Request for Proposal #2023-009
OpenHIE Testing Harness and Test Framework

I.   Summary of Deadlines

The expected schedule for this application is outlined in the following table. Note that PATH reserves the right to modify this schedule as needed. All parties will be notified simultaneously of any changes through a modification posted on Digital Square's website.

Release of Request for Application	April 10, 2023
Virtual Q&A session	April 24, 2023
Applications due	**May 12, 2023**
Shortlist design presentations	May 22 to June 9, 2023
Applicants notified of decision	June 30, 2023
Number of contracts, and duration.	**One** vendor contract for a duration of up to **12 months**.

II.   PATH Statement of Business

PATH is the leader in global health innovation. An international nonprofit organization, we save lives and improve health, especially among women and children. We accelerate innovation across five platforms—vaccines, drugs, diagnostics, devices, and system and service innovations—that harness our entrepreneurial insight, scientific and public health expertise, and passion for health equity. By mobilizing partners around the world, we take innovation to scale, working alongside countries primarily in Africa and Asia to tackle their greatest health needs. Together, we deliver measurable results that disrupt the cycle of poor health. Learn more at www.path.org.

III.   Project Background and Proposed Timeline

A. Project Background

In pursuit of our Mission: ***connect health leaders with the resources necessary for digital transformation***, Digital Square offers a new way to invest in digital health—providing a space where countries and members of the global community can gather to think big and do good, together. By convening government officials, technological innovators, donor and implementation partners, and others across borders and boundaries in the Digital Square, we can grow possibility into reality by focusing on our common goal: **connecting the world for better health**.

Digital Square's work support three result areas:

1. **Alignment and Co-investment:** Digital Square helps to identify promising investment opportunities and provides operational support to streamline procurement.

2. **Global goods:** Digital Square promotes the development, adoption, and reuse of global goods, and helps increase their availability, adaptability, and maturity.
3. **Regional and Country Systems:** Digital Square helps elevate country priorities and strengthen regional and national capacity.

Digital Square is requesting proposals for the development of an **open-source testing harness and complete test framework** that will facilitate testing how well technologies align to the OpenHIE Architecture specification and health and data content, as specified by WHO SMART Guidelines.

Digital Square is inviting applications from interested parties to build on existing initiatives and develop a test harness that is open source and focused on reuse in the digital health domain. In addition, applicants will be required to engage with the OpenHIE communities and WHO SMART Guidelines architectural team and develop the associated test framework (complete set of tests and test data to run on the harness) to allow for testing of tools/solutions for their conformance to the OpenHIE Architectural Specification.

Testing Harness

Digital Square refers to a test harness as a collection of tools and data used to test an application for conformance to a defined specification. The test harness is envisaged to be comprised of the test execution engine, test scripts and data used in testing with a clear separation of concerns between components.

The testing harness will be comprised of test execution engines and test script repositories. A test execution engine is the software used to perform the test, not the software being tested. The test script repository is the location where test scripts and cases are stored. The results are to be collated and presented as a report.

Not to be confused with a **test framework**, a testing harness is the collection of software and test data used to test a digital health solution (software), whereas test frameworks are the set of processes and procedures through which tests are designed and implemented.

The resulting solution will be leveraged by additional software applications and tools, and as such should have a permissive open-source license as it may be leveraged by vendors developing OpenHIE/SMART Guidelines compliant software and other teams, such as the WHO Digital Health Clearinghouse and the local country validation laboratories to test compliance of digital health solutions to WHO SMART Guidelines compliance requirements and/or their defined requirements.

B. Proposed Project Timeline

PATH anticipates that the implementation period for one vendor contract will be up to 12 months.

IV.   Scope of Work and Deliverables

A. Scope of Work
Background

The OpenHIE community has developed an architecture specification through a collaborative community process over the past 10 years. Through this time, there have been numerous tools that have been identified as reference applications that implement parts of the specification. Together, these applications come to work together as components of the OpenHIE specification, however, to date, there has been no

empirical way to confirm compliance of these technologies to the said architectural specification (evaluating the ability to meet the (*i*) *interoperability requirements, (ii) function,* and, to a degree, the *(iii) non-functional requirements).*

As OpenHIE leverages the IHE profiles in a subset of their workflows, there has been historic testing of a few tools leveraging the Integrating the Healthcare Enterprise's (IHE) Gazelle testing framework. Historically, a few technologies from within the OpenHIE community have undergone IHE testing to certify their alignment to the key profiles identified in the OpenHIE specification. The IHE Connectathon events allow for testing between two or more tools to confirm adherence to the profile and require attendance at a scheduled connectathon. This is often out of the reach of many LMIC technical innovators due to costs and location and as such is often overlooked in the planning and development cycles of tools.

To date, there is no "golden record" for testing (i.e., a well-formed set of cases with known and expected outputs and responses against which a tool is evaluated) for OpenHIE and as such, there is a lack of ability to clearly vet how well aligned a technology is the specification. Either as it aims to be recognized as a core component (register/business layer) or as being able to comply with the identified workflows and interoperability profiles (i.e., being a consumer and contributor to an OpenHIE based health information exchange).

With the release of the [WHO SMART guidelines](#) and the Digital Adaptation Kits (DAKs), the World Health Organization (WHO) has an initiative to develop a **WHO Digital Health Clearinghouse**. The Clearinghouse will be a platform where its stakeholders will be able to find solutions that fit their health program requirements as identified by the WHO SMART Guidelines and components of the DAKs. The clearinghouse will assess, curate, and catalogue digital solutions that meet minimum requirements in the delivery of digital health interventions at the primary healthcare level. Details about WHO Digital Health Clearing House [can be found here.](#)

In addition, various global good tools have begun their own initiatives and efforts to develop compliance and evaluation tests to identify how they comply with the interoperability requirements and needs. OpenMRS and OpenELIS, for example, have worked to develop a testing approach that has also been considered by OpenHIE; namely, the use of Gherkin as a test description and documentation language.

Digital health solutions are being developed by different organizations, public and private, non-profit, and for-profit, with the goal of increasing health equity. And with this, there is an increasing need for adequate testing processes and tools. So far, there has not been a standard way to evaluate these digital health solutions against a set of criteria of minimum requirements. The envisaged testing harness will be a tool to assess digital health solutions on their compliance to the OpenHIE Architecture specification-- facilitating and industrializing not only the test execution, but also the test preparation, management, and reporting.

Proposed solution

Digital Square is seeking proposals from suitable vendors/consortium/development partners (bidders) to create a virtual, open-source testing harness and complementary test framework that will allow the verification of tools against the OpenHIE architectural specification. The solution will include the development, and creation, of all the required testing artefacts needed to validate the OpenHIE specification.
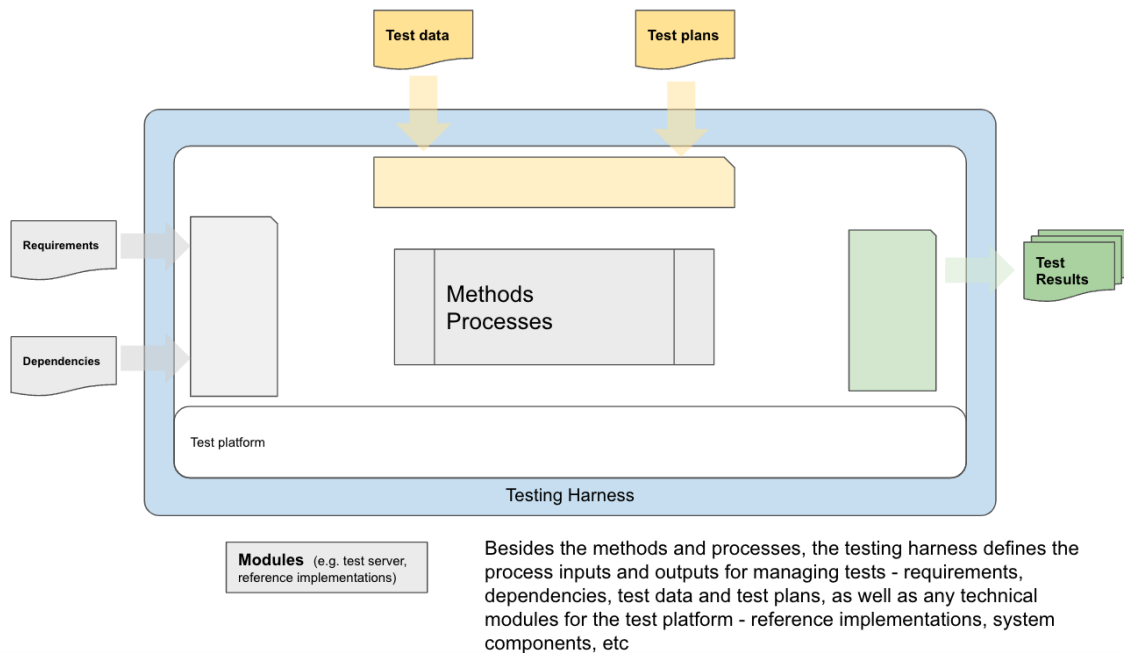
Besides the methods and processes, the testing harness defines the process inputs and outputs for managing tests - requirements, dependencies, test data and test plans, as well as any technical modules for the test platform - reference implementations, system components, etc

Figure 1: Conceptual overview of the testing harness

The envisaged solution will house the created test suites and cases and associated data to support the execution of tests to validate if a tool meets the requirements of the OpenHIE architecture, with an option to be expanded to meet the requirements of the WHO SMART Guidelines health content and generate a conformance report.

The primary requirement for the test harness to be developed is that it should be able to test a digital health solution's compliance to the OpenHIE Architecture specification. At the minimum, the test suite should support testing of the OpenHIE Component functional requirements and workflow requirements as well as the overall workflow specification as described in the OpenHIE Specification.
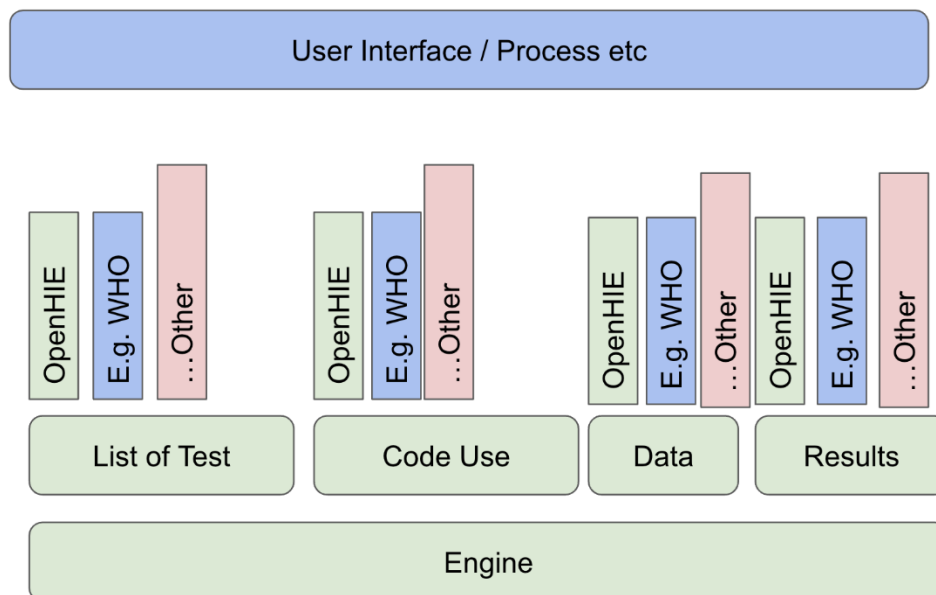

Figure 2: Conceptual diagram of the testing harness showing intended utilization of major components

The primary focus of this call is for the testing harness to be focused on facilitating testing against the OpenHIE requirements and specifications. However, the solution must be architected to accept the definitions of test suites for different test scenarios and should be able to run these test suites. I.e. the same underlying tooling and methods should allow for groups such as the WHO, Countries or other agencies to reuse the tool and test frameworks, adding and adjusting to meet their needs and generate their own outputs.

Note on HL7 FHIR

With the growing adoption and uptake of HL7 FHIR, there are many tools and use cases that are defaulting to HL7 FHIR as a data exchange standard. The envisaged solution is not just a FHIR conformance testing engine (there are tools that exist to support this). That said, with many interoperability profiles and approaches referencing FHIR the solution must be able to test against FHIR specifications as set out in the requirements. The solution must be designed and proposed in a way that allows the testing of other standards, profiles, and functions.

Testing FHIR specifications—clients, servers, consumers, repositories—can be facilitated using the same methods that are enabled by the FHIR specification: continuous delivery, automated documentation, and computable and versioned artefacts.

Testing types

OpenHIE represents an interoperability architecture, and as such, a large portion of the specification describes data exchange workflows and interactions between components. These exchanges expect key digital exchange functionalities (through the use of APIs) and as such are well suited for the use of automated testing to validate the functionality of a tool. The proposed solution must have automated tests for interoperability and, where possible, functional requirements to ensure that the required data sets and load conditions are present for accurate, repeatable results.

While automation testing works well for repeatable features and is prone to use for standard data exchange interfaces, there are functional requirements that are not easily automated for general reuse. For example, "Req 1: A user must log in with a username and password" or "Req 2: User should be presented with a graphical representation of the map of the selected area". As such, the solution must make an account for and have the ability to allow for manually stepping through a test approach documenting the steps, with appropriate evidence (such as screenshots, video etc.), and providing a manual evaluation of the test criteria.

Non-functional tests are more challenging to frame, however, the harness and proposal must make reference to approaches to document these as test criteria and propose ways to document the evaluation of a tool to meet these. Be it the uploading of narrative motivations or external documentation etc.

Performance metrics and tests are similarly varied for different tools and components but follow the pattern of the definition of the minimum expectation and the results of the evaluation; as such the proposed solution must showcase how performance tests are defined, documented, and run.

Examples of testable features

- Interoperability tests: allow testing a data exchange between two or more OpenHIE Architecture components.
- Functional tests: allow testing of specific functionalities (or workflows) within an OpenHIE Architecture component.

Test framework

A fully functioning OpenHIE testing harness requires that there are clearly documented test suites that describe the various test cases to justify conformance to the workflows and requirements of the architecture. As such the proposal must clearly articulate and show an understanding of the breadth of the OpenHIE specification and describe how it will approach the creation of the test framework. There is

expected to be clear leadership on how the tests will be described and documented using industry-standard languages (i.e., Gherkin), how and where the definitions, data sets, and execution code will be stored etc. All testing and automation scripts must be clearly documented and be published under open-source licenses.

Test results

The test harness should be able to produce open, standards-based test results report for review/interpretation. This report should be in a digital and API consumable format and follow open principles for sharing the results.

Alignment with WHO SMART Guidelines and Digital Clearinghouse assessment

As this solution will be leveraged by external projects, such as the WHO Digital Clearinghouse, the solution must allow for configuration to support this need. The WHO SMART Guidelines L3 layer will host a testable package which will include the test framework and guidance for test data. The test harness must allow for the loading of the test framework for a specific health domain to facilitate the assessment of digital solutions against WHO SMART Guidelines health content compliance requirements.

Existing works and community

Conformance testing is not a new concept in the health and health interoperability community, with groups such as IHE having their connectathons and HL7 FHIR having their own approaches. Proposals are expected to, where possible and remaining within the freely accessible approach, reuse and point to existing tests, data sets, executions etc., and have these referenced and directed to from the proposed testing harness. The applicant will be expected to engage in broader community to ensure that the work is informing the broader conversation. Communities here will include select OpenHIE Subcommunities such as the Architecture and DevOps subcommunities and the WHO Digital Health Clearing House.

In addition, the proposal is encouraged to clearly reference existing tests where possible. Some of the tests may already be existing such as from IHE profiles which are referenced in the OpenHIE Architecture. And the applicant is encouraged to leverage existing test artefacts that are available and load these into the testing harness, this could be external links—the process must be clearly described in the proposal).

The proposal should clearly outline the various communities and groups the applicant/team will be engaging in and leverage to influence the design and outputs of the testing harness and framework work.

Instant OpenHIE

The Instant OpenHIE ([wiki](#) | [github](#)) project aims to reduce the costs and skills required for software developers to deploy an OpenHIE architecture for quicker initial solution testing and as a starting point for faster production implementation and customization. Instant OpenHIE will be a simple way for technical persons to install and see a complex system working against a real-world use case. It will allow technical persons to illustrate how interoperability can work to solve health challenges and show how a national interoperability architecture could be created with open-source software and standards. This is an ongoing project and is community lead and the proposal team will be encouraged to leverage and contribute to this. The testing harness and test framework should include the proposed use (or clear description why not) of Instant OpenHIE as a set of HIE components to be used to test tools against.

Packaging and deployment

The proposed solution must include clearly outlined packaging and deployment approaches and is expected to adhere to the principles of [Shelf-Readiness;](#) particularly focusing on narrating how it will meet the (i) Product Information and Documentation, (ii) Installation and Deployment, and (iii) Alignment with DevOps and Cloud-Services Guidelines. The overall solution is expected to be containerized and deployable using industry standard tools such as Docker/Kubernetes etc.

Documentation

While a requirement of shelf-readiness it is important that all artefacts are clearly documented, and the proposal clearly references the user, implementer, and training guides that may be developed alongside this work.

A comprehensive set of testing harness documentation that uses consistent terms and language is required. The documentation should be in English, but it is highly advantageous if some or all of the documentation is available in other languages. Test cases must be written in Gherkin.

Documents should comprise:

- A testing harness "brochure" that outlines the value proposition of the testing harness and provides a comprehensive overview of the benefits to a non-technical audience. (*Intended target audience: high-level decision makers*).
- Technical documentation that describes the technical architecture of the solution. (*Intended target audience: system architects, QA engineers & test analysts, developers*).
- Technical documentation that describes how to deploy, configure, and validate the testing harness. This must support an Installation Qualification that provides documented evidence of a functioning infrastructure and successful installation deployment of the solution's components. (*Intended target audience: implementers, QA engineers & test analysts, developers*).
- A full suite of detailed test cases for the demonstration use case that can be used to demonstrate compliance with the functional requirements and evidence of conformance to the OpenHIE Architecture specification, together with a set of relevant sample test data that is consistent with the health content as specified by WHO SMART Guidelines. This should provide documented evidence and assurance that the testing harness works as expected and produces consistent results. (*Intended target audience: implementers, QA engineers and test analysts, development teams).*
- User documentation that describes how to use the testing harness that can also be used for training purposes. (*Intended target audience: end users i.e. QA engineers and test analysts, development teams).*
- Operational documentation that describes how to maintain and monitor the testing harness on an operational basis. *(Intended target audience =QA engineers and test analysts, ICT support).*
- Ideal but not required: Additional tools, checklists, and templates that will make it easier and quicker for QA and ICT staff to plan and manage the successful implementation of the testing harness.

Licensing

The technical outputs from this work are expected to be available under an [Open-Source Initiative (OSI)](#) approved license for the testing harness. Tests and texts are to be made available under an approved open content license. Where existing open-source licenses govern tools being used these will be respected; where possible, applicants are encouraged to avoid overly copy-left licenses and favor more neutral and permissive licenses.

Should a strong application be proposing a non-open-source license the application will incur additional review and engagement to understand how the proposed approach meets the concept of "no barrier to access or reuse". Digital Square reserves the right to select tools based on license merit and donor regulations.

B. Deliverables
The deliverables of this RFA should, at minimum, include:

- Documented design and specification of the testing harness.
- Product information and user manuals.
- Fully functioning testing harness meeting the described features above.

- Test suites covering different functionalities and scenarios.
- Full set of test suites for the OpenHIE Architecture specification.
- All tests described in Gherkin language.
- Test data sets and/or scripts to generate and load test data onto the test harness.
- Test harness package hosted on GitHub.
- A clear and well written set of documentation (as outlined above) for the test harness hosted on GitHub (or alternative hosting).

V.   Application Requirements – Technical

Provide a narrative on your technical approach to accomplish objective(s) identified in the Scope of Work identified in section IV, including:

- A detailed work plan.
- A well-documented design of the overall solution.
- Architectural overview of the test harness components (tools and links (including license types)).
- List of standards, norms, and international guidance to be used with justifications for each.
- Clear documentation on what tooling is being used.
- Work packages: All activities must be divided into clear work packages.
- Consortium experience and ability to meet the needs of the project. The team/consortium must have a demonstrated experience in software testing and quality assurance good practices.
- Documented user stories for the use cases of:
    - User wanting to evaluate a software tool against tests.
    - How tests are run against software tool.
    - How new tests are added, or previous tests are edited etc.

The submitted proposal must follow the proposal template and is limited to 14 pages (excluding appendices)

Design presentation

Shortlisted applicants will be invited to present an overview of their solution and design presentation to the technical evaluation committee.

VI.   Application Requirements - Cost

Digital Square will evaluate the cost proposals. No analysis will be performed on proposals determined as non-responsive or if the technical proposal is determined to be technically unacceptable. The price/business evaluation will be conducted in accordance with the quoted utility-based solution and proposed labor categories, their rates, and the Evaluation Matrix. Digital Square will conduct an analysis to determine if all quoted prices are reasonable. This evaluation is conducted with the expectation of adequate price competition and will rely heavily on market forces to determine whether proposed prices are fair and reasonable. The comparison of proposed prices in response to this solicitation is the preferred and intended price analysis technique.

Digital Square will also compare the proposed prices to historical prices paid for the same or similar services and the independent government cost estimate. Other techniques and procedures may be used to ensure quoted prices are fair and reasonable. A cost realism analysis will be performed to determine whether the quoted Level of Effort is realistic for the work to be performed, reflects a clear understanding of the requirements and is consistent with the unique methods of performance set forth in the company's technical quote.

Required Elements
The Cost Application must include a budget narrative, detailing the cost and cost basis applied in generating the application and describe the reasonableness of each proposed cost. The Cost Application

must also include a detailed budget that is itemized along the cost categories defined below. This detailed budget should be submitted in an unlocked Excel spreadsheet and must include the following information:

- Personnel at minimum the budget should detail:
  - All proposed staff/positions with daily rates.
  - Total number of days in total level of effort according to key staff.
- Itemization of all other costs (e.g., agency costs, service tax, administrative costs, supplies, etc.).
- Estimated schedule of other anticipated expenses (travel, subawardee resources, supplies, outside resources, etc.).
- Details of all subcontracting out of work, this includes proposed consultants as well as proposed subawardees.

The Cost Application shall begin with a summary budget detailing costs by respective categories:

Description	Budget
Personnel	
Fringe Benefits	
Travel	
Equipment	
Supplies	
Other Direct Costs	
Contractual	
Consultants	
Total Direct Costs	
Indirect Costs	
Total Project Costs	

Special Note on Prohibition on Certain Telecommunication and Video Surveillance Services or Equipment

Procurement of telecommunications or video surveillance equipment and services produced by Huawei Technologies Company, ZTE Corporation, Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, and Dahua Technology Company, or any other company, including affiliates and subsidiaries, owned or controlled by the People's Republic of China is strictly prohibited under this solicitation and applications will not be funded.

VII.   Additional Attachments, optional

1. Third-tier Subawardee Agreements, Contracts or Commitment. Offerors may submit any agreements, contracts or commitments it has with any potential third tier- subawardee.

VIII. Application Evaluation Criteria

The application will follow a two-stage evaluation. The first round will be a shortlisting of the applications based on the proposals submitted and associated documentation; the second round will comprise a solution presentation to the evaluation committee. A combination of the first-round scores and presentation scores will be utilized to make the final decision.

The following is a list of significant criteria against which applications will be assessed.

First round

Area	Points (100)
Technical 1. Workplan: - Clarity and detail - Relevance to project 2. User Stories: - Clarity and detail - Relevance to project 3. Design of Overall Solution: - Clarity and detail - Relevance to project 4. Architectural Overview: - Clarity and detail - Relevance to project 5. Documentation of Tooling: - Clarity and detail - Relevance to project 6. Work Packages: - Clarity and detail - Relevance to project	50
Experience 1. Consortium Experience: Demonstrated experience in software testing and good practices 2. Experience with OpenHIE and health data workflows 3. Experience with Health standards	20
Costs 1. Costs as detailed in Section VI	30

Second Round

Area	Points (100)

Presentation
 	
  1. Design Presentation
 	
  2. Quality of presentation
 	
  3. Relevance to project
	100

Note: PATH reserves the right to include additional criteria.

IX.   Instructions and Deadlines for Responding

A. PATH contacts
Program Contact: Maria Soc (msoc@path.org)

Procurement Contact: Andrew Juma (amjuma@path.org)

Technical Lead Contact: Carl Fourie, cfourie@path.org

B. Applications Due:
Completed applications should be submitted via WizeHive.

All applications should be entered into the WizeHive platform. Any questions related to the platform should be addressed to Maria Soc: msoc@path.org. The process for submission is as follows:

- Navigate to the submission portal and click "Sign Up" or "Log In."
- Once logged in, click "Create a Profile to Get Started." This step must be completed before you can proceed with the application.
- Click the "Get Started" box (marked with a "+").
- You can now access and edit the two required forms.
- All forms can be saved in draft prior to submission.
- Once both required forms are completed, the "Submit" button will be green and clickable. Once submitted, forms cannot be edited.

We advise that you pay close attention to upload instructions for file types. We will not accept responsibility for resolving technical transmission problems with applications.

C. Live Q&A Teleconference
During the RFP submission process, one virtual Q&A will take place on April 24, 2023, to address any questions related to RFA # 2023-009. All submitters are welcome to join, and for those unable to attend, or for those wanting to reconfirm answers to questions, a recording of the Q&A session will be posted on the solicitation pages of the Digital Square website and wiki found at https://digitalsquare.org/solicitations, and https://wiki.digitalsquare.io/index.php/Solicitations, respectively. Attendance at the Q&A session will not affect the scoring of applications. Register for the Q&A session here.

Asking a question
Participants are encouraged to join the teleconference with prepared questions, feel free to submit these questions in the chat box and we will address them during the session. There are two options for submitting a question during the Q&A teleconference:

- Chat: when accessing the teleconference via a browser, an option to select "chat" will appear in the bottom of the screen. Please feel free to type your questions to "everyone" and they will be addressed during the session.

- Voice: during the meeting, please place yourself on mute so that others in the meeting can easily hear the moderator. However, when prompted, please feel free to unmute your microphone and state your questions directly to the moderator.

D. Conclusion of Process
Applicants will be notified of the decision by 30 June 2023, PATH reserves the right to notify sooner. Final award is subject to the terms and conditions included in this solicitation, as well as successful final negotiations of all applicable terms and conditions affecting this work.

X. Terms and Conditions of the Solicitation

A. Notice of non-binding solicitation
PATH reserves the right to reject any and all bids received in response to this solicitation and is in no way bound to accept any application. The applications submitted through this RFA process are the responsibility of the submitter and do not necessarily reflect the views of the United States Agency for International Development (USAID), the United States Government, or PATH.

B. Confidentiality
All information provided by PATH as part of this solicitation must be treated as confidential. In the event that any information is inappropriately released, PATH will seek appropriate remedies as allowed. Applications, discussions, and all information received in response to this solicitation will be held as strictly confidential, except as otherwise noted.

C. Conflict of interest disclosure
Suppliers bidding on PATH business must disclose, to the procurement contact listed in the RFA, any actual or potential conflicts of interest. Conflicts of interest could be present if; there is a personal relationship with a PATH staff member that constitutes a significant financial interest, board memberships, other employment, and ownership or rights in intellectual property that may be in conflict with the supplier's obligations to PATH. Suppliers and PATH are protected when actual or perceived conflicts of interest are disclosed. When necessary, PATH will create a management plan that provides mitigation of potential risks presented by the disclosed conflict of interest.

D. Communication
All communications regarding this solicitation shall be directed to appropriate parties at PATH indicated in Section IX. A. Contacting third parties involved in the project, the review panel, or any other party may be considered a conflict of interest and could result in disqualification of the application.

E. Acceptance
Acceptance of an application does not imply acceptance of its terms and conditions. PATH reserves the option to negotiate on the final terms and conditions. We additionally reserve the right to negotiate the substance of the finalists' applications, as well as the option of accepting partial components of an application if appropriate.

F. Right to final negotiations
PATH reserves the option to negotiate on the final costs and final scope of work, and also reserves the option to limit or include third parties at PATH's sole and full discretion in such negotiations.

G. Third-party limitations
PATH does not represent, warrant, or act as an agent for any third party as a result of this solicitation. This solicitation does not authorize any third party to bind or commit PATH in any way without our express written consent.

H. Application Validity
Applications submitted under this request shall be valid for 90 days from the date the application is due. The validity period shall be stated in the application submitted to PATH.