# THE GOVERNMENT OF THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

**Ministry of Technology**

**BIDDING DOCUMENT – SCHEDULE OF REQUIREMENTS**

**Volume 02 of 03 - Annexure 4: Software Engineering**

**Single Stage Two Envelopes Bidding Procedure**

**FOR THE**

PROCUREMENT OF A MASTER SYSTEM INTEGRATOR (MSI) FOR DESIGNING, DEVELOPING, SUPPLYING, DELIVERING, INSTALLATION, IMPLEMENTING, SUPPORT AND MAINTAINING THE SOFTWARE, HARDWARE AND INFRASTRUCTURE FOR SRI LANKA UNIQUE DIGITAL IDENTITY (SL-UDI) PROJECT OF GOVERNMENT OF SRI LANKA

INVITATION FOR BIDS No: **ICTA/SLUDI/IS/2022/01**

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## 4.1 Software Development Life Cycle

Iteration_1 and Iteration_2 of implementation of SL-UDI Software System shall span across the following stages of software development lifecycle:

### 4.1.1 Delivery Plan

It is recommended that during the development stage, the team follows a scrum based agile approach. This allows the teams to deliver incremental value, while validating the implemented solutions with the relevant stakeholders. This creates an early and continuous feedback mechanism, which allows ICTA and other stakeholders to collaborate successfully with the development team and ensure that the intended solution is being built.

The MSI shall be responsible for developing a plan with regular deliveries with maximum 3-week iterations and sharing it with ICTA for approval. The plan should identify the key features developed and released with each iteration and demonstrate the deliverable for the necessary stakeholders.

The MSI should follow agile methodologies and practices throughout the project.

### 4.1.2 Requirements Gathering

(i) The MSI must perform a detailed assessment of the business and IT solution requirements as mentioned in this RFP. The MSI is required to carry out an exhaustive requirement gathering in coordination with the ICTA for understanding the detailed requirements. The requirements provided in RFP Volume-2 are indicative for the understanding of the bidder, and the MSI is required to conduct a detailed requirement gathering for the business, functional, non-functional, and technical requirements.

(ii) During requirement gathering stage, the MSI is expected to do the following, but not limited to, activities:

a. Develop and follow standardized templates for capturing requirements and system documentation

b. Undertake discussions, meetings, document reviews etc. to capture requirements

c. Prepare the Functional Requirement Specifications (FRS) and Use Case Design Document (UDD)

d. Prepare Comprehensive Detailed Software Requirement Specification (DSRS)

e. Maintain a traceability matrix from SRS stage onwards for the entire implementation

f. Obtain the required signoffs from ICTA & DRP.

(iii) While some processes SL-UDI system is attached, in Annexures to the RFP, Some of the processes, specifications etc. may undergo changes at the time of implementation. The bidder needs to consider this fact while submitting its proposal. Deviations which

are identified before the go-live against the scope mentioned in the Volume 2 should be accommodated by the MSI without a change request and at no additional cost to ICTA.

### 4.1.3   Design

(i)     A good design is important to achieve high reliability, low cost, and good maintainability. The MSI is expected to prepare the design of support applications of SL-UDI System in two levels viz. High-Level Design and Low-Level Design. The MSI shall ensure that the design developed is in compliance with the requirements outlined in this RFP. The MSI needs to comply with the Solution Architecture principles, SL-UDI System requirement architectures and other details mentioned in the Volume 2.

(ii)    In the high-level design, MSI shall develop an overview of entire system specifying the main components and interfaces. A high-level design shall provide an overview of a system, product, service, and process. This will be useful to identify critical components and interactions of all components. In the low-level design, MSI shall refine the components defined in the High-Level Design for the purpose of actual software development.

(iii)   During this stage the MSI is expected to, but not limited to, deliver the following documents:

   a.   Detailed Application, Data, Integration, and Infrastructure Architecture Definition Document.

   b.   A High-Level Design Specification document including the GUI wireframes, UML use cases, UML designs, Conceptual Data Model, Logical and Physical Data Model for different application modules, API Specifications (Signature /Contract), Stored Procedures Specifications etc.

   c.   Low-Level Design, with detailed algorithms and logic of the important API's stored procedures etc.

   d.   Traceability matrices with updated design features against the requirements.

### 4.1.4   Development and Customization

Following are required during development and customization.

(i)     In this stage, the MSI shall develop the required support applications of SL-UDI System as per the gathered requirements and design. As far as possible, MSI must ensure the open-source technologies and products are utilized for solution platform.

(ii)    In this phase of development, MSI's development team would construct different modules of the applications using the chosen languages/ tools. Development shall happen in parallel for different modules and wherever there is an integration need, manual stubs would be utilized so that there is no dependency on any other module and construction can happen seamlessly.

(iii)   During development of the support applications of SL-UDI System, MSI must note the following:

a.  **Development and Testing Environment**: MSI should host the development and testing environment on an infrastructure in its own premise along with all required tools and licenses.

b.  **Processes**: While developing the application and carrying out on-going maintenance, the processes may be in compliance with CMMi. The source code documentation should be done in a descriptive and intuitive manner in an easy-to-understand language.

c.  **Intellectual Property Rights (IPR)**: The ownership and Intellectual Property Rights (IPR) of the source code of the developed solution would be in the name of the ICTA. In case of a COTS product, the IPR of any customization done on the COTS product would be in the name of the ICTA.

d.  **User Friendly:** The application software developed by the MSI has to be user friendly so that users can access it without having extensive training.

e.  **Parallel Activities:** The lifecycle for each phase should be independent, i.e., different teams should work in parallel to complete the implementation as per the project timelines defined in this volume 2 of this RFP.

f.  **Supporting Tools and Accessories:** Any other tools and accessories required to complete the integrated solution per requirements should also be procured and provided as part of the solution.

(iv)    In case of customization of a COTS/OTS application, MSI should ensure that the following is adhered to:

a.  MSI will be responsible for supplying the application and licenses of related software products and installing the same so as to meet SL-UDI System requirements.

b.  MSI will be responsible for supplying tools, accessories, documentation required to make the integrated solution complete as per the requirements. Tools and accessories shall be part of the solution.

c.  MSI shall have to provision for procurement of licenses in a staggered manner. However, the transaction parameters are estimated based on certain assumptions and these assumptions might undergo a change which might impact the overall transaction volumes. MSI is expected to suggest the approach, which can address this business eventuality when actual transaction volume is different from that of indicative transaction volume.

d. The MSI shall perform periodic audits to measure license compliance against the number of valid end user software licenses consistent with the terms and conditions of license agreements, volume purchase agreements, and other mutually agreed upon licensed software terms and conditions. The MSI shall report any exceptions to license terms and conditions at the right time to the ICTA. However, the responsibility of license compliance solely lies with the MSI i.e. in case the MSI has not provided licenses or not provided licenses for right product from authentic source, or not provided them in required quantity, the MSI will be required to provide the same at no cost to ICTA. Any financial penalty imposed on ICTA during the contract period due to license non-compliance shall be borne by MSI.

(v) During implementation stage the MSI is expected to, but not limited to, deliver the following:

a. Updated System Requirement Specifications (SRS), if any

b. Compilation environment

c. Technical and product related manuals (among others, product specifications, related diagrams )

d. Installation guides

e. Data Model Descriptions

f. Frequently asked questions guide

g. User manuals

h. System administrator manuals

i. Toolkit guides and troubleshooting guides

j. Change management histories

k. Version control mechanism and data

l. SOPs, procedures, policies, processes, etc. developed for ICTA

m. Any other documents as prescribed by ICTA

n. Source code of the applications with older versions if any

The above documents need to be updated after each phase of project and to be maintained/periodically updated during entire contract duration. All documents will be the property of ICTA.

### 4.1.5 Testing

(i) International Institute of Information Technology, Bangalore(IIIT-B)  will test the MOSIP application and resolve the defects found therein. A tested MOSIP LTS (Long Term Support) version will be handed over to the MSI. The UAT for entire solution (MOSIP Applications and other applications) will be carried out by MSI under the guidance by ICTA or nominated party and DRP on an agreed test procedure. This test

procedure must be submitted by MSI to ICTA or nominated party and DRP. The deficiencies noted during the UAT of integrated solution shall be rectified by IIIT-B (for MOSIP components) and MSI (for support applications and MOSIP customizations).

a. End to End Test Scenario Preparation to be done by MSI: The test scenarios for MOSIP will be prepared by the MOSIP team. The MSI expected to coordinate with the MOSIP team. However, the test scenarios for the SL-UDI System comprising of MOSIP and Support Applications will be prepared by the MSI.

b. Troubleshoot issues during MSI testing: For troubleshooting during the testing, MOSIP-IA will provide process documents and templates for MOSIP. The documents and templates should also assist MSI in determining whether the bug has to be fixed by MOSIP-IA or MSI.

(ii) The MSI shall provide the testing strategy including traceability matrix, test cases and shall conduct the testing of various components of the software developed/customized and the SL-UDI System as a whole. The testing should be comprehensive and should be done at each phase of development and implementation.

(iii) The MSI shall demonstrate the testing criteria outlined in the table below prior to Go-Live. In case required, parameters might be revised by the ICTA in mutual agreement with the MSI and the revised parameters shall be considered as the acceptance criteria. A comprehensive system should be set up that would have the capability to log and track the testing results, upload, and maintain the test cases and log and track issues/bugs identified.

(iv) The table below depicts the details for the various kinds of testing activities required for each phase of the project:

| S. No. | Type of Testing | Responsibility | Scope of Work |
|---|---|---|---|
| 1. | Integration Testing | MSI | 1. The MSI shall prepare the Integration test plans and test cases<br>2. The MSI shall perform Integration testing<br>3. Integration testing will need to be performed through manual as well as automated methods<br>4. Automation testing tools will have to be provided by the MSI<br>5. Integration testing would include all data exchanged between various stakeholders<br>6. Integration testing would be performed for each phase of the application development.<br><br>For details, please also refer to Section *4.1.6 (Solution Testing) of the Volume-II* of this RFP. |
| 2. | System Testing | MSI | 1. The MSI shall prepare a test plan as well as test cases and maintain it. The ICTA may request the MSI to share the test cases and results, if required.<br>2. The testing should be performed through manual as well as automated methods<br>3. Automation testing tools will need to be provided by the MSI<br>4. Comprehensive System testing would be performed for each phase of the application development.<br><br>For details, please also refer to Section *4.1.6 (Solution Testing) of the Volume-II* of this RFP. |
| 3. | Performance and Load Testing | • MSI | For details, please also refer to *Section 4.1.6 (Solution Testing) of the Volume-II* of this RFP. |

| S. No. | Type of Testing | Responsibility | Scope of Work |
|---|---|---|---|
| 4. | Security Testing (including Penetration and Vulnerability testing) | • MSI | 1. The solution should demonstrate compliance with security requirements as mentioned in the RFP including but not limited to security controls in the application, network layer, and security monitoring systems deployed by the MSI. <br><br> 2. The SL-UDI System shall pass vulnerability and penetration testing for rollout of each version. The solution should pass web application security testing for the portal and security configuration review of the baseline infrastructure. <br><br> 3. The MSI should carry out security and vulnerability testing on the developed SL-UDI Information System. <br><br> 4. Security testing will need to be carried out in the exact same environment/architecture as the one set up for production. <br><br> 5. Security test reports and test cases should be shared with ICTA or nominated party. <br><br> 6. Testing tools, will have to be provided by the MSI. <br><br> 7. During the O&M phase, vulnerability assessment and penetration testing will need to be conducted as per the SLA annexure. <br><br> 8. The ICTA will appoint an organization to perform the audit/review/monitoring of the security testing carried out by the MSI. <br><br> For details, please also refer to Section *4.1.6 (Solution Testing) of the Volume-II* of this RFP. |

| S. No. | Type of Testing | Responsibility | Scope of Work |
|---|---|---|---|
| 5. | User Acceptance Testing of SL-UDI System | The ICTA or ICTA nominated auditor / DRP | 1. The ICTA will perform User Acceptance Testing. <br> 2. The MSI will need to prepare the User Acceptance Testing test cases with inputs from ICTA & DRP. <br> 3. UAT will have to be carried out in the exact same environment/architecture as the one set up for Production. <br> 4. The MSI should fix bugs and issues raised during UAT and seek approval on the fixes from the ICTA or nominated party/ DRP. <br> 5. Changes in the application as an outcome of UAT shall not be considered as a Change Request. The MSI will need to rectify the observations raised. <br><br> For details, please also refer to Section *4.1.6 (Solution Testing) of the Volume-II* of this RFP. |
| 6. | Benchmarking | MSI | For details, please also refer to Section *4.7 (Benchmarking) of the Volume-II of this RFP.* |
| 7. | Partial Acceptance Testing (After initial launch) | MSI | For details, please also refer to Section *4.1.6 (Solution Testing) of the Volume-II* of this RFP. |
| 8. | Biometric Quality improvement Testing | MSI | For details, please also refer to Section *4.1.6 (Solution Testing) of the Volume-II* of this RFP. |

*Table 4.1 : Types of Testing Activities*

(v) The MSI needs to provide the details of the testing strategy, test plan , test cases , test data in its technical proposal including details of intended tools/environment to be used by the MSI for testing.

(vi) The MSI must ensure deployment of necessary resources and tools during the testing phases. The MSI shall perform the testing of the solution based on the approved test plan,

document the results, and shall fix the bugs found during the testing. It is the responsibility of the MSI to ensure that the product delivered by the MSI meets all the requirements specified in the RFP. The MSI shall take remedial action based on outcome of the tests.

(vii) All tools/environment required for testing shall be provided by the MSI.

(viii) Post Go-Live, the Production environment should not be used for testing and training purpose.

(ix) The necessary changes to meet the test requirements shall be carried out by the MSI.

### 4.1.6 Continuous Build

(i) The SL-UDI System development should be highly modular and parallel development should be carried out for faster execution. All application modules within the same technology platform should follow a standardized build and deployment process. There should be instrumental process or tool to also capture the end user behaviour like the response time, browsing history etc.

(ii) The application is to be developed, tested, and released that adhere to:

    a. Smaller batch sizes

    b. Automated testing

    c. Rollback procedures

    d. Continuous integration

    e. Continuous deployment

    f. Test driven development

(iii) Following are some of the requirements to manage the development process along with virtualization of services:

    a. A dedicated 'development / customization' environment should be proposed and setup. Separate development and testing environment for application development and testing should be considered. There should be sandbox environment to test the APIs. Any change, modifications in any module must follow industry standard processes like change management, version control and release management in large and complex application development environment.

    The following environments should be set up by the MSI.

        o Development,
        o Quality Assurance,
        o Training ,
        o Service Creation,
        o Benchmarking,
        o Staging,
        o Production.

b. Application source code could be maintained in version control and could be broken up into several projects. Source control projects are created to abstract related set of modules or feature that can be independently included in another application.

c. Should be able to simulate delayed asynchronous responses with a transactions per second (TPS) metric using Performance Batch Simulation.

d. It is mandatory to create, update and maintain all relevant documentation throughout the contract duration.

e. Should be able to modify data, network, and performance models easily according to changes in test conditions and performance needs.

f. Should be able to create simulations of real-world application behaviour.

g. Should be able to expose virtual services for parallel development and early functional testing.

h. Should be able to define and visualize topology diagrams to understand dependencies and boundaries of underlying systems on the level of remote API calls.

i. Should ensure that a bug tracking tool is maintained for proper tracking of all bugs fixes as per various tests conducted on the application.

j. Should be able to virtualize database access, including Java Database Connectivity (JDBC), and manipulate resultant virtual data services.

### 4.1.7  Container Architecture

a. For development and deployment, the container-based architecture is proposed for seamless application development and deployment. Components should be developed as micro services.

b. MSI should use a Container Architecture tool for entire development life cycle e.g., developing, shipping, and running applications. With container Architecture, the developer teams can separate the applications from the infrastructure and treat the infrastructure like a managed application.  It can also help to ship code faster, test faster, deploy faster, and shorten the cycle between writing code and running code. It allows the developers to develop on local containers that contain the applications and services. It can then integrate into a continuous integration and deployment workflow.

c. Following objectives can be achieved by a Container Architecture:

- Faster delivery of the applications
- Easy Deployment and scaling
- Achieving higher density and running more workloads

d. Following principles need to be followed to develop a container architecture:

- There should be use of containers for application and data packaging and deployment

- While architecting Container Orchestration layer needs to be considered

- Container based architecture that has a rich API based architecture and support microservices.

- Should supports open source and open standards like OCI, CNCF and other frameworks / Languages / Databases etc..

*[refer Schedule of Requirements in Vol 2 and Annexure 3]*

### 4.1.8   Change and Version Control

The MSI should follow an approved industry standard Change Control Management process with all planned and emergency changes to any component of the UDI application. The MSI shall be responsible to ensure that proper impact analysis is conducted, ensure all relevant communications have been made and the relevant approvals are received before deployments. All deployments should be backed up by a roll back plan.

All changes must be clearly documented including proposed changes to the components, overall architecture, and functionality. The MSI should also ensure that all impacted documents are updated as part of this feature.

*[refer Volume 2  section 8 on Change Control Process]*

### 4.1.9   Maintain System Documentation

The MSI shall be responsible for maintaining up to date system and software documentation at all times.

### 4.1.10  Issue Identification and Resolution

Untreated application errors and bugs may impact a wider audience of users and tend to be difficult to resolve if persisted for a long time. The MSI shall be responsible for identifying such issues, resolving all application problems through identified solutions and provide Root Cause Analysis (RCA) . This includes functional issues, performance hindrances, capacity issues, data corruption, etc.

A monthly report containing the list of the identified and fixed issues should be submitted for ICTA's perusal. This report should also include the action plan and recommended solutions for any open defects.

## 4.2 Requirements of DevSecOps

The following are the requirements of the DevSecOps, Continuous improvement / continuous delivery (CI/CD) and release management tools.

   (i).   Integrate with the Source Code Control System.

   (ii).  Provide mechanism to script the release.

(iii). Build the relevant package (container or VM image or executable) via command line or automated process.

(iv). Auto deploy the build in the test, deployment (i.e. staging, dev) environments.

(v). Provision release package from staging to production based on the release criteria (and test criteria).

(vi). Should be fully integrated with the patch management solution.

(vii). Provide for auto labelling of releases and tracking of the release train.

(viii). Provide user interface for deploying builds/packages.

(ix). Provide workflow or orchestration for customizing the release process.

(x). Provide scripting tools to script and automate build, test and deploy processes.

(xi). Support Canary and Blue-Green Deployment processes.

(xii). Provide a Dashboard for tracking and managing the release build process.

(xiii). Integrate with security, code scanning, container image registry, vulnerability assessment tools to secure the build.

(xiv). Provide digitally signed builds/executables – integrate with the external keys.

(xv). Provide role-based access to the system for different stakeholders.