telemeta

une solution ouverte d'archivage pérenne pour les données musicales de la recherche

Guillaume Pellerin[1], Thomas Fillon[1,2], Joséphine Simonnot[3], Marie-France Mifune[4], Stéphanie Khoury[3], Maxime Le Coz[5], Estelle Amy de La Bretèque[3], David Doukhan[7], Dominique Fourer[6], Jean-Luc Rouas[6], Julien Pinquier[5], Julie Mauclair[5], Claude Barras [7]

[1]Parisson, Paris, France
[2]LAM, Institut Jean Le Rond d'Alembert, UPMC Univ. Paris 06, UMR CNRS 7190, Paris, France
[3]CREM, LESC, UMR CNRS 7186, MAE, Université Paris Ouest Nanterre La Défense, Nanterre, France
[4]CNRS-MNHN-Université Paris Diderot-Sorbonne Cité, UMR 7206, Paris, France
[5]IRIT - Université Toulouse 3 Paul Sabatier - Toulouse, France
[6]LaBRI - CNRS UMR 5800, Université Bordeaux 1, Talence, France
[7]Université Paris-Sud / CNRS-LIMSI - Orsay, France
This work was partially done inside the DIADEMS project
funded by the French National Research Agency ANR (CONTINT)

GIS SPADON - 23 septembre 2014 - LAM, Paris

Introduction

Introduction

Context

- Since 2007, the Research Center for Ethnomusicology (CREM) and Parisson have been developing an innovative, collaborative and open-source web-based multimedia platform for humanities and social sciences research.
- Official platform online since 2010 :

  Sound archives of the CNRS - Musée de l'Homme

  http://archives.crem-cnrs.fr
- This collaborative platform support numerous aspects of the field of ethnomusicology, ranging from musical analysis to comparative history and the anthropology of music. The platform also provides many useful resources for the fields of anthropology, linguistics and acoustics.

Introduction

Towards automatic audio content analysis ...

- Recently, an open-source audio analysis framework, TimeSide, has been developed to bring automatic audio content analysis capabilities to the Telemeta web platform.

... and interdisciplinary collaboration

- Since 2013, as part of the DIADEMS project, academic researchers and engineers from the *Science and Technology of Information and Communication* domain and researchers from the *Musicology and Ethnomusicology* domain have been collaborating to develop new computer tools to automatically index the recording contents.

The Telemeta platform

The Telemeta platform

A scalable web audio platform

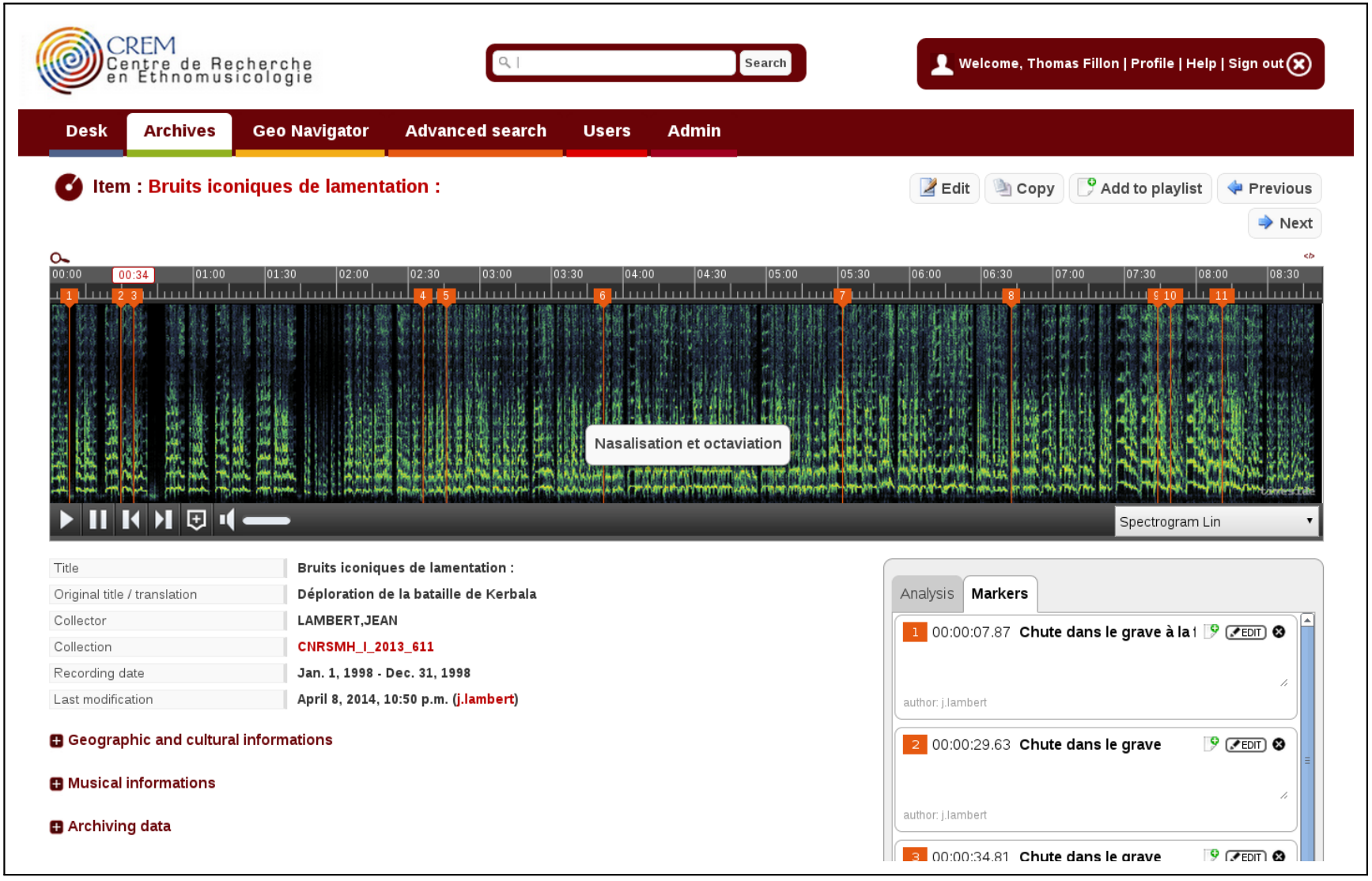
- access, preserve and share sound items
- enrich associated metadata that contains key information on the context and significance of the recording.

An open-source software

- Telemeta, is a free and open source software (*GPL-like* licence) in accordance with open web standards.

http://telemeta.org/

Telemeta *Item* page



Web audio content management features and architecture

Main features of Telemeta

- Pure HTML5 web user interface including dynamic forms.
- Database management through a Structured Query Language (SQL) or Oracle backend.
- On-the-fly audio analyzing, transcoding and metadata embedding in various multimedia formats, provided through an external component, *TimeSide*.
- Social editing with semantic ontologies, smart workflows, human or automatic annotations and segmentations.
- User management with individual desk, playlists, profiles and group access rights.
- High level search engine geolocation, instruments, ethnic groups, etc...).
- Multi-language support (currently english, german, french and chinese).

Metadata

In addition to the audio data, an efficient and dynamic management of the associated metadata is also offered.

- Metadata provides valuable informations about the source of the data and to the related work of peer researchers.
- Dynamically handling metadata in a collaborative manner optimizes the continuous process of knowledge gathering and the enrichment of the materials in the database.
- One of the major challenges is the standardization of audio and metadata formats with the aim of long-term preservation and usage of the different materials.
- The compatibility with other systems is facilitated by the integration of the metadata standards protocols *Dublin Core* and *OAI-PMH* (Open Archives Initiative Protocol for Metadata Harvesting).

Metadata
Contextual Information

Contextual Information

In an ethnomusicological framework, contextual information may include:

- Geographic information
- Cultural information (population, related cultural elements, ...)
- Musical information (title, instruments, ...)
- Archive or recording information (recording technical data, depositor, collector, year of the recording, year of publication of papers describing the work, ...)

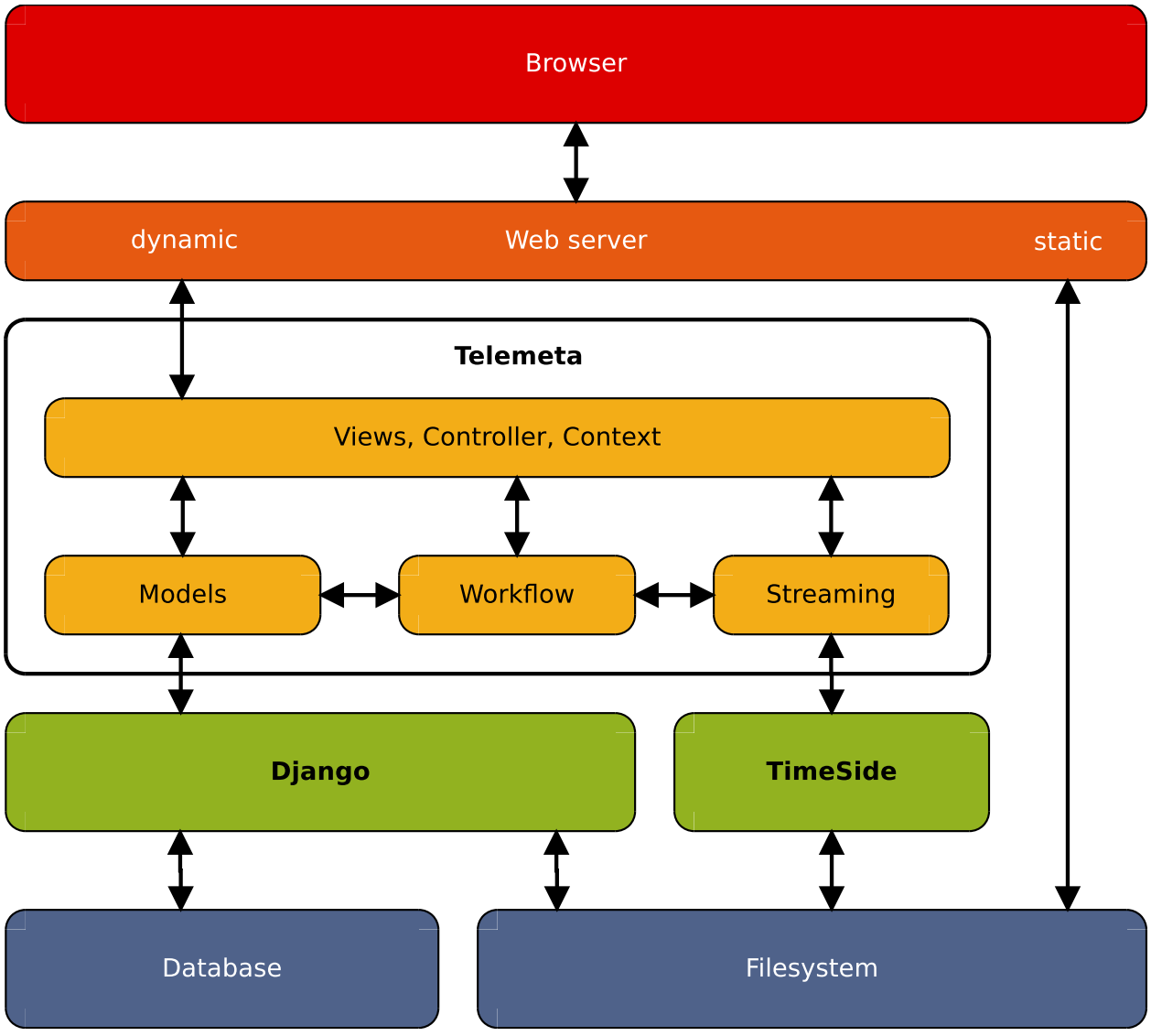
Additional materials

Moreover, through the platform, diverse materials related to the archives can be stored, such as:

- iconographies (digitalized pictures, scans of booklets and field notes, and so on),
- hyperlinks and
- biographical information about the collector.

Examples

Telemeta architecture

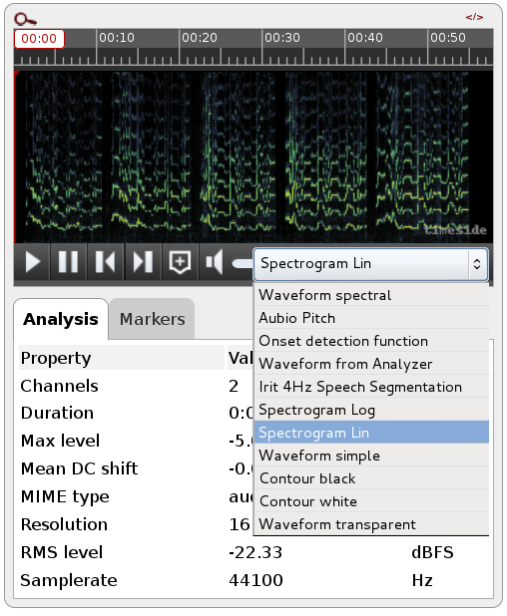


Descriptive and analytical information

Visual representation and segmentation

Visual representation of the sound

The embedded TimeSide audio player allows for a selection of various visual representations of the sound (e.g. waveforms and spectrograms) and some representations of computational analysis.



Segmentation

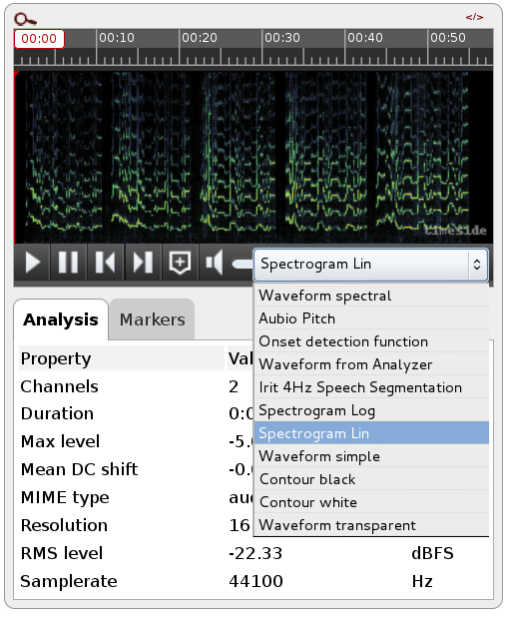
Automatic analysis can produce a list of time-segments associated with labels (e.g. detection of spoken versus singing voices, chorus, musical instrument categories, and so on).

Descriptive and analytical information

Visual representation and segmentation

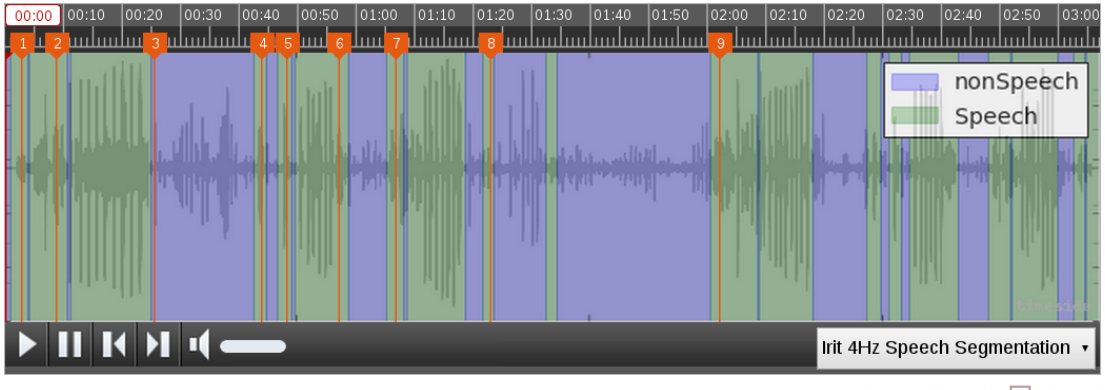
Visual representation of the sound

The embedded TimeSide audio player allows for a selection of various visual representations of the sound (e.g. waveforms and spectrograms) and some representations of computational analysis.



Segmentation

Automatic analysis can produce a list of time-segments associated with labels (e.g. detection of spoken versus singing voices, chorus, musical instrument categories, and so on).



Descriptive and analytical information on the audio content

Annotations

Markers

- The embedded audio player also enables annotation of the audio content through time-coded markers.
- These annotations are indexed through the database.
- Users can create their own annotations and share them with colleagues.

TimeSide, an audio analysis framework

TimeSide

An open web audio processing framework

- TimeSide is the signal processing engine of Telemeta developed and published as a separate project.
- TimeSide is an *open-source* audio analysis and visualization framework based on both Python and JavaScript languages that provides state-of-the-art signal processing and machine learning algorithms together with web audio capabilities for displaying and streaming files.

https://github.com/yomguy/TimeSide/

Audio management

TimeSide provides the following main features:

- Smart dynamic audio player with enhanced visualization (e.g. waveform, spectrogram) that can be embedded into any html page through *iframe* (live example: Yomguy's blog)
- Multi-format support: decodes the vast majority of audio and video formats
- On-the-fly audio analysis, transcoding, streaming and metadata embedding based on an easy plugin architecture.

Audio features extraction

Audio features extraction

TimeSide incorporates some state-of-the-art audio feature extraction libraries such as:

- Aubio: `http://aubio.org`
- Yaafe: `http://yaafe.sourceforge.net`
- Vamp plugins: `http://www.vamp-plugins.org`

Given the extracted features, every sound item in a given collection can be automatically analyzed.
The results of this analysis can be:

- Serialized to the web browser through common markup languages: XML, JSON and YAML
- Stored in a scientific file format (e.g. NumPy format or HDF5)
- Exported to sound visualization and annotation software (e.g. Sonic Visualizer)

TimeSide engine architecture

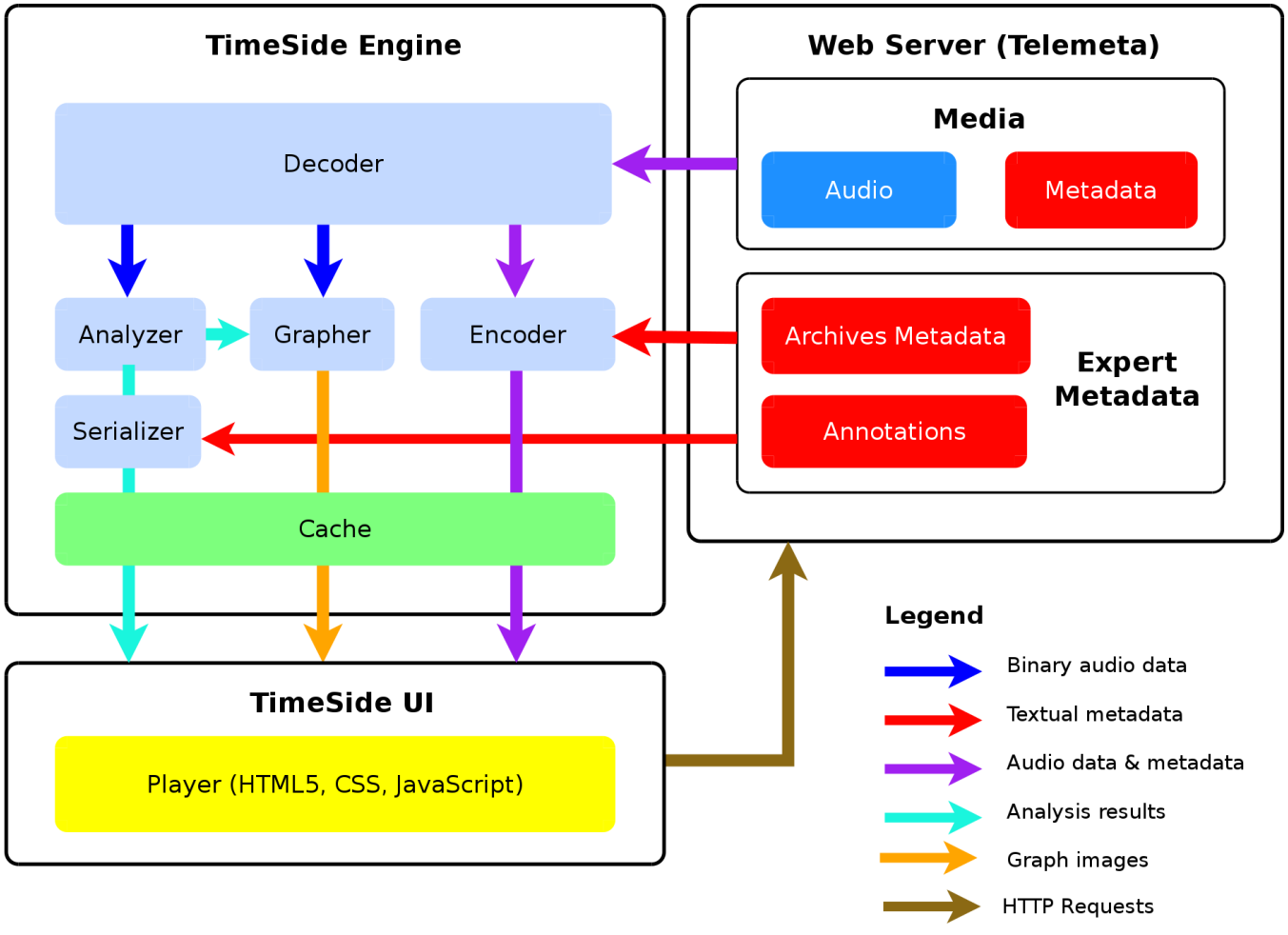
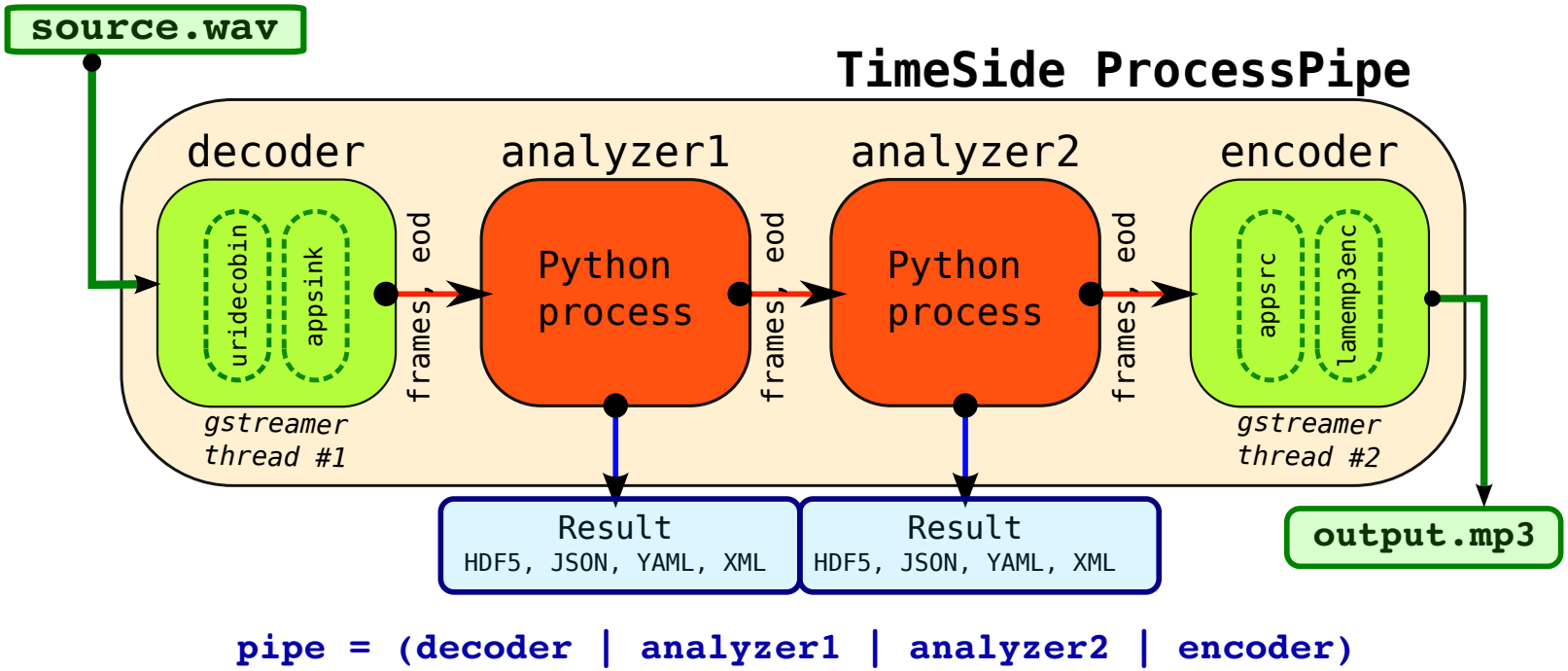


Figure: TimeSide engine architecture and data flow with Telemeta web-server

TimeSide engine architecture



Process Pipe

- On-the-fly audio processing by simultaneous processors (decoder, encoders, analyzers, graphers)
- Use of *Gstreamer* for audio decoding and encoding

Sound archives of the CNRS - Musée de l'Homme

Sound archives of the CNRS - Musée de l'Homme

- Since June 2011, the Telemeta platform has been used by the Sound archives of the CNRS - Musée de l'Homme[a] and managed by the CREM.
- These archives available for researchers, students and (when copyright allows) to a broader audience.
- It is one of the most important Sound archives librairy in Europe
- Through this platform, these archives can be shared, discussed and analyzed.

[a] http://archives.crem-cnrs.fr

Archiving research materials

- The Sound archives of the *CNRS - Musée de l'Homme* have been collected by researchers attached to numerous research institutions across the world.
- Most of the recordings come from the fieldwork of researchers in all continents during the last 110 years.
- Nearly 3700 hours of record collections e.g. more than 5000 discs, many of which are very rare)
- 4000 hours of unpublished recordings, from early research expeditions (e.g. Dakar-Djibouti (1932), Ogooué-Congo (1946)).
- 47,200 items containing more than 26,000 sound files (including 12,000 sounds on free access since May 2014).

Uses and users of digital sound archives

- Three main activities: archiving, research and education
- Three main disciplines: Ethnomusicology, Anthropology and Linguistic
- Primary users of the platform are archivists, researchers, students and professors of these disciplines.
- Nonetheless, a qualitative survey showed that other disciplines (such as Art History) have used the platform.
- When used for education, the platform provides a wide array of teaching materials to illustrate the work of students as well as support teaching curricula.

Uses and users of digital sound archives

A collaborative experience

- The sharing of data offer resources to researchers from all over the world and allows several people to collaborate on the enrichment of the database.
- Researchers from different institutions can work together on specific audio materials and conduct individual research from both synchronic and diachronic perspectives on their own material, the material of others, or both.
- Users can submit their own archives to protect them.
- Furthermore, it facilitates the ethical task of returning the recorded music to the communities who produced it and to get local populations involved in their own cultural heritage.

The DIADEMS project

The DIADEMS project

Started in January 2013, the French national research program DIADEMS is a multi-disciplinary project dedicated to the Description, Indexation, Access to Ethnomusicological and Sound Documents.

The consortium

Science and Technology of Information and Communication domain

- Institute of research in computing science of Toulouse
- Laboratory of computing and mechanics for engineering sciences
- Bordeaux Computer Science Research Laboratory
- Laboratory of Musical Acoustic, Jean Le Rond d'Alembert Institute

Musicology and Ethnomusicology domain

- Laboratory of Ethnology and Comparative Sociology
- Research Center for Ethnomusicology
- National Museum of Natural History

Development

- Parisson, the company involved in the development of Telemeta.

Goals of the DIADEMS project

Goals and on-going development

- The goal of the DIADEMS project is to develop computer tools to automatically index or assist the indexation of the recording content from the audio signal.
- Ongoing work consists of implementing advanced classification, indexation, segmentation and similarity analysis methods.
- Besides music analysis, such automatic tools also deal with speech and other types of sounds present ethnomusiclogical recordings like speech, environmental noises and noises generated by the recording process

The method of a new interdisciplinary research

- In this research program, groups from different backgrounds are working together.
- The first challenge was to initiate a common interest and a mutual understanding.
- In this process, DIADEMS gave us the opportunity to improve our understanding on the link between the semantics and acoustics of voice production in order to be able to specify the classification and indexation tasks.

Evaluation and Future improvements

Development and Evaluations

- Interesting preliminary results have been obtained regarding the detection of start times of recording sessions, speech recognition, singing voice recognition and musical instrument family classification.
- The robustness of these processings is assessed using criteria defined by the final users: teachers, students, researchers and musicians.
- After validation, Analysis and Annotation tools, as well as the provided annotations, will be integrated in the Telemeta platform.

Archivage pérenne

Stratégie

Problématiques

- comment archiver des données évolutives ?
- comment sauvegarder l'information audio et les metadonnées
- comment sauvegarder le système qui les lit/lie ?
- quels supports physiques choisir ?
- quel protocole ?
- quelle architecture ?
- comment éviter la sur-consommation des fermes de serveurs ?

Stratégie

Solutions

- OS libres et systèmes de fichiers ouverts
- formats de données standards et normalisés
- environnements logiciels virtualisés
- versionnement des logiciels et des données
- migrations des modèles de données (MVC)
- moissonage des données au fil de l'eau (OAI-PMH, API)
- architecture distribuée et sécurisée
- synchronisation hebdomadaire des OS, bases de données ET logiciels sur fermes de serveurs (IN2P3 / CINES)
- synchronisation mensuelle sur NAS dédiés et "réveillés" uniquement pour la sauvegarde

Standards et outils

Langages, technologies et formats ouverts

- WAV, FLAC, OGG, Opus
- HTML, CSS, JavaScript, JSON, RDF
- Django, TimeSide
- Python, C, C++
- MySQL, PostgreSQL, MongoDB
- Ext4, Btr
- GNU, Linux, Docker, Git

Backup / synchro

- Django (manage.py backup)
- Rsync + SSH
- IRODS

Supports physiques

Etude IBM 2012

- Tape
- HDD
- NAND

PDF link

Cas d'usage

- Edition (temps réel) : NAND + HDD
- Sauvegarde (moyen terme) : HDD (+ NAS)
- Conservation (long terme) : Tape

Conclusion

Conclusion

- Telemeta is a fully operational web audio framework for managing digital sound archives
- It's an open-source software (-> feel free to use, fork or contribute)
- Through the Sound archives of the CNRS - Musée de l'Homme, it is now used by many ethnomusicologists around the world for research or education purposes.
- Its collaborative nature enable a continuous enrichment of the audio content, the metadata and the analysis tools.

Conclusion

- Telemeta is a fully operational web audio framework for managing digital sound archives
- It's an open-source software (-> feel free to use, fork or contribute)
- Through the Sound archives of the CNRS - Musée de l'Homme, it is now used by many ethnomusicologists around the world for research or education purposes.
- Its collaborative nature enable a continuous enrichment of the audio content, the metadata and the analysis tools.

Conclusion

- Telemeta is a fully operational web audio framework for managing digital sound archives
- It's an open-source software (-> feel free to use, fork or contribute)
- Through the Sound archives of the CNRS - Musée de l'Homme, it is now used by many ethnomusicologists around the world for research or education purposes.
- Its collaborative nature enable a continuous enrichment of the audio content, the metadata and the analysis tools.

Conclusion

- Telemeta is a fully operational web audio framework for managing digital sound archives
- It's an open-source software (-> feel free to use, fork or contribute)
- Through the Sound archives of the CNRS - Musée de l'Homme, it is now used by many ethnomusicologists around the world for research or education purposes.
- Its collaborative nature enable a continuous enrichment of the audio content, the metadata and the analysis tools.

Conclusion

Future developments

Future developments will turn Telemeta into:

- an efficient annotation platform (with zoom and segment selection)
- an social and collaborative platform (user access managment and social stuff)
- an interdisciplinary collaborative platform between IT and ethno with the joint develoment of automatic analysis and indexation tools

Regarding TimeSide, a Web-API is being developed to provide audio analysis services over the web.

Thank You !

- Contact: guillaume.pellerin@parisson.com
- Telemeta:

http://telemeta.org

@telemeta

- TimeSide:

https://github.com/yomguy/TimeSide/

- Sound archives of the CNRS - Musée de l'Homme:

http://archives.crem-cnrs.fr

- The DIADEMS project:

http://www.irit.fr/recherches/SAMOVA/DIADEMS/

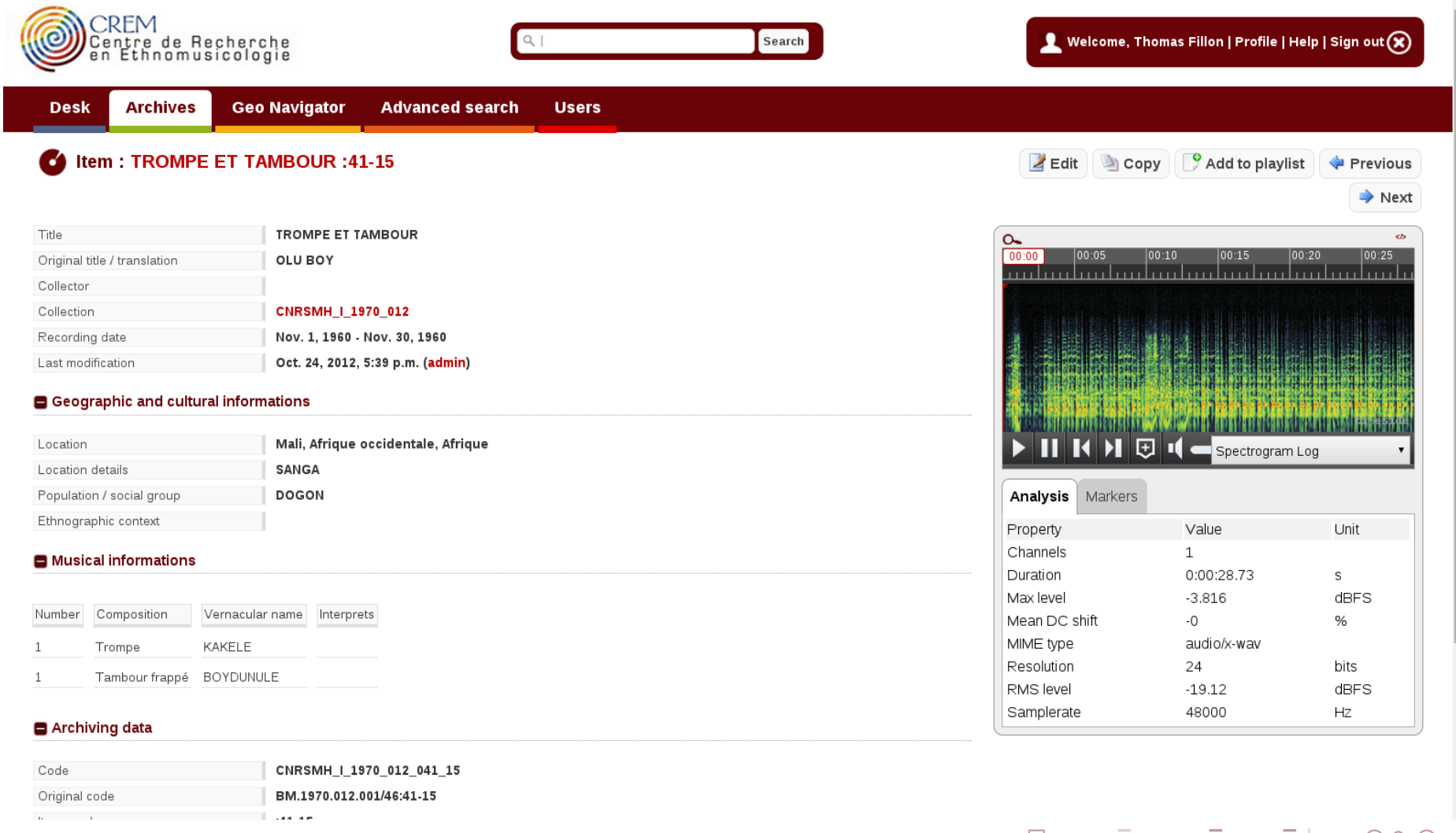
Additional Materials

Telemeta - Geographic Navigator

back

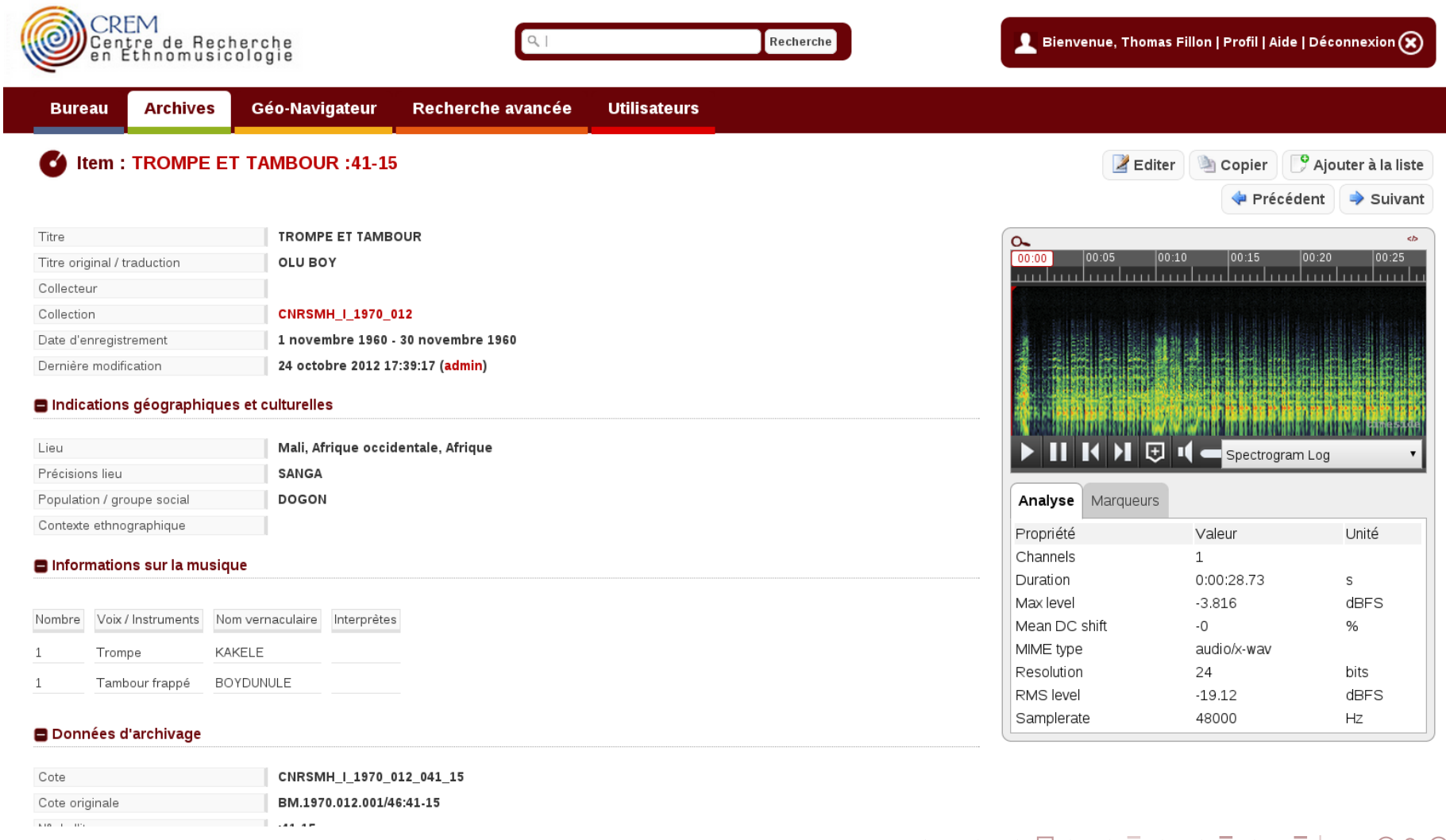
Telemeta - Multi language support

English



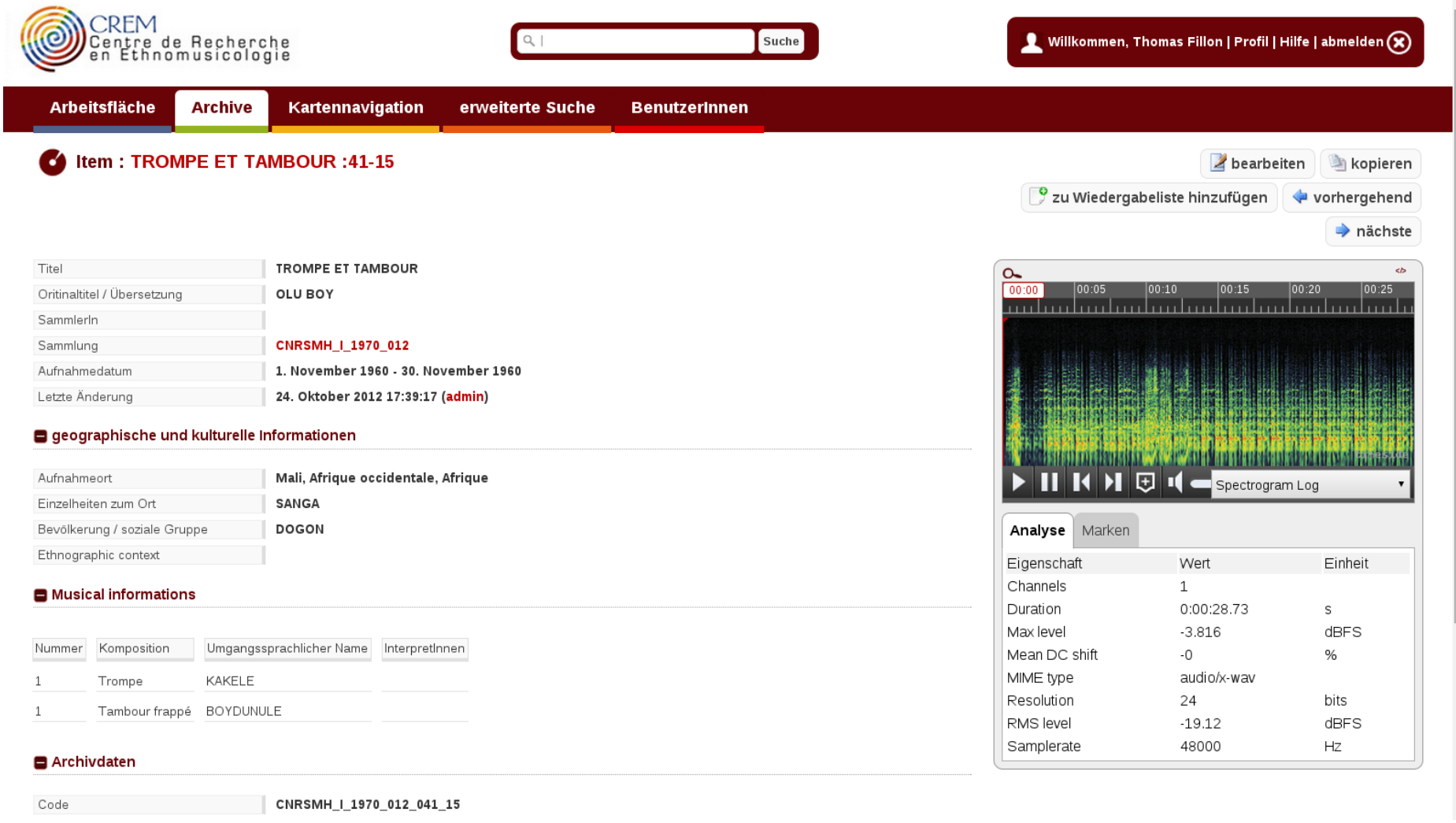
Telemeta - Multi language support

French



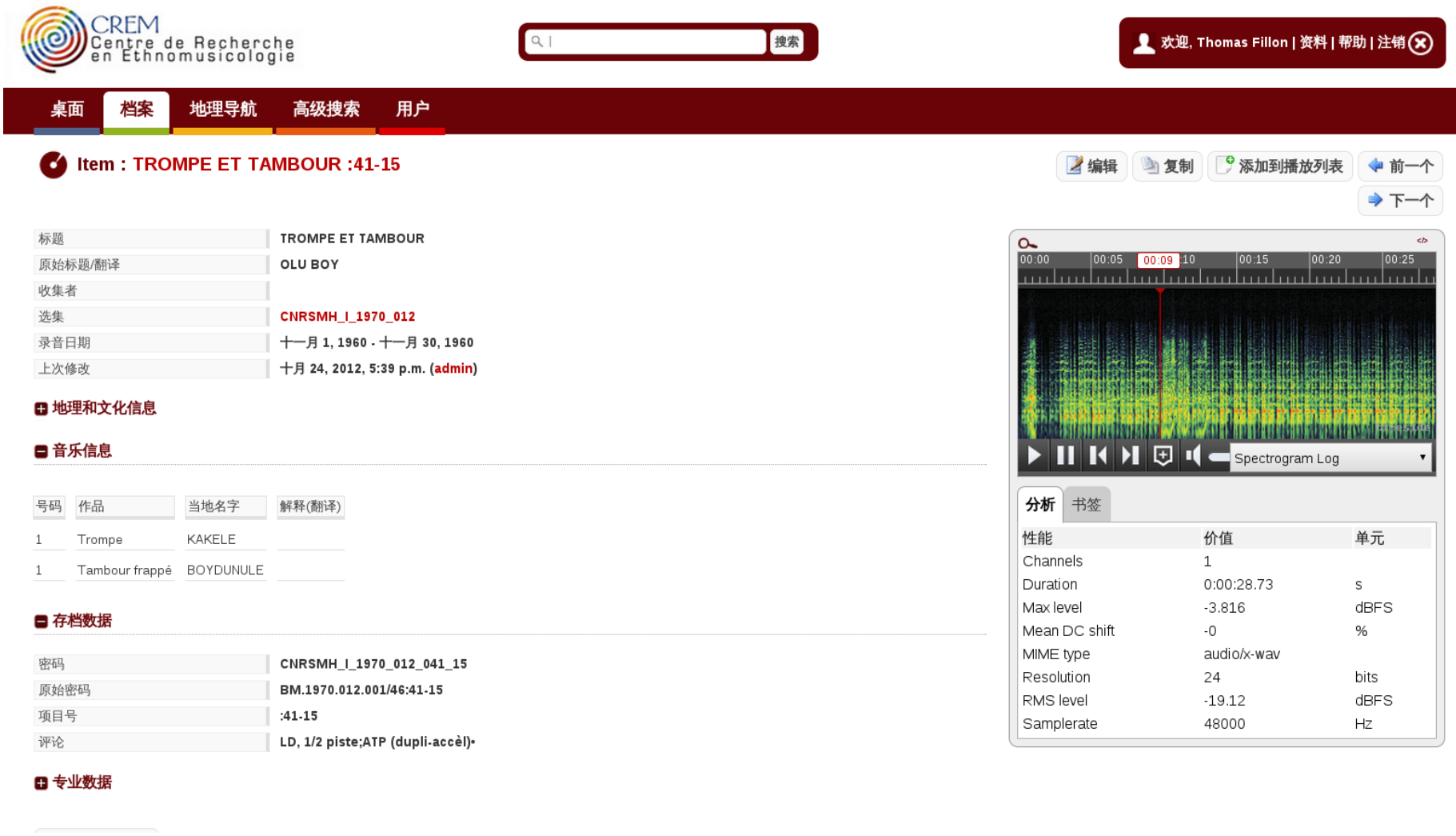
Telemeta - Multi language support

German

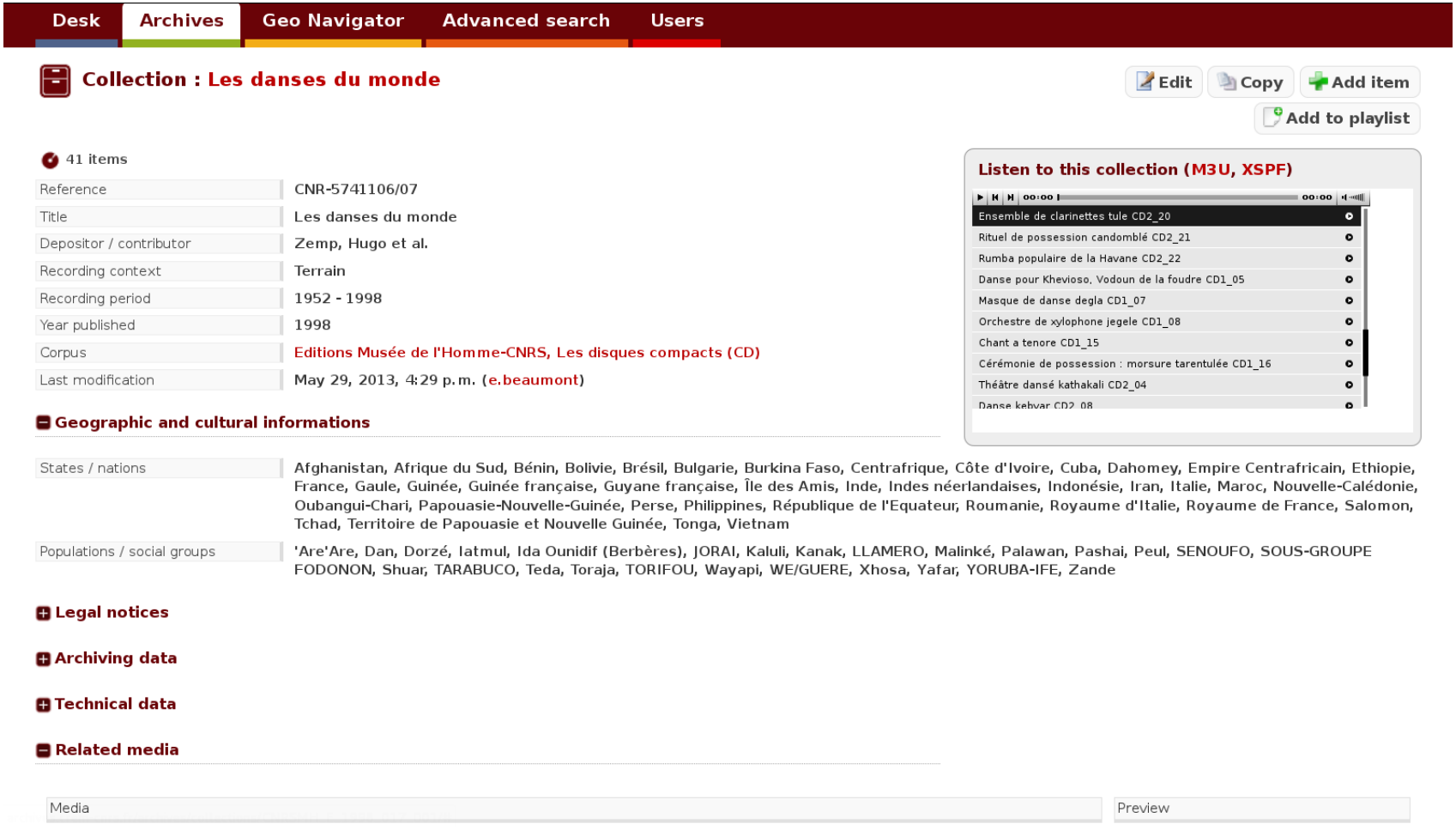


Telemeta - Multi language support

Chinese



Contextual Information example: Collection



Online Offline back

Contextual Information example: Item

Desk | Archives | Geo Navigator | Advanced search | Users

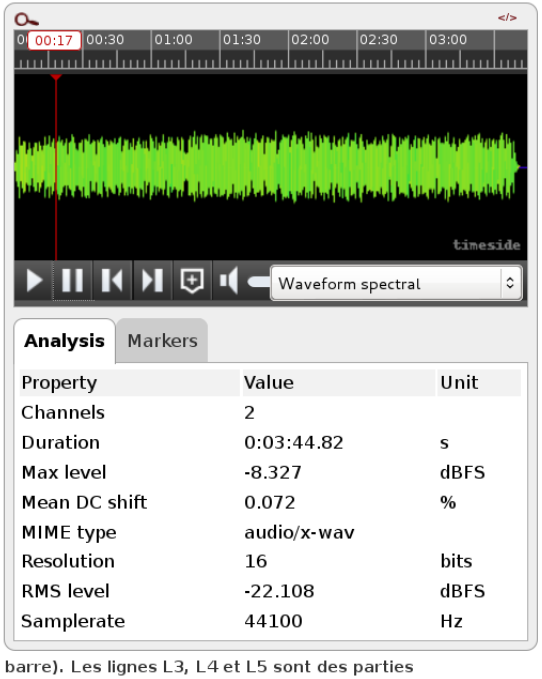
Item : Danse des garçons, umtshotsho / Chant Nontyolo CD1_01

Edit | Copy | Add to playlist | Previous | Next

Title	Danse des garçons, umtshotsho / Chant Nontyolo
Collector	Dargie, Dave
Collection	CNRSMH_E_1998_017_001
Recording date	Jan. 1, 1982 - Dec. 31, 1982
Last modification	June 24, 2013, 11:35 a.m. (e.beaumont)

Geographic and cultural informations

Location	Afrique du Sud, Afrique australe, Afrique
Location details	Sikhwankqeni, au sud de Lady Frere, Eastern Cape Province
Population / social group	Xhosa
Ethnographic context	Chanteuses menantes : Nothulethu Polowana et Nofuniswa Mehlo.



CD.I - Afrique / Afrique du Sud

"Comme tous les chants des Xhosa, le chant intitulé Nontyolo est caractérisé par une forme cyclique et responsoriale. Ici, c'est l'arc musical frotté (umrhubhe), joué par une jeune fille, qui tient le rôle de la chanteuse menante (ligne H1 de la transcription; H = hlabeli ; « menant »). Six autres filles chantent les parties des suivantes (L1 à L5 ; L = landela, « suivant »). Elles choisissent leurs lignes mélodiques pendant que l'arc musical continue à jouer la même ligne mélodique (H1). En modifiant le volume de la cavité buccale, la joueuse de l'arc musical sélectionne les harmoniques des deux sons fondamentaux pour en faire la mélodie.

Les lignes des « suivantes » (L1 et L2) sont en fait des parties en polyphonie parallèle (appelées en xhosa iintlobo, « variations ») de la ligne « menante » (H1). Pour cette raison, ces lignes commencent au même point rythmique que H1 (indiqué par une double barre). Les lignes L3, L4 et L5 sont des parties polyphoniques en tuilage, commençant à un autre point du cycle (L3 et L4 sont iintlobo, c'est-à-dire des parties parallèles utilisant le même texte et les mêmes tons de la langue). La polyphonie est basée sur les harmoniques de l'arc musical, mais d'autres « sons non harmoniques» sont également utilisés.

Les Xhosa emploient des rythmes complexes, souvent deux ou plusieurs rythmes simultanément, et l'art du déguisement rythmique est très

Online | Offline | back