

CASE STUDY

Communications Service Providers
China Mobile



Ixia,* Rebaca* Help China Mobile* Speed VoLTE Service Validation

China Mobile operates the world's largest¹ 4G network and leverages a highly automated, easy-to-use virtual test bench to reduce time needed to validate voice over LTE (VoLTE) production network deployments.



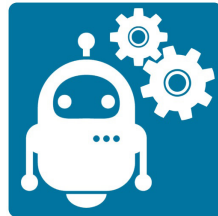
Mobile network operators (MNOs) are increasingly virtualizing network infrastructure and services. In addition to correctly selecting and certifying new virtual network infrastructure and functions, successful NFV adoption by operators requires new tools and techniques for field technicians to easily and effectively test virtual network functions (VNFs) and end-to-end network services during production network deployment.

Validating voice over LTE (VoLTE) services built with virtual evolved packet core (vEPC) and virtual IP multimedia systems (vIMS) can be challenging and lengthy given the breadth and complexity of the protocols, the variety of test scenarios for effective coverage, and the repetition needed to optimize core services and achieve desired service levels.

Operators need an automated, virtual test bench solution able to execute on open and scalable hardware to confirm VoLTE services operate as specified. Additionally, the solution should help field technicians troubleshoot issues and re-execute test suites until performance goals are met. In this case study, Intel® Network Builders ecosystem partner Ixia* (a Keysight* business) and its partner Rebaca* developed an automated test system that has helped China Mobile* to dramatically reduce the testing time needed to validate production VoLTE services.

The Solution

With Rebaca's ABot test orchestration framework and Ixia's IxLoad® Wireless Virtual Edition (VE) network tester, MNOs have an easy-to-learn, easy-to-use, and effective virtual test bench for verifying mobile core components and validating VoLTE network services. Some of the key elements of the solution include:



Rebaca ABot

The ABot test orchestration framework uses the concept of behavior-driven development (BDD) to enable and define test scenario collaboration among multiple stakeholders. The test cases are written in an easy-to-use domain specific language (DSL) quickly understood by network architects, operations engineers, and field technicians.

ABot can directly invoke tests or seamlessly integrate with continuous integration engines, such as the open source automation server Jenkins,* for scheduling test suite and individual test execution. The framework integrates with tools such as Juju* and Cloudify* for lifecycle management and orchestration on NFV platforms. ABot can incorporate plugins to emulate components of complex mobility and IoT systems to quickly enable comprehensive testing of new and emerging network services.

Ixia IxLoad® Wireless

IxLoad Wireless enables mobile operators and equipment manufacturers to test and validate complex wireless networks and components for greater end-to-end service quality. This “lab to live” LTE testing solution recreates networking environments and real-world subscriber traffic, such as voice, video, and data. At the same time, it emulates multiple mobile subscriber activities—including handovers, TAU, and idle-connected transitions—for comprehensive test coverage.

Using IxLoad's real-world subscriber modeling, users can perform capacity tests, detail a device's throughput, measure voice and video quality, model a wide variety of mobility scenarios, and much more. Whether modeling the behavior of thousands of subscribers or measuring end-user experience, IxLoad enables mobile operators to fast-track new networks and services with confidence.

Intel® Xeon® Scalable Processors for Mobile Core NFVI

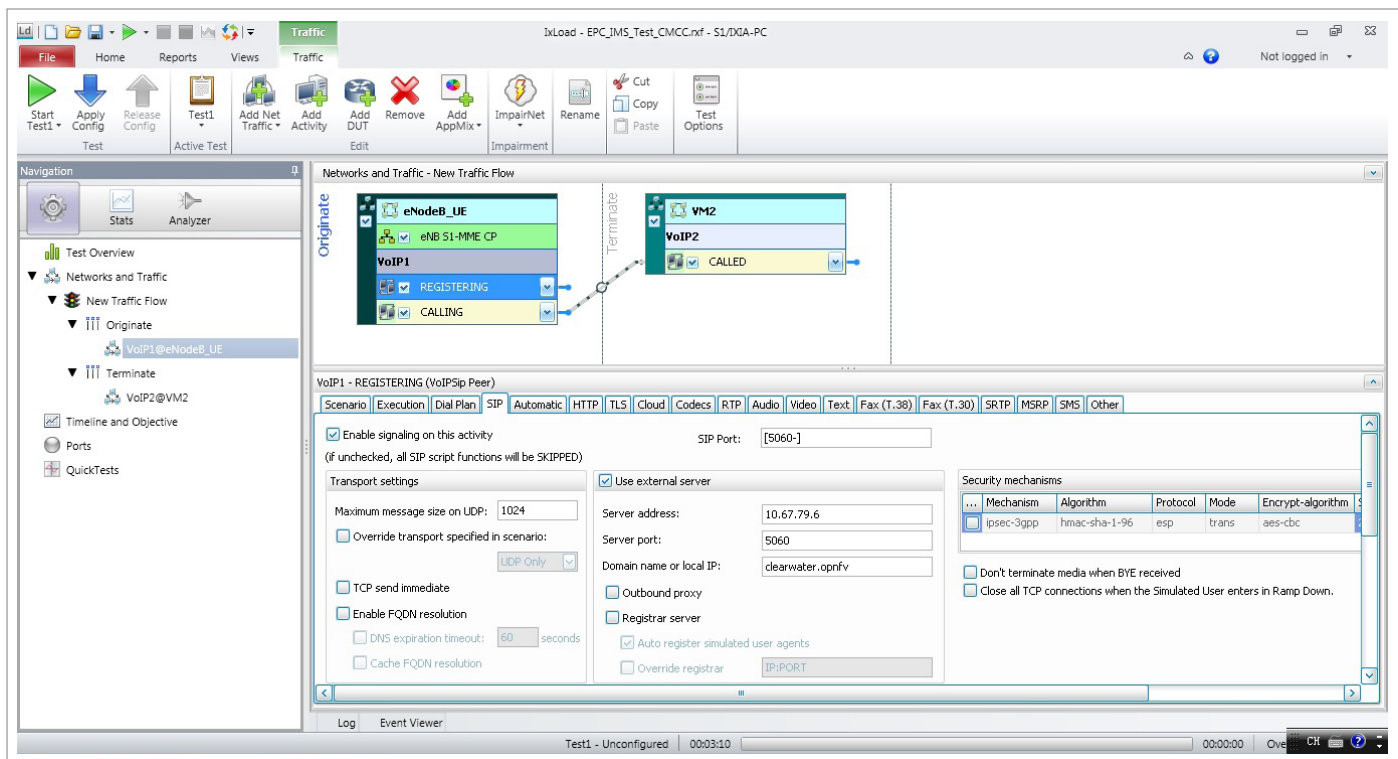
Intel Xeon Scalable processors are the next-generation platforms for cloud-optimized, 4G, and 5G-ready networks. With convergence of key workloads such as applications and services, control plane processing, high-performance packet processing, and signal processing onto Intel Xeon Scalable

platforms, MNOs can accelerate the transition to virtualized, software-defined infrastructure to enable cloud capabilities for agile service delivery throughout the network.

With up to 28 cores delivering highly advanced per-core performance, and increases in memory bandwidth (six memory channels) and I/O bandwidth and throughput (48 PCIe* lanes), this platform delivers efficiencies in deep packet inspection workloads and packet processing for virtual network functions. With crypto and compression workload acceleration now handled with integrated Intel® QuickAssist Technology (Intel® QAT), MNOs can optimize use of compute cores for high-value, revenue-generating network services. Innovative features such as the Intel® Advanced Vector Extension 512 (Intel® AVX-512) deliver workload-optimized performance and throughput increases for data compression workloads.

Overview of VoLTE Test System

Network tests and test parameters to be configurable at run-time are defined prior to service deployment using IxLoad Wireless VE. Individual vEPC and vIMS tests, as well as end-to-end VoLTE tests, are designed with VNF vendor specifications to ensure validation against specific VNF performance goals.



Test configurations are then exported from IxLoad Wireless VE and imported into the ABot test orchestration framework. ABot provides the ability to easily script tests using any variation of configurable test parameters found in the underlying IxLoad tests.

The ABot domain specific language keywords of “Given...When...Then” are used to create ABot feature files that include steps to configure and verify the test environment, confirm test execution has started, confirm test completion, and validate test results against goals.

The screenshot displays the ABot Reports web interface. The top header shows the ABot logo and the title 'ABot Reports'. Below the header, a sidebar on the left contains navigation icons. The main content area shows a feature file titled 'Feature Files / 010-epc-ims-volte.feature'. The file content includes Gherkin-style test scenarios and steps, such as 'When I configure IxLoad for template rxf_5 with the following parameters on node ABOT' and 'Then I verify the presence of the following values in the IxLoad response:'. The file is structured with a table of parameters and a list of test steps.

parameter	value
ue_count	1
epc_mme_ip	10.67.79.21
sip_server	10.67.79.6
data-files	SIPCall.tst

The file also includes steps for running IxLoad tests and verifying the results, such as 'When I run IxLoad tests with the configured parameters on node ABOT' and 'Then I verify the presence of the following values in the IxLoad response:'. The file is saved as 'ResourceBundle.xml' and is part of a bundle named 'ixload_files'.

Once defined, ABot feature files are executed using Jenkins to trigger functional and performance tests through IxLoad VE on the system under test (SUT) consisting of the vEPC and vIMS deployed on independent NFV infrastructure.

The screenshot displays the Jenkins web interface for the 'Project Ixia-Abot-Volte-EPC-IMS'. The interface shows the project name and a list of build history entries. The 'Build History' section includes a table with columns for build number, timestamp, and status. The 'Build' button is visible at the bottom right.

Build Number	Timestamp	Status
#3	28-Nov-2017 00:47	Success
#2	28-Nov-2017 00:31	Success
#1	27-Nov-2017 17:55	Success

The 'Build' button is located at the bottom right of the interface.

Test parameters can be easily modified using Jenkins or the ABot feature file editor. Test execution artifacts are saved from successive test runs and easily reviewed in a web browser.

How China Mobile Tests VoLTE

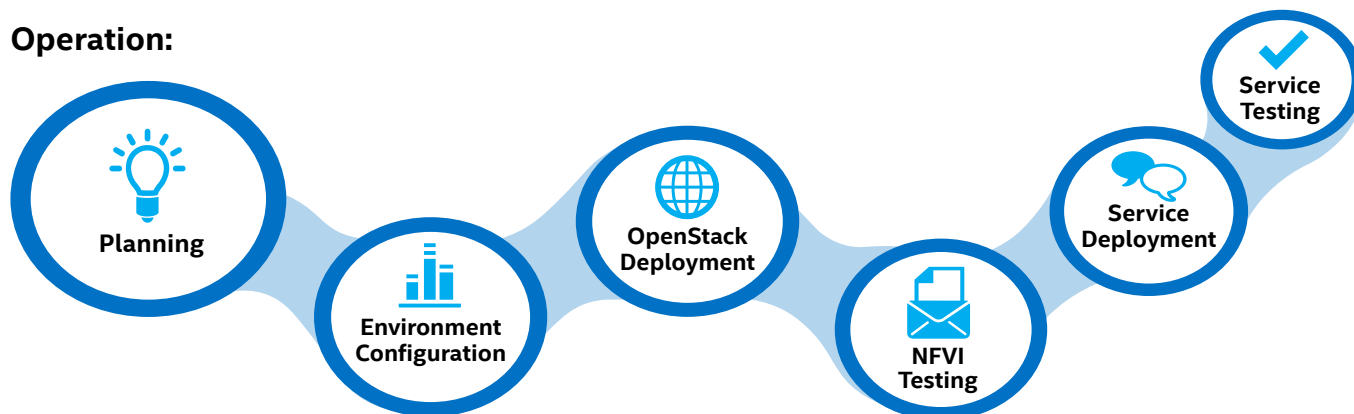
China Mobile is one of the world's leading network operators. Its 4G LTE network is the largest in the world with 583 million customers and 1.6 million base stations as of May 2017.¹

To address the challenges of adopting NFV, the company's research division, China Mobile Research Institute, is focused on designing and developing Telecom Integrated Clouds (TICs) to support increasing requirements for virtualized network infrastructure and services.

TICs can be built to meet varying criteria and sizes, and to support a wide variety of mobile network services. Fundamental TIC building blocks include design templates that pre-configure NFV orchestration, virtualized infrastructure manager and NFV infrastructure functions and specify standardized network designs and hardware models.

China Mobile has developed the Automatic TIC Onboarding System (AUTO), which includes six steps used to build and deploy TICs according to requirement specifications.

Operation:



In this workflow, China Mobile's goal is to reduce final service testing from about one week to on the order of 10 minutes. To accomplish this, the workflow must onboard highly reliable TICs according to specifications that do not require certification-oriented testing in the field during deployment.

In an attempt to meet this need, China Mobile is using the Ixia-Rebaca solution for defining and automating VoLTE component (e.g., vEPC, vIMS) and service testing. Executing VoLTE network service validation is easy and fast with test parameters and KPIs easily modified using ABot or Jenkins. Additionally, test results can be quickly inspected and explored using the VoLTE service validation dashboard.

Conclusion

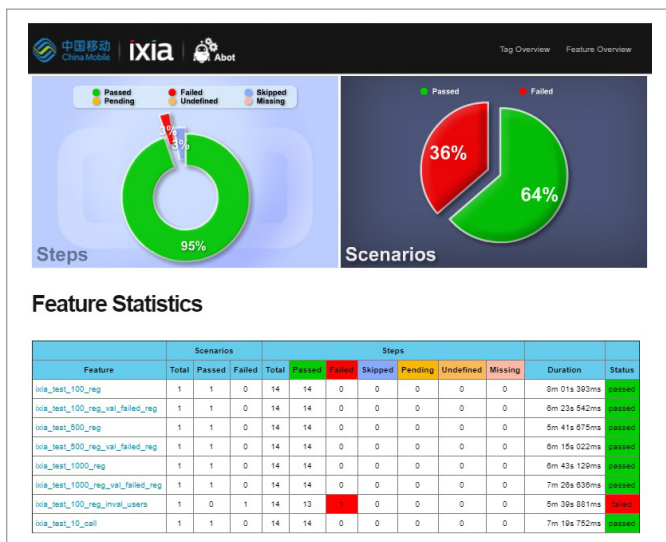
The complexity of virtual infrastructures makes testing the deployment readiness of virtualized VoLTE services time consuming, and yet performance of these networks is essential. This is a challenge for large MNOs that have many VoLTE installations across their network. Utilizing the Ixia-Rebaca VoLTE test solution, China Mobile was able to successfully deploy new VoLTE services across its massive network using their Automatic Telecom Integrated Cloud Onboarding System while significantly improving field technician productivity.

About Ixia

Ixia, a Keysight Business (NYSE:KEYS), provides testing, visibility, and security solutions to strengthen networks and cloud environments for enterprises, service providers, and network equipment manufacturers. Ixia offers organizations trusted environments in which to develop, deploy, and operate. Customers worldwide rely on Ixia to verify their designs, optimize their performance, and ensure protection of their networks and cloud environments. Learn more at www.ixiacom.com.

About Keysight Technologies

Keysight Technologies, Inc. (NYSE:KEYS) is a technology company that helps its engineering, enterprise, and service provider customers optimize networks and bring electronic products to market faster and at a lower cost. Keysight's solutions go where the electronic signal goes, from design simulation, to prototype validation, to manufacturing test, to optimization in networks and cloud environments.



Customers span the worldwide communications ecosystem, aerospace and defense, automotive, energy, semiconductor and general electronics end markets. More information is available at www.keysight.com.

About Rebaca

Rebaca is a technology consulting company serving OEMs and solution providers worldwide, and focuses on video delivery, wireless infrastructure, network security, data analytics, and test orchestration solutions. Rebaca develops solutions for customers with unique requirements and has a rich portfolio of innovative IP across multiple technologies that helps companies achieve strategic cost reduction through specialized development and advanced technology licensing. Learn more at www.rebaca.com.

About Intel Network Builders

Intel® Network Builders is an ecosystem of infrastructure, software, and technology vendors coming together with communications service providers and end users to accelerate the adoption of solutions based on network functions virtualization (NFV) and software defined networking (SDN) in telecommunications and data center networks. The program offers technical support, matchmaking, and co-marketing opportunities to help facilitate joint collaboration through to the trial and deployment of NFV and SDN solutions. Learn more at <http://networkbuilders.intel.com>.



¹ China Mobile targets 620 million 4G subscribers by year end, RCR Wireless: <https://www.rcrwireless.com/20170629/5g/china-mobile-4g-5g-tag23>

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