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Designing Bluebook and Beyond

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About Semantic Identity

Semantic Identity provides independent consulting, thought leadership, technical advice, research, and strategic direction for emerging ICT technologies. We focus our expertise around; Information Architecture, Semantic Web; eHealth, Social Media; Policy & Privacy; Information Modeling; Rights Management; Metadata and Identifiers and Data Analytics

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Table of Contents

1. Introduction

This whitepaper proposes an alternative information architecture for the Bluebook eHealth product that can lead to significant advantages over the long term. The solution is based on expanded functionality in the National Personally Controlled eHealth Record (PCHER) System and use of emerging HL7 standards. The purpose is to support a wider range of options for the detailed design phases of Bluebook services and reuse of national infrastructure.

Bluebook is a health diary used by parents and healthcare professionals to record developmental information for young children (0 to 4 years old). Such information includes weight, height, head circumference, vision, oral health, gait etc. One of the purposes is to check the child's progress by comparison to historical development norms, enabling a parent to check progress and healthcare providers to propose (if any) interventions.

The term Bluebook is a NSW concept [1] and other states have other terms, such as RedBook in Queensland. With the success in NSW, it has been proposed to add support for BlueBook in the National PCEHR System. The current approach will follow the existing model of defining Clinical Documents to capture and exchange this information. This may result in a dozen different Clinical Documents to capture BlueBook information - one for each type of data type captured (ie weight, height etc).

There is a high cost to implementers for creating Clinical Documents, and it is made even higher in cases where minimal information is actually represented (ie high overheads per clinical document). For example, The PCEHR Consumer Entered Note clinical document is in essence a single text field. The specifications that define this text field amount to 178 pages (40 pages for the Structured Content Specification [2] and 138 pages for the CDA Implementation Guide [3]). In other ICT sectors, not only would this seem excessive, but also serious questions would be asked as to the overall scalability of this information architecture.

2. A Better Way

The key issue is that we are naturally directed into a Clinical Document paradigm with the PCEHR (as this is the current paradigm) - when we should be looking at more efficient mechanisms to capture BlueBook data.

Fundamentally the PCEHR needs to be enhanced to also support a "Data Paradigm". The PCEHR offers web services for the exchange of clinical documents. Our proposal augments these with similar data-based web services, such as:

- submitData
- retrieveData
- removeData
- getDataList

The actual data that is sent would be based on the new emerging HL7 Fast Health Interoperable Resources (FHIR) specification [4]. HL7 FHIR supports more compact XML representations and is data-centric, rather than the document-centric and more complex HL7 CDA.

2.1. The Data Payload

Below is an example of the data payload for capturing the weight of a child for Bluebook. (Note that this is not the final HL7 FHIR code, but a close representation.)

```
<AssessmentData xmlns="http://hl7.org/fhir" uid="GUID">
  <subject uid="IHI">Billie</subject>
  <performer uid="HPI-I or ConsumerID">Dr Murphy</performer>
  <time>2012-12-07</time>
  <reason uid="http://ns.electronichealth.net.au/Bluebook"/>
  <interpretation uid="http://ns.electronichealth.net.au/Weight"/>
  <data>
    <quantity>
      <value>19.9</value>
      <uom uid="http://unitsofmeasure.org/kg"/>
    </quantity>
  </data>
  <text>Billie weighed 19.9kg on her birthday!</text>
</AssessmentData>
```

The subject, performer, and time would capture the relevant parties and time of the assessment/ measurement.

The reason uid would give the context of the assessment, and the interpretation would indicate the measurement type (and the scope of the elements inside the data element).

The data element captures the measurement; in this case it is a quantity with value and units. The optional text element can capture notes related to this assessment.

By using unique identifiers for interpretation, we can then specify other measurement type, such as height, and head circumference. We can also support other datatypes (such as boolean, fixed value lists, and text) for other measurement types such as vision, oral health, gait etc.

Another important design architecture is the use of full and unique URIs to represent concepts like BlueBook and Weight etc. This enables future interoperability with "linked data eHealth" services and the potential for greater semantic representations [5, 6].

2.2. How Does it Work

A client application can send data using submitData (multiple payloads can be sent in the same request). This would come from a Clinical Information System (CIS) or a Consumer Portal connected to the PCEHR.

When a client application (eg a PCEHR Consumer Portal) calls getDataList (with no parameters), the returned result would be a summary of the number of data results for that consumer (using their Individual Healthcare Identifier - IHI) per type. For example, it may return data shown in Figure 1.

http://ns.electronichealth.net.au/Bluebook	http://ns.electronichealth.net.au/Weight	10
http://ns.electronichealth.net.au/Bluebook	http://ns.electronichealth.net.au/Height	8
http://ns.electronichealth.net.au/Bluebook	http://ns.electronichealth.net.au/Headcircumfernce	6
http://ns.electronichealth.net.au/NurseBook	http://ns.electronichealth.net.au/Temperature	5

FIGURE 1 - RETURNED DATA

Figure 1 includes the identifier of the service type (in this case we can see 3 BlueBook entries and one (fictional) NurseBook entry) and the type of data being recorded (eg Weight) and the actual number of entries (eg 10).

This data would then enable a client to display a summary list of data assessments and measurement types, for the user to explore in more detail, as shown in Figure 2:

Available Data for Billie (aged 4)

Source	Type	#Records	
Bluebook	Weight	10	Show Add
	Height	8	Show Add
	Head Circumference	6	Show Add
Nursebook	Temperature	5	Show Add

FIGURE 2 - SUMMARY DATA

When the client application calls getDataList with a parameter of the reason identifier and interpretation identifier, then all the data (see above FHIR payload example in Figure 1) for that reason and matching interpretation data will be returned (ie this is effectively a query). Another option maybe to support just sending the reason identifier as a parameter, and then returning all data for all interpretations.

At this point the client application now has all the data requested. They can now present to the user their visualisation of the data. This can range from a simple list of data values such as shown in Figure 3.

BlueBook growth data for Billie (aged 4)

Date	Height	Source	
1 Dec 2010	60cm	Dr Murphy	
1 Dec 2011	75cm	Mum	
1 Dec 2012	90cm	Mum	

FIGURE 3 - SIMPLE LIST

A smarter consumer application could then extend the above table and add a new column comparing the data to the historical averages, as shown in Figure 4.

BlueBook growth data for Billie (aged 4)

Date	Height	Source	Comparison
1 Dec 2010	60cm	Dr Murphy	Normal
1 Dec 2011	75cm	Mum	Within 25th Percentile
1 Dec 2012	90cm	Mum	Normal

FIGURE 4 - MAPPING EXAMPLE

Additionally, some more advanced 3D charts can be created on mobile device apps for PCEHR consumer portals, as shown in Figure 5.

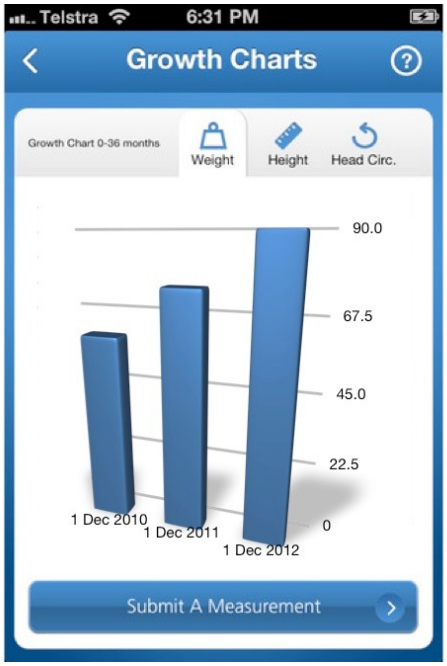

FIGURE 5 - MOBILE INTERFACE (BASED ON NSW HEALTH IPHONE APP)

2.3. Data Management

Removing data is supported. After data is obtained via the getDataList service, the unique identifiers can be used to send to the removeData service.

The retrieveData service can be used to return individual data items (parameter is the unique identifier).

Update of data, like documents, can be supported by submitData with the same unique identifier of the old data. Previous versions would be archived and not returned in the live service.

2.4. Advantages of this Approach

The advantage of this approach in design of the BlueBook service include:

- Significant reduction in producing BlueBook technical specifications (time and money).
- Specifications that are no more than a dozen pages long.
- Significant reduction in resources required for vendors adding support for BlueBook.
- Positions Australia favourably on the new HL7 FHIR specification.
- A general enhancement to PCEHR that can be used for any data-based application (Bluebook now, but any service in the future and requires no change to the PCEHR which will be cost-saving.)
- Increased flexibility to client applications to produce enhanced (and novel) visualisations of Bluebook (and other) data
- Better support for mobile devices that do not support complex CDA renderings (and smaller screens)

3. Conclusion

Bluebook and other data-based services that are consumer oriented will be a major and significant addition to national health infrastructure services such as the PCEHR.

From an information architecture point-of-view, these services should be based on a data-exchange paradigm. Forcing the solution into a document-centric model, especially one based on the complexities of CDA, is far from ideal, and will seriously limit the scope of such services. In essence, such an approach would not be seen as fit-for-purpose.

A data-centric approach will give implementors the flexibility to provide innovative services, and allow greater choice for consumers as Consumer Portals compete for attention.

The health infrastructure services would then not have to deal with creating static views of information (which are costly to change) and allow the service providers (who know their consumers best) to provide this value-add user experience.

4. References

[1] My First Health Record - Blue Book http://www.health.nsw.gov.au/pubs/2011/blue_book_2011.html

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[3] Consumer Entered Notes, CDA Implementation Guide, Version 1.0, 21 Dec 2011, NEHTA

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[5] Iram, S.; Al-Jumeily, D.; Fergus, P.; Randles, M.; Davies, M.; , "E-Health: The Potential of Linked Data and Stream Reasoning for Personalised Healthcare," Developments in E-systems Engineering (DeSE), 2011 , vol., no., pp.46-49, 6-8 Dec. 2011

[6] Semantic Web and eHealth Whitepaper, Semantic Identity, Jan 2013. http://semanticidentity.com/whitepapers/