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### **MyListBox**

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## Acknowledgements

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*“It takes a thought to make a word  
And it takes some words to make an action  
it takes some work to make it work  
It takes some good to make it hurt  
It takes some bad for satisfaction”*

*By JM*

MyListBox is growing each minute, and this thesis is a proof of it. What has begun with a thought is now a solid and structured project, and it has much more space to grow. This would not have been possible without the support of my family, my girlfriend, my friends, and MyListBox’s team, as such, I am very thankful to each one of them.

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## Resumo Alargado

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As redes sociais são estruturas compostas por indivíduos ou grupos que estão relacionados por gostos e preferências, culturas ou origens e valores ou ideais. Há alguns anos para cá, o conceito de rede social expandiu-se para a internet, e de um modo geral as redes sociais online têm como objectivo a criação de um perfil e a partilha do mesmo com amigos. Hoje em dia, há redes sociais que cumprem vários objectivos diferentes, seja apenas para partilhar o perfil de uma identidade (pessoa, grupo ou organização), seja para atingir um serviço específico, por exemplo partilhar o Curriculum Vitae. Embora haja muitos cépticos, as redes sociais ganham novos adeptos todos os dias, como tal, as redes sociais disponibilizam aplicações para dispositivos móveis para assim os seus utilizadores poderem obter a informação mais rápido, em qualquer altura, em qualquer lugar, no seu *smartphone* ou *tablet*.

É imperativo que as aplicações para dispositivos móveis estão continuamente fornecer funcionalidades mais ricas, e mesmo apesar da actual aceitação das pessoas em relação aos dispositivos móveis, a tendência é para continuarem neste ritmo, ou até mesmo aumentar, pois os utilizadores estarão sempre a pedir mais, além disso, a concorrência entre os vendedores irá manter viva a evolução natural da tecnologia.

Para construir uma empresa por trás de uma rede social exige um perfil empreendedor, e a vocação para o empreendedorismo não é baseada em Dna, cultura, origem ou religião, em breves palavras, não se nasce empreendedor. É algo que se desenvolve no tempo, e que se melhora com os erros cometidos, não só com os nossos mas como os erros de outros empreendedores. O espírito empreendedor é algo que cresce após a primeira ideia, e até mesmo antes, de forma inconsciente, através do desenvolvimento de competências específicas.

A MyListBox é uma rede social que fornece um serviço específico, de criação de listas de presentes e partilha das mesmas com amigos e familiares, que disponibiliza aplicações para dispositivos móveis com iOS e Android, e futuramente aplicação para Windows Phone 7, que permitem os utilizadores acederem às suas listas, e às listas dos seus amigos a qualquer hora, em qualquer lugar mesmo não estando ligado à internet.

No contexto do projecto MyListBox, o trabalho resultante desta tese teve como principais objectivos:

- Apresentar as experiências no mundo do empreendedorismo
- Resultados dos concursos de empreendedorismo
- Estado da arte no universo das aplicações móveis
- Avaliação dos mecanismos de segurança para aplicações móveis
- Critérios da decisão na implementação dos métodos de consistência e replicação de dados.

## Abstract

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Social networks are structures composed by individuals or groups that are related by life preferences, backgrounds and cultures, or values and ideals. A few years ago, the concept of social network has expanded to the Internet, and most of the online social networks aim to create a profile and share it with friends in order to interact with them. Social networks provide mobile applications to their users so they can get the information faster, anytime, anywhere, on their smartphones or tablets.

It's imperative that applications for mobile devices are continuously providing richer functionalities, and even though mobile devices have already gained acceptance by many people, the tendency is for them to continue at this rhythm, or even increase it, since users will always be asking for more, and competition between vendors will keep alive the natural evolution of technology.

To build a company behind a social network requires an entrepreneur profile, and the propensity for entrepreneurship is not based on Dna, culture, origin, or religion, that is, entrepreneurship is something that one is not born with. It is something that is developed in time, and improved with mistakes.

MyListBox is a social network social network, to create wishlists and share them with friends and family. It provides applications for mobile devices with iOS and Android. This project has competed in entrepreneurs contests and it has already won one.

**Keywords:** social network, internet, mobile devices, smartphone, tablet, entrepreneurship, iOS, Android.





# Index

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<b>CHAPTER 1. INTRODUCTION .....</b>	<b>1</b>
1.1 MOTIVATION AND CONTRIBUTIONS .....	2
1.2 THESIS OVERVIEW .....	3
<b>CHAPTER 2. STATE OF THE ART .....</b>	<b>5</b>
2.1 SOCIAL NETWORKS.....	5
2.1.1 <i>Examples</i> .....	6
2.1.2 <i>Social Networks Sustainability</i> .....	11
2.1.3 <i>Advantages and Disadvantages</i> .....	12
2.1.4 <i>Conclusion</i> .....	13
2.2 MOBILE APPLICATIONS.....	13
2.2.1 <i>Netbook vs. Tablet – Which to choose</i> .....	15
2.2.2 <i>Mobile Applications</i> .....	20
2.3 SUMMARY .....	23
<b>CHAPTER 3. ENTREPRENEURSHIP.....</b>	<b>25</b>
3.1 ENTREPRENEUR PROFILES .....	27
3.2 ENTREPRENEURSHIP IN INFORMATION TECHNOLOGIES.....	29
3.2.1 <i>Google</i> .....	29
3.2.2 <i>Facebook</i> .....	30
3.2.3 <i>Microsoft</i> .....	30
3.2.4 <i>Apple</i> .....	31
3.2.5 <i>YDreams</i> .....	31
3.3 MYLISTBOX .....	32

3.3.1	<i>Human Resources</i> .....	32
3.3.2	<i>Financing Methods</i> .....	34
3.3.3	<i>Competition Analyses</i> .....	36
3.3.4	<i>MyListBox Name</i> .....	37
3.4	SUMMARY .....	38
<b>CHAPTER 4. MOBILE PLATFORMS AND APPLICATIONS .....</b>		<b>39</b>
4.1	ARCHITECTURAL OPTIONS .....	39
4.2	THE CHALLENGES OF SUPPORTING MOBILE DEVICES TODAY .....	41
4.3	MOBILE OPERATING SYSTEMS .....	44
4.3.1	<i>Microsoft Operating System</i> .....	44
4.3.2	<i>Apple’s Operating System</i> .....	49
4.3.3	<i>Google’s Operating System</i> .....	54
4.4	SUMMARY .....	60
<b>CHAPTER 5. DEVELOPMENT AND RESULTS.....</b>		<b>61</b>
5.1	ENTREPRENEURSHIP.....	61
5.1.1	<i>Idea MyListBox</i> .....	61
5.1.2	<i>Contests</i> .....	62
5.1.3	<i>Market Research</i> .....	64
5.1.4	<i>Competition Analysis</i> .....	65
5.1.5	<i>Swot Analysis</i> .....	66
5.1.6	<i>Marketing Plan</i> .....	67
5.2	MYLISTBOX SYSTEM ARCHITECTURE .....	69
5.2.1	<i>Servers</i> .....	72
5.2.2	<i>Middleware API – Web Services Rest</i> .....	76
5.2.3	<i>Mobile Application</i> .....	90
5.3	SUMMARY .....	94
<b>CHAPTER 6. CONCLUSION AND FUTURE WORK.....</b>		<b>97</b>
6.1	ENTREPRENEURSHIP.....	97
6.2	APPLICATIONS FOR MOBILE DEVICES.....	98

## Figure Index

---

Figure 1 - Netbook Asus and Tablet Apple.....	15
Figure 2 - Asus EEE Pad Transformer .....	18
Figure 3 - Wireless Keyboard for Tablets .....	19
Figure 4 - CloneCloud System Model [Chun et al., 2010].....	23
Figure 5 - Windows Phone Architecture .....	45
Figure 6 - a) Windows Phone Start Page; b) Internet Explorer Page.....	46
Figure 7 - Windows Phone Applications States.....	48
Figure 8 - iOS Application Layers.....	50
Figure 9 - iOS Home Screen .....	53
Figure 10 - iOS Application Life Cycle.....	53
Figure 11 - Android System Architecture.....	55
Figure 12 - Android Home Application.....	57
Figure 13 - Task Stack: a) new Activity invocation; b) back to previous Activity....	57
Figure 14 - Activity Lifecycle.....	58
Figure 15 - Execution Environment of an Android Application .....	59
Figure 16 - System's Requirements .....	70
Figure 17 -System's Architecture.....	72
Figure 18 - Future System's Architecture .....	74
Figure 19 - Ideal System's Architecture.....	75
Figure 20 - Content to be transferred .....	77
Figure 21 - Environment Test: a) in a Wireless Network; b) in a 3G network.....	77
Figure 22 - Tests Wi-Fi with 3 Lists and 25 Items.....	79
Figure 23 - Tests Wi-Fi with 1 Lists and 2 Items.....	79

Figure 24 - Tests 3G with 3 Lists and 25 Items .....	80
Figure 25 – Data Sync Flowchart .....	83
Figure 26 – Scenario 1 – First Time and changes in mobile-side .....	84
Figure 27 - Scenario 2 - Changes in Server-side.....	85
Figure 28 - Scenario 3 - Changes in both sides: Conflict.....	86
Figure 29 - Components Diagram .....	91
Figure 30 - Navigation Diagram .....	92
Figure 31 - Asynchronous Work.....	93
Figure 32 - Login Screen.....	94
Figure 33 – My Lists with menu Screen .....	94
Figure 34 - Items From List .....	94
Figure 35 - Item Screen .....	94
Figure 36 – User’s Friends Screen.....	94
Figure 37 - Friend List's Items Screen.....	94

## Table Index

---

TABLE 1 - WORLDWIDE MARKET SHARE TABLETS .....	13
TABLE 2 - HARDWARE COMPARISON .....	17
TABLE 3 - MYLISTBOX STRENGTHS AND WEAKNESS.....	66
TABLE 4 - MYLISTBOX OPPORTUNITIES AND THREATS .....	67
TABLE 5 - QUICKGIFT PACKAGES .....	68
TABLE 6 - TYPES OF SERVER COMPARISON .....	70
TABLE 7 - DEDICATED SERVERS COMPARISON .....	71



## Notation

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API	Application Programming Interface
APK	Android Package
BA	Business Angel
CPU	Central Processing Unit
DAL	Data Access Layer
GUI	Graphical User Interface
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
IDE	Integrated Development Environment
IPP	Polytechnic Institute of Porto
ISEP	IPP School of Engineering Polytechnic of Porto
JSON	JavaScript Object Notation
KB	KiloByte
LAN	Local Area Network
MB	Megabyte
ms	Millisecond
OS	Operating System
OWASP	The Open Web Application Security Project
PC	Personal Computer
PDA	Personal Digital Assistance
RAM	Random Access Memory
REST	REpresentation State Transfer

SBS	Small Business Server
SDK	Software Development Kit
SMS	Short Message Service
SOAP	Simple Object Access Protocol
SQL	Structured Query Language
TCP	Transmission Control Protocol
UDDI	Universal Description, Discovery and Integration
UMTS	Universal Mobile Telecommunication System
URI	Uniform Resource Identifier
USB	Universal Serial Bus
VM	Virtual Machine
WLAN	Wireless Area Network
WWW	World Wide Web
XML	Extensible Markup Language



# Chapter 1. Introduction

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Social networks are structures composed by individuals or groups that are related by life preferences, backgrounds and cultures, or values and ideals. A few years ago, the concept of social network has expanded to the Internet, and most of the online social networks aim to create a profile and share it with friends in order to interact with them.

In this context, wanting to offer a gift to someone in the family or a boy/girlfriend, one always gets the same problems:

- What shall I give to my friend on his/her birthday?
- What if someone gives him/her the same gift?
- What is the best gift ever to offer my mother for Christmas?
- Will my girl/boyfriend like this gift for St. Valentine´s day?

All these questions take much time of us making us nervous and all the wondering will lead to bad decision about what to buy. In order to help with these problems, is this groundbreaking project “MyListBox” an online social network that allows its users to create wishlists and share them among their friends. This project was born due to the difficulty that is to give presents to our friends or family, whom often know what they want to receive. This website was developed in 2009 and it has been online since.

This thesis is then motivated by the need to (i) adjust the website’s functionalities, (ii) change some aspects of the client-server architecture, (iii) add new features, and (iv) change the website’s design to a more appealing one. The mobile applications area is an important part as it’s being implemented the light version of the website, and an application for mobile devices with iOS (iPhone and iPad), Android and Windows Mobile, that will allow every smartphone or tablet user to access their profiles, lists, and friends wherever, whenever.

This thesis considered social network analysis algorithms and existing mobile application's projects that share the same client-server architecture.

In 2011, "MyListBox" also embraced the contest "Poliempreende 8", a contest that aims at stimulating the entrepreneurship spirit within the IPP students. Two steps compose this contest: the regional edition and the national edition. "MyListBox" was the best from 8 other final projects, including health, environmental and social ones, projects that usually have high impact on the jury, won the 1st place in the regional edition, which consequently turned "MyListBox" into national edition finalist, competing with one team from each Polytechnic in Portugal.

Throughout this report, the above topics will be described in greater detail, as well as the used technologies. Also, this report reflects some of the biggest decisions that were necessary to be made.

MyListBox's business and financial plans are already defined, it is already a registered trademark, and it is in its final tests, hence, it is ready to go online and it is expected to do so at the beginning of December.

## **1.1 Motivation and Contributions**

The idea of developing a project such as MyListBox came in 2007, but this has never truly leave the paper until 2009, when this project began to materialize in Luís Rocha's Bachelor's Degree in Information Technologies. The project's goal was to create a virtual social network, to allow creation of user's accounts, lists and items; construction of a network of friends; and consulting friends' lists.

This year, there was another chance to grab this project with the completion of Master's Degree in Information Technologies, and since then, this idea grew in all areas, it appeared an attractive design and a complex client-server structure with a website full of new features, the mobile version of the website and applications for mobile devices.

Besides this technological side, "MyListBox" competed for the "Poliempreende 8" contest and took the 1st place in the regional edition and was one of the finalists in the national edition. For this competition was necessary to develop a financial plan and a business plan that forced us to have structured objectives. One of the most prominent was to have multiple companies interested in a partnership with "MyListBox", and after some time we had contacts with some well-known companies. Even though "MyListBox" didn't win, there were several positive aspects, for instance, important contacts were made that will help get a place in the market.

For all of the above, all the growth, the Poliempreende juries recognition, and for all the support from family, friends and everyone involved in this project, the motivation for this project is very high, and besides the natural personal ambition to succeed professionally, there are two very important aspects: (i) to create something that can be a national success, and as MyListBox internationalization is planned for soon, (ii) the possibility to elevate a Portuguese platform abroad, is something indescribably motivating.

## **1.2 Thesis Overview**

This thesis is organized in the following manner:

Chapter 1 presents the main objectives and motivations behind this research work. This chapter also gives a brief description of this work development context and organization.

Chapter 2 introduces a state of the art on the themes directly related to this thesis, which are: (i) Social Networks, (ii) Mobile Devices, and (iii) Applications for mobile devices. In this chapter, it is shown some brief introduction of some popular examples of each one of these themes, respectively. In the second theme is also shown a comparison between some mobile devices.

Chapter 3 provides information about entrepreneurship, some examples linked to the IT world, best practices and this theme applied to MyListBox.

Chapter 4 presents a succinct study of developing applications for mobile devices. The aim of this study is to present all the topics related to the development of Mobile Applications, in an abstract way.

Chapter 5 provides a case study, which assesses a comparison between developing for iOS and Android.

Chapter 6 presents the implementation details of the applications for mobile devices, and also provides a version of the business plan used in the Poliempreende competition, the problems, the solutions and the decisions.

Finally, chapter 7 contains conclusions, future work based on current limitations and new features that can be developed to integrate with actual system.



## Chapter 2. State of the Art

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If we go back 10 years in time, the world was a very different place, without online social networks with millions of users, and definitely without so many mobile devices users. Back then there were powerful computers, and smartphones, but the purpose was not the same as today. Some people buy smartphones just because is trendy and because of social networks, I argue.

As [Maia, 2010] said, “Nowadays, devices are becoming smaller but, still, each one is capable of running several concurrent (and parallel) applications”. Thus, mobile device owners have the ability of taking a picture and upload it to his/her social network account, while being in a phone call!

Thus, the goal of this chapter is to provide the reader with the necessary background about what is being done in areas like social networks, mobile devices and software applications for mobile devices.

### 2.1 Social Networks

As it was said before, a social network is a social structure made up of individuals or organizations that share common interests such as likes and preferences, cultures or origins and ideas or believes. The goal of a social network is to build a profile and be able to share it with fiends on the web, in a way that is possible to interact with all users.

After a profile has been created on a social network, each user can start to build a friend’s network. In order to do so, one has two options, other users already signed up can be simply invited, or if they are not users, an invitation can be sent by e-mail. In this last situation, the friend can then choose to sign up within the network, becoming a part of his friend’s network. A typical social network can copy all contacts from an email account, and

then send invitations to all of them, allowing each user to build a network of friends quite fast.

There is another reason for building a network of friends: one can invite unknown users of a social network, because they share common interests. If one is going through a website and finds persons with the same likes and preferences they can be invited to our network, so that one can debate and talk about matters of concern. Because this can bring people from any part of the world together, that otherwise would never meet, this is one of the most important features of social networks. This situation has clear advantages, but it can also come with some disadvantages, these matters are going to be discussed on the next sub chapter.

The exponential growth of social networks is nowadays a reality. These types of websites have millions of users on, and hundreds of millions of visits per day. According to [www.alexacom.com](http://www.alexacom.com), in the world 10 most visited websites, there are search engines like Google, Baidu, etc., and blogs, and news websites, and there are web applications that implement the virtual social networks concept, such as Facebook and LinkedIn, or web applications that share contents usually shared online, such as the videos on “www.YouTube.com” or the photos on [www.flickr.com](http://www.flickr.com). Although each has his particular features, they share a common goal: make the relationships between individuals easier by creating and sharing an online profile, even when they do not know each other and just share common interests such as dislikes and likings.

In this chapter, the reader is provided with information about some of the above, and other social network examples.

## 2.1.1 Examples

### 2.1.1.1 Facebook



In 2004 a project that would become one of the most visited websites on the world, was born- “The Face Book”. In the beginning its aim was as simple as share photos between students at Harvard University, but it did not took too long to spread to other universities and a year after it had already 5 million active users. In 2005 it was renowned for Facebook, and it kept its goals of profile creation (a common factor already mentioned), sharing contents and group creation. With the booming of Twitter, a new application was added, the “mini-feed”, that allows each user to share, in his profile what he has been doing, photos, music, videos links or their physical location.

Now in 2011, Facebook has more than 800 million active users, between Presidents, Actors, Musicians, etc. Almost everyone is in Facebook...

#### 2.1.1.2 Google +



After a yearlong project, Google has released their Social Network website, a beta version with a limited invites politic, like Google did in the beginning of Gmail. To develop this project, Google had to work hard on analyzing every detail on their direct competitor – Facebook, and one of their conclusion was that a good advantage was to adapt their design on all of its projects in order to standardize them all, and other was that they had to focus on figuring out what were Facebook flaws and gaps, and what they could do to fill them. For instance, Facebook chat system is very static, so Google created the Hangouts, which are virtual rooms where one's friends will know if he is free, and if he is, he can be invited for a "video hangout", anytime, anywhere.

Google had a particular question to overcome, the "Ghost" Google Buzz, which was a project in the social networks scope which wasn't the success Google expected. Google's vice president of the product, Bradley Horowitz, said that: "part of the problem was that Google Buzz was just "tacked on" as a link on millions of Gmail accounts, something that Google won't be repeating "[Parr, 2011]. There were some other initiatives like Google Me, but because this project is being well structured, and the competition analysis was deeper, it has everything to compete directly with the actual major social network – Facebook, I argue and I expect the big success of this project to start by the end of the current year, 2011.

#### 2.1.1.3 LinkedIn



LinkedIn is an online social network for professional relationships, more than the common factor already mentioned, allows its users to upload a curriculum vitae, instead of pictures or videos. The aim of this social network is strictly professional, as it does not allow one to make any query by marital status or sexual orientation. One of the most remarkable features of LinkedIn is that a company can post a letter of recommendation for an employee. According to LinkedIn's chairman, Dan Nye, the web site was created to introduce, in a professional way, his employees into the web.

LinkedIn applies a new concept “passive candidate”, a user that already has a job and is not currently looking. It allows the user to post his academic and professional features in to personal profile. These can help other companies on recruiting tasks.

LinkedIn had, in 2009, 40 million users and about a 100 thousand used it for professional recruitment, and this year -2011- in March it has reached the 100 million users milestone [Weiner, 2011].

#### 2.1.1.4 Hi5



Besides create and share an online profile, with Hi5 one can also share photos and videos between users. Hi5 has distinguished itself, by using a gaming platform that the company has been developing, which allows users to play simple games between themselves, such as “Mahjong Towers” or the classic “Pacman”. Hi5 is most popular on Europe and South America.

Virtual social networks are becoming a powerful tool for publicity and marketing, and a great example of this is that the car manufacturer FORD, who promoted a competition - “Ícones”- where contestants had to go through four challenges, one of them was developed using a partnership with Hi5. The goal was to get as many friends as one could into each personal page, instead of creating a social network, the goal was to build a friends network. Although, this competition, was nothing more than popularity contest between users. Persons within this kind of networks share likings, cultures or points of view.

#### 2.1.1.5 MySpace



According to “howstuffworks.com”: “In February of 2006, 54 million people had a profile on MySpace, and another 180 thousand join up every day to become users”. To show one of the biggest social networks online, on 2009, MySpace went from 54 million profiles in 2006, to 80 million on 2009. It is kind of amazing that so many people around the entire world get together on the same social network and this becomes even of more interest when one realizes that in just 3 years users have double. But, according to [Hernandez, 2011] MySpace is losing users and it now has 60 million active users.

MySpace is a social network that has all the features the ones talked before: Customized profile, photos and video uploads and since it can be uploaded with songs, is very used by musicians, such as singers and groups, to show their work to the world, as



publishers use it to search for new talents. Some of this musicians use MySpace to schedule their concerts in the events section.

#### 2.1.1.6 Twitter



In its plain form, Twitter is a way of friends, family and coworkers communicate between themselves using a simple question “What are you doing?”

The name Twitter comes from the word “tweet”, which means “The chirp of a small or young bird” and so the messages between users are short. It is like when one uses the mobile phone to text someone, messages are short (160 Characters) and objective.

Twitter is so popular that it is also used by national presidents.

#### 2.1.1.7 StandVirtual



This is an online platform for second-hand vehicles transactions, which started with 300 cars a year and it now transacts 200K vehicles a year, because, besides its growing, StandVirtual expander from cars to motorbikes and motorboats.

Until 2010 anyone who wanted to sell a vehicle in this website, just had to register an account and insert the vehicle – Cost Free. Now, if one wants to sell a vehicle through StandVirtual, there is an 8€ a monthly fee. StandVirtual has a monthly average of 4M visitors and, to become the second-hand vehicles transactions leader in Portugal is the goal of this website.

I argue that this website is also a social network because users interact with each other over cars, motorbikes and motorboats, which is the concept of a social network.

#### 2.1.1.8 Adegga



The Adegga.com was born as a simple website, and nowadays it is a worldwide, social network to share opinions and reviews about wines. It is considered to be a “social-networking site for fellow oenophiles” by the *Business Week*.

André Ribeirinho, the creator of addegga.com, is a 32 year-old Portuguese, working full-time in this project. This project has a 3 axes business model: (i) the winemaker which allows the access and participation in discussions within the website, (ii) the Adegga Selection which is the selected wine by the community for a period of time and (iii) the events are off-line initiatives in order to bring together the winemakers and the consumers.

Currently, Adegga.com has 10K registered users and 100K unique visitors, and it has been successful thanks to its business logic, technological structure, and social-networks explosion. As goal for the future, Adegga.com wants to create some sort of ISBN for wines.

#### 2.1.1.9 Sair



Sair+ is a young online tourism social network that allows its users to share geo-referenced tourism experiences and opinions. It provides recommendations for booking online. After register, the user configures his preferences and then creates interaction with other users through follower or friendship relations. There is also support for listings of user's galleries and given ratings, for instance, if a user visited a monument he can rate it in this network, and then others will see his opinion. The recommendation system relies mainly on tags and ratings, filtering items according to the frequency of occurrence of the ratings given by users with common tastes. A Portuguese Researcher created Sair+ and it has 200 unique visitors a day.

"Sair+" is also a social network, for the same reasons of StandVirtual: individuals or groups are related by life preferences, backgrounds and cultures, I argue.

#### 2.1.1.10 MyListBox



Like LinkedIn or Adegga, "MyListBox" will provide a specific service to its users, which is the creation, interaction and sharing of wishlists. This social network will be available in December of 2011, and it will provide a website and applications for mobile devices with iOS or Android. It will also be available a mobile version of the website which is a lighter edition specially designed for mobile devices.

“MyListBox” is all about making easier the moment of buying and receiving gifts, so this is an advantage, both for its users and for the stores who want to be partners with MyListBox. Partners are allowed to have their products available in an area called QuickGift.

With this service, users will no longer have concerns about what to offer to their friends, and in the other hand, they are going to receive exactly what they want.

### **2.1.2 Social Networks Sustainability**

With so many social networks available for free, how can they survive financially speaking? Accounting all free users, how can such a huge infrastructure be supported? Social networks such as Facebook with two thousands employees and offices in 15 countries, or MySpace with about six hundred need a lot of funding.

Most of the times, the answer comes from publicity, by using banners. Some of the biggest brands like Coca-Cola or Adidas, are attracted by the amounts of visitors to a certain website, which, as seen on the last sub chapter, grants a great feedback.

Other times, there are other ways, although LinkedIn has some publicity on Google’s web sites, it does not own any particular sponsor or commercial merchandising. There are two ways in which LinkedIn does business:

- **Paid Services:** LinkedIn has created premium accounts: Personal Plus, Business or Pro for different levels of access to the website (special searches and messages on inmail- a communication channel that allows one to send proposals for users, send presentation and an unlimited number of curriculum vitae, etc).
- **“LinkedIn Corporate Solutions”:** Corporations can search for “passive candidates” within the website in order to recruit them. This is the most profitable feature of LinkedIn.

Hi5 has another way of profiting with users. In 2009 Hi5 developed a gaming platform that, as it was said before, is used for simple games and is still active. These online games are only free for the first levels, if one wants clearance for higher levels in the game, he has to pay.

Facebook gets its revenue mainly from advertising using banners, and it has several publicity plans based on number of times that the banner is shown. Facebook partners are allowed to set a monthly budget and so their banners will appear while they have credits in their accounts.

No matter the method a website chooses to support itself, a level of commitment is required, such as new designs, new functionalities, etc. in order to keep the users on line.

### **2.1.3 Advantages and Disadvantages**

As it was said on the last sub chapter, social networks have the ability of bringing people from all over the world together, if one adds this to the high rates of users (topic for the next chapter), clear advantages can be found, but also some very troubling disadvantages.

#### Advantages

- Price: As for both personal and professional using, social networks are usually free of use.
- Relationships: We have our own friends, which have other friends, and so on. On a social network, one can picture the networks between all users in a fast, easy and approachable way.
- Utility: One of the many achievements to the project “MyListBox” is to be a helpful tool. By creating a profile and a wishlist with the most wanted gifts, one gets a “win-win” outcome, in one hand by avoid unwanted and/or repeated presents, and in the other hand friends get to know exactly what to buy and where to do it.

#### Disadvantages

- Pedophile networks: Since creating a user’s network is so fast and easy, social networks have become a useful tool for those who don’t mean well. In 2008, Brazilian police officers, tracked a pedophile network within “Orkut”, and with the help of some members, the pedophiles were caught. Some websites, like Hi5 or Facebook allow it’s users to report abuse to the Webmaster just by one click, any time they find anything dubious.
- Phishing: Is a way of attempting to acquire sensitive information such as usernames, passwords and credit card details by masquerading as a trustworthy entity in an electronic communication and is typically carried out by e-mail, spoofing or instant messaging and it often directs users to enter details in a fake website that looks and feels almost identical to the legitimate one. In Portuguese, it translates for fishing. Within the social networks, one can often receive e-mail, asking for passwords, with the excuse of a system update. This kind of situation is not only frequent in social networks, but also it is widespread within the web.

- Online profile: Although most social networks try to keep good levels of security, protect its users from harassment, on line fraud and identity thefts, they are not always successful.

#### 2.1.4 Conclusion

Nowadays, when one thinks about social networks, one thinks about Facebook, but this is not entirely universal, because it depends, for instance if one is Brazilian, he might think first about Orkut. Facebook, which is the first example of the above, is a general social network, because users are connected first through their friendship outside the virtual world. In social networks websites, users are allowed to create groups and invite friends to their groups, and then they will be connected. But the examples of LinkedIn, or Adegga.com represents a more specific, focused and flexible service, this type of services will never stop, because, for instance, even though Facebook has a professional network embedded in a Facebook Application inside the main website, people still are using LinkedIn, and they will always be, I argue.

Even though social networks have all this useful features, to continue to please their users they need to be releasing new features frequently, in order to keep them as active users.

## 2.2 Mobile Applications

As enterprises emerge from the global recession, the use of mobile devices is expected to increase, and it has already gained acceptance by many people. 2010 was tagged as “the tablet year”, Apple’s iPad was launched in April and it brought tablets to a point where no other device has ever been brought. This year, 2011, Apple released the iPad2 and the number of users increased again. Table 1 shows that Android tablets are also gaining some market share, and now, most of the major manufacturers have at least one tablet (Toshiba Thrive, Samsung Galaxy Tab, Asus Transformer TF, Motorola Xoom, etc.).

**Table 1 - Worldwide Market Share Tablets**

OS	2010	2011	2012
<b>iOS</b>	83,9%	68,7%	63,5%
<b>Android</b>	14,2%	19,9%	24,4%
<b>MeeGo</b>	0,6%	1,1%	1,2%
<b>Other OS</b>	1,3%	10,3%	10,9%

(Source= Gartner Report)

Table 1 has also Gartner's 2012 prediction of Tablets Market Share, and it reflects the growing of Android market share, in one hand because there are more Android tablets, and therefore users have a variety of devices that they can choose from, and in the other hand Apple devices are usually more expensive.

These two reasons are also applied to mobile phones from the Smartphone Generation. In 2005, Apple Engineers were investigating touchscreens to use in mobile phones, and two years later, the first iPhone became available in United States, and one year later iPhone 3G was released. In 2009, Apple took the 3G and added a more powerful processor, some new features, and therefore distanced themselves from the competition, which by then was specially Google Nexus One.

In 2010 Apple gave birth to iPhone 4 and according to their *motto*, "it is going to change everything, all over again". Some criticized this, because they advertised features that were already available in other devices with Android OS, such as devices from HTC or Samsung, for instance, features like the face-time video calls. Even the most fanatic Android person cannot disagree that Apple has a quite objective and successful marketing campaigns. This is proved by the long waiting lines to buy the new iPhone, every time each one of the iPhones is available. The high price that one has to pay, goes for the software and hardware high quality, I argue.

Even though in US the iPhone price is quite accessible, in Europe the price is still too high. And, as said before regarding tablets, this is one of the reasons Android devices are gaining more market share, and now, devices like Samsung Galaxy S2, LG Optimus 2x, Motorola Droid 2x, HTC Desire, Google Nexus S are very good alternatives to the Apple mobile phone. As it has been stated before regarding tablets, nowadays one has a wide variety of Android mobile phones to choose. These Android devices have advantages towards the iPhone, for instance, regarding hardware, some of them have a dual-core processor and more RAM, and some have larger screens. And when it comes to software, Android is more flexible than iOS, for instance, if one do not like the keyboard, one can easily change it, but more about this subject in chapter 4.

One can buy a cheaper Android device, but has to be aware that he can't compare a low-cost Android to any of the above examples nor to the iPhone 4. But, if one wants to enter into this amazing new world, where anytime anywhere you can access the internet to check emails, news, weather, bank accounts, etc., there are several and still useful options with a more accessible price.

[Jay, 2011] believes that 2011 is the Year of the “Dumb”<sup>1</sup> Smartphone User, as these new users will be less engaged and active than smartphone early adopters, who despite high prices would still purchase them, for their professional needs such as check emails, bank accounts, access online stock market, productivity applications (ToDo lists or online storage services like Dropbox) therefore improving their work capacities. As smartphone started to become cheaper, they are available to a new kind of users that just want to play funny games and access their social networks accounts, although a business man can still use his expensive smartphone to relax and play Angry Birds.

Forrester expects they’ll download fewer apps on average, but will consume more mobile media thanks to consumer education and convenience provided by the phones.

Smartphones have become powerful gaming devices for the mass market, and this one trend that will continue. The games evolution in Desktop computers is being felt also in smartphones, nowadays games for smartphones evolved from the typical basic game like Snake to powerful 3D games like FIFA 11 or PES 2011, but more on this in subchapter 2.2.2. Mobile applications vendors have created new business models based on subscriptions, micro-transactions (low-value transactions in high volume of sales) and in-app billing.

The mobile devices market, is growing and it will continue to grow, not only because of smartphones and tablets, but also because eReaders (Kindle, Sony Reader, etc.) and portable media devices (iPod for instance). Thus, services and applications for Mobile Devices are aiming to a point where a ubiquitous world is required, and consequently this is giving, and it will give even more importance to the Cloud.

### 2.2.1 Netbook vs. Tablet – Which to choose



Figure 1 - Netbook Asus and Tablet Apple

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<sup>1</sup> Note: The “dumb” reference is not meant to insult the intelligence of these new users.

It is imperative to assume that both netbooks and tablets fit in the same category, which is a secondary, lightweight and portable computer. Thus, according to this, how can consumers know which one is the best solution?

Netbooks purpose was to have a smaller, cheaper and lighter laptop computer, by removing some of typical notebooks' characteristics like optical drive, computing power and screen size. Even though this type of computer is optimized for surfing the web, managing emails, read and write documents, multi-tasking is a task that one can't push too hard, still this new generation of dual core netbooks is expected to overcome this problem. A couple of good examples of the use of netbooks is (i) Systems Administrators use them to evaluate wireless networks coverage and (ii) when travelling by train or bus one can use this type of device to access his email or do some document reviews.

The first netbook with notorious presence on the market was EEE Pc manufactured by Asus, in 2007.

The term tablet, made popular by Microsoft Tablet PC, is used to refer to a lightweight, usually keyboardless, computer device, operated mainly through a touch screen interface. Typically, a tablet is larger than a smartphone, and smaller than a notebook. Because this type of device is very lightweight, a tablet is a good option for persons with portable needs. Although, there were some tablet options in 2010, the biggest booster was definitely Apple iPad, I argue.

To do a comparison between these two devices, one has to consider four aspects:

- 1) User interface: Even though there are some with a touch-screen interface, the typical netbook has a keyboard and mouse / mouse pad interface. Also when one is considering a touchscreen netbook, one has to expect a higher price. As it was said above, instead of a keyboard the typical Tablet has a multi-touch screen interface that allows a rich interaction with device, in features like pan or zoom. Thus, the tablet user agrees on a tradeoff between a lighter device and a slow writing rate.

## 2) Hardware Specifications

A typical netbook "wins" this aspect, basically because it has more "space" available to fit in more hardware. Table 2 has a detailed analysis:



**Table 2 - Hardware Comparison**

Spec	Apple iPad 2 (with 3G)	Samsung Galaxy Tab 10.1	Asus EEE PC 1215N	Lenovo ThinkPad X120e
Vendor "Punch line"	"Less in your hands, more in your fingertips. It's fast times two."	"It's time for a better tablet. It's time to TAB"	"Excellent multimedia enjoyment with large HD widescreen Eee PC"	"Ultraportable, Ultra-affordable Laptop Performance for Businesses"
CPU	Apple A5 - dual-core 1GHz	Tegra 2 - dual-core - 1GHz	Intel Atom D525 - dual-core with Hyperthreading 1,8GHz	AMD E-350 Fusion CPU- dualcore 1,6GHz
RAM	512Ram	1GB	2GB	4Gb
Storage	16Gb   32Gb   64GB	16Gb   32Gb   64GB	300Gb - 5400rpm +500Gb WebStorage	300Gb - 7200 rpm
HD	1080p	1080p	1080p	1080p
Screen Size	9,7"	10,1"	12,1"	11,6"
Batery Autonomy	10 Hours	10Hours	6 Hours	5,5 Hours
Weight	600g	600g	1,45 Kg	1,49Kg
Price	624\$   724\$   824\$	499\$   599\$   N/A	500\$	529\$
Price in Portugal	599€   699€   799€	589€   699€   N/A	499 €	N/A
URL	<a href="http://www.apple.com/pt/ipad/">http://www.apple.com/pt/ipad/</a>	<a href="http://www.samsung.com/global/microsite/galaxytab/10.1/spec.html">http://www.samsung.com/global/microsite/galaxytab/10.1/spec.html</a>	<a href="http://www.asus.com/Eee/Eee_PC/Eee_PC_1215N/">http://www.asus.com/Eee/Eee_PC/Eee_PC_1215N/</a>	<a href="http://shop.lenovo.com/us/products/Laptops/ThinkPad/x-series/x120e/index.html">http://shop.lenovo.com/us/products/Laptops/ThinkPad/x-series/x120e/index.html</a>

Inside the hardware aspect, resides the autonomy topic, which is very important to whom is worried about portability. A tablet is capable of 8 to 12 hour autonomy while a netbook only holds from 4 to 8 hours.

### 3) Price

Tablets are usually more expensive than netbooks and I do not understand why. Even though a tablet is the best choice for ones who have portability needs, for a tablet's price one can buy a netbook with higher performance. The price difference could be about manufacturing costs, but in my opinion this reason is not valid, because producing hardware for netbooks is the same as producing hardware for tablets, so I believe. Therefore, the only valid reason is that, it is trendy to have a tablet because it is considered to be the wave of the future.

### 4) Operating system

Netbooks typically comes with Microsoft Windows or Linux, and lately there are solutions to install Google Android OS, but it's still a tricky situation and to install it, one must have advanced knowledge in IT, because it needs to convert the OS image to fit in a

USB flash drive, and then change some settings in BIOS, to be able to boot from the flash drive, and then start to install the OS. When Asus released EEE PC, the price with Linux was 25% lower than the same model with Windows.

As for tablets, the scenario is a bit different, because the market is composed by many options, but the main are:

- iOS (e.g. iPad)
- Android (e.g. Samsung Galaxy Tab)
- Windows (e.g. Asus Eee EP121)
- QNX OS (e.g. Blackberry Playbook)
- Meego (e.g. Acer M500)

And what about Linux? As said by [Wallen, 2011]: “And then there’s Linux. A platform that is ideal for tablet PCs, doing nothing. Oh, sure Mark Shuttleworth has made big claims that when Ubuntu 11.04 comes out it will be primed and ready for tablets (especially those made by Dell). But where are those tablets?”

The tablet world and Linux are linked through MeeGo, an open source project that provides a Linux-based software platform.

The debate regarding tablet vs. netbook is starting to change, since ASUS thought about creating a netbook that could be easily transformed into a tablet, and they released ASUS EEE Pad Transformer, with Android Honeycomb 3.1 OS, and a Dual-Core CPU, it has a full QUERTY Keyboard, a touchpad input, and a 16-hours long battery life. And as it can be seen in Figure 2, this amazing netbook can be transformed into a tablet, easily by separating the monitor from the keyboard!



**Figure 2 - Asus EEE Pad Transformer**

There is another option for Tablet users who want to use a keyboard in some particular circumstances, if the tablet has the ability, it will allow connecting a keyboard via USB or Bluetooth (Figure 3).



**Figure 3 - Wireless Keyboard for Tablets**

[<http://www.hardware.com.br/static/20110228/1a284544.jpg.optimized.jpg>]

To sum up, tablet PC is a good choice for a person with portability needs and who likes to own a fast and trendy gadget that is operated by finger touching. Netbooks will be a greater choice for people who want a durable mini laptop and who need a keyboard to do most of the work, and if the choice is a netbook and the purpose is to work, the state of the art is definitely the Lenovo equipment.

## 2.2.2 Mobile Applications

### 2.2.2.1 Top Games Applications

**Name:** Angry Birds

**Platforms:** iPhone, iPad, Android, Nokia, Palm;

**Price:** free or 1\$

**URL:** [www.angrybirds.com](http://www.angrybirds.com)



World phenomenon in Mobile Gaming applications of 2010,

Angry Birds is an addictive game, as like as many others, but with a tremendous marketing plan. The game scenario is very simple because the player uses a catapult to fire the birds at the fortresses built by a gang of evil pigs. Every time there is some big event worldwide, the Finnish game company releases a thematic Angry Birds version (e.g. Angry Birds Rio)

**Name:** Infinity Blade

**Platforms:** iPhone, iPad;

**Price:** 5.99\$

**URL:** <http://itunes.apple.com/app/infinity-blade/id387428400?mt=8>



This astonishing game consists in a sword fighting adventure with a super intuitive swipe-based control system and extraordinary graphics for a mobile game, where the depth and detail is amazing. Epicgames developers say that a multiplayer mode is coming.

**Name:** Fifa 2011

**Platforms:** iPhone

**Price:** 2,99\$

**URL:** <http://itunes.apple.com/us/app/fifa-11-by-ea-sports/id394220958?mt=8>



Being a worldwide known soccer game, sooner or later, EA

Sports had to develop an iPhone version, and they have released an application which provides an incredible soccer experience, with great and detailed graphics, quoting Ahearn 2010, "player models are smoother than they are even on Nintendo's Wii."

PLAYING not GOOD

**Name:** Fieldrunners

**Platforms:** iPhone, iPad; Android

**Price:** 2,39€

**URL:**

Tower defense, is one of the most played type of game, Fieldrunners is one of the best examples of this genre.

Basically, waves of enemies will attempt to make it across the screen and you'll lose a life for each one that does. To avoid losing, player has to build mazes of weapons to kill enemies and to eventually slow them down. This game was one of the first on the iPhone platform.



#### 2.2.2.2 Top Productivity Applications

**Name:** Evernote

**Platforms:** Multiple formats;

**Price:** Free

**URL:** [www.evernote.com](http://www.evernote.com)

Evernote is the ideal note-taking tool for your mobile. You can type notes in, of course, but the app also allows you to take a snapshot or a voice recording and add that as a note. The app does a good job of 'reading' the text that you photograph and making it searchable. Everything's easy to organize and can be copied back to Evernote's free desktop app.



**Name:** Dropbox

**Platforms:** iPhone, Android, BlackBerry;

**Price:** free

**URL:** [www.dropbox.com](http://www.dropbox.com)

Dropbox is a great web-based service that allows you to upload your files into the cloud and access them from any computer or mobile device, anytime with a great level of security. It allows sharing folders with anyone you need to collaborate. Most people use Dropbox as the backup storage. This app is free for every platform, and users can have 2GB of online storage for free. If one needs more space, he can purchase one of Dropbox's annual storage plans.



**Name:** Facebook

**Platforms:** iPhone, Android;

**Price:** free

**URL:** [www.facebook.com](http://www.facebook.com)



Facebook is a social network utility that connects people with friends and others who work, study and live around them. People use Facebook to keep up with friends, upload an unlimited number of photos, share links and videos, and learn more about the people they meet. With Facebook Mobile App, one can use Facebook on the go. Use Facebook Mobile to upload photos from your camera phone, receive and reply to Facebook messages, Wall posts using text messages.

**Name:** Advanced Task Killer

**Platforms:** Android;

**Price:** Free

**URL:** <https://market.android.com/details?id=com.rechild.advancedtaskkiller>



Task Killer is a task manager for android devices. Just like desktop applications, smartphone apps can run quietly in the background using up memory and, on a mobile device, depleting the battery. This app purpose is to shut them down.

**Name:** Layar

**Platforms:** Android, iPhone;

**Price:** Free



Augmented reality is touted as one of the Next Big Things. This app automatically serves up information such as restaurant reviews as you wander about with your phone's camera pointed ahead of you.

**Name:** Google Goggles

**Platforms:** Android, iPhone;

**Price:** Free



This clever image recognition technology from Google will attempt to serve information from the web about anything you snap with your phone's camera. So far it works best on things like books and artwork, but the firm's engineers are working on a more advanced recognition problems such as animals and plants.



**Name:** Word Lens

**Platforms:** iPhone

**Price:** Free (Languages Packs are bought within the application)

Instantly translate printed words from one language to another with your built-in video camera, in real time! Language packs must be purchased from within the app. One can use Word Lens on vacation, business travel, or just for fun.

## 2.3 Summary

It's imperative that applications for mobile devices are continuously providing richer functionalities, and the tendency is for them to continue at this rhythm, or even increase it, since it is the natural evolution of technology and users will always be asking for more.

The future in this area is converging to cloud-based applications, for example storage, like Dropbox, or a web-based service for note-taking tool, like Evernote. The main advantage of this type of applications is that one can access his information anytime anywhere.

A more complex theme which is "mobile cloud computing" is being studied in [Chun et al., 2010], and Figure 4, presents (a) the current scenario in which all computing is done by one device, and (b) the scenario that implements the concept of distributed computation, in which the processing is done, one part in the device, and the other part in the cloud. In this study, the authors predict that by the end of 2014 mobile cloud computing applications will deliver billions of dollars in annual revenues.

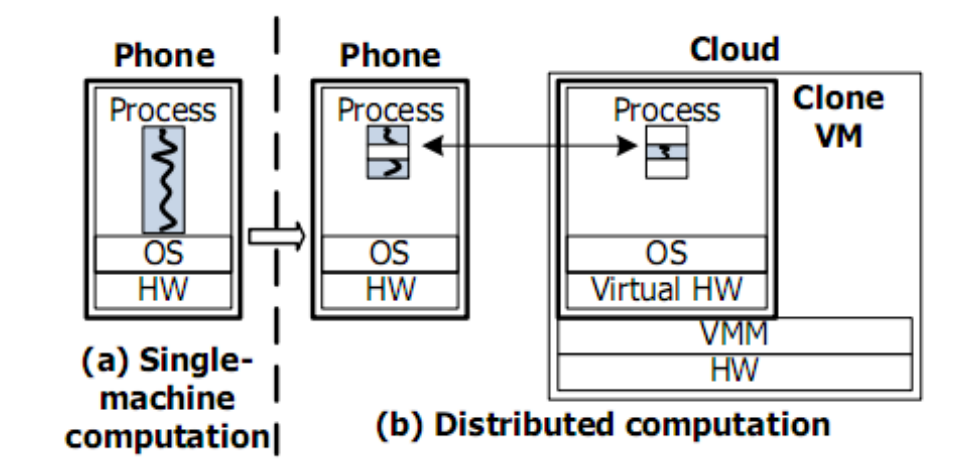


Figure 4 - CloneCloud System Model [Chun et al., 2010]

For mobile cloud computing to work properly, optimization in the data-transfer is needed. So with the combination of smart mobile devices and Cloud Computing with RESTful web-services we have entered a new era of computing [Christensen, 2009]. The

data-transfer optimization is obtained by improving the relation “number of requests vs. request size”, and the improvements of data speed plans by mobile network operators, will open the door to cloud processing, which leads to the ability of a distributed computation over a connected TCP network between the device, and a large number of other processors.

Regarding applications for mobile devices, quality-price relation is holding their success, and while mobile applications' industry keeps on delivering console-quality applications at such low prices, the success will continue. As for the mobile devices hardware, and despite the distributed computation concept presented above, their hardware will be improved as they always have been.



## Chapter 3. Entrepreneurship

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In this chapter, some themes related to entrepreneurship, my entrepreneur attitude, and the application of it in MyListBox will be presented. Some examples in the information technologies world are also studied.

The propensity for entrepreneurship is not based on Dna, culture, origin, or religion, that is, entrepreneurship is something that one is not born with. It is something that is developed in time, and improved with mistakes, similar approaches to leadership in an everyday life situation may help, but it does not define right away a generic entrepreneurial individual. The entrepreneurship spirit is something that grows after the first idea, and even before in an indirect way, by developing specific skills.

Before getting into entrepreneurship, it is necessary to know that there are 3 types of entrepreneurs:

- **Entrepreneur:** one that starts a new business, inventing a new technique or type of commercial activity, taking advantage of an unexplored market opportunity. In this perspective, the "entrepreneur" will always be the owner, principal partner CEO of the company.
- **Intrapreneur:** also called the corporate entrepreneur, an Intrapreneur has similar characteristics to the "entrepreneur" but with the difference that is not to start exciting new projects on his own initiative but at the service of an existing company or institution. "Intrapreneur" is one that, in any organization, is distinguished by its way of being and working in seek of the objectives of the institution he represents.
- **Social Entrepreneur:** are those who take a proactive approach regarding the integrated development of their community, their local land, their city or their country. They are, in every part of the world contributing in a direct way to resolve

social problems associated with poverty, drugs, the integration of handicapped, etc. They are usually in NGOs and government institutions.

George Bernard Shaw once said: "The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man."

The entrepreneur has the motivation to follow a dream, to create something new and to make a group of people his client. Of course he also has to adapt to the world in certain circumstances, and he will not reinvent the wheel, but he will have the idea to put two wheels, one in front and the other behind, a seat and handlebars everything together and he will create a vehicle to move around. That is, typically great ideas are based on other ideas. Entrepreneurs are the ones who walk through the world trying to change it, exploring and inventing a new business opportunities to create value for its customers. With all this innovation, they must be aware that it is inevitable that they will make mistakes, and normally they are.

When it comes to intrapreneurship, a Intrapreneur is an entrepreneur within a company, and the great difference between the regular employee and the intrapreneur is that employees are involved while intrapreneurs are committed to the company, that is, employees work because they get paid, and their employers pay them because they work, the Intrapreneur goes beyond that, they work in order to make the company grow by giving suggestions and analyzing situations in which they can improve, even though they may or may not be accepted. Sometimes an intrapreneur is considered a "revolutionary" because he is always thinking of ideas to change something, therefore challenging the "status quo", this can be something that their leaders do not like, and to avoid this intrapreneurs absolutely need a healthy relationship with their employer.

Instead of letting the problems and needs of society for the government or institutions for this purpose to handle, the social entrepreneur will find innovative solutions and try to convince the community about their ideas. Like the other types of entrepreneurs, these are equally persistent and ambitious people who live to change the world and they are normally concerned with the implementation of their thoughts. Typically the greatest desire of the social entrepreneur is to implement their solutions in a large scale. Some examples of social entrepreneurs:

- Susan Anthony: Women's Rights
- Vinoba Bhave: Natural Park System and the Sierra Club
- Jean Monnet: Reconstruction of France economy after World War II

### 3.1 Entrepreneur Profiles

As stated above, one is not born an entrepreneur. In my case, entrepreneurship came when I realized how difficult it is to offer gifts to others, and then asked myself "will it also be difficult for my family and friends, to choose the right gift for me?", and the answer was obvious "of course not, I am a person whom should be very easy to offer something," I said this because I know what I like, and know what I want to receive. Then I realized it should not be as easy as I thought, because I know what I receive, but maybe others do not. At this moment I started to have an entrepreneurial attitude: "what if I develop a platform where people were able to create and share a list of gifts?". And then the ideas began to emerge naturally. On the other hand, it is also after this moment that entrepreneurship difficulties begin to arise and when some skills are needed.

When one has a job ending at 6pm, but actually leave much latter than that, with a heavy mind of problems and complications, one must "switch off" so that he is possible to devote to our own project. For this, lot of energy is needed if we want to make our project a success, we must also start thinking about picking up the time that once was for leisure and / or rest and lose some weekends in the company of those we like best. In this respect, I had to arrange two methods to maintain a good level of productivity: the first, which I called "physical separator," is basically in those weekdays so bad in which many of the problems do not leave my mind, I leave the workplace and go to the beach for about 20 minutes to enjoy the sunset, and then, off to the office where I am building MyListBox, the second method is always save some time to hang out with family, girlfriend, and friends.

Not all the tasks related to our project go smoothly, and we start thinking, "I have so little time in my day to develop my project and these last couples of hours were just spent in vain ...." In these cases it is necessary to have three skills very well-developed: creativity, self-confidence and self-motivation. Creativity is needed to find new mechanisms to produce more efficiently, and notice that, it is not always necessary to find "Rocket Science" solutions, in my case, I found two solutions which had a great impact: manage my tasks by the methodology of "Getting Things Done" by David Allen, and another was something very simple, buy a whiteboard for brainstorming sessions, to define my daily To-Do's, and write the objectives for the next five years for MyListBox. I consider my whiteboard vital because it gave me perspective. When one is working in a task that is not going as expected, the tendency is to keep on doing that task until it is finished, which is a major mistake. Experience tells me if you stop doing it, start something else that is on the whiteboard, and then get back to it, the process will be much more productive.

Self-confidence and self-motivation are absolutely indispensable skills! During the process of developing the idea, there will be many people (certainly most) saying that the

idea is bad and that it is not worth spending time on it, it is so ugly and it should be done differently, etc. Ignoring all this negativity, requires a lot of self-confidence and self-motivation, and always having in mind that, "if we do not believe in the idea, who will?". Moreover, even if the project does not have the expected success, do not forget that "Experience is what you get, when you didn't get what you wanted" [Randy Paush].

There is a team of people working for MyListBox in different areas: information technology, marketing, design, accounting, and sales department. In this context arises a new competence: the ability to manage people. This skill is hard to develop because I believe that no one is born with this ability, which makes Human Resources the most valuable asset that companies have, making this issue is very important and delicate. The entrepreneur may have a natural way for leadership, yet one cannot assume that a leadership event in the past, in a certain group or situation, means that one is a good leader. I do not know if I am a good team manager, nor if I'll ever be, but what do I know, and what my experience tells me, is how to not manage people. There are several types of leadership, but in my opinion, a good manager should take a democratic and consensual leadership style, with an assertive type of communication, meaning one must listen to others, and discuss matters and options for a given problem with his team, and in the case of indecision one should make a statement. One thing that terrifies me the most is the sentence "we are going to do this way because I am the boss.", a key factor to avoid this is having clear and specific objectives, because when the leader is not aware of the responsibilities of his team, he will not be able to assign the pending tasks to the right people.

The manager should reflect to his team, that everyone must be aware that there will be moments of crisis but also times when everything runs softly, anyway, in both cases, he should pass on his compliments, or his criticism with due justification. In both cases he should say in proper time, and not let it go because the situation is more than certain to blister. I think that within style of leadership where people are not just involved in the project, they are also committed to it, because they no longer feel that they are simply carrying out their tasks alone, and come to feel like they are contributing to the company growth, and consequently for themselves. The manager must also remember that his team is not just a sum of people, and that they are different from machines, because people have emotions, which vary between sad to happy or between satisfied to unsatisfied. If one is not on his best conditions to work, maybe stopping for a few moments, will improve his productivity. Moreover, concerning achievements, leadership is less about the "I" and more about the "we" as for winning or losing is always as a team.

After coming up with the idea, the entrepreneur will first analyze wherever there is competition or not, and being his first business idea he had, he'll probably believe that there are no competitors, but one thing is guaranteed: there is always competition, direct or indirectly there is always a competitor. After that he is going to think about how to make the idea profitable, the type of promotion that he will do and where it will be released. The entrepreneur must be flexible and open-minded to allow changes to his initial idea, these skills that are not always easy though because the entrepreneur has to have self-confidence, but he must learn to see his project from the perspective of customers and investors, and determine if changes are consistent with the idea or not.

The entrepreneur must be careful when taking risks and should consider all possibilities when it comes to investments, and therefore, must rely on his team (when possible) for advice, being this one of his most important tasks. But the word "risk" does not only involve financial risk, there is the psychological risk within the possibility of failure, which leads to another skill an entrepreneur must have: to persist, to trust in the project and to always remember that he is the right person for the job. Moreover, in most businesses it is necessary that the entrepreneur is dedicated to the project during normal working hours, so he'll have to quit his job. Thus, the entrepreneur will take the risk of losing some of his social and financial status and start something from the beginning.

The entrepreneur must also be wise enough to determine if his idea is achievable as a business and if it is not then it should not be one, but if it is, only the time can prove he was right all along.

## **3.2 Entrepreneurship in Information Technologies**

This chapter will provide a summarized experience of entrepreneurship in some of the top companies in the IT world. These entrepreneurs also had a business idea, and turned it into a massive success.

### **3.2.1 Google**

Google Inc. is a multinational corporation worldwide known, dedicated to internet search, cloud-computing and advertising technology. It started in 1996 as Larry Page and Sergey Brin did a research project at Stanford University in California. The project was about creating a system to analyze the relation between websites, and it was called PageRank. A year later they changed the name for Google originated from misspelling the word "Googooooo".

Google was first financed by investors, the co-founder of Sun Microsystems contributed with \$100.000 in 1998. Then the company started growing, and in 1999 they realized that

Google was taking too much of their time, and wanted to sell it for \$1.000.000 but they got rejected by one possible buyer. A few months later it was already worth \$25.000.000 in funding. This evolution did not stop there, it continued to grow exponentially and now Google has more than 28.000 employees and their revenue ascends to \$29.3 billion [Wiki Google, 2011]. The evolution of Google regarding information technology also has interesting facts: Their servers were first in Larry Page's dorm and then relocated to a friend's garage in Menlo Park, and now they are all around the world.

Google is a case study concerning its actual facilities, their employees motivation is motivated by the most unusual and groundbreaking workplace. Actually Google has business in more areas than just IT.

### **3.2.2 Facebook**

Mark Zuckerberg is the face behind Facebook. He created the idea in his Harvard dorm on February 2004. With the success that his project was having within college, they expanded to other colleges in US, and one by one they covered all colleges.

A few months later, Zuckerberg moved to California with his team, where they leased a small house that served as an office. The first investment was done by co-founder of PayPal with an amount of \$200.000, and now their revenue is \$4.27 billion [Wiki Facebook, 2011].

Even though they had some buying offers, they turned them all down, because as Zuckerberg said: "it's not about the money". Their main income comes from advertising, and they are growing at the rate they want. As stated before, they now have 800 million active users all around the world, and an innovative work environment in every facility.

### **3.2.3 Microsoft**

The actual second richest man in the world, William Henry "Bill" Gates III, is one of the most successful entrepreneurs related to the personal computers. The success of Bill Gates and Paul Allen's idea is unparalleled. They also started their company in a garage and today it is one of the biggest multinational enterprises.

Even though being admired by many, he is also very criticized due to his anti-competition strategies. Today, Bill Gates is an investor, a philanthropist and an author. He resigned Microsoft's CEO position and became company chairman. The actual CEO is Steve Ballmer.

The name of the company was originated by joining microcomputer and software, which resulted in the name "Microsoft", that was established in 1975.

Gates built Microsoft empire by reshaping the way that companies conduct business, using strategic marketing techniques and careful product positioning.

### **3.2.4 Apple**

In 1976 Steve Jobs and Steve Wozniak found Apple Computer, Inc. with just 1.300\$ raised by the sale of a van and two calculators, and it is now largely responsible for the enormous growth of the personal computer industry in the 20th century.

The first order was from a local retailer who asked for 50 Apple I computers. These computers were built in Job's garage. In 1982 200 apple computers were sold, and to do be able to achieve that, Jobs hired local computer enthusiasts, many of them still in high school, to assemble circuit boards and design software.

In 1980 apple went public offering 4.6 million shares at \$22 each, which were sold out within minutes. Apple's growth didn't stop and now it counts with more than 10000 employees and revenue rises up to \$65.23 billion dollars [Wiki Apple, 2011].

The objective of Apple is bringing the best computing experience, innovative hardware, software and Internet applications for creative professionals as well as for students, teachers, basically, for everyone in the IT world.

### **3.2.5 YDreams**

In 2000, after returning from Silicon Valley, António Câmara founded "Ideias Interactivas S.A.", which was the first name of YDREAMS. He studied in New Lisbon University, and went to USA to work for NASA and MIT, in geographic information systems, multimedia and virtual reality areas.

Câmara says that the biggest challenge for them was a BBC competition, to develop a game for a TV series - spooks. This challenge had 90 enterprises competing, and this Portuguese Company won!

YDreams has now 2 spin-offs that are developing amazing new technologies, one in the robotic area, and the other responsible for creating animations in the papers, that is, in the future when one is reading the newspaper, it will have multimedia interaction, for instance, if the newspaper's front page is regarding a soccer match, the reader can view the highlights of it. YDreams first financing was done by private investors, and the spin-offs are in the stock market.

### **3.3 MyListBox**

MyListBox is starting now, and there are already many decisions made which will be provided in the next subchapters. From the experiences in the last chapter, lessons must be learned, and from these I draw the following conclusion: "Think BIG, start small...".

#### **3.3.1 Human Resources**

My opinion is that the difference between companies are humans, so I believe that for any company to be successful, people must be motivated, and since the beginning of MyListBox, I have proved that there are many more ways to motivate employees, besides a huge wage.

Although the idea has emerged in 2007, was in early 2011 that I decided to truly start MyListBox, so I started to gather objectives and came to the conclusion that regarding technology it was needed a website with an attractive design and mobile applications, and furthermore it was needed a good marketing campaign. As one of the reasons to retake my idea was the conclusion of the MSc in Computer Science, a major advantage for the thesis was, in addition to the technological part of mobile applications, apply for an entrepreneurship contest, which led to big pile of work, from market analysis to financial forecasts, and to achieve all this clearly a team was mandatory.

So, to be able to devote to what I had proposed was necessary to get people I trusted, and who looked at this project as a long-term opportunity, since the budget didn't allow me to pay any one. Initially, I spoke with two people, a web designer and a client manager who is also linked to marketing. These two people were chosen because we had worked together before and this resulted in a friendship relation, as such, we knew each other's personal and professional skills. And so these choices meet my requirements: trust and professionalism. With regard to their remuneration I learned a life lesson, because when we talked about wages, the answer was: "Let's build it because I see potential in MyListBox, when everything is structured and online we speak again." At the time, I was not very fond of their decision, but what was certain is that remuneration is not always the most important, and in this case, the motivation to create something innovative with great potential is stronger, and it has already paid off, because they are now able to put in their CVs that we won an entrepreneurship contest. Of course, a monetary compensation is necessary, but as both of them are in college, they can work in MyListBox in part-time.

In March / April, milestones were defined, and over time these have been changed because the targets have also been maximized to more ambitious levels. Currently, MyListBox is scheduled to be launched in early December to take advantage of the Christmas season, and to achieve this deadline, it was necessary to take some of my



responsibilities off, so that I could devote more to the core business. In this respect, it was necessary for someone to handle the commercial questions, one for the systems administration (servers and software) and another for accounting and taxation. So to achieve it, three more people were needed.

For commercial, I spoke with a longtime friend who is employed but wants something more from life, but with his qualifications and the actual conjecture is now very hard to get any better. In addition to trust, this choice was also based on an asset: he has to work in shifts, and as such he has the availability to attend clients during business hours. As he will have direct costs (fuel, meals, etc.) when going to our potential customers, the proposal was slightly different: as commercial-agent, he earns a fee on every package he sells. This creates a win-win solution because he is helping MyListBox growth, and MyListBox gives him a good opportunity for his life goals.

A computer engineer should know a little bit of everything, but in my opinion, should not know much of everything, and administration of servers and networks is not an area in which I am very comfortable. So the choice fell on another longtime friend, highly competent in his area, who is not completely satisfied with his current job. He also saw in MyListBox a better opportunity to apply their knowledge, and consequently feel more accomplished. The proposal made to the system administrator is the same as the one made to the web designer and marketer.

The financial area was handed over to someone who is more than my friend, is my brother. Besides having a lot of experience in accounting and taxation, he has business experience, and with him MyListBox can grow in a more sustained and controlled way

For readers who think that these agreements made with the team are disproportionate and naive, it should be noted that every single member of this team, have something in common: they saw that MyListBox have growth potential for high levels, and that they have the opportunity to work in their areas in the future, and so this risk is worth take, because they are already taking MyListBox profits and it is not even online. And besides this, they are all developing their skills and apply them in a practical way, which is not something that none of us can do in our current jobs.

As for myself, beside the responsibility of developing the website and the mobile applications, I am in charge of making the necessary decisions to run MyListBox, for instance decide the financing methods which will be discussed in the chapter 3.3.2. Another responsibility is to manage the team, and this is by far the easiest, when you work with people you trust, you can easily delegate tasks and expect them to be done in the best way possible.

All that has been obtained until this date, it could only be possible if we worked as a team, and we all are aware of this, because when we refer to achievements related to MyListBox, we refer as "we did" and not "I did"., Right now, we are all working part-time, but it is expected that year I can devote full-time, with a fixed salary and the rest of the team will work in part-time, also with fixed wages.

Of course that MyListBox may not have the expected success, but it is a risk we take and that we consider it's a risk worth taking.

### **3.3.2 Financing Methods**

The most critical point of turning an idea into a business is financing the project if necessary. The first task is to determine as precisely as possible the amount of money needed to invest, and after getting this value, multiply it by 125% to ensure a margin of maneuver in the event of budgetary slippage.

In my opinion, the different options for funding are:

- "Our Own Money": first we must turn to those savings we have been doing over the years, to be used in an investment. Even when it is not enough, some part of it should be used, and if the chosen option is this, the entrepreneur should be aware that he should only use a percentage of the money, because he never knows if might be need in the future.

- "Family Money": before resorting to the next option, the entrepreneur should check with his close family, if he can get the necessary capital, so as to avoid high interest rates from banks entities. In my opinion, the entrepreneur must however ask for the capital, but combining an interest rate with his family.

- Entrepreneurship Contests: this option should be used and abused, either if one has already investment or not, because entrepreneurship competitions much more than the prize money, require that the idea has a business plan well thought out and structured, and how many more contests to compete the many more you should apply, because in each contest one completes his idea with new features and services. Another positive aspect of this type of competitions is the contacts that one does, for example, in Poliempreende national edition, we got the Delta Cafes' marketing manager contact. In this contest, we were three days in Lisbon area, and among other things, we visited technology parks and one of the biggest Portuguese IT companies YDreams, we have also listened to successful entrepreneurs that shared their experiences: YDreams' CEO António Câmara and Delta Cafes' CEO Rui Nabeiro. This type of socializing and interaction made us open up to new horizons, which is very positive for those who are starting something new in the market.

- European Funds: Obtain funding from European investment funds is a lengthy process (usually several months), the selection criteria are very tight, and it is by competition, that is, even if the project meets the criteria for selection, there will be more projects to compete and so our project may not get funds because other projects that were ahead.

- Business Angels: A business angel (BA) is more than just an investor, because he has the ability to manage the business if the company is not being successful. In my opinion, the biggest disadvantage of using a BA is that the entrepreneur has to explain the whole idea and every detail of it, and as such if the BA is not a serious person, and he thinks the idea will be successful, he can easily pick up the idea and implement it by himself using his own money. Normally the BA does not sign confidentiality agreements, and it is understandable that he does not, for example, if an entrepreneur discuss with an idea with a BA about a renewable energy business, and they sign a confidentiality agreement, the BA cannot hear more ideas on renewable energy from another person. From the entrepreneur's point of view there is always the fear of somebody stealing his idea, but for those entrepreneurs that this is not a problem, it should be agreed at the start of the company, that there is a contract for purposes for which neither party will be harmed, that is, if the entrepreneur predicts that the business after 5 years will reach a value of turnover of € 1,000,000, but in fact it only has reached € 500,000, the BA will be jeopardized, and the reverse also applies, if the business reaches € 1,500,000 entrepreneur will not be set to gain. Therefore, it must be agreed that the percentages will be delivered if and only if the business reaches a certain value. Start a company with the support of a BA has a great advantage that is not achieved by other means of financing: the evaluation and optimization of the business plan. BA before investing in an idea, he will examine in detail the business plan and most likely he will get it optimized, because it has access to a network of contacts that the entrepreneur does not have, for example, the entrepreneur needs an estimated investment of 100,000 €, and when the BA review the business plan, he can check that he has a contact who produces a given raw material at a lower price and thus the value for investment will lower.

- Banking entities: Get credit via the bank is like a final exam in a discipline, because if the idea is not feasible then the bank will not lend, it's as simple as that. By getting the loan, the entrepreneur is aware that in addition to debt in the amount of the loan, he will have an interest rate that will be around the 3-month EURIBOR plus 3% or 4%. The banks usually have eligibility criteria that may cause the loan to not be approved, even if the project is feasible, for example, there are bank entities who do not approve loans for real estate companies, or companies to acquire financial assets.

- Credit institutions: in my opinion, one shouldn't ask for financing from this type of institutions, but if this is the chosen option, it will for one of two reasons: (i) banks asks personal information that the entrepreneur does not want to provide, or (ii) the investment proposal was turn down by the bank, or by a Business Angel. In any of these cases, the risk and the probability of failure are too high, and in the end if it does fail, we will be left with a big debt and a high interest rate.

In MyListBox's case, the initial investment is not very high because we agreed on a sustainable growth plan, growing at the same rate as selling do. Naturally, with a larger investment, we could do more expensive advertising campaigns to get more users and partners, and invest in better equipment, including servers with higher performances. However, we believe that our financial plan and predictions are more realistic this way. The business plan will be presented in more detail in chapter 5.1.

### **3.3.3 Competition Analyses**

As mentioned earlier, every business in the market has competition, as well as the ones who are just starting. This is a fact, and those entrepreneurs that came up with a new idea, thinking it is one a of kind, they are wrong, because in a direct or indirect way, there is always somebody selling / doing something alike. In MyListBox's case we have direct competitors like wishlitr.com and presentes.pt who provide a similar service, and in an indirect way we have mylist.com and we also considered Facebook as competitor in an indirect way.

Having competition normally scares initial entrepreneurs, as they tend to be sure that even if competitors exist, they will not deliver the same product / service, however a new perspective is needed in order to make the project grow. When we analyze competition we need to know what are our weakness and our strengths towards our competitors, and in this processes it is normally found that we can improve our weakness, for instance if competition has an android application, and one is not planning on having one, he might do a market research to check whether the mobile application is needed or not. Competition also has the ability to make us think in ways to improve our own business.

One has to be aware if in situations where the competition is hold by a large company like Facebook, his idea is strong enough to compete with it. Of course this example is rather exaggerated, but the entrepreneur must be aware that even though Facebook is not a direct competitor by the time the idea gets to the market, if the idea is successful, Facebook might be in a near future, as such, one has to consider several options to make a stand in the market, like a good marketing campaign to obtain as many users as possible. Typically, it is not what happens, in August 2011, Twitter has acquired

BagCheck, a small gear-sharing start-up that was becoming a success only after seven months. So in this case everybody won.

So let us have some competition, because if it is healthy, is something that will make our project growing, and everyone knows there is always room for improvement. In the other hand, when there are no direct competitors things tend to stagnate. And finally this words need to be remembered: if somewhere along the way, the entrepreneur says that “this process is done like that, because it always as”, then it is sure that the process can be enhanced.

### **3.3.4 MyListBox Name**

Until April 2011, this idea had a different name, it was called "A Lista", and the associated domain was [www.alista.com.pt](http://www.alista.com.pt). As internationalization is one of our goals we realized that we should go online with an English name. Then we agree that we should find a name that would be understood anywhere in the world. But this task was not as easy as it sounds, because in our opinion, it was mandatory that the project had a domain extension. "COM", and nowadays it is very hard to get a free TLD.

In these situations one has two solutions: finding a name that is related to the theme of the website, for instance "Facebook" we know that the website might be a related to people, or to invent a word without meaning, but which will be associate with the service, for example Google. It took too long for us to choose the proper name, because all names that came up were already registered: "TheList.com", "List.com", "Item.com", etc... Some of these cases are not even related to the concept of MyListBox, per instance, one of our possibilities is a site for a pharmaceutical company.

The second solution, come up with a word without meaning, has the disadvantage that our potential users have more difficulty to associate the name with the website, and when we are promoting the website we take the risk that potential users do not understand the name well, that is, if these words have letters that are easily confused with other letters, people may misspell the domain and cannot find the website. Although search engines are able to fix our searches, like Google does, it can still not be enough. Typically, the solution to find this type of words comes from anagrams of other words or phrases, and there are some websites that can do that for free.

So the solution we found was to write a list of words associated with the concept of MyListBox, and then trying to combine them to reach a valid name. So a few words were in this list: “List”, “item”, “box”, “my”, etc. By combining them we got the name “MyListBox”. There is also a very important aspect when trying to register a domain, which is in the

search engines look for the name you want, and validate if the name is or is not associated with adult content websites. After validating whether or not it was possible to register the domain, we register with the extension “.com” and “.net”.

There is also the option of buying a registered domain, that is, the name of the idea really has to be the same of the domain name, in this case, one can try to buy the domain, but usually what happens is that the price of the domain is very high compared with the cost of a new domain, for example, the price of a registered domain can easily go to 1.000€, 5.000€, 10.000€, while a new domain only costs between 5€ to 10€. Just out of curiosity, the most expensive domain ever is "insure.com" which was bought by QuinStreet in 2009, for \$ 16 million [Adams, 2011].

To sum up, getting the name MyListBox was a task that took about 2 to 3 weeks, and after making sure that in the search engines' results were not associated with adult content, we check if the TLD were free, and as they were, we registered the domains. In this process, unconsciously we were lucky, because the word BOX is a word that is catchy, thereby allowing people to quickly remember the name, and if they do not know the entire domain, when searching in Google for "list box" results will appear.

### **3.4 Summary**

Entrepreneurship is a very fascinating world, and once one enters it, he will never want to get out. In this chapter, it is provided information about entrepreneurship and the important decisions that had to be done regarding MyListBox.

What I am keeping from the experience I am having with MyListBox is that you need to have the skills provided in chapter 3.1 to be able to create and develop a project. From the history in the big IT companies it is proven that, to make a company grow, you need to have a team compromised with the project, and as they are the more important asset within it, they need to be motivated, and there is other ways of achieving this beside a huge wage.

When one is creating a business, he will find issues that will consume much time from him, besides the core-business problems, and some of them will look like they have no solution. But there is always a solution, even if it means to slow down the project. But for those like me who have a full-time job, and want to create something new, remember that “when you find a job you love, you will never have to work another day in your life. And if you don't find one, make one!”

## Chapter 4. Mobile Platforms and Applications

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As said in previous chapters, popularity and amount of users for mobile devices (smartphones and tablets) continues to grow. For web-oriented businesses this is a very important matter, since they need to provide the best browsing experience, in order to keep users pleased. In this chapter the reader is provided with information about architectural options, some of the challenges of developing software for mobile devices, a mobile operating systems comparison, and some of the entry barriers.

### 4.1 Architectural options

When a company has a website and is considering getting into the mobile world, usually there are 4 main possibilities:

- Keep the desktop website version: a standard, desktop-oriented web application is already created, so one can rely on mobile browsers to render it acceptably.
- Adapt CSS and use progressive enhancement<sup>2</sup> in order to create styles, markup, and scripts that are able to adapt to the viewing mobile device browser. Solution in the customer
- Create a mobile version of the website, with less information and adjusted to a smaller screen size. When a user access the website, the server knows, by the characteristics of that device's browser, whether it is a mobile device or not, and if it is the user is redirected to the mobile version.
- Create an application for mobile devices to access and show the website information in the smartphone or tablet.

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<sup>2</sup> "Progressive enhancement is a strategy for web design that emphasizes accessibility, semantic HTML markup, and external style sheet and scripting technologies." [Font: Wikipedia]

The first solution has the advantage of “no work necessary” but definitely the worst outcome of all, meaning that, the HTML render is done by the mobile device browser, and therefore the webpage will probably look misconfigured. But even if the browser renders the webpage the way a desktop browser would do, in order to access the information the user would be forced to scroll horizontally and vertically, and to zoom in and zoom out, thus providing a very bad user experience.

Adapting CSS is solving the issue on the client side which is good to (i) avoid server-side code duplicated and (ii) optimizing the rendering according to the device characteristics (screen-size and input). This option has the trade-off of these advantages with excessive high bandwidth used to transmit all the styles and markup, even the ones that the mobile device is not going to use. Other disadvantage is the fact that websites' mobile versions are typically very different than the website version, since mobile devices have a smaller screen and therefore less information can be shown. So distinguish the versions just by CSS may turn into a very difficult task.

The third option, that is to create a mobile version of the website turns the two disadvantages of option 2 into advantages, which are (i) the flexibility to adapt the main site to a lighter one with less content, and the use of the (ii) efficient bandwidth, since the device is only going to download exactly the information needed. In the other hand developing a mobile version may cause some code duplication and in some situations type of device detection is not straightforward.

The main advantage of creating an application for mobile devices is the ability to work offline, but it is also the solution that requires more time and skills to do it, because developers need to implement the most suitable synchronization methods, in order to guarantee that, if a data connection is available the application have to update the information in the device, but if it is not possible to communicate with the server, the application have to provide the last information received from it, and it also must warn the user that, as connection with the server wasn't possible, the information might not be updated. Thus, it's necessary to have a client-server architecture well defined with a middleware in between to achieve data quality, because even though the synchronization is not mandatory, if the application only works online it will be useless when data connection is not available. The main drawback is the fragmentation, that is, there are more than one mobile operating system so it may or may not be interesting to have an application for Android, another for iPhone/iPad, another for Windows Phone 7, another for Symbian, etc. Anyway, one has to be aware that even with the same operating system the devices may or may not run the application.



These options may and probably will overlap, that is, one can develop a mobile version and an application for mobile devices, for instance Facebook has a lighter version of the website specially designed for mobile devices, but it also has an application for iPhone and Android. The same thing happens with the Portuguese news portal [www.Sapo.pt](http://www.Sapo.pt) they also have a mobile version of their website and an application for Android and another for iPhone.

The decision on what solutions to implement will depend on the purpose of the business, that is, if the business is something related with luxury, developers may choose to care more about expensive smartphones and tablets and therefore aim the application and/or the mobile website for devices with larger screen-size and/or more powerful machines (in terms of CPU, RAM, etc.), but if the business target is the low-cost smartphone, which is still a more than valid option, the decisions may be different. This takes the question to another level, the challenges of supporting mobile devices, which is the theme of the next sub-chapter.

## **4.2 The challenges of supporting mobile devices today**

“There’s no one-size-fits-all solution; your application will have to look and behave differently according to the device accessing it. “ [Sanderson et.al, 2011]

Designing software for mobile computing systems has challenges quite different from those involved in the design of software for desktop systems and the quote above has an important message related to this, which is the mobile devices are not all equal, and as approached in the previous sub-chapter, the devices vary dramatically in several aspects, which are going to be approached in the next sub-chapters.

### **Input methods**

The input methods are the way of interaction with the mobile device, and they are:

- Physical keypad: in the beginning of mobile devices world, the interaction with the device was done by the traditional keypad with 10/16 keys which represented 0-9 digits, the # and \*, and the green button and the red button to deal with calls, and finally the menu and the directional keys used to navigate inside the device to make calls, send SMSs, configure the phone, etc., then the keypad evolve to a “QWERTY” or “AZERT” keyboard; Today there are still some devices with only this input method.
- Styluses pens: a very accurate way of interact with the device, the stylus pen is used especially in PDA’s.

- Touch: Touch ability sent the mobile devices to a new dimension, since in one hand, the capability to touch everywhere in the screen brought flexibility, but in the other hand, touch input on the small screen of a mobile device is problematic because a user's fingers obstruct the virtual objects he wishes to work with. It is being studied a device that might overcome this problem [Widger et al., 2011] called "Lucid Touch", which is basically a device that responds to touch in back of the device. The multi-touch, which is the actual trend, brought even more flexibility with the ability to pan and zoom the contents, using more than one finger.
- Voice: Human voice is another way of interacting with the device and it is normally used to give orders to the device such as making calls, interact with the music player (play, stop, next song, etc.).

### **Screen size**

Mobile devices differ widely from each other, especially in terms of physical shape, and therefore in screen-size dimensions. [Chittaro, 2006] The mobility context and technical limitations such as small screen size make it impossible to simply port visualization applications from desktop computers to mobile devices, but researchers are starting to address these challenges. The way that information is displayed in the mobile device is critical because of limited screen space. iPhone's screen-size is 3.5" whereas HTC HD7, Samsung Galaxy 1 and 2 is 4", so developers have to consider both sizes, as well as smaller ones, 3.2" and 2.5".

### **Battery**

Nowadays, mobile devices are having the abilities of desktop computers they are faster, with more applications and features. For that they need powerful processors, which consequently consume more battery. As important as screen size, mobile applications developers have to implement applications bearing in mind the optimization of algorithms in order to do less CPU processing cycles, for instance avoid infinite loops, to therefore consume less battery.

### **Bandwidth**

Mobile devices are able to connect to wireless networks when available, but when not, mobile device owners must have data plans for their smartphones. Mobile Communications Operators have different data plans which depends on the traffic (amount of megabytes) allowed, and data network performance (speed), thus, once again, developers must take

into account that these plans are normally limited, therefore they need to implement their applications considering offline availability for them.

## **Security**

The purpose of mobile devices and their biggest advantage is mainly portability, and therefore mobile devices including, smart phones, tablets, PDAs, laptops can expose organizational data outside organizations physical boundaries, if not properly protected.

There is another way of exposing information, which is through bad-intended applications, and Android Google's open source operating system for mobile phones, has a security model which attempts to unmask the complexity of secure application development. It is mandatory that mobile devices support a comprehensive and usable security interface and infrastructure, because as new features, services and applications come along, so do vulnerabilities.

In their study [Enck et.al, 2009] has shown that, Android's security framework is based on label-oriented and has two security mechanisms: (i) each application runs as a unique user profile, which lets Android limit the potential damage of programming flaws and (ii) application are protected at system level and at the Inter-component communication (ICC) level. Even though these mechanisms are equally important, the first is very straightforward as it is done by the operating system, it is transparent to the developer. The reader will be provided with more information about Google's Operating System – Android - in chapter 4.3.3.

As said before, with the popularity of mobile devices they become an increasingly attractive target for attackers willing to pick up all our personal data. Adding to this factor, an open platform (which is the case of Android) that allows anyone to publish their applications without control in Android Market, then the risk becomes even higher, since many people may assume that the application is implicitly safe. This leads to growing of malware attacks via unsafe and bad-intended advertising, or web links to download automatically a malicious application.

We all know that almost nobody cares for warnings saying that the application will access some feature, and to fight these attacks in the future, some actions need to be taken, although some attacks will always be inevitable. Apple's App Store is considered a "fully closed" store because in one hand, applications are less exposed to such threats, but in the other hand, the store acceptance department is can choose what applications to publish to general public and the one's considered "undesirable" are not.

What is certain is that, in one hand, the safety issue is beginning to grow to serious levels, not only in mobile segment as well as all other segments, but in the other hand people are also starting to be more aware of the risks with security.

## **4.3 Mobile Operating Systems**

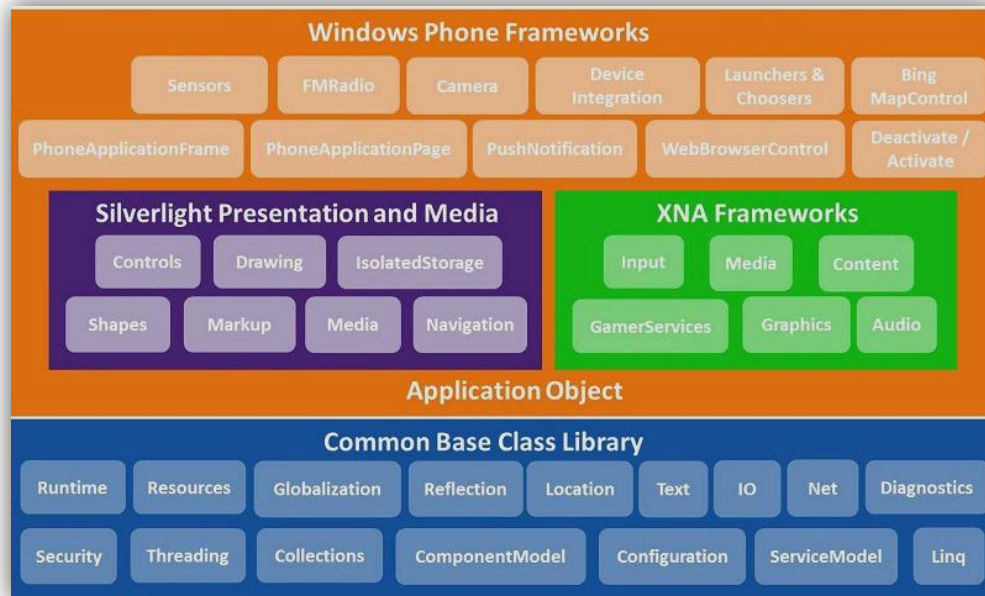
### **4.3.1 Microsoft Operating System**

Windows Phone is the current brand name for the Microsoft's mobile operating system. It has replaced the old brand Windows Mobile. This happened because it was obsolete, since it was based on the old Windows CE, which comes from the time of the PocketPC. For this reason the Windows Mobile's share on the smartphone market has been falling year-on-year. Now, it's the 5<sup>th</sup> mobile operating system most popular in the world and has a smartphone market share of 4%.

So, in the year of 2010 Microsoft announced a completely new phone platform, the Windows Phone 7, to compete with the iOS and Android (the two main rivals). This new operating system has a series of valuable features, as the integration to the Xbox and Zune Microsoft services.

With its new look, striking fonts, and new organizational paradigms, Microsoft Windows Phone 7 tries to represent a break with the Windows Mobile past, and intended to be used by several mobile devices manufacturers. The programs for Windows Phone 7 are written in .NET managed code (C#, Visual Basic, etc.) in conjunction with the Silverlight and XNA 2D frameworks.

With Silverlight and the XNA Framework, all development is done in managed code, in a protected sandbox allowing the rapid development of safe and secure applications. One big benefit is that the applications already written for Silverlight or the XNA Framework run on Windows Phone with only minor changes, such as for screen size or for device-specific features. These Libraries can be seen on figure 5.



**Figure 5 - Windows Phone Architecture**

Silverlight has given Web programmers functionalities to develop sophisticated user interfaces with a mix of vector graphics, media, and data binding that run on multiple platforms and browsers, Windows Phone 7 extends Silverlight to mobile devices, being generally used for writing applications or utilities. These programs are built from a combination of markup (Extensible Application Markup Language - XAML) and code. The XAML mostly defines a layout of user-interface controls and panels. Code-behind files can also perform some initialization and logic, but are generally relegated to handling events from the controls. Silverlight is great for bringing to Windows Phone the style of rich internet applications, including media and the Web.

XNA Microsoft's game platform supports both 2D and 3D graphics with traditional game-loop architecture. XNA is primarily used for writing high-performance games for the Xbox 360 console and PC, as well as to develop application to Zune HD.

Windows Phone mobile devices have some mandatory specifications to ensure that every Windows Phone has a consistent set of features that customers can rely on. Every Windows Phone device has one consistent screen size: WVGA (800 x 480), although a second screen size is expected in the future. The screens are capacitive 4-point multi-touch for a good phone control and DirectX 9 hardware acceleration is used to improve graphics.

In the front of the phone, besides the screen, are presented three hardware buttons positioned in a row below the display. These include the Back, Start and Search Buttons as shown on figure 6 a). A suite of sensors is also standard: A-GPS, accelerometer, compass, light, microphone and proximity. They have also a digital camera – used to take pictures or

make movies. The mobile devices RAM memory must be greater than 256MB and the flash storage needs to have at least 8GB. Wi-Fi and cellular network data connectivity are also present in these mobile devices.

A Windows Phone application has the following components:

- Tile
- Page
- WMAAppManifest.xml

A Tile is a link to an application displayed in Start Page – figure 6a). There are two types of Tiles – application Tiles and secondary Tiles. The application Tile can be seen as a shortcut to an application on the Start Page. A secondary Tile is created programmatically by an application to interact with the user. Typical uses for a secondary Tile include a weather application that has a Tile on the Start Page for each city that the user wants a weather report.

Windows Phone exposes its UI through a set of Pages. A Page is a user-recognizable collection of persistent state. It can be seen as a Silverlight Page that contains information, memorable content, or links to other Pages. In figure 6b) one can see a browser that basically represents a Page. In comparison, a screen is a pop-up window, dialog box, or splash screen that does not contain memorable content. It is not a user-recognizable collection of persistent state.

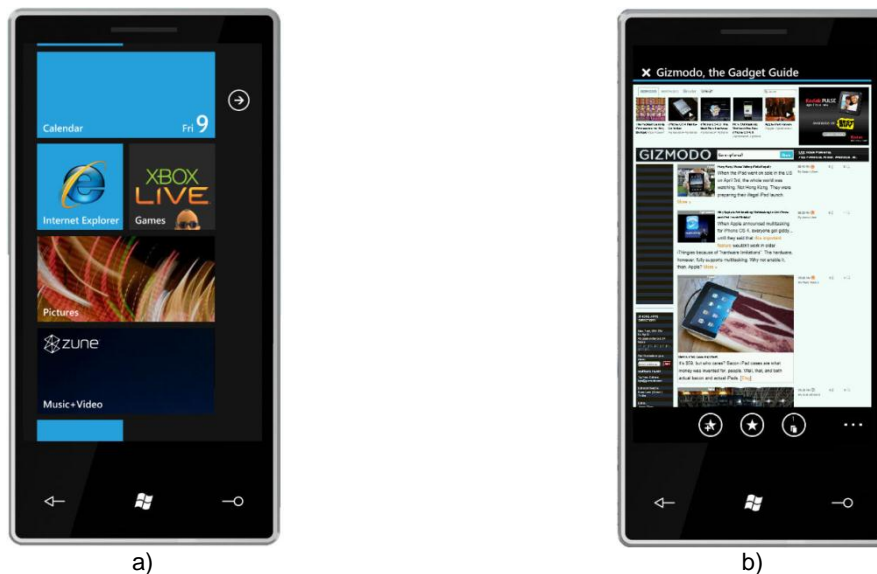


Figure 6 - a) Windows Phone Start Page; b) Internet Explorer Page

To navigate within the Pages a Navigation Service is used. This service contains properties, methods, and events related to UI navigation. To select the Page that we want to go (the XAML file) we use a URI to invoke that Page. There are four primary events used for application state management: Launching, Deactivated, Activated, and Closing. These

states have associated handlers, and are in these handlers that we write the code to manage the applications state.

An isolated storage allows an application to create and maintain data in a sandboxed isolated virtual folder. All I/O operations are restricted to isolated storage and do not have direct access to the underlying operating system file system. This prevents unauthorized access and data corruption by other applications. Structured data can be stored in a relational database and can be accessed by using LINQ to SQL. Windows Phone allows the developers to know the user's physical location information through the Microsoft Location Service for Windows Phone. Developers can query for the current location, subscribe to Location Changed events, set the desired accuracy of the data, get access to device heading and speed, and calculate the distance between points.

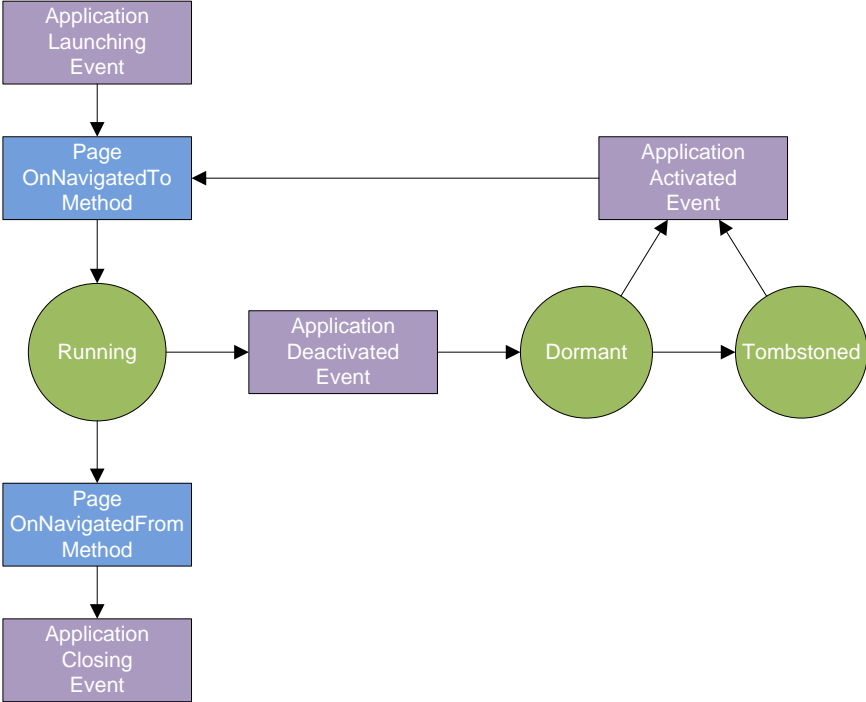
An interesting Windows Phone native feature is the "Push Notifications". Some Web services would normally require the phone to frequently poll the service to obtain updated information, and as we know, constantly Internet connections can drain battery life. To help out, this service has been integrated allowing any required polling to occur outside the phone permitting the phone to receive notifications only when data has been updated.

Each Windows Phone application has a manifest file (WMAppManifest.xml) that contains details about the application, such as the App ID and the capabilities that the application uses. The primary purpose of the manifest file is to be used by the Windows Phone Marketplace, to certificate the application, to filter the application correctly in the Windows Phone Marketplace, and to deploy and run the application on physical devices. The information from the manifest file is stored as metadata in the application database.

Windows Phone 7 multitasking capability manages multiple active applications using a stack. This is similar to an old-fashioned web browser with no tab feature and no Forward button. But it does have a Back button and it also has a Start button, which brings the Start screen and allows the user to launch a new program.

A simple multitasking usage scenario can be seen like this, we launch a program called Calculator. After we make some calculations we want to finish the application, so we press the Back button. The Calculator program is terminated and we're back at the Start Page. In a more complex scenario we decide to run Calculator again. While we're using Calculator, we need to check something on the Web, and by pressing the Start button we get to the Start screen and select Internet Explorer. Then the Calculator enters in a Dormant state and the Internet Explorer is presented in the foreground. After check what we want, we press the Back button and the Internet Explorer is closed and the Calculator is shown

again. To a better understanding of this process an application state diagram can be seen in figure 7.



**Figure 7 - Windows Phone Applications States**

The Windows Phone execution model governs the lifecycle of the running applications, from when the application is launched until it is terminated. The execution model is designed to provide end users with a responsive experience. To achieve this, Windows Phone allows only one application to run in the foreground at any given time. The operating system puts an application in a Dormant state when it is no longer in the foreground. If the device memory available for the foreground application is insufficient for a good user experience, then the operating system will begin to terminate Dormant applications, with the least recently used applications terminated first. A programming framework is provided for applications to manage their state as they are deactivated and reactivated. This helps to create a user experience in which applications appear to the user to maintain a single instance, even when they have been terminated and reactivated.

The execution model also provides users with a consistent navigation experience between applications. On Windows Phone, users' navigate forward by launching applications from the installed applications list or from a Tile on Start in addition to other means, such as tapping on a toast notification associated with an application. Users can also navigate backwards, through the Pages of a running application, or through the stack of previously running applications by using the hardware Back button.



The Tombstoned process is called when an application is terminated, but some data about the state of the application and the individual Pages within the application is preserved. The data that is saved includes the currently displayed application Page and the back stack of Pages that had previously been visited in the application. If the user navigates back to a Tombstoned application, the application is re-created, and the current Page and Page history are restored automatically.

Each Windows Phone application and application Page provides a Dictionary object in which we can store key/value pairs. These dictionaries are preserved when an application is Tombstoned. When an application is activated after being Tombstoned, these dictionaries are used to restore application state.

### **4.3.2 Apple's Operating System**

iOS is Apple's mobile operating system which is derived from Mac OS X that is therefore a Unix-like operating system. Originally developed for the iPhone, it has been extended to support other Apple devices such as the iPod touch, iPad and Apple TV. It is exclusive for Apple mobile devices since they do not license iOS for installation on third-party hardware. In the last quarter of 2010, it had a 15.7% share of smartphone operating system market in terms of units sold, behind Google's Android and Nokia's Symbian.

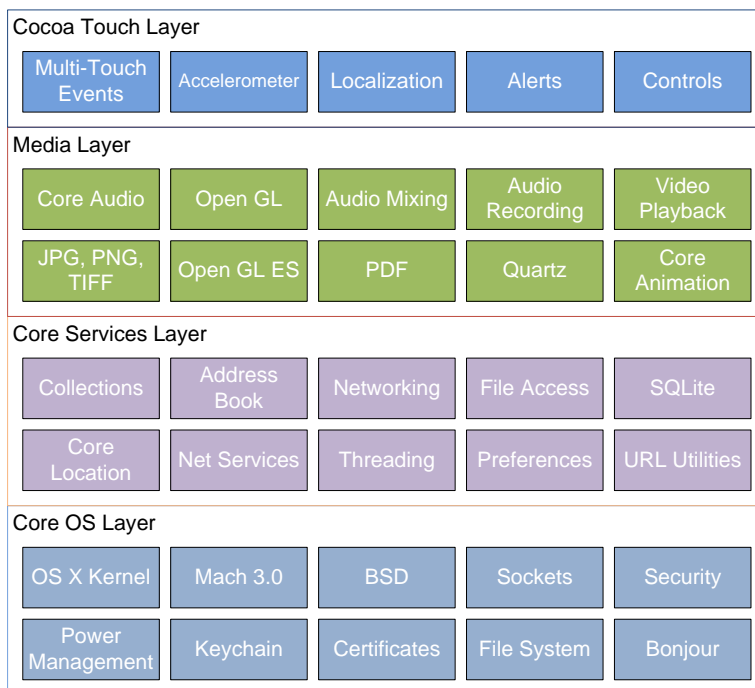
The display of an iOS-based device is at the heart of the user's experience. People do not only see beautiful text, graphics, and media on the display, but they also can interact with gestures (Multi-Touch) on the screen to drive their experience. The iOS UI is based upon the concept of direct manipulation, using multi-touch gestures. Interface control elements consist of sliders, switches and buttons. The response to user input is immediate and provides a fluid interface. Interaction with the OS includes gestures such as swipe, tap, pinch, and reverse pinch, all of which have specific definitions within the context of the iOS operating system and its multi-touch interface. This simple and intuitive interface was responsible for the iPhone huge success.

For security reasons, iOS restricts each application (including its preferences and data) to a unique location in the file system. This restriction is part of the security feature known as the application's *sandbox*. The sandbox is a set of fine-grained controls limiting an application's access to files, preferences, network resources, hardware, and so on. Each application has access to the contents of its own sandbox but cannot access other applications' sandboxes. When an application is first installed on a device, the system creates the application's home directory, sets up some key subdirectories, and sets up the security privileges for the sandbox. The use of a unique location for each application simplifies data storage options for the application, backup-and-restore operations,

application updates and uninstallation. Applications can also create custom directories inside the home directory, or any of its subdirectories.

In iOS 4 a new function was introduced, applications can use the file protection feature to encrypt files and make them inaccessible when the user's device is locked. File protection takes advantage of built-in encryption hardware to add a level of security for applications that work with sensitive data. Protected files are stored on disk in an encrypted format at all times. While the user's device is locked, not even the owning application can access the data in the encrypted files. Applications must designate which data files need to be protected and assign the appropriate metadata attributes to them

To manage program memory, iOS uses essentially the same virtual memory system found in Mac OS X. In iOS, each program still has its own virtual address space, but the amount of usable virtual memory is constrained by the amount of physical memory available. When it needs more space the virtual memory system simply releases read-only memory pages, such as code pages. However, such pages can always be loaded back into memory later if they are needed again. If memory continues to be constrained, the system may send notifications to any running applications, asking them to free up additional memory. All applications should respond to this notification and do their part to help relieve the memory pressure.



**Figure 8 - iOS Application Layers**

iOS is composed by four abstraction layers (Figure 8) and the functionalities in each layer are exposed through various frameworks:

- Core OS layer – is the foundation of the operating system. It is in charge of memory management, the file system, networking, and other OS tasks, and it interacts directly with the hardware;
- Core Services layer – provides an abstraction over the services provided in the Core OS layer. It provides fundamental access to iPhone OS services;
- Media layer – provides multimedia services that can be used in iOS applications;
- Cocoa Touch layer – gives an abstraction layer to expose the various libraries for programming an iOS application.

From the time an application is launched by the user, to the time it exits, the UI framework manages most of the application's core behavior. For example, an iOS application receives events continuously from the system and must respond to those events. To understand how UI objects work with developer custom code they are described below:

- **The `UIApplication` object** manages the application event loop and coordinates other high-level behaviors for an application. This object is mostly used to configure various aspects of the application's appearance. Custom application-level code resides in application delegate object, which works in tandem with this object;
- **The application delegate** is a custom object that initializes the application and presents its window on screen. The `UIApplication` object also notifies this object when specific application level events occur, such as when the application needs to be interrupted or moved to the background;
- **Data model objects** store application's content and are therefore specific to each application;
- **View controller objects** manage the presentation of application's content. Typically, this involves creating the views to present that content and managing the interactions between the views and application's data model objects. The `UIViewController` class is the base class for all view controller objects. It provides default functionality for animating the appearance of views, handling device rotations, and many other standard system behaviors;
- **A `UIWindow` object** coordinates the presentation of one or more views on the device screen or on an external display. Most applications have only one window, the content of which is provided by one or more views. An application changes the content of that window by changing the current set of views. In addition to hosting

views, windows are also responsible for delivering events to those views and to their managing view controllers.

- **Views and controls** provide the visual representation of application's content. A **view** is an object that draws content in a designated rectangular area and responds to events within that area. **Controls** are a specialized type of view responsible for implementing familiar interface objects such as buttons, text fields, and toggle switches. The UIKit framework provides standard views for presenting many different types of content. However we can also define custom views by subclassing UIView directly.

To create the iOS user interfaces an Interface Builder application is used. This application produce a document called a Nib files. Nib files play an important role in the creation of applications in iOS. A nib file describes the visual elements of application's user interface, including windows, views, controls, and many others. It can also describe non-visual elements, such as the objects in application that manage the windows and views. Nib files let the creation and manipulation of the user interfaces graphically, using the Interface Builder application, instead of programmatically. Because we can see the results of changes instantly, this gives the ability to experiment different layouts and configurations very quickly. It also gives the flexibility to change many aspects of user interface later without rewriting any code.

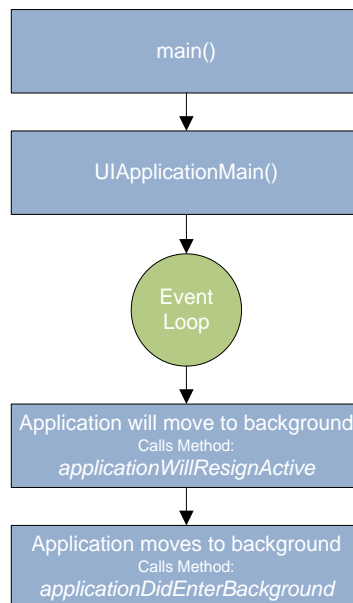
Only on iOS 4 multitasking functionality was enabled, this means that applications can reside in memory but do not actually execute any code. These applications are suspended by the system shortly after entering the background to preserve battery life. Keeping applications in memory adds complexity to the application life cycle but provides significant benefits to both the application and users.

The application life cycle constitutes the sequence of events that occurs between the launch and termination of an application. In iOS, the user launches an application by tapping its icon on the Home screen – Figure 9. Shortly after the tap occurs, the system launches the desired application by calling its `main` function. From this point on, the bulk of the initialization work is handed over to UIKit, which loads the application's main nib file and readies the event loop.



**Figure 9 - iOS Home Screen**

Figure 10 shows the application life cycle, where it presents the sequence of events that occur between the time the application starts up and the point at which another application is launched. At key points in the application's life, UIKit sends messages to the application delegate object to let it know what is happening. During the event loop, UIKit also dispatches events to the application's custom event handlers, which are the views and view controllers.



**Figure 10 - iOS Application Life Cycle**

Applications running in iOS 4 and later can be in one of several different states at any given time, which are listed below:

- Not running – the application has not been launched or was terminated by the system;

- Inactive – application is running in the foreground but is currently not receiving events. It may be executing other code though. An application usually stays in this state only briefly as it transitions to a different state. The only time it stays inactive for any period of time is when the user locks the screen or the system prompts the user to respond to some event, such as an incoming phone call or SMS message;
- Active – the application is running in the foreground and is receiving events;
- Background – the application is in the background and executing code. Most applications enter this state briefly on their way to being suspended. However, an application that requests extra execution time may remain in this state for a period of time;
- Suspended – the application is in the background but is not executing code. The system moves an application to this state automatically and at appropriate times. While suspended, an application is essentially freeze-dried in its current state and does not execute any code. During low-memory conditions, the system may purge suspended applications without notice to make more space for the foreground application.

Applications running in iOS 3.2 and earlier do not enter the background or suspended states, instead they are terminated and moved to the not running state.

### **4.3.3 Google's Operating System**

Android applications are developed using Java. Android itself is not a language, but rather an environment to run applications. As such, theoretically any distribution or Integrated Development Environment (IDE) can be used to develop Android applications.

To keep with the Open Handset Alliance's theme of truly opening the mobile development market, Eclipse is the recommended IDE for Android applications. Eclipse is one of the most fully featured, free and easy to work Java IDEs available. This consortium has released an Android plug-in for Eclipse that allows the creation of Android specific projects, compile them and use the Android Emulator to run and debug them. Still it is possible to create Android apps in other IDEs, but the Android plug-in for Eclipse creates certain setup elements such as files and compiler settings automatically. The help provided by Android plug-in for Eclipse saves precious development time and reduces the learning curve, which means more time to create applications.

To begin the creation of Android projects, Android SDK (Software Development Kit) is needed. It contains all the Java code libraries needed to create applications that run specifically on the Android platform. The Android SDK also contains libraries to applications

access into core Android features such as those associated with cell phone functions (making and receiving calls), GPS functionality and text messaging.

As can be seen on Figure 11, internally Android uses Linux for its memory management, process management, networking and other operating system services. The Android phone user will never see Linux, and programs never make Linux calls directly.



**Figure 11 - Android System Architecture**

The next layer above the kernel contains the Android native libraries. These shared libraries are all written in C or C++, compiled for the particular hardware architecture used by the phone and preinstalled by the phone vendor.

Some of the most important native libraries are the follows:

- **Surface Manager:** Android uses a window manager similar to Vista or Compiz, but it's much simpler. Instead of drawing directly to the screen buffer, drawing commands go into off-screen bitmaps that are then combined with other bitmaps to form the display that user's see. This lets the system to create all sorts of effects such as see through windows and fancy transitions;
- **2D and 3D Graphics:** These two elements can be combined in a single user interface with Android. The library use 3D hardware if the device has it or a software renderer if it does not;
- **Media Codec's:** Android can play or record a variety of video and audio formats;
- **SQL Database:** Android includes the lightweight SQLite database engine to be used for persistent storage on applications;

- **Browser Engine:** For the fast display of HTML (Hypertext Markup Language) content, Android uses the WebKit library. This is the same engine used in the Google Chrome browser, Apple's Safari browser and Apple iPhone's.

Also sitting on top of the kernel is the Android runtime, including the Dalvik virtual machine and the Java core libraries. The Dalvik VM (Virtual Machine) is Google's implementation of Java, optimized for mobile devices.

Sitting above the native libraries and runtime, is the Application Framework layer. This layer provides the high-level building blocks that are used to create applications. The framework comes preinstalled with Android, but can be also extended with new components if it is needed. The most important parts of the framework are the follows:

- **Activity Manager:** This controls the life cycle of applications and maintains a common "back stack" for user navigation;
- **Content Providers:** These objects encapsulate data that needs to be shared between applications, such as contacts;
- **Resource:** Is everything that goes with the program that is not code;
- **Location Manager:** To Android phone knows where it is;
- **Notification Manager:** Events such as arriving messages, appointments, proximity alerts and more can be presented in an unobtrusive way to the user;

On standard Linux or Windows operating systems, user can have many applications running and visible at once in different windows. One of the windows has keyboard focus, but otherwise all the programs are equal. Users can easily switch between them, but it's their responsibility to move the windows around to see what they are doing and close programs that are not needed anymore.

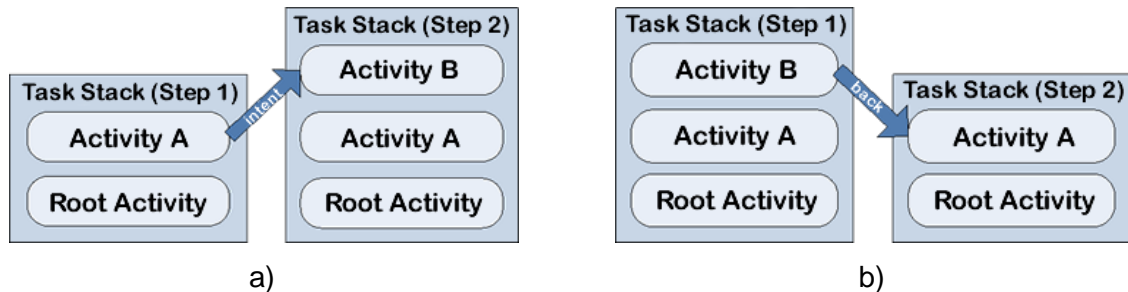
Android does not work that way. In Android, there is one foreground application, which typically takes over the whole display except for the status line. When the user turns on its phone, the first application he sees is the home application (Figure 12). This program typically shows a background image, a search or clock widget, and a scrollable list of other applications that user can invoke.





**Figure 12 - Android Home Application**

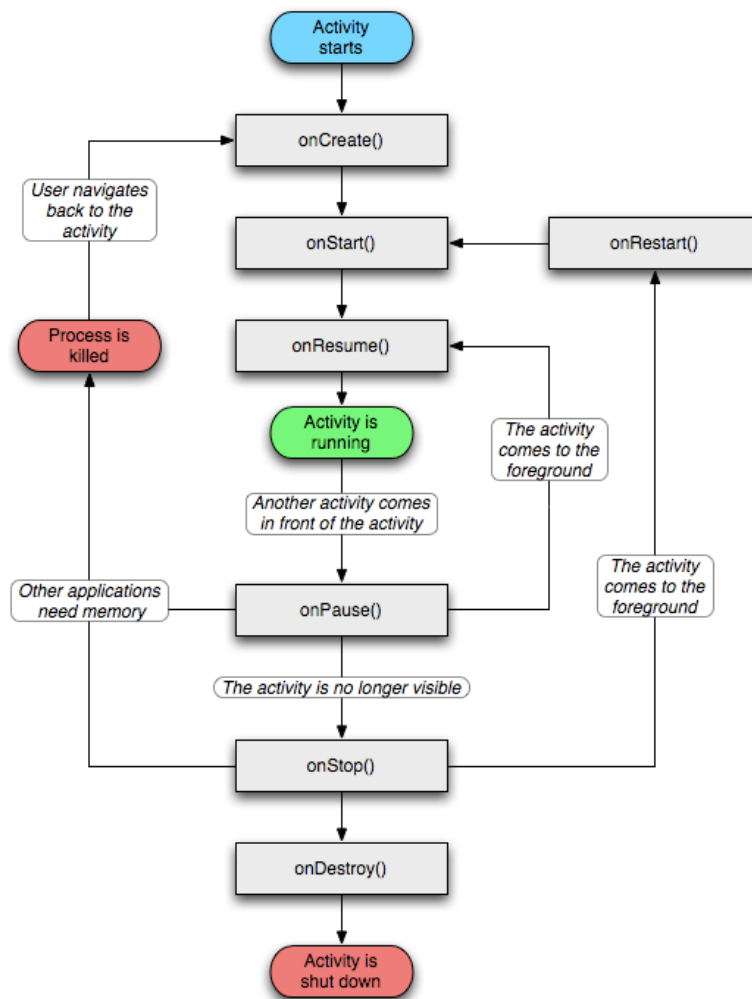
When the user runs an application, Android starts it and brings it to the foreground (Figure 13a). From that application, user might invoke another application, or another screen in the same application, and then another and another. The system's Activity Manager records all these programs and screens on the application stack. At any time, user can press the "back" button to return to the previous screen on the stack (Figure 13b). From the user's point of view, it works a lot like the navigation history in a web browser. Pressing "back" button it returns to the previous page.



**Figure 13 - Task Stack: a) new Activity invocation; b) back to previous Activity**

Internally, an Activity class represents each user interface screen. Each Activity has its own life cycle. One or more Activities plus a Linux process to contain them constitute an application. That sounds pretty straightforward, but it is not. In Android, an application can be "alive" even if its process has been killed. Putting it in another way, the Activity life cycle is not tied to the process life cycle. Processes are just disposable containers for Activities. This is probably different from every other system.

During its lifetime, each Activity of an Android program can be in one of seven states, as shown in Figure 14. The developer does not have control over what state the program is in. That's all managed by the system. However, a notification is sent when the state is about to change through the onXX() method calls, where XX is the new state.



**Figure 14 - Activity Lifecycle**

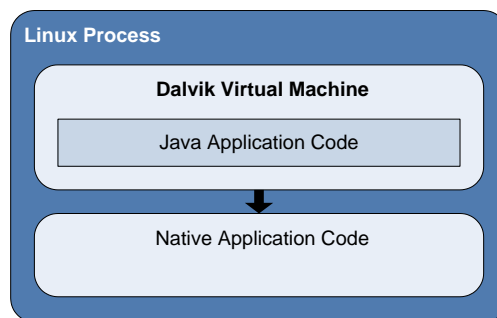
These states can be overridden in the Activity class and Android will call them at the appropriate time:

- **onCreate(Bundle):** This is called when the Activity first starts up. It can be used to perform one-time initialization such as creating the user interface. onCreate() takes one parameter that is either null or some state information previously saved by the onSaveInstanceState( ) method;
- **onStart():** This indicates the Activity is about to be displayed to the user;
- **onResume():** This is called when Activity can start interacting with the user. This is a good place to start animations and music;
- **onPause():** This runs when the Activity is about to go into the background, usually because another Activity has been launched in front of it. This is where should be saved the programs' persistent state, such as a database edited record;

- `onStop()`: This is called when the Activity is no longer visible to the user and it won't be needed for a while. If memory is tight, `onStop()` may never be called (the system may simply terminate the process);
- `onRestart()`: If this method is called, it indicates that the Activity is being redisplayed to the user from a stopped state;
- `onDestroy()`: This is called right before the Activity is destroyed. If memory is tight, `onDestroy()` may never be called (the system may simply terminate the process).

Activities that are not running in the foreground may be stopped or the Linux process that houses them may be killed at any time in order to create new Activities. This is a common occurrence, so it's important that the application must be designed from the beginning with this in mind. In some cases, the `onPause()` method may be the last method called in the Activity, so that's where the data should be saved.

As mentioned earlier, every application runs in its own Linux process. The hardware forbids one process from accessing to another process memory. Moreover, each process has its own virtual machine, creating an isolated execution environment for each application (Figure 15).



**Figure 15 - Execution Environment of an Android Application**

Another special feature in the implementation of Android applications is the fact that to each application is assigned a specific id. This allows that the application resources are not available for other applications, due to lack of access permissions.

In Android exists the possibility that an application uses components from another application, if that other application permits. This mechanism allows viewing an application as a set of components possibly independent, and not as a block of code with a single starting point (e.g., a method or function "main").

In addition, accesses to certain critical operations are restricted and must be specifically asked for permission to use them in a file named `AndroidManifest.xml`. When the application is installed, Package Manager either grants or does not grant the

permissions based on certificates and, if necessary, user prompts. Android can even restrict access to entire parts of the system.

All the application code and the used resources are encapsulated in an APK (Android Package) file, which is then used to distribute and install the application. A few objects are defined in the Android SDK that every developer needs to be familiar with. The most important ones are Activities, Intents, Services, Content Providers, Broadcast Receivers and Resources.

#### **4.4 Summary**

The differences between iOS and Android development are as different as night and day. From the ability to download and install the SDK, to the strategy one employees when testing apps, to the way one ultimately learns how to develop. Down to the last detail, the two platforms differ in both philosophy as well as technique, so consider carefully before deciding which path you should follow

To develop apps for iOS and get testing them in your iPhone / iPod it will cost you \$99 per year, against the \$25 flat fee to put your apps on the Android Market, plus \$20 if you want to charge for them. Moreover, Apple put in place some strict rules and regulations that the developer must consider if he wants to see his app in App Store, while in Android world rules are not so tight and there are also other app stores other than the official Google Market such as the Amazon App Store.

A thing of beauty is joy forever, and this goes with iOS apps. No doubt, Android apps are also quite impressive but iOS apps seem more beautiful and utilitarian, that's why they win love and affection of masses.

Even though Android is growing every day, I still think that it's hard to say who will become the best mobile platform because Android will have more users but iOS will have a better user interface experience.

## Chapter 5. Development and Results

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### 5.1 Entrepreneurship

In this subchapter, it will be presented the idea MyListBox, experience taken from contests, and the business plan. Regarding the technological side of this thesis, MyListBox architecture will be described, as well as, the decisions made in this area, how data is synchronized, tests done to client server communication and how Mobile Application was built.

#### 5.1.1 Idea MyListBox

Wanting to offer a gift to someone in the family or a boy/girlfriend, one always gets the same problems:

- What shall I give to my friend on his/her birthday?
- What if someone gives him/her the same gift?
- What is the best gift ever to offer my mother for Christmas?
- Will my girl/boyfriend like this gift for St. Valentine´s day?

All these doubts take much time of us, makes us nervous and all the wondering will lead to bad decision about what to buy.

In order to help with these problems, is this groundbreaking project – “MyListBox”, a social network, that will allow its users to share with friends and family the gifts that they would like to get in any occasion.

Within [www.mylistbox.com](http://www.mylistbox.com), each user will have access to an infrastructure that will allow an easy interaction between his contacts and his wishes, in a way that he can always be updated with the gifts that friends and family want, and where to buy them.

With just a register, the user will have free access to a structure that will allow him to have his own gift lists, birthdays, marriage, holidays, etc., and be able to share them with friends and family. In the same account each user will be able to check every contact's lists, with weekly updates being sent to his e-mail address, remembering of all the events as they come by.

It will be available a "QuickGift" section, which is a database of available products/gifts from "MyListBox" partners. There will three products/gifts, chosen randomly for each user according to their profile. The "QuickGift" will be presented, in an organized personal page of the website.

"MyListBox", will also have available mobile applications (Android, iOS (iPhone/iPad) and Windows mobile), that will allow every smartphone or tablet user to access their profiles, lists, and friends wherever, whenever.

To conclude, "MyListBox", offers an online service that allows its users to make the right choices in the right places, by buying the right gift, allowing also the partners to advertise their products and places of selling. Although "MyListBox" is on a growing process, it has already a corporative image, and the website is on its final tests. The web site will be online by the beginning of September, and the mobile applications are expect to start on October.

## **5.1.2 Contests**

The purpose of an entrepreneurship contest is to make entrepreneurs present their own business ideas through a business and financial plan that includes definition of the idea, market research, competition analyses, market plan and feasibility.

### **5.1.2.1 Poliempreende 8'**

Contest "Poliempreende 8" is a contest aiming for stimulation of the entrepreneur spirit within the IPP students. The contest is divided in two steps: first there is a regional edition and the second a national edition.

This was the first contest MyListBox participated, and as stated earlier, won the regional edition, therefore was the best from 8 other final projects, including health, environmental and social ones, projects that usually have high impact on the jury. In March 2011, it was predicted that winning the national edition was going to be a tough task, however, we worked hard to detail every aspect of the business plan, and even though we did not get the first place, this was a very important starting point for MyListBox.

#### 5.1.2.2 “MovimentoSim” by Samsung

Within the entrepreneur wave that is going on in Portugal, MovimentoSim is intended to support, promote and reward the creative industries through a movement for creativity. As said in [www.movimentosim.com](http://www.movimentosim.com), Samsung believes that the world is for those who inspire those who do, and those who try and try again. MyListBox's team also believes in this, so this is one of the reasons we applied. The contest's criteria are: innovation, market potential, community impact and economic viability, and the projects must be in the following categories: Architecture, performing arts, Visual Arts and Design, Marketing and Advertising, Film, Television and Radio, Fashion, Music, New Digital Technologies and Applications. The deadline for applications was August 2011, and the results are public on November of 2011, date in which the top five finalists will be known.

Another reason for applying was the promotion that MyListBox might get if it is among the five finalists, since it is possible to be interviewed in “Radio Comercial”. Last but not the least, the 25.000€ prize money is another reason for applying to this contest.

The business plan, is quite similar to the one used for Poliempreende, however far more ambitious but still cautious. In this contest the financial plan was changed to higher sales forecast, and therefore higher investment in servers. Since MovimentoSim's purpose, is to motivate creativity, it was thought that MyListBox should have a package especially designed for Portuguese Creators, at a lower price. Thus, PACK C was created with a 3 products limit at lower price per month.

Again, this is another proof that participating in entrepreneurship contests provides the entrepreneur with other advantages than the prize money.

#### 5.1.2.3 “IdeiaMove” by ANJE

With the main objective of identifying and developing innovative ideas for goods or services, IdeiaMove juries will select the best 18 projects and reward them with a 3.000€ prize money each. This evaluation will be carried out during a Training Camp for Entrepreneurs, an intermediate stage of the Ideas Competition that corresponds to coaching, which will allow selected developers to refine and develop their idea, in a kind of first market approach. At the end of each Field Training session there will be a presentation of projects to a panel of investors.

This contest is promoted by ANJE, as such this association became an important issue to discuss, since registered entrepreneurs have access to benefits that ANJE provides by their partnerships, for instance, ANJE's partner Microsoft supplies free software to technological start-ups.

#### 5.1.2.4 “StartUP” - AIRV

This contest is also designed to select entrepreneurial ideas that prove to be viable in the corporate world, from various sectors, around which one can foresee the creation of new companies including technology-based and likely to take part in the future incubators companies RIERC - Network Incubation and Entrepreneurship of the Central Region.

Startup has a slight difference than the above contests, it requires that the future company's headquarters is located in Viseu. However this type of contest must also be considered. For one who lives in Oporto to moving to Viseu has a big impact on daily life. Nevertheless, the entrepreneur need to know that, when moving the company into an incubator, he will have a new network of contacts and a set of services that are usually provided by the incubator, which are horizontal to every startup company, like accounting services, meeting rooms fully equipped, common spaces, etc.

StartUP also has a good prize money - 25.000€ - which can provide a good start to the company.

### **5.1.3 Market Research**

#### 5.1.3.1 User

Since online platforms are so common nowadays, “MyListBox” is betting for a target public on any Internet user, of any age.

We're living an era where that people of any age or social status use the internet to communicate and so, on line relations are becoming very powerful, “MyListBox” is taking advantage of that by providing for a need that everybody owns.

As “MyListBox” is expecting to attract the kind of public that is not used to online social networks, but when challenge by friends and families, start to exploit “MyListBox” world.

#### 5.1.3.2 Partners

In order to get as many users as possible, “MyListBox” expects to attract the interest of any companies or brands that are especially interested in publicize and shine through the Internet.

“MyListBox” will first start with online shops - shops selling all different kinds of products and goods in order to achieve a greater searchable database. The next step is to focus on street shops, and companies of greater dimensions.

Design and professionalism, are the means to get the attention of future partners, so “MyListBox”, is betting a great lot on marketing and communication, by using email



services, publicity banners on forums and online shops communities and also the use of salespersons.

When offering interesting prices for each package, “MyListBox” aims partners to profit from this, when having more logs into their own websites and ,of course, more costumers. Being a win-win situation, this will bring a satisfactory connection of interest for both sides.

In order to find if this business could be successful, a small group of persons were asked to work with a platform containing some features from “MyListBox”. Accounting with about 80 active users, this test went by for over a year, with the purpose of learning about their needs and interests. Most users showed a lot of interest and gave a positive feedback including new ideas for the website. This positive reaction arise the expectations of a simple project to became a business, with the purpose of getting “MyListBox” on everyone’s thoughts regarding presents or gifts to get and offer for any occasion.

To make “MyListBox” a profitable and sustainable business, one has been making contacts with several companies in order to find about their interest on being partners. By now “MyListBox” has already caught the attention of a telecommunications company “TMN” and a timepiece company “Marcolino”. Several contacts have been made in order to reach an agreement and useful ideas for a straighten partnership. “TMN” and “Marcolino”, where the first companies “MyListBox” reach out for, still, in July, more contacts to possible partners are to be made.

After the final stages of the website, the first partnership agreements will be presented.

#### **5.1.4 Competition Analysis**

After a meticulous analysis through the internet, “MyListBox” found a list of, actual and to be, direct competitors, such as:

- **Presentes.pt:** Presentes.pt can be seen as ”MyListBox” most important competitor since it has been on the market for several years, and provides its clients with the possibility of making lists for presents or gifts. It is focus on wedding lists for users in Lisbon.

It’s great advantage is the huge partners group, about 900 companies, from many and various kinds. Publicizing goes through magazines and banners on the internet.

The great disadvantages come from the fact that it’s partners are mostly in one place- Lisbon; low publicizing rates, a weak positioning, low levels on updates, as for the website and social networks.

- **Wishlitr:** Wishlitr is a website where gift list can be created. It's database for products is very small and it offers little choice and diversity. Wishlitr has also low levels on updates, and, although one cannot sustain this information, it seems to be offline for a while now.
- **Facebook:** Facebook is the most popular social network in the world, it has millions of users and it is nowadays one of the most important platforms on the Internet. Being one of the largest social networks, Facebook can fit within a service like the one "MyListBox" provides, throwing away all competition, or it can be seen as a possible partner for the future.

### 5.1.5 Swot Analysis

Table 3 - MyListBox Strengths and Weakness

STRENGTHS	WEAKNESS
<ul style="list-style-type: none"> <li>- Attractive design;</li> <li>- Website with easy navigation and interaction;</li> <li>- Follow-up on users and partner's needs;</li> <li>- Wide variety on packages available for partners, depending on which products they want to add and the money they want to invest;</li> <li>- Mobile application (available for the major operative systems);</li> <li>- Challenges and competitions for users;</li> <li>- Mobile version of the website.</li> </ul>	<ul style="list-style-type: none"> <li>- Unknown to the market;</li> <li>- Few partners;</li> <li>- Few users;</li> </ul>

**Table 4 - MyListBox Opportunities and Threats**

<b>OPPORTUNITIES</b>	<b>THREATS</b>
<ul style="list-style-type: none"> <li>- Number of social network´s users rising;</li> <li>- Easy access to the internet with mobile applications;</li> <li>- Friends connected through the internet;</li> <li>- Companies needing to publicize products or services in the internet;</li> <li>- Persons have a growing need to use platforms to make their day- to -day life easier;</li> <li>- Easy, effective and interesting services with gift lists are modest.</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of interest from potential users;</li> <li>- Users that sign in but do not make further use of the service;</li> <li>- Use of “MyListBox” idea from other platforms on the internet;</li> <li>- Lack of interest from potential partners.</li> </ul>

## **5.1.6 Marketing Plan**

### **5.1.6.1 Positioning**

“MyListBox” expects that, as times goes by, users will have just one thought when having to choose for a present or gift for themselves or others: let´s go and check “MyListBox”. Although it is not an easy goal, “MyListBox” team is very optimist as we believe on our own abilities and in how much the services offered to users and partners are worth.

When entering the market, “MyListBox” wishes to be seen as a reliable, useful and trustworthy service. In order to make this happen, “MyListBox” is betting on an attractive, functional and fast design, always trying to keep users and partners pleased.

By being active and powerful within social networks using competitions and publicity, “MyListBox” positioning within the Internet will be strengthened.

### **5.1.6.2 Product**

“MyListBox” is a platform that allows every registered user to go through the website and use all its functionalities for free. As it has been said before, this platform will offer useful functionalities for all users who wish to unveil and follow up on their contact´s wishes for presents or gifts.

As for partners, in order publicize products or services in “MyListBox”, there will be three available options:

#### QuickGift Packages

Within “MyListBox” there will be available an online platform where users can place gifts or presents that they would like to get all together in a list, with the purpose of sharing it with friends. For the most undecided users, or for the ones that want an update on their list, there will be a “QuickGift” area where users can search products by name or kind, and add them directly to their own list. In this area, “MyListBox” partners will be able to publicize their own products or services:

**Table 5 - QuickGift Packages**

<b>Name</b>	<b>Nº of Products</b>
Pack C <sup>3</sup>	3
Pack S	15
Pack M	30
Pack L	60

#### Publicity Banners

Publicity banners are the chance for partners to introduce and publicize their products or services within the web. As visitors and users start to rise, “MyListBox” hopes to get to the publicity levels wanted by partners.

Since every user profile can have different kinds of banners, there will be an offer of directional publicity for every partner. As an example, if the user is under 25 years old, he will see a different kind of banner that the ones over his age, being so “MyListBox” will provide for target banner publicity.

#### Promotional discounts

Promotional discounts are the key point to attract partner’s attention, as they will have a way to offer discounts for their products or services, distinguishing themselves from other companies and catching user’s attention to buy gifts on their shops instead of others.

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<sup>3</sup> This pack is only allowed to promote products of Portuguese creators (Music, Art or Fashion related products)

#### 5.1.6.3 Place

“MyListBox” distribution channel is the internet. It is through the internet that “MyListBox” unveils itself, and it is also through the internet, using Smartphone, tablets or computers, that users can access to “MyListBox” platform and use all its functionalities.

As for partners, they can place and handle their products through the internet. There will so be available statist data for their work with “MyListBox”.

#### 5.1.6.4 Promotion

In the beginning “MyListBox” will focus on social networks, such as Twitter, Google and Facebook. This will be essential for “MyListBox” success, since these platforms already have large numbers of users, allowing us to reach more people and without any costs.

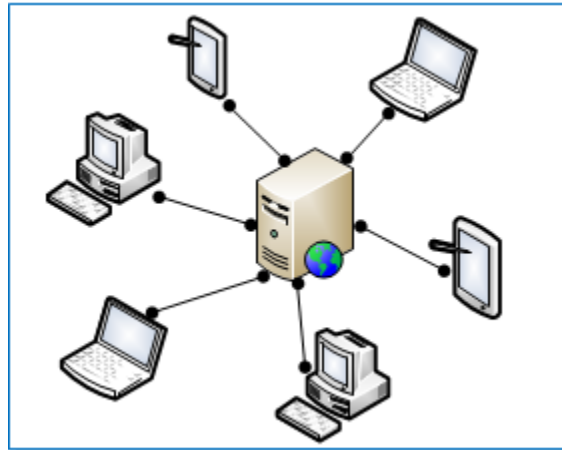
It is “MyListBox” aim to ensure great dynamics between users and social networks, by competitions and benefits, as discounts on partner’s stores, leading to a brand new way of interaction between users and “MyListBox”. There will also be available an application that will allow Facebook users to interact with some of “MyListBox” functionalities.

After the first semester and with the mobile platform up and running, “MyListBox” will start its own advertisement using banners on some of the most visible websites within the internet. Choosing these websites will be according to available budget and a study of the best places to do so, yet to be done.

As “MyListBox” turns out to be a success, other promotion campaigns will be thought about, being magazines and outdoor publicity a future idea.

## **5.2 MyListBox System Architecture**

To build a system like MyListBox that allows as much interaction and flexibility (multiple versions) between multiple heterogeneous devices (Figure 16 shows computers, smartphones and tablets connected to a single system), one must have high skills of abstraction to be able to see the system as a whole.



**Figure 16 - System's Requirements**

Once requirements are defined, it is necessary to study performance solutions, considering hardware costs versus system's needs, meaning, if the system has only a few users, maybe high performance servers will not be needed. In MyListBox beginning there was a hard decision to be made regarding servers: "Deploy the system (website, web services, and database) in a dedicated server, Virtual Private Server (VPS), or shared server?"

Table 6 represents the comparison done between types of servers, which was the base for the above decision, and the prices specified are from the hosting company that gave me my first job, therefore I have some advantages in working with them, such as discounts given. However, the biggest advantage is that they allowed performing an analysis via remote desktop to the server in which MyListBox's website is stored, to check memory consumption levels, allowing us to determine that a shared server would not be able to support the number of users that we expect to achieve, considering desktop computers, notebooks or mobile devices. So the conclusion was that, a VPS or a dedicated server was needed, even though their hardware costs were higher, and software licenses were also needed since they are not included. Basically, a VPS is a virtual server within a real server. Using virtualization, a VPS owner will have administrator access to a private environment with guaranteed resources, as one does in a dedicated server but for a lower price. Naturally, a dedicated server with the same characteristics will always have better performance results than the VPS.

**Table 6 - Types of Server comparison**

<b>Server Type</b>	<b>Disk Space</b>	<b>RAM</b>	<b>Cost (per year)</b>	<b>Licenses Costs</b>
Shared	4Gb	100 Mb (aprox.)	60 €	0 €
VPS	50 Gb	1 Gb (1024 Mb)	500 €	50 €
Dedicated	250 Gb	2 Gb (2048 Mb)	1.200 €	50 €

The decision was made with a bottom-up analysis, from the lower price type of server to the higher price type of server, and our decision was to rent a dedicated server. One of the main factors for this choice was that we could use some of the Poliemprenende's prize money in this investment.

However, the following question was raised: "Instead of renting, why not buy a server?" Table 7 answers the question, even though MyListBox would not be attached to a monthly fee, costs would be higher, and in the case of not having the expected success we would have bought a server way too big for the requirements. Other reason not to buy a server is that in terms of investment, one has to pay all in advance instead of doing it monthly.

**Table 7 - Dedicated Servers comparison**

Server	CPU	Disk Space	RAM	Cost
HP DL380G6 E5520	Intel Quad-Core E5520	300 Gb	6 Gb	1.965 €
DELL POWEREDGE R410 RACK	Intel Xeon E5620	500Gb	8 Gb	2.165 €

With the above decision made, it is time to design system's architecture. Figure 17 represents the actual system picture:

- a central server with Microsoft Windows SBS Standard 2011
  - a SQL Server database
  - the website and its version for mobile devices
  - RESTful web services that works as the middleware API for mobile devices
- the typical computer clients
- the mobile devices clients

In the next subchapters, these components will be described in greater detail, especially the mobile devices.

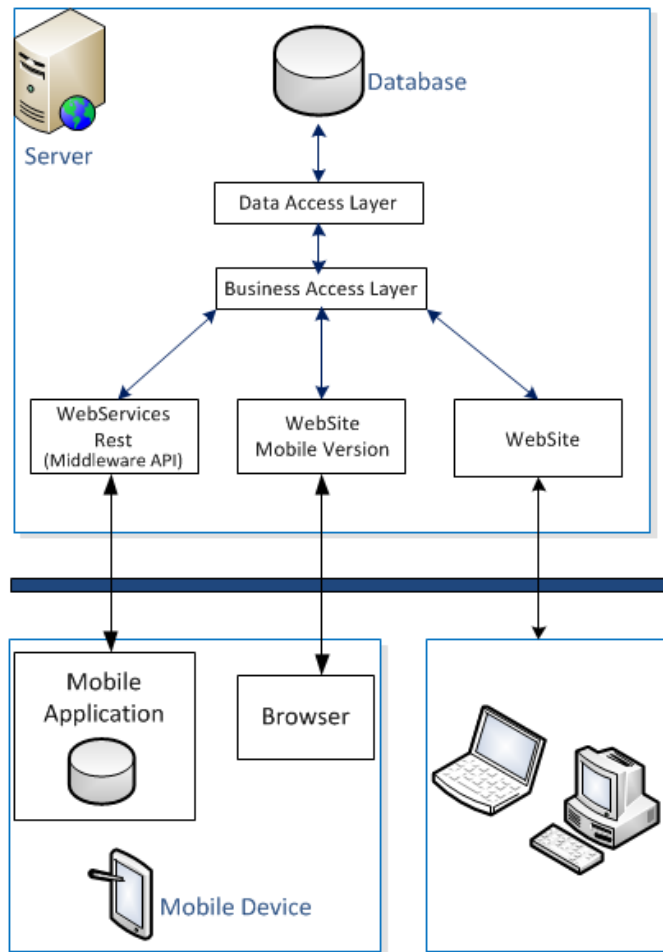


Figure 17 –System's Architecture

### 5.2.1 Servers

This architecture was designed in this way due to limited investment power. I believe that, like a house, there are four pillars for the success of a website:

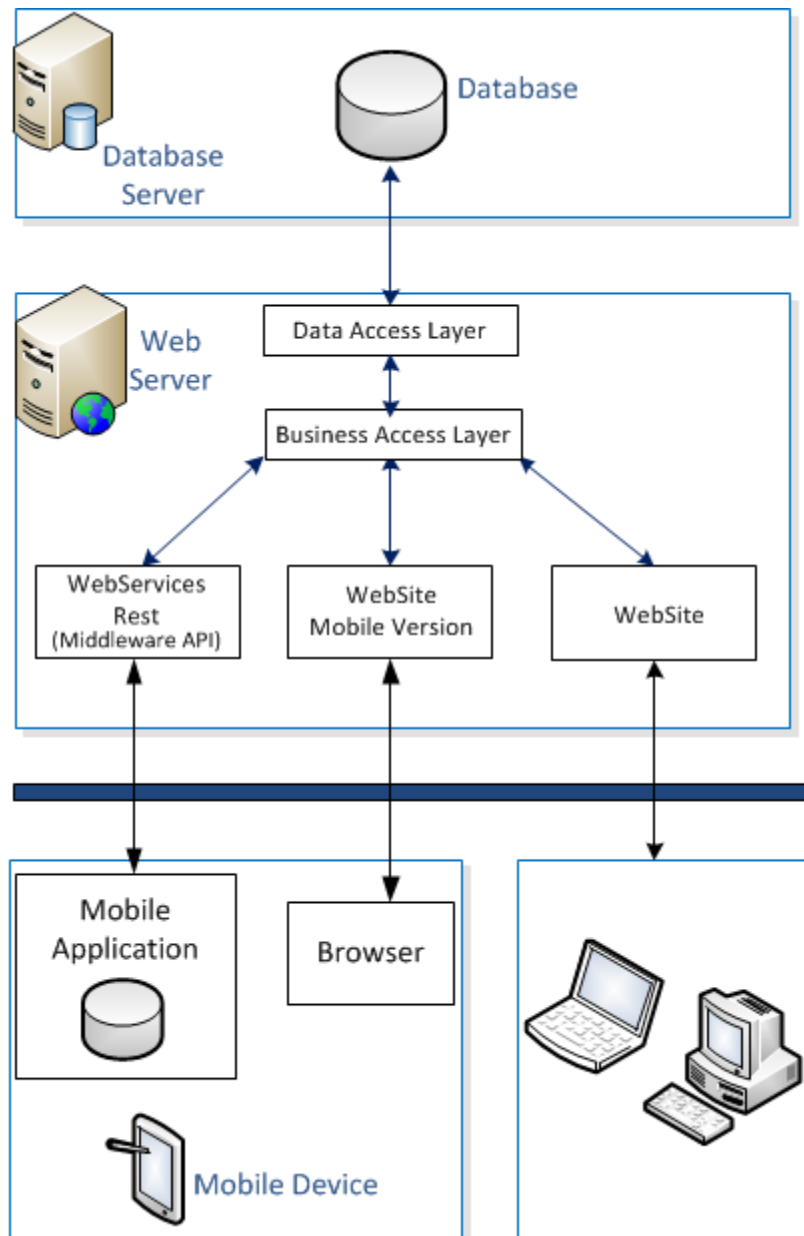
- 1) Utility: A website needs to be useful for their users, and provide them functionalities like applications for mobile devices.
- 2) Performance: No one likes to interact with any slow responding system, especially these days with IT Systems, meaning that people nowadays does not like to wait for any device (Coffee machine, Televisions, etc.), especially websites.
- 3) Attractive Design: If a website is unattractive, cybernauts will not become users. In my opinion, Facebook is an exception to this rule, but the utility it provides is enough to support this pillar.
- 4) Trustable: when users register in a website, they provide some of their personal information, so the website must be reliable enough to earn their trust. In this pillar, Google+ is the expectation because it was launched this year, and has already



millions of users. The reason is that the company behind this social network is a major and well-known IT corporation that everyone trusts.

In MyListBox's case, utility is held by the specific service we provide. Regarding design, we use peaceful colors (light green, blue and orange), so in my opinion our design is attractive. Since we are just starting, trust will be built by partnerships MyListBox will have. Thus, performance requires a detailed attention since it is important, right from start, to have users pleased with the website. So the next step, before going live, is to perform stress tests in order to determine system's performance limits.

As performance is an important issue, the next architecture will be designed like described in Figure 18. Basically, divide a single server in two: one for the database and other for receive requests from clients.

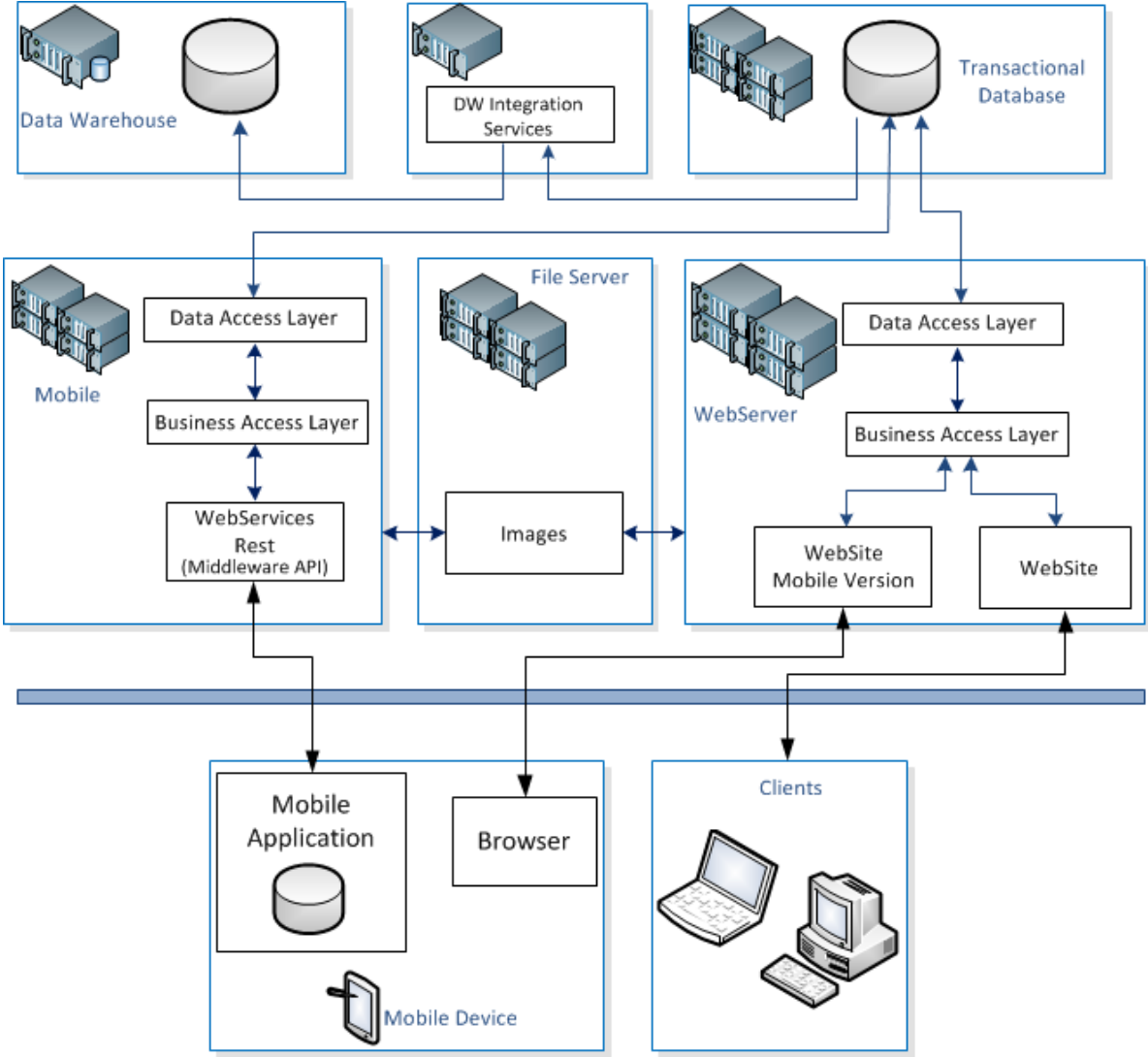


**Figure 18 - Future System's Architecture**

With both architectures, MyListBox's system will have the following qualities:

- Layered System: components are isolated and independent, and layers are transparently distributed.
- Scalable Components: Each module can be scaled independently.
- Service Driven: each layer is connected via well-defined interfaces which are the only entry point to access each layer.
- Application's Logic separated: application logic is encapsulated in API.

The ideal architecture is presented in Figure 19. The difference from previous architectures is that this one separates the mobile applications' module from the websites server in order to improve performance of each, and adds a File Server to store and provide images (users' and items' pictures). Another important change is the addition of a data warehouse.



**Figure 19 - Ideal System's Architecture**

Data warehousing is a collection of decision support technologies, aimed at enabling the knowledge worker (executive, manager, and/or analyst) to make better and faster decisions [Chaudhuri, 1997]. To ease complex data analyses, the data in a warehouse is typically multidimensionally modeled, for example, in a sales data warehouse some of the dimensions of interest might be: time of sale, sales district, salesperson, and product. For MyListBox, some of the following dimensions are important to create: number of users,

number of visits per day period, quick gift packages per partner per quarter, items added by category, etc.

This subject is not implemented and it does not have a beginning date set, however it will be considered in a near future. With it, the next step will be web mining which is the application of data mining techniques to discover patterns in the Web.

## **5.2.2 Middleware API – Web Services Rest**

This section provides the motivations and purposes for data synchronization and security methods, especially the ones implemented in MyListBox applications with the necessary justifications.

### **5.2.2.1 Web Services REST**

In an environment like MyListBox, client-server architecture is mandatory, since it is a modular structure that relies on messaging services for communication between components, which can be achieved, for instance, with Web Services or Sockets.

The chosen method for MyListBox communication is Web Services HTTP RESTful (REpresentational State Transfer), because is the appropriate method when performance is required, since other types of Web Services are heavier for a mobile environment, i.e., they have bigger headers than the REST method, thus increasing the amount of traffic used, and the computing time to parse the data in the mobile device. This decision was leveraged by a deep study about “Inter-process Communication flow” in PSiS Mobile [Anacleto, 2010], which proved that RESTful web services are faster. The tests done in this study were based on downloading different quantities of POIs (point of interest). The biggest test was to transfer a XML with 1875 Kb.

[Anacleto, 2010] also concludes that the HTTP method in conjunction with Protocol Buffers (PB) serialization is the best way to exchange information between server and mobile devices, since PB proved to be the lightest and fastest of all, and is the best and more efficient serialization method. However, [Anacleto, 2010] tests were based in devices with Android OS, and as MyListBox application is intended for Android, iPhone and Windows 7, XML was chosen.

Similar tests were done to MyListBox application. The purpose was to request the following information:

- all user’s lists and its’ corresponding items (Figure 20 - a)
- all user’s friends and their lists (Figure 20 - b)
- items’ themes (technology, entertainment, etc.)

- items' categories (smartphones, books, etc.)
- lists' types (birthday, Christmas, etc.)
- users' pictures
- items' pictures

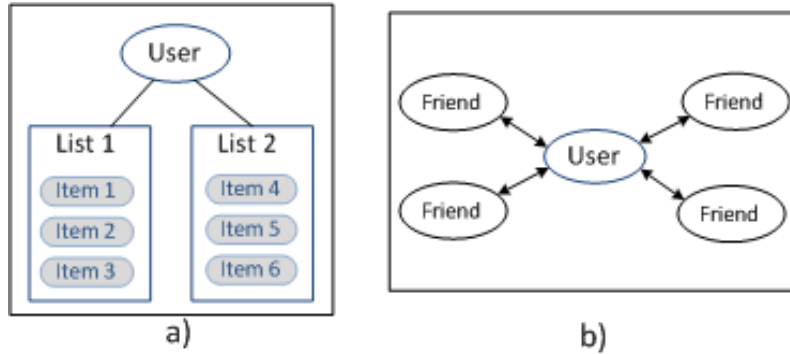


Figure 20 - Content to be transferred

Tests in MyListBox were done in two different environments (Figure 21), first (Figure 21-a) was three Android devices with different hardware and software characteristics inside an Wi-Fi network connection limited to 12Mb, and second (Figure 21-b) two of those mobile devices from the first test, but now connected via a 3G network (in UMTS).

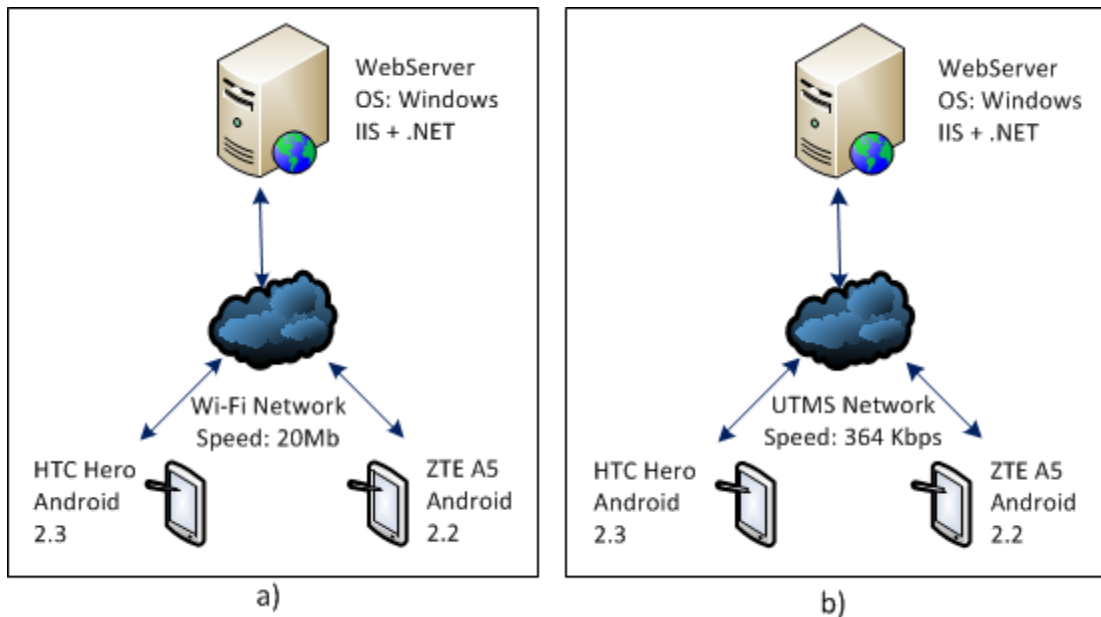


Figure 21 - Environment Test: a) in a Wireless Network; b) in a 3G network

Table 8 represents the test package done to MyListBox application. This package was applied in each mobile device for both environments. For each test in the package, it was made 10 tests, making a total of 240 Tests. (10 tests x 4 tests x 3 devices x 2 environments). Server's answer is sent in a XML file with different sizes, due to the number

of lists and items, and pictures size. The column “Download Size” from Table 8 represents both images files (when applied) and xml with information about lists, users, items.

**Table 8 - Tests' Description**

Test #	Description	Download Size (Bytes)
1	25 items distributed by 3 lists with images	871.477
2	25 items distributed by 3 lists without images	21.145
3	2 items in a single list with images	108.916
4	2 items in a single list without images	8.625

So far it was presented tests' descriptions, content requested and tests' environments. So, in order to completely understand the following results, it is needed the mobile devices hardware and software specifications, which are presented in Table 9:

**Table 9 - Mobile Device's Specifications**

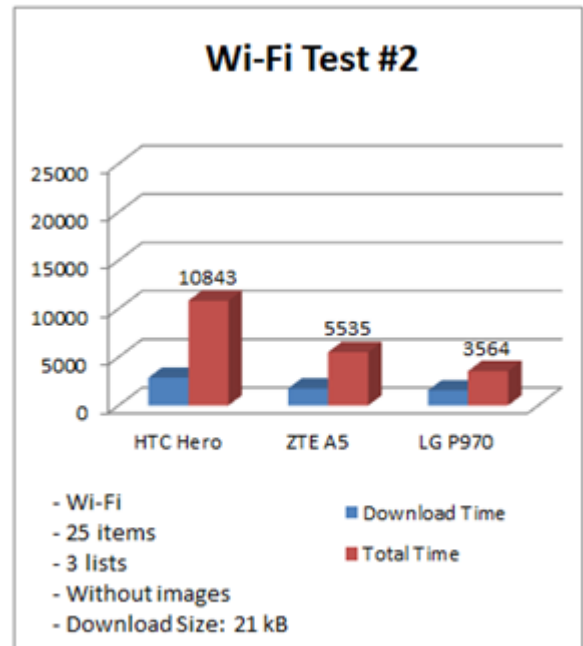
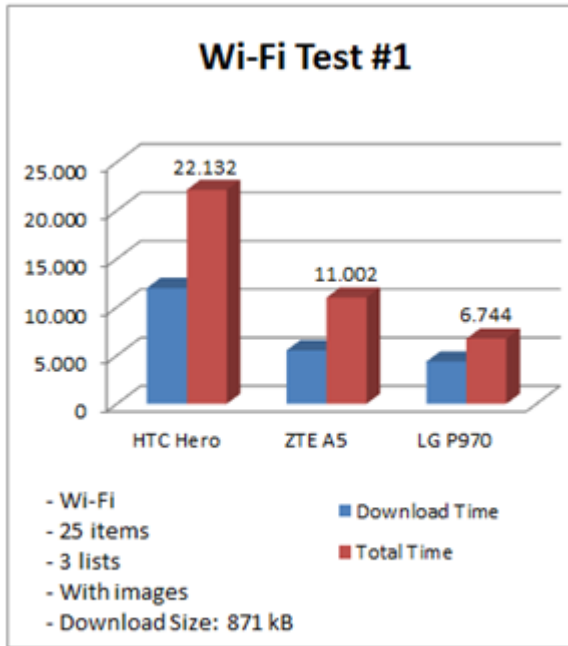
Device:	HTC Hero	ZTE A5 <sup>4</sup>	LG P970 <sup>5</sup>
<b>CPU</b>	528 MHz	600 MHz	1GHz
<b>RAM</b>	512 Mb	512 Mb	512 Mb
<b>Internal Memory</b>	288 Mb	160 Mb	2 Gb
<b>OS version</b>	Android 2.1	Android 2.2	Android 2.3

The following tests purpose was not to determine which device is better, instead they were done to determine the system response time in different environments, whatever the device.

As stated earlier, it is intended to develop an application for Android and another for iPhone. Although the coding language is different, logic and algorithms are similar. So, as there was no time to develop the two applications simultaneously, one of the platforms had to be chosen. The android was chosen for two reasons: (i) there was more knowledge in Android Applications (Java) than iOS (Objective C), and (ii) the entry barriers are lower in Android, since to develop an iPhone application it is mandatory to buy a MacBook and a developer's license. Even though the choice fell on Android, the iPhone application is also being developed, but as it was not prepared to receive information, it was not considered for these tests.

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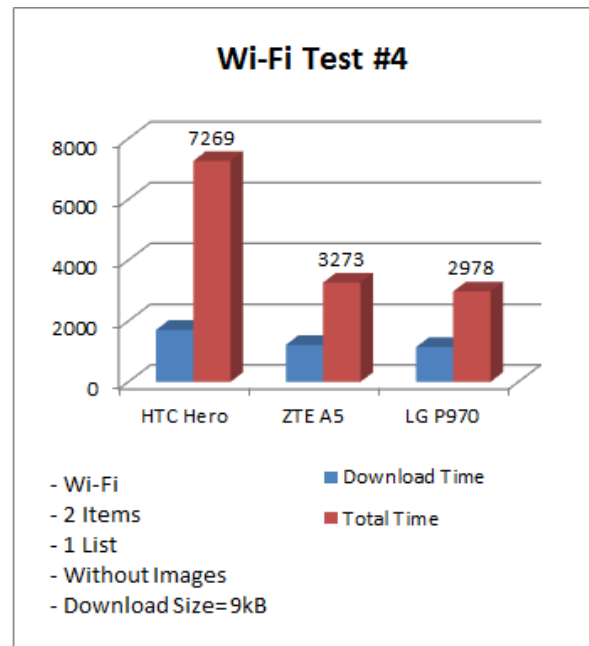
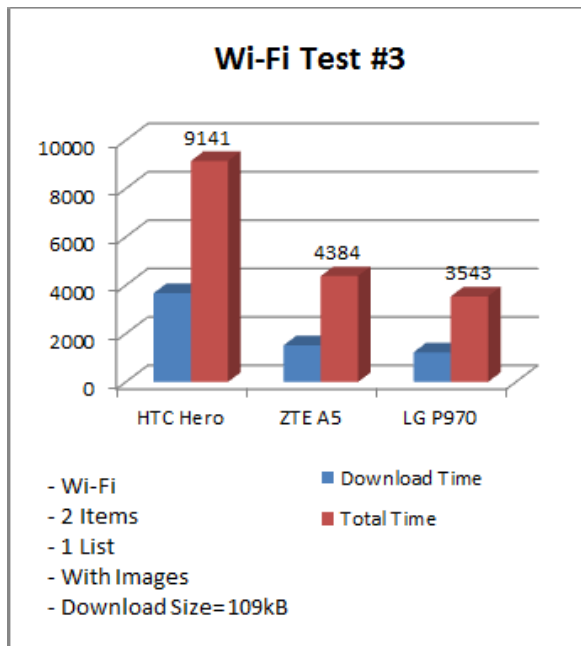
<sup>4</sup> Also known as TMN Sapó A5  
<sup>5</sup> Also known as LG Maximo Black



a)

b)

Figure 22 - Tests Wi-Fi with 3 Lists and 25 Items



a)

b)

Figure 23 - Tests Wi-Fi with 1 Lists and 2 Items

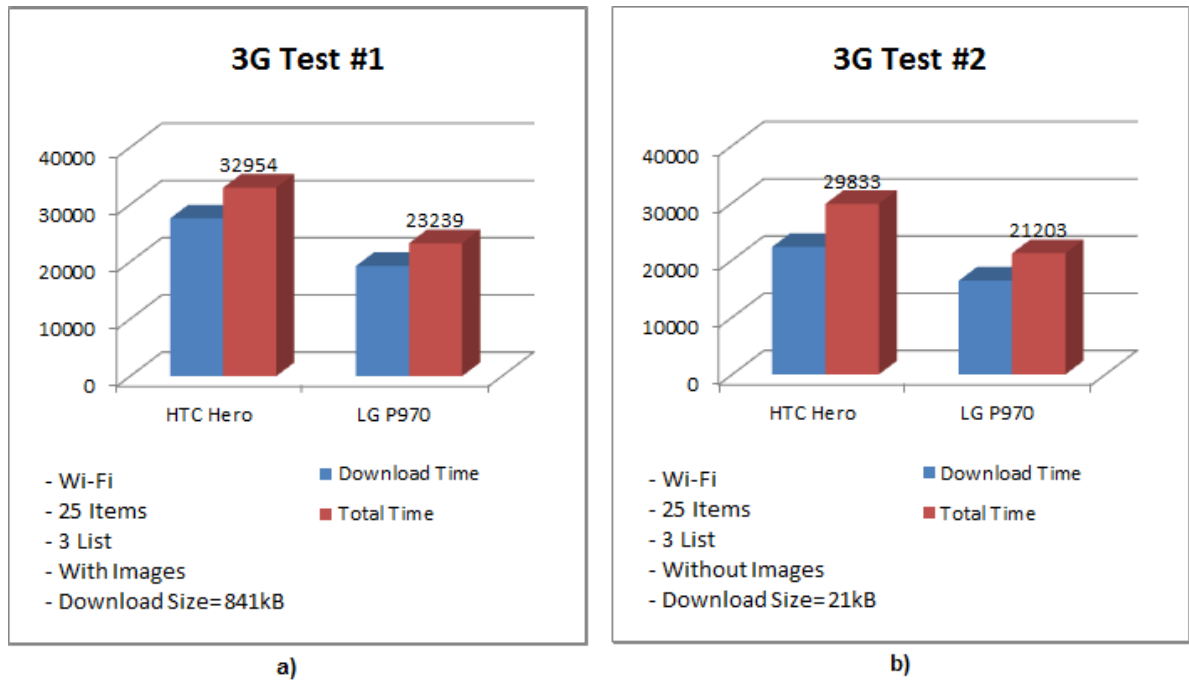


Figure 24 - Tests 3G with 3 Lists and 25 Items

As stated before, the purpose of these tests was not to determine the best device. The goal was to check the amount of time needed to transfer server data, with this type of Middleware (RESTfull + XML). The results prove that this method is appropriate, because even in 3G Test #1 (which is the slowest) the time needed to transfer data is quite acceptable.

#### 5.2.2.2 Data Replication, Consistency and Synchronization

“The purpose of replication is to enable simultaneous existence of multiple copies of the same data, therefore being a fundamental mechanism in current systems” [Pinho, 2010]

Data Replication has many benefits to improve user experience in terms of performance, and it can be implemented for four goals: (i) load balancing, (ii) to serve as a smokescreen to enable fault-tolerance, (iii) to deploy a local-copies scenario, and (iv) to facilitate system’s scalability.

To implement data replication, it is mandatory to create structured control mechanisms, in order to guarantee data synchronization. There are several studied mechanisms to achieve data consistency and all of them attend different purposes, so there is not one considered the best.

In the mobile world new challenges arise:

- 1) Network unavailability: Even though the device can be internet connected through a Wi-Fi network, or through a 2G or 3G Mobile data network, it may not have any networks available, or the device’s user may want to save some battery by turning



off wireless networks detection and background data sync applications. So this is a problem developers will have to ascertain a solution because once the mobile device's application starts it might not be updated.

- 2) Collaboration: Some systems have multiple input applications, for instance Evernote (studied in chapter 2.2) one user has the ability of creating a note in the website and updating it in the application for mobile device. Some systems allow their users to share a file with other users, so and all of them can read and write in the same file.
- 3) Heterogeneity: As studied before, applications depend on mobile device's OS, moreover, in some cases they can also depend on mobile device's hardware. When one is developing an application for mobile devices, it must be considered the possibility of having more than one mobile device.
- 4) Mobility: In wide scale systems, like Facebook, servers are distributed all over the world, so that performance can be improved by implementing in applications the skill to determine the closest server.

There is no such thing as an "ideal solution", but one thing is for sure applications must be developed considering the need for replication, by separating the database into modules in order to allow the application to work in a degraded environment, that is to be able to deal with: (i) loss of information during update transactions, and (ii) data conflicts resolutions.

As referred in [Burgener, 2010] is crucial to have fault management mechanisms that will automatically re-synchronize source and target devices, once network connections are re-established. Thus developers must ensure that devices can be re-synchronized with minimal bandwidth and very quickly. So as stated in the previous subchapter, performance and efficiency is a MyListBox requisite, therefore the importance of the previous tests, and the mobile application was developed very carefully to accomplish this requisite, as described in chapter 5.2.3.

Before start to implement data replication mechanisms between the mobile application and the server, one must consider what to sync, that is, the information from server's database that is going to be replicated in mobile application. The next step should be studying the existing data replication mechanisms and then choose the most appropriate method, even if it is a combination of other mechanisms (when possible). [Pinho, 2010] Chapter 4 studies several data replication mechanisms between mobile components, which were the starting point for Data Synchronization methods in MyListBox's System.

The main problem in data replication and consistency is treating conflicts. In MyListBox system, the mobile device sends his information to the server, and if the server detects data conflicts, they will be solved server-side. Thus, as mobile device does not have to resolve conflicts, its performance is increased. In Figure 25 is presented in a summary way, data synchronization and consistency between server and mobile application. When a user logs in for the first time, the application will create a database and set Last Modified Date (LMD)<sup>6</sup> to 01/01/2000, as it does not have any records, it will ask the server data since LMD (which in the first time it will be all data) and the process is finished until new updates are done. When a user returns to the application the flow is different, the first task is PUT, which consists in updating in server any changes in mobile application since LMD, if there are any conflicts, the server will detect and resolve server-side, and will answer that the application is outdated. If application is outdated it will ask the server for the updated data, and user will be notified.

In Figure 26 scenario, it is the first time user logs in the application, therefore the database is created, and LMD is set to "01/01/2000". Because it does not have any records, the application will get User's Lists, his friends and their lists, since 01/01/2000, which represents all data. In this scenario, after syncing information, user changes the name list nr 2 to "Christmas 2011". The application will update the information on server (PUT). As server did not detect any conflict, the application will sync with the mobile server.

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<sup>6</sup> Last modified date is the last date the application was connected to the server.

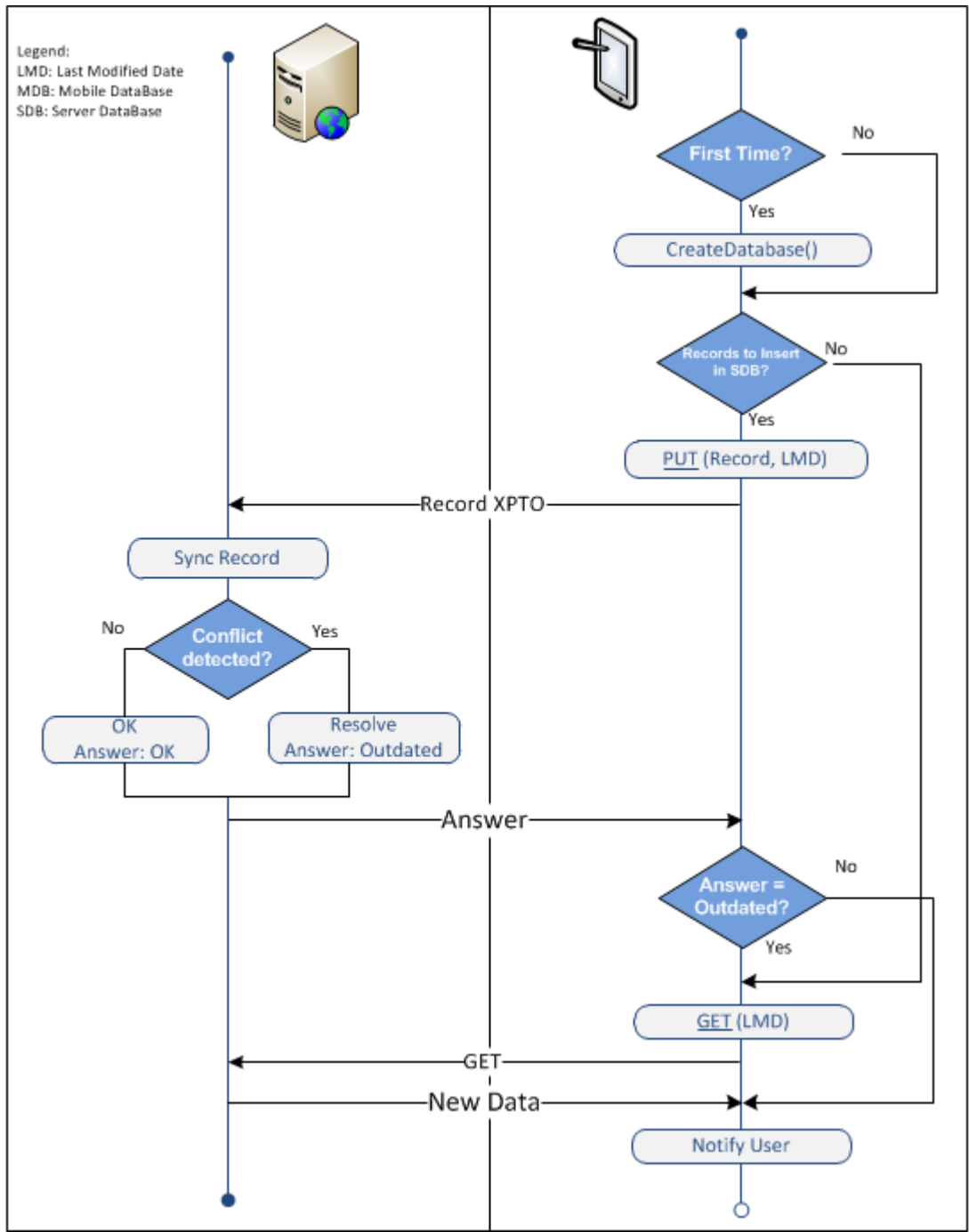


Figure 25 – Data Sync Flowchart

Scenario 2, shown in Figure 27, represents how system handles changes in server-side. First the mobile application synchronizes with server, updates it's LMD and after a few minutes, user switches it off. On 19/12/2011 at 22:12 the user changes the name of list nr 2 in the website. When application is started again, the first thing is to tell the server, the changes in mobile device's database, but since it has none, it will pass over the PUT process. The second task is to get all changes after its LDM (18/12/2011 12:30), which will

be the list's new name. After syncing the databases, mobile application will set a new LDM with 20/12/2011 which is the actual date in the example.

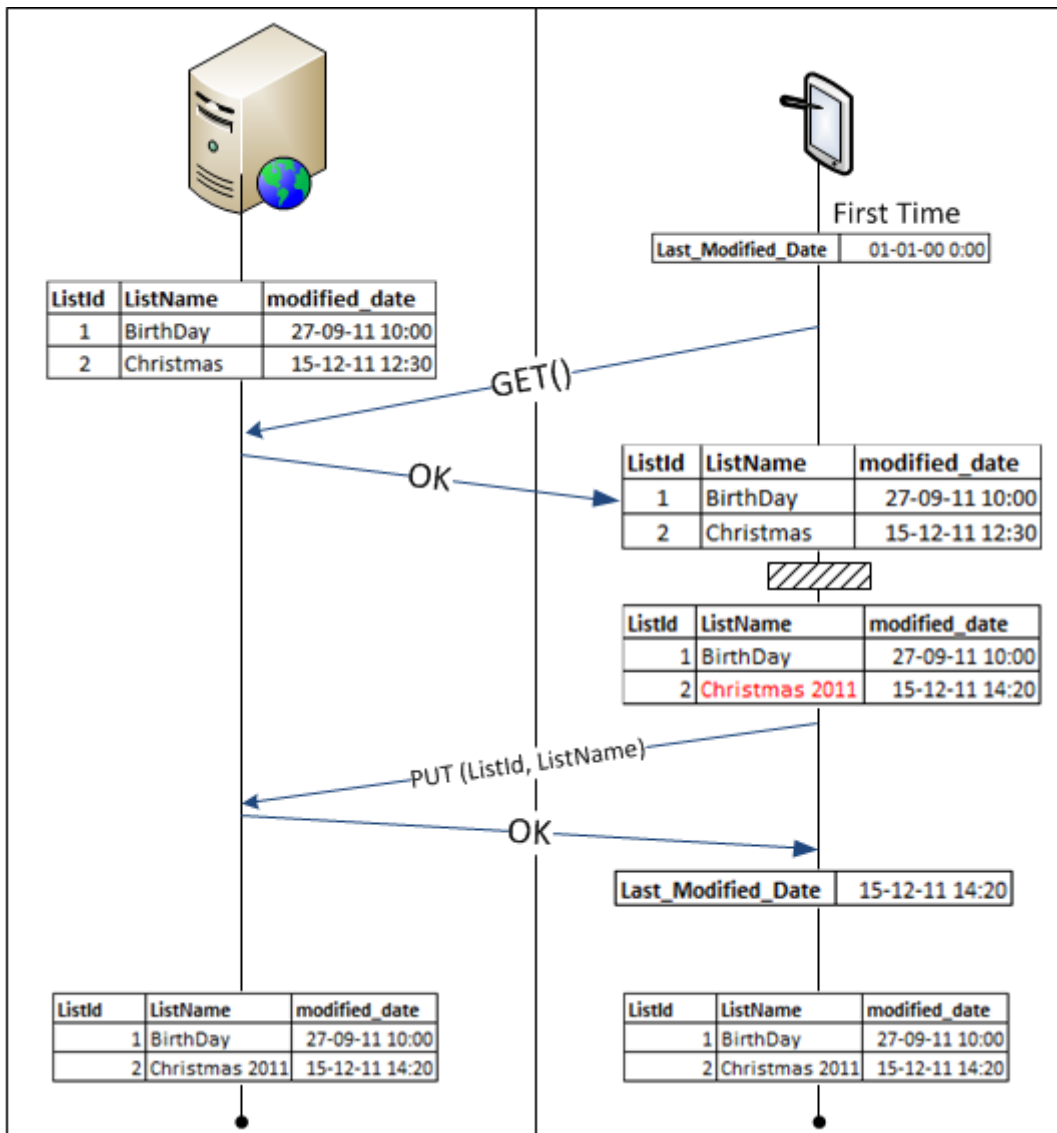


Figure 26 – Scenario 1 – First Time and changes in mobile-side

Figure 28 shows the problem stated above – data conflict. A conflict occurs when data is changed in both sides. MyListBox solves this by having a modified date in each record, and by using LDM. In scenario 3, user tried to change the name of list nr 2 to “Christmas 2011”, but as it was not available an internet connection, the application was unable to contact the server, so user stopped it. Meanwhile he got tired of waiting and he thought about changing the name through the website, but the name given was “XMAS 2011”, therefore different. When the internet connectivity is restored, the application will try to synchronize again, and when it does, the server will detect a conflict which is solved by the modified date column in list nr 2 record. The application is notified that it is outdated, and

will get all data since LDM. After receive new data, mobile application sets the new LDM according to the actual date and both databases are synchronized.

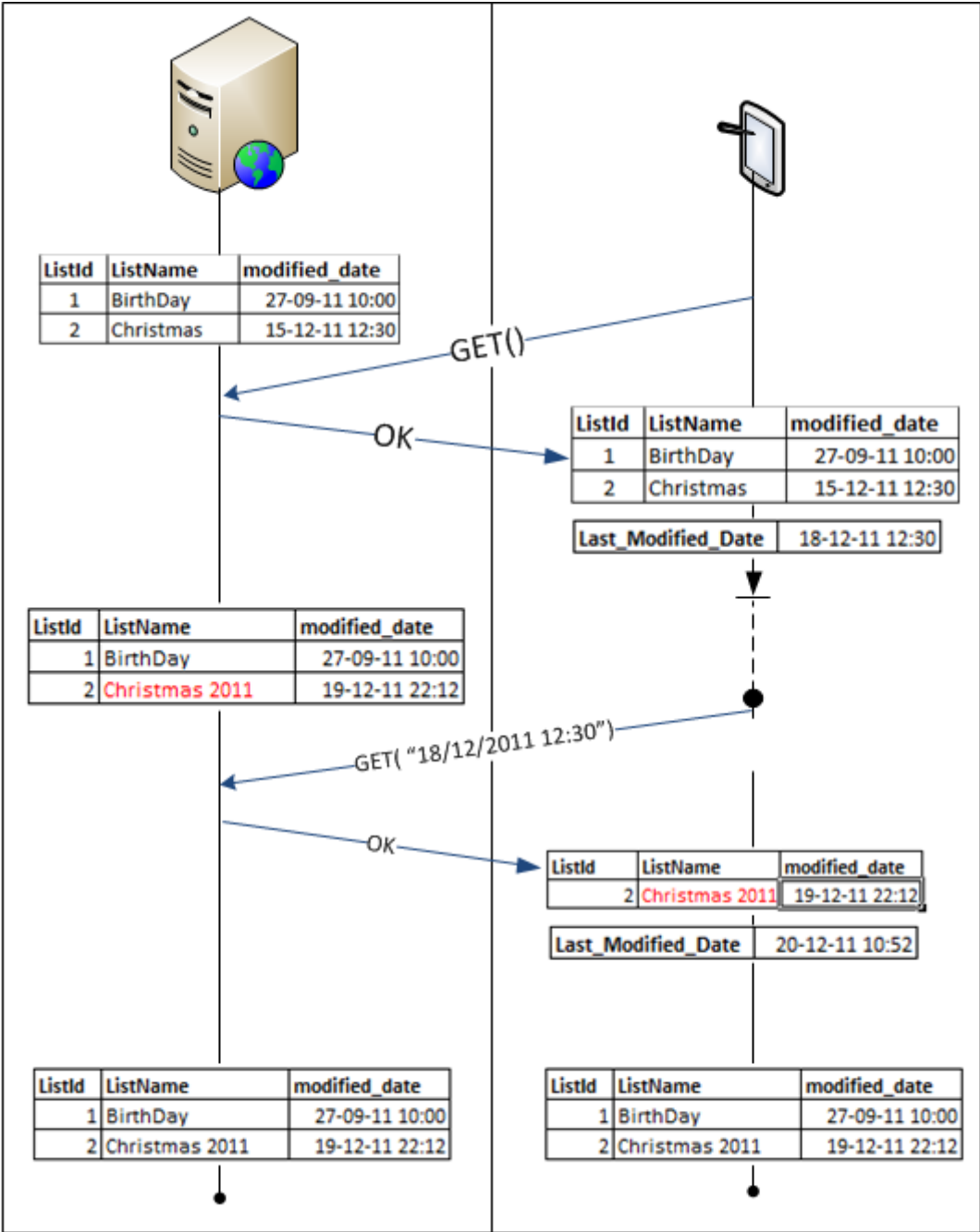


Figure 27 - Scenario 2 - Changes in Server-side

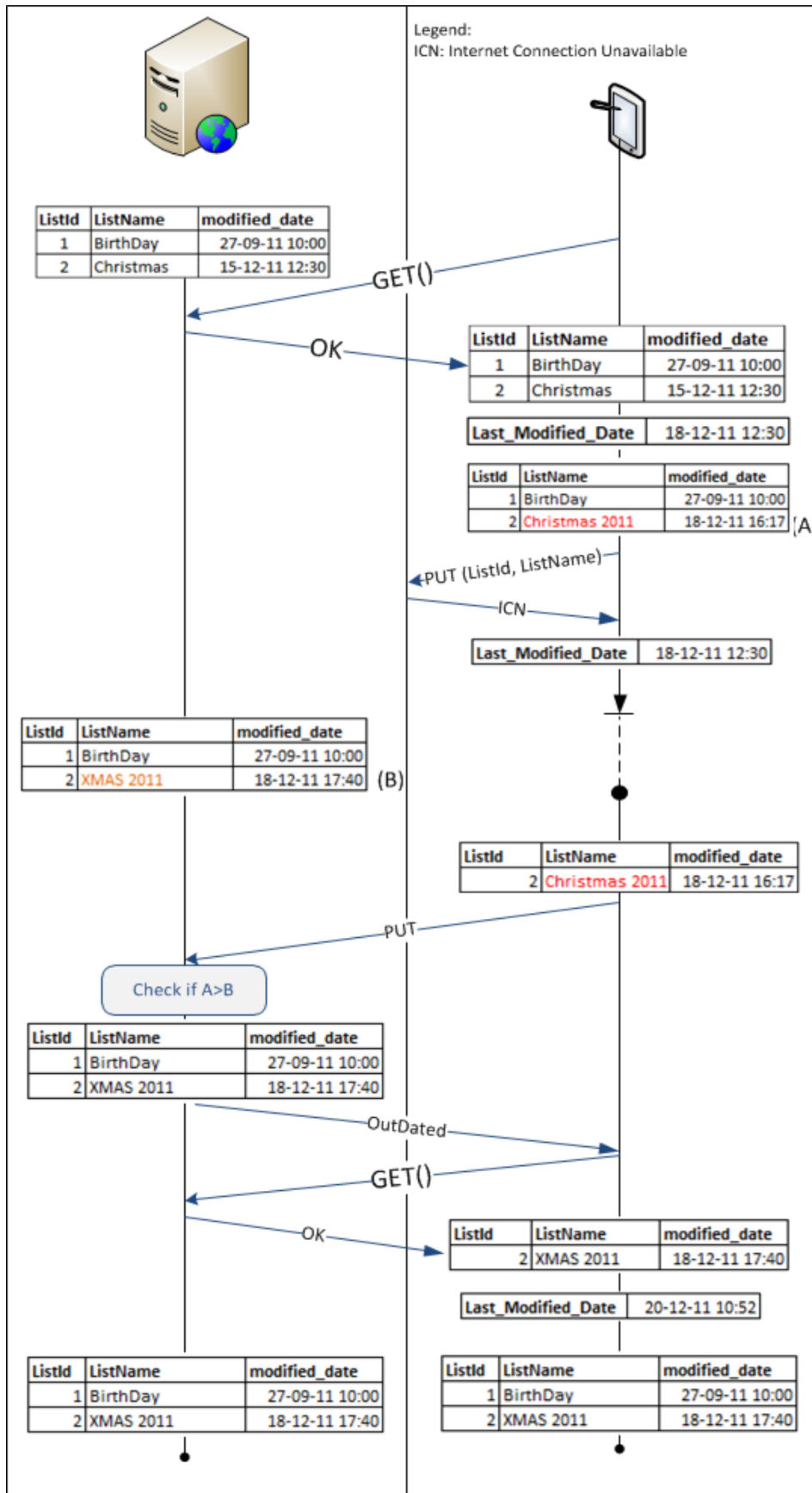


Figure 28 - Scenario 3 - Changes in both sides: Conflict

### 5.2.2.3 Security

[To avoid security leaks, in this chapter it is only provided the first security level implemented in MyListBox application – the client-server token based security]

When designing applications for mobile devices like MyListBox, one must consider security, since more and more it is easy for anyone who is curious about the security subject, to browse online for solutions to break down information transactions, for instance, if one wants to know how to “sniff” a wireless network, he will find a solution within 10 minutes. Moreover, and as stated before, the mobile devices market is evolving quickly driven by the high number of devices being deployed and by companies who have been and will continue to follow it closely for the next years, thus, third-party security providers will have lots of challenges ahead.

Encrypt data to prevent its loss is not enough, since with the current number of applications in a mobile device, it is easy to have a security leak by just copy data from one application and paste it in another, or paste it into an online application once information is decrypted and displayed. Encryption is useful but it should not work alone. New security measures are needed to detect forwarding information to non-approved apps and prevent it from happening. The user can view and interact with the information locally, but not move the data without approval [Gold, 2011].

The OWASP Mobile Security Project is a centralized resource intended to provide developers and security teams the resources they need to build and maintain secure mobile applications. The goal is to classify mobile security risks and provide developmental controls to reduce their impact or likelihood of exploitation [OWASP, 2011]. The list below is release candidate v1.0 of the OWASP Top 10 Mobile Risks, which was released on September 23, 2011 at Appsec USA, and the original presentation can be found in: [www.slideshare.net/JackMannino/owasp-top-10-mobile-risks](http://www.slideshare.net/JackMannino/owasp-top-10-mobile-risks).

OWASP Top 10 Mobile Risks:

1) Insecure Data Storage

Problem: If sensitive data is left unprotected, it will cause loss of confidentiality, privacy violations, and non-compliance.

MyListBox: for instance password are encrypted inside database, so if one discovers the credentials that will provide database access, we will not be able to read the passwords since they are not in plain-text.

2) Weak Server Side Controls

Problem: This applies to backend services, that is, a server’s API Interface not secure cause data integrity not to be trusted.

MLB: It is possible to get the Android APK and with some reverse engineering get the code. So even though, developers know what the application is supposed to do, the client can't be trusted, therefore API must be implemented with security methods that will force a frequent number of validations.

### 3) Insufficient Transport Layer Protection

Problem: the transmitted data is not encrypted and the user ignoring certificate validation errors, cause confidentiality loss and increasing the risk of man-in-the-middle attacks, especially within a wireless network.

MLB: Even though it is not implemented yet, it is intended that HTTP communication will be established through a SSL connection (HTTPS). Another measure is to have a different approach to warning messages through friendly and catchy message types, since users normally do not read security warnings.

### 4) Client Side Injection

Problem: This is one of the most important item to mitigate, because if the server is not prepared to this type of attacks, it will show information that it is not supposed to, especially users' personal data. There are well-known websites from major companies that are not protected to attacks like SQL injection or XSS, which shows all of their users' personal info.

MLB: There are several ways to mitigate this, one is to parse requests to the API before executing them, but this will decrease server performance. The one implemented in MyListBox is in database-stored procedures that convert request variables to their corresponding types.

### 5) Poor Authorization and Authentication

Problem: Some mobile applications rely only hardware identifiers that persist across factory resets, which are potentially compromised values, for instance IMEI. Besides allowing unauthorized access, this item can cause privilege escalation.

MLB: MyListBox applications do not use this type of authorization, instead it is used a 2 level token based system, in which the first level consists in exchanging a client-server token that is calculated with a Message-Digest algorithm several times. As stated in the introduction of this sub-chapter, the next levels of MyListBox security system is not going to be presented in this thesis due to avoid security leakage.

### 6) Improper Session Handling

Problem: Applications maintain sessions via HTTP cookies, OAuth tokens or SSO authentication services. In any case using a device identifier as a session token can compromise security.



MLB: MyListBox's tokens have an expiration date, and are more than 20-characteres long.

7) Security Decisions Via Untrusted Inputs

Problem: Leveraging the application to bypass permissions and security models can cause data exfiltration, privilege escalation and consuming paid resources.

MLB: in order to avoid this attack, MyListBox application casts every variable in each form.

8) Side Channel Data Leakage

Problem: Sensitive data ends up in unintended places like web cache and temp directories, keystroke logging, or logs, and will remain there indefinitely if user does not do anything about it, causing privacy violations.

MLB: before going to the market, applications are analyzed to check for files created to find out if it is creating files that it was not supposed to. System logs do not have sensitive data.

9) Broken Cryptography

Problem: Encrypting is usually confused with encoding and/or obfuscation, but it is not the same thing. Storing the key in the same place as the encrypted data may neutralize what was just encrypted, therefore causing data confidentiality loss.

MLB: MyListBox Application takes advantage of what the platform provides, therefore not "re-inventing the wheel".

10) Sensitive Information Disclosure

Problem: As said in a previous item of this list, applications can easily be reverse engineered, and code obfuscation raises the bar but only in cases where code can be obfuscated. Besides all of the above impacts, here arises a big impact: Intellectual property exposed.

MLB: the final tests, before the go-live date, have to find and cover all the backdoors used to speed up the early testing processes, for instance, remove secret buttons, and passwords hardcoded. As also mentioned above, business logic is stored in the server and not in the client. Developers must remember "Do not trust the client".

This list, provided by OWASP is a good start but it is not enough. MyListBox followed Facebook's example, and invited professionals in the security area to test the applications and the website, because developers usually looks for security breaches in the places they are expecting to find.

### 5.2.3 Mobile Application

#### Design for performance

An application for mobile devices should be efficient, since it will be running with limited computing power, storage, and constrained battery life. Battery life is a reason why one might want to optimize his app even if it already seems to run "fast enough", because user are able to check what is the application responsible for draining their battery, and therefore this raises an important aspect, performance in your application.

Android [Android Dev Guide, 2011] and iOS [iOS Dev Guide, 2011] Dev guides were followed in order to develop the applications according to best practices, for instance, do not allocate memory if you can avoid it, which is the first item on the list:

- **Avoid Creating Unnecessary Objects:** In a scenario where there is a function "X" returning an integer, the procedure who calls "X", will have an integer variable "A" to get the returned value from "X" and will pass "A" as an argument of another function Y. Avoiding creating variable "A" increases performance and memory management.
- **Avoid Internal Getters/Setters:** This item is a good example of the above item.
- **Prefer Static Over Virtual:** if field access is not required methods should be static, since invocations are 15% to 20% faster.
- **Threads for Large Computation Time:** If the application has long-running code, it will force the event handler to ask the user if he wants to kill the application. So, in this case, detect these situations and move them to threads.
- **Single Screen Overload:** As stated in this thesis, in Application Navigation section of this subchapter, there are several screens. It will be better handled by the Mobile Operating System, and in terms of code it increases maintenance.
- **Reinforcing Responsiveness:** generally, 100 to 200ms is the threshold beyond which users will perceive delays in an application. As such, if the application is doing work in the background in response to user input, it is shown the progress is being made. For instance, when user logins, if this takes more than 1 sec, he will see a loading progress bar.

Some of these items are called micro-optimization, however when the application has thousands of code lines, it is important to consider them. Anyway optimizing code only makes sense if there are performance issues, or if high performance and responsiveness are required, which in most cases are.

#### Application Components

As mentioned in Chapter 4.3 activities have states and they do not run all the time, so a service was created to run routines that must be always executing. Thus, the mobile application is divided in four main components (Figure 29):

- Context Service is responsible to (i) get information about mobile device context (battery status, Internet connectivity, GPS) through Phone Status Manager, and (ii) the communication and synchronization between server and mobile application.
- User interface that holds all the screens of the mobile application. It interacts with DAL and Context Service
- DAL is responsible handles the class that allows the interaction with database.
- Database is used to store information from the mobile application, and each user has one. That is, if a mobile device is shared between two or more users, each one of them is going to have a database.

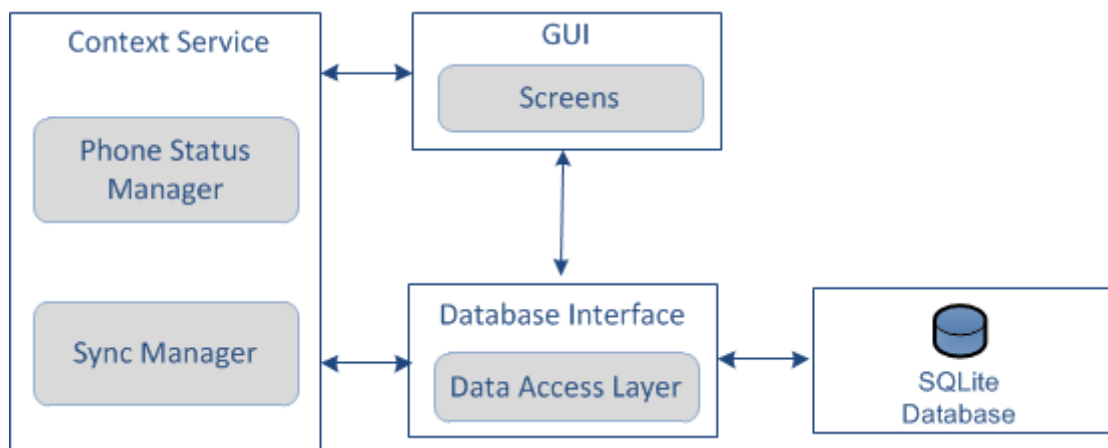


Figure 29 - Components Diagram

### Application navigation

An application interact with its users through its Graphical User Interface (GUI) which is composed by many screens, each one has a specific task. Figure 30 presents all screens of MyListBox application and the possible navigation between them.

As registration through the mobile app is not allowed, new users will be asked for their credentials, in Login screen. If user does not have them and wants to register he will be redirected to the website.

The first time user logs in, a database must be created with information regarding (i) his lists and items, and (ii) his friends and their lists. This happens after verifying login successfully, in the “Main Menu” screen, where all tabs are disabled, since there is no information to show. Server sends first themes, categories and list types, user’s lists second, and finally friends’ lists. To improve responsiveness, it was implemented an

asynchronous mechanism, shown in Figure 31 to ensure that once user’s lists are received, parsed and inserted in database, “My Lists” screen is enabled. At this point, “My Friends” screen is still disabled. It will be enabled once friends’ lists are received, parsed and inserted in database. This way user is able to navigate through his lists and through “Quick Gift” section, while there is not any information regarding his friends.

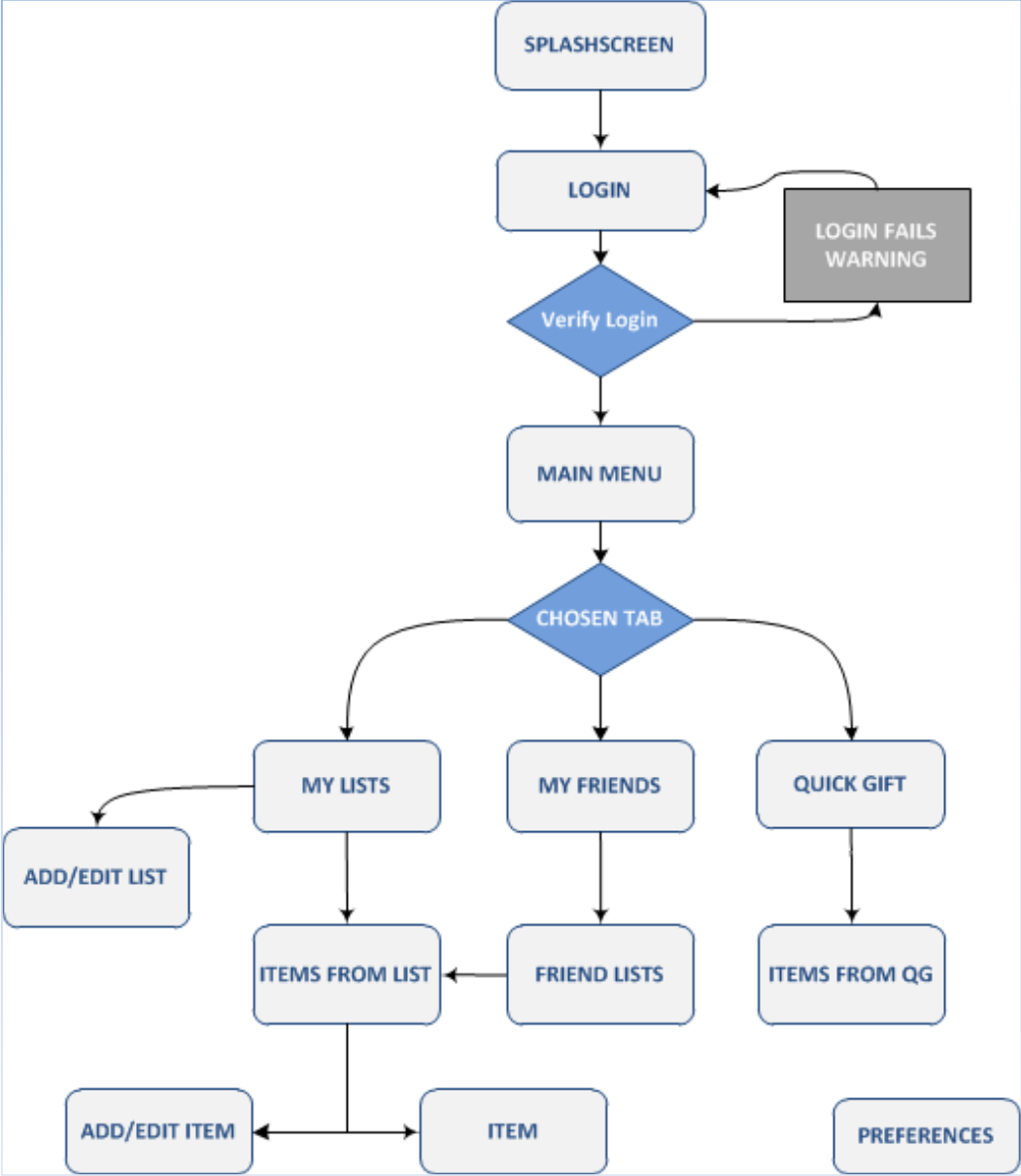


Figure 30 - Navigation Diagram

“Items from List” screen is navigable from “My Lists” and from “Friends Lists”, because the information that is presented in this screen can be fed up with both users’ lists and his friends’ lists.

Every screen from Main Menu down can navigate to “Preferences”. This screen is used to configure user account settings, to log off, or to unlink the account to the device. In this last option, user’s database is erased from the device.

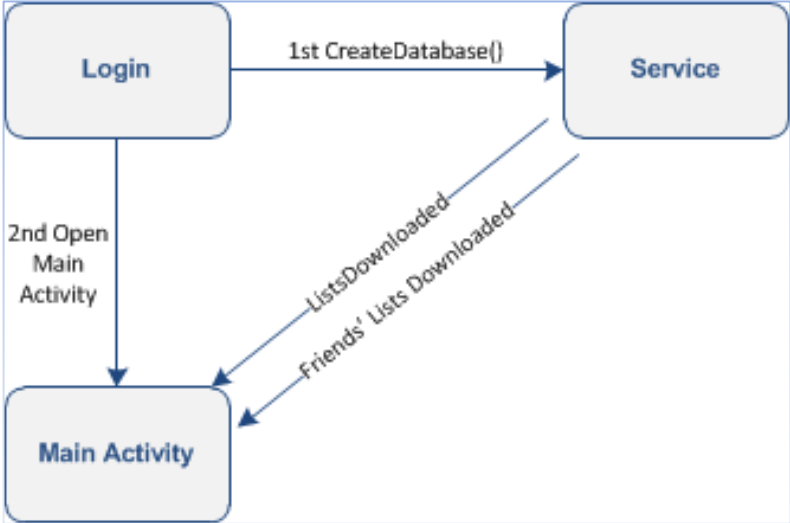


Figure 31 - Asynchronous Work

QuickGift information is not stored in the mobile device, therefore to browse QuickGift items internet connectivity is mandatory. This was implemented this way because incorrect information in a partner item that is already updated in server, but not updated in a mobile device, can cause serious judicial issues.

As for screens, the following images show the design implemented, and the controls in each screen. Note that, one of MyListBox’s goals is to keep the surprise effect on users. Even though the activity is the same, there is a slight difference between user’s list (Figure 34) and his friend’s list (Figure 37): a label tagging that item is available therefore the user can tag it. If it is not available, it means that some other friend is going to offer him that present.



Figure 32 - Login Screen

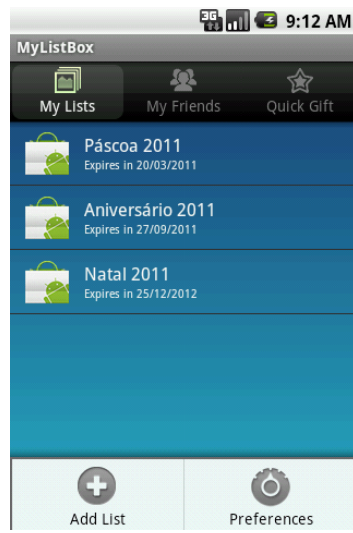


Figure 33 – My Lists with menu Screen

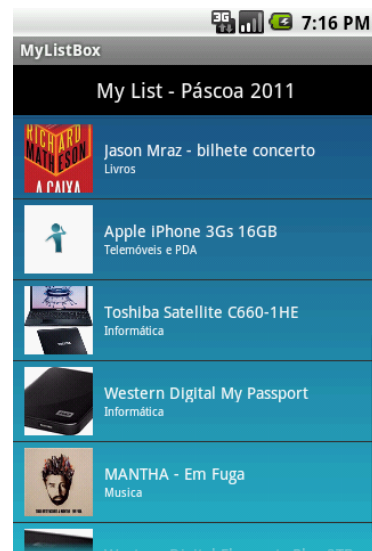


Figure 34 - Items From List

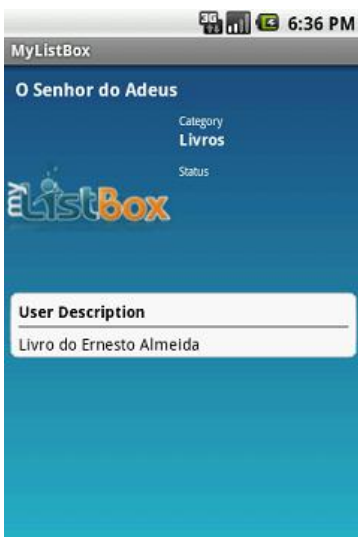


Figure 35 - Item Screen

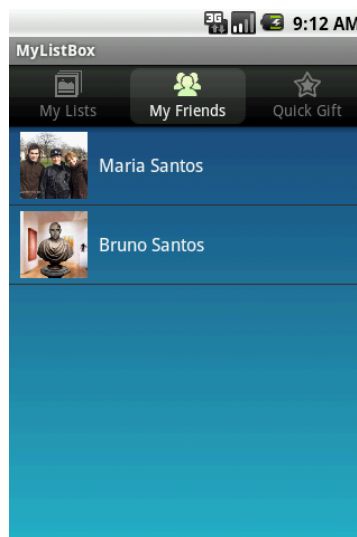


Figure 36 – User's Friends Screen

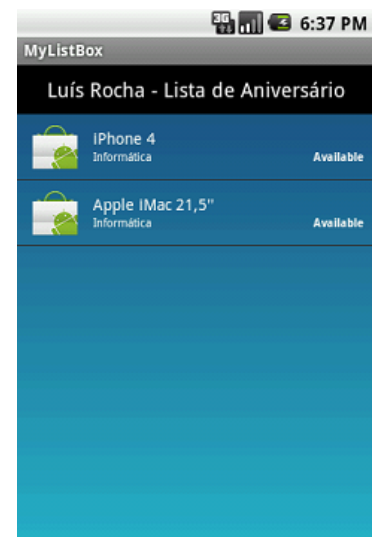


Figure 37 - Friend List's Items Screen

### 5.3 Summary

This chapter was composed by the two main themes results of this thesis: entrepreneurship and MyListBox applications for mobile devices.

In the entrepreneurship field it was presented the business plan, and entrepreneurship contests that MyListBox has applied or is going to apply.

As for the technological side, reader was provided with MyListBox architecture and the decisions made in this area, how data is synchronized, tests done to client server communication and how the Mobile Application was built. Unfortunately, due to time lack it was not possible to present the iOS applications results. As stated earlier, it was intended to develop a full working application for Android and another for iPhone, but since there was no time to develop the two applications simultaneously, it had to be decided one of the platforms. The choice was Android due to its lower entry barriers. However, this is not considered a problem, because the logic is all thought and tested in Android, therefore what is left to do is to code it in Objective C.

The most important aspect in this chapter is that it provides the experience taken from the decisions, both in entrepreneurship and application for mobile devices.





## Chapter 6. Conclusion and Future Work

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MyListBox was born in the early months of 2011, and the goal of this thesis was, in one hand to describe the entrepreneurship experiences taken from it, and in the other hand to provide information about MyListBox's applications for mobile devices.

### 6.1 Entrepreneurship

Over the last months, MyListBox has been growing, and with it the entrepreneur attitude. As issues' complexity increases, new solutions need to be found, for example the decision between rent a dedicated, virtual or a shared hosting server, was solved by winning the Poliemprende regional edition. Beside money prizes, there are other important aspects in competing in an entrepreneurship contest, for instance, despite the result in the national edition, just being there, making contacts and listening to successful entrepreneurs, was also very important to MyListBox's growth.

In this context, entrepreneurship contests forces contestants to think and re-think about the business plan, detailing every aspect of it, especially the financial part, because entrepreneur can calculate with a reasonable certain the expected expenses, but he will have a hard task when it comes to predict company's income. Besides providing a very interesting experience with all the activities promoted along the contest, entrepreneurship contests also promote a healthy competition between teams which is very important in terms of real market competition.

As future work in entrepreneurship area, MyListBox is going to compete in four more contests:

- "MovimentoSim" provided by Samsung
- "IdeaMove" supported by ANJE (Junior Entrepreneurship National Association)

- “StartUP” promoted by AIRV (Viseu Region Business Association)

Employees are gaining more and more importance within the companies, thus, is of paramount importance they are motivated, so team management takes on a principal role in this theme. It is mandatory to distinguish employees that are not productive because they do not want to be, from the ones that want to produce, but who do not feel committed nor involved in the project, and work out these last ones, because these are the ones who have new ideas that might make a difference.

The practical results of the entrepreneurship part are on chapter 5.1, where it is presented the business plan in detail: the market research, an analysis with MyListBox strengths and weakness towards the competition, and MyListBox marketing plan. My entrepreneur attitude and the application of it in MyListBox are presented in chapter 3.3.

As entrepreneur, it is required to continue the evolution process by learning from mistakes, and from others entrepreneurs' experiences, not only the ones who had success but from the others who did not, by studying what they have done wrong.

In the future, it is hoped that MyListBox succeeds as a social network providing a specific service, not only in Portugal but in a world-wide scale, because that is what MyListBox team is working for, and what it is compromised with.

## **6.2 Applications for Mobile Devices**

Regarding the subject of this subchapter, two different state of the art analyses were performed, the first focused on mobile devices (smartphones, tablets, and tablets vs. netbooks), and the second on the best software applications for mobile devices in the market.

In chapter 4 it was studied architectural options, and challenges of supporting applications for mobile devices, which were also considered in MyListBox's applications. Before implementing the mobile application, a platform had to be chosen, and since the time is not abundant, the choices had to be very well thought, and the reasons are in chapters 4.3 and 4.4. The decision was based on platform number of users and the entry barriers to develop the application. Android had to be chosen because it has many users and it is still growing, plus, the only entry barrier is a 25\$ fee to see the application in Android Market, so it was an easy decision. As for iOS, it was mandatory to develop an application since iPhone the trendiest mobile device. This was a hard decision, because to be able to have the application in App Store, there are direct costs like buying an Apple

computer and buying a developers license which costs 100\$. Windows Phone 7 application was postponed due to limited time issues.

Microsoft is finally aiming strong on bringing their Windows Phone 7 to compete with iOS and Android, and a fact of their strategy was the partnership with Finnish mobile devices manufacturer Nokia. As such, a Windows Phone 7 application is in the future work list.

To sum up, Future work in the technological side will include:

- Complete Application for iPhone
- Improve Application for Android
- Optimize Middleware API (Less requests and study other serialization methods)
- Create Application for Windows Phone 7
- Create Application for Tablets with Android
- Create Application for iPad.
- Implementation of a data warehouse to do complex analyses, for instance, using web mining to provide new functionalities to MyListBox's users.



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