Advancing OpenELIS Global Shelf-Readiness through Improved Quality Assurance
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I.   Overview

OpenELIS Global aims to improve its Shelf-Readiness through a transition from a manual software release testing model to a robust, comprehensive, and systematic automated testing process that will improve efficiency and reliability, reduce maintenance costs for the software, and facilitate re-use of OpenELIS Global code by community members. This investment will result in 1) adoption of the OpenHIE testing framework and tooling for automated testing of OpenELIS, 2) collaboration with the OpenHIE Laboratory Information Systems Community of Practice (LIS CoP) to establish re-usable LIS interoperability test cases that can be adopted by other software steward members in the LIS CoP, and 3) dissemination of LIS/LIMS software testing protocols and guidance for broader global goods communities to adapt in their software testing practices.

II.   Executive summary

OpenELIS Global is recognized as a leading open-source laboratory information system (LIS), used for nearly a decade in Cote d'Ivoire, Haiti, and Vietnam; and as part of the Bahmni HMIS distribution. The government of Mauritius also recently adopted OpenELIS in its national reference laboratory to manage information related to SARS-CoV-2 diagnostics and pandemic response.

The OpenELIS Global team will employ the proposed investment from Digital Square to use the OpenHIE testing framework to develop and implement an automated testing framework for its software development cycle. Moving from manual to automated testing will improve efficiency, lower the cost of maintenance, and most importantly, increase implementer trust in the product. Adoption of a framework will increase the reliability and completeness of software testing. A more robust quality assurance process will help ensure that OpenELIS Global implementers can rely on the software from the moment they download it to the time they deploy it in laboratories, to facilitate delivery of high-quality results and data to healthcare providers, patients, and public health agencies.

The OpenELIS Global team plans to collaborate with the OpenHIE community to incorporate the OpenHIE testing framework and tools into its quality assurance processes, using the OpenMRS QA automated testing approach as our model. We will collaborate with the OpenHIE Laboratory Information Systems community (LIS CoP) to prioritize and develop LIS interoperability test cases around established LIS interoperability specifications published by the LIS CoP that can be reused by other LIS software in the OpenHIE architecture, specifically in the Instant OpenHIE project. In addition, I-TECH will leverage its expertise in creating high-quality training curricula to develop a learning session on automated testing for broader global goods consumption, including in the OpenHIE Academy, to aid in disseminating

standardized test cases and promoting a shared foundation for quality assurance within the OpenHIE architecture.

III. **Consortium team**

The Digital Initiatives Group at I-TECH (DIGI), University of Washington (UW) is composed of digital health experts, experienced global goods developers, and country-level implementers in global public health who lead multiple digital health global goods communities of practice, and lead the identification of best practices and solutions that are the best fit-for-purpose in resource constrained environments. DIGI is the founder and ongoing steward for the OpenELIS Global codebase, supporting both the widely used OpenELIS code base and contributions, and the growing community at large.

OpenHIE Laboratory Information Systems Community of Practice (LIS CoP) is an OpenHIE subcommunity bringing together laboratory informatics experts and software teams to advance LIS/LIMS best practices and standards for use in digital health implementations. The LIS CoP collaborated closely with DIGI in Notice C in the OpenLIS-OpenMRS integration work that led to the publication of the OpenHIE LIS-EMR architectural pattern. The LIS CoP is co-founded by a DIGI faculty co-lead.

IV. **Project Description**

Problem statement: OpenELIS Global has long relied on manual testing for each of its releases due to constraints in funding and project schedules, resulting, over time, in slower iteration and requiring high levels of personpower in terms of both time and costs. Although OpenELIS Global is considered mature and is trusted by implementers, the reliance upon manual testing has prevented the product from achieving the highest level of quality for each and every release—essential for the safe and effective use of the product—which is a critical component for attaining shelf-readiness. In addition, implementer acceptance of product releases has been isolated and limited to date, leaving a gap in ensuring the product meets the anticipated prioritized needs of the implementer community. Lastly, to improve OpenELIS interoperability, there is a critical need to develop reusable automated interoperability testing cases in the OpenHIE architecture as part of the shelf-readiness scaffolding for the larger ecosystem of health information management, and use in the Instant OpenHIE project.

Objective for Work Package 1: Develop documented OpenELIS test cases and automated testing using the OpenHIE test framework and tooling.

Techniques/Process: The OpenELIS team will define an approach to developing OpenELIS test cases and automated testing using the OpenHIE testing framework and tools, with the OpenMRS QA initial automated testing approach serving as the model. The team will collaborate with the OpenHIE LIS CoP to ensure the test cases written in Gherkin can potentially be used by other LIS products. Using a consultative process, the team will draft and finalize test cases and document test libraries. Each component of the framework development, adaptation, and testing process will be assigned a deadline and have accompanying documentation of the process and outcome. Evaluation of the final deliverable will consist of testing of the framework within OpenELIS Global and running a test case for interoperability with other systems.

Deliverable/Schedule: Coherent package of test cases and documented test libraries (months 1-9).

Objective for Work Package 2: Collaborate with the LIS CoP to establish a portfolio of automated generalizable LIS/LIMS interoperability test cases for the OpenHIE framework, and use of LIS/LIMS products in the Instant OpenHIE product.

Techniques/Process: Our team will lead an initiative in the LIS CoP to create a community road map for interoperability test cases and support for the integration of the QA process and tooling into the LIS CoP. The team will convene working sessions with the community to identify and collaboratively develop reusable test cases and automated tests using the OpenHIE test framework. Through continuous outreach to implementers for feedback and contribution, the team intends to cultivate active participation and ownership of the business-acceptance side of the testing process. The road map will serve as an intermediate deliverable and tool for monitoring progress of test case development.

Deliverables/Schedule: OpenELIS Global shared practices, coding standards, and testing tools and libraries for interoperability using the OpenHIE testing framework (months 1-6) LIS CoP managed portfolio of re-usable LIS/LIMS interoperability test cases and automated tests following the published OpenHIE LIS/LIMS interoperability standards (month 1-9). These will be disseminated widely through the OpenELIS, OpenHIE, and LIS CoP community wikis, blogs, conferences, and webinars, as appropriate (months 7-9).

Objective for Work Package 3: Develop "OpenHIE Automated Testing" curriculum and education/training materials for dissemination in the OpenHIE Academy, and other potential digital health and global goods web-based forums and training packages.

Techniques/Process: The OpenELIS Global team will identify key learning objectives and practical, relevant content for skill building for rigorous QA processes, automated testing, and using the OpenHIE test framework. Using an informal assessment approach with the global goods community to gain an understanding of the cadres and needs, we will work with subject matter experts to design the course flow, identify existing content, and develop engaging, interactive content that addresses the key competencies and associated learning objectives.

Deliverables/Schedule: Facilitator and participant package of session materials that provide essential background and interactive, problem-based exercises to increase community knowledge of and adoption of OpenHIE automated testing principles and practices (months 4-9); course evaluation (month 9); outline for adapting the course to an online platform (month 9).

Risk Mitigation: There is a small risk of inability to fully use the OpenHIE testing framework and tooling. Any risk will be mitigated by collaborating with the OpenMRS QA team for lessons learned, best practices, and adapting successful approaches from their experience. In addition, there is a risk of being unable to generalize the documented test cases in Cucumber to be used by other LIS/LIMS in their testing. Following OpenHIE published architecture standards for interoperability will mitigate some of this risk, but inherently, there will be test cases for OpenELIS that simply do not apply to other LIS/LIMS or align with other LIS/LIMS custom use cases. Finally, there is some risk of the resulting test portfolio being unsustainable by the community due to resource constraints. This can be mitigated by using a well-managed roadmap for prioritizing test cases, integrating the QA process and tooling into the broader community to leverage other teams' resources, and by actively cultivating the implementer community to take ownership of business acceptance processes with regard to testing.