

# End-to-End Testing of Multimedia Product using 4G/5G Testbed

## Customer Overview

The customer is a world leader in open telecom solutions, powering business transformation in the telecom industry with innovative technology solutions. Their expertise in systems integration enables communications and content providers to solve their most complex deployment challenges.

## The Context

The customer had developed an innovative *On the Call Multimedia Solution* that would play video on the caller's mobile phone while ringing. The customer wanted to test the solution in a ViLTE setup with real IMS, EPS, and UEs. They required an independent third-party validation of the solution by testing in a production-like environment.

Understanding the complexities of the underlying call flows and end-to-end testing of the solution was very important as it involved multiple entities and protocols in both - the EPC and IMS. Comprehensive testing in such an environment would provide valuable inputs on interoperability of the solution with IMS nodes and the behavior of real UEs with this call flow.

## Type of Service Provided

Lab as a Service (LaaS), 4G Testbed, Integration Testing, End-to-End Functional Testing

## Technologies Used

- 4G, ViLTE, Open Source EPC, IMS
- GTPv2, SIP, SDP, Diameter, RTP
- SIPp, dsTest, Softphones/UEs, eNodeB

## Solution Summary

Leveraging GS Lab | GAVS' ViLTE expertise and full-fledged 4G/5G testbed with a production like setup, the solution was tested end-to-end for comprehensive analysis. This enabled validation of the product while also bringing to light multiple issues that had not surfaced in the customer's simulated environment.

## Challenges

- Integration and interoperability testing in a realistic ViLTE setup was critical and challenging since it was a first-of-its-kind solution
- Lack of a production like ViLTE environment for testing
- Highly complex solution requiring competent experts for testing
- Validation by an independent third party required for marketability

## Solution Highlights

- End-to-end functional testing with full-fledged 4G/5G testbed
- Provision of production-like test environment suitable for business requirements
- Expertise provided in 3GPP protocols, RAN, EPC, IMS, UEs, and more
- Compliance testing VoIP protocols and IMS call flows
- IMS + Application Server integrated with EPC, real eNB and UEs for ViLTE call flow testing
- Functional tests executed using multiple mobile phones of different vendors
- Testing of minute details of each node and different protocols involved in the call flow
- Groundbreaking inputs from expert team on interoperability bugs and real UE behavior

## Solution Impact

- Thorough validation of the solution thereby instilling confidence to present to end customers
- Enhanced solution stability through unearthing and fixing of multiple issues relating to integration, interoperability, feasibility, and protocol compliance
- Rich insights on UE behavior and detection of major issues not found in the customer's simulated environment, by testing with real UEs
- Informed decision making and better prospecting through comprehensive solution analysis in multiple scenarios

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## Solution Details

The GS Lab | GAVS team has extensive working experience and expertise in EPC, open source technologies, SIP and VoIP domains, among others. The complexity of the solution demanded expertise in 3GPP protocols and a deep understanding of RAN, EPC, IMS, and UEs. Importantly, GS Lab | GAVS is equipped with a full-fledged 4G/5G testbed to test multiple use cases for different players in the ecosystem. This testbed provides a production-like test environment that is suitable for business requirements.

A fully working, private ViLTE lab - involving multiple nodes and protocols in the IMS and LTE domains, was set up. The components included open source/commercial EPC/5GC, with real eNodeB/gNodeB, IMS, and softphones/UEs, commercial traffic simulators, and requisite government licenses.

As part of this project, the team had to integrate the solution with the IMS network and test end to end call flows with real UEs. The execution was divided into two phases. In phase 1 multiple open source options were evaluated for IMS, and the customer's Application Server was successfully integrated with the chosen IMS network. The first round of testing was done with a softphone for compliance testing VoIP protocols, interoperability testing, and analyzing IMS/SIP call flows.

Phase 2 consisted of evaluating multiple EPC cores for ViLTE capabilities. Then IMS + Application Server was integrated with the finalized EPC network, real eNB and UEs for ViLTE end to end call flow testing and validating calls from both IMS and EPC perspectives. Functional tests of the solution were executed using multiple mobile phones of different vendors. The team of experts took care of the minute details of each node (SIMs, UEs, eNB, EPC, IMS core, AS) and different protocols involved in the end-to-end call flow. Integration testing helped uncover multiple bugs in the call flows. Major issues - showstoppers from the real user perspective, were also discovered when testing with real UEs. The thorough testing in a real ecosystem helped stabilize and validate the solution before taking to end customers.

## Network Diagram

