

MusicFormats command user guide

<https://github.com/jacques-menu/musicformats>

v0.9.60 (February 11, 2022)

Jacques Menu

MusicFormats is open source software, available with source code and documentation at <https://github.com/jacques-menu/musicformats>. It is written in C++11 and provides a set of music scores representations and converters between various textual music scores formats. Building it only requires a C++11 compiler and `cmake`.

This document shows how to use the MusicFormats library, both from the command line and from within applications. It is part of the MusicFormats documentation, and can be found at [MusicFormatsCLIUserGuide.pdf](#).

MusicFormats can be used from the command line on Linux, Windows and Mac OS. The API also allows it to be used from applications, including in Web sites.

```
1 jacquesmenu@macmini > xml2ly -about
2 What xml2ly does:
3
4 This multi-pass converter basically performs 5 passes:
5   Pass 1: reads the contents of MusicXMLFile or stdin ('-')
6            and converts it to a MusicXML tree;
7   Pass 2a: converts that MusicXML tree into
8            a first Music Score Representation (MSR) skeleton;
9   Pass 2b: populates the first MSR skeleton from the MusicXML tree
10            to get a full MSR;
11   Pass 3:  converts the first MSR into a second MSR to apply options
12   Pass 4:  converts the second MSR into a
13            LilyPond Score Representation (LPSR);
14   Pass 5:  converts the LPSR to LilyPond code
15            and writes it to standard output.
16
17 Other passes are performed according to the options, such as
18 displaying views of the internal data or printing a summary of the score.
19
20 The activity log and warning/error messages go to standard error.
21 }
```

Minimal score



Contents

I	Preamble	5
1	Acknowledgements	6
2	About this document	7
II	Discovering MusicFormats	8
3	The MusicFormats architecture	9
4	A first example	11
4.1	Raw <code>xml2ly</code> usage.	11
4.2	Redirecting the output and error messages to files	12
4.3	The need for options	14
4.4	The passes at work	15
5	The MusicFormats repository	17
6	Library components	18
6.1	Formats	19
6.2	Representations	20
6.3	Passes	20
6.4	Generators.	21
6.5	General use converters	23
6.6	Specific converters.	24
6.7	MusicFormats services.	25
6.8	Other tools	25
III	Shell basics	26
7	Shell basics	27
7.1	Basic shell builtins	27
7.2	Commands	28
7.3	Quoting, variables and aliases.	28
7.4	Functions	29
7.5	MusicFormatsBashDefinitions.bash	30
IV	Installing MusicFormats	31
8	Choosing an installation mode	32
9	Basic installation	33
9.1	MacOS™ basic installation	33
9.2	Linux basic installation	36
9.3	Windows™ basic installation	36

10	Full installation.	38
10.1	Cloning the repository.	38
10.2	Building the library on Mac OS™ and Linux	39
10.3	Building the library on Windows™	40
V	Options and help (OAH)	41
11	Options and help design principles	42
12	Options use.	43
12.1	Options characteristics	44
12.2	The <code>-insider</code> option	45
12.3	Early options	46
13	Options and help introspection.	47
13.1	Restricting help to a given group or subgroup	47
13.2	Querying about options by name	47
13.3	Searching the help for a string	48
13.4	Displaying help about options usage	48
13.5	Displaying a help summary	49
14	Options examples.	50
14.1	Boolean options	50
14.2	Options simple values	50
14.3	Options more complex values	51
14.4	More complex options.	52
14.5	Displaying the options values	53
14.6	Displaying MusicFormats internal data	55
15	Including options and arguments from a file	57
15.1	An options and arguments file example	57
15.2	Options values and arguments in included files	58
15.3	Multi-level includes	59
15.4	Multi-level includes overflow	60
16	Non-musical options	62
16.1	Timing measurements	62
16.2	Chords structure	63
17	Trace options	65
VI	Warnings and errors (WAE)	67
18	Warnings and errors (WAE)	68
VII	Multiple languages support	69
19	Multiple languages support.	70
VIII	xml2ly	72
20	xml2ly	73
20.1	Why xml2ly?	73
20.2	What xml2ly does	73
20.3	Useful options to xml2ly	75

IX	xml2brl	76
21	xml2brl	77
21.1	Why xml2brl?	77
21.2	What xml2brl does	78
X	xml2xml	79
22	xml2xml	80
22.1	Why xml2xml?	80
22.2	What xml2xml does	80
XI	xml2gmn	82
23	xml2gmn	83
23.1	Why xml2gmn?	83
23.2	What xml2gmn does	84
XII	Indexes	85

List of Figures

3.1	The MusicFormats architecture	9
20.1	xml2ly architecture	74
21.1	xml2brl architecture	77
22.1	xml2xml architecture	80
23.1	xml2gmn architecture	83

Part I

Preamble

Chapter 1

Acknowledgements

Many thanks to Dominique Fober, the designer and maintainer of the `libmusicxml2` library. This author would not have attempted to work on a MusicXML to LilyPond converter without his work being already available.

In particular, the conversion of MusicXML data to a tree is extremely well done directly from the MusicXML DTD, and that was a necessary step to produce LilyPond code. Dominique also provided a nice way to browse this tree with a two-phase visitor design pattern, which this author uses extensively in his own code. The interested reader can find information about that in [libmusicxml2.pdf](#), and more technical details in [MusicFormatsMaintenanceGuide.pdf](#).

`xml2ly` and some of the specific examples presented in this document started as this author's contribution to `libmusicxml2`, and was later moved to a separate GitHub repository for practical reasons.

Chapter 2

About this document

This document is organized in four parts:

- the part II lets the user discover the library, as well as its architecture, see section [3](#), [The MusicFormats architecture], page [9](#);
- then the options and help so-called OAH infrastructure provided by the library is presented in part III;
- the part IV is dedicated to the handling or warnings and errors;
- the part V presents the multiple languages support provided by MusicFormats;
- parts VI to IX show the specific features of the various converter;
- and finally, there is a comprehensive set of indexes.

The use of MusicFormats through its APIs is described in a specific documentation, to be found at [MusicFormatsAPIUserGuide.pdf](#). This is intended for users who create applications such as Web sites that do not use command line commands, but call functions provided by the library instead. The exact same functionality is available this way.

In fact, the command line versions of the services merely use these API functions.

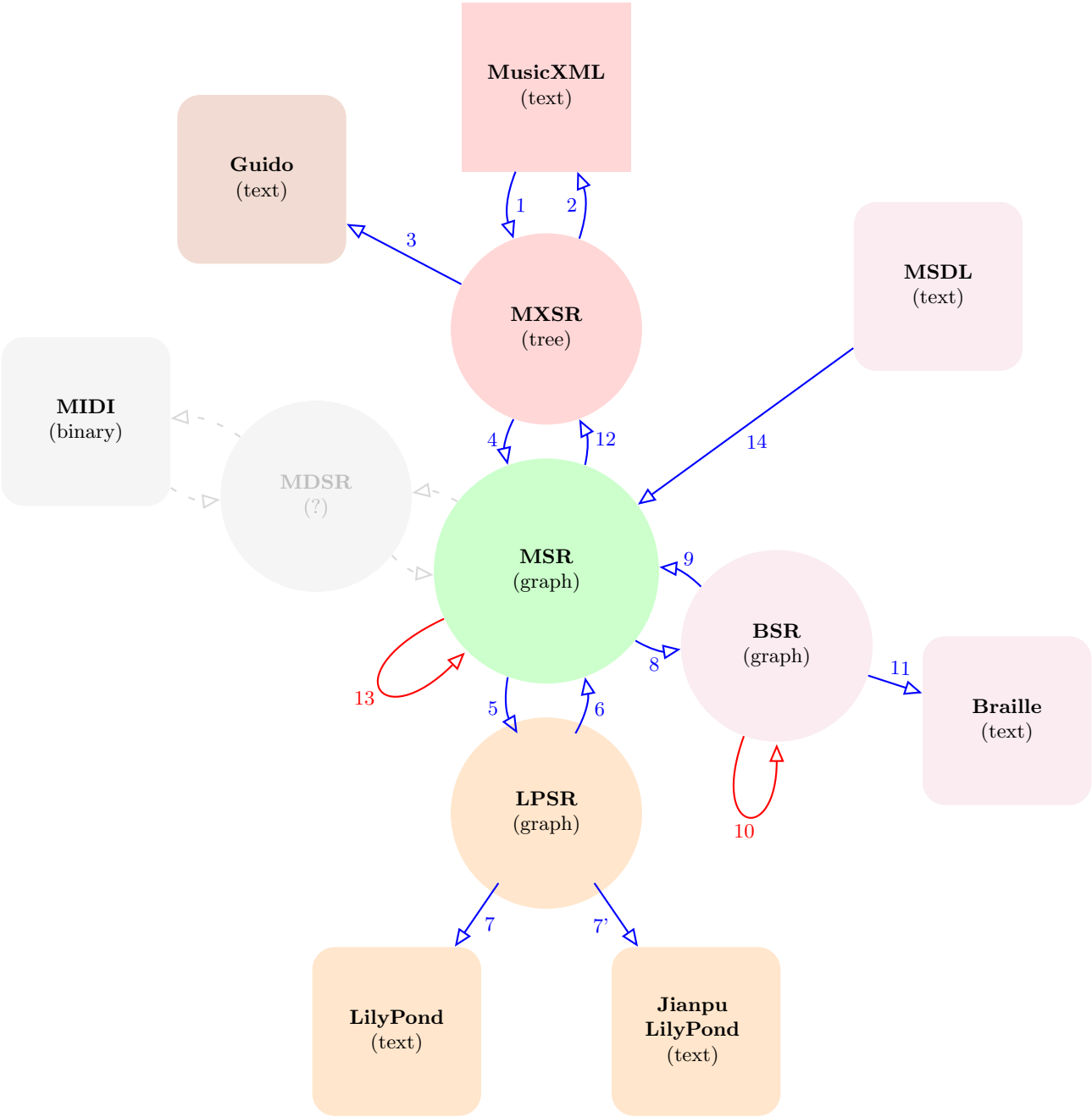
Part II

Discovering MusicFormats

Chapter 3

The MusicFormats architecture

Figure 3.1: The MusicFormats architecture



The picture at figure 3.1, [Architecture], page 9, shows how MusicFormats is structured:

- central to MusicFormats is MSR, an internal fine-grained representation of the musical contents of music scores;
- immediately around it, the round boxes are other (internal) representations used by various formats unitary conversions;
- the outermost square boxes are the (external) formats that MusicFormats supports;
- the numbered arrows are conversion steps between formats and/or representations. The numbers indicate roughly the order in which they were added to the library.

Some conversions are two-way, such as that of MXSR to MSR and back. Others are one-way, such as the conversion of LSPR to LilyPond text;

- the red arrows are conversions of a representation to the same one. These are meant to offer options to modify the contents of those representations;
- the dimmed, dashed boxes and arrows indicate items not yet available or supported.

Decomposing the conversion work into successive steps has many advantages:

- each step concentrates on a subset of the tasks to be performed without interfering with the others. For example, converting MusicXML text to MSR has nothing to do with LilyPond;
- development and debugging is therefore much easier than with a single, huge bulk of code;
- most important still, this architecture allows the *reuse* of the steps, which are combined to assemble the higher-level converters;
- icing on the cake, the options and help associated with the various steps are combined to obtain the options and help for the converters and generators.

Technically, the conversion steps are called *passes*, a term that comes from the compiler writing field. We shall use it throughout this document.

Chapter 4

A first example

Before presenting the MusicFormats library in detail, let's get an idea of what it has to offer. The commands used in this chapter will be explained in later chapters.

4.1 Raw xml2ly usage

MusicXML is a textual representation of music scores, that can be produced by scanning score images or exported from GUI scoring applications. It has been designed to facilitate the sharing of scores across applications, which represent scores their own way.

MusicFormats provides `xml2ly` that converts MusicXML data to LilyPond code.

In computer science, the simplest example one can write with a language is often named 'Hello World'. MusicFormats abides to this rule, supplying `basic/HelloWorld.xml`:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > cat basic/HelloWorld.xml
2 <?xml version="1.0" encoding="UTF-8" standalone="no"?>
3 <!DOCTYPE score-partwise PUBLIC
4     "-//Recordare//DTD MusicXML 3.0 Partwise//EN"
5     "http://www.musicxml.org/dtds/partwise.dtd">
6 <score-partwise version="3.0">
7   <work>
8     <work-title>Hello World!</work-title>
9   </work>
10  <!-- A very minimal MusicXML example -->
11  <part-list>
12    <score-part id="P1">
13      <part-name>Music</part-name>
14    </score-part>
15  </part-list>
16  <part id="P1">
17  <!--=====-->
18    <measure number="1">
19  <!-- A very minimal MusicXML example, part P1, measure 1 -->
20    <attributes>
21      <divisions>1</divisions>
22      <key>
23        <fifths>0</fifths>
24      </key>
25      <time>
26        <beats>4</beats>
27        <beat-type>4</beat-type>
28      </time>
29      <clef>
30        <sign>G</sign>
31        <line>2</line>

```

```

32     </clef>
33   </attributes>
34   <!-- A very minimal MusicXML example, part P1, measure 1, before first note -->
35   <note>
36     <pitch>
37       <step>C</step>
38       <octave>4</octave>
39     </pitch>
40     <duration>4</duration>
41     <type>whole</type>
42   </note>
43 </measure>
44 <!-- =====>
45 </part>
46 </score-partwise>

```

4.2 Redirecting the output and error messages to files

By default, the standard output and error streams are directed to the terminal in which the `xml2ly` command has been submitted.

Let's consider the case of `basic/UnknownMaintainerIdentification.xml`:

```

1  jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly basic/
   UnknownMaintainerIdentification.xml
2  *** MusicXML warning *** basic/UnknownMaintainerIdentification.xml:11: creator type "
   maintainer" is unknown
3  \version "2.22.0"
4
5  % Pick your choice from the next two lines as needed
6  %myBreak = { \break }
7  myBreak = {}
8
9  % Pick your choice from the next two lines as needed
10 %myPageBreak = { \pageBreak }
11 myPageBreak = {}
12
13 \header {
14   title           = "Hello World!"
15   workTitle       = "Hello World!"
16   title           = "Hello World!"
17 }
18
19 \paper {
20 }
21
22 \layout {
23   \context {
24     \Score
25     autoBeaming = ##f % to display tuplets brackets
26   }
27   \context {
28     \Voice
29   }
30 }
31
32 Part_P0ne_Staff_One_Voice_One = \absolute {
33   \language "nederlands"
34   \key c \major
35   \numericTimeSignature \time 4/4
36
37   \clef "treble"
38   c'1 | % 2

```

```

39   \barNumberCheck #2
40   | % 2
41   \barNumberCheck #2
42 }
43
44 \book {
45   \score {
46     <<
47
48     \new Staff = "Part_POne_Staff_One"
49     \with {
50       }
51     <<
52     \context Voice = "Part_POne_Staff_One_Voice_One" <<
53       \Part_POne_Staff_One_Voice_One
54     >>
55   >>
56
57   >>
58
59   \layout {
60     \context {
61       \Score
62       autoBeaming = ##f % to display tuplets brackets
63     }
64     \context {
65       \Voice
66     }
67   }
68
69   \midi {
70     \tempo 16 = 360
71   }
72 }
73
74 }
75 Warning message(s) were issued for input line 11

```

The standard output and error streams are merged into the terminal window, which may not be satisfactory. This behaviour can be changed using the shell's redirection operators:

- `>`: redirects the standard output stream to a file;
- `2>`: redirects the standard error stream to a file.

Thus, after executing:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly basic/
  UnknownMaintainerIdentification.xml > output.ly 2> error.txt

```

`output.ly` contains the LilyPond code produced, and `error.txt` contains:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > cat error.txt
2 *** MusicXML warning *** basic/UnknownMaintainerIdentification.xml:11: creator type "
  maintainer" is unknown
3 Warning message(s) were issued for input line 11

```

4.3 The need for options

Using `xml2ly` as in the previous section is somewhat limited. This command:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly basic/
   MinimalScore.xml > MinimalScore.ly
```

leads to this score:



What if we want to change the title in the LilyPond output? This is where options come into play. One of them is option `-query`:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly -query title
2 --- Help for atom "title" in subgroup "Header"
3   -title STRING
4       Set 'title' to STRING in the LilyPond code \header.
```

Using it this way:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly basic/
   MinimalScore.xml -title "U. N. Known" > MinimalScore.ly
```

produces that score:



The effect of the `-title` option is for `xml2ly` to generate this at the beginning of the LilyPond output:

```
1 \version "2.22.0"
2
3 % ... ..
4
5 \header {
6   title = "U. N. Known"
7   % ... ..
8 }
9
10 % ... ..
```

We could of course add this `title` setting by hand after `xml2ly` has produced LilyPond code, but all MusicFormats is about is to *automate* such things as much as possible.

This is why there are many options to the MusicFormats tools, which in turn explains why OAH, a powerful options and help handling infrastructure, is provided as part of the library.

4.4 The passes at work

The passes involved in a conversion can be seen with suitable options:

```

1 jacquesmenu@macmini-1: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly -auto-output-
  file-name -trace-passes -display-cpu-usage basic/Anacrusis.xml
2
3 %-----
4   Handle the options and arguments from argc/argv
5 %-----
6 This is xml2ly v0.9.52 (November 29, 2021) from MusicFormats v0.9.60 (January 25, 2022)
7 Launching the conversion of "basic/Anacrusis.xml" to LilyPond
8 Time is Thursday 2022-02-03 @ 14:19:32 CET
9 The command line is:
10 xml2ly -auto-output-file-name -trace-passes -cpu basic/Anacrusis.xml
11 or with options long names:
12 xml2ly -auto-output-file-name -trace-passes -display-cpu-usage basic/Anacrusis.xml
13 or with options short names:
14 -aofn -tpasses -cpu basic/Anacrusis.xml
15 LilyPond code will be written to Anacrusis.ly
16 The command line options and arguments have been analyzed
17
18 %-----
19   Pass 1: Create an MXSR reading a MusicXML file
20 %-----
21 % MusicXML data uses UTF-8 encoding
22
23 %-----
24   Pass 2a: Create an MSR skeleton from the MXSR
25 %-----
26
27 %-----
28   Pass 2b: Populate the MSR skeleton from MusicXML data
29 %-----
30
31 <!--== part "P1", line 60 ==-->
32
33 %-----
34   Pass 3: Convert the first MSR into a second MSR
35 %-----
36
37 %-----
38   Pass 4: Convert the second MSR into an LPSR
39 %-----
40
41 Opening file 'Anacrusis.ly' for writing
42
43 %-----
44   Pass 5: Convert the LPSR score to LilyPond code
45 %-----
46 Timing information:
47
48 Activity   Description                                     Kind      CPU (sec)
49 -----
50
51           Handle the options and arguments from argc/argv      mandatory    0.02798
52 Pass 1      Create an MXSR reading a MusicXML file                        mandatory    0.00420
53 Pass 2a     Create an MSR skeleton from the MXSR                          mandatory    0.00191
54 Pass 2b     Populate the MSR skeleton from MusicXML data                  mandatory    0.00314
55 Pass 3      Convert the first MSR into a second MSR                       mandatory    0.00069
56 Pass 4      Convert the second MSR into an LPSR                           mandatory    0.00090
57 Pass 5      Convert the LPSR score to LilyPond code                       mandatory    0.00156
58
59 Total (sec)  Mandatory  Optional
60 -----
61 0.04037      0.04037    0.00000

```


The optional passes are those that display MusicFormats internal data. They are triggered by suitable options, see section [14.6](#), [Displaying MusicFormats internal data], page [55](#).

The resulting `Anacrusis.ly` file leads to this score where submitted to LilyPond:

Anacrusis



Chapter 5

The MusicFormats repository

The MusicFormats repository contains several versions:

- the `dev` version, to be found at <https://github.com/jacques-menu/musicformats/tree/dev>, is where changes are pushed by the maintainers of MusicFormats. It is the most up to date, but should not be used for regular work, since it is not stable yet;
- the `test-v...` versions are the `dev` version frozen at some time for users to validate the new version;
- the `stable-v...` versions are `test-v...` versions frozen at some time, and can be used safely.

This document mentions sample files in various formats. They can be seen online on the `dev` version, whose name and URL never change, at <https://github.com/jacques-menu/musicformats/tree/dev/files>.

These examples are mentioned in this document as they appear in the MusicFormats repository, in subdirectories of the `files` directory. Currently, there are:

- `musicxmlfiles` for MusicXML files;
- `msdlfiles` for MSDL files.

A typical example is `basic/HelloWorld.xml`, which stands for the following, with the `dev` cloned locally in the `musicformats-git-dev` directory:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev > ls -sal files/musicxmlfiles/basic/HelloWorld
   .xml
2 8 -rw-r--r--@ 1 jacquesmenu  staff  1266 Apr 22  2021 files/musicxmlfiles/basic/HelloWorld
   .xml
```

Chapter 6

Library components

MusicFormats uses the following terminology for its components:

- a *format* is a description of music scores in textual or binary form, used in the field of music score applications, thus outside of the library;
- a *representation* is an internal data structure describing a music score. As of this writing, the supported representations are:
 - MXSR (MusicXML Score Representation);
 - MSR (Music Score Representation);
 - LSPR (LilyPond Score Representation);
 - BSR (Braille Score Representation).

There is another, non-musical, representation in MusicFormats: OAH contains a description of the options and help provided by the library and its 'musical' components.

- the formats known to MusicFormats can be seen as external representations of music scores, while representations are internal to the library;
- a *pass* performs a unitary conversion between a format and/or a representation to another such, as a *single step*. This term comes from the compiler writing field: it means that the whole music score description is traversed to produce another description;
- a *converter* is a sequence of two or more passes. Each one converts a representation, either external or internal, into another that is used by the next pass in a pipeline way, at the higher level. Such converters are thus said to be *multi-pass*.

The first one, provided by the libmusicxml2 library, was `xml2guido`.

Other converters provided by MusicFormats were added later by this author, currently: `xml2ly` `xml2brl` `xml2xml` and `xml2guido`.

For example:

```
1 jacquesmenu@macmini > xml2xml -about
2 What xml2xml does:
3
4     This multi-pass converter basically performs 6 passes:
5     Pass 1:  reads the contents of MusicXMLFile or stdin ('-')
6              and converts it to a MusicXML tree;
7     Pass 2a: converts that MusicXML tree into
8              a first Music Score Representation (MSR) skeleton;
9     Pass 2b: populates the MSR skeleton from the MusicXML tree
10             to get a full MSR;
11     Pass 3:  converts the first MSR into a second MSR, to apply options;
```

```

12      Pass 4:  converts the second MSR into a second MusicXML tree;
13      Pass 5:  converts the second MusicXML tree to MusicXML code
14              and writes it to standard output.
15
16      Other passes are performed according to the options, such as
17      displaying views of the internal data or printing a summary of the score.
18
19      The activity log and warning/error messages go to standard error.

```

- a *generator* is a multi-pass converter that creates the first representation of a score in the sequence *ex-nihilo*, without reading any input file. The ones provided by MusicFormats are `Mikrokosmos3Wandering` and `LilyPondIssue34`:

```

1 jacquesmenu@macmini > Mikrokosmos3Wandering -musicxml -about
2 What Mikrokosmos3Wandering does:
3
4      This multi-pass generator creates a textual representation
5      of Zoltán Kodály's Mikrokosmos III Wandering score.
6      It basically performs 4 passes when generating MusicXML output:
7
8      Pass 1:  generate a first MSR for the Mikrokosmos III Wandering score
9      Pass 2:  converts the first MSR a second MSR, to apply options;
10     Pass 3:  converts the second MSR into an MusicXML tree;
11     Pass 4:  converts the MusicXML tree to MusicXML code
12             and writes it to standard output.
13
14     Other passes are performed according to the options, such as
15     displaying views of the internal data or printing a summary of the score.
16
17     The activity log and warning/error messages go to standard error.

```

- MusicFormats also provides various examples and tools to create and manipulate music scores.

At the command line level, only the converters, generators and OAH are available to the user. The other components are used behind the scenes by the latter.

The MusicFormats APIs, on the other hand, give full access to all the components, more about this in Part V.

6.1 Formats

The formats supported by MusicFormats are:

Format	Description
MusicXML	a text containing markups such as <code><part-list/></code> , <code><time/></code> and <code><note/></code> ;
Guido	a text containing markups such as <code>\barFormat</code> , <code>\tempo</code> and <code>\crescEnd</code> ;
LilyPond	a text containing commands such as <code>\header</code> , <code>\override</code> and <code>\transpose</code> ;
Jianpu LilyPond	a text containing LilyPond commands and the use of <code>lilypond-Jianpu</code> (https://github.com/nybbs2003/lilypond-Jianpu/jianpu10a.ly) to obtain a Jianpu (numbered) score instead of the default western notation. lilypond-Jianpu should be accessible to LilyPond for it to produce the score. This file is provided in <code>lilypondstuff/jianpu</code> ;
Braille	a text containing 6-dot cells, as described in http://www.brailleauthority.org/music/Music_Braille_Code_2015.pdf ;

MSDL a text describing a score in the MSDL language.

6.2 Representations

The representations used by MusicFormats are:

Representation	Description
MSR	Music Score Representation, in terms of part groups, parts, staves, voices, notes, etc. This is the heart of the multi-format converters provided by MusicFormats;
MXSR	a tree representing the MusicXML markups such as <code><part-list/></code> , <code><time/></code> and <code><note/></code> ;
LPSR	LilyPond Score Representation, i.e. MSR plus LilyPond-specific items such as <code>\score</code> blocks;
BSR	Braille Score Representation, with pages, lines and 6-dots cells;
MDSR	MIDI Score Representation, to be designed.

6.3 Passes

In the picture, the arrows show the available passes. They are:

Arrow	Pass name	Description
1	mxm12mxsr	reads MusicXML data from a file or from standard input is '-' is supplied as the file name, and creates an MXSR representation containing the same data;
2	mxsr2mxm1	converts an MXSR representation into MusicXML data. This is a mere 'print()' operation;
3	mxsr2guido	converts an MXSR representation into Guido text code, and writes it to standard output;
4	mxsr2msr	converts an MXSR representation into an MSR representation. MusicXML represents how a score is to be drawn, while MSR represents the musical contents with great detail. This pass actually consists in two sub-passes: the first one builds an MSR skeleton containing empty voices and stanzas, and the second one fills this with all the rest;
5	mxsr2lpsr	converts an MSR representation into an LSPR representation, which contains an MSR component build from the original MSR (pass 5). The BSR contains LilyPond-specific formats such as <code>\layout</code> , <code>\paper</code> , and <code>\score</code> blocks;
6	lpsr2msr	converts an LSPR representation into an MSR representation. There is nothing to do, since the former contains the latter as a component;
7	lpsr2lilypond	converts an LSPR representation into LilyPond text code, and writes it to standard output;
7'	lpsr2lilypond	converts an LSPR representation into LilyPond text code using <code>lilypond-Jianpu</code> , and writes it to standard output. This pass is run with <code>xml2ly -jianpu</code> ;

8	<code>msr2bsr</code>	converts an MSR representation into a BSRrepresentation, which contains an MSR component built from the original MSR. The BSR contains Braille-specific formats such as pages, lines and 6-dot cells. The lines and pages are virtual, i.e. not limited in length. This the pass where skip (invisible) notes are added wherever needed to avoid the LilyPond #34 issue;
9	<code>bsr2msr</code>	converts a BSRrepresentation into an MSR representation. There is nothing to do, since the former contains the latter as a component;
10	<code>bsr2bsr</code>	converts a BSRrepresentation into another one, to adapt the number of cells per line and lines per page from virtual to physical. Currently, the result is a mere clone;
11	<code>bsr2braille</code>	converts a BSRrepresentation into Braille text, and writes it to standard output;
12	<code>msr2mxsr</code>	converts an MSR representation into an MXSR representation;
13	<code>msr2msr</code>	converts an MSR representation into another one, built from scratch. This allows the new representation to be different than the original one, for example to change the score after it has been scanned and exported as MusicXML data, or apply options;
14	<code>msdl2msr</code>	converts an MSDL score description into an MSR representation.

6.4 Generators

The ones generators by `libmusicxml2` create an MXSR representation and output it as MusicXML text:

- `libmusicxml/samples/RandomMusic.cpp`
generates an MXSR representation containing random music, and writes it as MusicXML to standard output;
- `libmusicxml/samples/RandomChords.cpp`:
generates an MXSR representation containing random two-note chords, and writes it as MusicXML to standard output;

MusicFormats supplies its own generators to demonstrate the use of its APIs: These generators are:

- `src/clisamples/MusicAndHarmonies.cpp`:
builds an MXSR representation containing notes and harmonies, and writes it as MusicXML to standard output:

```

1 jacquesmenu@macmini > MusicAndHarmonies | more
2 <?xml version="1.0" encoding="UTF-8" standalone="no"?>
3 <!DOCTYPE score-partwise PUBLIC "-//Recordare//DTD MusicXML 3.1 Partwise//EN"
4 "http://www.musicxml.org/dtds/partwise.dtd">
5 <score-partwise>
6   <movement-title>Random Music</movement-title>
7   <identification>
8     <creator type="Composer">Georg Chance</creator>
9     <encoding>
10      <software>MusicFormats Library's MusicAndHarmonies generator</software>
11    </encoding>
12  </identification>
13  <part-list>
14    <score-part id="P1">
15      <part-name>Part name</part-name>
16      <score-instrument id="I1">
17        <instrument-name>Any instr.</instrument-name>
18      </score-instrument>

```

```

19     </score-part>
20 </part-list>
21 <part id="P1">
22     <measure number="1">
23         <attributes>
24             <divisions>4</divisions>
25             <time>
26                 <beats>4</beats>
27                 <beat-type>4</beat-type>
28             </time>
29             <clef>
30                 <sign>G</sign>
31                 <line>2</line>
32             </clef>
33         </attributes>
34         <harmony>
35             <root>
36                 <root-step>C</root-step>
37             </root>
38             <kind text="F00">major</kind>
39             <staff>1</staff>
40         </harmony>
41         <note>
42             <pitch>
43                 <step>F</step>
44                 <octave>5</octave>
45             </pitch>
46             <duration>4</duration>
47             <type>quarter</type>
48         </note>
49
50 <!-- ... .. -->

```

- [src/clisamples/Mikrokosmos3Wandering.cpp](#): creates an MSR graph representing Bartok's Mikrokosmos III Wandering score, and then produces LilyPond, Braille, MusicXML or Guido from it. The LilyPond output gives:

Mikrokosmos III Wandering

Zoltán Kodály

- [src/clisamples/LilyPondIssue34.cpp](#): aims at creating an LSPR graph representing the score below, and then produces LilyPond, Braille, MusicXML or Guido from it. Currently, the code is the same as that of Mikrokosmos3Wandering, though:

Piano Sonata in A Major

Wolfgang Amadeus Mozart



6.5 General use converters

The available MusicXML converters available in MusicFormats are:

Converter	Description
xml2guido	supplied by libmusicxml2, converts MusicXML data to Guido code, using passes: 1 \Rightarrow 3
xml2ly	performs the 4 passes from MusicXML to LilyPond to translate the former into the latter, using these passes: 1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 5 \Rightarrow 7 The <code>-jianpu</code> option is supplied to create Jianpu (numbered) scores, in which the notes are represented by numbers instead of graphics, using passes: 1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 5 \Rightarrow 7'
xml2brl	performs the 5 passes from MusicXML to Braille to translate the former into the latter (draft); 1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 8 \Rightarrow 10 \Rightarrow 11
xml2xml	converts MusicXML data to MSR and back in 5 passes. This is useful to modify MusicXML data to suit the user's needs, such as fixing score scanning software limitations or to enhance the data: 1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 12 \Rightarrow 2
xml2gmn	converts MusicXML data to Guido code, using passes: 1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 12 \Rightarrow 3

The passes used by the converters are shown by their `-about`, `-a` option. For example:

```
1 jacquesmenu@macmini > xml2xml -about
2 What xml2xml does:
3
4 This multi-pass converter basically performs 6 passes:
5   Pass 1:  reads the contents of MusicXMLFile or stdin ('-')
6             and converts it to a MusicXML tree;
7   Pass 2a: converts that MusicXML tree into
8             a first Music Score Representation (MSR) skeleton;
9   Pass 2b: populates the MSR skeleton from the MusicXML tree
10            to get a full MSR;
11   Pass 3:  converts the first MSR into a second MSR, to apply options;
12   Pass 4:  converts the second MSR into a second MusicXML tree;
13   Pass 5:  converts the second MusicXML tree to MusicXML code
14            and writes it to standard output.
15
16 Other passes are performed according to the options, such as
```



```

17 displaying views of the internal data or printing a summary of the score.
18
19 The activity log and warning/error messages go to standard error.

```

Since the generators may produce various output formats, one should be specified:

```

1 jacquesmenu@macmini > Mikrokosmos3Wandering -about
2 What Mikrokosmos3Wandering does:
3
4 This multi-pass generator creates a textual representation
5 of Zoltán Kodály's Mikrokosmos III Wandering score.
6 It performs various passes depending on the output generated,
7 which should be specified a '-lilypond', '-braille', '-musicxml' or '-guido' option.
8
9 Other passes are performed according to the options, such as
10 displaying views of the internal data or printing a summary of the score.
11
12 The activity log and warning/error messages go to standard error.

```

Adding option `-braille`, for example we get:

```

1 jacquesmenu@macmini > Mikrokosmos3Wandering -braille -about
2 What Mikrokosmos3Wandering does:
3
4 This multi-pass generator creates a textual representation
5 of Zoltán Kodály's Mikrokosmos III Wandering score.
6 It basically performs 4 passes when generating braille output:
7
8 Pass 1: generate a first MSR for the Mikrokosmos III Wandering score
9 Pass 2: converts the first MSR a second MSR, to apply options;
10 Pass 3: converts the second MSR into a
11 Braille Score Representation (BSR)
12 containing one Braille page per MusicXML page;
13 Pass 4: converts the BSR into another BSR
14 with as many Braille pages as needed
15 to fit the line and page lengths;
16 Pass 5: converts the BSR to Braille text
17 and writes it to standard output.)
18
19 In this preliminary version, pass 3 merely clones the BSR it receives.
20
21 Other passes are performed according to the options, such as
22 displaying views of the internal data or printing a summary of the score.
23
24 The activity log and warning/error messages go to standard error.

```

6.6 Specific converters

MusicFormats provides only one compiler in the usual software meaning, namely `msdlconverter`.

MSDL (Music Score Description Language) is a language under evolution being created by this author. It is meant for use by musicians, i.e. non-programmers, to obtain scores from a rather high-level description. MusicFormatssupplies `msdl`, a compiler converting MSDL into Guido LilyPond, Brailleor MusicXML to standard output, depending on the `'-generated-code-kind'` option.

Translator	Description
------------	-------------

<code>msdlconverter -lilypond</code>	performs the 4 passes from MusicXML to LilyPond to translate the former into the latter, using these passes: $1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 5 \Rightarrow 7$ The <code>-jianpu</code> option is supplied to create Jianpu (numbered) scores, in which the notes are represented by numbers instead of graphics, using passes: $1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 5 \Rightarrow 7'$
<code>msdlconverter -braille</code>	performs the 5 passes from MusicXML to Braille to translate the former into the latter (draft); $1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 8 \Rightarrow 10 \Rightarrow 11$
<code>msdlconverter -musicxml</code>	converts MusicXML data to MSR and back. This is useful to modify the data to suit the user's needs, such as fixing score scanning software limitations or to enhance the data: $1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 12 \Rightarrow 2$
<code>msdlconverter -guido</code>	converts MusicXML data to Guido code, using passes: $1 \Rightarrow 4 \Rightarrow 13 \Rightarrow 12 \Rightarrow 3$

6.7 MusicFormats services

The MusicFormats library provides *services* to the user. As of this writing, they are:

- generators;
- converters.

Other services may be provided in the future, such as music score analyzers.

This is why this documentation uses the term *service* for the current generators and converters.

6.8 Other tools

`libmusicxml2` supplies a number of basic tools using its features:

- `xmlread` converts MusicXML data and displays the corresponding `xmlElement` tree;
- `countnotes` reads MusicXML data and displays the number of notes it contains;
- other programs such as `xmltranspose` and `partsummary` demonstrate the possibilities of the library, in particular those of the two-phase visitors pattern it uses.
- `xml2midi` reads MusicXML data and outputs a midi version of it.

It is to be noted that:

- LilyPond provides `midi2ly` to translate MIDI files to LilyPond code;
- LilyPond can generate MIDI files from its input.

Part III

Shell basics

Chapter 7

Shell basics

Since this document is about using MusicFormats from the command line, let's start by a short presentation of shell usage.

7.1 Basic shell builtins

Many builtins have very short names, dating back at a time where they were typed at a physical terminal. Many vowels were left out to minimize typing. For example, there are:

- `pwd` to show the current working directory;
- `cd` to change directory;
- `echo` to produce output in the terminal window.

The shell used for the examples in this documents displays the current working directory as the prompt.

The files on a computer are organized as a tree of so-called *directories*. When a shell is launched, a directory is chosen as the current *working directory*, usually the user's *home directory*.

```
1 jacquesmenu@macmini-1: ~ > pwd
2 /Users/jacquesmenu
3
4 jacquesmenu@macmini-1: ~ > cd musicformats-git-dev
5
6 jacquesmenu@macmini-1: ~/musicformats-git-dev > pwd
7 /Users/jacquesmenu/musicformats-git-dev
8 jacquesmenu@macmini-1: ~/musicformats-git-dev >
```

7.2 Commands

A command name is either provided by the shell itself, a so-called *builtin*, or the name of a piece of software that can be executed.

In this example, the command name is `xml2lyy`:

```
1 jacquesmenu@macmini-1 > xml2lyy +sdf 45
2 -bash: xml2lyy: command not found
```

The shell can be queried about a command name:

```
1 jacquesmenu@macmini-1 > type cd
2 cd is a shell builtin
3
4 jacquesmenu@macmini-1 > type xml2lyy
5 -bash: type: xml2lyy: not found
6
7 jacquesmenu@macmini-1 > type xml2ly
8 xml2ly is hashed (/Users/jacquesmenu/musicformats-git-dev/build/bin/xml2ly)
```

7.3 Quoting, variables and aliases

Shell commands are submitted as a sequence of words separated by spaces. If a word, such a file name, contains *spaces*, it has to be surrounded by quotes or double quotes in order to be seen by the shell as a single word:

```
1 jacquesmenu@macmini > xml2ly Nice file.xml
2 Several input file names supplied, only one can be used
3 The arguments vector contains 2 elements:
4   0: "Nice"
5   1: "file.xml"
6
7 jacquesmenu@macmini-1 > xml2ly 'Nice file.xml'
8 can't open file Nice file.xml
9 ### Conversion from MusicXML to LilyPond failed ###
10
11 jacquesmenu@macmini-1 > xml2ly "Nice file.xml"
12 can't open file Nice file.xml
13 ### Conversion from MusicXML to LilyPond failed ###
```

Note that if a quote or double quote is part of word, the word should be inclosed by the other such:

```
1 jacquesmenu@macmini-1: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly -find "tuplet's"
2 0 occurrence of string "tuplet's" has been found
3
4 jacquesmenu@macmini-1: ~/musicformats-git-dev/files/musicxmlfiles >
5 jacquesmenu@macmini-1: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly -find 'tuplet"s'
6 0 occurrence of string "tuplet"s" has been found
```

A shell *variable* is a name for a piece of text, called its *value*, that can be used instead of that text in commands. The value of the variable can be seen in the terminal with the `echo` command:

```
1 jacquesmenu@macmini-1: ~/musicformats-git-dev > DOC_DIR=documentation
2
3 jacquesmenu@macmini-1: ~/musicformats-git-dev > echo $DOC_DIR
4 documentation
```

Variables can be used surrounded by curly brackets, too:

```
1 jacquesmenu@macmini-1: ~/musicformats-git-dev/documentation > echo ${DOC_DIR}
2 documentation
```

This notation provides further possibilities such as string replacement, which are out of the scope of this document.

Using variables is interesting when there are several uses of its value: changing the value at one place causing the new value to be used at every such use:

```
1 jacquesmenu@macmini-1: ~/musicformats-git-dev > ls $DOC_DIR
2 CommonLaTeXFiles      MusicFormatsCLIUserGuide  presentation
3 IntroductionToMusicXML MusicFormatsMaintenanceGuide
4 MusicFormatsAPIUserGuide graphics
5
6 jacquesmenu@macmini-1: ~/musicformats-git-dev > cd $DOC_DIR
7
8 jacquesmenu@macmini-1: ~/musicformats-git-dev/documentation > pwd
9 /Users/jacquesmenu/musicformats-git-dev/documentation
```

The difference between quotes and double quotes is how variables are handled:

- the characters between quotes are used literally;
- variables occurring between double quotes are replaced by their value.

```
1 jacquesmenu@macmini-1: ~/musicformats-git-dev > DOC_DIR=documentation
2
3 jacquesmenu@macmini-1: ~/musicformats-git-dev > cd '$DOC_DIR'
4 -bash: cd: $DOC_DIR: No such file or directory
5
6 jacquesmenu@macmini-1: ~/musicformats-git-dev > cd "$DOC_DIR"
7
8 jacquesmenu@macmini-1: ~/musicformats-git-dev/documentation > pwd
9 /Users/jacquesmenu/musicformats-git-dev/documentation
```

Here is an example combining quotes and double quotes:

```
1 jacquesmenu@macmini-1: ~/musicformats-git-dev/files/musicxmlfiles > DOC_DIR=documentation
2 jacquesmenu@macmini-1: ~/musicformats-git-dev/files/musicxmlfiles > echo "DOC_DIR's value
3 is: ${DOC_DIR}"
4 DOC_DIR's value is: documentation
```

7.4 Functions

The shells allow the creation of *functions*, that contain several commands under a single name. An example is function `checkVersions ()`, which displays the versions of the main MusicFormats services:

```
1 function checkVersions ()
2 {
3     # set -x
4
5     xml2lly -v
6     xml2brl -v
7     xml2xml -v
8     xml2gmn -v
9
10    Mikrokosmos3Wandering -v
11
12    msdlconverter -v
13    # set +x
14 }
```

7.5 MusicFormatsBashDefinitions.bash

`MusicFormatsBashDefinitions.bash` contains a set of variables, aliases and function definitions used by this author. One of them is function `checkVersions` () above.

Feel free to use them, adapt them or ignore them depending on your taste.

Some settings we use in this document are:

```
1 jacquesmenu@macmini > type ll
2 ll is a function
3 ll ()
4 {
5     ls -salGTF $*
6 }
```

The options to `ls` may vary depending the on the operating system.

Part IV

Installing MusicFormats

Chapter 8

Choosing an installation mode

No user-friendly installer is available yet, so you will have to install the library at a lower level, sorry for the delay. . . .

How to install MusicFormats depends on the operating system. Linux users often build the software they use themselves, while those of Windows[™] and Mac OS[™] are accustomed to install in much simpler ways.

Depending on the needs, users may wish to install the *whole* MusicFormats with source code and examples, or to do a *basic installation*, that contains only the *libraries*, command line executables and documentation PDF files.

The following chapters show the details.

Chapter 9

Basic installation

The necessary files are found in file distrib:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev > ls -sal distrib
2 total 0
3 0 drwxr-xr-x  5 jacquesmenu  staff   160 Feb  9 12:05 .
4 0 drwxr-xr-x 31 jacquesmenu  staff   992 Feb  9 10:12 ..
5 0 drwx-----@ 4 jacquesmenu  staff   128 Feb  9 13:51 macos-distrib
6 0 drwx-----@ 4 jacquesmenu  staff   128 Feb  9 16:45 ubuntu-distrib
7 0 drwx-----@ 4 jacquesmenu  staff   128 Feb  9 13:51 windows-distrib
```

9.1 MacOS™ basic installation

After downloading, we get:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev/distrib/macos-distrib > ls -sal */*
2 build/bin:
3 total 685056
4   0 drwxr-xr-x@ 25 jacquesmenu  staff           800 Feb  9 11:25 .
5   0 drwxr-xr-x@  3 jacquesmenu  staff           96 Feb  9 13:51 ..
6 76800 -rwxr-xr-x  1 jacquesmenu  staff  38306592 Feb  9 11:25 LilyPondIssue34
7 76800 -rwxr-xr-x  1 jacquesmenu  staff  38309680 Feb  9 11:25 Mikrokosmos3Wandering
8  9216 -rwxr-xr-x  1 jacquesmenu  staff   4314896 Feb  9 11:25 MusicAndHarmonies
9  9216 -rwxr-xr-x  1 jacquesmenu  staff   4314880 Feb  9 11:25 RandomChords
10  9216 -rwxr-xr-x  1 jacquesmenu  staff   4314880 Feb  9 11:25 RandomMusic
11  9216 -rwxr-xr-x  1 jacquesmenu  staff   4414944 Feb  9 11:25 countnotes
12 17408 -rwxr-xr-x  1 jacquesmenu  staff   8313952 Feb  9 11:25 displayMusicformatsHistory
13 17408 -rwxr-xr-x  1 jacquesmenu  staff   8313952 Feb  9 11:25 displayMusicformatsVersion
14  80896 -rwxr-xr-x  1 jacquesmenu  staff  40526208 Feb  9 11:25 msdlconverter
15 13312 -rwxr-xr-x  1 jacquesmenu  staff   6387232 Feb  9 11:25 partsummary
16  9216 -rwxr-xr-x  1 jacquesmenu  staff   4528736 Feb  9 11:25 readunrolled
17 64512 -rwxr-xr-x  1 jacquesmenu  staff  32618592 Feb  9 11:25 xml2brl
18 68608 -rwxr-xr-x  1 jacquesmenu  staff  34088624 Feb  9 11:25 xml2gmn
19 17408 -rwxr-xr-x  1 jacquesmenu  staff   8781984 Feb  9 11:25 xml2guido
20 68608 -rwxr-xr-x  1 jacquesmenu  staff  34436992 Feb  9 11:25 xml2ly
21 13312 -rwxr-xr-x  1 jacquesmenu  staff   6342528 Feb  9 11:25 xml2midi
22 60416 -rwxr-xr-x  1 jacquesmenu  staff  30426688 Feb  9 11:25 xml2xml
23  9216 -rwxr-xr-x  1 jacquesmenu  staff   4657200 Feb  9 11:25 xmlclone
24 11264 -rwxr-xr-x  1 jacquesmenu  staff   4735296 Feb  9 11:25 xmlfactory
25  9216 -rwxr-xr-x  1 jacquesmenu  staff   4504976 Feb  9 11:25 xmliter
26  9216 -rwxr-xr-x  1 jacquesmenu  staff   4442496 Feb  9 11:25 xmlread
27 13312 -rwxr-xr-x  1 jacquesmenu  staff   6129744 Feb  9 11:25 xmltranspose
28 11264 -rwxr-xr-x  1 jacquesmenu  staff   4734368 Feb  9 11:25 xmlversion
29
30 documentation/IntroductionToMusicXML:
31 total 1672
```

```

32 0 drwxr-xr-x@ 3 jacquesmenu staff 96 Feb 9 13:51 .
33 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 13:51 ..
34 1672 -rw-r--r--@ 1 jacquesmenu staff 854295 Feb 9 11:25 IntroductionToMusicXML.pdf
35
36 documentation/MusicFormatsCLIUserGuide:
37 total 1616
38 0 drwxr-xr-x@ 3 jacquesmenu staff 96 Feb 9 13:51 .
39 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 13:51 ..
40 1616 -rw-r--r--@ 1 jacquesmenu staff 826403 Feb 9 11:25 MusicFormatsCLIUserGuide.pdf

```

Mac OS™ gets more and more stringent over time regarding security. The operating system part in charge of this is named Gatekeeper.

When installing MusicFormats from the repository on versions up to 10 (High Sierra), the executables in **build/bin** are available alright.

From version 11 (Catalina) on, though, the executables you get are not executable actually, because their developer is unknown to the operating system, and actions have to be taken for them to be usable.

The screenshot below has been made with Mac OS™ Monterey 12.0.1 with english as the user interface language. The texts vary of course depending on the language used.

After downloading, we get:

```

1 jacquesmenu@macmini: ~/Downloads/MusicFormats-for-macos/build/bin > ll
2 total 659992
3 0 drwxr-xr-x@ 25 jacquesmenu staff 800 Feb 5 10:17:27 2022 ./
4 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 5 10:17:26 2022 ../
5 74808 -rw-r--r--@ 1 jacquesmenu staff 38301488 Feb 5 08:40:16 2022 LilyPondIssue34
6 74816 -rw-r--r--@ 1 jacquesmenu staff 38304608 Feb 5 08:40:16 2022
7 Mikrokosmos3Wandering
8 8432 -rw-r--r--@ 1 jacquesmenu staff 4314896 Feb 5 08:40:16 2022 MusicAndHarmonies
9 8432 -rw-r--r--@ 1 jacquesmenu staff 4314880 Feb 5 08:40:16 2022 RandomChords
10 8432 -rw-r--r--@ 1 jacquesmenu staff 4314880 Feb 5 08:40:16 2022 RandomMusic
11 8624 -rw-r--r--@ 1 jacquesmenu staff 4414944 Feb 5 08:40:16 2022 countnotes
12 16232 -rw-r--r--@ 1 jacquesmenu staff 8308416 Feb 5 08:40:18 2022
13 displayMusicformatsHistory
14 16232 -rw-r--r--@ 1 jacquesmenu staff 8308416 Feb 5 08:40:18 2022
15 displayMusicformatsVersion
16 79144 -rw-r--r--@ 1 jacquesmenu staff 40521056 Feb 5 08:40:18 2022 msdlconverter
17 12480 -rw-r--r--@ 1 jacquesmenu staff 6387232 Feb 5 08:40:18 2022 partsummary
18 8848 -rw-r--r--@ 1 jacquesmenu staff 4528736 Feb 5 08:40:18 2022 readunrolled
19 63672 -rw-r--r--@ 1 jacquesmenu staff 32597328 Feb 5 08:40:20 2022 xml2brl
20 66544 -rw-r--r--@ 1 jacquesmenu staff 34067328 Feb 5 08:40:20 2022 xml2gmn
21 17160 -rw-r--r--@ 1 jacquesmenu staff 8781984 Feb 5 08:40:20 2022 xml2guido
22 67256 -rw-r--r--@ 1 jacquesmenu staff 34431984 Feb 5 08:40:22 2022 xml2ly
23 12392 -rw-r--r--@ 1 jacquesmenu staff 6342528 Feb 5 08:40:22 2022 xml2midi
24 59424 -rw-r--r--@ 1 jacquesmenu staff 30422064 Feb 5 08:40:22 2022 xml2xml
25 9104 -rw-r--r--@ 1 jacquesmenu staff 4657200 Feb 5 08:40:22 2022 xmlclone
26 9256 -rw-r--r--@ 1 jacquesmenu staff 4735296 Feb 5 08:40:22 2022 xmlfactory
27 8800 -rw-r--r--@ 1 jacquesmenu staff 4504976 Feb 5 08:40:22 2022 xmliter
28 8680 -rw-r--r--@ 1 jacquesmenu staff 4442496 Feb 5 08:40:24 2022 xmlread
29 11976 -rw-r--r--@ 1 jacquesmenu staff 6129744 Feb 5 08:40:24 2022 xmltranspose
30 9248 -rw-r--r--@ 1 jacquesmenu staff 4734368 Feb 5 08:40:24 2022 xmlversion

```

These files should first made executables:

```

1 jacquesmenu@macmini: ~/Downloads/MusicFormats-for-macos/build/bin > chmod +x *
2
3 jacquesmenu@macmini: ~/Downloads/MusicFormats-for-macos/build/bin > ll
4 total 659992
5 0 drwxr-xr-x@ 25 jacquesmenu staff 800 Feb 5 10:17:27 2022 ./
6 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 5 10:17:26 2022 ../
7 74808 -rwxr-xr-x@ 1 jacquesmenu staff 38301488 Feb 5 08:40:16 2022 LilyPondIssue34*

```

```

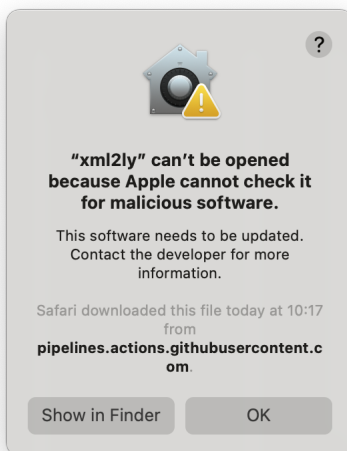
8 74816 -rwxr-xr-x@ 1 jacquesmenu staff 38304608 Feb 5 08:40:16 2022
    Mikrokosmos3Wandering*
9 8432 -rwxr-xr-x@ 1 jacquesmenu staff 4314896 Feb 5 08:40:16 2022 MusicAndHarmonies*
10 8432 -rwxr-xr-x@ 1 jacquesmenu staff 4314880 Feb 5 08:40:16 2022 RandomChords*
11 8432 -rwxr-xr-x@ 1 jacquesmenu staff 4314880 Feb 5 08:40:16 2022 RandomMusic*
12 8624 -rwxr-xr-x@ 1 jacquesmenu staff 4414944 Feb 5 08:40:16 2022 countnotes*
13 16232 -rwxr-xr-x@ 1 jacquesmenu staff 8308416 Feb 5 08:40:18 2022
    displayMusicformatsHistory*
14 16232 -rwxr-xr-x@ 1 jacquesmenu staff 8308416 Feb 5 08:40:18 2022
    displayMusicformatsVersion*
15 79144 -rwxr-xr-x@ 1 jacquesmenu staff 40521056 Feb 5 08:40:18 2022 msdlconverter*
16 12480 -rwxr-xr-x@ 1 jacquesmenu staff 6387232 Feb 5 08:40:18 2022 partsummary*
17 8848 -rwxr-xr-x@ 1 jacquesmenu staff 4528736 Feb 5 08:40:18 2022 readunrolled*
18 63672 -rwxr-xr-x@ 1 jacquesmenu staff 32597328 Feb 5 08:40:20 2022 xml2brl*
19 66544 -rwxr-xr-x@ 1 jacquesmenu staff 34067328 Feb 5 08:40:20 2022 xml2gmn*
20 17160 -rwxr-xr-x@ 1 jacquesmenu staff 8781984 Feb 5 08:40:20 2022 xml2guido*
21 67256 -rwxr-xr-x@ 1 jacquesmenu staff 34431984 Feb 5 08:40:22 2022 xml2ly*
22 12392 -rwxr-xr-x@ 1 jacquesmenu staff 6342528 Feb 5 08:40:22 2022 xml2midi*
23 59424 -rwxr-xr-x@ 1 jacquesmenu staff 30422064 Feb 5 08:40:22 2022 xml2xml*
24 9104 -rwxr-xr-x@ 1 jacquesmenu staff 4657200 Feb 5 08:40:22 2022 xmlclone*
25 9256 -rwxr-xr-x@ 1 jacquesmenu staff 4735296 Feb 5 08:40:22 2022 xmlfactory*
26 8800 -rwxr-xr-x@ 1 jacquesmenu staff 4504976 Feb 5 08:40:22 2022 xmliter*
27 8680 -rwxr-xr-x@ 1 jacquesmenu staff 4442496 Feb 5 08:40:24 2022 xmlread*
28 11976 -rwxr-xr-x@ 1 jacquesmenu staff 6129744 Feb 5 08:40:24 2022 xmltranspose*
29 9248 -rwxr-xr-x@ 1 jacquesmenu staff 4734368 Feb 5 08:40:24 2022 xmlversion*

```

Then, when launching one of these executables such as:

```
1 jacquesmenu@macmini > ./xml2ly
```

we get a alert telling that it cannot be opened, because the developer is not known to the operating system:



Clicking in either buttons in this dialog kill the process:

```
1 Killed: 9
```

The trouble is that these executables are in *quarantine* by default. To make them usable, they have to quit quarantine, which is done by removing one of their attributes:

```
1 xattr -d com.apple.quarantine *
```

From then on, the MusicFormats executables can be used seamlessly on the given machine.

Having to perform the preceding task for each executable is the price to pay for security. And it has to be performed again when installing new versions...

9.2 Linux basic installation

After downloading, we get:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/distrib/ubuntu-distrib > ls -sal */*
2 build/bin:
3 total 2264
4 0 drwxr-xr-x@ 25 jacquesmenu staff 800 Feb 9 16:45 .
5 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 16:45 ..
6 80 -rw-r--r--@ 1 jacquesmenu staff 39256 Feb 9 13:40 LilyPondIssue34
7 80 -rw-r--r--@ 1 jacquesmenu staff 39288 Feb 9 13:40 Mikrokosmos3Wandering
8 96 -rw-r--r--@ 1 jacquesmenu staff 47224 Feb 9 13:40 MusicAndHarmonies
9 96 -rw-r--r--@ 1 jacquesmenu staff 47216 Feb 9 13:40 RandomChords
10 96 -rw-r--r--@ 1 jacquesmenu staff 47216 Feb 9 13:40 RandomMusic
11 72 -rw-r--r--@ 1 jacquesmenu staff 33800 Feb 9 13:40 countnotes
12 40 -rw-r--r--@ 1 jacquesmenu staff 17648 Feb 9 13:40 displayMusicformatsHistory
13 40 -rw-r--r--@ 1 jacquesmenu staff 17648 Feb 9 13:40 displayMusicformatsVersion
14 104 -rw-r--r--@ 1 jacquesmenu staff 49760 Feb 9 13:40 msdlconverter
15 544 -rw-r--r--@ 1 jacquesmenu staff 275976 Feb 9 13:40 partsummary
16 88 -rw-r--r--@ 1 jacquesmenu staff 43720 Feb 9 13:40 readunrolled
17 80 -rw-r--r--@ 1 jacquesmenu staff 39200 Feb 9 13:40 xml2brl
18 88 -rw-r--r--@ 1 jacquesmenu staff 43336 Feb 9 13:40 xml2gmn
19 48 -rw-r--r--@ 1 jacquesmenu staff 23112 Feb 9 13:40 xml2guido
20 80 -rw-r--r--@ 1 jacquesmenu staff 39056 Feb 9 13:40 xml2ly
21 88 -rw-r--r--@ 1 jacquesmenu staff 42880 Feb 9 13:40 xml2midi
22 88 -rw-r--r--@ 1 jacquesmenu staff 43344 Feb 9 13:40 xml2xml
23 88 -rw-r--r--@ 1 jacquesmenu staff 43368 Feb 9 13:40 xmlclone
24 48 -rw-r--r--@ 1 jacquesmenu staff 22616 Feb 9 13:40 xmlfactory
25 168 -rw-r--r--@ 1 jacquesmenu staff 83488 Feb 9 13:40 xmliter
26 56 -rw-r--r--@ 1 jacquesmenu staff 28424 Feb 9 13:40 xmlread
27 56 -rw-r--r--@ 1 jacquesmenu staff 28656 Feb 9 13:40 xmltranspose
28 40 -rw-r--r--@ 1 jacquesmenu staff 17360 Feb 9 13:40 xmlversion
29
30 build/lib:
31 total 159744
32 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 16:45 .
33 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 16:45 ..
34 113664 -rw-r--r--@ 1 jacquesmenu staff 57941702 Feb 9 13:40 libmusicxml2.a
35 46080 -rw-r--r--@ 1 jacquesmenu staff 22806336 Feb 9 13:40 libmusicxml2.so
36
37 documentation/IntroductionToMusicXML:
38 total 1672
39 0 drwxr-xr-x@ 3 jacquesmenu staff 96 Feb 9 16:45 .
40 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 16:45 ..
41 1672 -rw-r--r--@ 1 jacquesmenu staff 854295 Feb 9 13:40 IntroductionToMusicXML.pdf
42
43 documentation/MusicFormatsCLIUserGuide:
44 total 1616
45 0 drwxr-xr-x@ 3 jacquesmenu staff 96 Feb 9 16:45 .
46 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 16:45 ..
47 1616 -rw-r--r--@ 1 jacquesmenu staff 826403 Feb 9 13:40 MusicFormatsCLIUserGuide.pdf

```

9.3 Windows™ basic installation

After downloading, we get:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/distrib/windows-distrib > ls -sal */*
2 build/bin:
3 total 1192
4 0 drwxr-xr-x@ 25 jacquesmenu staff 800 Feb 9 13:51 .
5 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 13:51 ..
6 64 -rw-r--r--@ 1 jacquesmenu staff 30208 Feb 9 12:03 LilyPondIssue34.exe
7 64 -rw-r--r--@ 1 jacquesmenu staff 30720 Feb 9 12:03 Mikrokosmos3Wandering.exe

```

```

8 56 -rw-r--r--@ 1 jacquesmenu staff 26112 Feb 9 12:03 MusicAndHarmonies.exe
9 56 -rw-r--r--@ 1 jacquesmenu staff 25088 Feb 9 12:03 RandomChords.exe
10 56 -rw-r--r--@ 1 jacquesmenu staff 25088 Feb 9 12:03 RandomMusic.exe
11 32 -rw-r--r--@ 1 jacquesmenu staff 14848 Feb 9 12:03 countnotes.exe
12 24 -rw-r--r--@ 1 jacquesmenu staff 10752 Feb 9 12:03 displayMusicformatsHistory.exe
13 24 -rw-r--r--@ 1 jacquesmenu staff 10752 Feb 9 12:03 displayMusicformatsVersion.exe
14 72 -rw-r--r--@ 1 jacquesmenu staff 35328 Feb 9 12:03 msdlconverter.exe
15 112 -rw-r--r--@ 1 jacquesmenu staff 56832 Feb 9 12:03 partsummary.exe
16 40 -rw-r--r--@ 1 jacquesmenu staff 18432 Feb 9 12:03 readunrolled.exe
17 64 -rw-r--r--@ 1 jacquesmenu staff 32768 Feb 9 12:03 xml2brl.exe
18 72 -rw-r--r--@ 1 jacquesmenu staff 33280 Feb 9 12:03 xml2gmn.exe
19 64 -rw-r--r--@ 1 jacquesmenu staff 29184 Feb 9 12:03 xml2guido.exe
20 64 -rw-r--r--@ 1 jacquesmenu staff 32768 Feb 9 12:03 xml2ly.exe
21 40 -rw-r--r--@ 1 jacquesmenu staff 17920 Feb 9 12:03 xml2midi.exe
22 72 -rw-r--r--@ 1 jacquesmenu staff 33280 Feb 9 12:03 xml2xml.exe
23 32 -rw-r--r--@ 1 jacquesmenu staff 14848 Feb 9 12:03 xmlclone.exe
24 32 -rw-r--r--@ 1 jacquesmenu staff 15360 Feb 9 12:03 xmlfactory.exe
25 40 -rw-r--r--@ 1 jacquesmenu staff 19456 Feb 9 12:03 xmliter.exe
26 56 -rw-r--r--@ 1 jacquesmenu staff 27136 Feb 9 12:03 xmlread.exe
27 32 -rw-r--r--@ 1 jacquesmenu staff 14848 Feb 9 12:03 xmltranspose.exe
28 24 -rw-r--r--@ 1 jacquesmenu staff 12288 Feb 9 12:03 xmlversion.exe
29
30 build/lib:
31 total 38912
32 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 13:51 .
33 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 13:51 ..
34 15360 -rw-r--r--@ 1 jacquesmenu staff 7517760 Feb 9 12:03 musicxml2.exp
35 23552 -rw-r--r--@ 1 jacquesmenu staff 11598816 Feb 9 12:03 musicxml2.lib
36
37 documentation/IntroductionToMusicXML:
38 total 1672
39 0 drwxr-xr-x@ 3 jacquesmenu staff 96 Feb 9 13:51 .
40 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 13:51 ..
41 1672 -rw-r--r--@ 1 jacquesmenu staff 854295 Feb 9 12:03 IntroductionToMusicXML.pdf
42
43 documentation/MusicFormatsCLIUserGuide:
44 total 1616
45 0 drwxr-xr-x@ 3 jacquesmenu staff 96 Feb 9 13:51 .
46 0 drwxr-xr-x@ 4 jacquesmenu staff 128 Feb 9 13:51 ..
47 1616 -rw-r--r--@ 1 jacquesmenu staff 826403 Feb 9 12:03 MusicFormatsCLIUserGuide.pdf

```

Chapter 10

Full installation

10.1 Cloning the repository

The library should be cloned locally, on the user's machine, with the command below. This creates a local copy (a *clone* in git's terminology) of the repository's contents, named here `musicformats_local_clone`:

```

1 jacquesmenu@macmini: ~ > git clone https://github.com/jacques-menu/musicformats.git
   musicformats_local_clone
2 Cloning into 'musicformats_local_clone'...
3 remote: Enumerating objects: 20619, done.
4 remote: Counting objects: 100% (15175/15175), done.
5 remote: Compressing objects: 100% (7546/7546), done.
6 remote: Total 20619 (delta 13189), reused 9420 (delta 7560), pack-reused 5444
7 Receiving objects: 100% (20619/20619), 107.32 MiB | 11.14 MiB/s, done.
8 Resolving deltas: 100% (15569/15569), done.

```

More precisely, the local copy is that of the *default branch*, which is a stable one, i.e. you can use it safely. It contains:

```

1 jacquesmenu@macmini: ~ > cd musicformats_local_clone
2 jacquesmenu@macmini: ~/musicformats_local_clone > ls -sal
3 total 96
4  0 drwxr-xr-x  22 jacquesmenu  staff    704 Feb  2 17:26 .
5  0 drwxr-xr-x+ 80 jacquesmenu  staff   2560 Feb  2 17:26 ..
6  0 drwxr-xr-x  12 jacquesmenu  staff    384 Feb  2 17:26 .git
7  0 drwxr-xr-x   3 jacquesmenu  staff     96 Feb  2 17:26 .github
8  8 -rwxr-xr-x   1 jacquesmenu  staff   1050 Feb  2 17:26 Build_libmusicformats.bash
9  0 drwxr-xr-x   3 jacquesmenu  staff     96 Feb  2 17:26 KEEP
10 40 -rw-r--r--   1 jacquesmenu  staff  16725 Feb  2 17:26 LICENSE
11  8 -rwxr-xr-x   1 jacquesmenu  staff   1055 Feb  2 17:26 README.md
12  0 drwxr-xr-x   9 jacquesmenu  staff    288 Feb  2 17:26 build
13  0 drwxr-xr-x  10 jacquesmenu  staff    320 Feb  2 17:26 docs
14  0 drwxr-xr-x   9 jacquesmenu  staff    288 Feb  2 17:26 documentation
15  0 drwxr-xr-x   6 jacquesmenu  staff    192 Feb  2 17:26 files
16  0 drwxr-xr-x   5 jacquesmenu  staff    160 Feb  2 17:26 javascript
17  0 drwxr-xr-x  21 jacquesmenu  staff    672 Feb  2 17:26 libmusicxml
18  0 drwxr-xr-x  10 jacquesmenu  staff    320 Feb  2 17:26 midisharelight
19 40 -rw-r--r--   1 jacquesmenu  staff  18502 Feb  2 17:26 musicFormatsBashDefinitions.bash
20  0 drwxr-xr-x   6 jacquesmenu  staff    192 Feb  2 17:26 packages
21  0 drwxr-xr-x   8 jacquesmenu  staff    256 Feb  2 17:26 schemas
22  0 drwxr-xr-x  12 jacquesmenu  staff    384 Feb  2 17:26 src
23  0 drwxr-xr-x   7 jacquesmenu  staff    224 Feb  2 17:26 validation
24  0 drwxr-xr-x  11 jacquesmenu  staff    352 Feb  2 17:26 web
25  0 drwxr-xr-x   4 jacquesmenu  staff    128 Feb  2 17:26 win32
26 jacquesmenu@macmini: ~/musicformats_local_clone > git branch
27 * stable-v0.9.59

```


10.2 Building the library on Mac OS™ and Linux

Mac OS™ and Linux have the same kind of tools behind the scenes for software development.

In order to build MusicFormats from source on your machine, you need:

- a C++11 compiler;
- the `cmake` tool.

The supported operating systems to build the library and run the command line tools are Linux, Windows and MacOS. Other systems may be fine but have not been tested.

MusicFormats requires C++11 at least. More recent versions are fine.

Once in the local repository clone, just execute:

```
1 cd build
2 make
```

The resulting executables are in `build/bin`:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev > ll build/bin
2 total 754368
3 0 drwxr-xr-x@ 26 jacquesmenu staff      832 Sep 27 00:05:02 2021 ./
4 0 drwxr-xr-x  11 jacquesmenu staff      352 Aug  1 18:32:54 2021 ../
5 72072 -rwxr-xr-x  1 jacquesmenu staff 36899440 Sep 27 00:04:52 2021 LilyPondIssue34*
6 72080 -rwxr-xr-x  1 jacquesmenu staff 36902528 Sep 27 00:04:54 2021
7   Mikrokosmos3Wandering*
8 8504 -rwxr-xr-x  1 jacquesmenu staff  4350480 Sep 27 00:04:49 2021 MusicAndHarmonies*
9 8504 -rwxr-xr-x  1 jacquesmenu staff  4350464 Sep 27 00:05:00 2021 RandomChords*
10 8504 -rwxr-xr-x  1 jacquesmenu staff  4350448 Sep 27 00:05:01 2021 RandomMusic*
11 8696 -rwxr-xr-x  1 jacquesmenu staff  4450928 Sep 27 00:04:56 2021 countnotes*
12 63904 -rwxr-xr-x  1 jacquesmenu staff 32717248 Sep 27 00:04:57 2021
13   libMultipleInitsTest*
14 76696 -rwxr-xr-x  1 jacquesmenu staff 39266928 Sep 27 00:05:01 2021 msdlconverter*
15 144 -rwxr-xr-x  1 jacquesmenu staff    70480 Sep 27 00:04:55 2021 musicformatsversion
16   *
17 12616 -rwxr-xr-x  1 jacquesmenu staff  6455376 Sep 27 00:04:59 2021 partsummary*
18 8920 -rwxr-xr-x  1 jacquesmenu staff  4564864 Sep 27 00:04:59 2021 readunrolled*
19 81048 -rwxr-xr-x  1 jacquesmenu staff 41496208 Sep 27 00:04:49 2021 xml2Any*
20 61232 -rwxr-xr-x  1 jacquesmenu staff 31347456 Sep 27 00:04:53 2021 xml2brl*
21 63704 -rwxr-xr-x  1 jacquesmenu staff 32615072 Sep 27 00:04:47 2021 xml2gmn*
22 17368 -rwxr-xr-x  1 jacquesmenu staff  8891744 Sep 27 00:04:56 2021 xml2guido*
23 63896 -rwxr-xr-x  1 jacquesmenu staff 32713936 Sep 27 00:04:50 2021 xml2ly*
24 12512 -rwxr-xr-x  1 jacquesmenu staff  6403968 Sep 27 00:04:55 2021 xml2midi*
25 56384 -rwxr-xr-x  1 jacquesmenu staff 28865024 Sep 27 00:04:59 2021 xml2xml*
26 9176 -rwxr-xr-x  1 jacquesmenu staff  4695472 Sep 27 00:04:55 2021 xmlclone*
27 9320 -rwxr-xr-x  1 jacquesmenu staff  4771024 Sep 27 00:05:00 2021 xmlfactory*
28 8912 -rwxr-xr-x  1 jacquesmenu staff  4559072 Sep 27 00:04:57 2021 xmliter*
29 8752 -rwxr-xr-x  1 jacquesmenu staff  4478336 Sep 27 00:04:55 2021 xmlread*
30 12104 -rwxr-xr-x  1 jacquesmenu staff  6193216 Sep 27 00:04:54 2021 xmltranspose*
31 9320 -rwxr-xr-x  1 jacquesmenu staff  4770128 Sep 27 00:05:02 2021 xmlversion*
```

The resulting libraries are in `build/bin`, here on MacOS:


```

1 jacquesmenu@macmini: ~/musicformats-git-dev > ll build/lib
2 total 1888712
3      0 drwxr-xr-x  10 jacquesmenu  staff      320 Sep 27 00:04:46 2021 ./
4      0 drwxr-xr-x  11 jacquesmenu  staff      352 Aug  1 18:32:54 2021 ../
5 104904 -rwxr-xr-x   1 jacquesmenu  staff 53707712 Sep 27 00:04:46 2021 libmusicxml2
6      .3.2.0.dylib*
7      0 lrwxr-xr-x   1 jacquesmenu  staff      24 Sep 27 00:04:45 2021 libmusicxml2.3.
8      dylib@ -> libmusicxml2.3.2.0.dylib
9 1055040 -rw-r--r--   1 jacquesmenu  staff 532838416 Sep 27 00:04:41 2021 libmusicxml2.a
10 591776 -rw-r--r--   1 jacquesmenu  staff 302989312 Sep 21 09:05:55 2021 libmusicxml2.a.
11      A93i4n
12 57056 -rw-r--r--   1 jacquesmenu  staff 29212672 Sep 21 09:01:27 2021 libmusicxml2.a.
13      KHrJT0
14 39968 -rw-r--r--   1 jacquesmenu  staff 20463616 Sep 21 09:11:20 2021 libmusicxml2.a.
15      gZfmqe
16 39968 -rw-r--r--   1 jacquesmenu  staff 20463616 Sep 21 09:09:22 2021 libmusicxml2.a.
17      tndUAV
18      0 lrwxr-xr-x   1 jacquesmenu  staff      20 Sep 27 00:04:45 2021 libmusicxml2.
19      dylib@ -> libmusicxml2.3.dylib

```

Make sure this bin directory is in your bash PATH, and there you are.

10.3 Building the library on Windows™

Part V

Options and help (OAH)

Chapter 11

Options and help design principles

MusicFormats having many services with many options makes options and help handling a challenge. This is why MusicFormats provides OAH (Options And Help), a full-fledged object-oriented options and help management infrastructure.

OAH (Options And Help) is supposed to be pronounced something close to "whaaaaah!" The intonation is left to the speaker, though... And as the saying goes: "OAH? why not!"

OAH organizes the options and the corresponding help in a hierarchy of groups, sub-groups and so-called atoms. OAH is introspective, thus help can be obtained for every group, sub-group or atom at will.

Each pass supplies a OAH group, containing its own options and help. The converters then aggregate the OAH groups of the passes they are composed of to offer their options and help to the user.

MusicFormats is equipped with a full-fledged set of options with the corresponding help. Since there are many options and the translation work is done in successive passes, the help is organized in a hierarchy of groups, each containing sub-groups of individual options called *atoms*.

The `-query` option used through-out this document will be presented in detail at section 13.2, [Querying about options by name], page 47.

The term *command line* means that the user launches the MusicFormats services in a terminal window, using a so-called *shell*. A shell writes a so-called *prompt* in the window, indicating that it waits for user input at the keyboard, and performs a loop:

- it *reads* a line from the keyboard, made of a command name, options and arguments;
- the command is analyzed to check that it is *well-formed*;
- the command is *executed* if it is well-formed;
- the shell displays the prompt again and waits for the next user input.

When a terminal window is created, a shell is launched automatically, waiting for user input in that window.

Various shell families have been created over time. The most widely used today is Bash (<https://www.gnu.org/software/bash/>). No worry though, the information presented in this section applies to all of them.

Chapter 12

Options use

The OAH options are very easy to use. They are inspired by GNU options, with more power and flexibility:

- the options can be supplied in the command line as usual;
- they can also be supplied in a call to an API function such as `musicxmlfile2lilypond ()`, in an options and arguments argument.
See the [MusicFormatsAPIUserGuide](#) for the details;
- options are introduced either by `-` or `--`, which can be used at will. Both ways are equivalent;
- all options have a long name, and some have a complementary short name. The latter is not provided if the long name is short enough, such as `-jianpu`, `-cubase`, `-ambitus` or `-custos`.
Short and long names can be used and mixed at will in the command line and in option vectors (API). Apart from very common options such as `-o`, the short names are meant for interactive use. This document uses only long name, which are more explicit in general;
- some short option names are supplied as is usual in open software, such as `-h` (help), and `-o` (output file name):

```
1 jacquesmenu@macmini > xml2ly -query o
2 --- Help for atom "o" in subgroup "Files"
3     -output-file-name, -o FILENAME
4         Write output to file FILENAME instead of standard output.
```

- options and arguments such as file names can be intermixed at will. Thus:

```
1 xml2ly --display-cpu-usage basic/HelloWorld.xml
```

and

```
1 xml2ly basic/HelloWorld.xml -display-cpu-usage
```

produce the exact same result;

- some options names, either long or short, share a common prefix. This allows them to be *contracted*, as in `-h=rests,notes`, which is equivalent to `-hrests`, `-hnotes`, and `-trace=voices,notes`, equivalent to `-trace-voices`, `-trace-notes`:

```
1 jacquesmenu@macmini > xml2ly -query h
2 --- Help for prefix "h" ---
3     '-h=abc,xyz' is equivalent to '-habc, -hxyz'
4
5 --- Help for atom "h" in subgroup "Options and help"
6     -help, -h
7         Display xml2ly's full help.
```

- the single-character options can be *clustered*: `-vac` is equivalent to: `-v, -a, -c`:

```

1 jacquesmenu@macmini > xml2ly -va
2 Command line version of musicxml2lilypond converter v0.9.52 (November 29, 2021)
3 A member of MusicFormats v0.9.59 (January 4, 2022)
4
5 Representations versions:
6   MXSR
7     v0.9.5 (October 6, 2021)
8   MSR
9     v0.9.52 (November 27, 2021)
10  LPSR
11    v0.9.5 (October 6, 2021)
12
13 Passes versions:
14   mxsr2msr
15     v0.9.51 (November 27, 2021)
16   msr2msr
17     v0.9.51 (November 15, 2021)
18   msr2lpsr
19     v0.9.5 (October 6, 2021)
20   lpsr2lilypond
21     v0.9.52 (December 16, 2021)
22 What xml2ly does:
23
24   This multi-pass converter basically performs 5 passes:
25     Pass 1:  reads the contents of MusicXMLFile or stdin ('-')
26              and converts it to a MusicXML tree;
27     Pass 2a: converts that MusicXML tree into
28              a first Music Score Representation (MSR) skeleton;
29     Pass 2b: populates the first MSR skeleton from the MusicXML tree
30              to get a full MSR;
31     Pass 3:  converts the first MSR into a second MSR to apply options
32     Pass 4:  converts the second MSR into a
33              LilyPond Score Representation (LPSR);
34     Pass 5:  converts the LPSR to LilyPond code
35              and writes it to standard output.
36
37   Other passes are performed according to the options, such as
38   displaying views of the internal data or printing a summary of the score.
39
40   The activity log and warning/error messages go to standard error.

```

12.1 Options characteristics

There are various options in MusicFormats for various needs. Every option controls a feature of a component or specifies a value used in the operation of the library.

An option can be:

- pure help: it provides information to the user, but does not do anything musical, such as option `-contact`, `-c`:

```

1 jacquesmenu@macmini > xml2ly -contact
2 To contact the maintainers of xml2ly:
3   Send a mail to mailto:lilypond-user@gnu.org describing the problem
4   and any error messages you get if relevant.

```

- self-sufficient, such as option `-quiet`, `-q`:

```

1 jacquesmenu@macmini-1 > xml2ly -query quiet
2 --- Help for atom "quiet" in subgroup "Warning and errors"
3     -quiet, -q
4         Don't issue any warning or error messages.

```

- expecting a value, which must be supplied right after the option name:

```

1 jacquesmenu@macmini > xml2ly -query msr-pitches-language
2 --- Help for atom "msr-pitches-language" in subgroup "Notes"
3     -msr-pitches-language, -mplang LANGUAGE
4         Use LANGUAGE to display note pitches in the MSR logs and text views.
5         The 13 MSR pitches languages available are:
6         arabic, catalan, deutsch, english, espanol, francais,
7         italiano, nederlands, norsk, portugues, suomi, svenska and vlaams.
8         The default is 'kQTPNederlands'.

```

- expecting an optional value, supplied with a '=' without any spaces: a default value is used if none is provided by the user, such as `-name-help`, `-nh`, presented in more detail at section 13.2, [Querying about options by name], page 47:

```

1 jacquesmenu@macmini > xml2ly -name-help=output-file-name
2 --- Help for atom "output-file-name" in subgroup "Files"
3     -output-file-name, -o FILENAME
4         Write output to file FILENAME instead of standard output.

```

Some options can be used *several times*, while the others can be used only once.

12.2 The `-insider` option

As mentioned above, the MusicFormats library components, i.e. representations, passes, converters and generators, have options and help attached to them. There are also other 'global' sets of options, independently of the individual components themselves.

MusicFormats has to 'modes' for options and help handling:

- in *regular* mode, the default, the options are grouped by subject, such as tuplets or chords. In other words, there are grouped in a user-oriented way;
- in *insider* mode, they are grouped as there are used internally by MusicFormats behind the scenes, in an implementation-oriented way, hence the name.

Switching from the default regular mode to the insider mode is done with the `-insider`, `-ins` option:

```

1 jacquesmenu@macmini > xml2ly -query insider
2 --- Help for atom "insider" in subgroup "Options and help"
3     -insider, -ins
4         Use the 'insider' mode for the options and help,
5         in which the options are grouped as they are used internally by MusicFormats.
6         In the 'regular' default mode, they are grouped by user-oriented topics,
7         such a slurs, tuplets and figured bass.

```

In regular mode, the options are displayed in subgroups only. The groups containing them are not displayed for simplicity, because a three-level options hierarchy is not what users expect and are used to.

For example, the `-ignore-ornaments`, `-oorns` option is displayed this way in regular mode:

```

1 jacquesmenu@macmini > xml2ly -query ignore-ornaments
2 --- Help for atom "ignore-ornaments" in subgroup "Ornaments"
3   -ignore-ornaments, -oorns
4       Ignore ornaments in MusicXML data.

```

In insider mode, on the contrary, the full group-subgroup-atom hierarchy is visible, as well as the attachment of the options to the groups managed internally by MusicFormats:

```

1 jacquesmenu@macmini > xml2ly -query ignore-ornaments -insider
2 --- Help for atom "ignore-ornaments" in subgroup "Notes" of group "mxsr2msr" ---
3   -ignore-ornaments, -oorns
4       Ignore ornaments in MusicXML data.

```

To summarize things up, it can be said that the regular mode offers a user-oriented *view* of the options available in the insider mode.

12.3 Early options

A particular case of options is the *early options*, which are taken into account prior to the options being actually analyzed. This is the case of option `-insider`, `-ins`, since the whole set of possible options depends on it being used or not.

An early option should be supplied in the command line itself. Having it in included options and arguments files prevents it from being applied early. See chapter 15, [Including options and arguments from a file], page 57 about this feature.

Chapter 13

Options and help introspection

13.1 Restricting help to a given group or subgroup

The OAH groups and subgroups can be displayed with their own options, such as option `-help-midi`, `-hmidi`:

```

1 jacquesmenu@macmini: ~ > xml2ly -help-midi
2 --- Help for subgroup "MIDI" in group "MIDI group" ---
3 MIDI group (-help-midi-group, -hmidi-group):
4 -----
5 MIDI (-help-midi, -hmidi):
6   -no-midi
7       Generate the '\midi' block as a comment instead of active code.
8   -midi-tempo, -mdtempo MIDI_TEMPO_SPEC
9       Generate a '\tempo' command in the \midi block.
10      MIDI_TEMPO_SPEC can be:
11      'DURATION = PER_SECOND'
12      or
13      "DURATION = PER_SECOND" .
14      DURATION is a string such as '8.', and PER_SECOND is an integer.
15      The single or double quotes are used to allow spaces around the '=' sign,
16      otherwise they can be dispensed with.
17      Using double quotes allows for shell variables substitutions, as in:
18      PER_SECOND=66
19      xml2ly -midiTempo "8. ${PER_SECOND}" .
20      The default is '8 = 180'.

```

13.2 Querying about options by name

One can obtain help on any specific group, sub-group or atom with the `-query` option:

```

1 jacquesmenu@macmini > xml2ly -query query
2 --- Help for atom "query" in subgroup "Options and help"
3   -query OPTION_NAME
4       Print help about OPTION_NAME.

```

```

1 jacquesmenu@macmini > xml2ly -query output-file-name
2 --- Help for atom "output-file-name" in subgroup "Files"
3   -output-file-name, -o FILENAME
4       Write output to file FILENAME instead of standard output.

```

Another option exists to obtain the same result: `-name-help`, `-nh` has an optional value:


```

1 jacquesmenu@macmini > xml2ly -name-help=output-file-name
2 --- Help for atom "output-file-name" in subgroup "Files"
3     -output-file-name, -o FILENAME
4         Write output to file FILENAME instead of standard output.

```

The default value if none is supplied is...name-help itself:

```

1 jacquesmenu@macmini > xml2ly -name-help
2 --- Help for atom "name-help" in subgroup "Options and help"
3     -name-help, -nh OPTION_NAME
4         Print help about OPTION_NAME.
5         OPTION_NAME is optional, and the default value is 'name-help'.

```

Choosing one option of the other is a matter of taste. To be honest, `-name-help`, `-nh` has been created to illustrate optional values...

13.3 Searching the help for a string

The MusicFormats services have a great number of options. Option `-find` comes in handy to search the available help:

```

1 jacquesmenu@macmini > xml2ly -query find
2 --- Help for atom "find" in subgroup "Options and help"
3     -find STRING
4         Find string STRING in the help.
5         The search is case insensitive, and a '-' is added in front of options names for
        clarity.

```

```

1 jacquesmenu@macmini > xml2ly -find output-file-name
2 2 occurrences of string "output-file-name" have been found:
3     1:
4         -output-file-name, -o FILENAME
5         Write output to file FILENAME instead of standard output.
6     2:
7         -auto-output-file-name, -aofn
8         This option can only be used when writing to a file.
9             Writethe output to a file in the current working directory.
10            The file name is derived from that of the input file:
11            any suffix after the '.' is replaced by one suited for the output
        format,
12            or such a suffix is adde if no '.' is present.

```

13.4 Displaying help about options usage

A minimal version of this chapter is displayed by the `--help-options-usage`, `-hou` option:

```

1 jacquesmenu@macmini > xml2ly -help-options-usage
2 xml2ly options usage:
3     In xml2ly, '-' as an argument, represents standard input.
4
5     Most options have a short and a long name for commodity.
6     The long name may be empty if the short name is explicit enough.
7
8     The options are organized in a group-subgroup-atom hierarchy.
9     Help can be obtained for groups or subgroups at will,
10    as well as for any option with the '-name-help, -nh' option.
11
12    A subgroup can be showm as a header only, in which case its description is printed

```

```
13 only when the corresponding short or long names are used.
14
15 Both '-' and '--' can be used to introduce options,
16 even though the help facility only shows them with '-'.
17
18 There some prefixes to allow for shortcuts,
19 such as '-t=voices,meas' for '-tvoices, -tmeas'.
20
21 The options can be placed in any order,
22 provided the values immediately follow the atoms that need them.
23
24 Using options that attempt to create files, such as '-o, -output-file-name',
25 leads to an error if the environment is read-only access,
26 as is the case of https://libmusicxml.grame.fr .
```

13.5 Displaying a help summary

This can be done with the `-help-summary`, `-hs` option:

```
1 jacquesmenu@macmini > xml2ly -query help-summary
2 --- Help for atom "help-summary" in subgroup "Options and help"
3     -help-summary, -hs
4         Display xml2ly's help summary.
```

Chapter 14

Options examples

14.1 Boolean options

Most of the options are boolean : the feature they control is `false` by default, and is set to `true` when the option is used, such as:

```
1 jacquesmenu@macmini > xml2ly -query display-cpu-usage
2 --- Help for atom "display-cpu-usage" in subgroup "Informations"
3     -display-cpu-usage, -cpu
4         Write information about CPU usage to standard error.
```

14.2 Options simple values

There are options to supply value of various types to the services, such a strings, integers, floating numbers and rationals:

```
1 jacquesmenu@macmini: ~ > xml2ly -query page-count
2 --- Help for atom "page-count" in subgroup "Paper"
3     -page-count PAGE_COUNT
4         Set the LilyPond 'page-count' paper variable to PAGE_COUNT in the LilyPond code.
5         PAGE_COUNT should be a positive integer.
6         By default, this is left to LilyPond'.
```

```
1 jacquesmenu@macmini: ~ > xml2ly -query msr-ignore-musicxml-part-id
2 --- Help for atom "msr-ignore-musicxml-part-id" in subgroup "Parts"
3     -msr-ignore-musicxml-part-id, -momp PART_ID
4         Ignore the part with ID PART_ID, which is a string.
5         There can be several occurrences of this option.
6         All the parts not ignored are kept.
7         This option is incompatible with '-mkpi, -msr-keep-musicxml-part-id'.
```

```
1 jacquesmenu@macmini: ~ > xml2ly -query global-staff-size
2 --- Help for atom "global-staff-size" in subgroup "Layout"
3     -global-staff-size, -gss NUMBER
4         Set the LilyPond '#(set-global-staff-size ...)' to NUMBER in the LilyPond code.
5         NUMBER should be a floating point or integer number.
6         The default is '20.000000'.
```

```

1 jacquesmenu@macmini: ~ > xml2ly -query lilypond-lyrics-durations-style
2 --- Help for atom "lilypond-lyrics-durations-style" in subgroup "Lyrics"
3   -lilypond-lyrics-durations-style, -ld STYLE
4     The 2 LilyPond lyrics durations STYLES available are:
5     explicit and implicit.
6     Using 'implicit' prevents the creation of lyrics attached to rests by LilyPond,
7     use 'explicit' in such cases.
8     The default is 'explicit'.

```

```

1 jacquesmenu@macmini: ~ > xml2ly -query delayed-ornaments-fraction
2 --- Help for atom "delayed-ornaments-fraction" in subgroup "Ornaments"
3   -delayed-ornaments-fraction, -dof NUM/DENOM
4     Place the delayed turn/reverseturn at the given fraction
5     between the ornamented note and the next one.
6     The default is '1/2'.

```

14.3 Options more complex values

There are options to supply value of various type to the services. Here are some examples:

```

1 jacquesmenu@macmini: ~ > xml2ly -query top-margin
2 --- Help for atom "top-margin" in subgroup "Paper"
3   -top-margin MARGIN
4     Set the LilyPond 'top-margin' paper variable to MARGIN in the LilyPond code.
5     WIDTH should be a positive floating point or integer number,
6     immediately followed by a unit name, i.e. 'in', 'mm' or 'cm'.
7     By default, this is left to LilyPond'.

```

```

1 jacquesmenu@macmini: ~ > xml2ly -query msr-replace-clef
2 --- Help for atom "msr-replace-clef" in subgroup "Clefs"
3   -msr-replace-clef, -mrc REPLACE_CLEF_SPEC
4     Ralplace clef ORIGINAL_CLEF by NEW_CLEF.
5     REPLACE_CLEF_SPEC can be:
6     'ORIGINAL_CLEF = NEW_CLEF'
7     or
8     "ORIGINAL_CLEF = NEW_CLEF"
9     The single or double quotes are used to allow spaces in the clef names
10    and around the '=' sign, otherwise they can be dispensed with.
11    The 23 clefs available are:
12    treble, soprano, mezzosoprano, alto, tenor, baritone, bass,
13    treble1, treble-15, treble-8, treble+8, treble+15, bass-15, bass-8,
14    bass+8, bass+15, varbaritone, tab4, tab5, tab6, tab7, percussion and
15    jianpu.
16    There can be several occurrences of this option.

```

```

1 jacquesmenu@macmini: ~ > xml2ly -query ledger-lines-color
2 --- Help for atom "ledger-lines-color" in subgroup "Staves"
3   -ledger-lines-color, -llc RGB_COLOR
4     Use RGB_COLOR for the ledger lines.
5     RGB_COLOR should be of the form 'r,g,b',
6     with r, g and b being float numbers between 0.0 and 1.0 inclusive.

```

```

1 jacquesmenu@macmini: ~ > xml2ly -query lilypond-transpose-part-name
2 --- Help for atom "lilypond-transpose-part-name" in subgroup "Parts"
3   -lilypond-transpose-part-name, -lilytpn PART_TRANSPOSITION_SPEC
4     Transpose part PART_NAME using TRANSPOSITION in the LilyPond code.
5     PART_TRANSPOSITION_SPEC can be:
6     'PART_NAME = TRANSPOSITION'
7     or
8     "PART_NAME = TRANSPOSITION"
9     The single or double quotes are used to allow spaces in the names

```

```

10      and around the '=' sign, otherwise they can be dispensed with.
11      TRANSPOSITION should contain a diatonic pitch, followed if needed
12      by a sequence of ',' or '\'' octave indications.
13      Such indications cannot be mixed, and they are relative to c\', i.e. middle C.
14      For example, 'a', 'f' and 'bes,' can be used respectively
15      for instruments in 'a', 'f' and B flat respectively.
16      Using double quotes allows for shell variables substitutions, as in:
17      SAXOPHONE="bes,"
18      EXECUTABLE -lilypond-transpose-part-name "P1 ${SAXOPHONE}" .
19      There can be several occurrences of this option.

```

```

1 jacquesmenu@macmini: ~ > xml2ly -query relative
2 --- Help for atom "relative" in subgroup "Notes"
3   -relative, -rel PITCH_AND_OCTAVE
4     Use relative octave entry reference PITCH_AND_OCTAVE in the generated LilyPond
5     code.
6     PITCH_AND_OCTAVE is made of a diatonic pitch and
7     an optional sequence of commas or single quotes.
8     It should be placed between double quotes if it contains single quotes, such as:
9     -rel "c'".
10    The default is to use LilyPond's implicit reference 'f'.

```

```

1 jacquesmenu@macmini: ~ > xml2ly -query lilypond-accidental-style
2 --- Help for atom "lilypond-accidental-style" in subgroup "Notes"
3   -lilypond-accidental-style, -as STYLE
4     STYLE should be one of the 18 LilyPond accidental styles available:
5     default, dodecaphonic, dodecaphonic-first,
6     dodecaphonic-no-repeat, forget, modern, modern-cautionary, modern-voice,
7     modern-voice-cautionary, neo-modern, neo-modern-cautionary, neo-modern-voice,
8     neo-modern-voice-cautionary, no-reset, piano, piano-cautionary, teaching and
9     voice.
10    The default is 'default'.

```

```

1 jacquesmenu@macmini: ~ > xml2ly -query chords-display
2 --- Help for atom "chords-display" in subgroup "Chords"
3   -chords-display, -chd SPECIFICATION
4     Use SPECIFICATION to display chords using LilyPond's chordNameExceptions.
5     SPECIFICATION should contain a chord contents such as '<c ees ges bes>',
6     followed by code to display it, for example:
7     '<c ees ges bes> \\super {"-7(" {\\small\\raise #0.5 \\flat} "5)"}'.
8     The LilyPond code has to escape backslashes, thus use '\\\\' to obtain '\\'.
9     These two elements are passed over to LilyPond verbatim, without any check.
10    This option can be used any number of times.

```

14.4 More complex options

The boolean options in MusicFormats can be combined:

```

1 jacquesmenu@macmini: ~ > xml2ly -query cubase
2 --- Help for atom "cubase" in subgroup "Times"
3   -cubase:
4     Useful settings for MusicXML data exported from Cubase.
5     This combined option is equivalent to:
6     -ignore-redundant-clefs, -irclefs:
7       Ignore clefs that are the same as the current one.
8     -ignore-redundant-keys, -irkeys:
9       Ignore keys that are the same as the current one.
10    -ignore-redundant-times, -irtimes:
11      Ignore times that are the same as the current one.
12 jacquesmenu@macmini: ~ >

```

Options can also share a common prefix:

```

1 jacquesmenu@macmini: ~ > xml2ly -query trace-when-handling-musicxml-data -insider
2 --- Help for atom "trace-when-handling-musicxml-data" in subgroup "MXSR Trace" of group "
  Mxsr" ---
3 -t<SHORT_NAME>, -trace--<LONG_NAME>
4     Trace SHORT_NAME/LONG_NAME when handling MusicXML data.
5 The 2 known SHORT_NAMES are:
6     enc and divs.
7 The 2 known LONG_NAMES are:
8     encoding and divisions.

```

OAH offers *macro options*, such as:

```

1 --- Help for atom "auto-utf8d" in subgroup "Files"
2 -auto-utf8d, -au8d:
3     To ease the production of braille files.
4     This macro option is equivalent to:
5     -auto-output-file-name, -aofn:
6         This option can only be used when writing to a file.
7         Writethe output to a file in the current working directory.
8         The file name is derived from that of the input file:
9         any suffix after the '.' is replaced by one suited for the output format,
10        or such a suffix is adde if no '.' is present.
11    -use-encoding-in-file-name, -ueifn:
12        Append a description of the encoding used
13        and the presence of a BOM if any to the file name before the '.'.

```

And finally, this macro option can be used to obtain informations on the fly and write the output to a file automatically:

```

1 jacquesmenu@macmini: ~ > xml2ly -query debug
2 --- Help for atom "debug" in subgroup "Options and help"
3 -debug:
4     To help debugging musicxml2lilypond.
5     This macro option is equivalent to:
6     -trace-passes, -tpasses:
7         Write a trace of the passes to standard error.
8     -auto-output-file-name, -aofn:
9         This option can only be used when writing to a file.
10        Writethe output to a file in the current working directory.
11        The file name is derived from that of the input file:
12        any suffix after the '.' is replaced by one suited for the output format,
13        or such a suffix is adde if no '.' is present.
14    -display-cpu-usage, -cpu:
15        Write information about CPU usage to standard error.

```

14.5 Displaying the options values

This can be done with the `-display-options-values`, `-dov` option:

```

1 jacquesmenu@macmini > xml2ly -query display-options-values
2 --- Help for atom "display-options-values" in subgroup "Options and help"
3 -display-options-values, -dov
4     Write the chosen options values to standard error.

```

Executing this command:

```

1 jacquesmenu@macmini > xml2ly -global-staff-size 30 -display-cpu-usage -display-options-
  values
2 The options values for xml2ly are:
3 Informations group (-help-informations-group, -hinfos-group), 1 atom chosen:
4 -----
5 Informations (-help-informations, -hinfos), 1 atom chosen:
6 fDisplayCPUUsage : true, has been set
7
8 Options and help group (-help-oah-group, -hoah-group), 1 atom chosen:
9 -----
10 Options and help (-help-oah, -hoah), 1 atom chosen:
11 fDisplayOptionsValues : true, has been set
12
13 Layout group (-help-layout-group, -hlayout-group), 1 atom chosen:
14 -----
15 Layout (-help-layout, -hlayout), 1 atom chosen:
16 fGlobalStaffSize : 30, has been set
17
18 Input file name or '-' for standard input expected

```

A exhaustive display of all the options values, chosen by the user or not, can be obtained with `-display-options-values-all`: displays the whole set of options with their values, and whether they have been set by the user:

```

1 jacquesmenu@macmini > xml2ly -global-staff-size 30 -display-cpu-usage -display-options-
  values-all
2
3 All the options values for xml2ly are:
4
5 OAH Trace (-help-trace, -ht):
6 -----
7 Other (-help-trace-other, -hto):
8 fTraceComponents : false
9 fTracePasses : false
10 fTraceGeometry : false
11 fTraceIdentification : false
12 fTraceForTests : false
13
14 ... ..
15
16 Informations group (-help-informations-group, -hinfos-group):
17 -----
18 Informations (-help-informations, -hinfos):
19 fDisplayCPUUsage : true, has been set
20
21 Files group (-help-files-group, -hfiles-group):
22 -----
23 Files (-help-files, -hfiles):
24 fOutputFileName :
25 fAutoOutputFileName : false
26
27 Options and help group (-help-oah-group, -hoah-group):
28 -----
29 Options and help (-help-oah, -hoah):
30 insider : fOptionHasBeenSelected: false
31 fOahVerboseMode : false
32 fReverseNamesDisplayOrder : false
33 fDisplayOptionsValues : true, has been set
34
35 ... ..
36
37 Staves group (-help-staves-group, -hstaves-group):
38 -----
39 Staves (-help-staves, -hstaves):
40 fCreateVoicesStaffRelativeNumbers : false
41 fLedgeLinesRGBColor : [0,0,0]

```

```

42
43 ... ..
44
45 Notes group (-help-notes-group, -hnotes-group):
46 -----
47 Notes (-help-notes, -hnotes):
48   fMsrQuarterTonesPitchesLanguageKind      : kQTPNederlands
49   OctaveEntryVariable :
50     fOctaveEntryKind      : kOctaveEntryAbsolute
51     : none
52   OctaveEntryVariable :
53     fOctaveEntryKind      : kOctaveEntryAbsolute
54     : none
55   fWhiteNoteHeads      : false
56   fGenerateStemsDirections : false
57   fGenerateCommentedOutVariables : false
58   fGenerateLpsrVisitingInformation : false
59   fAccidentalStyleKind : kAccidentalStyleDefault
60   fNonPrintNotesHeadRGBColor : [0,0,0]
61
62 ... ..
63
64 Paper group (-help-paper-group, -hpaper-group):
65 -----
66 Paper (-help-paper, -hpaper):
67   fPaperHeight      : [297 kUnitMillimeter]
68   fPaperWidth      : [210 kUnitMillimeter]
69   fPaperLeftMargin  : [15 kUnitMillimeter]
70   fPaperRightMargin : [15 kUnitMillimeter]
71   fPaperTopMargin   : [15 kUnitMillimeter]
72   fPaperBottomMargin : [15 kUnitMillimeter]
73   fRaggedBottom     : false
74   fRaggedLast       : false
75   fRaggedLastBottom : false
76   fRaggedRight      : false
77   fPaperHorizontalShift : [0 kUnitMillimeter]
78   fPaperIndent      : [0 kUnitMillimeter]
79   fPaperShortIndent  : [0 kUnitMillimeter]
80   fMarkupSystemSpacingPadding : [0 kUnitMillimeter]
81   fPageCount        : 0
82   fSystemCount      : 0
83
84 Layout group (-help-layout-group, -hlayout-group):
85 -----
86 Layout (-help-layout, -hlayout):
87   fGlobalStaffSize      : 30, has been set
88   fKeepStaffSize        : false
89
90 ... ..
91
92 MIDI group (-help-midi-group, -hmidi-group):
93 -----
94 MIDI (-help-midi, -hmidi):
95   fNoMidi      : false
96   fMidiTempo    : [MidiTempo, midiTempoDuration = "8",
97   midiTempoPerSecond = 180, line 0]
98 Input file name or '-' for standard input expected

```

14.6 Displaying MusicFormats internal data

MusicFormats provides many options to display its internals, including the representations it builds. Option `-find` can be used to see the various possibilities:


```
1 jacquesmenu@macmini > xml2ly -find display-
```

For example, consider `xml2ly`:

```
1 jacquesmenu@macmini > xml2ly -about
2 What xml2ly does:
3
4 This multi-pass converter basically performs 5 passes:
5   Pass 1:  reads the contents of MusicXMLFile or stdin ('-')
6             and converts it to a MusicXML tree;
7   Pass 2a: converts that MusicXML tree into
8             a first Music Score Representation (MSR) skeleton;
9   Pass 2b: populates the first MSR skeleton from the MusicXML tree
10            to get a full MSR;
11   Pass 3:  converts the first MSR into a second MSR to apply options
12   Pass 4:  converts the second MSR into a
13            LilyPond Score Representation (LPSR);
14   Pass 5:  converts the LPSR to LilyPond code
15            and writes it to standard output.
16
17 Other passes are performed according to the options, such as
18 displaying views of the internal data or printing a summary of the score.
19
20 The activity log and warning/error messages go to standard error.
```

The LPSR built in pass 4 and used in pass 5 to create the LilyPond output can be displayed with the following options:

```
1 jacquesmenu@macmini > xml2ly -find display-lpsr
2 3 occurrences of string "display-lpsr" have been found:
3   1:
4     -display-lpsr, -dlpsr
5     Write the contents of the LPSR data with a summary of its MSR component to standard
6     error.
7   2:
8     -display-lpsr-full, -dlpsrfull
9     Write the contents of the LPSR data with its full MSR component to standard error.
10  3:
11    -display-lpsr-short, -dlpsrshort
12    Write the contents of the LPSR data, short version, to standard error.
```

The resulting output is large of course, since LPSR represents the score in great detail. It can be used by curious users, and is a great help to the maintainers of MusicFormats.

Chapter 15

Including options and arguments from a file

MusicFormats converters have an `-include`, `-inc` option for this:

```
1 jacquesmenu@macmini-1 > xml2ly -query include
2 --- Help for atom "include" in subgroup "Options and help"
3     -include, -inc FILENAME
4         Include the options and arguments contained in FILENAME.
5         FILENAME is a string and should be a path to a text file.
6         Such a file is expected to hold at most one option or argument per line.
7         A '#' starts a comment that spans to the end of the line.
8         Comments and empty lines are ignored and can be used at will.
9         '-include, -inc' options may be used to include other files,
10        up to a maximum level of 10.
11        This is handy to share often used options in groups, for example.
```

Note that the current MusicFormats services can take at most one argument, that can be either a file name or `'-'`, that designates the standard input stream.

15.1 An options and arguments file example

A file that be included with the option sample is `basic/AnacrusisOptionsAndArguments.txt`:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > cat basic/
  AnacrusisOptionsAndArguments.txt
2 # some options
3
4 # output file
5 -auto-output-file-name
6
7 # contents
8 -title "Anacrusis created with '-include' option"
9 -subtitle "Just for the fun"
10
11 # layout
12 -global-staff-size 30
13
14 # non-musical
15 -cpu
16
17 # the MusicXML file
18
19 basic/Anacrusis.xml
```

Including this file with `xml2ly` gives:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly -include basic/
  AnacrusisOptionsAndArguments.txt
2 Timing information:
3
4 Activity      Description                                     Kind      CPU (sec)
5 -----
6
7             Handle the options and arguments from argc/argv      mandatory  0.03038
8 Pass 1        Create an MXSR reading a MusicXML file      mandatory  0.00353
9 Pass 2a       Create an MSR skeleton from the MXSR        mandatory  0.00071
10 Pass 2b      Populate the MSR skeleton from MusicXML data mandatory  0.00139
11 Pass 3       Convert the first MSR into a second MSR     mandatory  0.00037
12 Pass 4       Convert the second MSR into an LPSR        mandatory  0.00039
13 Pass 5       Convert the LPSR score to LilyPond code     mandatory  0.00088
14
15 Total (sec)  Mandatory  Optional
16 -----
17 0.03766      0.03766    0.00000
18
19 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > ls -sal Anacrusis.ly
20 8 -rw-r--r--@ 1 jacquesmenu  staff  1553 Feb  9 09:44 Anacrusis.ly

```

The resulting score is:

Anacrusis created with '-include' option

Just for the fun



15.2 Options values and arguments in included files

As shown in section 7.3, [Quoting, variables and aliases], page 28, the shell identifies words in the command line. This is why options values and arguments have to be inclosed in quotes or double quotes when they contain spaces.

In included files, these values are merely extracted from a line, and taken verbatim. To ease copying/pasting from the command line though, any quotes or double quotes around the values are ignored.

For example, `basic/QuotingInIncludedOptionsFiles.txt` contains:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles/basic > cat
  QuotingInIncludedOptionsFiles.txt
2 # contents
3 -title This year's title
4 -subtitle 'Last year's quoted multi-word subtitle'
5 -subsubtitle "Double quoted multi-word subsubtitle"
6
7 # display
8 -display-options-values
9
10 # LilyPond
11 -lilypond-generation-infos
12
13 # output
14 -auto-output-file-name

```

Including this file and displaying the options values, we get:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles/basic > xml2ly -include
  QuotingInIncludedOptionsFiles.txt HelloWorld.xml
2 The options values for xml2ly are:
3 Files group (-help-files-group, -hfiles-group), 1 atom chosen:
4 -----
5 Files (-help-files, -hfiles), 1 atom chosen:
6 fAutoOutputFileName : true
7
8 Options and help group (-help-oah-group, -hoah-group), 1 atom chosen:
9 -----
10 Options and help (-help-oah, -hoah), 1 atom chosen:
11 fDisplayOptionsValues : true
12
13 Header group (-help-header-group, -hheader-group), 3 atoms chosen:
14 -----
15 Header (-help-header, -hheader), 3 atoms chosen:
16 fTitle : This year's title
17 fSubTitle : Last year's quoted multi-word subtitle
18 fSubSubTitle : Double quoted multi-word subsubtitle
19
20 Output group (-help-output-group, -houtput-group), 1 atom chosen:
21 -----
22 Output (-help-output, -houtput), 1 atom chosen:
23 fXml2lyInfos : true

```

15.3 Multi-level includes

A file containing options and argument may itself use the `-include`, `-inc` option, which allows for options to be shared easily for various uses of the services.

Note, however, that early options are detected *before* the files inclusion are performed. In particular, the `-insider`, `-ins` option should be in the command line itself, at the top level so to say, to be taken into account.

For example, `basic/HelloWorldOptionsAndArguments_1.txt` contains:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > cat basic/
  HelloWorldOptionsAndArguments_1.txt
2 # output file
3 -auto-output-file-name
4
5 # contents
6 -title 'My title'
7 -subtitle " Nice subtitle"
8 -subsubtitle "Subsubtitle from HelloWorldOptionsAndArguments_1.txt"
9
10 # layout
11 -global-staff-size 30
12
13 # non-musical
14 -display-cpu-usage
15
16 # the MusicXML file
17 basic/HelloWorld.xml
18
19 # nested include
20 -include basic/HelloWorldOptionsAndArguments_2.txt

```

The included `basic/HelloWorldOptionsAndArguments_2.txt` file contains:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > cat basic/
  HelloWorldOptionsAndArguments_2.txt
2 # non-musical
3 -subsubtitle "Subsubtitle from HelloWorldOptionsAndArguments_2.txt"
4
5 # cycle detection check
6 # -include HelloWorldOptionsAndArguments_1.txt

```

Including `basic/HelloWorldOptionsAndArguments_1.txt`, we get:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly -include basic/
  HelloWorldOptionsAndArguments_1.txt
2 Timing information:
3
4 Activity      Description                                     Kind      CPU (sec)
5 -----
6
7             Handle the options and arguments from argc/argv      mandatory    0.02962
8 Pass 1        Create an MXSR reading a MusicXML file          mandatory    0.00362
9 Pass 2a       Create an MSR skeleton from the MXSR             mandatory    0.00185
10 Pass 2b      Populate the MSR skeleton from MusicXML data      mandatory    0.00288
11 Pass 3       Convert the first MSR into a second MSR           mandatory    0.00092
12 Pass 4       Convert the second MSR into an LPSR              mandatory    0.00090
13 Pass 5       Convert the LPSR score to LilyPond code          mandatory    0.00143
14
15 Total (sec)  Mandatory  Optional
16 -----
17 0.04122     0.04122   0.00000

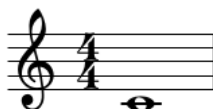
```

The resulting score is:

My title

Nice subtitle

Subsubtitle from HelloWorldOptionsAndArguments_2.txt



15.4 Multi-level includes overflow

There are resources limitations on the machines MusicFormats is used on, and we should prevent them to be overflowed. This could occur is including a file runs into a loop in which the same file is included again.

MusicFormats prevents this by limiting the level of such includes.

Let us uncomment the `-includeinc` option in `basic/HelloWorldOptionsAndArguments_2.txt`, leading to:

```

1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > cat basic/
  HelloWorldOptionsAndArguments_2.txt
2 # non-musical
3 -subsubtitle "Subsubtitle from HelloWorldOptionsAndArguments_2.txt"
4
5 # cycle detection check
6 -includeinc basic/HelloWorldOptionsAndArguments_1.txt

```

Now we get:

```
1 jacquesmenu@macmini: ~/musicformats-git-dev/files/musicxmlfiles > xml2ly -include basic/  
  HelloWorldOptionsAndArguments_1.txt  
2           Including file [basic/HelloWorldOptionsAndArguments_1.txt]: more  
  than 10 include levels, quitting  
3           The include file names stack contains 10 elements:  
4             1: [basic/HelloWorldOptionsAndArguments_2.txt]  
5             2: [basic/HelloWorldOptionsAndArguments_1.txt]  
6             3: [basic/HelloWorldOptionsAndArguments_2.txt]  
7             4: [basic/HelloWorldOptionsAndArguments_1.txt]  
8             5: [basic/HelloWorldOptionsAndArguments_2.txt]  
9             6: [basic/HelloWorldOptionsAndArguments_1.txt]  
10            7: [basic/HelloWorldOptionsAndArguments_2.txt]  
11            8: [basic/HelloWorldOptionsAndArguments_1.txt]  
12            9: [basic/HelloWorldOptionsAndArguments_2.txt]  
13           10: [basic/HelloWorldOptionsAndArguments_1.txt]
```

Chapter 16

Non-musical options

MusicFormats supplies options to obtain informations without inferering with the conversion activities in any way.

16.1 Timing measurements

There is a option `-cpu` option to see show much time is spent in the various translation activities. Note that the numbers obtained depend on the other activities on the machine. Also, on recent versions of Mac OS™, the first run of an executable may be a bit slower that subsequent runs, because the operating system loads the code in a cache for further use:

```

1 menu@macbookprojm > xml2ly -query cpu
2
3 --- Help for option 'cpu' in subgroup "CPU usage" of group "General" ---
4
5 General (-hg, -help-general):
6 -----
7   CPU usage (-hgcpu, -help-general-cpu-usage):
8
9   -cpu, -display-cpu-usage
10      Write information about CPU usage to standard error.
```

In practise, most of the time is spent in passes 1 and 2b. The `time` command is used to obtain the total run time, since `xml2ly` cannot account for input/output activities:

```

1 menu@macbookprojm > time xml2ly -aofn -display-cpu-usage xmlsamples3.1/ActorPreludeSample.
  xml
2 *** MusicXML warning *** xmlsamples3.1/ActorPreludeSample.xml:44: <system-distance /> is
  not supported yet by xml2ly
3 ... ..
4 *** MusicXML warning *** xmlsamples3.1/ActorPreludeSample.xml:27761: <direction/> contains
  2 <words/> markups
5 Warning message(s) were issued for input lines 44, 45, 46, 551, 584, 732, 1121, 1215,
  4724, 27761
6
7 Timing information:
8
9 Activity          Description          Kind    CPU (sec)
10 -----
11
12 Pass 1           build xmlelement tree from file  mandatory  0.268994
13 Pass 2a          build the MSR skeleton           mandatory  0.076413
14 Pass 2b          build the MSR                     mandatory  0.276732
15 Pass 3           translate MSR to LPSR             mandatory  0.056381
16 Pass 4           translate LPSR to LilyPond        mandatory  0.082213
```

```

17
18 Total      Mandatory  Optional
19 -----
20 0.760733    0.760733    0
21
22
23 real  0m0.814s
24 user  0m0.751s
25 sys   0m0.058s

```

This compares favorably with musicxml2ly measurements:

```

1 menu@macbookprojm > time musicxml2ly xmlsamples3.1/ActorPreludeSample.xml
2 musicxml2ly: Reading MusicXML from xmlsamples3.1/ActorPreludeSample.xml ...
3 musicxml2ly: Converting to LilyPond expressions...
4 ... ..
5 musicxml2ly: Converting to LilyPond expressions...
6 musicxml2ly: Output to 'ActorPreludeSample.ly'
7 musicxml2ly: Converting to current version (2.19.83) notations ...
8
9 real  0m4.113s
10 user  0m3.659s
11 sys   0m0.407s

```

16.2 Chords structure

In order to invert chords, as specified by the `<inversion/>` element in MusicXML data, musicxml2ly knows the structure of many of them. This can be queried with the options in the **Extra** group:

```

1 menu@macbookprojm > xml2ly -help=extra
2
3 --- Help for group "Extra" ---
4
5 Extra (-he, -help-extra):
6 These extra provide features not related to translation from MusicXML to other formats.
7 In the text below:
8   - ROOT_DIATONIC_PITCH should belong to the names available in
9     the selected MSR pitches language, "nederlands" by default;
10   - other languages can be chosen with the '-mpl, -msrPitchesLanguage' option;
11   - HARMONY_NAME should be one of:
12     MusicXML chords:
13       "maj", "min", "aug", "dim", "dom",
14       "maj7", "min7", "dim7", "aug7", "halfdim", "minmaj7",
15       "maj6", "min6", "dom9", "maj9", "min9", "dom11", "maj11", "min11",
16       "dom13", "maj13", "min13", "sus2", "sus4",
17       "neapolitan", "italian", "french", "german"
18     Jazz-specific chords:
19       "pedal", "power", "tristan", "minmaj9", "domsus4", "domaug5",
20       "dommin9", "domaug9dim5", "domaug9aug5", "domaug11", "maj7aug11"
21 The single or double quotes are used to allow spaces in the names
22 and around the '=' sign, otherwise they can be dispensed with.
23 -----
24 Chords structures (-hecs, -help-extra-chord-structures):
25   -scs, -show-chords-structures
26     Write all known chords structures to standard output.
27 Chords contents (-hecc, -help-extra-chords-contents):
28   -sacc, -show-all-chords-contents PITCH
29     Write all chords contents for the given diatonic (semitones) PITCH,
30     supplied in the current language to standard output.
31 Chord details (-hecd, -help-extra-chords-details):
32   -scd, -show-chord-details CHORD_SPEC
33     Write the details of the chord for the given diatonic (semitones) pitch
34     in the current language and the given harmony to standard output.

```



```

35 CHORD_SPEC can be:
36 'ROOT_DIATONIC_PITCH HARMONY_NAME'
37 or
38 "ROOT_DIATONIC_PITCH = HARMONY_NAME"
39 Using double quotes allows for shell variables substitutions, as in:
40 HARMONY="maj7"
41 xml2ly -show-chord-details "bes ${HARMONY}"
42 Chord analysis (-heca, -help-extra-chords-analysis):
43 -sca, -show-chord-analysis CHORD_SPEC
44 Write an analysis of the chord for the given diatonic (semitones) pitch
45 in the current language and the given harmony to standard output.
46 CHORD_SPEC can be:
47 'ROOT_DIATONIC_PITCH HARMONY_NAME INVERSION'
48 or
49 "ROOT_DIATONIC_PITCH = HARMONY_NAME INVERSION"
50 Using double quotes allows for shell variables substitutions, as in:
51 HARMONY="maj7"
52 INVERSION=2
53 xml2ly -show-chord-analysis "bes ${HARMONY} ${INVERSION}"

```

For example, one can obtain the structure of the B^b dominant minor ninth chord's second inversion this way:

```

1 menu@macbookprojm > xml2ly -show-chord-analysis 'bes dommin9 2'
2 The analysis of chord 'bes dommin9' inversion 2 is:
3
4 Chord 'bes dommin9' inversion 2 contents, 5 intervals:
5   d      : majorThird
6   bes    : perfectUnison
7   ces    : minorNinth
8   aes    : minorSeventh
9   f      : perfectFifth
10
11 Chord 'bes dommin9' inversion 2 inner intervals:
12   f      -> aes    : minorThird      (perfectFifth      -> minorSeventh)
13   f      -> ces    : diminishedFifth (perfectFifth      -> minorNinth)
14   f      -> bes    : perfectFourth   (perfectFifth      -> perfectUnison)
15   f      -> d      : majorSixth      (perfectFifth      -> majorThird)
16
17   aes    -> ces    : minorThird      (minorSeventh      -> minorNinth)
18   aes    -> bes    : majorSecond     (minorSeventh      -> perfectUnison)
19   aes    -> d      : augmentedFourth (minorSeventh      -> majorThird)
20
21   ces    -> bes    : majorSeventh    (minorNinth        -> perfectUnison)
22   ces    -> d      : augmentedSecond (minorNinth        -> majorThird)
23
24   bes    -> d      : majorThird      (perfectUnison     -> majorThird)
25 This chord contains 2 tritons

```

Chapter 17

Trace options

xml2ly is equipped with a range of trace options, that are crucially needed by this author when testing and fine-tuning the code base.

The bulk of these options is placed in a group that is hidden by default:

```
1 Trace (-ht, -help-trace) (hidden by default)
2 -----
```

The interested reader can see them with the option `-help-trace` group option:

```
1 menu@macbookprojm > xml2ly -help=trace
2
3 --- Help for group "Trace" ---
4
5 Trace (-ht, -help-trace) (hidden by default)
6   There are trace options transversal to the successive passes,
7   showing what's going on in the various translation activities.
8   They're provided as a help for the maintenance of MusicFormats,
9   as well as for the curious.
10  The options in this group can be quite verbose, use them with small input data!
11  All of them imply '-trace-passes, -tpasses'.
12  -----
13  Options handling trace          (-htoh, -help-trace-options-handling):
14    -toah, -trace-oah
15      Write a trace of options and help handling to standard error.
16      This option should best appear first.
17    -toahd, -trace-oah-details
18      Write a trace of options and help handling with more details to standard error.
19      This option should best appear first.
20  Score to voices                (-htstv, -help-trace-score-to-voices):
21    -t<SHORT_NAME>, -trace<LONG_NAME>
22      Trace SHORT_NAME/LONG_NAME in score to voices.
23      The 9 known SHORT_NAMES are:
24        score, pgroups, pgroupsd, parts, staves, st, schanges, voices and voicesd.
25      The 9 known LONG_NAMES are:
26        -score, -part-groups, -part-groups-details, -parts, -staves.
27  ... ..
```

As can be seen, there are event options to trace the handling of options and help by xml2ly.

The source code contains many instances of trace code, such as:

```
1 #ifdef TRACE_OAH
2   if (gtracingOah->fTraceVoices) {
3     gLogOstream <<
4       "Creating voice \"" << asString () << "\"" <<
5     endl;
6   }
7 #endif
```

Chapter 17. Trace options

Building `xm121y` with tracing disabled only gains less than 5% in speed, this is why tracing is available by default.

Part VI

Warnings and errors (WAE)

Chapter 18

Warnings and errors (WAE)

Part VII

Multiple languages support

Chapter 19

Multiple languages support

The MusicFormats components support a number of languages, most of which being taken over from MusicXML and LilyPond.

For example, `xm12ly` offers several languages options:

```

1 jacquesmenu@macmini > xm12ly -find language
2 6 occurrences of string "language" have been found:
3   1:
4     -msr-pitches-language, -mplang LANGUAGE
5     Use LANGUAGE to display note pitches in the MSR logs and text views.
6         The 13 MSR pitches languages available are:
7         arabic, catalan, deutsch, english, espanol, francais,
8         italiano, nederland, norsk, portugues, suomi, svenska and vlaams.
9         The default is 'kQTPNederland'.
10  2:
11     -lpsr-pitches-language, -lppl LANGUAGE
12     Use LANGUAGE to display note pitches in the LPSR logs and views,
13     as well as in the generated LilyPond code.
14         The 13 LPSR pitches languages available are:
15         arabic, catalan, deutsch, english, espanol, francais,
16         italiano, nederland, norsk, portugues, suomi, svenska and vlaams.
17         The default is 'kQTPNederland'.
18  3:
19     -lpsr-chords-language, -lpcl LANGUAGE
20     Use LANGUAGE to display chord names, their root and bass notes,
21     in the LPSR logs and views and the generated LilyPond code.
22         The 5 LPSR chords pitches languages available are:
23         french, german, ignatzek, italian and semiGerman.
24         'ignatzek' is Ignatzek's jazz-like, english naming used by LilyPond by
25         default.
26         The default is 'kChordsIgnatzek'.
27  4:
28     -show-all-harmonies-contents, -sacc PITCH
29     Write all harmonies contents for the given diatonic (semitones) PITCH,
30     supplied in the current language to standard output.
31  5:
32     -show-harmony-details, -scd HARMONY_SPEC
33     Write the details of the harmony for the given diatonic (semitones) pitch
34     in the current language and the given harmony to standard output.
35     HARMONY_SPEC can be:
36     'ROOT_DIATONIC_PITCH HARMONY_NAME'
37     or
38     "ROOT_DIATONIC_PITCH = HARMONY_NAME"
39     Using double quotes allows for shell variables substitutions, as in:
40     HARMONY="maj7"
41     xm12ly -show-harmony-details "bes ${HARMONY}"
42  6:
43     -show-harmony-analysis, -sca HARMONY_SPEC

```

```
43 Write an analysis of the harmony for the given diatonic (semitones) pitch
44 in the current language and the given harmony to standard output.
45 HARMONY_SPEC can be:
46 'ROOT_DIATONIC_PITCH HARMONY_NAME INVERSION'
47 or
48 "ROOT_DIATONIC_PITCH = HARMONY_NAME INVERSION"
49 Using double quotes allows for shell variables substitutions, as in:
50 HARMONY="maj7"
51 INVERSION=2
52 xml2ly -show-harmony-analysis "bes ${HARMONY} ${INVERSION}"
```


Part VIII

xml2ly

Chapter 20

xml2ly

The initial name of `xml2ly`, when it started as a clone of `xml2guido`, was `xml2lilypond`. Both Dominique Fober and Werner Lemberg, an early tester active in the LilyPond community, found it too long, and they chose `xml2ly` among other names this author proposed to them.

20.1 Why xml2ly?

LilyPond comes with `musicxml2ly`, a converter of MusicXML files to LilyPond syntax, which has some limitations. Also, being written in Python, it is not in the main stream of the LilyPond development and maintainance group. The latter has much to do with C++ and Scheme code already.

After looking at the `musicxml2ly` source code, and not being a Python developer, this author decided to go for a new converter written in C++.

The design goals for `xml2ly` were:

- to perform at least as well as `musicxml2ly`;
- to provide as many options as needed to adapt the LilyPond code generated to the user's needs.

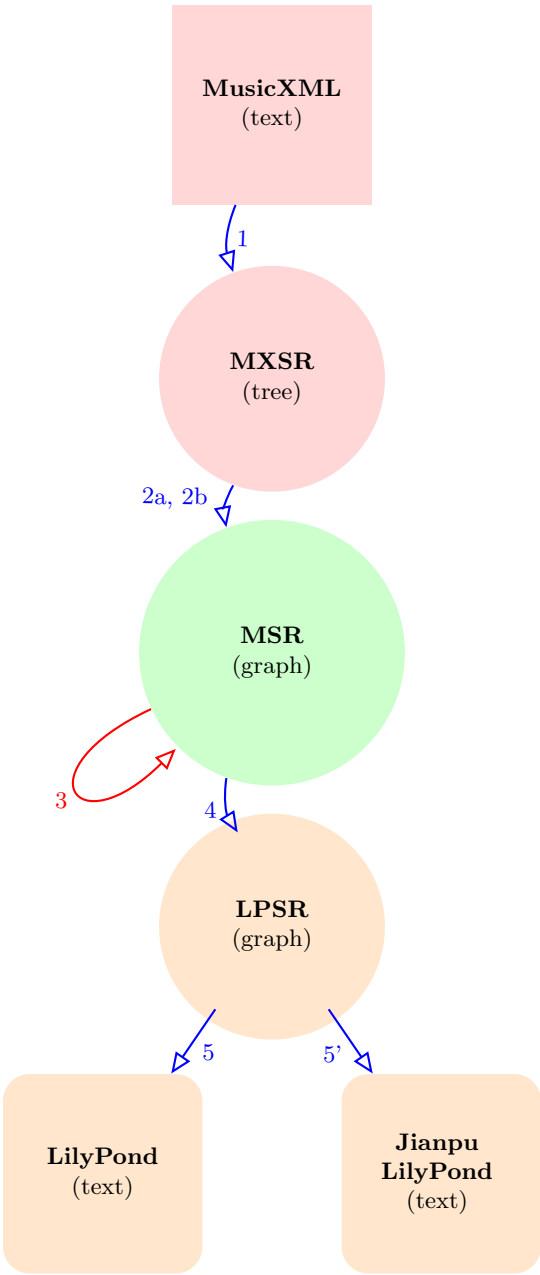
Speed was not an explicit goal, but as it turns out, `xml2ly` is not bad in this respect.

20.2 What xml2ly does

`xml2ly` performs the 5 steps from MusicXML to LilyPond to translate the former into the latter, as shown in figure 20.1, [xmlToLyArchitecture], page 74. Converting from MXSR to MSR is done in two sub-phases for implementation reasons.

The `'-about'` option to `xml2ly` details that somewhat:

Figure 20.1: xml2ly architecture



```

1 jacquesmenu@macmini > xml2ly -about
2 What xml2ly does:
3
4 This multi-pass converter basically performs 5 passes:
5   Pass 1:  reads the contents of MusicXMLFile or stdin ('-')
6             and converts it to a MusicXML tree;
7   Pass 2a: converts that MusicXML tree into
8             a first Music Score Representation (MSR) skeleton;
9   Pass 2b: populates the first MSR skeleton from the MusicXML tree
10            to get a full MSR;
11   Pass 3:  converts the first MSR into a second MSR to apply options
12   Pass 4:  converts the second MSR into a
13            LilyPond Score Representation (LPSR);
14   Pass 5:  converts the LPSR to LilyPond code
15            and writes it to standard output.
16
17 Other passes are performed according to the options, such as
18 displaying views of the internal data or printing a summary of the score.
19
20 The activity log and warning/error messages go to standard error.

```

Step 5' is merely step 5 plus the generation of a numbered score, which happens when the `-jianpu` option is used:

```

1 jacquesmenu@macmini > xml2ly -query jianpu
2 --- Help for atom "jianpu" in subgroup "Output"
3   -jianpu
4       Generate the score using the Jianpu (numbered) notation
5       instead of the default western notation.
6       That option needs lilypond-Jianpu to be accessible to LilyPond
7       (https://github.com/nybbs2003/lilypond-Jianpu/jianpu10a.ly).

```

20.3 Useful options to xml2ly

Option `-avoid-msr2msr`, `-am2m` can be used to avoid running the `src/passes/msr2msr/` pass:

```

1 jacquesmenu@macmini: ~ > xml2ly -query avoid-msr2msr
2 --- Help for atom "avoid-msr2msr" in subgroup "Rests"
3   -avoid-msr2msr, -am2m
4       Avoid the msr2msr pass, for TESTS.

```

Part IX

xml2brl

Chapter 21

xml2brl

Figure 21.1: xml2brl architecture



21.1 Why xml2brl?

After first creating `xml2ly`, the design goals for `xml2brl` were:

- to experiment the re-use of MSR for other needs than generating LilyPond code;
- to provide a MusicXML to Braille translator that might prove useful.

The first goal has been reached, but the second one has not at the time of this writing: nearly none of the individuals and bodies this author contacted to ask whom might help him with technical details about the generation of Braille files answered.

So this whole effort got frozen as some point.

xml2brl is incomplete in that it does not support, by far, the full range of Braille complexities. Anyone interested may take over if needed, though, which is why this part of MusicFormats is presented in this document and detailed in the maintenance guide.

21.2 What xml2brl does

xml2brl performs the 5 steps from MusicXML to LilyPond to translate the former into the latter, as shown in figure 20.1, [xmlToLyArchitecture], page 74. Converting from MXSR to MSR is done in two sub-phases for implementation reasons.

The '-about' option to xml2brl details that somewhat:

```

1 jacquesmenu@macmini > xml2brl -about
2 What xml2brl does:
3
4     This multi-pass converter basically performs 6 passes:
5         Pass 1:  reads the contents of MusicXMLFile or stdin ('-')
6                 and converts it to a MusicXML tree;
7         Pass 2a: converts that MusicXML tree into
8                 a first Music Score Representation (MSR) skeleton;
9         Pass 2b: populates the MSR skeleton from the MusicXML tree
10                to get a full MSR;
11         Pass 3:  converts the first MSR into a second MSR, to apply options
12         Pass 4:  converts the second MSR into
13                 a first Braille Score Representation (BSR)
14                 containing one Braille page per MusicXML page;
15         Pass 5:  converts the first BSR into a second BSR
16                 with as many Braille pages as needed
17                 to fit the line and page lengths;
18         Pass 6:  converts the BSR to Braille text
19                 and writes it to standard output.
20
21     In this preliminary version, pass 3 merely clones the MSR it receives.
22
23     Other passes are performed according to the options, such as
24     displaying views of the internal data or printing a summary of the score.
25
26     The activity log and warning/error messages go to standard error.

```

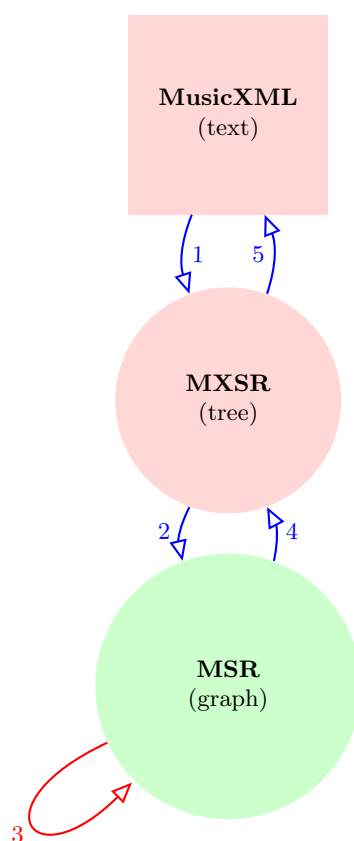
Part X

xml2xml

Chapter 22

xml2xml

Figure 22.1: xml2xml architecture



22.1 Why xml2xml?

xml2xml has been designed to operate on MusicXML data, applying options to apply the desired changes. It does a good job already, and will be completed as needed.

22.2 What xml2xml does

xml2xml performs the 5 steps from MusicXML to LilyPond to translate the former into the latter, as shown

in figure 20.1, [xmlToLyArchitecture], page 74. Converting from MXSR to MSR is done in two sub-phases for implementation reasons.

The '-about' option to xml2xml details that somewhat:

```
1 jacquesmenu@macmini > xml2xml -about
2 What xml2xml does:
3
4 This multi-pass converter basically performs 6 passes:
5     Pass 1:  reads the contents of MusicXMLFile or stdin ('-')
6              and converts it to a MusicXML tree;
7     Pass 2a: converts that MusicXML tree into
8              a first Music Score Representation (MSR) skeleton;
9     Pass 2b: populates the MSR skeleton from the MusicXML tree
10             to get a full MSR;
11     Pass 3:  converts the first MSR into a second MSR, to apply options;
12     Pass 4:  converts the second MSR into a second MusicXML tree;
13     Pass 5:  converts the second MusicXML tree to MusicXML code
14             and writes it to standard output.
15
16 Other passes are performed according to the options, such as
17 displaying views of the internal data or printing a summary of the score.
18
19 The activity log and warning/error messages go to standard error.
```

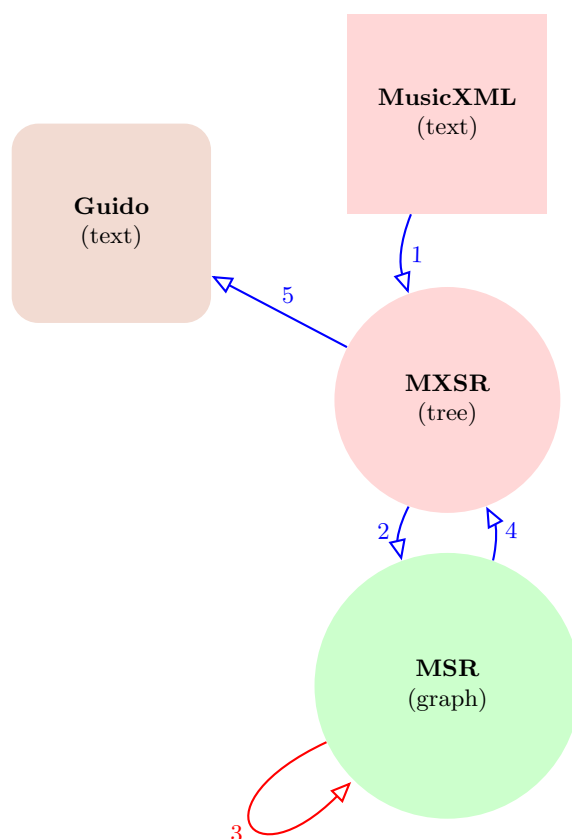
Part XI

xml2gmn

Chapter 23

xml2gmn

Figure 23.1: xml2gmn architecture



23.1 Why xml2gmn?

`libmusicxml2` comes with `xml2guido`, a converter of MusicXML files to Guido syntax, which has some limitations. It is supplied as as sample of the library's use.

`xml2gmn` has been designed to complement `libmusicxml2` features: it provides the same translation as `xml2guido`, with more options for flexibility.

Work remains to be done in the conversion of MSR to MXSR, but `xml2gmn` is already fairly complete.

23.2 What xml2gmn does

xml2gmn performs the 5 steps from MusicXML to LilyPond to translate the former into the latter, as shown in figure 20.1, [xmlToLyArchitecture], page 74. Converting from MXSR to MSR is done in two sub-phases for implementation reasons.

The '-about' option to xml2gmn details that somewhat:

```
1 jacquesmenu@macmini > xml2xml -about
2 What xml2xml does:
3
4     This multi-pass converter basically performs 6 passes:
5         Pass 1:  reads the contents of MusicXMLFile or stdin ('-')
6                 and converts it to a MusicXML tree;
7         Pass 2a: converts that MusicXML tree into
8                 a first Music Score Representation (MSR) skeleton;
9         Pass 2b: populates the MSR skeleton from the MusicXML tree
10                to get a full MSR;
11         Pass 3:  converts the first MSR into a second MSR, to apply options;
12         Pass 4:  converts the second MSR into a second MusicXML tree;
13         Pass 5:  converts the second MusicXML tree to MusicXML code
14                 and writes it to standard output.
15
16     Other passes are performed according to the options, such as
17     displaying views of the internal data or printing a summary of the score.
18
19     The activity log and warning/error messages go to standard error.
```

Part XII

Indexes

Files index

Symbols

Anacrusis.ly	16
MusicFormatsBashDefinitions.bash	30
build/bin	39
cmake	39
distrib	33
error.txt	13
files	17
lilypondstuff/jianpu	19
msdlfiles	17
musicformats-git-dev	17
musicxmlfiles	17
output.ly	13

B

build	
bin	34

C

clisamples	
LilyPondIssue34.cpp	22
Mikrokosmos3Wandering.cpp	22
MusicAndHarmonies.cpp	21

L

libmusicxml/samples	
RandomChords.cpp	21
RandomMusic.cpp	21

S

src/clisamples	
LilyPondIssue34.cpp	22
Mikrokosmos3Wandering.cpp	22
MusicAndHarmonies.cpp	21

Options

Symbols

--help-options-usage, -hou	48
-about, -a	23
-ambitus	43
-avoid-msr2msr, -am2m	75
-braille	24, 25
-contact, -c	44
-cpu	62
-cubase	43
-custos	43
-display-options-values, -dov	53
-display-options-values-all, -dova	54
-find	48, 55
-guido	25
-h	43
-help-midi, -hmidi	47

-help-summary, -hs	49
-help-trace	65
-ignore-ornaments, -oorns	45
-include	60
-include, -inc	57, 59
-insider, -ins	45, 46, 59
-jianpu	23, 25, 43
-lilypond	25
-musicxml	25
-name-help, -nh	45, 47, 48
-o	43
-query	14, 42, 47
-quiet, -q	44
-title	14
-vac	44

MusicXML index

Symbols

inversion </>63
note </>19, 20

part-list </>19, 20
time </>19, 20

Main index

Symbols

[<inversion />](#) 63
[<note />](#) 19, 20
[<part-list />](#) 19, 20
[<time />](#) 19, 20
[-](#) 43, 57
[--](#) 43
[--help-options-usage, -hou](#) 48
[-about, -a](#) 23
[-ambitus](#) 43
[-avoid-msr2msr, -am2m](#) 75
[-braille](#) 24, 25
[-contact, -c](#) 44
[-cpu](#) 62
[-cubase](#) 43
[-custos](#) 43
[-display-options-values, -dov](#) 53
[-display-options-values-all, -dova](#) 54
[-find](#) 48, 55
[-guido](#) 25
[-h](#) 43
[-h=rests,notes](#) 43
[-help-midi, -hmidi](#) 47
[-help-summary, -hs](#) 49
[-help-trace](#) 65
[-hrests, -hnotes](#) 43
[-ignore-ornaments, -oorns](#) 45
[-include](#) 60
[-include, -inc](#) 57, 59
[-insider, -ins](#) 45, 46, 59
[-jianpu](#) 23, 25, 43
[-lilypond](#) 25
[-musicxml](#) 25
[-name-help, -nh](#) 45, 47, 48
[-o](#) 43
[-query](#) 14, 42, 47
[-quiet, -q](#) 44
[-title](#) 14
[-trace-voices, -trace-notes](#) 43
[-trace=voices,notes](#) 43
[-v, -a, -c](#) 44
[-vac](#) 44
[2>](#) 13
[>](#) 13
[Anacrusis.ly](#) 16
[Extra](#) 63
[LilyPondIssue34](#) 19
[Mikrokosmos3Wandering](#) 19, 22
[MusicFormatsBashDefinitions.bash](#) 30

[PATH](#) 40
[bin](#) 40
[build/bin](#) 39
[cd](#) 27
[cmake](#) 39
[dev](#) 17
[distrib](#) 33
[echo](#) 27, 28
[error.txt](#) 13
[false](#) 50
[files](#) 17
[lilypondstuff/jianpu](#) 19
[ls](#) 30
[msdlfiles](#) 17
[musicformats-git-dev](#) 17
[musicformats_local_clone](#) 38
[musicxmlfiles](#) 17
[name-help](#) 48
[output.ly](#) 13
[pwd](#) 27
[stable-v...](#) 17
[test-v...](#) 17
[time](#) 62
[title](#) 14
[true](#) 50
[checkVersions \(\)](#) 29, 30
[musicxmlfile2lilypond \(\)](#) 43

A

[API](#) 1, 7, 19, 21, 43
[atoms](#) 42
[automate](#) 14

B

[Bash](#) 42
[basic installation](#) 32
[before](#) 59
[Braille](#) 18, 19, 21--25, 77
[BSR](#) 18, 21
[builtin](#) 28

C

[Catalina](#) 34
[clone](#) 38
[clustered](#) 44
[command line](#) ... 1, 7, 19, 27, 32, 39, 42, 43, 46, 58, 59
[compiler writing](#) 10
[contracted](#) 43
[converter](#) 18, 19, 25, 45, 57, 73, 83

- D**
- default branch38
 - directories27
 - Dominique Fober6, 73
 - double quotes28, 29, 58
 - DTD6
- E**
- early option46, 59
 - early options46
 - ex-nihilo19
 - executed42
- F**
- format18
 - function43
 - functions29
- G**
- Gatekeeper34
 - generator19, 25, 45
 - git38
 - GNU43
 - Guido19, 22, 24, 83
- H**
- High Sierra34
 - home directory27
- I**
- insider45
- L**
- libmusicxml26, 18, 21, 23, 25, 83
 - libraries32
 - LilyPond ..6, 10, 11, 13, 14, 16, 18--22, 24, 25, 70, 73, 77
 - LilyPond code generated73
 - lilypond-Jianpu19, 20
 - LilyPondIssue34.cpp22
 - Linux32, 39
 - LSPR10, 18, 20, 22, 56
- M**
- Mac OS™.....32, 34, 39, 62
 - macro options53
 - Mikrokosmos3Wandering.cpp22
 - Monterey34
 - MSDL17, 20, 21, 24
 - MSR10, 18, 20--22, 77, 83
 - multi-pass18
 - MusicAndHarmonies.cpp21
 - MusicFormats1, 7, 10, 11, 14, 16--21, 23--25, 27, 29, 32, 34, 35, 39, 42, 44--46, 48, 52, 55--57, 60, 62, 70, 78
 - MusicXML ..6, 10, 11, 17--25, 63, 70, 73, 77, 78, 80, 83, 84
 - MXSR10, 18, 20, 21
- O**
- OAH7, 14, 18, 19, 42, 43, 47, 53
 - operating system30, 32, 34, 35, 39, 62
- P**
- pass18, 45
 - passes10
 - PDF32
 - prefix43
 - prompt42
- Q**
- quarantine35
 - quotes28, 29, 58
- R**
- RandomChords.cpp21
 - RandomMusic.cpp21
 - reads42
 - regular45
 - repository34
 - representation18, 45
 - reuse10
- S**
- service7, 25, 29, 42, 48, 50, 51
 - services25
 - several times45
 - shell42
 - single step18
 - space28
- V**
- value28
 - variable28
 - view46
- W**
- Web1, 7
 - well-formed42
 - whole32
 - Windows™.....32
 - working directory27