally or Locally**

git config --global user.name "Shamim Hasan"	configuration user globally to git by user name
git config --local user.name "Targaryen Hasan"	configuration user locally to git by user name
git config --global user.email "shamim.hasan@mycit.ie"	configuration user globally to git by user email
git config --local user.email "targaryen.hasan@mtu.ie"	configuration user locally to git by user name
git config --global color.ui "auto"	
git config --list	See configuration user list

## **Getting & Creating Projects**

<b>Command</b>	<b>Description</b>
git init	Initialize a local Git repository
git clone ssh://git@github.com/[username]/[repository-name].git	Create a local copy of a remote repository

<b>Basic Snapshotting</b>	
<b>Command</b>	<b>Description</b>
git status	Check status
git add [file-name.txt]	Add a file to the staging area
git add -A	Add all new and changed files to the staging area
git commit -m "[commit message]"	Commit changes
git rm -r [file-name.txt]	Remove a file (or folder)

<b>Branching &amp; Merging</b>	
<b>Command</b>	<b>Description</b>
git branch	List branches (the asterisk denotes the current branch)
git branch -a	List all branches (local and remote)
git branch [branch name]	Create a new branch
git branch -d [branch name]	Delete a branch
git push origin --delete [branch name]	Delete a remote branch
git checkout -b [branch name]	Create a new branch and switch to it
git checkout -b [branch name] origin/[branch name]	Clone a remote branch and switch to it
git branch -m [old branch name] [new branch name]	Rename a local branch
git checkout [branch name]	Switch to a branch
git checkout -	Switch to the branch last checked out
git checkout -- [file-name.txt]	Discard changes to a file
git merge [branch name]	Merge a branch into the active branch
git merge [source branch] [target branch]	Merge a branch into a target branch
git stash	Stash changes in a dirty working directory

git stash clear	Remove all stashed entries
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Sharing & Updating Projects	
Command	Description
git push origin [branch name]	Push a branch to your remote repository
git push -u origin [branch name]	Push changes to remote repository (and remember the branch)
git push	Push changes to remote repository (remembered branch)
git push origin --delete [branch name]	Delete a remote branch
git pull	Update local repository to the newest commit
git pull origin [branch name]	Pull changes from remote repository
git remote add origin ssh://git@github.com/[username]/[repository-name].git	Add a remote repository
git remote set-url origin ssh://git@github.com/[username]/[repository-name].git	Set a repository's origin branch to SSH

Inspection & Comparison	
Command	Description
git log	View changes
git log --summary	View changes (detailed)
git log --oneline	View changes (briefly)
git diff [source branch] [target branch]	Preview changes before merging