# GSoC 2025 Final Report

## VideoLAN – DVD-Audio Deciphering Module in VLC

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## General Information

**Organization:** VideoLAN
**Project:** DVD-Audio Deciphering Module in VLC
**Mentors:** Jean-Baptiste Kempf, Steve Lhomme
**Proposal Link:** available here

## Abstract

This project's initial aim was to add CPPM decryption support into VLC, however, more was required to support the DVD-Audio format, so the initial aims were expanded upon. The final deliverables were updates to the libdvdread, to support the DVD-Audio format and libdvdcss for the decryption support as well as a submodule for simple playback into VLC. All of this is documented through comments, and this page: Link

## 1 Goals

- Goal 1 – provide a public API to read CPPM encrypted DVD-Audio blocks to libdvdcss
- Goal 2 – provide a public API to change libdvdread's behavior to read DVD-Audio discs
- Goal 3 – provide a way for the user to play encrypted DVD-Audio discs inside of the VLC media player

## 2 Project Timeline

### 2.1 Phase 1: Research and Discovery (early weeks)

This took up a significant portion of this project. Familiarizing myself with the specifications for both CPPM, and DVD-Audio discs as well as understanding the already existing `libdvdread` and `libdvdcss` code was not only quite challenging but I would say it was probably the main hurdle I needed to cross before this project could materialize. I would say this phase was around a month or more.

### 2.2 Core Implementation (mid-project)

Once I had built an understanding of everything, the changes I needed to make became very clear. After I had made the modifications to both libraries, fixing up and understanding how to create a VLC module that fit into the current DVD module took a substantial amount of time as well. This phase was a little less than a month.

### 2.3 Integration and Refinement (later weeks)

It was in this phase that I was able to get my first encrypted disc to play, and I started to make merge requests for my changes in the DVD libraries. I would say this was the phase with the most work, considering that code refactoring was a very labor intensive process, though it was very rewarding seeing my work become ready to be a part of the VLC codebase. This phase lasted less than a month, though I had to do more work than I usually had to.

### 2.4 Testing and Validation (later weeks)

It was in these weeks that I was cleaning up and validating the changes I had made to my libraries. `libdvdread` required a lot of changes and adjustments to ensure that its use was seamless and logical, with regards to DVD-Audio behavior. It was around this phase that I also began drafting my final report and notes that I had in my own little documentation page (link available in the header). This was when my changes to VLC had also been thoroughly reviewed and deemed acceptable.

## 3 Work Completed and Results

VLC now supports simple audio title based playback on encrypted DVD-Audio discs intuitively, no need to extract the Audio Data. This now makes VLC one of the only ways to play this type of disc as is. And both libdvdread and libdvdcss have been extended to support DVD-Audio features (IFO files, path structures, etc) in an OS agnostic way (previous implementations of DVD-Audio software across the web is only built for Windows). These additions were tested and validated on the following discs:

1. Deep Purple - Machine Head (encrypted)
2. Brain Salad Surgery (unencrypted)
3. Say You Will - Fleetwood Mac (encrypted)
4. Eagles - Hotel California (encrypted)

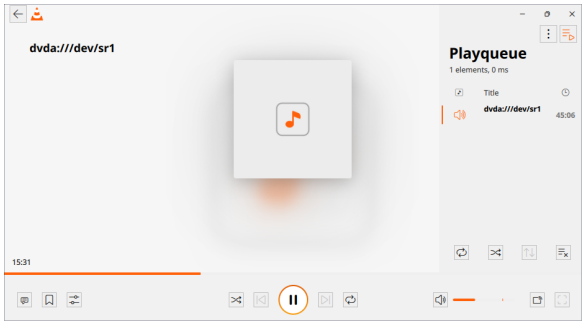


Figure 1: DVD-Audio Disc Playback

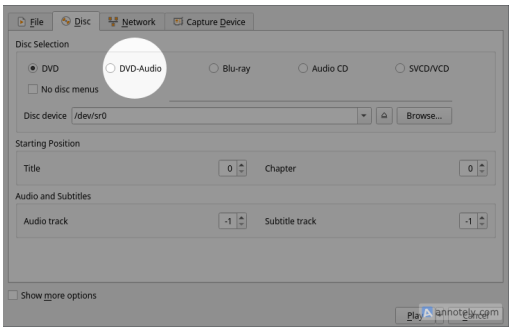


Figure 2: Addition to Disc Menu

## 4 Merge Requests

| Project | + | - | Description | Link |
|---|---|---|---|---|
| libdvdread (v6.1.3 to v7.0.0) | 1205 | 133 | Initial DVD-Audio additions | link |
| | 20 | 7 | Follow-up adjustments/fixes | link |
| | 95 | 73 | Follow-up adjustments/fixes | link |
| | 199 | 81 | Follow-up adjustments/fixes | link |
| libdvdcss (v1.4.3 to v1.5) | 1492 | 9 | Initial CPPM support integration | link |
| VLC (v4.0.0) | 512 | 126 | DVD-Audio disc menu addition and sub-module | link |

## 5 Challenges

This topic is heavily undocumented, and the available resources are often poorly explained or contain errors. Much of the effort was spent manually analyzing the format in order to try to replicate the wanted behaviors. There was also initially trouble acquiring material to work on, though discs were generously provided by the foundation.

The DVD libraries are also not as well documented as many of the other pieces of software in VLC, so there was initial friction when it came to understanding how they worked and how I'd extend their functionality without breaking API.

Once the initial research and discovery phase were completed, the remainder of the project ran more smoothly, though reorganizing my commits to fit with VLC code standards was very time consuming as well.

Additionally, the VLC demuxer had some issues working with MLP DVD-Audio streams that were difficult to resolve; this issue was dealt with by my mentor, Steve Lhomme, in a separate merge request.

## 6 Learning and Skills Development

### 6.1 Reading/Extending Large Codebases

Since I had never worked on a project of this size before, let alone a project that wasn't my own, so this was a novel experience for me. I can now say for sure that after some initial friction, I've become much quicker at reading code and understanding how large codebases work.

### 6.2 More Advanced Git Skills

I, of course, was already familiar with git, using it to coordinate with teammates on code projects before this. Though I had never used many of its more advanced features like rebase, reflog, and I had never really had to organize and keep my commits easily workable. I've also become very familiar with working on merge requests, issues, etc.

### 6.3 Code Practices/ Getting Accustomed to the Review Process

In group projects before GSoC, I had never been put under a formal code review process or made to reform code/commits to adhere to a project's code practices. Because I am now more familiar with this process, I would say contributing to open source has become far less intimidating. It is likely that I will contribute to projects in the future because of this.

## 7 Future Work

Support for hybrid disc behavior with video linking titles is not supported, as well as DVD-Audio menu integration similar to that in libdvdnav since the information required to implement these features is currently unavailable, and undocumented in the available unofficial specifications. Exposing still images to the API should be added as well, according to the unofficial specifications these are included in the Audio Still Video Set (ASVS)

## 8 Project Impact

This work builds the foundation for full DVD-Audio disc capabilities, making it by far the most thoroughly implemented DVD-Audio code so far. While many DVD-Audio discs are also DVD-Video, not all are, and DVD-Audio contains far higher audio quality as well as features built specifically for music albums that don't exist in DVD-Video, such as song lyrics that will now be easier to implement in the future. Due to how uncommon these discs are, they are considered collectors' items and require special DVD players to use fully. Making the software to play these discs more widely available will help preserve this media long term, which aligns with VLC's goals.

## Acknowledgements

I would like to thank both of my mentors, Jean-Baptiste Kempf and Steve Lhomme, for their patience and time. I would also like to thank the foundation for providing me with difficult-to-access material for my work. This wouldn't have been possible without their guidance and support