# LiveTV for Mobile Applications
# Final Project Report

## Version 1.0

# Revision History

| Date | Version | Description | Author |
| --- | --- | --- | --- |
| 2010-01-11 | 0.01 | Initial Draft | Darko Ronić |
| 2010-01-13 | 0.5 | Added 80% of documentation | Darko Ronić |
| 2010-01-14 | 1.0 | Done | Darko Ronić |
| | | | |

# Table of Contents

# 1. Introduction

## 1.1 Purpose of this document

Purpose of this document is to describe the final product and metrics of the *LiveTV for Mobile Applications* project with special attention to milestones, requirements fulfillment etc.

## 1.2 Intended Audience

The intended audience is:

- Project customer (Damir Isović and Klaas Eriksen)
- Project supervisor (Rikard Land)
- Team members

## 1.3 Scope

The document will give the final report of the project. This will include requirements fulfillment, milestones fulfillment, team member performance, project timeline etc.

## 1.4 Definitions and acronyms

### *1.4.1 Definitions*

| Keyword | Definitions |
| --- | --- |
| | |
| | |
| | |
| | |

### *1.4.2 Acronyms and abbreviations*

| Acronym or abbreviation | Definitions |
| --- | --- |
| FER | Faculty of electrical engineering and computing, Zagreb |
| MdH | Mälardalen University, Vasteras, Sweden |
| SVN | Subversion revision control software |
| API | Application Programming Interface |
| S60 | Symbian S60 operating system |
| VLC | VideoLAN server used for streaming |
| FER | Faculty of electrical engineering and computing, Zagreb |
| MdH | Mälardalen University, Vasteras, Sweden |
| SVN | Subversion revision control software |

## 1.5 References

# 2. Background and Objectives

# 3. Organization

## 3.1 Project Manager

Project managers for the *LiveTV* project were:

- Clément Fouque – Project Leader
- Darko Ronić – Team Leader

## 3.2 Project group

| Name | Initials | Responsibility (roles) |
| --- | --- | --- |
| Clément Fouque | CF | Project leader; Studio application developer (C#); Testing |
| Amer Tahir | AT | VLC and Studio application developer (C# and C++); System Integrator |
| Dalibor Mesarić | DM | Studio application developer (C#); Testing |
| Nima Moghaddami Khalilzad | NMK | Java player developer (Java); Android player developer :D |
| Darko Ronić | DR | Team leader; Recording application developer (Symbian C++); VLC recompiler |
| Neven Vujasinović | NV | Recording application developer (Symbian C++); GUI designer |
| Željko Rumenjak | ŽR | Java player developer; Android Recorder developer; SVN manager |

## 3.3 Steering Group

Project implementation is practically opened to interpretation. Customer's opinion was that the team should decide how to implement the system. Since a half-working version of the system already exists, it was be used as a guideline but without any important influence to the project. Regular meetings were held with project supervisor. Iterations in the development gave us a good feedback to see if our path was correct.

## 3.4 Customer

Project customers are Damir Isović (vice-dean at MdH) and Klaas Eriksson (OneDial AB).

## 3.5 Others

Project supervisor is Rikard Land from MdH.

# 4. Milestones

| Id | Milestone Description | Responsible Dept./Initials | Finished week | | | | Metr. | Rem. |
|---|---|---|---|---|---|---|---|---|
| | | | Plan | Forecast | | Actual | | |
| | | | | Week | +/- | | | |
| M001 | Requirements analysis & definition | DR, CF | 41 | 41 | 0 | 41 | 0 | |
| M002 | Basic recording application | DR, NV | 43 | 43 | 0 | 48 | +5 | REM1 |
| M003 | Basic player application | ŽR, NMK | 43 | 43 | 0 | 42 | -1 | |
| M004 | Basic VLC streaming functionality | AT | 43 | 43 | 0 | 44 | +1 | |
| M005 | System – Alpha version | Re + Pl + AT | 44 | 44 | 0 | 44 | 0 | |
| M006 | Studio application - GUI | CF, DM | 45 | 45 | 0 | 45 | 0 | |
| M007 | Studio application - complete | CF, DM, AT | 47 | 47 | 0 | 46 | -1 | |
| M008 | System – Beta version | ALL | 47 | 47 | 0 | 47 | 0 | |
| M009 | System – Release Candidate | ALL | 51 | 51 | 0 | 50 | -1 | |
| M010 | Testing and Documentation | CF, DM, NV | 1 | 1 | 0 | 2 | +1 | |

## 4.1 Remarks

| Remark Id | Description |
|---|---|
| REM1 | Serious problems with recording functionality. Late but we now have two recorders. |
| | |
| | |
| | |

# 5. Project Results

## 5.1 Requirements

### *5.1.1 Requirement Compliance Matrix*

| Identity | Requirement Description | completed | Rem |
|---|---|---|---|
| | Recorder Application | | |
| REC-1 | Record video using phone's camera | Yes | |
| REC-2 | Stream video to a remote server | Yes | |
| REC-3 | Change the recording resolution | Yes | |
| REC-4 | Receive feedback from server | Dropped | |
| | Player Application | | |
| PLY-1 | Play video stream from remote server | Yes | |
| PLY-2 | Check streaming support on the mobile device | Yes | |
| PLY-3 | Send feedback to the server | Partially | REM1 |
| PLY-4 | Platform independent | Yes | |
| | Studio Application | | |
| STU-1 | Receive at least 6 different streams at a time | Yes | |
| STU-2 | Show all incoming streams | Yes | |
| STU-3 | User can choose which stream to broadcast | Yes | |
| STU-4 | Insert a commercial at any point in a stream | Yes | |
| STU-5 | Send feedback from players to recorders | Dropped | |

| | Project-wide | | |
|---|---|---|---|
| PWR-1 | The delay introduced by the system should be less than 5 seconds | Yes | |
| PWR-2 | The video streaming must be done through some existing mobile network, e.g., 3G | Yes | |
| PWR-3 | The quality of the sound should not be compromised, the quality of the video can be lowered to match available system resources | Yes | REM2 |

*Completed: Yes (completely implemented)*
*No (not implemented at all)*
*Partially (partially implemented, more description under Remarks subsection)*
*Unknown (completion status not known)*
*Dropped (requirement was dropped during the course of the project)*

### *5.1.2 Requirements Compliance Summary*

| | |
|---|---|
| Total number of requirements | 16 |
| Number of requirements implemented | 13 |
| Requirements partially fulfilled | 1 |
| Requirements not fulfilled | 0 |
| Requirements dropped | 2 |

### *5.1.3 Remarks*

| Remark Id | Description |
|---|---|
| REM1 | Feedback exists on the players but isn't implemented in the Studio |
| REM2 | DSS drops the video quality if necessary |
| | |
| | |

## 5.2 Work Products and Deliverables

| To | Output | Planned week | Promised week | Late +/- | Delivered week | Rem |
|---|---|---|---|---|---|---|
| Steering group | Project Description | 40 | 40 | 0 | 40 | |
| Steering group | Requirement Definition | 40 | 40 | 0 | 40 | |
| Steering group | Design Description | 41 | 41 | 0 | 41 | |
| Steering group | Revised Design Description (opt.) | 43 | 43 | 0 | 43 | |
| Steering group | Acceptance test plan | 50 | 50 | 0 | 50 | |
| Steering group | Final Project Report | 2 | 2 | 0 | 2 | |
| Steering group | Code and documentation | 2 | 2 | 0 | 2 | |

# 6. Project Experiences

## 6.1 Positive Experiences

The whole idea of working in a distributed project team is by itself a positive experience. This project has been, in particular, a challenging one. There are many reason for it, but a few most important will be shown here in this final report:

- using technologies in a way they weren't designed to be used – using VLC for stream switching and stream display in the studio application
- streaming a recorded video in real time from a mobile phone – very difficult and is again based on using the technology in a different way
- complicated formal specification of a standard such as: RTP, h263, AMR
- difficult testing of the system
- difficult developing because mobile phone development

Because of that, there are many conditions that have to be met in order for the project to be successful:

- constant communication with the customer
- needed technology to be available to the project team
- a lot of time for research – in particular, research for a way the problem can be solved
- detailed project specification – probably was impossible because no one knew how this could be done in the first place
- infrastructure needed for testing – Internet link

Although there were problems because of these things, the project was an extremely good experience. Each of us learned to develop on a new platform, learned new technologies, and became a better engineer by using the technologies in a different way that they were meant to be used.

Distributed development has also been a positive experience because we all learned how to work in a team of different individuals which we never met before. During the time we spent together we learned of each others' habits and strong sides.

## 6.2 Improvement Possibilities

The *LiveTV* project can be improved in lot of areas and this is also planned for further development of the project. This is just a basis for a better system:

1. Larger recording resolution support for Symbian version – it can record only in 176x144 resolution because of the format used and the mobile phone
2. Working AMR support for Android version – currently Android AMR recording has a lot of issues and doesn't record correctly. Solution may be to write encoder in the same way G711 is implemented.
3. Switch to MP4 and AAC for recording – this is a big improvement but extremely difficult.
4. Make the stream switching work better with both Symbian and Android interchanging.
5. Implement the feedback in the recorders and add the player feedback in the Studio application because it exists in the players.
6. Make the DSS support load balancing.
7. Implement the ability to make the sound quality better and video quality lower if the Internet connection is slow.
8. Implement the system for informing the viewers when the stream starts.
9. Work on the synchronization of various stream – make the recording process unified using the same timestamp for all the recorders.

# 7. Financials

## 7.1 Project Cost Summary

| | |
| --- | --- |
| Planned Cost | 40960$ |
| Actual Cost | 39680$ |

## 7.2 Work per Member

| Member | W40 | W41 | W42 | W43 | W44 | W45 | W46 | W47 | W48 | W49 | W50 | W51 | W52 | W53 | W1 | W2 | Total |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| DM | 12 | 11 | 6 | 11 | 7 | 6 | 7 | 5 | 2 | 1 | 1 | 5 | 0 | 0 | 4.5 | 7.5 | 86 |
| CF | 8 | 6 | 3 | 12 | 11 | 13 | 8 | 15 | 4 | 6 | 5 | 5 | 0 | 0 | 4 | 8 | 108 |
| AT | 8 | 5 | 13 | 10 | 10 | 16 | 11 | 13 | 17 | 8 | 8 | 7.5 | 0 | 0 | 6 | 8.5 | 141 |
| NMK | 1 | 10 | 8 | 9.5 | 5 | 7.5 | 10 | 11.5 | 7 | 7.5 | 12 | 3 | 0 | 0 | 2 | 7 | 101 |
| NV | 8 | 7 | 5 | 4 | 9 | 14 | 11 | 12 | 10 | 10 | 13 | 8 | 4 | 4 | 5 | 14 | 137 |
| DR | 10.5 | 12 | 6 | 7 | 21 | 17 | 14.5 | 18 | 6 | 10 | 37 | 32 | 5 | 5 | 10 | 14 | 225 |
| ŽR | 8 | 7 | 5 | 8 | 14 | 19 | 21 | 16 | 18 | 8 | 26 | 8 | 5 | 8 | 13 | 10 | 194 |
| **Total** | 55.5 | 58 | 46 | 61.5 | 77 | 92.5 | 82.5 | 90.5 | 64 | 42.5 | 102 | 68.5 | 14 | 16 | 44.5 | 69 | 992 |

# 8. Metrics

## 8.1 Milestone Metrics

| Completed as planned or earlier | Total | Timeliness |
| --- | --- | --- |
| 7 | 10 | 70% |

## 8.2 Effort Metrics

| Activity | Actual Effort | Planned Effort | Deviation (%) |
| --- | --- | --- | --- |
| Project preparations | 46 | 40 | + 15% |
| Requirements analysis & definition | 43 | 56 | - 23.2% |
| Recorder app – video capture | 116 | 72 | + 61.1% |
| Recorder app – network streaming | 85 | 56 | + 51.7% |
| VLC server – setting up and config | 52 | 64 | - 18.8% |
| Player app – developing | 79 | 64 | + 23.4% |
| C# application - GUI | 68 | 72 | - 5.6% |
| C# application - core | 59 | 88 | - 32.9% |
| System integration | 103 | 104 | - 0.9% |
| Recorder app – additional features | 89 | 96 | - 7.2% |
| Player app – additional features | 72 | 96 | - 25% |
| C# application – feature upgrade | 42 | 96 | - 56.3% |
| Testing | 138 | 120 | + 15% |
| **TOTAL** | 992 | 1024 | - 3.2% |

| **Effort estimation accuracy (%)**<br>*(100*(1 - abs(Actual – Planned)/Actual))* | 96.77% |
| --- | --- |