

# ETSI TS 102 518 V1.1.1 (2008-02)

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*Technical Specification*

**Methods for Testing and Specification (MTS);  
Internet Protocol Testing (IPT);  
IPv4 to IPv6 Transitioning;  
Conformance Test Suite Structure and  
Test Purposes (TSS&TP)**

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## Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Methods for Testing and Specification (MTS).

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# 1 Scope

The purpose of the present document is to provide Test Suite Structure and Test Purposes (TSS&TP) for conformance tests of the IPv4 to IPv6 transitioning protocol based on the requirements defined in the IPv6 requirements catalogue (TS 102 599 [2]) and written according to the guidelines of TS 102 351 [1], ISO/IEC 9646-2 [4] and ETS 300 406 [5].

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## 2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ETSI TS 102 351: "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); IPv6 Testing: Methodology and Framework".
- [2] ETSI TS 102 599: "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); IPv4 to IPV6 Transitioning; Requirements Catalogue".
- [3] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".
- [4] ISO/IEC 9646-2: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification".
- [5] ETSI ETS 300 406: "Methods for Testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".
- [6] IETF RFC 2529: "Transmission of IPv6 over IPv4 Domains without Explicit Tunnels".
- [7] IETF RFC 2765: "Stateless IP/ICMP Translation Algorithm (SIIT)".
- [8] IETF RFC 3056: "Connection of IPv6 Domains via IPv4 Clouds".

[9] IETF RFC 4213: "Basic Transition Mechanisms for IPv6 Hosts and Routers".

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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions given in ISO/IEC 9646-1 [3] apply.

**abstract test case**

**Abstract Test Method (ATM)**

**Abstract Test Suite (ATS)**

**Implementation Under Test (IUT)**

**Lower Tester (LT)**

**Test Purpose (TP)**

### 3.2 Abbreviations

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

ATS	Abstract Test Suite
IETF	Internet Engineering Task Force
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IUT	Implementation Under Test
RC	Requirements Catalogue
RQ	Requirement
TP	Test Purpose
TSS	Test Suite Structure

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## 4 Test Suite Structure (TSS)

Test Purposes have been written for 6to4-Nodes, 6to4-Routers, IPv6/IPv4\_Nodes and IPtranslators according to the requirements (RQ) of the requirements catalogue (RC) in TS 102 599 [2]. Test purposes have been written for behaviours requested with "MUST", optional behaviour described with "SHOULD", "MAY" or similar wording indicating an option has not been turned into test purposes.

The test purposes have been divided into four groups:

Group 1: IPv6 Transitioning - RFC 2529 [6]

Group 2: IPv6 Transitioning - RFC 2765 [7]

Group 3: IPv6 Transitioning - RFC 3056 [8]

Group 4: IPv6 Transitioning - RFC 4213 [9]

The sub-grouping of these two groups follows the structure of the RC.

Group 1 RFC 2529 [6]

Group 1.1 Node Tests

Group 1.1.1 Encapsulating IPv4 Header frame format validation

Group 1.1.2 Stateless Auto-configuration and Link-local addresses on 6over4

Group 1.1.3 Source and Target Link layer address options

Group 1.1.4 IPv6 Multicast address mapping to IPv4 multicast address to support Neighbor Discovery

Group 1.2 Router Tests

Group 1.2.1 Boundary routers handling multicast IPv4 packets from 6over4 domain

Group 2 RFC 2765 [7]

Group 2.1 IPv4-to-IPv6 translation

Group 2.2 IPv6-to-IPv4 translation

Group 3 RFC 3056 [8]

Group 3.1 Node Tests

Group 3.1.1 Test IPv6 Prefix Allocation

Group 3.2 Encapsulation in IPv4

Group 3.2.1 Encapsulation of an IPv6Packet in an IPv4Packet

Group 3.3 6to4 Site Communication

Group 3.3.1 Unicast scenario

Group 3.4 Security Consideration

Group 3.4.1 Security consideration during Encapsulation of IPv6 packet in an IPv4 packet

Group 3.4.2 Security consideration during Decapsulation of IPv6 packet from IPv4 packet

Group 4 RFC 4213 [9]

Group 4.1 Node Tests

Group 4.1.1 Resolver libraries

Group 4.1.2 Configured tunneling - encapsulation

Group 4.1.2.1 Encapsulation of an IPv6Packet in an IPv4Packet

Group 4.1.3 Configured tunneling - decapsulation

Group 4.1.3.1 Decapsulation of IPv6Packet from IPv4Packet

Group 4.1.3.2 Handling erroneous packet while decapsulation

Group 4.1.3.3 Link-local address on tunnel interface

Group 4.1.4 Neighbor Discovery messages on tunnel interface

Group 4.1.4.1 Processing Probes packets on tunnel interface

Group 4.1.4.2 Processing Neighbor discovery packets on tunnel interface

Group 4.1.4.3 Sending Neighbor Discovery packets on tunnel interface

## Annex A (normative): Test Purposes (TP)

The test purposes have been written in the formal notation TPlan as described in annex A of TS 102 351 [1]. This original textual output file is contained in an ASCII file (TRANS.tplan) (contained in archive "ts\_102518v010101p0.zip") which accompanies the present document. The raw text file has been converted to a table format in this annex to allow better readability.

The two formats shall be considered equivalent. In the event that there appears to be syntactical or semantic differences between the two then the textual TPlan representation takes precedence over the table format in this annex.

### A.1 IPv6 Transitioning - RFC 2529

#### A.1.1 Node Tests

##### A.1.1.1 Encapsulating IPv4 Header frame format validation

Test Purpose	
<b>Identifier:</b>	TP_TRA_1003_01
<b>Summary:</b>	Test Dont fragment bit in an encapsulating IPv4 header
<b>References:</b>	RQ_003_1003
<b>IUT Role</b>	6over4-Node
<b>Test Case:</b>	TC_TRA_1003_01
with { IUT ready to send IPv6Packet } ensure that { when { IUT generates IPv6Packet } then { IUT encapsulates IPv6Packet in IPv4Packet and IUT sends IPv4Packet containing 'dont fragment bit' set to 0 } }	

Test Purpose	
<b>Identifier:</b>	TP_TRA_1004_01
<b>Summary:</b>	Test protocol field in an encapsulating IPv4 header
<b>References:</b>	RQ_003_1004
<b>IUT Role</b>	6over4-Node
<b>Test Case:</b>	TC_TRA_1004_01
with { IUT ready to send IPv6Packet } ensure that { when { IUT generates IPv6Packet } then { IUT encapsulates IPv6Packet in IPv4Packet and IUT sends IPv4Packet containing protocol set to 41 } }	



Test Purpose			
<b>Identifier:</b>	TP_TRA_1007_01		
<b>Summary:</b>	Test TTL field in an encapsulating IPv4 header		
<b>References:</b>	RQ_003_1007		
<b>IUT Role</b>	6over4-Node	<b>Test Case:</b>	TC_TRA_1007_01
<p><b>with</b> { IUT configured 'TTL value of 8'  <b>and IUT ready to send IPv6Packet</b> }</p> <p><b>ensure that</b></p> <p>{ <b>when</b> { IUT generates IPv6Packet }</p> <p>  <b>then</b> { IUT encapsulates IPv6Packet in IPv4Packet  <b>and IUT sends IPv4Packet</b>            <b>containing</b> ttl            <b>set to</b> 8</p> <p>  }</p> <p>}</p>			

### A.1.1.2 Stateless Auto-configuration and Link-local addresses on 6over4

Test Purpose			
<b>Identifier:</b>	TP_TRA_1009_01		
<b>Summary:</b>	Test IPv6 Link-local address format		
<b>References:</b>	RQ_003_1009, RQ_003_1010, RQ_003_1011, RQ_003_1012		
<b>IUT Role</b>	6over4-Node	<b>Test Case:</b>	TC_TRA_1009_01
<p><b>with</b> { IUT ready to 'form IPv6 Link-local address' }</p> <p><b>ensure that</b></p> <p>{ <b>when</b> { IUT generates 'its Link-local address' }</p> <p>  <b>then</b> { IUT 'forms Link-local address'            <b>containing</b> 'universal or local bit set to zero'            <b>and containing</b> 'last 32 bits as hexadecimal representation of IPv4 address appended to the prefix FE80::/64'</p> <p>  }</p> <p>}</p>			

### A.1.1.3 Source and Target Link layer address options

Test Purpose			
<b>Identifier:</b>	TP_TRA_1013_01		
<b>Summary:</b>	Test Frame format of Target Link-layer address option in the Neighbor Advertisement		
<b>References:</b>	RQ_003_1013, RQ_003_1014, RQ_003_1015, RQ_003_1016		
<b>IUT Role</b>	6over4-Node	<b>Test Case:</b>	TC_TRA_1013_01
<p><b>with</b> { IUT ready to send 'Neighbor Advertisement' }</p> <p><b>ensure that</b></p> <p>{ <b>when</b> { IUT generates 'a Neighbor Advertisement'            <b>containing</b> 'Target Link-layer Address option'</p> <p>  }</p> <p>  <b>then</b> { IUT sends 'Neighbor Advertisement' <b>containing</b> Link_layer_Address_option            <b>containing</b> type            <b>set to</b> 2 'bit 1 to 8'            <b>containing</b> length            <b>set to</b> 1 'bit 9 to 16'            <b>containing</b> reserved            <b>set to</b> 0 'bit 17 to 32'            <b>containing</b> IPv4_address            <b>set to</b> '32 bit address of the interface in network byte order'</p> <p>  }</p> <p>}</p>			

Test Purpose			
<b>Identifier:</b>	TP_TRA_1013_02		
<b>Summary:</b>	Test Frame format of Source Link-layer address option in the Neighbor Solicitation		
<b>References:</b>	RQ_003_1013,RQ_003_1014, RQ_003_1015, RQ_003_1016		
<b>IUT Role</b>	6over4-Node	<b>Test Case:</b>	TC_TRA_1013_02
<p>with { IUT ready to send 'Neighbor Solicitation' }</p> <p>ensure that</p> <pre> { when { IUT generates 'a Neighbor Solicitation'   containing 'Source Link-layer Address option' } then { IUT sends 'Neighbor Solicitation' containing Link_layer_Address_option   containing type     set to 1 'bit 1 to 8'   containing length     set to 1 'bit 9 to 16'   containing reserved     set to 0 'bit 17 to 32'   containing IPv4_address     set to '32 bit address of the interface in network byte order' } } </pre>			

Test Purpose			
<b>Identifier:</b>	TP_TRA_1013_03		
<b>Summary:</b>	Test Frame format of Source Link-layer address option in the Router Advertisement		
<b>References:</b>	RQ_003_1013,RQ_003_1014, RQ_003_1015, RQ_003_1016		
<b>IUT Role</b>	6over4-Router	<b>Test Case:</b>	TC_TRA_1013_03
<p>with { IUT ready to send 'Router Advertisement' }</p> <p>ensure that</p> <pre> { when { IUT generates 'a Router Advertisement'   containing 'Source Link-layer Address option' } then { IUT sends 'Router Advertisement' containing Link_layer_Address_option   containing type     set to 1 'bit 1 to 8'   containing length     set to 1 'bit 9 to 16'   containing reserved     set to 0 'bit 17 to 32'   containing IPv4_address     set to '32 bit address of the interface in network byte order' } } </pre>			

Test Purpose			
<b>Identifier:</b>	TP_TRA_1013_04		
<b>Summary:</b>	Test Frame format of Source Link-layer address option in the Router Solicitation		
<b>References:</b>	RQ_003_1013,RQ_003_1014, RQ_003_1015, RQ_003_1016		
<b>IUT Role</b>	6over4-Node	<b>Test Case:</b>	TC_TRA_1013_04
<p>with { IUT ready to send 'Router Solicitation' }</p> <p>ensure that</p> <p>{ when { IUT generates 'a Router Solicitation'</p> <p>    containing 'Source Link-layer Address option'</p> <p>    }</p> <p>  then { IUT sends 'Router Solicitation' containing Link_layer_Address_option</p> <p>    containing type</p> <p>      set to 1 'bit 1 to 8'</p> <p>    containing length</p> <p>      set to 1 'bit 9 to 16'</p> <p>    containing reserved</p> <p>      set to 0 'bit 17 to 32'</p> <p>    containing IPv4_address</p> <p>      set to '32 bit address of the interface in network byte order'</p> <p>    }</p> <p>  }</p>			

#### A.1.1.4 IPv6 Multicast address mapping to IPv4 multicast address to support Neighbor Discovery

Test Purpose			
<b>Identifier:</b>	TP_TRA_1017_01		
<b>Summary:</b>	Test IPv6 all-node multicast address mapped to IPv4 multicast address		
<b>References:</b>	RQ_003_1017, RQ_003_1018, RQ_003_1020, RQ_003_1027		
<b>IUT Role</b>	6over4-Node	<b>Test Case:</b>	TC_TRA_1017_01
<p>with { IUT configured 'organization local scope address block i.e: 192'</p> <p>  and IUT '6over4 interface is enabled'</p> <p>  }</p> <p>ensure that</p> <p>{ when { IUT generates IPv6Packet 'with IPv6 destination address set to all-nodes multicast address FF02::1' }</p> <p>  then { IUT sends IPv6Packet tunneled in IPv4Packet</p> <p>    containing ipv4_dst_addr</p> <p>      set to 'IPv4 multicast address 239.192.0.1'</p> <p>    }</p> <p>  }</p>			

Test Purpose			
<b>Identifier:</b>	TP_TRA_1017_02		
<b>Summary:</b>	Test IPv6 all-routers multicast address mapped to IPv4 multicast address		
<b>References:</b>	RQ_003_1017, RQ_003_1018, RQ_003_1020, RQ_003_1027		
<b>IUT Role</b>	6over4-Node	<b>Test Case:</b>	TC_TRA_1017_02
<p>with { IUT configured 'organization local scope address block i.e: 192'</p> <p>  and IUT '6over4 interface is enabled'</p> <p>  }</p> <p>ensure that</p> <p>{ when { IUT generates IPv6Packet 'with IPv6 destination address set to all-routers multicast address FF02::2' }</p> <p>  then { IUT sends IPv6Packet tunneled in IPv4Packet</p> <p>    containing ipv4_dst_addr</p> <p>      set to 'IPv4 multicast address 239.192.0.2'</p> <p>    }</p> <p>  }</p>			

Test Purpose			
<b>Identifier:</b>	TP_TRA_1017_03		
<b>Summary:</b>	Test IPv6 solicited-node multicast address mapped to IPv4 multicast address		
<b>References:</b>	RQ_003_1017, RQ_003_1018, RQ_003_1020, RQ_003_1027		
<b>IUT Role</b>	6over4-Node	<b>Test Case:</b>	TC_TRA_1017_03
<p><b>with</b> { IUT configured 'organization local scope address block i.e: 192'  <b>and IUT</b> '6over4 interface is enabled'            }</p> <p><b>ensure that</b></p> <p>{ <b>when</b> { IUT generates IPv6Packet 'with IPv6 destination address set to solicited-node multicast address FF02::1:FF28:9C5A' }</p> <p>  <b>then</b> { IUT sends IPv6Packet tunneled in IPv4Packet                <b>containing</b> ipv4_dst_addr                <b>set to</b> 'IPv4 multicast address 239.192.156.90'            }</p> <p>}</p>			

## A.1.2 Route Tests

### A.1.2.1 Boundary routers handling multicast IPv4 packets from 6over4 domain

Test Purpose			
<b>Identifier:</b>	TP_TRA_1024_02		
<b>Summary:</b>	Test multicast IPv4 packets with unknown organization-local scope destination address		
<b>References:</b>	RQ_003_1024		
<b>IUT Role</b>	6to4-Router	<b>Test Case:</b>	TC_TRA_1024_02
<p><b>with</b> { IUT configured 'organization local scope address block i.e: 192' }</p> <p><b>ensure that</b></p> <p>{ <b>when</b> { IUT ready to receive IPv4Packet }</p> <p>  <b>then</b> { IUT discards 'IPv4 multicast packets'                <b>containing</b> 'destination address'                <b>set to</b> 'unknown organization-local scope address block i.e: 50'            }</p> <p>}</p>			

## A.2 IPv6 Transitioning - RFC 2765

### A.2.1 IPv4-to-IPv6 translation

Test Purpose			
<b>Identifier:</b>	TP_TRA_3003_01		
<b>Summary:</b>	Test 4to6 packet translation where DF bit is not set and fragmentation is necessary		
<b>References:</b>	RQ_003_3003, RQ_003_3006, RQ_003_3007, RQ_003_3011,		
<b>IUT Role</b>	IPTranslator	<b>Test Case:</b>	TC_TRA_3003_01
<p><b>with</b> { IUT ready to translate IPv4Packet }</p> <p><b>ensure that</b></p> <p>{ <b>when</b> { IUT receives IPv4Packet <b>with</b> 'data leading to overall size &gt;1280 bytes'                <b>containing</b> protocol                <b>and containing</b> ip_identification                <b>and containing</b> DF_bit <b>set to</b> 0                <b>and containing</b> ttl                <b>and containing</b> ipv4_src_addr                <b>and containing</b> ipv4_dst_addr }</p> <p>  <b>then</b> { IUT sends IPv6Packet                <b>containing</b> flow_Label <b>set to</b> 'all zero bits'            }</p>			