openIMIS-based Client Registry

Two-Sentence Overview

The goal of this project is to increase the scope of the open-source Insurance Management Information System (openIMIS) by extending the beneficiary management module, which already deals with insurees' personal and identification information, to respond to Client Registry's (CR) requirements and standards, to be self-sufficient and, at the same time, compatible with the largest open-source programs for healthcare providers through the existing but yet to be extended openIMIS FHIR module.

The team composed by Swiss Tropical and Public Health Institute (Swiss TPH), the designer and developer of the legacy openIMIS version, implemented in five countries, and experienced with Civil Registration and Vital Statistics (CRVS) systems, and SolDevelo, the developer of the openIMIS FHIR module and with experience in integrating health systems, will join their expertise to respond to OpenHIE project requirements in general and to OpenHIE Client Registry Community's requirements and expectations.

Executive Summary

Although several CR specific tools exist, we are convinced that openIMIS can be easily and effectively enhanced to compete in this very specific and well-defined market. With already existing functionalities to manage beneficiaries, we will use Digital Square's investment to build a tool that manages all the client registration in one place. The openIMIS-based CR will be a self-sufficient product. As a standalone tool, the openIMIS-based CR will work with open-source libraries and tools, making it free for use and accessible in Low and Middle-Income Countries. In the core of our tool, we will allow a flexible data model, a strong de-duplication mechanism, a strong and configurable ID mechanism, and an advanced search feature.

Specific user interfaces will be developed for clients management and administration, including import and export functionalities. Specific "patient identification" modules (based on technologies like fingerprint or QR codes) will allow easy and effective user identification, allowing the implementers to use the best-suited solution for their needs. The existing openIMIS FHIR module will be enhanced with resources that will meet the relevant Fast Healthcare Interoperability Resources (FHIR) profiles and will support "Registration as a Service". Quality Assurance and documentation are part of our development processes. To allow easy and efficient installation, we will provide Docker packaging mechanisms satisfying Instant OpenHIE requirements.

Consortium Team

SolDevelo

- Responsible for:
    - technical project management, software development

- Point of contact:

  - Jakub Sławiński - SolDevelo CTO

- Organization's relevant qualifications

  - SolDevelo is a dynamic IT company focused on delivering high-quality software and innovative solutions. It has a deep expertise in the IT projects management and development, gathering experience in various projects during the last decade, for such institutions as:

    - VillageReach

    - Terre des hommes

    - Grameen Foundation

    - Pathfinder International

    - Benetech

    - FrontlineSMS

    - And many, many others

  - SolDevelo will be able to gather exact requirements, prepare project timeline, manage development according to SCRUM principles and deliver the final results back to the community.

- Relevant experience and examples of related work

  - SolDevelo has been involved in many opportunities that required skill sets relevant to this particular project, for example OpenMRS (core contributors), Health Level Seven International (HL7) FHIR (OpenMRS Sync 2.0 module), nationwide micro-service based implementations (OpenLMIS), nationwide OpenHIE architecture based implementations (National Health Infrastructure project with such components like OpenELIS, DHIS2, OpenMRS and many other HIE compatible applications, health standards-based workflows for the Client Registry, Facility Registry, Health Management Information System, Shared Health Record, and Interoperability Layer).

- Qualifications of key members of the proposed project team

  - *Kamil Madej*

    - Senior-level Java Developer/Team Leader (BSc. Engineering) at SolDevelo

    - Working in international teams for various projects/clients, like:

      - openIMIS

      - OpenMRS

      - MOTECH

      - Terre des hommes

      - Connect for Life

    - Performing code review

    - Creating high-level designs using tools for wireframing

- - - Leading several frontend and backend development teams
- Number of years in operation
    - SolDevelo was established in 2009 and started contributing to openIMIS since January 2019.

Swiss TPH

- Responsible for:
    - Know-how in Health Beneficiary Registry, openIMIS, inputs for Concept development, openIMIS system/architecture design, drafting of technical specifications for development to be undertaken on openIMIS
- Point of contact:
    - Dragos Dobre - IT Systems Architect
- Organization's relevant qualifications
    - The Swiss Tropical and Public Health Institute (Swiss TPH) is a world-leading institute in global health, with a particular focus on low- and middle-income countries. By uniquely combining research, services, and education and training, Swiss TPH aims to improve the health and well being of populations through a better understanding of disease and health systems and by acting on this knowledge.
- Relevant experience and examples of related work
    - Swiss TPH is currently active in 300 projects in over 100 countries, working across a variety of topics from infectious and non-communicable diseases, environment, society and health as well as health systems and innovative interventions. It has more than 800 employees and students from over 70 nations currently work at Swiss TPH. About 600 are based in Basel, while another 200 are based abroad in 40 different countries.
    - Swiss TPH currently hosts the WHO Collaborating Centre for Health Technology Management and eHealth. The Swiss Centre for International Health (SCIH) provides consultancy and project implementation services. As a department of the Swiss TPH, SCIH draws on in-house expertise and synergies between the research and education departments to design and innovate solutions including information systems. The in-house know-how is state-of-the-art knowledge in a broad range of topics including primary healthcare, health economics and financing, health technologies, sexual and reproductive health and health promotion.
    - The Health Economics and Financing and the Health Technology and Telemedicine Unit jointly has been involved in the design and implementation of the Insurance Management Information System (which is the genesis of the openIMIS initiative) since its inception in Tanzania and has supported its implementation in a number of countries. Having worked on grounded solutions with local software vendors and generalizing it for operations by different insurance models it now supports the direction of the software to becoming more modularized and adhering to global standards to ensure better interoperability in its IT environment.
    - Swiss TPH is currently implementing two projects at scale for deployment of insurance schemes through openIMIS, in Tanzania and Cameroun, and two openIMIS pilots in Chad and Democratic Republic of Congo. In addition, Swiss TPH

is actively involved in the development of openIMIS as part of the IT & product team of the openIMIS initiative.

- In parallel of these health insurance-related projects, Swiss TPH is also implementing projects focused on systems' interoperability such as a Clinical Decision Support System (CDSS) in Nigeria where data collected through CommCare is automatically integrated in DHIS2, or more globally, a civil registration system collecting and evaluating birth and death events through ODK and integrating them as tracked entities in DHIS2.

- Qualifications of key members of the proposed project team

  - *Dragos Dobre*

    - IT System Architect at Swiss Tropical and Public Health Institute

    - OMG-Certified Systems Modeling Professional™

    - Over 4 years of IT teaching experience at University Level

    - Management of software life cycle (from specification to development to deployment)

    - Development of open source applications

    - Maintenance of open source software source code

    - Speaking at international conferences

    - Publication of scientific articles

  - *Michael Stahl*

    - Involved in various projects on Interoperability and his focus in recent consultancy missions was on linking the health service delivery ICT solutions with the Health Financing side

    - Worked on health identifiers under the Asian Development Bank and worked intensively on strategic solutions for better connecting existing ICT applications within the health domain

    - Involved in a pilot project in Cambodia which aimed on setting up a Health Beneficiary Registry (2018) and is currently advising the National Social Protection Council inPhnom Penh during the set-up of a Social Protection Registry

    - Advisor and facilitator for the GIZ openIMIS project and already worked on process design and requirement specifications for including the formal sector requirements to the product

    - Experience with CRVS Systems and the required linkages to Client Registries (which is the enabler foreGovernment solutions)

- Number of years in operation

  - Swiss TPH founded in 1943 is based in Basel, Switzerland and is an associated institute of the University of Basel.

Background or Problem Statement

Developed from 2012, openIMIS was built by Swiss TPH as a monolithic system using Microsoft technologies (the legacy openIMIS version). openIMIS supports beneficiaries management and already covers information like personal information (including ID card number), family relations, identification mechanisms (unique insuree number, photo, QR code).

Since 2018, the solution has been redesigned and redeveloped by Bluesquare using open source technologies (Python/Django and Javascript/ReactJS) to compose a modular architecture of the solution (the modular openIMIS version). Because the migration from the legacy to the modular version is a long process, openIMIS Initiative, the group behind openIMIS, has decided to migrate the solution module-by-module. On this day, the modular architecture is well specified and developed, and two openIMIS modules were already migrated (Claim and Location modules).
In addition, the new modular architecture has permitted SolDevelo to develop the FHIR module, allowing the integration of three open-source health systems (OpenMRS, Bahmni and DHIS2), the first step for OpenHIE architecture integration. The development of the FHIR module focused on the claim submission process that limits the support of beneficiary registration workflows.

Under the Digital Square D1 scope, the enrollment process-related modules will be migrated and we expect the Insuree module to be available at the beginning of this project.

Building an openIMIS-based Client Registry has several advantages: openIMIS already integrates beneficiary management features, both builders know very well openIMIS' infrastructure and know exactly what new functionalities are required to create a full and successful Client Registry tool. Moreover both organizations for several years were thinking about creating a client registry module which will be a modern, fully developed tool for the 21st century but which include several modern solutions for problems occurring in developing countries. SolDevelo as a main developer has experience with client registry which was even used in one of their implementations in Haiti. However, it didn't meet their requirements and the team had to face up with many problems which had blocked the whole workflow process.

With a developed Insurance Module, Client Registry could be one of the most fulfilling requirements tools and be implemented not only in the most remote areas.

Digital Health Technologies

This project is based on the openIMIS digital health tool. There are lots of advantages to start from this tool, from beneficiary management features to interoperable interfaces.

Fast Healthcare Interoperability Resources (FHIR) is a draft standard describing data formats and elements (known as "resources") and an application programming interface (API) for exchanging electronic health records. The standard was created by the Health Level Seven International (HL7) health-care standards organization. We will use this standard for the API communication protocol and as the internal data structure using PostgreSQL, thus developing an interoperable solution ready to be integrated into standardized health architectures (e.g. OpenHIE). Since FHIR will be used as the standard of data exchange, it will be possible for the CR to integrate with different systems that implement the standard.

Use Cases and User Stories
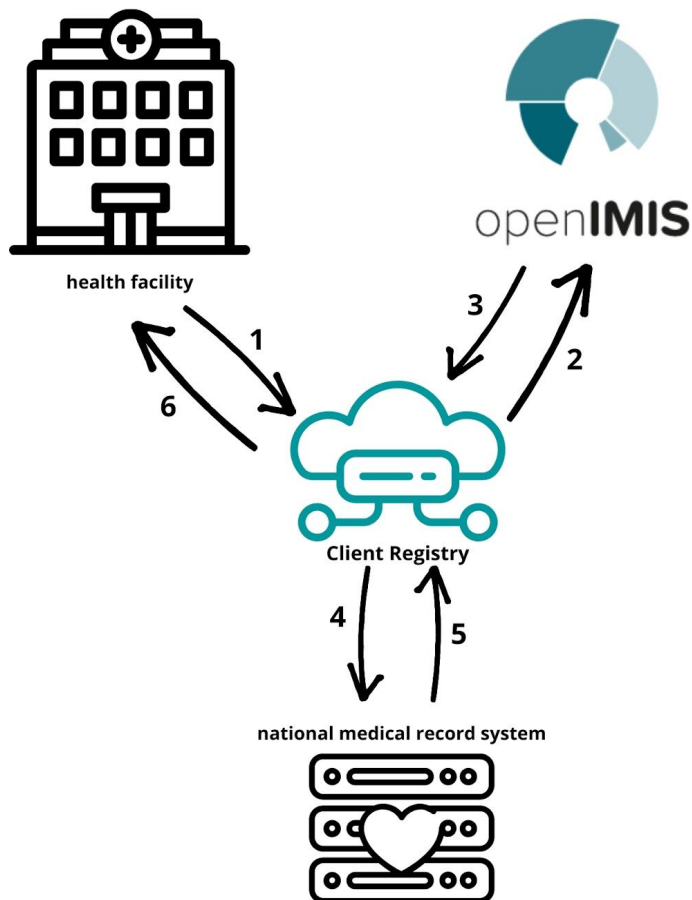
A person gets registered in a health facility, then:

1. openIMIS based Client Registry which is used by health facilities is contacting a server where all the data is stored.

2. The server connects with openIMIS database to find all information about the patient.

3. Regardless of the effect, openIMIS sends information back to the server with info about fault or success of the process

4. If openIMIS didn't find information about the patient, server connects with national medical record system

5. National medical record system sends back information to the server if the patient has ever been registered in any clinic in the country. It has to save that info in its data

6. Local server sends back information from national medical record system with the whole information

The situation is quite different when a patient goes for the first time in its life to a doctor/health clinic and he/she hasn't been ever registered. Then the health facility has to register a person in its server and then upload the information in the main health management system. Depending on the possibility

we want to make once a month or once a week, a big update of the whole information in the health facility so the server will keep a backup.

We will allow a flexible data model, a strong de-duplication mechanism, a strong and configurable ID mechanism, and an advanced search feature.

Objectives and Activities

The technical activities will be grouped into five work packages (WP).

WP1. openIMIS CR Module

Objective 1.1: openIMIS DB migration to PostgreSQL

Activity 1.1.1: openIMIS DB migration to PostgreSQL

It is required to work with open-source libraries and tools, making it free for use and accessible in Low and Middle-Income Countries. This activity is already included in the openIMIS roadmap.

Objective 1.2: openIMIS CR backend module development

Activity 1.2.1: Create initial openIMIS CR module and link with other components

In scope of this activity, we will create an initial module and link with required openIMIS modules

Activity 1.2.2: Create a flexible data model

Create a flexible data model to meet CR requirements. We will use JSONB data type.

Activity 1.2.3: Implement strong de-duplication mechanism

Based on smart deterministic and probabilistic algorithms, the system shall constantly look for duplicate records in the registration system. The algorithms scan for data elements within the patient's information including demographic data, identity data and, depending on the country, biometric data, such as AFIS data or facial data.

Activity 1.2.4: Implement strong and configurable ID mechanism

Upon a new (first-time) registration of a patient a new unique key number will be issued. This key will be used as the master key (also known as the golden key or master index) and all further keys will be added to the patient as "further key" together with the assigning authority. The code will be completely random, without any partitioning and the number of digits shall be freely configurable prior to implementing the system. The default shall point to 12 digits and 1 checksum digit. The Verhoeff algorithm, a checksum formula for error detection or a similar strong, robust error detection algorithm shall be used for the checksum digit.

Activity 1.2.5: Create advanced search feature

Advanced search will be based on different fields and parameters to cover multiple use cases from different integrated systems.

Activity 1.2.6: Use existing and add new patient matching algorithms

The openIMIS CR module will provide smart deterministic and probabilistic algorithms to identify a patient. This matching algorithm, as described during the deduplication, is used to formulate an effective statistical measure of how closely profiles match. The matching capabilities during identification, matching and deduplication shall be the same and include: Soundex matching, pattern matching, name variant matching amongst others.

Activity 1.2.7: Improve logging and full audit trails of all changes

We will extend current logging and audit trails in openIMIS to be sure that the most important information can be easily verified in the history.

Objective 1.3: QR and fingerprint modules development

Activity 1.3.1: Implement QR and fingerprint modules in openIMIS

Specific "patient identification" modules (based on technologies like fingerprint or QR codes) will allow an easy and effective user identification, allowing the implementers to use the best suited solution for their needs.

Objective 1.4: openIMIS CR frontend module development

Activity 1.4.1: Develop specific user interfaces for clients management

Based on a previously created backend module, we will provide a user interface for clients management. We will use Material Design and will follow the openIMIS UI design principles.

Activity 1.4.2: Implement import and export patient functionalities

CR administrators will have the possibility to import and export patients through CSV files.

WP2. openIMIS FHIR Module

Objective 2.1: openIMIS FHIR module extension

Activity 2.1.1: FHIR extensions development

To support the Client Registry interface, we have to add new resources to FHIR and to make it work as Registration as a Service. New extensions and resources will be defined and developed.

Objective 2.2: openIMIS FHIR module documentation

Activity 2.2.1: FHIR module documentation improvement

openIMIS FHIR module documentation will be extended to include the CR related resources. In addition, CR-specific integration documentation and FHIR profile will be produced to allow end-users to use the CR as a stand-alone system.

WP3. Packaging and Installation

Objective 3.1: Docker package with openIMIS CR module

Activity 3.1.1: Docker package with openIMIS CR module

Docker packages to easily install the openIMIS CR will be developed. This will install necessary openIMIS modules for backend and frontend for a completely working CR.

Community Feedback

We want to use the creative power of this enormous community. Creating topics on chats, doing daily stand-ups, that are public and open to everyone who is interested in this project and also doing showcases will help us achieve this task. Working with the community everyday of the project will allow us to incorporate their feedback, comments and suggestions as quickly as possible.

Swiss TPH has been involved in the design and development of openIMIS in all its implementation sites so far, and as such, will be able to source feedback from users on new developed features and their practicality in the field. Also, Swiss TPH is currently mandated in the Implementers and Developers Committees within the openIMIS initiative which will allow direct feedback of the developments to the community via it's dedicated communication and contribution platforms (JIRA, Wiki, GitHub).

Also, both organizations take part in community's meetings of OpenHIE conferences (SolDevelo was even last year at the conference in Addis Ababa (Ethiopia) where with OpenHIE they shared their experience and discussed topics).

Schedule

The following is a high-level work plan.

Activity	Lead Team	Month					
		1	2	3	4	5	6
OpenIMIS DB migration to PostgreSQL	SolDevelo	▓					
openIMIS CR backend module development	SolDevelo	▓	▓	▓			
QR and fingerprint modules development	SwissTPH			▓			
openIMIS CR frontend module development	SolDevelo			▓	▓		
openIMIS FHIR module extension	SolDevelo					▓	
openIMIS FHIR module documentation	SolDevelo					▓	
Docker package with OpenIMIS CR module	SolDevelo						▓

Deliverables

Work Package	Deliverable	Schedule
1. openIMIS CR module	openIMIS DB migration to PostgreSQL	November 2020

	openIMIS CR backend module development	January 2021
	QR and fingerprint modules development	January 2021
	openIMIS CR frontend module development	February 2021
2. openIMIS FHIR module	openIMIS FHIR module extension	March 2021
	openIMIS FHIR module documentation	March 2021
3. Packaging and installation	Docker package with openIMIS CR module	April 2021

Global Good Maturity Model Assessment

In the attachment: Global Good Maturity Model Assessment for openIMIS