Software Synthesizer
MIDI Player /Driver Library
Specification

Version 2.2

CONFIDENTIAL

CRIMSON
TECHNOLOGY

History:

Date	Version	Description
1apr2009	2.1	
1jul2011	2.2	

References:

- Software Synthesizer Engine Library Specification（CRIMSON TECHNOLOGY, Inc.）
- Standard MIDI File 1.0（RP001）(Association of Musical Electronics Industry)

目次

1. About This Document

This document defines the specification of the Software Synthesizer MIDI Player / MIDI Driver Library.

2. Abstract

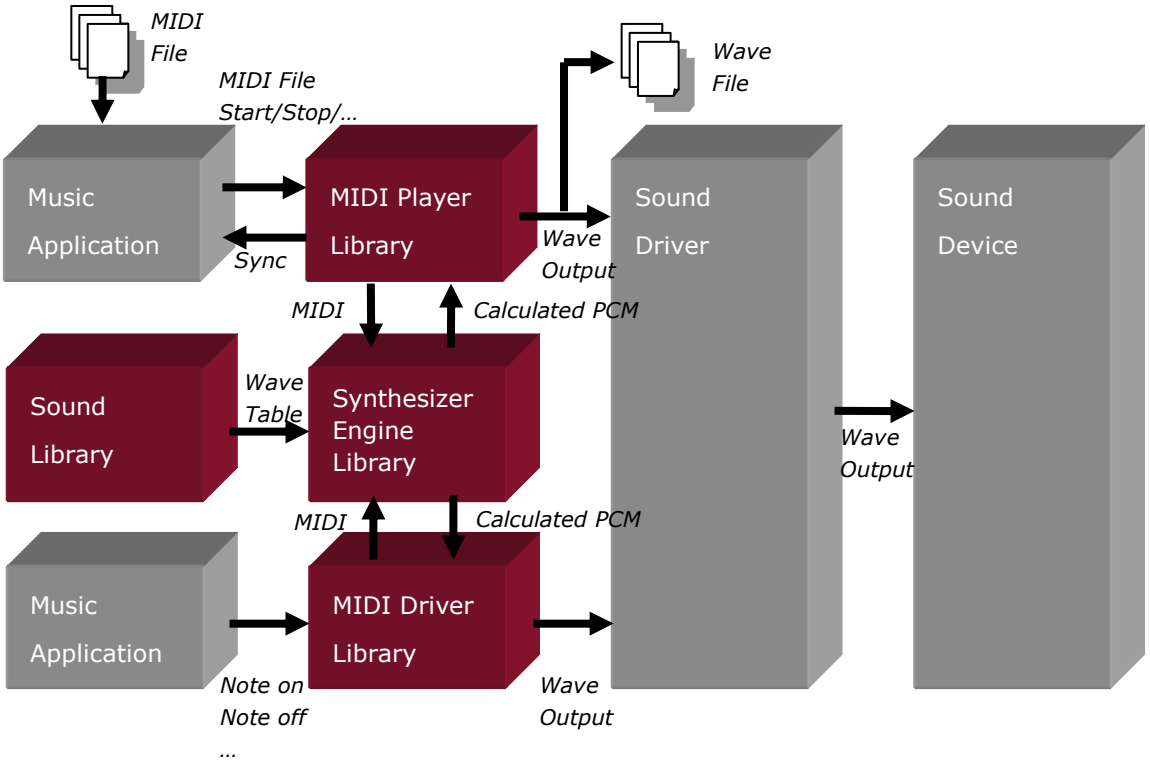
This library include Synthesizer Engine Library (crse: CRIMSON Synthesizer Engine), and Sound Library, also offers application interfaces for MIDI Player (crmp: described later), and MIDI Driver (crmd: described later).

crmp (CRIMSON MIDI Player) library is an additional library for Synthesizer Engine Library. It provides functions to construct MIDI file players, Karaoke players, MIDI to Wave converts easily.
The main basic functions of crmp library are follows;

- Import MIDI files
  - Supporting SMF (Standard MIDI File)
  - Supporting compressed MIDI files by M-compression technology
  - Also can be added the user specified file formats as customization
- MIDI to Wave conversion using Synthesizer Engine Library
  - Including wave output device and thread schedule control for various OS
  - Export to wave files
- Application support
  - API for playback start, stop
  - Callback functions for sending synchronizing information to the application

crmd (CRIMSON MIDI Driver) library is an another additional library for Synthesizer Engine Library. It enables the substitution of hardware MIDI modules, and provides Real-time MIDI function and simple MIDI file player for virtual musical instrument applications.
The main basic functions of crmd library are follows;。

- Real-time MIDI
  - Including wave output device and thread schedule control for various OS
- Simple MIDI file player
  - Supporting SMF (Standard MIDI File)



crmp and crmd library can not be used at the same time.

2.1. Supported OS

- Microsoft Windows
  - MBCS build
  - UNICODE build
- Linux/BSD
- Mac OS X
- iOS (Base SDK 4.3 / Deployment Target: iOS 3.1)

2.2. Inputs

2.2.1. MIDI Files

- SMF (Standard MIDI File)
  - Format: 0 or 1
  - Number of track: Up to 64
  - Division / TPQN: No limitation
  - File extension: *.mid
- M-compression Encoded File
  - File Extension: *.mc*

2.2.2. Sound Library Files

- DLS (Downloadable Sounds)[1]
  - Level1, Level2, Mobile DLS
  - File extension: *.dls
- CRIMSON TECHNOLOGY's Original Format
  - File extension: *.dlsc

2.3. Outputs

2.3.1. Wave Output Devices

- Win:
  - MME drivers

[1] There are some limitations for supporting DLS specification. Please refer to 5.1 About DLS File Format

  - Steinberg ASIO 2.1 drivers (Only crmd driver, 44100Hz sample rate)
- Linux: /dev/dsp
- Mac OS X / iOS:
  - AudioQueue
  - AudioUnit (Only crmd driver)

- Playback sample rate: Depends on each wave output drivers

2.3.2. Wave Files

crmp library only.

- Microsoft RIFF Wave
- Apple AIFF
  - Playback sample rate: No limitation
  - Output bit depth: 16[bit]
  - Number of output channels: 2 (Interleaved)

2.4. File Lists

- Common
  - crmd.h : crmd (MIDI Driver Library) header file
  - crmp.h : crmp (MIDI Player Library) header file
- Win (DLL / Shared library)
  - crmpd*.dll : Shared library
  - crmpd*.lib : Library module
- Linux / Mac OS X / iOS (Static library)
  - libcrmpd*.a

2.5. Related Libraries

- Synthesizer Engine Library
  - Win
    - Included
  - Linux / Mac OS X / iOS

        - ✧ libcrse*.a: Static library
- Sound Library
    - ➢ Win
        - ✧ Included
    - ➢ Other OS
        - ✧ crsynth.dlsc: Default GM library
- M-compression Decoder Library
    - ➢ Win
        - ✧ mclib.dll: Shared library
    - ➢ Other OS
        - ✧ mclib.a: Static library
- Other
    - ➢ Linux
        - ✧ libm : link option "-lm"
        - ✧ libpthread : link option "-lpthread"

3. MIDI Player Library Specification

3.1. Constants

3.1.1. CRMP_ERR

typedef enum for result code.

code	description	
CRMP_OK	Success	
CRMP_ERR_PROTECTION	Protection error	
CRMP_ERR_INVALID_HANDLE	Invalid handle error	
CRMP_ERR_FILE	File error	
CRMP_ERR_MEMORY	Memory error	
CRMP_ERR_RESOURCE	Resource error	
CRMP_ERR_PARAM	Parameter error	
CRMP_ERR_AUDIO_DRIVER	Wave output error	
CRMP_ERR_DATA	Data error	
CRMP_ERR_MODULE	External module error	
CRMP_ERR_NOT_SUPPORTED	Unsupported error	
CRMP_ERR_UNDEFINED	Undefined	

3.1.2. CRMP_CTRL

typedef enum for control API. Please refer to section 3.4.21 ctrl.

3.1.3. CRMP_CALLBACK_TYPE

typedef enum for callback types. Please refer to section 3.5 Callback (CRMP_CALLBACK).

3.1.4. CRMP_WAVE_FILE

typedef enum for bounced wave file formats.

code	description	
CRMP_WAVE_FILE_RIFF	Microsoft RIFF Wave	
CRMP_WAVE_FILE_AIFF	Apple AIFF	

3.1.5. CRMP_SOUND_LIBRARY_SEL_MODE

typedef enum for selection modes of sound library files.

code	description	
CRMP_SOUND_LIBRARY_SEL_MODE_NORMAL	Default mode	

3.2. Typedefs

3.2.1. CRMP_HANDLE

Handle for controlling this library.

3.2.2. CRMP_CALLBACK

Callback function type for sending information from this library to the user application. Please refer to section 3.5 Callback (CRMP_CALLBACK).

callback ()			
	Input:	*CRMP_HANDLE handle*	*Effective handle of the library*
		CRMP_CALLBACK_TYPE type	*Callback type*
		*void *data*	*Pointer of the data*
		*void *user*	*Pointer of the specified user area*
	Output:	*void*	

3.2.3. CRMP_CALLBACK_BOUNCE

Callback function type for displaying progress on exporting wave files. This callback will be used on calling the API "bounce" described on section 3.4.20.

CRMP_CALLBACK_BOUNCE ()			
	Input:	*int percent*	*Progress value (%)*
		*void *user*	*Pointer to the specified user area*
	Output:	*int*	*0: Continue* *1: Cancel exporting*

3.2.4. CRMP_LOAD

Function type for Geting the API table（CRMP_FUNC）.

3.3. Structures

3.3.1. CRMP_FUNC

Structure for API table. Please refer to section 3.4 API.

3.3.2. CRMP_SOUND_LIBRARY

Structure for specifying the sound library file.

```
typedef struct {
        int index; /* Index for the sound library file */
        LPCTSTR path; /* Full path of the sound library file */
} CRMP_SOUND_LIBRARY;
```

3.3.3. CRMP_SOUND_LIBRARY_MEMORY

Structure for specifying the sound library file mapped on the memory.

```
typedef struct {
        int index; /* Index for the sound library file */
        char *address; /* Memory address for the mapped sound library file */
        unsigned long *size; /* Size of the sound library file [Byte] */
} CRMP_SOUND_LIBRARY_MEMORY;
```

3.3.4. CRMP_SOUND_LIBRARY_SEL

Structure for specifying details of referring the sound library files.

```
typedef struct {
        int module; /* Module index (0, 1, ...) */
        int part; /* Part index (0, 1, ..., 15) */
        int index; /* Index of the sound library file */
        CRMP_SOUND_LIBRARY_SEL_MODE mode; /*  selection modes (section 3.1.5) */
} CRMP_SOUND_LIBRARY_SEL;
```

3.4. API

3.4.1. initialize

CRMP_ERR initialize ()		
Input:		
	*CRMP_HANDLE *handle*	*Pointer of the handle (!= NULL)*
	CRMP_CALLBACK callback	*Pointer of the callback function*
	*void *user*	*Pointer of the user area for callback*
	*void *target*	*Target independent data*
	*const unsigned char *key*	*Key code*
Output:		
	Error code	

Initialize the library and Synthesizer Engine Library.

Synthesizer Engine Library loads the default sound library (from own resource, or from the defined path) to index #0.

Before using the library, the application have to call the on of initialize* () functions.

The application have to set 64 byte key code to the argument "key".

This functions requires the fixed processing time because of loading the sound library.

The application have to set the following values to argument "target"

- Win: The handle of the parent window (HWND)
- Other OS: NULL

3.4.2. initializeWithSoundLib

CRMP_ERR initializeWithSoundLib ()		
Input:		
	*CRMP_HANDLE *handle*	*Pointer of the handle (!= NULL)*
	CRMP_CALLBACK callback	*Pointer of the callback function*
	*void *user*	*Pointer of the user area for callback*
	LPCTSTR libraryPath	*Full path of the sound library file*
	*void *target*	*Target independent data*

	*const unsigned char *key*	*Key code*
Output:		
	Error code	

Initialize the library and Synthesizer Engine Library.

Synthesizer Engine Library loads the sound library file on the specified path to index #0.

3.4.3. initializeWithSoundLibMemory

CRMP_ERR initializeWithSoundLibMemory ()

Input:		
	*CRMP_HANDLE *handle*	*Pointer of the handle (!= NULL)*
	CRMP_CALLBACK callback	*Pointer of the callback function*
	*void *user*	*Pointer of the user area for callback*
	*char *libraryAddress*	*Address of the mapped sound library*
	unsigned long librarySize	*Size of the sound library file [Byte]*
	*void *target*	*Target independent data*
	*const unsigned char *key*	*Key code*
Output:		
	Error code	

Initialize the library and Synthesizer Engine Library.

Synthesizer Engine Library loads the sound library file on the specified memory to index #0.

3.4.4. exit

CRMP_ERR exit ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*

Output:

Error code

Finalize the library.

The application have to call this function before termination. If the library is playing, the application have to stop playback before calling this function.

3.4.5. getNumDrivers

int getNumDrivers ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*

Output:

The number of supported drivers.

Get the number of wave output drivers supported by the library.

3.4.6. getNumDevices

int getNumDevices ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*
LPCTSTR driver	*Name of wave output driver*

Output:

The number of available wave output devices

Get the number of available wave output devices in the specified wave output driver.

3.4.7. getDriverName

LPCTSTR getDriverName ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*
int index	*Index for the wave output driver*

Output:

Name of the specified wave output driver

Get the name of the specified wave output driver.

3.4.8. getDeviceName

LPCTSTR getDeviceName ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*
LPCTSTR driver	*Name of the wave output driver*
int index	*Index for the wave output device*

Output:

Name of the specified wave output device

Get the name of the specified wave output device.

3.4.9. showDeviceControlPanel

void showDeviceControlPanel ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*
LPCTSTR driver	*Name of the wave output driver*
LPCTSTR device	*Name of the wave output device*

Display the control panes of the specified wave output device

3.4.10. open

CRMP_ERR open ()

Input:

	CRMP_HANDLE handle	*Effective handle of the library*
	LPCTSTR driver	*Name of the wave output driver*
	LPCTSTR device	*Name of the wave output device*
Output:		
	Error code	

Open the specified wave output device. If the argument "driver" and "device" is NULL, default wave output driver and device will be selected automatically.

3.4.11. close

CRMP_ERR close ()		
Input:		
	CRMP_HANDLE handle	*Effective handle of the library*
Output:		
	Error code	

Close the wave output device.

3.4.12. setFile

CRMP_ERR setFile ()		
Input:		
	CRMP_HANDLE handle	*Effective handle of the library*
	LPCTSTR path	*Full path of the MIDI file*
Output:		
	Error code	

Specify the MIDI sequence file with file path. See **2.2 Inputs** for available file formats.

3.4.13. setFileMemory

CRMP_ERR setFileMemory ()		
Input:		
	CRMP_HANDLE handle	*Effective handle of the library*
	*char *address*	*Memory address for the mapped MIDI file*
	long size	*Size of the MIDI file [byte]*
Output:		
	Error code	

Specify the MIDI sequence file mapped on the memory controlled by the application.

3.4.14. getFileMemory

CRMP_ERR getFileMemory ()		
Input:		
	CRMP_HANDLE handle	*Effective handle of the library*
	*char **address*	*Pointer of the memory address*
	*long *size*	*Pointer of the file size [byte]*
Output:		
	Error code	

Get the memory address and size used for loading MIDI file. This memory is controlled by the library.

3.4.15. getFileInfo

CRMP_ERR getFileInfo ()		
Input:		
	CRMP_HANDLE handle	*Effective handle of the library*
	*int *format*	*Pointer of the MIDI file format*
	*unsigned short *division*	*Pointer of the MIDI file division [TPQN]*
	*unsigned long *totaltick*	*Pointer of the number of tick*
	*unsigned long *totaltime*	*Pointer of the length [s]*
Output:		
	Error code	

Get information of the specified MIDI sequence file.

3.4.16. start

CRMP_ERR start ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*

Output:

Error code

Start playback of the specified MIDI file from current song position.

3.4.17. stop

CRMP_ERR stop ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*

Output:

Error code

Stop playback of the specified MIDI file.

Calling this function means the application instructs the start of fade out process, and the playback still alive. The application has to detect the completion of the playback by the callback function described later.

Current song position will be saved after calling this function.

3.4.18. seek

CRMP_ERR seek ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*
unsigned long tick	*Song Position [MIDI tick]*

Output:

Error code

Specify song position.

3.4.19. isPlaying

int isPlaying ()

Input:

CRMP_HANDLE handle	*Effective handle of the library*

Output:

1: playing

0: not playing

Get the flag for the library is playing the MIDI file, or not.

3.4.20. bounce

CRMP_ERR bounce ()		
Input:		
	CRMP_HANDLE handle	*Effective handle of the library*
	LPCTSTR path	*Full path of the output file*
	CRMP_WAVE_FILE type	*Output file type*
	CRMP_CALLBACK_EXPORT callback	*Callback function*
	*void *user*	*User parameter for the callback*
Outpu:		
	Error code	

Outputs the result of the specified MIDI file to the wave file. This function can not be used when normal playback process is effective. (Started with 3.4.16 start)

3.4.21. ctrl

CRMP_ERR ctrl ()		
Input:		
	CRMP_HANDLE handle	*Effective handle of the library*
	CRMP_CTRL ctrl	*Control target*
	*void *data*	*Address of data*
	int size	*Size of data [byte]*
Output:		
	Error code	

Do various operations.

ctrl	data		description
	type	I/O	
CRMP_CTRL_SET_MASTER_VOLUME	int	I	Set playback volume (CRMP_VOLUME_MIN ~ CRMP_VOLUME_MAX). The default value is CRMP_VOLUME_DEF.
CRMP_CTRL_GET_MASTER_VOLUME	int	O	Get playback volume
CRMP_CTRL_SET_MASTER_KEY	int	I	Set playback key (CRMP_KEY_MIN ~ CRMP_KEY_MAX). The unit of the values is 100[cent], and the default value is CRMP_KEY_DEF. This value is not cleared on the end of the playback.
CRMP_CTRL_GET_MASTER_KEY	int	O	Get playback key.
CRMP_CTRL_SET_MASTER_TUNE	int	I	Set fine tuning (CRMP_TUNE_MIN ~ CRMP_TUNE_MAX). The unit of the values is 1[cent], and the default value is CRMP_TUNE_DEF. This value is not cleared on the end of the playback.
CRMP_CTRL_GET_MASTER_TUNE	int	O	Get fint tuning.
CRMP_CTRL_SET_SPEED	int	I	Set playback speed. (CRMP_SPEED_MIN ~ CRMP_SPEED_MAX). The unit of the value is 1[%], and the default value is CRMP_SPEED_DEF. This value is not cleared on the end of the playback.
CRMP_CTRL_GET_SPEED	int	O	Get playback speed.

ctrl	data		description
	type	I/O	
CRMP_CTRL_SET_GUIDE	int	I	Set guide melody playback volume (CRMP_GUIDE_MIN ~ CRMP_GUIDE_MAX). The default value is CRMP_GUIDE_DEF. This value is not cleared on the end of the playback.
CRMP_CTRL_GET_GUIDE	int	O	Get guide melody playback volume.
CRMP_CTRL_SET_GUIDE_MAIN_CH	int	I	Set target of guide melody control. -1: off 0: MIDI port A, MIDI channel 1 1: MIDI port A, MIDI channel 2 … 15: MIDI port A, MIDI channel 16 16: MIDI port B, MIDI channel 1 …
CRMP_CTRL_GET_GUIDE_MAIN_CH	int	O	Get target of guide melody control
CRMP_CTRL_SET_GUIDE_SUB _CH	int	I	Same as CRMP_CTRL_SET_GUIDE_MAIN_CH
CRMP_CTRL_GET_GUIDE_SUB _CH	int	O	Same as CRMP_CTRL_SET_GUIDE_MAIN_CH

ctrl	data		description
	type	I/O	
CRMP_CTRL_SET_REVERB	*int*	I	Set effectiveness of reverb. This value is not cleared on the end of the playback.
CRMP_CTRL_GET_REVERB	*int*	O	Get effectiveness of reverb
CRMP_CTRL_GET_REVERB _AVAILABLE	*int*	O	Get availability of reverb
CRMP_CTRL_SET_CHORUS	*int*	I	Set effectiveness of chorus. This value is not cleared on the end of the playback.
CRMP_CTRL_GET_CHORUS	*int*	O	Get effectiveness of chorus
CRMP_CTRL_GET_CHORUS _AVAILABLE	*int*	O	Get availability of chorus
CRMP_CTRL_SET_DELAY	*int*	I	Set effectiveness of delay. This value is not cleared on the end of the playback.
CRMP_CTRL_GET_DELAY	*int*	O	Get effectiveness of delay
CRMP_CTRL_GET_DELAY _AVAILABLE	*int*	O	Get availability of delay

ctrl	data		description
	type	I/O	
CRMP_CTRL_SET_SAMPLE_RATE	unsigned long	I	Set playback sample rate [Hz]
CRMP_CTRL_GET_SAMPLE_RATE	unsigned long	O	Get playback sample rate [Hz]
CRMP_CTRL_SET_BLOCK_SIZE	long	I	Set frame size [sample] of wave output.
CRMP_CTRL_GET_BLOCK_SIZE	long	O	Get frame size [sample] of wave output.
CRMP_CTRL_SET_CHANNELS	int	I	Not supported
CRMP_CTRL_GET_CHANNELS	int	O	Get number of output channels
CRMP_CTRL_SET_POLY	int	I	Set polyphonic number of synthesizer
CRMP_CTRL_GET_POLY	int	O	Get polyphonic number of synthesizer

ctrl	data		description
	type	I/O	
CRMP_CTRL_GET_SOUND_LIBRARY_NUM	int	O	Get number of the slots for sound libraries
CRMP_CTRL_SET_SOUND_LIBRARY	CRMP_SOUND_LIBRARY	I	Set sound library with file path
CRMP_CTRL_SET_SOUND_LIBRARY_MEMORY	CRMP_SOUND_LIBRARY_MEMORY	I	Set sound library with memory
CRMP_CTRL_SET_SOUND_LIBRARY_SEL	CRMP_SOUND_LIBRARY_SEL	I	Set selection mode for the loaded sound library
CRMP_CTRL_GET_SOUND_LIBRARY_SEL	CRMP_SOUND_LIBRARY_SEL	I/O	Get selection mode for the loaded sound library
CRMP_CTRL_INIT_EXPORT	long	I	Initialize EXPORT processing
CRMP_CTRL_GET_EXPORT_BUFFER		I/O	Get status and buffer of EXPORT processing

ctrl	data		description
	type	I/O	
CRMP_CTRL_GET_INSTRUMENT_NAME ~ CRMP_CTRL_GET_INSTRUMENT_NAME + 15	char (TCHAR)	O	Get instrument name of the specified part (Ch1~16)
CRMP_CTRL_SET_MUTE ~ CRMP_CTRL_SET_MUTE + 15	int	I	Set mute (0: Off, 1: On) to the specified part (Ch1~16)
CRMP_CTRL_GET_MUTE ~ CRMP_CTRL_GET_MUTE + 15	int	O	Get mute (0: Off, 1: On) of the specified part (Ch1~16)
CRMP_CTRL_SET_SOLO ~ CRMP_CTRL_SET_SOLO + 15	int	I	Set solo (0: Off, 1: On) to the specified part (Ch1~16)
CRMP_CTRL_GET_SOLO ~ CRMP_CTRL_GET_SOLO + 15	int	O	Get solo (0: Off, 1: On) of the specified part (Ch1~16)

3.4.22. version

void version ()		
Input:		
	CRMP_HANDLE handle	*Effective handle of the library*
	LPTSTR engine	*Version of Synthesizer Engine Library*
	int engineSize	*Length of engine*
	LPTSTR player	*Version of MIDI Player Library*
	int playerSize	*Length of player*

Get the name of MIDI Player Library and Synthesizer Engine Library.

3.5. Callback (CRMP_CALLBACK)

Callback function provides various information to the application. It is specified on 3.4.1 initialize, with function type defined in section 3.2.2 CRMP_CALLBACK.

This callback is not called on processing the function 3.4.20 bounce.

Each callback is called from calculation thread of synthesizer. So the application can not spend long duration on receiving them.

3.5.1. Open

type = CRMP_CALLBACK_TYPE_OPEN, data = Not used

Wave output driver has been opened

3.5.2. Close

type = CRMP_CALLBACK_TYPE_CLOSE, data = Not used

Wave output driver has been closed

3.5.3. Start

type = CRMP_CALLBACK_TYPE_START, data = Not used

Playback has been started

3.5.4. Stop

*type = CRMP_CALLBACK_TYPE_STOP, data = (unsigned long *) errorcode*

Playback has beed stopeed.

errorcode:

0 : Normal

CRMP_ERR_AUDIO_DRIVER : Error stop by wave output driver

CRMP_ERR_DATA : Error stop by data

3.5.5. Seek

type = CRMP_CALLBACK_TYPE_SEEK, data = Not used

Playback song position has been changed

3.5.6. MIDI Clock

type = CRMP_CALLBACK_TYPE_CLOCK, data = Not used

Standard MIDI clock (24[TPQN])

3.5.7. Tempo

*type = CRMP_CALLBACK_TYPE_TEMPO, data = (unsigned long *) tempo*

Playback tempo has been changed ([usec/beat])

3.5.8. Time Signature

*type = CRMP_CALLBACK_TYPE_TIME_SIGNATURE, data = (unsigned long *) timeSignature*

Playback time signature（nn/dd/cc/bb）has been changed.

3.5.9. Channel Message

*type = CRMP_CALLBACK_TYPE_CHANNEL_MESSAGE, data = (unsigned long *) data*

Channel message has been sent by player

bit 31-24: MIDI Port (0x00 ~)

bit 23 - 16: Status Byte (0x90 ~ 0xEF)

bit 15 – 8 : First Data (0x00 ~ 0x7F)

bit 7 – 0 : Second Data (0x00 ~ 0x7F)

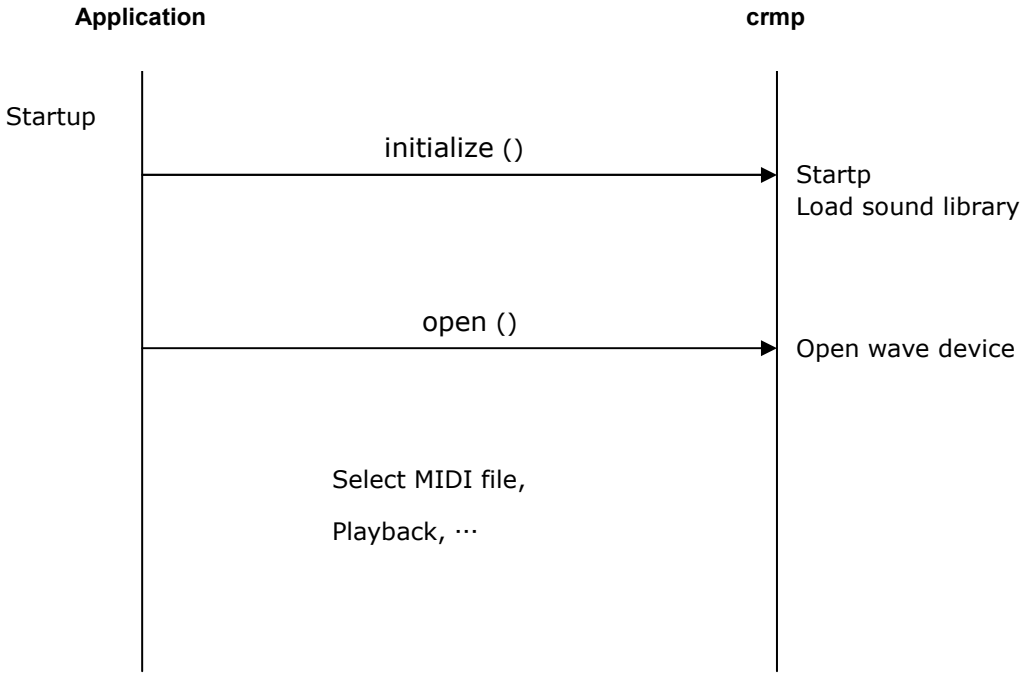
3.5.10. System Exclusive Message

type = CRMP_CALLBACK_TYPE_SYSTEM_EXCLUSIVE_MESSAGE, data = Not used

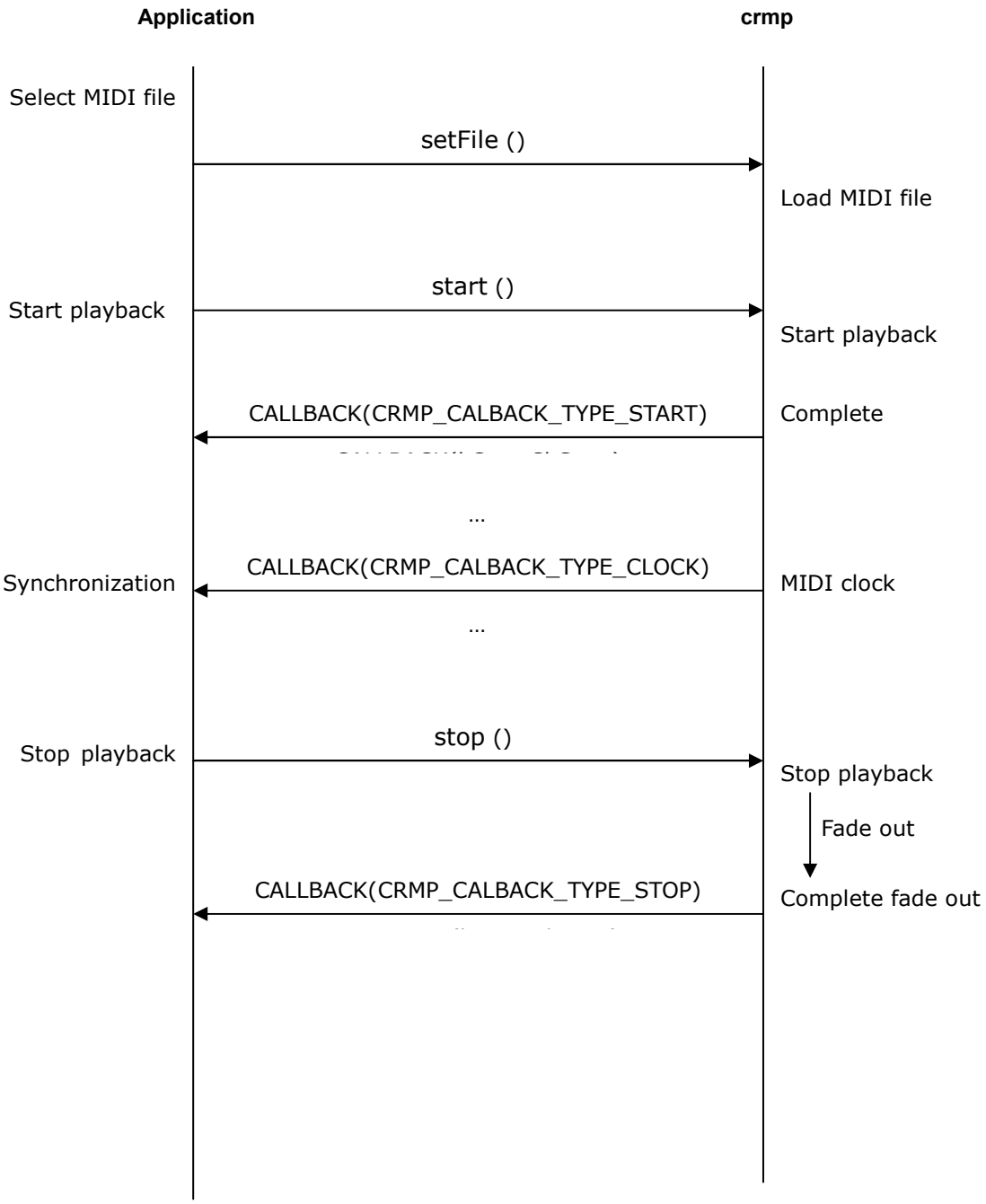
System exclusive message has been sent by player.

3.6. Sequences

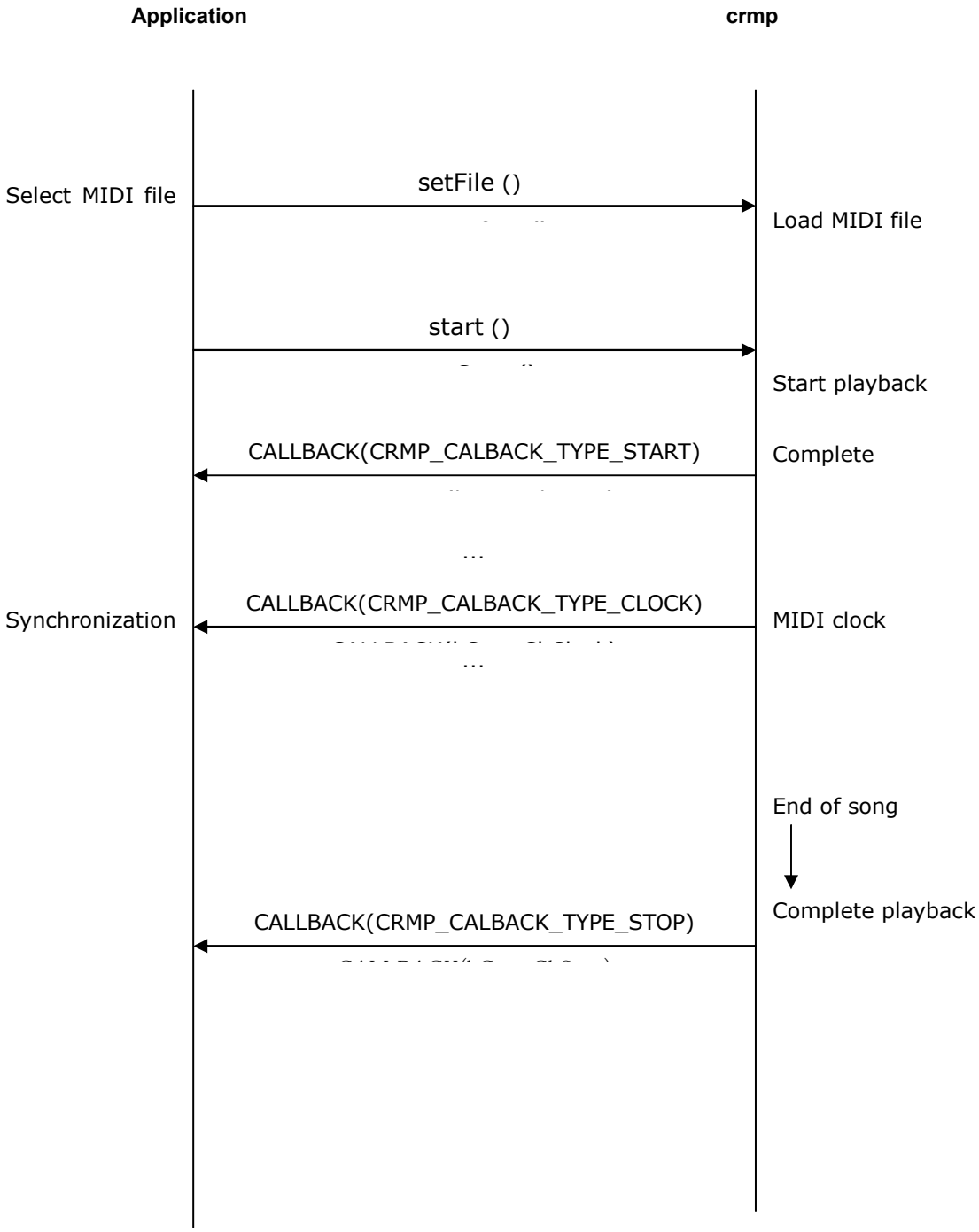
3.6.1. Initialization



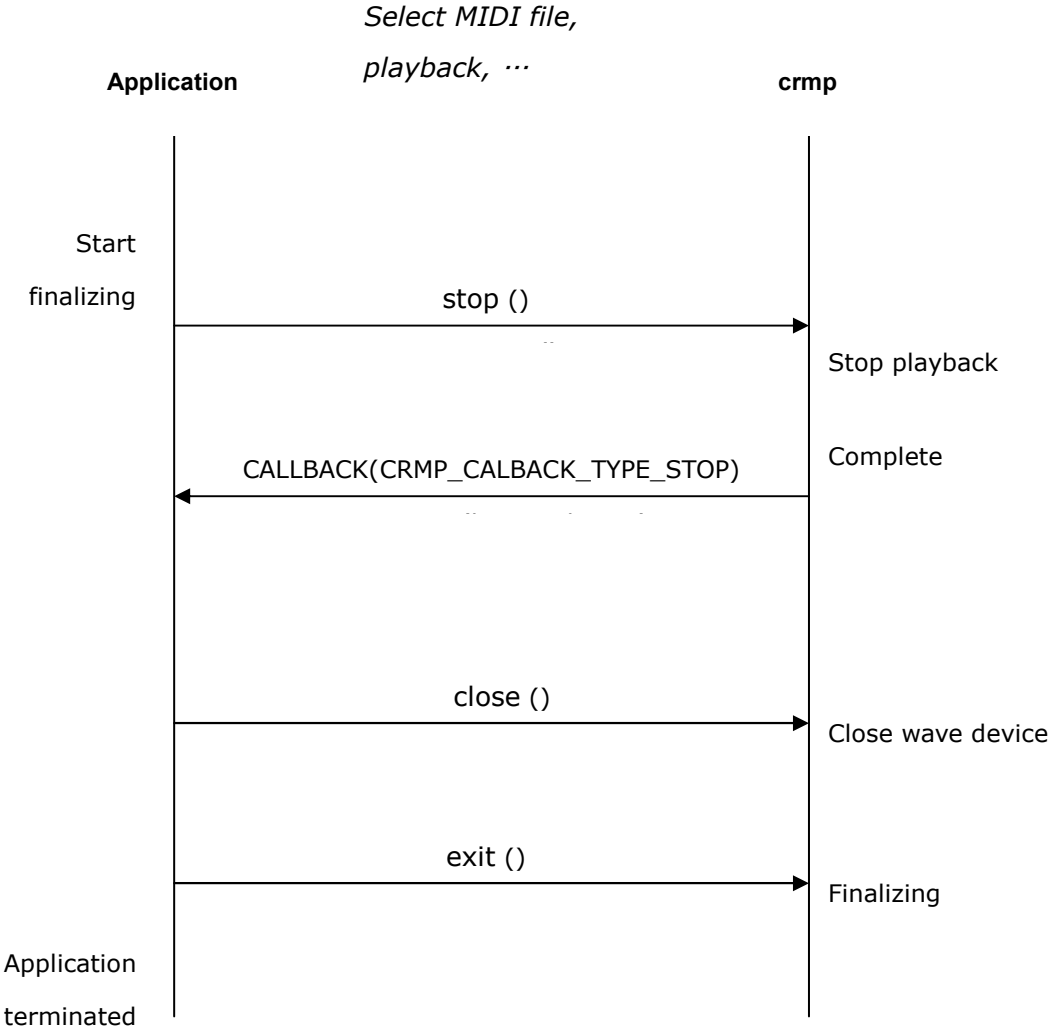
3.6.2. Specifying the MIDI Files - Start Playback – Stop by User



3.6.3. Specifying the MIDI File – Start Playback - End of the Song



3.6.4. Finalizing



4. MIDI Driver Library Specification

4.1. Constants

4.1.1. CRMD_ERR

typedef enum for result code.

code	内容	
CRMD_OK	Success	
CRMD_ERR_PROTECTION	Protection error	
CRMD_ERR_INVALID_HANDLE	Invalid handle error	
CRMD_ERR_FILE	File error	
CRMD_ERR_MEMORY	Memory error	
CRMD_ERR_RESOURCE	Resource error	
CRMD_ERR_PARAM	Parameter error	
CRMD_ERR_AUDIO_DRIVER	Wave output error	
CRMD_ERR_DATA	Data error	
CRMD_ERR_MODULE	External module error	
CRMD_ERR_NOT_SUPPORTED	Unsupported error	
CRMD_ERR_UNDEFINED	Undefined	

4.1.2. CRMD_CTRL

Typede enum for control API. Please refer to section 4.4.25 ctrl.

4.1.3. CRMD_CALLBACK_TYPE

Typedef enum for callback types. Please refer to section 4.5 Callback (CRMD_CALLBACK).

4.1.4. CRMD_SOUND_LIBRARY_SEL_MODE

typedef enum for selection modes of sound library files.

code	内容	
CRMD_SOUND_LIBRARY_SEL_MODE_NORMAL	Default mode	

4.2. Typedefs

4.2.1. CRMD_HANDLE

Handle for controlling this library.

4.2.2. CRMD_CALLBACK

Callback function type for sending information from this library to the user application. Please refer to section 4.5 Callback (CRMD_CALLBACK).

CRMD_CALLBACK ()		
Input:	*CRMD_HANDLE handle*	*Effective handle of the library*
	CRMD_CALLBACK_TYPE type	*Callback type*
	*void *data*	*Pointer of the data*
	*void *user*	*Pointer of the specified user area*
Output:	*void*	

4.2.3. CRMD_LOAD

Function type for Geting the API table(CRMP_FUNC).

4.3. Structures

4.3.1. CRMD_FUNC

Structure for API table. Please refer to section 4.4 API.

4.3.2. CRMD_SOUND_LIBRARY

Structure for specifying the sound library file.

```
typedef struct {
        int index; /* Index for the sound library file */
        LPCTSTR path; /* Full path of the sound library file */
} CRMD_SOUND_LIBRARY;
```

4.3.3. CRMD_SOUND_LIBRARY_MEMORY

Structure for specifying the sound library file mapped on the memory.

```
typedef struct {
        int index; /* Index for the sound library file */
        char *address; /* Memory address for the mapped sound library file */
        unsigned long *size; /* Size of the sound library file [Byte] */
} CRMD_SOUND_LIBRARY_MEMORY;
```

4.3.4. CRMD_SOUND_LIBRARY_SEL

Structure to specify relationship between each part and sound library files.

```
typedef struct {
        int module; /* Module index (0, 1, ...) */
        int part; /* Part index (0, 1, ..., 15) */
        int index; /* Index of the sound library file */
        CRMD_SOUND_LIBRARY_SEL_MODE mode; /* selection modes (section 4.1.4) */
} CRMD_SOUND_LIBRARY_SEL;
```

4.3.5. CRMD_FRAME

Structure for callback (CRMD_CALLBACK_TYPE_FRAME)

```
typedef struct {
        long sampleFrames; /* audio frame length [sample] */
        void *data; /* buffer for output audio (Signed 16bit, 2ch interleaved) */
} CRMD_FRAME;
```

4.4. API

4.4.1. initialize

CRMD_ERR initialize ()		
Input:		
	*CRMD_HANDLE *handle*	*Pointer of the handle (!= NULL)*
	CRMD_CALLBACK callback	*Pointer of the callback function*
	*void *user*	*Pointer of the user area for callback*
	*void *target*	*Target independent data*
	*const unsigned char *key*	*Key code*
Output:		
	Error code	

Initialize the library and Synthesizer Engine Library.

Synthesizer Engine Library loads the default sound library (from own resource, or from the defined path) to index #0.

Before using the library, the application have to call the on of initialize* () functions.

The application have to set 64 byte key code to the argument "key".

This functions requires the fixed processing time because of loading the sound library.

The application have to set the following values to argument "target"

- Win/WinCE: The handle of the parent window (HWND)
- Other OS: NULL

4.4.2. initializeWithSoundLib

CRMD_ERR initializeWithSoundLib ()		
Input:		
	*CRMD_HANDLE *handle*	*Pointer of the handle (!= NULL)*
	CRMD_CALLBACK callback	*Pointer of the callback function*
	*void *user*	*Pointer of the user area for callback*
	LPCTSTR libraryPath	*Full path of the sound library file*
	*void *target*	*Target independent data*

	*const unsigned char *key*	*Key code*
Output:		
	Error code	

Initialize the library and Synthesizer Engine Library.

Synthesizer Engine Library loads the sound library file on the specified path to index #0.

4.4.3. initializeWithSoundLibMemory

CRMD_ERR initializeWithSoundLibMemory ()		
Input:		
	*CRMD_HANDLE *handle*	*Pointer of the handle (!= NULL)*
	CRMD_CALLBACK callback	*Pointer of the callback function*
	*void *user*	*Pointer of the user area for callback*
	*char *libraryAddress*	*Address of the mapped sound library*
	unsigned long librarySize	*Size of the sound library file [Byte]*
	*void *target*	*Target independent data*
	*const unsigned char *key*	*Key code*
Output:		
	Error code	

Initialize the library and Synthesizer Engine Library.

Synthesizer Engine Library loads the sound library file on the specified memory to index #0.

4.4.4. exit

CRMD_ERR exit ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*

Output:

Error code

Finalize the library.

The application have to call this function before termination. If the library is playing, the application have to stop playback before calling this function.

4.4.5. getNumDrivers

int getNumDrivers ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*

Output:

The number of supported drivers.

Get the number of wave output drivers supported by the library.

4.4.6. getNumDevices

int getNumDevices ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*
LPCTSTR driver	*Name of wave output driver*

Output:

The number of available wave output devices

Get the number of available wave output devices in the specified wave output driver.

4.4.7. getDriverName

LPCTSTR getDriverName ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*
int index	*Index for the wave output driver*

Output:

Name of the specified wave output driver

Get the name of the specified wave output driver.

4.4.8. getDeviceName

LPCTSTR getDeviceName ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*
LPCTSTR driver	*Name of the wave output driver*
int index	*Index for the wave output device*

Output:

Name of the specified wave output device

Get the name of the specified wave output device.

4.4.9. showDeviceControlPanel

void showDeviceControlPanel ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*
LPCTSTR driver	*Name of the wave output driver*
LPCTSTR device	*Name of the wave output device*

Display the control panes of the specified wave output device

4.4.10. open

CRMD_ERR open ()

Input:

	CRMD_HANDLE handle	*Effective handle of the library*
	LPCTSTR driver	*Name of the wave output driver*
	LPCTSTR device	*Name of the wave output device*
Output:		
	Error code	

Open the specified wave output device. If the argument "driver" and "device" is NULL, default wave output driver and device will be selected automatically.

4.4.11. close

CRMD_ERR close ()

Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
Output:		
	Error code	

Close the wave output device.

4.4.12. start

CRMD_ERR start ()

Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
Output:		
	Error code	

Start Real-time MIDI function.

4.4.13. stop

CRMD_ERR stop ()

Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
Output:		

	Error code	

Stop Real-time MIDI function.

4.4.14. isPlaying

int isPlaying ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
Output:		
	1: playing	
	0: not playing	

Get the flag for the library's Real-time function is enabled, or not.

4.4.15. setChannelMessage

void setChannelMessage ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
	unsigned char port	*MIDI Port (0 = A, 1 = B, ...)*
	unsigned char status	*MIDI Status (0x80～0xEF)*
	unsigned char data1	*1st data (0x00～0x7F)*
	unsigned char data2	*2nd data (0x00～0x7F)*

Set MIDI channel message.

4.4.16. setSystemExclusiveMessage

void setSystemExclusiveMessage ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
	unsigned char port	*MIDI Port (0 = A, 1 = B, ...)*
	unsigned char status	*MIDI Status (0xF0)*
	*unsigned char *data*	*Address of data array*

int size	*Length of data [byte]*

Set MIDI system exclusive message.

4.4.17. setFile

CRMD_ERR setFile ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
	LPCTSTR path	*Full path of the MIDI file*
Output:		
	Error code	

Specify the MIDI sequence file with file path. See **2.2 Inputs** for available file formats.

4.4.18. setFileMemory

CRMD_ERR setFileMemory ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
	*char *address*	*Memory address for the mapped MIDI file*
	long size	*Size of the MIDI file [byte]*
Output:		
	Error code	

Specify the MIDI sequence file mapped on the memory controlled by the application.

4.4.19. getFileMemory

CRMD_ERR getFileMemory ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
	*char **address*	*Pointer of the memory address*
	*long *size*	*Pointer of the file size [byte]*
Output:		
	Error code	

Get the memory address and size used for loading MIDI file. This memory is controlled by the library.

4.4.20. getFileInfo

CRMD_ERR getFileInfo ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
	*int *format*	*Pointer of the MIDI file format*
	*unsigned short *division*	*Pointer of the MIDI file division [TPQN]*
	*unsigned long *totaltick*	*Pointer of the number of tick*
	*unsigned long *totaltime*	*Pointer of the length [s]*
Output:		
	Error code	

Get information of the specified MIDI sequence file.

4.4.21. startFilePlay

CRMD_ERR startFilePlay ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*

Output:

Error code

Start playback of the specified MIDI file from current song position.

4.4.22. stopFilePlay

CRMD_ERR stopFilePlay ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*

Output:

Error code

Stop playback of the specified MIDI file.

Calling this function means the application instructs the start of fade out process, and the playback still alive. The application has to detect the completion of the playback by the callback function described later.

Current song position will be saved after calling this function.

4.4.23. seekFilePlay

CRMD_ERR seekFilePlay ()

Input:

CRMD_HANDLE handle	*Effective handle of the library*
unsigned long tick	*Song position [MIDI tick]*

Output:

Error code

Specify song position.

4.4.24. isFilePlaying

int isFilePlaying ()

Input:

CRMD_HANDLE handle *Effective handle of the library*

Output:

1: playing

0: not playing

Get the flag for the library is playing the MIDI file, or not.

4.4.25. ctrl

CRMD_ERR ctrl ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
	CRMD_CTRL ctrl	*Control target*
	*void *data*	*Address of data*
	int size	*Size of data [byte]*
Output:		
	Error code	

Do various operations.

ctrl	data		description
	type	I/O	
CRMD_CTRL_SET_SAMPLE_RATE	unsigned long	I	Set playback sample rate [Hz]
CRMD_CTRL_GET_SAMPLE_RATE	unsigned long	O	Get playback sample rate [Hz]
CRMD_CTRL_SET_CHANNELS	int	I	Not supported
CRMD_CTRL_GET_CHANNELS	int	O	Get number of output channels
CRMD_CTRL_SET_BLOCK_SIZE	long	I	Set frame size [sample] of wave output. This value affects the latency of Real-time MIDI function. In ASIO / AudioUnit drives, this value is overwrote by the device drivers. So the applications have to get this value after calling open in section 3.4.10, using CRMD_CTRL_GET_BLOCK_SIZE.
CRMD_CTRL_GET_BLOCK_SIZE	long	O	Get frame size [sample] of wave output.
CRMD_CTRL_SET_BUFFERS	int	I	Set number of frames for wave output. This value affects the latency of Real-time MIDI function. In ASIO / AudioUnit drivers, this value is fixed (= 1).
CRMD_CTRL_GET_BUFFERS	int	O	Get number of frames for wave output.
CRMD_CTRL_SET_POLY	int	I	Set polyphonic number of synthesizer
CRMD_CTRL_GET_POLY	int	O	Get polyphonic number of synthesizer

ctrl	data		description
	type	I/O	
CRMD_CTRL_SET_MASTER_VOLUME	int	I	Set playback volume (CRMP_VOLUME_MIN ~ CRMP_VOLUME_MAX). The default value is CRMP_VOLUME_DEF.
CRMD_CTRL_GET_MASTER_VOLUME	int	O	Get playback volume

ctrl	data		description
	Type	I/O	
CRMD_CTRL_SET_REVERB	*int*	I	Set effectiveness of reverb. This value is not cleared on the end of the playback.
CRMD_CTRL_GET_REVERB	*int*	O	Get effectiveness of reverb
CRMD_CTRL_GET_REVERB _AVAILABLE	*int*	O	Get availability of reverb
CRMD_CTRL_SET_CHORUS	*int*	I	Set effectiveness of chorus. This value is not cleared on the end of the playback.
CRMD_CTRL_GET_CHORUS	*int*	O	Get effectiveness of chorus
CRMD_CTRL_GET_CHORUS _AVAILABLE	*int*	O	Get availability of chorus
CRMD_CTRL_SET_DELAY	*int*	I	Set effectiveness of delay. This value is not cleared on the end of the playback.
CRMD_CTRL_GET_DELAY	*int*	O	Get effectiveness of delay
CRMD_CTRL_GET_DELAY _AVAILABLE	*int*	O	Get availability of delay

ctrl	data		description
	type	I/O	
CRMD_CTRL_GET_SOUND_LIBRARY_NUM	int	O	Get number of the slots for sound libraries
CRMD_CTRL_SET_SOUND_LIBRARY	CRMD_SOUND_LIBRARY	I	Set sound library with file path
CRMD_CTRL_SET_SOUND_LIBRARY_MEMORY	CRMD_SOUND_LIBRARY_MEMORY	I	Set sound library with memory
CRMD_CTRL_SET_SOUND_LIBRARY_SEL	CRMD_SOUND_LIBRARY_SEL	I	Set selection mode for the loaded sound library
CRMD_CTRL_GET_SOUND_LIBRARY_SEL	CRMD_SOUND_LIBRARY_SEL	I/O	Get selection mode for the loaded sound library

ctrl	data		description
	type	I/O	
CRMD_CTRL_GET_INSTRUMENT_NAME ~ CRMD_CTRL_GET_INSTRUMENT_NAME + 15	char (TCHAR)	O	Get instrument name of the specified part (Ch1~16)
CRMD_CTRL_SET_MUTE ~ CRMD_CTRL_SET_MUTE + 15	int	I	Set mute (0: Off, 1: On) to the specified part (Ch1~16)
CRMD_CTRL_GET_MUTE ~ CRMD_CTRL_GET_MUTE + 15	int	O	Get mute (0: Off, 1: On) of the specified part (Ch1~16)
CRMD_CTRL_SET_SOLO ~ CRMD_CTRL_SET_SOLO + 15	int	I	Set solo (0: Off, 1: On) to the specified part (Ch1~16)
CRMD_CTRL_GET_SOLO ~ CRMD_CTRL_GET_SOLO + 15	int	O	Get solo (0: Off, 1: On) of the specified part (Ch1~16)

4.4.26. version

void version ()		
Input:		
	CRMD_HANDLE handle	*Effective handle of the library*
	LPTSTR engine	*Version of Synthesizer Engine Library*
	int engineSize	*Length of engine*
	LPTSTR driver	*Version of MIDI Driver Library*
	int driverSize	*Length of driver*
Output:		
	void	

Get the name of MIDI Driver Library and Synthesizer Engine Library.

4.5. Callback (CRMD_CALLBACK)

Callback function provides various information to the application. It is specified on 4.4.1 initialize, with function type defined in section 4.2.2. CRMD_CALLBACK.
Each callback is called from calculation thread of synthesizer. So the application can not spend long duration on receiving them.

4.5.1. Open

type = CRMD_CALLBACK_TYPE_OPEN, data = Not used

Wave output driver has been opened

4.5.2. Close

type = CRMD_CALLBACK_TYPE_CLOSE, data = Not used

Wave output driver has been closed

4.5.3. Start

type = CRMD_CALLBACK_TYPE_START, data = Not used

Real-time MIDI function has been started

4.5.4. Stop

type = CRMD_CALLBACK_TYPE_STOP, data = Not used

Real-time MIDI function has been stopped

4.5.5. Audio Frame

*type = CRMD_CALLBACK_TYPE_FRAME, data = (CRMD_FRAME *) frameData*

Called on every frames of wave output process

4.5.6. File Start

type = CRMD_CALLBACK_TYPE_FILE_START, data = Not used

Playback has been started

4.5.7. File Stop

*type = CRMD_CALLBACK_TYPE_FILE_STOP, data = (unsigned long *) errorcode*

Playback has been stopped

errorcode:

0 : Normal

CRMD_ERR_AUDIO_DRIVER : Error stop by wave output driver

CRMD_ERR_DATA : Error stop by data

4.5.8. File Seek

type = CRMP_CALLBACK_TYPE_FILE_SEEK, data = 未使用

Playback song position has been changed.

4.5.9. MIDI Clock

type = CRMP_CALLBACK_TYPE_CLOCK, data = 未使用

Standard MIDI clock (24[TPQN])

4.5.10. Tempo

*type = CRMP_CALLBACK_TYPE_TEMPO, data = (unsigned long *) tempo*

Playback tempo has been changed ([usec/beat])

4.5.11. Time Signature

*type = CRMP_CALLBACK_TYPE_TIME_SIGNATURE, data = (unsigned long *) timeSignature*

Playback time signature（nn/dd/cc/bb）has been changed.

4.5.12. Channel Message

*type = CRMP_CALLBACK_TYPE_CHANNEL_MESSAGE, data = (unsigned long *) data*

Channel message has been sent by player

bit 31-24: MIDI Port (0x00 ~)

bit 23 - 16: Status byte (0x90 ~ 0xEF)

bit 15 – 8 : First Data (0x00 ~ 0x7F)

bit 7 – 0 : Second Data (0x00 ~ 0x7F)

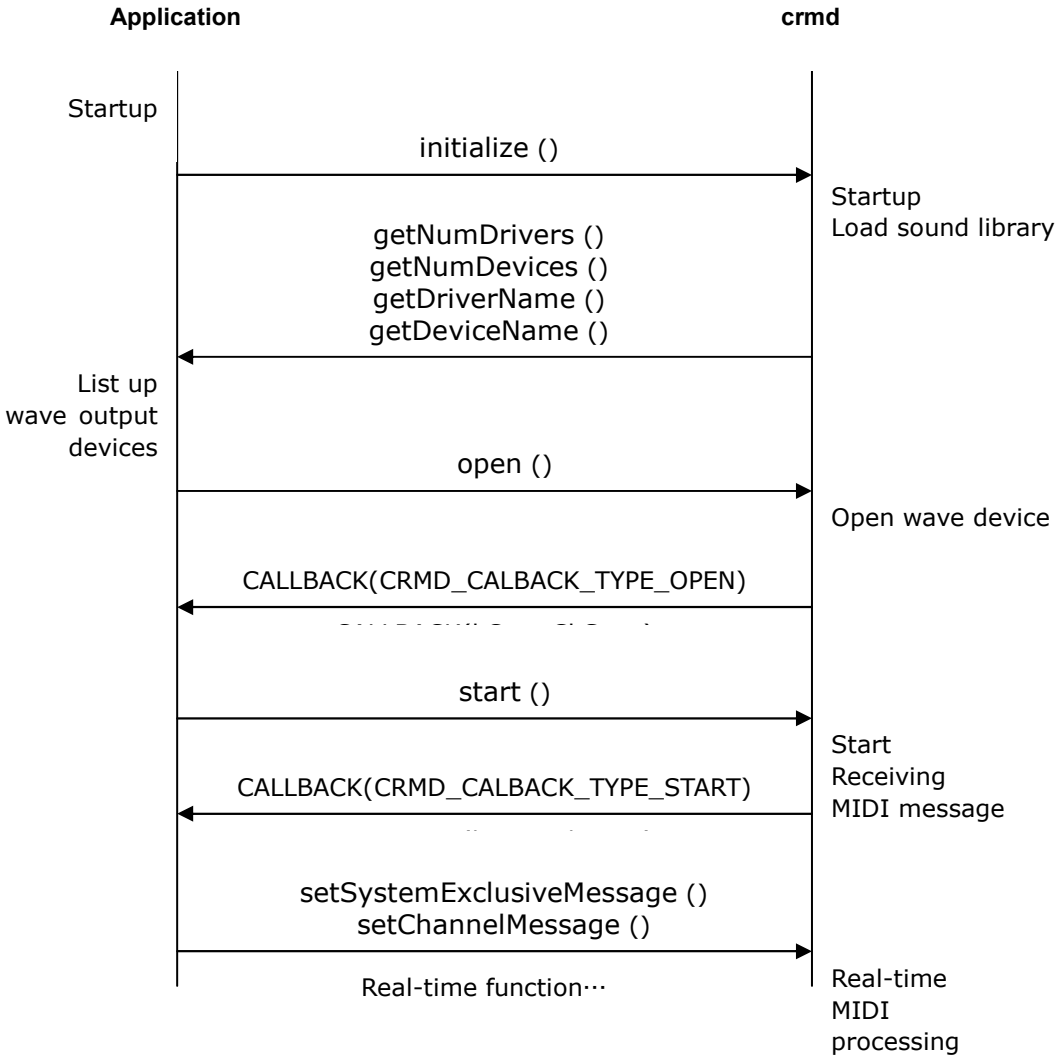
4.5.13. System Exclusive Message

type = CRMP_CALLBACK_TYPE_SYSTEM_EXCLUSIVE_MESSAGE, data = Not used

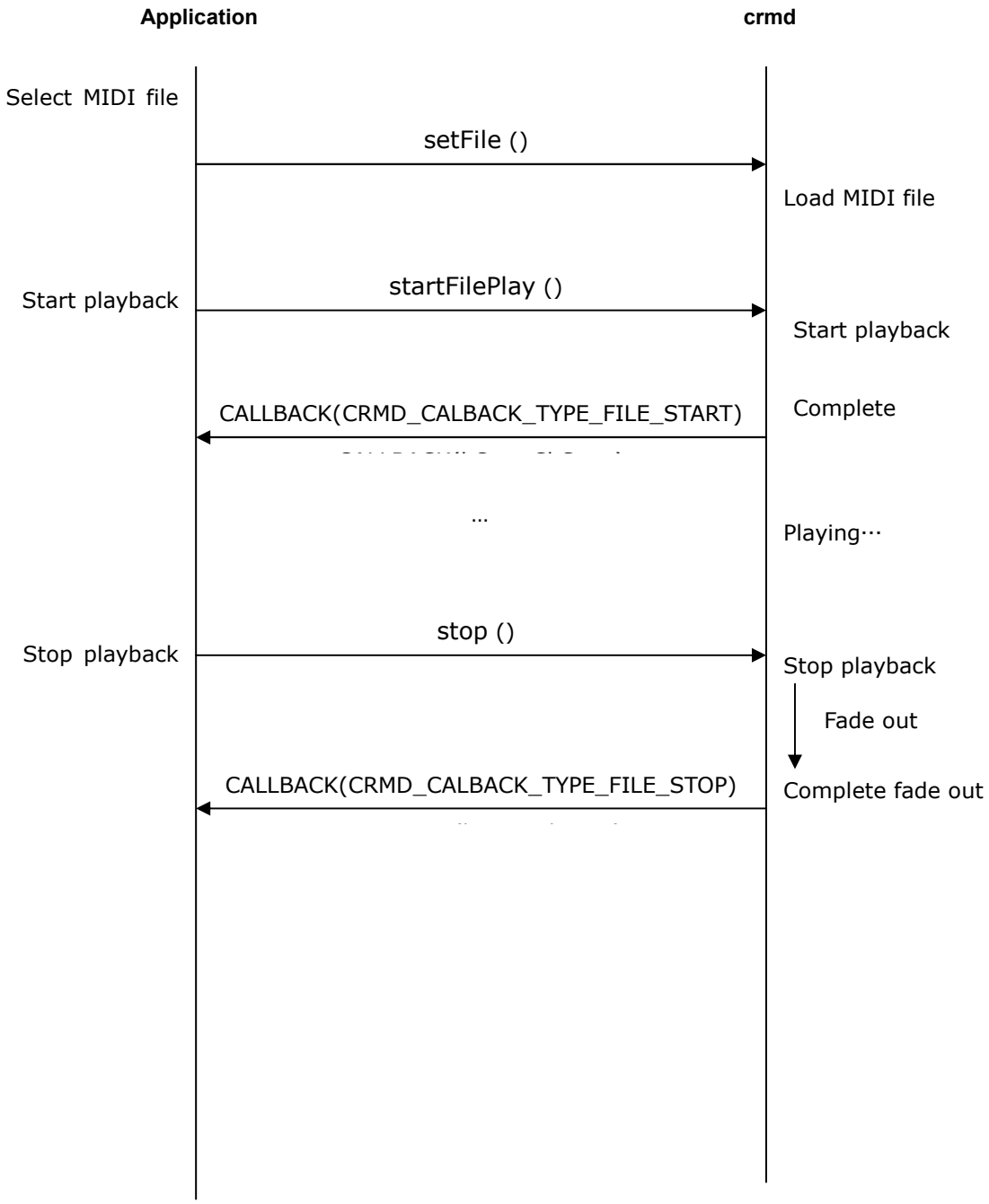
System exclusive message has been sent by player.

4.6. Sequences

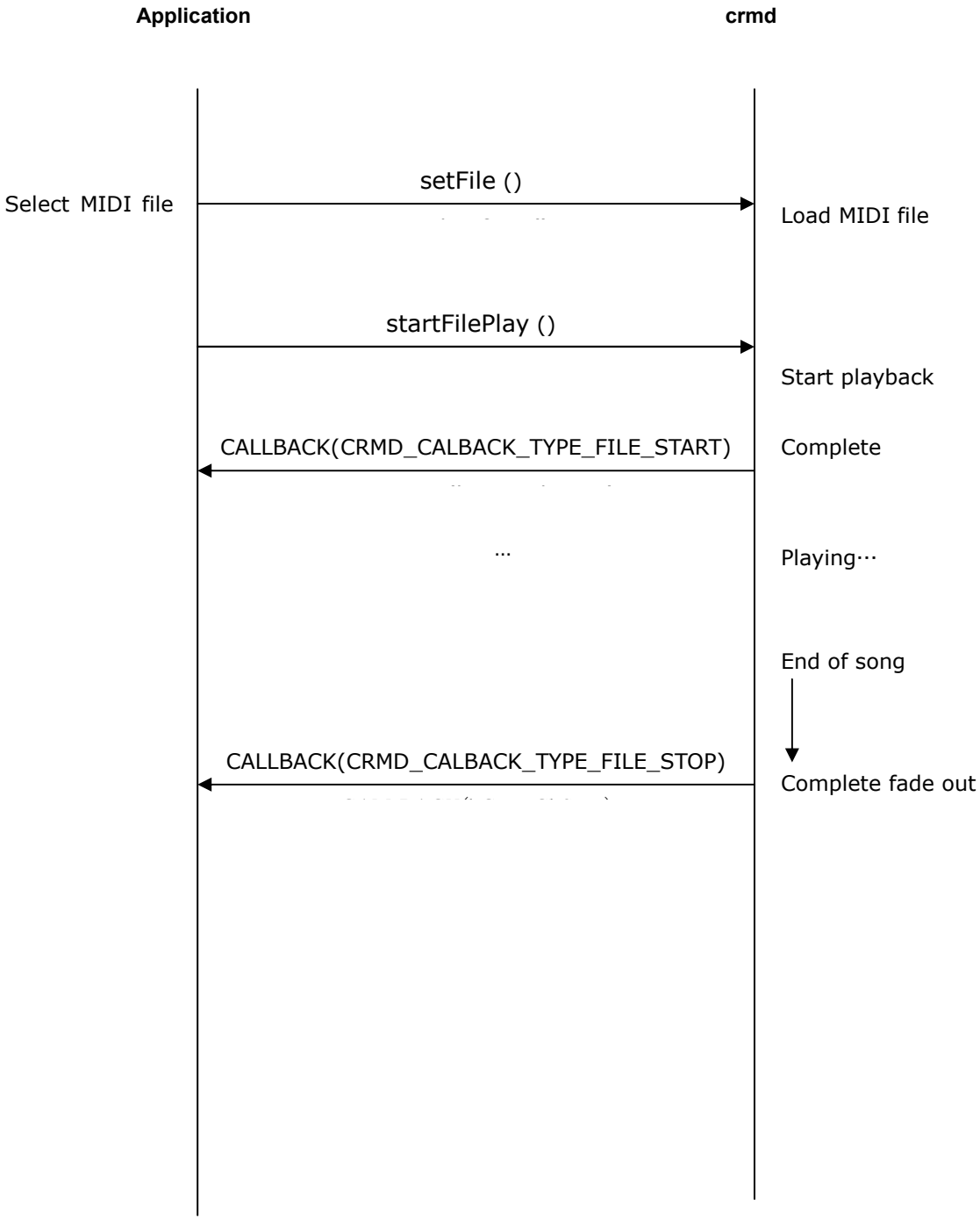
4.6.1. Initializing



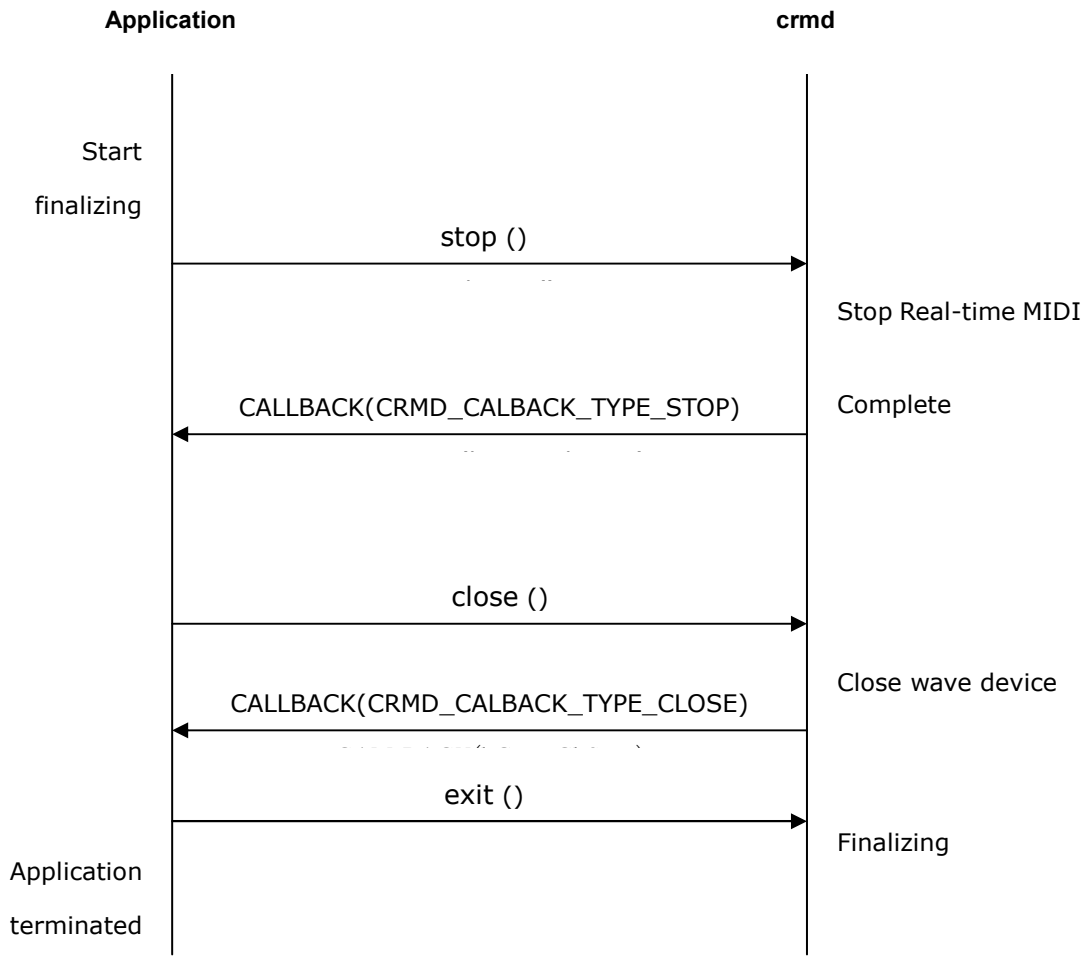
4.6.2. Specifying the MIDI Files – Start Playback – Stop by User



4.6.3. Specifying the MIDI File – Start Playback – End of the Song



4.6.4. Finalizing



5. Appendix

5.1. About DLS File Format

Wave format in <wave-list> chunk should satisfy following specification.

- linear PCM
- monaural

Following modulation routings are not supported. All parameters work with default value.

- Key Number Generator
  - MIDI Note to Key
  - RPN2 to Key
- Filter
  - Mod LFO CC1 to Fc
  - Mod LFO Channel Press. to Fc
- Gain
  - Mod LFO CC1 to Gain
  - Mod LFO Chan. Press. to Gain
  - Velocity to Gain
  - MIDI CC7 to Gain
  - MIDI CC11 to Gain
- Pitch
  - Pitch Wheel RPN0 to Pitch
  - RPN1 to Pitch
  - Vib LFO CC1 to Pitch
  - Vib LFO Chan. Press. to Pitch
  - Mod LFO CC1 to Pitch
  - Mod LFO Chan. Press. to Pitch
- Output
  - MIDI CC10 to Pan
  - Default Reverb Send
  - Default Chorus Send

5.2. API Diffs (Version 2.1 -> 2.2)

5.2.1. MIDI Player Library

- Constants
  - Added following definitions
    - CRMP_TUNE_MIN
    - CRMP_TUNE_DEF
    - CRMP_TUNE_MAX
- API
  - Removed “pause”
  - Removed “isPaused”
  - Added “seek”
  - “ctrl” (3.4.21)
    - Added following targets
      - CRMP_CTRL_SET_MASTER_TUNE
      - CRMP_CTRL_GET_MASTER_TUNE
      - CRMP_CTRL_GET_INSTRUMENT_NAME
      - CRMP_CTRL_SET_MUTE
      - CRMP_CTRL_GET_MUTE
      - CRMP_CTRL_SET_SOLO
      - CRMP_CTRL_GET_SOLO
- Callback
  - Added following callback types
    - CRMP_CALLBACK_TYPE_CHANNEL_MESSAGE
    - CRMP_CALLBACK_TYPE_SYSTEM_EXCLUSIVE_MESSAGE
  - Removed following callback types
    - CRMP_CALLBACK_TYPE_PAUSED
    - CRMP_CALLBACK_TYPE_RESUME

5.2.2. MIDI Driver Library

- Structures
  - Added "CRMD_FRAME"
- API
  - Removed "pauseFilePlay"
  - Removed "isFilePaused"
  - Added "seekFilePlay"
  - "ctrl" (3.4.21)
    - Added following targets
      - CRMP_CTRL_GET_INSTRUMENT_NAME
      - CRMP_CTRL_SET_MUTE
      - CRMP_CTRL_GET_MUTE
      - CRMP_CTRL_SET_SOLO
      - CRMP_CTRL_GET_SOLO
- Callback
  - Added following callback types
    - CRMD_CALLBACK_TYPE_FILE_SEEK
    - CRMD_CALLBACK_TYPE_TIME_SIGNATURE
    - CRMD_CALLBACK_TYPE_CHANNEL_MESSAGE
    - CRMD_CALLBACK_TYPE_SYSTEM_EXCLUSIVE_MESSAGE
  - Removed following callback types
    - CRMD_CALLBACK_TYPE_FILE_PAUSED
    - CRMD_CALLBACK_TYPE_FILE_RESUME
  - Added callback parameter to CRMD_CALLBACK_TYPE_FRAME