CS 580 Client-Server Programming
Fall Semester, 2012
Doc 14 Canceling AsyncTask, Multiple Request-One Socket
Oct 11, 2012

Handling User Cancel Requests

How to cancel an AsyncTask

Call cancel(boolean) on AsyncTask

true to interrupt AsyncTask thread

In AsyncTask

Call isCancelled() to see if have been cancelled

If in read on SocketChannel catch exceptions

NotYetConnectedException

ClosedChannelException

AsynchronousCloseException

ClosedByInterruptException

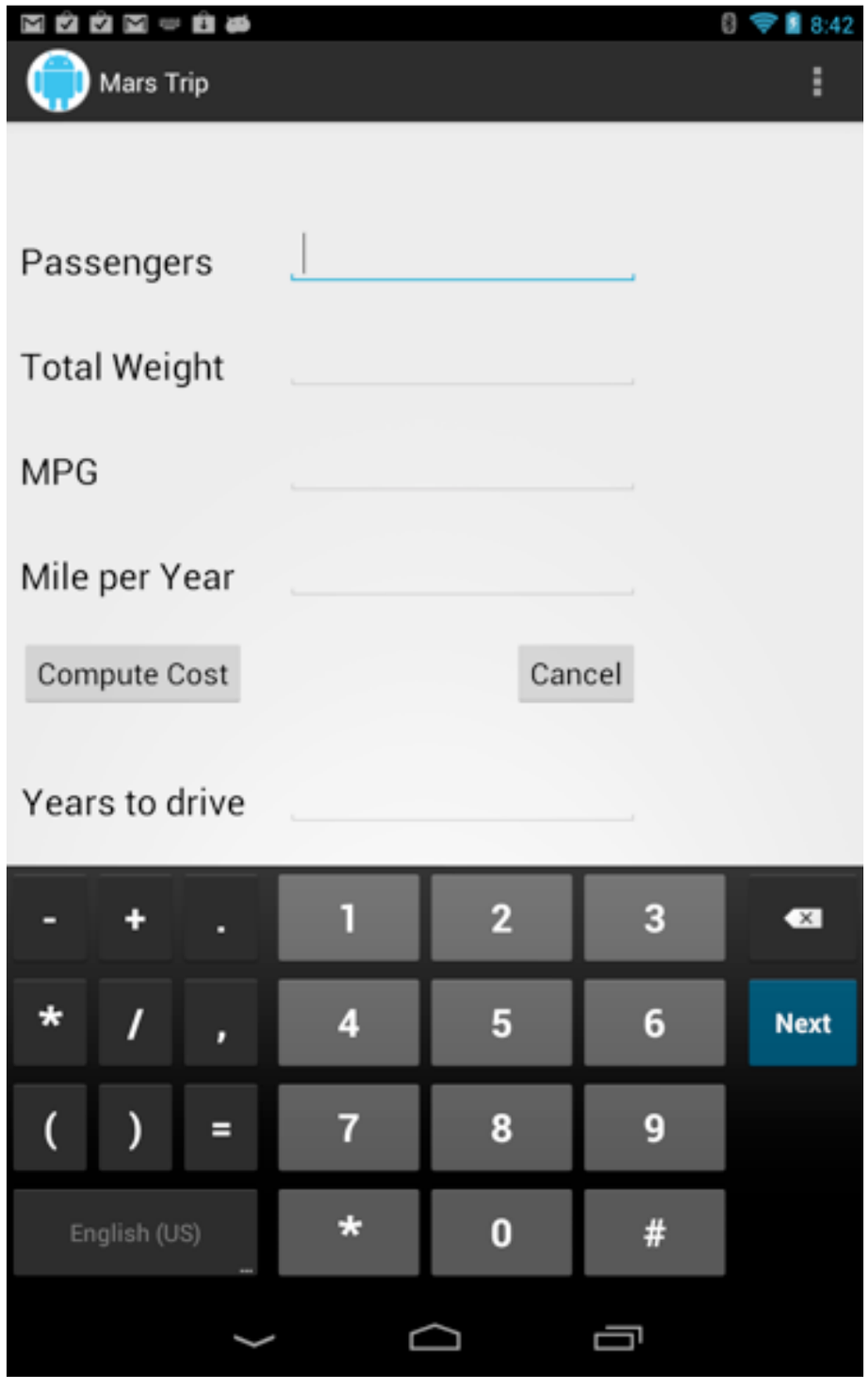
IOException

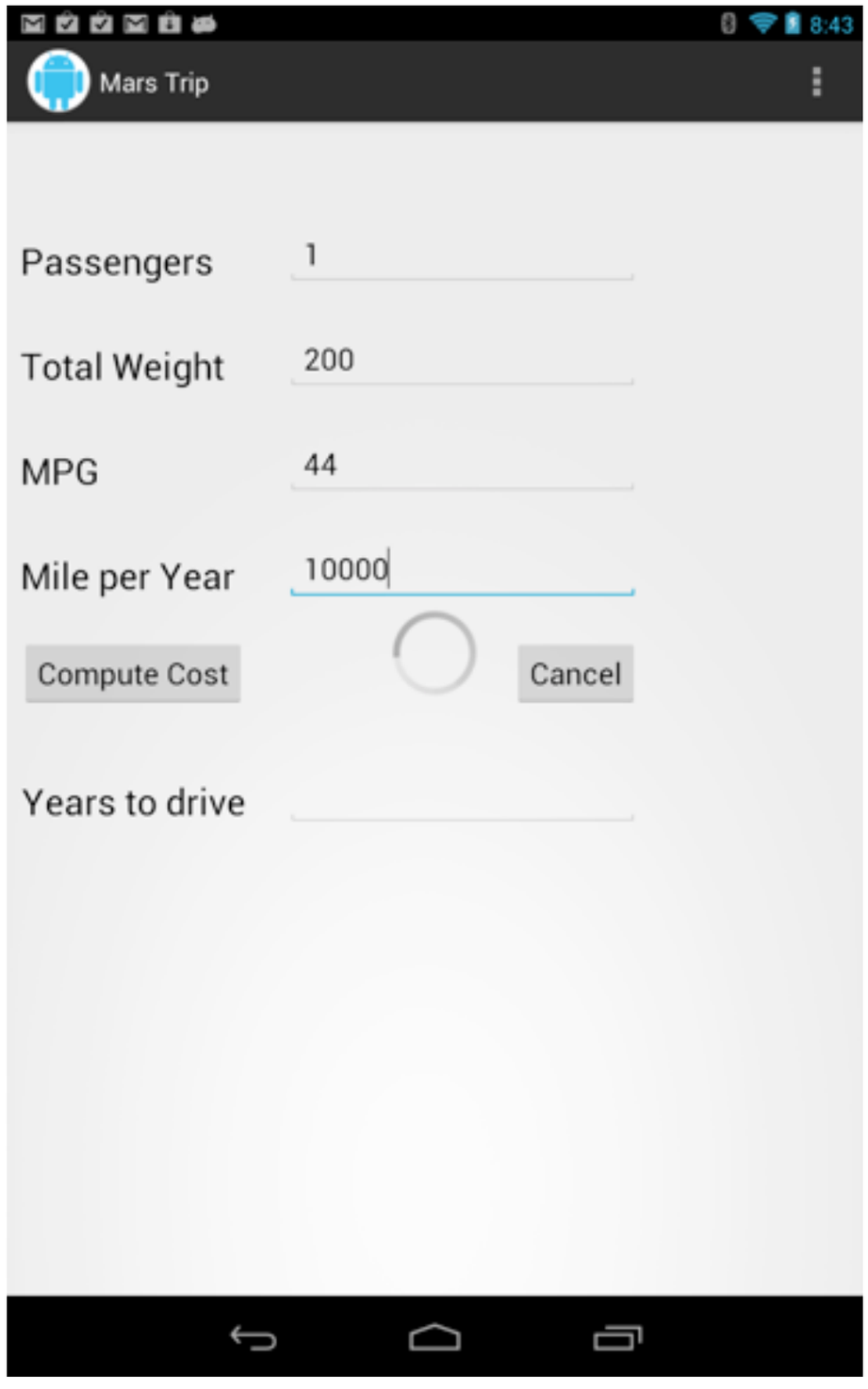
Implement onCancelled() method

Run on UI thread

Used to clean up

Mars Example





delayedtrip Message

Command on Mars Server

Waits 30 seconds before sending back response

For testing Cancel operation

MainActivity

```
public class MainActivity extends Activity {
      TripDetailsTask getResult;

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

    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
        getMenuInflater().inflate(R.menu.activity_main, menu);
        return true;
    }

    public void cancel(View aView) {
      boolean wasCancelled = getResult.cancel(true);
    }
```

MainActivity

```
public void compute(View aView) {
  Log.i("mars","compute now");
  TextView peopleView = (TextView) this.findViewById(R.id.people);
  TextView weightView = (TextView) this.findViewById(R.id.weight);
  TextView mpgView = (TextView) this.findViewById(R.id.mpg);
  TextView milesPerYearView = (TextView) this.findViewById(R.id.milePerYear);
  int peopleCount = Integer.parseInt(peopleView.getText().toString());
  float weight = Float.parseFloat(weightView.getText().toString());
  float mpg = Float.parseFloat(mpgView.getText().toString());
  float milesPerYear = Float.parseFloat( milesPerYearView.getText().toString());
  TextView totalMiles = (TextView) this.findViewById(R.id.totalMiles);
  ProgressBar showWait = (ProgressBar) this.findViewById(R.id.serverWait);
  MarsClient client = new MarsClient("bismarck.sdsu.edu",8009);
  getResult = new TripDetailsTask(totalMiles, showWait,client);
  getResult.execute((float)peopleCount,weight, mpg, milesPerYear);
}
```

TripDetailsTask

```
public class TripDetailsTask extends AsyncTask<Float, Void, Float> {
      TextView totalMiles;
      ProgressBar waiting;
      MarsClient client;

      public TripDetailsTask(TextView out,ProgressBar bar, MarsClient client) {
            super();
            totalMiles = out;
            waiting = bar;
            this.client = client;
      }

      protected void onPreExecute () {
            waiting.setVisibility(View. VISIBLE);
      }
```

TripDetailsTask

```
protected Float doInBackground(Float... params) {
        int people = (int)(float)params[0];
        float weight = params[1];
        float mpg = params[2];
        float milesPerYear = params[3];
        Hashtable<String, Float> result;
        if (isCancelled()) return (float) -1;
        try {
                result = client.trip(people,weight,mpg,milesPerYear);
                client.quit();
                return result.get("food") + result.get("weight");
        } catch (ClosedByInterruptException e) {
                Log.i("mars", "User canceled operation");
        } catch (IOException e) {
                Log.e("mars", "error on get result from server", e);
        } finally {
                client.quit();
        }
        return (float) -1;
}
```

TripDetailsTask

```
protected void onCancelled(Float result) {
        waiting.setVisibility(View.INVISIBLE);
}

 protected void onPostExecute(Float result) {
        Log.i("mars", "in Post");
        waiting.setVisibility(View.INVISIBLE);
        if (result == -1) return;
          DecimalFormat format = new DecimalFormat("#.#");
       totalMiles.setText(format.format(result));
    }
}
```

Handling Multiple Request

Basic Situation

AsyncTask runs once

We want to use one connection to handle multiple requests

How to do that?

First Solution

Activity creates SocketChannel (or MarsClient in example)

- But do not open the SocketChannel

Pass the SocketChannel to each AsyncTask

Make sure that only one AsyncTask uses channel at a time

- Only one task active a time
- Synchronize critical section

Second Solution

Requires some background

Java Safety - Synchronize

A call to a synchronized method locks the object

Object remains locked until synchronized method is done

Any other thread's call to any synchronized method on the same object

will block until the object is unlocked

Java Safety - Synchronize

```
class SynchronizeExample {
        int[]  data;

        public String toString() {
                return "array length " + data.length + " array values " + data[0];
        }

        public synchronized void initialize( int size,  int  startValue){
                data  =  new  int[ size ];
                for  ( int  index  = 0; index < size;  index++ )
                        data[ index ]  =  (int ) Math.sin( index * startValue );
        }

        public  void unSafeSetValue( int  newValue) {
                for  ( int  index  = 0; index < data.length;  index++ )
                        data[ index ]  =  (int ) Math.sin( index * newValue );
        }

        public  synchronized void safeSetValue( int  newValue) {
                for  ( int  index  = 0; index < data.length;  index++ )
                        data[ index ]  =  (int ) Math.sin( index * newValue );
        }
}
```

Synchronized Static Methods

Locks class

Blocks other synchronized class methods

```
class SynchronizeExample {
        int[]  data;

        public String toString() {
                return "array length " + data.length + " array values " + data[0];
        }

        public synchronized void initialize( int size,  int  startValue){
                data  =  new  int[ size ];
                for  ( int  index  = 0; index < size;  index++ )
                        data[ index ]  =  (int ) Math.sin( index * startValue );
        }

        public  void unSafeSetValue( int  newValue) {
                for  ( int  index  = 0; index < data.length;  index++ )
                        data[ index ]  =  (int ) Math.sin( index * newValue );
        }

        public  synchronized void safeSetValue( int  newValue) {
                for  ( int  index  = 0; index < data.length;  index++ )
                        data[ index ]  =  (int ) Math.sin( index * newValue );
        }
}
```

Synchronized Statements

```
synchronized
( expression ) {
        statements
}
```

expression must evaluate to an object

That object is locked

```
class LockTest {
        public synchronized void enter() {
            System.out.println( "In enter");
        }
    }
```

```
class LockTest {
        public void enter() {
            synchronized ( this ) {
                System.out.println( "In enter");
            }
        }
    }
```

Lock for Block and Method

```
public class LockExample extends Thread {
        private Lock myLock;

        public LockExample( Lock aLock ) {
                myLock = aLock;
        }
        public void run()       {
                System.out.println( "Start run");
                myLock.enter();
                System.out.println( "End run");
        }
        public static void main( String args[] ) throws Exception {
                Lock aLock = new Lock();
                LockExample tester = new LockExample( aLock );

                synchronized ( aLock ) {
                        System.out.println( "In Block");
                        tester.start();
                        System.out.println( "Before sleep");
                        Thread.currentThread().sleep( 5000);
                        System.out.println( "End Block");
                }
        }
}
```

```
class Lock {
        public synchronized void enter() {
                System.out.println( "In enter");
        }
}
```

Output

```
In Block
Start run
Before sleep
End Block
In enter
End run    (why is this at the end?)
```

Synchronized and Inheritance

```
class Top {
        public void synchronized left() {
                // do stuff
        }

        public void synchronized right() {
                // do stuff
        }
}
```

methods do not inherit synchronized

```
class Bottom extends Top {
        public void left() {
                // not synchronized
        }

        public void right() {
                // do stuff not synchronized
                super.right(); // synchronized here
                // do stuff not synchronized
        }
```

How to use to allow multiple AsyncTasks?

Make sure all access to server is in one synchronized block

In MarsClient example just need to synchronize MarsClient methods

As only need to call one method

wait and notify

public final void wait(timeout) throws InterruptedException
public final void wait(timeout, nanos) throws InterruptedException
public final void wait() throws InterruptedException

Causes a thread to wait until it is notified or the specified timeout expires.

Throws: IllegalMonitorStateException
If the current thread is not the owner of the Object's monitor.

Throws: InterruptedException
Another thread has interrupted this thread.

public final void notify()
public final void notifyAll()

Notifies threads waiting for a condition to change.

wait - How to use

The thread waiting for a condition should look like:

```
synchronized void waitingMethod()
      {
      while ( ! condition )
            wait();

      Now do what you need to do when condition is true
      }
```

Everything is executed in a synchronized method

The test condition is in loop not in an if statement

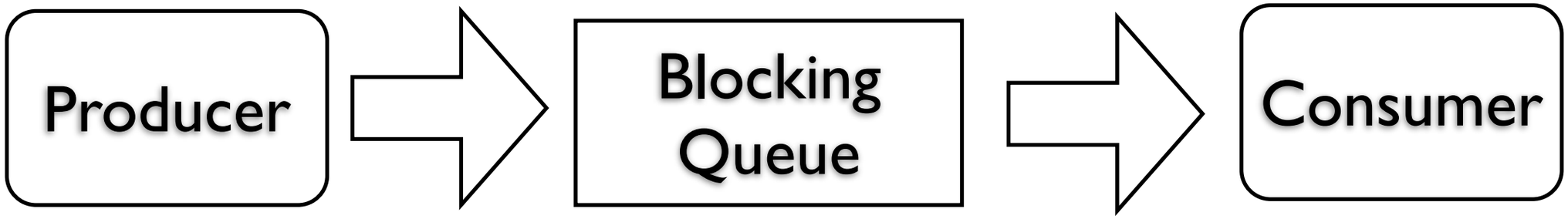
The wait suspends the thread it atomically releases the lock on the object

notify - How to Use

```
synchronized void changeMethod()
    {
    Change some value used in a condition test

    notify();
    }
```

wait and notify Example

When can Consumer read from queue?



Blocking Queue Basic operations

put

- Adds an element to the end of the queue
- If needed blocks until there is room
- After adding element call notify

take

- Removes element from queue
- Only one thread at a time can remove
- If queue is empty
  - Calling thread blocks (ie take uses wait())
  - When another thread add element (ie calls notify)
    - Calling thread can proceed

wait and notify - Producer

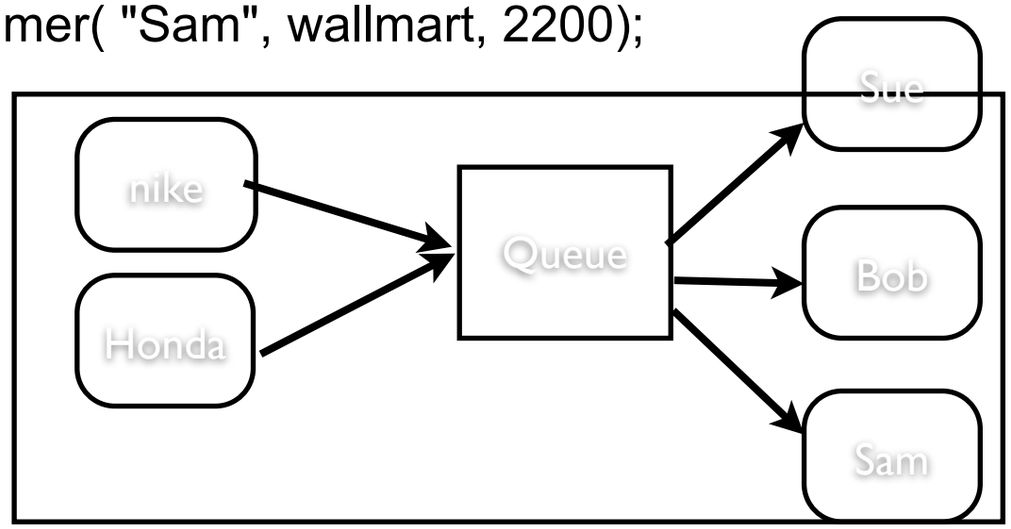
```
import java.util.concurrent.*;

public class Producer extends Thread {
        BlockingQueue<String> factory;
        int workSpeed;

        public Producer( String name, BlockingQueue<String> output, int speed ) {
                setName(name);
                factory = output;
                workSpeed = speed;
        }

        public void run() {
                try {
                        int product = 0;
                        while (true) {
                                System.out.println( getName() + " produced " + product);
                                factory.put( getName() + String.valueOf( product) );
                                product++;
                                sleep( workSpeed);
                    }
                }
                 catch ( InterruptedException workedToDeath ) {
                        return;
                }
        }
}
```

wait and notify - Consumer

```
import java.util.concurrent.*;

class Consumer extends Thread {
        BlockingQueue<String> localMall;
        int sleepDuration;

        public Consumer( String name, BlockingQueue<String> input, int speed ) {
                setName(name);
                localMall = input;
                sleepDuration = speed;
        }

        public void run() {
                try {
                        while (true) {
                                System.out.println( getName() + " got " +  localMall.take());
                                sleep( sleepDuration );
                        }
                }
                catch ( InterruptedException endOfCreditCard ) {
                        return;
                }
        }
}
```

wait and notify - Driver Program

```
import java.util.concurrent.*;
public class ProducerConsumerExample {
        public  static  void  main( String  args[] ) throws Exception {
                BlockingQueue<String> wallmart = new ArrayBlockingQueue(100, true);
                Producer nike = new Producer( "Nike", wallmart, 500 );
                Producer honda = new Producer( "Honda", wallmart, 1200 );
                Consumer valleyGirl = new Consumer( "Sue", wallmart, 400);
                Consumer valleyBoy = new Consumer( "Bob", wallmart, 900);
                Consumer dink = new Consumer( "Sam", wallmart, 2200);
                nike.start();
                honda.start();
                valleyGirl.start();
                valleyBoy.start();
                dink.start();
        }
}
```



Java Blocking Queues

ArrayBlockingQueue
DelayQueue
LinkedBlockingQueue
PriorityBlockingQueue
SynchronousQueue

How to use Blocking Queues in AsyncTask

AsyncTasks are designed to handle only one request

So need to use Thread

In thread

```
class Consumer extends Thread {
      BlockingQueue<String> requests;

      public Consumer( BlockingQueue<String> input ) {
            requests = input;
            }

      public void run() {
            try {
                  while (true) {
                        Request current = (Request) requests.take());
                        connect to server, get response
             Send answer back to Activity
                  }
            }
            catch ( InterruptedException endOfCreditCard ) {
                  return;
            }
      }
```

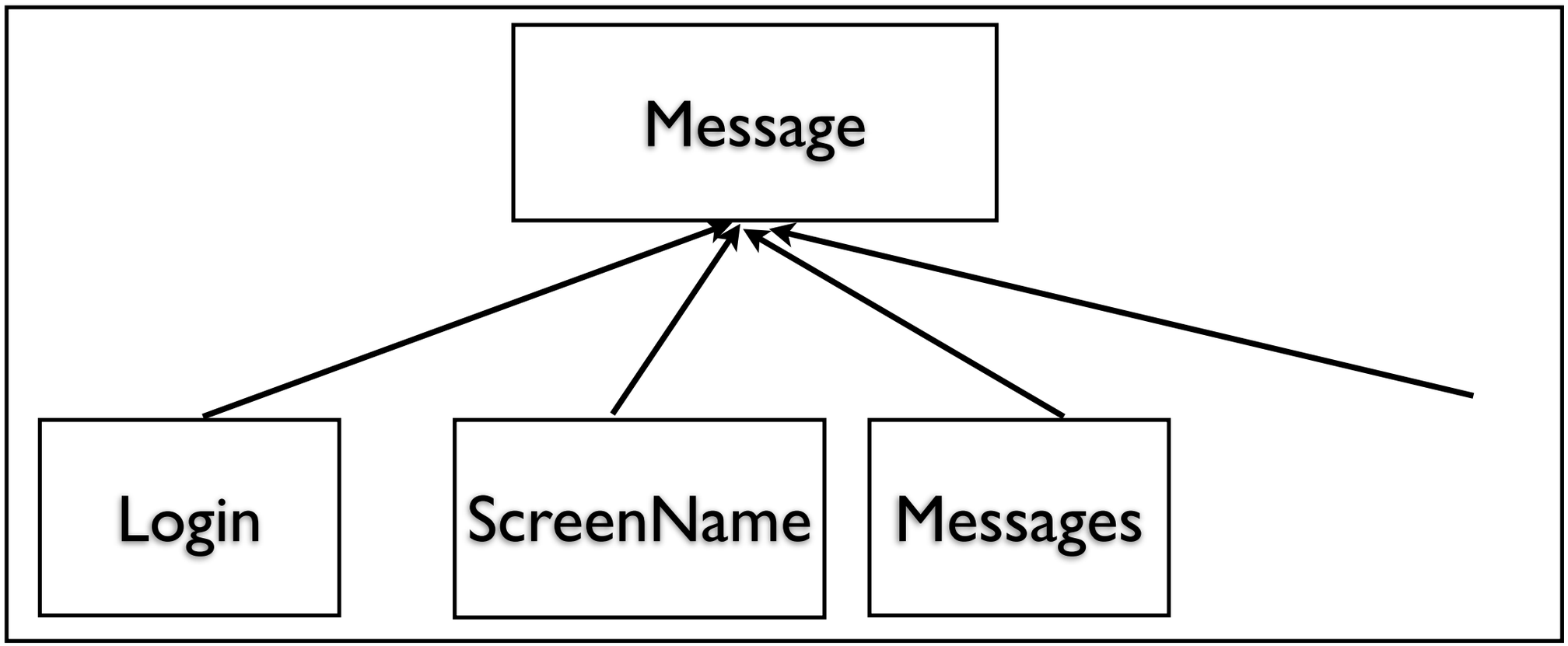
How to Send Request to Thread?

Easier if thread just does the same thing for each request

Need to do more work if thread handle different requests

From Parsing Lecture

```
InputStream rawIn = connection.getInputStream();
SDwitterReader in = new SDwitterReader(rawIn);
Message answer = in.next();
```


Message
Login
ScreenName
Messages

Message Responsibilities

Hide all message syntax

Read message and convert to object

```
TransmitMessage message =
TransmitMessage.from(“transmitMessage:duh\;now what;;”);
```

Create message from values

```
TransmitMessage message = new TransmitMessage("duh;now what);
```

Convert object to required protocol string

```
message.toString()  // returns “transmitMessage:duh\;now what;;”
```

Access information about message

```
message.isLogin();
message.name();
```

Put Message objects in Queue

```
class Consumer extends Thread {
    BlockingQueue<String> requests;

    public Consumer( BlockingQueue<String> input ) { requests = input; }

    public void run() {
        try {
            while (true) {
                Message current = (Message) requests.take());
        if (!interrupted() ) {
                    send(currrent.toString());
            response = readServerResponse();
            Send answer back to Activity
         }
            }
        }
        catch ( InterruptedException e ) {
            return;
        }
}
```

How to send Response back to Activity

Thread can not change UI widgets

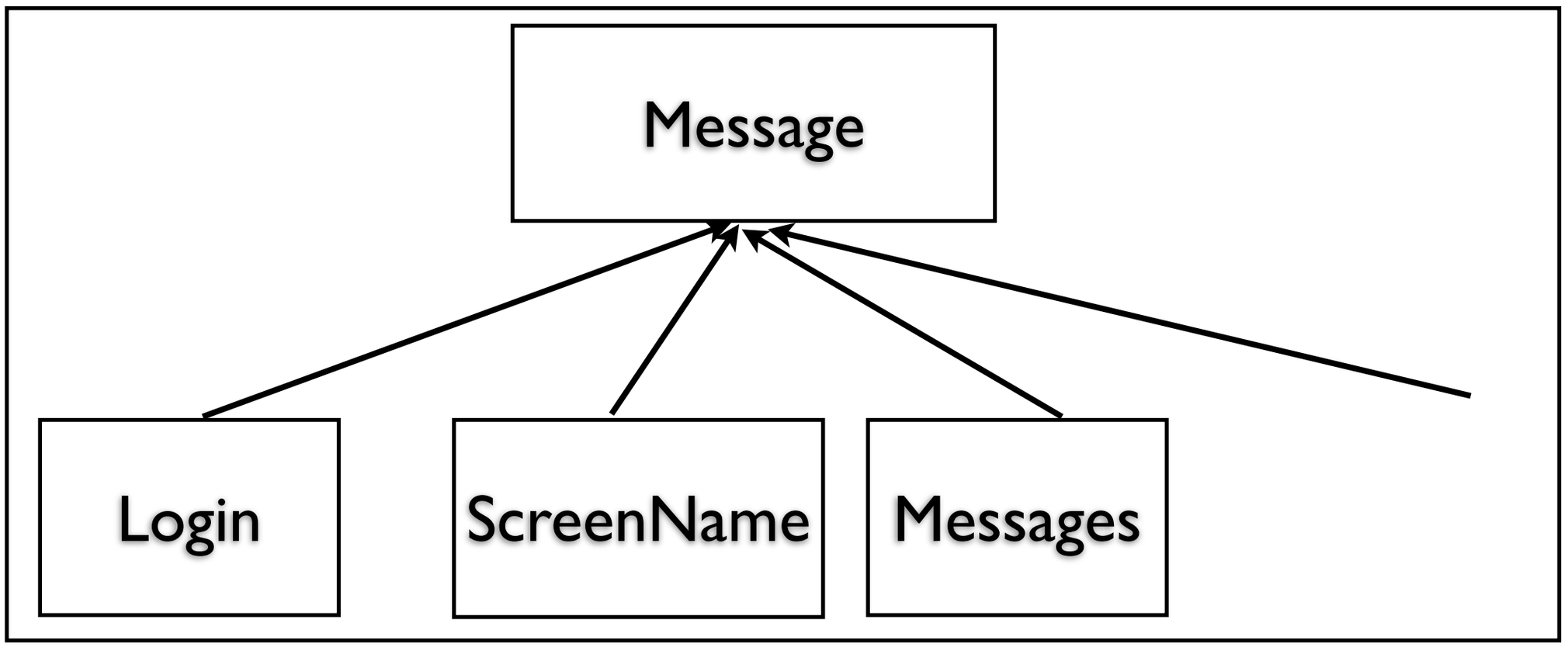
Thread can use following to have code run on UI thread

Activity.runOnUiThread(Runnable)
View.post(Runnable)
View.postDelayed(Runnable, long)

But each Request requires different response

So have each Message object produce the correct Runnable

Runnable is sent to UI thread to update Activity/Views



Multiple AsyncTasks Verses One Thread

Multiple AsyncTasks

- More Direct
- Clear what each AsyncTask is doing
- Need AsyncTask for each operation

One Worker Thread

- More general
- Potentially fewer classes
- Details in Message classes not AsyncTasks
- Harder to understand and debug