Enabling Healthcare Terminology Interoperability using HDD Access

http://www.hddaccess.com

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Conflict of Interest Disclosure

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Overview

- Understanding terminology needs of healthcare organizations
- The need for interoperability
- Our approach to the interoperability question
- Business model – publicly available and open source
- HDD Access community
- What’s next for HDD Access?
- HDD Access demo
In a typical hospital near you...
Their computers often don’t speak the same language

How do you do?

Nimeni on Linus.

Nǐmeni hēshīngkì yì lín Ròng wū kěn bǐ zhèng tiān.

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How do you do? My name is Linus.
How do you do? My name is Linus.
Nimeni on Linus.

I am from Helsinki.
I am from Helsinki.
I am from Helsinki.

I'm 30 years old.
I'm 30 years old.
I'm 30 years old.

My blood glucose is 90 mg/dL.
My blood glucose is 90 mg/dL.
My blood glucose is 90 mg/dL.

Chest X-ray shows no abnormal findings.
Chest X-ray shows no abnormal findings.
Chest X-ray shows no abnormal findings.

That will be $200. Thank you.
That will be $200. Thank you.
That will be $200. Thank you.
How Many Terminologies Does an Organization Need?

- **Standard terminologies**
  - Clinical: SNOMED CT
  - Lab: LOINC
  - Pharmacy: RxNorm, other proprietary pharmacy terminologies
  - Billing/reporting: ICD-9-CM, ICD-10-CM, ICD-10-PCS, CPT, HCPCS, DRG, and many others

- **Local terminologies**
  - Those created by vendors of EMRs, pharmacy and lab systems
  - Those created by hospitals themselves
  - Often “uncontrolled” without consistent governance processes
Our Answer to the Terminology Management Question

- The 3M Healthcare Data Dictionary (3M HDD) was created in the early 90s through an SBIR grant.
- Two of the early users were the DoD EHR and Intermountain Healthcare.
- The 3M HDD is a concept-based terminology server that integrates the current version of many standard and local terminologies used by hospitals and other healthcare organizations.
- Partitioning capabilities are included to support terminology content from different organizations.
DoD, VA and HDD Access

- DoD AHLTA EHR uses the HDD as its data dictionary
- VA VistA EHR system uses its own terminology
- In 2009, the DoD and the VA announced the joint iEHR (Integrated Electronic Health Record) project
- The DoD and VA gave 3M a contract in 2012 to make the 3M HDD publicly available as HDD Access, and they will use HDD Access for interoperability between their EHR systems
What is HDD Access?

- An open source terminology engine to enable
  - Implementation of various standard terminologies
  - Interoperability between multiple local and standard terminologies
- Contains various standard terminologies and a subset of the 3M HDD to enable interoperability between them
- HDD Access supports standard terminologies by bridging the gap between SDOs and users – it doesn’t compete with standard terminologies, but it helps their implementation
### HDD Access Components

- **Includes terminologies that we have permission to release publicly**
- **User can create local extensions without modifying the core content**
- **Database (Oracle, SQL Server, MySQL, PostgreSQL)**
- **Terminology browser, authoring tool and search engine**
- **API (HL7 CTS, 3M)**
- **Ran on Windows and Linux**
- **Import/export tools**
- **1500+ users**
- **Discussion forum, blog, FAQ**
- **Open Exchange – users can share their contributions**
Components of the HDD

- **Controlled Medical Vocabulary**
  - Collection of clinical concepts

- **Knowledge Base**
  - Relationships among concepts

- **Medical Information Model**
  - Establishes clinical context
Concept Based Vocabulary

A collection of medical concepts, organized to support synonyms and other lexical characteristics

- concept: a unique, definable idea or object that has a very specific, known meaning
### Concept Based Vocabulary

**Concept Representation:**
- **COLD**
- a sensory perception
- “I’m feeling cold”
- 68215

**Concept Domain:**
- Chronic Obstructive Lung Disease
- a pulmonary diagnosis
- 1005480

**Concept Definition:**
- an upper respiratory viral infection
- “I have a cold”
- 1005313
Knowledge Base/Relationships

Lab Test

Chem 4

Sodium

Potassium

Chloride

Glucose

Lab Result

→ is-component-of

→ is-a
Medical Information Model

Allergy Event

- Drug: Aspirin
- Type: Allergen
- Severity: Mild
- Reaction: Rash
- Date: 20000703

Information Model - instantiated

Allergy Event
- Allergy Type
- Allergen (Aspirin)
- Severity (Mild)
- Reaction (Rash)
- Date (20000703)

Instance Data

Patient Allergy
- Drug (1550): Aspirin (3000252119)
- Mild (1554)
- Rash (82559)
- 20000703
Point-to-Point vs Centralized Mapping

HDD reduces mapping and maintenance efforts by using centralized mapping. We add point to point mappings when necessary in a small number of cases.

\[ \frac{n(n-1)}{2} \text{ maps} \]

\[ (n-1) \text{ maps} \]
HDD Access Content v.29 – Standard Terminologies

Terminologies that we have permission to include in HDD Access are supported and duly acknowledged

- ICD-9-CM Diagnoses
- ICD-9-CM Procedures
- ICD-10-CM
- ICD-10-PCS (codes but not attributes/hierarchies)
- HCPCS Level II
- HCPCS Modifiers
- MS-DRG
- TRICARE/CHAMPUS MS-DRG
- APC
- MS-DRG MDC
- TRICARE/CHAMPUS MS-DRG MDC
- RxNorm
HDD Access Terminology Design

- Concept-based terminology, with concept permanence and graceful evolution
- Multi-hierarchical terminology
- Supports semantic relationships
- Supports and integrates terminology models and content of multiple standard and local terminologies
- Supports mappings between equivalent and non-equivalent concepts
HDD Access Licenses

- HDD Access **software** is open source under the **Apache License v2** – source code is published in addition to the binary installers

- HDD Access **content** is “publicly available” under the **HDD Access Content License**
  - You cannot modify or re-release the core HDD Access content
  - But you can extend it and release your extensions as you please
  - This is done to protect the integrity of the terminology content, and in turn, patient safety
HDD Access Community

- More than 1,500 users, from government, industry (HIS vendors, consulting), academia, and international users
- Active discussion forums, blog, FAQ
HDD Access Content – Data Row Counts

- Concepts
- Relationships
- Representations
- Representation Contexts
Enabling Interoperability
Local Extensions
Namespace Dependencies
Demo
Local Extensions

- Local extensions are implemented as “namespaces” where the user can author their own terminology content without modifying the core content.
- We provide a unique range of identifiers for each user’s local extension to avoid collision with other users’ extensions.
- HDD Access Content License allows the user to use or share their local extension with others.
- HDD Access tools allow export and import of local extensions.
Namespace Dependencies

- HDD Access core content and local extensions are made of “namespaces”, which are logical partitions of the content.

- Namespaces may have dependencies among them, since we integrate multiple terminologies using a central concept-based terminology.

- Example 1: The SNOMED CT concept of “Aspirin (substance)” and the RxNorm concept of “Aspirin” (ingredient) are mapped to the HDD concept “Aspirin” – the SNOMED CT namespace and the RxNorm namespace depend on the core namespace.
Namespace Dependencies

- Example 2: If we load the “SNOMED CT to ICD-10-CM Mappings from NLM” into HDD Access, the map set will be in a separate namespace which depends on the SNOMED CT namespace and the ICD-10-CM namespace.

- Soon, we will have a complex network of namespaces.

- The dependencies are between specific versions of namespaces, rather than the namespaces themselves.

- The “versioned” namespace dependencies form a directed acyclic graph.
Namespace Dependencies – Our Approach

- Users define the namespaces that their namespace depends on
- The “versioned” namespace dependencies are automatically calculated by the software
- Namespace dependencies form a directed acyclic graph
- Content can only be moved from the “leaf” towards the “root” of the dependency tree, not in the other direction (which would break concept permanence)
Demo

- Creating your own local extension
  - Your namespace will be automatically created

- Creating your own terminology
  - Let’s create an example drug terminology

- Creating your own mappings
  - Let’s map your drug terminology concepts to RxNorm
Thank you!

References

- Online browser: [http://search.hddaccess.com](http://search.hddaccess.com)
- Discussion forums: [http://www.hddaccess.com/forum](http://www.hddaccess.com/forum)
- Apache License v2: [http://www.apache.org/licenses/LICENSE-2.0.html](http://www.apache.org/licenses/LICENSE-2.0.html)
- Contact us: [http://www.hddaccess.com/contact](http://www.hddaccess.com/contact)
- 3M HDD: [http://www.3mhis.com/terminology](http://www.3mhis.com/terminology)

Please send your questions to

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