

# ETSI TS 102 514 V2.1.1 (2008-02)

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*Technical Specification*

## **Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT): IPv6 Core Protocol; Requirements Catalogue**

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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 a catalogue of requirements extracted from the core IPv6 RFCs (see references in clause 2) and from ETSI Specifications. The catalogue follows the guidelines defined by the MTS IPv6 Testing: Methodology and Framework (see TS 102 351 in bibliography).

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# 2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
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NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

## 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] IETF RFC 1122: "Requirements for Internet Hosts - Communication Layers".
- [2] IETF RFC 1981: "Path MTU Discovery for IP version 6".
- [3] IETF RFC 2373: "IP Version 6 Addressing Architecture".
- [4] IETF RFC 2402: "IP Authentication Header".
- [5] IETF RFC 2460: "Internet Protocol, Version 6 (IPv6) Specification".
- [6] IETF RFC 2461: "Neighbor Discovery for IP Version 6 (IPv6)".
- [7] IETF RFC 2462: "IPv6 Stateless Address Autoconfiguration".
- [8] IETF RFC 2463: "Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification".
- [9] IETF RFC 2464: "Transmission of IPv6 Packets over Ethernet Networks".
- [10] IETF RFC 2675: "IPv6 Jumbograms".
- [11] IETF RFC 3513: "Internet Protocol Version 6 (IPv6) Addressing Architecture".

- [12] ETSI TS 123 060: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); General Packet Radio Service (GPRS); Service description; Stage 2 (3GPP TS 23.060)".
- [13] ETSI TS 123 221: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Architectural requirements (3GPP TS 23.221)".
- [14] ETSI TS 123 228: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); IP Multimedia Subsystem (IMS); Stage 2 (3GPP TS 23.228)".
- [15] ETSI TS 129 061: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN) (3GPP TS 29.061)".

### 3 Abbreviations

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

ICMP	Internet Control Message Protocol
IE	Information Element
MTU	Maximum Transmission Unit
ND	Neighbor Discovery
PDP	Packet Data Protocol
PMTU	Path MTU
TCP	Transfer Control Protocol
UDP	User Datagram Protocol

### 4 Requirements Catalogue

The requirements below have been extracted from IETF RFCs 1981 [2], 2460 [5], 2461 [6], 2462 [7], 2463 [8], 2464 [9], 2675 [10], 3513[11]) and ETSI specifications TS 123 060 [12], TS 123 221 [13], TS 123 228 [14], TS 129 061 [15]).

#### 4.1 Requirements extracted from TS 123 060

##### **RQ\_000\_7003 Configure Address**

TS 123 060 9.2.1.1

MANDATORY

Applies to: Host

Context:

An IPv6 Mobile Station is performing either stateless or stateful address autoconfiguration

Requirement:

An IPv6 Mobile Station SHALL use the interface identifier provided by the Gateway GPRS Support Node to configure its link-local address

Specification Text:

To ensure that the link-local address generated by the MS does not collide with the link-local address of the GGSN, the GGSN shall provide an interface identifier (see RFC 2462 [69]) to the MS and the MS shall use this interface identifier to configure its link-local address. This is applicable for both stateful and stateless IPv6 address autoconfiguration. In case of stateless address autoconfiguration however, the MS can choose any interface identifier to generate addresses other than link-local, without involving the network. In particular, the SGSN and the GGSN are not updated with the actual address used by the MS, as the prefix alone identifies the PDP context.

**RQ\_000\_7004 Detect Duplicate Address (DAD)**

TS 123 060 9.2.1.1

OPTIONAL

Applies to: Host

## Context:

An IPv6 Mobile Station is performing stateless address autoconfiguration using a prefix advertised by a Gateway BPRS Support Node in a PDP context.

## Requirement:

The IPv6 Mobile Station MAY omit duplicate address detection.

## Specification Text:

**Because any prefix that the GGSN advertises in a PDP context is unique within the scope of the prefix (i.e. site-local or global), there is no need for the MS to perform Duplicate Address Detection for this IPv6 address.** Therefore, the GGSN shall silently discard Neighbor Solicitation messages that the MS may send to perform Duplicate Address Detection. It is possible for the MS to perform Neighbor Unreachability Detection towards the GGSN, as defined in RFC 2461[71]; therefore if the GGSN receives a Neighbor Solicitation as part of this procedure, the GGSN shall provide a Neighbor Advertisement as described in RFC 2461.

**RQ\_000\_7005 Detect Duplicate Address (DAD)**

TS 123 060 9.2.1.1

MANDATORY

Applies to: Router

## Context:

An IPv6 Mobile Station is performing stateless address autoconfiguration using a prefix advertised by a Gateway BPRS Support Node in a PDP context.

## Requirement:

The IPv6 Gateway GPRS Support NODE SHALL silently discard any Neighbor Solicitation messages sent by the IPv6 Mobile Station.

## Specification Text:

**Because any prefix that the GGSN advertises in a PDP context is unique within the scope of the prefix (i.e. site-local or global), there is no need for the MS to perform Duplicate Address Detection for this IPv6 address.** Therefore, the GGSN shall **silently discard Neighbor Solicitation messages that the MS may send to perform Duplicate Address Detection.** .

**RQ\_000\_7006 Stateless Autoconfiguration**

TS 123 060 9.2.1.1

MANDATORY

Applies to: Router

## Context:

An IPv6 Mobile Station has sent an "Activate PDP Context Request" to its Serving GPRS Support Node

## Requirement:

The IPv6 Gateway GPRS Support Node SHALL NOT advertise the same prefix on more than one PDP context on a given APN or set of APNs, within the same addressing scope.

## Specification Text:

The GGSN sends a Router Advertisement message. The Router Advertisement messages shall contain the same prefix as the one provided in step 2. **A given prefix shall not be advertised on more than one PDP context on a given APN, or set of APNs, within the same addressing scope.** The GGSN shall be configured to advertise only one prefix per PDP context

After the MS has received the Router Advertisement message, it constructs its full IPv6 address by concatenating the interface identifier received in step 3, or a locally generated interface identifier, and the prefix received in the Router Advertisement. **If the Router Advertisement contains more than one prefix option, the MS shall only consider the first one and silently discard the others.**

**RQ\_000\_7007 Stateless Autoconfiguration**

TS 123 060 9.2.1.1

MANDATORY

Applies to: Host

## Context:

An IPv6 Mobile Station receives a Router Advertisement message which contains more than one prefix.

## Requirement:

The IPv6 Mobile Station SHALL use the first prefix and silently discard the others.

## Specification Text:

The GGSN sends a Router Advertisement message. The Router Advertisement messages shall contain the same prefix as the one provided in step 2. **A given prefix shall not be advertised on more than one PDP context on a given APN, or set of APNs, within the same addressing scope.** The GGSN shall be configured to advertise only one prefix per PDP context

After the MS has received the Router Advertisement message, it constructs its full IPv6 address by concatenating the interface identifier received in step 3, or a locally generated interface identifier, and the prefix received in the Router Advertisement. **If the Router Advertisement contains more than one prefix option, the MS shall only consider the first one and silently discard the others.**

#### **RQ\_000\_7009 Startup Router Advertisement Behavior**

TS 123 060 9.2.1.1

MANDATORY

Applies to: Router

Context:

##### Requirement:

An IPv6 Gateway GPRS Support Node shall automatically and periodically send Router Advertisement messages towards the Mobile Station after a PDP context of type IPv6 is activated

##### Specification Text:

IPv6 stateful address autoconfiguration uses the standard External PDN Address Allocation procedure, as described in TS 29.061. The GGSN informs the MS that it shall perform stateful address autoconfiguration by means of the Router Advertisements, as defined in RFC 2461. For this purpose, **the GGSN shall automatically and periodically send Router Advertisement messages towards the MS after a PDP context of type IPv6 is activated.** The use of stateless or stateful address autoconfiguration is configured per APN.

## 4.2 Requirements extracted from TS 123 221

#### **RQ\_000\_7010 3GPP UE supports IPv6**

TS 123 221 5.6

MANDATORY

Applies to: Host

Context:

##### Requirement:

A 3GPP User Equipment supporting IPv6 SHALL comply with the Basic IP group of specifications as defined in RFC3316.

##### Specification Text:

The set of IPv6 functionality a 3GPP UE will require is dependent on the services (IMS, Packet Streaming etc.) it will use.

**As a minimum, a 3GPP UE shall comply with the Basic IP group of specifications as defined in RFC3316.** This IPv6 functionality is sufficient to provide compatibility towards IPv6 entities external to 3GPP.

A 3GPP UE shall follow the recommendations for the IP Security set of functions in RFC3316 when a specific service requires such functions.

According to the procedures defined in TS 23.060, when a UE is assigned an IPv6 prefix, it can change the global IPv6 address it is currently using via the mechanism defined in RFC 3041, or similar means, without updating the PS domain. Any application that requires full IP address knowledge shall provide a mechanism to get the latest IPv6 address when the IPv6 address in the UE has been changed. An example of such means is defined in TS 23.228.

Note: RFC3316 does not make any recommendations on preferred transition and interoperability mechanisms between IPv4 and IPv6.

## 4.3 Requirements extracted from TS 129 061

#### **RQ\_000\_7000 Configure Address**

TS 129 061 11.2.1.3

MANDATORY

Applies to: Host

Context:

An IPv6 Mobile Station which is capable of both stateless and stateful autoconfiguration.

##### Requirement:

The IPv6 Mobile Station SHALL use stateless autoconfiguration to configure the address and stateful autoconfiguration to configure additional parameters only.

##### Specification Text:

**Stateful and Stateless Autoconfiguration may also co-exist. In that case, the MS shall use Stateless to configure the address and Stateful to configure additional parameters only.** The MS shall not use Stateless and Stateful Address Autoconfiguration simultaneously since GPRS only supports one prefix per PDP.



**RQ\_000\_7001 Configure Address**

TS 129 061 11.2.1.3

MANDATORY

Applies to: Host

Context:

**Requirement:**

An IPv6 Mobile Station SHALL NOT use both stateless and stateful autoconfiguration simultaneously.

**Specification Text:**

Stateful and Stateless Autoconfiguration may also co-exist. In that case, the MS shall use Stateless to configure the address and Stateful to configure additional parameters only. **The MS shall not use Stateless and Stateful Address Autoconfiguration simultaneously since GPRS only supports one prefix per PDP Context**

**RQ\_000\_7002 Configure Address**

TS 129 061 11.2.1.3

MANDATORY

Applies to: Host

Context:

**Requirement:**

An IPv6 Mobile Station SHALL support stateless address autoconfiguration.

**Specification Text:**

**For MS, IPv6 Stateless Address Autoconfiguration is mandatory**, and IPv6 Stateful Address Autoconfiguration is optional.

**RQ\_000\_7008 Startup Router Advertisement Behavior**

TS 129 061 11.2.1.3.2

OPTIONAL

Applies to: Router

Context:

**Requirement:**

AN IPv6 Gateway GPRS Support Node MAY omit the randomisation of the period between sending Router Advertisements.

**Specification Text:**

The handling of Router Advertisements shall be consistent with what is specified in RFC 2461 [44]. For the MS-GGSN link however, some specific handling shall apply. **The randomisation part to determine when Router Advertisements shall be sent may be omitted since the GGSN is the only router on the link.** Furthermore, some 3GPP specific protocol constants and default values shall apply (see subclause "IPv6 Router Configuration Variables in the GGSN"). These relate to the periodicity of the Router Advertisements initially and during continued operation. The motivation for this is to have a faster user-plane set-up even in bad radio conditions and to minimize MS power consumption during long continued operation.

**RQ\_000\_7011 Configure Address**

TS 129 061 11.2.1.3

OPTIONAL

Applies to: Host

Context:

**Requirement:**

An IPv6 Mobile Station MAY support stateful address autoconfiguration.

**Specification Text:**

**For MS, IPv6 Stateless Address Autoconfiguration is mandatory**, and **IPv6 Stateful Address Autoconfiguration is optional**.

**RQ\_000\_7012 MaxRtrAdvInterval**

TS 129 061 11.2.1.3.4

MANDATORY

Applies to: Router

Context:

**Requirement:**

The default value of the configurable timer, MaxRtrAdvInterval in a 3GPP IPv6 router shall be 21,600s (6 hours).

**Specification Text:**

For IPv6 Stateless and Stateful Address Autoconfiguration to work properly the GGSN shall behave as an IPv6 router towards the MS. In this respect the GGSN shall be consistent with the RFCs specifying this process (for example RFC 2462 and RFC 2461), unless stated otherwise in this or other 3GPP specifications.

RFC 2461 specifies a set of conceptual router configuration variables. Some of these variables require particular attention in GPRS in order to preserve radio resources and MS power consumption while still allowing for appropriate robustness and fast user-plane set-up time even in bad radio conditions, or simply because they have a particular meaning in GPRS. These particular variables are listed below with appropriate (default) values and shall be configurable per APN. **The values specified hereafter are specific to GPRS and supersede those specified in RFC 2461.**

**MaxRtrAdvInterval**

Shall have a default value of 21 600 s (6 h).

**MinRtrAdvInterval**

Shall have a default value of  $0,75 \times \text{MaxRtrAdvInterval}$  i.e. 16 200 s (4,5 h).

**AdvValidLifetime**

Shall have a value giving Prefixes infinite lifetime, i.e. 0xFFFFFFFF.  
The assigned prefix remains Preferred until PDP Context Deactivation.

**AdvPreferredLifetime**

Shall have a value giving Prefixes infinite lifetime, i.e. 0xFFFFFFFF.  
The assigned prefix remains Preferred until PDP Context Deactivation.

RFC 2461 also specifies a number of protocol constants. The following shall have specific values for GPRS:

**MAX\_INITIAL\_RTR\_ADVERT\_INTERVAL**

This constant may be a variable within GPRS. It may have a value that gradually increases (exponentially or by some other means) with the number of initial Router Advertisements sent. This will enable a fast set-up of the MS-GGSN link in most cases, while still allowing the MS to receive a Router Advertisement within the initial phase, even in case of bad radio conditions or slow response time, without having to send a large number of initial Router Advertisements.

**MAX\_INITIAL\_RTR\_ADVERTISEMENTS**

This is the number of Router Advertisements sent during the initial phase after the MS-GGSN link has been established. The value of this constant shall be chosen carefully, and in conjunction with MAX\_INITIAL\_RTR\_ADVERT\_INTERVAL, so as to not overload the radio interface while still allowing the MS to complete its configuration in a reasonable delay. For instance, the default value could be chosen so that initial Router Advertisements are sent for at least 30 s.

After the initial phase, the periodicity is controlled by the MaxRtrAdvInterval and the MinRtrAdvInterval constants.

**RQ\_000\_7013 MinRtrAdvInterval**

TS 129 061 11.2.1.3.4

MANDATORY

Applies to: Router

Context:

**Requirement:**

The default value of the configurable timer, MinRtrAdvInterval in a 3GPP IPv6 router SHALL be  $0.75 \times \text{MaxRtrAdvInterval}$  (4,5 hours).

**Specification Text:**

For IPv6 Stateless and Stateful Address Autoconfiguration to work properly the GGSN shall behave as an IPv6 router towards the MS. In this respect the GGSN shall be consistent with the RFCs specifying this process (for example RFC 2462 and RFC 2461), unless stated otherwise in this or other 3GPP specifications.

RFC 2461 specifies a set of conceptual router configuration variables. Some of these variables require particular attention in GPRS in order to preserve radio resources and MS power consumption while still allowing for appropriate robustness and fast user-plane set-up time even in bad radio conditions, or simply because they have a particular meaning in GPRS. These particular variables are listed below with appropriate (default) values and shall be configurable per APN. **The values specified hereafter are specific to GPRS and supersede those specified in RFC 2461.**

**MaxRtrAdvInterval**

Shall have a default value of 21 600 s (6 h).

**MinRtrAdvInterval**

Shall have a default value of  $0,75 \times \text{MaxRtrAdvInterval}$  i.e. 16 200 s (4,5 h).

**AdvValidLifetime**

Shall have a value giving Prefixes infinite lifetime, i.e. 0xFFFFFFFF.  
The assigned prefix remains Preferred until PDP Context Deactivation.

**AdvPreferredLifetime**

Shall have a value giving Prefixes infinite lifetime, i.e. 0xFFFFFFFF.  
The assigned prefix remains Preferred until PDP Context Deactivation.

RFC 2461 also specifies a number of protocol constants. The following shall have specific values for GPRS:

**MAX\_INITIAL\_RTR\_ADVERT\_INTERVAL**

This constant may be a variable within GPRS. It may have a value that gradually increases (exponentially or by some other means) with the number of initial Router Advertisements sent. This will enable a fast set-up of the MS-GGSN link in most cases, while still allowing the MS to receive a Router Advertisement within the initial phase, even in case of bad radio conditions or slow response time, without having to send a large number of initial Router Advertisements.

**MAX\_INITIAL\_RTR\_ADVERTISEMENTS**

This is the number of Router Advertisements sent during the initial phase after the MS-GGSN link has been established. The value of this constant shall be chosen carefully, and in conjunction with MAX\_INITIAL\_RTR\_ADVERT\_INTERVAL, so as to not overload the radio interface while still allowing the MS to complete its configuration in a reasonable delay. For instance, the default value could be chosen so that initial Router Advertisements are sent for at least 30 s.

After the initial phase, the periodicity is controlled by the MaxRtrAdvInterval and the MinRtrAdvInterval constants.

**RQ\_000\_7014 RA Prefix Option**

TS 129 061 11.2.1.3.4

MANDATORY

Applies to: Router

Context:

**Requirement:**

The default value of the configurable timer, AdvValidLifetime in a 3GPP IPv6 router SHALL be 0xFFFFFFFFH

**Specification Text:**

For IPv6 Stateless and Stateful Address Autoconfiguration to work properly the GGSN shall behave as an IPv6 router towards the MS. In this respect the GGSN shall be consistent with the RFCs specifying this process (for example RFC 2462 and RFC 2461), unless stated otherwise in this or other 3GPP specifications.

RFC 2461 specifies a set of conceptual router configuration variables. Some of these variables require particular attention in GPRS in order to preserve radio resources and MS power consumption while still allowing for appropriate robustness and fast user-plane set-up time even in bad radio conditions, or simply because they have a particular meaning in GPRS. These particular variables are listed below with appropriate (default) values and shall be configurable per APN. **The values specified hereafter are specific to GPRS and supersede those specified in RFC 2461.**

**MaxRtrAdvInterval**

Shall have a default value of 21 600 s (6 h).

**MinRtrAdvInterval**

Shall have a default value of  $0,75 \times \text{MaxRtrAdvInterval}$  i.e. 16 200 s (4,5 h).

**AdvValidLifetime**

Shall have a value giving Prefixes infinite lifetime, i.e. 0xFFFFFFFF.  
The assigned prefix remains Preferred until PDP Context Deactivation.

**AdvPreferredLifetime**

Shall have a value giving Prefixes infinite lifetime, i.e. 0xFFFFFFFF.  
The assigned prefix remains Preferred until PDP Context Deactivation.

RFC 2461 also specifies a number of protocol constants. The following shall have specific values for GPRS:

**MAX\_INITIAL\_RTR\_ADVERT\_INTERVAL**

This constant may be a variable within GPRS. It may have a value that gradually increases (exponentially or by some other means) with the number of initial Router Advertisements sent. This will enable a fast set-up of the MS-GGSN link in most cases, while still allowing the MS to receive a Router Advertisement within the initial phase, even in case of bad radio conditions or slow response time, without having to send a large number of initial Router Advertisements.

**MAX\_INITIAL\_RTR\_ADVERTISEMENTS**

This is the number of Router Advertisements sent during the initial phase after the MS-GGSN link has been established. The value of this constant shall be chosen carefully, and in conjunction with MAX\_INITIAL\_RTR\_ADVERT\_INTERVAL, so as to not overload the radio interface while still allowing the MS to complete its configuration in a reasonable delay. For instance, the default value could be chosen so that initial Router Advertisements are sent for at least 30 s.

After the initial phase, the periodicity is controlled by the MaxRtrAdvInterval and the MinRtrAdvInterval constants.

**RQ\_000\_7015 RA Prefix Option**

TS 129 061 11.2.1.3.4

Applies to: Router

Context:

MANDATORY

**Requirement:**

The default value of the configurable timer, AdvPreferredLifetime in a 3GPP IPv6 router SHALL be 0xFFFFFFFFH

**Specification Text:**

For IPv6 Stateless and Stateful Address Autoconfiguration to work properly the GGSN shall behave as an IPv6 router towards the MS. In this respect the GGSN shall be consistent with the RFCs specifying this process (for example RFC 2462 and RFC 2461), unless stated otherwise in this or other 3GPP specifications.

RFC 2461 specifies a set of conceptual router configuration variables. Some of these variables require particular attention in GPRS in order to preserve radio resources and MS power consumption while still allowing for appropriate robustness and fast user-plane set-up time even in bad radio conditions, or simply because they have a particular meaning in GPRS. These particular variables are listed below with appropriate (default) values and shall be configurable per APN. **The values specified hereafter are specific to GPRS and supersede those specified in RFC 2461.**

**MaxRtrAdvInterval**

Shall have a default value of 21 600 s (6 h).

**MinRtrAdvInterval**

Shall have a default value of  $0,75 \times \text{MaxRtrAdvInterval}$  i.e. 16 200 s (4,5 h).

**AdvValidLifetime**

Shall have a value giving Prefixes infinite lifetime, i.e. 0xFFFFFFFFH.  
The assigned prefix remains Preferred until PDP Context Deactivation.

**AdvPreferredLifetime**

Shall have a value giving Prefixes infinite lifetime, i.e. 0xFFFFFFFFH.  
The assigned prefix remains Preferred until PDP Context Deactivation.

RFC 2461 also specifies a number of protocol constants. The following shall have specific values for GPRS:

**MAX\_INITIAL\_RTR\_ADVERT\_INTERVAL**

This constant may be a variable within GPRS. It may have a value that gradually increases (exponentially or by some other means) with the number of initial Router Advertisements sent. This will enable a fast set-up of the MS-GGSN link in most cases, while still allowing the MS to receive a Router Advertisement within the initial phase, even in case of bad radio conditions or slow response time, without having to send a large number of initial Router Advertisements.

**MAX\_INITIAL\_RTR\_ADVERTISEMENTS**

This is the number of Router Advertisements sent during the initial phase after the MS-GGSN link has been established. The value of this constant shall be chosen carefully, and in conjunction with MAX\_INITIAL\_RTR\_ADVERT\_INTERVAL, so as to not overload the radio interface while still allowing the MS to complete its configuration in a reasonable delay. For instance, the default value could be chosen so that initial Router Advertisements are sent for at least 30 s.

After the initial phase, the periodicity is controlled by the MaxRtrAdvInterval and the MinRtrAdvInterval constants.