Mobile Application Development

Produced by

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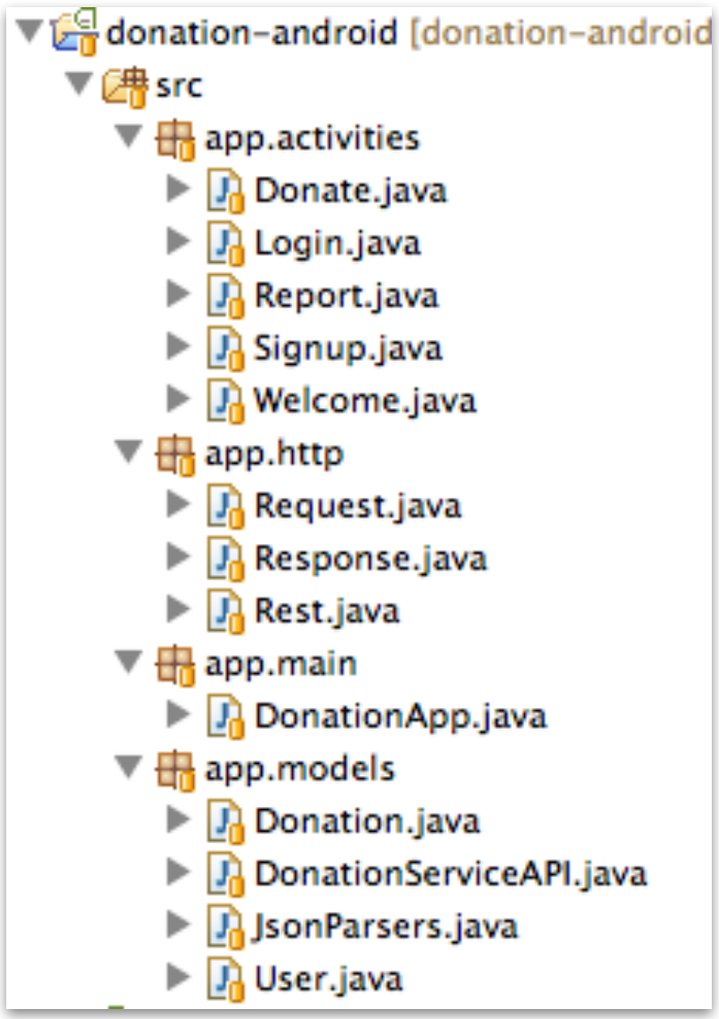
eLearning support unit

Android <-> Play (3) - Android

donation-android Project v4

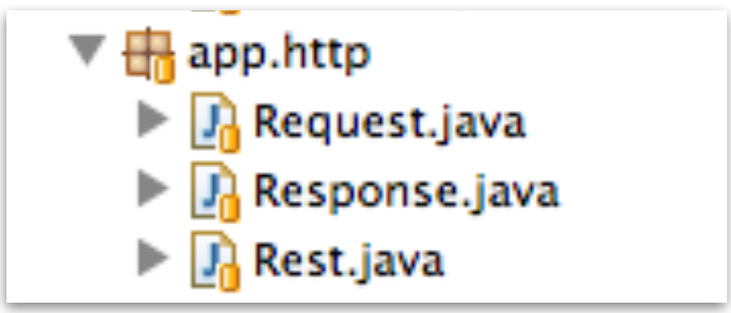


- **activities**
  - display and hander all UI
- **main**
  - retain application wide data structures (users + donations)
- **models**
  - Gateway object for accessing donation-service application
  - Local copies of core information models for the application (download from donation-play)
  - Parsers (transformers) for converting objects into format suitable for upload/download to/from donation-service
- **http**
  - General purpose classes to support asynchronous http request/response to/from donation-service

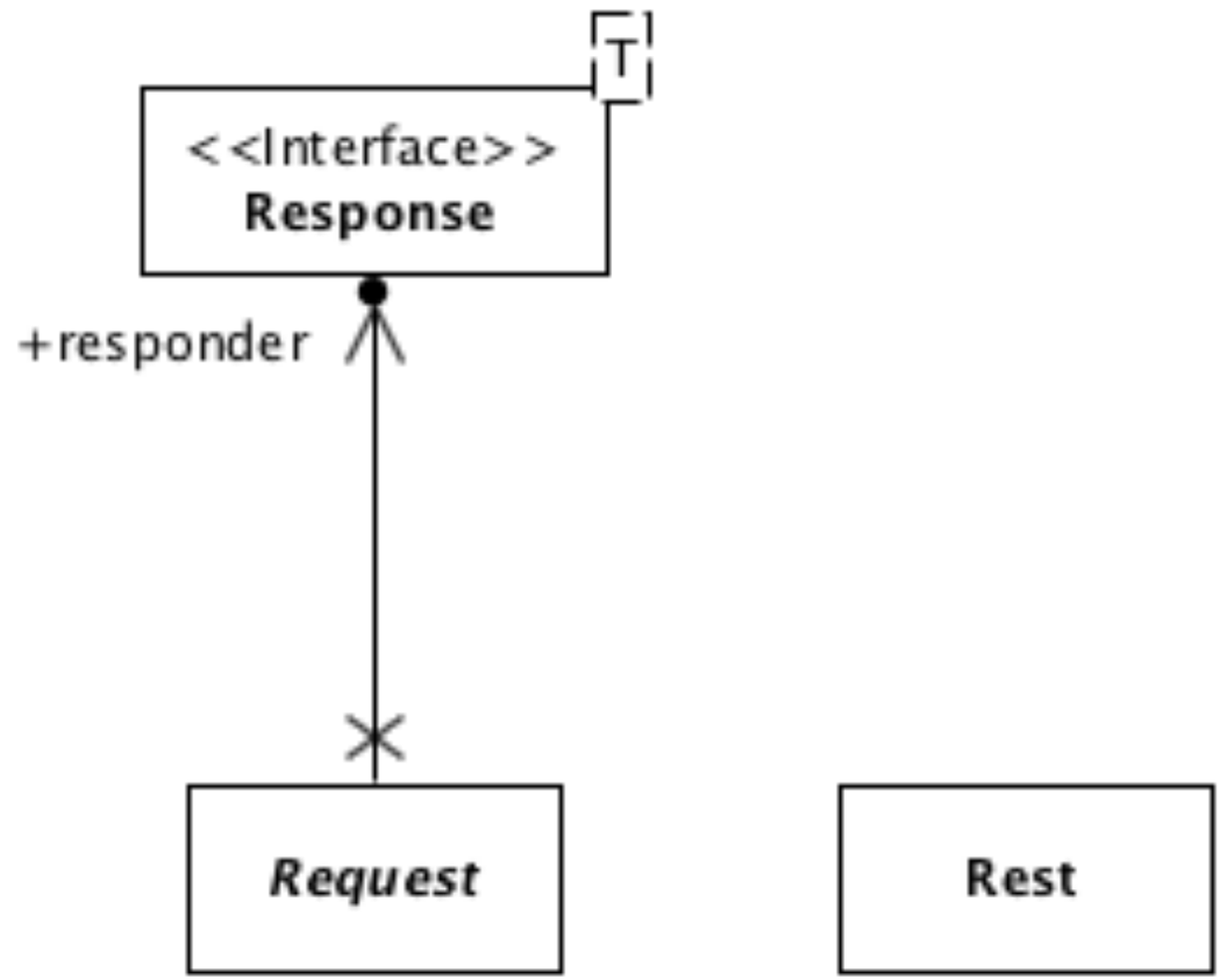
Android AsyncTask Class

- AsyncTask allows you to perform asynchronous work on your user interface.
- It performs the blocking operations in a **worker thread** and then publishes the results on the UI thread.
- You subclass AsyncTask and implement the doInBackground() callback method, which runs in a pool of background threads.
- To update your UI, you implement onPostExecute(), which delivers the result from doInBackground() and runs in the UI thread, so you can safely update your UI.

HTTP



- **http**
  - General purpose classes to support **asynchronous** http request/ response to/from donation-service
  - These requests are performed in a separate thread of execution


T
<<Interface>>
Response
+responder
Request
Rest

Rest

This server is your development machine

- Issue HTTP requests to a server
  - GET
  - DELETE
  - PUT
  - POST
- (http verbs)

```
public class Rest
{
  private static final String URL = "http://10.0.2.2:9000";

  public static String get(String path) throws Exception
  {
    //...
  }

  public static String delete(String path)
  {
    //...
  }

  public static String put(String path, String json)
  {
    //...
  }

  public static String post(String path, String json)
  {
    //...
  }
}
```

Rest

```
public class Rest
{
  private static final String URL = "http://10.0.2.2:9000";

  public static String get(String path) throws Exception
  {
    //...
  }

  public static String delete(String path) throws Exception

  {
    //...
  }

  public static String put(String path, String json) throws Exception

  {
    //...
  }

  public static String post(String path, String json) throws Exception

  {
    //...
  }
}
```

- Rest class can only send/receive strings (no Model objects like User or Donation)
- Assumes all strings are Json encoded
- Will very likely throw ‘exceptions’ if server error, network problem or other related issue
- No need to edit/maintain this class as it adheres to HTTP protocol conventions
- Is independent of donation application, and can be used in other apps as is

Response

- An Interface that must be implemented by the Activity that initiated the request.
- Is ‘paramaterised’ by T, which will typically be some model object we are requesting/updating
  - e.g. User, Donation
- However, interface is application independent, and can be used in other applications not related to Donation app.

```
public interface Response<T>
{
  public void setReponse(List<T> aList);
  public void setReponse(T anObject);
  public void errorOccurred (Exception e);
}
```

Callbacks

```
public interface Response<T>
{
  public void setReponse(List<T> aList);
  public void setReponse(T anObject);
  public void errorOccurred (Exception e);
}
```

- When a request is made by an activity, then the activity will be ‘called back’ when a result becomes available.
- One of these three methods will be called:
  - A single object of type T is returned from the service
  - A list of T objects is returned
  - An error has occurred
- The callback will occur on the UI Thread, so the activity can update its components safely

Request

- Put up a dialog saying ‘Processing…’
- Launch a background thread/ task
- Report when finished to callback
- Reusable class, can be used in apps unrelated to donation.

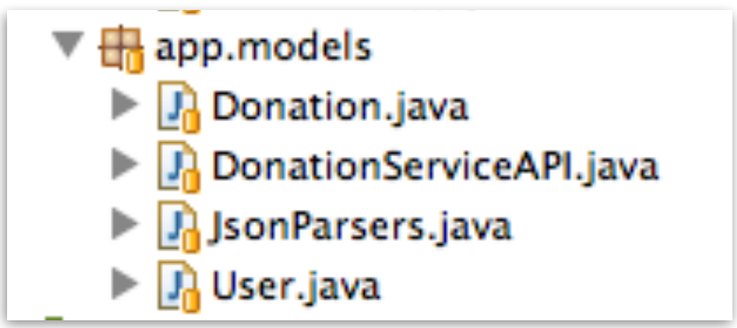
```
public abstract class Request extends AsyncTask<Object, Void, Object>
{
  //...

  public Request(Context context, Response responder, String message)
  {
    //...
  }

  @Override
  protected void onPreExecute()
  {
    //...
  }

  @Override
  protected  Object doInBackground(Object... params)
  {
    //...
  }

  protected abstract  Object doRequest(Object... params) throws Exception;

  @Override
  protected void onPostExecute(Object result)
  {
    //...
  }
}
```

```java
public abstract class Request extends AsyncTask<Object, Void, Object>
{
  //...

  public Request(Context context, Response responder, String message)
  {
    //...
  }

  @Override
  protected void onPreExecute()
  {
    //...
  }

  @Override
  protected  Object doInBackground(Object... params)
  {
    //...
  }

  protected abstract  Object doRequest(Object... params)

  @Override
  protected void onPostExecute(Object result)
  {
    //...
  }
}
```

Request

- An ‘Abstract’ class, so ‘abstract’ method ‘doRequest’ must be provided to do the actual background process
- For donation-android app, this will be a call to http.Rest methods to get/set data in android-service

donation-android Project v4



- **models**
  - Gateway object for accessing donation-service application
  - Local copies of core information models for the application (download from donation-play)
  - Parsers (transformers) for converting objects into format suitable for upload/download to/from donation-service

//...

User & Donation

```java
public class User
{
  public String firstName;
  public String lastName;
  public String email;
  public String password;

  public User(String firstName, String lastName,
              String email,     String password)
  {
    this.firstName = firstName;
    this.lastName = lastName;
    this.email = email;
    this.password = password;
  }
}
```

```java
public class Donation
{
  public int    amount;
  public String method;

  public Donation (int amount, String method)
  {
    this.amount = amount;
    this.method = method;
  }

  public String toString()
  {
    return amount + ", " + method;
  }
}
```

- No change from earlier versions

JsonParsers

- Same class as in donation-play!
- Convert Model object to/from Json format

```
public class JsonParsers
{
  static Gson gson = new Gson();

  public static User json2User(String json)
  {
    return gson.fromJson(json, User.class);
  }

  public static List<User> json2Users(String json)
  {
    Type collectionType = new TypeToken<List<User>>() {}.getType();
    return gson.fromJson(json, collectionType);
  }

  public static String user2Json(Object obj)
  {
    return gson.toJson(obj);
  }

  public static Donation json2Donation(String json)
  {
    return gson.fromJson(json, Donation.class);
  }

  public static String donation2Json(Object obj)
  {
    return gson.toJson(obj);
  }

  public static List<Donation> json2Donations(String json)
  {
    Type collectionType = new TypeToken<List<Donation>>() {}.getType();
    return gson.fromJson(json, collectionType);
  }
}
```

DonationServiceAPI

- Enable Activities to ‘invoke’ services on donation-service app.
- Specifically:
  - GetUsers
  - GetDonations
  - CreateUser
  - CreateDonation
- Each of these requests is ‘spun-out’ into separate thread

```
public class DonationServiceAPI
{
  public static void getUsers(Context        context,
                              Response<User> response,
                              String         dialogMesssage)
  {
    new GetUsers(context, response, dialogMesssage).execute();
  }

  public static void createUser(Context        context,
                              Response<User> response,
                              String         dialogMesssage)
 {
    new CreateUser(context, response, dialogMesssage).execute(user);
  }

  public static void getDonations(Context        context,
                              Response<User> response,
                              String         dialogMesssage)
  {
    new GetDonations(context, response, dialogMesssage).execute();
  }

  public static void createDonation(Context        context,
                              Response<User> response,
                              String         dialogMesssage)
  {
    new CreateDonation(context, response, dialogMesssage).execute(donation);
  }
}
```

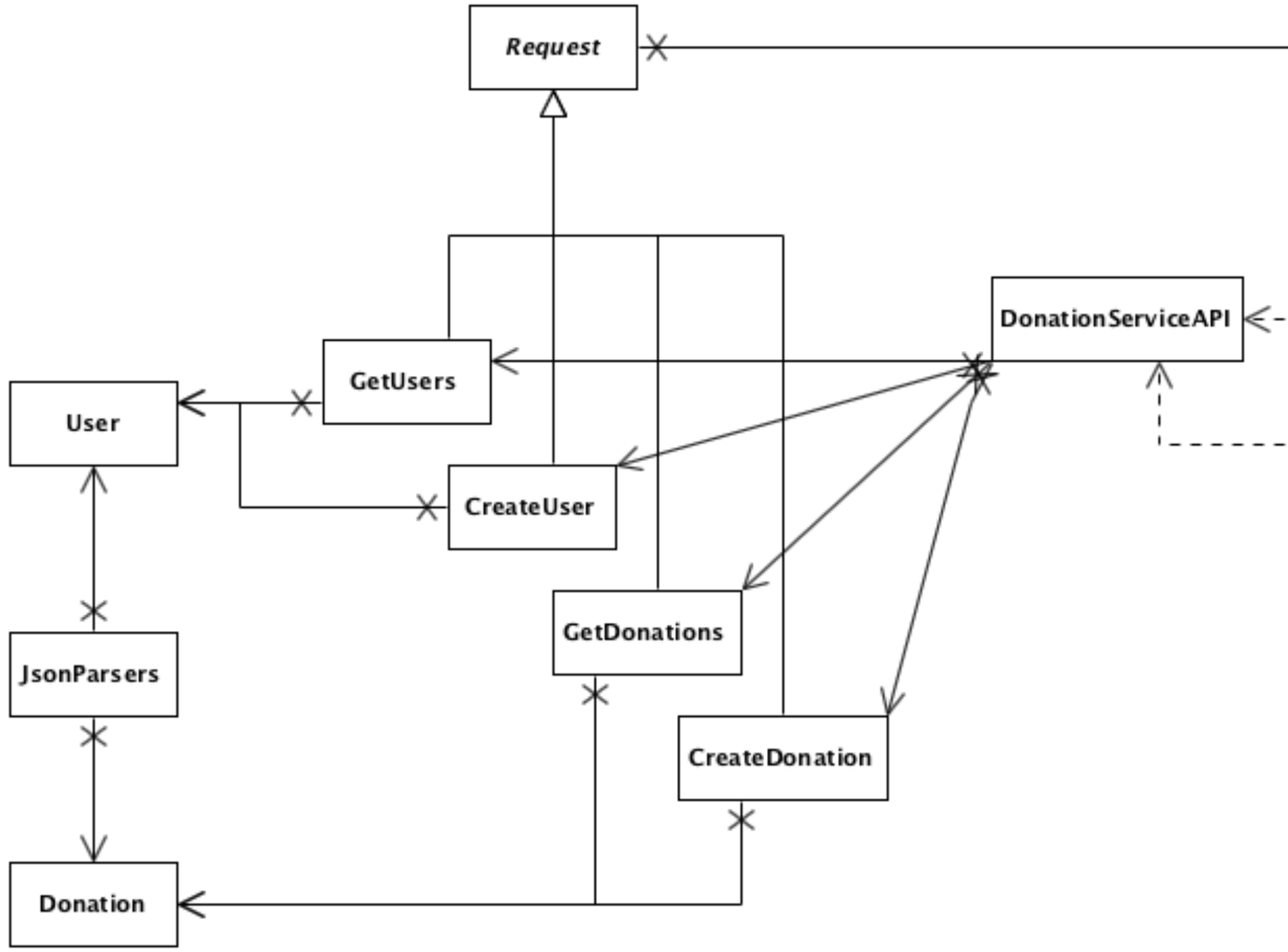
GetUsers and CreateUser Requests

- The doRequest() methods will run in a background thread
- … and will use the Rest class to communicate with the server

```
class GetUsers extends Request
{
  public GetUsers(Context context, Response<User> callback, String message)
  {
    super(context, callback, message);
  }

  @Override
  protected List<User> doRequest(Object... params) throws Exception
  {
    String response =  Rest.get("/api/users");
    List<User> userList = JsonParsers.json2Users(response);
    return userList;
  }
}

class CreateUser extends Request
{
  public CreateUser(Context context, Response<User> callback, String message)
  {
    super(context, callback, message);
  }

  @Override
  protected User doRequest(Object... params) throws Exception
  {
    String response = Rest.post ("/api/users", JsonParsers.user2Json(params[0]));
    return JsonParsers.json2User(response);
  }
}
```

GetDonations and CreateDonation Requests

```
class GetDonations extends Request
{
  public GetDonations(Context context, Response<Donation> callback, String message)
  {
    super(context, callback, message);
  }

  @Override
  protected List<Donation> doRequest(Object... params) throws Exception
  {
    String response =  Rest.get("/api/donations");
    List<Donation> donationList = JsonParsers.json2Donations(response);
    return donationList;
  }
}

class CreateDonation extends Request
{
  public CreateDonation(Context context, Response<Donation> callback, String message)
  {
    super(context, callback, message);
  }

  @Override
  protected Donation doRequest(Object... params) throws Exception
  {
    String response = Rest.post ("/api/donations", JsonParsers.donation2Json(params[0]));
    return JsonParsers.json2Donation(response);
  }
}
```


Request
DonationServiceAPI
GetUsers
User
CreateUser
GetDonations
JsonParsers
CreateDonation
Donation

Activities

- If an Activity needs to make a request of the donation-service, it must do two things:

  1. Initiate a request by calling one of the methods in DonationServiceAPI

  2. Implement the Response interface, though which the response (or error) will be delivered.

```
public class DonationServiceAPI
{
  public static void getUsers(..)
    //..
  public static void createUser(..)
   //..
  public static void getDonations(..)
  //..
  public static void createDonation(..)
}
```

```
public interface Response<T>
{
  public void setReponse(List<T> aList);
  public void setReponse(T anObject);
  public void errorOccurred (Exception e);
}
```

Login

- When the Login activity starts we can:
  - Request the list of users from the donation-service
  - … and when those requests arrive, we store them in the application object
- Then, when Login button pressed, we authenticate agains this list as usual.

Login Activity

(no features hidden)

```
public class Login extends Activity implements Response<User>
{
  @Override
  protected void onCreate(Bundle savedInstanceState)
  {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_login);
    DonationServiceAPI.getUsers(this, this, "Retrieving list of users");
  }

  public void signinPressed (View view)
  {
    DonationApp app = (DonationApp) getApplication();
    TextView email     = (TextView)  findViewById(R.id.loginEmail);
    TextView password  = (TextView)  findViewById(R.id.loginPassword);
    if (app.validUser(email.getText().toString(), password.getText().toString()))
    {
      startActivity (new Intent(this, Donate.class));
    }
    else
    {
      Toast toast = Toast.makeText(this, "Invalid Credentials", Toast.LENGTH_SHORT);
      toast.show();
    }
  }

  @Override
  public void setReponse(List<User> aList)
  {
    DonationApp app = (DonationApp) getApplication();
    app.users = aList;
  }

  @Override
  public void errorOccurred(Exception e)
  {
    Toast toast = Toast.makeText(this, "Donation Service Unavailable. Try again later",
                                        Toast.LENGTH_LONG);
    toast.show();
    startActivity (new Intent(this, Welcome.class));
  }

  @Override
  public void setReponse(User anObject)
  {}
}
```

Login Activity

```
public class Login extends Activity implements Response<User>
{
  @Override
  protected void onCreate(Bundle savedInstanceState)
  {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_login);

    DonationServiceAPI.getUsers(this, this, "Retrieving list of users");
  }

  public void signinPressed (View view)
  {
    DonationApp app    = (DonationApp) getApplication();

    TextView email     = (TextView)  findViewById(R.id.loginEmail);
    TextView password  = (TextView)  findViewById(R.id.loginPassword);

    if (app.validUser(email.getText().toString(), password.getText().toString()))
    {
      startActivity (new Intent(this, Donate.class));
    }
    else
    {
      Toast toast = Toast.makeText(this, "Invalid Credentials", Toast.LENGTH_SHORT);
      toast.show();
    }
  }

  //…`
}
```

Login Activity

```
public class Login extends Activity implements Response<User>
{
  //..
  @Override
  public void setReponse(List<User> aList)
  {
    DonationApp app = (DonationApp) getApplication();
    app.users = aList;
  }

  @Override
  public void errorOccurred(Exception e)
  {
    Toast toast = Toast.makeText(this, "Donation Service Unavailable. Try again later",
                                        Toast.LENGTH_LONG);
    toast.show();
    startActivity (new Intent(this, Welcome.class));
  }

  @Override
  public void setReponse(User anObject)
  {}
}
```

Report Activity

```java
public class Report extends Activity implements Response <Donation>
{
  private ListView        listView;
  private DonationApp     app;
  private DonationAdapter adapter;

  @Override
  public boolean onCreateOptionsMenu(Menu menu)
  //.. no change

  @Override
  public boolean onOptionsItemSelected(MenuItem item)
   //.. no change

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

    app = (DonationApp) getApplication();

    listView = (ListView) findViewById(R.id.reportList);
    adapter = new DonationAdapter (this, app.donations);

    listView.setAdapter(adapter);

    DonationServiceAPI.getDonations(this, this, "Downloading Donations List..");
  }

  @Override
  public void setReponse(List<Donation> aList)
  {
    app.donations     = aList;
    adapter.donations = aList;
    adapter.notifyDataSetChanged();
  }

  @Override
  public void setReponse(Donation anObject)
  {
  }

  @Override
  public void errorOccurred(Exception e)
  {
    Toast toast = Toast.makeText(this, "Donation Service Unavailable!", Toast.LENGTH_LONG);
    toast.show();
    startActivity (new Intent(this, Welcome.class));
  }
}
```

Report Activity

```
public class Report extends Activity implements Response <Donation>
{
  private ListView        listView;
  private DonationApp     app;
  private DonationAdapter adapter;

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

    app = (DonationApp) getApplication();

    listView = (ListView) findViewById(R.id.reportList);
    adapter = new DonationAdapter (this, app.donations);

    listView.setAdapter(adapter);

    DonationServiceAPI.getDonations(this, this, "Downloading Donations List..");
  }

}
```

Report Activity

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public class Report extends Activity implements Response <Donation>
{
  private ListView        listView;
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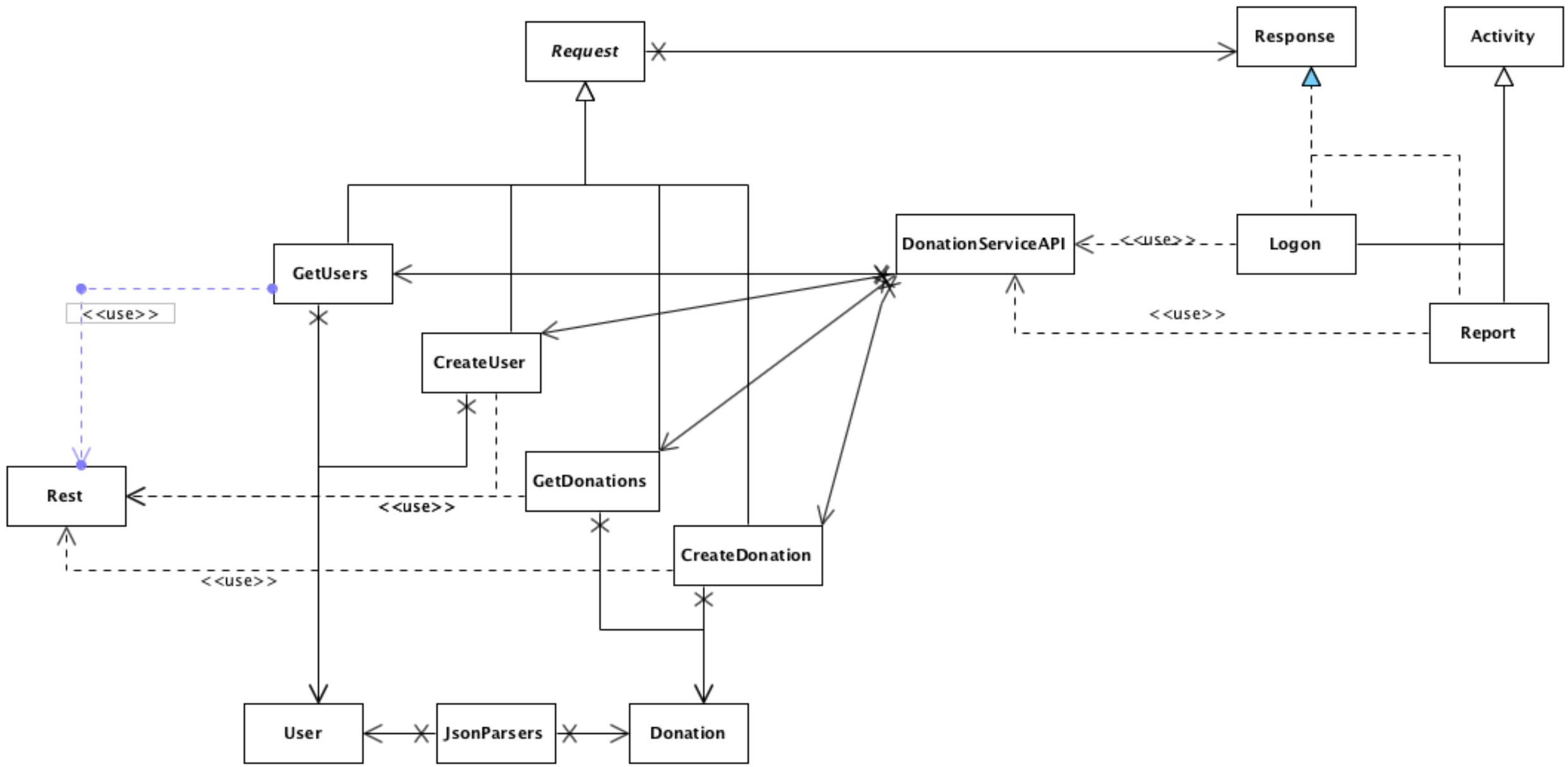
  @Override
  public void setReponse(List<Donation> aList)
  {
    app.donations     = aList;
    adapter.donations = aList;
    adapter.notifyDataSetChanged();
  }

  @Override
  public void setReponse(Donation anObject)
  {
  }

  @Override
  public void errorOccurred(Exception e)
  {
    Toast toast = Toast.makeText(this, "Donation Service Unavailable!", Toast.LENGTH_LONG);
    toast.show();
    startActivity (new Intent(this, Welcome.class));
  }
}
```


Request
Response
Activity
GetUsers
DonationServiceAPI
<<use>>
Logon
<<use>>
<<use>>
Report
CreateUser
Rest
GetDonations
<<use>>
CreateDonation
<<use>>
User
JsonParsers
Donation

Some of this material is adapted from
http://www.vogella.com/articles/JavaConcurrency/article.html
An excellent source for well structured tutorials and explanations of all thing related ot Java, Eclipse and Android development