Activities Access

Background

Android activity navigation is quite like how Internet navigation works. In web-based applications, many pages are public. For example, we could access many pages by adding its name after the domain name, like so: http://host/home.html. In Android, we could do the same thing -- we could navigate to any activity using "am" package commands.

This could be quite the security problem. There are certain activities whose access should be restricted. Take a bank app that has two activities: the first activity for login and the second activity for making transactions the user must login to do transactions.

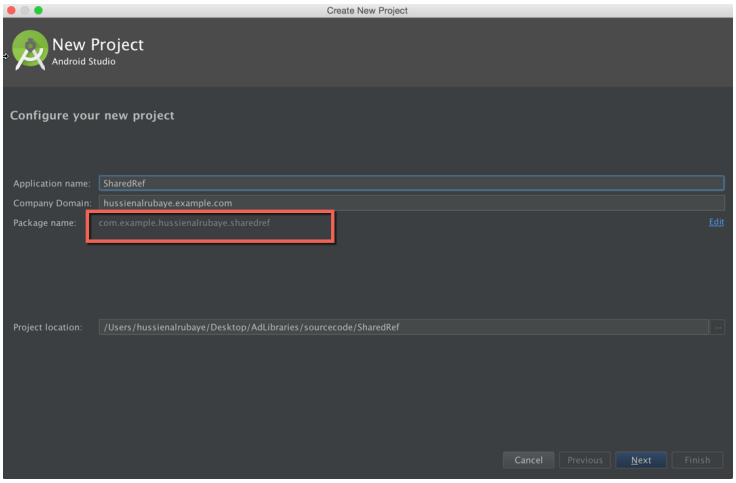
The security weakness here is that hackers could possibly circumvent login and navigate to the restricted-access activities by using "am" package commands.

Activity Instructions

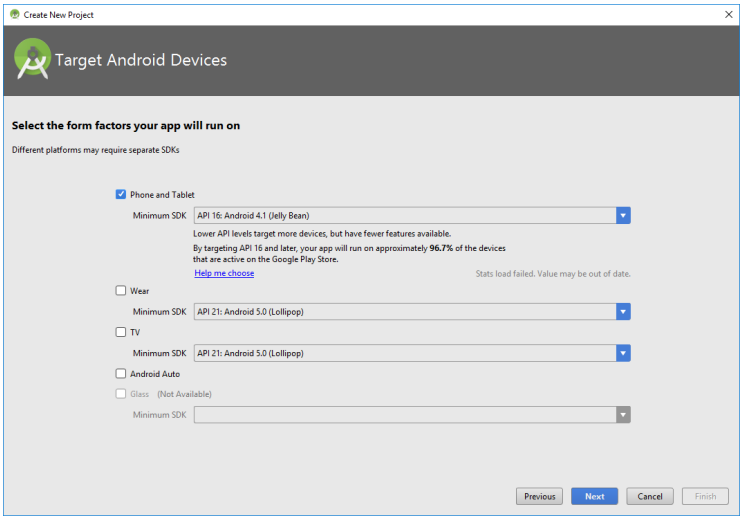
We will illustrate the problem by creating an app and exploiting it ourselves.

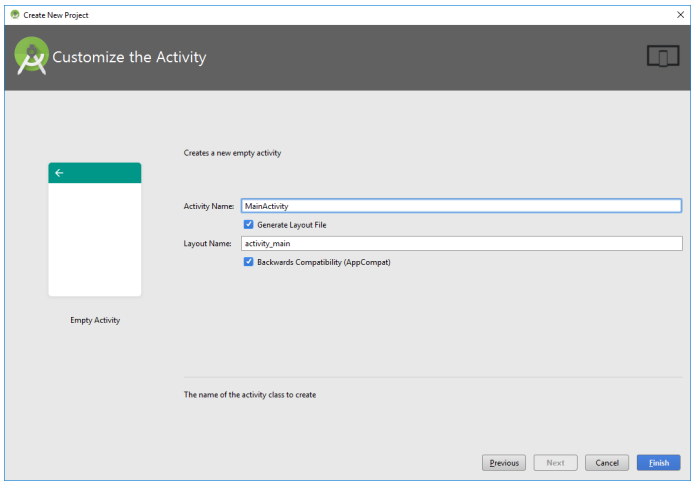
i. Create an app that asks the user to enter a username and password. Upon correct entry of login credentials, the user will be redirected to the second page to change their password.
ii. Show how an attacker might access the activity to change the user password without login.
iii. Explain techniques we might use to defend ourselves.

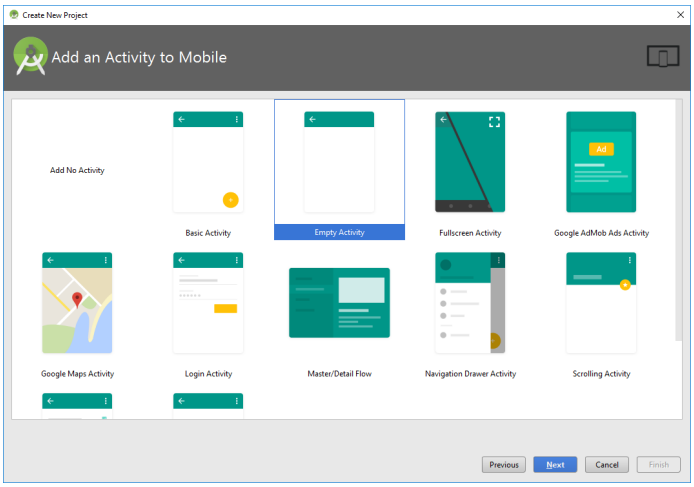
1. Project Creation
    a. Follow the screens below to create a new project:



Name the project “SecureActivityAccess”.







2. Add an Activity
    a. Add a new activity called “Main2Activity.java” by opening “ActivityMain.java”, found under “app/java/package_name_here/MainActivity”. Under the panel at the top, click File > New > Activity > Basic Activity.
3. Construct User Interface
    a. From the Palette tool window, add the following UI controls into the screen layout.

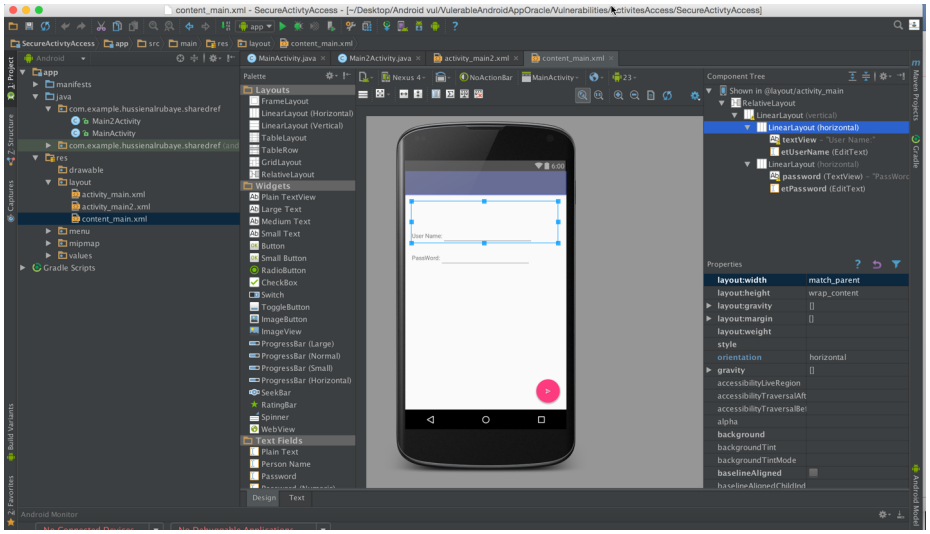
    Access the screen layout by going to “app/res/layout/activity_main.xml”.

i. Within the existing Relative Layout:

- Add the following UI controls:
    1. **TextView**:
        - Update the following properties:
            - `id="textView”`
            - `text="Username”`
    2. **TextView**
        - Update the following properties:
            - `id="password"`
            - `text=”Username”`
    3. **EditText**
        - Update the following properties:
            - `id=”usernameEditText"`
            - `text=””`
            - `inputType=”textPersonName”`
    4. **EditText**
        - Update the following properties:
            - `id=”passwordEditText"`
            - `hint=”Password”`
            - `inputType=”textPassword”`

Comment [JM1]: Please update this. As it is now, it is broken with Google's newer updates, which use CoordinatorLayout by default (instead of RelativeLayout by default). There isn't enough information here for the students to use to reproduce the layout.

This is what the layout should look like:



b. Construct the layout for the second activity we created the same way, only with the "Username" and "Password" labels changed to "Change Password" and "Repeat Password". Remember to change both EditTexts to take input of type password.

4. Code

Open MainActivity.java, found under "app/java/your_package_name", and add the following code:

a. Declare the following variables:

```
public class MainActivity extends AppCompatActivity {
    // key for user name
    public final String UserName = "admin";
    // key for password
    public final String Password = "admin";
    // shared references instance to access to virtual file
    SharedPreferences sharedpreferences;
    // input text name
    EditText usernameEditText;
    // input text password
    EditText passwordEditText;
```

b. Add the following code inside the **onCreate** method:

```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
    Toolbar toolbar = (Toolbar) findViewById(R.id.toolbar);
    setSupportActionBar(toolbar);
    // initialize  user name  instance with the real input in xml
    etUserName = (EditText)findViewById(R.id.usernameEditText);
    // initialize  password  instance with the real input in xml
    etPassword  =(EditText)findViewById(R.id.passwordEditText);
    // initialize shared references
    FloatingActionButton fab = (FloatingActionButton) findViewById(R.id.fab);
    // listen to floating button when click
    fab.setOnClickListener(new View.OnClickListener() {
        @Override
        public void onClick(View view) {

            if(UserName.equals(etUserName.getText().toString()) &&
Password.equals(etPassword.getText().toString()))
            //display message saved
            {
                Toast.makeText(MainActivity.this, "Data is Saved",
Toast.LENGTH_LONG).show();
                Intent intent = new Intent(getApplicationContext(),
Main2Activity.class);

                startActivity(intent);
            }
        }
    });}
```

c. Add the following imports to the file, below the package declaration.

```
import android.content.Intent;
import android.content.SharedPreferences;
import android.os.Bundle;
import android.support.design.widget.FloatingActionButton;
import android.support.v7.app.AppCompatActivity;
import android.support.v7.widget.Toolbar;
import android.view.View;
import android.widget.Toast;
import android.widget.EditText;
```

Open Main2Activity.java, and add the following code:

a. Add the following code inside the **onCreate** method:

```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main2);
    Bundle b=getIntent().getExtras();

}
```

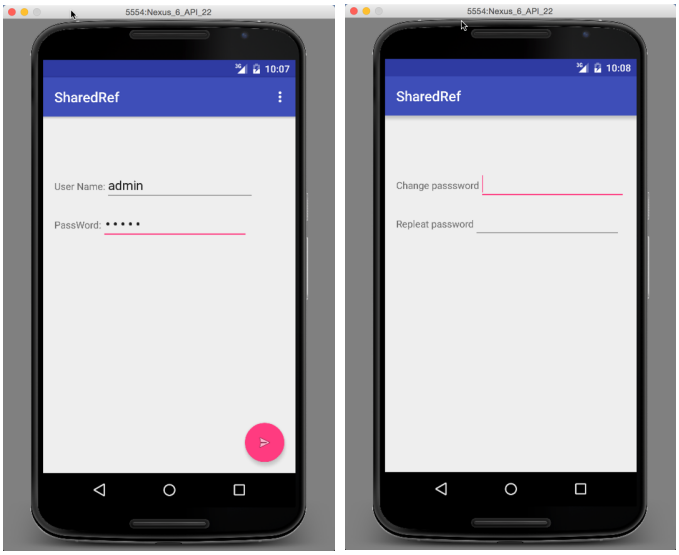
The above code achieves the following:

1. Upon creation of the MainActivity class, the **onCreate** method executes.
    a. Passes the Bundle named `savedInstanceState` to the superclass `AppCompatActivity`
    b. Initializes the variables declared in the first part with their corresponding layout objects.
    c. Creates a listener for the store button that upon click, will:
        i. Compare the credentials entered to the strings we have saved. If the credentials match what we have, we create an Intent with the second activity.
        ii. Start the second activity.
2. Upon creation of the Main2Activity class, the **onCreate** method executes.
    a. Passes the Bundle named `savedInstanceState` to the superclass `AppCompatActivity`
    b. Sets the content view to be the layout we designed for the second activity.
    c. Grabs the bundle that came with the Intent.

Exploitation Instructions

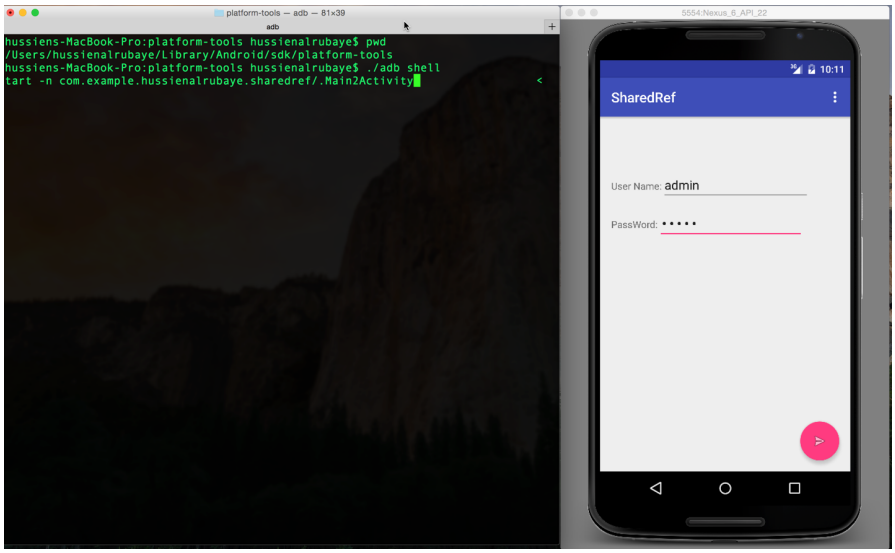
We shall see for ourselves how we can view the login credentials.

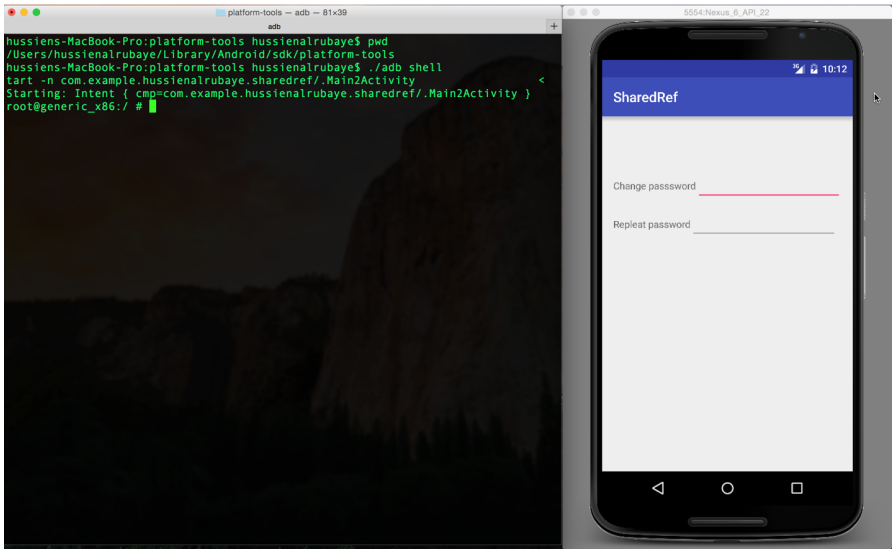
1. Run the app. Enter the login credentials of “admin” for username and “admin” for password (demonstration purposes only).



2. Using adb shell, view the saved preferences file by:
    i. Open Terminal or Command Prompt.
    ii. Run the following commands.
        i. On Mac OS X:
        ```
        cd Library/Android/sdk/platform-tools
        ```

        On Windows:
        ```
        cd C:\Users\YOUR_USERNAME_HERE\AppData\Local\Android\sdk\platform-tools
        ```
        ii. From here, it doesn't matter what platform you are running this on. We simply needed to find the Android/sdk/platform-tools directory.
        ```
        ./adb shell
        ```
        iii. `am start -n package_name/.ActivityName`
3. Once you have executed the commands above, you will be sent to the activity that is supposed to be after login only. We will be able to change the password without login.


platform-tools — adb — 81×39
adb
hussiens-MacBook-Pro:platform-tools hussienalrubaye$ pwd
/Users/hussienalrubaye/Library/Android/sdk/platform-tools
hussiens-MacBook-Pro:platform-tools hussienalrubaye$ ./adb shell
tart -n com.example.hussienalrubaye.sharedref/.Main2Activity
5554:Nexus_6_API_22
10:11
SharedRef
User Name: admin
PassWord: •••••


platform-tools — adb — 81×39
adb
hussiens-MacBook-Pro:platform-tools hussienalrubaye$ pwd
/Users/hussienalrubaye/Library/Android/sdk/platform-tools
hussiens-MacBook-Pro:platform-tools hussienalrubaye$ ./adb shell
tart -n com.example.hussienalrubaye.sharedref/.Main2Activity
Starting: Intent { cmp=com.example.hussienalrubaye.sharedref/.Main2Activity }
root@generic_x86:/ #
5554:Nexus_6_API_22
10:12
SharedRef
Change passsword
Repleat password

Defense

To fix this problem, we will send the key associated with the value over the intent to change password activity. In the second activity, we will then read the key and make sure the value is correct. If it is correct, we can start the password-changing activity. Otherwise, we will dismiss the activity. Then, when we run the "am" command without the key to open Main2Activity, it will not open.

1. Code
   The **onCreate** method of the MainActivity class is very like the one we see in the previous part. The only thing that has changed is the highlighted line: we include a key-value pair with the intent we are passing to the startActivity function.

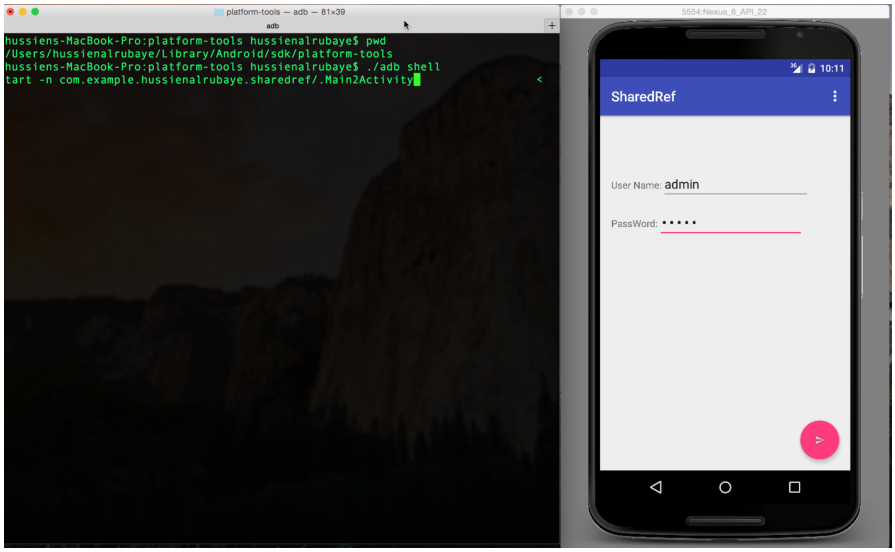
```
@Override
protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);
    Toolbar toolbar = (Toolbar) findViewById(R.id.toolbar);
    setSupportActionBar(toolbar);
    // initialize  user name  instance with the real input in xml
    etUserName=(EditText)findViewById(R.id.etUserName);
    // initialize  password  instance with the real input in xml
    etPassword=(EditText)findViewById(R.id.etPassword);
    //  // initialize shared references
    FloatingActionButton fab = (FloatingActionButton) findViewById(R.id.fab);
    // listen to floating button when click
    fab.setOnClickListener(new View.OnClickListener() {
        @Override
        public void onClick(View view) {

            if(UserName.equals(etUserName.getText().toString()) &&
Password.equals(etPassword.getText().toString()))
            //display message saved
            {
                Toast.makeText(MainActivity.this, "Data is Saved",
Toast.LENGTH_LONG).show();
                Intent intent = new Intent(getApplicationContext(),
Main2Activity.class);
                intent.putExtra("key", 3433);
                startActivity(intent);
            }

        }
    });
}
```

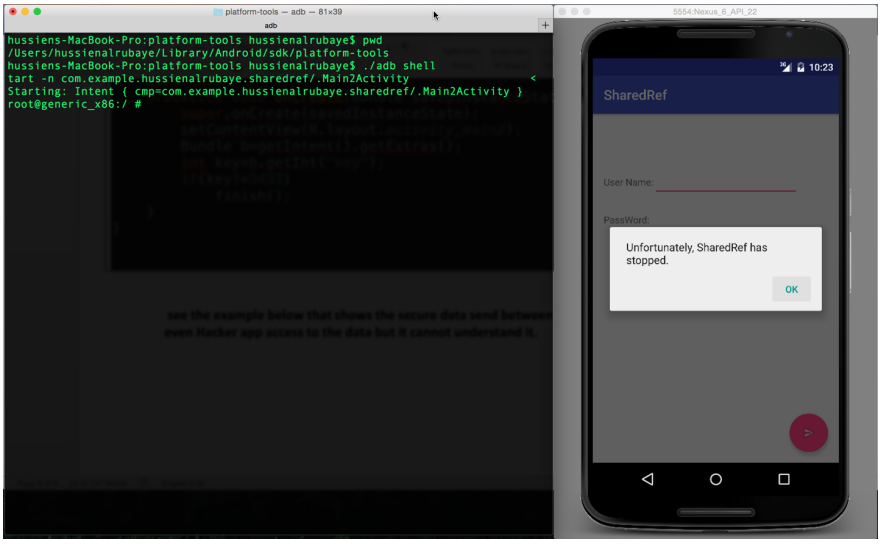
Now, we change the **onCreate** method of the Main2Activity class to check the intent it is passed for the key-value pair. If it is incorrect, or non-existent, then the Main2Activity class will simply not start.

```
public class Main2Activity extends AppCompatActivity {
    @Override
    protected void onCreate(Bundle savedInstanceState) {
```

```
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main2);
        Bundle b = getIntent().getExtras();
        int key = b.getInt("key");
        if (key != 3433)
            finish();
    }
}
```

2. When we run the same commands in adb again, we will get the following screens:





As we can see, an attacker would no longer be able to access the “change password” screen without the key-value pair.