Arden Syntax Software: New Features and Technical Integration
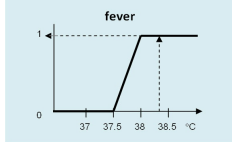
In the last couple of years, substantial progress was made in terms of the Arden Syntax Software. In our role as member of Health Level Seven (HL7) International's Arden Syntax Work Group, Medexter Healthcare was significantly involved in the further development of the Arden Syntax as well as in the introduction of new important features. We are glad to present two new and improved versions of the Arden Syntax (2.9 and 2.10), introducing fuzziness and ArdenML. Moreover, we would like to show the possibilities of integrating our Arden Syntax software into different health information technology environments.
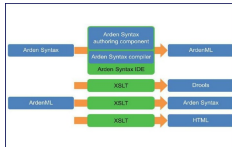
Arden Syntax version 2.9

The American National Standards Institute (ANSI) approved the latest version of the HL7 Arden Syntax for Medical Logic Systems in March 2013. This version was prepared by members of Medexter Healthcare, discussed in the Arden Syntax Work Group, and successfully balloted by the HL7 community. Through the integration of fuzzy sets and fuzzy logic, this new and augmented version of the Arden Syntax is able to include linguistic and propositional uncertainty into the medical knowledge representation and its processing.

Especially in clinical medicine, the inherent linguistic uncertainty of clinical terms is evident. The new fuzzy feature of the Arden Syntax enables the modeling of these terms using fuzzy sets. This Fuzzy Arden Syntax is already in use, for example as part of Medexter's Moni system. Moni (monitoring of nosocomial infections) provides fully automated surveillance and reporting of intensive care unit (ICU)-acquired infections. The introduction of fuzziness in this context is nicely illustrated in "Fuzziness in Healthcare-Associated Infection Monitoring and Surveillance".

Arden Syntax version 2.10

Successfully balloted by HL7 International in May 2014, the latest Arden Syntax version contains a new feature: ArdenML, an XML representation of the Arden Syntax's medical logic modules (MLMs). Medexter Healthcare offers cross compilation/transformation between the text-based and the XML-based representations of Arden Syntax MLMs. Thus, Arden Syntax is now compatible with all other HL7 standards bas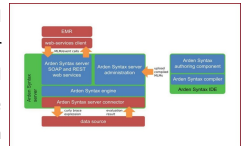ed on XML (HL7 version 3, vMR, and others). As a further benefit, it is now possible for developers to use available XML tools in their work with MLMs.

Technical integration possibilities:

The Arden Syntax server harbors the Arden Syntax MLMs. MLMs can call each other, be interconnected, even intertwined, and can thus form entire medical knowledge packages (MKPs) consisting of sets of MLMs. These MKPs are written, tested, and compiled using the integrated Arden Syntax development environment (IDE). To connect the server with host systems and data sources, Medexter offers three basic forms of technical integration into different health information technology environments:

Web services for calling and data—Using the first form of integration, MLM and event calls are realized by SOAP or RESTful web services, with the respective service call also transferring the necessary data required for MLM processing. Examples are (a) the connection between the Arden Syntax server and Siemens' hospital information system i.s.h.med via SOAP web services, and (b) the calling of and providing data for the iPhone and iPad App Hepaxpert via RESTful web services.

Web services for calling and server/database connector—The second form of interconnecting Medexter's suite of Arden Syntax software with external applications and patient data sources is to call MLMs and events through SOAP or RESTful web services, but to access patient data directly from data sources through a so-called server/database connector (being an add-on to the Arden Syntax server). The server connector can be used to query patient data through SOAP or RESTful web services offered by the host system to access its data; the database connector connects directly to a database to access data (e.g., SQL database). Examples are (a) the connection of Medexter's Arden

Syntax server with the EPIC hospital information system, (b) with the VistA system by the Department of Veterans Affairs, and (c) accessing SQL databases through a database connector to obtain patient data from routine patient databases or from databases for research (and teaching).

Data warehouse + rule engine = autonomous clinical decision support—Here, Medexter's Arden Syntax server, including its rule engine and database connector, accesses a project-specific data warehouse (which can be quite general and extensive). This data warehouse receives "raw" patient data through communication servers or import routines from any external data source (in HL7/XML/SQL or other formats). The received data triggers the rule engine (when appropriate), and the data warehouse makes data available for further processing. The data warehouse may store the final or even the intermediate results generated by rule processing. These results can subsequently be transferred back to the calling host application for presentation or—if the data warehouse is part of a separate solution—to the solution's presentation layer. The stored results can be used for reporting and benchmarking, or for data and knowledge mining. One example is Medexter's Moni system, which monitors and reports on hospital-acquired infections in ICUs with adult and neonatal patients.

Meet us at one of the following international conferences:

September 14–19, 2014: Health Level Seven International's 28th Annual Plenary & Working Group Meeting in Chicago, IL, U.S.A. Members of Medexter Healthcare are participating in HL7's Arden Syntax and Clinical Decision Support Work Groups.

November 1–2, 2014: Medexter's CEO and Scientific Head, Professor Klaus-Peter Adlassnig, will give a talk at the APAMI 2014 Health IT Solutions conference in New Delhi/India on "Service-Oriented Fuzzy-Arden-Syntax-Based Clinical Decision Support".

November 26, 2014: At the Nordic Mobile Healthcare Technology Congress 2014 in Copenhagen/Denmark, CEO Prof. Klaus-Peter Adlassnig will give a presentation on "Patient-Oriented Automated Monitoring of Critical and Adverse Events".

December 2, 2014: A lecture on "Patient-Specific Automated Monitoring of Adverse Events" will be held by CEO and Scientific Head Prof. Klaus-Peter Adlassnig at the Digital Health Conference as part of the Healthcare Innovation Days (Innovationstage Gesundheit) in Berlin/Germany.

We value personal contact and interesting conversations about all topics related to clinical decision support! Feel free to approach us at the conference or make an appointment in advance via email!

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