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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Integrated broadband cable telecommunication networks (CABLE).

The present document is part 3 of a multi-part deliverable covering the conformance test specification for NAT64 technology:

Part 1**:** "Test requirements and Protocol Implementation Conformance Statement (PICS) proforma";

Part 2: "Test Suite Structure and Test Purposes (TSS&TP)";

Part 3: "Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".

The development of the present document follows the guidance provided in the ETSI EG 202 798 [i.1]. Therefore the present document is also based on the guidance provided in ETSI EG 202 798 [i.1].

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1 Scope

The present document contains the Abstract Test Suite (ATS) for NAT64 technology as defined in RFC 6052 [1] and RFC 6146 [2] which address specific cable industry requirements as defined in ETSI TS 101 569-1 [11] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [6].

The objective of the present document is to provide a basis for conformance tests for NAT64 technology equipment giving a high probability of inter-operability between different manufacturer's equipment.

The ISO standards for the methodology of conformance testing (ISO/IEC 9646-1 [3] and ISO/IEC 9646-2 [4]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [7]) are used as a basis for the test methodology.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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The following referenced documents are necessary for the application of the present document.

[1] IETF RFC 6052: "IPv6 addressing of IPv4/IPv6 translators".

[2] IETF RFC 6146: "Stateful NAT64: Network Address and Protocol Translation from IPv6 Clients to IPv4 Servers".

[3] ISO/IEC 9646-1 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

[4] ISO/IEC 9646-2 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 2: Abstract Test Suite specification".

[5] ISO/IEC 9646-6 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 6: Protocol profile test specification".

[6] ISO/IEC 9646-7 (1995): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 7: Implementation Conformance Statements".

[7] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

[8] ETSI ES 201 873-1: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".

[9] ETSI TS 103 238-1: "Integrated broadband cable telecommunication networks (CABLE); Integrated Broadband Cable and Television Networks Cable IPv6 Transition Test Plan for NAT64; Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) proforma".

[10] ETSI TS 103 238-2: "Integrated broadband cable telecommunication networks (CABLE); Integrated Broadband Cable and Television Networks Cable IPv6 Transition Test Plan for NAT64; Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

[11] ETSI TS 101 569-1: "Integrated Broadband Cable Telecommunication Networks (CABLE); Cable Network Transition to IPv6 Part 1: IPv6 Transition Requirements".

2.2 Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI EG 202 798: "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI TR 101 569-1 [11], ISO/IEC 9646-1 [3] and ISO/IEC 9646-7 [6] apply.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply.

ALG	Application Layer Gateway
ASP	Abstract Services Primitives
ATM	Abstract Test Method
ATS	Abstract Test Suite
CPE	Customer Premises Equipment
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
FTP	File Transfer Protocol
GRT	Global Routing Table
HTTP	HyperText Transfer Protocol
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPv4	IP version 4
IPv6	IP version 6
IUT	Implementation Under Test
LAN	Local Area Network
LSN	Large Scale NAT
MSS	(TCP) Maximum Segment Size
MTC	Main Test Component
MTS	Methods for Testing and Specification
MTU	Maximum Transmission Unit
NAT	Network Address Translation / Network Address Translator
NPU	Network Processing Unit
PA	Platform Adaptor
PIXIT	Protocol Implementation eXtra Information for Testing
PPTP	Point-to-Point Tunneling Protocol
PTC	Parallel Test Component
RSTP	Rapid Spanning Tree Protocol

RTSP	Real-Time Streaming Protocol
SA	System Adaptor
SIP	Session Initiation Protocol
SUT	System Under Test
TA	Test Adaptor
TC	Test Case
TCP	Transmission Control Protocol
TP	Test Purpose
TSS	Test Suite Structure
TTCN	Testing and Test Control Notation
VRF	Virtual Routing and Forwarding

4 Abstract test method

This clause describes the ATM used to test the NAT64 technology.

4.1 Abstract protocol tester

An abstract protocol tester presented in figure 1 is a process providing the test behaviour for testing an IUT. Thus it will emulate an entity which is capable of proving the IUT functionalities. This type of test architecture provides a situation of communication which is equivalent to real operation between real devices. The test system will simulate valid and invalid behaviours, and will analyse the reaction of the IUT. Then the test verdict, e.g. pass or fail, will depend on the result of this analysis. Thus this type of test architecture enables to focus the test objective on the IUT behaviour only.

In order to access an IUT, the corresponding abstract protocol tester needs to use lower layers to establish a proper connection to the system under test (SUT) over a physical link (Lower layers link).

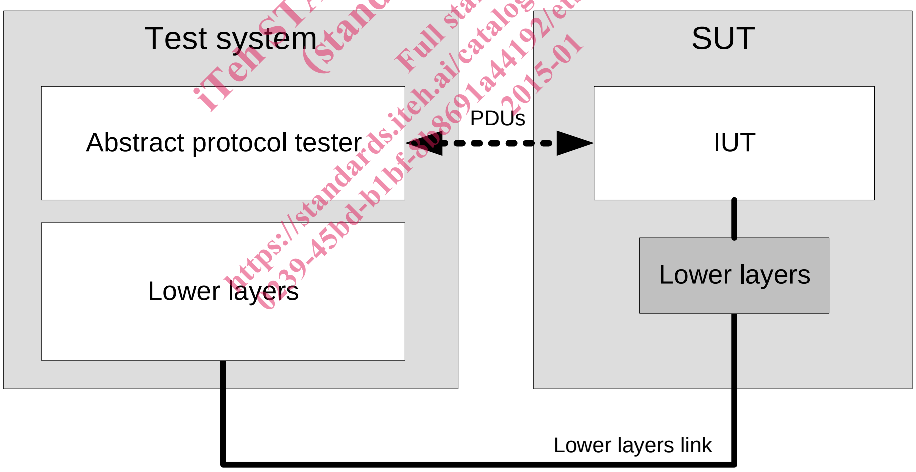
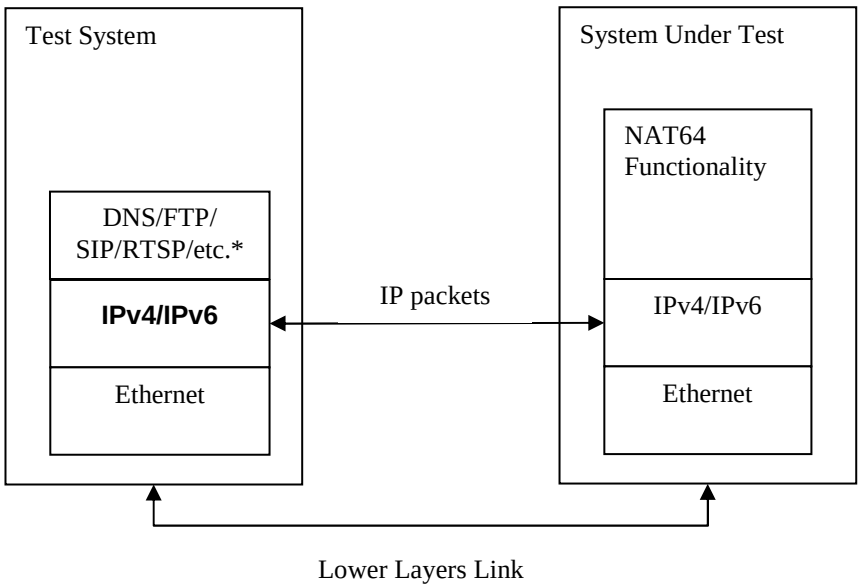


Figure 1: Generic abstract protocol tester

The "Protocol Data Units" (PDUs) are the messages exchanged between the IUT and the abstract protocol tester which permits to trigger the IUT and to analyse its reactionThe result of the analysis allows to assign the test verdict.

Further control actions on the IUT may be necessary from inside the SUT, for instance to simulate a primitive from the upper layer or the management/security entity. Further details on such control actions are provided by means of an upper tester presented in clause 4.3.

The above "Abstract Test Method" (ATM) is well defined in ISO/IEC 9646-1 [3] and supports a wide range of approaches for testing including the TTCN-3 abstract test language [8].The abstract protocol tester used for NAT64 test suite is described in figure 2. The test system will send and receive IP packets, by using other upper layer protocols such as DHCP, DNS and FTP, in order to analyse NAT64 functionality.



NOTE: * Those protocols are used to prove certain NAT64 functionalities.

Figure 2: Abstract Protocol Tester - NAT64

4.2 Test configurations

The test suite for NAT64 uses only a test configuration to cover the different test scenarios where Large Scale NAT (LSN) is the IUT.

4.2.1 CF01: LSN as IUT

In this configuration, the LSN is the IUT and the test system simulates an IPv6 client in one side and a IPv4 server in the other side.

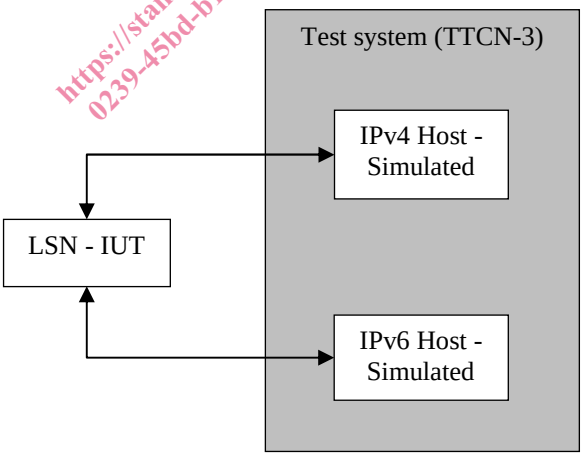


Figure 3: CF01, LSN equipment is the IUT

4.3 TTCN-3 Test architecture

In general, a conformance test system architecture based on TTCN-3 is as figure 4 shows.

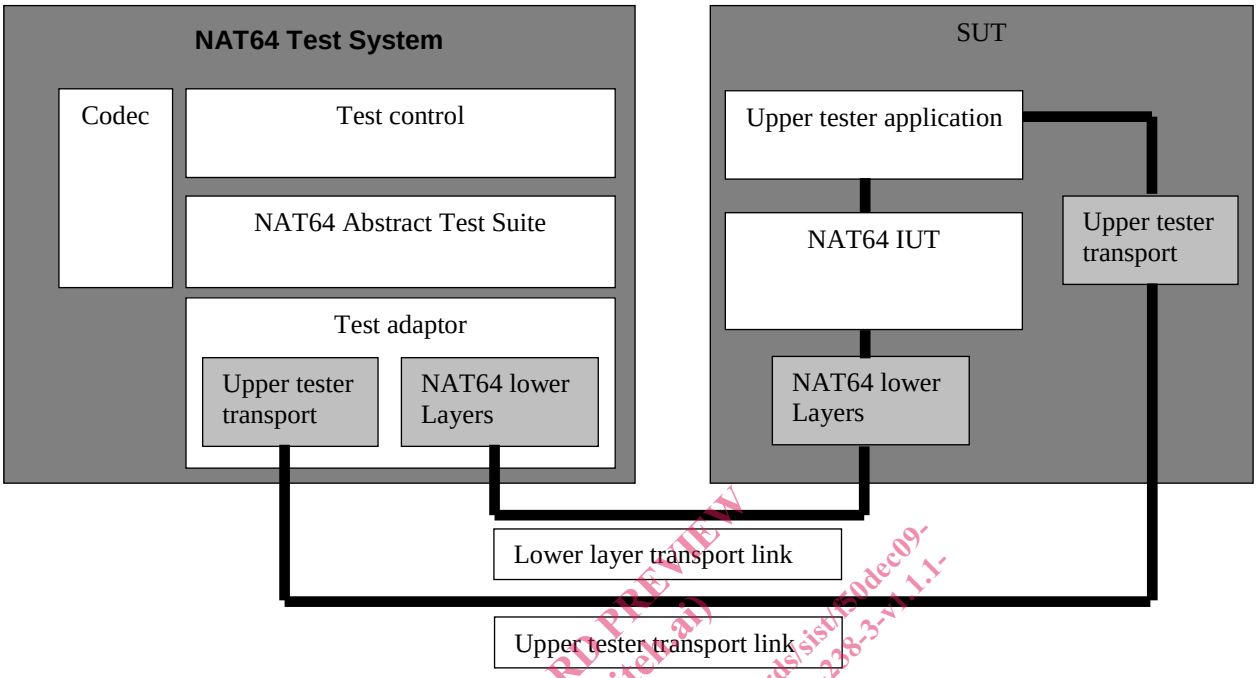


Figure 4: Global test architecture

The "System Under Test" (SUT) contains:

- The "Implementation Under Test" (IUT), i.e. the object of the test.
- The "Upper tester application" enables to trigger or capture some actions (i.e. higher layer service primitives) on the IUT.
- The "NAT64 lower layers" enable to establish a proper connection to the system under test (SUT) over a physical link (Lower layer transport link).
- The "Upper tester transport" is a functionality, which enables the test system to communicate with the upper tester application. Then the upper tester can be controlled by a TTCN-3 test component as part of the test process.

The "NAT64 test system" contains:

- The "TTCN-3 test components" are processes providing the test behaviour. The test behaviour may be provided as one single process or may require several independent processes.
- The "Codec" is a functional part of the test system to encode and decode messages between the TTCN-3 internal data representation and the format required by the related base standard.
- The "Test Control" enables the management of the TTCN-3 test execution (parameter input, logs, test selection, etc.).
- The "Test adaptor" (TA) realizes the interface between the TTCN-3 ports using TTCN-3 messages, and the physical interfaces provided by the IUT.

Based on the above test architecture, figure 5 shows a detailed test architecture used for the NAT64. The NAT64 ATS requires using several Parallel Test Components (PTC) dealing with specific communication protocols and a Main Test Component (MTC) dealing with PTCs' synchronization. The different test components communicate with the NAT64 SUT over several ports (described in section 4.4) which are used to exchange protocol messages between the test components and the NAT64 IUT.