Ontological Processing of Sound Resources

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Composers' Real Hard Life

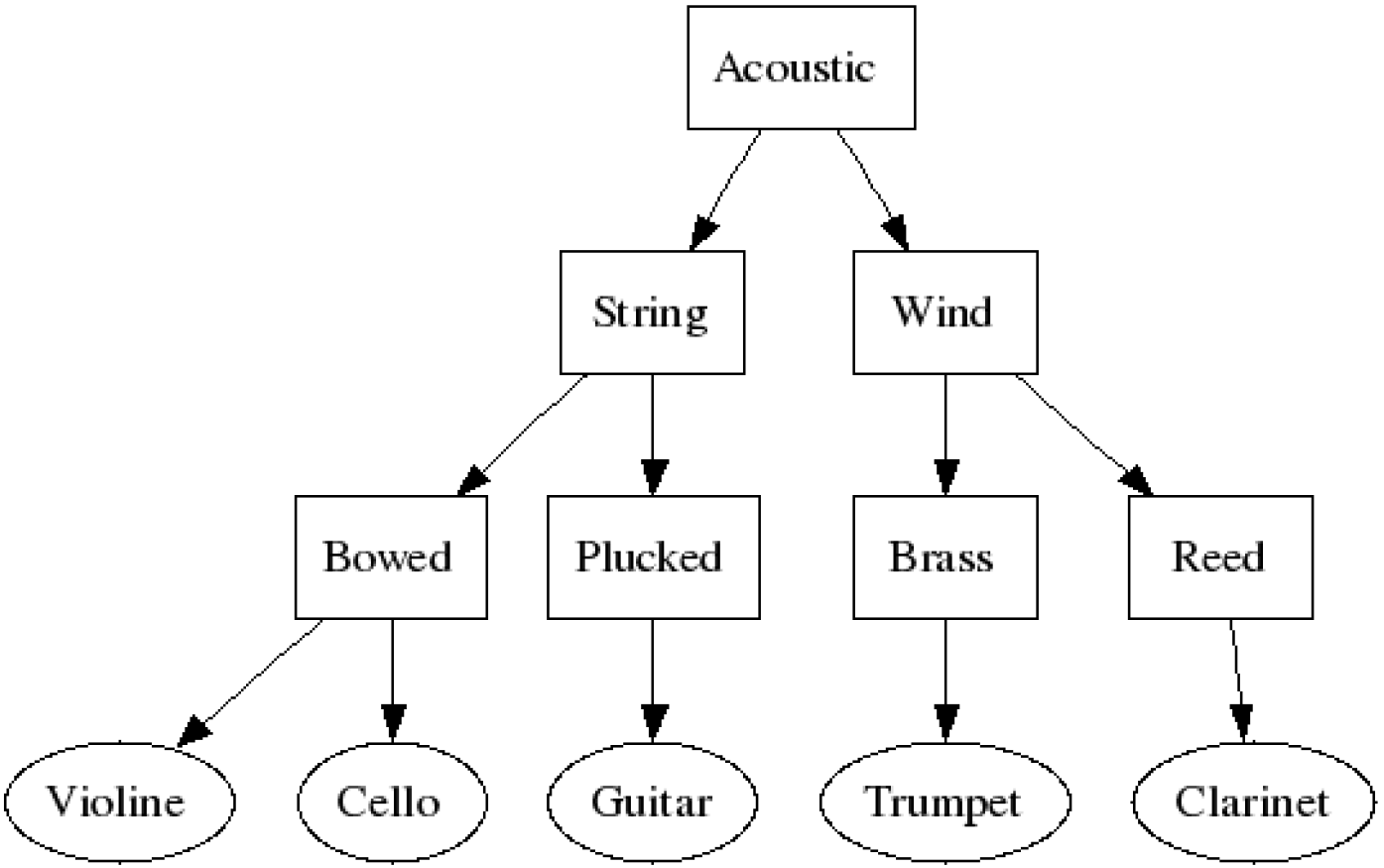
- *"On **which synth** and in **what sound bank** was that cool trumpet sound?"*
- *"I somewhere saved that funny synth pad patch that I created for my last song, but **where did I store it**?"*
- *"Give me a **list** of all the **string synth sounds** that are scattered across my synths and banks!"*

What’s the problem?

- Too many sounds in too many synths and synth banks
- Sounds mostly not at all sorted or ordered in a musical sense
- No standardized, uniform way of sound browsing or lookup across synths
- No central sound registry for a single lookup of sounds across all synths in a system

How to Order Sounds?

- Instrument Taxonomies

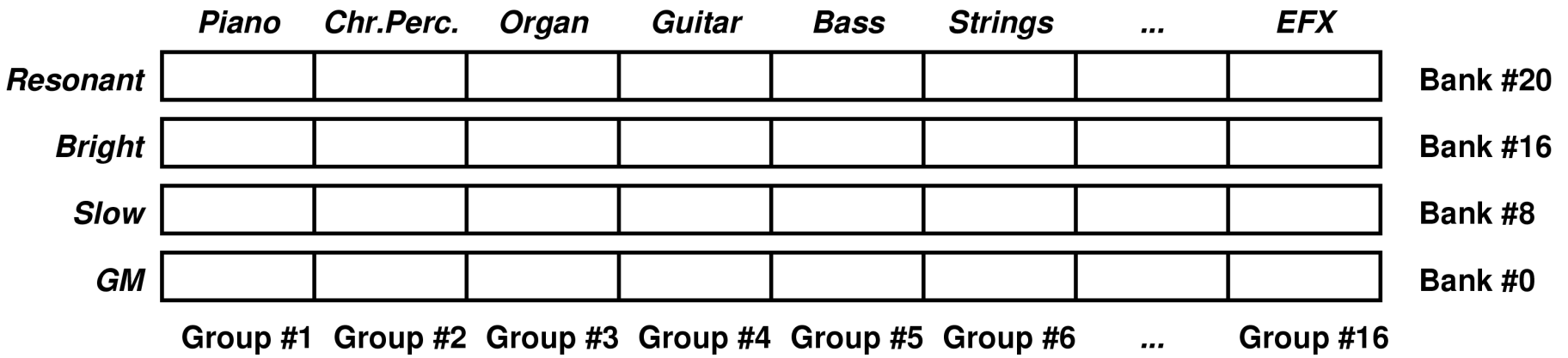


How to Order Sounds? (cont.)

- Acoustic Organ Registers
  - Classify by **pitch**
    - 16’’, 8’’, 4’’, …
  - Classify by **construction principle** of pipes
    - labial / lingual pipes, open / closed pipes, ...
  - Classify by **function** of sound
    - solo, principal, mixture, ...
  - Classify by similarity to **prototype sounds**
    - flute, bassoon, trumpet, ...

How to Order Sounds? (cont.)

- Grouping, banking
  - 128 GM Level 1 MIDI instruments, 16 groups
  - GM Level 2 banks



How to Order Sounds? (cont.)

- Tagging
  - Generalizes grouping
  - Enables sound to be member of multiple groups
  - Serves for annotating qualities of a sound

More on Tagging

- Find (at least) 4 types of tags
  - **prototype-driven** (similarity to known sound or group of sounds)
    - string, violin, synth, percussive, bright, resonant, ...
  - **function-driven** (purpose of sound)
    - effect, lead, melodic, drums, ...
  - **construction-driven** (way of creating)
    - arpeggiator, decay, FM, vocoder, ...
  - **user-defined**
    - favorites, ...

More on Tagging (cont.)

- Tags are deductive
  - `violin` ⇒ `string`
  - `drum` ⇒ `percussive`
  - `vocoder` ⇒ `synth`
  - `lead` ⇒ `melodic`
  - `...`

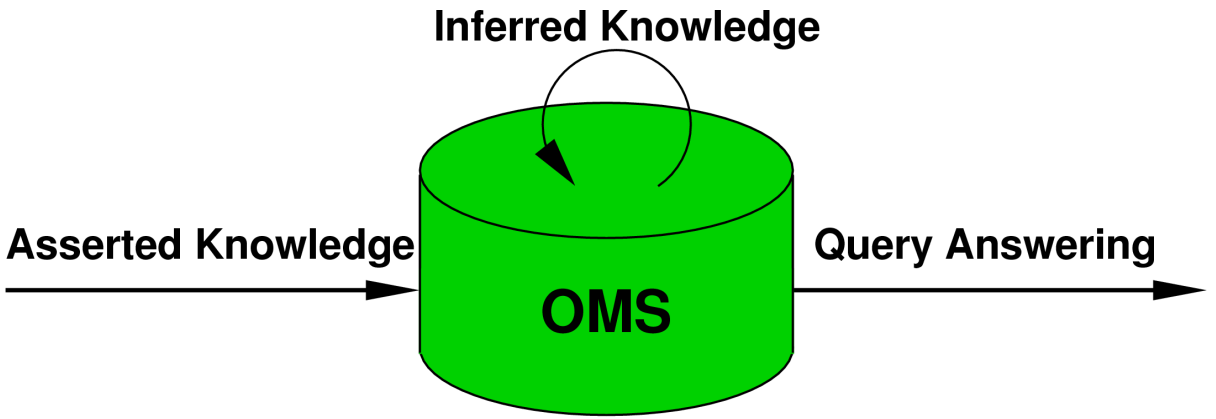
⇒ plain Relational Database Management System (RDBMS) not sufficiently expressive

Ontology Management System (OMS)

- Builds upon description logics (aka concept languages)
  - represents decidable fragment of first-order logic
  - supports modeling in terms of classes, properties, and individuals
- Recently has become widely supported through OWL standard

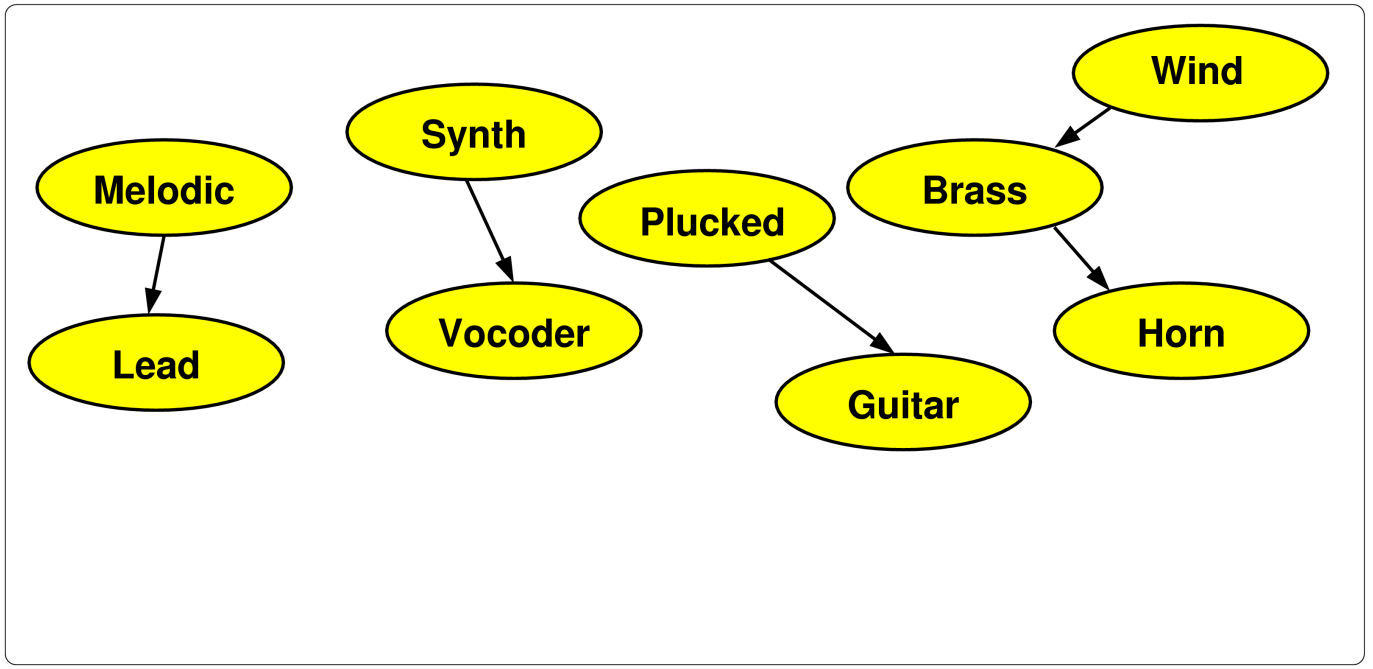
OMS vs. RDBMS

- Like a RDBMS, can serve as a central repository of information
- Unlike a RDBMS, also provides reasoning support for deducing knowledge



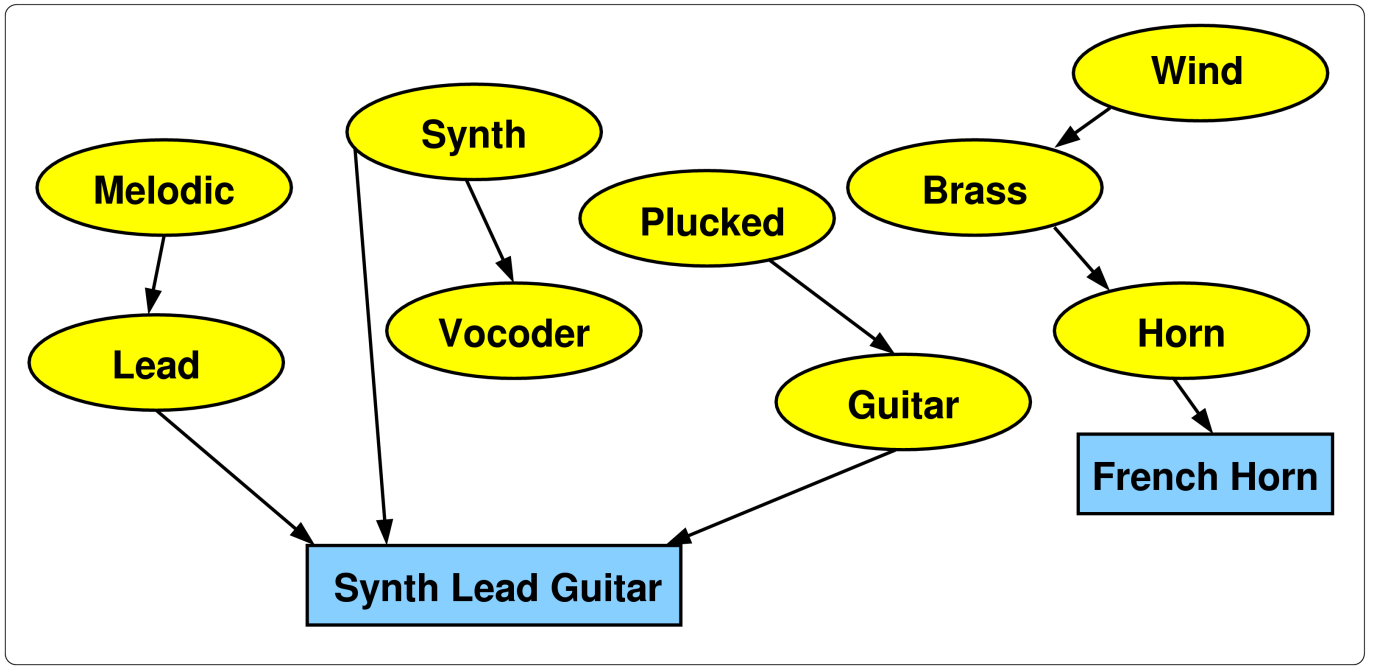
Ontologies

- Classes
  - create classes for tags and groups of sounds



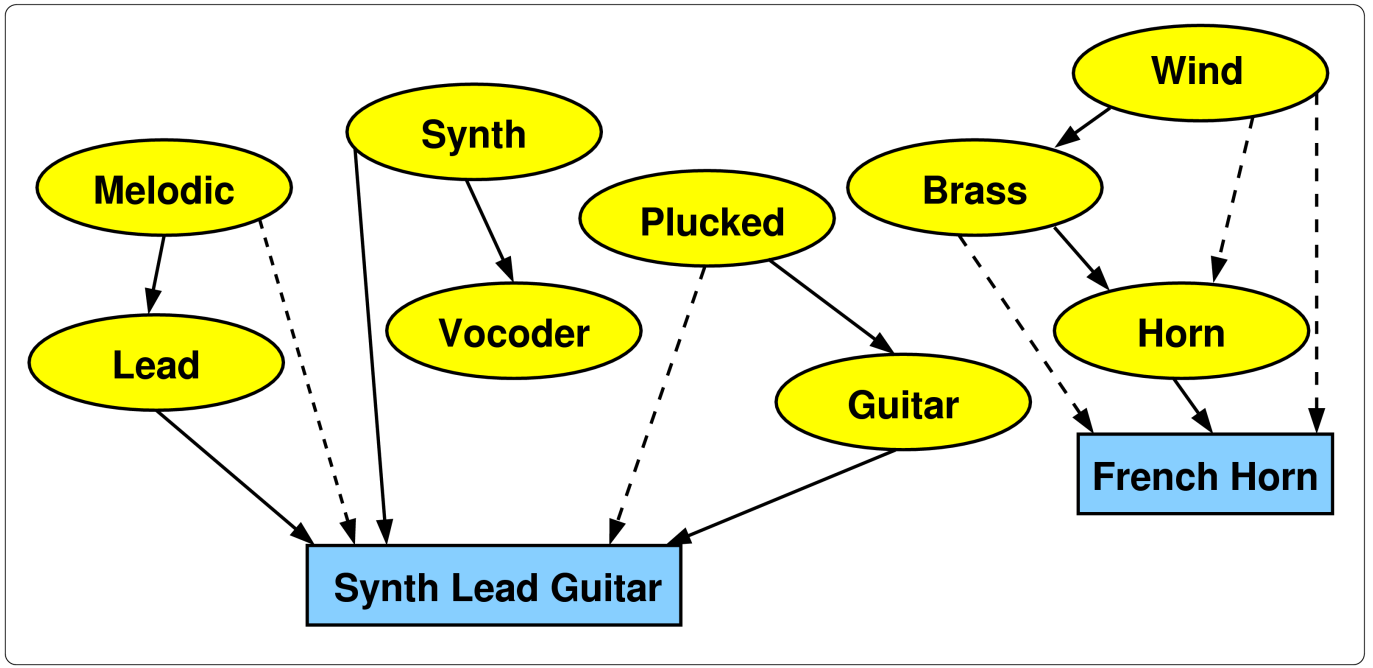
Ontologies (cont.)

- Individuals
  - store actually available sound resources as class members



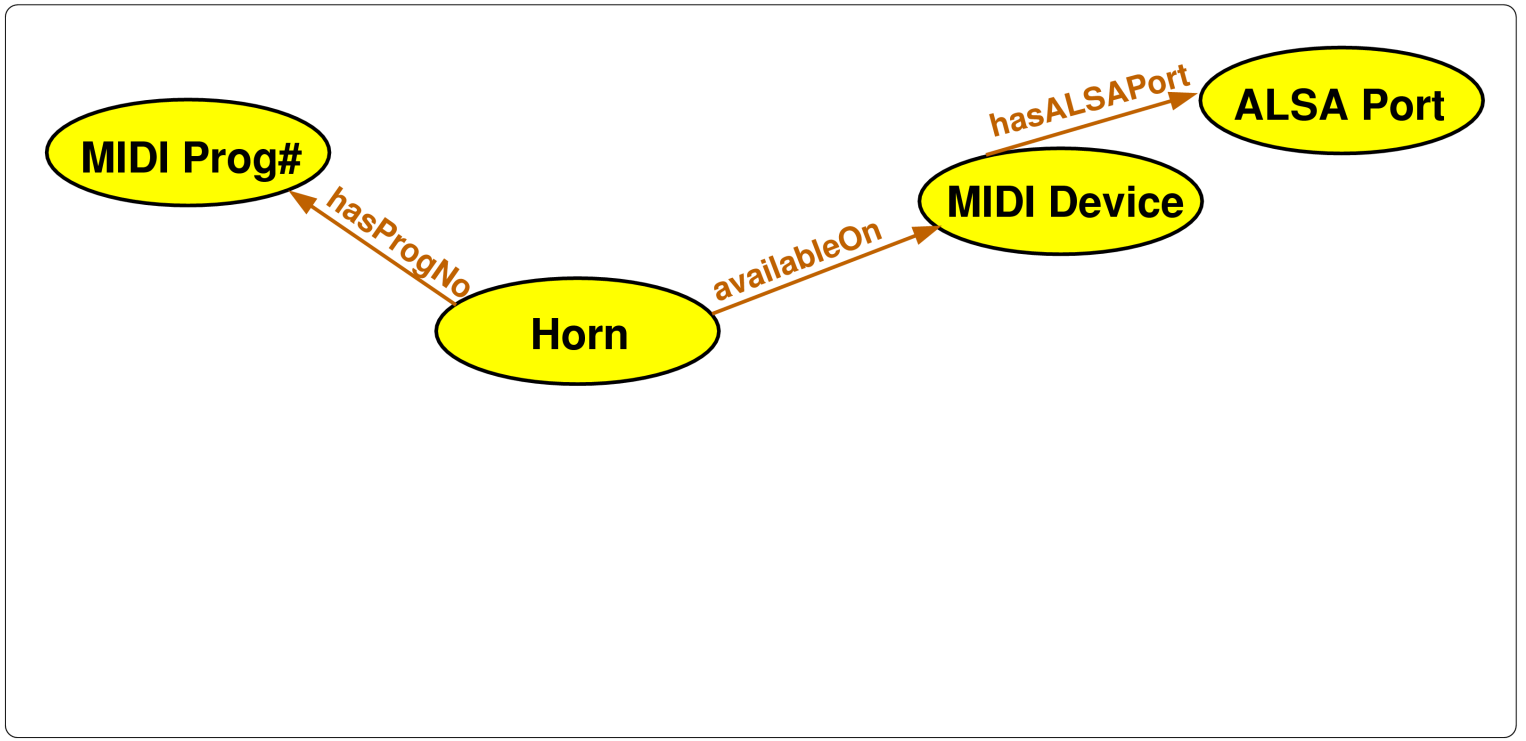
Ontologies (cont.)

- Individuals
  - infer inherited class memberships



Ontologies (cont.)

- Properties
  - associate each sound resource with related info (e.g. MIDI program number, ALSA port)



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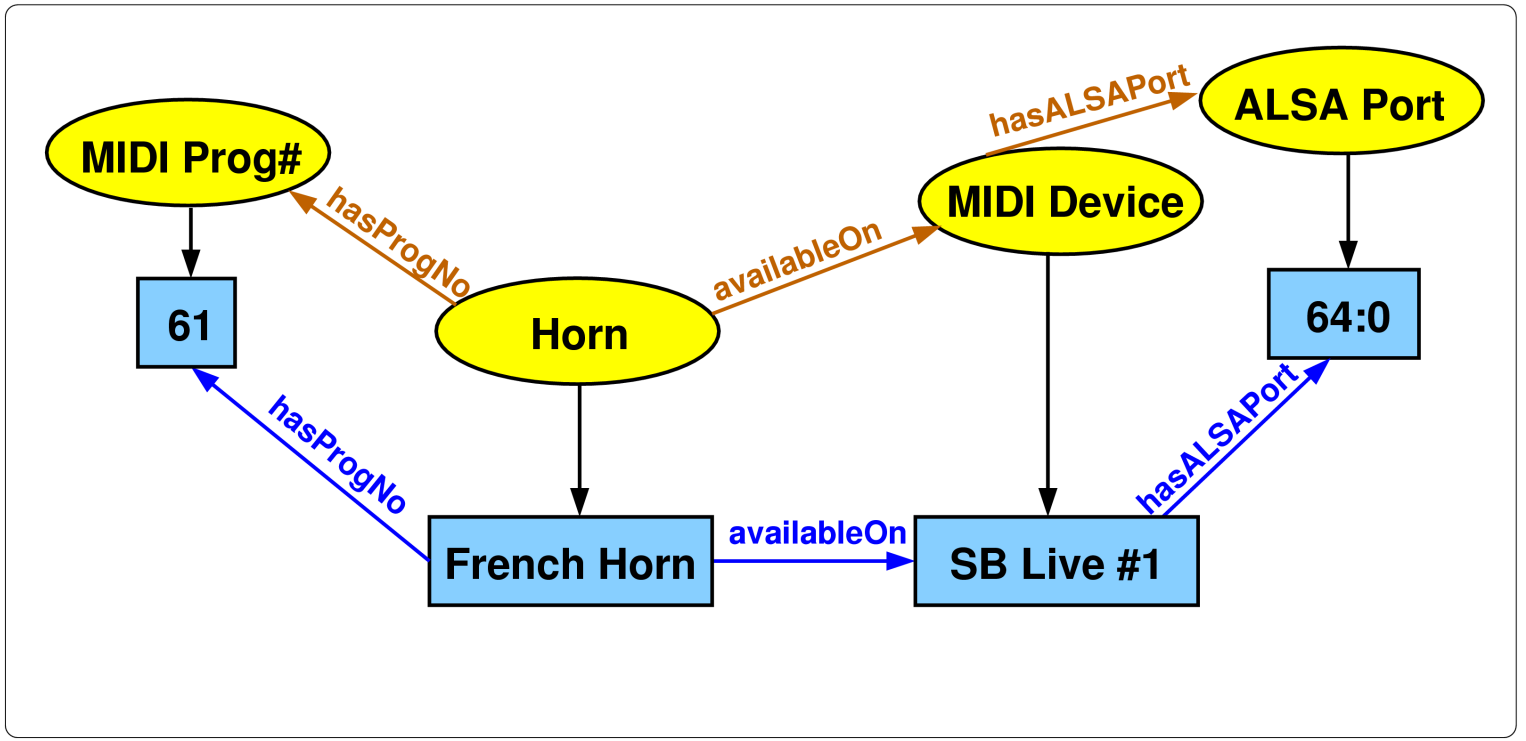


Example: Protégé

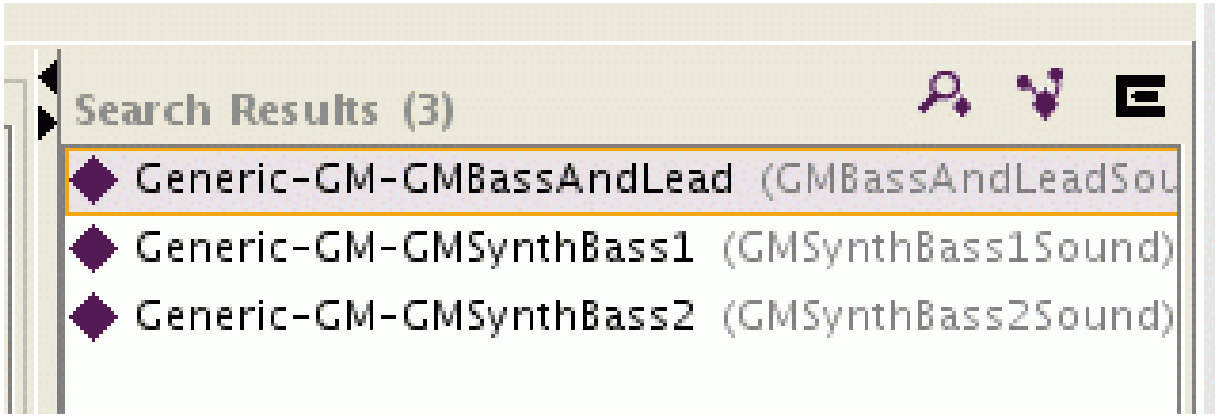
- Ontology editor and knowledge-base framework
  - Developed at Stanford University
  - Open source (Mozilla Public License)
  - Supports ontology editing, browsing, consistency checking, reasoning, ...
  - Used here to demonstrate feasibility of ontological sound resource processing

Example: Protégé (cont.)

- Query: `Sound ∏`
  `∃hasQuality.BassQuality ∏`
  `∃hasQuality.SynthQuality ∏`
  `∃livesOn.MU-50_1`

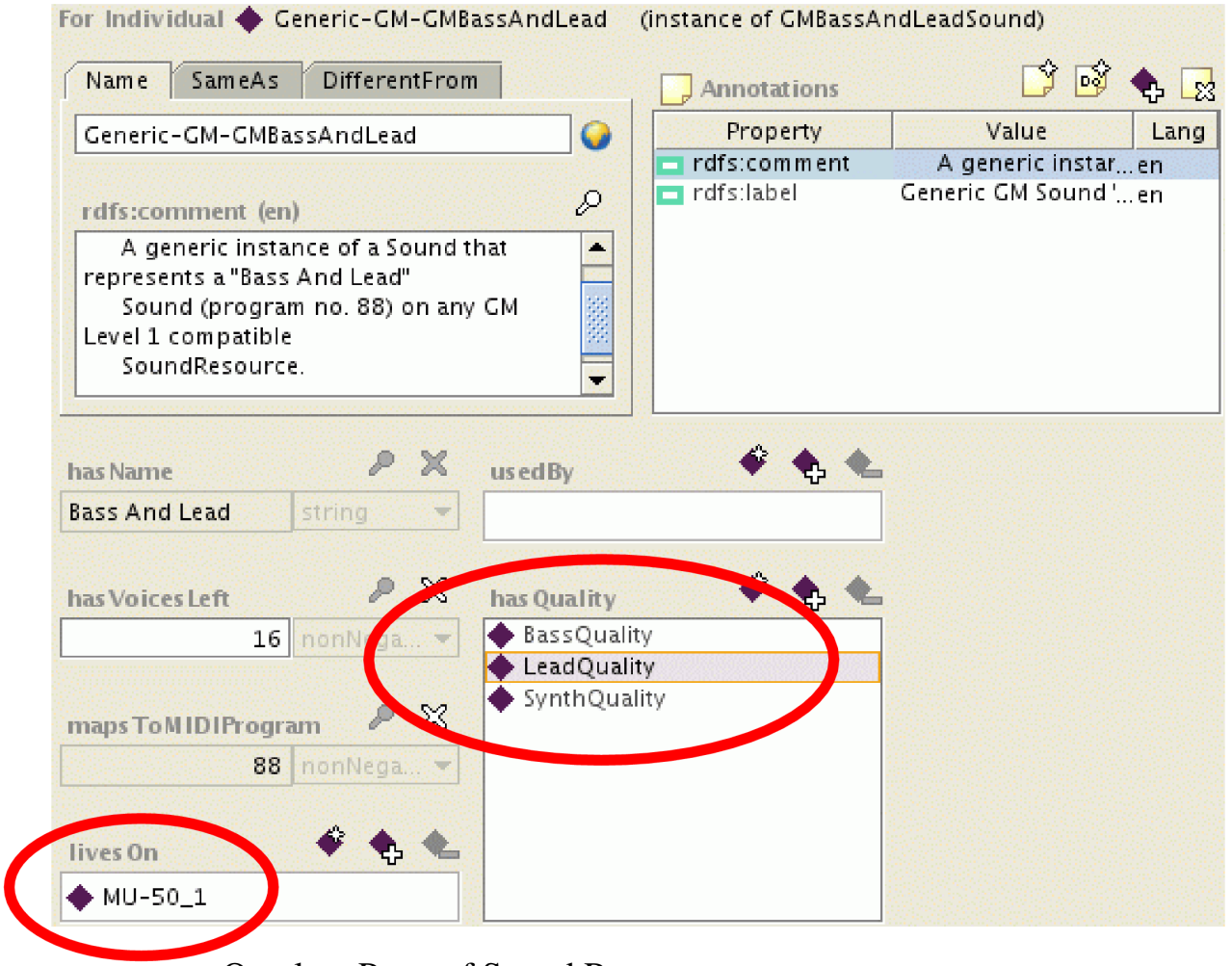
Example: Protégé (cont.)

- Search yields 3 matches:



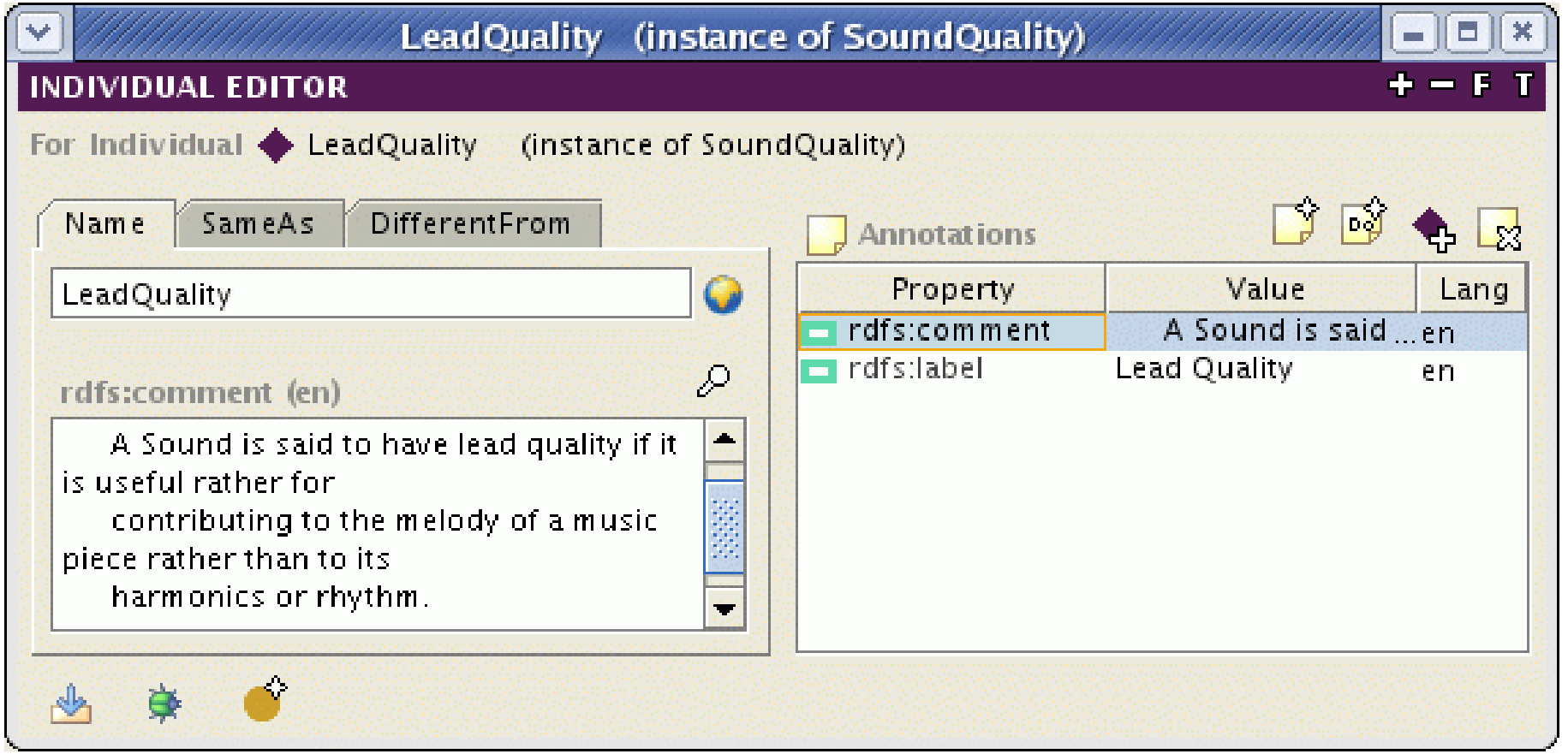
Example: Protégé (cont.)

- Result details



Example: Protégé (cont.)

- More on the “Lead” sound quality



@ ALSA Developers

- Based on this presentation,
  - further elaborate a proper ontology
  - set up OMS that
    - serves as central sound registry
    - tracks available sound resources
  - design a registry management API
- Maybe promote ontological framework as cross-platform standard

@ Synth Application Developers

- Announce sounds to central registry
- Annotate sounds with tags
- Announce tags to central registry
- Think about proper tags for standardization
  - Can lead to much cleaner synth design!
- Let synth GUI design be guided by ontology of tags

Conclusion

- Management of sound resources is strongly desired.
- It is feasible based on an ontological framework.
- An OMS can serve as central registry.
- Applications should use query and update the OMS database.

Questions?