

An Implementation of Arden Syntax in a Service-oriented Architecture

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Background

- Arden Syntax is a standard formalism for Medical Logic Module (MLM, in short)
- interoperability problem for sharing MLMs(i.e. curly brace problem)

Curly Brace Problem:

```
serum_sodium := read {  
  
};
```

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Curly Brace Problem:

```
serum_sodium := read {  
    Whatever you want!  
};
```

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Curly Brace Problem:

```
serum_sodium := read {  
  SELECT *  
    FROM labo_results  
   WHERE labo_code = "3H0100000023261"  
   ORDER BY seq  
};
```

Background

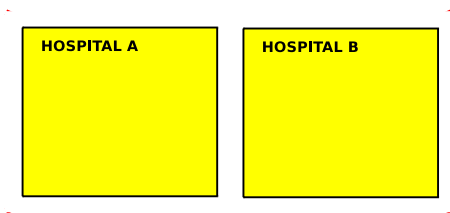
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- interoperability problem for sharing MLMs(i.e. curly brace problem)

Curly Brace Problem:

```
serum_sodium := read {  
    labo_result('3H0100000023261', Value, Date)  
                ,latest(Value, Date).  
};
```

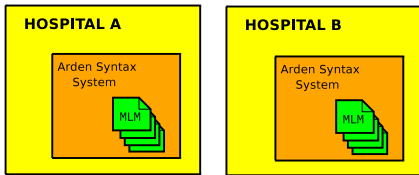
Purpose

To solve the curly brace problem, and make the Arden Syntax available between various healthcare systems.



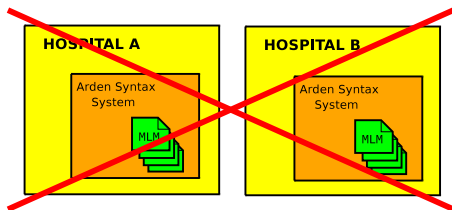
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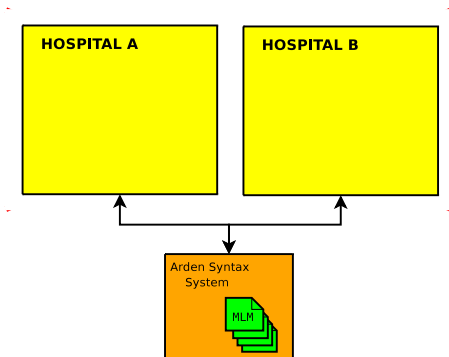
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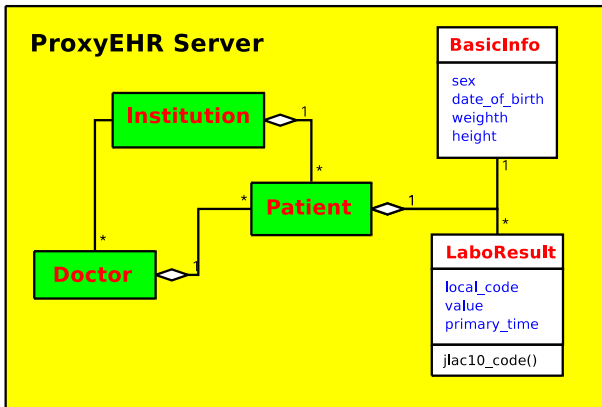


Methods

- Define a Patient Information Model
- Design Query Syntax
- Create web application servers with REST Web Services

Patient Information Model

A patient information model represents the healthcare domain for decision support



Query Syntax

A path should indicate data in the patient information model

Examples:

```
body_weight := read {AQL:1.0d  
  path: /basic_info/weight  
  AQL:1.0d};
```

```
serum_sodium := read {AQL:1.0d  
  path: /labo_results/[j1ac10(local_code,  
    '3H0100000023262')]  
  AQL:1.0d};
```

Query Syntax

A path should indicate data in the patient information model

Examples:

```
body_weight := read {AQL:1.0d  
  path: /basic_info/weight  
AQL:1.0d};
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serum_sodium := read {AQL:1.0d  
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AQL:1.0d};
```

Query Syntax

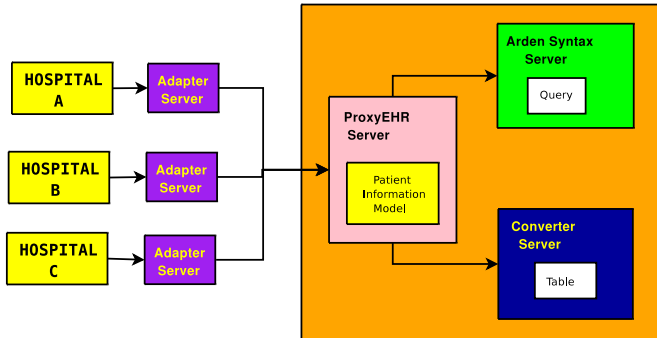
A path should indicate data in the patient information model

Examples:

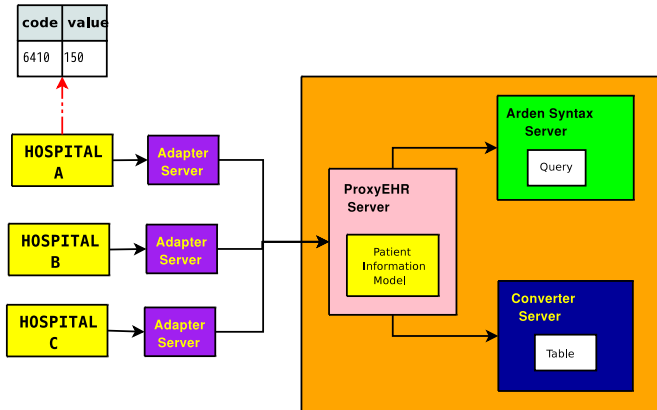
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body_weight := read {AQL:1.0d  
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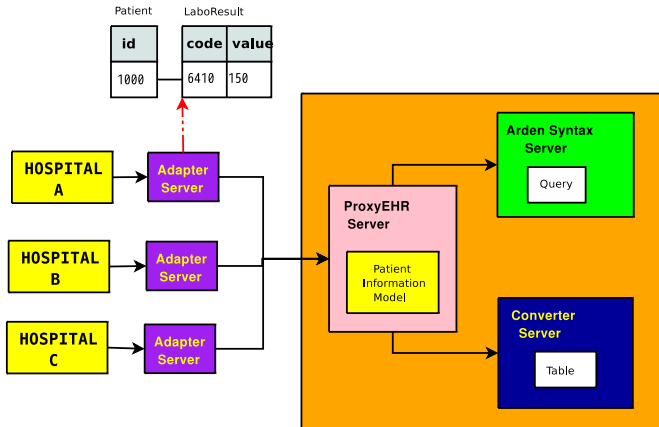
System architecture



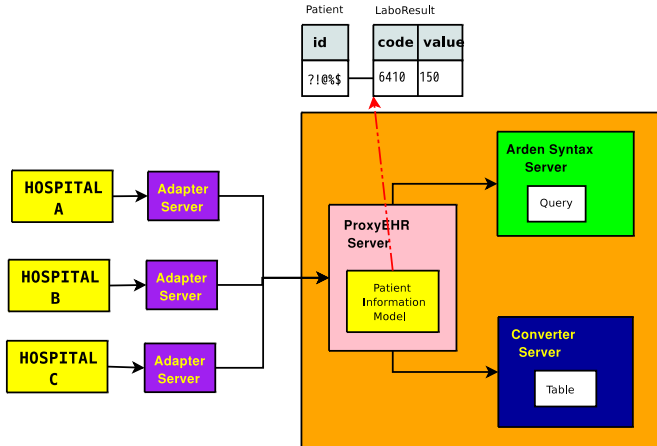
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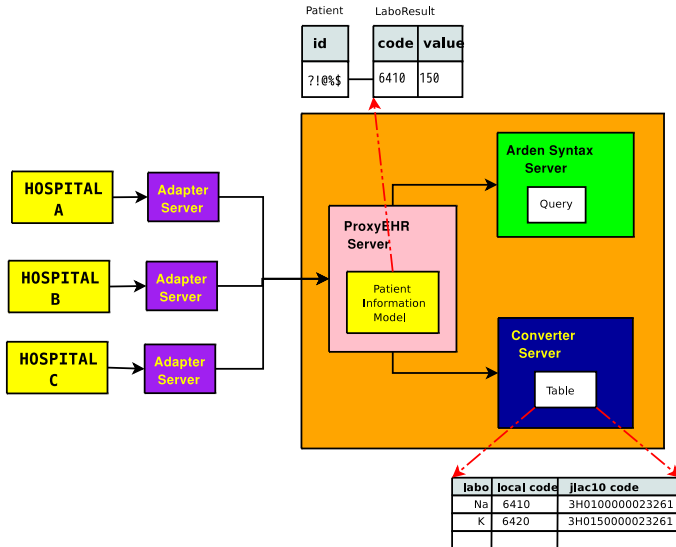
System architecture



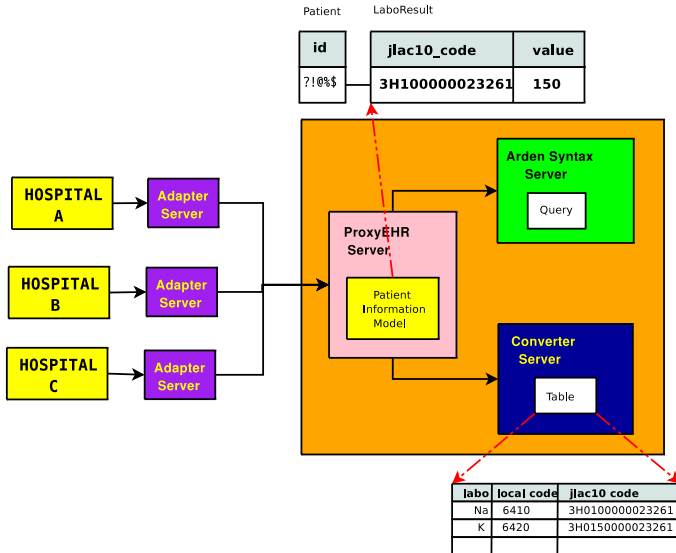
System architecture



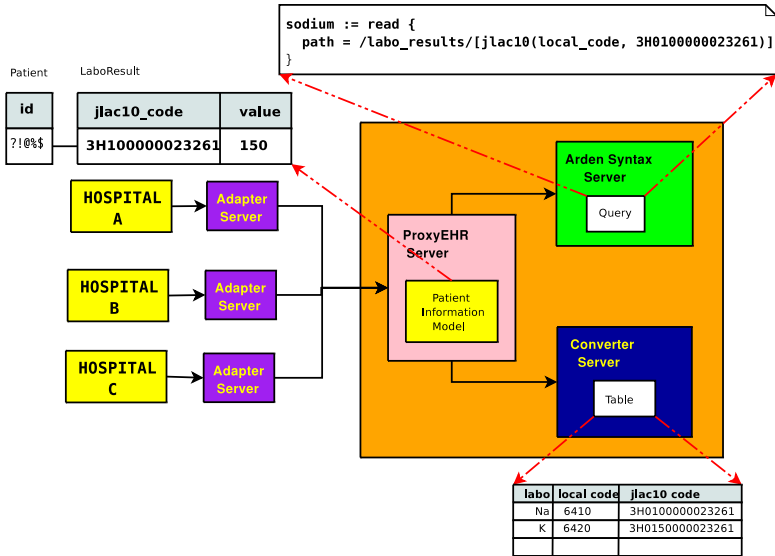
System architecture



System architecture



System architecture



REST Web Service

In REST, each resource is identified by its URL and accessed by HTTP method.

URL: `http://proxyehr/institutions
/todai/labo_results.xml`

HTTP Method: POST

POST Parameters:

```
<labo_result>  
  <local-code> 6410 </local-code>  
  <value> 150.0 </value>  
  <primary-time>  
    20080131T120000  
  </primary-time>  
</labo_result>
```

Conclusions

In order to solve the curly brace problem in Arden Syntax,

- A common model, the query syntax as path format, and methods for accessing data are defined
- REST-styled Service-oriented architecture is useful for connecting components

Limitations

- The patient model is small and limited
- Some semantic mismatches are left unsolved (e.g. metrics)
- The usability and performance of the system should be evaluated

Thank you for your attention.



A Pittsburgh view(<http://commons.wikimedia.org>)

Arden Syntax MLM I

maintenance:

title: Alert for hyponatremia;;
mlmname: hyponatremia;;
arden: version 2.5;;
version: 2.12;;
institution: Todai hosp;;
author: Akimichi Tatsukawa;;
specialist: ;;
date: 2009-5-9;;
validation: testing;;

library:

purpose: Alert for hyponatremia;;
explanation: ;;
keywords: sodium;;
citations: ;;

Arden Syntax MLM II

knowledge:

type: data_driven;;

data:

```
event_sodium := event {AEL:1.0d
    path: /labo_results/[jlac10(local_code,'3H0100000023261')] ;
AEL:1.0d};
```

```
data_sodium := read latest {AQL:1.0d
    path: /labo_results/[jlac10(local_code,'3H0100000023261')] ;
AQL:1.0d};
;;
```

evoke: event_sodium;

;;

logic:

```
conclude data_sodium < 120;
;;
```

action:

```
write "A danger of severe hyponatremia!! ";
;;
```

end:

REST I

Operation	HTTP Method	SQL
Create	POST	INSERT
Read	GET	SELECT
Update	PUT	UPDATE
Delete	DELETE	DELETE

SOAP and REST I

	SOAP	XML
Endpoint	1	Many
Client types	App	App, Web browser
Representation	XML	Many
Overhead	High	Low

SOAP and REST I

SOAP way

```
POST /StockQuote HTTP/1.1
Host: www.stockquoteserver.com
Content-Type: text/xml; charset="utf-8"
Content-Length: nnnn
SOAPAction: "Some-URI"

<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
  <SOAP-ENV:Body>
    <m:GetLastTradePrice xmlns:m="Some-URI">
      <symbol>DIS</symbol>
    </m:GetLastTradePrice>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

REST style

```
http://stockquoteserver.example/query?symbol=DIS
```