Graduate Program in Information Science and Telecommunications and Networking

School of Information Sciences

University of Pittsburgh

Lab: Access Control for EHR

Version 1.2, Last Edited 3/24/2016

Group Members: Emily Kauffman (emk103@pitt.edu)

Jeffrey James (jaj63@pitt.edu)

Date of Experiment: March 26th, 2018

Graduate Program in Information Science and Telecommunications and Networking

School of Information Sciences

University of Pittsburgh

Read the following guidelines before working in the lab

General Guidelines

Through this lab you will work on OpenMRS 2.3.1 Standalone Edition. It's a Java web application that can be installed on Linux, Mac OS X, and Windows. You can work with its demo that contains data for 5,000 sample patients. The demo can be downloaded and installed on your own system, or you can use its online web application. You must have Java 6+ installed on your system to run OpenMRS. Use username: **admin** and password: **Admin123** for logging into the demo.

A written lab report is required for this assignment. You should turn in a printed copy of the lab report. Space has been provided to answer some of the questions of the exercises in this lab. However, you should attach extra sheets of paper with your answers for some of the questions. Please label your extra sheets with your name and indicate precisely which questions you are answering.

Graduate Program in Information Science and Telecommunications and Networking

School of Information Sciences

University of Pittsburgh

Part I: Objective

The objective of the exercises presented here is to familiarize the students with the role based access control features available in OpenMRS, which is an open source EHR system.

Part II: Equipment/Software

The exercises of this lab are based on OpenMRS, which is an open source EHR system and is freely available at http://openmrs.org/download/.

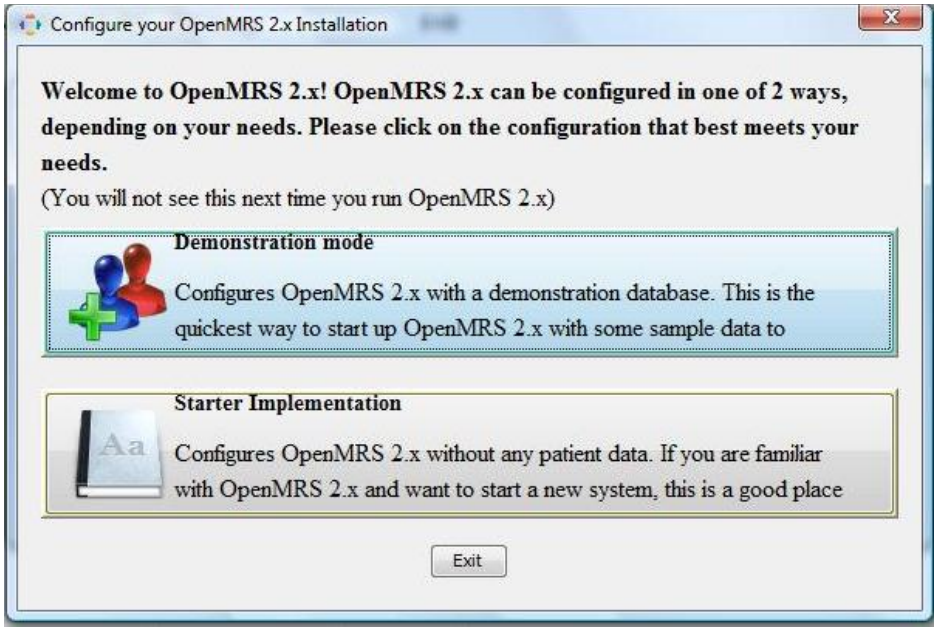
You can download and install the latest version of the demo, which is OpenMRS 2.3.1 Standalone Edition or you can use its online web application that is available at http://demo.openmrs.org/openmrs/login.htm. As the online demo is not stable and it's not available occasionally, it's recommended that you install the demo on your computer.

The database of the demo web application is automatically reset periodically, so you can make any changes that you want, but your modifications will be lost during automatic reset.

Find OpenMRS user guide at https://wiki.openmrs.org/display/docs/User+Guide.

Part III: Installation

You can download OpenMRS Standalone from the OpenMRS web site http://openmrs.org/download/. You must have Java 6+ installed on your system to run OpenMRS. To install the standalone version, download the ZIP file and extract it, then run the openmrs-standalone.jar file. During setup choose an option that installs the demo data, the first option in the following picture.



By default, the initial username and password are as follows: ***Username: admin*** and ***Password: Admin123***.

When OpenMRS is running you can access the application by opening the following URL in your browser:

http://localhost:8081/openmrs-standalone/

If you want to stop the application, use the **Stop** button in the user interface. You can restart the application by clicking **Start**, or running the JAR file again.

Part IV: Access control for EHR

OpenMRS is an open-source EMR (electronic medical records) system that has been deployed in many developing countries, including South Africa, Kenya, Rwanda, India, Pakistan, the Philippines, etc.

OpenMRS is a Java web application that follows MVC (Model-View-Controller) model. It uses MySQL as a database engine, and implements **RBAC** as its access control model.

OpenMRS employs privileges and roles to control access to data in the EMR system. A privilege specifies what can or cannot be done in the system (e.g., ***Add Patients*** or ***Delete Notes***). Roles are used to gather privileges into more manageable groups. Roles can inherit privileges from their parent roles.

Roles and **Privileges** are managed through the **Advanced Administration** page, under the **Manage Users** section.

Exercise 1:

Study different privileges in OpenMRS Demo and list four of them that seems most important to you.

Exercise 2:

Study different roles in OpenMRS Demo and name four main roles that have maximum set of privileges.

First, let's look at a simple example[1]:

Assume there are several privileges related to patient data—e.g., ***View Patients***, ***Edit Patients***, and ***Add Patients***. The ***View Patients*** privilege lets users look at patients in the system, the ***Edit Patients*** privilege lets users edit information about existing patients, and the ***Add Patients*** privilege allows users to create a new patient record within the system. Now imagine that you need to assign the proper roles to three people: *Mary* the Medical Student, *Bob* the Data Assistant, and *Erica* the Data Manager. You want medical students to be able to view patients, but not edit or add them. Data assistants should be able to not only view, but also edit patient data. And you want your data managers to be able to create new patients within your system.

In order to give these privileges to the relevant users, you must define a role for each of these types of user.

[1] This example is based on OpenMRS user guide.

Role	**Privilege(s)**
Medical Student	View Patients
Data Assistant	View Patients Edit Patients
Data Manager	View Patients Edit Patients Add Patients

After defining the main roles for the users of the system, add users *Mary*, *Bob*, and *Erica* and assign each user to its proper role.

Exercise 3:

Define the above mentioned roles and users in OpenMRS and attach the screenshot.

Now, let's take this process one step further. While it may not seem necessary in this simple example, as EMR system grows, it will likely end up with a large number of different roles. Very often, certain roles can be defined as a combination of other roles. In this example, a Data Manager oversees the Data Assistants and therefore should have all of their privileges plus some additional privileges. Now, redesign roles slightly to show how this might work.

Role	**Inherit Privilege(s) from Role(s)**	**Additional Privilege(s)**
Medical Student		View Patients
Data Assistant		View Patients Edit Patients
Data Manager	Data Assistant	Add Patients

You can see that the Data Manager role can be more clearly defined as a senior of Data Assistant role with the extra ability to add patients to the system. In addition, if you

should change or enhance the privileges of the Data Assistant role at any time in the future, the Data Manager will automatically adapt to those changes.

In a common deployment scenario, you will have several roles that use the same privileges with only a few differences. It is simpler to manage these privileges by defining a new role from which the others can all inherit. For example, you may have roles like **Clinician, Data Assistant**, and **Caregiver** that all have the same rules about viewing patient data. You might benefit from creating a new **Patient Data Viewer** role, assigning it to each of those other roles, and then managing the privileges in one place.

Exercise 4:

Now, you will work on a more complex scenario. Assume following roles are defined in an EHR system. Now, before defining these roles in OpenMRS, try to combine the roles that can inherit privileges from each other. You can define new roles if it makes managing your role hierarchy easier. Report your role hierarchy.

Role	**Privilege(s)**
Nurse	Add/ Edit/ View Patients Add/ Edit/ View Laboratory Orders Add/ Edit/ View Observations Add/ Edit/ View Reports
Doctor	Add/ Edit/ View Patients Add/ Edit/ View Laboratory Orders Add/ Edit/ View Encounters Add/ Edit/ View Visits
Health Secretary	Add/ Edit/ View Encounters Add/ Edit/ View Diet Orders
Physiotherapist	Add/ Edit/ View Encounters Add/ Edit/ View Physiotherapy Orders
Psychologist	Add/ Edit/ View Encounters

	Add/ Edit/ View Psychology Orders
Radiologist	Add/ Edit/ View Laboratory Orders Add/ Edit/ View Radiology Orders
Dentist	Add/ Edit/ View Encounters Add/ Edit/ View Diet Orders
Ambulance Personnel	View Patients Add Reports
System Administrator	Add/ Edit/ View Users Add/ Edit User Passwords Add/ Edit/ View Roles
Registration Clerk	Add/ Edit/ View Users Add/ Edit/ View Patients Add/ Edit/ View Appointments

Exercise 5:

Define your role hierarchy in OpenMRS. (You can add a new privilege If it's not defined in OpenMRS). Attach the screen shot of your defined roles in OpenMRS.

Built-in roles: There are some predefined roles in OpenMRS such as ***Anonymous***, ***Authenticated***, and ***System Developer***.

Exercise 6:

Study the OpenMRS User Guide about these predefined roles and their privileges and report their usage. Create different users with these roles and check what the differences between their access lists are.

Graduate Program in Information Science and Telecommunications and Networking

School of Information Sciences

University of Pittsburgh

Exercise 7:

What are the challenges you encounter while working with access control model in OpenMRS? What are your suggestions for improving the access control model of OpenMRS?

Study HL7 Role-Based Access Control (RBAC) Engineering Process (http://csrc.nist.gov/groups/SNS/rbac/documents/hl7_rolebased_access_control_(rbac).pdf).

Two types of roles are defined in the document: ***Functional Roles*** and ***Structural Roles***.

Exercise 8:

What are the differences between these two roles?

Exercise 9:

Define two Functional Roles and two Structural Roles in a healthcare environment and assign three proper privileges to each of them. Report your roles and their privileges.

Exercise 10:

Define your roles and their privileges in OpenMRS. Attach the screen shot.

Lab2
INFSCI 2150
Spring 2018
University of Pittsburgh

Emily Kauffman (emk103@pitt.edu)
Jeffrey James (jaj63@pitt.edu)

Exercise 1:

1. Add Patients
2. Add Orders
3. Add Users
4. Edit Patients

Exercise 2:

1. System Developer
2. Application: Has Super User Privileges
3. System Administrator
4. Hospital Administrator

Exercise 3:

Role Management:

☐ Medical Student	View Patients
☐ Data Assistant	View Patients , Edit Patients
☐ Data Manager	Add Patients , Edit Patients ...

Current Users

System Id	Username	Given	Family Name	Roles
8-3		Mary	Lincoln	Medical Student

System Id	Username	Given	Family Name	Roles
9-1		Bob	Builder	Data Assistant

System Id	Username	Given	Family Name	Roles
10-9		Erica	Jobs	Data Manager

Exercise 4:

Role	Inherit Privilege(s) from Role(s)	Additional Privilege(s)
Encounter Manager		Add/ Edit/ View Encounters
Patient Manager		Add/ Edit/ View Patients
Laboratory Manager		Add/ Edit/ View Laboratory Orders
User Administrator		Add/ Edit/ View Users
Ambulance Personnel		View Patients Add Reports

Nurse	Ambulance Personnel, Patient Manager, Laboratory Manager	Add/ Edit/ View Observations Edit/ View Reports
Doctor	Patient Manager, Laboratory Manager, Encounter Manager	Add/ Edit/ View Visits
Health Secretary	Encounter Manager	Add/ Edit/ View Diet Orders
Physiotherapist	Encounter Manager	Add/ Edit/ View Physiotherapy Orders
Psychologist	Encounter Manager	Add/ Edit/ View Psychology Orders
Radiologist	Laboratory Manager	Add/ Edit/ View Radiology Orders
Dentist	Encounter Manager	Add/ Edit/ View Diet Orders
System Administrator	User Administrator	Add/ Edit User Passwords Add/ Edit/ View Roles
Registration Clerk	User Administrator, Patient Manager	Add/ Edit/ View Appointments

Exercise 5:

Role Management:

Lab2: Ambulance Personnel		Add Reports , View Patients
Lab2: Dentist	Lab2: Encounter Manager	View Diet Orders , Edit Diet Orders ...
Lab2: Doctor	Lab2: Encounter Manager , Lab2: Patient Manager	Add Visits , View Visits ...
Lab2: Encounter Manager		View Encounters , Add Encounters ...
Lab2: Health Secretary	Lab2: Encounter Manager	View Diet Orders , Edit Diet Orders ...
Lab2: Laboratory Manager		Edit Laboratory Orders , Add Laboratory Orders ...
Lab2: Nurse	Lab2: Patient Manager , Lab2: Laboratory Manager	Edit Reports , View Reports ...
Lab2: Patient Manager		Add Patients , Edit Patients ...
Lab2: Physiotherapist	Lab2: Encounter Manager	View Physiotherapy Orders , Add Physiotherapy Orders ...
Lab2: Psychologist	Lab2: Encounter Manager	Add Psychology Orders , View Psychology Orders ...
Lab2: Radiologist	Lab2: Laboratory Manager	View Radiology Orders , Add Radiology Orders ...
Lab2: Registration Clerk	Lab2: Patient Manager , Lab2: User Administrator	Edit Appointments , Add Appointments ...
Lab2: System Administrator	Lab2: User Administrator	Add User Passwords , Edit User Passwords ...
Lab2: User Administrator		Add Users , View Users ...

Exercise 6:

Anonymous: People who don't sign-in to OpenMRS are given the privileges of this role, they are usually given very restricted access and view-only

Authenticated: Anyone that signs-in to Open-MRS is given the privileges of this role, they are common to all users

Provider: This is the basic medical provider role. It can be used to build more specialized medical provider roles.

System Developer: This role has access to everything (all privileges) in Open-MRS. Should only be granted to system administrators.

In our Open-MRS system, those with an *Anonymous* role and *Provider* have no privileges by default, those with an *Authenticated* role have many "Get" and "View" privileges (basically read only access), and those with a *System Developer* role have all privileges available in the system.

Exercise 7:

The system did not appear to have any way of resizing columns in the Role Management page. We were not able to see all of the information we had wanted due to this issue. It would be great if this function would be added to the system.

It was difficult searching through the various privileges to find the ones we wanted to select. It would good to be able to sort, filter, and search through these to make selections more quickly.

We found it hard to navigate through the users. It would be nice if the system had a single page view of all users and their roles or the users could be added on the "Role Management" page under each role.

Exercise 8:

Functional Roles: These roles consist of all the permissions needed to perform a task. They reflect the essential business functions that need to be performed. They are defined by a set of standard healthcare tasks (e.g. Neurologist).

Structural Roles: These roles place people in the organizational hierarchy. Such a role is a type of healthcare personnel warranting differing levels of access control.

Exercise 9:

Roles	Privileges
Functional: Anesthesiologist	Add/ Edit/ View Allergies Add/ Edit/ View Reports Add/ Edit/ View Observations
Functional: Neurologist	Add/ Edit/ View Laboratory Orders Add/ Edit/ View Reports Add/ Edit/ View Radiology Orders
Structural: Attending Physician	Add/ Edit/ View Patients Add/ Edit/ View Laboratory Orders Add/ Edit/ View Reports
Structural: Attending Registered Nurse	Add/ Edit/ View Patients Add/ Edit/ View Observations View Appointments View Orders

Exercise 10: