

Research Report

IMPLEMENTING THE SPATIAL SOUND DESCRIPTOR INTERCHANGE FORMAT SPATDIF

Chikashi Miyama
College of Music Cologne
Studio for Electronic Music
me@chikashi.net

Jan C. Schacher
Zurich University of the Arts
Institute for Computer Music and Sound Technology
jan.schacher@zhdk.ch

ABSTRACT

Here we have an abstract

necessary to make this lightweight standard functional were put forward, for example the capability of dealing with temporal interpolation of scene descriptors.

1. INTRODUCTION

In this article we present the development of a tool for easy integration of SpatDIF into existing software. The concepts and guidelines are implemented in a C-Library and applied in an example surround-playback application.

SpatDIF, the Spatial Sound Description Interchange Format, presents a structured approach for working with spatial sound information, addressing the different tasks involved in creating and performing spatial sound.

The goal of SpatDIF is to simplify and enhance the methods of working with spatial sound content. SpatDIF proposes a simple, minimal, and extensible format as well as best-practice implementations for storing and transmitting spatial sound scene descriptions. It encourages portability and the exchange of compositions between venues with different surround sound infrastructures. SpatDIF also fosters collaboration between artists such as composers, musicians, sound installation artists, and sound designers, as well as researchers in the fields of acoustics, musicology, sound engineering and virtual reality.

SpatDIF is developed as a collaborative effort and has evolved over a number of years. The community and all related information can be found at www.spatdif.org.

2. HISTORY OF THE PROJECT

SpatDIF was coined in [3] when Peters stated the necessity for a format to describe spatial sound scenes in a structured way, since at that time the available spatial rendering systems all used self-contained syntax and data-formats. Through a panel discussion [1, 2] and other meetings and workshops, the concept of SpatDIF has since been extended, refined, and consolidated.

After a long and thoughtful process, the SpatDIF specification was informally presented to the spatial sound community at the ICMC 2011 in Huddersfield in August 2011, at a workshop at the TU-Berlin in September 2011 and in its current form in a Computer Music Journal article in 2013 [4]. The responses in these meetings suggested the urgent need for a lightweight and easy to implement spatial sound scene standard, which could contrast the complex MPEG specification [4]. In addition, many features

3. CONCEPTUAL EXPLANATION / STRUCTURE

One of the guiding principles for SpatDIF is the idea that authoring and rendering of spatial sound might occur at completely separate times and places, and be executed with tools whose capabilities cannot be known in advance. It formulates a concise semantic structure that is capable of carrying the necessary information, without being tied to a specific implementation, thought-model or technical method. SpatDIF is a syntax rather than a programming interface or file-format and may be represented in any of the structured mark-up languages or message systems that are in use today or in the future. It describes only the aspects required for the storage and transmission of *spatial information*. A complete work typically contains additional dimensions that lie outside the scope of SpatDIF. These are only addressed to the extent necessary for linking the elements to the descriptions of the spatial dimension (i.e. the Media extension).

explaining the library idea: WHY a library
score-example in XML / JSON -> turenas xml score
format of SpatDIF 'bundle'

4. LIBRARY DETAILS/STRUCTURE

4.1. Features

SpatDIFLib is an open source C/C++ multi-platform library, that offers the following functionalities to the developers of SpatDIF compatible softwares (clients).

- Loading and storing SpatDIF scenes from/to a XML, JSON, and YAML formatted string
- Addition, deletion, and modification of entities in SpatDIF scenes
- Addition, deletion, and modification of events
- Associating events with entities
- Activation and deactivation of extensions
- Answering queries in regard to entities and events in SpatDIF scenes

- Controlling data in SpatDIF Scenes via OSC Messages

In order to maintain platform independency and to achieve maximum flexibility, the library does not handle files directly. Instead, it interprets XML, JSON or YAML formatted string, employing TinyXML-2¹ and libjson².

Though SpatDIFLib is controllable employing OSC formatted string, it does not handle network sockets directly for OSC communication; the library interprets provided OSC string as commands. The client application should prepare sockets and threads for OSC communication. Likewise no scheduler or timer are implemented in the library.

4.2. C++ Class Structure

Figure 1 shows simplified class hierarchy of the library.

4.2.1. sdScene

sdScene maintains all data associated to a certain SpatDIF scene. This class offers clients the following three functionalities

1. adding, removing and modifying entities in its scene
2. activation and deactivation of the extensions
3. editing meta data associated to the scene

Once the client activates an extension in a scene, sdScene automatically add extended functionality and storage to all existing and newly created instances of sdEntityCore. By the deactivation of an extension, sdScene removes all extended functionality and previously allocated storage of all existing sdEntities. Subsequently, all the data associated to the extension will be discarded.

4.2.2. sdLoader/sdSaver

These two classes provide several utility functions and enable clients to easily convert a XML, JSON, or YAML string to a sdScene and vice versa,

4.2.3. sdEntityCore

An instance of sdEntityCore maintains events with SpatDIF core descriptors and keep a vector to hold instances of SpatDIF extensions. This class is also responsible for answering query from the client about events. For example, if a client asks an entity a value of a certain descriptor at a specific time, the sdEntity returns value to the client. The client is able to request multiple events within a certain time frame and filter events by descriptor. If the client request values of extended descriptors, the sdEntityCore forwards the query to the attached extension.

4.2.4. sdEntityExtension

This is a pure abstract class of extensions. The subclasses of this class. e.g. sdEntityExtensionMedia handle the events with extended descriptors. If the client activates an extension in a scene, all existing sdEntityCore create an instance of designated subclass of sdEntityExtension and register it to the internal vector.

4.3. Simple Example

The following example code shows how to load a XML formatted string to a sdScene and query a event stored in it.

How to query.cpp → turenas xml score C++ example

4.4. Future plan

The above mentioned basic class hierarchy is already implemented in the library. The library is also able to interpret simple XML, JSON and OSC messages and currently examined against SpatDIFRenderer, in order to further improve flexibility and practicality. All extensions defined in the SpatDIF specification 0.3 will be implemented in early 2014 and C interface will be added in the late 2014. The library will be completed by the end of 2014 and released under the MIT or similar license.

5. REFERENCE RENDERER

ref openFrameworks ref libsndfile
(rough sketch....)
app scope / what does it do
app interfaces to lib → task distribution between app and lib
i.e. scheduler
or sockets / file-IO

References

- [1] Gary S. Kendall, Nils Peters, and Matthias Geier. "Towards an Interchange Format for Spatial Audio Scenes". In: *Proc. of the International Computer Music Conference*. Belfast, UK, 2008, pp. 295–296.
- [2] Nils Peters. "Proposing SpatDIF - The Spatial Sound Description Interchange Format". In: *Proc. of the International Computer Music Conference*. Belfast, UK, 2008, pp. 299–300.
- [3] Nils Peters, Sean Ferguson, and Stephen McAdams. "Towards a Spatial Sound Description Interchange Format (SpatDIF)". In: *Canadian Acoustics* 35.3 (2007), pp. 64–65.
- [4] E.D. Scheirer, R. Vaananen, and J. Huopaniemi. "AudioBIFS: Describing audio scenes with the MPEG-4 multimedia standard". In: *IEEE Transactions on Multimedia* 1.3 (1999), pp. 237–250.

6. AUTHOR'S PROFILE

Chikashi Miyama

Chikashi Miyama is a composer, video artist, interface designer, performer, and author. He received a MA (Sonol-

¹ <http://www.grinninglizard.com/tinyxml/> accessed Oct. 9. 2013

² <http://sourceforge.net/projects/libjson/> accessed Oct. 9. 2013

REFERENCES

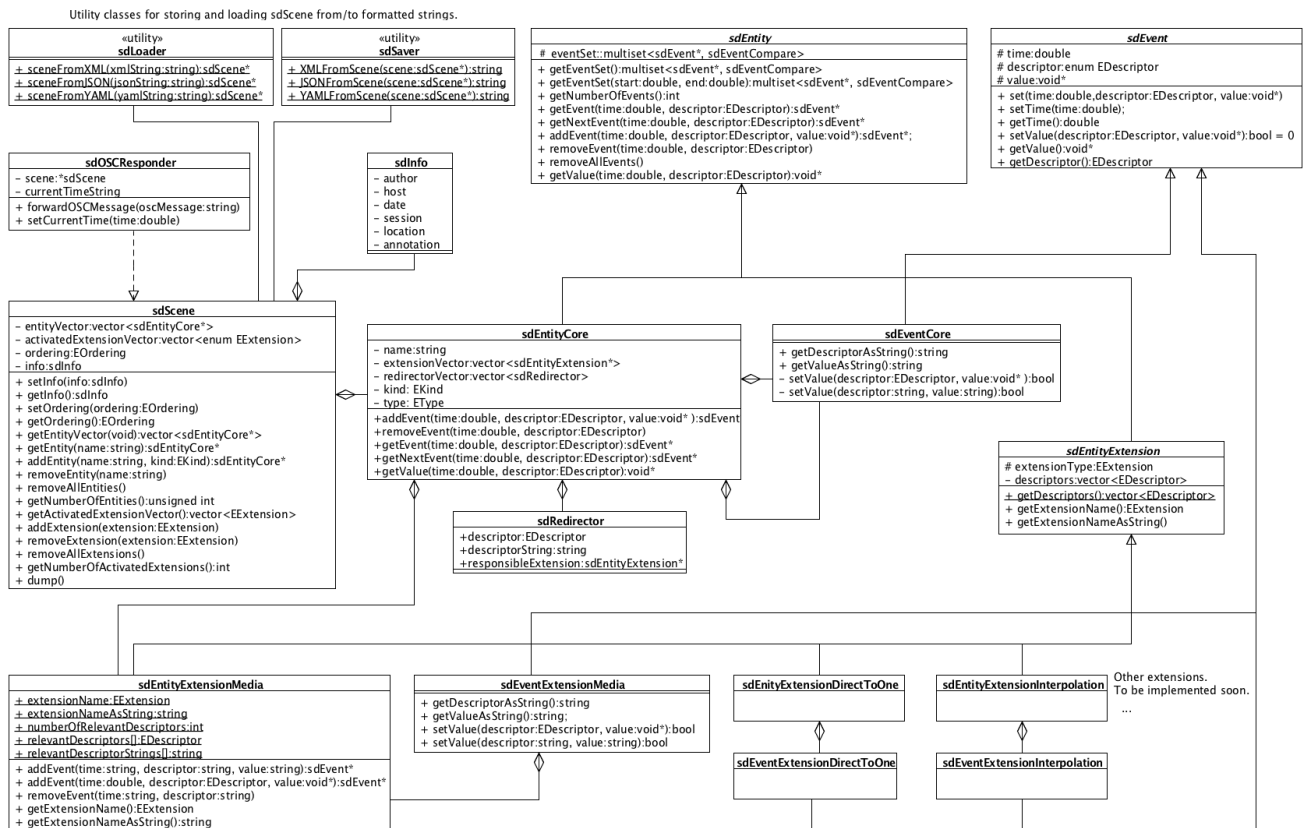


Figure 1. Class Structure

ogy(2004) from Kunitachi College of Music, Tokyo, Japan, a Nachdiplom (Komposition im Elektronischen Studio/2007) from Music academy of Basel, Switzerland, and a Ph.D (Composition/2011) from University at Buffalo, New York, USA. His compositions have received an ICMA award (2011/UK) from the International Computer Music Association, a second prize in SEAMUS commission competition (2010/St. Cloud, USA), a special prize in Destellos Competition (2009/Argentina), and a honorable mention in the Bourges Electroacoustic Music Competition (2002/France). Several works of him are included on the DVD of the Computer Music Journal Vol.28 by MIT press, and ICMC official CD/DVD(2005/2011). In 2011, he received a research grant from DAAD (German Academic Exchange Service) and worked as a visiting researcher at ZKM, Karlsruhe, Germany. He has taught computer music at University at Buffalo, USA, Music Academy Basel, and College of Arts Bern, Switzerland. He is currently teaching at College of Music and Dance, Cologne, Germany.

Jan C. Schacher

A doublebass-player, composer and digital artist, Jan Schacher is active in electronic and exploratory music, in jazz, contemporary music, performance and installation art as well as writing music for chamber-ensembles, theatre and film. His main focus is on works combining digital sound and images, abstract graphics and experimental video in the field of electro-acoustic music and in mixed-media projects for the stage and in installations.

Jan Schacher has been invited as artist and lecturer to numerous cultural and academic institutions and has presented installations in galleries and performances in clubs and at festivals such as R?sonance Festival (Paris), Sonar Festival (Barcelona), Transmediale Festival (Berlin), the Holland Festival (Amsterdam) and many other venues throughout Europe, North America, Australia and Asia.