

SERVICE-ORIENTED ARDEN-SYNTAX-BASED CLINICAL DECISION SUPPORT

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Motivation CDSS

Amount of digitalized data increases

Automated abstraction/aggregation required

Machine-readable definition of clinical knowledge needed

Share of clinical knowledge and processes

Motivation service-oriented

Simplifies integration

- simple integration into arbitrary software systems

Re-use

- simplifies implementation of client applications

Standards-based communication

- access the CDSS from any platform and programming language
 - network access
-

Arden Syntax I

Standard approved by ANSI

Maintained by HL7

Arden Syntax aims

- transfer and share knowledge bases between institutions
- human readable
- special constructs for CDS

maintenance:

title: Interpretation of hepatitis A serolog
mlmname: Hepaxpert_Arden_Hepatitis_A_Serology_
arden: Version 2.1;;
version: SW 1.1.13/KB 2.1.0;;
institution: Medexter Healthcare GmbH, Vienna, Aus
author: Reinhard Pitsch, MSc;;
specialist: Wolfgang Horak, MD;
Klaus-Peter Adlassnig, PhD, MSc (kpa@
date: 2007-12-20;;
validation: production;;

library:

purpose: Knowledge-based interpretation of hep
explanation: The general aim to develop the Hepaxp
available precise and exhaustive inte
serology test results by automaticall
relevant, textual interpretations.;;

keywords: Hepaxpert; expert system; hepatitis A
citations: Chizzali-Bonfadin, C., Adlassnig, K.-
(1997)

A WWW-Accessible Knowledge Base for t
International Journal of Medical Info
57-60.

Adlassnig, K.-P. & Horak, W.
(1995)
Development and Retrospective Evaluat
Artificial Intelligence in Medicine 7
1-24.

Lee, S.-D., Lo, K.-J., Tsai, Y.-T., W
.....

Arden Syntax II

MLM

- Medical Logic Module
- contains sufficient logic for at least a single medical decision
- designed to evaluate a single patient's data at a certain time

Knowledge base (Medical Knowledge Package)

- contains many MLMs
 - interaction between MLMs
-

Arden Syntax server

Abstraction of Arden Syntax engine

- Arden Syntax engine executes compiled MLMs
- platform and programming language independent access

JAVA application server

MLM manager

- manages uploaded MLMs
 - finds correct MLM for specific MLM/event call
-

Interfaces

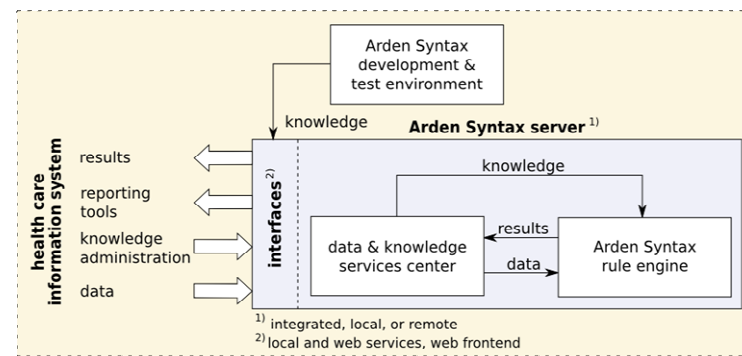
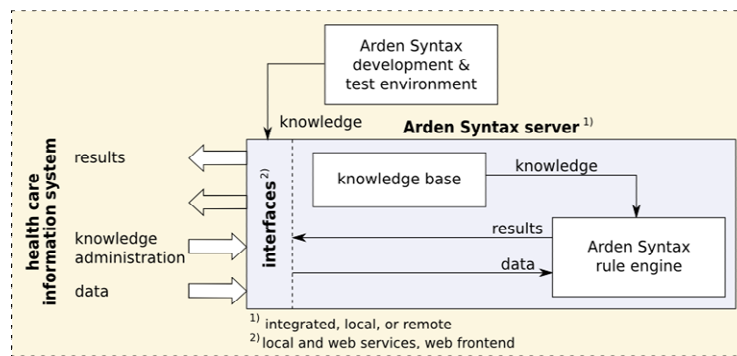
Browser-based front end for administration

- manage MLMs
- statistics

Web service interface for calling MLMs/events

- SOAP/REST/WSDL

Internal adapter for data access (curly braces)

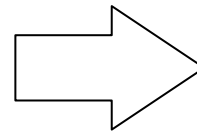


XML schema

XML-encoded content of web service call

XML schema follows specification

```
<?xml version = "1.0" encoding="UTF-8"?>
<usecase>
  <medexter version = "1.0" />
  <callMIm>
    <key>
      <mImName>body mass index</mImName>
      <institution> ... </institution>
    </key>
    <arguments>
      <number>1.75</number> <!--height-->
      <number>55.125</number> <!--weight-->
      <date>1977-12-12</date> <!--birth-->
    </arguments>
  </callMIm>
</usecase>
```



```
<key>
  <mImName>body mass index</mImName>
  <institution> ... </institution>
</key>
<arguments>
  <number>1.75</number> <!--height-->
  <number>55.125</number> <!--weight-->
  <date>1977-12-12</date> <!--birth-->
</arguments>
<results>
  <string>
    "The patient's BMI (18)
    is not in the normal
    range and is classified
    as Underweight."
  </string>
</results>
</callMIm>
</usecase>
```

Results: MONI

Monitoring of hospital-acquired infections in ICUs and NICUs

- Integration with Philips CareVue and ICIP
- two KBs with about 75 and 150 complex MLMs, resp.
- 12 ICUs with 96 beds; 4 NICUs with 42 beds
- sensitivity 90.3%, specificity 100% (see Koller et al.)

Backward explanation

- stores intermediate and final results
 - logs reasoning steps
-

Results: AKIM

Integration of the Arden Syntax server into i.s.h.med

Different knowledge bases in use

- prediction of metastatic events in patients with melanoma
- Derma-SOPs

Infrastructure for development/verification/routine

Conclusion

Easy to integrate architecture

Standards-based knowledge representation

Standards-based communication

**Functionality and scalability proven in
routine application**

