

Terminology Management within the context of the Italian federated Electronic Health Record

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Objective

- ▶ Present and discuss the **adoption and use of clinical standards** (terminologies and coding systems) **in Italy**:
 - ▶ **Management and Integration** of clinical terminologies within the Italian Federated Electronic Health Record (*Fascicolo Sanitario Elettronico - FSE*)
 - ▶ Analysis of the issues related to **Semantic Interoperability**
 - ▶ It enables systems to combine received information with other information resources and to process it in a meaningful manner, ensuring that data content is not only understandable within its original context, but also in the destination one

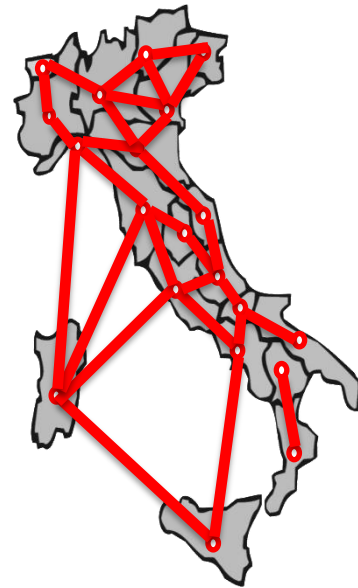
Background - Italy

- ▶ **Regional autonomy** has caused a proliferation of heterogeneous **EHR-S not interoperable** with each other
- ▶ **A first prototypal architectural model** for the realization of an interoperability secure EHR infrastructure, named **InFSE**, was defined and developed in 2009 by CNR in collaboration with national organizations
- ▶ **The InFSE software components** were also used within the national **IPSE** project linked to **epSOS**



Italian law on EHR

- ▶ In 2012 a first **Italian law on EHR has been emanated**
- ▶ **A National Technical Board has been established** by the Agency for Digital Italy and the Ministry of Health (with the participation of Regions and CNR) that defined:
 - ▶ **the national architectural model** of reference, and
 - ▶ **the functional and technical requirements** to be respected by all the Italian Regions
- ▶ In 2015 a **national framework** providing **basic services** (e.g. documentation validation) has been realized, and
- ▶ A **test environment** able to simulate the cross-border services has been implemented
- ▶ <http://www.fascicolosanitario.gov.it>



FSE Architecture: principles

- ▶ The main architectural constraints imposed are the following:

- ▶ **Patient consent**



- ▶ **First implementation of EHRs**

Integration of primary
care physicians
and hospitals by each
Region

Two types of documents

Patient
Summary



Laboratory
report



Use of clinical standards: critical issues

- ▶ Clinical standards are far from being flawless
 - ▶ **Not complete** for the users needs
 - ▶ Too **complex** in their structure and syntax
 - ▶ Not easy to **update** and **translate**
 - ▶ Often **adapted to different purposes**
 - ▶ Still **not interoperable**
- ▶ A lot of data, a lot of internal and local terminologies use among regions ... a lot of confusion!



Healthcare data difficult to manage, to be coded and to integrate!

Italian regulations for the use of clinical standards

- ▶ Ministerial Decree 26/07/1993
 - ▶ Makes mandatory diagnoses encoding in the hospital discharge letters by using ICD-9-CM
- ▶ Prime Minister Decree N. 178/2015 on FSE
 - ▶ Addresses medical terminologies use in two specific clinical documents
 - ▶ Patient Summary
 - ▶ Laboratory reports

Clinical standards required in FSE

▶ **ICD-9-CM**

for diagnoses coding in the Problem list and for interventions coding in the Patient Summary

▶ **LOINC** (*Logical Observation Identifiers Names and Codes*)

for laboratory tests and observations coding in the Laboratory report

▶ **ATC**

for medications' active ingredient coding

▶ **AIC** (*Autorizzazione all'Immissione in Commercio*)

for medications' commercial name coding

Current problems with ICD-9-CM

Misspecification

- ▶ Misalignment between reported clinical information (in free text) and the chosen ICD-9-CM code
 - ▶ Studies revealed that just 30% of the codes used by GPs are equivalent


Miscoding

- ▶ Wrong association of ICD-9-CM codes to the free text diagnosis used by GPs

Generalization

- ▶ Frequent use of:
 - ▶ the generic code “799.9” - Other unknown and unspecified cause of morbidity and mortality
 - ▶ Three digit codes
- ▶ Massive use of acronyms, abbreviations, synonyms, etc. in free text

LOINC Implementation in Italy

- ▶ Formal agreement with the Regenstrief Institute and creation of the  working group
- ▶ Translation into Italian:
 - ▶ First release in 2010 (43,152 codes)
 - ▶ Last release in 2016 (63,367 codes)
- ▶ Use of LOINC in the HL7 CDA 2 documents
- ▶ Test the introduction of LOINC in many Italian laboratories
- ▶ Validation of the mappings to LOINC
- ▶ Helpdesk online (www.loincitalia.it)



What about ICPC?

- ▶ Not required neither considered by the FSE regulations for the coding of Episode of cares, problem list, or diagnoses.
- ▶ Used by ~300/54,000 GPs in ad hoc softwares which integrates the ICPC-2-E version translated by ICPC Club Italy.
 - ▶ Transcoding between ICPC2 e ICD-9-CM was needed to share data codified in ICPC
- ▶ Experimental uses for the coding of the main problem and complaints in the Triage record (Emergency Department setting in the Campania Region)

Integrated Terminology Service for FSE

- ▶ Development of a **terminology service**, namely **STI (Servizio Terminologico Integrato)** to centralize terminology content used in FSE representing it in a consistent format
- ▶ It follows the standard HL7 protocols **Common Terminology Services Release 2 (CTS2)** to develop interfaces to manage, search and access terminology content
- ▶ CTS2:
 - ▶ identifies the minimum set of functional characteristics a terminology resource must possess for use in HL7.
 - ▶ gives a cohesive model (Service Functional Model) and specification for representing, accessing, querying, exchanging and updating terminological resources (Code Systems, Nomenclatures, Value Sets, Mappings, etc.)
 - ▶ Development Framework toolkit is provided by Mayo Clinic Informatics and is available for reuse

Main services and functionalities

- ▶ Terminology Services **for Humans**
 - ▶ Import/Export
 - ▶ Navigation and Query
 - ▶ Authoring: Creation and Editing of Code System/CS Version, Value Set and VS Version, Mapping and M Version
- ▶ Terminology Services **for Applications**
 - ▶ Import/Export
 - ▶ Query
- ▶ Federation and Organization Services **for Humans and Applications**
 - ▶ Publish and Subscribe of Code System, Value Set, Mapping and their revisions
 - ▶ Receiving notification on creation, revision, availability in the organizational context of Code System/CS Version, Value Set/VS Version, Mapping/M Version

STI users

Two main categories:

- ▶ **Healthcare operators, GPs, laboratorists**

- ▶ Support in the correct use of coding systems and terminologies in the two CDA2 documents required by the law previsti dalla norma: Patient Summary and Laboratory report.

- ▶ **Applicazioni/services and regional referents**

- ▶ Administrative support, alignment to the international updates of the coding systems

Implementazioni di Servizi terminologici in CTS2 HL7

▶ International

- ▶ CTS2 Development Framework
- ▶ Standard Terminology Services
- ▶ Dortmund Terminology Server
- ▶ Central eHealth terminology source



▶ National

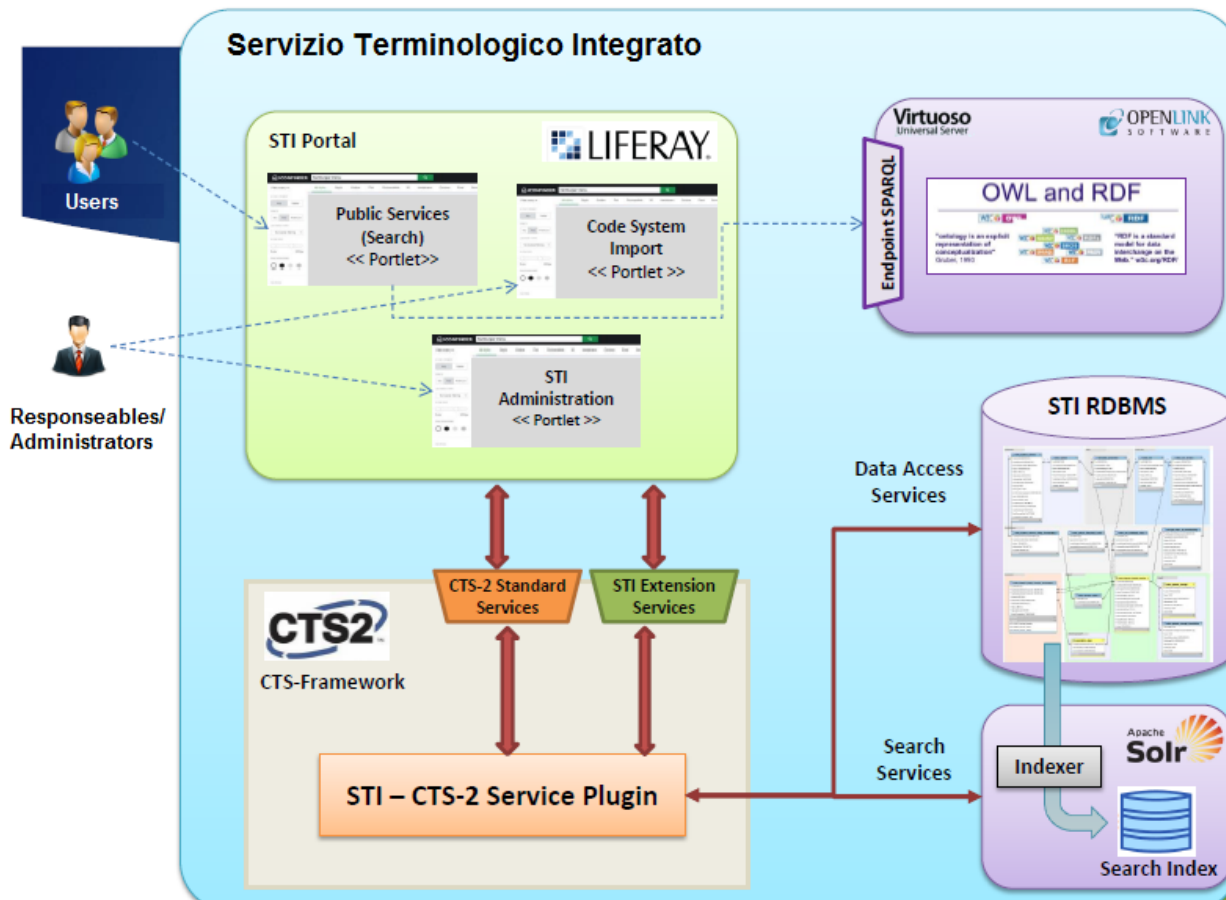
- ▶ HQuantum
- ▶ Distributed Terminology Assets Management system (DITAM)



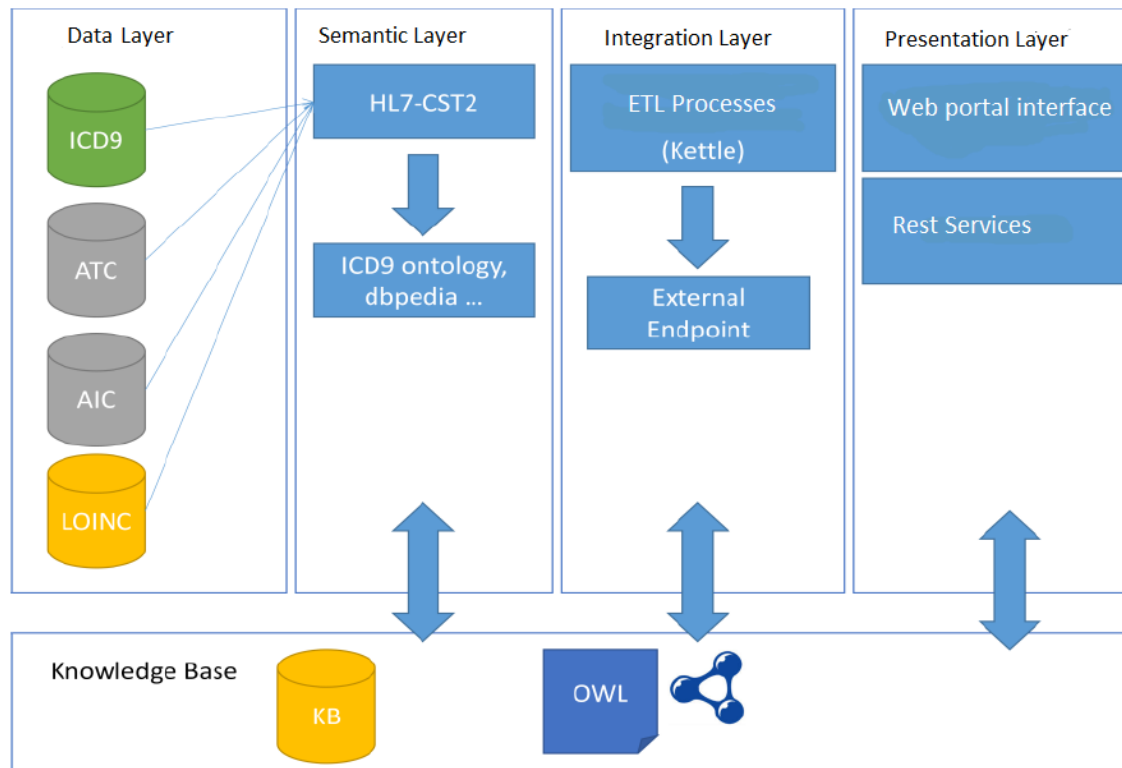
Main components and technologies in STI

- ▶ **Content Management System Liferay 6.2CE**
 - ▶ It is able to manage multiple access by simultaneous users, content versioning and content classification by the use of tags and categories.
- ▶ **CKAN**
 - ▶ For data export into Open Data standard format, and their publication within specific Open Data platforms
- ▶ **Virtuoso Open Source Edition**
 - ▶ For the implementation of an RDF server and the publication of data as Linked Data
- ▶ **Kettle**
 - ▶ To create ETL processes (Extraction, Transformation and Loading) useful for data integration , for the creation and population of the Knowledge Base.

STI Deployment Framework



Application layers



STI Knowledge Base statistics

Resources	Version	Concepts (EN)	Concepts (IT)
LOINC	2.34	+60,000	+43,100
LOINC	2.52	+72,000	+58,000
LOINC	2.54	+73,000	+61,400
LOINC	2.56	~ 80,000	+60,800
LOINC	2.58	+80,000	~63,400
ICD-9-CM	2007	16,100	16,100
ATC	2014	-	+5,500
AIC	Jan 2017	-	+18,300
Mapping LOINC – Umbria Laboratory tests	2016	-	111
Mapping ATC - AIC	2017	-	18,310
Total		+400,000	~345,200

Web service query examples

▶ Entity Description Query Service

Search the entity “*Immunoglobulina*” in the code systems ICD9-CM and LOINC:

- ▶ <http://sti.iit.cnr.it/cts2framework/entities?matchvalue=immunoglobulina&page=0&maxtoreturn=20&codesystem=ICD9-CM>
- ▶ <http://sti.iit.cnr.it/cts2framework/entities?matchvalue=immunoglobulina&page=0&maxtoreturn=20&codesystem=LOINC&format=json>

▶ Code System Version

Entity “*Immunoglobulina*” in LOINC version 2.56:

- ▶ <http://sti.iit.cnr.it/cts2framework/codesystem/LOINC/version/2.56/entities?matchvalue=immunoglobulina&page=0&maxtoreturn=20&format=json>

Web service query examples

▶ Entity Description Read Service

Read the detailed information of AIC code 19227038:

- ▶ <http://sti.iit.cnr.it/cts2framework/codesystem/AIC/version/16.01.2017/entity/AIC:19227038>

▶ Association Query Service

Existing cross-mapping associated to the ATC v. 2014 code “B02AA01”.

- ▶ <http://sti.iit.cnr.it/cts2framework/associations?list=true&codesystemversion=2014&sourceortargetentity=B02AA01&format=json>

▶ Export Service

Export of AIC csv format, version January 2017:

- ▶ http://sti.iit.cnr.it/cts2framework/exporter?codesystem=AIC:16.01.2017&aictype=class_h

New e-Health Projects

- ▶ HL7 Italy VPS Task Force
 - ▶ Collaboration with HL7 Italy to support the implementation of the CDA 2 Template for the First Aid Report and Emergency Discharge Report
- ▶ SISCO.web – Sistema di supporto web alla codifica della SDO
 - ▶ Collaboration with the WHO Italian Collaborating Center to develop a coding support system (CSS) for physicians of the Friuli – Venezia – Giulia Region to help them in the coding of diagnoses in the Hospital Discharge Letter.
- ▶ MISE - Baseline: Big data e Salute in reEte per Le malattle croNiche
 - ▶ Aimed at building an innovative platform to support physicians in the monitoring of patients with chronic diseases with a focus on the Chronic Kidney Disease.

Thank you for your
kind attention !



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