Smile Guide: SMART on FHIR

Development and configuration of SMART on FHIR with Smile CDR

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What to Expect

🕑 *Reading time = 1 hour*

By the end of this guide you'll be able to:

- Configure Smile CDR to support a Smart on FHIR app on an EHR or resource server
- Create a simple SMART on FHIR app and
- Connect it to Smile CDR

Background

SMART on FHIR is an open source standards-based API which enables innovators to develop an app once and have it run anywhere in the healthcare system. SMART on FHIR has defined a secure authorization method that allows health apps to connect and access protected information from EHR systems.

Prerequisites

The following items/knowledge are required:

1. It's assumed that there's an understanding of the documentation below:
    a. SMILE CDR
    b. SMART on FHIR or Smarthealthit
    c. FHIR HL7
2. Smile CDR is already installed. If it's not installed, please consult the link here:
3. The following SMART app development prerequisites are available:
    a. A local server to host the app. (For the purposes of this document, we'll use node-based http-server. There's no need to install it separately.)
    b. A basic understanding of JavaScript is beneficial to understand this app.
    c. NodeJs installed. If it's not installed, please consult the link here

Tools

The following tools/software will be needed to complete this guide.

- API Testing Platform (Insomnia, Postman or similar)
- Visual Studio Code or Notepad++ to edit HTML and JSON files
- Local server to host the app

Configuring Smile CDR

To use Smile CDR as a launch platform for Smart on FHIR apps, we need to configure the following modules:

1. OIC Client Configuration
2. SMART Outbound Security Module
3. FHIR Endpoint Module

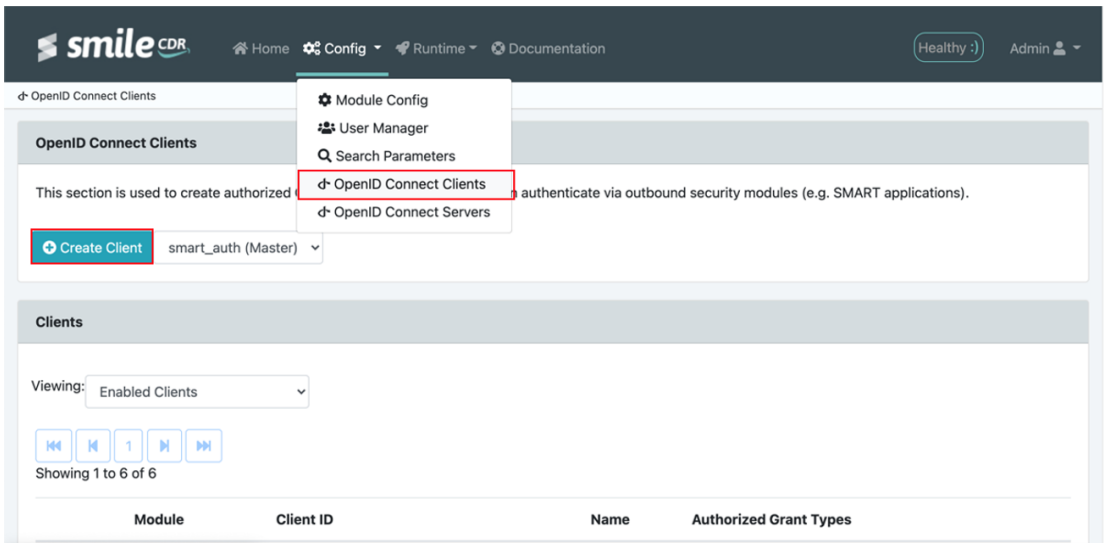
OIC Client Configuration/Creation of an OIC Client

To support launching the SMART on FHIR applications using Smile CDR, we need to configure the *OpenId Connect Client* (OIC Client) module. OpenId Client or OIC is a simple identity layer built on top of the OAuth 2.0 protocol. It allows clients to verify the identity of the End-User based on the authentication performed by an Authorization Server as well as obtain basic profile information about the End-User in an interoperable and REST-like manner. To configure the OIC:

1. **Sign in** to the Web Admin Console of Smile CDR by typing in this link:

   http://localhost:9100

2. On the top menu bar, **select** "Config," then **select "***OpenID Connect Client*." You should see a page like this:



3. To create a new client, **click** on **"***Create Client*."

4. On the "Create Client" page **set the configurations** to the specifications below. (There are more configurations than given below; however, for this guide, only the configurations indicated below are required.)

Configuration	Sample Value	Description
Client ID	patient_app_demo	This value needs to match the value of client_id being passed from the App while sending an authorization request
Client Name	SMART Patient	Name of the SMART App. This will be shown to the user while authorizing.
Authorized Grant Types	Authorization Code	Enable authorization types that the SoF app will support. For more information see here
Access Token Validity	3600	Tokens requested by this client will be valid for the given time period.
Refresh Token Validity	86400	If refresh tokens are enabled, any refresh tokens requested by this client will be valid for the given time period
Authorized Redirect URLs	http://127.0.0.1:9201/ http://127.0.0.1:9201/index.html	These are the URLs that the SoF app is allowed to use. Upon successful authorization, the user will be redirected to this URL.
Scopes	openid launch patient/*.read offline_access	A list of SMART scope (space separated) that client is permitted to request. Click here to read more about scopes

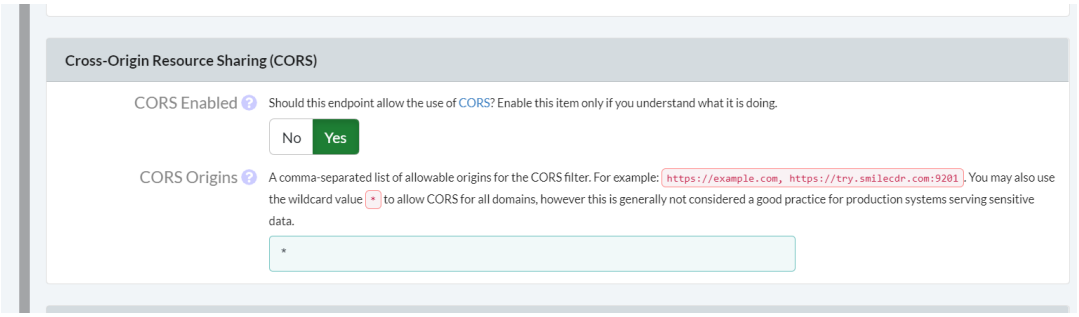
5. **Click "***Create"* and it should create an OIC client for you.

6. The client list should display newly created OIC clients. For future changes to the clients configuration, **click "***Modify"* and change any configurations as desired.

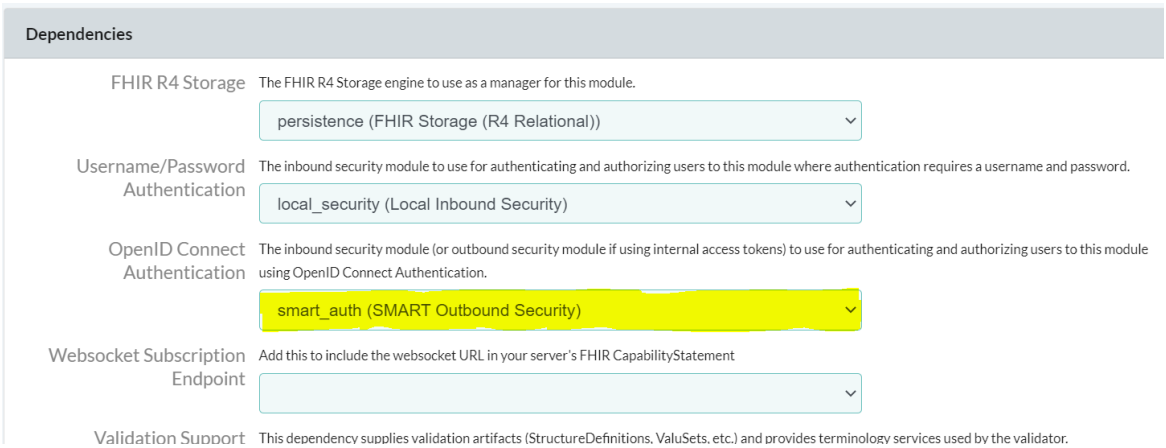
Enable SMART on FHIR requests

We'll need to make a few more module configurations to allow the SMART on FHIR App to submit a FHIR request to Smile CDR.

1. From the top menu bar, **select** "*Config*," then select "*Module Config.*"
2. We need to enable CORS for the SMART Authentication Module. To do this:
    a. On the left pane, **go** to the "*smart_auth module*."
    b. **Scroll down** to the "*Cross-Origin Resource Sharing (CORS)*" section**.**
    c. **Toggle "***CORS Enabled*" to "**YES**."

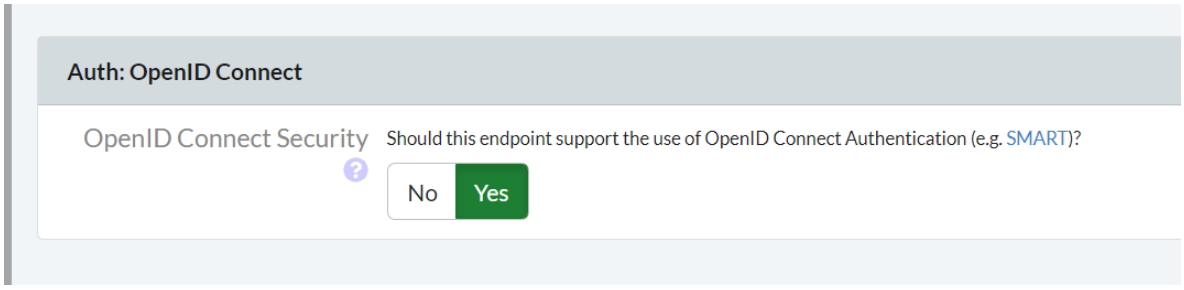


    d. Scroll to the top of the page and then, **click** "*Save*" and then **click "***Restart*."
3. Next, we need to enable the SMART Authentication for the FHIR Endpoint Module.
    a. **Select** the "*fhir_endpoint*" module from the left pane.
    b. **Scroll down** to the *"Dependencies"* section.
    c. For the "*OpenID Connect Authentication*" config, **select** "*smart_auth*" from the drop-down menu.



d. On the left pane, **scroll down** to *"Auth: OpenID Connect."*

e. **Toggle "***OpenID Connect Security***"** to"**YES**".

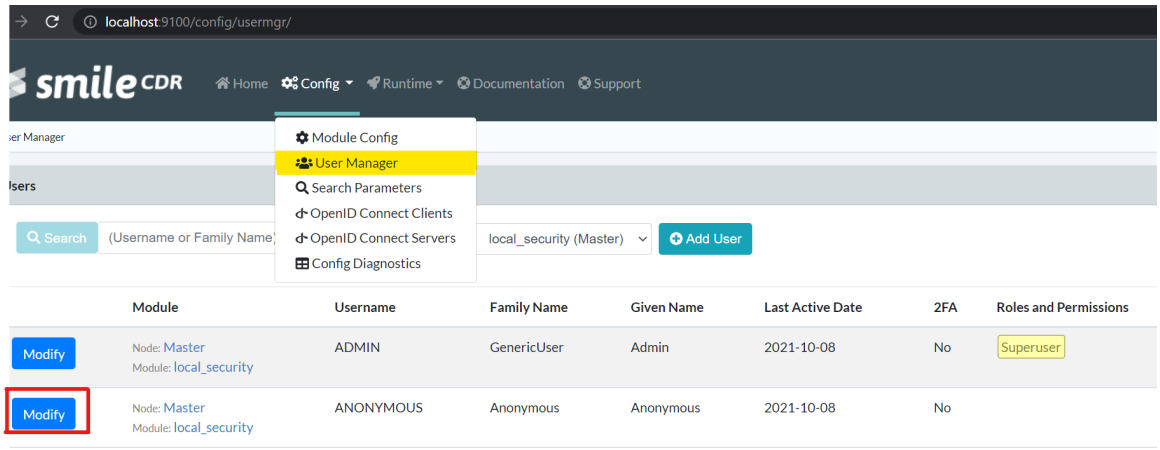


f. **Click** *"Save,"* then "*Restart."*

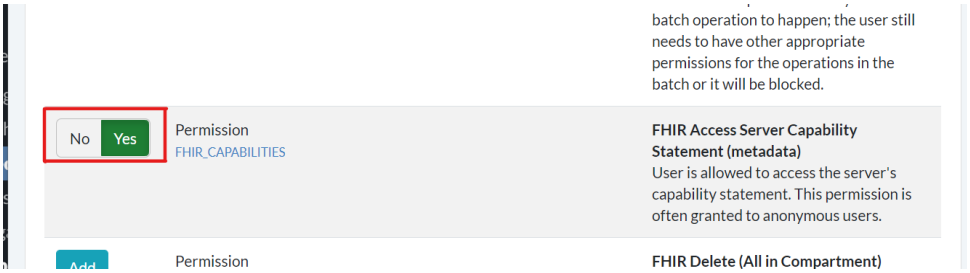
4. Now we need to enable the Anonymous Access to Capability Statement. When doing this, any requests that don't supply credentials will be granted the authorities of the designated Anonymous user. By default, this is a user with the username "ANONYMOUS," but can be modified using the Anonymous Account Username setting:

   a. From the main menu on top, **select** "*Config,"* then "*User Manager*."

   b. Look for the ANONYMOUS user from the list and **select** "*Modify."*



c. From the *"Roles and Permissions"* section, **scroll down** to "FHIR_CAPABILITIES" and **click** on *"YES"* to enable the permission.



d. **Click** "*Save*" the user from the top of the page.

At this stage, we have Smile CDR configured to handle SMART on FHIR app requests. In the next section, we'll create a SMART on FHIR app.

Creating SMART on FHIR WebApp.

In this section we'll create a web app for our SMART on FHIR demo app.

To complete this section, you'll need:

- An API platform like Postman or Insomnia to send and receive data,
- A text editor to create html and JSONfiles

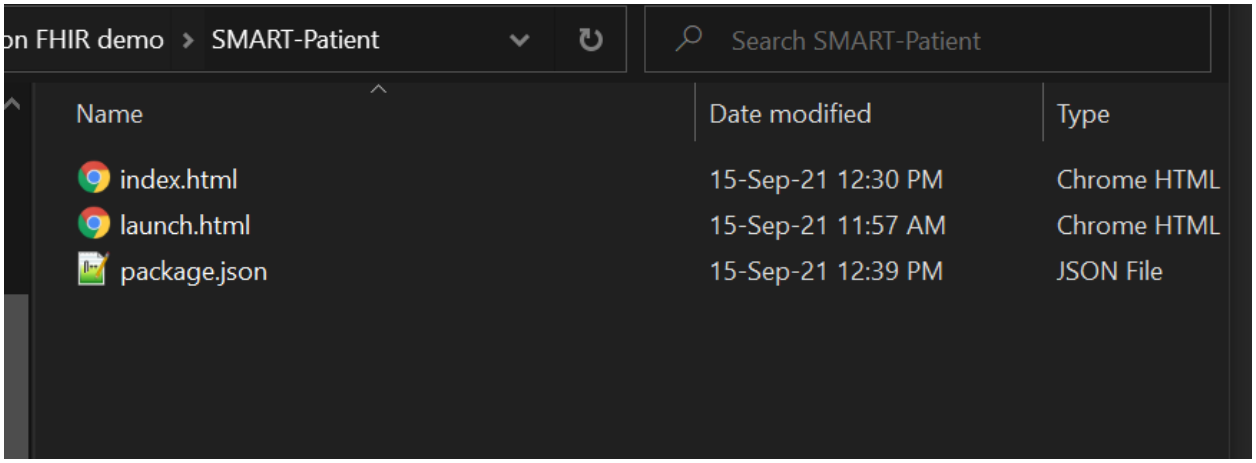
Creating the App

We'll use the fhir-client.js library to connect our SMART app to the FHIR server. Additional documentation on fhir-client.js can be found here.

We'll need to create a new directory and three files; two .html files and a .json file.

To begin:

1. **Create** a project directory called "SMART-Patient" for this SMART app project
2. **Open** the project directory
3. **Create** two .html files named *index.html* and *launch.html*
4. **Create** a .json file with the name *package.json* for the Node.js project configuration



launch.html

launch.html is the SMART app's initial entry point and in a real production environment would be invoked by the application (i.e. App Gallery/App Sphere) launching your SMART app. This page typically initiates authorization flow which means it will take parameters from the URL and send the user to the authentication screen.

To begin:

1. **Insert** the code below in your "launch.html" file, then save and close the file.

```
<!DOCTYPE html>
<html>
<head>
    <meta charset="UTF-8" />
    <title>SMART: Patient App</title>
    <script src="https://cdn.jsdelivr.net/npm/fhirclient/build/fhir-client.js"></script>
</head>
<body>
<script>
    FHIR.oauth2.authorize({
        // this value should match with the value in the OIC Client config
        clientId: "patient_app_demo",
        // this list should not include any scope that is
        // not mentioned in the Client configuration
        scope: "openid launch/patient patient/*.read offline_access",
        // (Optional) many servers are capable of using index.html by default
        redirectUri: 'index.html',
    });
</script>
</body>
</html>
```

index.html

After the SMART authorization procedure, the authorization server will redirect users to this page. When this page is invoked, the SMART app will have the authorization to access the FHIR server.

To begin:

1. **Insert** the code below to your "index.html" file, then save and close the file. Note: **replace** the patient id (patient-a) in JavaScript code (line no. 19) with one of the existing patients' ID, or create a new patient with this ID. The next section of this guide explains how to create a patient resource.

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8"/>
   <title>Example SMART App</title>
   <!-- import fhir-client library-->
   <script src="https://cdn.jsdelivr.net/npm/fhirclient/build/fhir-client.js"></script>
</head>
<body>
<h2 id="patient_header"> Patient Details</h2>
<h4>Patient Information:</h4>
<pre id="info">Loading...</pre>
<script type="text/javascript">
   // this function generated name from HumanName object from Patient resource
   function displayName (name) {
       return (name.prefix || '') + name.given.join(' ') + ' ' + name.family
   }
   // Request current logged in Patient Data using fhir-client library and updates DOM on
successful response
   FHIR.oauth2.ready().then(async (client) => {
       return client.patient.read()
   }).then(
       function (pt) {
           document.getElementById('patient_header').innerText = displayName(pt.name[0])
           document.getElementById('info').innerText = JSON.stringify(pt, null, '\t')
       },
       function (error) {
           document.getElementById('patient_header').innerText = 'Error Occurred'
           document.getElementById('info').innerText = error.stack
       },
   ).catch(console.error)
</script>
</body>
</html>
```

package.json

The objective of the package.json script is to record the metadata of the project. This file includes any dependencies needed to run the Node.js project. Here it just has one example of a dependency; an http-server—a package that creates a static HTTP server on your computer.

To begin:

1. **Insert** the code below to the “package.json” file, then save and close the file.

```
{
  "name": "smart_patient_app",
  "version": "1.0.0",
  "scripts": {
    "serve": "http-server -p 9201 -c-1",
    "start": "npm run serve"
  },
  "dependencies": {
  },
  "devDependencies": {
    "http-server": "^0.12.3"
  }
}
```

Create Patient Resource

To create a Patient resource with id “patient-a” perform the following.

1. Complete the HTTP operation using either Postman or Insomnia:

URL: `http://localhost:8000/Patient/patient-a`

(this URL is for default settings. If you have a custom setting, change this URL to reflect those settings)

Method: `PUT`

Header: `Authorization: Basic YWRtaW46cGFzc3dvcmQ=`

(this creates the credentials admin/password)

Header: `Content-Type: application/fhir+json`

Body: (feel free to change name or birthdate, or to add additional patient details as you wish)

```
{
  "resourceType": "Patient",
  "id": "patient-a",
  "meta": {
    "versionId": "1",
    "lastUpdated": "2020-11-10T20:24:48.194+00:00"
```

```
  },
  "name": [ {
    "family": "Smith",
    "given": [ "John" ]
  } ],
  "gender": "male",
  "birthDate": "2020-01-01"
}
```

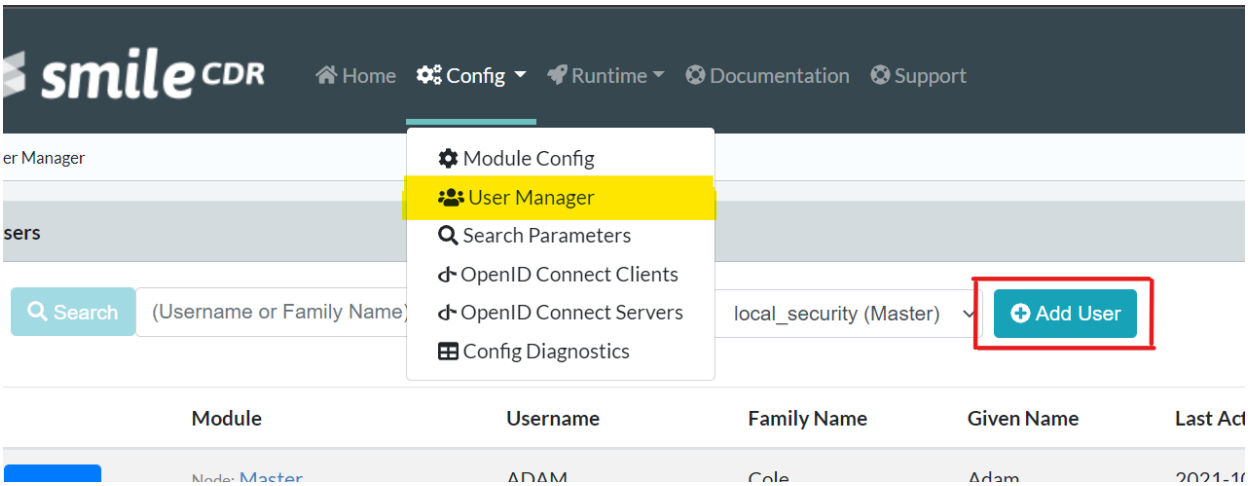
2. **Click** on "*Send*" (from Insomnia or Postman to send the request). The response should contain the resource data that we just created. If you want to learn more about different FHIR REST operations, please checkout [this guide](#).

Create Test User with Launch Context.

In order to test the SMART on FHIR WebApp, we'll need to create a user with appropriate permissions and launch contexts.

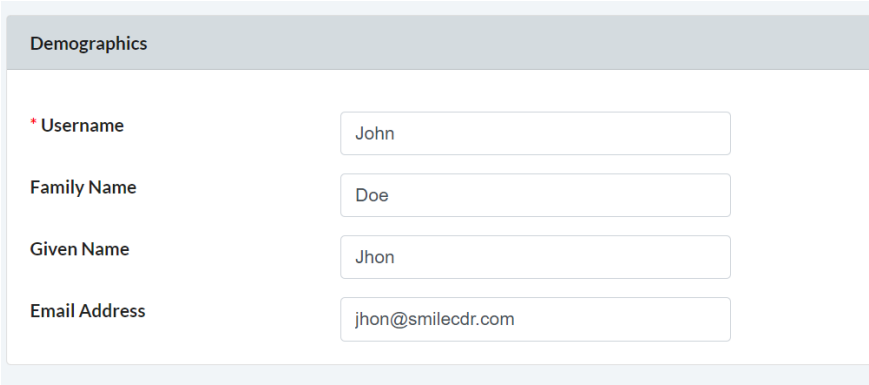
To create a user:

1. **Go** to the "*Web Admin Console*" and **log in**.
2. **Click** on "*Config*" *on* the top menu bar,then *"User Manager."*
3. **Click** on "*Add User.*"

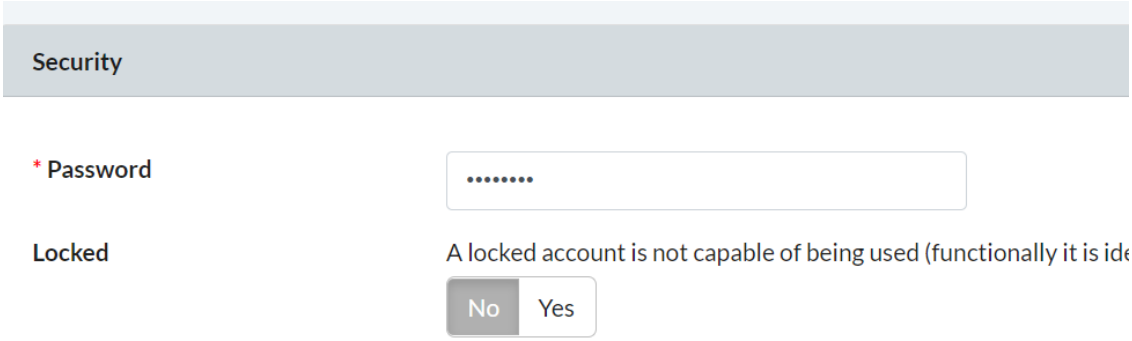


4. **Fill** the necessary fields as indicated below:

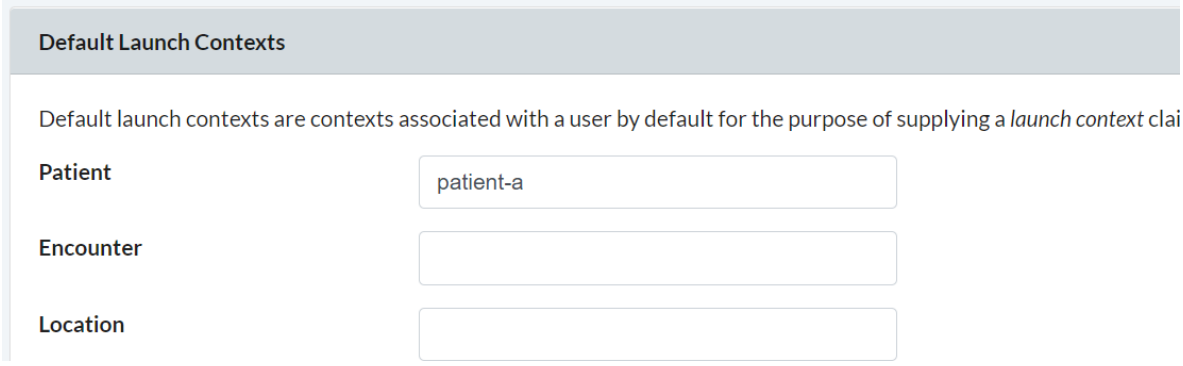
a. *Demographics*: set up the username (required) , name and email of the user in this section.



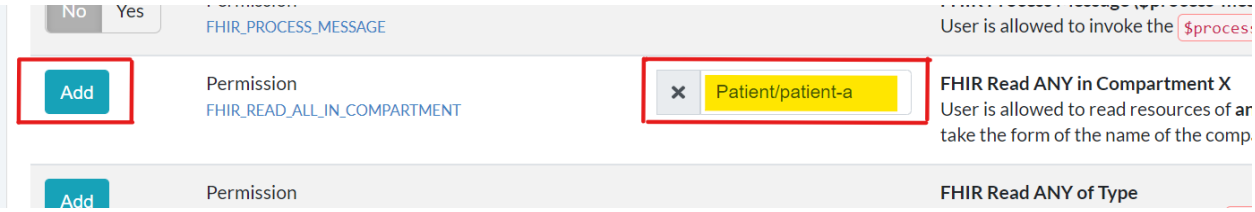
b. *Security*: set the password for the user.



c. *Default Launch Context*: set the contexts associated with a user. These context(s) will be added to SMART auth session, depending on the launch scopes requested(*i.e.* launch, launch/patient, launch/location etc..) In other words, these context(s) associate the user account with the default resources IDs.



d. *Roles and Permissions*: scroll down to *FHIR_READ_ALL_IN_COMPARTMENT* and **select "***Add.*" This will allow access to the resources of its own compartment and the user to access any resources related to a given patient. Fill the text box with resource ID: "*Patient/patient-a*" as below.



5. Scroll to the top of the page and **select** "*Save*" to create the user.

Run and Test the App

Now that the Smart Web APP is created and Smile CDR is configured, we need to make sure that everything is functioning correctly.

1. **Open** the "*terminal/command*" prompt.
2. **Navigate** to the "*project directory,*" then **run** the following command:

   cd <path-to-project-dir>

   Note: replace the <path-to-project-dir> with the actual path to project directory. i.e. D://SMART-Patient

3. **Run** the following command:

   npm install

   Note: this will install required dependencies for a node project listed in the package.json file. (You need to run this command only once unless you make any changes in the package.json file.)

4. **Run** the command to start the server:

   npm start

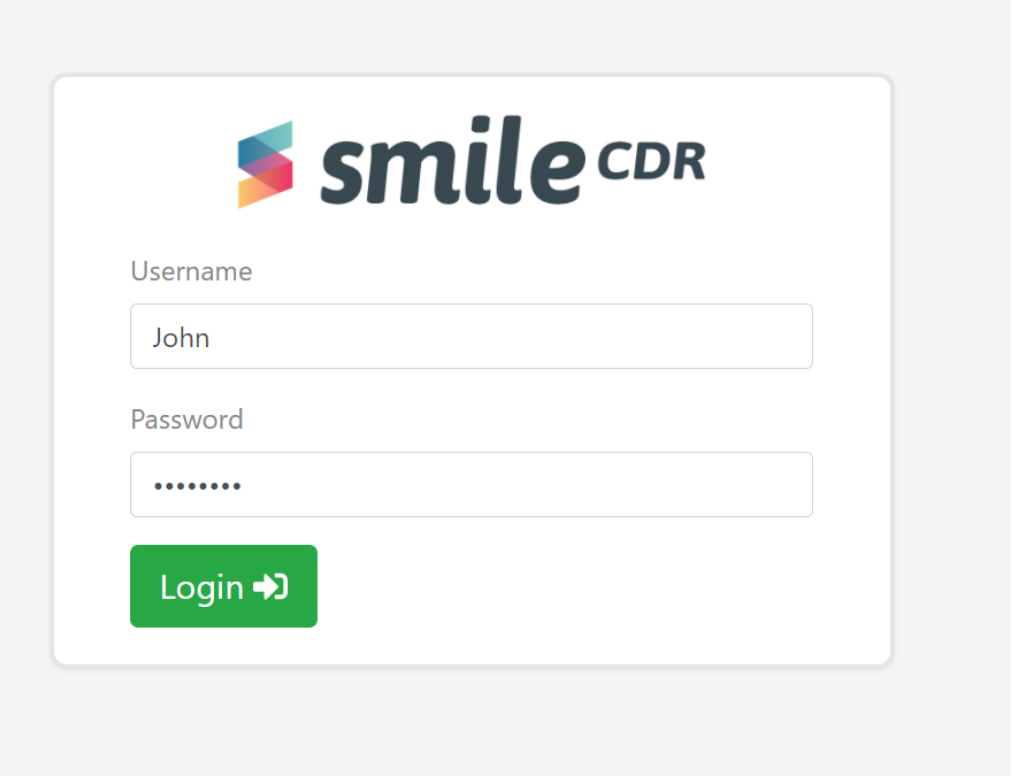
5. **Copy** and **paste** the following URL into the address bar:

   http://127.0.0.1:9201/launch.html?iss=http://localhost:8000&launch=A000

iss: The base URL for the FHIR endpoint. The app will load the server capability statement from this endpoint which allows it to figure out where to authorize.

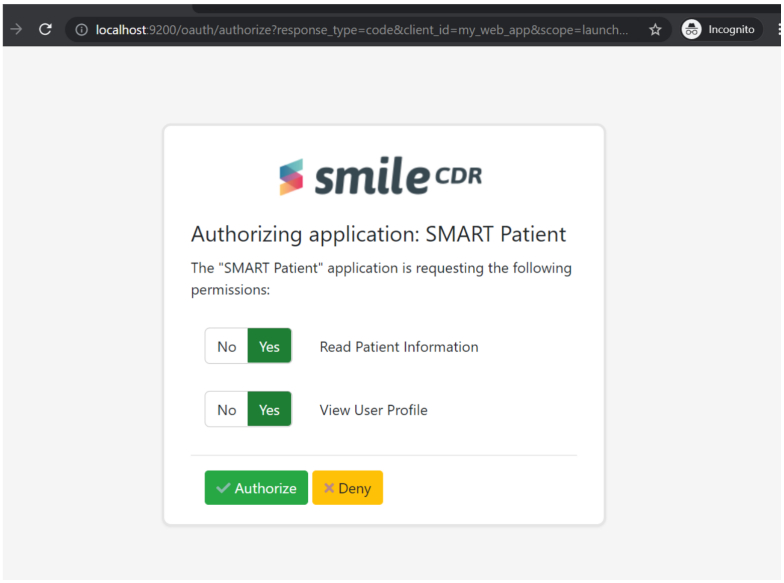
launch: This is intended to be a one-time nonce. In a real scenario, this would be randomly generated.

6. After launching, an authentication page similar to the image below will appear:



7. **Enter** the credentials then **select** *"Login,"*(Use the credential of the user created in the previous section.) The authorization screen should appear like the image below:

    a. **Select "***Authorize"*



8. The authorization server will redirect the user to index.html or root "/" whichever was requested from launch.html

John Smith

Patient Information:


```
{
        "resourceType": "Patient",
        "id": "patient-a",
        "meta": {
                "versionId": "1",
                "lastUpdated": "2021-12-07T18:11:37.533+00:00",
                "source": "#6yA3dLe4hnRBtQpe"
        },
        "name": [
                {
                        "family": "Smith",
                        "given": [
                                "John"
                        ]
                }
        ],
        "gender": "male",
        "birthDate": "2020-01-01"
}
```

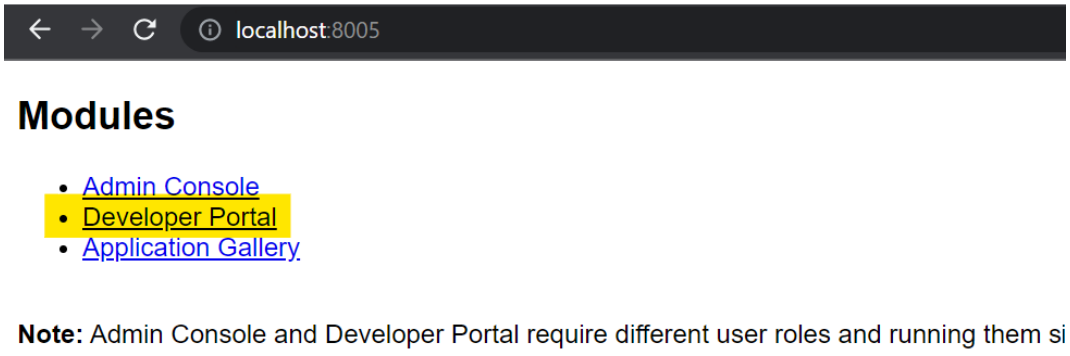

Congrats, you've now successfully created and tested your first SMART on FHIR app with Smile CDR!

Registering an App with the appSphere.

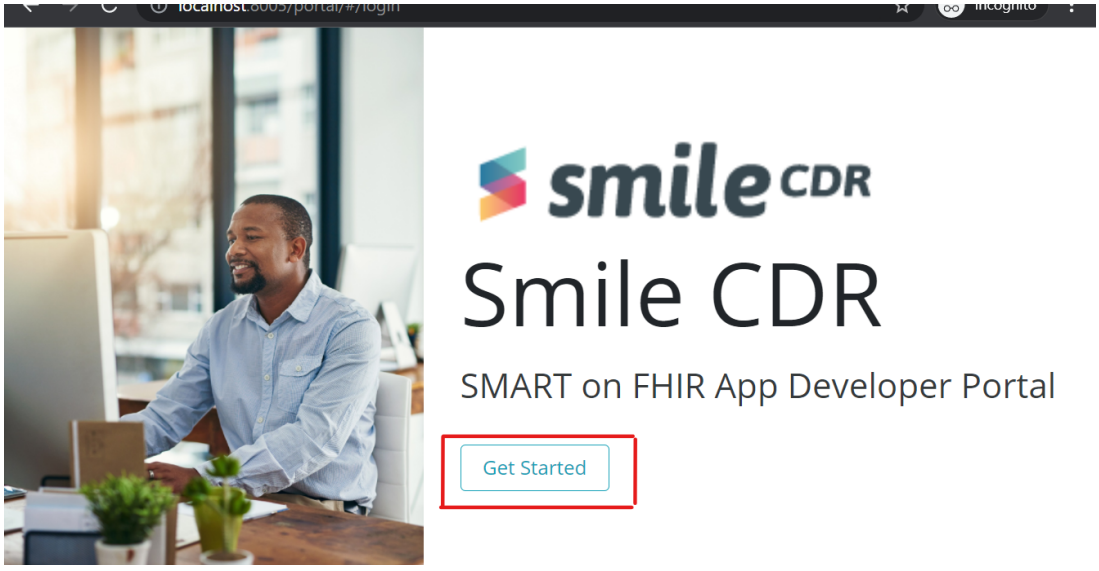
For the purpose of this guide, we'll use a locally installed App Gallery from Smile CDR. To use a local instance of Smile CDR, you need the App Gallery/App Management Tool module configured in Smile CDR. Check out this document to learn how to configure it locally.

To register the app:

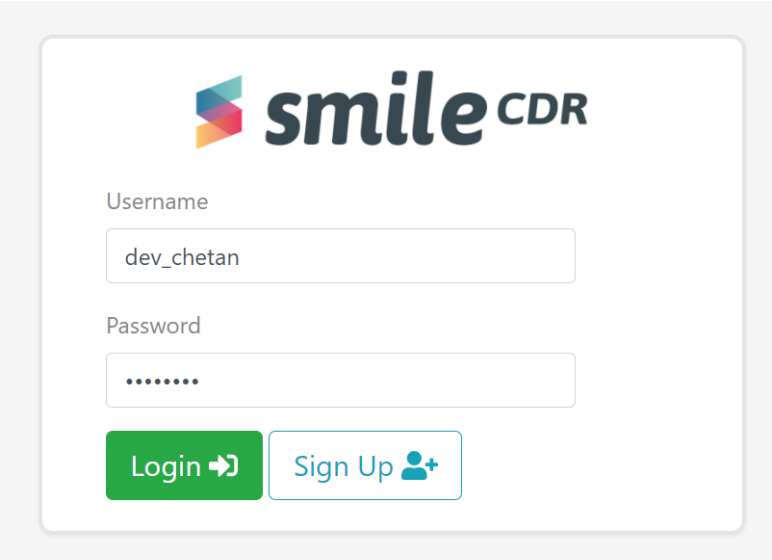
1. **Go to** the App Gallery portals's homepage, then **click** on the "*Developer Portal*"



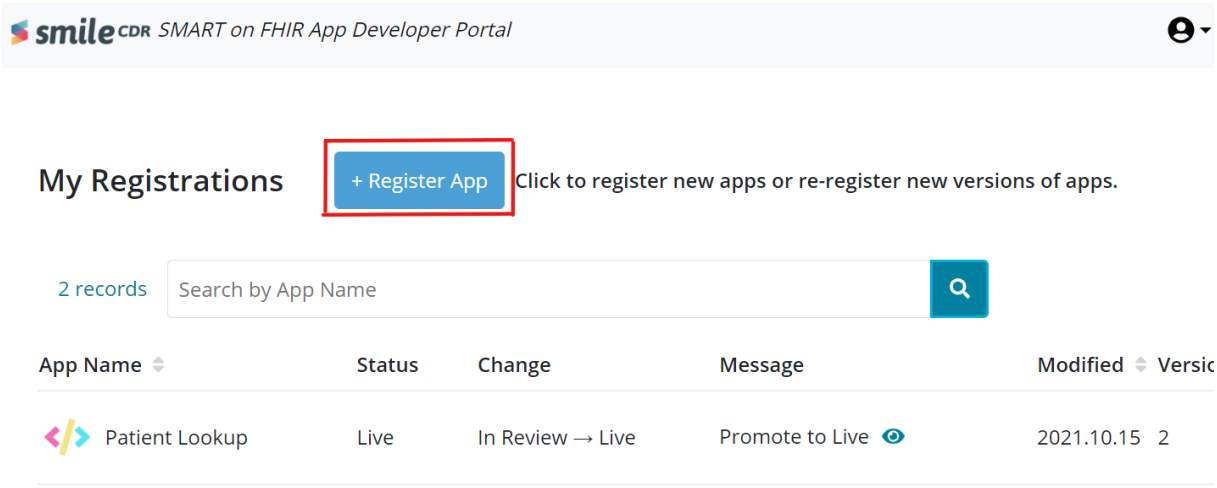
2. The developer homepage will appear. **Select** "*Get Started*" button



3. This will take you to the authentication screen below:

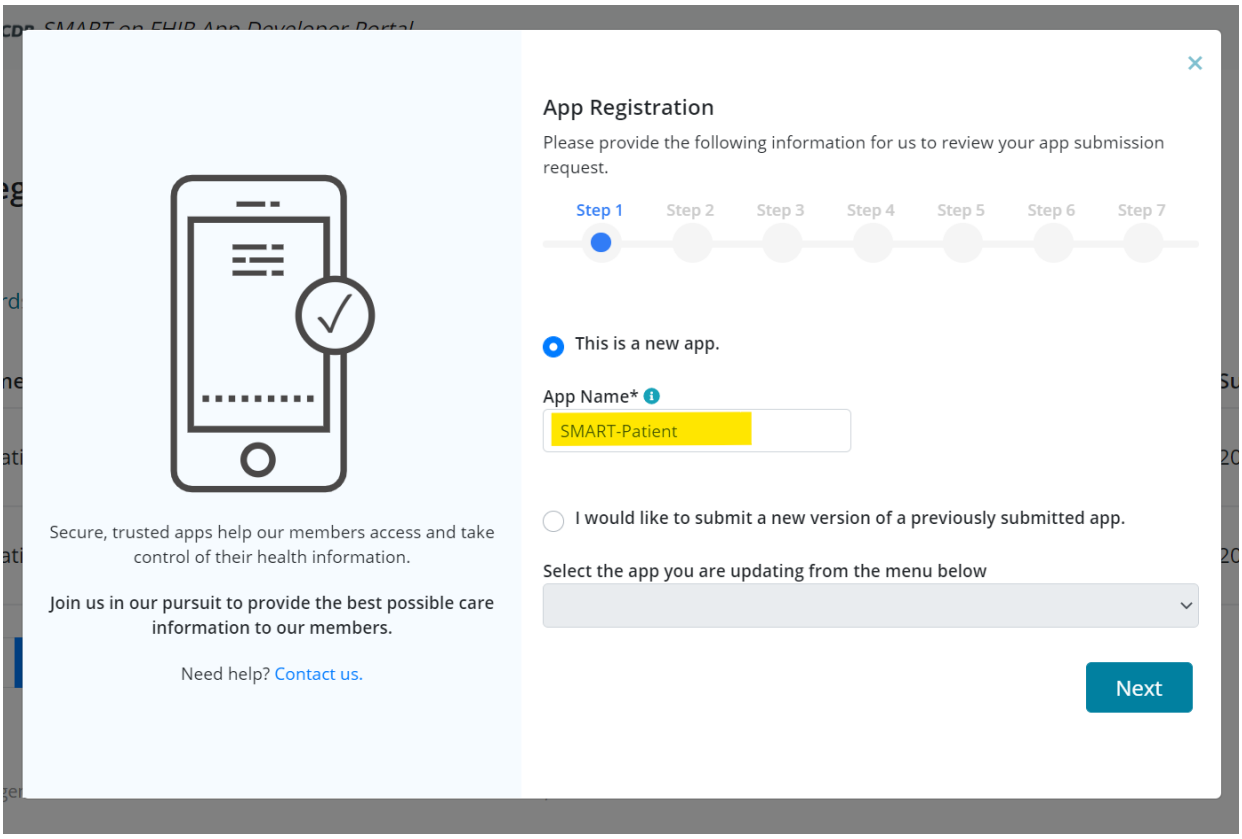


4. **Enter** your developer credentials and **click** "*Login*" (if you do not have an account, **create one** by clicking "*Sign Up*"). Upon successful login, you should see the developer dashboard (below). **Select** "*Register App.*"



5. This opens a popup for the app registration process. **Proceed** with the steps below:

   Step 1: Provide the app name as I=it will be displayed on the App Gallery.



Step 2: Select the operating system (i.e., web, iOS or Android) for which the app is available and to be published in the public-facing site. **Fill** in the other information as shown below:

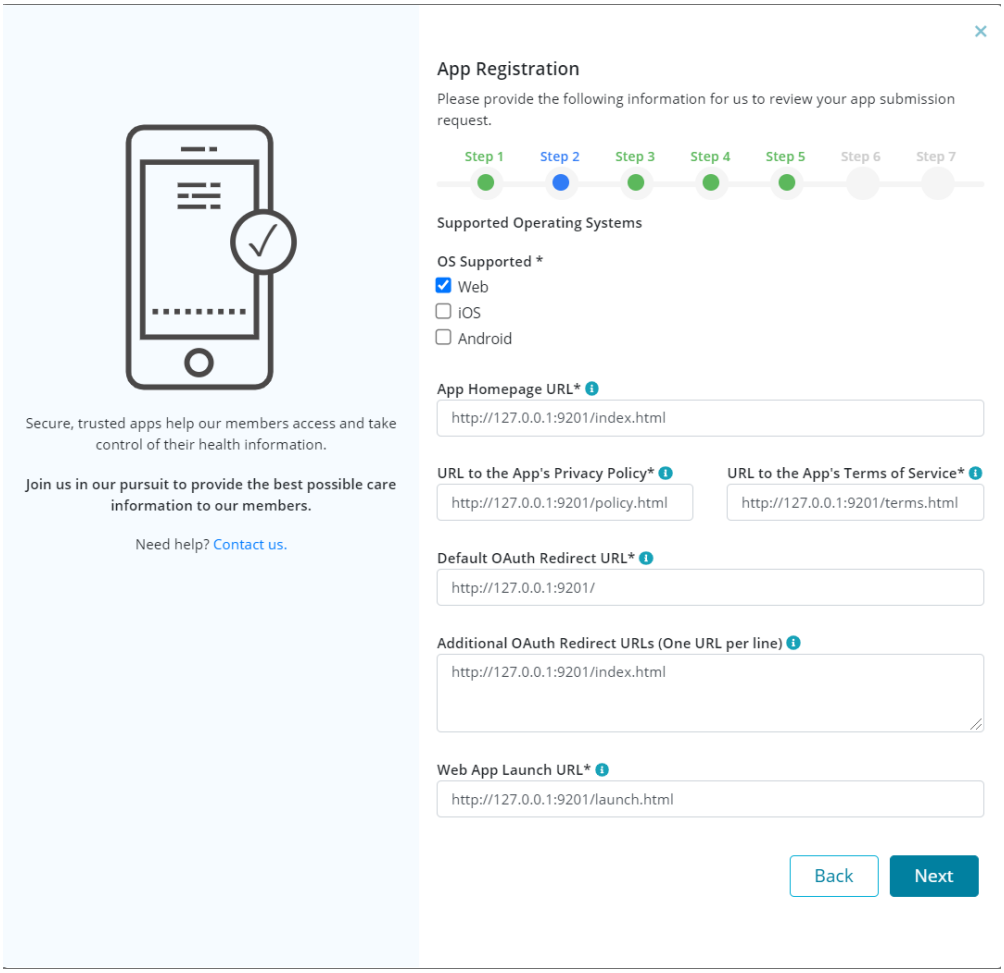
a. *App Homepage URL*: the URL where the app's download sites can be found. (Note: provide a homepage URL if no specific app page exists.)

b. *URL to the App's Privacy Policy*: URL of a webpage providing the app's Privacy Policy.

c. *URL to the App's Terms of Service*: URL of a webpage describing the app's Terms of Service.

d. *OAuth Redirect URL*: URL to which developers are redirected upon successful authentication.

e. *Web App Launch URL*: URL used to start the authentication process for web apps only.

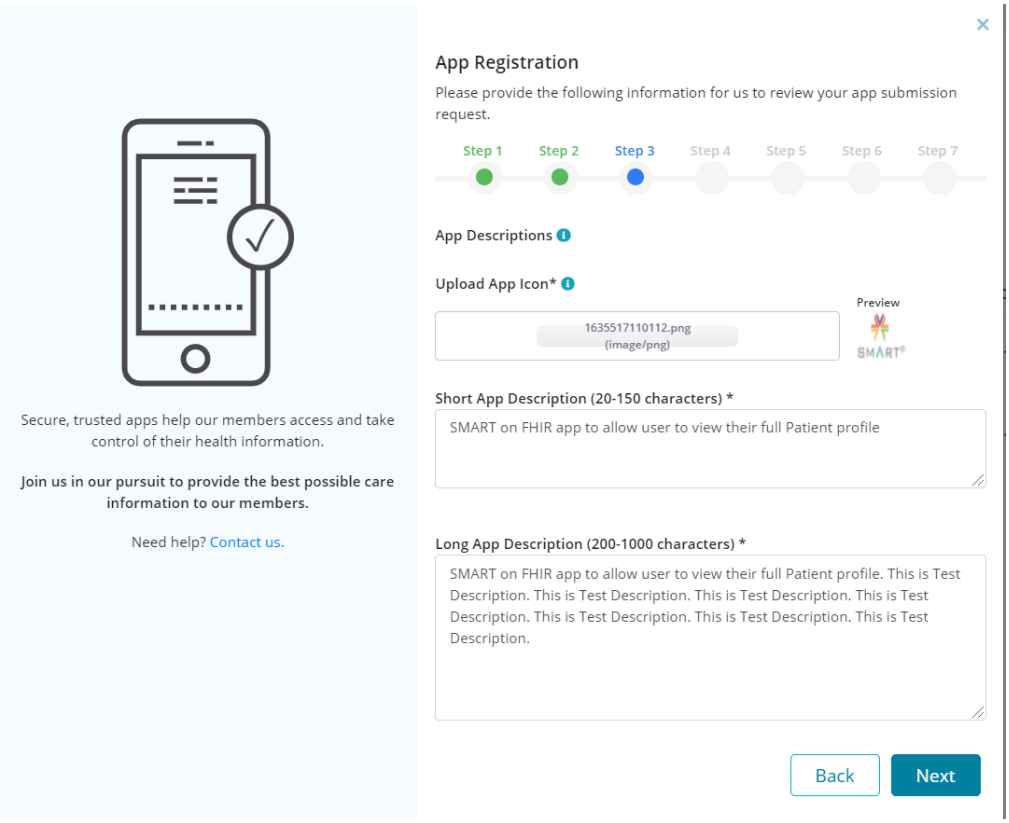


Step 3: Provide an app description for the public-facing site.

a. **Upload** an *a*pp icon: use the guidelines from the Google Play store (link provided) to upload an app icon of the acceptable specifications. An option to preview the uploaded image is provided.

b. **Add** a short app description: this should be between 20-150 characters for the public-facing site.

c. **Add** a long app description: this should be between 200-1000 characters for the public-facing site.



Step 4: Select all applicable categories from the given options.

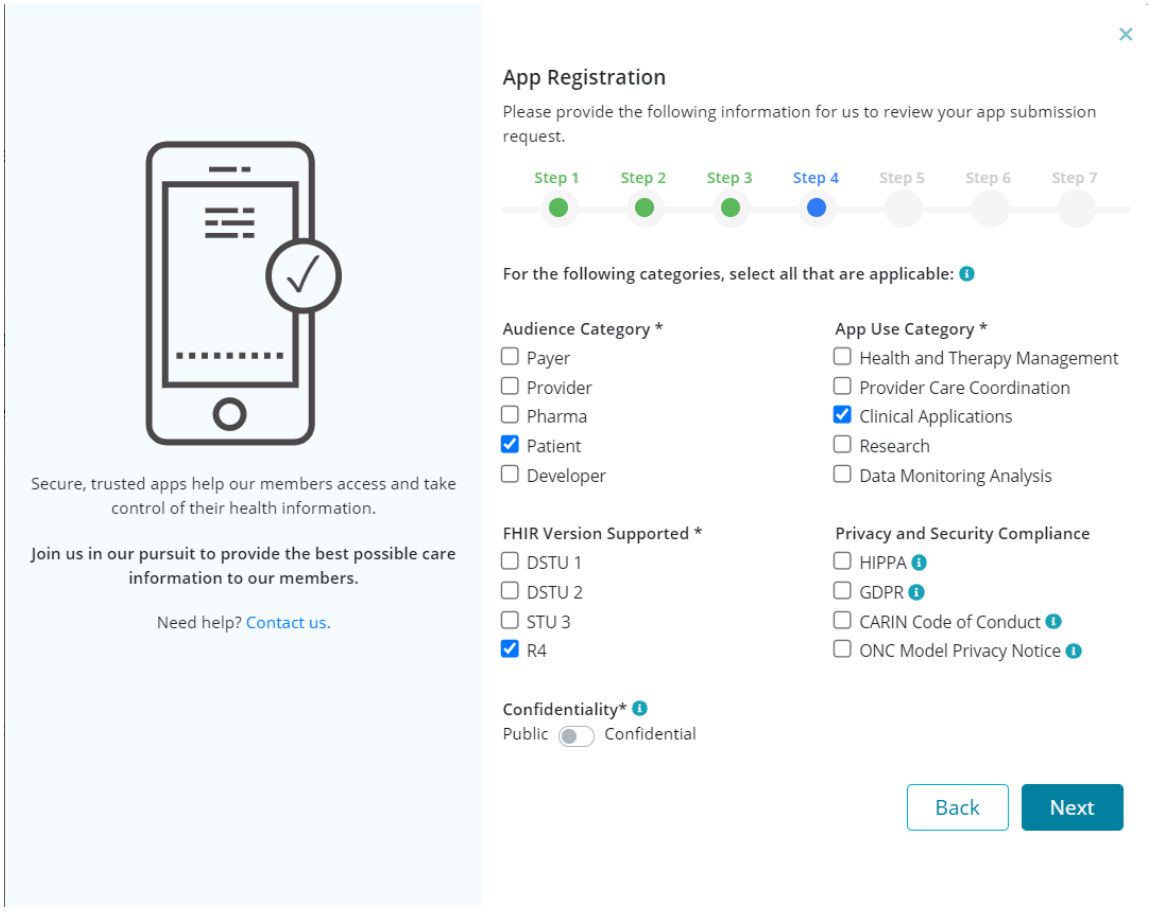
a. *Audience Category*: options include payer, provider, pharma, patient and developer.

b. *App Use Category*: options include Health & Therapy Management, Provider Care, Coordination, Clinical Applications, Research and Data Monitoring Analysis.

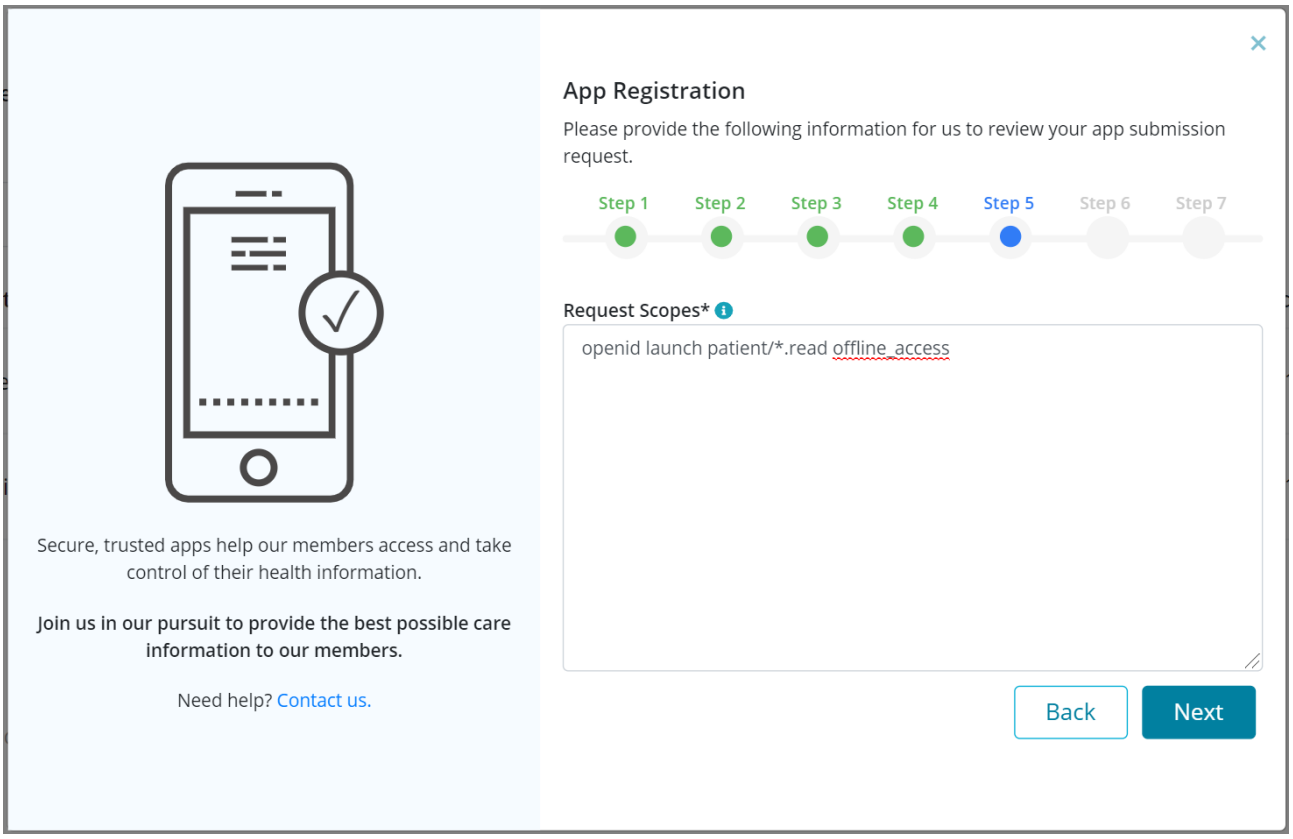
c. *FHIR Version Supported*: options include DSTU1, DSTU2, STU3 and R4.

d. *Privacy & Security Compliance*: options include HIPPA, GDPR, CARIN Code of Conduct and ONC Model Privacy Notice (note: users may be asked to provide supporting documents).

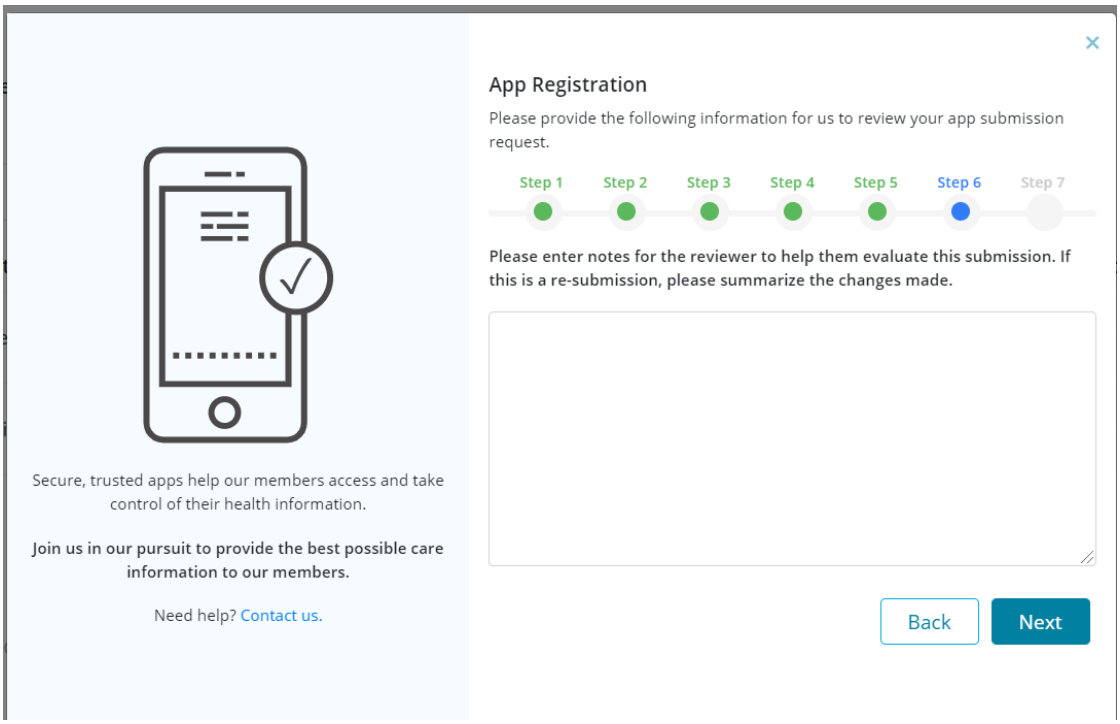
e. *Confidentiality*: if the app runs in an execution environment that enables the app to protect confidential information, leave it as “confidential;” if not, toggle to “public.”


Secure, trusted apps help our members access and take control of their health information.
Join us in our pursuit to provide the best possible care information to our members.
Need help? Contact us.
App Registration
Please provide the following information for us to review your app submission request.
Step 1
Step 2
Step 3
Step 4
Step 5
Step 6
Step 7
For the following categories, select all that are applicable:
Audience Category *
Payer
Provider
Pharma
Patient
Developer
App Use Category *
Health and Therapy Management
Provider Care Coordination
Clinical Applications
Research
Data Monitoring Analysis
FHIR Version Supported *
DSTU 1
DSTU 2
STU 3
R4
Privacy and Security Compliance
HIPPA
GDPR
CARIN Code of Conduct
ONC Model Privacy Notice
Confidentiality*
Public
Confidential
Back
Next

Step 5: Enter any scopes that will be requested from the app from the authorization process. This field is similar to the scopes configured in the [OIDC client configuration].



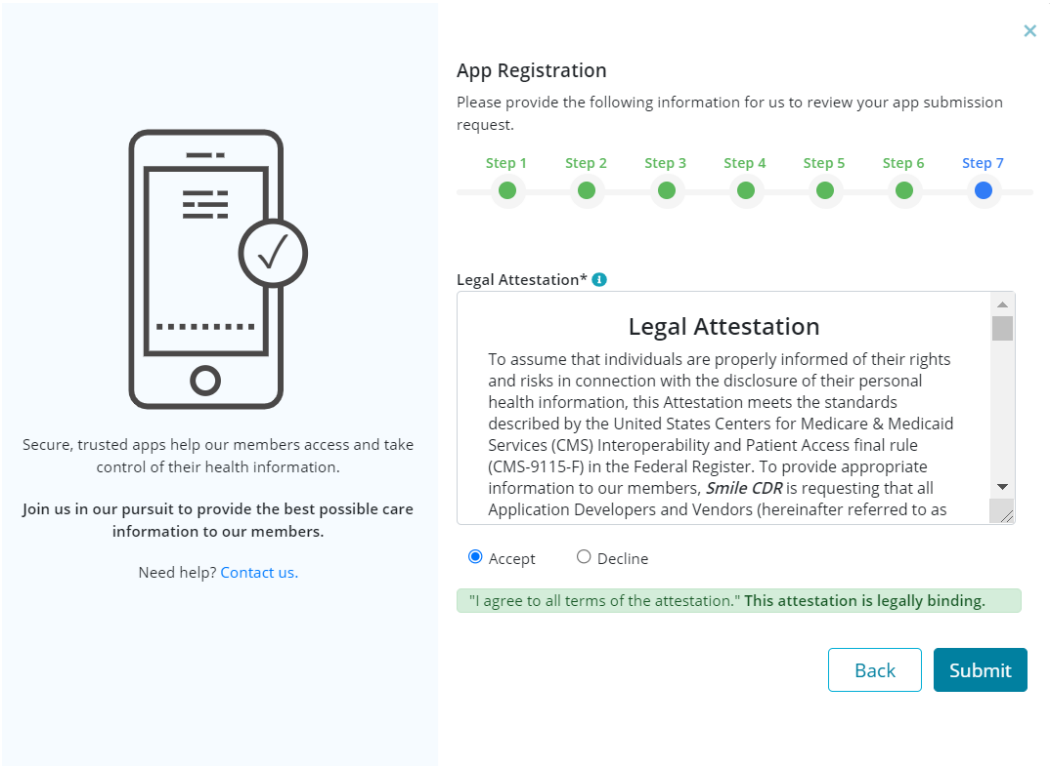
Step 6 (Optional): Enter details about the app for reviewer evaluation purpose. These will not be shown to users and are only for the reviewer to verify. If you're just updating the app and not submitting a new version, summarize the changes made.



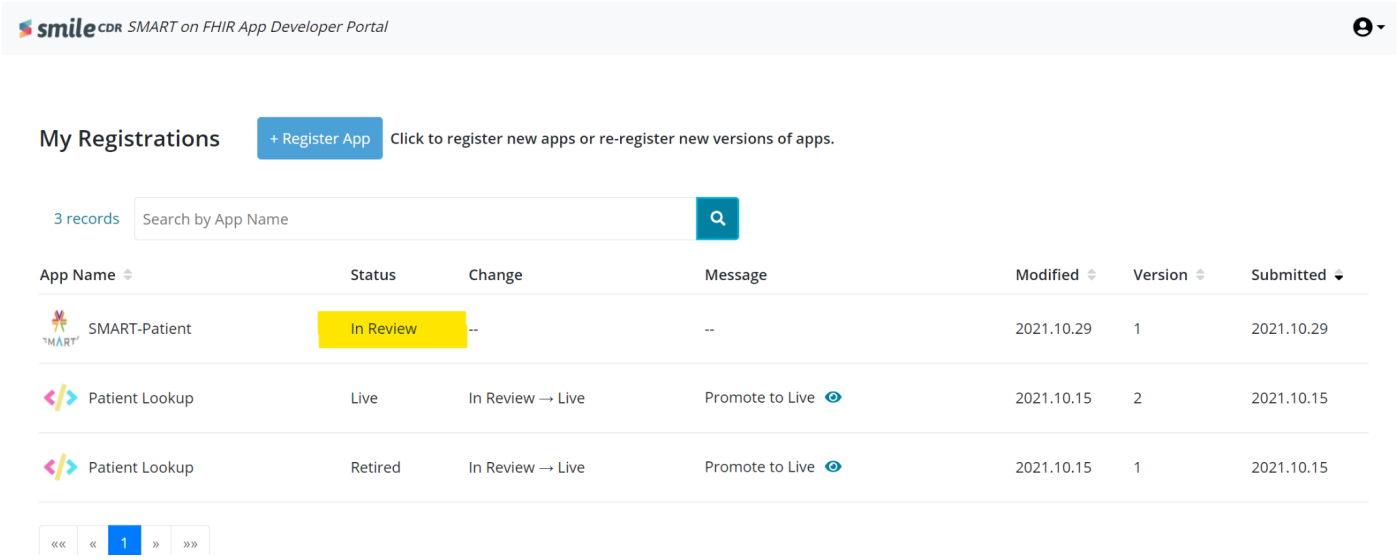
Step 7: Carefully review the legal attestation and either accept or decline the terms that describe the minimum privacy and security criteria to sufficiently protect patients' protected health information in accordance with the CMS and ONC.

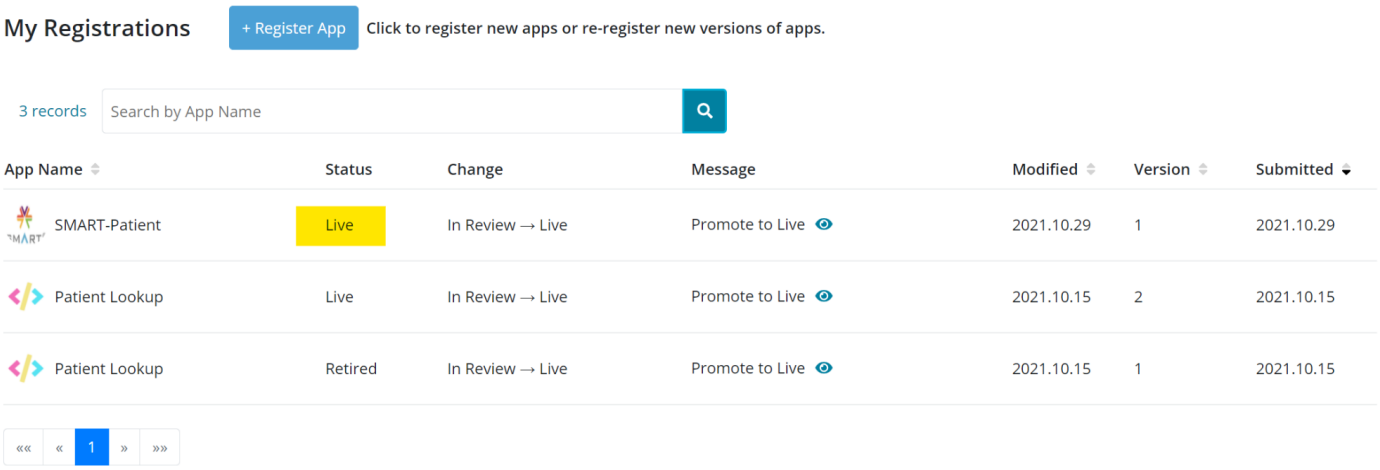
If you decline, the app will still be allowed to submit and can be approved, too. However, users will be warned that the app does not attest to the CMS ruling.

Submit the app for review.



The app is now submitted for review and should be listed on the developer dashboard as shown below. An "In Review" status means it has been submitted to admin for review. The status will change once the admin either approves or rejects it. Results will be displayed as either "Live" or "Rejected."





Should you run into trouble, contact your Smile CDR Account Rep.

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