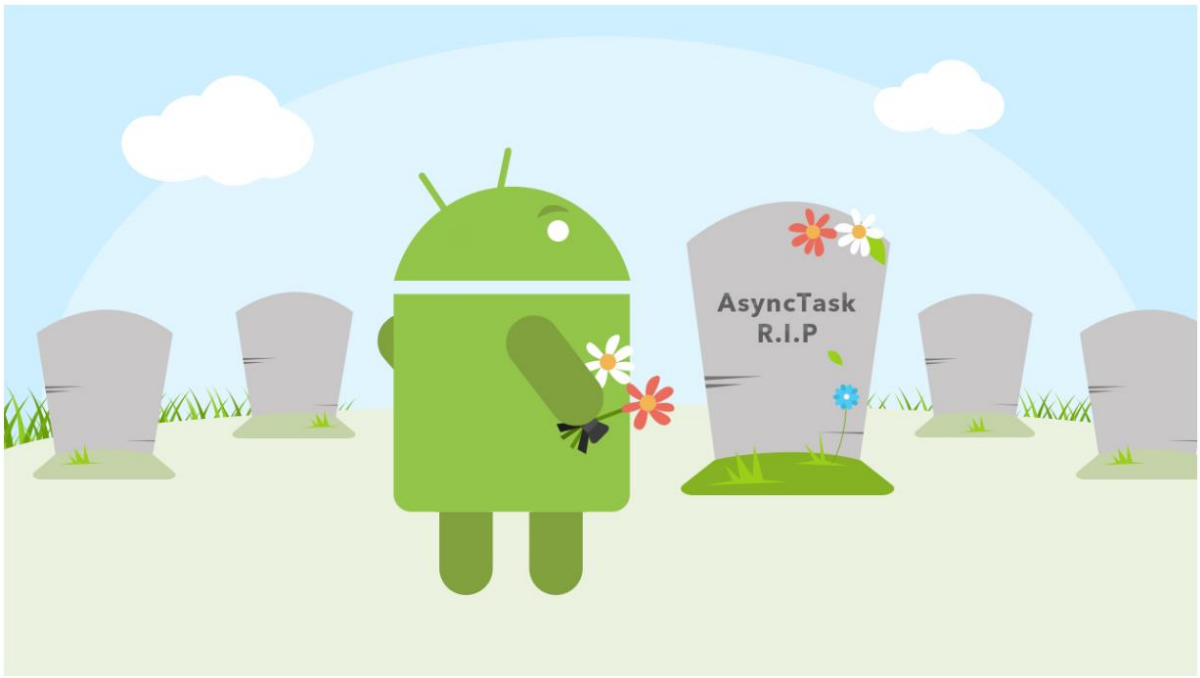
CSE3MAD Lab 4 Part B WorkManager and Running tasks separate to the UI Thread

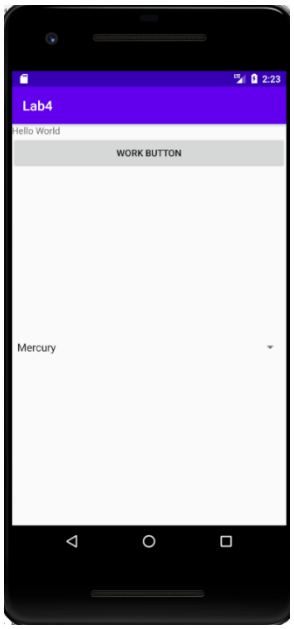


Aim:

a) To build an application that uses WorkManager to execute a long running task and have the main UI thread serviceable (you will continue to be able to use the spinner)
b) To send data to the Worker from MainActivity
c) To receive data from the Work on completion of its task

Step 1: Create a new Android Studio Project and choose 'Empty Activity' as the project type.

Step 2: Create a UI as per the layout enclosed.




```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity">

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        android:orientation="vertical"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent">

        <TextView
```

```
            android:id="@+id/textView"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:text="Hello World" />

        <LinearLayout
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:orientation="horizontal">

            <Button
                android:id="@+id/WorkButton"
                android:layout_width="wrap_content"
                android:layout_height="wrap_content"
                android:layout_weight="1"
                android:text="Work Button" />

        </LinearLayout>

        <Spinner
            android:id="@+id/spinner"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:layout_weight="1" />
    </LinearLayout>
</androidx.constraintlayout.widget.ConstraintLayout>
```

Step 3: Lets store the values for the spinner. Got to the 'res/values' folder and open strings.xml, enter the following.

```
<string-array name="planets_array">
    <item >Mercury</item >
    <item >Venus</item>
    <item >Earth</item>
    <item >Mars</item >
    <item >Jupiter</item >
    <item >Saturn</item >
    <item >Uranus</item >
    <item >Neptune</item >
</string-array >
```

In general, if you have static data, it is best to store it in the project resource folder.

Step 4: Fill out the class members of MainActivity.

```
private Button startWorkBtn =null;
private TextView txtView = null;
private Spinner spinner = null;

private String[] urls;
```

Step 5: Refer back to the lecture notes in week 4 on WorkManager, we are going to implement it next.

i) Let's import the code

```
import androidx.annotation.Nullable;
import androidx.appcompat.app.AppCompatActivity;
import androidx.lifecycle.Observer;
import androidx.work.Data;
import androidx.work.OneTimeWorkRequest;
import androidx.work.WorkInfo;
import androidx.work.WorkManager;
```

ii) Implement the onCreate()

```
super.onCreate(savedInstanceState);
setContentView(R.layout.activity_main);

// initialise the UI widgets
startWorkBtn = (Button) findViewById(R.id.WorkButton);
txtView = (TextView) findViewById(R.id.textView);
spinner = (Spinner) findViewById(R.id.spinner);

// Create an ArrayAdapter using the string array and a default spinner layout
ArrayAdapter<CharSequence> adapter = ArrayAdapter.createFromResource(this ,
        R.array.planets_array, android.R.layout.simple_spinner_item);

// Specify the layout to use when the list of choices appears
adapter.setDropDownViewResource(android.R.layout.simple_spinner_dropdown_item);

// Apply the adapter to the spinner
spinner.setAdapter(adapter);


// initialise the class member with some data
initURLS();
```

At this stage implement initURLS() as a member of MainActivity

```
// this will be the data to pass to the worker
// init a class member of MainActivity
private void initURLS(){
    try {
        urls = new String[]{
                new String("http://www.amazon.com/somefiles.pdf" ),
                new String("http://www.wrox.com/somefiles.pdf" ),
                new String("http://www.google.com/somefiles.pdf" ),
                new String("http://www.learn2develop.net/somefiles.pdf" ),
                new String("http://www.wrox.com/somefiles.pdf" )};
    }catch (Exception e){
        e.printStackTrace();
    }
}
```

Go back to onCreate(), <u>all the below code to be added to this method.</u>

```
// data to pass to worker
Data data = new Data.Builder().putStringArray(BackgroundWorker.URLS, urls)
        .build();
```

```
// build the work request (BackgroundWorker.class will do the 'work' for us
final OneTimeWorkRequest workRequest =
        new OneTimeWorkRequest.Builder(BackgroundWorker.class)
                .setInputData(data)
                .build();
```

Here we begin to use WorkManager. First we create a data object (it will contain the String[] urls), note we use a key-value pair (BackgroundWorker.***URLS***, **urls**). The keen-eyed amongst you will have seen that we will be using a user defined class 'BackgroundWorker' with a member ***URLS*** as the key. Since we are only interested in a one-off request we use OneTimeWorkRequest in conjunction with BackgroundWorker.class, and we set input data to be our array of URL's.

Before we implement the class BackgroundWorker, let's register a listener for the button.

```
startWorkBtn.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View view) {
        txtView.setText("Starting Work ....." + "\n");
        startWorkBtn.setEnabled(false);
        WorkManager.getInstance(getApplication()).enqueue(workRequest);
    }
});
```

Note: here in the button to 'do some work', we are adding a work request to the queue.

Lastly, we need some code to handle changes that are occurring in the worker class.

```
// listen for changes of the worker
WorkManager.getInstance(this.getApplication()).getWorkInfoByIdLiveData(workRequest
.getId())
        .observe(this, new Observer<WorkInfo>() {

            @Override
            public void onChanged(@Nullable WorkInfo workInfo) {

                //Displaying the status into TextView
                txtView.append(workInfo.getState().name() + "\n");

                // check to see if the worker has completed
                if(workInfo != null && workInfo.getState().isFinished()) {

txtView.append(workInfo.getOutputData().getString(BackgroundWorker.RETURNTEXT) +
"\n");
                    startWorkBtn.setEnabled(true);
                }
            }
        });
```

Here we are observing changes using the Observer pattern. There are a few UI changes we wish to make depending on what the worker is doing. First we wish to print the state of the worker. Note it cycles through Enqueued, Running and Succeeded states if all goes well. We simple print this to the textView.

The final conditional block checks to see if the worker is finished, if so, we add the value contained in the worker to the txtView. We access this with a specific key, BackgroundWorker.***RETURNTEXT.*** As would expect, this would appear as a member of the worker class.

Step 6: Implement the BackgroundWorker class

Create a new Java Class in your project and paste the code below.

```
package com.example.lab4;

import android.content.Context;
import android.util.Log;

import androidx.annotation.NonNull;
import androidx.work.Data;
import androidx.work.Worker;
import androidx.work.WorkerParameters;

public class BackgroundWorker extends Worker {

    public static final String URLS = "URLS"; // from the MainActivity

    public static final String RETURNTEXT = "receivedWorkerText"; // to the
MainActivity

    public BackgroundWorker(
            @NonNull Context context,
            @NonNull WorkerParameters params) {
        super(context, params);
    }

    @Override
    public Result doWork() {

        Context appContext = getApplicationContext();

        try {
            // do something that may take some time
            downloadFile(getInputData().getStringArray(URLS));

            // Indicate the work finished successfully with the Result
            Data data = new Data.Builder()
                    .putString(RETURNTEXT, "Work Done!!")
                    .build();

            return Result.success(data);
        } catch (Throwable throwable) {
            Log.e("ERROR", "doWork() Failed", throwable);
            // Indicate  the work failed with the Result
            Data data = new Data.Builder()
                    .putString(RETURNTEXT, "Work Failed!!")
                    .build();
            return Result.failure();
```

```
        }
    }


     private void downloadFile(String[] urls) {
        try {

            for (String url: urls) {
                //---simulate taking some time to download a file---
                Thread.sleep( 2000);
            }

        } catch (InterruptedException e) {
            e.printStackTrace();
        }

    }
}
```

The first thing to note is the class extends Worker, it will be used to run a task.

The Class has static ID's that are used to reference to/from links.

After the constructor, we implement doWork() where will be create long running execute, downloadFile simulates a lengthy task.

At its completion, we build a new data object, insert a string for display and return. This value is printed from MainActivity.

In summary, you have used WorkManager to create a worker that free the main UI from being encumbered with a long running task. You have learnt how to pass data to and from the worker and in doing so, implemented your own class that extends Worker.

Homework Task (on your own for next week): Once the worker has completed, click the button on the UI to start it again, note what happens. Look at the code and determine why, once you have done that, come up with a solution. This may stretch you a little and we will discuss it in the next class, sometimes personal investigation and problem solving will enhance your learning instead of wrote directions.

Appendix.

MainActvity.java

```
package com.example.lab4;


import androidx.annotation.Nullable;
import androidx.appcompat.app.AppCompatActivity;
import androidx.lifecycle.Observer;
import androidx.work.Data;
import androidx.work.OneTimeWorkRequest;
import androidx.work.WorkInfo;
import androidx.work.WorkManager;

import android.os.Bundle;
import android.view.View;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.Spinner;
import android.widget.TextView;

public class MainActivity extends AppCompatActivity {

    private Button startWorkBtn =null ;
    private TextView txtView = null ;
    private Spinner spinner = null ;

    private String[] urls ;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        // initialise the class member with some data
        initURLS();

        // initialise the UI widgets
        startWorkBtn = (Button) findViewById(R.id.WorkButton);
        txtView = (TextView) findViewById(R.id.textView);
        spinner = (Spinner) findViewById(R.id.spinner);

        // Create an ArrayAdapter using the string array and a default spinner
layout
        ArrayAdapter<CharSequence> adapter = ArrayAdapter.createFromResource(this
,
                R.array.planets_array, android.R.layout.simple_spinner_item);

        // Specify the layout to use when the list of choices appears

adapter.setDropDownViewResource(android.R.layout.simple_spinner_dropdown_item);

        // Apply the adapter to the spinner
        spinner.setAdapter(adapter);


        // data to pass to worker
```

```
        Data data = new Data.Builder().putStringArray(BackgroundWorker.URLS, urls)
                .build();

        // build the work request (BackgroundWorker.class will do the 'work' for
us
        final OneTimeWorkRequest workRequest =
                new OneTimeWorkRequest.Builder(BackgroundWorker.class)
                        .setInputData(data)
                        .build();



        startWorkBtn.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View view) {
                txtView.setText("Starting Work ....." + "\n");
                startWorkBtn.setEnabled(false);
                WorkManager.getInstance(getApplication()).enqueue(workRequest);
            }
        });

        // listen for changes of the worker

WorkManager.getInstance(this.getApplication()).getWorkInfoByIdLiveData(workRequest
.getId())
                .observe(this, new Observer<WorkInfo>() {

                    @Override
                    public void onChanged(@Nullable WorkInfo workInfo) {

                        //Displaying the status into TextView
                        txtView.append(workInfo.getState().name() + "\n");

                        // check to see if the worker has completed
                        if(workInfo != null && workInfo.getState().isFinished()) {

txtView.append(workInfo.getOutputData().getString(BackgroundWorker.RETURNTEXT) +
"\n");
                            startWorkBtn.setEnabled(true);
                        }
                    }
                });
    }


    // this will be the data to pass to the worker
    // init a class member of MainActivity
    private void initURLS(){
        try {
            urls = new String[]{
                    new String("http://www.amazon.com/somefiles.pdf" ),
                    new String("http://www.wrox.com/somefiles.pdf" ),
                    new String("http://www.google.com/somefiles.pdf" ),
                    new String("http://www.learn2develop.net/somefiles.pdf" ),
                    new String("http://www.wrox.com/somefiles.pdf" )};
        }catch (Exception e){
            e.printStackTrace();
        }
    }


}
```

BackgroundWorker.java

```
package com.example.lab4;

import android.content.Context;
import android.util.Log;

import androidx.annotation.NonNull;
import androidx.work.Data;
import androidx.work.Worker;
import androidx.work.WorkerParameters;

public class BackgroundWorker extends Worker {

    public static final String URLS = "URLS"; // from the MainActivity

    public static final String RETURNTEXT = "receivedWorkerText"; // to the
MainActivity

    public BackgroundWorker(
            @NonNull Context context,
            @NonNull WorkerParameters params) {
        super(context, params);
    }

    @Override
    public Result doWork() {

        Context appContext = getApplicationContext();

        try {
            // do something that may take some time
            downloadFile(getInputData().getStringArray(URLS));

            // Indicate the work finished successfully with the Result
            Data data = new Data.Builder()
                    .putString(RETURNTEXT, "Work Done!!")
                    .build();

            return Result.success(data);
        } catch (Throwable throwable) {
            Log.e("ERROR", "doWork() Failed", throwable);
            // Indicate  the work failed with the Result
            Data data = new Data.Builder()
                    .putString(RETURNTEXT, "Work Failed!!")
                    .build();
            return Result.failure();
        }
    }


     private void downloadFile(String[] urls) {
        try {

            for (String url: urls) {
                //---simulate taking some time to download a file---
                Thread.sleep( 2000);
            }

        } catch (InterruptedException e) {
            e.printStackTrace();
```

```
            }

        }
    }
```