



**AALBORG UNIVERSITY**  
**STUDENTS STUDYREPORT**

GROUP SW604F12

BACHELOR PROJECT

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**Oasis Administration for GIRAF**

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## Synopsis:

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## Preface

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This report was written as a 6th semester project by a group of software students from the Department of Computer Science at Aalborg University (AAU) in the spring of 2012. The report will document the process of developing an administration module of the GIRAF system. The GIRAF system is designed to support guardians of children with autism spectrum disorder.

When references are used in the report they will be referred to in the format [abc] with a corresponding entry in the bibliography (located in the back of the report). For larger works a range of relevant pages will also be specified in the format [p. 10-11]. Figures, tables and equations will be referred to in the format [2.1], where the first number refers to the chapter in which it is placed and the second number is the actual number of the figure, table or equation.

The reader is expected to have an understanding of basic programming concepts.

Throughout this report the abbreviation “SDC” will be used, which stands for *self-driving car*.

The CD-ROM included with this report contains the source code for the system developed during this project, as well as a copy of this report.

The Oasis administration project group would like to thank the educators whom helped developing and designing the GIRAF system, as well as our supervisor for the interest and cooperation in the project.



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# **Part I**

## **Common Introduction**

# CHAPTER 1

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## Introduction

---

In order to describe the context of the system, we – as a multi project group – will in the following state the motivation of the project, the group of people we are aiming at helping, the technological platform chosen, the used development method, followed by a problem definition, a system description and architecture, and the conducted usability test.

### 1.1 Motivation

As this is a student report written as part of a learning project, we are required to comply with the study regulation. The main areas of focus, according to the study regulation, are: multi-project management and quality assurance in the form of requirements analysis, requirements management, and testing. The goal is to create a comprehensive software system, across multiple project groups, in order to enhance our competences in analysis, design, implementation, and evaluation of software applications in regards to the system requirements [?].

This project builds on top of a previous project, and is further developed, with the aim of having other students continue the development. The goal of the project, we are building on top of, is to create a touch based tablet system to support children and their guardians in everyday scenarios.

## 1.2 Target Group

Our target group is both children and their guardians. These guardians have certain needs for special tools and gadgets that help to ease the communication between them and the children.

Five teachers and educators, who work with children, act as customers. They will provide requirements and information about the institutions' way of working to give us an insight into their daily struggles.

### 1.2.1 Working with Children with ASD

This section is based upon the statements of a woman with ASD [?], explaining what it is like to live with ASD, and an interview with an educator at Birken, a special kindergarten for children (see section 6.12 for interview notes).

People with ASD are often more visual in their way of thinking. Rather than visualizing thoughts in language and text, they do it in pictures or visual demonstrations. Pictures and symbols are therefore an essential part of the daily tools used by children and the people interacting with them. Also, children can have difficulties expressing themselves by writing or talking, and can often more easily use electronic devices to either type a sentence or show pictures, to communicate with people around them. Another characteristic of children is their perception of time. Some of them simply do not understand phrases like "in a moment" or "soon", they will need some kind of visual indicator that shows how long time they will have to wait.

Different communication tools for children with autism already exist, but many of them rely on a static database of pictures, and often these has to be printed on paper in order to use them as intended. Other tools, such as hour-glasses of different sizes and colors, are also essential when working with children, and these tools are either brought around with the child, or a set is kept every place the child might go, e.g. being at an institution or at home.

There exists tools today which helps the guardians in their daily life, although – as stated in Drazenko's quote – none of them are cost-effective enough to be used throughout the institutions. From the quote, it is clear that there is a need for a more cost-effective solution.

The price of the existing solutions are not sufficiently low such that we can afford to buy and use them throughout the institution.

- Drazenko Banjak, educator at Egebakken.

## **1.3 Target Platform**

Since we build upon last year's project, we are bound to use the platform they used, which is tablets running the Android operating system.

In this project we have been provided with five Samsung Galaxy Tab 10.1 devices[?]. The firmware on the tablets is version 3.2. This version, as of project start, is the latest stable version available for these specific tablets. [?]

## **1.4 Development Method**

As a part of the study regulation we have been required to use the same development method in each individual group. Two methods have been considered, XP (eXtreme Programming) [?], and Scrum [?].

With the knowledge of both XP and Scrum, we decided in the multi project to use Scrum of Scrums, which is the use of Scrum nested in a larger Scrum project [?].

The reason for choosing Scrum of Scrums is that everyone, at all times, will be able to know what the vision of the project is, and how close every group is to achieving their individual goals of the vision.

Another element of the Scrum method is that a close contact with the customers is maintained. This helps keep the product backlog up to date and correctly prioritized. The customers are presented with the vision of the project, as well as showing the latest release when we have meetings with our customers.

We customized Scrum to fit our project. The changes are as follows:

- The sprint length have been shortened to approximately 7 - 14 half days.
- Some degree of pair programming have been introduced.
- There is no project owner because this is a learning project.
- Everyone is attending the Scrum of Scrums meetings.
- The Scrum of Scrums meetings are only held once at sprint planning.

## **1.5 Problem Definition**

The problem statement is as follows:

How can we ease the daily life for children with ASD and their guardians, while complying with the study regulation?

This problem statement is necessarily vague to allow the individual groups some freedom in their projects, while we maintain the overall structure of the multi project, however there are limiting factors. We are limited by resources and time available, as we are only working on this project for a single semester. However, all work done in this multi project will be passed on to the next line of students, which means we can make a full system design and pass on anything we do not have the time or resources for. This also requires that our work need to be of such quality that it is understandable by students of the same educational level as ourselves.

## 1.6 System Description

GIRAF is a collection of applications, either fully or partially interdependent, for the Android platform, designed to be used by guardians and children. GIRAF consists of five projects with various degree of interaction. These projects are named Launcher, PARROT, WOMBAT, Oasis, and Savannah. Each of the groups have produced individual products, which are parts of a greater project, GIRAF.

**Launcher** handles execution of GIRAF apps, and at the same time it provides safety features to ensure that a user that is not authorized to interact with the rest of the system will not be able to do so. When the launcher executes an app, it will provide it with profile information, specifying which child is currently using the app, as well as which guardian is signed in.

**PARROT** is an app which provides access to pictograms – pictures with associated information such as sound and text – which can be used for communication. PARROT also gives guardians functionality for adding additional pictograms, as well as organizing the pictograms into categories for ease of access, based on the needs of the individual child.

**WOMBAT** is an app which purpose is to help the children to understand the aspect of time, by visualizing it. WOMBAT provides different ways of displaying time, as well as the possibility to configure the app for the needs of individual children.

**Oasis** locally stores the data and configuration of the GIRAF platform, and provides an API to access it. The stored data and configurations are synchronized to the Savannah server, if available. In addition, an app is provided for the guardian to access the stored data and configurations.

**Savannah** provides Oasis with a way to synchronize tablets running GIRAF. Furthermore, a website is provided to ease administration of the synchronized data.

## 1.7 Architecture

Our System architecture – shown in Figure 1.1 has been designed with simplicity in mind and was greatly inspired by the MVC pattern. This means that the architecture is divided into three layers. The lowest layer is the database where the information is stored. Above this layer is the controller layer which, in the GIRAF platform, is known as Oasis. The controller is responsible for querying the database for information needed in an app and the controller is also responsible for storing information in the database. The last layer is the apps. This division of layers give the GIRAF platform a low cohesion which makes it easier to work with individual parts of the platform independently.

We have chosen to redesign last year's architecture [?] to make it easier to work with. We have simplified the architecture because we feel it is unnecessarily complex.

## 1.8 Usability Test

As stated in the motivation, quality assurance through testing of the system is required. Therefore a usability test was conducted in order to measure the current usability of the GIRAF platform as a whole, as well as of the individual parts of the platform. Furthermore, the next wave of developers will immediately be able to start correcting the found usability issues.

### 1.8.1 Approach

The test group consists of the five contact persons. We assess that they, as a test group, are representative. We base this on them being a mix of educators and teachers, with varying computer skills.

They have prior knowledge about the overall idea of the GIRAF platform, and although some of the contact persons had previously informally used some aspects or parts of the system, they had not been exposed to the platform as a whole, and therefore still are of value.

The invitation sent to the test persons can be found in Figure 6.17.

The Instant Data Analysis (IDA) method for usability is chosen. A traditional video analysis method could be used, but since IDA is designed for small test groups, this approach is used. [?]

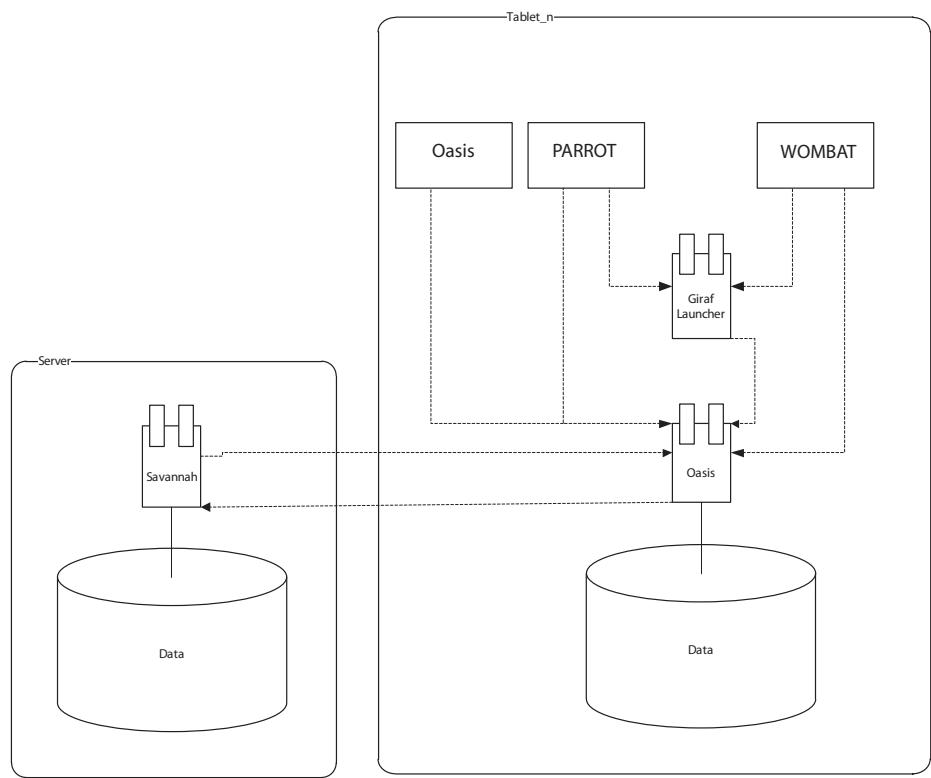


Figure 1.1: The GIRAF architecture

## **Setup**

The usability test is divided into two tests: A test of three user applications, and a test of two administrative applications. The user applications are: The launcher, PARROT, and WOMBAT. The administrative applications are: The Oasis app and the Savannah web application. Each test is assigned a team to accommodate the need to run two tests simultaneously. The teams are made with respect to the criteria of the Instant Data Analysis process.

Each team consisted of:

- 1 x Test Coordinator
- 1 x Test Monitor
- 1 x Data Logger
- 2 x Observers

The usability lab at Aalborg University is designed with two rooms for usability testing and a control room to observe and record the tests. The two test chambers are assigned a test each and the control room is used to observe both tests as seen in figure 1.2.

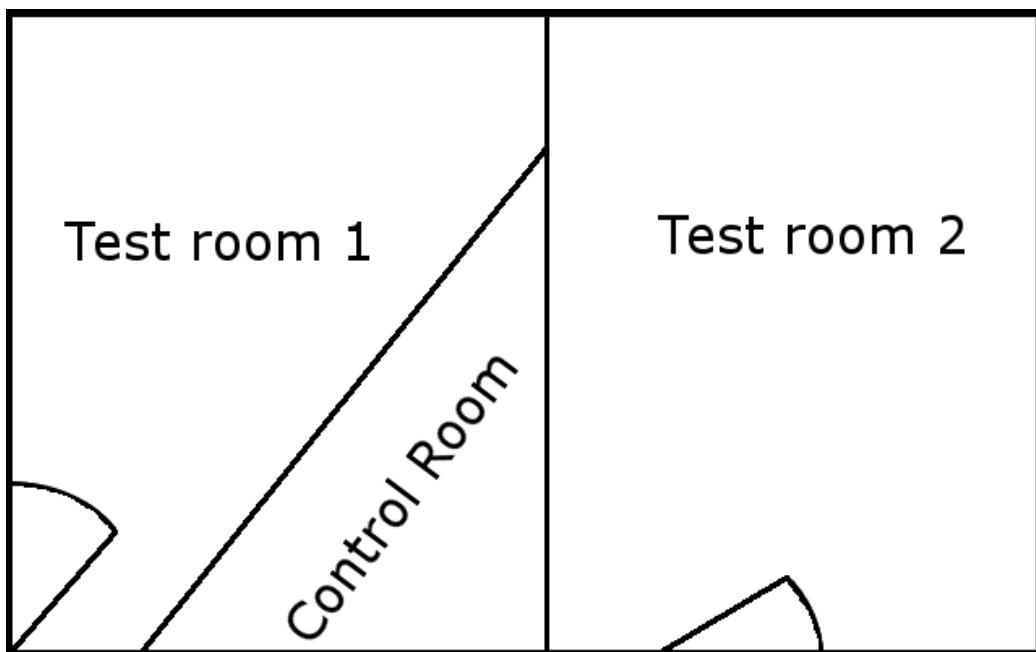


Figure 1.2: An overview of the usability lab at Cassiopeia, Department of Computer Science, Aalborg University.

## **Execution**



Figure 1.3: The schedule of the usability test.

The tests are conducted according to the schedule in Figure 1.3.

Briefing, debriefing, and questionnaire documents can be found in section 6.13, and the results of the test can be found in subsection 6.4.1.

## **Part II**

# **Introduction**



# CHAPTER 2

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## Analysis

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As a part of the multi project, we are not directly solving the problem ourselves, but providing a part such that the other project groups can perform that task easier. As we did not solve the problem directly we have made our own problem definition: *How can we provide a set of tools which can help develop application for the GIRAF-system?* As a way to solve this we have chosen to make 3 projects, a library providing methods and classes, a database to save information and an application to control the content of the database.

## 2.1 Requirements

When we where to develop our library we asked the other groups to supply requirements. We received the following requirements: Save data on the device Various classes for: Profiles Media Apps Departments As an example for the requirements received from the other groups, see appendix 6.7 on page 60.

## 2.2 System architecture

### 2.2.1 In the multi project

The way Oasis fit into the multi project, is by being a middle layer between the Apps and the server, as seen in figure ?? on page ?. Oasis will handle the communication from the apps to save in the local database, as well as synchronizing the local database, with the server.

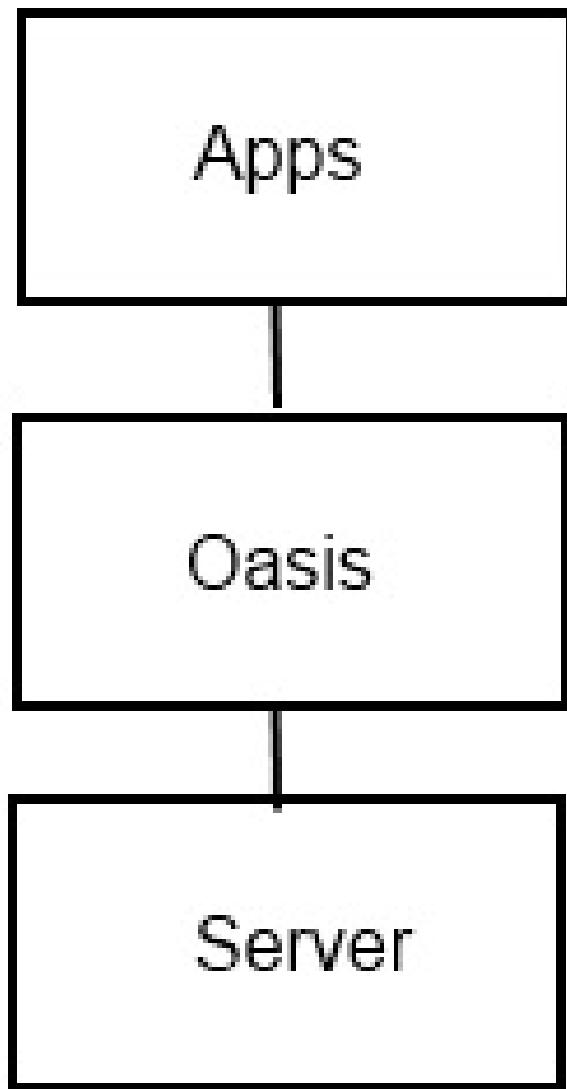


Figure 2.1: The multi project architecture

### **2.2.2 Each part**

Oasis consists of 3 parts, the oasis library which is the core of the project, the administration app, and the local database, as shown in figure ?? on page ??.

The Oasis library will handle applications interaction with the local database, and every giraf app should be utilizing this library. The Oasis library will also make sure that the local database is synchronized with the server's database.

The administration application is an app from which the user can interact with the database directly, creating or deleting users and departments, and making sure these are connected.

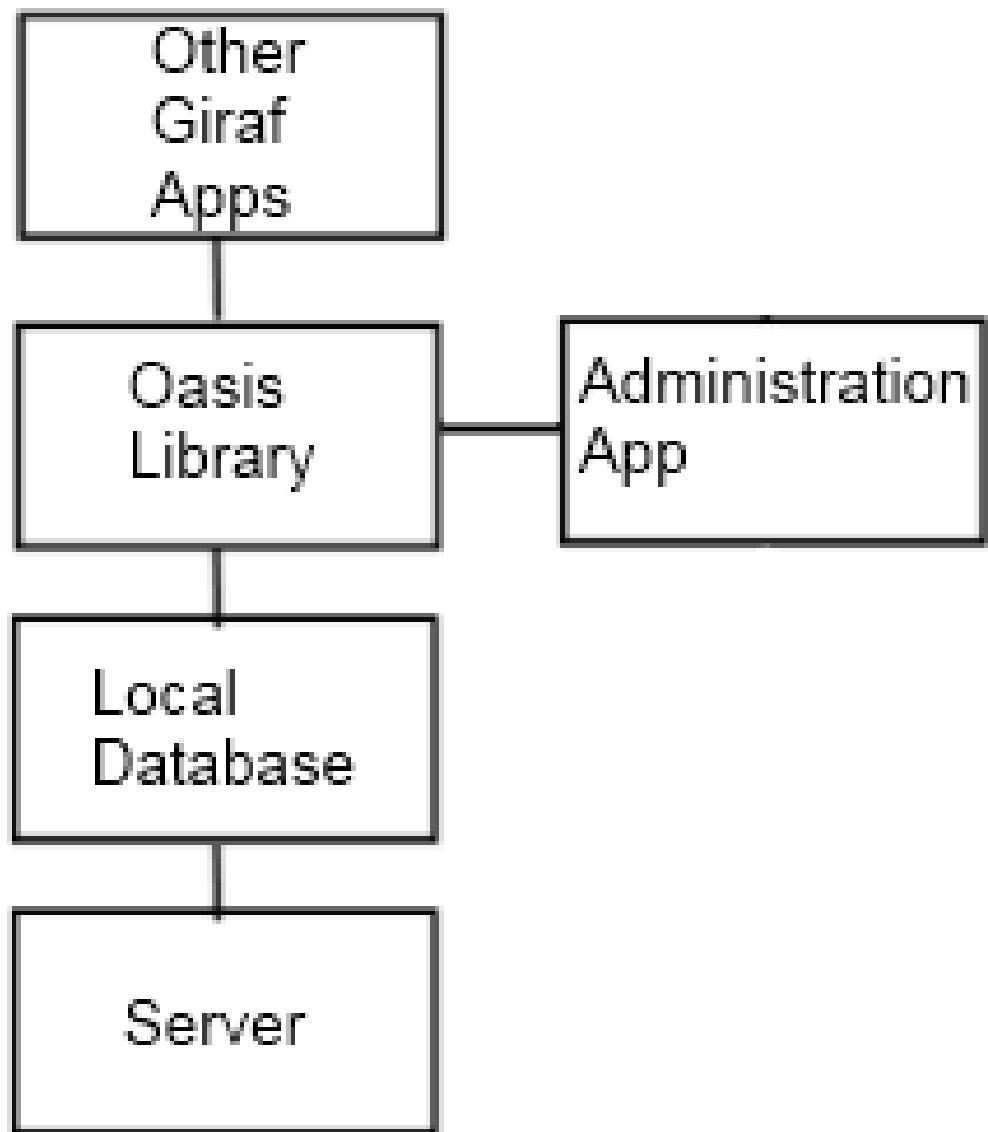


Figure 2.2: The project part architecture

# CHAPTER 3

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## Sprint Process

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In this chapter we describe the sprint process of our project. In the project period we underwent eight sprints. The length of the sprints was decided at every sprint meeting, but they were usually no longer than 10 half days long. At the end of every sprint period, we held a meeting to discuss what we learned through the sprint, and if all the tasks was finished. In the following a description of the different sprints is presented. The Burndown charts and sprint backlog can be seen in the Appendix 6.9 on page 61.

### 3.1 Sprints

#### 3.1.1 Sprint One

Sprint one started on 19/03-2012 and lasted seven half days. In this sprint period we started making the local database, the model objects, that is supposed to wrap the data from the database, and some methods to the library, we got as requirements from the other groups.

##### **Experience gained**

In this sprint we learned that we should be a bit better at estimating the time of each task and that we needed to combine the tasks into bigger tasks, so we could work one big task a day, instead of 10 small tasks.

### **3.1.2 Sprint Two**

Sprint two started on 26/03-2012 and lasted eight half days. In this sprint period we updated the local database and the library with the new requirements we got from the other groups. Besides that we used a little time on setting a counter-strike server up, so we had something to do socially between the groups.

#### **Experience gained**

In this sprint we learned that we still should be a bit better at estimating the time of each task, because there was some tasks we did not even start on.

### **3.1.3 Sprint three**

Sprint three started on 10/04-2012 and lasted 9 half days. In this sprint period we continued on updating the local database and library with the new requirements gathered from the other groups. Besides that we started thinking on our "‘BMI App’", which is not necessary a BMI application, but it is an application, which shows the functionality of the library and local database.

#### **Experience gained**

In this sprint we learned that we should be a bit better at not taking new tasks in to the sprint backlog when the sprint has started, because this will prevent us from making any progress. Besides that we overestimated the size of the tasks, which lead to tasks not being completed before the end of the sprint, because they are connected to each other.

### **3.1.4 Sprint four**

Sprint four started on 23/04-2012 and lasted 6 half days. In this sprint period we continued on updating the local database and library with the new requirements gathered from the other groups. Besides that we started writing javadoc to the library, re factored the code in the local database, started making a method, which created dummy data, and wrote a section of the common report (Target Platform and Developing method).

#### **Experience gained**

In this sprint we learned that we still needs to be better at saying no to other groups, which come with new tasks in the middle of the sprint period.

### **3.1.5 Sprint five**

Sprint five started on 07/05-2012 and lasted 6 half days. In this sprint we worked on the Oasis app, adding functionality to it. We also planed to work on synchronizing with the online database, that did not happen due to the server side not being ready. We improved the library with minor bug fixes.

#### **Experience gained**

In this sprint we learned to get information beforehand on what functionality is available from other people, before trying to use it. We also learned that our structure of the Oasis library could be better.

### **3.1.6 Sprint six**

Sprint six started on 14/05-2012 and lasted 8 half days. In this sprint we continued work on the Oasis App, adding extra functionality to the library, and started creating a structure for the rapport.

#### **Experience gained**

In this sprint we learned that working together on the same files can be a challenge. And that SVN errors can happen easy if two people are editing the same files, without telling eachother.

### **3.1.7 Sprint seven**

Sprint seven started on 21/05-2012 and lasted 9 half days. In this sprint we worked on makeing unit tests for Oasis app. In this sprint, we also had the usability test, where we testet the Oasis app. We also added more content to the rapport.

#### **Experience gained**

in this sprint we learned that not every choice you make as a programmer is easy to understand for someone without much technical knowledge.

### **3.1.8 Sprint eight**

Sprint eight started on 28/05-2012 and lasted 8 half days. In this sprint we finished the report.

## **Experience gained**

In this sprint we learned that writing some parts of the report earlier might be a good idea.

### **3.1.9 Change Log**

In almost every sprint changes have been made in the software platform. All these changes have been accumulated into a change log. The change log can be seen in section 6.10.

*Tail*

# **Part III**

# **Development**



# CHAPTER 4

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## Oasis Local Db

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In this chapter we describe the local database, called Oasis Local Db. Oasis Local Db is used for saving the data, which is used by the GIRAF applications. First the structure of Oasis Local Db is described in section 4.1. After that the implementation of Oasis Local Db on the android system is described in section 4.2 on page 26.

### 4.1 Structure

The structure of Oasis Local Db is developed in cooperation with the savannah server group. The reason for that is to alleviate the complexities that could occur during a synchronization of the tablet and the savannah server. The database schema can be seen in figure Figure 4.1. There are a few differences between our database schema and the savannah server's. The reason for that is that there only is SQLite, which is embedded into the Android system. SQLite is an open source database. It supports three kinds of data types; TEXT, which is similar to String type in Java, INTEGER, which is similar to long type in java, and REAL, which is similar to double type in java. SQLite does not validate if the types written to the columns actually are of the defined type. This means that it for instance is possible to write an integer into a TEXT column. On the positive site SQLite only requires a little portion of memory at runtime ( 250 KByte).

When making a SQLite Database on an Android device it is only needed to define the SQL statements for creating and updating the database. After that

the Android system will manage it. An example of how we implemented a table in the database can be seen in section ?? on page ??.

## 4.2 Implementation

As said above, we implemented the local database using SQLite. First we made metadata files for each table in the database. The one for the AuthUsers table can be seen in listing 4.1

```
1 package dk.aau.cs.giraf.oasis.localdb;
2
3 import android.net.Uri;
4 import android.provider.BaseColumns;
5
6 public class AuthUsersMetaDataAdapter {
7
8     public static final Uri CONTENT_URI =
9         Uri.parse("content://dk.aau.cs.giraf.oasis.localdb.AutismProvider/authusers");
10
11    public static final String CONTENT_TYPE_AUTHUSERS_LIST =
12        "vnd.android.cursor.dir/vnd.dk.authusers";
13    public static final String CONTENT_TYPE_AUTHUSER_ONE =
14        "vnd.android.cursor.item/vnd.dk.authusers";
15
16    public class Table implements BaseColumns {
17        public static final String TABLE_NAME = "tbl_authusers";
18
19        public static final String COLUMN_ID = "_id";
20        public static final String COLUMN_CERTIFICATE = "authusers_certificate";
21        public static final String COLUMN_ROLE = "authusers_role";
22    }
23}
```

Listing 4.1: The AuthUsers MetaData

The uri, CONTENT\_URI and the two strings, CONTENT\_TYPE\_AUTHUSERS\_LIST and CONTENT\_TYPE\_AUTHUSER\_ONE, is not used by the SQLite Database and will be explained later in the content provider section [INSERT FIGURE REF](#). The inner class Table defines the Strings, which are used as names of the table and the columns.

When the metadata file is created we make a table class file, which defines the SQL statements for creating, updating and deleting the table. The table class file for AuthUsers can be seen in listing 4.2.

```
1 package dk.aau.cs.giraf.oasis.localdb;
2
3 import android.database.sqlite.SQLiteDatabase;
4
5 public class AuthUsersTable {
6
7     private static final String TABLE_CREATE = "CREATE TABLE "
8         + AuthUsersMetaDataAdapter.Table.TABLE_NAME
9         + "("
10         + AuthUsersMetaDataAdapter.Table.COLUMN_ID + " INTEGER NOT NULL, "
11         + AuthUsersMetaDataAdapter.Table.COLUMN_CERTIFICATE + " TEXT NOT NULL, "
12         + AuthUsersMetaDataAdapter.Table.COLUMN_ROLE + " INTEGER NOT NULL, "
13         + "PRIMARY KEY (" + AuthUsersMetaDataAdapter.Table.COLUMN_ID + ", " +
14             AuthUsersMetaDataAdapter.Table.COLUMN_ID + ")"
15         + ");";
```

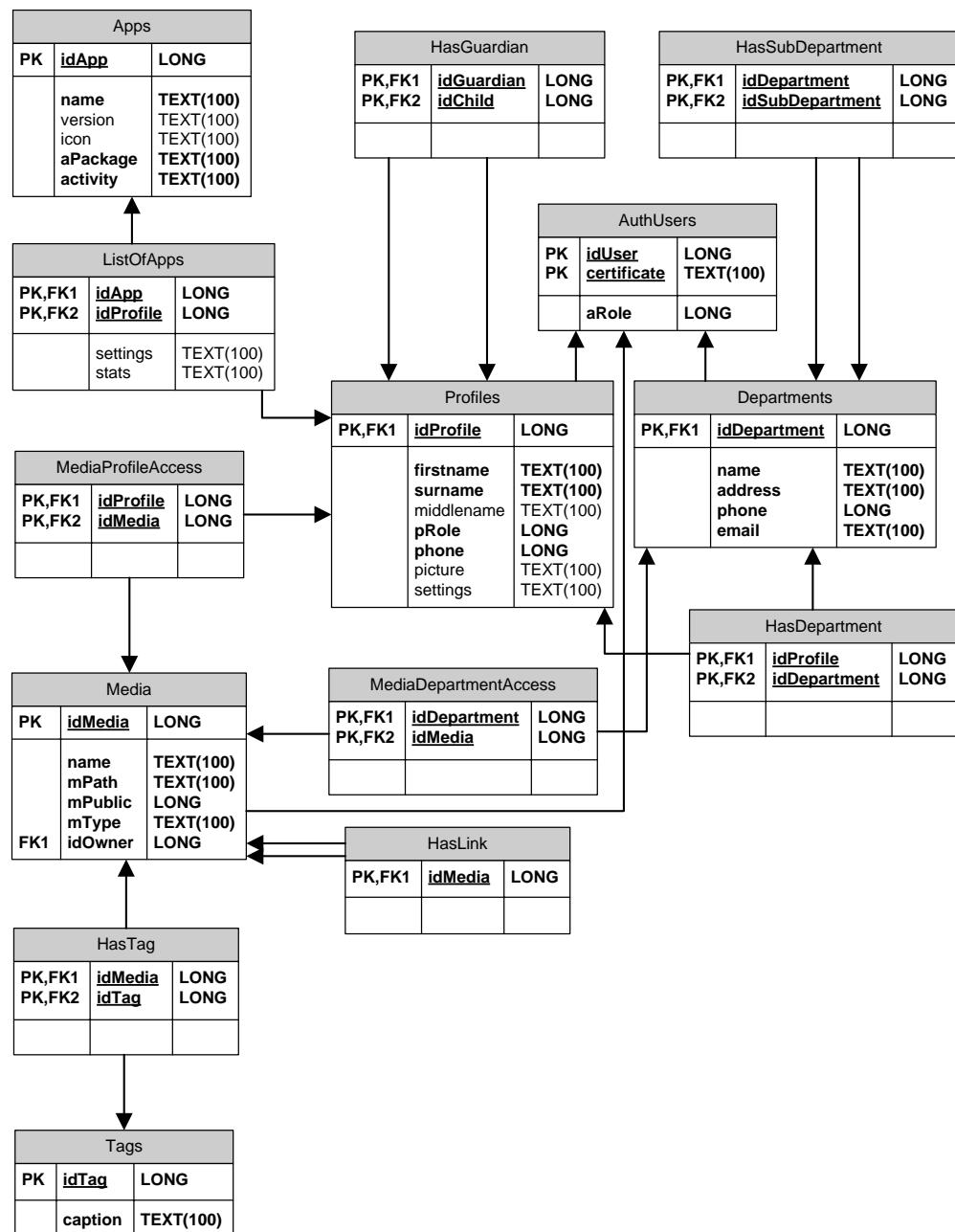


Figure 4.1: The database schema for the local database.

```

16  private static final String TABLE_DROP= "DROP TABLE IF EXISTS " +
17      AuthUsersMetaDataTable.TABLE_NAME + ";";
18
19  /**
20   * Executes sql string for creating certificate table
21   * @param db this is an instance of a sqlite database
22   */
23  public static void onCreate(SQLiteDatabase db) {
24      db.execSQL(TABLE_CREATE);
25  }
26
27  /**
28   * executes a sql string which drops the old table and then the method calls oncreate, which
29   * creates a new certificate table
30   * @param db this is a instance of a sqlite database
31   * @param oldVersion integer referring to the old version number
32   * @param newVersion integer referring to the new version number
33   */
34  public static void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
35      db.execSQL(TABLE_DROP);
36      onCreate(db);
37  }
38 }
```

---

Listing 4.2: The AuthUsers Table

Now is the Oasis Local Db created, but to be able to access the Oasis Local Db from other applications, it needs to implement a content provider. A content provider allows other applications to fetch data from the application, which implement the content provider. The access to a content provider is done by using a URI, which is defined in the AndroidManifest file. The content provider must implement several methods. These methods are:

- `onCreate()` - called at startup to initialize the content provider.
- `getType()` - called when an application needs to know the type of the data. This is not used in Oasis Local Db.
- `query()` - called when an application wants to query in the Oasis Local Db.
- `insert()` - called when an application wants to insert data into the Oasis Local Db.
- `update()` - called when an application wants to update existing data in the Oasis Local Db.
- `delete()` - called when an application wants to delete existing data in the Oasis Local Db.

An example of how we have implemented our content provider, with focus on the authusers table, can be seen in listing 4.3

---

```

1 package dk.aau.cs.giraf.oasis.localdb;
2 .
3 .
```

```

4 .
5 public class DbProvider extends ContentProvider {
6
7     private DBHelper dbHelper;
8     private static final UriMatcher sUriMatcher;
9
10    .
11    .
12    private static final int AUTHUSERS_TYPE_LIST = 3;
13    private static final int AUTHUSERS_TYPE_ONE = 4;
14
15    .
16    .
17    static {
18        sUriMatcher = new UriMatcher(UriMatcher.NO_MATCH);
19        .
20        .
21        sUriMatcher.addURI(DbHelper.AUTHORITY, "authusers", AUTHUSERS_TYPE_LIST);
22        sUriMatcher.addURI(DbHelper.AUTHORITY, "authusers#", AUTHUSERS_TYPE_ONE);
23        .
24        .
25        .
26    }
27
28    .
29    .
30    .
31    private static final HashMap<String, String> authusersProjectionMap;
32    static {
33        authusersProjectionMap = new HashMap<String, String>();
34        authusersProjectionMap.put(AuthUsersMetaData.Table.COLUMN_ID,
35            AuthUsersMetaData.Table.COLUMN_ID);
36        authusersProjectionMap.put(AuthUsersMetaData.Table.COLUMN_CERTIFICATE,
37            AuthUsersMetaData.Table.COLUMN_CERTIFICATE);
38        authusersProjectionMap.put(AuthUsersMetaData.Table.COLUMN_ROLE,
39            AuthUsersMetaData.Table.COLUMN_ROLE);
40        .
41    }
42
43    @Override
44    public boolean onCreate() {
45        dbHelper = new DBHelper(getContext());
46        return false;
47    }
48
49    @Override
50    public int delete(Uri uri, String where, String[] whereArgs) {
51        SQLiteDatabase db = dbHelper.getWritableDatabase();
52        int rowsDeleted = 0;
53        String rowId;
54
55        case AUTHUSERS_TYPE_LIST:
56            rowsDeleted = db.delete(AuthUsersMetaData.Table.TABLE_NAME, where, whereArgs);
57            break;
58        case AUTHUSERS_TYPE_ONE:
59            rowId = uri.getPathSegments().get(1);
60            rowsDeleted = db.delete(AuthUsersMetaData.Table.TABLE_NAME,
61                AuthUsersMetaData.Table.COLUMN_ID + " = " + rowId + (!TextUtils.isEmpty(where) ?
62                    " AND (" + where + ")" : ""),
63                whereArgs);
64            break;
65
66        default:
67            throw new IllegalArgumentException("Unknown URI: " + uri);
68        }
69
70        getContext().getContentResolver().notifyChange(uri, null);
71        return rowsDeleted;
72    }
73
74    @Override
75    public String getType(Uri uri) {
76        switch(sUriMatcher.match(uri)) {
77        .
78        .
79        case AUTHUSERS_TYPE_LIST:
80            return AuthUsersMetaData.CONTENT_TYPE_AUTHUSERS_LIST;
81
82

```

```

83     case AUTHUSERS_TYPE_ONE:
84         return AuthUsersMetaData.CONTENT_TYPE_AUTHUSER_ONE;
85     .
86     .
87     default:
88         throw new IllegalArgumentException("Unknown URI: " + uri);
89     }
90 }
91 @Override
92 public Uri insert(Uri uri, ContentValues values) {
93     SQLiteDatabase db = dbHelper.getWritableDatabase();
94     long rowId;
95     Uri _uri;
96     .
97     switch(sUriMatcher.match(uri)) {
98     .
99     .
100    case AUTHUSERS_TYPE_LIST:
101        try {
102            rowId = db.insertOrThrow(AuthUsersMetaData.Table.TABLE_NAME, null, values);
103            _uri = ContentUris.withAppendedId(AuthUsersMetaData.CONTENT_URI, rowId);
104            getContext().getContentResolver().notifyChange(_uri, null);
105        } catch (SQLiteConstraintException e) {
106            _uri = ContentUris.withAppendedId(AuthUsersMetaData.CONTENT_URI, -1);
107        }
108        return _uri;
109    .
110    .
111    default:
112        throw new IllegalArgumentException("Unknown URI: " + uri);
113    }
114 }
115 @Override
116 public Cursor query(Uri uri, String[] projection, String selection, String[] selectionArgs,
117                     String sortOrder) {
118     SQLiteQueryBuilder builder = new SQLiteQueryBuilder();
119     .
120     switch(sUriMatcher.match(uri)) {
121     .
122     .
123     case AUTHUSERS_TYPE_LIST:
124         builder.setTables(AuthUsersMetaData.Table.TABLE_NAME);
125         builder.setProjectionMap(authusersProjectionMap);
126         break;
127     case AUTHUSERS_TYPE_ONE:
128         builder.setTables(AuthUsersMetaData.Table.TABLE_NAME);
129         builder.setProjectionMap(authusersProjectionMap);
130         builder.appendWhere(AuthUsersMetaData.Table.COLUMN_ID + " = " +
131                             uri.getPathSegments().get(1));
132         break;
133     .
134     .
135     default:
136         throw new IllegalArgumentException("Unknown URI: " + uri);
137     }
138     .
139     .
140     .
141     .
142     SQLiteDatabase db = dbHelper.getReadableDatabase();
143     Cursor queryCursor = builder.query(db, projection, selection, selectionArgs, null, null,
144                                       null);
145     queryCursor.setNotificationUri(getContext().getContentResolver(), uri);
146     return queryCursor;
147 }
148 @Override
149 public int update(Uri uri, ContentValues values, String where, String[] whereArgs) {
150     SQLiteDatabase db = dbHelper.getWritableDatabase();
151     int rowsUpdated = 0;
152     String rowId;
153     .
154     switch(sUriMatcher.match(uri)) {
155     .
156     .
157     case AUTHUSERS_TYPE_LIST:
158         rowsUpdated = db.update(AuthUsersMetaData.Table.TABLE_NAME, values, where, whereArgs);
159         break;
160     case AUTHUSERS_TYPE_ONE:
161         rowId = uri.getPathSegments().get(1);
162

```

```
163     rowsUpdated = db.update(AuthUsersMetaData.Table.TABLE_NAME,
164         values,
165         AuthUsersMetaData.Table.COLUMN_ID + " = " + rowId + (!TextUtils.isEmpty(where) ?
166             " AND (" + where + ")" : ""),
167             whereArgs);
168     .
169     .
170     .
171     default:
172         throw new IllegalArgumentException("Unknown URI: " + uri);
173     }
174
175     getContext().getContentResolver().notifyChange(uri, null);
176     return rowsUpdated;
177 }
178 }
```

---

Listing 4.3: A small part of the content provider

# CHAPTER 5

---

## Oasis Lib

---

In this chapter we describe the library of the administration module, called Oasis Lib. The Oasis Lib is the library, which works as a connection between the Oasis Local Db (see chapter 4) and the applications, which runs on the GIRAf system, by providing an API, which the GIRAf applications can use. First the structure of Oasis Lib is described in section 5.1. Then the implementation of the Oasis Lib is described in section 5.2.

### 5.1 Structure

The structure of the Oasis Lib, have been inspired of the MVC pattern, where the system is divided into three parts; Model, View, and Controller.

In Oasis Lib the Model part is a package containing model objects. Each model object represent a table in the Oasis Local Db. The model objects is used to encapsulate the data, which is to be saved and loaded from the Oasis Local Db. The reason that we use model objects is to ease it for the users of the library and to make a uniform way of saving and loading data. The models can be seen in ??.

The controller part is the package containing all the methods, which the developers can use to interact with Oasis Local Db. The controller methods have been divided into several classes. The division can be seen in Figure 5.2

They are divided by the models that manipulate, this means that for each table in the db there is a model and a controller. This gives a good overview that helps the programmers that use the library.

-  [\*\*dk.aau.cs.giraf.oasis.lib.models\*\*](#)
  -  [\*\*App.java\*\*](#)
  -  [\*\*AuthUser.java\*\*](#)
  -  [\*\*Department.java\*\*](#)
  -  [\*\*EqualsUtil.java\*\*](#)
  -  [\*\*HasDepartment.java\*\*](#)
  -  [\*\*HasGuardian.java\*\*](#)
  -  [\*\*HasLink.java\*\*](#)
  -  [\*\*HasSubDepartment.java\*\*](#)
  -  [\*\*HasTag.java\*\*](#)
  -  [\*\*ListOfApps.java\*\*](#)
  -  [\*\*Media.java\*\*](#)
  -  [\*\*MediaDepartmentAccess.java\*\*](#)
  -  [\*\*MediaProfileAccess.java\*\*](#)
  -  [\*\*Profile.java\*\*](#)
  -  [\*\*Setting.java\*\*](#)
  -  [\*\*Stat.java\*\*](#)
  -  [\*\*Tag.java\*\*](#)

-  dk.aau.cs.giraf.oasis.lib
  - ▷  Helper.java
-  dk.aau.cs.giraf.oasis.lib.controllers
  - ▷  AppsHelper.java
  - ▷  AuthUsersController.java
  - ▷  DepartmentsHelper.java
  - ▷  HasDepartmentController.java
  - ▷  HasGuardianController.java
  - ▷  HasLinkController.java
  - ▷  HasSubDepartmentController.java
  - ▷  HasTagController.java
  - ▷  ListOfAppsController.java
  - ▷  MediaDepartmentAccessController.java
  - ▷  MediaHelper.java
  - ▷  MediaProfileAccessController.java
  - ▷  ProfilesHelper.java
  - ▷  ServerHelper.java
  - ▷  TagsHelper.java

Figure 5.2: The controllers in the Oasis library

In the library there are no direct reference to the views from the MVC pattern. This is because the individual applications in the GIRAF system is seen as a view and they have the same function as a view.

## 5.2 Implementation

The Oasis Library's controllers is what make up the main part of the library. It is divided into a number of different sub controllers, the public ones seen in figure ?? on page ??.

```
1 public Profile authenticateProfile(String certificate) {
2     if (certificate == null || !certificate.matches("[a-z]{200}")) {
3         return null;
4     }
5
6     Profile profile = null;
7     long id = au.getIdByCertificate(certificate);
8
9     if (id != -1) {
10         profile = getProfileById(id);
11     }
12
13     return profile;
14 }
```

Listing 5.1: This is the code for the authenticateProfile method.

```
1 public Profile getProfileById(long id) {
2     Profile profile = null;
3
4     if (id <= 0) {
5         return null;
6     }
7
8     Uri uri = ContentUris.withAppendedId(ProfileMetaData.CONTENT_URI, id);
9     Cursor c = _context.getContentResolver().query(uri, columns, null, null, null);
10
11    if (c != null) {
12        if (c.moveToFirst()) {
13            profile = cursorToProfile(c);
14        }
15        c.close();
16    }
17
18    return profile;
19 }
```

Listing 5.2: This is the code for the getProfileById method.

There are a number of other sub controllers as well, but they are only for internal use within the Oasis library. For further information on how the Oasis library's methods work, see the JavaDoc which is place on the appended CD-Rom.

# CHAPTER 6

---

## Oasis App

---

In this chapter we describe the application of the administration module, called Oasis App. The Oasis App is an application, which demonstrates some of the utilities the Oasis Lib offers. The idea behind the Oasis App is that we want to make a tool, for the guardians, to manage data of the profiles, by giving them CRUD (Create, Read, Update, and Delete) options. First the structure of the Oasis App is described in section 6.1. After that the implementation of the Oasis Lib is described in section 6.2 on page 38.

## 6.1 Structure

The Oasis Application is build upon two activities; MainActivity and FragParentTab.

### 6.1.1 MainActivity

The MainActivity is the activity that starts on application startup. It uses the main.xml as its layout file, which is a layout file containing three buttons, which can be seen on figure **INDSÆT SCREEN CAP AF MAINACTIVITY**. A snap of the MainActivity's code can be seen in listing 6.1.

---

```
1 .
2 .
3 .
4 public class MainActivity extends Activity implements OnClickListener {
5     private Button bMyProfile, bAllProfiles, bAllDepartments, bAddDummyData;
```

```

7   private Intent direct;
8   private long guardianId;
9   public Helper helper;
10  public static Profile guardian;
11  public static Profile child;
12  public static int color;
13
14  @Override
15  public void onCreate(Bundle savedInstanceState){
16      super.onCreate(savedInstanceState);
17
18      .
19      .
20      .
21
22      helper = new Helper(this);
23
24      Bundle extras = getIntent().getExtras();
25      if (extras != null) {
26          guardianId = extras.getLong("currentGuardianID");
27          color = extras.getInt("appBackgroundColor");
28          guardian = helper.profilesHelper.getProfileById(guardianId);
29      }
30
31      setContentView(R.layout.main);
32
33      initializeViews();
34  }
35
36  private void initializeViews() {
37      findViewById(R.id.UpperLayout).setBackgroundColor(color);
38
39      bMyProfile = (Button) findViewById(R.id.bMyProfile);
40      bMyProfile.setOnClickListener(this);
41      bAllProfiles = (Button) findViewById(R.id.bAllProfiles);
42      bAllProfiles.setOnClickListener(this);
43      bAllDepartments = (Button) findViewById(R.id.bAllDepartments);
44      bAllDepartments.setOnClickListener(this);
45      bAddDummyData = (Button) findViewById(R.id.bAddDummyData);
46      if (guardian == null) {
47          bAddDummyData.setOnClickListener(this);
48      } else {
49          bAddDummyData.setVisibility(View.GONE);
50      }
51  }
52
53  @Override
54  public void onClick(View v) {
55      direct = new Intent(this, FragParentTab.class);
56
57      switch (v.getId()) {
58          case R.id.bMyProfile:
59              if (guardian != null) {
60                  direct.putExtra("tabView", FragParentTab.TABPROFILE);
61                  startActivity(direct);
62              } else {
63                  Toast.makeText(this, R.string.noprofile, Toast.LENGTH_SHORT).show();
64              }
65              break;
66          case R.id.bAllProfiles:
67              direct.putExtra("tabView", FragParentTab.TABALLPROFILES);
68              startActivity(direct);
69              break;
70          case R.id.bAllDepartments:
71              direct.putExtra("tabView", FragParentTab.TABALLDEPARTMENTS);
72              startActivity(direct);
73              break;
74          .
75          .
76          .
77      }
78  }
79 }

```

---

Listing 6.1: The MainActivity class

When the activity starts it gets the information of which guardian that is currently logged in to the GIRAF system and what background color the Oasis

App is currently set to by the Launcher application. When one of the buttons is clicked the mainactivity will start the FragParentTab activity, but depending on which button is clicked, the mainactivity will put an integer in the intent's extra data.

### 6.1.2 FragParentTab

The FragParentTab is the activity, which, as stated above, is started by the Main-Activity activity. The activity has the responsibility of managing what view to show, by using fragments. The reason for choosing fragments instead of making new activities is that the layout we want is a tab layout. The layout can be seen in figure [Indsæt FIGUR REF](#). The FragParentTab activity can be seen in listing ?? on page ??.

---

```
1 .
2 .
3 .
4 public class FragParentTab extends Activity {
5
6     private int tabView;
7     public final static int TABPROFILE = 0;
8     public final static int TABAPP = 1;
9     public final static int TABMEDIA = 2;
10    public final static int TABALLPROFILES = 3;
11    public final static int TABALLDEPARTMENTS = 4;
12    public final static int TABCHILD = 5;
13    public final static int TABCHILDAPP = 6;
14    public final static int TABCHILDMEDIA = 7;
15    static FragmentManager t;
16
17    @Override
18    protected void onCreate(Bundle savedInstanceState) {
19        super.onCreate(savedInstanceState);
20
21        .
22        .
23        .
24
25        Bundle extras = getIntent().getExtras();
26        if (extras != null) {
27            tabView = extras.getInt("tabView");
28        } else {
29            tabView = -1;
30        }
31
32        setContentView(R.layout.fragments_view);
33
34        findViewById(R.id.fragUpperLayout).setBackgroundColor(MainActivity.color);
35
36        t = getFragmentManager();
37
38        switch(tabView) {
39            case TABPROFILE:
40                t.beginTransaction().add(R.id.fDetails, new TabManagerProfile()).commit();
41                break;
42            case TABALLPROFILES:
43                t.beginTransaction().add(R.id.fDetails, new TabManagerAllProfiles()).commit();
44                break;
45            case TABALLDEPARTMENTS:
46                t.beginTransaction().add(R.id.fDetails, new TabManagerAllDepartments()).commit();
47                break;
48            case TABCHILD:
49                t.beginTransaction().add(R.id.fDetails, new TabManagerChild()).commit();
50            }
51
52
53        public static void switchTab(int tabViewId) {
54
55            switch(tabViewId) {
```

```

56     case TABPROFILE:
57         t.beginTransaction().replace(R.id.fDetails, new TabManagerProfile()).commit();
58         break;
59     case TABMEDIA:
60         t.beginTransaction().replace(R.id.fDetails, new TabManagerMedia()).commit();
61         break;
62     case TABAPP:
63         t.beginTransaction().replace(R.id.fDetails, new TabManagerApp()).commit();
64         break;
65     case TABCHILD:
66         t.beginTransaction().replace(R.id.fDetails, new TabManagerChild()).commit();
67         break;
68     case TABCHILDMEDIA:
69         t.beginTransaction().replace(R.id.fDetails, new TabManagerChildMedia()).commit();
70         break;
71     case TABCHILDAPP:
72         t.beginTransaction().replace(R.id.fDetails, new TabManagerChildApp()).commit();
73         break;
74     }
75 }
76
77 @Override
78 protected void onResume() {
79     super.onResume();
80     t = getSupportFragmentManager();
81 }
82 }
```

---

Listing 6.2: The FragParentTab class

The way in which the activity controls which fragment it must show is done in two ways. First, when created, the activity decides which fragment to show, by using the integer it gets from the MainActivity. This integer represents a fragment class of every view, called TabManager[keyword]. This fragment is then added to the fragment stack. The other way is when a fragment wants to replace itself with another fragment. Then the fragment calls the switchTab method, in the FragParentTab activity, with the replacing view integer as parameter.

## 6.2 Implementation

When using the Oasis Lib it is necessary to do a few things. First it is needed to import the Oasis Lib as a library project. This can be done by either including a jar file we made for the purpose or by telling Eclipse that the Oasis Lib project is a library project. Then Eclipse will automatically include the needed files at compile time. When the Oasis Lib is included to be able to call the methods inside the library it is necessary to initialize a helper object. When initializing the object it is needed to put the current activity's context as a parameter. This is needed to give the Oasis Lib the information about where it is called from. An example of how to initialize the helper object can be seen in listing 6.3.

---

```
1 Helper helper = new Helper(getActivity().getApplicationContext());
```

---

Listing 6.3: Example of Initializing a Helper

Now it is possible to call all the methods in the library. An example of calling a method can be seen in listing 6.4

---

```
1 guardian = helper.profilesHelper.getProfileById(guardianId);
```

---

Listing 6.4: Call method from Oasis Lib

## 6.3 Dynamic White Box Testing

To ensure the correctness of the Oasis Library we enforce dynamic white box testing (side 106 - 107, Software Testing - af Ron Patton) through unit tests. Kilde: The library is used by all GIRAF applications this means that if a bug exists in the library there is a potential bug in all GIRAF application. Therefore the library must be thoroughly tested to make sure that few or no bugs exists.

As this project have been developed using the agile development methods Scrum we have not devised a full test plan (side 263 - 275, Software Testing - af Ron Patton) as this is not needed. As a part of Scrum we have been testing the code snippets before they have been marked as completed. A decision has been made ?? to make a full functioning library for this semester. This decision means that the development time has to be prioritized and therefore the focus will be on test-to-pass tests (side 66, Software Testing - af Ron Patton). This ensures that the library will function as intended, though there is no guarantee that the library will work if bad parameters are used.

### 6.3.1 The Test Design

A test design (side 281 - 282, Software testing - af Ron Patton) have been elaborated for each method in the helper classes of the Oasis Library. This way the library methods will be tested along with the database thus saving some time. This means that the tests will be more efficient as more code will be tested in every test, but it has the drawback that if a bug is found more code will have to be investigated in order to locate the bug.

The test design in Table 6.1 is for the authenticateProfile() method. This test design tests if a profile can be authenticated. This is an essential method for the whole GIRAF platform, and therefore it is tested both using test-to-pass and test-to-fail tests to ensure that this method is particular robust.

The test design in Table 6.2 is for the getProfileById method. This is also a very important method for the whole GIRAF platform therefore it is tested with the same mix of test-to-pass and test-to-fail tests. The test make sure that a

Identifier:	TD00001
Feature to be tested:	Authenticate profile.
Approach:	<p>An automated test will be made to authenticate a profile by its certificate.</p> <ol style="list-style-type: none"> <li>1. Enter a profile with a specific certificate in the database.</li> <li>2. Authenticate the profile by its certificate.</li> </ol>
Test case identification:	<p>Check valid certificate Test Case ID# 00001            Check too long certificates Test Case ID# 00002            Check too short certificates Test Case ID# 00003            Check invalid certificates Test Case ID# 00004</p>
Pass/fail criteria:	All valid profile certificates that matches the certificate in the database must be accepted as well as all invalid certificates must be rejected.

Table 6.1: Test Design for authenticatingProfile().

profile can be found by its id and that negative id's and id's not in the database will not make it crash.

The test design in Table 6.3 is for the getChildrenByGuardian method. This test ensures that the method performs as intended under normal operation. This is done with a single test-to-pass test, which tests if children associated to a guardian can be retrieved from the database.

More test designs have been elaborated but have not been entered in the report due to the similarities and the large amount. Those test designs look similar to the test design for the getChildrenByGuardian method.

### 6.3.2 The Test Cases

One or more test cases are created for each test design (see 283 - 285, Software testing - af Ron Patton). Every test case is created in order to test a part of a method to ensure that the method performs as intended in the tested situation.

The test cases for the test designs in the prior Section can be seen in Table 6.4, Table 6.5, Table 6.6, Table 6.7, Table 6.8, Table 6.9, Table 6.10, and Table 6.11.

Identifier:	TD00002
Feature to be tested:	Get profile by id.
Approach:	<p>An automated test will be made in order to ensure that the Oasis Library supports getting a profile by its id from the database.</p> <ol style="list-style-type: none"> <li>1. Add Profiles to the database.</li> <li>2. Get profile by id and verify the output.</li> </ol>
Test case identification:	<p>Check valid id present in the database Test Case ID# 00005</p> <p>Check id not in the database Test Case ID# 00006</p> <p>Check negative id Test Case ID# 00007</p>
Pass/fail criteria:	The profile matching the id should be returned else null should be returned.

Table 6.2: Test Design for getProfileById().

Identifier:	TD00003
Feature to be tested:	Get children by guardian.
Approach:	<p>An automated test will be made to ensure that the Oasis Library supports getting all children associated with one guardian.</p> <ol style="list-style-type: none"> <li>1. Children and guardians should be added to the database.</li> <li>2. Associations between some children and guardians should be made.</li> <li>3. Get children by guardian should be called and the output verified.</li> </ol>
Test case identification:	Check valid guardian with children associated Test Case ID# 00008
Pass/fail criteria:	The list of children should match the children associated with the guardian.

Table 6.3: Test Design for get children by guardian.

Identifier:	TC00001
Test item:	Valid Certificate handling of the authenticateProfile() method.
Input specification:	A valid certificate.
Output specification:	The model of the authenticated profile.
Environmental needs:	A database is needed and the profile model.
Special procedural requirements	None.
Intercase dependencies:	None.

Table 6.4: Test Case for valid certificate handling of the authenticateProfile() method.

Identifier:	TC00002
Test item:	Certificate lenght too short handling of the authenticateProfile() method.
Input specification:	A certificate shorther than 200 chars.
Output specification:	Null.
Environmental needs:	A database is needed and the profile model.
Special procedural requirements	None.
Intercase dependencies:	None.

Table 6.5: Test Case for certificate lenght too long handling of the authenticateProfile() method.

Identifier:	TC00003
Test item:	Certificate lenght too long handling of the authenticateProfile() method.
Input specification:	A certificate longer than 200 chars.
Output specification:	Null.
Environmental needs:	A database is needed and the profile model.
Special procedural requirements	None.
Intercase dependencies:	None.

Table 6.6: Test Case for certificate lenght too long handling of the authenticateProfile() method.

Identifier:	TC00004
Test item:	Invalid Certificate handling of the authenticateProfile() method.
Input specification:	An invalid certificate.
Output specification:	Null.
Environmental needs:	A database is needed and the profile model.
Special procedural requirements	None.
Intercase dependencies:	None.

Table 6.7: Test Case for invalid certificate handling of the authenticateProfile() method.

Identifier:	TC00005
Test item:	Valid id present in the database handling of the getProfileById() method.
Input specification:	A valid id.
Output specification:	The profile matching the id.
Environmental needs:	A database is needed and the profile model.
Special procedural requirements	None.
Intercase dependencies:	None.

Table 6.8: Test Case for valid id handling of the getProfileById() method.

Identifier:	TC00006
Test item:	Invalid id present not present in the database handling of the getProfileById() method.
Input specification:	An invalid id.
Output specification:	Null.
Environmental needs:	A database is needed and the profile model.
Special procedural requirements	None.
Intercase dependencies:	None.

Table 6.9: Test Case for invalid id handling of the getProfileById() method.

Identifier:	TC00007
Test item:	Negative id handling of the <code>getProfileById()</code> method.
Input specification:	A negative id.
Output specification:	Null.
Environmental needs:	A database is needed and the profile model.
Special procedural requirements	None.
Intercase dependencies:	None.

Table 6.10: Test Case for negative id handling of the `getProfileById()` method.

Identifier:	TC00008
Test item:	Valid guardian with children associated handling of the <code>getChildrenByGuardian()</code> method.
Input specification:	A valid guardian.
Output specification:	A list of associated children.
Environmental needs:	A database is needed and the profile model.
Special procedural requirements	None.
Intercase dependencies:	None.

Table 6.11: Test Case for valid guardian with children associated handling of the `getChildrenByGuardian()` method.

### 6.3.3 The Unit Tests

All the tests cases have been used to construct the 89 unit tests, which have helped in the development of the library. The tests have been split up into three parts: Initialization, execution, and assertion.

The unit test for the `testAuthenticateProfileWithValidCertificate()` method can be seen in Listing 6.5. The method starts by initializing the environment. This means that a random valid certificate is created and a profile – the expected profile – is entered in the database and the certificate for the profile is set to the newly created certificate.

After the initialization the method is executed and the retrieved profile is stored as the actual profile in order to have some data for the assertion. At the end an `assertEquals` is called to ensure that the expected profile is the same as the actual profile. If this is the case the test passes, otherwise the test fails the two profiles are printed in the test log.

---

```
1 public void testAuthenticateProfileWithValidCertificate() {
2     Random rnd = new Random();
3     StringBuilder cert = new StringBuilder();
4     for (int i = 0; i < 200; i++) {
5         {
6             cert.append((char)(rnd.nextInt(26) + 97));
7         }
8     String certificate = cert.toString();
9     Profile expectedProfile = new Profile("Test", "Profile", null,
10        Profile.pRoles.GUARDIAN.ordinal(), 12345678, null, null);
11     long id = mActivity.helper.profilesHelper.insertProfile(expectedProfile);
12     expectedProfile.setId(id);
13     mActivity.helper.profilesHelper.setCertificate(certificate, expectedProfile);
14     Profile actualProfile = mActivity.helper.profilesHelper.authenticateProfile(certificate);
15     assertEquals("Should return profile; Test Profile", expectedProfile, actualProfile);
16 }
17 }
```

---

Listing 6.5: The `testAuthenticateProfileWithValidCertificate()` method.

The unit test for the `testAuthenticateProfileWithInvalidCertificate()` method can be seen in Listing 6.6. This method also starts by initializing its environment but in this method the created certificate is different. The created certificate consists of chars in the range from 65 - 91 while a valid certificate has a range from 97 - 123. The rest of the initialization is the same as in the valid test and the execution is the same as well. But in this test `assertNull` is used to confirm that there is not retrieved a profile from the database due to an invalid certificate.

---

```
1 public void testAuthenticateProfileWithInvalidCertificate() {
2     Random rnd = new Random();
3     StringBuilder cert = new StringBuilder();
4     for (int i = 0; i < 200; i++) {
5         {
6             cert.append((char)(rnd.nextInt(26) + 65));
```

---

```

7     }
8     String certificate = cert.toString();
9     Profile expectedProfile = new Profile("Test", "Profile", null,
10    Profile.pRoles.GUARDIAN.ordinal(), 12345678, null, null);
11    long id = mActivity.helper.profilesHelper.insertProfile(expectedProfile);
12    expectedProfile.setId(id);
13    mActivity.helper.profilesHelper.setCertificate(certificate, expectedProfile);
14    Profile actualProfile = mActivity.helper.profilesHelper.authenticateProfile(certificate);
15    assertNull("Should return null", actualProfile);
16
17
18
19 }
```

---

**Listing 6.6:** The `testAuthenticateProfileWithInvalidCertificate()` method.

The remaining tests from the test suite have been created in the same manor with an initialization face, an execution face and one or more assertions and the can be seen in the source code of the Oasis App.

### 6.3.4 The Test Results

The overall result for the unit tests are 88 out of 89 tests passed and it can be seen in Figure 6.2.

The test that failed is `testGetChildrenByDepartmentAndSubDepartments()` and the result can be seen in Figure 6.1.

Thinks that last pictures could be put into the appendix

## 6.4 Usability Test

We decided to have a usability test performed on the Oasis App eventhough it was not completed. This gives a unique opportunity to modify the app before it is done.

The approach for the usability test can be found in section 1.8. The questions for this specific usability test can be seen in ??.

### 6.4.1 Results and Observations

The result of the usability test can be seen in Table 6.12 here it can be seen that the are the following number of issues: two cosmetic issues, two serious issues, and one critical issue.

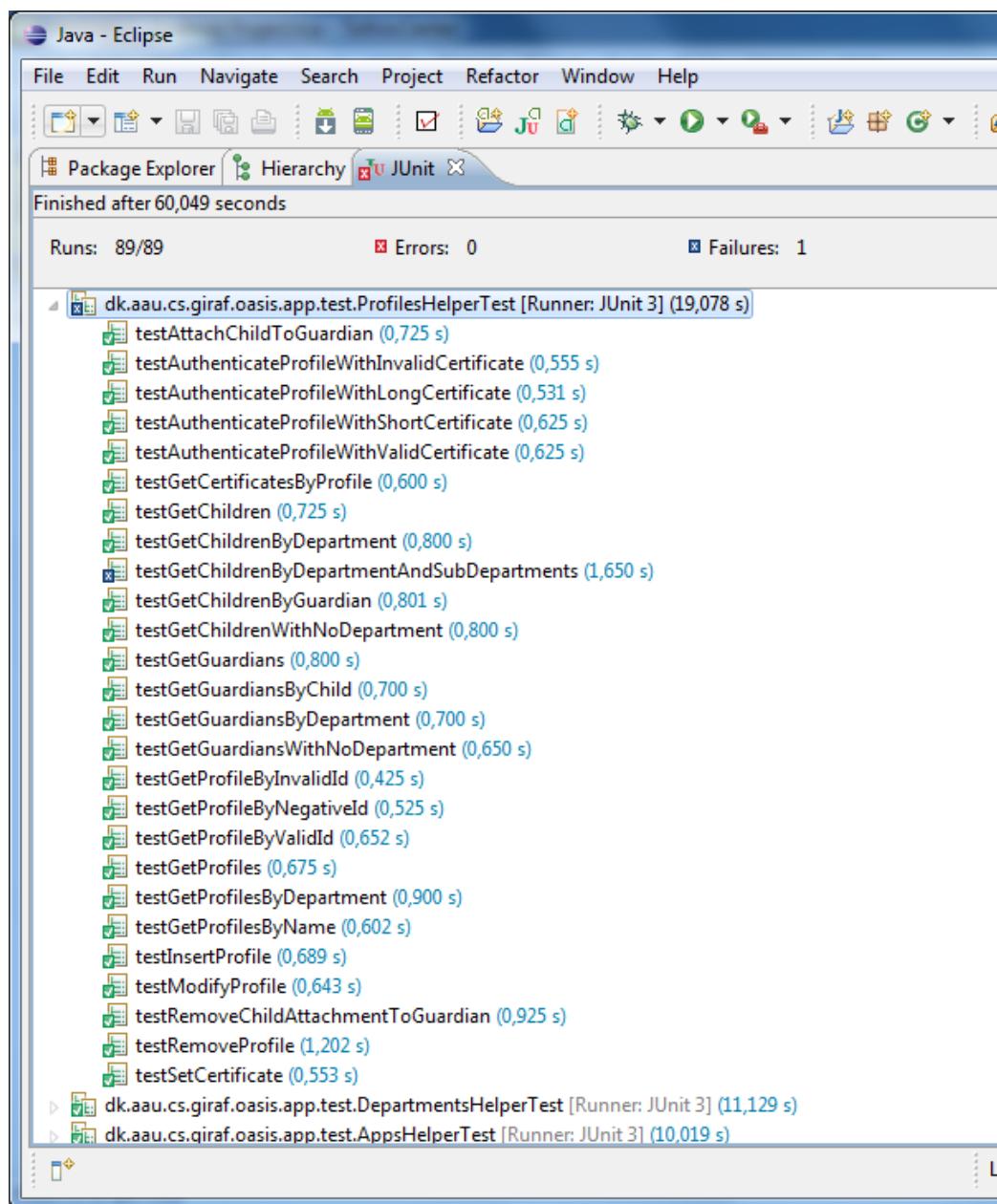


Figure 6.1: The result from the profilesHelper tests.

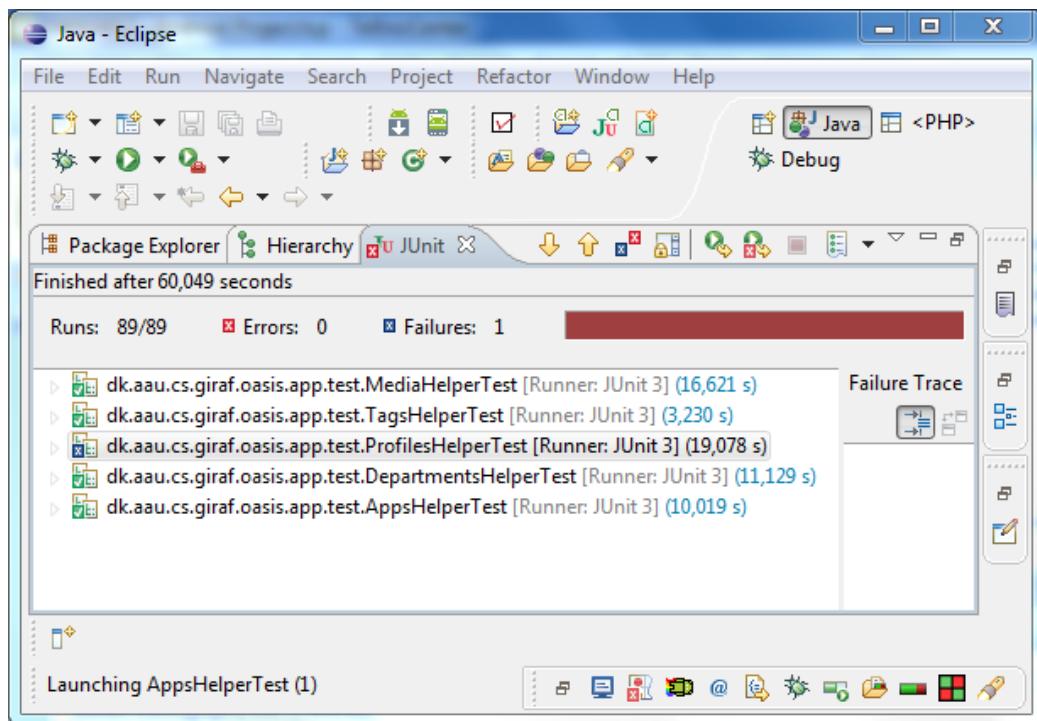


Figure 6.2: The result from all the performed unit tests.

Issues	Description
Cosmetic:	Profile id was showing. "Add child" not clear howto.
Serious:	Too many options, missing the overview. Difficult finding a childs profile.
Critical:	Data availability unclear.

Table 6.12: The issues found in the usability test.

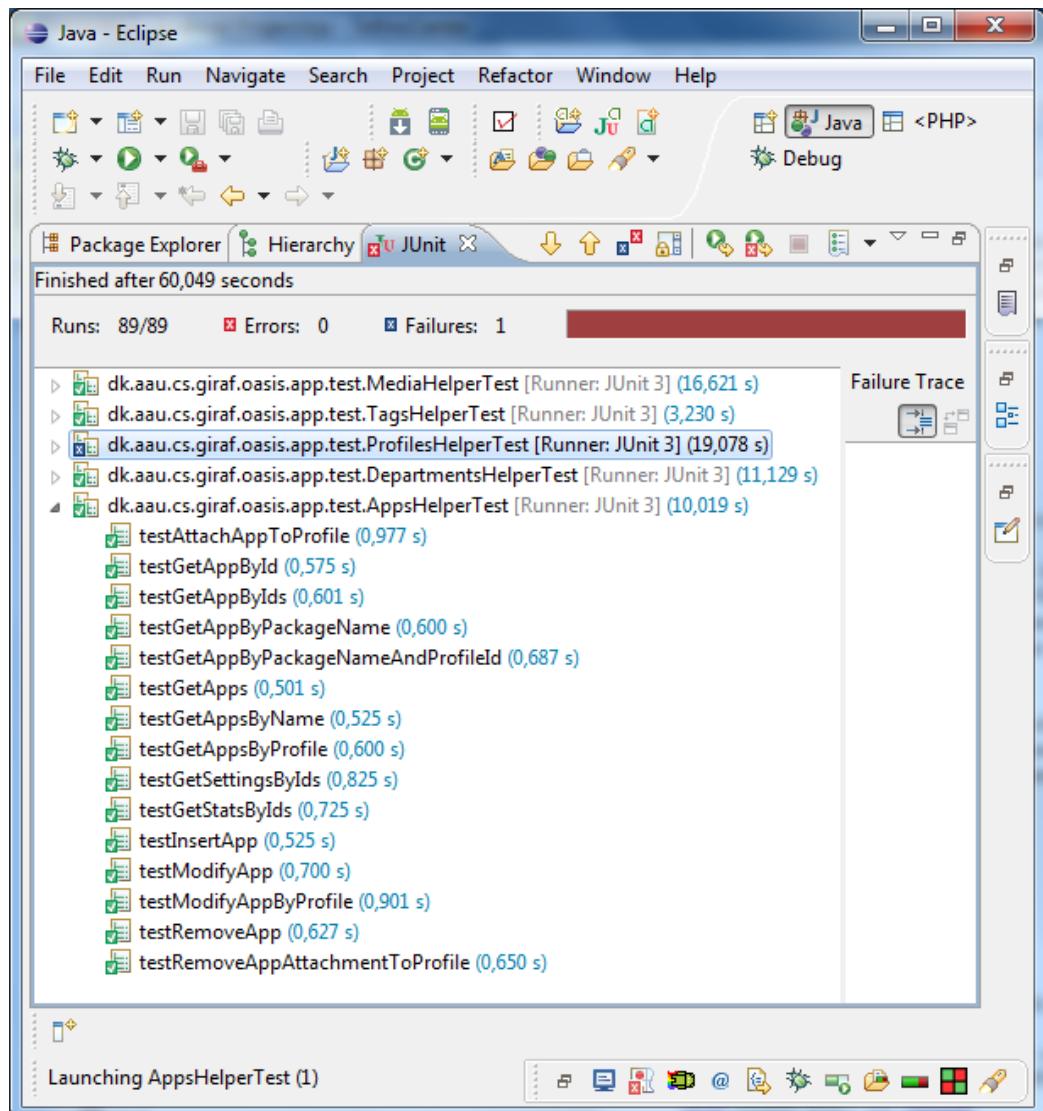


Figure 6.3: The result from the appsHelper tests.

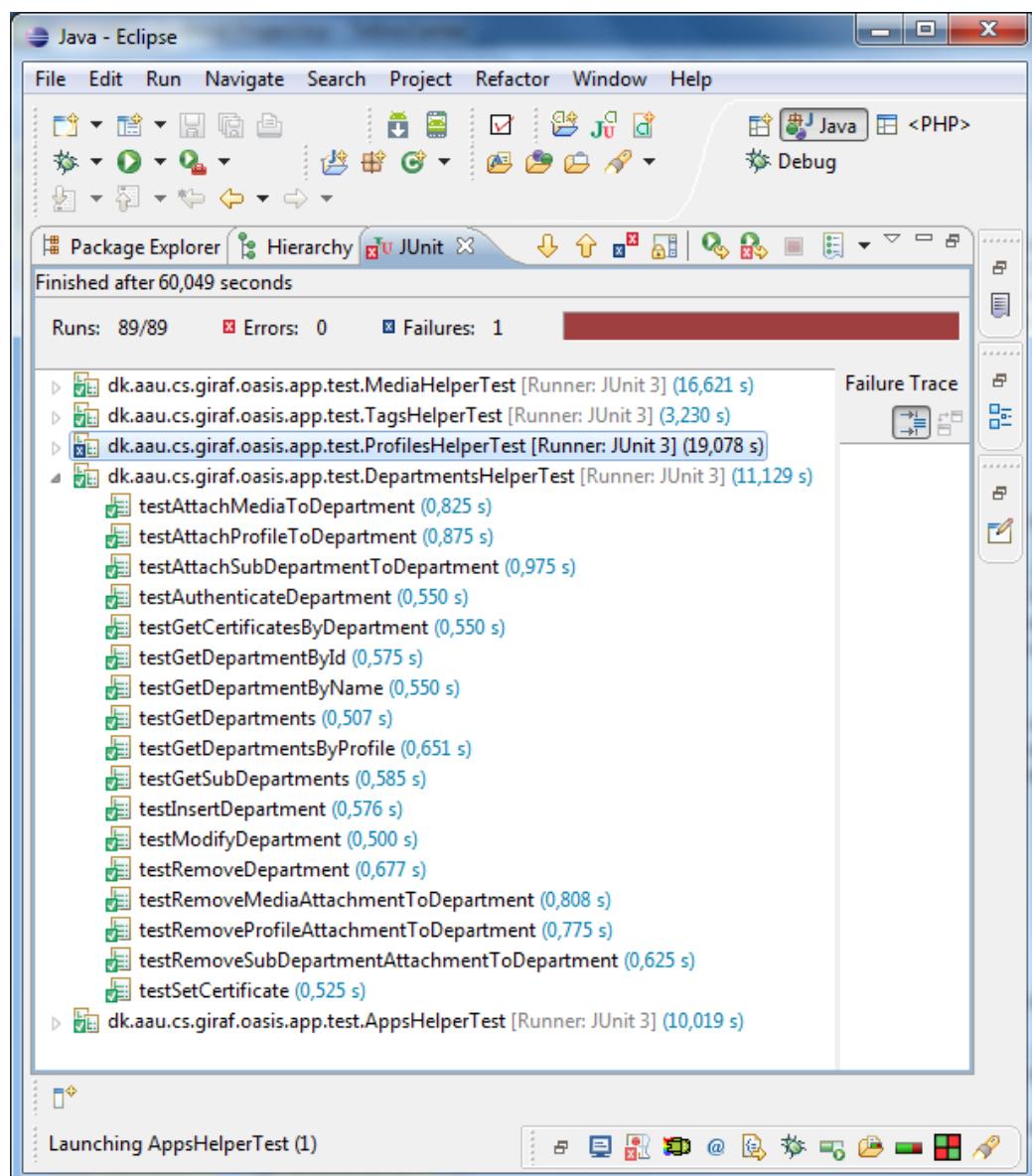


Figure 6.4: The result from the departmentHelper tests.

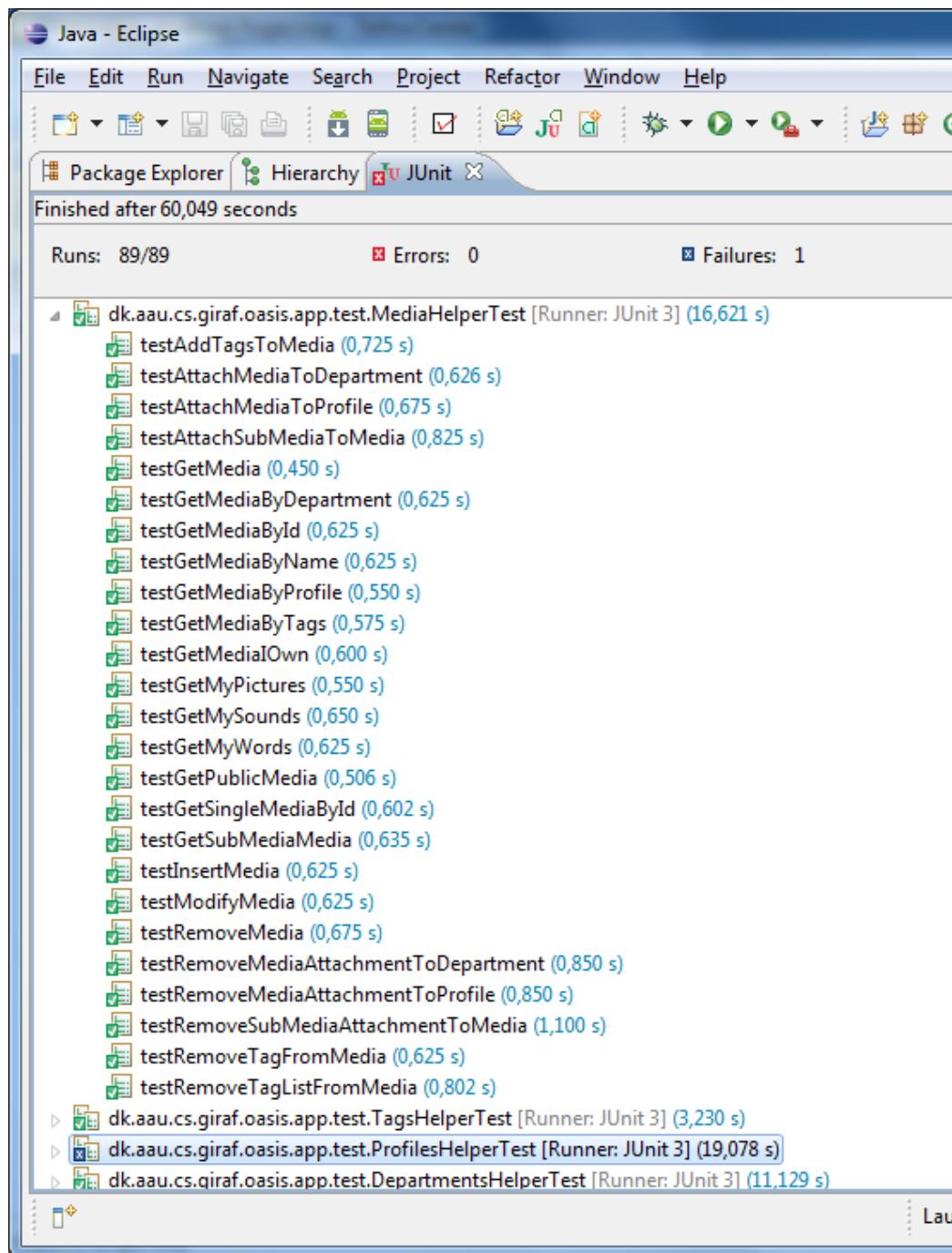


Figure 6.5: The result from the mediaHelper tests.

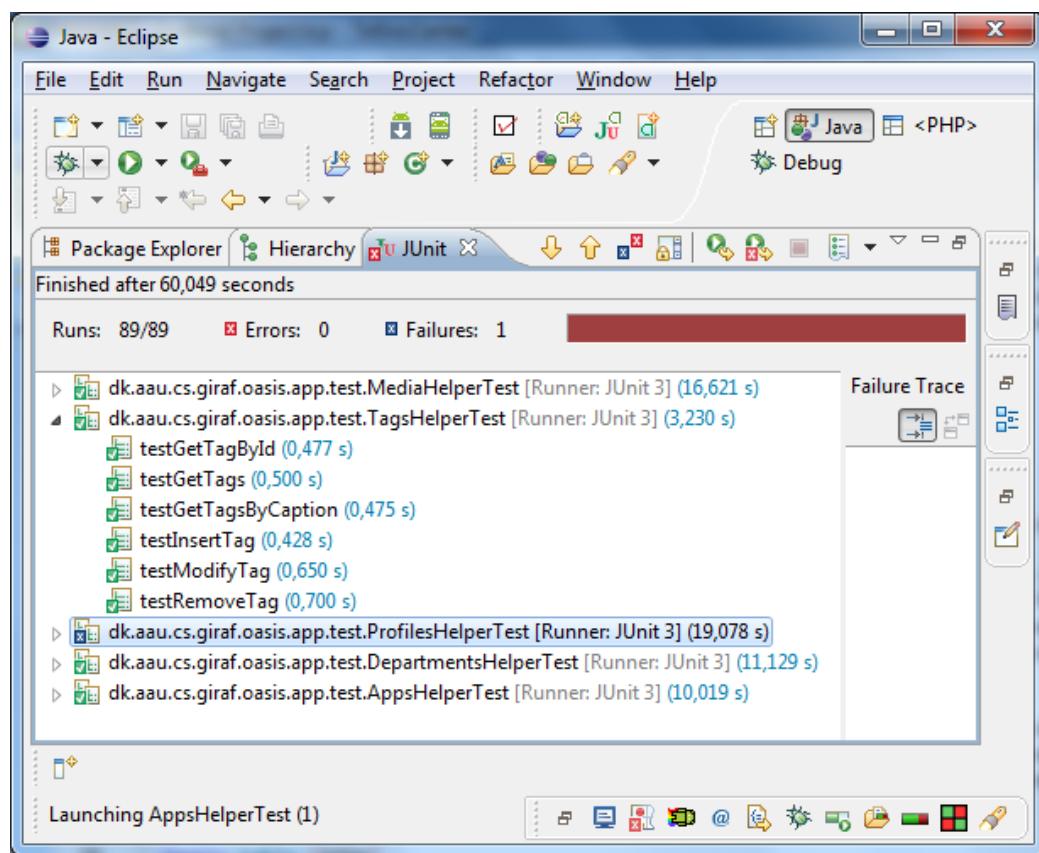


Figure 6.6: The result from the tagsHelper tests.

*Tail*

# **Part IV**

## **Discussion**

*Head*

## 6.5 Conclusion

In this chapter we described the things we concluded along the project. In the whole multi-project we made a problem definition **FIX REF TIL PROBLEM DEFINITION**. The problem definition is as follows:

How can we ease the daily life for children with ASD and their guardians, while complying with the study regulation?

To comply with the study regulations, we have designed and implemented one multi-project called GIRAF. To ensure that every project group has the opportunity to be up to date of the progress of the multi-project, we (the multi-project) agreed on using the same development method **ref til develop afsnit i comon rapport**.

we have designed and implemented an administration module for the GIRAF system. The administration module consists of three parts: a local database, called Oasis Local Db, a library, called Oasis Lib, and an administration application, called Oasis App. The Oasis Local Db ensures that the data is saved correctly. The Oasis Lib ensures that the different applications of the GIRAF system can interact with Oasis Local Db. The Oasis App ensures that the guardians can manage profiles of the GIRAF system, directly on the Samsung Tab.

We began by examine the last year's reports, to check if there was some things we could reuse in the project. After that we examined the possibilities of how to save data on an Android device, which lead us to start working on the architecture of the local database. Along with that we gathered requirements from the other groups to start working on the architecture of the library. When we finished the Oasis Local Db and the Oasis Lib we started working on the Oasis App. The Oasis App shows some of the capabilities of the Oasis Lib, and by the same time give the guardians a possibility on managing the different profiles of the GIRAF system.

To verify the quality of the multi-project, we conducted a usability test. The test subjects consisted of the customers of the multi-project. The test highlighted some issues in the Oasis App, which could be corrected by the next group of developers. **ref til usability test**. Besides that, we made unit tests for our Oasis Local Db. We made the tests at the end of the project period. This should in the future be an ongoing process instead of doing them at the end of the semester. The tests ensures indirectly, that the Oasis Local Db works.

## 6.6 Future Work

A number of tasks did not get completed in this semester. As this project is properly going to be continued by others students, it is not that big of a problem.

### 6.6.1 Server synchronization

One of the main things which did not get completed, due to when the component we needed was available, we did not have more time to implement it, was the synchronization with the server. This can be implemented by using the components which the server group made. This would also make the sync status component in the launcher work. Another improvement which could be implemented in a future continuation of the project, is the ability to synchronize images on the device, and update the paths dynamically.

### 6.6.2 Unit tests

Unit testing is an essential part of the project. We did manage to unit test all the helper classes in the Oasis Lib, but for future work it could be nice to make unit tests for the Oasis Local Db and the Oasis App. This would make the administration module more robust, because every "part" of the module is tested.

### 6.6.3 Certificates

Certificates is one of the core elements in the launcher, and therefore it is also reflected in the Oasis library. A couple of features where not completed for the certificates. The first one, was the possibility to set a time limit on the certificate, so it would have to renew itself after for instance. 7 days. This would make the system more secure, but would rely on the users printing out new QR-codes each week, and the Oasis library to generate new QR-codes each week as well. Another feature which certificates could have made use of, is the possibility to have multiple certificates per user, this would make it possible to have a QR-code for each department a person is in, and thereby only have access to the children in the department in question.

### 6.6.4 Oasis App

The Oasis App shows how the Oasis Lib can be utilized. A couple of changes and improvements could be done. One thing is that the code could use a round of refactoring. This refactoring would lower the amount of classes, because

some the class has the same purpose, but only for a different profile. Besides that the Oasis App is still missing some functionality. The functionality that is missing is: View other guardians profiles, Create new media, Create new apps, and Create and manage settings of the apps and profiles. At last the usability test showed that the Oasis app could use a better visual design to give at better overview of the application.

*Tail*

# **Part V**

# **Appendix**

---

## Appendix

---

### 6.7 Requirements from Wombat

I behøver ikke smide det ind i objekter, da vi har vi allerede lavet objekter til vores data. Hvis vi blot kan få dataen i en eller anden form for array, er det helt fint.

Vi ved ikke helt hvad for noget data der skal gemmes i settings, men vi har forstået på Henrik at man selv kan definere det når man gemmer. Template

Function template Her skriver man funktionen skal kunne Data Her skriver man hvilken data man gerne vil modtage Damer Create

Funktion createAutistSettings Lave multiple Settings der er forbundet til en Autist

Funktion createLastUsedGuardian Lave LastUsed liste der er forbundet til en Guardian Retrieve

Funktion retrieveGuardianAutists Man skal kunne hente Guardian samt alle autister der er linket til denne guardian. Data Guardian Navn på guardian Autister

Funktion retrieveAutistSettings Man skal kunne hente en specifik autist. Data Autist Navn på autist Settings på autist

Funktion retrieveLastUsed Hente LastUsed liste fra en guardian Data Guardian LastUsed Update

Funktion updateAutistSetting Update setting på en bestemt autist

Funktion updateLastUsedGuardian Update en bestemt guardians LastLused Delete

Funktion deleteSettingAutist Slette en setting for en bestemt autist Funktion deleteLastUsedGuardian Slette LastUsed liste på en guardian

## **6.8 Project Backlog**

Here is the full project backlog for the project.

## **6.9 Burndown Charts and Sprint Backlogs**

Here are an overview of all the sprints in this project.

## **6.10 Change Log**

Here is the full change log for the Oasis Library – along with the models used in it – and the Oasis Local Database.

## **6.11 Mail correspondence with Customer**

### **6.11.1 Mail To Customer**

Hej Kristine

Vi er blevet tildelt dig som kontakt person i forbindelse med vores projekt. Som nævnt sidst så arbejder vi på at udvikle applikationer til android, som kan bruges enten af jer som pædagoger og måske af autisterne på sigt. Vi vil udvikle flere forskellige applikationer, og vi vil gerne løbende aftale møder med dig, hvor vi kan vise det samlede produkt som er lavet. På den måde kan vi få feedback på hvad der går godt og hvad der er knap så godt.

Vores udviklings gruppe består af tre personer og vi skal lave en applikation der kan hjælpe med at lave profiler der passer til børnene.

Da vi stadig kun er i gang med at planlægge mener vi ikke at det er nødvendigt at holde et møde endnu. Men vi har nogen spørgsmål som vi gerne vil have dig til at svare på:

#### **Hvilke informationer gemmer i omkring det enkelte barn?**

- Journal nummer?
- Person nummer?
- Navn?
- Alder?
- Særlige behov?

### Oasis Project Backlog

ID	Name	Area	Prioritet	Estimat	Dependency	How to demo	Note	Status
19	Sync with the online database	Server	1	10	Server	Enter data to the local db and sync with the online db. Open the online db and validate that the data is entered.		Not started
27	Oasis app	App	5	30	Oasis lib	Show the app		Done
1	Create table scheme for profiles	Database	5	2	None	CRUD via demo app		Done
2	Create table scheme for media	Database	5	2	None	CRUD via demo app		Done
3	Create table scheme for departments	Database	5	2	None	CRUD via demo app		Done
4	Create table scheme for certificates	Database	5	2	None	CRUD via demo app		Done
5	Create table scheme for a list of apps	Database	5	2	None	CRUD via demo app		Done
6	Create table scheme for apps	Database	5	2	None	CRUD via demo app		Done
7	Create view mode for a profile	Model	3	1	Profile table	CRUD via demo app		Done
8	Create view mode for an app	Model	3	1	Media table	CRUD via demo app		Done
9	Create view mode for a department	Model	3	1	Department table	CRUD via demo app		Done
10	Create a certificate mode	Model	3	1	Certificate table	CRUD via demo app		Done
11	Create a mode for a list of apps	Model	3	1	List of apps table	CRUD via demo app		Done
12	Create view mode for an app	Model	3	1	Apps table	CRUD via demo app		Done
13	Create a profile controller	Controller	4	3	Profile model	CRUD via demo app		Done
14	Create a media controller	Controller	4	3	Media model	CRUD via demo app		Done
15	Create a department controller	Controller	4	3	Department model	CRUD via demo app		Done
16	Create a certificate controller	Controller	4	3	Certificate model	CRUD via demo app		Done
17	Create a list of apps controller	Controller	4	3	List of apps model	CRUD via demo app		Done
18	Create an app controller	Controller	4	3	Apps table	CRUD via demo app		Done
20	Elaborate on the database design	Database	7	10	None	New database schema		Done
21	Update the database tables	Database	10	5	None	CRUD via demo app		Done
22	Update the data models	Model	10	5	Database tables	CRUD via demo app		Done
23	Update the controller	Controller	10	5	Database tables, Data models	CRUD via demo app		Done
24	Database schema	Database	10	5	None	Show the db schema		Done
25	Settings model	Model	8	20	Database tables	CRUD via demo app		Done
26	Settings controller	Controller	8	20	Database tables	CRUD via demo app		Done
30	Run Game Server	Server	100	100	Savannah	Open CS and play		Done
31	Common report	Report	15	5	Earlier sections	Report pdf		Done
32	Update the database tables	Database	10	5	None	CRUD via demo app		Done
33	Update the data models v0.3	Model	10	5	Database tables	CRUD via demo app		Done
34	Update the controller v0.3	Controller	10	5	Database tables, Data models	CRUD via demo app		Done
35	Update and implement the hasControllers in the other helpers	HasControllers	10	10				Done
36	return tagId	TagHelper	15	2				Done
37	attachTagsToMedia removeTagsAttach insertMedia should return tagId	MediaHelper	12	12				Done
38	profilesHelper should handle settings and stats	ProfilesHelper	5	5				Done
39	loc should handle settings and stats	ListOfAppsController	5	5				Done
40	Add some new fields to app model record Update getter/setter	AppModel	20	4				Done
41	Add some new columns to app helper columns insertApp should return appId	AppHelper	20	5				Done
42	Add some columns icon, packageName, activityName to database	App DB	20	5				Done
43	aucUser and cert should have primary key make aRole enum	AuthUsersDB	10	4				Done
44	Refactor local db	Database	12	2				Done
45	Java doc	All	3	3				Done
46	Dummy data	All	20	5				Done
47	Correct comment report	Report	25	10				Done
48	Remove error correction in the library	Library	4	5				Done
49	Add extra functionality to the library	Library	4	5				Done
50	Create report structure	Report	2	10		Read the report		Done
51	Unit tests	Library	15	20		See the result of the test		Done
52	Usability	Oasis app	10	10		See the result of the usability test		Done
53	Report content	Report	5	200		Read the report		Done
54	Improve Oasis App	Oasis app	5	10	Oasis lib	Show app		Not started

Figure 6.7: The burndown chart and sprint backlog from sprint 1.

Oasis Burndown Chart/Sprint1 Backlog

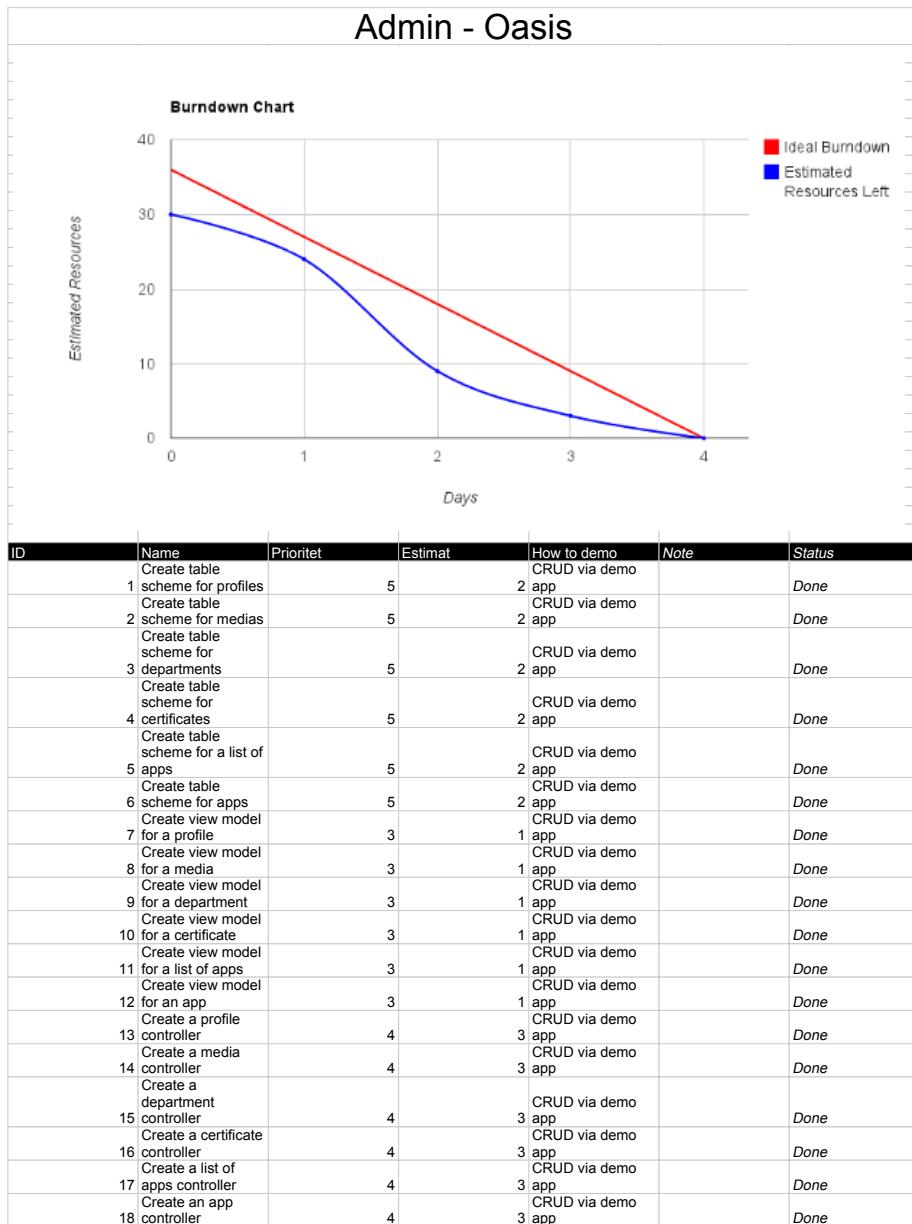


Figure 6.8: The burndown chart and sprint backlog from sprint 1.

Oasis Burndown Chart/Sprint2 Backlog

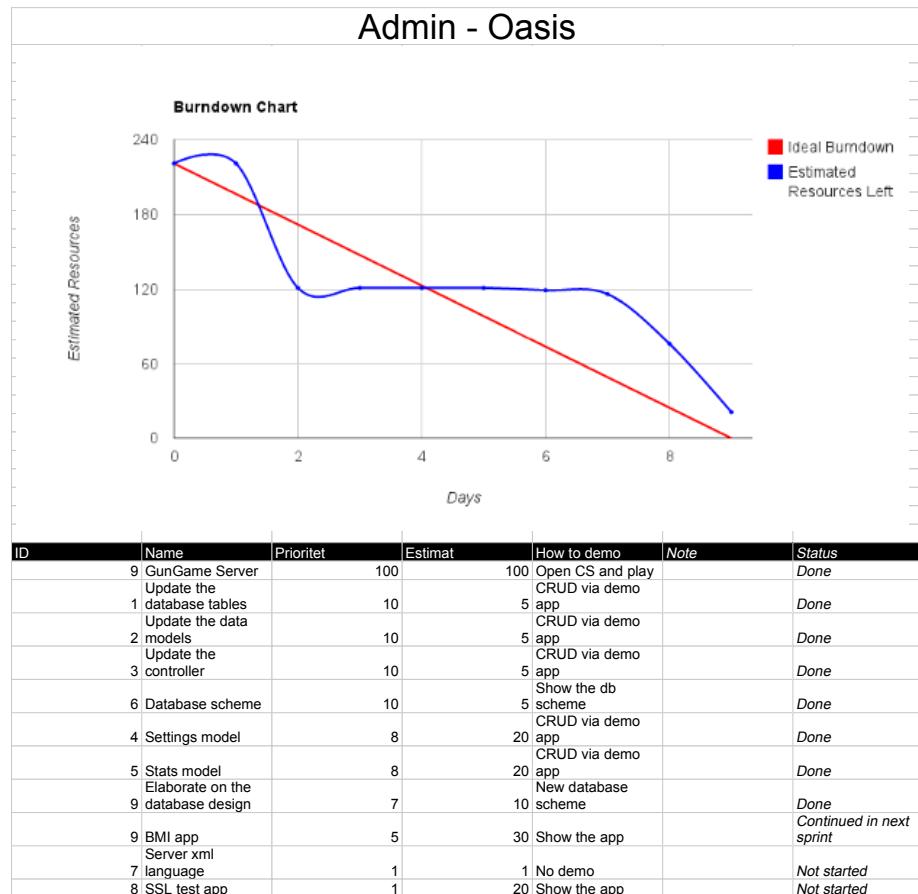


Figure 6.9: The burndown chart and sprint backlog from sprint 2.

Oasis Burndown Chart/Sprint3 Backlog

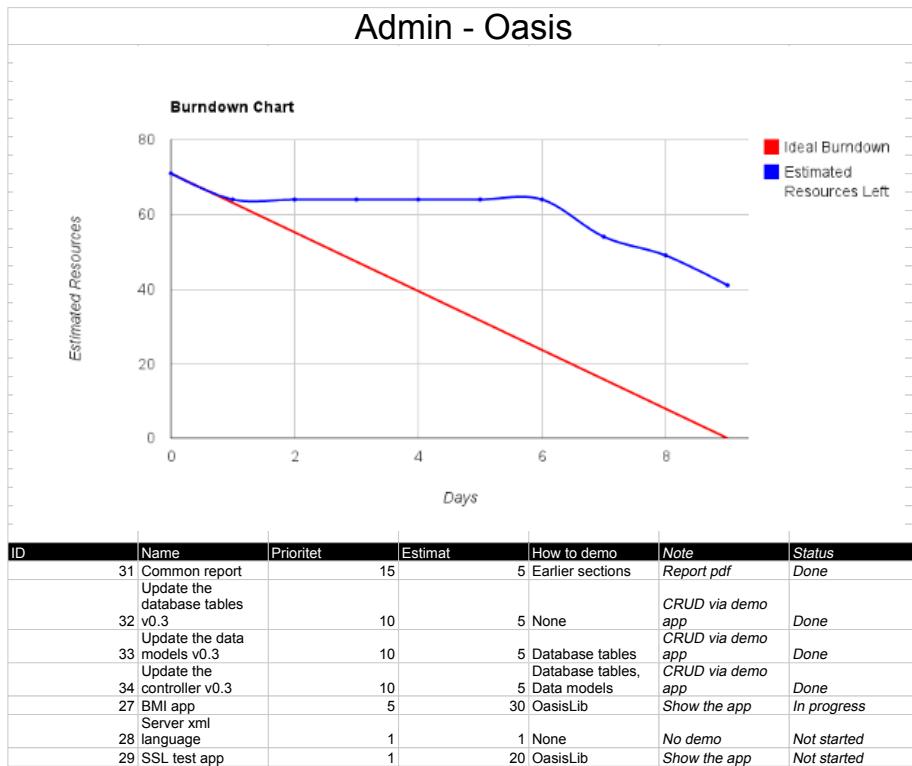


Figure 6.10: The burndown chart and sprint backlog from sprint 3.

Oasis Burndown Chart/Sprint4 Backlog

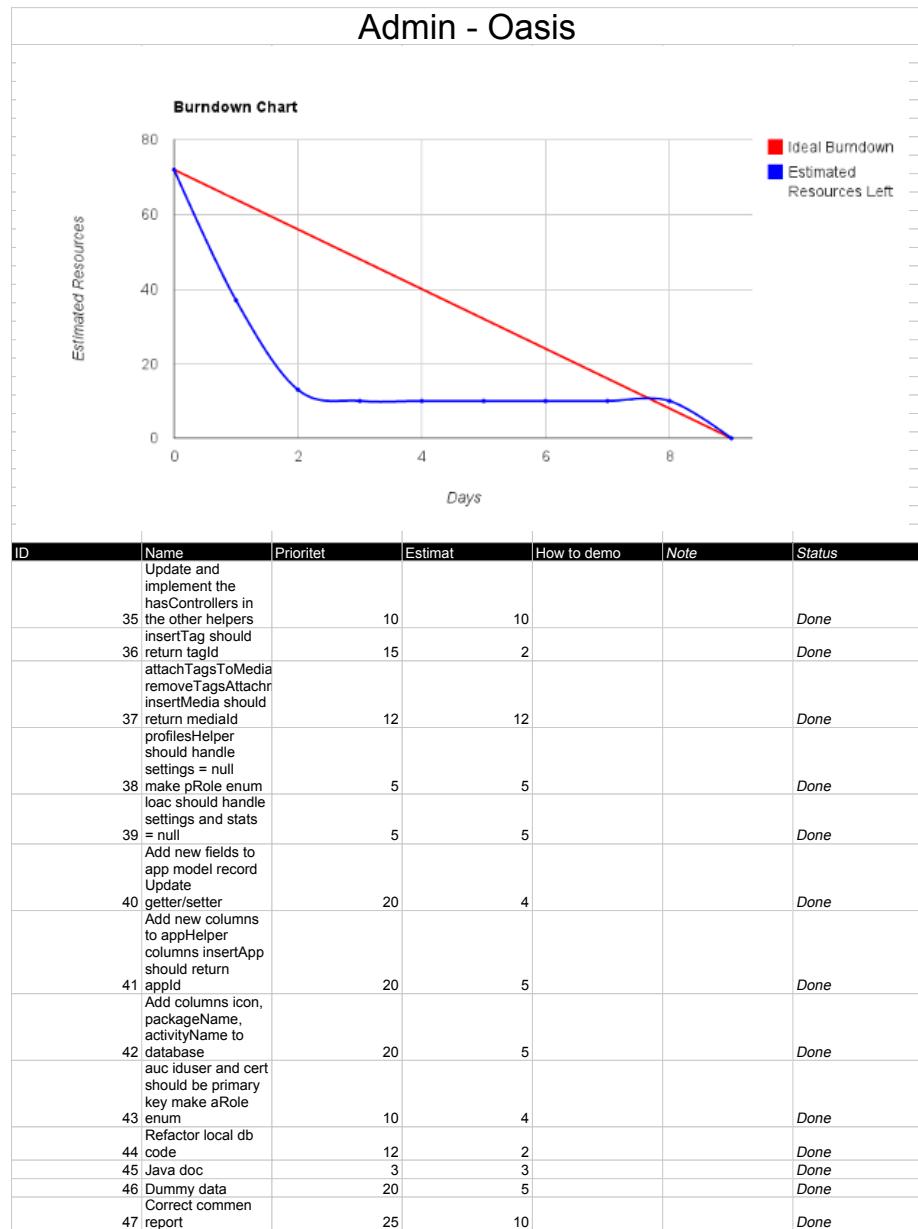


Figure 6.11: The burndown chart and sprint backlog from sprint 4.

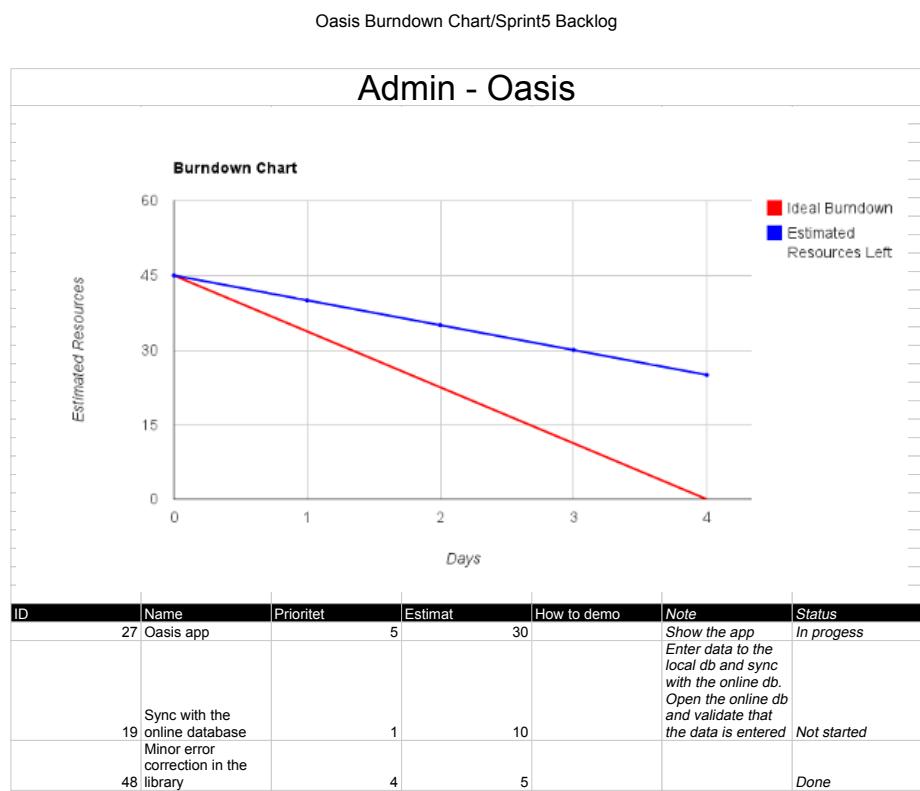


Figure 6.12: The burndown chart and sprint backlog from sprint 5.

Oasis Burndown Chart/Sprint6 Backlog



Figure 6.13: The burndown chart and sprint backlog from sprint 6.

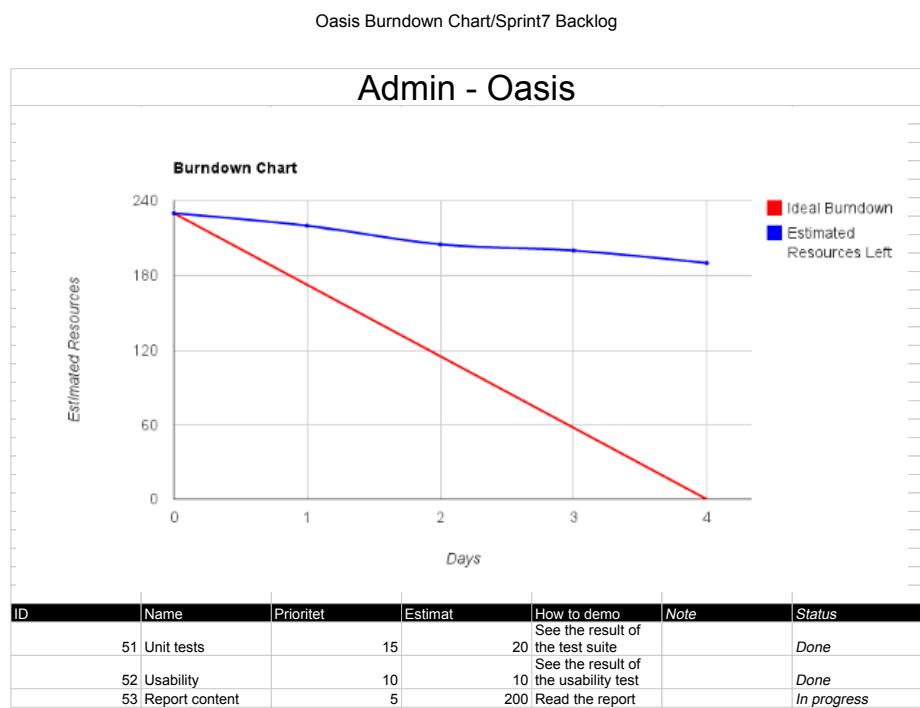


Figure 6.14: The burndown chart and sprint backlog from sprint 7.

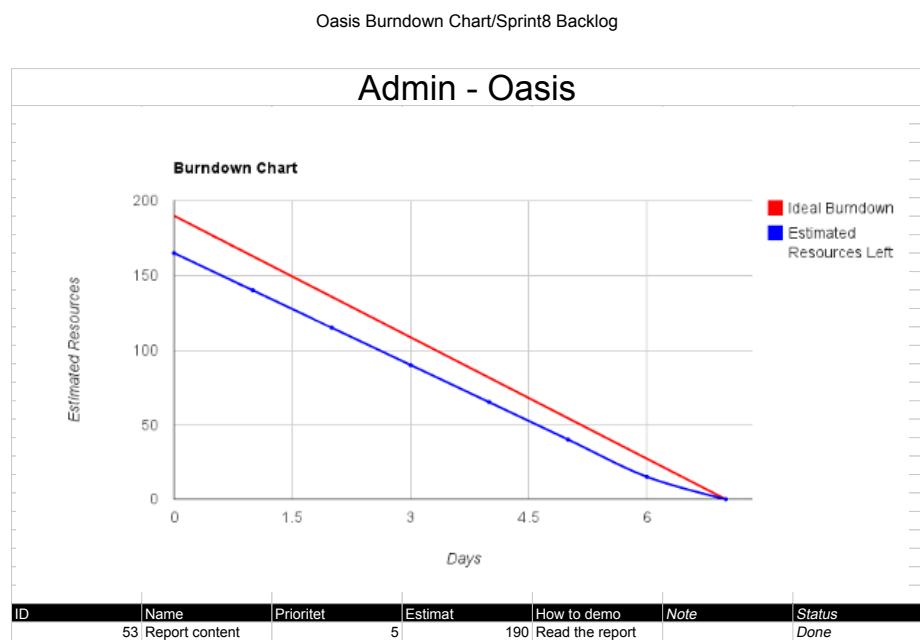


Figure 6.15: The burndown chart and sprint backlog from sprint 8.

# Oasis Changelog

## OasisLib version 0.8

- Minor bug fixed to the controllers

## OasisLib version 0.7

- Minor bug fixed to the controllers

## OasisLib version 0.6

- Controllers
  - Added AppsHelper.removeApp
  - Renamed AppsHelper.modifyAppSettingsByProfile to AppsHelper.modifyAppByProfile
  - Added AuthUsersController.removeAuthUser
  - Added DepartmentsHelper.removeDepartment
  - Added HasDepartmentController.removeHasDepartmentByDepartmentId
  - Added HasDepartmentController.removeHasDepartmentByProfileId
  - Added HasGuardianController.removeHasGuardianByProfile
  - Added HasGuardianController.removeHasGuardian
  - Added HasLinkController.removeHasLinkByMediaId
  - Added HasLinkController.removeHasLinkBySubMediaId
  - Added HasSubDepartmentController.removeHasSubDepartmentBySubDepartmentId
  - Added HasSubDepartmentController.removeHasSubDepartmentByDepartmentId
  - Added HasTagController.removeHasTagByTagId
  - Added HasTagController.removeHasTagByMediaId
  - Added ListOfAppsController.removeListOfAppsByProfileId
  - Added ListOfAppsController.removeListOfAppsByAppld
  - Added MediaDepartmentAccessController.removeMediaDepartmentAccessByMediaId
  - Added MediaDepartmentAccessController.removeMediaDepartmentAccessByDepartmentId
  - Added MediaHelper.removeMedia
  - Added MediaHelper.getMyPictures
  - Added MediaHelper.getMySounds
  - Added MediaHelper.getMyWords
  - Added MediaProfileAccessController.removeMediaProfileAccessByProfileId
  - Added MediaProfileAccessController.removeMediaProfileAccessByMediaId
  - Added ProfilesHelper.removeProfile
  - Added ProfilesHelper.getGuardians
  - Added ProfilesHelper.getChildren
  - Added ProfilesHelper.getChildrenWithNoDepartment
  - Added ProfilesHelper.getGuardiansWithNoDepartment
  - Added ProfilesHelper.getGuardiansByChild
  - Added TagsHelper.removeTag

Figure 6.16: The change log for the library and database.



Bemærk venligst at vi er ikke tester din kendskab til applikationen eller evner med en tablet, men derimod om GIRAF applikationen er nem at bruge, vi har kun interesse i at kende til de svagheder der ville være i applikationen. Dette betyder også at du ikke kan give nogle forkerte svar, da du er eksperterne.

Derfor vil vi gerne invitere dig ud i vores brugervenligheds laboratorie, hvor vi kan studere din brug af applikationen. Under brugervenligheds testen vil du blive givet en række opgaver, som skal udføres. Yderligere vil du blive bedt om at tænke højt og fortælle alle tanker, indtryk og valg du tager ved brug af applikationen under testen. Under testen af applikationen vil der blive optaget både video og lyd, til at studere testen senere.

Dagen kommer til at bestå af:



Vi vil meget gerne høre fra dig hvis du har lyst og tid til at deltage i denne brugervenligheds test, den 22/5 - 2012, på Aalborg Universitet.  
For at vide hvornår på dagen du kan komme vil vi gerne, at du går ind på denne side (<http://www.doodle.com/d2h6swgbtsdf6z2b>) skriver dit navn og vælger det tidspunkt på dagen du helst vil komme, dette er svar nok for at vi ved du gerne vil komme.

Kommentarer og spørgsmål kan sendes retur til den mail invitationen kom fra.

På forhånd tak,  
Android projektet  
Software 6. semester  
Aalborg Universitet  
Selma Lagerlöfs vej 300, 9220 Aalborg



Figure 6.17: Invitation sent to the test persons of the usability test.

### **a - Ur**

- a1. Vil barnet kunne forstå at en hel cirkel kan have forskelligt tidsinterval? a1.1 Eller er det bedst hvis cirklen har et fast tidsrum fx 1 time?
- a2. Hvis man skal måle et tidsinterval på uret, er det så bedst at lade uret efterligne et almindeligt ur med 12 timer eller et stop-ur med kun 1 time?

### **b - Timeglas**

- b1. Vil barnet kunne forstå at det samme timeglas med den samme mængde sand kan varierer i tid?
- b2. Er det bedst at man varierer i mængden af sand i timeglasset eller at man varierer i timeglassets størrelse?

### **c - Aktivitetstid**

- c1. Vil barnet kunne forstå at en linje der går hele vejen hen over skærmen kan varierer i tidsinterval? c1.1 Eller er det bedre hvis linjen har et fast tidsinterval og fx en halv linje derfor svarer til en halv time og en hel linje til en hel time?

### **d - Dagsplan**

- d1. Hvis man laver en visuel dagsplan er det så bedst at man laver et interval som viser tiden imellem to aktiviteter, eller at man viser alle aktiviter i løbet af dagen kombineret med en tidslinje?

## **6.11.2 Mail From Customer**

Hej. Tak for jeres mail. Jeg skal besvare jeres mail så godt som muligt, og så må i give lys hvis i har brug for at jeg uddyber.

Vedr. informationer vedr. barnet: Vi benytter et elektronisksystem som hedder, EKJ, hvor alle oplysninger på børnene er gemt. Det vil sige, pers. nr., adresse oplysninger, indbydelser, handleplaner og referater fra diverse møder.

UR: Hvis det er tydeligt vist at "tiden går" /skiven bliver mindre/forsvinder, som tiden går, vil barnet forstå meningen med uret. For at indikere forskellig tid, kan man benytte forskellige farvet baggrunde. Lilla:5 min. Grøn:10 min osv. Vi benytter kun kortere tidsintervaller,(1. min. 3. min. 5 min. -op til ca. 10-15. min) da 1 time er for abstrakt.

Timeglas: Hvis der er en tydelig markering af tidsintervallet, som beskrevet ovenfor, er det muligt at bruge samme timeglas. Tror det vil give bedst forståelse for barnet, hvis mængden af sand varieres efter tid.

Aktivitetstid og dagsplan: (Tror J) Aktivitetstid kan bruges ved, at tiden bliver

indikeret af mængden af aktiviteter. - Altså 3-5 viste aktiviteter af gangen, og ikke så meget om det er en time eller 15 min. Tiden kunne være en mulighed at tilføre, om nødvendigt. Mange af vores børn har manglende fornemmelse for tid, og ofte har de brug for at se små konkrete sekvenser/beskeder frem for mange over længere tid. Derfor vil jeg tror de bedst kan overskue  $\frac{1}{2}$  dag af gangen, men stadig have mulighed for at have dagen på skemaet, hvor det kan vises i sekvenser.

Jeg har samlet de to ovenstående punkter, da de nemt kommer til at gibe ind i hinanden. Vores ugeskemaer i børnehaven er vist med internationale farver, dem vil i ligeledes kunne benytte til at tydeliggøre ugedagene. Mandag: Grøn, Tir.: Lilla, Ons.: orange, tors.: blå, Fre.: gul, lør.: rød og søndag: hvid.

Håber dette er uddybende nok, ellers må i gerne skrive eller ringe til mig hvis det er nemmere.

Ser frem til at hører fra jer igen.

## 6.12 Notes from Interview

*This is notes from an interview with Mette Als Andreasen, an educator at Birken in Langholt, Denmark.*

Når tiden løber ud (kristian har tage et billede):

Færdig - symbol

Gå til skema - symbol

Taget fra boardmaker

Kunne være godt hvis man kunne sætte egne billeder ind som start/stop symboler.

Rød farve = nej, stop, aflyst.

De har sådan et ur på 60 minutter hvor tid tilbage er markeret med rød, og så bipper den lige kort når den er færdig.

Det ville være fint hvis de kunne bruge sort/hvid til dem der ikke kan håndtere farver, men også kan vælge farver.

Stop-ur:

en fast timer på 60 minutter + en customizable som ikke ser helt magen til ud, som f.eks, kan være på 5, 10 eller 15 minutter for en hel cirkel.

timeglas:

skift farve på timeglassene, men ikke nødvendigvis gøre dem større. Kombinere

med mere/mindre sand. Eventuelt kombinere med et lille digitalt ur, til dem der har brug for det, skal kunne slåes til og fra.

Dags-plan:

ikke særlig relevant til de helt små og ikke særligt velfungerende børn. Men kunne være rigtig godt til de lidt ældre.

En plan går oppefra og ned, og hvis der så skal specificeres noget ud til aktiviteterne, så er det fra venstre mod højre ud fra det nedadgående skema.

Til parrot:

Godt med rigtige billeder af tingene, som pædagogerne selv kan tage, eventuelt også af aktiviteter, så pedagogerne kan have billeder af aktiviter som de kan liste efter skeamet.

Der var mange skemaer rundt omkring, og der henviser det sidste billede i rækken til næste skema, som hænger f.eks. på badeværelset eller i garderoben.

## 6.13 Usability Documents

### 6.13.1 Questionnaires from usability

## Briefing

Goddag og velkommen til denne brugervenlighedsundersøgelse.

Vi vil gerne starte med at takke dig for, at du vil hjælpe os med at gennemføre denne brugervenlighedsundersøgelse. Vi læser op fra dette dokument for at sikre os, at alle personer som deltager i vores studie for samme introduktion. Hvis du har spørgsmål undervejs, er du naturligvis meget velkommen til at stille disse spørgsmål.

Vi har i dette semester bygget et system til Android til at hjælpe børn med autisme og deres pædagoger og forældre, og det er nu nået til et stadiet hvor vi gerne vil teste systemet. Denne test handler udelukkende om at finde problemer og mangler i systemet, og ikke om at teste jeres viden af systemet, så alle tanker I må have om produktet vil vi meget gerne høre.

Før vi starter første del af testen, vil jeg bede dig om at underskrive denne samtykkeerklæring for at sikre, at du er indforstået med rammerne for studiet. Derudover skal du også svare på et demografisk spørgeskema inden testen går i gang.

Testen består af fire dele:

- Test af applikationer (20 min)
- De-briefing og spørgeskema (5 min)
- Test af Administrations applikation og web applikation (20 min)
- De-briefing og spørgeskema (5 min)

Undervejs vil der være en pause.

I de to tests vil du blive stillet en række opgaver som du skal løse. Læs opgaveformuleringen grundigt og fortæl så test hjælperen hvad du mener opgaven går ud på. Derefter skal du forsøge at løse opgaven så godt som muligt. Opgaverne skal løses i den rækkefølge de står således at du starter med opgave 1 og arbejder dig ned af.

Det er meningen at du skal tænke højt mens du løser opgaverne. Dvs. at du siger hvad du har tænkt dig at gøre for at løse opgaven, hvilke ting du synes virker uklare eller komplicerede og hvordan du tror systemet virker. For eksempel vil det være godt hvis du nævner hvad du forventer en knap gør inden du trykker på den.

Når testen er færdig vil der være nogle afsluttende spørgsmål som du skal besvare omkring hvordan du synes testen er forløbet og hvad din opfattelse af systemet er.

Figure 6.18: The document used to brief and de-brief the test persons.

## Usabilitytest - Spørgeskema

1. Hvilket køn er du?

Kvinder  Mand

2. Hvor erfaren vurderer du at du selv er med computerer? (vælg en)

Meget begrænset erfaring  
 Lettere erfaren  
 Forholdsvis erfaren  
 Meget erfaren

3. Har du brugt en tablet før (f.eks. en iPad)?

Ja  Nej

4. Tror du at en tablet med de rigtige programmer vil kunne forbedre din arbejdsgang?

Ja  Nej

5. Tror du at en tablet med de rigtige programmer vil kunne forbedre børnenes hverdag?

Ja  Nej

Hvor let mener du at applikationerne var at bruge?

GIRAF:

- Meget let
- Let
- Middel
- Svær
- Meget svær

Parrot:

- Meget let
- Let
- Middel
- Svær
- Meget svær

Wombat:

- Meget let
- Let
- Middel
- Svær
- Meget svær



Admin:

- Meget let
- Let
- Middel
- Svær
- Meget svær

Hvor let mener du at Web interfacet var at bruge?

- Meget let
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