Steps towards an industrial implementation of HSSP standards

F. Staccoli Castracane – Almaviva
D. Guerri – Dedalus
L. Maesano – Simple Engineering
**Health Service Oriented Architecture Framework**

- Project Lifetime: 3 years

- **Budget:**
  - Total Cost: **6.7M €**
  - Total Funding: **4.3M €**

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**Consortium**

**Companies**
- AlmavivA The Italian Innovation Company S.p.A. (Coordinator)
- Dedalus S.p.A.
- e-bag s.r.l.
- LP1 s.r.l.

*Subcontractor*
- Simple Engineering s.r.l.

**University / Research Center**
- Università della Calabria - DEIS - Dipartimento di Elettronica, Informatica e Sistemistica
- TEBAID - Consorzio per le tecnologie Biomediche Avanzate
Objective

Implement a framework of plug-and-play SOA service components for second generation e-health based on HSSP international standards.

Addressing in a comprehensive and broad way the complex cooperation of a large number of heterogeneous healthcare entities (organizations, companies, users, systems, applications, devices) by supplying standard and interoperable general purpose services.

The HealthSOAF framework will allow integration of distributed back-end healthcare functions and front-end advanced interaction with and between patients, practitioners, operators and healthcare organizations.
Expected results

Services

- Design and implement standard, generic, plug-and-play, resilient and knowledgeable HSSP (RLUS, IXS, CTS2, HCSPD, DSS, PASS) service bricks

Test framework

- Design, build and set-up an automated black-box test environment based on TTCN-3 and an interoperability test framework for HSSP services

Pilot

- Build a Demonstrator – an implemented services architecture of a diagnostic-therapeutic process in a real healthcare environment
- Support the integrated clinical management process of cephalalgic and migraine patients

Standards

- Assess the HL7 DSTU specifications and provide feedbacks
- Reverse model and check the OMG HSSP specifications and provide feedbacks
- Instantiate the generic services in compliance with the Italian healthcare guidelines and standards
Adopted approach (1)

Project deliverables: Service bricks - for each HSSP service:

- **Service consumer proxy library**
  allowing applications, systems, intelligent devices to access service providers
  Ex.: Using RLUS primitives to retrieve health record elements

- **Service provider skeleton library**
  allowing systems endowed with enabling capabilities to provide the service
  Ex.: Encapsulate a MPI in order to provide IXS service functions
  Ex.: Encapsulate an IHE registry/repository in order to provide RLUS service functions
  Ex.: Encapsulate a IAA system in order to provide PASS Access Control service functions

- **Service provider system**
  Full implementation of the service provider
  Ex.: Full implementation of a healthcare practitioners and operators directory as a HCSPD provider

Service brokers and multi-service providers to be built by composition of service bricks

- Ex.: A health record broker implementing RLUS provider and consumer parts
- Ex.: A healthcare system implementing patient demographics & health record management and providing RLUS & IXS service functions
Contract-based, model-driven (CBMD) service orientation

- Service descriptions are **service contracts** - bundles of rights and duties for service providers and consumers
- Service contracts are **Model Driven Architecture multi-layered models**
  - Service Computation Independent Model (CIM),
  - Service Platform Independent Model (PIM),
  - Service Interoperability Platform Specific Models (SOAP, REST... platforms – example: RLUS/SOAP vs. RLUS hData RESTful transport)
- Service models are **collections of functional (and non functional) requirements** for implementations
- The HSSP **OMG specifications are models** at the PIM / Interoperability PSM levels of the HSSP generic services
- **Reverse formal modeling** (OMG SoaML notation, simpleSOAD® methodology by Simple Engineering) of the OMG specifications at the PIM level – check the compliance with the corresponding HL7 Service Functional Models
Adopted Approach (3)

Model-based automated testing

- In the CBMD service approach: **interoperability = conformance of implementations with formal contracts / models** – must be easily verified by testing

- Reverse formal service PIMs are the starting point of test case design and generation - **Functional compliance, robustness, fault-tolerance** and **safety** (absence of unintended side effects) tests to be modeled / generated from Service PIM in the project early stage

- **Test and Test Control Notation** (TTCN-3 - http://www.ttcn-3.org/) is a powerful language / environment for black-box testing automation – standardized by the European Telecommunications Standards Institute (ETSI - www.etsi.org)

- On the basis of Simple Engineering’s **TTCN4SOA™**, a TTCN-3 generic framework (library) that helps to build SOA automated testing environments, the HealthSOAF project will build a “**standard**” automated testing framework for **HSSP generic services** that can be instantiated for concrete healthcare services architectures

- The **HSSP testing framework** will be employed to build and run the HealthSOAF Pilot test campaigns and will be available as a project deliverable together with the HSSP service bricks

- **Dependability** and **security** of eHealth services architecture is a must – testability is a competitive advantage
HealthSOAF modules

- **Health Record Module (HRM)**
  - **RLUS** proxy, skeleton & system
  - handling distributed patient records and data (profile, medications, clinical history, ...)

- **Health Identity Module (HIM)**
  - **IXS** proxy, skeleton & system
  - uniquely identifying various kinds of entities (e.g. people, patients, providers, devices and so on) within disparate systems within a single enterprise and/or across a set of collaborating enterprises

- **Health Terminology Module (HTM)**
  - **CTS2** proxy, skeleton & system
  - managing clinical and healthcare terminology and coding

- **Health Directory Module (HDM)**
  - **HCSPD** proxy, skeleton & system
  - managing a directory of information relating to organizations and individuals that provide services in the areas of Healthcare, Aged Care and Community Care

- **Health Privacy Module (HPM)**
  - **PASS AC and Audit** proxy, skeleton & system
  - providing Access Control services to protected resources in a distributed healthcare environment and handling the recording and maintenance of service events from other services

- **Health Knowledge Module (HKM)**
  - **DSS** proxy, skeleton & system
  - searching, inquiring and executing healthcare decision-aid modules

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*Service bricks*
Development cycle

Starting from the state-of-the-art of the HSSP projects

RLUS | IXS | DSS | CTS2 | HCSPD | PASS AC | PASS Audit

- RLUS
- IXS
- DSS
- CTS2
- HCSPD
- PASS AC
- PASS Audit

- Normative standard
- Normative in balloting
- DSTU
- Beta 1
- RFP
- No RFP

Module implementation
- Software components development
- Test framework development
- Service compliance testing

Module design
- Service brick design
- Test framework design

Service specification
- PIM and interoperability
- PSM
- Specification by reverse modeling

PILOT
Implementation

- **Health Record Module (HRM)**
  
  *Dedalus*: Enhancing the X1.V1 platform with an RLUS Provider Interface

- **Health Identity Module (HIM)**
  
  *Dedalus*: Enhancing the X1.V1 platform with an IXS Provider Interface

- **Health Terminology Module (HTM)**
  
  *Dedalus*: Development from scratch

- **Health Directory Module (HDM)**
  
  *Almaviva*: Development from scratch

- **Health Privacy Module (HPS)**
  
  *Almaviva*: Enhancing the AlmaIAM platform with a PASS AC and Audit Interface

- **Health Knowledge Module (HKM)**
  
  *Università della Calabria*: Enhancing the UNICAL Decision Aid System with a DSS Provider Interface
Distributed platform for supporting interoperability and cooperation between distributed healthcare units and health professionals

Enabling tool for the implementation of both EHR (One-stop-shop to access both health information related to the patient, and an umbrella of health services for the citizens) and EPR (enterprise level)

Based on the IHE XDS* architecture, it adopts a set of international standards for the patients identity management (IHE PIX/PDQ), for the healthcare documents sharing (XDS.b, XDS-SD, XDS-MS, XDS-I, XCA), for the cross enterprise clinical workflow management (XDW) and for the events management (NAV). It adopts also SAML 1.1 for authentication and authorization among distinct security domain

New functionalities and interfaces, compliant with evolving standards

HealthSOAF RLUS & IXS Provider Systems core
Integrating RLUS & IXS

Healthcare Enterprise

IHE based integration profiles
X1.V1 - Interoperability platform

Other application
Non-integrated application
Legal Hold

Repository
Repository PACS
RIS
LIS

EHR

GPs

HSSP (RLUS, IXS)
SOA Interfaces

Other Enterprise level interoperability platforms
Integrating RLUS & IXS (2)

- EHR
- Other Cross Enterprise level (Regional, national ...) interoperability platforms
- HSSP (RLUS, IXS) SOA Interfaces

IHE based integration profiles
- X1.V1 – Cross Enterprise Interoperability platform

- Repository
- Repository PACS
- RIS
- LIS
- Other application
- Non-integrated application
- Legal Hold

Healthcare Enterprise
**UNICAL Decision Aid System**

HealthSOAF DSS
Provider Systems core

- Data Base
  - Knowledge Base
  - Inference Engine
  - User Interface

- HSSP (DSS) SOA Interfaces

- Healthcare Information Systems

- CDSS

End-Users

- Alarm
  - Alert
  - Reminder

- Recommendation
  - Suggestion

- Exploration

- Dialogue
  - Consultation
Almaviva AlmaIAM

- Framework & platform enabling and checking fine grain authorizations on protected resources

  - Compliance with
    - international standards and technical best practices (SAML – XACML – RBAC)
    - Italian regulations and technical standards

- Access Manager
  - engine based on open source solutions
  - high reliability, performance

- Identity Manager
  - connectors based on open source solutions
  - innovative application architecture
Integrating PASS AC & Audit

AlmaIAM Access Manager

- implements XACML standard
- is candidate for PASS AC & Audit integration

**Key**

- PEP - Policy Enforcement Point
- PDP - Policy Decision Point
- PIP - Policy Information Point
- PAP - Policy Administration Point
Pilot

Define, set-up, configure and deploy a Demonstrator

- to verify the semantic and syntactic accuracy, the effectiveness and efficiency of the implemented service bricks
- to experiment how the interoperable standard services enables heterogeneous distributed actors to cooperate within complex clinical workflows

A specific initiative will be carried out involving, a number of healthcare operators (GPs, Hospitals, Clinics, local healthcare Authorities and service Providers) and patients

Scenario

*integrated clinical management of cephalalgic and migraine patients*
Integrated clinical management of cephalalgic and migraine patients

- Knowledge Bases
- Inference Engines

HC Local Authority
- Main HR Registry & Repository
- Main Demographics
- HC Services Directory
- Terminology Manager

Clinical Research Center
- Local HR Repository
- Local Demographics

DSS
- RLUS
- IXS
- HCSPD
- CTS2

Web, email, phone...

Patient

Clinic
- Local HR Repository
- Local Demographics

Hospital
- Local HR Repository
- Local Demographics

GP
- Local HR Repository
- Local Demographics
**Industrial vision**

- Foster the introduction of cutting-edge technology able to noticeably improve the overall healthcare effectiveness and efficiency

- Explore innovative ways to support the quality and the continuity of care by developing solutions based on
  - clinical suitability, according to national and international guidelines
  - economical sustainability and efficiency
  - delivery based on equality and “transparent” access to services

- Contribute to create added-value by information sharing and process automation and follow-up
**Exploitation strategy**

- Gain in-depth-knowledge about solutions able to interoperate at application level, by designing and developing standard services based on the SOA paradigm.

- Seize the opportunity to demonstrate in a real context a prototype services architecture of cooperating distributed healthcare systems:
  - Designed for interoperability among heterogeneous healthcare actors,
  - Able to fully support clinical and healthcare processes centered on patients and based on the continuity of care.

- Gain competitive advantage by implementing cutting-edge products conform to international standards and designed according to a service oriented / model driven approach.

- Strengthen the industrial collaboration among the project’s partners in the healthcare market, in continuity with previous experiences in e-Government and Healthcare.
Any Question?

Thank you

HealthSOAF web site: www.healthsoaf.it