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The Audio Commons initiative and the technologies for facilitating the reuse of open audio content

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http://audiocommons.org

Outline

- Introduction

- AudioCommons project presentation

- The Audio Commons Ecosystem

- Relevant state of the art

- AudioCommons project tasks

- Conclusions

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ABOUT THE AUDIO COMMONS INITIATIVE

The **Audio Commons Initiative** aims at *bringing Creative Commons audio content to the creative industries*. But what does this mean? We realise that significant amounts of user-generated audio content, such as **sound effects**, **field recordings**, **musical samples** and **music pieces** (among others), are uploaded to online repositories and made available under Creative Commons licenses. Furthermore, a constantly increasing amount of multimedia content, originally released with traditional copyright licenses, is becoming public domain as its copyright expires. However, we believe that the professional creative industries (e.g. videogames, film and music industries) are **not yet using much of all this content** in their media productions.

There are a number of reasons why such content is not yet extensively used in the professional sector. We think that a major one is the lack of a **shared culture** within the creative industries of open content and its potential use. But there are also **technical and practical issues** that do not facilitate this usage. Despite the amount of Creative Commons audio content available in online repositories such as Jamendo or Freesound, other potentially useful content remains scattered around the web (if available at all) and typically not properly labeled with specific licenses or reachable through search engines. Also, the nature of this content, coming from a variety of sources and from authors with different levels of expertise, results in unstructured (or **not uniformly structured**) mass of resources, limiting its potential retrieval and reuse possibilities. Moreover, no tools are easily available to search and incorporate Creative Commons audio content in the **production workflows** of the creative industries.

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Introduction: Motivation

- Creative Commons audio content has a huge potential for reuse which *is not being* exploited by the creative industries.

    - Limited understanding of CC licenses.

    - Content scattered.

    - Content not properly labeled, unstructured.
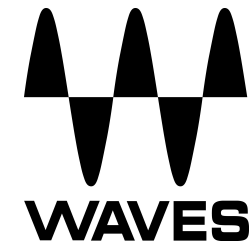
    - Lack of tools for seamless integration.

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Project presentation: goals

- Promote publication of AC content and foster its reuse.

- Develop open technologies to support publication and reuse of AC content.

- Develop open technologies for the semantic annotation of AC content.

- Bootstrap the Audio Commons Ecosystem (ACE).

- Define standard procedures for joining the ACE.

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Project presentation: consortium

- Academic partners:

- Industrial partners:

The AudioCommons Ecosystem

Content users negotiate license for CC-BY-NC content with content creators

Licensing procedures

Content users can become content creators by publishing derivative or new content

Content creator e.g., individual user

Creative Comons audio content

Content creator e.g., sound fx producer

Annotation tools

Music sharing site (music pieces)

Sound sharing site (music samples and non-musical content)

...

AC API

AC API

AC API

Creative Comons audio content enhanced with generated metadata

Embeddable tools

Videogame developers

Music producers

Sound designers

...

Content creators

Content providers

Content users

AC Ontology Specification

AC API Specification

Tool developers

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AudioCommons initial content

freesound

300k sound samples

jamendo

470k music pieces

creative commons

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Relevant state of the art

- Availability and access to CC audio content.

- Licensing procedures for CC audio resources.

- Semantic representation of sound and music.

- Semantic annotation of sound and music.

- Production tools supporting CC audio.

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Availability an access to CC audio content

- Few CC audio content sites with APIs (e.g. freesound.org, jamendo.com, ...).

- Limited access due to lack of high quality and unified metadata.

- No unified access mechanism for APIs (APIs have different specifications).

- Inadequate content retrieval tools.

- CC audio content not frequently used in professional environments.

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Freesound

Freesound API

- Browse, search, and retrieve sounds and information about them.

- Find similar sounds to a given target (based on content analysis) and retrieve automatically extracted features from audio files.

- Perform advanced queries combining content analysis features with other metadata (tags, etc...).

- Upload, comment, rate and bookmark sounds.

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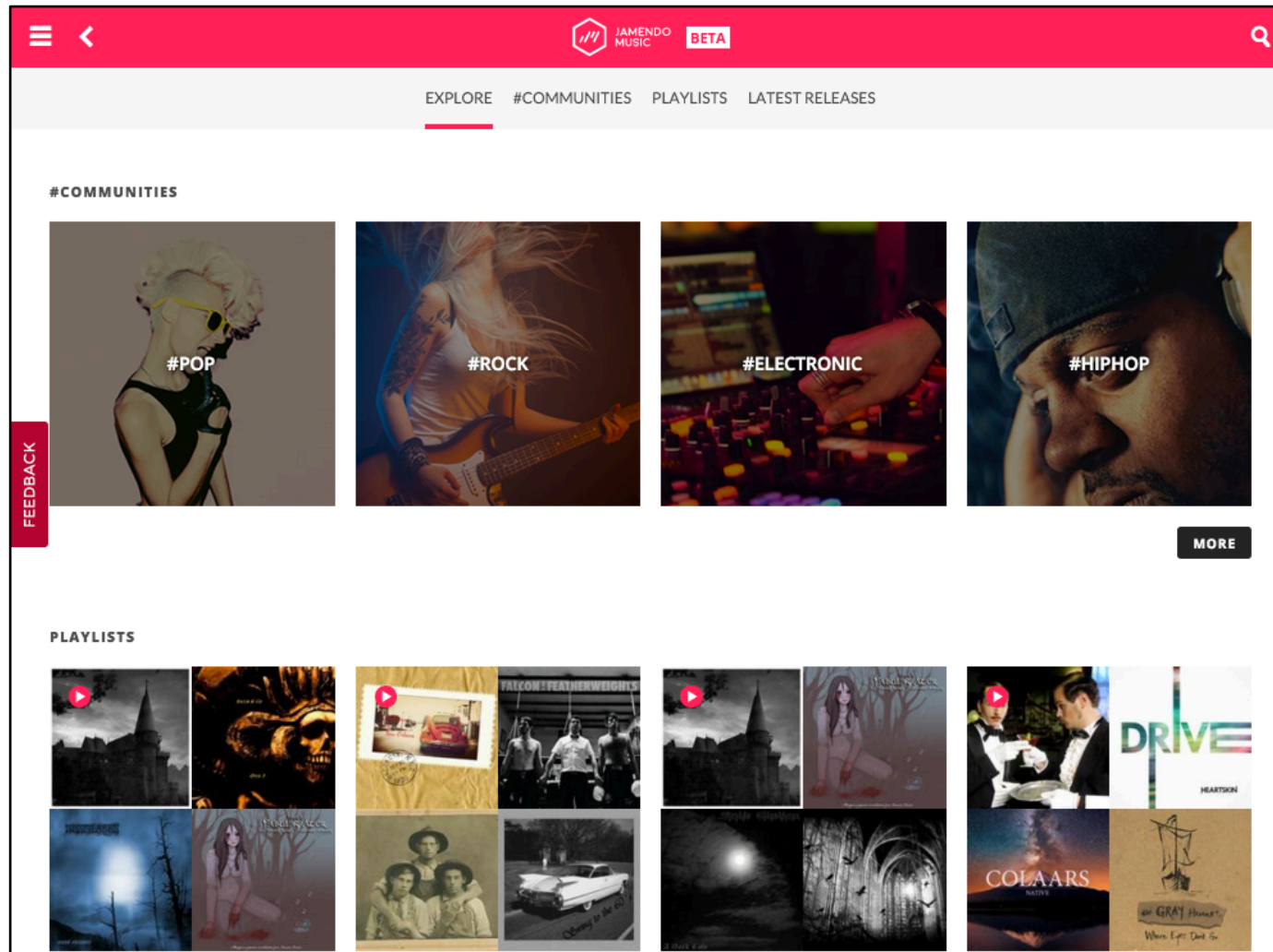
Jamendo

Jamendo API

- 20 different read methods to access a catalog of half-a-million tracks.

- Some powerful features for music discovery like search and radios.

- OAuth2 based authentication, 5 write methods to manage user library.

- Website to monitor your app statistics.

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CC audio repositories

	Content type	Size	CC-licenses	License friendly	API	Access via API	Licensing tools
Jamendo	Music pieces	470k	All 6 CC variants + CC0	Yes	Yes	Yes	Yes
Freesound	Music samples, sound effects, field-recordings	290k	CC0, CC-BY, CC-BY-NC	Yes	Yes	Yes	No
CC-mixter	Music stems, music pieces	38k	All 6 CC variants + CC0	Yes	Yes (old)	No	Yes
Free Music Archive	Music pieces	89k	All 6 CC variants + CC0	Yes	Yes	No	No
Internet Archive	Music pieces, radios, live concerts	2.6M	All 6 CC variants + CC0 + non-CC licenses	No	Yes	No	No
Eruopeana		574k	All 6 CC variants + CC0 + non-CC licenses	Yes	Yes	No	No
Looperman	Music stems, music pieces	196k	No (looperman open license)	-	No	No	No
Soundcloud	Music pieces, audio books	?	All 6 CC variants + non-CC licenses	No	Yes	No	No
Bandcamp	Music pieces	?	CC-BY, CC-ND, CC-NC, CC-BY-NC-SA, CC-BY-NC-ND	No	No	No	Yes
Magnatune	Music pieces	?	CC-BY-NC-SA	-	No	No	Yes

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Licensing procedures for CC resources

- Some license CC music pieces for commercial use (e.g. jamendo.com, magnatune.com, …).

- Uncertainties about licensing for using CC content in commercial productions.

- Lack of standardized procedures for (re)licensing content with CC licenses.

- Uncertainties about business models based on CC audio content.

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Creative Commons

Some CC licenses

Public domain, no restrictions on use and redistribution, no attribution to source needed.

You can copy, modify and redistribute the sound, but you need to give an attribution to the original source.

You can copy, modify and redistribute the sound, but you need to give an attribution to the original source and you cannot use it commercially.

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Jamendo Licensing

Freesound licenses

License of sound of A	B wants to distribute the new sound under	Can B do this?
cc0	cc0	Yes
cc0	by	Yes (*)
cc0	by-nc	Yes (*)
by	cc0	No
by	by	Yes (**)
by	by-nc	Yes (**)
by-nc	cc0	No
by-nc	by	No
by-nc	by-nc	Yes (**)

(*)   If a third user C uses the sound from B, she must attribute to B.
(**) B must attribute the sound to A. If a third user C uses the sound from B, she must attribute both A and B.

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Semantic representation of sound and music

- Standardized generic metadata for media content (e.g. Dublin Core ontology, …).

- A few sound and music models (e.g. Music Ontology, Europeana Data Model, MusicBrainz, …)

- Some rights management ontologies in the media domain (e.g. MPEG-21 Media Value Chain Ontology, …).

- Existing Semantic Web technologies (proposed by W3C) (e.g. Resource Description Framework, OWL Web Ontology Language, …).

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The Music Ontology

A vocabulary for publishing and linking music-related data on the Web.
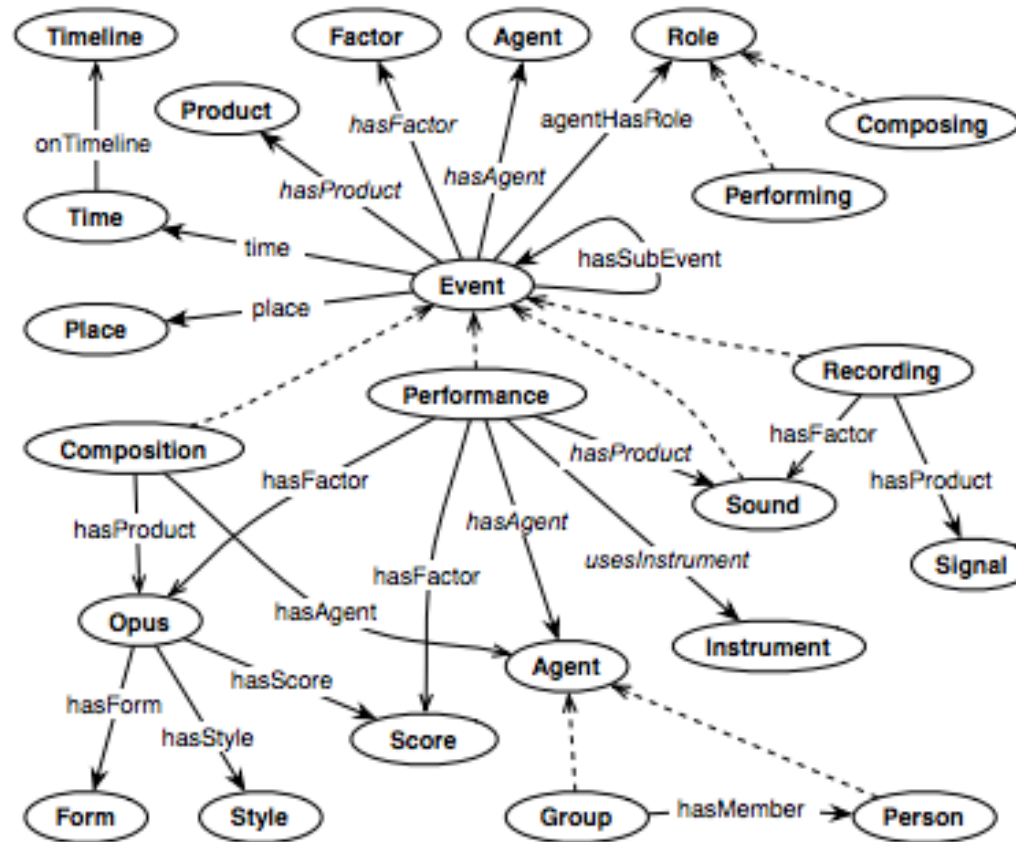
MusicBrainz

MusicBrainz

Core Entities	
Artists:	1,015,192
Release Groups:	1,239,983
Releases:	1,533,141
Mediums:	1,716,960
Recordings:	15,400,787
Tracks:	19,263,543
Labels:	100,508
Works:	644,963
URLs:	3,191,989
Areas:	114,635
Places:	13,547
Series:	3,805
Instruments:	756
Events:	8,421

Other Entities		
Editors (valid / deleted):	1,410,893 /	1,851
Relationships:		11,432,300
CD Stubs (all time / current):	331,472 /	283,353
Tags (raw / aggregated):	2,078,893 /	54,474
Ratings (raw / aggregated):	323,248 /	262,570

Identifiers		
MBIDs:		47,034,833
ISRCs (all / unique):	521,590 /	499,997
ISWCs (all / unique):	96,967 /	96,530
Disc IDs:		638,252
Barcodes:		514,326
IPIs:		22,088
ISNIs:		14,201

Semantic annotation of sound and music

- Existing audio features extraction tools (e.g. essentia, ...).

- Many algorithms for mid/high-level annotation of music signals: chord/key, tempo/rhythm/meter, pitch, genre/mood, structure, instrument, ...

- Satisfactory accuracies only achieved with algorithms trained for particular use-cases.

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Essentia

Open-source C++ library for audio analysis and audio-based music information retrieval.
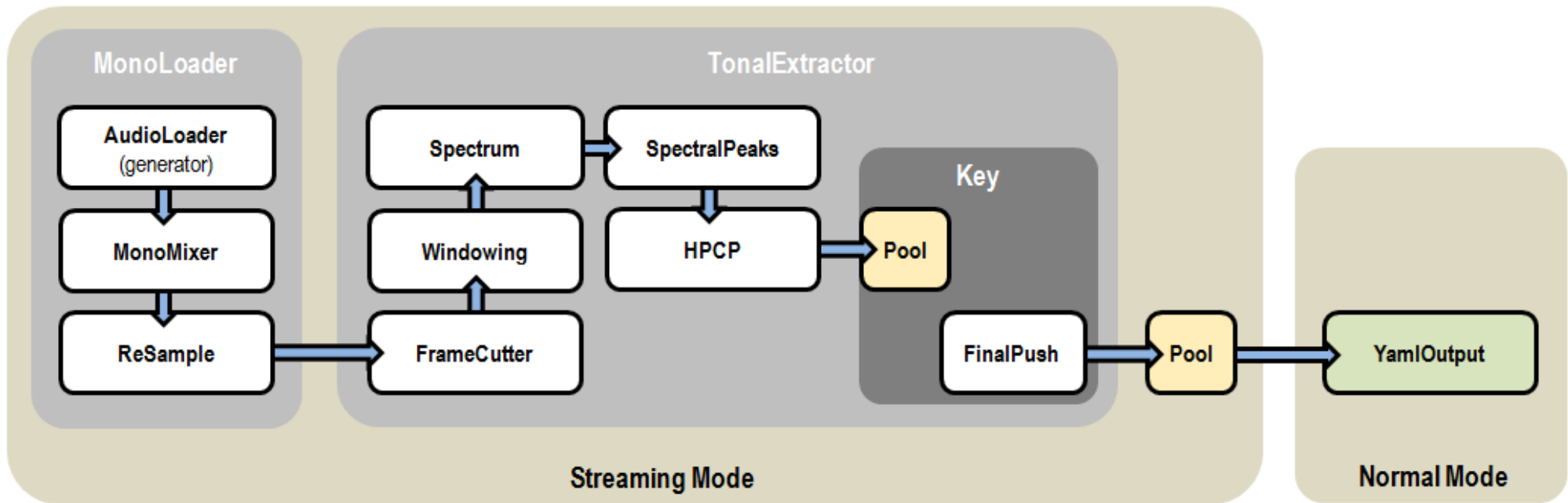
Essentia algorithms

- **Audio file I/O:** read and write audio files (wav, mp3, ogg, flac, etc.)

- **Standard signal processing blocks:** FFT, frame cutter, windowing, …

- **Filters (FIR & IIR):** low/high/band pass, DC removal, equal loudness, …

- **Statistical descriptors:** median, mean, variance, kurtosis, skewness, …

- **Time-domain descriptors:** loudness, LARM, Leq, Vickers' loudness, zero-crossing-rate, log attack time , …

- **Spectral descriptors:** Bark/Mel/ERB bands, MFCC, GFCC, LPC, spectral peaks, complexity, roll-off, contrast, HFC, inharmonicity, …

- **Tonal descriptors:** Pitch salience function, predominant melody and pitch, HPCP (chroma), chords, key and scale, tuning frequency, …

- **Rhythm descriptors:** beat detection, BPM, onset, rhythm transform, …

- **Other high-level descriptors:** danceability, dynamic complexity, audio segmentation, SVM classifier, …

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AcousticBrainz

Essentia music extractor

ESSENTIA

HOME | DOCUMENTATION | DOWNLOAD | APPLICATIONS | NEWS | ABOUT |

Music extractor

Usage

streaming_extractor_music computes a large set of spectral, time-domain, rhythm, tonal and high-level descriptors. The frame-wise descriptors are summarized by their statistical distribution. This extractor is suited for batch computations on large music collections and is used within AcousticBrainz project.

It is possible to customize the parameters of audio analysis, frame summarization, high-level classifier models, and output format, using a yaml profile file. For example, in the following profile, the extractor is set to analyze only the first 30 seconds of audio, output frame values as well as their statistical summarization, and apply two high-level models associated with the respective filepaths.

```
startTime: 0
endTime: 1e6
analysisSampleRate: 44100.0
outputFrames: 0
outputFormat: json
requireMbid: false
indent: 4

lowlevel:
    frameSize: 2048
    hopSize: 1024
    zeroPadding: 0
    windowType: blackmanharris62
    silentFrames: noise
    stats: ["mean", "var", "median", "min", "max", "dmean", "dmean2", "dvar", "dvar2"]

average_loudness:
    frameSize: 88200
    hopSize: 44100
    windowType: hann
    silentFrames: noise
```

Essentia Freesound extractor

Audio annotation tools

|	Low-level features	Machine learning based features	Open license	Core language	Interface to other languages	Easy for large scale analysis	Last release
Essentia	Yes	Yes	Yes	C++	Python, Matlab, Javascript	Yes	Nov 2015
jMIR/jAudio	Yes	Yes	Yes	Java		No	Oct 2013
LibROSA	Yes	No	Yes	Python		No	Oct 2015
Aubio	Yes	No	Yes	C	Python	Yes	Aug 2015
MIRtoolbox	Yes	Yes	Yes	Matlab		No	Dec 2014
Marsyas	Yes	Yes	Yes	C++		Yes	Feb 2015
Sonic Annotator	Yes	Yes	Yes	C++	Python	Yes	Nov 2015
LibXtract	Yes	No	Yes	C	Python/Java	Yes	Jul 2014
yaafe	Yes	No	Yes	C++	Python/Matlab	Yes	Nov 2011

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Production tools supporting CC audio

- Client libraries for some CC-ready APIs (e.g. for Freesound-API and Jamendo-API).

- Standard audio plugins architectures (e.g. VST, Audio Units, VAMP, …).

- Open-source audio production tools easy to extent and supporting plugins (e.g. Ardour)

- No CC-ready audio production tools.

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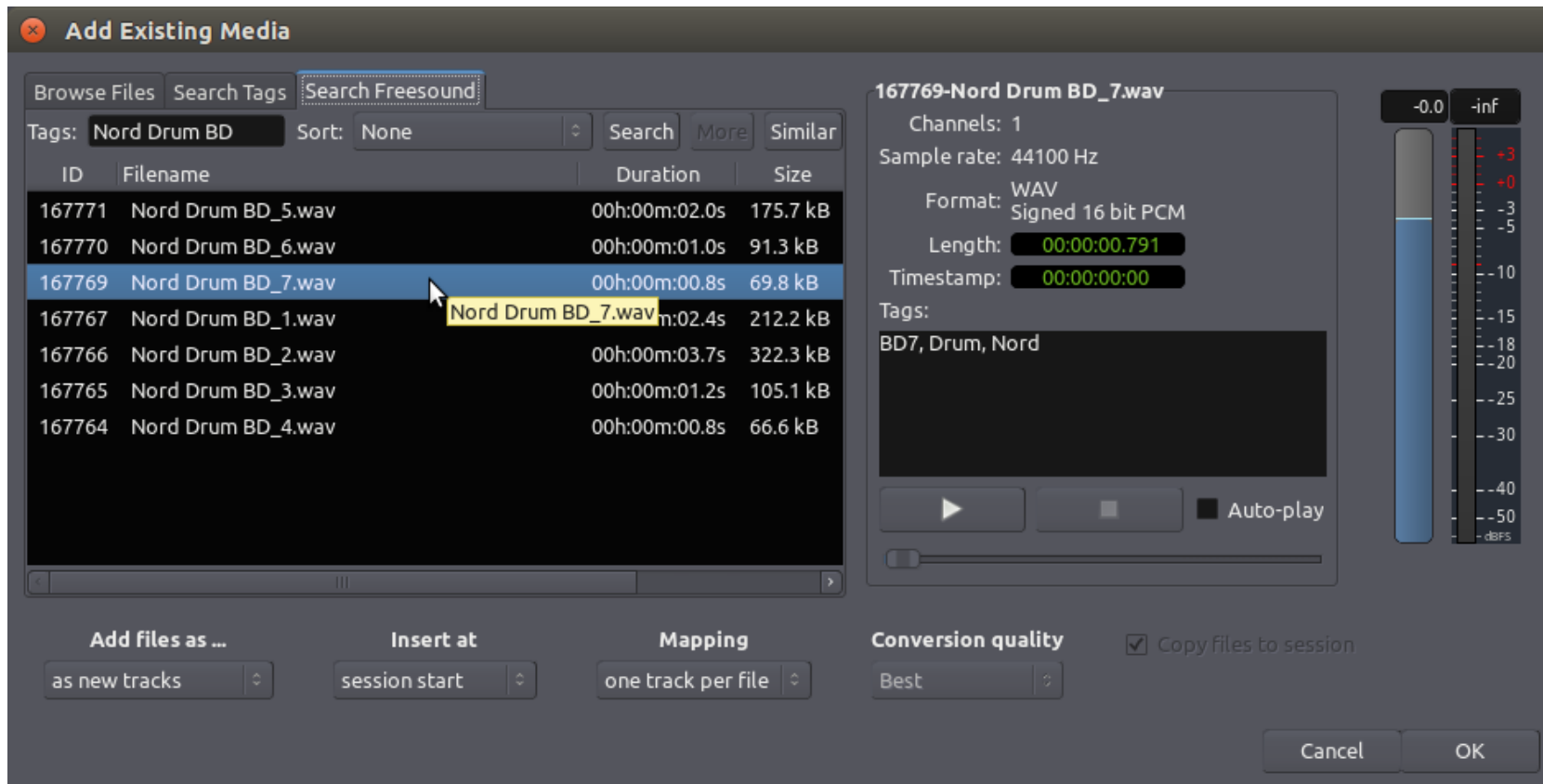
Ardour

Cloud browser (VST plugin)
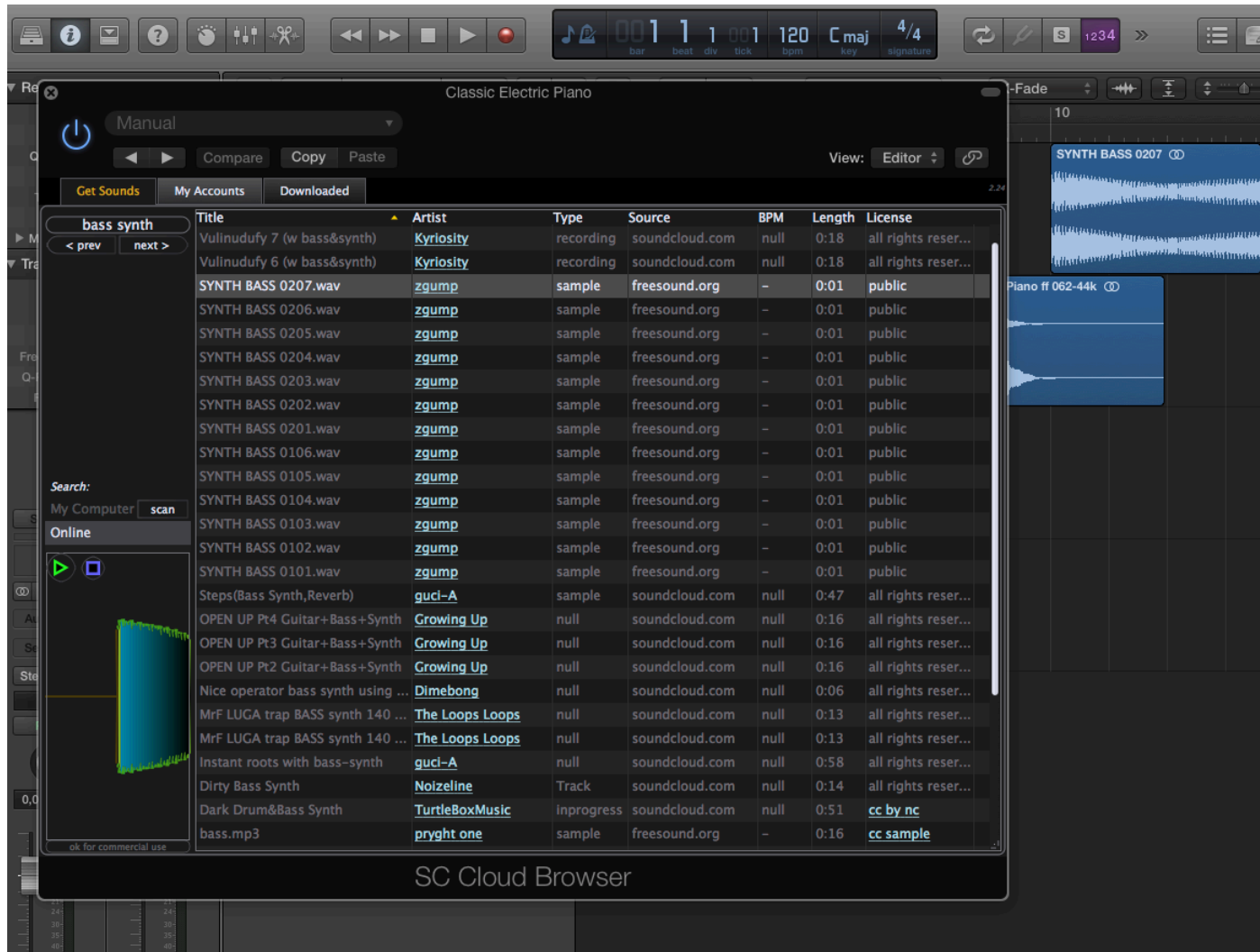
Production tools

	Retrieve	Upload	Repository
Ardour	Yes	No	Freesound
Cyberlink PowerDVD	Yes	No	Freesound
Logic Pro	No	Yes	Soundcloud
Cubase	No	Yes	Soundcloud
Pro-tools	No	Yes	Soundcloud
Soundly	Yes	No	Freesound
SoundCloud browser	Yes	Yes	Soundcloud/Freesound

AC project tasks: production tools to be developed

- Music sampler

- Drum machine

- Loop navigator

- Music browser

- Sound FX browser

- Procedural audio SDK for videogames

- …

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AC project tasks: Ontology and API specification

- Define an ontology for the semantic annotation of musical and non-musical audio content (requirements from industry use cases)

- Design API specification for accessing content annotated using the ontology (+ implement it in Freesound)

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AC project tasks: Description of musical sounds

- High-level description of music pieces (e.g. large-scale genre and mood classification, …).

- Mid/High-level description of music samples (e.g. loop properties, instrument notes, …).

- Manual/crowd-sourced annotation of datasets.

AcousticBrainz

freesound
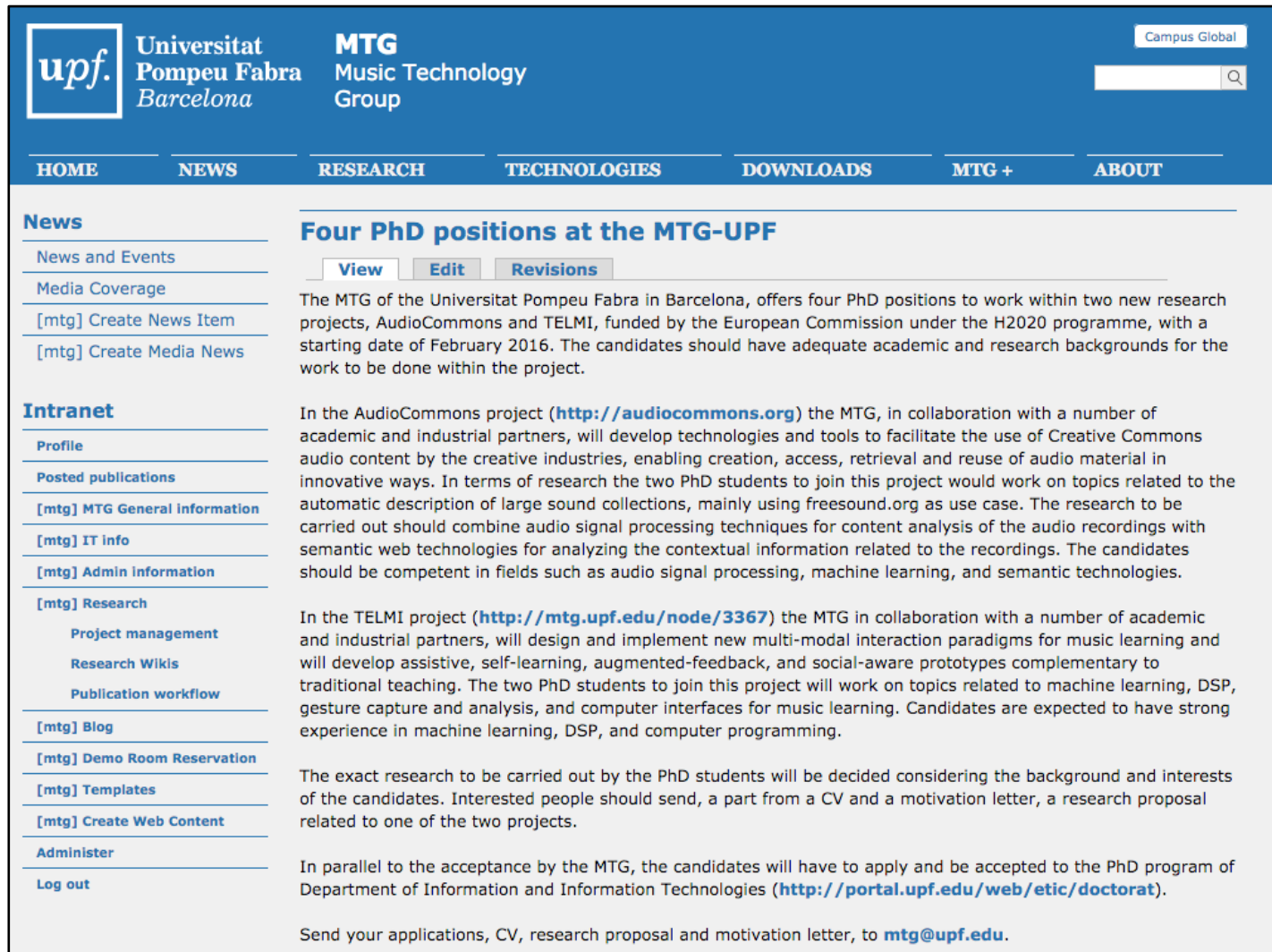
ESSENTIA

AC project tasks: Description of non-musical sounds

- High-level description of timbral properties for non-musical audio content (e.g. to query by "bright" or "dark" sounds).

- Manual/crowd-sourced annotation of datasets.

freesound

ESSENTIA

AC project: looking for people at MTG

Conclusions: The AC initiative

- AudioCommons is a 3-year project (2016-2019).

- Think beyond the lifetime of the project.

- Engage new stakeholders, content providers, tool developers, ...

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