Distributed Systems – Assignment 1

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The Exercise

- Objectives
  - Get familiar with Android programming
    - Emulator, debugging, deployment
  - Learn to use UI elements and to design an Activity
  - Learn how to connect Activities and Services using Intents
  - Learn how to use the Sensor API
  - Tackling problems with developing a real app

- Dates:
  - Exercise begins: Now
  - Exercise is due: 9:00am, October 09, 2015

The Exercise

- **Task 1:** Sensors and Actuators
  - Create an application to access all available sensors
  - Use selected actuators
- **Task 2:** AntiTheft Alarm
  - Create an application to *“secure”* the device against theft
- **Task 3:** Bluetooth Low Energy
  - Create an application to sense temperature and humidity

Task 1: Sensors and Actuators

- **Objectives:**
  - Learn how to create an Android project
  - Familiarize yourself with UI Elements
  - Understand the concept of Activities and Intents
  - Learn to use the sensor API
- **To do:**
  - Write an app that displays all available sensors in a `ListView`
  - Show sensor readings in a second activity
  - Trigger actuator events in a third activity

Hints

- Project names: VS_*nethz*_Sensors (leader's nethz ID)
- Do not forget to add all components (Activities, Services) to the application in the manifest file
- Do not forget the permissions in the manifest file
- Listing all the sensors:

```
private SensorManager sensorMgr;
private List <Sensor> sensors;
```

```
sensorMgr = (SensorManager) getSystemService(SENSOR_SERVICE);
sensors = sensorMgr.getSensorList(Sensor.TYPE_ALL);
```

- Also see: http://developer.android.com/guide/topics/sensors/sensors_overview.html

Hints

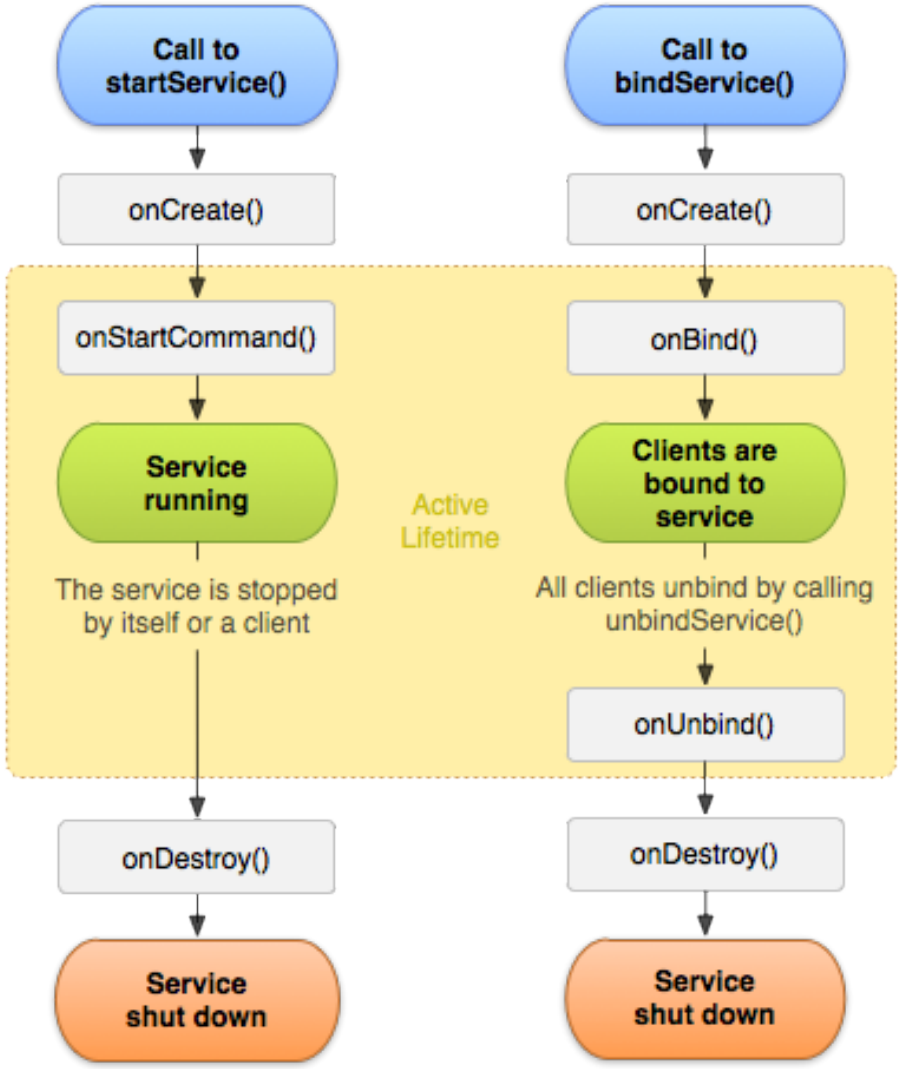
- When starting `SensorActivity`, the Intent should carry the information which sensor to display in detail
- `SensorActivity` should implement the `SensorEventListener` interface and continuously present the sensor's value(s)
- Check the `ArrayList<String>` and `ArrayAdapter<String>` classes, as they are useful to hold the sensor values as `Strings` for the `ListView`
- Also see: http://commonsware.com/Android/excerpt.pdf

Task 2: AntiTheft Alarm

- **Objectives:**
  - Transfer the knowledge of Task 1 into a real app
    - Understand problems stemming from a framework under development
  - Think about how to make use of the sensors
  - Learn how to use background services
- **To do:**
  - Write an app to *"secure"* the device against theft
    - Sound an alarm when the device is moved without authorization
  - The app MUST implement the code skeleton provided to you on the course website
    - AntiTheftService { startAlarm(); }
    - AbstractMovmentDetector { doAlarmLogic(float[] values); }

Hints

- Study service lifecycle
- A **Started** Service (unbound service) is good for us



unbound service ***bound service***

http://developer.android.com/guide/components/services.html

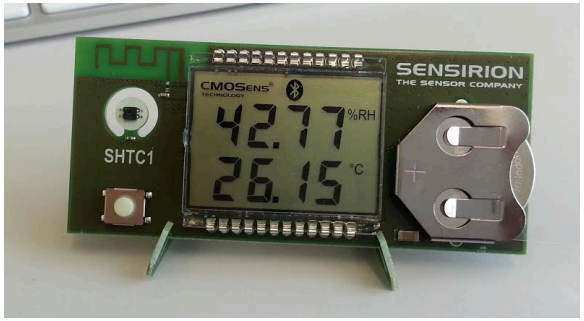
Hints

- We know that a service always runs in the same process as its clients, we don't need to deal with inter-process communication
- See the **LocalService.java** and the **ServiceStartArguments.java** examples
- Do not forget to declare the Service in the manifest file!

Task 3: Bluetooth Low Energy

https://developer.android.com/guide/topics/connectivity/bluetooth-le.html

- **Objective:**
  - Exploit the capabilities of smart gadgets and bluetooth low energy
  - Familiarize with the new generation of ‘wearable computers’
- **To do:**
  - Use Android’s Bluetooth Low Energy (BLE) framweork
  - Connect to an SHTC1 Smart Gadget to sense temperature and humidity
  - Display the current sensor measurements to the user

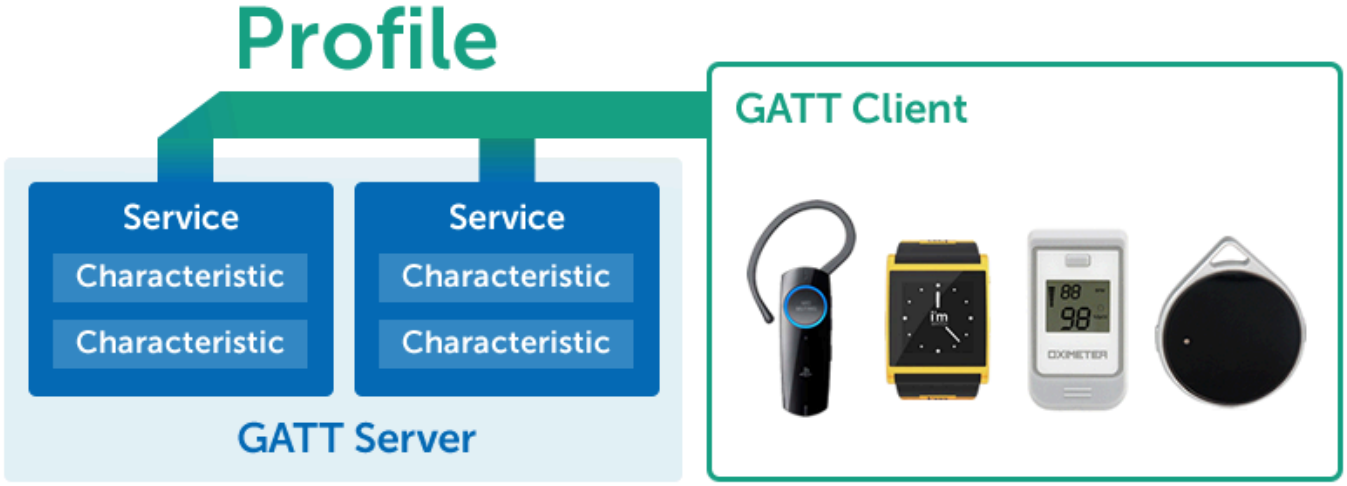


Hints

- You will be given a smart gadget and a Nexus 5 phone
- Update the software on the phone from 4.4.2 to 4.4.3 before using it (very unstable otherwise!)
- Check first if bluetooth is enabled on the device
- Request to enable bluetooth without leaving the app
- Limit the scan time, not to drain the battery

Hints

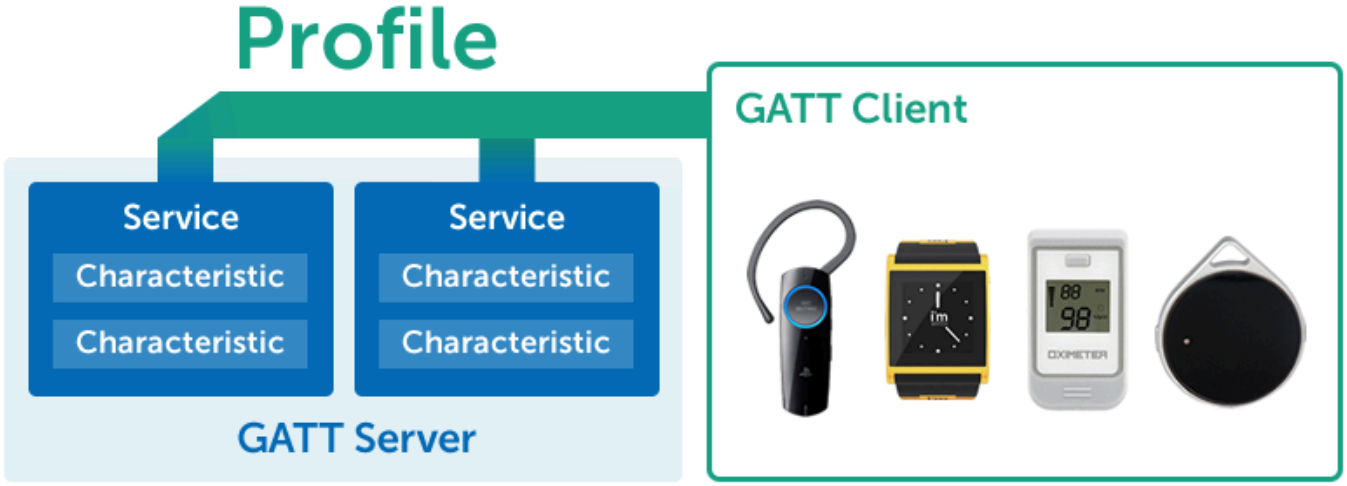
- The Android phone acts as a GATT client
- The SHTC1 smart gadget acts as a GATT server
- We are interested in one service, and one characteristic



http://blog.lemberg.co.uk/

Hints

- The UUID of the RH&T service is 0000AA20-0000-1000-8000-00805f9b34fb
- The UUID of the H&T characteristic is 0000AA21-0000-1000-8000-00805f9b34fb



http://blog.lemberg.co.uk/

Hints

- To be able to read the temperature and humidity values, add the following lines before calling readCharacteristic():

```
1 // set the READ perimission on the characteristic
2 BluetoothGattCharacteristic rht = new BluetoothGattCharacteristic(
3                 UUID_RHT_TEMPERATUREHUMIDITY,
4                 BluetoothGattCharacteristic.PROPERTY_READ
5                         | BluetoothGattCharacteristic.PROPERTY_NOTIFY,
6                 BluetoothGattCharacteristic.PERMISSION_READ);
7 // add the characteristic to the discovered RH&T service
8 service.addCharacteristic(rht);
```

Designing Compelling and Usable Applications

- Purpose of the app
  - How does the app make life better?
  - Understand your user!
- Context of the app
  - Target user group: student/child/elderly
  - Activity: sitting/walking/driving/etc.
  - Environment: office/street/car/home/etc.
  - Device: phone/tablet/coffee machine

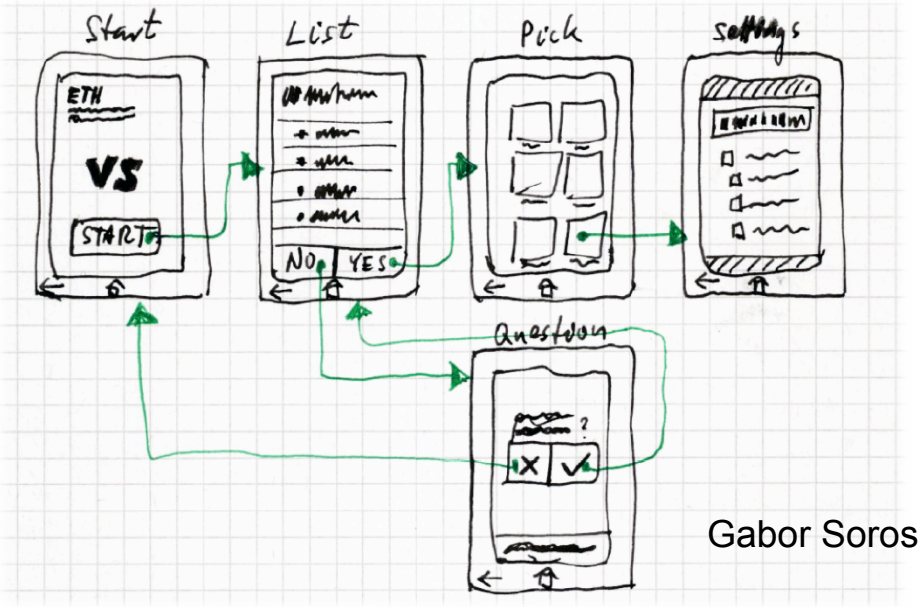
The 10 Usability Principles (Jakob Nielsen)

1. Keep the interface simple!
2. Speak the user's language!
3. Minimize the user's memory load!
4. Be consistent and predictable!
5. Provide feedback!
6. Design clear exits and closed dialogs!
7. Offer shortcuts for experts!
8. Help to recover from errors, offer Undo!
9. Prevent errors!
10. Include help and documentation!

www.useit.com

Workflow Prototyping and Evaluation on Paper

- Concrete guidelines: http://developer.android.com/design
  - Visual appearance, e.g., icon design
  - Purpose of user interface elements
  - Layout of user interface elements
  - Behavior, conventions of system features



Hints – Settings Activity (1)

http://developer.android.com/guide/topics/ui/settings.html

MySettingsActivity.java

```
package ch.ethz.inf.vs.android.nethz.project;
import android.os.Bundle;
import android.preference.PreferenceActivity;

public class MySettingsActivity extends PreferenceActivity {
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        // Load the preferences from an XML resource
       // Do not add a layout of views by calling setContentView()!
        addPreferencesFromResource(R.xml.preferences);
    }
}
```

Do not forget to add this Activity to your application in the manifest file!

Hints – Settings Activity (2)

\res\xml\preferences.xml

```
<?xml version="1.0" encoding="utf-8"?>
<PreferenceScreen xmlns:android="http://schemas.android.com/apk/res/android">
    <PreferenceCategory android:title="Server IP settings">
        <CheckBoxPreference
           android:key="network_mode_enable"
           android:title = "Stream to server"
           android:summary = "Enable to stream the sensor values to the server"
           android:defaultValue = "true" />
        <EditTextPreference
            android:key = "server_ip"
           android:dependency = "network_mode_enable"
           android:title = "IP address"
           android:summary = "IP address of the fancy server"
           android:layout = "?android:attr/preferenceLayoutChild"
           android:dialogTitle = "IP address of the Tracker"
           android:defaultValue = "192.168.1.1" />
        <EditTextPreference
           android:key = „server_port"
           android:dependency = "network_mode_enable"
            . . . />
    </PreferenceCategory>
</PreferenceScreen>
```

Hints – Settings Activity (3)

MyMainActivity.java

```
import android.preference.PreferenceManager;
```

```
SharedPreferences sharedPrefs =
      PreferenceManager.getDefaultSharedPreferences( getApplicationContext() );

boolean network_mode_enable =
      sharedPrefs.getBoolean( "network_mode_enable", false );

InetAddress saddr =
      InetAddress.getByName( sharedPrefs.getString( "server_ip", "192.168.1.1" ) );

int sport =
      Integer.parseInt( sharedPrefs.getString( "server_port", "8080" ) );
```

Mini-Test

- Required for each project
- LaTeX or Word
- English
- 6 questions (essay, true/false, code snippets, …etc)
- General Android questions + Assignment-related questions
- Submit as **answers.pdf** in PDF format

Deliverables

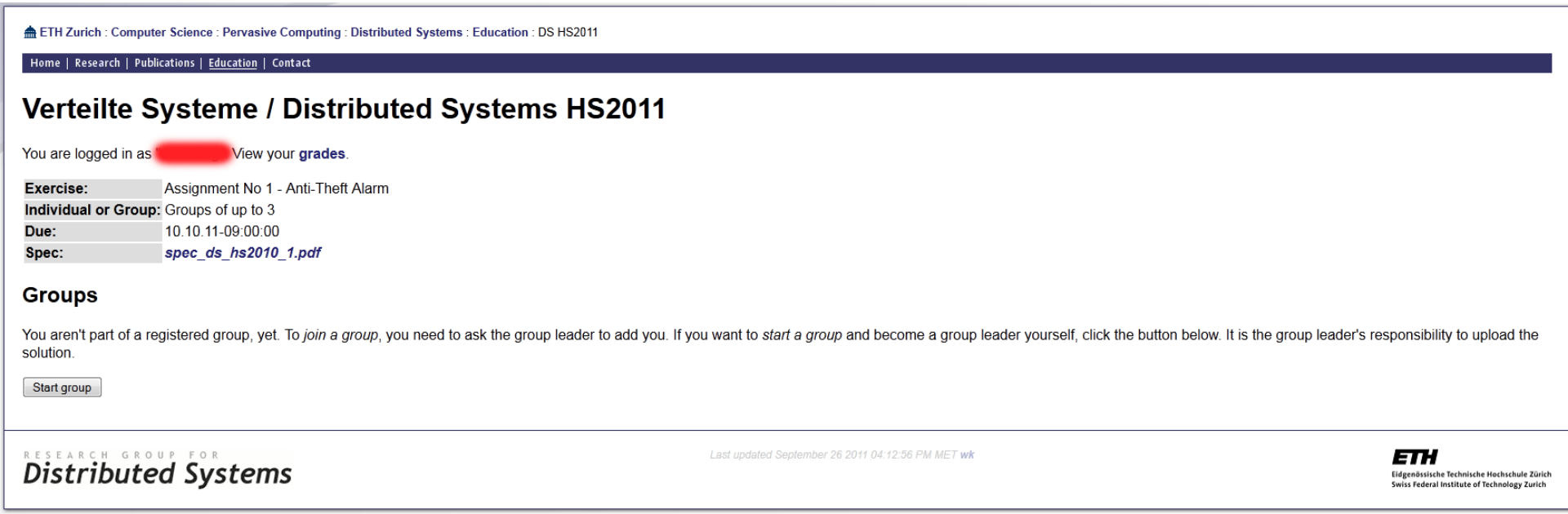
- https://www.vs.inf.ethz.ch/edu/vs/submissions/
- Use your *nethz* logins
- File names: **answers.pdf** and **code.zip**
- New uploads will overwrite the old ones
- Check uploaded files

LEADER:

- Create group
- Add members
- Upload files

MEMBERS:

- Sign the submission



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Exercise:	Assignment No 1 - Anti-Theft Alarm
Individual or Group:	Groups of up to 3
Due:	10.10.11-09:00:00
Spec:	***spec_ds_hs2010_1.pdf***

Groups

You aren't part of a registered group, yet. To *join a group*, you need to ask the group leader to add you. If you want to *start a group* and become a group leader yourself, click the button below. It is the group leader's responsibility to upload the solution.

Start group

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Leader creates a group

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Groups

You are the leader of this group. You have to upload the solution. Every time you change the submissions, the others will have to re-sign confirming they agree with the submission. However, it is sufficient if they only do so *once for the final version*. Please bear this in mind when you make last minute changes!

NETHZ ID	Role	Last change	Remove	Signature
[redacted]	LEADER	26.09.11-16:48:22	**Close group**	Not required

[redacted] Add

Submission

Upload your submission files to the server. Please note the supported *filename(s)* and *format(s)*. You may change your submission until the deadline of this assignment. However, be aware that only your most recent submission is kept and can be marked.

It is your responsibility to check that the files below have been uploaded correctly! Please use the links to check your submission!

Filename	Last Change	Size	Maximum Size	Supported Formats	Upload	Status
report	nA	nA	2 MB	pdf	Browse...	Missing submission
code	nA	nA	12 MB	zip	Browse...	Missing submission

By clicking on *Submit Changes*, you declare the above documents to be **your own work, only**. Any contributions made by other people must be acknowledged and sources must be properly referenced!

Submit Changes

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Leader adds team mates

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NETHZ ID	Role	Last change	Remove	Signature
[redacted]	LEADER	26.09.11-16:19:30	**Close group**	Not required
[redacted]	MEMBER	26.09.11-16:19:36	**Remove**	Not signed yet **BAD**
[redacted]	MEMBER	26.09.11-16:20:21	**Remove**	Not signed yet **BAD**

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report	26.09.11-16:23:12	120.95 KB	2 MB	pdf	Browse...	Submission available
code	26.09.11-16:23:12	120.95 KB	12 MB	zip	Browse...	Submission available

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Submit Changes

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Leader uploads the files

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You have been added to a group by **soeroesg**. Please make sure that you sign for the work submitted by the leader. Every time the submission is changed, you will have to re-sign. So we recommend you sign the submission only once *(i.e. for the final submission)*. Your group members are as follows:

NETHZ ID	Role	Last change	Remove	Signature
[redacted]	LEADER	26.09.11-16:19:30	Not available	Not required
[redacted]	MEMBER	26.09.11-16:19:36	**Remove me**	Missing signature **BAD** [**Sign**]
[redacted]	MEMBER	26.09.11-16:20:21	Not available	Not signed yet **BAD**

Submission

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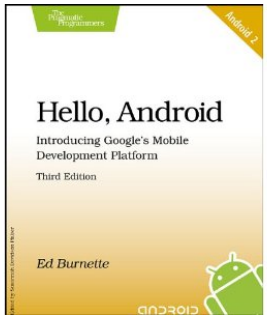
Member signs the submission

Remarks

- Point reduction if the project does not compile!
- Point reduction if the project does not follow the naming conventions!
- Point reduction if the project does not use the code skeleton provided to you!

- Elements of Task 1 can be reused in Task 2.

Books



- Ed Burnette – Hello, Android (Pragmatic Bookshelf 2010)
  http://kronox.org/documentacion/Hello.Android.new.pdf

- Mark L. Murphy – The Busy Coder's Guide to Android Development (CommonsWare)
  http://commonsware.com/Android/

- Arno Becker – Android Grundlagen und Programmierung
  http://www.dpunkt.de/ebooks_files/free/3436.pdf

Have fun!

Questions?