Leveraging SNOMED CT with a General Purpose Terminology Server

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SNOMED CT

- Clinical terminology
- Concepts
  - Numerous
  - Detailed
  - Highly interconnected
  - Mapped to other terminologies
- Useful in many contexts as part of an overall solution
What is a Terminology Server?

A terminology server is

a networked software component

that centralizes terminology content and reasoning

to provide (complete, consistent and effective)

terminology services for other network applications

*Deploys* SNOMED and other terminologies
How is a Terminology Server Used?

- By informaticists
  to create, maintain, localize and map terminologies
- By clinical applications and their users
  to select and record standardized data
- By integration engines
  to map data elements between applications
Examples of Terminology Services

- **Term/name normalization:**
  What is the SNOMED CT name for heart attack? *Myocardial Infarction*

- **Code translation:**
  What is the ICD-9 code for Myocardial Infarction? *410.9*

- **Grouping and aggregation:**
  Is Myocardial Infarction a Cardiac Disease? *Yes*

- **Clinical knowledge:**
  What drug treats Myocardial Infarction? *Streptokinase*

- **Local information:**
  Add L227 as the local code for Serum Calcium. *OK*
Distributed Terminology System

- Integrated repository for all terminologies
  - Varying release cycles ➔ regular releases
  - Inconsistent data models ➔ common object model
  - Independent views ➔ integrated view with mappings
- Local terminology and maps
- Easy subscription updates (with exception reports)
- Desktop editor
- Web browser interface
- Workflow support
- Flexible import, export and integration
- Open source license
DTS Knowledge Base

Subscription Namespaces
- Derived from industry sources
- Delivered by Apelon

Local Namespaces
- Customer-specific
  - Concepts and terms
  - Properties
  - Associations (e.g., mappings)
Software Architecture

DTS Database

DTS Server

Tomcat (DTS Client)

DTS Editor

DTS Browser

DTS Client Application

Apelon
Challenges to SCT Deployment

- Size and complexity
  - Breadth and depth of coverage
  - Detailed data model
- Varied local needs
- Consistent modeling and usage
- ...
Advanced SNOMED Capabilities

- Modular extension (via Description Logic)
- Subsets
- Templates
- …
Description Logic (DL)

- Formal logic
- Focused on descriptions
- Concepts denote sets of individuals
  Myocardial infarction, Appendectomy, ...
- Taxonomy
- Automatic classification
Benefits of DL Software

- Enables precise concept definitions
- Makes implicit information explicit
- Detects redundancy and circularity
- Ensures logical consistency
- Automatically classifies concepts
  - Assists organization of complex taxonomies
  - Guarantees that concepts are found in predictable locations based on their definitions
  - Facilitates navigation
- Fosters disciplined knowledge engineering
Modular Extension

- **Create** additional concepts to increase breadth and/or depth of coverage
- Supported by *modular classification*
Modular Classification

- Extend DL terminologies
  - Such as SNOMED CT
  - Easily and accurately
  - Using the same language
  - To meet local needs
  - In a timely manner
  - For multiple purposes

- Share extensions for review; possible adoption

- Expedite term submission (to curators)
Modular Classification Aspects

- “Base Namespace”
  - SNOMED CT
- “Base Concept”
  - Hereditary Disease
- “Extension Namespace”
  - Your Extension
- “Extension Concept”
  - Familial vertigo
Multiple Extensions

- Personal Extensions
- Project Extensions
- Organization Extensions
- Specialty Extensions
- Authority Extensions
Independent Extensions
Base and Extended Views
Define

Classify

Familial vertigo

- Familial disease (disorder) [SNOMED CT]
- Hereditary disease (disorder) [SNOMED CT]
- Vertiginous syndrome (disorder) [SNOMED CT]

Defining Concepts:
- some Finding site (attribute): Brain structure (body structure)
- some Finding site (attribute): Labyrinth structure (body structure)
- some Has definitional manifestation (attribute): Vertigo (finding)
DTS Subsets

- Powerful way to select from terminologies
- Purposes
  - Pick lists
  - Value sets, e.g., populate or validate fields in HL7 messages
  - Context-dependent browsing and searching
- Workflow assignments, e.g., for mapping and review
Subset Expressions

- Concise *description* of subset
Subset Expressions

- Concise *description* of subset
- Include B and its descendants …
Subset Expressions

- Concise *description* of subset
- … but exclude \(C\) and its descendants …
Subset Expressions

- Concise *description* of subset
- ... and include concepts whose names start with ‘D’ ...

```
A
  B   C   D
   E  F   G  H  I  J
```
Subset Expressions

- Concise *description* of subset
- ... and your extension concepts too!
Subset Expression
SNOMED Taxonomy
Subset in SNOMED Taxonomy

![Concept Tree]

- **Namespace:** SNOMED CT
- **View Axis:** Superconcepts / Subconcepts
- **Subset:** SCT Chronic Diseases mapped to ICD
Chronic disease (disorder)

-ID: 37624

-Defined

-Synonym: Chronic disease (Preferred)
-Synonym: Chronic disease (disorder)
-Synonym: Chronic disease, NOS

-Properties
  -Code in Source: 27624003
  -Concept Status: Current
  -NHS Clinical Terms Version 3: XUA0r
  -SNOMED Legacy-style Code: DF-00003
  -SNOMED_ICD9_MAP: 799.89
  -subset: H
  -UMLS CUI: C0008679
  -UMLS Semantic Type: Disease or Syndrome

-Defining Concepts
  -Disease (disorder)

-Defining Roles
  -some Clinical course (attribute): Chronic (qualifier value)

-Associations
  -Episodicty (attribute): Episodicties (qualifier value)
  -Severity (attribute): Severities (qualifier value)

-SNOMED CT to ICD-9-CM MAPPING: Other ill-defined conditions [45001001]

-Subsets
  -Human Subset
  -SCT Chronic Diseases mapped to ICD
Subset Management
Subset Export Wizard

The DTS Subset Export Wizard will guide you through the steps needed to export Concepts from the CT Fluoroscopies subset.

19 Concepts will be exported.
## Sample Exported Subset

<table>
<thead>
<tr>
<th>Procedure Description</th>
<th>Code</th>
<th>Code Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoroscopy - brain (procedure)</td>
<td>P5-06004</td>
<td>168997</td>
</tr>
<tr>
<td>Fluoroscopy - esophagus (procedure)</td>
<td>P5-20205</td>
<td>169005</td>
</tr>
<tr>
<td>Fluoroscopy - gallbladder (procedure)</td>
<td>P5-0600C</td>
<td>169010</td>
</tr>
<tr>
<td>Fluoroscopy - intestine - large (procedure)</td>
<td>P5-06009</td>
<td>169007</td>
</tr>
<tr>
<td>Fluoroscopy - intestine - small (procedure)</td>
<td>P5-06008</td>
<td>169006</td>
</tr>
<tr>
<td>Fluoroscopy - lungs (procedure)</td>
<td>P5-20203</td>
<td>169003</td>
</tr>
<tr>
<td>Fluoroscopy - skull (procedure)</td>
<td>P5-06005</td>
<td>168998</td>
</tr>
<tr>
<td>Fluoroscopy - stomach (procedure)</td>
<td>P5-0600A</td>
<td>169008</td>
</tr>
<tr>
<td>Fluoroscopy - heart/mediastinum (procedure)</td>
<td>P5-20201</td>
<td>169001</td>
</tr>
<tr>
<td>Fluoroscopy and radiography - brain (procedure)</td>
<td>P5-06011</td>
<td>169015</td>
</tr>
<tr>
<td>Fluoroscopy and radiography - heart (procedure)</td>
<td>P5-20206</td>
<td>169019</td>
</tr>
<tr>
<td>Fluoroscopy and radiography - skull (procedure)</td>
<td>P5-06012</td>
<td>169016</td>
</tr>
<tr>
<td>Fluoroscopy of abdomen (procedure)</td>
<td>P5-0601E</td>
<td>303941</td>
</tr>
<tr>
<td>Fluoroscopy of chest (procedure)</td>
<td>P5-20200</td>
<td>38930</td>
</tr>
<tr>
<td>Fluoroscopy of diaphragm (procedure)</td>
<td>P5-2020A</td>
<td>169002</td>
</tr>
<tr>
<td>Fluoroscopy of head (procedure)</td>
<td>P5-0601D</td>
<td>303940</td>
</tr>
<tr>
<td>General body warming therapy (regime/therapy)</td>
<td>P0-00798</td>
<td>182656</td>
</tr>
<tr>
<td>Photofluorography of lungs (procedure)</td>
<td>P5-20209</td>
<td>169115</td>
</tr>
<tr>
<td>Video soft palate (procedure)</td>
<td>P5-06003</td>
<td>241124</td>
</tr>
</tbody>
</table>
The SNOMED Model

- Rich and detailed
- Example: procedures
  - Must specialize *Procedure (procedure)*
  - *Direct substance* relationships are constrained

<table>
<thead>
<tr>
<th>Defining Attribute</th>
<th>Permissible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIRECT SUBSTANCE</td>
<td>• Substance</td>
</tr>
<tr>
<td></td>
<td>• <em>Pharmaceutical/biologic product</em></td>
</tr>
</tbody>
</table>

And much, much more …
Subset for *Direct substance*
Templates

- Guide concept creation / update *in context*
  - SNOMED findings
  - SNOMED procedures
  - ...

- Tools
  - Template Builder
  - Template Editor

- Support extension / post-coordination

- A simplified example …
### Template Select

- **Template Name:** My Procedures

### Template Edit

#### Base Information

- **Template Type:** Concept
- **Concept/Term Namespace:** My SNOMED E...

#### Attributes

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct substance (attribute) [SNOMED CT] (DR)</td>
<td>BR</td>
<td>RDV</td>
<td>BHDQ</td>
<td>V</td>
<td>BLM</td>
</tr>
</tbody>
</table>
Template Editor (Concepts and Terms)
Template Editor

Template Select

Template Name: My Procedures

Template Entry

Procedure name: Snake venom identification (procedure)
Defining procedure:
Direct substance:
Primitive/Defined: Primitive
Editor: Tony Weida
Timestamp: @D @T
Priority:
Comment:

Save Reset Clear Delete
Procedure name: Snake venom identification (procedure)
Defining procedure: Toxin detection (procedure) [SNOMED CT]
Direct substance: 
Primitive/Defined: Primitive
Editor: Tony Weida
Timestamp:
Priority:
Comment:
Procedure name: Snake venom identification (procedure)
Defining procedure: Toxin detection (procedure)[SNOMED CT]
Direct substance: Snake venom (substance)[SNOMED CT]
Primitive/Defined: Defined
Editor: Tony Weida
Timestamp: @D @T
Priority: Medium
Comment: Looks good!
SNOMED Extension Capabilities

- Create a SNOMED Extension Namespace
- Import data in SNOMED Release Format
- Update with DTS Editor (or API)
- Classify
- Generate SCTIDs
- Export in SNOMED Release Format
Graphic Viewer
# Table Editor

![Table Editor Screenshot](image)

## Table Content

<table>
<thead>
<tr>
<th>State</th>
<th>Admitted (Year)</th>
<th>Capital (State)</th>
<th>Flower (State)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>1819</td>
<td>Montgomery</td>
<td>Camellia</td>
</tr>
<tr>
<td>Alaska</td>
<td>1959</td>
<td>Juneau</td>
<td>Forget Me Not</td>
</tr>
<tr>
<td>Arizona</td>
<td>1912</td>
<td>Phoenix</td>
<td>Saguaro Cactus Bloom</td>
</tr>
<tr>
<td>Arkansas</td>
<td>1836</td>
<td>Little Rock</td>
<td>Apple Blossom</td>
</tr>
<tr>
<td>California</td>
<td>1850</td>
<td>Sacramento</td>
<td>California Poppy</td>
</tr>
<tr>
<td>Colorado</td>
<td>1875</td>
<td>Denver</td>
<td>Red Mountain Columbine</td>
</tr>
<tr>
<td>Connecticut</td>
<td>1788</td>
<td>Hartford</td>
<td>Mountain Laurel</td>
</tr>
<tr>
<td>Delaware</td>
<td>1787</td>
<td>Dover</td>
<td>Peach Blossom</td>
</tr>
<tr>
<td>East</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Florida</td>
<td>1845</td>
<td>Tallahassee</td>
<td>Orange Blossom</td>
</tr>
<tr>
<td>Georgia</td>
<td>1788</td>
<td>Atlanta</td>
<td>Cherokee Rose</td>
</tr>
<tr>
<td>Hawaii</td>
<td>1959</td>
<td>Honolulu</td>
<td>Pine Alaska</td>
</tr>
<tr>
<td>Idaho</td>
<td>1890</td>
<td>Boise</td>
<td>Syringa - Mock Orange</td>
</tr>
<tr>
<td>Illinois</td>
<td>1818</td>
<td>Springfield</td>
<td>Purple Rose</td>
</tr>
<tr>
<td>Indiana</td>
<td>1816</td>
<td>Indianapolis</td>
<td>Penny</td>
</tr>
<tr>
<td>Iowa</td>
<td>1846</td>
<td>Des Moines</td>
<td>Wild Prairie Rose</td>
</tr>
<tr>
<td>Kansas</td>
<td>1861</td>
<td>Topeka</td>
<td>Sunflower</td>
</tr>
<tr>
<td>Kentucky</td>
<td>1792</td>
<td>Frankfort</td>
<td>Goldenrod</td>
</tr>
<tr>
<td>Louisiana</td>
<td>1812</td>
<td>Baton Rouge</td>
<td>Magnolia</td>
</tr>
<tr>
<td>Maine</td>
<td>1820</td>
<td>Augusta</td>
<td>White Pine cone and basset</td>
</tr>
<tr>
<td>Maryland</td>
<td>1788</td>
<td>Annapolis</td>
<td>Black-eyed susan</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>1789</td>
<td>Boston</td>
<td>Treliving-Arbutus</td>
</tr>
<tr>
<td>Michigan</td>
<td>1837</td>
<td>Lansing</td>
<td>Apple Blossom</td>
</tr>
<tr>
<td>Minnesota</td>
<td>1858</td>
<td>St. Paul</td>
<td>Pink and white lady's-slipper</td>
</tr>
<tr>
<td>Mississippi</td>
<td>1817</td>
<td>Jackson</td>
<td>Magnolia</td>
</tr>
<tr>
<td>Missouri</td>
<td>1821</td>
<td>Jefferson City</td>
<td>Hawthorn</td>
</tr>
<tr>
<td>Montana</td>
<td>1889</td>
<td>Helena</td>
<td>Bitterroot</td>
</tr>
<tr>
<td>Nebraska</td>
<td>1855</td>
<td>Lincoln</td>
<td>Sandhill</td>
</tr>
</tbody>
</table>

---

**Note:** The table above is a simplified representation of the data displayed in the Table Editor. For more detailed information, please refer to the software documentation or user manual.
Import Wizard
Terminology Query Language

```
from ["States"]
with Admitted>1900
export concept_name, Admitted, Capital;
```

<table>
<thead>
<tr>
<th>Concept_Name</th>
<th>Admitted</th>
<th>States</th>
<th>Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>1959</td>
<td>Juneau</td>
<td></td>
</tr>
<tr>
<td>Arizona</td>
<td>1912</td>
<td>Phoenix</td>
<td></td>
</tr>
<tr>
<td>Hawaii</td>
<td>1968</td>
<td>Honolulu</td>
<td></td>
</tr>
<tr>
<td>New Mexico</td>
<td>1912</td>
<td>Santa Fe</td>
<td></td>
</tr>
<tr>
<td>Oklahoma</td>
<td>1907</td>
<td>Oklahoma City</td>
<td></td>
</tr>
</tbody>
</table>

Field delimiter for text files:  |
Discussion
Thank you!