

Part C – Future Issues

Topics

- [Arden Syntax 2.5](#)
- [Arden Syntax 3.0](#)
- Fostering knowledge sharing

I. Arden Syntax 2.5

- Curly Braces solution: Transitional, backward compatible object-oriented data model
 - Initial focus on data queries
- XML

Using Shared Components in Arden: Curly Braces Problem

- Site-specific data mappings are not part of the standard
 - Enclosed in { }
- [Example](#)
last_creat := read last [select "OBSRV_VALUE" from "LCR" where qualifier in ("CREATININE", "QUERY_OBSRV_ALL")];
- [Types of Elements](#)
 - Data queries
 - Events
 - Destinations

Addressing the Curly Braces Problem: Two Approaches

- [Backward-Compatible](#) (transitional)
 - Standard (object-oriented) data model
 - Standard vocabularies
 - Add “dot notation” to make variables more object-like
 - Operator parameters must be simple/current data types
- [Backward-Incompatible](#)
 - Fully object-oriented variables
 - Methods
 - Operator parameters may be objects

Backward-Compatible Approach (v2.5)

- Focus first on data queries (bulk of MLM processing time)
- [Elements](#)
 - Query language = SQL
 - Data model = RIM
 - Vocabulary = SNOMED-CT, LOINC, CPT-4, ICD-9, etc
- [General form](#)
*<variable> :=
 READ <aggregation> <attribute>
 FROM <RIM object>
 WHERE <constraint>;*

Standardized Curly Braces: Examples

- *plasma_cell_count := read value from observation where code='24103-4'^'PLASMA CELLS'^'LN'^'2.05' and classCode = 'OBS' and moodCode='EVN';*
- *(name, sex, location) := read name, administrative Gender Code, addr from person where name = 'Jones';*
- *oral_meds := read code from substanceAdministration where routeCode = 'PO' and classCode = 'SBADM' and moodCode = 'EVN';*

Arden Syntax: Object-Oriented Model

- Declare an object
*<variable> := OBJECT [<attribute-1>,
<attribute-2>,...]*
- Instantiate object with a query
*<variable> := READ AS <object type>
<aggregation> (<mapping>) WHERE
<constraint>;*

Arden Syntax: Object-Oriented Example

mal := OBJECT [code, route];

*pt_meds := READ AS mal (code,
routeCode) from substanceAdministration
where classCode = 'SBADM' and moodCode =
'EVN';*

Variable References (must reduce to a current data type to avoid changing current operators)

*mal.code
mal.routeCode*

Backward-Incompatible Approach (v3.0)

- Fully object-oriented on both sides of assignment operator
 - Queries (“curly braces”)
 - Variables
- Current Arden operators would have to be redefined to handle objects as parameters
- Application: GELLO

Arden as XML – Why?

- MLM indexing and retrieval – XML-based data retrieval
- Transmission – XML-based message systems
- Translations into other representations
 - Computer languages
 - Display
- Tool development
 - Authoring environments
 - Execution engines

XML and Arden 2.5

- XML-encoded MLMs
- Encode
 - Maintenance category slots and content
 - Library category slots and content
 - Separate knowledge category slots, but do not encode content

II. Arden Syntax 3.0

- RIM conformance
- Objects and data model
 - Common expression language (GELLO)
 - Virtual Medical Record (vMR)
- XML

RIM Conformance

- Arden Syntax 3.0 will conform to the HL7 Version 3 Reference Information Model
- Arden Syntax and RIM will probably both have to be modified to make this work

Arden Syntax Object-Oriented Data Model

- Institute backward-incompatible approach
 - Redefine operators to handle objects
 - Extend expression language from queries to events and destinations

Expression vs. Query Languages

- | Expression | Query |
|---|---|
| <ul style="list-style-type: none">• Functions / Operators<ul style="list-style-type: none">– Mathematical– Logical (tri-state)– String– Temporal– Uncertainty | <ul style="list-style-type: none">• Describes interactions with data source• Uses standardized data model• Uses Expression Language |

Shareable Guideline Components: Expression Language

- Purposes
 - Query data (READ)
 - Logically manipulate data (IF-THEN, etc)
- Current work: GELLO (BWH) = Guideline Expression Language

Ogunyemi O, Zeng Q, Boxwala A. Object-oriented guideline expression language (GELLO) specification: Brigham and Women's Hospital, Harvard Medical School, 2002. Decision Systems Group Technical Report DSG-TR-2002-001.

Expression Language: GELLO

- Original goal (InterMed): Procedural component for high-level guideline format (GLIF)
- Subsequent goal: Provide similar functionality for current HL7 KR standard (Arden Syntax)
- Emphasis: Shareability of queries and expressions
- Mechanism: Reference data in OO fashion

GELLO (continued)

- Provides basic data types
- Allows reference to underlying standard data model (vMR)
- Based on the Object Constraint Language (UML)
- Current goal: Ballot as a separate HL7 standard during the coming 12 months

GELLO: Examples

Queries

```
Observation.select(coded_concept='03245')
```

```
Observation.selectSorted(coded_concept='C0428279')
```

Expressions

- The variables calcium and phosphate are not null

```
calcium.notEmpty() and phosphate.notEmpty()
```

- The patient has renal failure and the product of calcium and phosphate exceeds a threshold signifying osteodystrophy

```
renal_failure and calcium_phosphate_product > threshold_for_osteodystrophy
```

vMR -- What is it?

Virtual Medical Record

- Simplification of medical record
- Focus on concepts important to DSS
- The minimal set of record types & attributes required to achieve semantic interoperability
- Expression language has to be able to write criteria using these

Current Sharing of Knowledge Bases

- Medical Record Schema variation
 - Terminology (controlled vocabulary/codes) variation
 - Physical Quantity Units variation
- So far this has meant reengineering guideline systems for each clinical system



- To add to a new system
- Need new software using that system's patient record schema
- Need revised guideline knowledge using the right terminology codes
- Too expensive, maintenance nightmare
- What we need are **standards** to enable reuse

Motivation for virtual Medical Record

- To provide safe mediation between **many** disparate clinical systems and **one** decision support system
 - DSS needs only a simplified view of a real medical record – and that we *can* standardize

Schema simplification

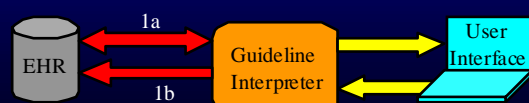
- only distinctions important to DSS
- drop administrative, audit trail data
- generalize to basic EMR entities
- minimum number of record types
- minimum number of attributes

Terminology simplification

- queries usually generalize
- generalisation reduces mis-mapping
- and copes with system idiosyncrasies

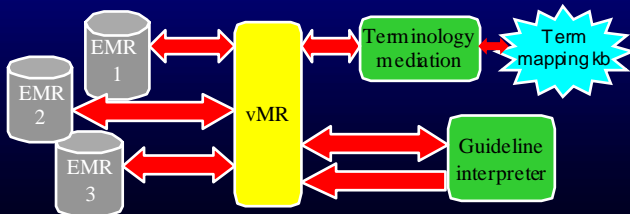
virtual Medical Record (vMR)

- Required to represent standardized view of EHR for
 - 1a – standard names in expressions, result sets
 - 1b – writing new records to the EHR



vMR mediation

- Minimize expense in area most resource intensive:
 - guideline creation, maintenance, verification
 - guideline interpreter software, testing
- Additional requirement (less resource)
 - Term and schema mapping knowledge and components



vMR Benefits vs. Costs

- Benefits
 - Most expensive parts of DSS get reused
 - Guideline Interpreter software component
 - Guideline Knowledge base
 - Decoupling these from terminology/schema changes
 - Rapid deployment on new clinical systems
- Costs
 - Need to provide/maintain terminology mapping knowledge
 - Need to provide terminology mapping software components
 - Vendors must map their system into vMR format

XML and Arden Syntax 3.0

- XML encoding similar to 2.5
- Probable additions
 - Encoding of structured queries
 - Encoding of external references/links
- Possible additions
 - Encoding of control structures and operators

III. Knowledge Sharing: IMKI

- Institute for Medical Knowledge Implementation = Vendor consortium
- Goals
 - Provide tools for encoding knowledge
 - Provide a library of shareable knowledge (directly executable or automatically translatable)
- Initial effort: Arden Syntax MLMs
- Current status: On hiatus

Tutorial Summary

- Clinical decision support is needed
- Arden Syntax = standard, shareable KR formalism
 - procedural / production rule hybrid
 - rich collection of (time-oriented) operators
 - curly braces problem
- Ongoing efforts to increase Arden shareability through a standard data model

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