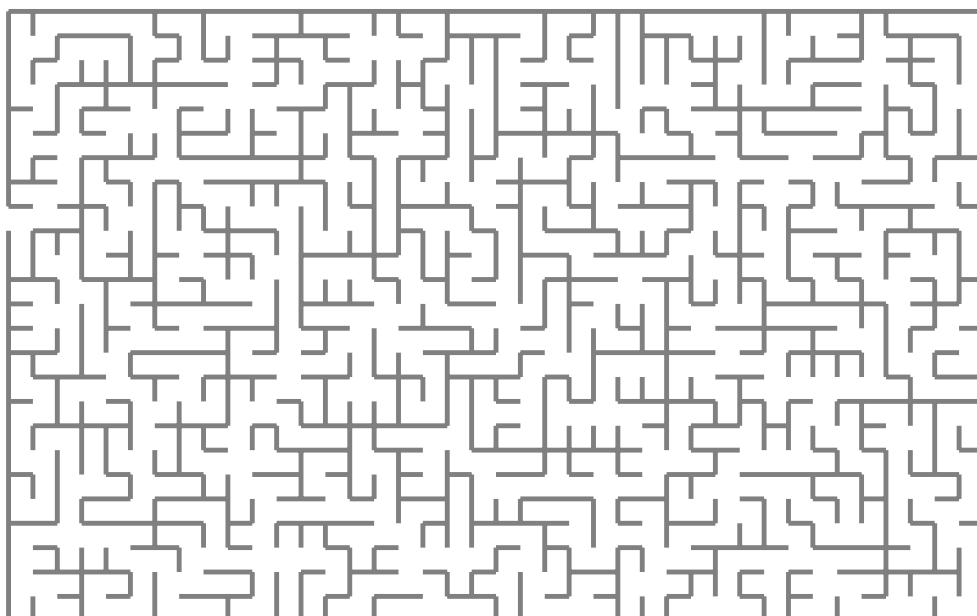


# A music app fully owned and run by its users

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*Version of April 30, 2020*



Tim Wissel



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THESIS

submitted in partial fulfillment of the  
requirements for the degree of

MASTER OF SCIENCE

in

COMPUTER SCIENCE

by

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Cover picture: Random maze.

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# A music app fully owned and run by its users

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## Abstract

Widely used paid audio streaming services such as Spotify, Google Play, iTunes pay their artists only a small amount of income. A decentralized audio streaming system can directly connect artists to listeners, without a middleman. This can lead to a near-100 percent cut of revenue for the artist. This describes a decentralized autonomous audio streaming system called X. X is hosted, used and updated by a decentralized autonomous organization (DAO) consisting of artists and listeners. X uses torrents for serving audio files and the Delft TrustChain (a blockchain implementation) for an immutable database of artists and releases. In addition, X uses a micro-payment system for peer-to-peer donations to artists using EuroToken (TODO).

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# Preface

Preface here.

Tim Wissel  
Delft, the Netherlands  
April 30, 2020





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# Chapter 1

## Introduction

Most audio streaming services are run by companies, incentivized to make money. They take large cuts of the subscription money from its users. As a result, the artists receive a low compensation. The distributors Spotify, iTunes and Google Play take on average a 25% cut for signed records and 40% cut for unsigned records. This thesis investigates the feasibility and usability of an audio streaming service without a central distributor.

This thesis proposes a solution in the form of a decentralized system which uses a decentralized autonomous organization (DAO) to operate. Listeners, artists and robots form this DAO. The DAO has a shared responsibility for distributing content. In this system, its users (artists and listeners) share audio files and metadata without any middleman. Additionally, users can give donations to artists while the system does not take a cut of these donations. The user can use this system to discover, search and play audio files, targeted at music and podcasts.

Section X describes the design of the system, section Y its implementation and Z its testing results.

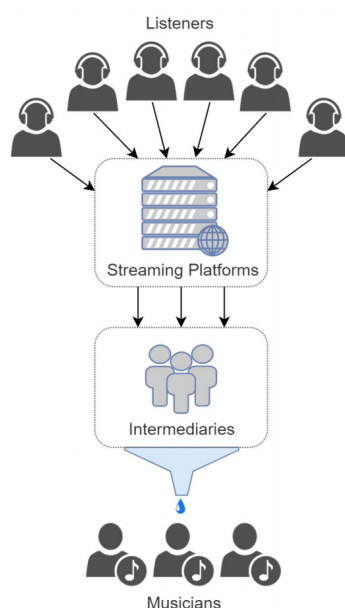


Figure 1.1: Artist compensation inconsistency





## Chapter 2

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# Evaluation

Evaluation here.



# Chapter 3

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## Related work

### 3.0.1 Decentralized audio streaming services

Multiple decentralized audio streaming services exist. Examples are Audius<sup>1</sup>, Resonate<sup>lindner2018investin</sup> and eMusic<sup>2</sup>. All of these systems have in common that they save metadata and identifiers of audio files on a blockchain, and save the audio files in an off-chain database. All these off-chain databases are structured like IPFS<sup>3</sup> with a company-run centralized interface between the user interface and the database. For a system to be fully decentralized, this layer should be removed. These solutions are closed source. Moreover, they use their own cryptocurrency to pay their artists which is an unstable income.

### 3.0.2 Decentralized content delivery networks

Decentralized content delivery networks are being investigated by multiple systems such as VideoCoin<sup>4</sup> and DCDN<sup>5</sup>. Most of these start-ups use blockchain technology and their own-released cryptocurrency as a token to pay nodes that serve the content. This means that the incentive for running a node depends on the value of those cryptocurrencies, so this is an unstable situation for workers. A fully decentralized audio streaming service requires sharing and streaming audio files over a network of nodes in which any participant can start and run a node. An example of such network is BitTorrent. The challenge with BitTorrent acting as a streaming service is that the requirement from the user perspective is to have low latency for streaming and buffering media files. For each file, the peer discovery algorithm is run, which is a slow-start algorithm. It also relies on having enough seeders per file available. Torrent files contain a list of chunks, which represent the different parts of the related file. These chunks are called torrent pieces. Flawless streaming of media files over BitTorrent requires a smart algorithm to predict what file is requested next, and what torrent pieces should be loaded. BitTorrent relies on trackers to perform peer discovery. However, trackers are a central point of failure. To make the system more decentralized, a solution using independent trackers and a gossip protocol<sup>dan2011efficient</sup> can be used.

### 3.0.3 Incentives for file spreading

In a DAO, the party responsible for hosting and spreading of files is not well-defined. To tackle the tragedy of the commons, entities should be incentivised just enough for the system to be sustainable and usable, but no more. An example incentive system is bandwidth tokens<sup>Vos2018ABM</sup>.

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<sup>1</sup><https://audius.co>

<sup>2</sup><https://eMusic.com>

<sup>3</sup><https://ipfs.io/>

<sup>4</sup>[www.videocoin.io](http://www.videocoin.io)

<sup>5</sup><https://www.dcdn.com/>



## Chapter 4

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## Conclusion

Conclusion here.



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# Acronyms

**AST** abstract syntax tree

**DSL** domain-specific language





# Appendix A

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**A**

Appendix here.