Standard MIDI Files 1.0

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Introduction

The document outlines the specification for MIDI Files. The purpose of MIDI Files is to provide a way of interchanging time-stamped MIDI data between different programs on the same or different computers. One of the primary design goals is compact representation, which makes it very appropriate for a disk-based file format, but which might make it inappropriate for storing in memory for quick access by a sequencer program. (It can be easily converted to a quickly-accessible format on the fly as files are read in or written out.) It is not intended to replace the normal file format of any program, though it could be used for this purpose if desired.

MIDI Files contain one or more MIDI streams, with time information for each event. Song, sequence, and track structures, tempo and time signature information, are all supported. Track names and other descriptive information may be stored with the MIDI data. This format supports multiple tracks and multiple sequences so that if the user of a program which supports multiple tracks intends to move a file to another one, this format can allow that to happen.

This spec defines the 8-bit binary data stream used in the file. The data can be stored in a binary file, nibbleized, 7-bit-ized for efficient MIDI transmission, converted to Hex ASCII, or translated symbolically to a printable text file. This spec addresses what's in the 8-bit stream. It does not address how a MIDI File will be transmitted over MIDI. It is the general feeling that a MIDI transmission protocol will be developed for files in general and MIDI Files will used this scheme.

Sequences, Tracks, Chunks: File Block Structure

Conventions

In this document, bit 0 means the least significant bit of a byte, and bit 7 is the most significant.

Some numbers in MIDI Files are represented in a form called a variable-length quantity. These numbers are represented 7 bits per byte, most significant bits first. All bytes except the last have bit 7 set, and the last byte has bit 7 clear. If the number is between 0 and 127, it is thus represented exactly as one byte.

Here are some examples of numbers represented as variable-length quantities:

Number (hex)	Representation (hex)
00000000	00
00000040	40
0000007F	7F
00000080	81 00
00002000	C0 00
00003FFF	FF 7F
00004000	81 80 00
00100000	C0 80 00
001FFFFF	FF FF 7F
00200000	81 80 80 00
08000000	C0 80 80 00
0FFFFFFF	FF FF FF 7F

The largest number which is allowed is 0FFFFFFF so that the variable-length representation must fit in 32 bits in a routine to write variable-length numbers. Theoretically, larger numbers are possible, but 2 x 10^8 96ths of a beat at a fast tempo of 500 beats per minute is four days, long enough for any delta-time!

Files

To any file system, a MIDI File is simply a series of 8-bit bytes. On the Macintosh, this byte stream is stored in the data fork of a file (with file type 'Midi'), or on the Clipboard (with data type 'Midi'). Most other computers store 8-bit byte streams in files — naming or storage conventions for those computers will be defined as required.

Chunks

MIDI Files are made up of chunks. Each chunk has a 4-character type and a 32-bit length, which is the number of bytes in the chunk. This structure allows future chunk types to be designed which may easily be ignored if encountered by a program written before the chunk type is introduced. Your programs should *expect* alien chunks and treat them as if they weren't there.

Each chunk begins with a 4-character ASCII type. It is followed by a 32-bit length, most significant byte first (a length of 6 is stored as `00 00 00 06`). This length refers to the number of bytes of data which follow: the eight bytes of type and length are not included. Therefore, a chunk with a length of 6 would actually occupy 14 bytes in the disk file.

This chunk architecture is similar to that used by Electronic Arts' IFF format, and the chunks described herein could easily be placed in an IFF file. The MIDI File itself is not an IFF file: it contains no nested chunks, and chunks are not constrained to be an even number of bytes long. Converting it to an IFF file is as easy as padding odd-length chunks, and sticking the whole thing inside a FORM chunk.

MIDI Files contain two types of chunks: header chunks and track chunks. A header chunk provides a minimal amount of information pertaining to the entire MIDI file. A track chunk contains a sequential stream of MIDI data which may contain information for up to 16 MIDI channels. The concepts of multiple tracks, multiple MIDI outputs, patterns, sequences, and songs may all be implemented using several track chunks.

A MIDI file always starts with a header chunk, and is followed by one or more track chunks.

```
MThd  <length of header data>
<header data>
MTrk  <length of track data>
<track data>
MTrk  <length of track data>
<track data>
  ...
```

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