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Software Engineering 2 Project

Travlendar+

Design Document

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Contents

Table of Contents . . . 3

List of Figures . . . 5

1 Introduction . . . 6
- 1.1 Purpose . . . 6
- 1.2 Scope . . . 6
- 1.3 Definitions, Acronyms, Abbreviations . . . 6
  - 1.3.1 Definitions . . . 6
  - 1.3.2 Acronyms . . . 6
  - 1.3.3 Abbreviations . . . 6
- 1.4 Document structure . . . 6

2 Architectural design . . . 7
- 2.1 Overview: High-level components and their interaction . . . 7
- 2.2 Component view . . . 7
- 2.3 Deployment view . . . 7
- 2.4 Runtime view . . . 7
- 2.5 Component interfaces . . . 7
- 2.6 Selected architectural styles and patterns . . . 7

3 Algorithm design . . . 8
- 3.1 Object class . . . 8
  - 3.1.1 Appointment class . . . 8
  - 3.1.2 Travel class . . . 9
  - 3.1.3 Movement class . . . 9
- 3.2 Algorithms . . . 9
  - 3.2.1 Compute travel . . . 9
  - 3.2.2 View daily schedule . . . 10
  - 3.2.3 Check overlap . . . 11
  - 3.2.4 Check unreachability . . . 11
  - 3.2.5 Check travel alternative . . . 11
  - 3.2.6 Check movement alternative . . . 12

4 User interface design . . . 14
- 4.1 Registration/Login . . . 14
- 4.2 Calendar views . . . 15
- 4.3 Create new appointment . . . 16
- 4.4 Edit existing appointment . . . 17
- 4.5 manage preferences . . . 18
- 4.6 View daily schedule and travel/movement details . . . 19
- 4.7 Buy and control bought tickets . . . 20

5 Requirements traceability . . . 21

6 Implementation, integration and test plan . . . 22
- 6.1 Overview . . . 22
- 6.2 Strategy . . . 22
- 6.3 Dependecies . . . 22

7 Effort spent **25**

List of Figures

1 User Interface: registration and login 14
2 User Interface: calendar views and menu 15
3 User Interface: creation of new appointment 16
4 User Interface: edit of an existing appointment 17
5 User Interface: manage preferences 18
6 User Interface: daily schedule and travel/movement details 19
7 User Interface: buy ticket and 'My tickets' section 20

1 Introduction

1.1 Purpose

1.2 Scope

1.3 Definitions, Acronyms, Abbreviations

1.3.1 Definitions

1.3.2 Acronyms

1.3.3 Abbreviations

1.4 Document structure

2 Architectural design

2.1 Overview: High-level components and their interaction

2.2 Component view

2.3 Deployment view

2.4 Runtime view

2.5 Component interfaces

2.6 Selected architectural styles and patterns

3 Algorithm design

In the following paragraph are presented the most relevant and significant algorithm used in Travlendar+ application. More specifically are described the following algorithm:

- Compute travel;
- View daily schedule;
- Check appointments overlapping;
- Check appointments unreachability;
- Check travel alternatives;
- Check movement alternatives;

The application is written in Java, but the algorithms are shown in pseudocode.

3.1 Object class

Before to explain the algorithms details, it is needed to introduce the class Appointment, Travel and Movement that are the most important entities for the whole application.

3.1.1 Appointment class

The class Appointment has as attributes:

- The appointment name;
- The date;
- The start time;
- The place of arrival;
- The expected time of arrival;
- The appointment duration;
- The associated travel to reach the appointment;

Here the appointment class written in Java:

```
public class Appointment {

        String name;
        Date date;
        Time time;
        Place place;
        Time arrivalTime;
        Time duration;
        Travel travel;
}
```

3.1.2 Travel class

The travel class has the following attributes:

- The related appointment;
- The departure point;
- The destination point;
- The desired time to leave;
- The movements list in which the travel is split;

Here the travel class written in Java:

```
public class Travel {

        Appointment appointment;
        Place placeOfDeparture;
        Place placeOfArrival;
        Time departureTime;
        ArrayList<Movement> movements;
}
```

3.1.3 Movement class

The movement class has the following attributes:

- The departure point;
- The destination point;
- The estimated time;
- The time of departure;

Here the movement class written in Java:

```
public class Movement {

        Place placeOfDeparture;
        Place placeOfArrival;
        Time estimatedTime;
        Time timeOfDeparture;
}
```

3.2 Algorithms

3.2.1 Compute travel

The function computeTravel is used to create a new travel for a specific appointment. The followed procedure is composed by four steps:

1. Read the different information from the appointment passed as parameters.

2. Call the function queryMaps. this uses Google Maps API to compute the travel, the response is JSON object and the function parse this and extracts all information related to the computed travel.

3. For each steps, which put together with the other steps produces the travel, is created a new Movement and it is added to MovementList presents in Travel class.

4. Call the function computeWeatherCondition, that with specific API can compute the weather condition, and if the travel includes some walking or bicycling movement and it is expected 'rain', the system shows to the user a message.

```
function COMPUTETRAVEL(appoinment)
    READ(appointment.departure)
    READ(appointment.destination)
    READ(appointment.date)
    READ(appointment.beginTime)
    READ(appointment.travelPreferences)
    travel = QUERYMAPS(departure,destination,travelPreferences)
    for all movement detected in travel do
        createdMovement = CREATEMOVEMENT(movement)
        ADDTOMOVEMENTLIST(createdMovement)
    end for
      weather = COMPUTEWEATHERCONDITION(departure,destination, date, time)
    if wheater is 'rain' and ( (travelPreferences is 'green') or (exists one movement : movementType
is 'walk' or 'bike') ) then
        NOTIFYUSER("Rain expected, not reccomended use of bike or walks")
    end if
end function
```

3.2.2 View daily schedule

When the user clicks on view daily schedule button, the system computes the daily schedule through this function and show to the user all appointments expected for the selected day and all travel to reach them. This method has only one parameter, the day desired to compute the schedule.
The function is composed by four steps:

1. Extract first appointment expected in the selected day (appointment-i) and check its unreachability.

2. Extract the second appointment (appointment-i+1) and check its unreachability.

3. If both appointments are reachable then it is necessary to check the overlapping between them.

4. If all controls are successfully passed then it is possible to compute the travel for the appointment-i.

5. Go on with the next appointment and repeats the loop until all appointments are examinated.

```
function VIEWDAILYSCHEDULE(day)
    for all appointment in day do
        if CHECKUNREACHABILITY(appointment-i) is unreachable then
            MANAGEUNREACHABILITY(appointment-i)
        end if
    end for
    if CHECKUNREACHABILITY(appointment-i+1) is unreachable then
        MANAGEUNREACHABILITY(appointment-i+1)
    else if CHECKOVERLAP(appointment-i, appointment-i+1) is overlap then
```

```
            MANAGEOVERLAP(appointment-i,appointment-i+1)
        end if COMPUTETRAVEL(appointment-i) INCREMENT(i)
    end function
```

3.2.3 Check overlap

When the system has to check the overlapping between two appointments invokes this function that has as parameter the two appointments. The function controls which appointment starts before and then controls if the begin time of the second appointment overlaps with end time of the first appointment.

```
function CHECKOVERLAP(app1, app2)
    if app1.beginTime is before of app2.beginTime and (app2.beginTime is before (app1.beginTime + app1.duration)) then
        return overlap
    else if app1.beginTime is before (app2.beginTime + app2.duration) then
        return overlap
    end if;
    return no overlap
end function
```

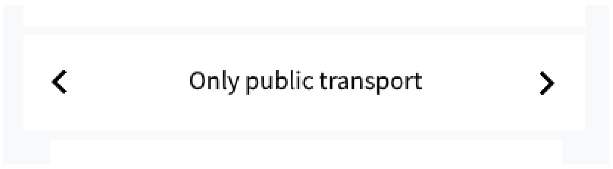
3.2.4 Check unreachability

This function checks the unreachability of one appointment passed as parameter. To check the unreachability it is necessary to control if the arrival time of one appointment is compatible with departure time added to estimated travel time.

```
function CHECKUNREACHABILITY(appointment)
    if appointment.arrivalTime is before (appointment.departureTime + travel duration) then
        return unreachable;
    else
        return reachable;
    end if
end function
```

3.2.5 Check travel alternative

The user can check all available travel alternatives and modify the actual one with another. This is possible switching the different alternatives.



The function checkTravelAlternative reads the selected alternative and computes the travel with the inserted TravelType.
View more detailed these steps:

1. There is a control on a travel type selected from the user and there are two possible cases:
    (a) 'only-own-car' or 'only-public-transport' or 'green: when one these travel type is selected, it is created a new travel alternative based on related travel mode (driving for only-own-car, transit for only-public-transport and bicycling for green).

   (b) 'faster' or 'cheaper': in this case, it is created a set that contains all possible travel computable.

2. Then it is selected the travel alternative:

   (a) In case of cheaper or faster travel, it is necessary to find among all computed travels the cheaper or the faster.

   (b) In other cases, return the only one alternative computed.

```
function CHECKTRAVELALTERNATIVE(travel, travelType)
    if travelType is 'only-own-car' then
        compute driving travel alternative
    else if travelType is 'only-public-transport' then
        compute transit travel alternative
    else if travelType is 'green' then
        compute bicycling travel alternative
    else if travelType is 'faster' or travelType is 'cheaper' then
        compute a set of differents travel alternatives
    end if
    if travel alternative exists then
        if travelType is 'faster' then
            find faster travel in the computed set and return it
        end if
        if t thenravelType is 'cheaper'
            find cheaper travel in the computed set and return it
        end if
        return the travel alternative found
    end if
end function
```

3.2.6 Check movement alternative

When the user views a movement details and clicks on a "means icon" from the bar, the system calls this function that read the movement type selected and computed the relative movement.
If the user selects 'car-sharing' or 'bike-sharing' it is added a new movement to reach the car or bike.

```
function CHECKMOVEMENTALTERNATIVE(movement, movementType)
    if movementType is 'car' then
        compute driving movement
    else if movementType is 'walk' then
        compute walking movement
    else if movementType is 'public-transport' then
        compute transit movement
    else if movementType is 'bike' then
        compute bicycling movement
    else if movementType is 'car-sharing' then
        compute walking movement to reach the car
        add a further driving movement
    else if movementType is 'bike-sharing' then
        compute walking movement to reach the bike
        add a further bicycling movement
    end if
    **if** computed movement exists **then**
        **return** movement alternative
    **end if**
**end function**
```

4 User interface design

4.1 Registration/Login

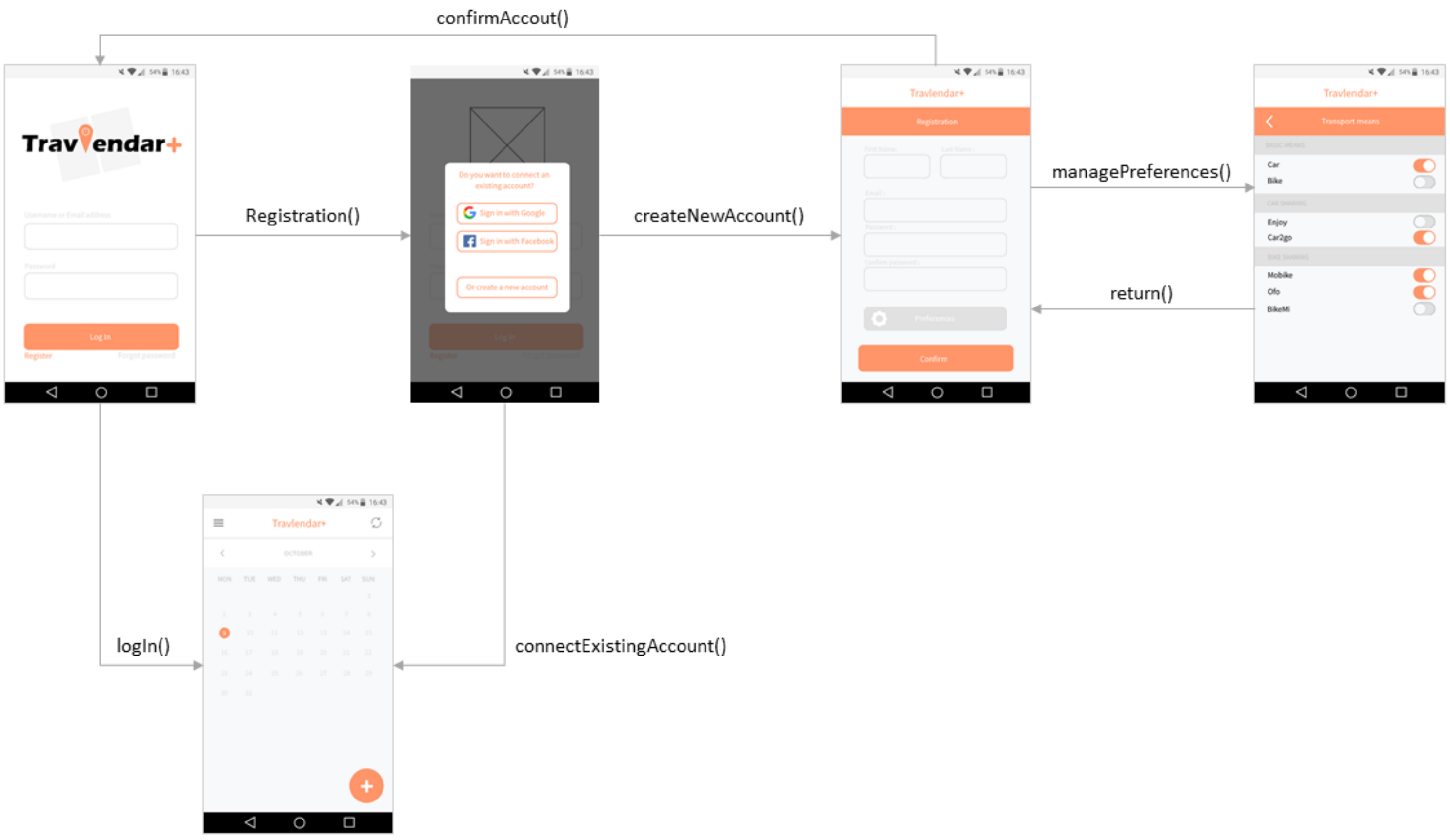


Figure 1: User Interface: registration and login

4.2 Calendar views

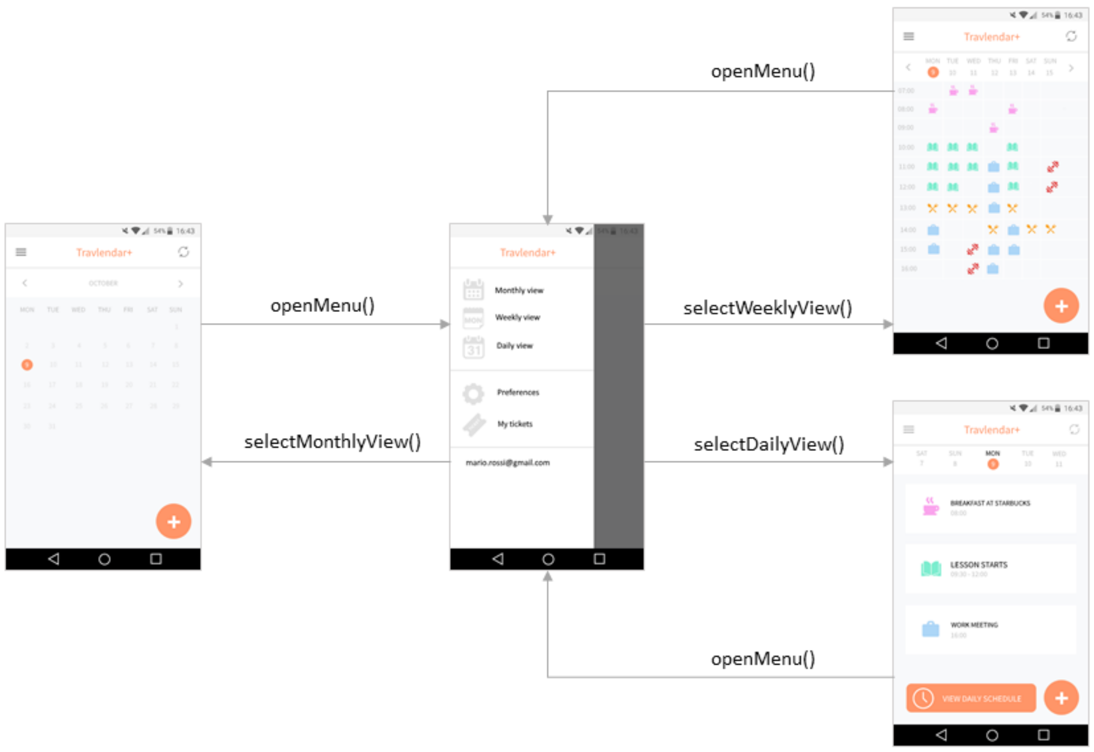


Figure 2: User Interface: calendar views and menu

4.3 Create new appointment

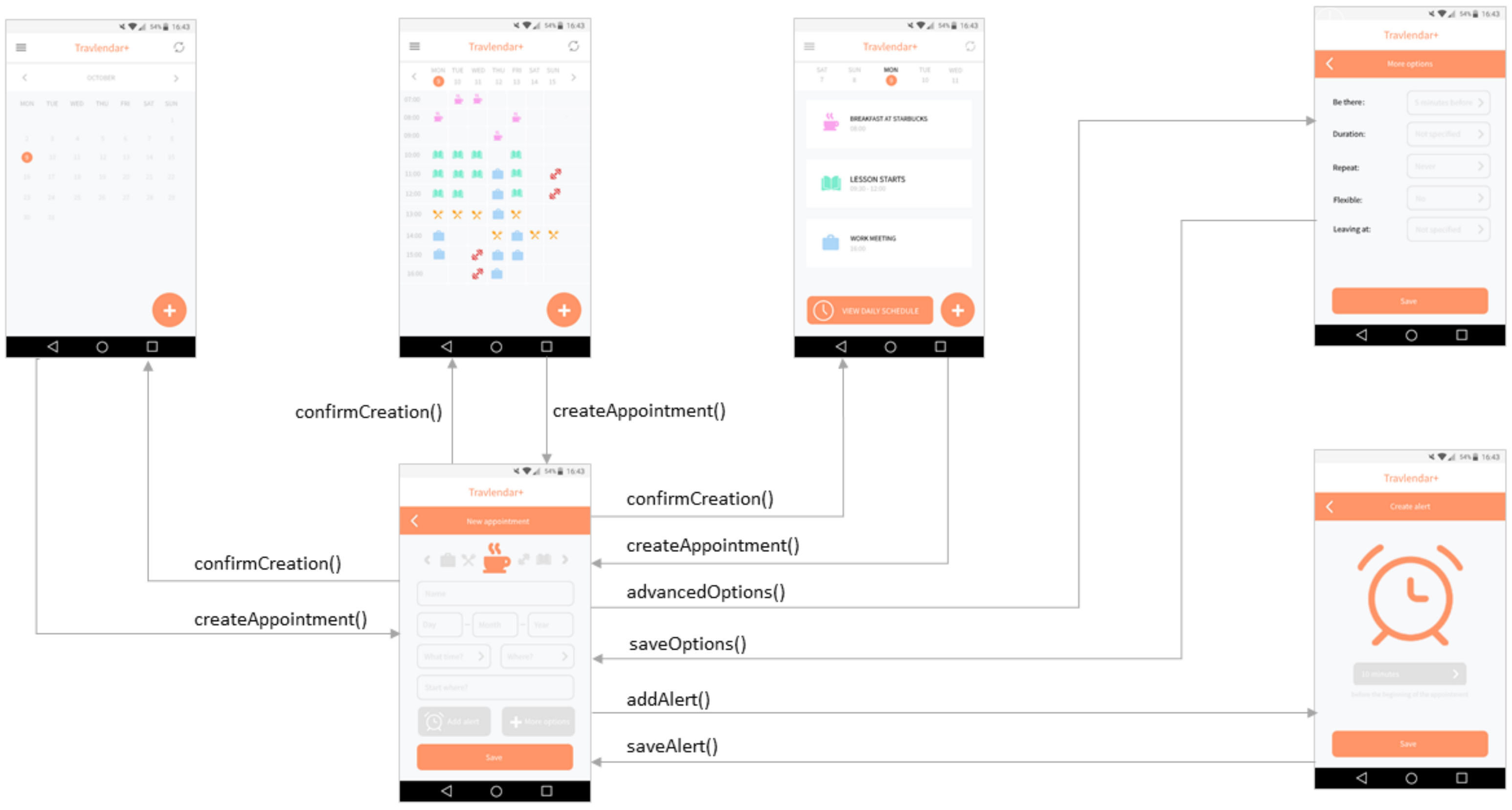


Figure 3: User Interface: creation of new appointment

4.4 Edit existing appointment

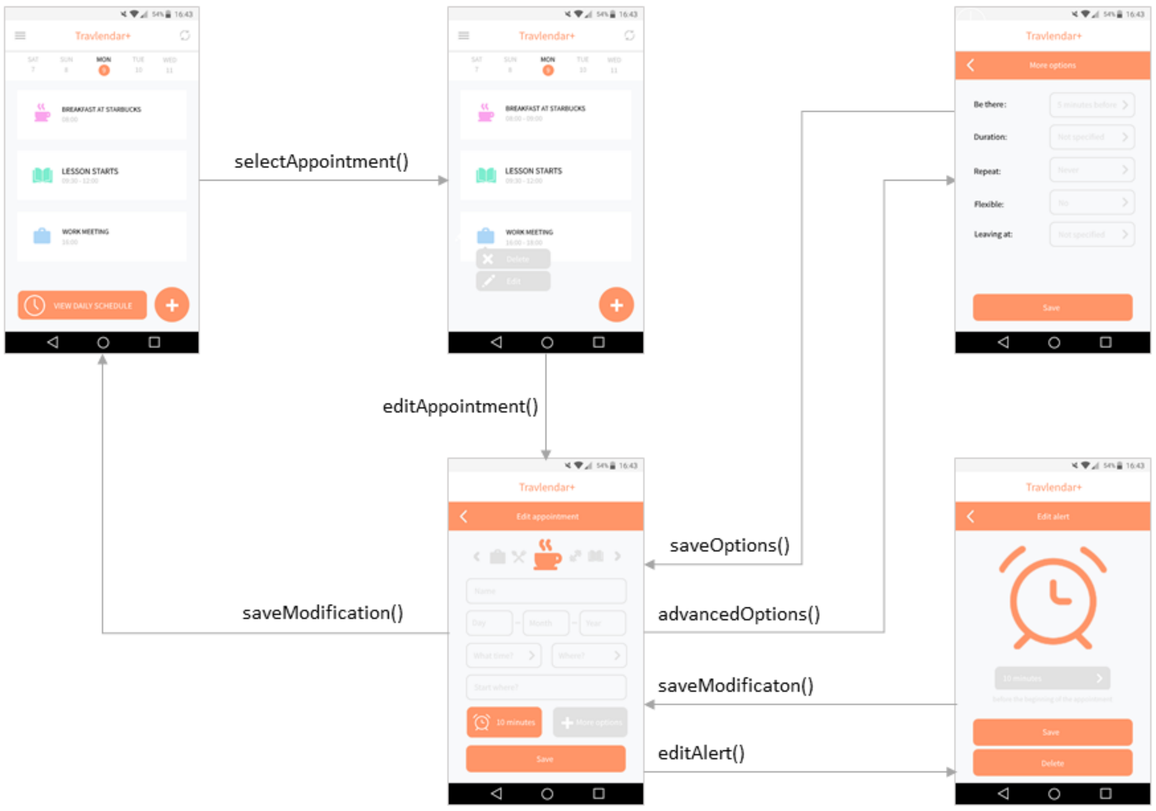


Figure 4: User Interface: edit of an existing appointment

4.5 manage preferences

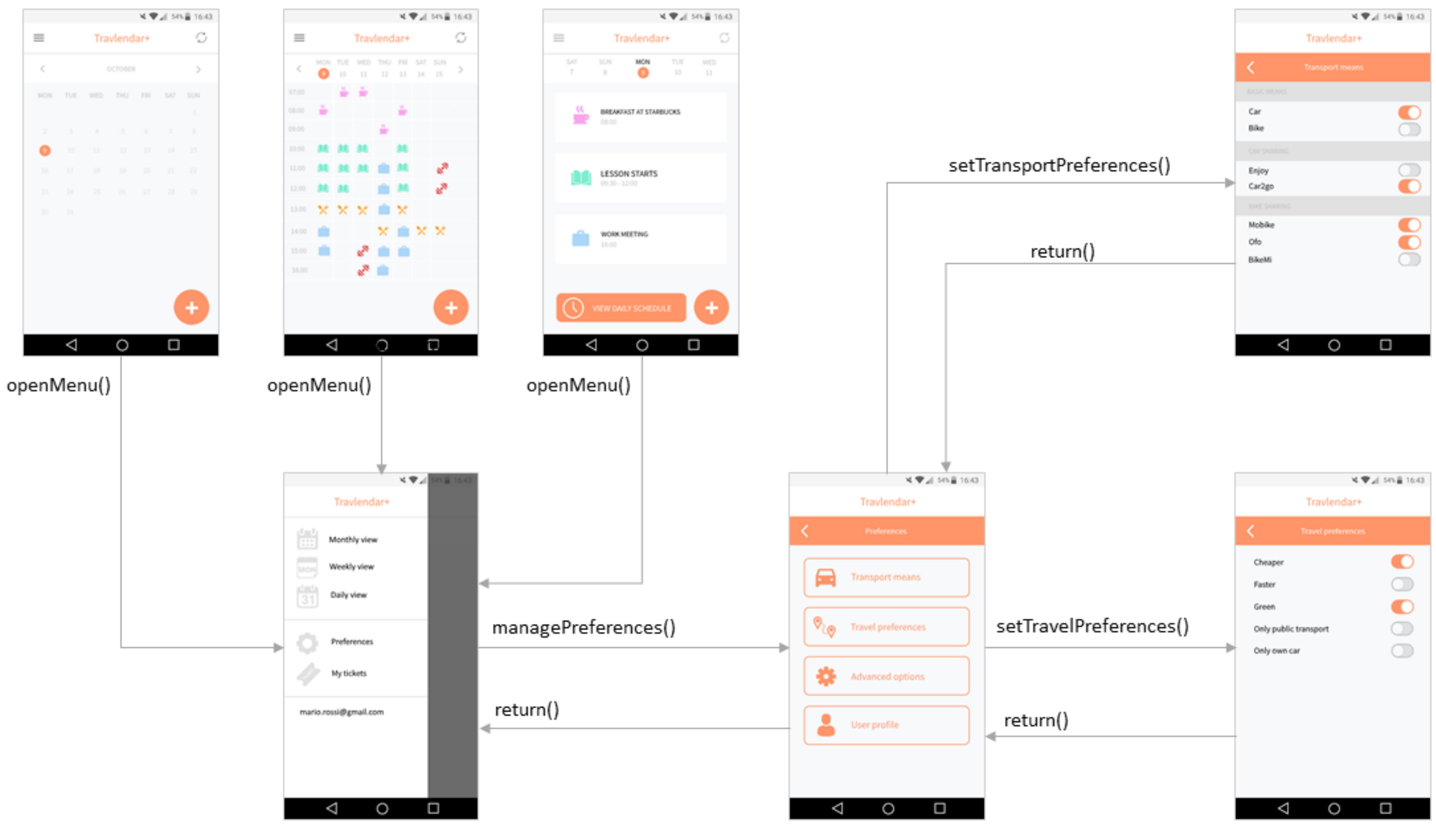


Figure 5: User Interface: manage preferences

4.6 View daily schedule and travel/movement details

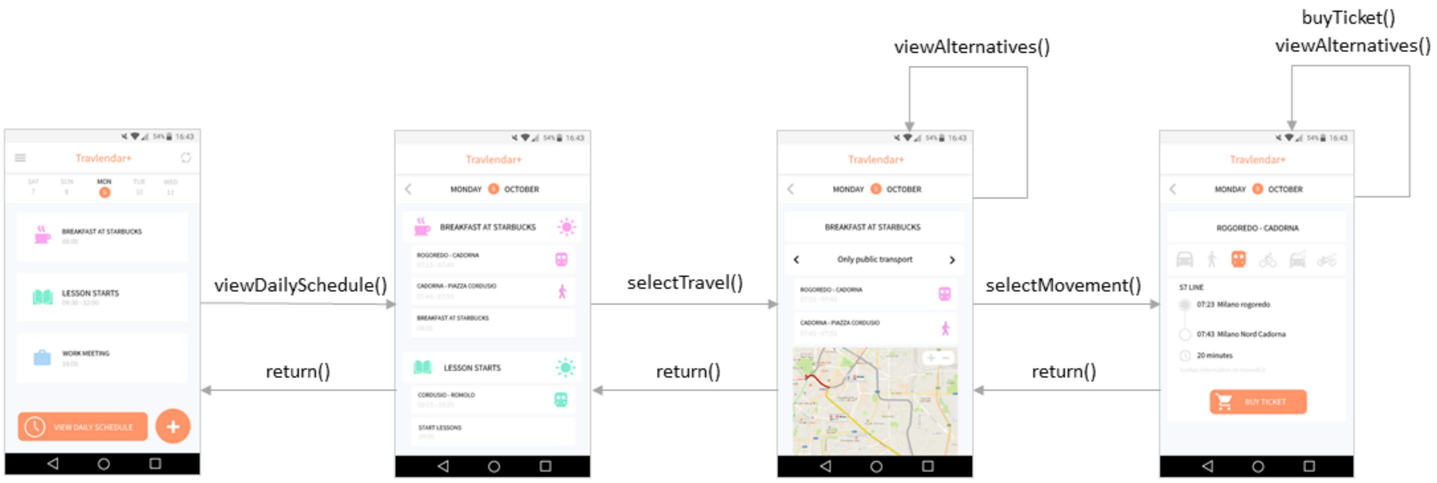


Figure 6: User Interface: daily schedule and travel/movement details

4.7 Buy and control bought tickets

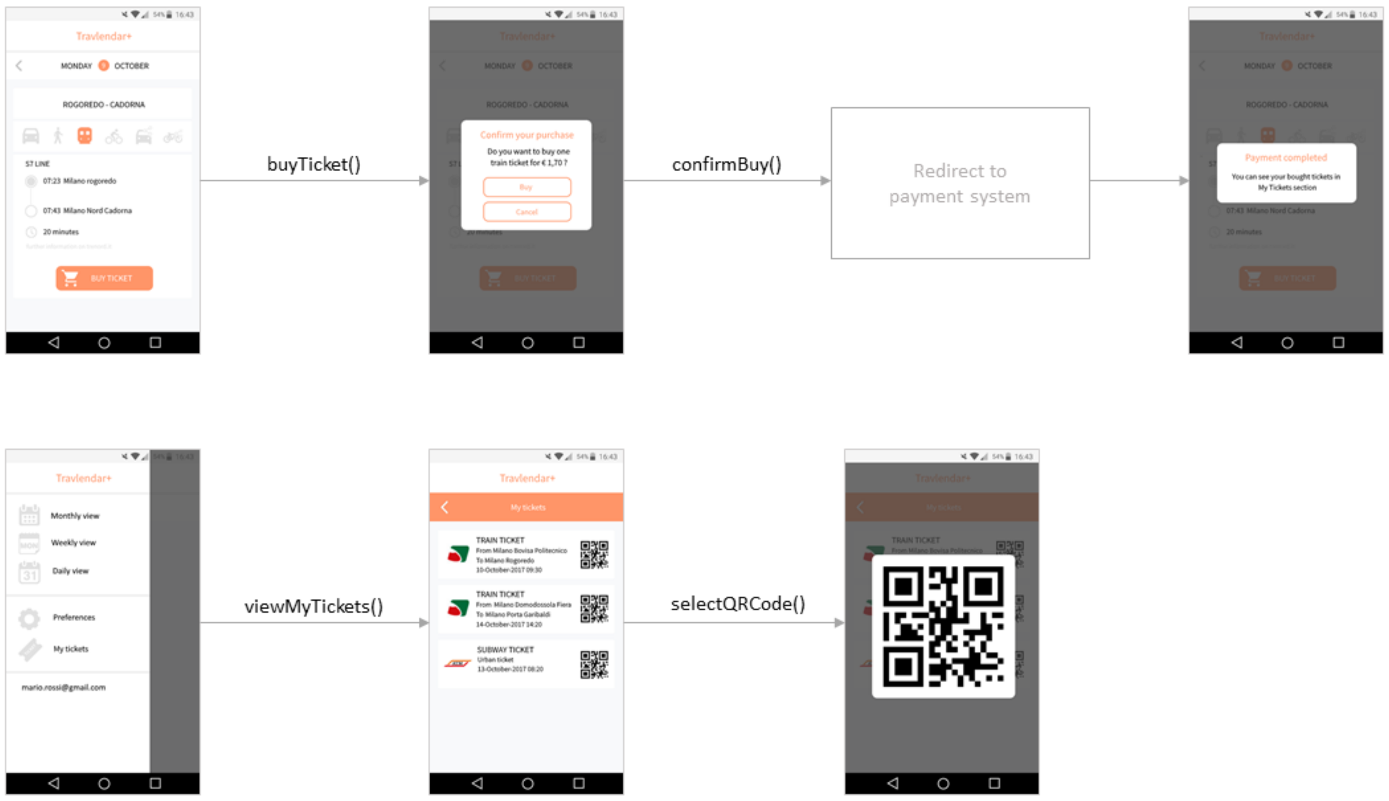


Figure 7: User Interface: buy ticket and 'My tickets' section

5 Requirements traceability

6 Implementation, integration and test plan

6.1 Overview

As explained in the RASD and DD documents, the system requires the following components to be fully developed and working:

- **Travlendar+ mobile application, working on Android v 4.0.3 and later;**
- **JBoss 7.0.1 Java Server, running the Travlendar+ application services;**
- **MySQL 5.7.19 DBMS for users data managing;**

Furthermore, the Travlendar+ application services component is composed by the following subsystems, wich must be developed and correctly integrated:

- **Appointment manager**, which makes use of Calendar APIs and requires DBMS connection;
- **Travel manager**, which implements Weather and Maps APIs;
- **Account manager**,
- **Tickets manager**,

Finally, the following connection must be implemented and full working:

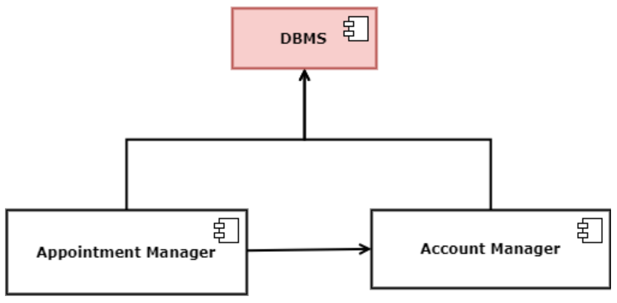
- **Remote Method Invocation** connection between client and application server, using JRMP protocol;
- **JDBC** connection between application server and DBMS.

6.2 Strategy

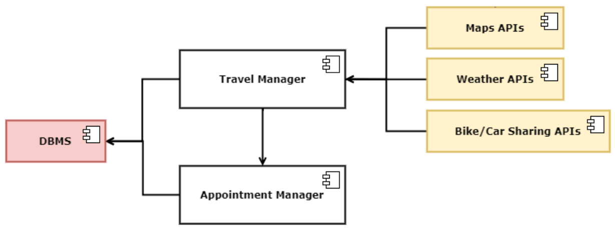
In order to guarantee observability and efficacy, the testing strategy follows an incremental integration logic. The chosen approach is bottom-up: this choice allows us to gradually build the system and continuously provide feedbacks as soon as the single parts are finished. Our goal is to first develop subcomponent that are able to work independently and do not require connections with other parts of the systems. Then, once that all sub-components are fully developed and tested, we plan to proceed in connecting them and fulfill the dependencies to implement gradually the main super-component functions. Final part of the integration will require the main component to be full working and tested, and consists in testing the correct working of connections between main-components.

6.3 Dependecies

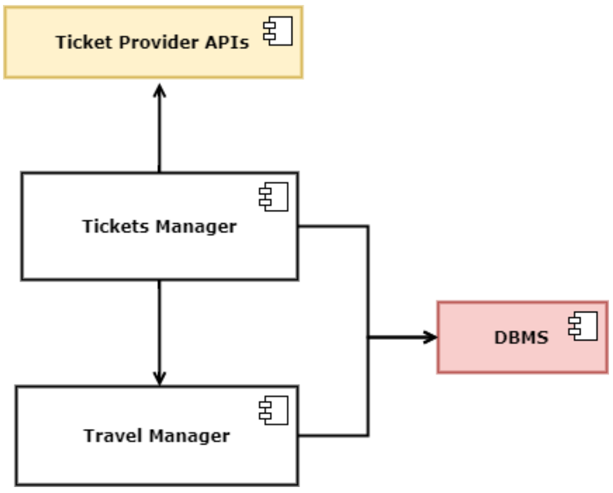
The interaction with DBMS is essential for the correct working of all the four main components of the Application services. Plus, Appointment Manager requires Account Manager to be implemented to ensure the correctness of the links between different accounts and relative calendars:



In order to work properly, Travel Manager makes use of different external APIs such as Maps APIs, Weather APIs and different APIs from car sharing and bike sharing services. The correct functionality of these interfaces must be checked before proceeding in developing the component. In addition, Travel Manager requires an integration with Appointment Manager to acquire data relative to the different locations of the appointments.



Finally, Tickets Manager strictly depends on the correct working of the APIs of the chosen ticket provider to pay and acquire travel tickets. It also requires Travel Manager to work properly, because the user can accesstickets functionalities only after selecting a movement from the daily schedule.



Given the previous information, an appropriate plan of integration and testing could be the following one:
Week 27/11/17 – 4/12/17:

- DBMS: build a simple Java application that interacts with MySQL 5.7.19 Database Manage System by JDBC and correctly store and manage data from a small database.
- ACCOUNT MANAGER: expand the application, allowing different users to register and insert personal info.
- MAPS APIs: testing APIs with small example applications to ensure correct working.
- WEATHER APIs: testing APIs with small example applications to ensure correct working.

Week 4/12/17 – 18/12/17:

- CAR/BIKE SHARING APIs: testing APIs with small example applications to ensure correct working.
- ACCOUNT MANAGER: fully development and testing of all component functionalities: allow multiple users to register and login, manage personal data and connect existing Facebook/Google account.

- APPOINTMENT MANAGER: expand the application by giving the user the possibility of creating, editing and delete simple appointments (no alert/advanced option). Test the correct storage in the database and the correct integration with Account Manager.
- start working on network platform: develop a small application that makes use of RMI technology to invoke methods on an example application running on JBoss 7.0.1 Java Server.

Week 4/12/17 – 18/12/17:

- APPOINTMENT MANAGER: fully development and testing of all component functionalities: allow the user to add advanced options to the different appointments. Test full integration with Account Manager.
- TRAVEL MANAGER: integrate use of Maps/Weather/Car&Bike Sharing APIs with data provided by Appointment Manager to compute travels for each appointment. Testing of the functionalities.
- TICKET PROVIDER APIs: testing APIs with small example applications to ensure correct working.
- Export the application on JBoss 7.0.1 Java Server, testing of RMI methods to access the application features from remote.

Week 18/12/17 – 8/1/18:

- TRAVEL MANAGER: fully development and testing of all component functionalities: the application accesses correctly appointment and user data to compute travels. Test complete integration with Appointment Manager.
- TICKET MANAGER: expand the application by adding functionalities for tickets purchase using the tested APIs. Test integration with Travel Manager.

Week 8/1/18– 18/1/18:

- General testing of full application functionalities.

7 Effort spent