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Fontys

Social TV

FONTYS

GRADUATION THESIS



civolution



University of Applied Sciences

**GRADUATION PROJECT REPORT
FONTYS UNIVERSITY OF APPLIED SCIENCES**

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Preface

This thesis is written by Son Nguyen, final year student of Fontys Hogescholen ICT. This document is based upon an internship project assignment conducted during the period of February 2012 to June 2012 at Civolution B.V, located in Eindhoven, The Netherlands. This internship project is to develop a demo application which applies the uses of fingerprint identification and watermark detection to smart TV. After the technology is embedded to smart TV, a number of social media features will be implemented based on the results of identification and detection.

This graduation project generally consists of 90 working days, which taken place during the third and fourth blocks of the fourth year.

There is no way this project would have been finished successfully without the contributions from many people who had given me their supports and encouragements. Therefore, I would like to express my deepest gratitude to the company supervisor, Mr. Jeroen Kratz, my internal client, Mr. Wim Bus and all of my company colleagues, for their guidance, quick and constructive feedback and interesting discussions during my work on this thesis.

I would also like to thank my university supervisor, Mrs. Agnes Veugen, who always gives her support about the structure and content of my report and project plan. That helps to ensure the highest quality of the project deliverables.

*Son Nguyen,
Eindhoven, June 2012*

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Summary

This report describes the internship consists of 90 working days, which was carried out by Son Nguyen, an ICT student of Fontys University, Eindhoven. The internship is carried out at Civolution B.V, Eindhoven which is today the world's leading digital watermarking and fingerprinting technology solution provider. Based on these technologies, Civolution offers a range of products and solutions to help media content owners, right holders and distributors to better protect, manage and monetize their asset.

The main reason for Civolution to initialize this project is to create a demo application which can be used to motivate the Fingerprint Identification technology at the business show case NAB 2012. The project was started with gathering requirements from the internal client, Mr. Wim Bus. A project plan has been drawn up according to the agreement from both the client and development side. After the project plan has been finalized, design, implementation and testing were carried out.

XBMC is one of the development environments which have been chosen for building the demo application. The product is an application that can stream a certain type of video contents. These video contents are categorized into News channel, Movies channel and Sports channel. This application also contains a number of demo features which are related to the streaming contents. During the application designing and developing process, there were many client meetings and result discussion for keeping track on the progress of the product and minimize the project risks. The project was arranged in 8 phases. At the end of each phase, a review of the process, an evaluation of the deliverables and a project closedown were followed. This approach is meant for the developers and clients to manage the project systematically. The requirements in phase 1 and 2 are to perform experiments in order to prove that XBMC is a suitable development platform. The next five phases are the implementation phases of the project. The demo application is built step by step during the implementation phases. When a phase is completed, a functional application is delivered to the clients with the agreed number of features implemented. From phase 3 until phase 5, the application's features are built based on the channel's types in the order of Movies, News, and Sports. Phase 6 is planned to test the product before deploying to the NAB Show. Phase 7 is carried out after the demonstration of the product at the NAB show. The task of this phase is mainly to improve the product based on client's feedback. The last phase is planned for the trainee to complete the thesis for his graduation in university.

In the end of the project, the product was tested and approved by the internal client and suggestions or alterations were proposed. The project is completed in 18 weeks. The final product which is delivered at the end of the internship is a demo application called Social TV that contains all of the required demo features.

The assignment was successfully accomplished, providing the company with the initially agreed deliverables, but it is not the indicator of project worth. The knowledge and experiences obtained during the project and development process that makes the project truly valuable. The experiences obtained are not only IT related issues but also contains organizational culture, communication skills and project management. It was a great opportunity to work in a multi-cultural, multinational environment and to make new acquaintances.

Glossary

API	Application Programming Interface
GUI	Graphical User Interface
ICT	Information and Communication Technology
NAB	The National Association of Broadcasters advocates on behalf of America's free, local radio and television stations and broadcast networks before Congress, the Federal Communications Commission and the courts
Python	Computer programming language which runs on Windows, Linux/Unix, MacOS X, and has been ported to the Java and .NET virtual machines
OS	Operation System
SDLC	Systems development life cycle
URL	Uniform resource locator (URL) is a specific character string that constitutes a reference to an Internet resource.
XBMC	XBox Media Center
XML	Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable

Chapter 1: Introduction

The future career of a student depends mostly on his or her ability to adapt a new working environment. In order to prepare for this, internship is a program that helps students to acquire working experiences and necessary skills in workplaces. As a final-year student of Fontys Hogescholen, I am required to do an internship of 90 days starting on February 2012. My purpose in this internship is getting the working experiences in a Western company and also prepares myself for the graduation this year.

The company which I choose to do my final internship is Civolution, an organization which researches about digital watermarking and fingerprinting technologies of audios and videos. I have also worked at this company in my first internship and this is one of the advantages that helped me to easily adapt and greatly improve myself in the workplace. The project I carried out is developing a demo application which can motivate the Fingerprint Identification technology and it is used in the NAB business showcase on April 2012. The main purpose of this assignment is to integrate the social media features to a media platform and apply the uses of Fingerprint Identification technology for social purposes. The outcome of the assignment is a software application – XBMC media center is one of the selected development environment - which is able to identify contents of streaming videos and then analyzes these identified contents, so that the information can be applied for a particular social interacting scenario. For example, one of the scenarios is that users will be provided additional information which is related to subject of the playing movie or news. Users can also perform a number of social activities on the given information, such as: rating the movie or purchase a product which is showed on the videos. The completed application will be installed, tested, and improved by the employees of the company.

With the guidelines of my company tutor, Mr. Kratz, and the helps of other company colleges, together we are going to build a completed project and at the end a promised product will be delivered. In order to achieve the goal, I am required to put a lot of efforts in this internship, not only to get result but also to acquire valuable working experiences, communication and technical skills from a real life workplace.

The purpose of this report is to describe what I have done during my project along with the result in the end of my internship at Civolution. This report will be submitted to Stagebureau Fontys and assessed by the graduation jury.

The next chapter gives an introduction to Civolution company, what technology they are working on and brief information about the organization.

Chapter 3 describes the project in detail, such as how the project was initialize in the beginning, what are the current situation, what are the products and so on.

Chapter 4 gives the information on what researches have been conducted during the internship project and details in the research results.

Chapter 5 of this report provides in detail the project progress through every phase. Each phase includes a short description, goal, activities, result and self-evaluation. The discussion of the result in each phase describes how the result is accepted, what should be improved and also shows what the limitations are during the implementation.

The final conclusion and recommendation is given in the last chapter.

Chapter 2: About Civolution

This chapter contains all the general information which is related to my internship company – Civolution

• History of Civolution:

Civolution was formed in October 2008 as a spin off from Royal Philips Electronics. In August 2008 Philips Content Identification, a business unit of Philips Electronics assumed full ownership of its joint venture Teletrax. The combined entity was spun out of Philips in October giving birth to Civolution. In July 2009, Civolution took over the Software and Technology Solution from Thomson (Thomson STS), formerly NextAmp. Civolution is today the world's leading watermarking and fingerprinting technology solutions provider.

• What Civolution does:

Based on audio and video watermarking and fingerprinting technologies, Civolution offers a range of products and solutions to help media content owners, rights holders and distributors to better protect, manage and monetize their assets. By enabling the identification of content, Civolution allows content owners to protect, manage and monetize their assets throughout the content lifecycle. From pre-release stage, digital cinema, pay TV, online delivery, broadcast and online.

• Company data:

Civolution is headquartered in Eindhoven (The Netherlands) and has offices in Rennes (France) London (UK), New York, Hollywood and Hong Kong. Civolution currently has over 100 employees worldwide.

- **Type:** Privately Held
- **Company Size:** 51-200 employees
- **Website:** <http://www.civolution.com>
- **Industry:** Information Technology and Services
- **Founded:** 2008

• The technologies of Civolution:

▪ Digital fingerprinting:

Digital fingerprinting analyses the unique features of an audio or video asset and compares these against 'reference' fingerprints stored in a database. One of the key characteristic of fingerprinting is that it does not modify the content. Similar to a human fingerprint that uniquely identifies a human being, a digital fingerprint uniquely identifies a piece of video/audio content. The analogy can be extended to the process of fingerprint matching: first, known fingerprints ('reference' fingerprints) must be stored in a database; then, a 'candidate's' fingerprint is queried against the fingerprint database for a match. Sometimes fingerprinting technology is referred to as robust video hashing. Conventional cryptographic hashing (e.g. MD5) is fragile; an error in a single bit is sufficient for the hash to completely change. These fragile hashing technologies are not considered to be content-based identification technologies since they do not consider the content, understood as information, just the bits.

▪ Digital watermarking:

Digital watermarking embeds indelible and imperceptible data, the payload, into a media asset to give it a persistent identity. This data can later be extracted and interpreted by devices to identify, manage or monetize the asset.

The figure 1 shows one of the uses of the Fingerprinting technology. Basically in this concept, what the technology does is that it identifies media content which the user wants to identify and gets the identification result back from the database. Depending on the particular business scenarios, the identification result will be a trigger to apply corresponding business rule.

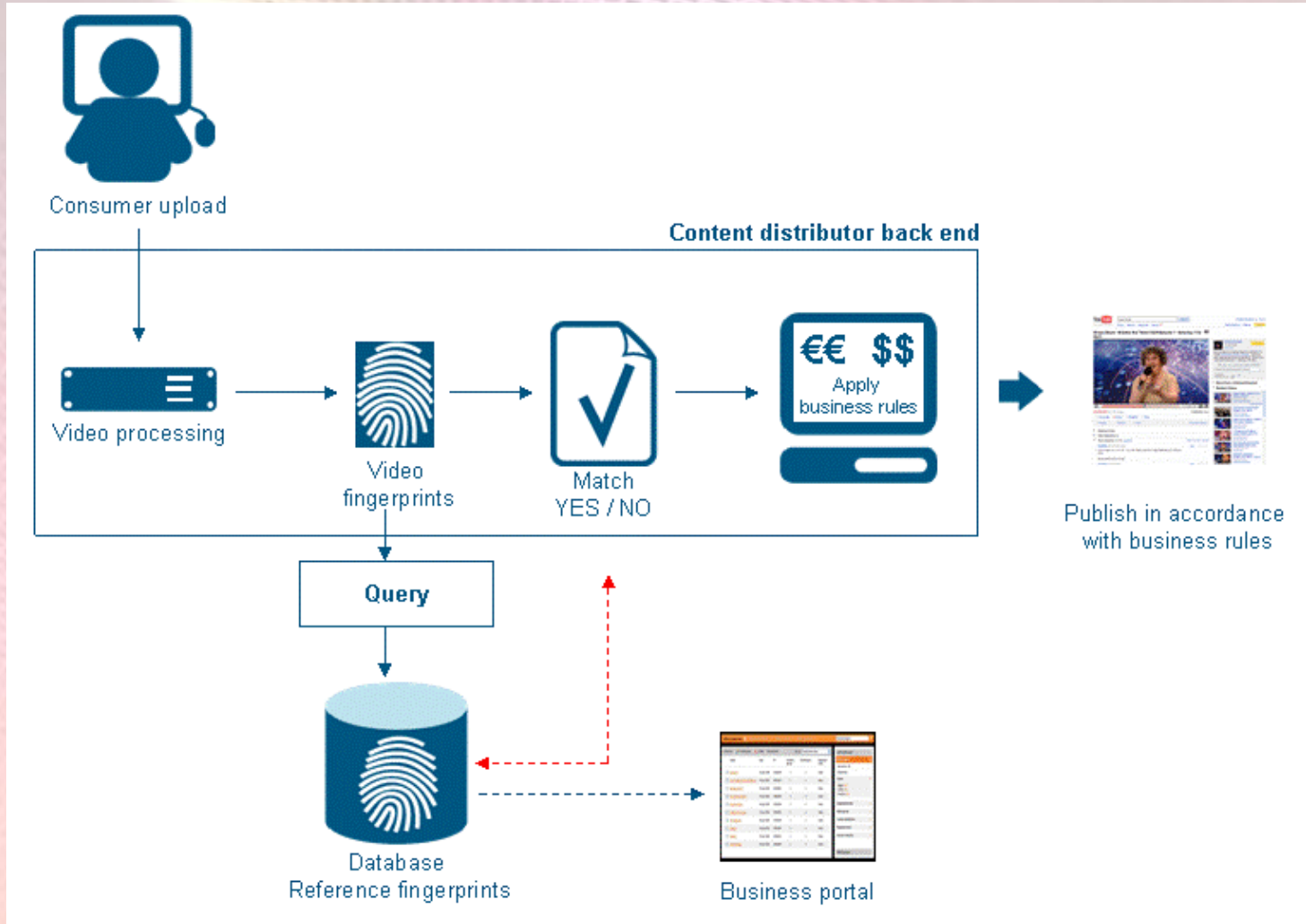


Figure 1: Example of Fingerprint monetization applications

• Organization chart:

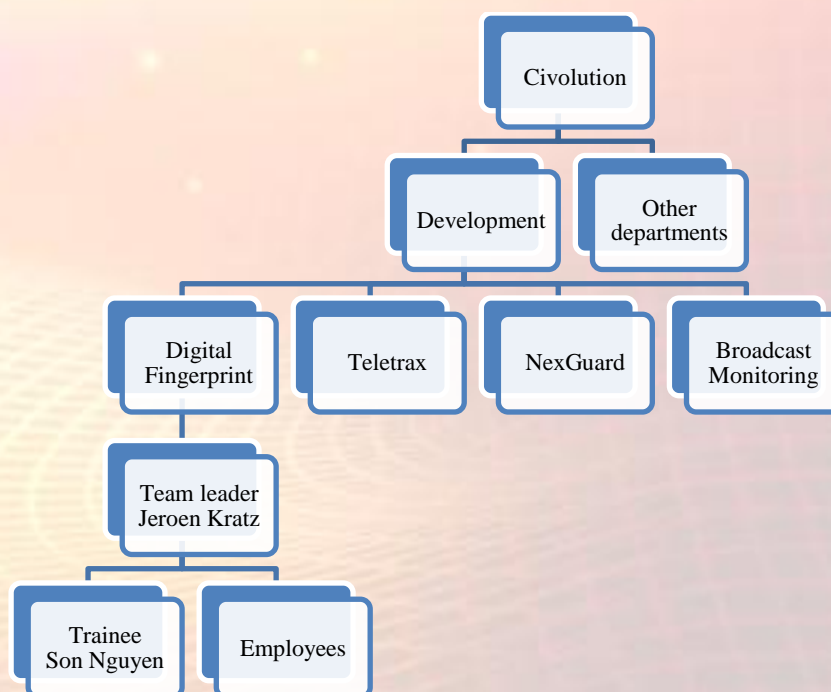


Figure 2: Civolution organization chart

Chapter 3: Assignment Overview

This chapter gives brief information about the project in general and describes the tools and methodology which have been used during the process.

3.1 Introduce to the project:

Civolution fingerprint development team has given me as a software engineer an assignment to build a demo application that can demonstrate and motivate the uses of digital fingerprint technology. The outcome of the assignment is a software application which the sales and marketing team of Civolution can use in introducing the company technology to customers.

3.2 Current situation:

Even though the fingerprinting and watermarking technology has been existed and widely used for a long time, their usages haven't been fully exploited yet. In order to motivate their current and potential users to realize and experience more about the technologies, Civolution is going to hold a trade show on April 2012 to demonstrate their products to the market. In this showcase event, Civolution is going to present numbers of new production ideas for the fingerprinting and watermarking technology. One of the ideas is that they will develop a Social TV which applies the fingerprint identification and watermark detection to social network interactions. The demo application will be run on a big screen television in the show and give the users the opportunity to experience this new feature.

According to the current situation, Mr. Jeroen Kratz, the fingerprint team leader, together with Mr. Stefan Maris and Mr. Wim Bus, the product managers, have planned a project for developing a demo application for Smart TV called Social TV. One of the platforms has been chosen to be developed is XBMC Media Center. The XBMC platform is used as an environment to run the Social TV demo application. This version of XBMC has already applied the fingerprint identification feature. When a video or audio is played on this platform, the content will be identified and the identity will be retrieved from a fingerprint server. With the information – metadata - got from the identification, me as the project carrier will carry out the next tasks which are to analyze the metadata and use them for the integration of social TV features. However, during the formal discussion together with our internal clients and development team, we have reconsidered about demo product due to the time limitation of the project. Instead of using the real fingerprint identification technology, we decided to build a specific demo application which is only available to a certain demo features and only used for marketing purposes. This way, we narrow down the risks and make sure that the outcome of the project is feasible.

3.3 Project Product:

The most importance deliverable is the first prototype of the Social TV demo on XBMC platform. This outcome is a XBMC add-on which is a GUI application in XBMC environment. The Social TV demo has 3 main scenarios that are based on the types of real TV channels. In our case, we focus our interests to the three common TV channels: News, Movies and Sports. Each of the scenarios holds a specific number of features which is applied the fingerprint identification technology. The news channel of the Social TV demo is developed as a modern TV interface with 25% of the screen run video contents and the rest is used to apply a certain number of discussed social interaction features, such as: Google Maps, Topic of Interests, Channel Switching, World Cloud and etc. On the other hand, the movies and sports channels are run in full screen mode and all the applied features are less intrusive than in the news channel. The features in the movies channels are mostly used to motivate other services to understand what the fingerprint identification can provide, such as: subtitle timing, content filtering, and product placement.

While the sport features are more about user's experiences, likes: Twitters, content related ratings, advertisements. A special scenario in the sport channel is that all the mentioned features will be implemented on a second screen application – means that you can have the second screen application on your Ipad, for example, and it will synchronize with the content you are watching on the TV and provide some features, such as: play a similar commercial as the one you are watching on the TV.

The second increment is a continued development product which means to be improved based on the requirements of our clients. In this increment, the internal clients request for improvement based on the result of the first increment in the NAB Show 2012. The deliverables of the second increment are a stable Social TV application and a second version of the second screen apps which are available on a real Ipad. This is also the final deliverable of my internship project.

In general, the deliverables of the project are specified:

- First increment: Social TV demo application
 - ✓ News features
 - ✓ Movies features
 - ✓ Sport features
 - ✓ Second screen app (on Windows)
- Second increment: Social TV demo application
 - ✓ Features improvements
 - ✓ Second screen app (on Ipad)

Refer to the Project Plan in Appendix A

3.4 Methodology:

The method which I use in this project is Agile/SCRUM. The project tasks are divided into small increments with minimal planning. After each increment, there are always deliverables, tests, discussions on improvement and feedbacks from client.

This method promotes adaptive planning, evolutionary development and delivery, a time-boxed iterative approach, and encourages rapid and flexible response to change. Therefore, the project's result is ensured with a high quality software in least possible time duration and satisfied customer.

The figure 3 displays the differences between agile and waterfall development processes. By delivering working, tested, deployable software on an incremental basis, agile development delivers increased value, visibility, and adaptability much earlier in the life cycle, significantly reducing project risk.

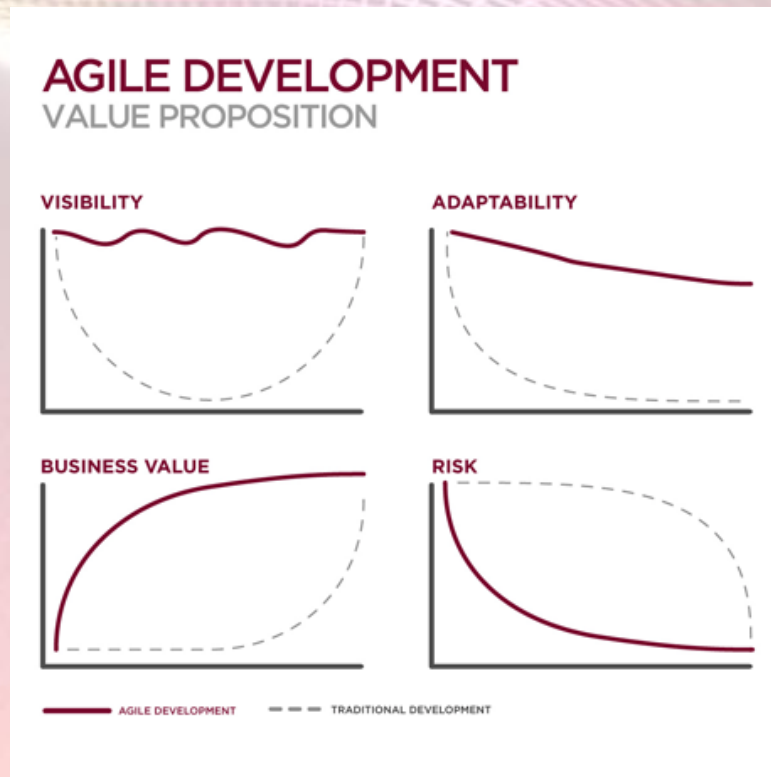


Figure 3: Agile development compare to Tradition development

There are always acceptance tests and meetings with client after a phase or a task is finished. The acceptance test is based on the client's requirements compare to the deliverable. Depends on the client's feedback, if the product meets his demands, the project will be carried on to the next step. Otherwise, it will be taken into consideration to improve or redo. This way the quality of the deliverable is always be ensured and the risks are minimized.

During the internship, I found out that this methodology is very effective for my project since in my case this is mostly a single person project. This is also a good learning point during my internship because in my school projects I only used Object Oriented systems analysis and design methodology.

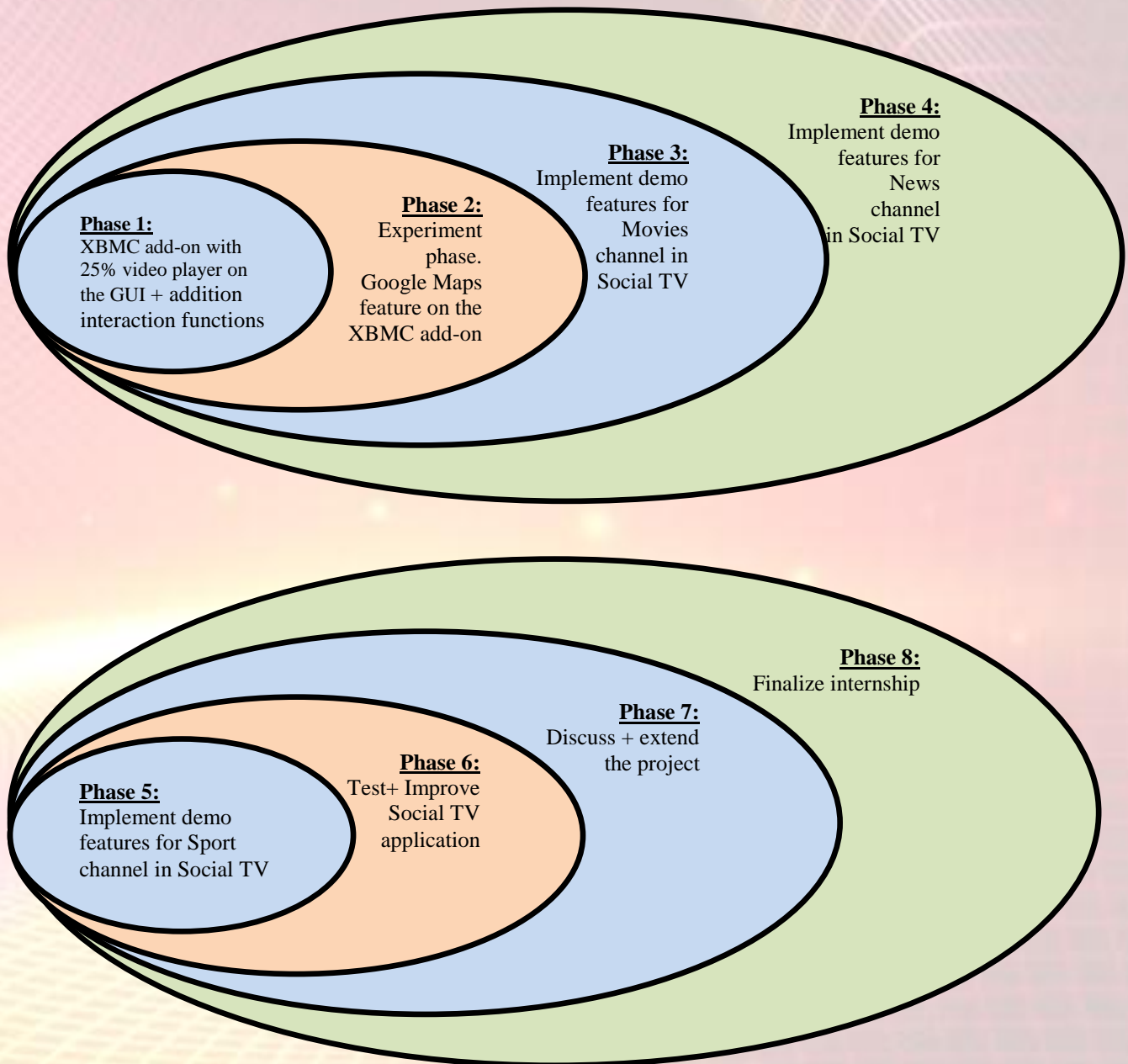
3.5 Tools:

The tools which are used mostly in this projects are:

- Eclipse development environment
- Visual studios 2010, .NET environment
- XCode
- Microsoft Windows 7
- Mac OS
- Ipad 2
- Microsoft Office
- Oracle VM VirtualBox
- XBMC development environment
- Programming languages: Python, C#, Objective-C

3.6. Phases:

The whole project is divided into 8 phases which are agreed upon the project plan. The first 6 phases are clear and fully discussed between the project carrier, Son Nguyen and the clients, Mr. Wim Bus and Mr. Stephen Maris. The last 2 phases were discussed after the first increment - the first version of the application – and the decisions were drawn up based on the client's demands and the time the trainee has left in the internship. The figure 4 bellows shows the concept of the project phases.



Unlike the SDLC methodology I used to work for my school project, there are a number of differences in the project process during the internship. We keep it short and straight forward in the initiative phase. The main purpose of the initiative phase is to understand what exactly the clients want from the product. With the Agile methodology I was using, we don't gather all of the detailed requirements at once but to have the requirements for each phase. In the end of each phase, we schedule a meeting to demonstrate our current product and deliverables to the clients and then discuss for further development. However, it also doesn't mean that we only plan step by step. The whole picture of the project is still drawn up and planned in the beginning and also the time aspect is seriously taken into concern. One of the advantages I have in this internship is that I have worked for the company before. This helps me to get used to the working environment quite fast and also I was able to start my project in the first week of my internship. After the initiative phase is initialized and the project plan is done, I have started the first phase in project directly to build the application.

Chapter 4: Research

This chapter contains the information of the researches which have been studied during the internship.

In this project, I have conducted a lot of personal researches to be able to carry out the project tasks. Most of the researches are to find out in what ways the application can be built effectively and timelessly. The other researches are specifically to how to develop the application.

In the initiative phase, many discussions and meetings with clients and development team had been held in order to make sure that the project is feasible. The requirements from the clients and the guidelines from the team leader are gathered during the weekly meetings and then filled in the project plan and design document. During the implementation phases, most of the information was acquired through the internet searching and guidelines from the XBMC development forum. In general, in order to be able to carry out the project, my basic knowledge in programming simply not enough; therefore, I am required to do a lot of studying to improve my skills, such as:

- XBMC platform understanding
- Linux, Mac OS, XBMC environment
- XML design
- Objective-C programming language

The XBMC platform is built by C++ language in Windows environment, however, the application which I am building is an XBMC add-on which runs in XBMC environment and it can only be done by Python script. Moreover, in order to program an add-on for XBMC, it requires some internal libraries which can only be acquired inside the XBMC environment, which means the debug cannot be performed in other environment, such as: Windows. Therefore, without a base knowledge in XBMC add-on development, there is no way I can continue with my project. A lot of studies are conducted in XBMC development community forum to make sure that I can acquire enough knowledge in this platform and carry on. The most efficient way which I found during my research is that starting a thread on the XBMC forum and asking for the needed information. After getting the information, I tried out the given solutions with current program project to see if there are possibilities or limitations. In the weekly client meetings, we have discussed what I found in my research and come up with a mutual solution on both sides. This way, the clients can keep track on their products and also adjust the expectation of the deliverable. After the decision is final, I step by step design the product based on the researched information and the client's requirement.

Another researching point is how to build a graphical interface application in XBMC environment. This is a big change in my programming point of view. Since in school, I only worked with Visual studios environment and windows form, everything was much easier because most of graphical components are available. In my project, to build a graphical interface I have to be able to understand XML which I didn't have much experience. In this study, starting from the beginning is very time costly; therefore, I tried to learn mostly from examples or existed add-on project in XBMC and I found that it is very effective. Also I found a lot of useful information about XML from the development consulting threads on the XBMC community forum. Since this is an XBMC application based, XML knowledge is a must in my skills.

The last part of my research is on the iOS system because my clients want to have the second screen application running on a real Ipad device instead of a demo application in Windows in the first increment. Getting used to Mac OS and iOS is not difficult but it is time consume, that's why we have held several meetings with the clients to have a fixed decision on the application improvements. This way we can manage and adjust the time aspect. All of the needed information was gathered in this last research is

from the Apple Developers website, in order to complete the second screen applications on iOS.

In conclusion, there were three main researches I have conducted during the internship project:

- XBMC developing environment
- XML scripting
- Objective-C language in XCode - Mac OS environment

I have been working with the XBMC platform before; however, I only worked with the XBMC source code to develop a new patch – with Visual Studios C++ in Windows environment. With this new project, I am going to build an application which will run inside the XBMC environment not a patch like before. Therefore, I must understand the architecture of XBMC platform. Most of the information is retrieved from the XBMC development wiki site: http://wiki.xbmc.org/index.php?title=XBMC_development

A new thing that I learn in my research on XBMC platform is that you can create a lot custom program which can run in XBMC environment by using Python scripting. In XBMC, they categorize all kind of XBMC add-ons into two types: Script and Plugin. XBMC features a Python Scripts Engine and WindowXML application framework (a XML-based widget toolkit for creating GUI window structure) in a similar fashion to Apple Mac OS X Dashboard Widgets and Microsoft Gadgets in Windows Sidebar. With Script, normal users can add new functionality to XBMC themselves by using the easy to learn Python programming language without an illegal copy of the XDK or without knowledge of the complex C/C++ programming language. On the other hand, Plugins, unlike Scripts, do not really provide new functionality to XBMC, instead what they do is provide an easy way to present content listings in XBMC through the native GUI interface. Therefore, the application which I am going to develop is XBMC Script. With this finding, I know where my focus is in XBMC development guideline.

In the research about XML, I didn't dive deep into the theory but to look up on the internet for the XBMC XML scripting tutorial. XML scripting doesn't play a very important role in my project. Basically, I only need to understand how XML skinning works in XBMC so I can create a GUI for my application in XBMC environment. With my findings, I realize that to be able have XBMC read a custom texture or display a graphical component on the interface of an application, we need to follow a fixed structure of application folder, such as, under the main folder of the application, the structure bellow must be followed:

- myskin/font: This subdirectory contains all fonts used by the skin. you can add/replace fonts here
- myskin/media: This subdirectory contains all the media files (.png/.gif/.jpg...) You can replace/edit these as you like.
- myskin/addon.xml: This contains the information that XBMC uses to find the other files that XBMC requires to describe it's skin. It also contains credits information, and versioning information.
- myskin/720p: This is a resolution-specific directory. XBMC can run in multiple resolutions, and thus can use different files for some resolutions (as there is a big difference between NTSC at 720x480 pixels and 1080i at 1920x1080 pixels!)

After this, in the script, we can use any graphical components by calling its name. This saved me a lot of time than try to clarify every directory or location which contains my graphical components. Another interesting finding is that some of the built-in functions in XBMC can be invoked by just using a simple line of code in the XML script of your application, for example: enter this line "<onclick>PlayDVD</onclick>" for your button will basically call XBMC to play the inserted CD or DVD media from the DVD-ROM drive. With this, I don't need to write any code in my script but still can invoke a XBMC built-in function easily.

The last research, I gathered information mostly on the Apple developer site: <https://developer.apple.com/library/ios/navigation/>. This is a self-study process for improving my

knowledge programming skill. It wasn't so hard to learn a new programming language since I already had a basic knowledge in programming. From the way I look, the only differences I saw in programming in XCode environment than other environments such as Visual Studios are just program syntaxes, coding structures, project arrangements... however, the way of working are more or less the same.

When I first opened up XCode to create a new project, it was very confusing. I had to begin reading tons of Apple Documentation and was still unsure of how to begin. In fact, after one week, I only started to understand what the basic projects where and how to run them. After that, I still had no idea how to write code or even put buttons on the screen. After about 2 weeks of watching tutorials and reading online eBooks I finally figured out how to add buttons and link them up to code. In Visual Studio, I can just drop a button, double click on it, and add my code. Here I had to make new classes, make Interface Builder aware of the classes, and then take the classes and define my buttons and other GUI elements. After another week, I finally began to appreciate the way things were done. I hate it at first, but after working with XCode for a certain time, I finally understand why everything is done as the way it is. I find that programming in XCode is quite fun and it is better than Visual Studios in some ways.

Chapter 5: Project Process

This chapter contains all detail information about the activities I have done in every phase during my internship.

5.1. Phase 1: XBMC add-on with 25% video player on the GUI + addition interaction functions

a. Description:

This is a starting phase which helps me to experiment the scope of my project and find out whether it is possible to develop the demo application on the XBMC platform. The main objective is to create a XBMC add-on which can have 25% of the screen streaming a video content. Also, I need to implement some sample functions to the add-on to prove that XBMC platform can be used as a development environment for the demo application.

Goal:

- Tangible:
 - XBMC add-on GUI as deliverable
- Intangible:
 - Python programming knowledge
 - XBMC add-on scripting knowledge
 - XML knowledge

b. Activities:

This phase lasted for 2 weeks includes the first week for getting used to the company and setting up my working environment. In this period, there were two meetings with my internal clients Mr. Wim Bus and Mr. Stephan Maris and my team leader Mr. Jeroen Kratz. In the first meeting, we only discussed about the idea of the demo application and drawn up a picture for the whole project. A lot of ideas were generated from both sides - development and client – we have tried to come up with a mutual agreement on how the application would look like and make sure that whether it is feasible or not. Since my clients are also the members of the company, they understand how the development process work, so they try to not put any pressure on the development side and always consult our idea – the project carriers – if things are gone too far from the project scope. After the first meeting, I started to build the first prototype of the application which is a XBMC add-on. Since I have already had some knowledge on the XBMC platform and also with Python language, the setting up step was done fluently. The only problem I faced in this step was that I couldn't be able to debug my program to keep track of my code. This problem was caused because the XBMC development guideline on their website has already been outdated while I was working on a newer version of XBMC. I have spent a lot of time consulting the solutions from the XBMC development forum, unfortunately, the result wasn't good enough. In order to not losing more time on this, I have decided to continue working on my program without the debug system. It was a challenge but it was not impossible, the only thing that I needed to do was to pay attention on my code and tried to narrow down coding errors by running the program every time I created a new function or even insert a new line of code. It was time consuming but it was doable. After 2 days working on the program, I was finally able to make the add-on which can stream video content on the 25% of the screen GUI. There were still some defects in the program and I knew it, however, the result of this had proven that XBMC platform is good for developing demo application. After showing the result to my team leader and

clients, we have come to a decision to use XBMC as a platform for the demo.

The rest of the time in this phase I spent to experiment further what the XBMC add-on is capable of, such as, create a function to make the add-on window response to a certain request from users or animating the graphical components of the add-on. Also I have used this time to get familiar with XML, such as create a custom XBMC graphical window. In the end of the phase, we hold a meeting with the clients to show the first deliverable.

c. Result:

Deliverables: XBMC add-on GUI with 25% of the screen can stream video contents

The result of phase 1 has been discussed on Monday, February 27th 2012.

In the meeting, Mr. Wim Bus was satisfied with the result and quite impressed with the graphical interface of the XBMC platform. We have agreed to continue the project using the XBMC as the development environment.

d. Evaluation:

The work of this phase is simple; however there were some difficulty in setting up the environment in the beginning. Working without the debug system was also a challenge since I cannot keep track of variables or errors in my code. But on the other hand, it helped me to learn to be careful when coding. It required some efforts to get the job done even I already had experience in working in the XBMC platform.

5.2. Phase 2: Implement Google Maps feature on the XBMC add-on

a. Description:

The task of this phase is still to experiment the capability of the XBMC add-on. One of the discussed features that we agreed is to have the Google Map display on the interface of the demo application. The result of this phase is to prove that within XBMC environment scope, the application is able to apply the Google API and have the map display on the interface. During this phase, we also had several meetings with Twisted design group to discuss on the graphical interface of the demo application. The activities of this phase are divided to:

- Getting start with the Google Maps API
- Continuing develop the Social TV add-on for XBMC
- Integrating the Google Maps feature to the add-on
- Discussing about the graphical design with Twisted
- Testing the add-on
- Discussing for further development

Goal:

- Applying the Google Maps API to the Social TV add-on

b. Activities:

This phase only lasted for one week because the tasks were not much. In the beginning of this phase, I have spent most of the time to do some researches on the internet how to use the Google Maps API. There are a lot of guidelines and ways to implement the API to an application, but to integrate it to an XBMC add-on is not easy. Firstly, I tried to write my own Python script and apply the Google Maps API to it. It was a very simple script just to request a location and get a URL link from Google Maps API. The challenge was I had to analyze the data I got from the responded URL and try to get the picture of the map. After a lot of tries, I have figured out that this wasn't a good way to implement because after got the data, I still need to translate it to a viewable map in XML. With my lack of knowledge in XML, doing this approach would take a lot

time and also it is not guaranteed that it will work in the custom XML in XBMC. That is why I spent more time to search for another approach for the implementation. After a lot of tries and tests, I finally found a simple way to get it done. Google Maps API also offers a static maps service which we can request a map image without requiring JavaScript or any dynamic page loading. All I need to do is to follow a structure of the HTTP URL request of Google Maps static service. For example, we can request the map image of New York simply by enter this url:

<http://maps.googleapis.com/maps/api/staticmap?center=New+York,NY&zoom=13&size=600x300&maptype=roadmap&sensor=false>

Following the parameters which are described on the Google Static Maps service website, we can custom the map image as we want, even switch it to a street view mode or put a marker on the map. After getting a map image, I did some programming to save this image at the resources location of the add-on and then later on just display it on the GUI of the add-on via some line of codes. With this approach, everything became simpler, I didn't have to do a lot of scripting or use other external libraries just to be able to translate URL map data to an image.

After finished the main task of the phase, I did several tests on the add-on to make sure that it runs stable. There were no major issues occur, except that I found out using this Google Map static service as a free user we can only request 1000 map images every 24 hours. This was also an important notice for the client to know that something could go wrong while they are presenting the demo application to customers.

During this phase, we had a meeting with Twisted design group on 29th of February to talk about the NAB demo scenarios for the Social TV application. In this meeting, I have showed Mr. Wim Bus and Twisted design group the result of the first phase phase and also explained to them the capability of the XBMC add-on. Another meeting was held on 7th of March and there were also 2 members from Twisted Company joined us in the meeting: Dennis Danen and Gertjan Willems. They are hired by Civolution to help on designing graphic of the demo application. In this meeting, we have looked at the result of phase 2 and discussed further about the application GUI design and also the new idea for the demo scenarios in the NAB show.

c. Result:

Deliverables: XBMC add-on with Google Maps feature applied

The result of phase 2 has been discussed on 7th of March 2012.

The result is accepted by the internal client, Mr. Wim Bus with some feedback on the GUI design. We have discussed and generated more ideas and scenarios for the demo in the next step.

d. Evaluation:

The work load of this phase was not much but in order to achieve the goal, it required a lot of efforts in solution searching and problem solving. I have spent a lot of time to improve my Python scripting skill in order to be able to integrate the Google Maps API to the add-on. The time which I have spent on testing the application were quite long but it was necessary and efficient since I have found an important issue which could affect the demo at the NAB show.

5.3. Phase 3: Implement demo features for Movies channel in Social TV

a. Description:

This is where the real work begins. After the client meeting on 7th of March, we have agreed on a number of features that will be implemented on the Movies channel of the Social TV application. During this phase, I was also developing the News channel demo scenarios and implementing some features which based on the results of phase 1 and phase 2. This phase was planned for two weeks but due to some problem during the process, it was extended for one more week. The general activities in this phase are:

- Client weekly meetings and discussions
- Implement Movie channel features for the demo application
- Present short demos after each step is completed (each week)
- Discuss about the GUI design, second screen apps
- Follow up and improve features/GUI based on client's feedback
- Test and improve the application

Goal:


- Social TV demo application with the News channel features: subtitle selection, content filtering, product placement

b. Activities:

The phase has started with a discussion on March 7th with Mr. Wim Bus and Twisted group about the Movies and News demo scenarios. We have focused more on discussing the Movies channel than News channel because we have got some difficulties in getting a clearance for News content in the NAB show. In the meeting, Mr. Wim Bus presented a number of development ideas in his presentation. Then, we had a discussion to contribute more ideas and agree on certain possible development features. I have given some of my thoughts about these features and clarify which feature is possible and the approximated time to develop it. After some discussion between two sides, we have come up with these specific demo features for the Movies channel:

- Subtitle selection which the users are able to selection up till 3 different languages: Spanish, Japanese and Vietnamese.
- Maturity rating or content filtering option which allows users to skip a certain number of inappropriate scenes based on viewer's ages.
- Product placement which displays the products occurs in the movie as icons and also allows users to have the ability select and have the product information display on their second screen app.


These are the three major features which we found out are important for NAB viewers to acknowledge the benefits of the Fingerprint Identification technology. The meeting has ended with an agreement on the three sides, Mr. Wim Bus – client, Twisted group – graphic design and me – project carrier. We have planned a next meeting with Twisted group to collect the graphic design elements of the demo application on March 20th at Twisted company. The figure 5 shows the three Movies demo features which we have agreed on.



SyncNow demonstration - Movie+ Ad's

Clearplay, maturity rating!
8-12-16 menu to select age

2nd screen additional ad
+ thumbnails for commercial
block + settings



Subtitle service for 3 selectable languages / Music

Figure 5: Social TV Movies channel: demo features

After the client meeting, I have started to program the first prototype application of the Social TV application. The main activity I did in this step was coding with Python script to build an XBMC add-on as the Social TV demo application. In other word, the Social TV demo application is an XBMC add-on. I have started with implementing the subtitle selection feature according to my company tutor's advice, Mr. Jeroen Kratz. This step is quite simple since the XBMC platform already has a built-in function which can read subtitle format files and display the texts to the screen during a video is streaming. The only job I need to do is to search for a suitable subtitle set for the movie in the three languages. We have agreed to choose "Harry Potter: The Deadly Hollow part 1" to be the content for the NAB show. However, I still need to pick a scene in the movie which its content is able to demonstrate the three discussed demo features. The reason is that in NAB demo show, we only give a presentation for around 10 to 15 minutes, so there wouldn't be time for a whole movie. It took me a day to be able to select a suitable scene for the demo since Harry Potter is a PG 13 rated movie; there are not a lot of scenes which suits for the content filtering and product placement features. After selecting the most suitable scene, I have a small discussion with Mr. Wim Bus to have his approval on the content. It went well and I continued to work on the subtitle selection implementation. Since the content is just a clip in the movie, I need to do some video editing works, such as: cut, render, alternate the file format and synchronize subtitle. Timing the subtitle to fit the movie clip was time consuming. After the subtitle selection feature was successfully implemented, I continued with the content filtering feature. This step required the understanding of XBMC playback behavior because when we skip a certain scene during the decoding by using the seek function of XBMC built-in, it caused some delay and was very noticeable. My first solution of this problem was to prepare 2 clips for the movie content, one is for the clear play and one is filtered. However, during the process, I did some more tests on the XBMC playback behavior and found out the delay problem only happens if the skipping is longer than around 1 minute. The reason is because if we jump from for example 01:00 to 02:00, XBMC will do the decoding again because at that time, the movie frames have not

been pre-decoded. Luckily, in our case, the skipping scenes are not longer than 60 seconds, so the performance is still good. Also, with the new release of XBMC version 11, there is an improvement in XBMC video decoder and the delay problem seemed to be less concerned. That was why I decided to not using the approach of using 2 different movie contents anymore. After the delay problem was solved, everything seemed to work well. I have demonstrated my work to Mr. Wim Bus in our weekly meeting and he was satisfied with the outcome. The rest of the time I spent on implementing the product placement feature. This was also not a complicated task; however, working with the graphic in XBMC environment was a challenge. In order to display an icon or any graphic element on the XBMC GUI is complicated. It also caused some conflicts with the XBMC original playback tool bar, for example, if the XBMC playback tool bar is "modaling", it is not possible to perform another GUI window modal. I was struggling with this issue for a couple of days until I found an example XBMC add-on which also deal with the same problem I had. The sample add-on is "PseudoTV". What they did to prevent the problem of XBMC playback tool bar is that they created a transparent window as an overlay above the playback tool bar. And this way any interaction between users to the XBMC original playback tool bar will be blocked. I applied this solution for my add-on and it worked. It was however still exist some minor issues but in general functionality worked well. After the problem was solved, putting the graphic elements on the add-on GUI became simple. The rest of the implementation was to timing whether the product needs to be appeared on the screen. For this, I created a new timer thread on my program to check the matching moment and trigger an event to display the product icon on the screen. The figure 6 shows the final result of this phase.

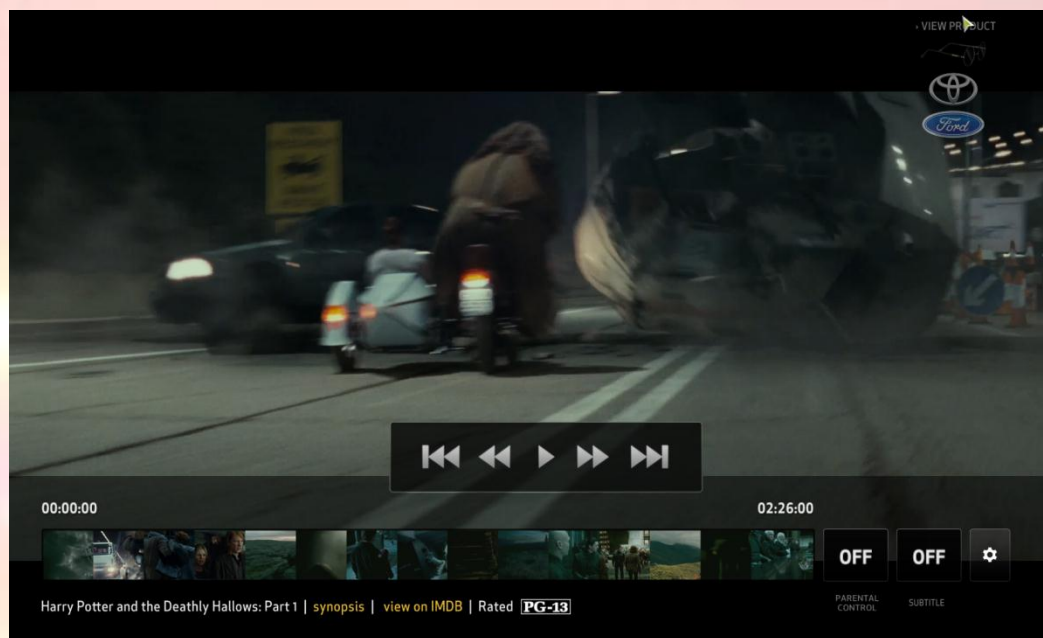


Figure 6: Screenshot of the Social TV demo Movies channel

The main tasks of this phase have been completed in the end of the week 4, March 17th. However, we had some problem of getting a clearance for the News content for the NAB Show, so the next phase has been postponed for one week. Therefore, I spent the additional time to test my product and also did some research how to implement some programming function for the News features. This way I can save time for the next phase implementation.

During the last week of this phase, we had a meeting with Twisted group at Twisted company. Together with my internal client, Mr. Wim Bus, we have visited Twisted company in the morning of March 20th to collect the graphical design elements for my application and also to have a further discussion on the NAB demo show. In the meeting, I have showed the result of my work and got some feedback from the group for improvement. There were not major corrections from

the client as well as the Twisted. We continued the meeting with looking at the design from Twisted and giving our opinions. We had a few ideas for improvement the graphical design but there were not many major changes in the design because we all have already agreed on the demo features we have discussed. We also talked about the demo scenarios for the News and Sports channels. In general, the ideas for the News channel were already concluded, the only problem was that we still need to wait for the clearance of the News contents and the content's copies themselves. After the meeting, I had small discussion with Twisted group since we were working on the same project together. We have exchanged email addresses to be able to contact and exchanged the graphical components.

c. Result:

Deliverables: Social TV demo application with News channel features implemented

The result of phase 3 has been discussed on 17th and 20th of March 2012.

The result is accepted by the internal client, Mr. Wim Bus. In the meetings, we have discussed some improvements for the application and planning for the next step.

d. Evaluation:

This phase lasted longer than planned but the time was well spent. I had a lot of meetings and discussions during this phase, the main reason is to keep in touch with the client and make sure that the product is developed as client's expectation. There were a delay problem during the process but it was caused external reason and was not affect much on the project. I have managed to spend the extra time to improve my programming skill and test my product. The result was good and this phase was successfully completed.

5.4. Phase 4: Implement demo features for News channel in Social TV

a. Description:

The main task of this phase is to implement the demo features for the News channel in the Social TV application. Similar to the implementation of the Movies channel, everything is done step by step:

- Weekly meetings with client
- Develop features for the Social TV News channel by step:
 - Making discovery mode and full screen mode for the channel
 - Google Maps
 - Word-cloud
 - Channel switching
 - Topic of interests
- Discuss on GUI design and second screen apps
- Present the deliverables for the internal clients and development team
- Discussing for further development

Goal:

- Social TV demo application with News and Movies features implemented

b. Activities:

The implementation process of this phase was similar to the last phase. I have started with gathering the requirements from the client and after we agreed on a final conclusion, I began to build the application. This phase has started on March 20th, a week delay from the plan, and lasted for one week. The workload of this phase was much more than the previous phases. However, because I have already done some preparation in the extra time I had in the last phase,

the implementation went fluently. In this week, we have received the approval for the News content and we have scheduled an appointment to quickly review the discussed features to make sure that it is suitable with the contents. The News contents which we used were the "Volcano in Hawaii" and "Car accidents in Ohio". In this phase, I have spent a lot of time sitting together with Mr. Wim Bus to work on the content analyzing. Together, we tried to generate keywords from the contents since in this demo application we did not use the real closed captioning function of Fingerprint feature. We also discussed in detail how the features should be functioning in the NAB show. After understand exactly how the system should work, I began to program the functionality for the demo application. Since the Google Map integration has been done in the phase 2, I only need to apply it to the new application and adjust it with the graphical designs from Twisted.

After I finished integrating the new graphical design to the application's GUI, I started to work on the channel switching function. It wasn't a difficult job but there were a lot of errors during the test process in this step. For some reasons, the XBMC decoding process seemed to have conflict problem with my application. Every time I tried to call the function to switch to other channel or simply to play another video content, the application was freeze and then crashed. I was struggling with this problem for almost two days just to find out what was the reason. Since I didn't have a debug system in my program, it took a lot of time to trace back errors. However, finally, I found a solution from an example add-on. Even though the reason of the problem hasn't been discovered yet, but the solution I got somehow mitigated the issue. Basically, before calling the function to switch the channel, I implemented a thread sleep method which to wait for the last decoding process to stop completely then start switch to other channel. With this solution, it worked perfectly. Later on, I came back to this problem in the testing phase, to find out again the real reason of the problem to make sure that the solution I used is valid. The reason which I found was most logical is that when XBMC player is streaming the current video, if I call it to stream another video without putting it to the queue first, it still proceed the command but it doesn't stop the current process, and that causes the crash. Therefore, later on, I implemented another function to stop the whole streaming process before starting another one. I have also added some semaphores to prevent the situation of 2 processes execute one function at the same time and this prevents the crash problem from happening.

I continued with the next task after the crashing problem in the switching channel was solved. The job I need to do in this step is to implement the topic of interests feature to the demo application. This feature basically allows users to open a website base on the topics which are available during the news they are watching. This task is simple because I have discussed together with Mr. Wim Bus about some specific topics and websites which will be demonstrated in the presentation. The only requirement for this step is to have the website open on the second screen monitor instead of the main screen monitor. I have found a very simple solution for this since the clients only want to use one pc for the whole demo. The solution was to have the presenter to open a web browser on the second screen monitor first and then all of other website will be opened in that browser by default. With this approach I didn't have to spend a lot of time on figure out how to do it programmatically.

The last task in this phase was implementing the world-cloud feature. Because we didn't use the real technology for demo, this step was also straight forward. With the keyword set we have discussed, I only need to do some timing to put them on the GUI then add some animating effects for the words. In this step, I have to do everything manually based on the News content, so it took a lot of time. For example, in order to have a keyword to appear on the GUI during the news is presenting, I need to do some timing to have the keyword match with the content. When a keyword is mentioned, the keyword should appear around one or two second delay then fade out if it is not mentioned in a long time. There are around 20 keywords for each of the news content and all of them appear several times include animating effects. All of them need to be program manually, so it took me more than two days to complete everything.

The figure 7 shows the final result of this phase. A meeting was hold on 23rd of March with Mr. Wim Bus to discussing the result and giving feedback.



Figure 7: Final result of phase 4 - Social TV News channel interface

c. Result:

Deliverables: Social TV demo application with News channel features implemented

The result of phase 4 has been discussed on 23rd of March 2012.

The result is accepted by the internal client, Mr. Wim Bus. In the meetings, the demo application is run on the 46-inch TV in the development room to simulate real demo for the NAB show. We had some discussion on the interface of the application for improvement, but in general Mr. Wim Bus was satisfied with the result. We have planned for the next meeting to discuss about the demo scenarios for the Sport channel.

d. Evaluation:

The workload of this phase was quite heavy and the time was limited. The tasks were not complicated but they took a lot of time because I had to make sure that there wouldn't be any major defects after completed them. There were some small issue during the result demonstration but in general the phase has been completed successfully. I have also learned a lot of new things in programming, for example, XML scripting, and also the way of working, such as: communication with clients and colleagues during this phase.

5.5. Phase 5: Implement demo features for Sports channel in Social TV

a. Description:

This phase is the last step of prototyping the demo application. The major goal of this phase is to implement the last demo features for the Social TV application – Sport channel. The activities in this phase are quite different from the previous phase because I am not only working on the XBMC environment but also working with Visual Studios in Windows environment. In general, the activities in this phase are:

- Discuss about the demo features of Sports Channel
- Discuss about the GUI design + second screen apps
- Develop the second screen applications for the demo: movies app and sports app
- Present the complete Social TV for the internal clients and development team
- Discuss for further development

Goal:

- The completed Social TV demo application with all the functionalities implemented
- Second screen applications which can synchronize with the Social TV demo application

b. Activities:

This phase was original planned from March 26th to March 30th; however, due to some issues occurred during the meeting on 23rd of March, we have extended the time frame of this phase. The decision was to use the time we have planned for the testing phase for this phase. The testing will be conducted during the process to save time for development. There was also a confusion between the client, the Twisted design group and the project carrier. This issue caused the change in planning for the last phase. The problem was that Mr. Wim Bus has planned to short for the last implementation while the tasks were very heavy and took a lot of time to develop. The discussion in the last meeting was also not clear who was responsible for developing the second screen application. In the meeting, I have misunderstood that the Twisted group was the one who was going to develop the second screen apps; however, actually they were only responsible for the graphical design of the apps. After clarified the confusion, Mr. Wim Bus decided to extend the time for this phase to solve the current situation. However, it was also a difficult situation since I haven't prepared for developing the second screen applications. We had another meeting on 2nd of April to find a solution for the problem. In the meeting, we have consulted Mr. John Pierre – leader of Teletrax group – for a proper solution since he has a lot of experiences in software development. After a few proposals, we have come to a final solution was to develop the second screen applications on Windows as a widows form application. The solution was given based on my programming experiences on the Windows platform. After the solution was final, I have started to make a design for developing the second screen applications. The figure 8 shows the basic concept of the second screen applications and the Social TV demo application.

The concept shows that both the Social TV demo application and the second screen app are running on the same PC machine and they communicate through TCP/IP protocols. In other words, I need to develop a client server application for both the applications so they can send and receive requests from each other. With the knowledge of distributed application development I have acquired during my study at Fontys, the applications were developed step by step fluently. In this specific scenario, the second screen app plays the role of a TCP server and the Social TV demo application is the client. The server will be created when the second screen app is launched and it will listen to all the requests from the client side. Basically, in the client side, I wrote a function in my script for requesting a number of messages which will be used to trigger the second screen app to perform some actions, such as: when the Social TV demo application sends a request for opening the sport GUI window, the second screen app will receive this request and trigger the event to open this window. On the server side – the second screen app, I developed the app with all the features based on the client's requirements:

- Open a corresponding window every time the channel in the demo application is switched: Sport GUI or Movie GUI
- Swap a score list on the Sport GUI after a certain scene occurs in the demo video
- Play a corresponding commercial if a commercial appears in the demo video

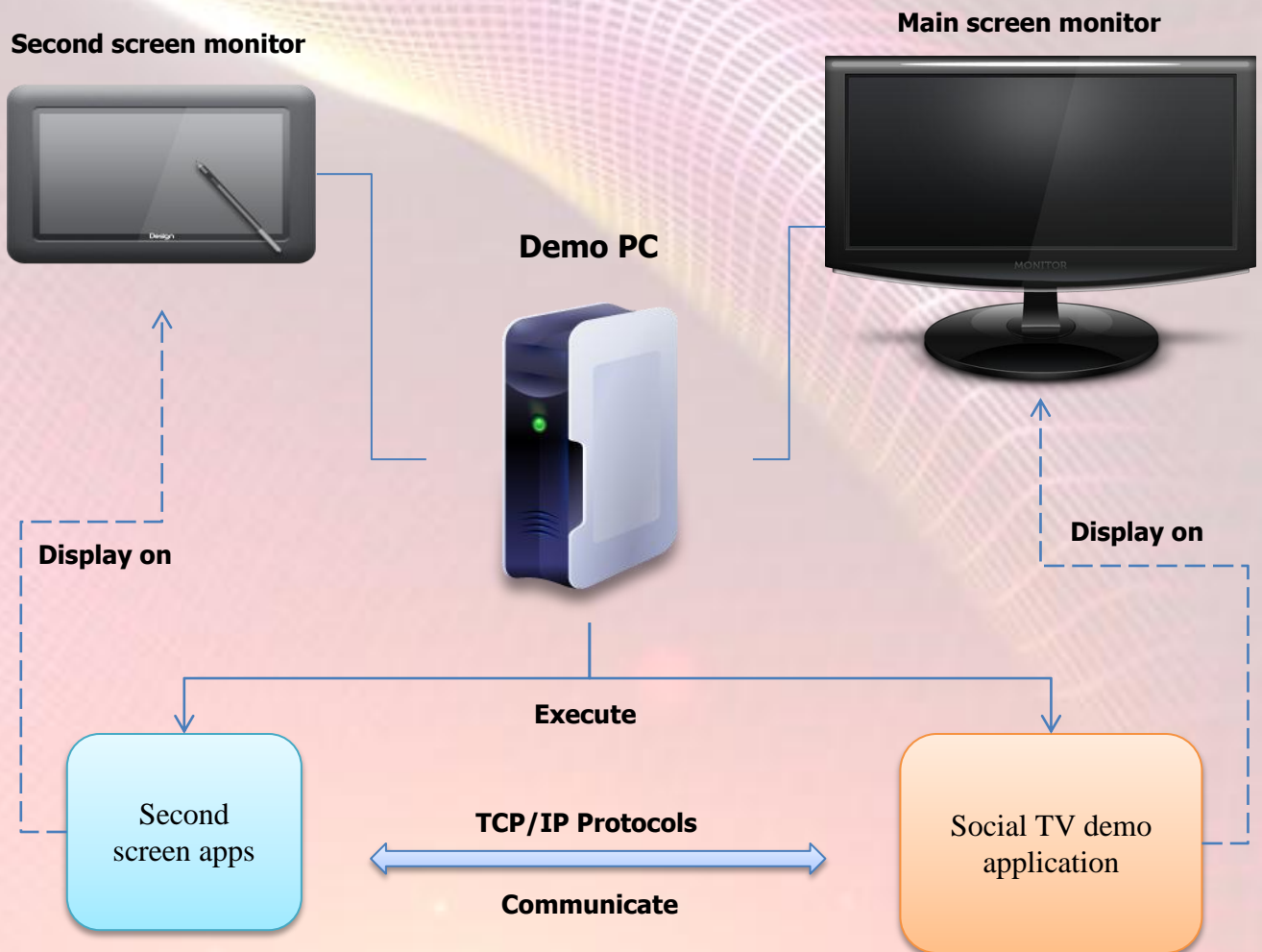


Figure 8: Basic concept of Social TV and Second screen app demo setup

It took me sometime to have all of the features of the second screen application up and running. The most difficult part I faced in this progress was to have a video play on the second screen app. I was advised to use Window Media Player framework in the app; however, I have never worked with this component before so it was a big challenge for me. I was struggling with the framework for a long time because everything was not working properly at first. Every time I implemented a new method which is related to the framework, a number of errors and warnings have been generated. I had to trace back every error and looked for a solution on the internet. It took me a lot of time until I can have everything run properly. After the implementation was successful, I took a day to perform some tests to make sure that the apps are stable.

After all of the basic functions have been implemented, I started working on the graphical interface of the second screen apps based on the design of Twisted. Most of the time I spent on this step was to adjust the components' size and to have the app automatically display on the second screen monitor. During this phase, there was a new internal client have joined the project, Mr. Pim Hertogs, together with Mr. Wim Bus, he is responsible for a certain demo case at the NAB shows and the products of Fingerprint technology. There were also a few demo meetings in between during the development with my clients to keep track on the demo product.

On Thursday 5th of April, we had a monthly R&D meeting and the Social TV demo application was show briefly during the meeting. The final result of this phase was demonstrated on Wednesday 11th of April, with the additional appearance of Mr. Alex Terpstra – Civolution CEO, we have discussed about the real scenarios in the NAB show and also giving general feedback to improve the demo application before the show. The figure shows the final result of phase 5.

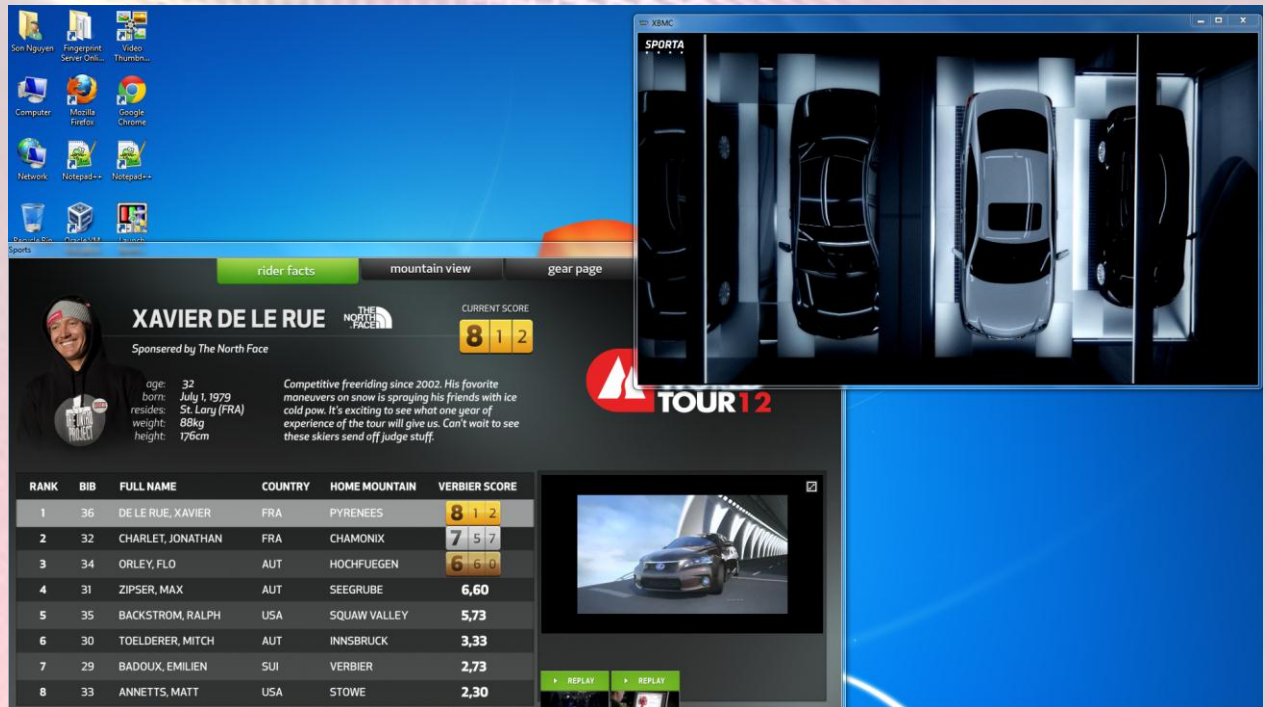


Figure 9: Screenshot of the phase 5 result
Second screen app (left) and Social TV demo Sport channel (right)

c. Result:

Deliverables: Completed Social TV demo application and Second screen apps (Sports & Movies)

The result of phase 5 has been discussed on 11th of April 2012.

The result is accepted by the internal client, Mr. Wim Bus. In the meetings, the demo application was run on the 46-inch TV in the development room to simulate real demo for the NAB show. There were some feedback and advices on the demo application from Mr. Alex Terpstra for improvement the demo application in the future. We have arranged a next meeting for setting up the demo for the NAB show on Friday 13th of April 2012.

d. Evaluation:

One of the lessons I have learned in this phase is that making sure that everything is clear and confirmed after every client meeting or development meeting. The confusion in this phase caused some troubles in the project progress and planning. Fortunately, with the help of my Civolution colleagues, we have solved all the problems and come to a successful result. The workload of this phase was quite heavy, but with the knowledge I have learned in school and some efforts I have managed to complete the tasks on time.

5.6. Phase 6: Test+ Improve Social TV application

a. Description:

This phase was originally planned for 2 weeks duration. However, because of some issues during the whole process, we have adjusted and finally planned it for 2 days. The tests were conducted during every phase; therefore, the tasks in this phase were only meant to review the applications and prepare for the NAB show.

Goal: The Social TV demo application and second screen application are set up on the demo PC machine.

b. Activities:

On Thursday 12th of April, I spent the day to look into my code and fix the last remaining issues I found on the application. Luckily, there were no major issues that are needed to be fixed or improved. In the end of the day, I had a small discussion with Mr. Wim Bus about the demo setup and together we have made a last change in the application. Instead of making a separated PowerPoint presentation for the demo at the NAB show, Mr. Wim Bus wanted to have the presentation script to run on the XBMC environment too. This was a small change, so I spent around 2 hours working on it and finally it successfully implemented.

On Friday 13th of April, we have a final meeting to wrap up everything before the NAB show on Monday 16th of April. In this meeting, we have made a sample video record of the application and sent it to the hired professional presenter at the NAB show. Everything was good until we have faced a last minute problem at 5pm of the day. The problem was we didn't check the monitor type of the real NAB show, and it didn't support the HDMI output which we have used during the development. We tried to set up the demo with other output type: DVI and VGA, and then another issue occurred. For some reasons, the demo application didn't run with the new output setup. We were working on this problem from 5pm until 8pm to find a solution for the problem. Fortunately, with the help of Pavel Mironchyk and Mehmet Celik – two senior software engineers in the research department – we finally solved the issue. The problem was simply caused by a missing driver of audio device on the demo PC. When the XBMC couldn't recognize the audio driver of the PC, it automatically refused to render videos frame and caused the video freezing in the demo. After the problem is solved, I helped Mr. Wim Bus to pack up all the necessary devices for the NAB show and at 8pm, we officially finished all the tasks.

c. Result:

The Social TV demo application and second screen apps have been successfully setup on the demo PC and ready to dispatch to the NAB show in Las Vegas, US.

I have continued assist Mr. Wim Bus during the demo remotely via telephone and Skype.

On 16th of April 2012, I have received an email from Mr. Wim Bus that inform that "the demo works great" at the NAB show.

The presentation of the Social TV demo at NAB can be found at: <http://vimeo.com/40932655>

d. Evaluation:

In this phase, we have faced a last minute problem which was critical to the final result of my work. Fortunately, the problem has been solved with the help from my senior colleagues and finally we have managed to have a decent result at the NAB show. After this phase completed, I have learned that it will always has a chance that a problem occur in the last minute and it is vital to have everything planned and tested carefully to minimized this risk.

5.7. Phase 7: Discuss + extend the project

a. Description:

The tasks of this phase were not planned in the first period because we have agreed to have a discussion on extending my project after the NAB show is finished. According to the meeting on Monday 7th of May 2012, we decided to continue improve the Social TV demo application by adding more demo features because it will also be used for other business and technology showcases. The activities which I have conducted during this phase are:

- Discuss about the further improvement for the project
- Test and improve the previous version of the demo
- Develop the second screen application on the real Ipad

- Demonstrate the final result to the clients and development team

Goal:

- Social TV demo application is compatible with the second screen apps on Ipad
- Second screen apps on Ipad

b. Activities:

This phase was original planned from May 7th until June 29th 2012. However, according to the plan we have discussed with my university tutor and my company mentor on 29th of March 2012, we decided to have this phase completed before the 8th of June. Then, the remaining of the project will be carried on after I have finished my graduation thesis, until the last day of my internship at Civolution 2th of July 2012. Based on the change of the plan, this phase was rescheduled to the period of May 7th until May 30th 2012; and after that, the next phase will be carried on from May 31st until June 8th for completing my graduation thesis.

In the starting week of this phase, we had a client meeting on May 7th to discuss about the result of the project after the NAB show. In the meeting, I have got some feedback from Mr. Wim Bus and Mr. Pim Hertogs about the performance of the demo application at the show. In general, everything worked properly; however, there were some minor issues happened during the preparation before and during the demo. There were two major issues which were considered to be a "must" for the next improvement:

- The second screen apps should be run on a separated device (in this case we use Ipad) instead of the same device with the Social TV demo application
- The controlling of the application needs to be changed to be more user friendly interaction

Based on the priority of the situation, we have decided to implement the improvement for the first issue – second screen app on Ipad – and it was the main task of this phase. The second issue was planned to implement after phase 8 when I have finished my graduation thesis.

After the tasks have been planned, I spent the first week of this phase on fixing and improving the Social TV demo application according to the feedback of the clients. Most of the performance issues were caused because my codes had not yet been optimized. Some of the functions in the add-on script were not cleaned up after released and caused some memory leak. I spent two days cleaning up my code and fixing other bugs and finally the application's performance has been improved. On Friday May 11th, I have demonstrated the updated version of the demo for the clients and we have discussed further on the second screen application on Ipad. In the second week of this phase, I spent my time on searching a guideline for developing apps on iOS and make a first design for my second screen apps project. Since I didn't have any experience on developing on iOS environment, I have consulted Mr. John Pierre for advices and guidelines. We have a small discussion to arrange the development tool for the apps. I have been assigned a Mac PC in order to be able to develop the apps for Ipad. However, this PC is a shared development tool, so I had to wait for almost 3 days to get this device. During this period, we had a small change in the Fingerprint department. The Fingerprint department has been moved from the office upstairs to downstairs. We spent a day for moving and setting up for the new office. After everything was arranged, I started to work on the main task of phase 7 – developing the second screen app on Ipad. It was difficult at first because I was not familiar with working in the Mac OS environment. It took me more than two days to get used to the new environment and almost a week to be able to program with XCode. In this phase, I worked parallel both learning XCode and developing apps. Since I have never been programming with Objective-C in XCode before, I started with a very simple "Hello World" program to try to understand the general concept of the language step by step. In this learning process, I learned everything quite fast

because it was more or less similar to all other programming languages. After one week learning, I have already been able to start my main project. I got some trouble with making the GUI for the second screen app at first because XCode environment is quite different from Visual Studios. For example, to create button function like in Visual Studios, it took me almost a day to figure out how to it works in XCode. However, once I get used to the XCode environment, everything became easier and clearer. After a while, I found that program in XCode was somehow easier than in Visual Studios because a lot of components and functions in XCode are very visual and easy to implement. After I have done with the GUI design, I tried to make some simple functions for the apps, such as, using the Media player framework in XCode to make a video playing function in my app. It was similar in Visual Studios, so I finished this step quite fast. However, the problem began when I tried to create a TCP socket server in the app. I found some tutorials on the internet but somehow when I tried to implement it to my application, everything became complicated. Most of the examples and tutorials I found were quite advanced and it required a deep understand in networking. Since I didn't have a lot of time to spend on this issue, I tried to look for an example which was simplest and closest to my situation. Finally, after a lot of searching, I found an sample program in C language which shows how to create a TCP socket listener and I was able to applied it in my program. When this step was done, I spent the rest of the time to figure out how to create the request handles for all the requests from client side in my app. In this step, I dived deep into the concept of delegates and events handler in Objective-C. After I understand how it works, the implementation became much simple. When the apps were almost completed, I have faced the last problem with threading in the program. The problem was when a function in the main view controller is executed in the main thread, the functions of other the child view controllers will be executed in the background, so even when I call a function to display another view controller, it is still not appeared on the GUI because it was performed in the background. I have struggled with this problem for two days until I found a proper solution. Apparently, in Mac OS or iOS environment, the way of threads and processes are executed is different than in Windows. Therefore, what I understand in Windows environment cannot be applied in Mac OS environment. After a lot of testing, I finally understand how threads and GUI work in Mac OS. Basically, when the main GUI or the main view controller is performed on the main thread, you can call and execute any methods inside the child view controller class from the parent view controller class and all the method will be executed on the main thread as well. After that, the problem was solved easily.

The second screen apps were completed after two weeks and on 27th of May, I have demonstrated the products to my internal clients, Mr. Wim Bus and Mr Pim Hertogs. They were satisfied with the results, however, the apps were only able to run on an Ipad simulator in the Mac OS environment and not yet deployed to a real Ipad. This was because in order to deploy an app to a real device, it requires a paid Apple developer account and I haven't got the account yet. We have a small discussion on this issue and after that we have request a help from Mr. John Pierre. Together with Mr. John Pierre, we tried to finish the last step of this phase. However, after getting an Apple develop account, another problem occurred. The problem was the version of XCode I used to developed the apps were not compatible with the iOS version on the sample Ipad. We tried to update the XCode on the Mac PC, but then another problem occurred: the new version of XCode requires the newest version of the Mac OS. Up till this problem, we had to request the financial department of Civolution to purchase the new version of Mac OS. This step took more than three days because there were a lot of complications during the financial request. But finally, we were able to deploy the apps successfully on the Ipad and the final result discussion was scheduled on Wednesday 6th of June 2012.

c. Result:

Deliverables: The improved Social TV application and the second screen apps on Ipad

The result of this phase was accepted by the internal clients, Mr. Wim Bus, Mr. Pim Hertogs and my company mentor, Mr. Jeroen Kratz on 27th of May 2012. After the result was accepted, we have discussion about the next improvement for the demo applications in the next business show case. We have also agreed on the plan of phase 8 – internship report writing.

After the phase 8 is completed we are planning another meeting to discuss about next tasks for the project

d. Evaluation:

The main problem I have faced in this phase was not in programing but in the way of working. We had some delay problem in acquiring the new development tools and this was the main reason caused some delay in the progress. However, the tasks were all completed on time and the result was also good. In this phase, I have improved a lot of skills and knowledge in programing because I had to work on a total new development environment, Mac OS.

5.8. Phase 8: Finalize the internship

a. Description:

This phase is not the last phase in my internship because I still continue working at Civolution after completing my graduation thesis in order to have enough the working experience. In this phase, most of the tasks were to finalize what I have done since the beginning of my internship and finish my final report, and complete all the related internship documents.

b. Activities:

I have started the make the first draft of my internship report since April 2012 after the first project increment was completed. In this phase, I have started to make the first version of my report from the draft. Most of the activities I did in this phase were communicating with my school tutor, Mrs. Agnes Veugen, to have her help on my report writing process. We have exchanged questions and answers through emails and make sure that I was able to complete my thesis on time. We have decided on a number of report versions to be submitted and feedback. In the end, we had a final report which was read and approved by my company mentor, Mr. Jeroen Kratz. After having the report signed and included with all the documents: Day Declaration, Evaluation forms, Project plan as attachments, the document were submitted to Stageburo at Fontys on June 8th 2012

c. Result:

The final internship documents were delivered to Fontys Stageburo on June 8th 2012 with the approvals from Mr. Jeroen Kratz, my company mentor.

d. Evaluation:

There was no major problem during this process, except the time I have planned for this phase was limited. Therefore, I had to work extra time at home in order to be able to complete my thesis and other related documents on time.

Chapter 6: Conclusion and Recommendation

• Conclusion:

My project during the internship was to develop a demo application – Social TV which motivates the Fingerprint Identification technology for a business show case. After 5 months working at Civolution, I have successfully achieved the project goal which was approved by my company mentor and the internal clients. The product was used at the NAB show on 16th of April 2012 and was a great success.

The internship project was initialized on 14th of February 2012. The project started with an experimental phase which has proven that XBMC platform was suitable environment for the application development. Several meetings have been hold between the clients and the development team after the first phase and as a result a project plan has been drawn up. Based on the project plan, the whole development process has been divided into 8 phases. In each phase, there is an agreement from both sides on a number of deliverables as result in the end. All of the phases have been completed successfully with some remarks and feedback from the clients for product's improvement. The first seven phases are related directly to the Social TV demo application development process and the last phase is for the student to work on the graduation thesis for the school. The Social TV demo application was developed and its features were assembled piece by piece during the phases. In the end of phase 6, the first increment was completed. The result of the application in phase 6 was used as a demo in the NAB Show on 16th of April and it was successful at the show. The phase 7 began with a discussion on the product improvement and in the end a final decision has been made: the second screen apps which were one of the features in the demo application will be implemented on Ipad. The result of phase 7 has been completed successfully on June 6th 2012 and was approved the internal clients.

The internship was great success and as a result my graduation thesis was completed on June 6th 2012 after the last project phase. The outcome of my internship project is kept on the archive of Civolution company and will be used as a continued development project in the future.

• Recommendation:

I realize that communication is one of the important skills during my internship at Civolution. It is important because when you got a problem in your work, you can always ask for help, this way you will learn more than just try to work on your own, also it helps to save time. Without the help of my colleagues, I don't think I can achieve my goal on time according to the plan. I found it very interesting when I have work at Civolution is that every day we all have a small meeting together in the beginning of the day to talk about what we have done for the previous day and what we are going to do for today at work. This is a very nice experience and I found it is really effective. This way you have the idea of what exactly the work of your colleagues, what is going on in the office, and also you can share your difficulties or problems to others so they can help you to find a solution, you can also contribute and improve your knowledge during these meetings. Keep track on my work and learn from others was one of the reasons for me to improve myself during this internship. My advice for the junior students is that try to express yourself as the workplace so people have an idea what you are working and with that they provide their support when you need.

Another recommendation is to have everything planned in detail and always keep track on your progress. Try to plan some spare time in between each planning phase, so you can have additional time to work on the issue if it happens in the last minute.

Evaluation

My main motivation since I started the internship, after understanding the situation, is able to develop a decent product that meets all of the client's requirements and got approved by the company. I am very interested in the assignment from the start because I know the product which I am going to develop will be used as a demo for technology of the Civolution at a big technology show case, NAB.

This was a very interesting and fun project. I did a lot but also learned a lot during this internship. I have spent many efforts in order to complete all the assigned tasks step by step and in the end it was well rewarded. Concerning the project I had, it was interesting to discover something new that I wasn't taught in my engineering school, such as: Objective-C programming language, XML, Python scripting... They are things which I have never known before working in this project. To be able to work on the project and achieve the goal, it requires some new technical knowledge which I have never tried or learnt before. Therefore, the time which I have spent on this internship was rather more about learning and practicing than actually implementing. However, with my existing knowledge in IT, programming, it wasn't so difficult to start everything from the beginning, it was only time consuming. With the specific tasks for each period which specified clearly in the project plan, I have managed to finish all of requirements and got result in every phase. I find myself improve a lot after the internship in both programming and communication skills.

During the implementation process, there were a lot of issues and problems happened that led me to step by step learning and improving my skill in problem solving. The result which I got from each phase always contained at least one or two issues even though I spent a lot of time testing the product. And this is one of the valuable learning points that I have learnt during my internship, always double check the work to minimize the risk.

The main reason that helps me to achieve the project goal after five month intern at Civolution without any trouble is the working environment. I was familiar with the way of working in Civolution because I also did my first internship here. I tried to exploit this advantage in order to learn to be as a real employee than a trainee, and this might help me to improve myself in the workplace later on in my future career. The final result which I have done in the end of my internship was one of my best achievement projects since I have started studied at Fontys. It was challenging, but once I got the result and got approved by my company, it was really a good paid off for all of my efforts.

This internship was a great experience. It was a real pleasure to work in Civolution with nice people in a good atmosphere. Carrying out this internship in a foreign country allows me to be immersed in a different culture and faced the problem of living and working entirely in a non-native language, English. I have met several interesting people in and out of the office such as researchers, engineers, trainees like me, and also other people not connected with technical work, for example, sale managers, production managers...