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One Timeline, Many Renderings

A Wolfram Language Paclet for Heterogeneous Musical Output

ICSC 2026 · Trapani

CMEC MAG C C

CONSERVATORIO DI MUSICA Niccolò Piccinni BARI

Many outputs, one composition

A mixed work may need several, each counting time differently

Csound score
seconds · samples

Notation
MusicXML divisions

Live control
OSC · milliseconds

Click track
rebuilt in a DAW

Authored separately, their timelines drift.

Ontology in computer science

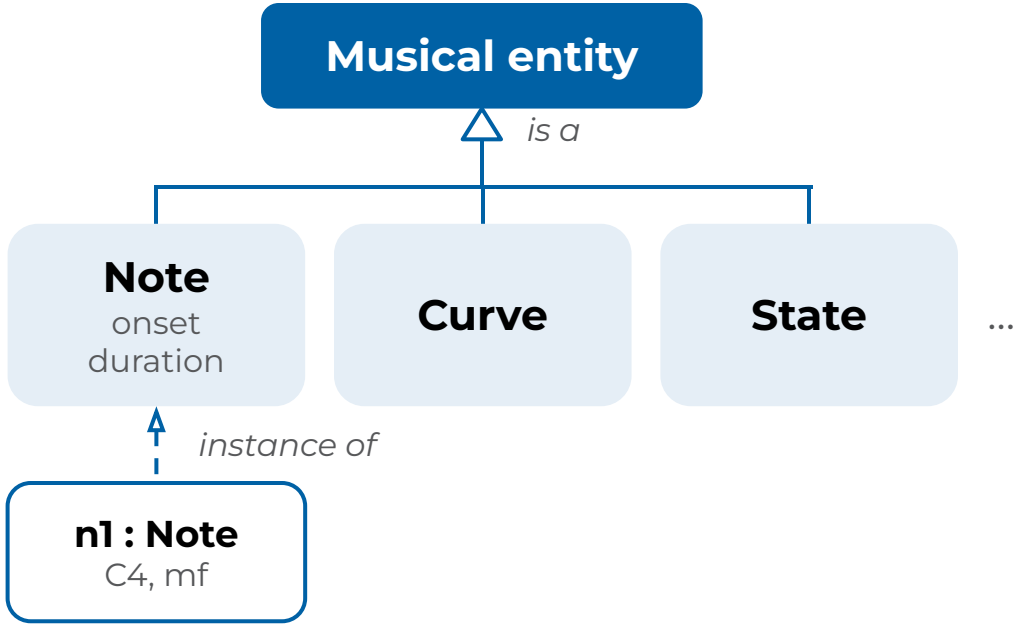
Which entity types exist, with which properties and relations

DEFINITION

“A formal, explicit specification of a shared conceptualisation”

Studer, Benjamins & Fensel (1998), combining Gruber (1993) and Borst (1997)

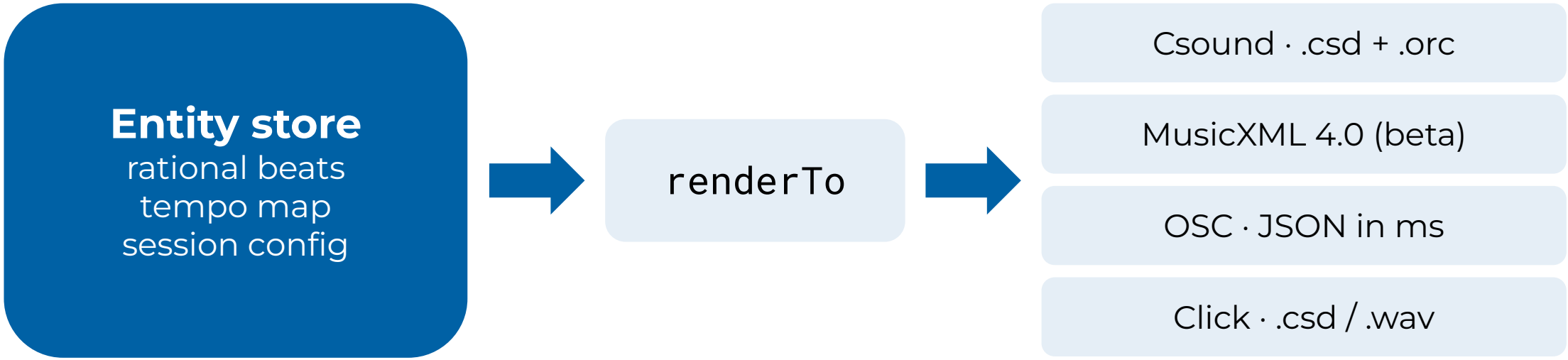
formal	machine-interpretable
explicit	concept types and constraints declared
shared	a common, agreed vocabulary



Source: R. Studer, V. R. Benjamins, D. Fensel, “Knowledge engineering: Principles and methods”, Data & Knowledge Engineering 25(1–2), 1998, 161–197. It combines T. R. Gruber, Knowledge Acquisition 5(2), 1993, 199–220, and W. N. Borst, PhD thesis, University of Twente, 1997.

One timeline, many renderings

Units are bound only at render time

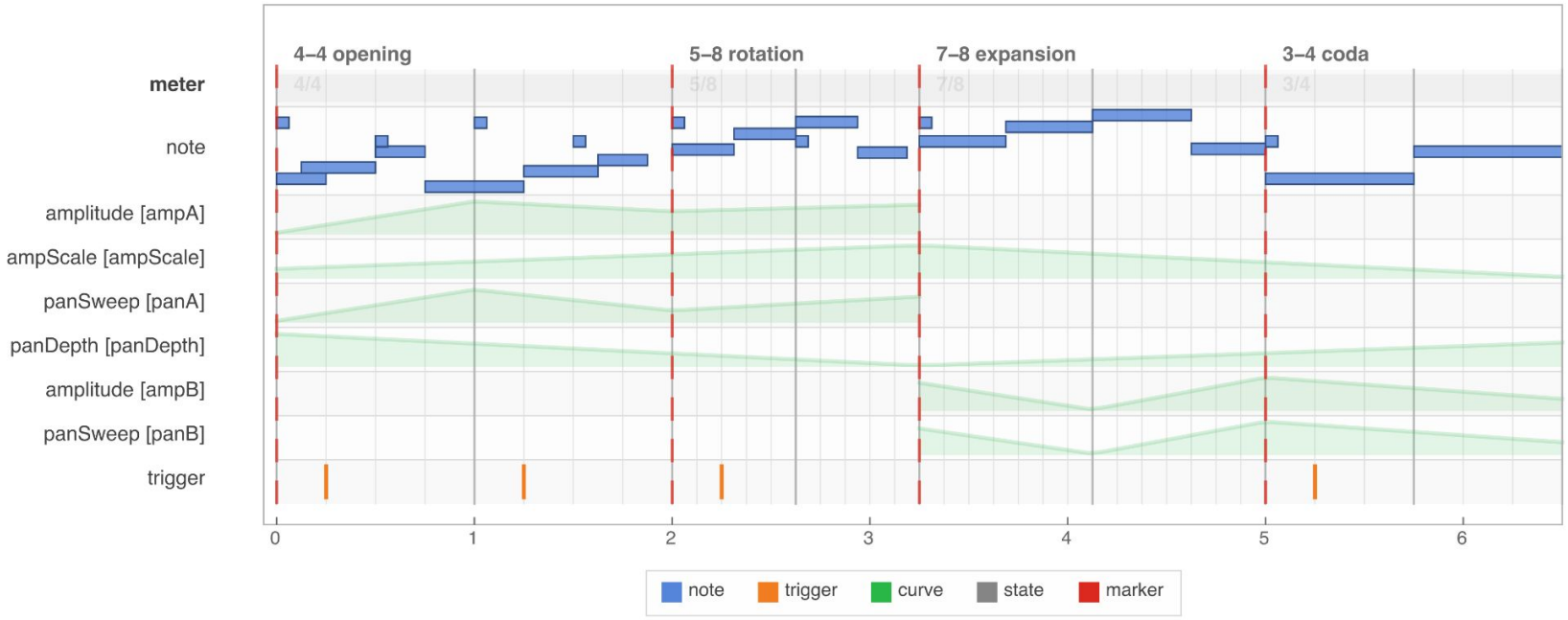


Layers I–II · backend-agnostic

Layer III · one contract per backend

One store, drawn by the paclet itself

drawTimeline



One lane per entity type · metric grid from authored meter: 4/4 → 5/8 → 7/8 → 3/4

Csound: late conversion, named instruments

Default p-field contract · actual paclet output



Retune or re-tempo: p2, p3, p4 regenerate, no entity is edited

Blue: computed at render time · A4, mf, two whole notes at 120 BPM · instrument named by its .orc file

One curve, three projections

Same beat-space curve, same tempo map

amplitude curve · beat space

Csound
k-rate signal
scaling p5

OSC
timed messages
sampled, in ms

MusicXML
textual direction
with a warning

2 s ramp at 10 Hz, half-open: last OSC event at 1900 ms

A click track from the same timeline

Meter + tempo map → one event per beat

two 4/4 bars · 120 BPM



downbeat 1760 Hz · other beats 1100 Hz

≈140 lines · Csound serializer reused unchanged

Simplest backend: it shows reuse, not the general cost of a new one

One tempo edit, no drift

4/4 · 4/4 · 3/4 at 120 then 90 BPM · edit 90 → 60

Projection	Bar 3 downbeat	Note at 9/4, after edit
Csound	4.0 s	4.667 → 5.0 s
OSC	4000 ms	same shift
Click	strong click, 4.0 s	same shift
MusicXML	bar 3, beat 1	tempo mark only

Notation lives in beat space; seconds are bound only at render time

Beyond the paper: four more entity types

Declared for future use in the paper, now implemented

Type	Csound	OSC	MusicXML
gesture	notes	child events	notes, across staves
trajectory	GEN-2 tables	sampled /spat	skipped, diagnosed
process	score comment	start / stop	skipped, diagnosed
interval	—	—	diagnosed, not emitted

A gesture stores proportions; scaled by its duration it becomes ordinary notes

Limits and next steps

Boundaries of the present results

No MIDI · no continuous tempo
no named-channel adapter yet

Paclet unreleased · MusicXML in beta
Proprietary authoring, open plain-text outputs

Next: paclet release · Python/Julia core · channel-based adapter

One timeline, many renderings

Unequal but synchronized projections
of one rational-beat store

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Resources and references

Discussion material · outside the timed talk

Supplementary material

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Notebook, Csound/OSC/MusicXML/click outputs, audio, tempo-edit demonstration · paclet release pending