Integrating Standards to Achieve Semantic Interoperability

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DS&P provide a broad range of services to all development programmes in the National Programme for IT, and to the NHS in General.
DS&P Mission

To develop, maintain and support a comprehensive range of clinically-related data standards that effectively support healthcare within the NHS in an integrated and holistic manner, facilitating the delivery of a full longitudinal healthcare record for patients that can support a diverse set of secondary uses.
**DS&P Products**

**Terminologies**
- Read
- CTV3
- SNOMED CT
- DM+D

**Classifications**
- OPCS
- ICD10
- Cross maps

**Messaging**
- HL7 V3 for Spine
- CDA + Templates
- Commissioning Data Sets

**Content Modelling**
- Clinical Archetypes (CEN13606)
- Content models for suppliers
Choose and Book: Over seven million (7,656,482) bookings have been made to date. Choose and Book has achieved over 24,000 bookings in a single day.

Electronic Prescription Service (EPS)
Over 72 million (72,680,070) prescription messages have now been transmitted electronically.
6,897 GP practices have had technical upgrades to the new system. 5,450 of these practices are actively operating the Electronic Prescription Service (EPS).
8,138 pharmacy systems have had technical upgrades to the new system and 6,720 are actively operating EPS.

GP2GP has now been used for 92,535 medical record transfers.
4,687 GP practices have had technical upgrades to the new system. 3,757 of these practices are now actively operating GP2GP.

N3: By 29 February 2008, there have been 29,730 connections to N3 and 100% of existing GP sites who require a connection have had this delivered.
N3 is one of the largest Virtual Private Networks (VPN) in the world.

PACS: There are 127 Picture Archiving and Communications System (PACS) from NHS Connecting for Health now live across England.
Over 613 million (613,001,624) images have been stored using PACS from NHS CFH. PACS has been used for over 24 and a half million (24,521,613) patient studies.

NHS Care Records Service
153,188 Summary Care Records have now been uploaded to the Spine.
There are 462,570 Smartcard holders who are registered and approved for access to the Spine.
The patient journey

- **Referral**: Standard in place, go forward 20
- **Diagnosis**: Shared record available, go forward 25
- **Treatment**: Patient given drug in emergency, no record available, go back 35
- **Allergy**: Paper record lost, retake all tests, go back 45
- **Discharge**: Discharge record recorded, go forward 15
- **Lost record**
The patient journey (North American version)

- **Referral**
  - Standard in place, go forward 20

- **Diagnosis**
  - Shared record available, go forward 25

- **Treatment**
  - Lost record
  - Paper record lost, retake all tests, go back 45

- **Allergy**
  - Patient given drug in emergency, no record available, go back 35

- **Discharge**
  - Record recorded, go forward 15
Data Standards and Products

Killing Snakes

- Single patient identifier
- Traceable patient records
- Integrated infrastructure
- Critical information available everywhere instantly
- More detailed records accessible
- Safe, secure access for clinicians
Creating Ladders

Single demographic service
Summary Care Record
Electronic Prescribing
Electronic Booking
PACS
Locatable Detailed Records
Defined Interchange Standards
Access Control Framework
Some of the challenges

Vendor solutions collect and manage data in very different ways.
Most standards are framework standards that need localisation and customisation.
No standard is comprehensive, and standards overlap and compete in some areas.
There are gaps in the standards.
How we need to view the problem

Recognise the end-to-end problem and work to solve it
  • What and how you collect data
  • What is stored
  • What and how it is communicated
  • How it is located and retrieved
  • How it is searched, aggregated, sifted, ...

Rigorously adapt the standards stack, and make it work

Rigorously enforce the standards
Incompatible standards are worse than no standards
Overlapping standards can generate confusion
Two standards-compliant solutions may not actually interoperate!
Message-centric solutions to interoperability hide problems until late in the life cycle
Clinical Interoperability today

Message

Ontology

No common model of meaning
Clinical Interoperability tomorrow

Service Provider  Service Calls  Service Provider

Ontology

Common models of meaning
Technical Architecture for Semantic Interoperability
How Does SOA fit?

SOA adds

- Discoverability / searchability
- Adaptability
- Dynamic configuration

SOA has the challenges

- Semantics of the process
- What it ships is not neutral – the semantics of the data are important
The Standards Solar System

ISO Data Types

UML

SNOMED

ICD10

LOINC

openEHR

HL7

SOA

IHE

V3

V2

Data Standards and Products
Copernican Standards

We need to rethink our “physics”
No individual standard is the centre of the universe
No SDO can manage all the standards
The EHR should be the centre of the standards universe
The EHR needs to be thought of in terms of
  • Data structure
  • Location and retrieval
  • Access and audit
  • Clinical safety
The new physics for the EHR

Collect once, use many times
Operational not managerial collection
We need a model of re-use that reflects clinical practice and that is supported by standards
Transformations can be dangerous – they reduce quality
Replication is problematic – how do you rectify data that has been distributed widely?
Information needs to be available soon after it is collected
Information needs to be discoverable
Information needs to be searchable and comparable
Standards in the context of an EHR

- Terminology
- Collection Models
- Search and Retrieval Models
- Communication Models
- Interoperability
- Recording
- Decision Making
- Registration and Location Models
- Information Model
- Classifications
- Expressiveness
- Precision/rigour
- Searchability
- Comparability
- Best Practice
- Utility
- Categorisation
- Secondary use
- Structure
- Detail
- Search
- Storage
- Notify, Find
Standards in the context of an EHR

- Terminology
  - CUI, openEHR, SNOMED CT
  - SNOMED CT, dm+d

- Classifications
  - OPCS, ICD10, Data Dictionary
  - openEHR, HL7 RIM, CDA

- Information Model
  - SOA, HL7 V3, CDA, SNOMED CT

- Registration and Location Models
  - SOA, XDS

- Collection Models
  - SOA, HL7 V3, openEHR, SNOMED CT

- Search and Retrieval Models
  - SOA, HL7 V3, openEHR, SNOMED CT

- Communication Models
  - SOA, HL7 V3, CDA, SNOMED CT

- Decision Making
  - SOA, HL7 V3, CDA, SNOMED CT

- Recording
  - SOA, HL7 V3, openEHR, SNOMED CT

- Interoperability
  - Notify, Find

- Utility
  - Structure, Detail, Search, Storage

- Expressiveness
  - Precision/rigour, Searchability, Comparability, Best Practice

- Best Practice
  - Structure, Detail, Search, Storage
Perspectives on the EHR

- IT vendor
- Developer
- Administrator
- Standards organisation
- Ontological
- Services
- Architectural
- Data
- Structural
- Communications
- Patient
- Clinician

Data Standards and Products
Connecting for Health

NHS
EHR Logical Record Architecture

Distributed, heterogeneous

Local, access controlled

EHR

EHR Entry

Care Entry

Expression

Provenance

Label 0..1

Term 0..1

Other value *

Who did what to whom and why
EHR Logical Record Architecture

Logical Systems Architecture

Logical Record Architecture

Template

Archetype

Terminology

EHR

EHR Entry

Care Entry

Expression

Provenance

Label 0..1

Term 0..1

Other value *
EHR Logical Record Architecture

Logical Systems Architecture

Logical Record Architecture

Template

Archetype

Terminology

Core Entry

Expression

Label

Term

Other value

0..1

0..1

* 

Organisation, location, discovery, search, exchange, access control

Structure, ownership, context

Combination, contextualisation, use case specificity

Re-use, standardisation, data interoperability

Rigour, standardisation, best practice, interoperability

Data Standards and Products
Supporting Clinical Use Cases

Clinical Perspective

- Clinical Use Case
- Screens
- Templates
- Archetypes – 4,000 concepts
- SNOMED CT – 400,000 terms

Informatics Perspective

Data Standards and Products
Interoperable Clinical Use Cases

If you want these to interoperate, then these need to be compatible.

Otherwise this is just a ship to transport between icebergs.

Clinical Perspective

SOA

Informatics Perspective
Common standards, components and ontology as a basis for interoperability
Conclusion

There is no one quick fix
Harmonisation and interoperability of standards is key
Holistic, end-to-end design and use of standards is essential
Standards cannot be used like glue to fit together incompatible parts, the parts have to standardise too
SOA provides an important set of tools in the standards arena, but alone cannot solve interoperability
Clinical buy-in is an imperative, but do not expect clinicians to understand the informatics