# Real UE Testing Automation framework

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| 1 | **Problem Statement** | To develop a Testing Automation Framework to automate the end-to-end testing of telecom services voice, data, video and SMS for C-DOT 4G-5G-IMS core with real UEs |
| 2 | **Technology Area** | Automation Framework for 4G-5G/IMS core services testing using Real UEs |
| 3 | **Project Introduction** | C-DOT's 4G/5G IMS core software undergoes continuous validation testing cycles using real UEs/ Simulators. This involves testing of key product capabilities across multiple mobile vendors to ensure services offered by C-DOT core works on all type of mobile devices. This process covers:<br>• Thorough testing of voice/data/video/SMS services using real UEs<br>• Testing of core services with mobile handsets of different OEMs or chipset vendors<br>• Quality testing of voice and video calls<br>• Monitoring and validation of data traffic<br>• Regression testing of call feature scenarios (Handover, supplementary services etc.) with end-to-end verification via call logs and protocol messages exchanged<br><br>**Challenges with manual testing from real mobile devices:**<br>• With limited number of real UEs, simultaneous testing of multiple feature testing is limited.<br>• Real-time generation of traffic across bulk devices is not feasible<br>• Manual analysis of logs and traces increases the testing time<br><br>**Objective of proposed solution**<br>• To programmatically generate protocol messages from real UE and automate the test cases.<br>• Possible to generate real UE traffic across multiple devices of different chipsets with different types of subscriber profile<br>• Possible to execute simultaneous execution of automated cases<br><br>The proposed solution should be customizable to serve testing of features on Wi-Fi (EPDG/TWAG), MCX or other type of telecommunication networks. |

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| 4 | **Problem Description** | The proposed solution will emulate real UE traffic from different chipsets available in the market to automate validation testing of C-DOT's 4G/5G/IMS etc. core product features. The solution will support<br>Bulk traffic generation and will provide interfaces for automating end-to-end verification of voice, video, data and SMS services.<br><br>**Project Scope**:<br><br>• Develop an end-to-end testing automation framework to generate real UE traffic at scale from multiple vendor chipsets and verify results from diverse interfaces like CLI, CDR logs, performance KPIs etc.<br>• Test, Validate and Deploy the solution in C-DOT Lab<br>• Conduct Training, Documentation and knowledge transfer<br>• Demonstrate reusability in other C-DOT related projects of Wi-Fi, MCX, 5G or IOT network. |
| 5 | **Feature Sets and Capabilities** | **The "Real UE Testing Automation Framework" will provide following capabilities:**<br><br>1. **Functional Testing –** To automate testing of 4G/5G-IMS telecom core services (voice, video, SMS, data, supplementary, emergency or IOT services)<br>2. **Quality evaluation –** To measure audio/video/data quality from real UE calls<br>**3. Mutli-chipset real UE emulation –** To generate bulk real UE across UE chipsets from multiple vendors<br>4. **Negative and Customized Testing –** Feasible to alter sequence or modify protocol messages for negative or customized testing<br>5. **Codeless Automation** – Allows tester to develop test cases without having dependency on programmer.<br>6. **Complex real Traffic simulation –** Allows to execute variants of call scenarios across multiple UE sets simultaneously<br>7. **Dynamic selection/mapping of subscriber profile–** Allows tester to select or map subscriber profile in real UE accordingly to requirement of testing scenario |

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| | | 8. **Regression Testing –** Supports execution of multiple iterations of automated test cases with user friendly reports<br>**9. End-to-End Validation –** Captures KPIs, traffic data, logs, performance statistics, CDR, IPLOGs, Wireshark PCAPs etc. and automates the verification and configuration<br>**10. Web-Based Access –** User friendly web-based interface to remotely execute real UE test cases and check test results<br>11. **User Management –** Secure and authorized access to system allowing testers to develop and execute automated test scripts in parallel<br>12. **Testing reports and Dashboard –** Generates user friendly test results dashboards and Reports<br>13. **North-bound Interface –** Offers North bound APIs for third-party integration<br>14. **Quick Failure debugging –** Provides failure diagnostics to identify root cause analysis from logs and Wireshark PCAP correlation<br>15. **Test Case Version Management** – Organizes, categorizes and version-controls test cases across product releases<br>16. **Reusability in Future networks –** Provides capability to reuse the framework in testing of other Wi-Fi, 5G/IOT telecom networks |
| 6 | **Role & Responsibilities of C-DOT** | C-DOT will provide technical development assistance, and financial support to the project partner(s) selected through a process of evaluation and due diligence conducted by a committee of subject experts.<br><br>Development costs of the module, whether developed from scratch or derived from existing background technology of partner(s), shall be borne by C-DOT. C-DOT shall use the final solution for integration with production grade software. C-DOT reserves the right to modify and enhance the solution and provide it to C-DOT customers or another Partner(s).<br><br>C-DOT shall engage with Partner(s) on a non-exclusive basis and shall retain its right to develop similar projects/products through other developmental programs. |

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| 7 | **Role & Responsibilities of Partner** | The Partner(s) may build the required module afresh or by modifying pre-existing background technologies available with them. As per the project demand or project type, the Partner(s) may utilize the available test and infrastructure facilities offered by C-DOT with no/some financial implication for its usage.<br><br>Any simulators or 3rd party software's required for proposed solution development will be provided by the Partner(s)<br><br>Participation in the project shall be on a non-exclusive basis. All partner(s) shall be required to demonstrate commitment to the project by entering into a formal agreement with C-DOT as per the CCRP policy. |
| 8 | **Expected Deliverables** | Approved System Software Requirement Document<br><br>Approved System Architecture Design<br><br>Approved Functional Requirements Specification and detailed design of subsystems<br><br>Approved Test Plan and Testing Reports<br><br>System User Manual and Training documents for test case development, deployment and integration testing<br><br>Source code handover and training for enhancements/customization in solution |
| 9 | **Timeline for Project** | 6 Months for delivery and in functional use by C-DOT<br><br>+ 2 years support for enhancements and capacity building for acceptance by C-DOT team.<br><br>+ 1 year post deployment support |
| 10 | **Ownership of Background & Foreground IP** | All technologies created during the project shall be owned by the respective development partner(s), individually or collectively as the case may be. Any agreement required for collective ownership shall be settled directly by the concerned partners, but the ownership/IPR of the final solution shall rest with C-DOT only with all the deliverables including complete source code etc. |
| 11 | **Vendor Selection Criteria** | 1. The vendor is Indian Domestic Company/MSME or start-up recognized by DPIIT and having minimum 2 years of |

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| | | experience in Real UE traffic automation for telecom services testing<br>2. Solution is already deployed at minimum two telecom networks/setups<br>3. The vendor has Industry Recognition and VRP Rankings acknowledged by leading mobile handsets companies<br>4. The vendor must have strong portfolio of customization in proprietary automation requirement with proven capabilities in designing and implementation of automation of Voice and Data call scenarios testing.<br>5. The vendor solution is successfully integrated and has successfully proven the capability on listed requirements. |