Meaningful Use

epsos

Bridging Patient Summaries across the Atlantic

EU-US Joint Effort Toward Transatlantic Semantic Interoperability

Jamie Ferguson, Kaiser Permanente

SNOMED Implementation Showcase

Amsterdam, 31 October 2014

Purpose: Why We Participate
A Real Life Case Example, (2009)

- A military veteran patient presented for a medical visit at Kaiser Permanente

- He neglected to mention the occurrence of two new life-threatening allergic reactions that had recently been documented at the VA Medical Center

- We queried his CCD summary record at VA through the eHealth Exchange

- His physician was instantly able to see those two medication allergies

- One allergy was to a statin and the other an anti-hypertensive

- The patient's last cholesterol and current blood pressure were not well-controlled, therefore it would have been easy to prescribe a drug in the same class of medications as the recently defined allergies, which may have resulted in a life-threatening event

- Instant availability of the HL7 CDA information via XDS-based exchange was critical to proper decision-making and may have saved this patient's life

Opportunity: 26 Nations in epSOS Project
+ Over 100mm Americans on US eHealth Exchange

US-EU Emergency Care Market Size

Emergency Departments Estimates
Need for Patient Summary & HC encounter reports

International visitors to US each year	66,600,000
US people travel abroad each year	58,496,587
Average stay (days) when travelling	4
Total Person-Days in Foreign Country	500,278,348
Total Person-Years in Foreign Country	1,370,626
US ED Visits/year	129,800,000
US Population	309,300,000
ED Visits/1000 US Citizens	42
Expected ED visits by travelers to/from US	575,317

Source: Larry Garber, Atrius Health

Additional US-EU Exchange Drivers

Medical Tourism	• Patient summary transfer and translation • Access to accredited point of care only • Access information anywhere anytime after patient consent	Tour Operators Tourism Providers
Disease Management	• Monitor wellness and new society diseases (diabetes, Obesity) • Use m-Health and web applications • Update medical data repositories (EHR, PHR, etc)	Insurance Institutions
Clinical Second Opinion	• Second opinion and prior authorization before costly treatment • Get access to accredited networks of medical competence center • Translate Med Rec. from country of origin to country of treatment	Patient Communities Governments
Telemedicine & Mobile Health	• Machine to Machine Connectivity – Mobile health • Medical device connectivity and data monitoring • Get Access specialized competence centers	Healthcare Provider Organizations
Chronic Care	• Disease Management Protocols and exchange coded data • Use of Consolidated CDA • Get Prior Authorization	Workflow Organizations Telecare Providers
Clinical Trial Management	• Connect disparate data repositories • Conduct complex clinical trials with patients in many countries with one unique data structure	Pharma Industry

10/22/14   *Source: Alex Berler, Gnomon*   5

EU-US Exchange Barriers and Accelerators

- Content standards: EU vs US patient summary
- Privacy policies and trust frameworks
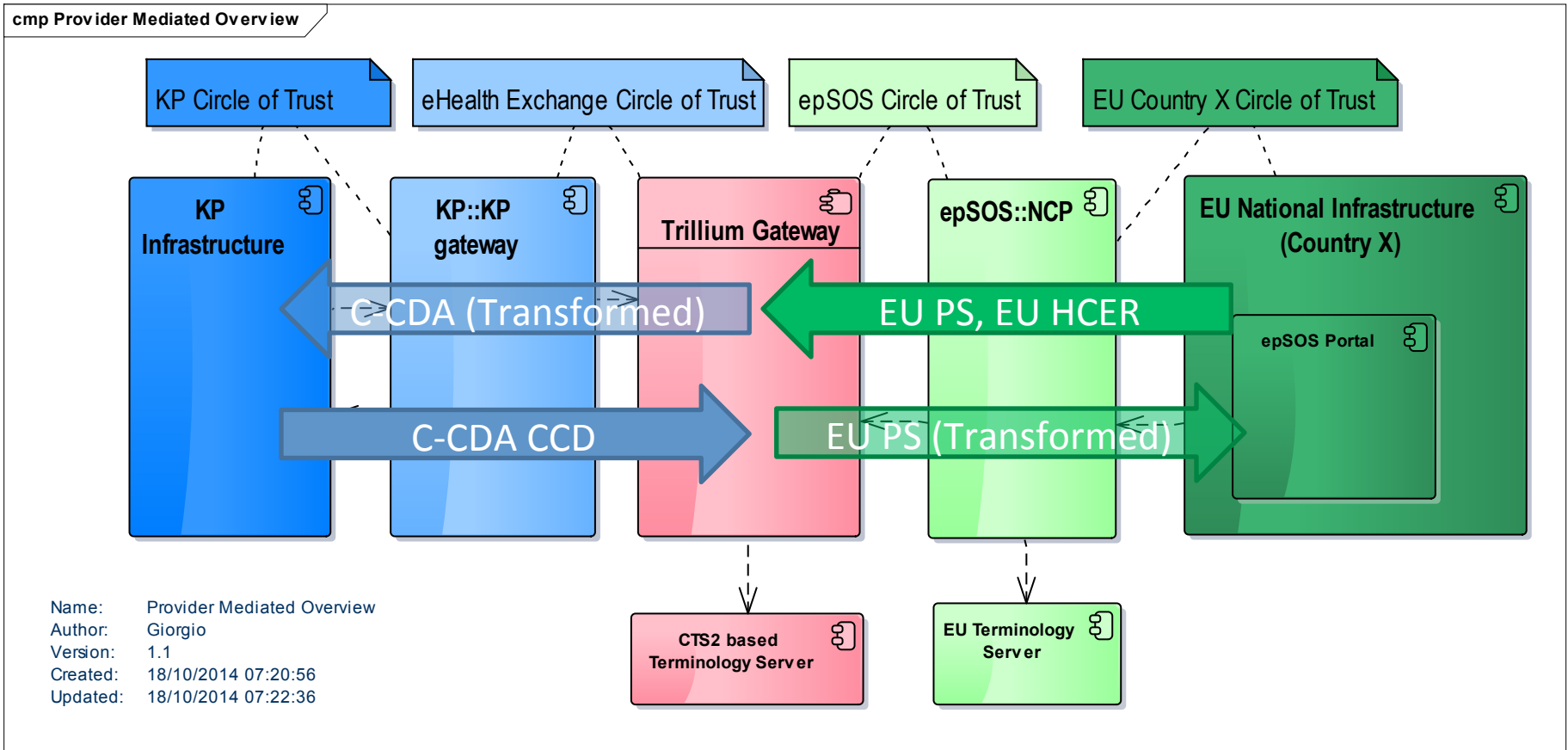- Clinician training and workflow integration

- International standards collaboration:
  - HL7 with ISO, CEN international patient summary
  - SNOMED CT in CIMI and ISO semantic modeling
- Continuing opportunities
  - Privacy policy coordination
  - Integration of patient and provider modalities

Trillium Bridge Project Scope

- **Emergency Care** for international travel

- Demonstrate the **Provider Mediated** Use Case

- Show with real systems (*test environment*) how the **European epSOS** and the **US eHealth Exchange networks now** may technically cooperate for the purpose of

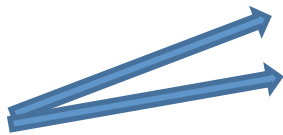 - Discovering Patients, Resolving Identities

  - Exchanging Patient Summaries

Who

IT Architectural Overview

cmp Provider Mediated Overview

KP Circle of Trust

eHealth Exchange Circle of Trust

epSOS Circle of Trust

EU Country X Circle of Trust

KP Infrastructure

KP::KP gateway

Trillium Gateway

epSOS::NCP

EU National Infrastructure (Country X)

epSOS Portal

C-CDA (Transformed)

EU PS, EU HCER

C-CDA CCD

EU PS (Transformed)

CTS2 based Terminology Server

EU Terminology Server

Name: Provider Mediated Overview
Author: Giorgio
Version: 1.1
Created: 18/10/2014 07:20:56
Updated: 18/10/2014 07:22:36

EU-US CDA Section Comparison

epSOS/EU Directive	EU Patient Guidelines	epSOS PS	CCD	
Section	**Optionality**	**Optionality**	**Optionality**	**Optionality**
Allergy	R	R	Allergies	R
List of current medicines	R	R	Medications	R
List of current problems / diagnoses	R	R	Problem	R
Surgical Procedures prior to the past six months	R	O	Procedures	O (R only for inpatients)
Major Surgical Procedures in the past six months	R	R	Procedures	O (R only for inpatients)
Medical Devices and implants	R	R	Medical Equipment	O
Vaccinations	O	O	Immunizations	O
Social History Observations	O	O	Social History	O
Pregnancy history (Expected date of delivery)	O	O	Social History (Pregnancy Observation)	O
Physical findings (Vital Signs Observations)	O	O	Vital Signs	O
Diagnostic tests (Blood group)	O	O	Results Section	R
Treatment Recommendations	R	O	Plan of Care	O
Autonomy / Invalidity	R	O	Functional Status	O
List of resolved, closed or inactive problems			Advance Directives	O
			Family History	O
			Payer	O
			Encounters	O

Table 52: History

Used By:

Consultation Note (optional)
Discharge Summary (optional)
History and Physical (required)
Procedure Note (optional)

Using same template OID, can be grouped together, only difference is the date

Text only

Not equivalent in regular specification CCD, can add as an open template, not included

4 sections not present in epSOS PS

Mapped Data Elements

100s of data elements, 2 types:

- Structural data elements– they come across as they are: moodCode, classCode, typeCode
- Value data elements (bound to specific value sets)*

HEADER
- Administrative Gender
- Country
- EntityNamePartQualifier
- Healthcare Professional Roles
- Confidentiality Code
- Language
- Contact Relationship
- Telecom address use
- Next of Kin or Emergency Contact

BODY

ALLERGY
- Allergic Response
- Adverse Event Response
- Allergen (Medication)
- Allergen (Non-medication)

MEDICATIONS
- Active Ingredient
- Route of administration
- Dose From
- Units per Intake

PROBLEM (LIST OF CURRENT PROBLEMS/DIAGNOSES, LIST OF RESOLVED, CLOSED OR INACTIVE PROBLEMS)
- Problem Code
- Problem Type
- Clinical Status
- Health Status

PROCEDURES (LAST 6 MONTHS+BEFORE)
- Procedure Description (Type)

MEDICAL DEVICES (MEDICAL EQUIPMENT)
- Medical Device Description

PLAN OF CARE (TREATMENT RECOMMENDATIONS)
AUTONOMY/ INVALIDITY (FUNCTIONAL STATUS)
- Narrative only

VACCINATIONS (IMMUNIZATIONS)
- Vaccination Code

SOCIAL HISTORY
- Social History Observation Type
- Pregnancy Observation - Estimated delivery date

RESULTS
- Blood Group

VITAL SIGNS
- Blood Pressure

Syntactic Mapping

- XSLT transformation for the value data elements
- Can range from very simple (only changing the template ID) to complex (change template ID, change structure, map from two possible ways of expressing a data element to one or vice versa).

7.1.2.4 Prefered HCP/ Legal Organization Country

7.1.2.4.1 epSOS and CCD XPaths for This Data Element

epSOS:

```
/ClinicalDocument[templateId/@root="1.3.6.1.4.1.19376.1.5.3.1.2.3"]/participant/associate
dEntity/addr/country
```

OR

```
/ClinicalDocument[templateId/@root="1.3.6.1.4.1.19376.1.5.3.1.2.3"]/participant/associate
dEntity/scopingOrganization/addr/country
```

CCD:

```
/ClinicalDocument[templateId/@root="2.16.840.1.113883.10.20.22.1.2"]/participant/associat
edEntity/addr/country
```

7.1.2.4.2 Functional Requirements for the Transformer

FRT07 - The transformation will have to change the template ID and the structure from **epSOS** to **CCD** for the data element **Country (Prefered HCP/ Legal Organization Country)** as per the Xpaths. Please note that there are two possibilities to express the preferred HCP in epSOS as it is seen a point of contact for the patient. They both need to be mapped to the same element in CCD. The mapping providing a common vocabulary for the value of this data element from the CTS2 server is listed in section 7.1.2.8.

FRT08 - The transformation will have to change the template ID and the structure of the **CCD** to **epSOS** for the data element **Country (Prefered HCP/ Legal Organization Country)** as per the Xpaths. Please note that there are two possible ways in which the preferred HCP can be expressed in epSOS as it is seen as point of contact for the patient. The CCD structure needs to map to both way of expression. The mapping providing a common vocabulary for the value of this data element from the CTS2 server is listed in section 7.1.2.8.

Value Sets Mapping (1)

- Incorrect, we never map the value sets, we see if the value sets are equivalent in their significance, then we see if the concepts they contain can be mapped between themselves.

- We will only focus on value sets that can be "mapped"

- 2 situations present:
  - Value sets based on the same code system
  - Value sets based on different code systems

Value set based on the same code system:

1. Value sets are based on the same code system, they contain exactly the same concepts

epSOS Code	epSOS Display Name	CCD Code	CCD Display Name
419199007	Allergy to substance	419199007	Allergy to substance (disorder)
416098002	Drug allergy	416098002	Drug allergy (disorder)
59037007	Drug intolerance	59037007	Drug intolerance (disorder)
414285001	Food allergy	414285001	Food allergy (disorder)
235719002	Food intolerance	235719002	Food intolerance (disorder)
420134006	Propensity to adverse reactions	420134006	Propensity to adverse reactions (disorder)
419511003	Propensity to adverse reactions to drug	419511003	Propensity to adverse reactions to drug (disorder)
418471000	Propensity to adverse reactions to food	418471000	Propensity to adverse reactions to food (disorder)
418038007	Propensity to adverse reactions to substance	418038007	Propensity to adverse reactions to substance (disorder)

Table 15 – *The mapping between the value sets epSOSAdverseEventType and Allergy/Adverse Event Type*

Value Sets Mapping (2)

2. Value sets are based on the same code system, there is partial overlap

epSOS Code	English Display Name	CCD Code	CCD Display Name
WP	work place	WP	work place
MC	mobile contact	MC	mobile contact
HV	vacation home	HV	vacation home
HP	primary home	HP	primary home
PG	pager	Not matched	
H	home	Not matched	
EC	emergency contact	Not matched	
AS	answering service	Not matched	

Table 10 – *Mapping between the value sets epSOSTelecomAddress and Telecom Use (US Realm Header)*

epSOS Code	epSOS Display Name	CCD Code	CCD Display Name
ECON	emergency contact	ECON	RoleClass
NOK	next of kin	NOK	RoleClass
	no match	PRS	RoleClass
	no match	CAREGIVER	RoleClass
	no match	AGNT	RoleClass
	no match	GUAR	RoleClass
	no match	ECON	RoleClass

Table 11 – *Mapping between the value sets epSOSRoleClass and INDRoleclassCodes*

Value Sets based on different code systems

1. Official mapping exists, however it is limited

- Mapping exists between

  - *SNOMED CT International –ICD-10 version 2010*

  - *SNOMED CT US Extension – ICD-10 CM version 2013* (other ICD-10 CM versions also available).

  - *NDF-RT – ATC*

  - *RxNorm – ATC*

Value Sets Mapping (4)

- Official mapping in uni-directional (SNOMED CT-ICD10), the reverse does not exist

- The official map was used in reverse to get the mapping ICD-10-SNOMED CT

- Initially we wanted to look at one-to-one, many-to-one and one-to-many mappings

- It quickly became evident that the **one-to-many mappings must be excluded** as it introduces ambiguity (which term to choose to send? All? If receiving 4 terms, which one is the correct one?)

- Synonyms were counted only once

- Stringent rules were chosen in the mapping of SNOMED CT

SNOMED CT code	SNOMED CT designation	ICD-10-CM code	ICD-10 designation
193003	Benign hypertensive renal disease	I12.9	Hypertensive renal disease without renal failure
193003	Benign hypertensive renal disease	N18.9	Chronic kidney disease, unspecified
2355008	Rud Syndrome	Q80.3	Congenital bullous ichthyosiform erythroderma
2355008	Rud Syndrome	F79	Unspecified intellectual disabilities
2355008	Rud Syndrome	Q87.1	Congenital malform syndromes predom assoc w short stature

ICD-10-CM code	ICD-10-CM designation	SNOMED CT code	SNOMED CT designation
A00.9	Cholera, unspecified	63650001	Cholera
A00.9	Cholera, unspecified	240350003	Cholera - non-O1 group vibrio
A00.9	Cholera, unspecified	240351004	Cholera - O139 group Vibrio cholerae
A00.9	Cholera, unspecified	446672004	Intestinal infection due to Vibrio cholerae non-O139
A00.9	Cholera, unspecified	447282003	Intestinal infection due to Vibrio cholerae O1

Value Sets Mapping (5)

2. In-house mapping, done one concept by one concept, in both directions:

ISCO-08	epSOSHealthcareProfessionalRoles	ISCO_NUCC_epSOSHealthcareProfessionals_VS
NUCC	CCD_Provider Type	NUCC_ISCO_ProviderType_VS

SNOMED CT	epSOSAllergenNoDrugs	UNII_to_SNOMED CT_IngredientName_VS
UNII	CCD_Ingredient Name	SNOMED CT_UNII_epSOSAllergenNoDrugs_VS

*Code system contains over 63, 000 concepts, only 5,300 were mapped due to limited resources

EDQM Standard Terms	epSOSRoutesofAdministration	EDQM_NCI_epSOSRRouteofAdministration_VS
	epSOSDoseForm	EDQM_NCI_ epSOSDoseForm _VS
NCI_Thesaurus	CCD_Medication Route FDA	NCI_EDQM_ Medication Route FDA _VS
	CCD_Medication Product Form	NCI_EDQM_ Medication Product Form _VS

SNOMED CT	CCD_Problem	CVX_SNOMED CT_ Vaccine Administered_VS
CVX	CCD_Vaccine Administered	SNOMED CT_CVX_ epSOSVaccine_VS

Mapping Statistics (1 of 3)

22 Code Systems	25 CCD value set (out of 65)	26 epSOS value set (out of 46)
ATC	CCD_ HITSP Vital Sign Result Type	epSOSActiveIngredient
CVX	CCD_Administrative Gender (HL7)	epSOSAdministrativeGender
EDQM Standard Terms	CCD_AgePQ_UCUM	epSOSAdverseEventType
HL7 AddressUse	CCD_Allergy/Adverse Event Type	epSOSAllergenNoDrugs
HL7 AdministrativeGender	CCD_CountryValueSet	epSOSBloodGroup
HL7 Confidentiality	CCD_EntityNamePartQualifier	epSOSBloodPressure
HL7 EntityNamePartQualifier	CCD_HealthStatus	epSOSCodeProb
HL7 RoleClass	CCD_HITSPProblemStatus	epSOSConfidentiality
HL7 RoleCode	CCD_HL7 BasicConfidentialityKind	epSOSCountry
ICD-10	CCD_INDRoleclassCodes	epSOSDoseForm
ICD-10-CM	CCD_Ingredient Name	epSOSEntityNamePartQualifier
ISCO-08	CCD_Language	epSOSHealthcareProfessionalRoles
ISO 3166-1 Country Codes	CCD_Medication Brand Name	epSOSLanguage
ISO 639-1	CCD_Medication Clinical Drug	epSOSMedicalDevices
LOINC	CCD_Medication Drug Class	epSOSPersonalRelationship
NCI Thesaurus	CCD_Medication Product Form	epSOSPregnancyInformation
NDF-RT	CCD_Medication Route FDA	epSOSProcedures
NUCC	CCD_Personal Relationship Role Type	epSOSReactionAllergy
RxNorm	CCD_Problem	epSOSResolutionOutcome
SNOMED CT	CCD_Problem Type	epSOSRoleClass
UCUM	CCD_Provider Type	epSOSRoutesofAdministration
UNII	CCD_Social History Type Set Definition	epSOSSocialHistory
	CCD_Telecom Use (US Realm Header)	epSOSStatusCode
	CCD_UCUM Units of Measure	epSOSTelecomAddress
	CCD_Vaccine Administered	epSOSUnits
		epSOSVaccine

19 Association or Mappings

ATC_NDF-RT_epSOSActiveIngredient_VS
ATC_RxNorm_epSOSActiveIngredient_VS
CVX_SNOMED CT_ Vaccine Administered_VS
EDQM_NCI_ epSOSDoseForm _VS
EDQM_NCI_epSOSRRouteofAdministration_VS
ICD 10 CM_SNOMED CT_epSOSIllnesses_VS
ICD 10_SNOMED CT_epSOSIllnesses_VS
ISCO_NUCC_epSOSHealthcareProfessionals_VS
NCI_EDQM_ Medication Product Form _VS
NCI_EDQM_ Medication Route FDA _VS
NDF-RT_ATC_Drug_Class_VS
NUCC_ISCO_ProviderType_VS
RxNorm_ATC_Clinical_Drug_VS
RxNorm_ATC_Medication_Brand_VS
SNOMED CT_CVX_ epSOSVaccine_VS
SNOMED CT_to_ICD 10 CM_CCD_Problem_VS
SNOMED CT_to_ICD 10_CCD_Problem_VS
SNOMED CT_UNII_epSOSAllergenNoDrugs_VS
UNII_to_SNOMED CT_IngredientName_VS

Terminology Assets present in the CTS2-based terminology server:
http://extension.phast.fr/STS_UI/

Mapping Statistics (3 of 3)

Applicability of the maps to the value sets – examples:

epSOS Value Set	epSOS Code System	concepts with corresponence/ concepts present/ (% covered)	CCD Value Set	CCD Code System	concepts with corresponence/ concepts present/ (% covered)
epSOSActiveIngredient	ATC	606/5592 (6%)	Medication Drug Class	NDF-RT	1365/10699 (13%)
epSOSActiveIngredient	ATC	2836/5592 (51%)	Medication Brand Name	RxNorm	3329/13885 (24%)
epSOSActiveIngredient	ATC	2836/5592 (51%)	Medication Clinical Drug	RxNorm	9642/31214 (31%)
epSOSAllergenNoDrugs	SNOMED CT	79/112 (71%)	Ingredient Name	UNII	5315/63996 (8%)*
epSOSRoutesofAdministration	EDQM Standard Terms	55/73 (75%)	Medication Route FDA	NCI Thesaurus	57/118 (48%)
epSOSDoseForm	EDQM Standard Terms	28/457 (6%)	Medication Product Form	NCI Thesaurus	99/153 (65%)
epSOSIllnessesandDisorders	ICD-10	1775/9525 (19%) IHTSDO maps	Problem	SNOMED CT	7204/16443 (44%) IHTSDO maps
epSOSIllnessesandDisorders	ICD-10	1147/9525 (12%) NLM maps	Problem	SNOMED CT	6914/16443 (42%) NLM maps
epSOSVaccine	SNOMED CT	27/31 (87%)	Vaccine Administered	CVX	87/163 (53%)

Lessons Learned

- Alignment on vision and roadmap critical to success
- Where the same standards are in use across networks, different implementations of those standards observed.
  - Detailed gap analysis of messages to identify processing issues
  - Agreement on remediation (EU or KP) for purposes of demonstration
  - Teamwork
  - Developed message translation engine to bridge difference between eHealth and Epsos messages and gateway requirements
- Opportunity to provide feedback to standards bodies
- Demonstrated technical feasibility. Trust, Legal, Compliance and Governance questions a greater challenge.

The Common Denominator

- Files exchanged!

- For a rigorous QA process, subject matter experts are needed in many areas

- Original code is always sent for safety reasons

- The translated and transcoded Trillium document bears the indication that it has undergone a transformation, the original document is always available in its entirety

- Trillium Bridge performed an important **Feasibility Study** to prepare the road for future projects and harmonization efforts

Expectations

- Many provider systems are ready today
  - Rapid growth in US eHealth exchange network, reaching over 100 million Americans today

- Robust market of products and services for interconnectivity, security, and identity

- Expansion of current solutions is the best path toward future interoperability capabilities that will use new standards and methods