

**Axmedis Conference 2005**

**3rd International Workshop for  
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Business Models for Virtual Goods:**

# **The Value of Metadata in the Digital Music Industry**

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# Overview

- Introduction
- Current Metadata Services and Technologies
- Methods for Data Acquisition
- Application Scenarios
- Some Service Data
- Upcoming Technologies and Services
- Summary

# Introduction

Though focus is on audio, the following can be generalized to multimedia content (e.g. Apple's Video iPod)

- Music distribution has diversified significantly over recent years
- The end user has many more options to access and store music
- Audio content is available
  - through multiple sources/media (LP, CD, digital/analog radio, internet,...)
  - in various formats (PCM, mp3, aac, wma, ogg,...)
  - with various levels of metadata (artist, title, album, genre, artwork,...)
- Ability to store 1000's of tracks requires better data management tools
  - demand for improved browsing interfaces, automated playlisting, sorting, personalized radio streams (internet)

But: most applications require **descriptive metadata** associated with content to function

# Current Metadata Services and Technologies

- Ripping of CD content & lack of descriptive metadata on media created need for automated identification
- Large scale automated identification of audio started with CD recognition service (CDDB - 1995)
  - Same time frame when first mp3-player was commercially available
- Commercial company was founded in 1998
- CD TOC is used for look-up index generation
- Database entries were end-user driven
  - data quality was not consistent
- Lack of metadata in audio formats other than CD
  - other identification methods:
    - Text based identification
    - Audio fingerprinting
- More metadata required to drive more sophisticated applications

# Excursion: What Is Audio Fingerprinting?

Motivation: Attempt to mimic human recognition abilities

- Capture ‘essential features’ within audio signal → ‘fingerprint’
- Compare against database of previously identified and registered fingerprints

To provide good recognition performance features need to be

- robust against commonly encountered signal alterations
  - compact representation to facilitate quick searching of large databases (millions of entries)
- trade-off between size and robustness

Various fingerprinting algorithms deployed for different applications (e.g. broadcast monitoring, file identification, mobile music recognition)

# Methods for Data Acquisition

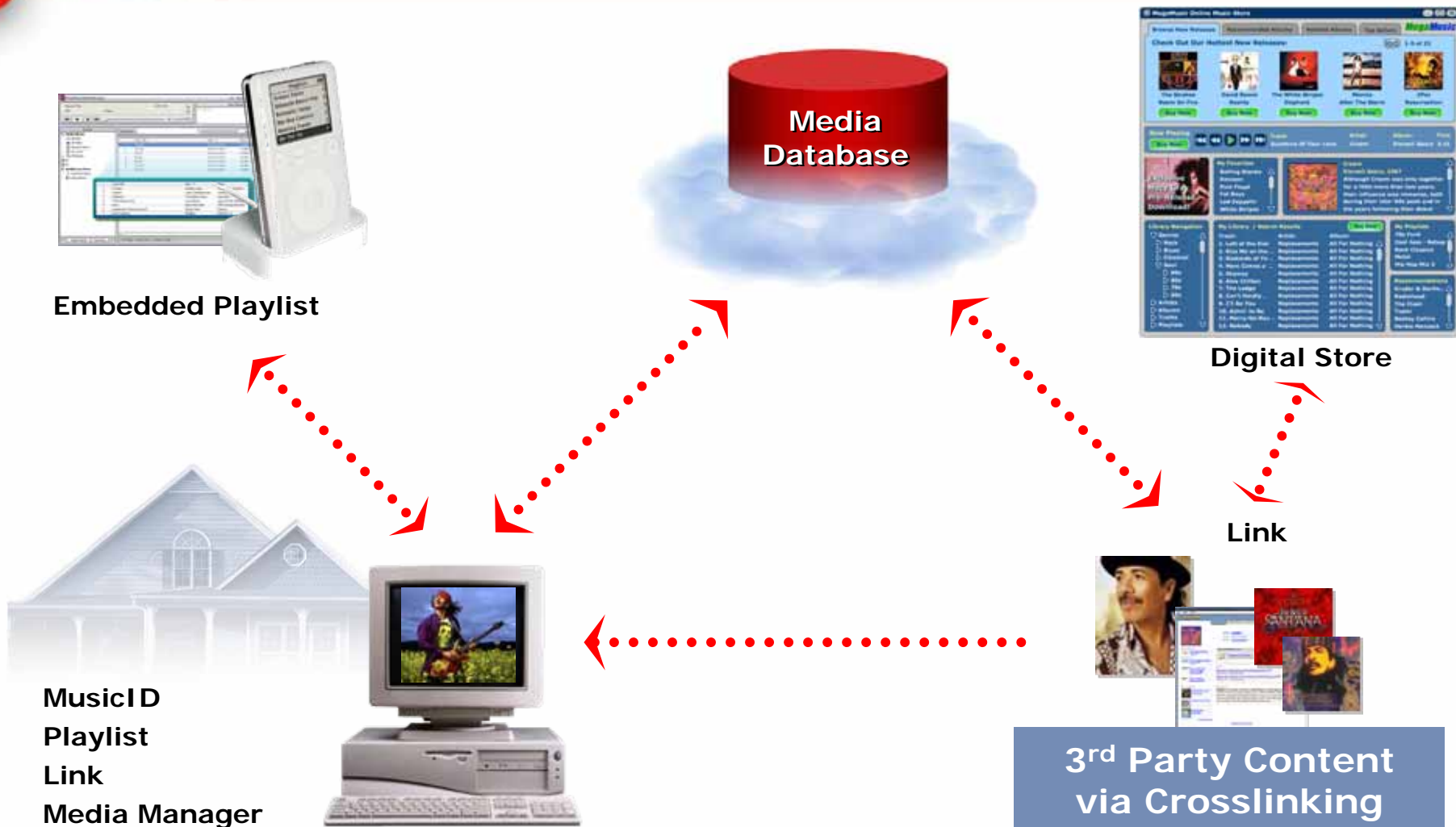
The following methods for gathering metadata are currently employed:

- End user input, (con-)text acquisition (file name, tag information)
  - + fast method of collecting large quantities of data
  - high variance in data representation and quality
- Professionally annotated data by hired musical experts or record labels / artists
  - + high data quality and consistency
  - very time consuming and costly
- Collaborative filtering of web pages
  - + completely automated
  - filtering out good data from 'noise' is challenging
- Automated extraction of metadata from content
  - + very good scalability
  - works only on audio itself, can only enhance but not replace editorial data

# Application Scenarios

- Music/multimedia content recognition anywhere at any time using:
    - CD recognition
    - File identification
    - Audio/video stream fingerprinting
  - Thus enabling:
    - Delivery of identification metadata as genuine service (e.g. artist, title,...)
    - Additional metadata to drive applications such as playlisting, sorting, etc.
    - Linking to new / commercially available products, such as
      - Music downloads
      - Ring tones
      - Wallpapers
      - Concert tickets
      - T-Shirts, etc.
- Requires abstraction of track level metadata, 'smart' association of data

# Application Scenarios (cont'd)



# Some Service Data

## Data in 80 Languages, Servicing 213 Countries

### Regional Features

- Content in 80 Languages
- Regional Targeting Based Upon Popularity Data



### Technology

- Multi-byte Character Support for all Unicode Character Sets

### Metadata

- 4.2M+ CDs
- 53M+ Tracks
- 7M Waveform Fingerprints
- 18K+ Movies

### Editorial Data

- Global Genre System (1,500 Micro-Genres)
- Extended Playlist Attributes

### Preference Data

- 2B Lookup & Play Events Captured
- Track Similarity

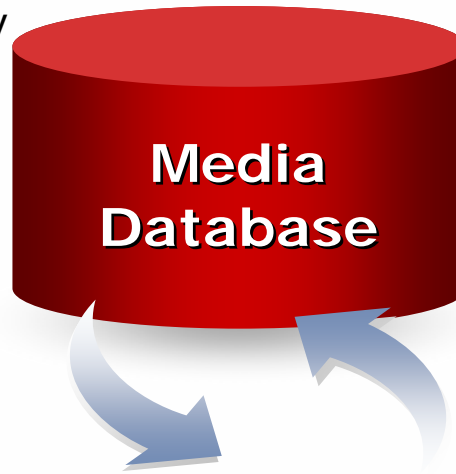
# Some Service Data (cont'd)

## Consumers

### Voluntarily Submit Data

- 97M Networked Users Annually
- 2.5K CDs Daily
- 50K Fingerprints Daily
- 2M Unique Users a day

**Submissions  
and Popularity Data**



## Partners

### Submit Data

- 250 Labels, Artists and Content Owners
- Automated Submissions Application

**Submissions**

## In-house Media Experts

Genre System  
and Media  
Classification

Data  
Quality

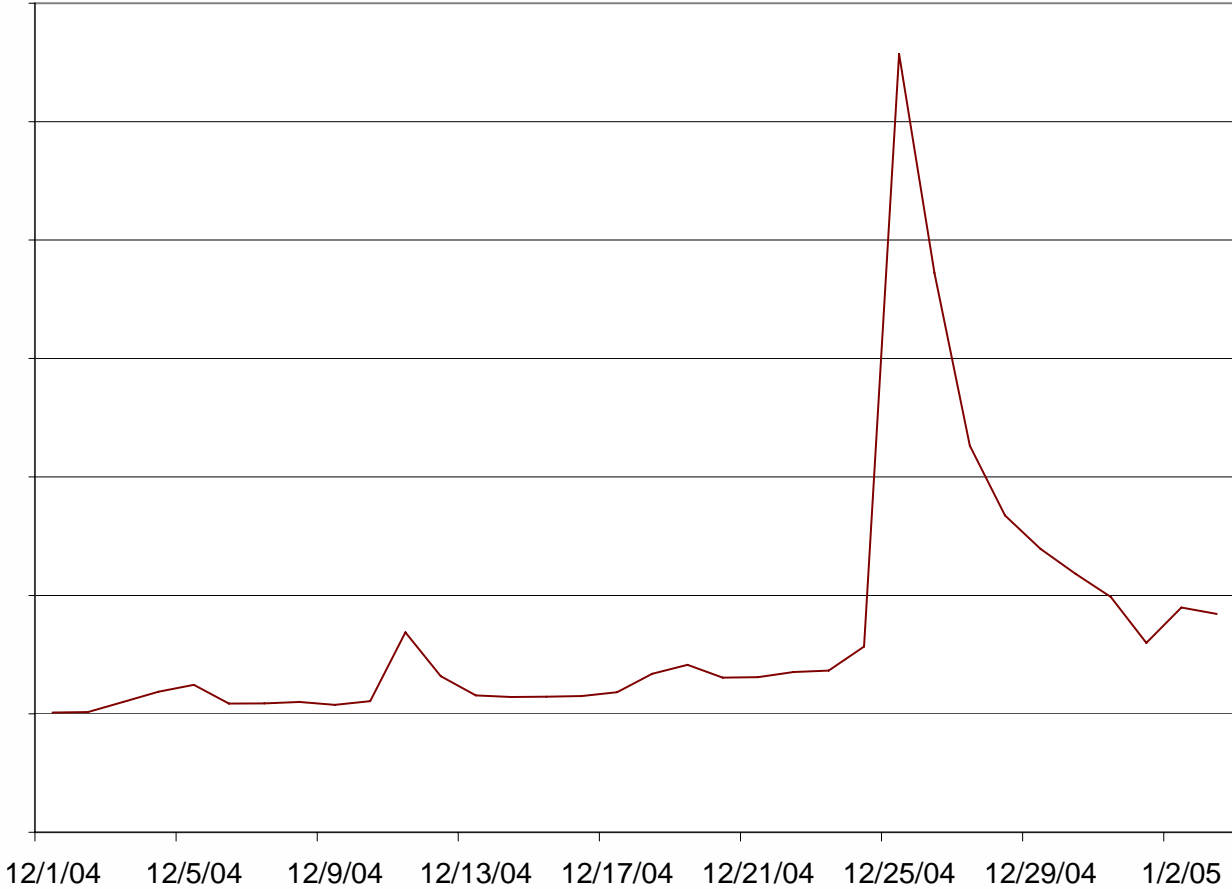
Extended  
Playlist  
Attributes

Movie  
Metadata  
Creation

Rich Content  
and Commerce  
Integration

# Some Service Data (cont'd)

Service utilization during Christmas holidays:



# Upcoming Technologies and Services

- Online content distribution will win market shares
  - New distribution methods / business models will take over
  - Relevance of labels as distributors / manufacturers will be reduced
- Harddrive based devices will diversify
  - Portable players → car radios, mobile phones
  - Requires (limited) network infrastructures to transport data from and to devices
  - Metadata database on device
- Devices will become multifunctional
  - Video iPod, mobile phones, set top boxes as MM home servers
  - Challenge: multiple sources of multimedia content have to be navigable in unified and consistent format → identification and re-tagging
  - More sophisticated management tools have to be developed / deployed
- P2P exchange of multimedia data satisfies a basic end user need
  - Several devices with P2P capabilities announced / released
  - Business models have to be adapted, not additional limitations imposed

# Summary

- The multimedia content market is growing and diversifying
  - Increasing use of
    - Mobile phones with multimedia capabilities (ring tones were just the beginning)
    - Online download stores and subscription services
    - P2P networks
- Good quality metadata are essential for managing content in current and future multimedia products and applications
- Multiple media sources: one cannot rely on consistent metadata delivered along with content
  - Consistency is vital for good user experience with content management tools
  - Data has to be unified using various identification technologies

Thanks for Listening,  
Any Questions?