



Behavioral Health Information Technology and Standards (BHITS) Project

Consent2Share Version 3.2.0 Deployment Guide

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Contents

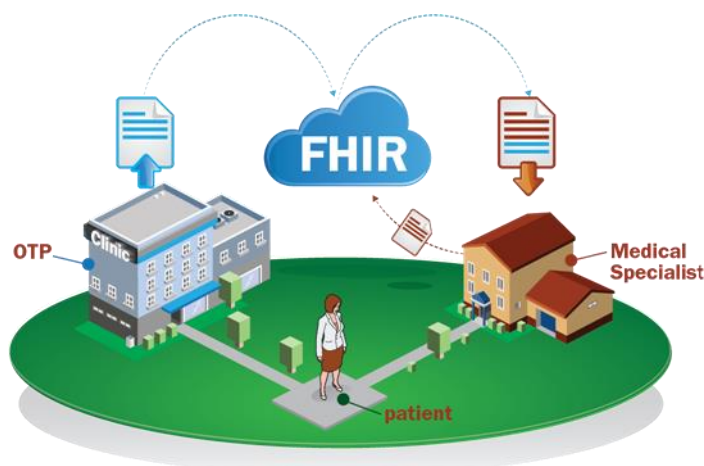
1	INTRODUCTION	4
1.1	Overview	4
1.2	Purpose	4
1.3	Organization of this Guide.....	5
1.4	Technology Stack.....	5
1.5	Prerequisites.....	6
1.6	Technical Support.....	6
2	DEPLOYMENT SERVER SETUP	6
2.1	Docker Installation.....	6
2.1.1	Prerequisites	6
2.1.2	Install Docker and Docker Compose	6
2.1.3	Add User Accounts to Docker Group	7
3	CONSENT2SHARE DEPLOYMENT.....	7
3.1	One-Server Setup	7
3.1.1	Server Info	7
3.1.2	Configure.....	7
3.1.3	Compose Containers	9
3.2	Two Servers Setup.....	9
3.2.1	Server Info	9
3.2.2	Configure Database Server.....	9
3.2.3	Configure Application Server	11
3.2.4	Compose Containers on Database Server	13
3.2.5	Compose Containers on Application Server.....	13
3.3	Populate sample data.....	13
3.3.1	Sample Providers (pls).....	13
3.3.2	Sample Value Sets (vss).....	14
3.3.3	Sample Data for Consent Management (pcm).....	14
3.3.4	Sample Data for User Management Service	15
3.3.5	Sample Document Type Code (phr)	15
3.4	Create Provider User Account	15
3.5	Possible Deployment Errors	16
3.6	UI URLs	16
3.7	Generate and Reconfigure UAA Public and Private Keys.....	17
4	APPENDIX	17
4.1	HAPI FHIR Server Installation.....	17



1 Introduction

1.1 Overview

Specially protected health information (PHI) covered under the federal confidentiality regulation 42 CFR Part 2 (health information from federally assisted drug and alcohol treatment programs) has generally not been included in the electronic exchange of patient information between health care providers. One of the primary reasons is the lack of technology options for patients to share part of their health information while not sharing others.



To address this issue, the Federal Office of the National Coordinator for Health Information Technology (ONC) developed the Data Segmentation for Privacy (DS4P) initiative to allow patients to share portions of an electronic medical record while not sharing others. In collaboration with the ONC, the Substance Abuse and Mental Health Services Administration (SAMHSA) developed the Consent2Share application to address the specific privacy protections for substance use treatment patients covered by the federal confidentiality regulation 42 CFR Part 2.

Consent2Share is an open source application for data segmentation and consent management. It is designed to integrate with existing FHIR (Fast Health Interoperability Resources) systems. Initially, SAMHSA funded the Open Behavioral Health Information Technology Architecture (OBHITA) contract to develop the Consent2Share application. Subsequently, SAMHSA funded the Behavioral Health Information Technology and Standards (BHITS) contract to further develop and conduct pilot testing of Consent2Share. Through a process of electronic consent, the patient controls how his or her sensitive health data will be shared by selecting categories.

1.2 Purpose

This document was prepared by the application developers of Consent2Share primarily to document key infrastructure setup, installation, configuration, and deployment technologies required to operationalize Consent2Share. This document is not a step-by-step software application development guide. Rather, this document is a reference guide to help developers and system administrators install, configure, deploy, and validate the key software components that operationalize Consent2Share. Since Consent2Share is designed to integrate with FHIR (Fast Health Interoperability Resources) Systems, this document assumes that the reader has in place FHIR Servers and is employing interoperability standards. However, the Consent2Share application can be configured to work without FHIR connections. The Consent2Share development team has an instance of HAPI FHIR Restful Server installed as the FHIR environment. Please refer to the Appendix 4.1 for more information.

1.3 Organization of this Guide

This Deployment Guide is divided into four Chapters:

- Chapter One provides an introduction to Consent2Share and the purpose of this guide
- Chapter Two provides information about setting up the deployment environment based on Docker
- Chapter Three provides instructions to deploy and configure Consent2Share using Docker on Linux servers
- Chapter Four is an appendix that provides information about FHIR Server setup

1.4 Technology Stack

The current version of Consent2Share (Consent2Share Version 2) employs [Docker](#). In short, Docker is an open-source tool that automates the deployment of applications inside software containers. Docker containers wrap up a piece of software in a complete filesystem that contains everything it needs to run. This includes code, runtime, system tools, and system libraries. This enables the ability that the application will always run the same, regardless of the environment within it is running.

Consent2Share is designed to integrate with existing FHIR systems via interoperability standards. To do so, the technology stack for Consent2Share configuration is as follows. The references for these technologies located in the Appendix 4.2.

- [AngularJS](#)
- [Angular Material](#)
- [Angular CLI](#)
- [Node.js](#)
- [npm](#)
- [MD2](#)
- [RxJS](#)
- [TypeScript](#)
- [JavaScript - ES6](#)
- [HTML5](#)
- [CSS3](#)
- [Oracle Java 8](#)
- [Spring Framework](#)
- [Spring Boot](#)
- [Spring Cloud](#)
- [Apache Maven](#)
- [Apache Tomcat](#)
- [MySQL](#)
- [Flyway](#)
- [Docker and Docker Compose](#)
- [Cloud Foundry User Account and Authentication \(UAA\) Server](#)

1.5 Prerequisites

This document is designed for developers and system administrators who install, configure, deploy, and maintain distributed applications. Familiarity with the following is recommended.

- Basic Linux system administration
- Basic knowledge of Docker and Docker-Compose
- Basic knowledge of Public Key Infrastructure (PKI) and creating SSL certificates

1.6 Technical Support

If you have specific questions about a specific API deployment, setup server environment, or anything related to the Consent2Share application, you should:

- Check the [Consent2Share Project site](#)
- Check the readme files available for each API in [Consent2Share GitHub repository](#).
- Check the [Issues](#) in consent2share repository.

2 Deployment Server Setup

2.1 Docker Installation

The following provides instructions about how to install Docker on a Linux CentOS 7.X server.

2.1.1 Prerequisites

- Docker requires a 64-bit installation regardless of your CentOS version.
- Your kernel must be 3.10 at a minimum, which CentOS 7 runs. To check the CentOS version, run the command “uname -r” in the terminal.
- User account should have sudo or root privileges
- Ensure yum and curl are installed, and networking is operational.

2.1.2 Install Docker and Docker Compose

- Get the [c2s_docker_install.sh](#) and run the file.

```
sh c2s_docker_install.sh
```

- Verify the Docker installation.

```
sudo docker version
```

```
sudo docker run hello-world
```

Output message will contain the following:

```
Hello from Docker!
```

This message shows that your installation appears to be working correctly.

- Verify Docker compose installation.

```
sudo docker-compose --version
```

Note: if docker-compose gives the command “not found” try with following:

/usr/local/bin/docker-compose --version

2.1.3 Add User Accounts to Docker Group

The user accounts that need to run Docker and Docker Compose commands must be added to the Docker group. Run the following command by replacing the *** with the actual username to add a user to the Docker group

```
sudo usermod -aG docker ***
```

3 Consent2Share Deployment

Two server deployment options are provided to run the Consent2Share application on Linux. Here we use CentOS 7.X as an example to describe the setups.

Consent2Share Docker images will be downloaded from [Dockerhub BHITS](#) public registry.

3.1 One-Server Setup

This option is designed to run all Consent2Share services, UIs, and databases on a single server.

3.1.1 Server Info

	MAX	MIN
Memory	65 GB	20GB
Storage	80GB	25GB
CPU	2	1

3.1.2 Configure

- Get the [c2s_config.sh](#) and run the file.

```
curl https://raw.githubusercontent.com/bhitsu-dev/consent2share/master/infrastructure/scripts/c2s_config.sh > c2s_config.sh
```

```
sh c2s_config.sh oneServerConfig
```

Expected Results:

The following subfolders and the Consent2Share configurations will be created under '/usr/local/' folder.

- Java
 - ✓ [docker-compose](#) file : docker-compose.yml
- Application Files
 - java /C2S_PROPS/uaa
 - ✓ [uaa configuration](#) file: /uaa/uaa.yml
 - java /C2S_PROPS/[c2s-config-data](#)
 - ✓ [Consent2share configuration](#) files: /c2s-config-data
 - java /keystore
 - The [c2s_one_server_env](#) file will be placed as **c2s_env.sh** file in '/etc/profile.d/' folder.
- Database Files
 - java /C2S_PROPS/pcm
 - ✓ [insert consent attestation term.sql](#) file:

- /pcm/ insert_consent_attestation_term.sql
- ✓ [insert_consent_revocation_term.sql](#) file:
 - /pcm/ insert_consent_revocation_term.sql
- ✓ [insert_purposes.sql](#) file:
 - /pcm/ insert_purposes.sql
- java /C2S_PROPS/phr
 - ✓ [Document Type](#) file: /phr/insert_document_type_codes.sql
- java /C2S_PROPS/pls
 - ✓ [Pls sample provider data](#) file: /pls/pls_db_sample.sql
 - ✓ [State Code Lookup Data](#): /pls/insert_state_code_lookup_data.sql
- java /C2S_PROPS/vss
 - ✓ [VSS sample provider data](#) file: /vss/vss_db_sample.sql
- java /C2S_PROPS/ums
 - ✓ [Administrative Gender Code](#) file: /ums/insert_administrative_gender_code_lookup_data.sql
 - ✓ [Country Code file](#) : /ums/ insert_country_code_lookup_data.sql
 - ✓ [Locale file](#): /ums/ insert_locale_lookup_data.sql
 - ✓ [Identifier file](#): /ums/insert_npi_identifier_system.sql
 - ✓ [Role sample file](#): /ums/insert_role_scopes_lookup_data.sql
 - ✓ [State Code file](#) : /ums/insert_state_code_lookup_data.sql

➤ Edge-server security:

- Create/Obtain a valid SSL certificate
- Export the public and private keys from the SSL certificate to a JKS formatted keystore file named 'edge-server.keystore'
- upload the 'edge-server.keystore' file into '/usr/local/java/keystore' folder
- Add the following in the
'/usr/local/java/C2S_PROPS/[c2s-config-data](#)/edge-server.yml' file.

spring.profiles: your_app_Server_specific_profile

server:

ssl:

key-store: /java/keystore/edge-server.keystore

key-store-password: "keystore password"

- Modify the ENV_APP_PROFILE= your_app_Server_specific_profile in oneServerConfig() function in the '/etc/profile.d/ c2s_env.sh' file.

➤ Modify the following configuration files

- Set edge server, config server, and SMTP variables to the server specific values in the '/etc/profile.d/ c2s_env.sh' file.
- Replace 'localhost' with 'uaa-db.c2s.com' for **database.url** variable in '/usr/local/java/C2S_PROPS/uaa/uaa.yml' file.

- There are many Consent2Share API codes. The configurations in these codes can be overridden using the corresponding API YAMLS that are available in the **c2s-config-data** folder. The structure of the API YAMLS should be similar to the corresponding application.yml mentioned in the each API code. They can be found in the 'src/main/resources' folder.

- ✓ For instance, to override database variables for PCM API. The following can be added in the pcm.yml as below

```
spring.profiles: your_app_Server_specific_profile
spring:
  datasource:
    url: "database url"
    username: "database user name"
    password: "{cipher} encrypted database pwd"
```
- ✓ Follow the instructions mentioned in the [config server api](#) to encrypt/decrypt server specific sensitive configurations.

➤ Re-login to the server in order for the file `c2s_env.sh` to run automatically during the login

- Verify by checking any variable mentioned in the file
Ex: echo \${C2S_BASE_PATH} should show the value set in the file

3.1.3 Compose Containers

Run the following command from the '/usr/local/java' folder to start up all Consent2Share services, UIs, and databases:

```
docker-compose up -d
```

Run 'docker ps -a' to verify all the containers are up running except data-only containers.

3.2 Two Servers Setup

This option is to run Consent2Share services and UIs on an application server and databases on a separate database server.

3.2.1 Server Info

APP Server	MAX	MIN
Memory	40 GB	20GB
Storage	80GB	15GB
CPU	2	1

DB Server	MAX	MIN
Memory	20GB	10GB
Storage	80GB	10GB
CPU	2	1

3.2.2 Configure Database Server

➤ Get the [c2s_config.sh](#) and run the file.

```
curl https://raw.githubusercontent.com/bhits-dev/consent2share/master/infrastructure/scripts/c2s_config.sh > c2s_config.sh
sh c2s_config.sh twoServerDbConfig
```



Expected Results:

The following subfolders and the Consent2Share configurations will be created under '/usr/local/' folder.

- Java
 - ✓ [docker-compose-db-server](#) file : docker-compose.yml
 - java /C2S_PROPS/pcm
 - ✓ [insert_consent_attestation_term.sql](#) file:
 - /pcm/ insert_consent_attestation_term.sql
 - ✓ [insert_consent_revocation_term.sql](#) file:
 - /pcm/ insert_consent_revocation_term.sql
 - ✓ [insert_purposes.sql](#) file:
 - /pcm/ insert_purposes.sql
 - java /C2S_PROPS/phr
 - ✓ [Document Type](#) file: /phr/insert_document_type_codes.sql
 - java /C2S_PROPS/pls
 - ✓ [Pls sample provider data](#) file: /pls/pls_db_sample.sql
 - ✓ [State Code Lookup Data](#): [/pls/insert_state_code_lookup_data.sql](#)
 - java /C2S_PROPS/vss
 - ✓ [VSS sample provider data](#) file: /vss/vss_db_sample.sql
 - java /C2S_PROPS/ums
 - ✓ [Administrative Gender Code](#) file: /ums/
insert_administrative_gender_code_lookup_data.sql
 - ✓ [Country Code file](#) : /ums/ insert_country_code_lookup_data.sql
 - ✓ [Locale file](#): /ums/ insert_locale_lookup_data.sql
 - ✓ [Identifier file](#): /ums/insert_npi_identifier_system.sql
 - ✓ [Role sample file](#): /ums/insert_role_scopes_lookup_data.sql
 - ✓ [State Code file](#) : /ums/insert_state_code_lookup_data.sql
 - The [c2s_two_servers_db_env](#) file will be placed as c2s_env.sh file in '/etc/profile.d/' folder.
- Re-login to the server in order for the file c2s_env.sh file to run automatically during the login
- Verify by checking any variables mentioned in the file
Ex: echo \${C2S_BASE_PATH} should show the value set in the file

3.2.3 Configure Application Server

- Get the [c2s_config.sh](#) and run the file.
- ```
curl https://raw.githubusercontent.com/bhits-dev/consent2share/master/infrastructure/scripts/c2s_config.sh > c2s_config.sh
```
- ```
sh c2s_config.sh twoServerAppConfig
```

Expected Results:

The following subfolders and the Consent2Share configurations will be created under '/usr/local/' folder.

- Java
 - ✓ [docker-compose-app-server](#) file : docker-compose.yml
 - Application Files
 - java /C2S_PROPS/uaa
 - ✓ [uaa configuration](#) file: /uaa/uaa.yml
 - java /C2S_PROPS/[c2s-config-data](#)
 - ✓ [Consent2share configuration](#) files: /c2s-config-data
- Note: If not present clone it by using the following command
- ```
git clone https://github.com/bhits-dev/c2s-config-data.git
```
- java /keystore
  - java/C2s\_PROPS/ums
    - Create and activate provider user account
      - [create activate provider user.sh](#)
    - Activate Provider user account file :
      - [activate user account.sh](#)
    - The [c2s two servers app env.sh](#) file will be placed as c2s\_env.sh file in '/etc/profile.d/' folder.

➤ Edge-server security:

- Create/Obtain a valid SSL certificate
- Export the public and private keys from the SSL certificate to a JKS formatted keystore file named 'edge-server.keystore'
- upload the 'edge-server.keystore' file into '/usr/local/java/keystore' folder
- Add the following in the '/usr/local/java/C2S\_PROPS/[c2s-config-data](#)/edge-server.yml' file.

```
spring.profiles: your_app_Server_specific_profile
```

```
server:
```

```
ssl:
```

```
key-store: /java/keystore/edge-server.keystore
```

```
key-store-password: "keystore password"
```

- Modify the ENV\_APP\_PROFILE= your\_app\_Server\_specific\_profile in twoServerAppConfig() function in the '/etc/profile.d/ c2s\_env.sh' file.

➤ Modify the following configuration files

- Set edge server, config server, and SMTP variables to the server specific values in the '/etc/profile.d/ c2s\_env.sh' file.
- There are many Consent2Share API codes. The configurations in these codes can be overridden using the corresponding API YAMLS that are available in the c2s-config-data folder. The structure of the API YAMLS should be similar to the corresponding

application.yml mentioned in the each API code. They can be found in the 'src/main/resources' folder.

- ✓ For instance, to override database variables for PCM API. The following can be added in the pcm.yml as below  
spring.profiles: your\_app\_Server\_specific\_profile  
spring:  
  datasource:  
    url: "database url"  
    username: "database user name"  
    password: "{cipher} encrypted database pwd"
- ✓ Follow the instructions mentioned in the [config server api](#) to encrypt/decrypt server specific sensitive configurations.

➤ Re-login to the server in order for the file `c2s\_env.sh` to run automatically during the login

- Verify by checking any variable mentioned in the file  
Ex: echo \${C2S\_BASE\_PATH} should show the value set in the file

### 3.2.4 Compose Containers on Database Server

Run the following command from the '/usr/local/java' folder to start up all databases:

```
docker-compose up -d
```

Run 'docker ps -a' to verify all the containers are up running except data-only containers.

### 3.2.5 Compose Containers on Application Server

Run the following command from the '/usr/local/java' folder to start up all Consent2Share services, UIs:

```
docker-compose up -d
```

Run 'docker ps -a' to verify all the containers are up running.

## 3.3 Populate sample data

Perform the following in the database docker containers

### 3.3.1 Sample Providers (pls)

➤ Login to docker pls database container

```
docker ps | grep pls-db
```

```
docker exec -it <<pls-db container id>> bash
```

➤ Run pls\_db\_sample.sql from container directory `/java/C2S\_PROPS/pls`.

- cd /java/C2S\_PROPS/pls
- mysql -p  
Enter root pwd(default is admin)
- use pls;
- source insert\_state\_code\_lookup\_data.sql;
- source pls\_db\_sample.sql;

### 3.3.2 Sample Value Sets (vss)

- Login to docker vss database container

```
docker ps | grep vss-db
```

```
docker exec -it <<vss-db container id>> bash
```

- Run vss\_db\_sample.sql from container directory `/java/C2S_PROPS/vss``.
  - `cd /java/C2S_PROPS/vss`
  - `mysql -p`  
Enter root pwd(default is admin)
  - `use vss;`
  - `source vss_db_sample.sql;`

### 3.3.3 Sample Data for Consent Management (pcm)

- Login to docker pcm database container

```
docker ps | grep pcm-db
```

```
docker exec -it <<pcm-db container id>> bash
```

- Run pcm sample files from container directory `/java/C2S_PROPS/pcm``.
  - `cd /java/C2S_PROPS/pcm`
  - `mysql -p`  
Enter root pwd(default is admin)
  - `use pcm;`
  - `source insert_consent_attestation_term.sql;`
  - `source insert_consent_revocation_term.sql;`
  - `source insert_purposes.sql;`
  - `update consent_revocation_term`  
`set text = 'I have previously signed a patient consent form allowing my providers to access my electronic health records through the Consent2Share system and now want to withdraw that consent. If I sign this form as the Patient\'s Legal Representative, I understand that all references in this form to \"me\" or \"my\" refer to the Patient.\n\nBy withdrawing my Consent, I understand that:\n\n 1. I Deny Consent for all Participants to access my electronic health information through Consent2Share for any purpose, EXCEPT in a medical emergency.\n 2. Health care provider and health insurers that I am enrolled with will no longer be able to access health information about me through Consent2Share, except in an emergency.\n 3. The Withdrawal of Consent will not affect the exchange of my health information while my Consent was in effect.\n 4. No Consent2Share participating provider will deny me medical care and my insurance eligibility will not be affected based on my Withdrawal of Consent.\n 5. If I wish to reinstate Consent, I may do so by signing and completing a new Patient Consent form and returning it to a participating provider or payer.\n 6. Revoking my Consent does not prevent my health care provider from submitting claims to my health insurer for reimbursement for`

services rendered to me in reliance on the Consent while it was in effect.\n 7. I understand that I will get a copy of this form after I sign it.'

where id = 1;

### 3.3.4 Sample Data for User Management Service

- Login to docker ums database container  

```
docker ps | grep ums-db
```

```
docker exec -it <<ums-db container id>> bash
```
- Run pcm sample files from container directory `/java/C2S\_PROPS/ums`.
  - ```
cd /java/C2S_PROPS/ums
```
 - ```
mysql -p
```

  
Enter root pwd(default is admin)
  - ```
use ums;
```
 - ```
source insert_administrative_gender_code_lookup_data.sql;
```
  - ```
source insert_country_code_lookup_data.sql;
```
 - ```
source insert_locale_lookup_data.sql;
```
  - ```
source insert_role_scopes_lookup_data.sql;
```
 - ```
source insert_state_code_lookup_data.sql;
```
  - Add sample identifier system  

```
insert into identifier_system (display, oid, system, reassignable)
```

```
values ('BHITS EHR System', null, 'http://github.com/bhits', 0);
```

### 3.3.5 Sample Document Type Code (phr)

- Login to docker pls database container  

```
docker ps | grep phr-db
```

```
docker exec -it <<phr-db container id>> bash
```
- Run phr\_db\_sample.sql from container directory `/java/C2S\_PROPS/phr`.
  - ```
cd /java/C2S_PROPS/phr
```
 - ```
mysql -p
```

  
Enter root pwd(default is admin)
  - ```
use phr;
```
 - ```
source insert_document_type_codes.sql;
```

## 3.4 Create Provider User Account

Perform the following in the Application Server

- Login to docker ums application container  

```
docker ps | grep ums
```

```
docker exec -it <<ums container id>> bash
```

- Run create\_activate\_provider\_user.sh from container directory `/java/C2S_PROPS/ums``.
  - `cd /java/C2S_PROPS/ums`
  - `chmod 700 create_activate_provider_user.sh`
  - `./ create_activate_provider_user.sh`  
 Note: If the script errors out with following error  
`bash: ./create_activate_provider_user.sh: /bin/bash^M: bad interpreter: No such file or directory`  
 Convert line separator of the file to unix and run again
  - Enter sample provider account details. These credentials are used to login to the provider ui.

### 3.5 Possible Deployment Errors

If you encounter an error in the deployment:

- *ERROR: for dss.c2s.com UnixHTTPConnectionPool(host='localhost', port=None): Read timed out. (read timeout=60)*

Follow the steps below to resolve the error:

1. Restart the Docker service: `sudo service docker restart`
  2. Check for all Docker containers that are running: `docker ps -a`  
 If you notice any containers that are exited or down except the data-only containers based on ``busybox`` image, follow the next steps
  3. For instance, if MySQL containers are not running
    - a. Go to `/usr/local/java` and then remove all containers : `docker-compose down`
    - b. Go to `/usr/local/java` and then remove mysql folder : `sudo rm -rf mysql/`
  4. Start up all containers: Re-run from `'/usr/local/java'` folder: `docker-compose up -d`
- *ERROR: for any issues while mounting volumes to the containers from `'/usr/local/java'`*

If SELinux is enabled, run the command below to assign the relevant SELinux policy type as a workaround to prevent mounting issues.

```
sudo chcon -Rt svirt_sandbox_file_t /usr/local/java
```

### 3.6 UI URLs

- Consent2Share Provider UI: [https://<application\\_server>/provider-ui](https://<application_server>/provider-ui)
  - Use the credentials that were created as part of the [Create Provider User Account](#) section.
  - Follow the [Consent2Share Provider User Guide](#) to verify Consent2Share provider user features

By default, Consent2Share comes with sample providers as documented in Section#3.3. Please refer to [Consent2Share Patient User Guide](#) to add providers and then create consents

- Consent2Share Staff UI: [https://<application\\_server>/staff-ui](https://<application_server>/staff-ui)
  - By default, Consent2Share comes with a staff admin user `c2s-admin@mailinator.com`.
  - Login to Consent2Share staff UI as a staff using username `'c2s-admin@mailinator.com'` and password `'AAA#aaa1'`
  - Follow the [Consent2Share Staff User Guide](#) to verify Consent2Share staff admin features



By default, Consent2Share comes with sample providers as documented in Section#3.3. Please refer to [Consent2Share Patient User Guide](#) to add providers and then create consents

- Consent2Share UI: [https://<application\\_server>/c2s-ui](https://<application_server>/c2s-ui)
  - Create and activate a patient using provider-ui mentioned in [Consent2Share provider User Guide](#).
  - Follow the [Consent2Share Patient User Guide](#) to verify Consent2Share patient features
    - ✓ By default, Consent2Share comes with sample providers as documented in Section#3.3. Please refer to [Consent2Share Patient User Guide](#) to add providers and then create consents.

### 3.7 Generate and Reconfigure UAA Public and Private Keys

By default, Consent2Share has created public and private keys that are available in the configuration files. It is recommended to change them, especially in production environment.

- Create a temporary folder uaa-keystore under /usr/local/java
- Go to uaa-keystore folder, Run following in command line to generate a pair of public and private key. Enter pass phrase when promoted.
  - `openssl genrsa -des3 -out uaa_token_key_private.pem 2048`
  - `openssl rsa -in uaa_token_key_private.pem -outform PEM -pubout -out uaa_token_key_public.pem`
  - `openssl rsa -in uaa_token_key_private.pem -out uaa_token_key_private_unencrypted.pem -outform PEM`
- Update uaa.yml under /usr/local/java/C2S\_PROPS/uaa.
  - Replace `jwt.token.verification-key` with public key in `uaa_token_key_public.pem`.
  - Replace `jwt.token.signing-key` with private key in `uaa_token_key_private_unencrypted.pem`.
- Update `c2s_docker.sh` under /etc/profile.d
  - Replace `UAA_PUBLIC_KEY` with public key in `uaa_token_key_public.pem`.
    - ✓ Ensure no spaces in the key value, check the default value for reference
  - Re-login to the server for latest `UAA_PUBLIC_KEY` to be effective.

## 4 Appendix

### 4.1 HAPI FHIR Server Installation

The Consent2Share version of the HAPI FHIR Server [docker image](#) is available at the Docker Hub. Please refer to the full description of the image and run it accordingly.