Android Threads

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Thread

- Main thread (UI thread)
  - When an application is launched, the system creates the main thread.
- Worker thread
  - perform non-instantaneous operations in separate threads ("background" or "worker" threads).

Why we need worker thread?

Android enforces a worst case reaction time of applications. If an activity does not react within 5 seconds to user input, the Android system displays an Application not responding (ANR) dialog. From this dialog the user can choose to stop the application.

Rules to use thread in Android

- Do not block the UI thread
- Do not access the Android UI toolkit from outside the UI thread

http://developer.android.com/guide/components/processes-and-threads.html

Worker threads

- Java threads
  - Not convenient and has several limitations
- AsyncTask
  - The simplest way to use thread
- Handler
  - Can handle multiple runnable tasks and messages

Java Threads

- Android supports the usage of the Thread class to perform asynchronous processing
- If you need to update the user interface from a new Thread, you need to synchronize with the UI thread.

Take ImageLoader as an Example

```
public void onClick(View v) {
    new Thread(new Runnable() {
        public void run() {
            Bitmap b = loadImageFromNetwork("http://example.com/image.png");
            mImageView.setImageBitmap(b);
        }
    }).start();
}
```

Take ImageLoader as an Example

```
public void onClick(View v) {
    new Thread(new Runnable() {
        public void run() {
            Bitmap b = loadImageFromNetwork("http://example.com/image.png");
            mImageView.setImageBitmap(b);
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```

this seems to work fine

- a new thread to handle the downloading task

but it violates the second rule

- change UI from outside UI thread

Disadvantages to Use Java Thread in Android

- Without synchronization with the UI thread if you post back results to the user interface
- Cannot stop the thread by destroy() or stop()
- No default for handling configuration changes in Android

How to Use Java Thread to Update UI?

```
public void onClick(View v) {
    new Thread(new Runnable() {
        public void run() {
            final Bitmap bitmap =
                    loadImageFromNetwork("http://example.com/image.png");
            mImageView.post(new Runnable() {
                public void run() {
                    mImageView.setImageBitmap(bitmap);
                }
            });
        }
    }).start();
```

AsyncTask & Handler

- They provide a function to help you post the resulting data to UI thread
  - conform the second rule
- Automatically handle the configuration changing
- Have function to stop the tasks

AsyncTask

- The simplest way to use thread
- Each task can only be executed once
  - If you want to execute again, you need to create a new task

Steps of AsyncTask

- onPreExecute():
  - used to set up the task
- doInBackground(Params...):
  - perform background computation that can take a long time
- onProgressUpdate(Progress...):
  - This method is used to display progress
- onPostExecute(Result):
  - result of the background computation is passed to this step

Rules of AsyncTask

- The AsyncTask class must be loaded on the UI thread
- execute(Params...) must be invoked on the UI thread
- Do not call the functions of 4 steps manually
- The task can be executed only once

Sample Code Of Saving Image

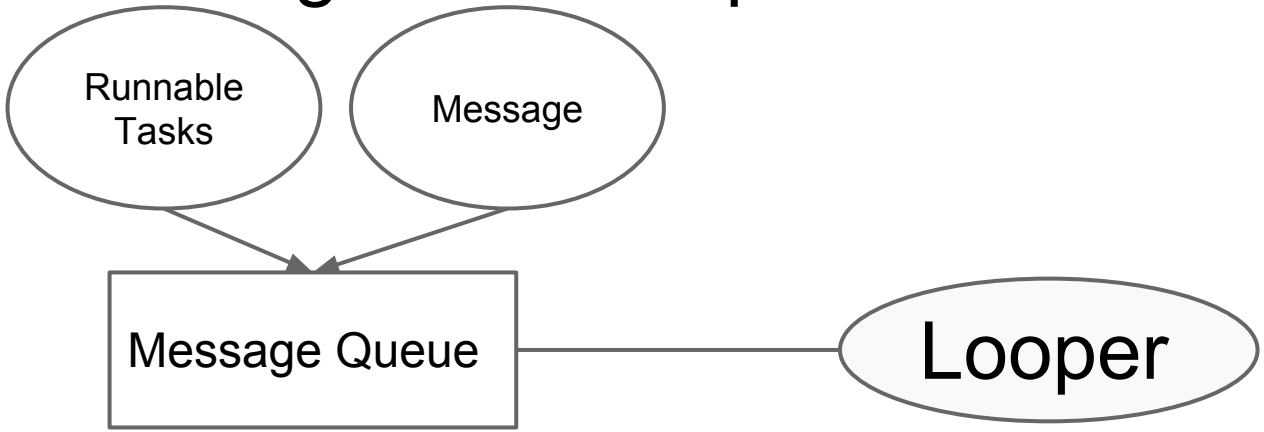
- 140.114.79.79/dropbox/SaveFile.rar

Handler

- A Handler object registers itself with the thread in which it is created
- If you create a new instance of the Handler class in the onCreate() method of your activity, the resulting Handler object can be used to post data to the main thread.

Message Queue & Looper

- When a Handler is created, it is bound to a specific Looper (and associated thread and message queue)
- A Handler is a utility class that facilitates interacting with a Looper



How to Use Handler

- To process a Runnable you can use the post() method
- Override the handleMessage() method to process messages. Your thread can post messages via the sendMessage(Message) method to the Handler object.

Sample of Handling Runnable Task

- 140.114.79.79/dropbox/BluetoothExample.zip

Sample of Handling Messages

- Bluetooth Chat Sample