



audiogen offline solutions

White paper

Version:	1.2.1
Date:	2010-12-23



Contents

Contact.....	3
mufin technology overview.....	4
audiogen offline solutions.....	5
Introduction.....	5
System requirements.....	6
audiogen features.....	7
Technical information.....	9
audiogen on mobile devices.....	10
About mufin.....	12
Company background.....	12
Benefits.....	12
References (Selection)	13
In the press.....	13



Contact

mufin GmbH

Friedrichstraße 200

10117 Berlin

Germany

Phone: +49 (0) 30 / 29392 – 454

Fax: +49 (0) 30 / 29392 – 400







For business enquiries: Boris Löhe: bloehe@mufin.com

For technical enquiries: Dirk Schönfuß: dschoenfuss@mufin.com

<http://business.mufin.com>

mufin technology overview

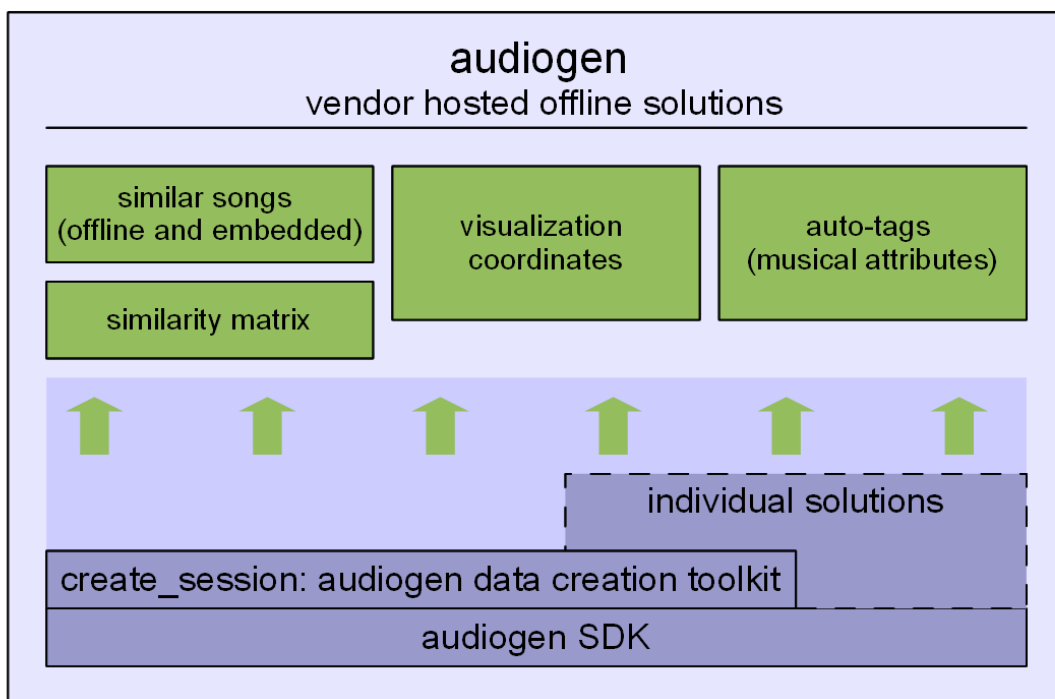
mufin is a leading provider of advanced music recommendation and music identification solutions. Our solutions power music services and music applications all over the world.

<p>audioid music identification</p> 	<ul style="list-style-type: none"> • retrieve metadata for unknown tracks • repair tag information • identify music on mobile platforms • find duplicates in music collections
<p>audioid broadcast monitoring</p> 	<ul style="list-style-type: none"> • track radio streams • observe advertisements • analyse music charts
<p>audiogen offline solutions</p> 	<ul style="list-style-type: none"> • generate music attributes (auto-tags) • analyse song similarity • generate mufin vision coordinates
<p>audioscout online webservices</p> 	<ul style="list-style-type: none"> • search music • retrieve editorial metadata • retrieve music attributes (auto-tags) • get song similarity • get artist similarity • retrieve mufin vision coordinates
<p>mufin white label solutions</p> 	<ul style="list-style-type: none"> • utilize desktop player • access music cloud storage • utilize web-based player • utilize mobile player
<p>unified media database</p> 	<ul style="list-style-type: none"> • contains editorial metadata (tracks, artists, labels, etc.) • contains rich metadata(fingerprints, visualization, cover-art, shop-links, etc.) • powers other mufin services such as audioscout webservices or audioid

audiogen offline solutions

Introduction

The audiogen technology offers an opportunity to browse and discover music in a new way. Based on signal-processing algorithms the musical similarity of different songs can be evaluated and playlists containing similar songs can be created automatically. Since the audiogen system is based on mathematical analysis of the audio signals, it is completely deterministic and independent of any „human factor” like cultural background, listening habits, etc. Depending on the database used, it can also work way off the mainstream and thus give the user the opportunity to discover music he may never have found otherwise.





System requirements

The audiogen executables are available for both Windows and Linux.

General requirements:

- Intel x86 compatible CPU
- 32-bit or 64-bit operating system
- No special hardware requirements

Windows version:

- Windows XP or higher
- Optional: Microsoft DirectShow 9 or higher

Linux version:

- Up-to-date distribution with active package support
- Linux Kernel 2.6.20 or higher
- GLIBC 2.6 or higher, C and C++ standard library 3
- Up-to-date Boost libraries

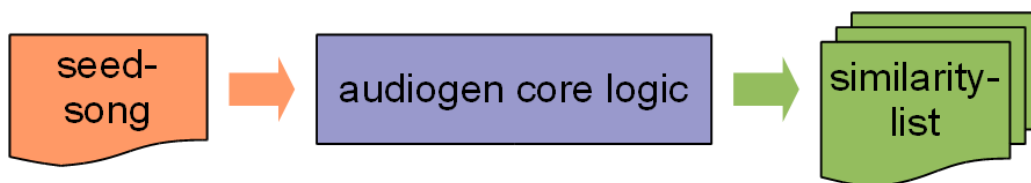
Software versions for other operating systems and software development kits (SDKs) are available upon request.

audiogen features

Composing playlists with song similarity

Consumers are able to access and store thousands of songs on today's computers and devices, be it on a desktop PC or mobile phone. However, with large music collections creating playlists becomes a tedious task as it's increasingly difficult to keep track of each song's style and mood in the library. mufin audiogen can be used for dynamic playlist generation for both desktop and embedded platforms.

The listener simply selects a song from the music collection (seed song) and mufin audiogen returns a playlist with a mix of music from the same music collection. The music will match the seed song's style and sound but will cross genre's and time-era to allow for a true music discovery experience, enabling the listener to find lost gems in the personal music collection. mufin audiogen even allows to control which music is used for the playlist by leveraging semantic musical attributes such as mood or sound characteristics.



Audio files in personal digital music collections are often missing complete meta information like artist or song title. Unlike other playlist generation technologies, mufin audiogen analyzes acoustical similarities and will include songs in a mix even if there is no meta information about the song's artist or genre available – of course only if it matches the seed song's mood and fits into the mix. The listener can even use such a meta information-less song as seed song for the playlist. Of course, mufin audiogen can assist in completing any missing meta-information and find out which song is actually playing.

Create perfect playlists on any device

mufin audiogen's highly efficient architecture and low-memory footprint allows for implementation on almost any device. In combination with mufin player PC application, playlists can be created on mobile phones, home CD and DVD players, car stereos or flash memory-based portable MP3 players with low CPU and memory resources – no matter if there's Internet connectivity or not. Especially on embedded and portable devices with small screens mufin audiogen is an invaluable tool, as it helps to easily navigate music collections with thousands of files.

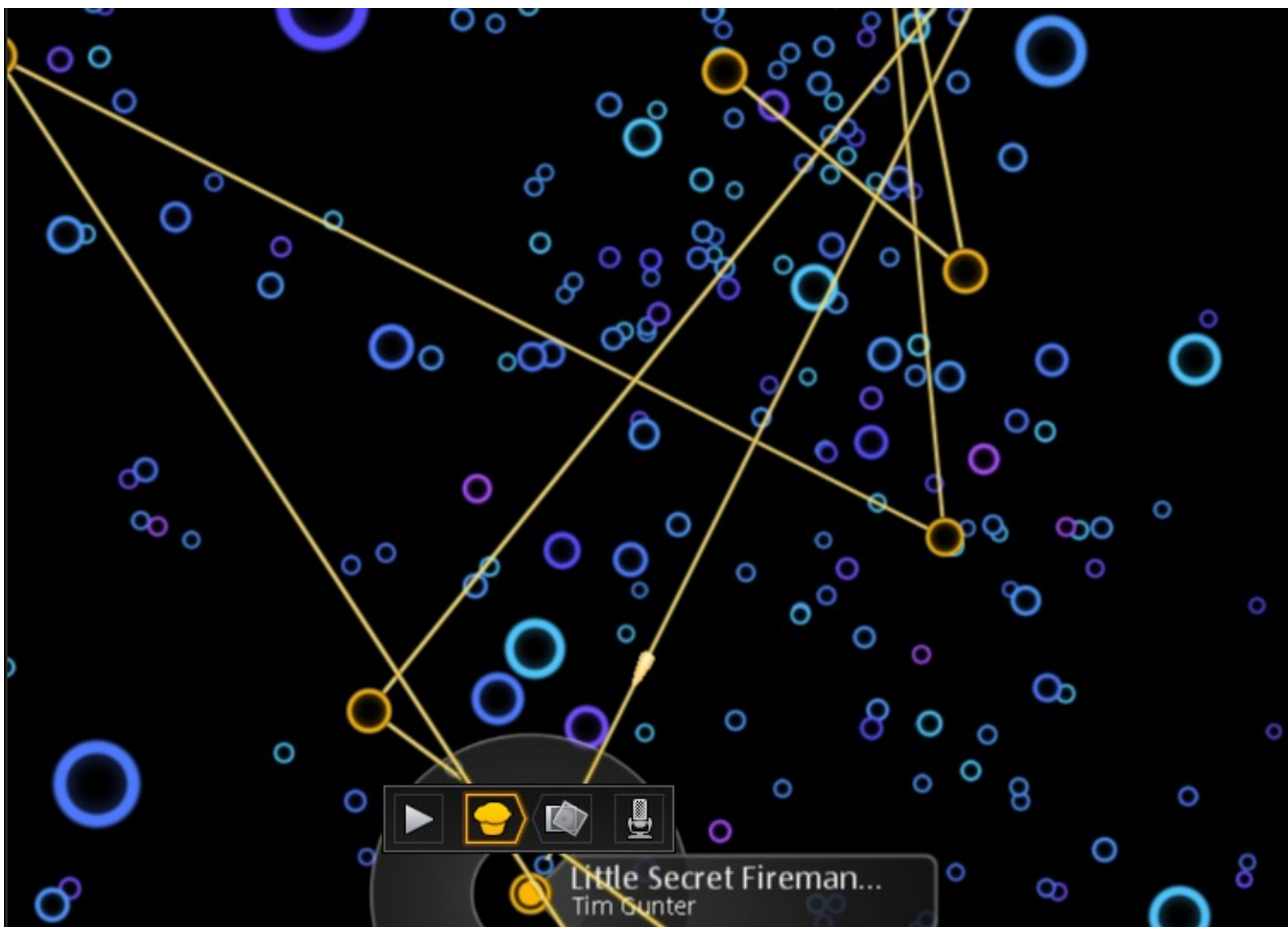
Generate auto-tags

The mufin audiogen technology is capable of analysing music for specific attributes that characterize a song in a unique way. Applying and relevant music aspects are delivered as single auto-generated tags such as „aggressive“, „happy“ or „synthetic“.

These tags can then be used in applications to add additional information about the songs to their metadata.

Generate visualization coordinates

Instead of accessing a music collection or a shop's content by browsing pre-defined categories, with the help of mufin vision, a multidimensional graphical display of a complete music catalog allows visual and soundbased browsing. Users can select from a variety of attributes including tempo and sound color to allocate to all vision axes. The user can further select which criterion he wants to put onto which axis. Available attributes include tempo, acoustic color amongst others.



Technical information

Retrieving data from song analysis with mufin audiogen is a two-step process:

Collecting analysis information

In the first step the audio signal is analyzed using several mathematical algorithms. The analysis-results (or fingerprints) are stored in an analysis database also referred as session. Metadata associated with the content may also be added to the analysis DB.

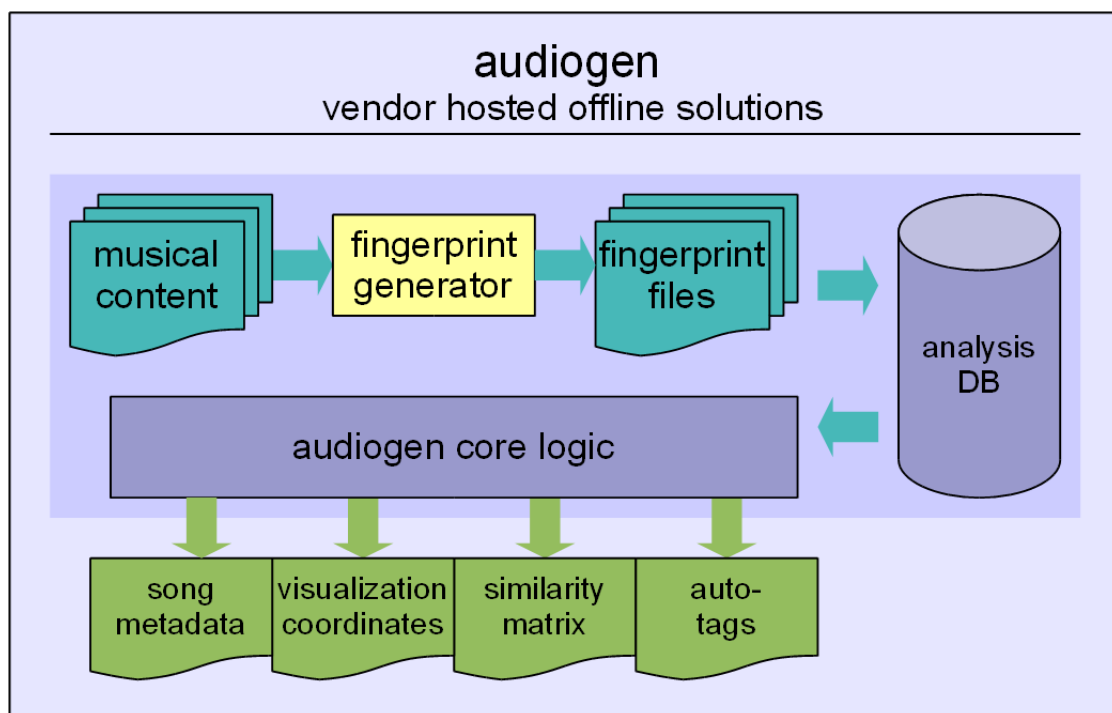
A fingerprint does not contain any audio information, nor is it possible to reconstruct the audio from it. The extraction process is controlled by the extraction-configuration file.

Retrieving information from the analysis database

Based on the information stored in a session audiogen calculates lists of songs that are similar to a given query song. Thereto it compares the characteristics of the query song with those of every other signature contained in the session. Prior knowledge about musical relations is also applied in the process. The result is a percent value that describes each song's similarity to the seed song. This is used to build up an ordered list of similar songs.

From the musical aspects of each song in the session, audiogen generates the appropriate auto-tags which can be supplied for each analysed song.

On the basis of several musical attributes, audiogen will generate coordinates for a visualization of the specific song and therefore for a complete music collection. Thus, a music collection can be viewed in a unique perspective without considering any metadata information.



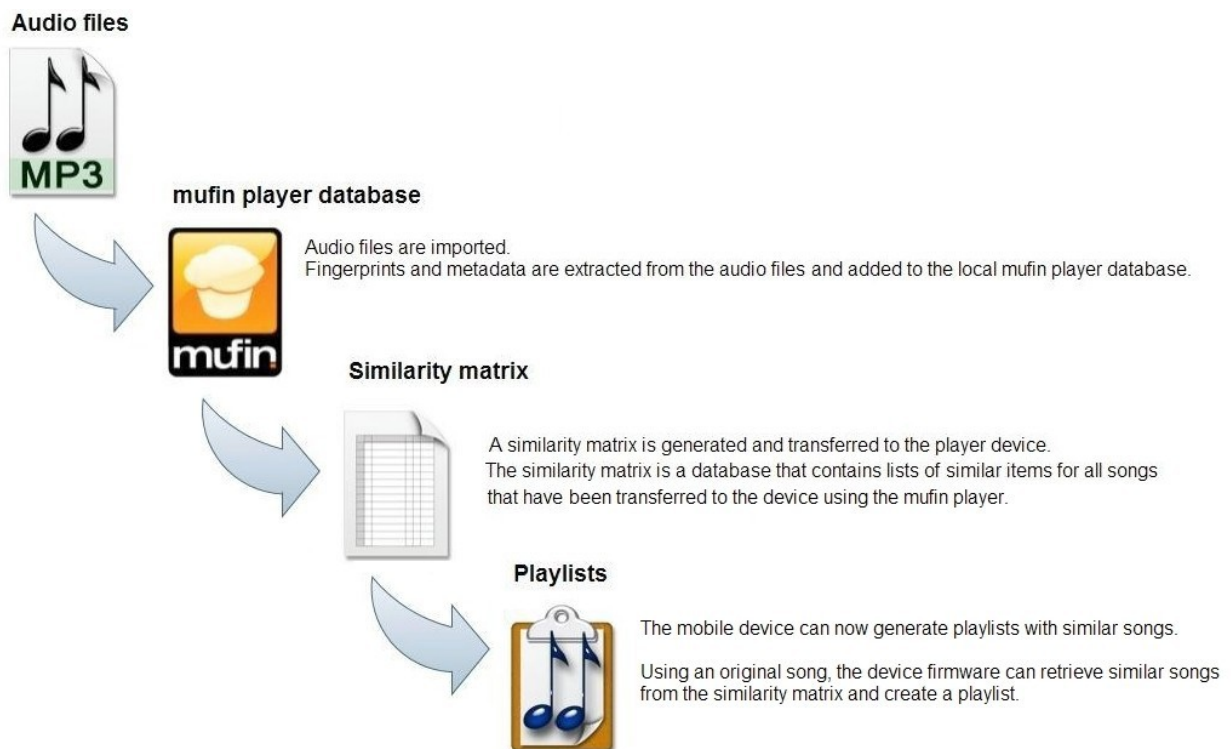


audiogen on mobile devices

By using similarity lists, mufin offers a fast and efficient way to use state-of-the-art music search technology and intelligent playlist generation directly on devices such as mobile phones or MP3 players.

mufin embedded workflow

Similarity lists for all audio files are generated on the PC and then transferred to the mobile device. The integration of the one-touch playlist functionality into the device requires minimum effort and the playlist handling itself will work very fast even with low-performance hardware.





Integration use-cases

Here are a few examples of how the mufin functionality may be implemented on the audio player device. These are just examples; there are no reference implementations for these use-cases.

Intelligent skip or shuffle

Some audio players have a shuffle button that plays a random song when it is pressed. Using the mufin function, for instance a long press of the shuffle or skip button can be used to play not just any but a similar song.

mufin player menu

The player may offer a menu option which allows the user to generate automatic playlists based on any song on the device.

mufin radio

Instead of just using the list of similar songs for an original song, the software can also work recursively and play only the first similar song, then the first similar song for that song, etc. Alternatively, it may use not the first but a random recommendation to further broaden the musical range of the playlist.

Implementing mufin on the player device

Each partner needs to do his own integration of the mufin technology into the device's firmware.

Partners will receive

- a detailed specification of the file formats
- a sample application including full C source code
- The mufin player PC application

If you have any questions or need further information do not hesitate to contact us.



About mufin

Company background

mufin is the leading expert for content protection services and audio retrieval solutions based on the most advanced fingerprinting technology for the purpose of

“identifying and filtering copyrighted content on behalf of the right holders to enforce the copyright policy”

while

“adding value to music applications and devices plus stimulating music sales anywhere and anytime”.

In August 2005, mufin exclusively acquired the associated patents for audioid technology, which is an innovative system for extracting audio fingerprints from digital files and identifying them. mufin is a 100% subsidiary of MAGIX with its headquarters in Berlin, Germany.

mufin’s technology has been developed with the music consumer in mind. Our music identification and music recommendation technologies enable consumers to enjoy music anytime and anywhere.

Benefits

Our solutions help consumers

- Discover new music they might enjoy
- Listen to music that matches their mood
- Build playlists with one touch
- Navigate music libraries visually

Helping consumers directly benefits your business, since

- Newly discovered music presents new purchase options
- Engaging music experiences increase customer browsing time and repeat visits



References (Selection)



Music recommendation for ringtones and full-track music downloads on mobile portal



Audio recognition of user uploads to avoid copyright infringements with audioid on a German music platform



Audio recognition of user uploads to avoid copyright infringements with audioid on a German video portal



Ad monitoring in Australia with mufin audioid technology



Ad monitoring in Kenya with mufin audioid technology

In the press



'I was very impressed by Vision and spent quite some time playing around with it.'



'Mufin: An Automated Music Recommendation Engine That Actually Works'



'Mufin brings better music recommendations to iTunes'