An Infrastructure for Storage and Retrieval of GEM Guidelines

BLISS D, LOBER WB, TRIGG LJ, KARRAS BT

Clinical Informatics Research Group, Division of Biomedical and Health Informatics
University of Washington School of Medicine, Seattle, WA

ABSTRACT

We have developed an object oriented data store for GEM encoded guidelines, which allows for content based retrieval of clinical guidelines. Our design permits transformation of the query result to provide guideline content customized for diverse uses.

ENCODED GUIDELINES

Clinical guidelines are in wide use, and much attention has been devoted recently to developing methods for encoding structured representations of guideline content\(^1,2\). Encoded guidelines are useful in part because the content can be selectively repurposed, both for content display applications and for retrieval of computable algorithms.

GEM\(^1\) has been proposed as a guidelines representation scheme based on an extensible markup language (XML). However, GEM specifies a guidelines document schema, not a database architecture for storing guidelines. We present an object-based architecture for storing GEM encoded guidelines, and retrieving them in either full document format, encoded in XML, or transformed to accommodate specific presentation or computing needs.

METHODS

We have implemented a database that uses the GEM schema, supplied in the form of a data type definition document (DTD). The DTD is used to create the relational database schema. GEM guidelines can be stored in the database, and queried by a browser or application program using standard URL’s. Sets of guidelines satisfying query criteria can be retrieved as XML documents or, though the optional application of an XSL (extensible stylesheets language) transformation, as either transformed XML or HTML.

Our implementation is based on Microsoft’s XML for SQL enhancements to their SQL Server 2000 product (www.microsoft.com/products). The GEM DTD is transformed mechanically into an XDR (XML-Data Reduced) schema using XML Authority (www.tibco.com). We developed an algorithm, using Perl, to further process the schema. It adds information regarding the mapping to a relational layout and creates an annotated XDR schema. This is used directly by SQL Server to create the database tables, and to prepare documents for storage and retrieval.

Data retrieval uses Microsoft XML for SQL to accept queries in the simple, legible XPath language over a standard Web interface. The queries are automatically converted to database format and the results converted back to XML. Any requested stylesheets are applied, and the results are returned to the browser. One of the most powerful features of our system is the ability to apply a user-specified stylesheet. It enables us to produce output at any level of detail, in any needed format, using the same collection of guidelines, without any modification to the guidelines themselves.

RESULTS

We developed a prototype system. We have imported both guidelines that we encoded in GEM, and guidelines encoded by others. We have validated our retrieval strategy by developing two prototype display formats, implemented as XSL stylesheets. One of these emulates the National Guideline Clearinghouse (http://www.guideline.gov) format, and the other generates a format suitable for use on a portable computing device during clinical patient interaction.

DISCUSSION

We are exploring several applications of our database. Our academic medical center has a set of online guidelines that we will encode using GEM. Storing them in the database will allow us to deliver customized views of those guidelines to different users and for different display devices. We are also exploring the idea of using the database and its transformation ability as a way of converting between guideline representation formats.

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