Internationalization of Medical Logic Modules and Extended Time Operations in Arden Syntax Version 2.6

Isabel Barth[a]; Sven Tiffe[a]; Michael Dahlweid[b]

[a]*Agfa HealthCare, Base Technologies, Metatools, Germany*

[b]*Agfa HealthCare, Product Management, Germany*

AGFA HealthCare

Arden Syntax V 2.6

- Arden Syntax for Medical Logic Modules
  - Knowledge representation & transfer format maintained by HL7
  - Knowledge bases consist of a set of individual rules
    - Medical Logic Modules (MLMs)
    - MLMs consists of Categories structured by slots
    - Each MLM should contain all knowledge for one specific decision
- Additions in version 2.6
  - Internationalization (I18N) of MLMs
  - Extended temporal elements and operators (“time of day” data type)

Rationale: I18N

- Usually, results of MLMs are textual messages
  - Contents are mostly unstructured
  - Arbitrary contents
- International use of MLMs in “Orbis”
  - Individual countries require messages in their own language
  - Some countries may require more than one language (US, Belgium,…)
- Requirement for broad reusability: good maintainability
  - “Orbis” Hospital Information System ~ 1200 installations in Europe
  - Decision logic of a rule may be valid without modifications for many countries
  - Goal: Split logic and translatable resources, but keep them in one MLM

MLM's Resources Category

- As knowledge representation format, MLMs keep information all information for the decision in one file

```
maintenanance:
   […]
;;
library:
   […]
;;
knowledge:
   […]
;;
resources:
   […]
;;
```

Information about author, version, state of the MLM

Explanatory information

Decision and data access logic

New: structured language resources

- MLM text file composed by "categories" structured by "slots"

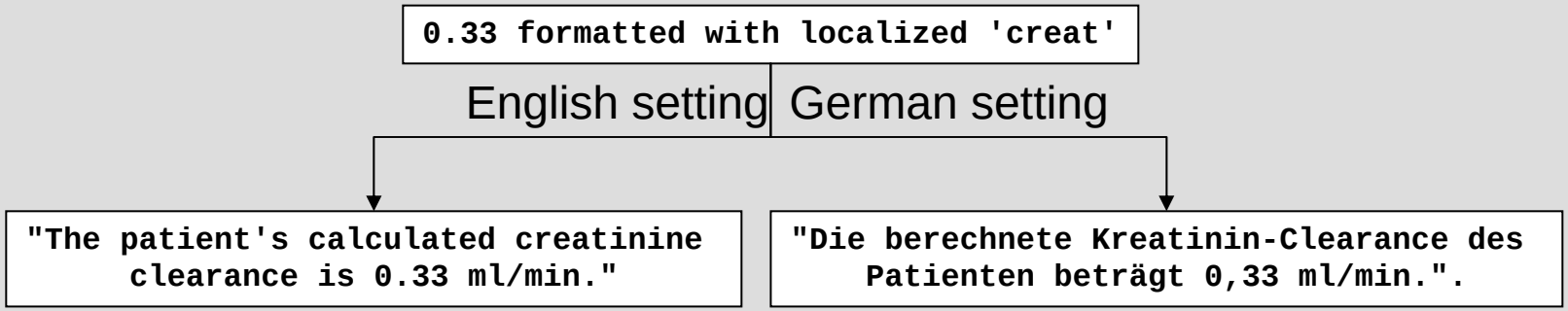
Structure of Resources Category

- All translations for the required languages defined in “language slots”
- Use of 2-character ISO 639-1 language code or combined language code and ISO 3166-1 geographical code

```
language: en
   'msg': "Caution, the patient has the following
           allergy to penicillin documented: ";
   'creat': "The patient's calculated creatinine
             clearance is %f ml/min."
;;
language: de
   'msg': "Vorsicht, zu diesem Patienten wurde die
        folgende Penicillinallergie dokumentiert: ";
   'creat': "Die berechnete Kreatinin-Clearance des
             Patienten beträgt %f ml/min."
;;
```

“localized” operator

- String operator that retrieved the translated resource from the resources category



- The simple use of this operator presumes that the implementing system is able to determine the current language setting
- If the current setting cannot be retrieved, either
  - a default code can be defined in the resources category or
  - the “localized” operator can be used with an explicit language code as additional argument

Arden Syntax I18N: Limitations

- Focus on crucial parts of message creation
  - Messages are usually built in logic or action slot of an MLM
  - Message parts can be translated
- Other free text sections of an MLM have not been extended
  - Explanation slot, description slot, etc.
- The resulting message that is written from the MLM to the implementing system is still “plain”
  - The message itself is not multi-lingual
  - Message handling depends on implementing system
  - Future extensions of Arden Syntax may be harmonized with HL7’s Reference Information Model (RIM) and be structured and standardized

Rationale: Extended Time Operators

- One focus of Arden Syntax lies on temporal conditions

```
bg_values where they occurred within past 3 months
```

  - selects those blood glucose values from a list that occurred in the last 3 months
  - Other operators allow additional kinds of time ranges
- Time constants are defined either by timestamps or by dates
  - Time constants always refer to points in absolute time
  - Temporal conditions that refer to a specific time of day without being affected by the day itself are hard to express
    - “Do not send an order to a specific lab from 20:00 to 06:00”
    - “Have all blood glucose measurements been taken after lunch?”
- A new data type “time of day” has been introduced
  - Existing operators have been extended to work with this data type
  - In addition, constants and operators for “week of day” have been defined

“Time of day” data type

- Time of day constants are defined in a similar way like Arden Syntax timestamps (“time” data type), for example
  - 20:00:00
  - 00:00:00.000 (midnight)
- Time of day values (constants and variables) can be used with most existing operators in Arden Syntax, for example

```
if now is within 20:00:00 to 06:00:00 then
    msg := "Orders to this organizational unit during night hours are
            not possible!";
endif;
```

or

```
irregualar_measurements := measurements where measurements.time not
occurred within 1 hour surrounding 14:00;
```

- As shown in the first example, time ranges may span midnight

Day of Week extensions & Delayed MLM Triggers

- "Day of Week"
  - extensions are based on
    - A set of constants (Monday, Tuesday, …, Sunday)
    - The "day of week" operator
  - Like expressions that refer to a time of day, this extension can be used for easy readable temporal conditions that refer to a day of

```
If Day of week of now is in (SATURDAY, SUNDAY) then
   msg := „Sorry, we're closed.";
Endif;
```

- Both extensions can be used in Evoke slot to delay execution, for example to execute an MLM at
  - Today at 18:00:00;
  - Tomorrow at 05:00:00;
  - Monday at 12:00:00 or Wednesday at 12:00:00;

Conclusion

- I18N of Medical Logic Modules
  - Focus on knowledge representation and exchange format
    - All information is stored in one file and one format
    - Implementing systems may organize their language resources in other ways
  - Important step for international reusability
    - Further extensions may be required to translate also explanatory sections
    - First, good experiences during roll out of Orbis in European countries
- Temporal expressions based on “Time of day” data type
  - Easy readable way to express temporal conditions that not refer to points in absolute time
  - Fits into Arden Syntax’ philosophy of dealing with time constraints
    - Usable by most existing operators
    - Low efforts to extend existing Arden Syntax based implementations

Thank you

Address for Correspondence

Dr. Sven Tiffe
Agfa HealthCare
Monaiser Str. 11
D-54294 Trier
Germany

Email: Sven.Tiffe@agfa.com
Web: http://www.agfa.com/en/he/

AGFA HealthCare