Gian Biondi **Musical Notation Formats**  6/26/12

The storage and display of musical score is an interesting problem. There are a multitude of file types and formats for storing music, such as MP3, FLAC and MIDI. Many tools are available for artist to record audio, but there is also a need for storing the written music. This paper will explore the tools available for storing musical notation.

There are several options around for storing musical scores digitally. The biggest formats include MusiXTeX, LilyPond, ABC and MusicXML. These formats store all the information contained in sheet music in a textual format. The text data can then later be parsed to generate a more traditional sheet music document. They differ from MIDI storage formats in that they store musical scores and MIDI is more geared towards storing descriptions for sounds. MIDI is actually a set of instructions for musical instruments and isn’t really sufficient for storing musical notation.

MusiXTeX is one of the oldest ways of storing musical notation. It was created in in 1987 and sports continued support even today. MusiXTeX is an open-source library of macros and fonts used with the TeX typesetting language, similar to LaTeX. It is used for music engraving, or creating sheet music for printing. It uses a three-pass method for compiling the engraving. The first pass generates the bars and stores it in a file. That file is used by the second pass which is run by a program known as ‘musixflx’ which determines the space between notes for each beat and writes it to another file. That file is used in the final pass to produce the final formatted score in the form of a PDF or PostScript file. While it does create great scores for printing, it is rather awkward and cumbersome to use. The text file is not very easy to read by humans and it is also quite large. The compilation procedure is also long and intense. As a result, it is not the best way to store or display sheet music on a mobile platform.

Another file format for score storage and musical engraving is GNU LilyPond. GNU LilyPond is free software created in 1996 for score creation. It is both a file format as well as the program for rendering it into a document. GNU LilyPond began as a component of MusiXTeX. Specifically, it began as a pre-processor for MusiXTex. In 1996 the creators departed development for MusiXTeX and created GNU LilyPad. Two years later, GNU LilyPad had completely separated from MusiXTeX. Today, GNU LilyPad supports a much more readable markup and is a bit easier to write than MusiXTeX. The text files are still rather large, consisting of hundreds if not thousands of lines, and GNU LilyPad does not support a graphical user interface.As a program it is still very similar to TeX.

A more popular format is MusicXML. It is a standard for musical notation and many applications use MusicXML. MusicXML is a markup language used for the creation and exchange of musical scores, even between different composition tools. It was first created in 2004 by Recordare LLC, and is based on XML. As such it is significantly more readable than other languages such as MusiXTeX. It is also extremely lightweight, as it consists only of tags and does not require the use of heavy libraries or fonts or styling. MusicXML is designed to be easy for automated tools to parse and manipulate the musical notation. Version 2.0 even supports a compressed zip format which greatly reduces the size of the text file by roughly a factor of twenty. This format does not have a built-in or a specific tool associated with it. It is solely a format to store musical scores. MusicXML does not even have an official way of converting the score to sheet music. The task of parsing and rendering the notation is entirely up to the program used to read the MusicXML file.

A large competitor to MusicXML is the ABC notation. ABC notation derives from an older shorthand way of writing music. ABC notation is designed to notate music in a plain text format which is extremely human-readable and writable. ABC notation is also extremely compact as it does not use tags or a highly rigorous syntax. This readability greatly distinguishes ABC notation from other notation formats. It is intended to be converted into standard staff notation or to play the music described in the notation through computer speakers. ABC notation, like MusicXML, does not have a specific tool associated with it. It is a free and standardized format which is used by many programs. Again, the appearance of the sheet music is completely up to the tool rendering it.

With a need for storing musical notation, there are several options. As with any format, there are features and drawbacks to all choices. Ultimately, the main difference is in readability and rendering. More complicated formats such as MusiXTeX are more complicated but render music engravings beautifully and easily. This greatly contrasts ABC notation which is extremely easy to read but does not offer any guarantee or enforcement to the appearance of the rendered sheet music. The best choice for a mobile application would be either MusicXML or ABC notation due to their smaller file size and ease of use.

An important candidate to note is MIDI format. MIDI is a specification for the Electronic Musical Instrument industry. It was introduced in 1983 and it forever changed the music industry. It enables many computers, instruments and other devices to communicate. MIDI is a format/protocol used to capture note events (when notes occur) as well as pitch, velocity, tempo, and other digital inputs. MIDI is used by audio sequencers to edit and play back audio data. MIDI is simple and standard across almost all musical equipment. Unfortunately, we have already decided that we will not be using MIDI format because it is designed for digital music and audio, not really for engraving.

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| Format | Notes | Suitability |
| MusixTeX | LaTeX based engraving Language, used for generating PDF sheet music | Not suitable |
| LilyPond | Engraving Language based off MusixTeX, used for generating PDF sheet music | Not Suitable |
| ABC | Easy to read, used for tunes, compact | Suitable, but maybe too simple |
| MusicXML | Musical Standard, based on XML, easy to parse/read, | Suitable |
| MIDI | Musical specification, used for communication between computer and instruments, digital music, used for audio | Not suitable |

Bibliography

<http://www.doc.ic.ac.uk/~nd/surprise_97/journal/vol1/aps2/>

<http://www.makemusic.com/musicxml>

<http://www.music-notation.info/en/formats/NIFF.html>

<http://lilypond.org/doc/v2.15/Documentation/web/authors>

[http://abcnotation.com/#](http://abcnotation.com/)

<http://www.mab.jpn.org/musictex/index_en.html>