



# MusicXML

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# History

- Written by Michael Good (Good 2001a; Good 2001b; Good 2013)
- First released in 2001
- Based on XML
- Incorporated into notation software and other apps (e.g., Khan and Lee 2014; Watanabe et al 2006; Arora 2011)
- Now used by 269 programs (Good 2013)

# XML

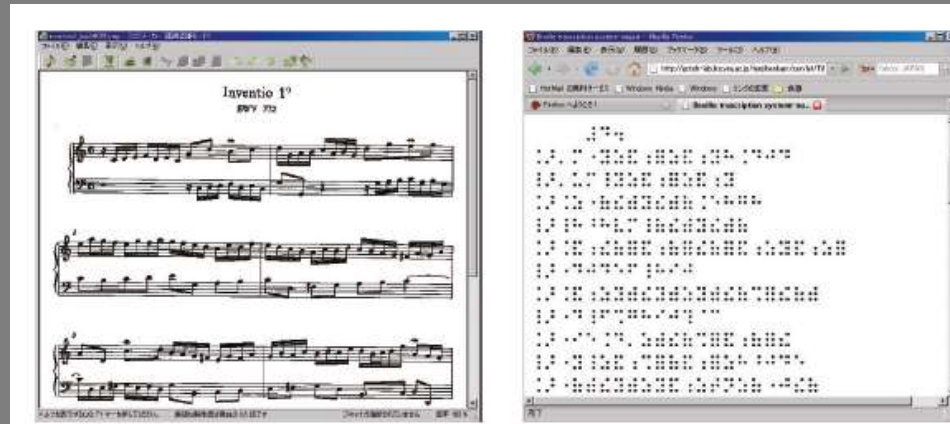
- Extensible markup language
- Developed in the 1990s from the much older SGML (XML Core working group 2017)
- Like HTML, but custom tags can be defined
- Standardized text-based format
- Human- and machine-readable
- Can be stored and shared

# XML

- Can be searched
- Can be read into memory as a data structure
- Tags are formatted as `<name>My Name</name>` or `<name />` (empty element)
- Pairs of tags can enclose other tags (nesting), but the tags should not cross
- Nesting and other formatting issues will cause fatal errors

# Advantages

- Several hundred programs can read and write the MusicXML format
- Any software that can read or write XML will also work on MusicXML
- MusicXML can be converted into braille music notation to a high standard (Goto 2006)



- The format has been expanded, and can be expanded in the future

# Limitations

- Intended for Western music using a traditional staff
- Guitar tablature is included, but no other type of tablature
- Notes are indicated with letter names as in North America; European note-naming conventions are not used
- MusicXML files are much larger (~70x) than the corresponding MIDI files
- Several different ways to modify notes and arrange data make analysis/automatic playback complex (but the complexity is also an advantage)

# MusicXML format

- Partwise (measures within parts) or timewise (parts within measures) hierarchy can be used
  - The two hierarchies can be alternated within a single file
- Key indicated by the “fifths” parameter
- Note durations indicated as numbers of divisions specified at the beginning of the file
  - Duration indicated as both the sounding duration and the appearance of the note

# Sample MusicXML code

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE score-partwise PUBLIC
"-//Recordare//DTD MusicXML 0.5 Partwise//EN"
"http://www.musicxml.org/dtds/partwise.dtd">
<score-partwise>
<part-list>
<score-part id="P1">
<part-name>Music</part-name>
</score-part>
</part-list>
```



# Sample MusicXML code

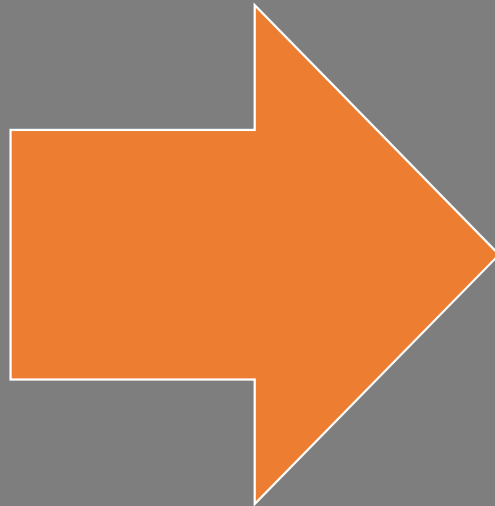
```
<part id="P1">  
<measure number="1">  
<attributes>  
<divisions>1</divisions>  
<key>  
<fifths>0</fifths>  
</key>
```

# Sample MusicXML code

```
<time>  
<beats>4</beats>  
<beat-type>4</beat-type>  
</time>  
<clef>  
<sign>G</sign>  
<line>2</line>  
</clef>  
</attributes>
```

# Sample MusicXML code

```
<note>  
<pitch>  
<step>C</step>  
<octave>4</octave>  
</pitch>  
<duration>4</duration>  
<type>whole</type>  
</note>  
</measure>  
</part>  
</score-partwise>
```



# Comparison of MusicXML and MIDI

## MIDI (recall Mael's presentation)

- Intended to make digital instruments produce sounds
- No rests, stems, clefs, or time signatures
- Time is given as NoteOn and NoteOff events (no rests)
- Must be interpreted by notation software, and errors often occur
- Limited in types of performance information that can be included
- Binary format

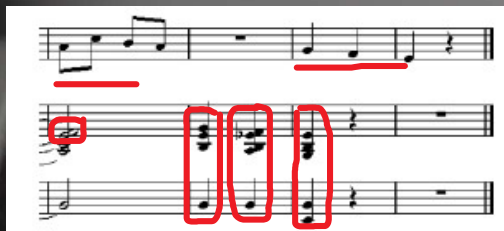
## MusicXML

- Intended to produce notation for humans to use as they make music
- Connects directly to notation
- Time is given as relative to the tempo/time signature, rests explicitly indicated
- Directly indicates how music should appear on the staff
- Lyrics and other performance markings can be included
- Human- and machine-readable format

# Comparison of MusicXML and MIDI



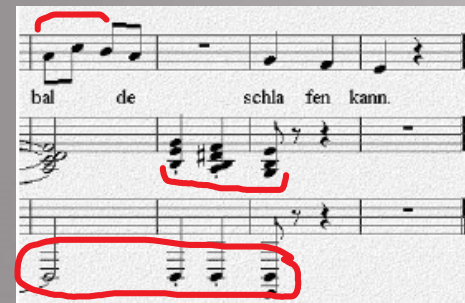
Original music (Schumann Op 24, No. 4) scanned into SharpEye



Imported into Finale using MIDI



Imported into Finale using MusicXML



Imported into Sibelius using MIDI

Example from Good (2001)

# Comparison of MusicXML and MEI

- Music Encoding Initiative (Library of Congress 2022), already presented by Yufan
- MEI can encode a wider range of notation than MusicXML
  - Neumes, tablature, mensural notation
  - Useful for preservation of early scores and music (e.g. Guatamalan choirbooks, Martha E. Thomae's thesis work)
- Only Sibelius software and the Verovio website (Pugin 2022) can export in MEI format

# Research using MusicXML

- Musicological analysis
  - Ganseman et al. (2008) – descriptions of various possible statistical analyses
  - Viglianti (2007) – analysis of Puccini tenor arias
- Audio to score transcription
  - Nishikimi et al. (2021) – neural network and hidden Markov model (HMM) for transcription – output in MusicXML format
- Computer music generation
  - Shapiro and Huber (2021) – MusicXML files used as training data for music composition using HMM

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