Improving the Automated Testing, Interoperability, and Privacy of the Open Smart Register Platform (OpenSRP)

Two-Sentence Overview

The goal of this project is to improve the automated testing, interoperability, and privacy of the Open Smart Register Platform (OpenSRP) as a point-of-service application in alignment with the OpenHIE architecture. We propose a series of individual work packages that will improve test automation, support mobile Care Services Discovery (mCSD), and mask personally identifiable information.

Executive Summary

The Open Smart Register Platform (OpenSRP) was recognized as a global good in 2018 and has progressively improved in maturity through support of consortium members, implementing partners, and donors. OpenSRP is a person-centered digital register and point-of-care software system for frontline workers that offers a suite of customizable features for countries wanting to digitize their legacy paper registers, which complements and integrates with common national-level digital systems (HMIS, EMR, LMIS). A committed collective of technology, research, and implementation partners have evolved the software to a point of maturity characterized by multiple national deployments, high performing technology at scale, and emerging documentation around specific use cases for RMNCAH, TB, HIV, Malaria and Early Childhood Development. OpenSRP is seeking investment to improve the shelf readiness as a feature-rich service used by health workers at the point-of-service so it can be more easily deployed and supported in our current and future deployments. Funding would help OpenSRP overcome identified constraints associated with more broad adoption and interoperability aligned with the OpenHIE architecture.

We propose three work packages which can be independently funded:

- **Work Package 1:** Improving QA by Adding an automated testing framework and improving modular test coverage to 80%.
- **Work Package 2:** Establishing OpenHIE interoperability by improving mobile Care Services Discovery (mCSD) support.
- **Work Package 3**: Add Personally Identifiable Information masking across all OpenSRP APIs.

Consortium Team

Ona is a technical social enterprise focused on global health and data solutions, based in the United States & Nairobi, Kenya. The company has over 60 employees - Approximately 40 of whom are software developers, architects, data and machine learning experts. Ona has extensive experience designing, developing and implementing health information systems that are used at national scale and integrate with existing government health information systems and open standards. Ona has developed numerous open source standard tools and libraries in the space that are used by mobile teams to add functionality to their existing technologies. Ona serves as the technical lead for global goods product, OpenSRP, having co-created the platform with the World Health Organization and various partners between 2014 and 2018 in the THRIVE Consortium study that ran in India, Bangladesh and Indonesia.

Ona's key team members working on this proposed project include our OpenSRP engineering leads Martin Ndegwa and Samuel Githengi who each have years of experience developing OpenSRP. The project will be led by our technical project manager Hildah Ngondoki and advised by our health technical

lead Craig Appl, MPH. This team combined has decades of experience in implementing platforms at scale across a wide range of industries including telecommunications, banking, and health. We lead a team of 20 OpenSRP engineers as well as the global OpenSRP Technical community. All software development will take place in our Kenyan office in Nairobi with support from US and South Africa based team members.

Background or Problem Statement

The Open Smart Register Platform, OpenSRP, is a mobile-first platform, built to enable data-driven decision making at all levels of the health system. It is a digital global good that was designed to address the problem with existing technology solutions that are fragmented, unscalable, functionally limited, and are not interoperable with national-level information systems. It connects frontline health workers with their constituencies and the health system at large. It supports the health worker in doing point-of-care prioritization of tasks, tracking service delivery and greatly simplifies reporting from the field. Once installed on an android device using a data connection, the tool can work completely offline to accommodate low bandwidth constraints - in even the most remote locations on earth.

OpenSRP is deployed at scale across multiple countries and covering a broad range of health challenges. Beyond immunization (one of the first use cases of the app), OpenSRP is currently deployed and live in 6 countries with different donors, implementing partners and stakeholders. Another 9 country programs are in progress or planned for roll-out by the end of 2020. The longest-running deployments to date are in Pakistan, Bangladesh, Indonesia, and Zambia, where the tool enjoys great buy-in from Ministries of Health and local implementing partners.

The goal of this proposed project is to **improve the shelf readiness of OpenSRP by improving the quality assurance and testing, interoperability, and privacy as a point-of-service application in alignment with the OpenHIE architecture**. We propose a series of individual work packages that will improve test automation, integration with health worker - and facility registries, and mask personally identifiable information. These work packages will allow implementing partners to ensure a higher level of platform resiliency and interoperability in current and future deployments.

Digital Health Technologies Overview

OpenSRP has three core technical components, the native Android client, Java server, and a data warehouse. We propose to develop on all three components for each of these independent work packages. We intend to improve unit -, functional -, and integration tests in the Android client and Java server, improve the REST Application Programming Interfaces (API) in the Java server, and improve the Extract, Transform, Load (ETL) process that moves data from the OpenSRP server to the data warehouse so we can protect personally identifiable information.

The target of this proposal is to define three distinct work packages that could be independently funded by Digital Square. We have restructured the standard template into three distinct sections for ease of comparison.

Work Package 1: Improving QA by Adding an automated testing framework and improving modular test coverage to 80%

Digital Health Technologies

OpenSRP is a modular platform that allows implementing partners to select and deselect features that they wish to deploy in their context. More than a dozen modules are available across the OpenSRP

server, Android client, and web interface. The target of this work package is to implement a unified automated QA and testing framework across these multiple technical components so that we can build standardized unit, functional, and integration tests.

OpenSRP's Continuous Integration/Continuous Deployment (CI/CD) process includes automated testing of all modules that are compiled and deployed using Travis CI. Additionally, each repository is linked to coveralls.io, which analyzes test coverage across each module across the platform. Finally, we utilize popular test libraries in Java and our Android development environments.

Use Cases and User Stories

This work package will systematically improve all testing across the platform by increasing test coverage, automating many manual steps, and systematically improving the quality assurance process for all implementing organizations. Ultimately, this will enable Ona and our technical collaborators to deliver a better product across the globe and set us up to maintain that quality for the future. Technically, we will need to adjust our human and user acceptance testing workflows that are performed by our Quality Assurance team and ministries implementing OpenSRP.

Objectives and Activities

Improved test coverage is critical to ensure that the platform functions in production environments. However, our test coverage across the platform is between 0% and 85%. With this funding we will formalize and implement the testing framework and improve test coverage across the platform with a target of reaching 80% as measured on our Coveralls test coverage platform.

Objective 1.1: Add an automated testing framework and improve modular test coverage to 80%

- *Activity 1.1.1: Adding the automated test framework to the Android client, data warehouse, and server libraries*
- *Activity 1.1.2: Updating test coverage across 12 modules to reach 80%*

Schedule

The following is a high-level work plan.

Activity	Team Location Month	Month			
		M 1	M 2	M 3	M 4
Activity 1.1.1: Adding the automated test framework to the Android client, data warehouse, and server libraries	Kenya	x			
Activity 1.1.2: Updating test coverage across 12 modules to reach 80%	Kenya	x	x	x	x

Deliverables

Deliverable	Month
Activity 1.1.1: Demonstration of automated test framework across the platform and link to GitHub code	1
Activity 1.1.2: Report of test coverage progression from start to end of project.	4

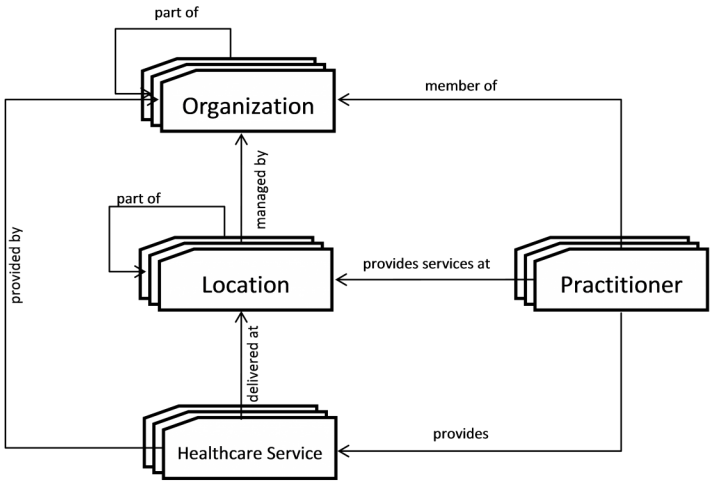
Work Package 2: Establishing OpenHIE interoperability by improving mobile Care Services Discovery (mCSD) support.

Digital Health Technologies

OpenSRP supports FHIR Organizations, Locations, Practitioners, and PractitionerRoles modeled off of the mCSD profile. We use these data elements to manage where work is being performed and linking teams to the appropriate information. We believe these data elements are foundational for information exchange. This work package focuses on improving the OpenSRP REST API for Locations, Organizations, Practitioners, and PractitionerRoles so that we fully support the FHIR API patterns for searching, creating and updating each resource in accordance with the IHE supplement. Additionally, we will add support for HealthcareService, OperationOutcome and Bundle in order to achieve full compliance. Ultimately, this will allow OpenSRP to pull in master lists from OpenHIE infrastructure systems that manage locations and the health workforce.

Use Cases and User Stories

The mobile Care Services Discovery profile by the Integrating the Health Enterprise (IHE) organization defines a process for standardizing and accessing information about health care provided within a geographic area. The standard defines the locations, healthcare services provided, practitioners responsible for providing care, and organizations who are responsible for managing the locations and practitioners. mCSD defines specific domain objects and workflows that must be supported. Implementation of this standard allows OpenSRP to interact with a health worker registry and facility registry in order to standardize information exchange across the geographic area.



Our team has implemented GET and POST API endpoints that conform to the mCSD standards for organizations, locations and practitioners. We have also implemented practitionerRoles. However, we have not fully implemented the other endpoints that are required by the IHE profile for these endpoints, nor implemented the Healthcare Service endpoints.

Objectives and Activities

Objective 2.1: Establishing OpenHIE interoperability by improving mobile Care Services Discovery (mCSD) support.

- *Activity 2.1.1: Improve and demonstrate that the OpenSRP REST API offers a FHIR compliant pattern for Locations, Organizations, Practitioners, and PractitionerRoles*
- *Activity 2.1.2: Build and demonstrate that the OpenSRP REST API can support HealthcareService, OperationOutcome, and Bundle*
- *Activity 2.1.3: Perform integration testing with Instant OpenHIE*

Schedule

The following is a high-level work plan.

Activity	Team Location Month	Month		
		M 1	M 2	M 3
Activity 2.1.1: Improve and demonstrate that the OpenSRP REST API offers a FHIR compliant pattern for Locations, Organizations, Practitioners, and PractitionerRoles	Kenya, US (scoping)	x		
Activity 2.1.2: Build and demonstrate that the OpenSRP REST API can support HealthcareService, OperationOutcome, and Bundle	Kenya, US (scoping)		x	x
Activity 2.1.3: Perform integration testing with Instant OpenHIE	Kenya			x

Deliverables

Deliverable	Month Due
Activity 2.1.1: Gap analysis report, link to source code, report of work completed	1
Activity 2.1.2: Link to source code, demonstration of features, documentation on OpenSRP wiki	3
Activity 2.1.3: Demonstration of integration with Instant OpenHIE	3

Work Package 3: Add Personally Identifiable Information (PII) masking across all OpenSRP APIs.

Digital Health Technologies

OpenSRP stores personally identifiable information (PII), which is any data collected that can be used to identify a person. This allows frontline health workers to be able to identify individuals in their communities and health facilities and better perform their job duties. PII is centrally stored with access managed by OpenSRP's role-based access control. However, our REST APIs do not mask personally identifiable information. This becomes problematic when moving information from the transactional database to third party applications and the data warehouse because our APIs return all information regardless of the sensitivity of the underlying information. This exposes PII to any middleware or software systems that have access to the REST APIs when it isn't necessarily needed. For example, a customer may need access to the APIs to store information in PowerBI. The middleware that performs the ETL will have

access to PII, even though information, like patient names, don't need to be extracted to fully perform the ETL process.

Use Cases and User Stories

E.McCallister(2010) defines PII as "any information about an individual that is maintained by an agency that can be used to distinguish or trace a person's identity". De identification is the process of masking, obscuring, or removing PII data such that the information cannot be used to identify an individual. The systems would be in a position to use algorithms to re-identify a person when needed.

Third party applications have a need to access information so that we can report on activities that are captured by the platform. We actively support integrations with data warehousing technologies, large data extracts, and Monitoring and Evaluation teams. We wish to streamline this process by offering de-identification of information as a service by hashing or removing PII based on permissions established in the system. Additionally, we aim to provide an internal process available to system administrators on the OpenSRP server to re-identify PII so we can continue to support troubleshooting.

Objectives and Activities

The target of this work package is to build a templated pattern in the application to identify which fields should be considered sensitive at varying levels. Once we identify which fields should be masked, the team will implement masking across all REST APIs by default and implement role-based access controls to unmask PII only for frontline health workers and those users who need access to the PII.

Objective 3.1: Add Personally Identifiable Information masking across all OpenSRP APIs.

- *Activity 3.1.1: Build and demonstrate the process for identifying which fields should be masked from the moment data is collected.*
- *Activity 3.1.2: Build and demonstrate that all APIs that include PII are masked by default unless the user accessing the API has the appropriate permissions*

Schedule

The following is a high-level work plan.

Activity	Team Location Month	Month		
		M 1	M 2	M 3
Activity 3.1.1: Build and demonstrate the process for identifying which fields should be masked from the moment data is collected.	Kenya	x		
Activity 3.1.2: Build and demonstrate that all APIs that include PII are masked by default unless the user accessing the API has the appropriate permissions	Kenya		x	x

Deliverables

Deliverable	Month Due
Activity 3.1.1: Scoping document, link to source code, demonstration of feature	1
Activity 3.1.2: Link to source code, demonstration of features of all APIs	3

Community Feedback

Ona regularly contributes to multiple open source communities including the World Health Organization's Computable Guidelines working groups and OpenHIE. Our team has contributed to numerous OpenHIE communities and works to actively build shared understanding of best in practice work in our space. We will continue these efforts and contribute any content, workflows and documentation to the OpenHIE communities as we develop these work packages.

Notes on Final Proposal

We need to add the following attributes to the final proposal after it has been reviewed by the community:

- Global good maturity model assessment
- Budget
- CVs of key members