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Request for Quotation

1. Project Review

As part of the MeitY funded India Open source for 5G Networks project, the procurement is being done for setting up the lab infrastructure. We seek quotations from qualified vendors. The selected devices will be utilised for processing and analysing the network log data, and to perform drive tests, along with troubleshooting and analysis capability for a variety of KPIs related to 5GNR.

2. RFQ Details

RFQ Number: FSID/IOSMCN/13-01
RFQ Issue Date: 09th Oct 2024
RFQ Deadline: 23rd Oct 2024
Delivery Date: 30th Oct 2024
Delivery Location: IISc, Bangalore
Contact Person: Chethan (+91 6363672928)

3. Scope of Work

The RFQ is focused mainly on establishing, operationalising and maintaining core network testing environment with respective tools that the vendors would bring to streamline IOS-MCN's release delivery with quality. The response to RFQ technical, in addition the vendors will also cover the following-

1: Testing Infrastructure Requirements

A: 5G Core Network Simulation Environment

- Ability to simulate all key 5G core network functions
- Access and Mobility Management Function (AMF)
- Session Management Function (SMF)
- User Plane Function (UPF)
- Network Repository Function (NRF)
- Policy Control Function (PCF)
- Network Slice Selection Function (NSSF)
- Simulation of real-world traffic load, device densities, and network slices.
- Capability to emulate various UE (User Equipment) profiles and configurations

B: Testing Resources and Competencies

- 2 FTE Remote Test engineers – 8 hours per day * 5 days (in week)
- Core competencies of testing resources
- Deep understanding of STLC and experience in all testing phases (unit, integration, system, etc.).
- In-depth knowledge of 3GPP Release 15 and 16 5G procedures, RAN components, and management functions.
- Ability to comprehend and relate to various 3GPP technical documents.
- Experienced in testing, manual and automated, 5G Core.
- Experience in test case development based on BDD, using Gherkin, for 5G Core.
- Proficiency in bash and/or Python for test automation.
- Experience with API testing tools (Citrus, Postman, JMeter), Selenium/Appium
- Hands-on experience in using existing 5G core test tool in the IOS-MCN test lab.
- Must have experience and proficiency to understand the 5G core requirements, map the
- requirement with the 3GPP procedure and, to design the test cases using BDD
- techniques as per the requirement based on the specification.
- Developing and modifying test cases for control plane procedures, data plane traffic,
- IoT scenarios, performance, scale, longevity, and data throughput.
- Ability to gather necessary artifacts from the SUT for analysis.
- Working knowledge of cloud, on-premises, and hybrid environments.
- Proven experience in working with CI/CD pipelines is essential.
- Ability to identify, collect, and analyze artifacts for failure analysis.
- Exposure to AI-based analytics systems for failure analysis and RCA.

2: Functional Testing Requirements

A: 3GPP Compliance:

- Full compliance with 3GPP Release 15 and 16 specifications for 5G core network elements and procedures.
- Ability to validate protocol conformance for all 5G interfaces, including N1, N2, N3, N4, and N6.

B: Automated Testing Framework:

- Identification and integration of Test Frameworks
- Test cases development for core to cover call processing and OAM scenarios
- Automated test case execution for the 5G core network covering:
    - UE registration and authentication.
    - Session establishment and teardown.
    - Handover and mobility management.
    - Network slicing management and isolation testing.
- Support for automation frameworks for scriptable, reusable test cases.
- Integration with CI/CD pipelines to trigger automated tests upon new 5G core releases.
- Support to integrate all tools and tests with CI/CD Pipeline.

C: Test Design and Testing

- Test design for 5G Core and SMO.
- Add new test cases to the Testing Framework.
- Modify/delete test cases from the Testing Framework.
- Creation of Documentation and FAQ for the testing Frameworks.

D: End-to-end Functional Testing

- Validate the integration between 5G core and Radio Access Network (RAN) using standardized protocols (e.g., F1, Xn, N2).
- End-to-end testing across the 5G core, ensuring proper isolation and differentiated QoS.

3: Performance and Stress Testing

A: Performance Benchmarking

- Conduct performance testing to benchmark key network KPIs such as:
    - Latency
    - Throughput (gigabit speeds for eMBB)
    - Packet loss rate
    - Jitter
    - Session setup time
    - Use of traffic generators and load testers to simulate high-bandwidth and low-latency traffic.

B: Load and Stress Testing:

- Ability to test network scalability by simulating large numbers of devices (i.e up to 500 or more devices)
- Load testing to assess the network's capacity to handle peak traffic loads without degrading performance. (up to 10 Gbps).
- Stress testing under extreme traffic conditions to identify potential bottlenecks or points of failure.

4. Monitoring and Reporting Requirements:

A: Real-time Monitoring Tools:

- Real-time monitoring tools to observe core network performance, including traffic flow, latency, bandwidth utilization, and packet error rates.
- Capability to monitor and analyse logs from 5G core functions (AMF, SMF, UPF) in real-time for diagnostics and troubleshooting.

B: Detailed Test Reports:

- Automated generation of detailed test reports, including:
- Functional test results and pass/fail criteria.
- Performance metrics (e.g., throughput, latency, session success rates).
- Network performance metrics (QoS, resource allocation).
- Provide recommendations for optimizing performance, troubleshooting issues, and identifying potential improvements in the core network.
- Seamless integration of the testing framework with existing CI/CD pipelines (e.g., Jenkins, GitLab) for continuous testing.
- Capability to trigger automated tests upon network configuration changes, software updates, or new feature rollouts.
- This set of technical requirements ensures that vendors provide a comprehensive solution tailored to the testing and validation of the 5G-NR core network, ensuring its performance, reliability, and compliance with global standards.

4: Technical Requirements:

Phase	Timeline	Technical Requirements	Deliverables	Milestones
Phase 1: Initial Setup, Planning, Development	Month 1	**Testing Infrastructure Setup**: Establish a 5G Core Network Testing Environment	**1:** Approved architecture and design documents for the 5G Core Testing	**1:** Architecture and infrastructure plan approved. **2:** Hardware

& Deployment		capable of simulating AMF, SMF, UPF, and other 5G core components. **Hardware & Network Resources**: Procure and deploy network equipment, servers, and simulators. **Automation Framework**: Develop and deploy a test automation framework for 5G core elements and interfaces (N1, N2, N3, N4). **End-to-End Testing Setup**: Integrate testing framework with CI/CD pipeline and orchestration tools.	Infrastructure. **2:** 5G core simulation setup for functional testing (AMF, SMF, UPF). - Procurement and installation of necessary hardware and software tools. **3:** Test automation framework deployed and integrated with CI/CD pipeline. **4:** Initial end-to-end testing setup for 5G core to validate UE registration, session management, mobility, and service continuity	and network resources setup. **3:** Ready to start core network simulation. **4:** Test framework operational. **5:** Initial functional test cases executed. **6:** Basic end-to-end testing environment ready for use
Phase 2: Functional Testing, Performance Testing, Load & Stress Testing	Month 2-6	**Functional Testing**: Test 5G core network functions, including UE registration, session establishment, mobility management. **Performance Testing**: Conduct latency, throughput, and scalability tests. **Load & Stress Testing**: Simulate high traffic loads, stress test network capacity (high	**1:** Detailed reports on functional testing outcomes (pass/fail) for UE registration, session establishment, mobility, etc. **2:** Performance benchmark reports for throughput, latency, jitter, and scalability. **3:** Load and stress test reports for traffic handling and scalability (up to 1 million connections per	**1:** Successful functional tests with documented outcomes. **2:** Performance benchmarks and stress test reports submitted. **3:** Load and stress testing completed. **5:** Final stress test reports submitted

		device density and traffic).	square kilometer).	
Phase 3: Continuous Monitoring & Maintenance	Month 7-12	**1: Real-time Monitoring**: Integrate with IOSMCN-SMO to real-time monitoring tools to track core network health, latency, and other KPIs. **2: Maintenance and Updates**: Regular maintenance to ensure system is up to date with 5G standards. **3:** Testing of New features and enhancements, Comprehensive Testing as specified in phase 2 above.	**1:** Real-time monitoring system operational with detailed KPI tracking. **2:** Finalized maintenance plans and procedures. **3:** Full documentation of testing processes, infrastructure, and results.	**1:** Real-time monitoring tools operational. **2:** Full documentation delivered.

Key Milestones Summary for 1 Year

1. **Month 1**: Core Testing Infrastructure design approved, and setup completed, Automated test framework developed and integrated; initial end-to-end testing initiated.

2. **Month 2-6**: Functional and performance testing reports generated, including interoperability validation, Load and stress testing completed with security vulnerability assessments.

3. **Month 7-12**: Continuous monitoring tools deployed, final documentation completed, and system handed over.

If the vendor has not responded to the TOR, https://ios-mcn.org/ please provide your input/response to the TOR also. This is a mandatory input for the technical evaluation.

1. **Submission Requirements:**

The quotation should be submitted in the form of 2 separate documents as specified below:

1. TECHNICAL EVALUATION DOCUMENT: This should contain the following:

a. A detailed workplan based on the technical requirements based on the section (Please check any deviation from requirements).

b. Detailed specifications of any tools that will be required for the execution of the work plan.

c. Detailed description of additional resources (including human resources) that will be needed for the execution of the work plan.

d. Specify any dependencies, known risks and mitigation plans.

e. If the vendor has not responded to the TOR, https://ios-mcn.org/ please provide your input/response to the TOR also. This is a mandatory input for the technical evaluation.

2. COMMERCIAL BID DOCUMENT:

a. Quotations should include detailed pricing, including unit prices, taxes,, and any additional fees.

b. Provide information on warranty terms, technical support services, and maintenance agreements.

c. Include company profile, relevant experience, and references from past projects.

d. Quotes for the product must be enclosed in a password protected PDF file format.

e. Quotations must be addressed to

**Director,
Foundation for Science Innovation and Development
Innovation Centre, IISc Campus Near Maramma Circle gate
Bengaluru 560012 GSTIN: 29AAECF1802E1Z1**

2. **Evaluation Criteria:**

The evaluation criteria include for considering the quote and awarding with the purchase order includes,

- Compliance with RFQ requirements and specifications.
- Price competitiveness.
- Vendor experience, and track record.
- Warranty and support offerings.
- Technical capabilities and compatibility with existing infrastructure.

3. **Important Notes**:

   ● The lowest-priced quotation may not necessarily be selected; quality, reliability, and vendor reputation will also be considered.
   ● IOS MCN reserves the right to reject any or all quotations and to award the purchase order on its own evaluation criteria.
   ● Any clarifications or questions regarding this RFQ should be directed to the contact person listed above.