



VoIP Conformance Labs

the Path to Excellence

ALBEDO Telecom Laboratories emulate common VoIP architectures to execute acceptance, conformance and inter-connectivity procedures.

The design of a VoIP, IPTV, or Multiplay network begins with a small-scale model that permits verification of the architecture and connectivity. The key features to address are the quality and performance that can be achieved through protocols, nodes and terminals. Generally, this verification process takes place prior to any massive investment and roll-out, and answers the following key questions:

- **Design:** Is the VoIP network architecture correct?
- **Conformance.** Do nodes/terminals conform to standards?
- **Selection Process:** Which is the most convenient VoIP phone to be used?
- **Quality Assurance.** Does the VoIP network fulfil end-to-end quality?
- **Connectivity.** Are terminals, nodes, and gateways 100% compatible?
- **Internetworking:** Do new deployments operate with other VoIP networks?
- **Protocols Trunking:** Is full interoperability supported for ISDN/POTS/GSM?
- **Monitoring Systems:** Are monitoring and OSS tools appropriate?
- **Compatibility:** Will VoIP calls succeed under heavy data traffic?

VoIP benchmarking

Specialised engineers may use testing suites to assure the compliance of VoIP equipment and networks on behalf of the certification authority. A VoIP testing suite is a set of procedures that can demonstrate full compliance of a VoIP environment with specifications. These procedures, based on international standards, are intended to assist during network and service design, prior to and during the roll-out of a VoIP service.

“It is not possible to verify VoIP compliance of nodes, terminals and applications using ad-hoc procedures”

Testing suites are not necessarily the only way to demonstrate compliance in terms of quality, compatibility or internetworking. However, testing suites are indeed a cost effective strategy and are most efficient in terms of time and resources.

Without a testing suite it is impossible to demonstrate compliance using empirical benchmark procedures, as this would mean no control of traffic conditions, no test tools, no methodology, and no ability to reproduce conditions.



Lab Architecture

ALBEDO VoIP Laboratories are built in a rack that hosts three subsystems:

- Generation / Analysis of VoIP traffic;
- Emulation of live traffic conditions;
- Simulation of network services; and
- Replication of a converged network.

These Labs are built using next-generation nodes and the network topology includes access, aggregation, backbone and CPE.

“Speech level analysis of Voice quality”

performance and tolerance of selected devices. An additional set of tests analyses the effects of parameters that determine VoIP QoE, such as packet loss, delay or jitter, applying standard measurements such as PESQ, PSQM, PAMS, R-Factor.



The switching layer includes a number 10/100/1000BASE-T ports to connect multiple terminals and is powerful enough to avoid becoming a bottleneck which could affect lab performance and measurements.

This point is important since ALBEDO Telecom Labs clearly separate signalling subsystem and networking layers to help engineers identify causes of non-conformance or interconnectivity problems.

Traffic Conditions

Many issues, often caused by multiple congestion events, might affect IP packets in transit. For example, packet loss and packet delay cause quality degradation such as VoIP stutter and breakup.

Therefore it is essential to emulate all common events and then to measure how these affect VoIP quality. Some codecs, terminals and protocols have been designed to be tolerant to network events so as to minimise quality degradation. However, only a lab will permit qualitative and quantitative verification of the most robust devices.

For example, IPTV and VoIP receivers incorporate buffers to absorb the effects of delay variation without losing data. This minimises service degradation but causes the unwanted effect of increased delay.

Net.Storm is the ALBEDO generator used to test the network and terminal response to common events and their effects on the form of degradation, Net.Storm is parameterized according to international standards.

VoIP call Generation

This structural element of the Lab is able to support advanced SIP and H.323 signalling to simulate end users while generating and analysing VoIP calls.

100% Control

ALBEDO Telecom Labs incorporate a full converged VoIP network, permitting operators, carriers, service providers and vendors to test and approve specific VoIP features, nodes or terminals which will be used in an operational network.

“Generation of any SIP message to emulate complex transactions”

Comprehensive test suites designed by ALBEDO permit a deep analysis of VoIP terminals, routers and gateways interconnected exactly as they would be in the operational network. Moreover, there are requirements that cannot be verified by black-box techniques, and require a 100% controlled lab to stress the networks elements.

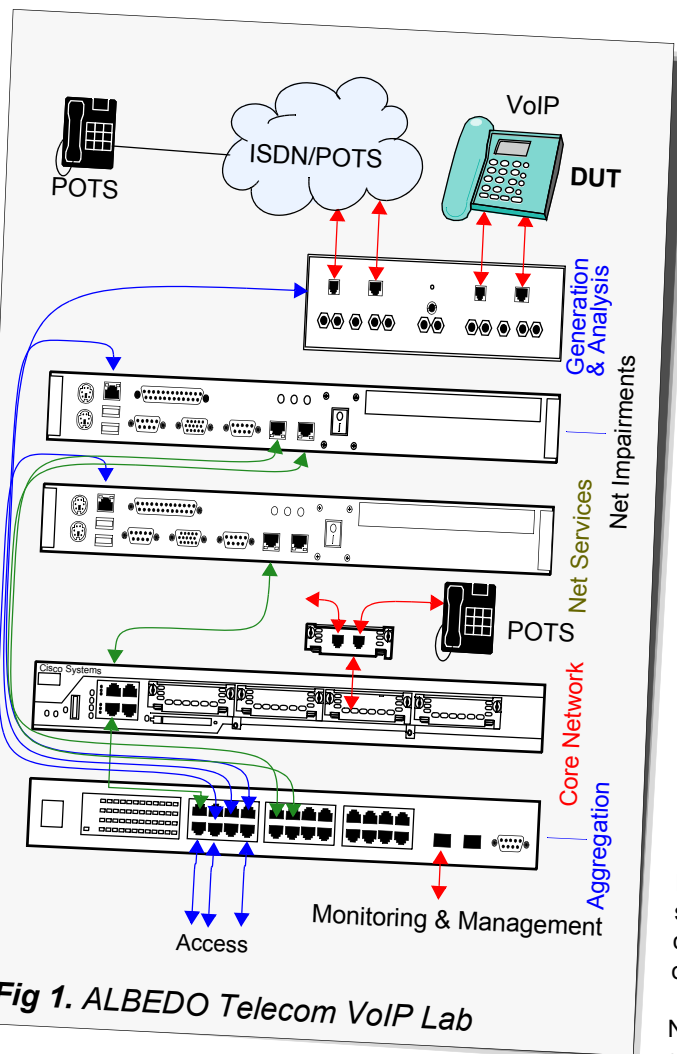
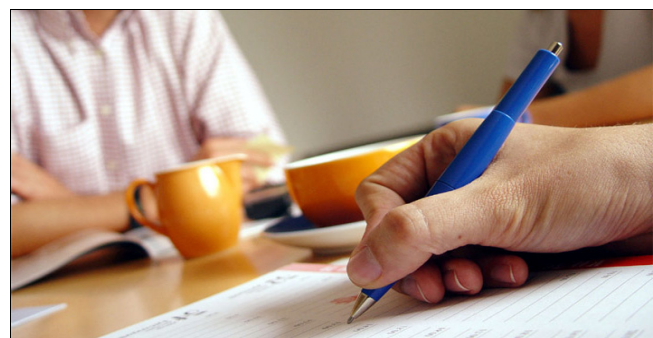


Fig 1. ALBEDO Telecom VoIP Lab

Analysis and Generation

Laboratories are able to generate concurrent VoIP calls that can be routed to the devices under test or simply used to stress the network. The lab allows the generation of signalling messages that can be set to any level of detail.

A scripting capability for signalling messages is used to check the conformity of the equipment under test. Malformed messages can be generated to check the



VoIP LABS USERS

- Planning Departments
- R+D Centers
- Acceptance Labs
- Development Engineers
- VoIP Vendors

APPLICATIONS

- Equipment Evaluation
- Acceptance Tests
- Product Conformance
- IP Trunking
- Interoperability Tests
- IMS Interoperability



BENEFITS

- Ensure successful migration to VoIP services
- Guarantee the competitiveness of all facilities
- Ability to introduce additional enhanced VoIP services
- Prevent user rejection
- Save deployment cost
- Discover connectivity limitations and drawbacks
- Identify the most cost-effective network equipment

Lab Applications

ALBEDO Labs replicate accurately the actual VoIP scenarios to execute approval and acceptance procedures in optimal conditions that will guarantee new investments on nodes, protocols and terminals.

Evaluation of New Solutions

Evaluating all new devices that are today available can be a very time-consuming task. By taking advantage of ALBEDO expertise you can make this task a lot easier, as we can offer objective methodologies and advice to choose the solution that best meet your infrastructure needs and business goals.

Interoperability Testing Services

Interoperability is the key for most vendors and operators today that do prefer two or more network suppliers. The VoIP laboratory provides all the tools and procedures you need to ensure the quality and growth of the services you offer by means of interoperability.

ALBEDO Telecom supplies everything you may need including network equipment, configuration, guided test suite, comprehensive documentation, and the training always customized to your necessities. Your team of experts will immediately execute not only those procedures that were specified internationally but also those that particularly apply to your organization.

Acceptance and Approval Tests

Approval and acceptance tests make it easier for operators to compare devices from different vendors. Once the VoIP equipment is chosen, every single model is usually tested to confirm that they are working properly before they are accepted. This is essential to make sure that they provide the functionality needed and are compatible with existing technologies. Furthermore when the equipment has been finally selected a series of tests should also be carried out to a percentage and in some cases to every single device to confirm that they are working properly before they were accepted by the buyer.

Nevertheless in many organisations there just simply are not enough resources to carry out these procedures. If this is the case new product enhancements may not always fully verified, or even in some

cases new features may be upgraded to a live network without real benchmarking.

IP Trunking

Service Providers have begun the shift their enterprise customers from traditional ISDN primary interfaces to IP-based SIP trunks. Cost, efficiency and voice/data integration have been stated as drivers for this transition.

A number of test must be executed to certify the compatibility level of IP PBX VoIP terminals to join the provider network and interoperate with other manufacturers within, and outside, the network. ALBEDO VoIP suite helps discovering the ability and limitations to interoperate VoIP with legacy ISDN and POTS solutions.



IMS Interoperability

IMS Conformance/Interoperability to verify products including testing to the IMS specifications, interoperability among IMS components and certification of third-party applications into trusted networks, is one of the most demanded applications of ALBEDO VoIP Labs.

Product Conformance

The laboratory VoIP is ready for certification testing of all VoIP handset models from any vendor. Considering how each one manage under any network condition combining high level of jitter, delay, packet loss or disorder, and errors, then you will be able to compare the most convenient model and vendor.

Even the ability of H.323 and SIP protocols to interconnect with other terminals. We have designed a library of more than 90 tests intended to certify and trace and performance of each terminal.



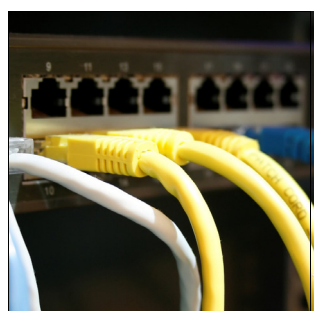
VoIP Suite	
VOIP QUALITY ASSESSMENT	Includes up to 28 tests to assess the VoIP quality, i.e clarity measurements with/without perturbations, DTMF tones, delays, etc.
VOIP SIGNALLING TESTS	Includes up to 43 tests to assess the conformance/interconnectivity of the VoIP signalling protocol, SIP INVITE/CANCEL methods, and more.
IP LAYER VERIFICATION	Includes up to 17 tests to check the IP layer, i.e. DNS communication with dynamic IP - primary DNS server failures, and more.
OTHER TESTS	Includes a number of verifications highly dependent on the implementation i.e. Dynamic IP assignment.
DOCUMENTATION	Comprehensive description of the Acceptance Suite , plus a full user guide to assist engineers in executing step-by-step approval and acceptance tests, Also includes results evaluation by means of PASS/FAIL

VoIP Network Architecture	
AGGREGATION SWITCH	L2 rack 24 or similar.
VOICE OVER IP GATEWAY	Comprising a full unified Ethernet-IP network for packet transport.
COPPER ACCESS NETWORK	Copper pair DSLAM supporting ATU-C for ADSL, ADSL2, ADSL2+, VDSL.
FTTx ACCESS NETWORK	Configured P2P as EFM or P2M as GPON or GEAPON.
WIRELESS ACCESS	Wi-Fi or Wi-Max.
RACK CABINET	All the elements are 19' rack-mount. Patch panel, console, screen, keyboard, cables, and other connectors are included.

Test & Measurement Subsystem	
VoIP GENERATOR & ANALYZER	Full capability to generate and modify SIP protocol for VoIP call control, SIP-T, SIP-I, call control, PESQ, SIP Scripting, PESQ-WB.
IP ROUTER	Voice IP Gateway or similar. A full unified Ethernet-IP network for packet transport.
IMPAIRMENTS GENERATOR (Hw)	ALBEDO Net.Storm (hardware-based). Generates packet disturbances such as lost, jitter, delay, etc. 1 Gbit/s throughput, accuracy 1 μs.
IMPAIRMENTS GENERATOR (Sw)	Software-based solution. Generates packet disturbances such as lost, jitter, delay, etc. 25 Mbit/s throughput, accuracy 1 ms.
FTTx ACCESS NETWORK	Configured P2P as EFM or P2M as GPON or GEAPON.
VoIP HAND-HELD TESTER	Several models available. Gbit interface, MOS, R-Factor, SIP, H323, Carrier-Ethernet features, RF2544, Y.1541, bandwidth profile, etc.
RACK CABINET	All the elements are 19' rack-mount. Patch panel, console, screen, keyboard, cables, and other connectors are included.

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ALBEDO Telecom VoIP Portfolio:



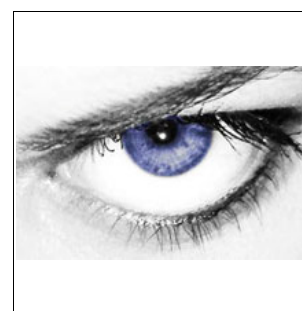
VoIP.Lab



Net.Storm



Ether.Genius



Net.Audit



- + UNDERSTAND causes of telecom interoperability issues
- + EXPERIENCE the best QoS in unified networking
- + ASSESS different solutions for hardware and firmware design
- + LEARN from telecom experts by means of network consultancy