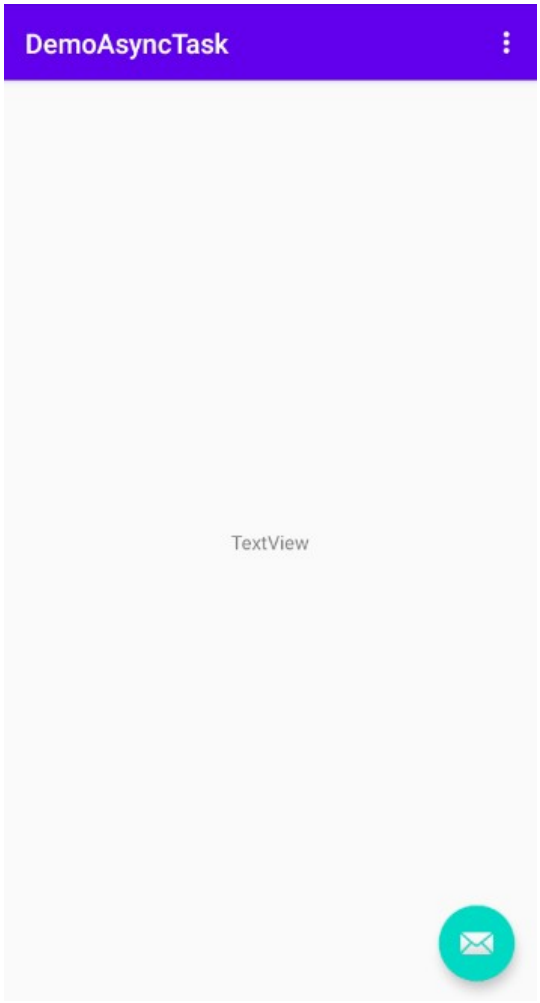
AsyncTask - In class Lab and Project
I am demoing a concept so I am not going to worry about handling phone rotations
Build app as below
(I used activity with fab, and dumped the fragments.)



In MainActivity:

have some constants

```
private static final int NUMBER_UPDATES = 200;
private static final int ONE_SECOND = 10;
private static final String RUNNING_CALC = "Running Calculation for thread ";
```

```
private static final String DONE = "Done with thread ";
private static final String USER_CANCELED = "User chose to cancel";
```

get a reference to the textview

```
private TextView tv;
protected void onCreate(Bundle savedInstanceState) {
  :

   tv=findViewById(R.id.textview_first);
```

:

add associated FAB handler in OnCreate

```
fab.setOnClickListener(new View.OnClickListener() {
  @Override
  public void onClick(View v) {
    //run calculation
    MainActivity.this.tv.setText(RUNNING_CALC); //never see this
    runCalcs(NUMBER_UPDATES);  //if this is run outside of thread never
                               // see above change, button stays
                               // depressed until runCalcs done
                               // then see one below
    MainActivity.this.tv.setText(DONE);         //
  }
});
```

create a long running function

```
void runCalcs(Integer numb_updates)
{
    for (int i = 0; i <= numb_updates; i++) {
        try {
            Thread.sleep(ONE_SECOND);
        } catch (InterruptedException e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
    }
}
```

Now click the do calc button (nothing happens, no text change either until everything finishes running) that's cause the main thread can't change the text until we return from this function, bummer so lets put it in a thread.

```
//this is static, so it does not hold an implicit reference
//enclosing activity, but I am explicitly holding a ref in the constructor.
Rotate the phone and activity CANNOT be Gced.  We will fix this in a bit
private static class MyTask extends AsyncTask<Integer,Void,Void> {
  private final MainActivity act;
  private static int numberInstances=0;   //how many threads are running
  public MyTask(MainActivity act){
    //want to be able to modify UI
    //in parent so save parent
    this.act = act;
  }
  @Override
  protected Void doInBackground(Integer... params) {
    act.runCalcs(params[0]);
    return (null);
  }
  @Override
  protected void onPreExecute() {
    super.onPreExecute();
    act.tv.setText(RUNNING_CALC + Integer.toString(++numberInstances));
  }
  @Override
  protected void onPostExecute(Void aVoid) {
    super.onPostExecute(aVoid);
    act.tv.setText(DONE + Integer.toString(numberInstances--));
  }
}
```

change the FAB handler in main code

```
fab.setOnClickListener(new View.OnClickListener()
@Override
public void onClick(View v) {
  MyTask  mt= new MyTask(MainActivity.this);
  mt.execute(NUMBER_UPDATES);
}
});
```

But all the UI is still available, and I want the user to only be able to run 1 thread at a time?

Progress bar? Nah does not solve the multiple click problem

How about if we go and disable all the elements while we run the calculations?

PITB. Have to get a reference to each and set enabled to false.

How about if we pop a Dialog that indicates that we are busy so that the user cant touch other buttons? When thread is finished it stops that UI?

Add private variable

```
private ProgressDialog myProgressDialog;
```

and a couple of methods to start and stop it

```
private void progressDialog_start() {
        myProgressDialog = new ProgressDialog(this);
        myProgressDialog.setTitle("Please wait");
        myProgressDialog.setMessage("Notice user cannot interact with rest of UI\
nincluding starting additional threads");
        myProgressDialog.setCancelable(false);
        myProgressDialog.show();
    }

    private void progressDialog_stop(){
        myProgressDialog.dismiss();
    }
```

start and stop in onPre and onPost in thread

==========

so what if the thread goes on forever and we want to cancel it?
Make the async a member variable of activity
Add a cancel button to progress dialog
Add an onclick handler, if user clicks call **async.cancel(true)**

```
private void progressDialog_start() {
  myProgressDialog = new ProgressDialog(this);
  myProgressDialog.setButton(DialogInterface.BUTTON_NEGATIVE,
"Cancel", new DialogInterface.OnClickListener() {
      @Override
      public void onClick(DialogInterface dialog, int which) {
        mt.cancel(true);
        dialog.dismiss();
      }
    }
  );
  myProgressDialog.setTitle("Please wait");
  myProgressDialog.setMessage("Notice user cannot interact with
rest of UI\nincluding starting additional threads");
  myProgressDialog.setCancelable(false);
  myProgressDialog.show();
}
```

tidy up doInBackground so it checks for canceled

```
protected Void doInBackground(Integer... params) {
  for (int i = 0; i <= params[0]; i++) {
    act.runCalcs(1);
    if (this.isCancelled())
      break;
  }
  return (null);
}
```

```
add a canceled method
protected void onCancelled(Void aVoid) {
    super.onCancelled(aVoid);
    numberInstances--;
    act.tv.setText(USER_CANCELED);
    act.progressDialog_stop();
}
```

```
================================================================
But… Our thread is holding onto activity via member var, what happens if phone
rotates? (start then rotate look at logcat, leaked window…)
E/WindowManager: android.view.WindowLeaked: Activity
com.example.demoasynctask.MainActivity has leaked window DecorView@a8aeb3a[Please
wait] that was originally added here
        at android.view.ViewRootImpl.<init>(ViewRootImpl.java:597)
```

Plus you crash since returned thread wants to update ui that aint there. Plus, not checking for act==null and even if you do there is a race condition between the null check and the dereference

```
if(act)
        act.runCalcs(...)
```

update build.gradle

```
implementation "androidx.lifecycle:lifecycle-viewmodel"
```

Fix… Move thread to App with a Viewmodel, let ViewModel hosts thread

add a ViewModel class

```
package com.example.asynctaskpdialog_inclass; //whatever your package name is here

import androidx.lifecycle.ViewModel;

public class DataVM extends ViewModel {

}
```

Move AsyncTask into ViewModel

now some stuff changes in main, progress dialog functions for instance need public access

add a ViewModel member to MainActivity

```
//persists accross config changes
DataVM myVM;
```

and in onCreate add the following

```
// Create a ViewModel the first time the system calls an
activity's
// onCreate() method.  Re-created activities receive the same
// MyViewModel instance created by the first activity.
myVM = new ViewModelProvider(this).get(DataVM.class);
```

launch thread from ViewModel

```
fab.setOnClickListener(new View.OnClickListener() {
      //a better (but still bad) way
      @Override
      public void onClick(View v) {
        //what is this funkyness? create a new instance of the thread and attach to
        //myVM.mt
        myVM.mt= myVM.new AST_task(MainActivity.this);
        myVM.mt.execute(NUMBER_UPDATES);
      }

    });
```

But… still tied directly to activity.. rotate the phone and you keep the thread but what happens to act?

Simple but misguided ?
Have attach and detach in thread
Mainactivity attaches in onCreate and detaches in OnDestroy
but now I have to do a LOT of null checks AND I am still mixing my UI with my threads, a recipe for confusion
AND I am not threadsafe… Where is the problem in the following?

```
protected void onPostExecute(Void aVoid) {
  super.onPostExecute(aVoid);
  if (act != null) {
    act.tv.setText(DONE + Integer.toString(numberInstances--));
    act.progressDialog_stop();
  }
}
```

what if activity destroyed after null check? Or progressdialog for that matter?

How about if we just seperate them totally…
Enter LiveData – An observer pattern where all the data is kept in the ViewModel and the Activity is notified when the data changes, the framework correctly manages all the lifecycle events for you.

Get rid of the dependency on the Activity in the ViewModel

get rid of attach and detach in ViewModel
get rid of calls to attach and detach in MainActivity

Add the datamanagers (subject) in DataVM and add a getter

```
private MutableLiveData<String> et;
public MutableLiveData<String> getCurrentText() {
  if (et == null) {
    et = new MutableLiveData<String>();
  }
  return et;
}
```

start to migrate data functions from MainActivity to DataModel

runcalcs(…

refactor the async task not to use the activity
note the use of setValue… thats how you change these mutable types!

```
@Override
protected void onPreExecute() {

  super.onPreExecute();

  et.setValue(RUNNING_CALC + Integer.toString(++numberInstances));

  bpd.setValue(true);

}
```

In MainActivity onCreate set up all the listeners for livedata changes

```
// Create the observer which updates the UI.
final Observer<String> textObserver = new Observer<String>() {
  @Override
  public void onChanged(@Nullable final String newText) {
    // Update the UI, in this case, a TextView.
    tv.setText(newText);
  }
};
// Observe the LiveData, passing in this activity as the LifecycleOwner and
the observer.
myVM.getCurrentText().observe(this, textObserver);

// Create the observer which updates the UI.
final Observer<Boolean> bpdObserver = new Observer<Boolean>() {
  @Override
  public void onChanged(@Nullable final Boolean bpd) {
    // Update the UI, in this case, a TextView.
    if(bpd == true)
      progressDialog_start();
          else
      progressDialog_stop();
  }
};
// Observe the LiveData, passing in this activity as the LifecycleOwner and
the observer.
myVM.getProgressDialogState().observe(this, bpdObserver);
```