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Day In The Life Of eHealth Technologies

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Overview

- Health Principles and Strategies
- eHealth Architectures
- Clinical Information
 - Clinical Documents and Data
- Clinical Terminologies
 - **SNOMED**
- eHealth Solutions
 - Prescriptions
 - National eHealth Record Systems
- Fowards Semantic eHealth
 - The future path

eHealth Strategy

- Foundations
 - Core foundations for information exchange
- eHealth Solutions
 - Stimulate the delivery of priority solutions by the marketplace
- Change and Adoption



- Foster consumer and provider adoption with training, tools, and services
- Governance
 - Effective leadership, coordination, accountability and oversight of the eHealth program

eHealth Pr

eHealth architecture princi architecture developments eHealth environment

- eHR development should be go
 HA's systems and know-how
- Data privacy and system secur
 be accorded paramount import
- Participation in eHR sharing sl compulsory for both patients a
- eHR Sharing System should be common technical standards a
- Development of eHR Sharing Symbols
 block approach, involving part
- http://www.ehealth.gov.hk/en/about_ehr
- Improve the safety and quality of healthcare Improve the efficiency of healthcare services Ensure eHealth solutions support interoperability Ensure solutions are fit for purpose Support services-based approaches • Comply with legislative and policy requirements Re-use eHealth components Adopt pragmatic approaches Engage with all relevant stakeholders Maintain security Assess whole-of-life costs Use common terminologies and data definitions Manage information quality Manage information assets > Ensure information consistency in distributed environments Express policy compliance as business rules Support loose coupling > Express policy in technology-independent terms **Observe standards** • Ensure supportability, sustainability and continuity Govern change Manage technical diversity

eHealth Architecture

- Health is a complex sector and ICT environment
 - Huge Stakeholder base
 - Serious consequences from failures
- Health Architecture design
 - Requirements Driven approaches
 - Use cases and Scenarios
 - Community & Capability Models
 - Capture Current-State and Target-State Architectures
 - Conceptual, Logical, Implementable Views
 - Information and Services
 - High-Level System Architecture
- Architecture Design Authority

eHealth Solution Capability Model



Community Model



Architecture



Clinical Information

HL7 Reference Information Model (RIM)

- A universal model covering the entire healthcare domain
- Grammar for messages, permitted relationships, data types



Information Model

Conceptual



Document Architecture

- Clinical Document Architecture (CDA) is a mechanism to encode the HL7 RIM in machine format (XML)
 - Typically for message payload
- Follows the "Document paradigm"
 - Header Who, Where, When
 - Body What
 - Human-readable parts
 - Render as HTML
 - Coded Entries (from Terminologies)

HL7 FHIR

- Fast Healthcare Interoperability Resources (FHIR)
- FHIR solutions are built from a set of modular components called Resources
 - Can easily be assembled into working systems that solve real world clinical and administrative problems
- Strong focus on implementation
 - Simple XML, JSON, RESTful interfaces
- Evolutionary development from HL7 Version 2 and CDA
- Interoperability base resources can be used as is can also be adapted for local requirements
- Backed by solid ontologies and rigorous formal mapping for correctness"



FHIR Model Example



Clinical Terminologies

- ICD-10 classify diseases and other problems for payment, management, and research/statistical purposes
- LOINC laboratory and other clinical observations
- SNOMED Systematized Nomenclature of Medicine Clinical Terms (CT)
 - Comprehensive multilingual clinical healthcare terminology
 - Collection of about 400,000 clinical concepts, associated with about 800,000 description terms, and a hierarchy consisting of about 1,200,000 relationships
 - Can be profiled into smaller "Reference Sets" for specific domains

SNOMED-CT



Post-coordination

- SNOMED CT provides a compositional syntax that can be used to create expressions that represent new clinical ideas
- For example, there is no explicit concept for
 - "third degree burn of left index finger caused by hot water"
- > Using the compositional syntax it can be represented as

284	196006 burn of skin :
	116676008 associated morphology = 80247002 third degree burn injury
,	272741003 laterality = 7771000 left
,	246075003 causative agent = 47448006 hot water
,	363698007 finding site = 83738005 index finger structure

 SNOMED is based on a formal model that is extensible and still preserves semantics (can infer outcomes)

eHealth Solutions - ETP

- Medication errors cost the public hospital system approximately \$380 million each year (Australia)
- > ETP manage prescriptions and dispense via PES
- The complete Electronic Medication Management (EMM) will cover plans, schedule, order, notification, administration



National eHR Systems

- Electronic Health Record (eHR) provides:
 - Improved continuity of care for consumers accessing multiple providers
 - Access to consolidated information about an individual's medicines
 - Reductions in avoidable medication-related adverse events



- Enabling individuals to participate more actively in their healthcare
- Improved diagnostic and treatment capabilities through enhanced access to health information
- Supported by National Legislation and Regulations



National EHR Interface - National Consumer Portal

Australian Government	1h	Showing All O Q						
epartment of Health and Ageing eHealth	Health Record Overview		Shared Health Summary					
	_	Clinical Documents	PATIENT: Mr Frank HAR	DING SEX: Male Do	OB: 21 May 1946	AGE: 64 years		
My Home My Details Help		 Discharge Summary Event Summary 	Administrative Deta Identifiers	ils 🗹 Provider		IHI: 8003 6081 6667 5496		
🔰 IANNELLA, RENATO DOB		Shared Health Summary 31-Oct-2010 Shared Health Sun	PATIENT DETAILS	dillama Craudan				
Showing All 💿 🔍		Personal Nedicare Records	Sex Date of Birth IHI	Male 21 May 1946 (64 years) 8003 6081 6667 5496	Document S	hared Health Summary		
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Clinical Documents				Australia Postal Address:	Date/Time 3 Attested Document 4	1 Oct 2010 12:00 808392		
Shared Health Summary				Croydon, VIC 3136, , Australia	ID Document 0	f10f185-8c0f-4425-b19c-		
Personal	6		Contact	Phone: 0499 801 101 (Workplace) 0499 801 101 (Workplace)	Set ID b Document 1 Version	8148d2945b8		
▶ Personal Health Notes				Email:	Completion F	inal		
Personal Health Summary				(Workplace)	Author D	r. Chris Javad (General Medical ractitioner)		
Advance Care Directive Custodian	Sh				Author M	[HPI-I: 8003 6116 7159 6207] ediHome Croydon [HPI-0: 8003 6208 3333 4894]		
Your Personal Details					on Author	ediHome Croydon		
Emergency Contact Details					Departmen			
Medicare Records			Administrative Observ	ations				
Australian Organ Donor Register			Adverse Reactions					
Medicare/DVA Benefits Report			Adverse Reactions		Manifestation			
Pharmaceutical Benefits Report			Prozac allergy		 Vomiting, Ras 	h (moderate)		
Medicare Services Overview R			Penicillin allergy		Urticaria			
Restricted Settings								
Notification Settings	4		Medications Medications					
Manage Access to this Record			Medication	Directions	Clinical Indication	Comment		
Manage Access to this Record			Citalopram (Celica) 20mg tablet::	One tablet daily	Depressive disorder	Nil		
Restricted Settings			Metformin hydrochloride 500mg tablet::	One tablet twice daily	NIDDM - Non-insulin dependent diabetes	s Nil		
Nestricted Settings			-		menitus			

Hong Kong eHR System

李敏敏 LEE, MAN MAN HKIC : Q001003(7)	DOB : Au	ıg-1953	Age : 59 years	Sex : F	Details	•		Allergy & ADR	Close Record Select Patient	×
醫健補 All Local	Non-Local	Problem / Di	agnosis Summary		Details >	Allergy & Ad	lverse Drug l	Reaction	Detai	ls ⊧
chealth	Legend	Date	Description			Allergen		Aller	gy Information	
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🚹 📝 🐻 🔤 🛄	🗋 🧪	12-Aug-2011	Cancer of Colon							
 Clinical Note & Summary 		12-Jan-2011	Follow-up examinat	ion following	surgery					
Clinical Note & Summary	,	05-Sep-2008	Postmenopausal bl	eeding						
Encounter	·	01-Aug-2008	🦲 No abnormality dete	cted						
 Problem & Procedure 					>>More	ADR Causative	e Agent	ADR	Information	
Problem / Diagnosis										
Procedure		Laboratory S	summary		Details >					
Investigation Report		Date	Description	Institution			N	lo Record		
 Medication 		18-Feb-2013	Hb A1c	PWH						
Prescribing History		18-Feb-2013	Albumin, Spot, Urine, Alb	PWH						
Dispensing History		08-Feb-2013	CEA	PWH		D 111				
 Laboratory Record 		30-Nov-2012	CEA	PWH		Prescribing	History Sum	mary	Detai	ls ►
Chemical Pathology		30-Nov-2012	LFT,RFT	PWH		Date	Medication			
Microbiology & Virology					>>More	16-Apr-2013	CHLORPHE	NIRAMINE		
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 Radiology Record 		Start Date	Specialty	Institution			PARACETAN	IOL		
General Radiology	S	04-Apr-2014	Ophthalmology	PWH		03-Apr-2013	METFORMIN	I		
Fluroscopy		22-Oct-2013	Surgery / General surgery	PWH		05-Feb-2013	SENNA			
Ultrasonography		24-Jul-2013	GOP	PWH		12-Dec-2012	CHLORPHE	NIRAMINE		
Nuclear Medicine		03-Jun-2013	Clinical Oncology	PWH			AMMONIA AN		IHA	
		16-Apr-2013	GOP	PWH			BROMHEXIN	IE		
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Singapore NEHR

Merlion EHR	R v0.03a - Dashboard - Mozi	lla Firefox									
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Mark Lo	ooi, 64 yrs, Male, C	Chinese									
NRIC: S123 Clinic)	34567A Care Provider:	Dr. Alvin Tan(SGH) Dr.	Daniel Wong(Merlion					Good Afterno	on! Welcome To EHR v0.01a		
Allergies: F	Panadol Aspirin								Logout		
Recent I	Events				Investigat	ions			>X•Ray		
Date	Institution	Specialty	Event Type		Date	Investigation		Institution			
01/05/2009	Merlion Hospita	I Haematology	Discharge		13/06/09 15/06/09	Full Blood Cou Lipid Panel	unt	SGH Tan Clinic			
Diagnos	sis			SORT	Current M	edications					
Last Entry	Description		Alert		Date	Name	Dose	Frequency	Route		
11/06/2009	Diabetes Mellit	us (x5)	•		18/06/09	Metformin 850 mg bd		x3	Oral		
12/06/2009	Hypertension (<1)		- 1	18/06/09	Losartan 50 mg om		×1	Oral		
20/06/2009	Colon Cancer	×1)	•		18/06/09	Simvastatin 20 mg on		×1	Oral		
Procedu	ures				Care Plan	i i	_				
Date Pr	Procedure	Summary of Procedur	e		Category Sei	rvice Detail	ls A	ppt Date/Time/Time	Interval		
12/05/09 Ri	Revision of central/other htravascular line	Revision of Hickmann	Line		Specialist Ma Clinic hae	lignant Clinic ematology CXR	D, FBC, 2 on arrival	2/07/09 2pm			
Recent F	Referrals/Discharg	jes									
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11/06/09	SGH FMCC	SGH Endocrine	Referral	Нур	ertension						
13/06/09	SGH Endocrine	SGH Endocrine	Discharge	Diab	Diabetes mellitus						
15/06/09	SGH FMCC	GP	Referral	Con	Congestive heart failure						

Towards Semantic eHealth

- RIM Modelled as a "closed system"
 - Designed for "constraint"-based modelling (not common)
 - Scope of Acts very large and overwhelming
 - CDA produces very complex XML
- The independent layers (conceptual/logical/implementable) causes interoperability issues - No Connections or Linkages
- The same information can be expressed in different ways using SNOMED and HL7 CDA structures
 - BUT modelled fundamentally different
- The W3C Semantic Web is a collection of standards for modelling and representing information (open-world assumption)
 - Based on formal model so can guarantee reasoning outcomes

Case Study: Medications



Semantic eHealth Model



Summary

- eHealth has many complex information standards
 - HL7 CDA v FHIR for the immediate future
- Challenge now to preserve semantics between closed info models (eg RIM) and open terminology models (ie SNOMED)
- Move towards the information model based on the same model as terminologies
- Semantic eHealth can achieve a level of functionality that current methods/technologies cannot provide
 - Decision support can have guaranteed outcome and hence reduce clinical errors
- Benefits will be significant by improving provider decisions and consumers healthcare outcomes - in the long term