Enabling Load Testing with TTCN-3

Guarantee the re-usability of TTCN-3 based function and conformance test for load testing

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1 Introduction

1.1 Function- / Feature- / Regression- / Load-Testing

Progressive liberalization in the telecommunications market, together with the evolution of technology, challenges the manufactures and operators of wireless and wire-line networks. The highly competitive market situation forces the frequent launch of new services and features in order to keep pace with their competitors. To ensure an advantage over the competitor, testing is mandatory. A key success factor in testing is the re-usability, flexibility and maintenance efforts for the test tools.

Testing new services in the development laboratories can be a costly task, combined with the risk that previously working functionality could be adversely affected by new software. The regression tests of the new software, as well as the programming of new tests for the new service, can be time consuming. Nexus8610 addresses both these issues in that it continues to drive towards shortened and improved test cycles.

The Nexus8610 automates the test execution over 24 hours, and provides automated reporting and alarm threshold settings in the case of faults.

1.2 Testing and Test Control Notation - Edition 3 (TTCN-3)

TTCN-3 is a universal Testing and Test Control Notation based on an internationally standardized testing language, which can define formal standard test scenarios – purely designed for testing. It addresses the various tests needs by using multiple test components and is adaptable to the System Under Test’s (SUT) structure.

TTCN-3 has been introduced by ETSI in the year 2000 as a proper language with well defined syntax and semantics, allowing enhanced communication, configuration and control. Permanent updates ensure the language’s usability for the latest testing requests, where the latest update was in 2006.

TTCN-3 is used to define standard test specifications for various technologies (e.g. SIP, SCTP, IPv6 ...). Also more and more suppliers of telecom network elements are using the universal test and control notation to develop tests on new system components and functions, and for the complete service application. These TTCN-3 function/-regression tests are not available for load and stress testing, because the test-tools available today for load-/stress tests do not supporting TTCN-3. As a consequence the load and stress tests are performed in a different language, which prevents any re-use of written test scenarios based on TTCN-3. Nexus8610 has changed this! With the TTCN-3 interface, Nexus8610 enables the use of TTCN-3 based test scenarios for load and stress testing.
1.3  TTCN-3 on Nexus8610

Nexus8610 enables the use of the TTCN3 Runtime Interface (TRI) and therefore the usage of the function/regression test scenarios based on TTCN-3 for load- and stress testing. Nexus8610 TTCN-3 support consists of:

- The possibility to execute the TTCN-3 test script under load condition enables any tester to re-use their own TTCN-3 written code and perform (after a few clicks) load tests on these previously written function tests.
- A large library set of TTCN-3 based test case are provided by Nexus Telecom AG
- TTCN-3 is a common language for test scenarios which is easy to read and understand, and the existing knowledge on the TTCN-3 test and test control notation can be re-used
- Nexus Telecom AG provides, together with its partner Testing Technologies, the tools for the test case writing (text base and in graphical form) and expertise in writing TTCN-3 based test scenarios
- Nexus8610 provides tools to get the load and stress test results within seconds to reports
- Nexus8610 provides tools to enable debugging and detailed single call analysis

Nexus8610 extends its market strengths in different types of testing methods. These are widely used in the communications industry today and each focus on a specific aim, but now newly available using the TTCN-3 based test scenarios:

- Function & Inter-working Testing
  - Verification of the correct function of a new feature (or component parts of it)
  - Verification of the correct inter-working of different protocols and interfaces.
- Regression Testing
  - Verification of existing services after the installation of new software or hardware releases.
- Stress & Load Testing
  - Verification of the correct behavior of a feature or service under load conditions.
- Conformance Testing
  - Verification of the correct function of a protocol, according the standard defined conformance tests.
2 Nexus8610 – TTCN-3 Solution

The Nexus8610 Telecom Test System enables the definition of the subscriber’s message flows and behavior in TTCN-3. This TTCN-3 based definition replaces fully the former OPTEC based test cases.

TTCN-3 based load test are available for the following technologies:

- SIP / RTP
- SIP-T / SIP-I
- H.248 / Megaco
- LTE/SAE
- UMTS IuCS
- GSM-A
- ISUP
- UMTS IuPS
- GPRS Gb
- CAP/CAMEL
- TCAP
- IVR
- PESQ
- Data Services
- New technologies only available on TTCN-3

The various simulations are available on the following interfaces:

- E1 / T1
- STM-1 / ATM
- STM-4
- Fast Ethernet
- GigaBit Ethernet (copper and optical)

2.1 TTCN-3 test scenario writing

This is supported by using:

- Graphical tool to write message flows, where the tool generates the TTCN-3 code on completion. (TTworkbench)
2.2 Test Preparation

Test preparation is done by defining individual test slices into one test campaign. A campaign itself can be executed as an entity on Nexus8610. Several test campaigns can run in parallel on Nexus8610 (no limitation applies)

A test slice is a group of subscribers performing the same end to end testcase (e.g. Mobile Originating Call on 3G, terminating in 2G, with 25 seconds hold time). Multiple test slices with various testcases over various technologies can be grouped into one campaign. Each slice is editable.
2.3 Test execution

2.3.1 Single step debugger for TTCN-3 subscriber

To test new message flows for function tests and fault analysis, it is possible to select a subscriber and run this subscriber’s messages in a single step mode (TT workbench).

In Step 1, this is used for functional test only, and controls the Java Engine.

2.3.2 Load Test Result Presentation

When executing a load test, individual subscribers are not of interest, but instead the general results overall have to be visualized, with the possibility to analyze faults in details and get an indication over subscriber groups. This is done in the Test Control Center (TCC).

The results include:

- Success/Faults Rates
- Transactions per second
- Total transactions during the test
- Transactions per day/hour/minute/second
- Error causes (time subscriber, error (incl. cause), related tests)
All results are available for

- Total Test
- Interface/Link
- Test Piece

2.4 Reporting / Alarming

As known from the Nexus8610 application, the system provides a wide set of reporting facilities and alarming possibilities. This includes:

Automated report generation on test scenarios performed based on

- Link/Switch, Test scenario, Subscriber ranges …

Reports can be received in the following formats

- PDF
- CSV
- RTF
- …

Nexus8610 also supports the generation of alarms. For more information on this feature contact your Nexus Telecom AG.
3  TTCN-3 Load Testing

The Implementation of TTCN-3 is done in two steps.

3.1  Step 1 – TTCN3 based function testing

This feature is immediately available. By using Nexus8610 as transport / interface enabler to the SUT and the TTworkbench to execute TTCN-3 based tests.

3.2  Step 2 – Native Traffic Load testing

This step will enable the simulation of large number of subscribers based on TTCN-3 using Nexus8610. By integrating the TTCN-3 into the Nexus8610 real time environment, the load numbers are achieved. The customer is able to define groups of subscribers using TTCN-3 based message flows to execute the calls and activate the services (MMS, HTTP, Email, SMS, Speech Quality, Speech recognition …) that have to be tested. The single message flow is held in TTCN-3, where the multiplication and distribution over the selected subscribers is done on Nexus8610.

This new high performance functionality will be achieved by generating native lightweight threads for each Nexus8610 underlying real time operation system using the TTCN-3 Source Code, which can be executed in parallel on the Nexus8610 Test System.

The modularity of the Nexus8610 Test System allows the multiplication of this approach by adding additional hardware until the total number of subscribers (10’000, 100’000, 1’000’000 or 10’000’000) is reached. The system has no limit in number of total subscribers supported.

For more details please contact Nexus Telecom.
4  About Nexus Telecom

Founded in 1994, Nexus Telecom is a privately-held company with headquarters in Zurich, Switzerland and regional offices in Canada, Chile, South Africa and Pakistan. With over 200 employees, Nexus Telecom is a major OSS/BSS vendor delivering sophisticated state-of-the-art telecom management solutions to 2G, 3G, NGN and VoIP service providers and network operators worldwide.

Nexus Telecom - Network and Service Investigation

Nexus Telecom provides investigation tools and techniques with which telecommunication service and network malfunctions and degradations can quickly be determined and successfully solved. Based on scientific analysis methods, these investigation, troubleshooting and monitoring tools help to unravel the hidden secrets behind often complex and mysterious service malfunctions.

Product Portfolio - Full range of investigation tools

Nexus Telecom offers a wide range of such investigation tools used to effectively study problem cases, to collect and process transaction ‘evidence’ data, to correlate and combine events, to translate and decrypt transaction details and ultimately, to solve the case and fully restore the respective service quality. Clearly, such tools are indispensable to network operators and service providers who are committed to improving service quality to all their business and residential customers.

Nexus Telecom - Partners and Customers

With solutions deployed in over 100 countries, Nexus Telecom’s installed customer base spans the globe, assuring service quality and revenue streams for many of the world’s best-known telecom operators. For small and large service providers alike, including the world’s largest GSM/UMTS network operated by T-Mobile, the highly scalable and modular end-to-end solutions from Nexus Telecom maximize the service provider’s competitive edge through excellent ROI, quick and smooth launch of new services, and greatly increased end-customer satisfaction.

Nexus Telecom’s fast time-to-market strategy is to gain early in-depth know-how about upcoming network technologies through strong development partnerships with leading network equipment manufacturers such as Nokia Siemens Networks, Nortel and Alcatel Lucent.
5  About Testing Technologies

Testing Technologies designs and markets a variety of ready-to-run test solutions for commercial, proprietary or PC based test systems. Our goal is to enhance your test system to become the ultimate tester experience.

Testing Technologies helps you creating high-quality products by high-quality testing. Our solutions enable test automation across technologies, development phases and any types of testing. With a wide range of services, our experts support you in all phases of your test life-cycle.

As a market leader in customer-oriented testing for standards-based technologies, Testing Technologies is dedicated to TTCN-3 only. Together with ETSI, we guarantee durability and continuous improvement of standardized test solutions to secure your investments.

Through cooperation with strong global and local partners, Testing Technologies is able to respond more effectively to customer needs in testing. Numerous partner companies across Europe, USA and Asia spread the ideas and basic principles of systematic, automated testing worldwide.

Testing Technologies was founded as a spin-off of the Fraunhofer Institute FOKUS in 2000. Testing Technologies team of experts is continuously developing new products to meet the expectations of evolving markets.