3GPP TSG-CN Meeting #22 **NP-030563**
10th - 12th December. Maui, Hawaii.

Source: TSG CN WG3

Title: CRs on R99 Work Item GPRS.

Agenda item: 7.3

Document for: APPROVAL

Introduction:

This document contains **4** CRs on **R99 Work Item GPRS,** including the corresponding mirror CRs (as required).

These CRs have been agreed by TSG CN WG3 and are forwarded to TSG CN Plenary meeting for approval.

WG_tdoc	Title	Spec	CR	Rev	Cat	Rel
N3-030701	Updated reference for DHCPv6	27.060	088		F	Rel-5
N3-030767	Updated reference for DHCPv6	29.061	096	1	F	R99
N3-030768	Updated reference for DHCPv6	29.061	097	1	A	Rel-4
N3-030769	Updated reference for DHCPv6	29.061	098	1	A	Rel-5

3GPP TSG-CN WG3 Meeting #30 **N3-030701**
Bangkok, Thailand. 27th - 31st October 2003.

CR-Form-v7

CHANGE REQUEST

⌘ **27.060** **CR** **088** ⌘ **rev** **-** ⌘ Current version: **5.5.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title:	⌘	Updated reference for DHCPv6
Source:	⌘	TSG_CN WG3
Work item code:	⌘	GPRS
Date:	⌘	31/10/2003
Category:	⌘	**F**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	The specification of DHCPv6 has now become RFC 3315.
Summary of change:	⌘	Reference to “draft-ietf-dhc-dhcpv6-24.txt” is replaced by RFC 3315.
Consequences if not approved:	⌘	Incorrect reference to an IETF draft.

Clauses affected:	⌘	2

		Y	N		
Other specs affected:	⌘		X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

Start of modified section

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] Void.

[2] Void.

[3] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service Description Stage 1".

[4] Void.

[5] Void.

[6] Void.

[7] Void.

[8] Void.

[9] 3GPP TS 23.060: "General Packet Radio Service (GPRS) Service Description Stage 2".

[10] Void.

[11] Void.

[12] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core Network protocols; Stage 3".

[13] Void.

[14] Void.

[15] Void.

[16] 3GPP TS 27.007: "AT command set for 3GPP User Equipment (UE)".

[17] 3GPP TS 29.061: "Packet Domain; Interworking between the Public Land Mobile Network (PLMN) supporting Packet Based Services and Packet Data Networks (PDN)".

[18] ITU-T Recommendation E.164: "Numbering plan for the ISDN era".

[19] ITU-T Recommendation V.42 bis: "Data communication over the telephone network – Data compression procedures for data circuit-terminating equipment (DCE) using error correction procedures".

[20] Void.

[21] Void.

[22] Void.

[23] Void.

[24] Void.

[25] Void.

[26] IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).

[27] IETF RFC 791 (1981): "Internet Protocol" (STD 5).

[28] IETF RFC 792 (1981): "Internet Control Message Protocol" (STD 5).

[29] IETF RFC 793 (1981): "Transmission Control Protocol" (STD 7).

[30] ITU-T Recommendation V.250 (ex V.25ter): "Serial asynchronous automatic dialling and control".

[31] ITU-T Recommendation V.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[32] ITU-T Recommendation V.28: "Electrical Characteristics for unbalanced double-current interchange circuits".

[33] ITU-T Recommendation V.80: "In-band DCE control and synchronous data modes for asynchronous DTE".

[34] IETF RFC 1661 (1994): “The Point-to-Point Protocol (PPP)” (STD 51).

[35] IETF RFC 1662 (1994): “PPP in HDLC-like framing” (STD 51).

[36] IETF RFC 1700 (1994): “Assigned Numbers” (STD 2).

[37] IETF RFC 1570 (1994): ”PPP LCP Extensions“.

[38] IETF RFC 1989 (1996): ”PPP Link Quality Monitoring“.

[39] IETF RFC 1332 (1992): ”The PPP Internet Protocol Control Protocol (IPCP)“.

[40] IETF RFC 1877 (1995): ”PPP IPCP Extensions for Name Server Addresses “.

[41] IETF RFC 2153 (1997): ”PPP Vendor Extensions“.

[42] IETF RFC 1334 (1992): ”PPP Authentication Protocols“.

[43] IETF RFC 1994 (1996): ”PPP Challenge Handshake Authentication Protocol“.

[44] IETF RFC 2686 (1999): ”The Multi-Class Extension to Multi-Link PPP”.

[45] IETF RFC 1990 (1996): ”The PPP Multilink Protocol (MP)“.

[46] IETF RFC 2472 (1998): ”IP Version 6 over PPP".

[47] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[48] 3GPP TS 23.221: "Architectural requirements".

[49] IETF RFC 2373 (1998): "IP version 6 Addressing Architecture".

[50] 3GPP TS 24.228: "Signalling flows for the IP multimedia call control based on SIP and SDP; Stage 3"

[51] 3GPP TS 24.229: " IP Multimedia Call Control Protocol based on SIP and SDP; Stage 3".

[52] 3GPP TS 29.207: "Policy control over Go interface".

[53] 3GPP TS 29.208: "End-to-end QoS signalling flows".

[54] IETF RFC 3261 (March 2002): "SIP: Session Initiation Protocol".

[55] IETF RFC 3315 (2003) ~~Internet-Draft~~: “Dynamic Host Configuration Protocol for IPv6 (DHCPv6)”, R. Droms, J. Bound, B. Volz, T. Lemon, C. Perkins, M. Carney. ~~draft-ietf-dhc-dhcpv6-24.txt, work in progress.~~

[56] IETF RFC 1034 (1987): "Domain Names - Concepts and Facilities" (STD 13).

[57] IETF RFC 1035 (1987): "Domain Names - Implementation and Specification" (STD 13).

[58] IETF RFC 1886 (1995): "DNS Extensions to support IP version 6".

End of modified section

3GPP TSG-CN WG3 Meeting #30 **N3-030767**
Bangkok, Thailand. 27th - 31st October 2003.

CR-Form-v7

CHANGE REQUEST

⌘ **29.061** **CR** **096** ⌘ **rev** **1** ⌘ Current version: **3.13.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Updated reference for DHCPv6
Source:	⌘	TSG_CN WG3
Work item code:	⌘	GPRS
Date:	⌘	31/10/2003
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
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D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	The specification of DHCPv6 has now become RFC 3315. The Client Message Option and the Server Message Option used in some earlier drafts have been combined into the new Relay Message Option
Summary of change:	⌘	Reference to "draft-ietf-dhc-dhcpv6-28.txt" is replaced by RFC 3315. Some related, temporary text is removed. The Client Message Option and the Server Message Option are replaced by the Relay Message Option
Consequences if not approved:	⌘	Incorrect reference to an IETF draft. Incorrect options in DHCPv6 messages.

Clauses affected:	⌘	2, 11.2.1.3.1, 13.1, 13.2.1.2, 13.2.2

Other specs affected:	⌘	Y	N		⌘
			X	Other core specifications	
			X	Test specifications	
			X	O&M Specifications	

Other comments: ⌘

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First Modified Section

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] 3GPP TS 01.04: "Abbreviations and acronyms".

[2] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service Description; Stage 1".

[3] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service Description; Stage 2".

[4] 3GPP TS 03.61: "General Packet Radio Service (GPRS); Point-to-Multipoint Multicast Service Description; Stage 2".

[5] 3GPP TS 03.62: "General Packet Radio Service (GPRS); Point-to-Multipoint Group Call Service Description; Stage 2".

[6] 3GPP TS 03.64: "General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2".

[7] 3GPP TS 04.60: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol".

[8] 3GPP TS 04.64: "General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".

[9] 3GPP TS 24.065: "General Packet Radio Service (GPRS); Mobile Station (MS) - Serving GPRS Support Node (SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[10] 3GPP TS 27.060: "Packet Domain; Mobile Station (MS) supporting Packet Switched Services".

[11] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[12] Void.

[13] Void.

[14] Void.

[15] IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).

[16] IETF RFC 791 (1981): "Internet Protocol" (STD 5).

[17] IETF RFC 792 (1981): "Internet Control Message Protocol" (STD 5).

[18] IETF RFC 793 (1981): "Transmission Control Protocol" (STD 7).

[19] IETF RFC 1034 (1987): "Domain names - concepts and facilities" (STD 7).

[20] Void.

[21a] IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).

[21b] IETF RFC 1662 (1994): "PPP in HDLC-like Framing" (STD 51).

[22] IETF RFC 1700 (1994): "Assigned Numbers" (STD 2).3.

[23] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core Network protocols; Stage 3".

[24] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".

[25] IETF RFC 2794 (2000): "Mobile IP Network Access Identifier Extension for IPv4", P. Calhoun, C. Perkins.

[26] IETF RFC 2131 (1997): "Dynamic Host Configuration Protocol".

[27] IETF RFC 1542 (1993): "Clarifications and Extensions for the Bootstrap Protocol".

[28] IETF RFC 2373 (1998): "IP Version 6 Addressing Architecture".

[29] IETF RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".

[30] IETF RFC 2002 (1996): "IP Mobility Support", C. Perkins.

[31] IETF RFC 2486 (1999): "The Network Access Identifier", B. Aboba and M. Beadles.

[32] IETF RFC 1112 (1989): "Host extensions for IP multicasting", S.E. Deering.

[33] IETF RFC 2236 (1997): "Internet Group Management Protocol, Version 2", W. Fenner.

[34] IETF RFC 2362 (1998): "Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification", D. Estrin, D. Farinacci, A. Helmy, D. Thaler, S. Deering, M. Handley, V. Jacobson, C. Liu, P. Sharma, L. Wei.

[35] IETF RFC 1075 (1988): "Distance Vector Multicast Routing Protocol", D. Waitzman, C. Partridge, S.E. Deering.

[36] IETF RFC 1585 (1994): "MOSPF: Analysis and Experience", J. Moy.

[37] IETF RFC 2290 (1998): "Mobile-IPv4 Configuration Option for PPP IPCP", J. Solomon, S. Glass.

[38] IETF RFC 2865 (2000): "Remote Authentication Dial In User Service (RADIUS)", C. Rigney, S. Willens, A. Rubens, W. Simpson.

[39] IETF RFC 2866 (2000): "RADIUS Accounting", C. Rigney, Livingston.

[40] 3GPP TS 23.003: "Numbering, addressing and identification".

[41] IETF RFC 2882 (2000): "Network Access Servers Requirements: Extended RADIUS Practices", D. Mitton.

[42] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[43] Void.

[44] IETF RFC 2461 (1998): "Neighbor Discovery for IP Version 6 (IPv6)", T. Narten, E. Nordmark, W. Simpson.

[45] IETF RFC 3118 (2001): "Authentication for DHCP Messages", R. Droms, W. Arbaugh.

[46] IETF RFC 3315 (2003) ~~Internet-Draft~~: "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", R. Droms, J. Bound, B. Volz, T. Lemon, C. Perkins, M. Carney.~~draft-ietf-dhc-dhcpv6-28.txt, work in progress.~~

[47] 3GPP TS 24.229: "IP Multimedia Call Control Protocol based on SIP and SDP; Stage 3".

[48] IETF RFC 2710 (1999): "Multicast Listener Discovery (MLD) for IPv6", S. Deering, W. Fenner, B. Haberman.

[49] IETF RFC 2460 (1998): "Internet Protocol, Version 6 (IPv6) Specification", S.Deering,, R.Hinden.

[50] IETF RFC 3162 (2001): "RADIUS and IPv6", B. Adoba, G. Zorn, D. Mitton.

[51] IETF RFC 2548 (1999): "Microsoft Vendor-specific RADIUS Attributes", G.Zorn.

[52] IETF RFC 1035 (1987): "Domain names - implementation and specification".

[53] IETF RFC 1771 (1995): "A Border Gateway Protocol 4 (BGP-4)".

[54] IETF RFC 1825 (1995): "Security Architecture for the Internet Protocol".

[55] IETF RFC 1826 (1995): "IP Authentication Header".

[56] IETF RFC 1827 (1995): "IP Encapsulating Security Payload (ESP)".

[57] IETF RFC 2044 (1996): "UTF-8, a transformation format of Unicode and ISO 10646".

[58] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core Network Protocols - Stage 3".

Next Modified Section

11.2.1.3.1 IPv6 PDP Context Activation

In this case:

- the GGSN provides the MS with an IPv6 Prefix belonging to the Intranet/ISP addressing space. A dynamic IPv6 address shall be given using either stateless or stateful address autoconfiguration. This IPv6 address is used for packet forwarding within the packet domain and for packet forwarding on the Intranet/ISP;
- the MS may send an authentication request at PDP context activation and the GGSN may request user authentication from a server, e.g. AAA, …, belonging to the Intranet/ISP;
- the protocol configuration options are retrieved (if requested by the MS at PDP context activation) from some server, e.g. AAA, …, belonging to the Intranet/ISP;
- in order to avoid any conflict between the link-local address of the MS and that of the GGSN, the Interface-Identifier used by the MS to build its link-local address shall be assigned by the GGSN. The GGSN ensures the uniqueness of this interface-identifier. The MT shall then enforce the use of this Interface-Identifier by the TE. This is valid for both stateless and stateful address autoconfiguration.
- the communication between the Packet Domain and the Intranet/ISP may be performed over any network, even an insecure e.g. the Internet. In case of an insecure connection between the GGSN and the Intranet/ISP there may be a specific security protocol over the insecure connection. This security protocol is defined by mutual agreement between PLMN operator and Intranet/ISP administrator.
- the MS may request DNS server IPv6 addresses using the PCO IE in e.g. the PDP Context Request message. In that case the GGSN may return the IP address of one or more DNS servers in the PCO in the PDP Context Response message. The DNS address(es) shall be coded in the PCO as specified in 3GPP TS 24.008 [58]. If a list of servers is received, the MS shall adhere to the explicit prioritisation order of the list.

In the following signalling flow example, PPP is used as layer 2 protocol over the R reference point. The MT behaves as a PPP server and translates Protocol Configuration Options into SM message IEs. GTP-C carries this information unchanged to the GGSN which uses the information e.g. for RADIUS authentication. The result of the host authentication is carried via GTP-C back to the SGSN, which then relays the result to the MT. The MT finalises the IPV6CP negotiation by sending an IPV6CP Configure-Ack message to the TE with the appropriate options included, e.g. Interface-Identifier. The Interface-Identifier shall be used in the TE to create a link-local address to be able to perform the IPv6 address autoconfiguration (see subclauses 11.2.1.3.2 and 11.2.1.3.3).

1) The TE sends an AT-command to the MT to set up parameters and enter PPP mode. The MT responds with an AT-response.

2) LCP negotiates Maximum-Receive-Unit and authentication protocol. The negotiated authentication protocol is either CHAP, PAP or 'none'. The MT shall try to negotiate for CHAP as first priority.

3) If the negotiated authentication protocol is either of CHAP or PAP, the TE authenticates itself towards the MT by means of that protocol. The MT stores the necessary authentication data and sends a forced positive acknowledgement of the authentication to the TE.

4) The TE requests IPv6 Interface-Identifier negotiation by sending the IPV6CP Configure-Request message to the MT.

5) The MT sends the Activate PDP Context Request message to the SGSN, including the Protocol Configuration Options. The Protocol Configuration Options IE may contain negotiated LCP options such as negotiated Authentication Protocol as well as any authentication data previously stored in the MT. It may also contain a request for dynamic configuration of DNS server IPv6 addresses. The MS shall for dynamic address allocation leave PDP Address empty and set PDP Type to IPv6. The SGSN sends the Create PDP context request message to the chosen GGSN including the unmodified Protocol Configuration Options.

6) The GGSN deduces from local configuration data associated with the APN:

   - IPv6 address allocation type (stateless or stateful);
   - the source of IPv6 Prefixes in the stateless case (GGSN internal prefix pool, or external address allocation server);
   - any server(s) to be used for address allocation, authentication and/or protocol configuration options retrieval (e.g. IMS related configuration, see 3GPP TS 24.229 [47]);
   - the protocol e.g. RADIUS, to be used with the server(s);
   - the communication and security feature needed to communicate with the server(s);

   As an example the GGSN may use one of the following options:

   - GGSN internal Prefix pool for IPv6 prefix allocation and no authentication;
   - GGSN internal Prefix pool for IPv6 prefix allocation and RADIUS for authentication. The AAA server responds with either an Access-Accept or an Access-Reject to the RADIUS client in the GGSN;
   - RADIUS for authentication and IPv6 prefix allocation. The AAA server responds with either an Access-Accept or an Access-Reject to the RADIUS client in the GGSN;

NOTE: DHCPv6 may be used for IPv6 prefix allocation ~~when an appropriate RFC becomes available~~.

IPv6 Prefixes in a GGSN internal Prefix pool shall be configurable and structured per APN.

The GGSN shall in the PDP Address IE in the Create PDP Context Response return an IPv6 address composed of a Prefix and an Interface-Identifier. The Interface-Identifier may have any value and it does not need to be unique within or across APNs. It shall however not conflict with the Interface-Identifier the GGSN has selected for its own side of the MS-GGSN link. The Prefix assigned by the GGSN or the external AAA server shall be globally or site-local unique, if stateless address autoconfiguration is configured on this APN. If, on the other hand, stateful address autoconfiguration is configured on the APN, the Prefix part of the IPv6 address returned in the PDP Address IE shall be set to the link-local prefix (FE80::/64).

The GGSN shall analyse the requested values of all the protocol options contained in the received Protocol Configurations Options IE. The GGSN response shall be in accordance with the relevant standards e.g. the PPP standards RFC 1661 [21a] and RFC 1662 [21b].

7) The GGSN sends back to the SGSN a Create PDP Context Response message, containing the PDP Address IE and the Protocol Configuration Options IE. The Protocol Configuration Options IE may contain configuration data such as a list of DNS server IPv6 addresses. The cause value shall be set according to the outcome of the host authentication and configuration.

8) Depending on the cause value received in the Create PDP Context Response, the SGSN either stores the PDP Address and sends an Activate PDP Context Accept to the MS or, sends an Activate PDP Context Reject, to the MS.

If Protocol Configuration Options are received from the GGSN, the SGSN shall relay those to the MS.

9) The MT extracts the Interface-Identifier from the address received in the PDP Address IE and ignores the Prefix part. If this Interface-Identifier is identical to the tentative Interface-Identifier indicated in the IPV6CP Configure-Request message sent from the TE , the MT sends an IPV6CP Configure Ack packet, indicating this Interface-Identifier, to the TE.

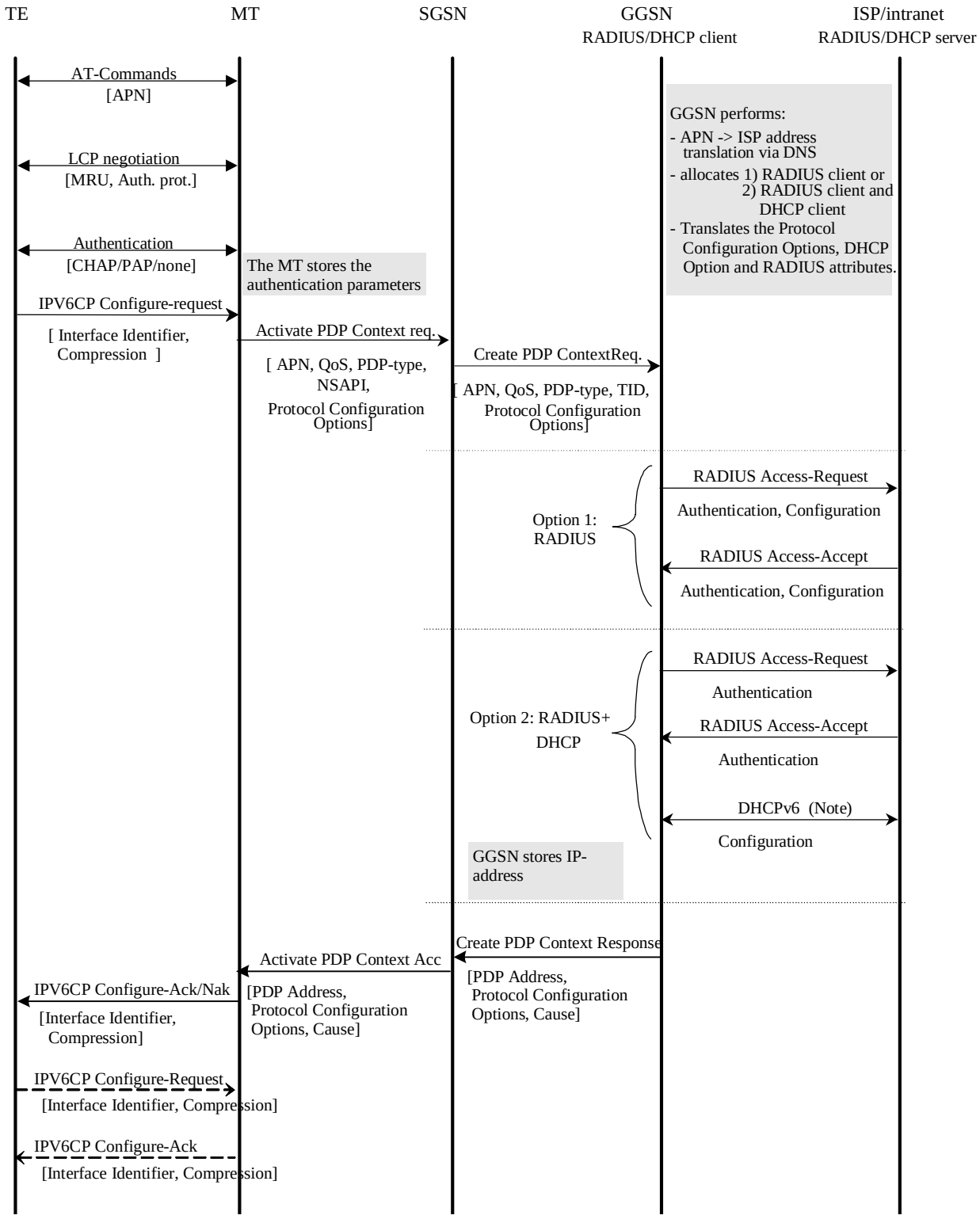
   If the Interface-Identifier extracted from the address contained in the PDP Address IE is not identical to the tentative Interface-Identifier indicated in the IPV6CP Configure-Request message sent from the TE, the MT sends an IPV6CP Configure-Nak packet, indicating the Interface-Identifier extracted from the address contained in the PDP Address IE, to the TE. The TE then sends a new IPV6CP Configure-Request message to the MT, indicating the same Interface-Identifier as was indicated in the received IPV6CP Configure Nak (as indicated by the dotted IPV6CP Configure-Request and Configure-Ack in figure 11ba). Finally the MT responds with a IPV6CP Configure Ack packet.

   In case a PDP Context Reject was sent to the MS the MT sends an LCP Terminate-Request to the TE.

10) When the TE has accepted the Interface-Identifier given by the MT, the user plane link from the TE to the GGSN and the external ISP/Intranet is established and the IPv6 address autoconfiguration may proceed.

    In case a link terminate request packet was sent to the TE, the TE and MT negotiates for link termination. The MT may then send a final AT-response to inform the TE about the rejected PDP Context activation.

    An LCP Terminate-request causes a PDP context deactivation.



NOTE: DHCPv6 may be used for IPv6 prefix allocation ~~when an appropriate RFC becomes available~~.

Figure 11ba: PDP Context Activation for the IPv6 Non-transparent case

Figure 11ba is valid for both Stateless and Stateful Address Autoconfiguration case. In the Stateful case though, option 2 does not apply and option 1 may only be used for authentication. The use of DHCPv6 above is different and used in a different context than when used for Stateful Address Autoconfiguration as in subclause 11.2.1.3.3.

Next Modified Section

13.1 General

In current LAN environments the most commonly used configuration protocol is DHCP (Dynamic Host Configuration Protocol, RFC 2131 [26]) and DHCPv6 (Dynamic Host Configuration Protocol for IPv6, IETF RFC 3315 [46])~~when the DHCPv6 IETF internet-draft [46]becomes an RFC standard.~~ It provides a mechanism for passing a large set of configuration parameters to hosts connected to a TCP/IP network (IP address, sub-net mask, domain name, MTU, etc.) in an automatic manner. Moreover DHCP may assign IP addresses to clients for a finite lease time, allowing for sequential reassignment of addresses to different users.

The lease time is chosen by the administrator of the DHCP server (in the external network), and is therefore out of the scope of the present document.

The Packet Domain offers the end user the possibility to run DHCP end-to-end the same way as he does when connected directly to a LAN (e.g. an enterprise Intranet). No modifications should be required in common implementations of DHCP clients and servers. However a Packet Domain-specific DHCP relay agent RFC 1661 [21a] and RFC 1662 [21b] is needed in the GGSN so as to allow correct routing of DHCP requests and replies between the TE and the DHCP servers.

At PDP context activation no IP address is allocated, this is done afterwards through DHCP. After the TE's configuration has been completed by DHCP, the PDP context is updated by means of the GGSN-initiated PDP Context Modification Procedure in order to reflect the newly assigned IP address.

In the following cases the corresponding PDP context shall be deactivated and the whole procedure starting with PDP context activation shall be restarted by the MS:

- if the DHCP lease expires;
- if the DHCP renewal is rejected by the DHCP server;
- if the IP address is changed during the renewal process. Usually when the lease is renewed, the IP address remains unchanged. However, if for any reason (e.g. poor configuration of the DHCP server), a different IP address is allocated during the lease renewal process the PDP Context shall be deactivated.

Next Modified Section

13.2.1.2 Address allocation using DHCPv6

The following description bullet items describe the signal flow. For a detailed description of the DHCPv6 messages refer to the DHCPv6 IETF ~~Internet-draft~~ RFC 3315 [46]. In the context of IPv6, address allocation through DHCP is also referred to as Stateful Address Autoconfiguration. The end-to-end protocol configuration is depicted in figure 16e.

The PDP Context activation part and the initial Router Advertisement that triggers the MS to do the Stateful Address Autoconfiguration is described in subclause "IPv6 Non Transparent access to an Intranet or ISP".

1) The TE sends a SOLICIT message with the IP destination address set to the All_DHCP_Relay_Agents_and_Servers multicast address defined in the DHCPv6 IETF ~~Internet-draft~~ RFC 3315 [46]. The source address is the link local address created by the MS. The SOLICIT message shall contain one IA option.

2) The GGSN creates a RELAY-FORWARD message. The "Relay ~~Client~~ Message" option shall include the entire SOLICIT message. The GGSN sends the message to the DHCP server(s) configured for the APN using unicast addresses or All_DHCP_Servers multicast address. More details on the parameters for the RELAY-FORWARD are found in the DHCPv6 IETF ~~Internet-draft~~ RFC 3315 [46]. The GGSN may store a PDP Context ID in the Interface-Id option if this aids it in handling the Relay-Reply (the DHCP server will echo the Interface-Id option).

3) DHCP servers receiving the RELAY-FORWARD message including the SOLICIT request reply by sending a RELAY-REPLY message. The "Relay ~~Server~~ Message" option includes the ADVERTISE message with an offered IP address.

4) GGSN extracts the ADVERTISE messages and forwards the messages to the proper MS.

5) The TE chooses one of the possibly several ADVERTISE messages and sends a REQUEST confirming its choice and requesting additional configuration information.

6) GGSN embeds the REQUEST in the "Relay ~~Client~~ Message" option of the RELAY-FORWARD and sends it as explained in step 2.

7) The selected DHCP server receives the RELAY-FORWARD and replies with a RELAY-REPLY. The "Relay ~~Server~~ Message" option includes the REPLY message containing the configuration information requested by the TE.

8) The GGSN extracts the REPLY message and forwards it to the proper MS. GGSN also extracts IA option information such as the allocated MS IPv6 address and its lifetime and stores it in the corresponding PDP context. The GGSN shall silently discard any Neighbour Solicitation message sent by the MS to perform Duplicate Address Detection (see 3GPP TS 23.060 [3]).

9) The GGSN initiates a PDP context modification procedure by sending an Update PDP Context Request to the appropriate SGSN with the End User Address information element set to the allocated IPv6 address.

10) The SGSN sends a Modify PDP Context Request to the MT with the allocated IPv6 address in the PDP Address information element.

11) The MT acknowledges by sending a Modify PDP Context Accept to the SGSN.

12) The SGSN sends an Update PDP Context Response to the GGSN. The PDP context has been successfully updated with the allocated IPv6 address.

In the Stateful Address Autoconfiguration, Router Advertisements sent by GGSN on the MS-GGSN link shall not contain any Prefix Information option, even when GGSN has knowledge of the Prefix of the MS through the DHCP relay agent. The Prefix need not be advertised since the MS is the only host on the link and Stateless Address Autoconfiguration shall not be performed concurrently to Stateful Address Autoconfiguration.

EXAMPLE: In the following example a successful PDP context activation with use of DHCPv6 from end to end is shown.

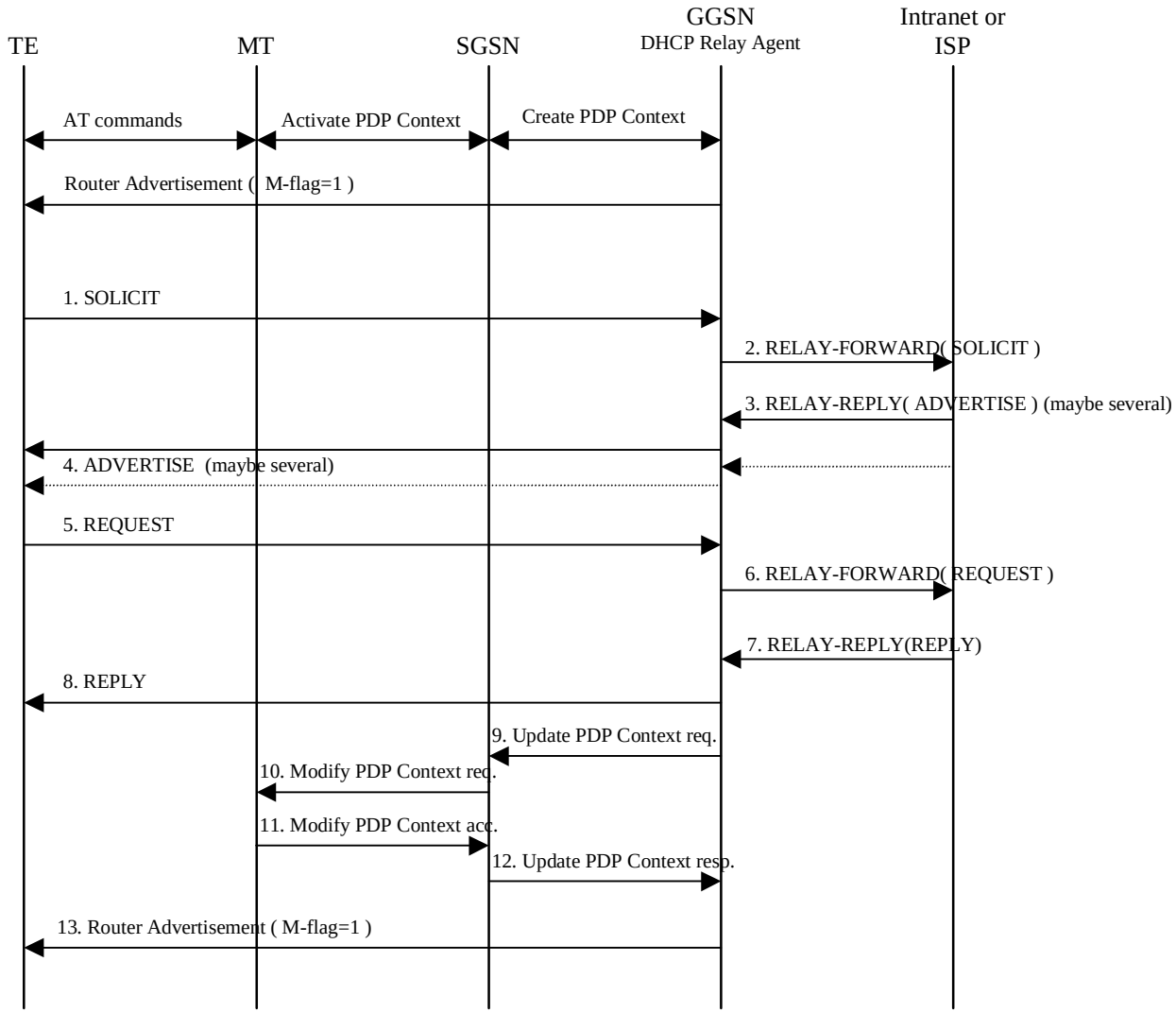


Figure 16e: DHCPv6 signal flow

Next Modified Section

13.2.2 Other configuration by the Intranet or ISP (IPv6 only)

When using IPv6, in some situations the MS may need additional configuration information from the Intranet or ISP besides the IP address. It may for example be IMS related configuration options (see 3GPP TS 24.229 [47]). If the MS is DHCP capable and the IPv6 address has been allocated using Stateless Address Autoconfiguration, the MS may use a procedure as in the example below to configure additional external network protocol parameters, or other parameters that apply to the Intranet or ISP. The GGSN shall in this case indicate to the MS that there is additional configuration information to retrieve by setting the O-flag in the Router Advertisements. This shall be configured per APN in the GGSN.

The following description bullet items describe an example of a signal flow, where the MS directs an Information-Request to the All_DHCP_Relay_Agents_and_Servers multicast address. The MS may also direct the message to a specific server instead of all servers. For a detailed description of the DHCPv6 messages refer to the DHCPv6 IETF ~~Internet-draft~~ RFC 3315 [46]. The sequence is depicted in figure 16f.

1) A Router Advertisement with the O-flag set, is sent from GGSN to TE to indicate to it to retrieve other configuration information.

2) The TE sends an INFORMATION-REQUEST message with the IP destination address set to the All_DHCP_Relay_Agents_and_Servers multicast address defined in the DHCPv6 IETF ~~Internet-draft~~ RFC

3315 [46]. The source address shall be the link-local address of the MS. The DHCP relay agent in the GGSN shall forward the message.

3) DHCP servers receiving the forwarded INFORMATION-REQUEST message, reply by sending a RELAY-REPLY message, with the "Relay ~~server m~~Message" option including a REPLY message with the requested configuration parameters.

The TE chooses one of the possibly several REPLY messages and extracts the configuration information.

EXAMPLE: In the following example a request for information with use of DHCPv6 from end to end is shown.

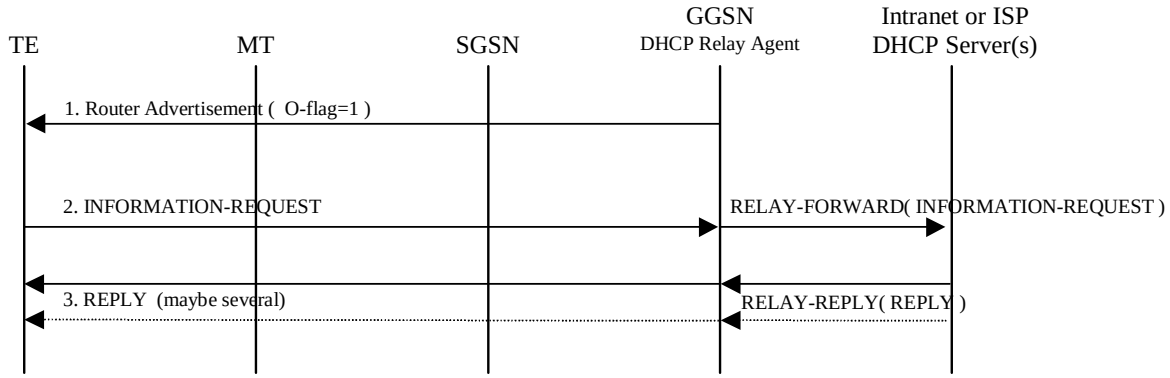


Figure 16f: DHCPv6 Other configuration signal flow

End of Modifications

3GPP TSG-CN WG3 Meeting #30 **N3-030768**
Bangkok, Thailand. 27th - 31st October 2003.

CR-Form-v7

CHANGE REQUEST

⌘ **29.061** **CR** **097** ⌘ **rev** **1** ⌘ Current version: **4.8.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Updated reference for DHCPv6
Source:	⌘	TSG_CN WG3
Work item code:	⌘	GPRS
Date:	⌘	31/10/2003
Category:	⌘	**A**
Release:	⌘	Rel-4

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	The specification of DHCPv6 has now become RFC 3315. The Client Message Option and the Server Message Option used in some earlier drafts have been combined into the new Relay Message Option
Summary of change:	⌘	Reference to "draft-ietf-dhc-dhcpv6-28.txt" is replaced by RFC 3315. Some related, temporary text is removed. The Client Message Option and the Server Message Option are replaced by the Relay Message Option
Consequences if not approved:	⌘	Incorrect reference to an IETF draft. Incorrect options in DHCPv6 messages.

Clauses affected:	⌘	2, 11.2.1.3.1, 13.1, 13.2.1.2, 13.2.2

Other specs affected:	⌘	Y	N		⌘
			X	Other core specifications	
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

First Modified Section

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] Void.

[2] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service Description; Stage 1 ".

[3] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service Description; Stage 2".

[4] 3GPP TS 03.61: "Point-to-Multipoint Multicast Service Description; Stage 2".

[5] 3GPP TS 03.62: "Point-to-Multipoint Group Call Service Description; Stage 2".

[6] 3GPP TS 03.64: "General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; Stage 2".

[7] 3GPP TS 04.60: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol".

[8] 3GPP TS 04.64: "General Packet Radio Service (GPRS); Mobile Station - Serving GPRS Support Node (MS-SGSN) Logical Link Control (LLC) layer specification".

[9] 3GPP TS 24.065: "General Packet Radio Service (GPRS); Mobile Station (MS) - Serving GPRS Support Node(SGSN); Subnetwork Dependent Convergence Protocol (SNDCP)".

[10] 3GPP TS 27.060: "Packet Domain; Mobile Station (MS) supporting Packet Switched Services".

[11] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[12] Void.

[13] Void.

[14] Void.

[15] IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).

[16] IETF RFC 791 (1981): "Internet Protocol" (STD 5).

[17] IETF RFC 792 (1981): "Internet Control Message Protocol" (STD 5).

[18] IETF RFC 793 (1981): "Transmission Control Protocol" (STD 7).

[19] IETF RFC 1034 (1987): "Domain names - concepts and facilities" (STD 7).

[20] Void.

[21a] IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).

[21b] IETF RFC 1662 (1994): "PPP in HDLC-like Framing".

[22] IETF RFC 1700 (1994): "Assigned Numbers" (STD 2).

[23] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core Network protocols; Stage 3".

[24] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".

[25] IETF RFC 2794 (2000): "Mobile IP Network Address Identifier Extension for IPv4", P. Calhoun, C. Perkins.

[26] IETF RFC 2131 (1997): "Dynamic Host Configuration Protocol".

[27] IETF RFC 1542 (1993): "Clarification and Extensions for the Bootstrap Protocol".

[28] IETF RFC 2373 (1998): "IP Version 6 Addressing Architecture".

[29] IETF RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".

[30] IETF RFC 2002 (1996): "IP Mobility Support", C. Perkins.

[31] IETF RFC 2486 (1999): "The Network Access Identifier", B. Aboba and M. Beadles.

[32] IETF RFC 1112 (1989): "Host extensions for IP multicasting", S.E. Deering.

[33] IETF RFC 2236 (1997): "Internet Group Management Protocol, Version 2", W. Fenner.

[34] IETF RFC 2362 (1998): "Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification", D. Estrin, D. Farinacci, A. Helmy, D. Thaler, S. Deering, M. Handley, V. Jacobson, C. Liu, P. Sharma, L. Wei.

[35] IETF RFC 1075 (1988): "Distance Vector Multicast Routing Protocol", D. Waitzman, C. Partridge, S.E. Deering.

[36] IETF RFC 1585 (1994): "MOSPF: Analysis and Experience", J. Moy.

[37] IETF RFC 2290 (1998): "Mobile-IPv4 Configuration Option for PPP IPCP", J. Solomon, S. Glass.

[38] IETF RFC 2865 (2000): "Remote Authentication Dial In User Service (RADIUS)", C. Rigney, S. Willens, A. Rubens, W. Simpson.

[39] IETF RFC2866 (2000): "RADIUS Accounting", C. Rigney, Livingston.

[40] 3GPP TS 23.003: "Numbering, addressing and identification".

[41] IETF RFC 2882 (2000): "Network Access Servers Requirements: Extended RADIUS Practices", D. Mitton.

[42] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[43] Void.

[44] IETF RFC 2461 (1998): "Neighbor Discovery for IP Version 6 (IPv6)", T. Narten, E. Nordmark, W. Simpson.

[45] IETF RFC 3118 (2001): "Authentication for DHCP Messages", R. Droms, W. Arbaugh.

[46] IETF RFC 3315 (2003)~~Internet-Draft~~: "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", R. Droms, J. Bound, B. Volz, T. Lemon, C. Perkins, M. Carney.~~draft-ietf-dhc-dhcpv6-28.txt, work in progress.~~

[47] 3GPP TS 24.229: "IP Multimedia Call Control Protocol based on SIP and SDP; Stage 3".

[48] IETF RFC 2710 (1999): "Multicast Listener Discovery (MLD) for IPv6", S. Deering, W. Fenner, B. Haberman.

[49] IETF RFC 2460 (1998): "Internet Protocol, Version 6 (IPv6) Specification", S.Deering,, R.Hinden.

[50] IETF RFC 3162 (2001): "RADIUS and IPv6", B. Adoba, G. Zorn, D. Mitton.

[51] IETF RFC 2548 (1999): "Microsoft Vendor-specific RADIUS Attributes", G.Zorn.

[52] IETF RFC 1035 (1987): "Domain names - implementation and specification".

[53] IETF RFC 1771 (1995): "A Border Gateway Protocol 4 (BGP-4)".

[54] IETF RFC 1825 (1995): "Security Architecture for the Internet Protocol".

[55] IETF RFC 1826 (1995): "IP Authentication Header".

[56] IETF RFC 1827 (1995): "IP Encapsulating Security Payload (ESP)".

[57] IETF RFC 2044 (1996): "UTF-8, a transformation format of Unicode and ISO 10646".

[58] 3GPP TS 24.008: “Mobile radio interface layer 3 specification; Core Network Protocols - Stage 3”.

Next Modified section

11.2.1.3.1 IPv6 PDP Context Activation

In this case:

- The GGSN provides the MS with an IPv6 Prefix belonging to the Intranet/ISP addressing space. A dynamic IPv6 address shall be given using either stateless or stateful address autoconfiguration. This IPv6 address is used for packet forwarding within the packet domain and for packet forwarding on the Intranet/ISP;

- the MS may send an authentication request at PDP context activation and the GGSN may request user authentication from a server, e.g. AAA, …, belonging to the Intranet/ISP;

- the protocol configuration options are retrieved (if requested by the MS at PDP context activation) from some server, e.g. AAA, …, belonging to the Intranet/ISP;

- in order to avoid any conflict between the link-local address of the MS and that of the GGSN, the Interface-Identifier used by the MS to build its link-local address shall be assigned by the GGSN. The GGSN ensures the uniqueness of this interface-identifier. The MT shall then enforce the use of this Interface-Identifier by the TE. This is valid for both stateless and stateful address autoconfiguration.

- the communication between the Packet Domain and the Intranet/ISP may be performed over any network, even an insecure e.g. the Internet. In case of an insecure connection between the GGSN and the Intranet/ISP there may be a specific security protocol over the insecure connection. This security protocol is defined by mutual agreement between PLMN operator and Intranet/ISP administrator.

- the MS may request DNS server IPv6 addresses using the PCO IE in e.g. the PDP Context Request message. In that case the GGSN may return the IP address of one or more DNS servers in the PCO in the PDP Context Response message. The DNS address(es) shall be coded in the PCO as specified in 3GPP TS 24.008 [58]. If a list of servers is received, the MS shall adhere to the explicit prioritisation order of the list.

In the following signalling flow example, PPP is used as layer 2 protocol over the R reference point. The MT behaves as a PPP server and translates Protocol Configuration Options into SM message IEs. GTP-C carries this information unchanged to the GGSN which uses the information e.g. for RADIUS authentication. The result of the host authentication is carried via GTP-C back to the SGSN, which then relays the result to the MT. The MT finalises the IPV6CP negotiation by sending an IPV6CP Configure-Ack message to the TE with the appropriate options included, e.g. Interface-Identifier. The Interface-Identifier shall be used in the TE to create a link-local address to be able to perform the IPv6 address autoconfiguration (see subclauses 11.2.1.3.2 and 11.2.1.3.3).

1) The TE sends an AT-command to the MT to set up parameters and enter PPP mode. The MT responds with an AT-response.

2) LCP negotiates Maximum-Receive-Unit and authentication protocol. The negotiated authentication protocol is either CHAP, PAP or 'none'. The MT shall try to negotiate for CHAP as first priority.

3) If the negotiated authentication protocol is either of CHAP or PAP, the TE authenticates itself towards the MT by means of that protocol. The MT stores the necessary authentication data and sends a forced positive acknowledgement of the authentication to the TE.

4) The TE requests IPv6 Interface-Identifier negotiation by sending the IPV6CP Configure-Request message to the MT.

5) The MT sends the Activate PDP Context Request message to the SGSN, including the Protocol Configuration Options. The Protocol Configuration Options IE may contain negotiated LCP options such as negotiated Authentication Protocol as well as any authentication data previously stored in the MT. It may also contain a request for dynamic configuration of DNS server IPv6 addresses. The MS shall for dynamic address allocation leave PDP Address empty and set PDP Type to IPv6. The SGSN sends the Create PDP context request message to the chosen GGSN including the unmodified Protocol Configuration Options.

6) The GGSN deduces from local configuration data associated with the APN:

   - IPv6 address allocation type (stateless or stateful);
   - the source of IPv6 Prefixes in the stateless case (GGSN internal prefix pool, or external address allocation server);
   - any server(s) to be used for address allocation, authentication and/or protocol configuration options retrieval (e.g. IMS related configuration, see 3GPP TS 24.229 [47]);
   - the protocol e.g. RADIUS, to be used with the server(s);
   - the communication and security feature needed to communicate with the server(s);

   As an example the GGSN may use one of the following options:

   - GGSN internal Prefix pool for IPv6 prefix allocation and no authentication;
   - GGSN internal Prefix pool for IPv6 prefix allocation and RADIUS for authentication. The AAA server responds with either an Access-Accept or an Access-Reject to the RADIUS client in the GGSN;
   - RADIUS for authentication and IPv6 prefix allocation. The AAA server responds with either an Access-Accept or an Access-Reject to the RADIUS client in the GGSN;

NOTE: DHCPv6 may be used for IPv6 prefix allocation ~~when an appropriate RFC becomes available~~.

   IPv6 Prefixes in a GGSN internal Prefix pool shall be configurable and structured per APN.

   The GGSN shall in the PDP Address IE in the Create PDP Context Response return an IPv6 address composed of a Prefix and an Interface-Identifier. The Interface-Identifier may have any value and it does not need to be unique within or across APNs. It shall however not conflict with the Interface-Identifier the GGSN has selected for its own side of the MS-GGSN link. The Prefix assigned by the GGSN or the external AAA server shall be globally or site-local unique, if stateless address autoconfiguration is configured on this APN. If, on the other hand, stateful address autoconfiguration is configured on the APN, the Prefix part of the IPv6 address returned in the PDP Address IE shall be set to the link-local prefix (FE80::/64).

   The GGSN shall analyse the requested values of all the protocol options contained in the received Protocol Configurations Options IE. The GGSN response shall be in accordance with the relevant standards e.g. the PPP standards RFC 1661 [21a] and RFC 1662 [21b].

7) The GGSN sends back to the SGSN a Create PDP Context Response message, containing the PDP Address IE and the Protocol Configuration Options IE. The Protocol Configuration Options IE may contain configuration data such as a list of DNS server IPv6 addresses. The cause value shall be set according to the outcome of the host authentication and configuration.

8) Depending on the cause value received in the Create PDP Context Response, the SGSN either stores the PDP Address and sends an Activate PDP Context Accept to the MS or, sends an Activate PDP Context Reject, to the MS.

   If Protocol Configuration Options are received from the GGSN, the SGSN shall relay those to the MS.

9) The MT extracts the Interface-Identifier from the address received in the PDP Address IE and ignores the Prefix part. If this Interface-Identifier is identical to the tentative Interface-Identifier indicated in the IPV6CP Configure-Request message sent from the TE, the MT sends an IPV6CP Configure Ack packet, indicating this Interface-Identifier, to the TE.

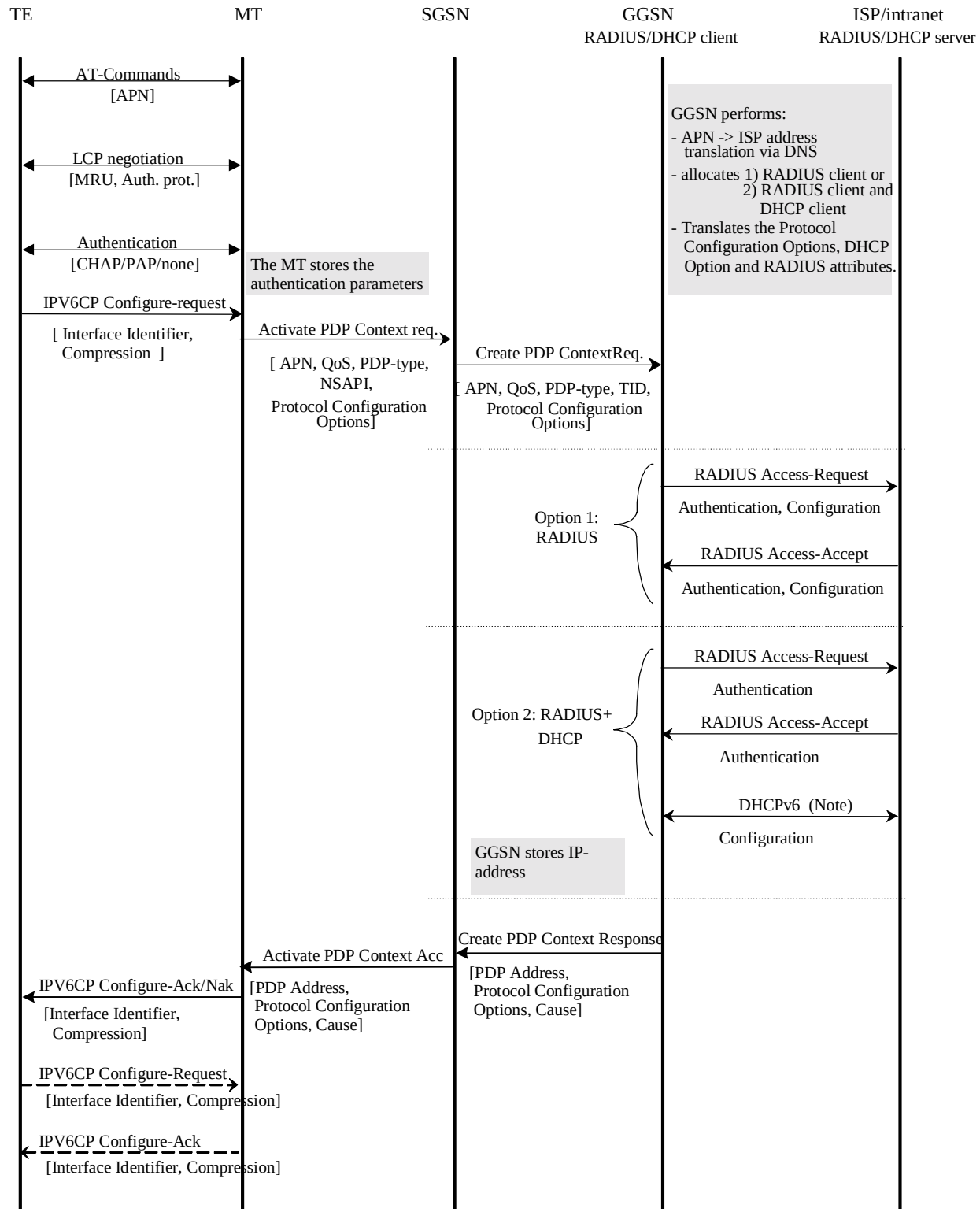
   If the Interface-Identifier extracted from the address contained in the PDP Address IE is not identical to the tentative Interface-Identifier indicated in the IPV6CP Configure-Request message sent from the TE, the MT sends an IPV6CP Configure-Nak packet, indicating the Interface-Identifier extracted from the address contained in the PDP Address IE, to the TE. The TE then sends a new IPV6CP Configure-Request message to the MT, indicating the same Interface-Identifier as was indicated in the received IPV6CP Configure Nak (as indicated by the dotted IPV6CP Configure-Request and Configure-Ack in the figure below). Finally the MT responds with a IPV6CP Configure Ack packet.

   In case a PDP Context Reject was sent to the MS the MT sends an LCP Terminate-Request to the TE.

10) When the TE has accepted the Interface-Identifier given by the MT, the user plane link from the TE to the GGSN and the external ISP/Intranet is established and the IPv6 address autoconfiguration may proceed.

    In case a link terminate request packet was sent to the TE, the TE and MT negotiates for link termination. The MT may then send a final AT-response to inform the TE about the rejected PDP Context activation.

    An LCP Terminate-request causes a PDP context deactivation.



NOTE: DHCPv6 may be used for IPv6 prefix allocation ~~when an appropriate RFC becomes available~~.

Figure 11ba: PDP Context Activation for the IPv6 Non-transparent case

Figure 11ba is valid for both Stateless and Stateful Address Autoconfiguration case. In the Stateful case though, option 2 does not apply and option 1 may only be used for authentication. The use of DHCPv6 above is different and used in a different context than when used for Stateful Address Autoconfiguration as in subclause 11.2.1.3.3.

Next Modified section

13.1 General

In current LAN environments the most commonly used configuration protocol is DHCP (Dynamic Host Configuration Protocol, RFC 2131 [26]) and DHCPv6 (Dynamic Host Configuration Protocol for IPv6, RFC 3315 [46])~~when the DHCPv6 IETF Internet-Draft [46] becomes an RFC standard~~. It provides a mechanism for passing a large set of configuration parameters to hosts connected to a TCP/IP network (IP address, sub-net mask, domain name, MTU, etc.) in an automatic manner. Moreover DHCP may assign IP addresses to clients for a finite lease time, allowing for sequential reassignment of addresses to different users.

The lease time is chosen by the administrator of the DHCP server (in the external network), and is therefore out of the scope of the present document.

The Packet Domain offers the end user the possibility to run DHCP end-to-end the same way as he does when connected directly to a LAN (e.g. an enterprise Intranet). No modifications should be required in common implementations of DHCP clients and servers. However a Packet Domain-specific DHCP relay agent RFC 1661 [21a] and RFC 1662 [21b] is needed in the GGSN so as to allow correct routing of DHCP requests and replies between the TE and the DHCP servers.

At PDP context activation no IP address is allocated, this is done afterwards through DHCP. After the TE's configuration has been completed by DHCP, the PDP context is updated by means of the GGSN-initiated PDP Context Modification Procedure in order to reflect the newly assigned IP address.

In the following cases the corresponding PDP context shall be deactivated and the whole procedure starting with PDP context activation shall be restarted by the MS

- if the DHCP lease expires;
- if the DHCP renewal is rejected by the DHCP server;
- if the IP address is changed during the renewal process. Usually when the lease is renewed, the IP address remains unchanged. However, if for any reason (e.g. poor configuration of the DHCP server), a different IP address is allocated during the lease renewal process the PDP Context shall be deactivated.

Next Modified section

13.2.1.2 Address allocation using DHCPv6

The following description bullet items describe the signal flow. For a detailed description of the DHCPv6 messages refer to the DHCPv6 IETF ~~Internet-draft~~ RFC 3315 [46]. In the context of IPv6, address allocation through DHCP is also referred to as Stateful Address Autoconfiguration. The end-to-end protocol configuration is depicted in figure 16e.

The PDP Context activation part and the initial Router Advertisement that triggers the MS to do the Stateful Address Autoconfiguration is described in subclause "IPv6 Non Transparent access to an Intranet or ISP".

1) The TE sends a SOLICIT message with the IP destination address set to the All_DHCP_Relay_Agents_and_Servers multicast address defined in the DHCPv6 IETF ~~Internet-draft~~ RFC 3315 [46]. The source address is the link local address created by the MS. The SOLICIT message shall contain one IA option.

2) The GGSN creates a RELAY-FORWARD message. The "Relay ~~Client~~ Message" option shall include the entire SOLICIT message. The GGSN sends the message to the DHCP server(s) configured for the APN using unicast addresses or All_DHCP_Servers multicast address. More details on the parameters for the RELAY-FORWARD are found in the DHCPv6 IETF ~~Internet-draft~~ RFC 3315 [46]. The GGSN may store a PDP Context ID in the Interface-Id option if this aids it in handling the Relay-Reply (the DHCP server will echo the Interface-Id option).

3) DHCP servers receiving the RELAY-FORWARD message including the SOLICIT request reply by sending a RELAY-REPLY message. The "Relay ~~Server~~ Message" option includes the ADVERTISE message with an offered IP address.

4) GGSN extracts the ADVERTISE messages and forwards the messages to the proper MS.

5) The TE chooses one of the possibly several ADVERTISE messages and sends a REQUEST confirming its choice and requesting additional configuration information.

6) GGSN embeds the REQUEST in the "Relay ~~Client~~ Message" option of the RELAY-FORWARD and sends it as explained in step 2.

7) The selected DHCP server receives the RELAY-FORWARD and replies with a RELAY-REPLY. The "Relay ~~Server~~ Message" option includes the REPLY message containing the configuration information requested by the TE.

8) The GGSN extracts the REPLY message and forwards it to the proper MS. GGSN also extracts IA option information such as the allocated MS IPv6 address and its lifetime and stores it in the corresponding PDP context. The GGSN shall silently discard any Neighbour Solicitation message sent by the MS to perform Duplicate Address Detection (see 3GPP TS 23.060 [3]).

9) The GGSN initiates a PDP context modification procedure by sending an Update PDP Context Request to the appropriate SGSN with the End User Address information element set to the allocated IPv6 address.

10) The SGSN sends a Modify PDP Context Request to the MT with the allocated IPv6 address in the PDP Address information element.

11) The MT acknowledges by sending a Modify PDP Context Accept to the SGSN.

12) The SGSN sends an Update PDP Context Response to the GGSN. The PDP context has been successfully updated with the allocated IPv6 address.

13) In the Stateful Address Autoconfiguration, Router Advertisements sent by GGSN on the MS-GGSN link shall not contain any Prefix Information option, even when GGSN has knowledge of the Prefix of the MS through the DHCP relay agent. The Prefix need not be advertised since the MS is the only host on the link and Stateless Address Autoconfiguration shall not be performed concurrently to Stateful Address Autoconfiguration.

EXAMPLE: In the following example a successful PDP context activation with use of DHCPv6 from end to end is shown.

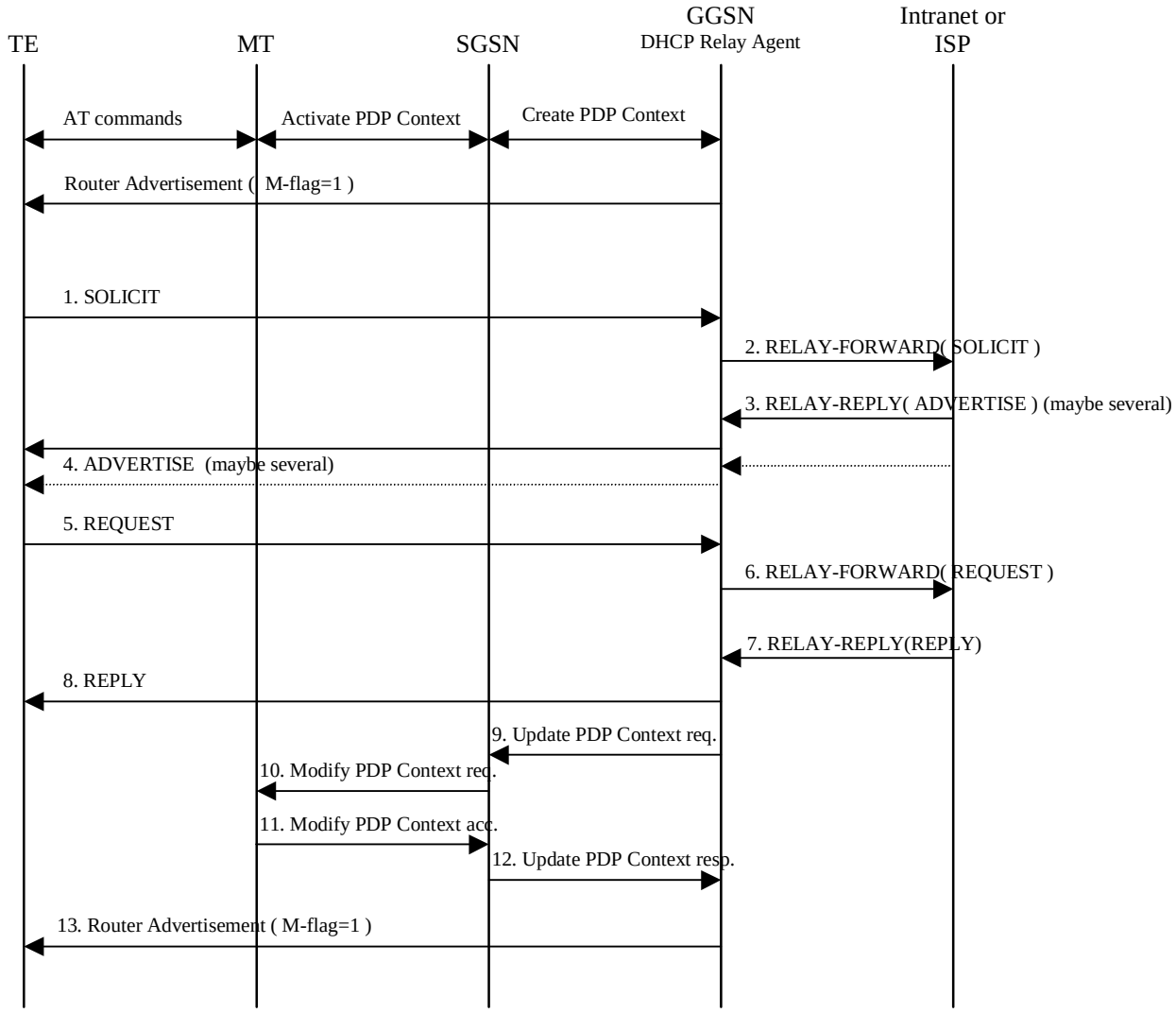


Figure 16e: DHCPv6 signal flow

Next Modified section

13.2.2 Other configuration by the Intranet or ISP (IPv6 only)

When using IPv6, in some situations the MS may need additional configuration information from the Intranet or ISP besides the IP address. It may for example be IMS related configuration options (see 3GPP TS 24.229 [47]). If the MS is DHCP capable and the IPv6 address has been allocated using Stateless Address Autoconfiguration, the MS may use a procedure as in the example below to configure additional external network protocol parameters, or other parameters that apply to the Intranet or ISP. The GGSN shall in this case indicate to the MS that there is additional configuration information to retrieve by setting the O-flag in the Router Advertisements. This shall be configured per APN in the GGSN.

The following description bullet items describe an example of a signal flow, where the MS directs an Information-Request to the All_DHCP_Relay_Agents_and_Servers multicast address. The MS may also direct the message to a specific server instead of all servers. For a detailed description of the DHCPv6 messages refer to the DHCPv6 IETF ~~Internet-draft~~ RFC 3315 [46]. The sequence is depicted in figure 16f.

1) A Router Advertisement with the O-flag set, is sent from GGSN to TE to indicate to it to retrieve other configuration information.

2) The TE sends an INFORMATION-REQUEST message with the IP destination address set to the All_DHCP_Relay_Agents_and_Servers multicast address defined in the DHCPv6 IETF ~~Internet-draft~~ RFC

3315 [46]. The source address shall be the link-local address of the MS. The DHCP relay agent in the GGSN shall forward the message.

3) DHCP servers receiving the forwarded INFORMATION-REQUEST message, reply by sending a RELAY-REPLY message, with the "Relay ~~server m~~Message" option including a REPLY message with the requested configuration parameters.

The TE chooses one of the possibly several REPLY messages and extracts the configuration information.

EXAMPLE: In the following example a request for information with use of DHCPv6 from end to end is shown.

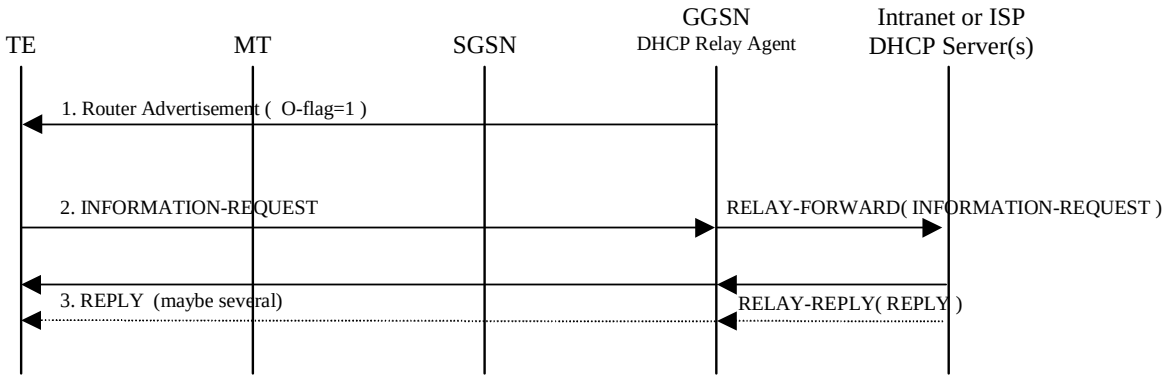


Figure 16f: DHCPv6 Other configuration signal flow

End of Modifications

3GPP TSG-CN WG3 Meeting #30 **N3-030769**
Bangkok, Thailand. 27th - 31st October 2003.

CR-Form-v7

CHANGE REQUEST

⌘ **29.061** **CR** **098** ⌘ **rev** **1** ⌘ Current version: **5.7.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☐ Radio Access Network ☐ Core Network ☒

Title:	⌘	Updated reference for DHCPv6
Source:	⌘	TSG_CN WG3
Work item code:	⌘	GPRS
Date:	⌘	31/10/2003
Category:	⌘	**A**
Release:	⌘	Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	The specification of DHCPv6 has now become RFC 3315. The Client Message Option and the Server Message Option used in some earlier drafts have been combined into the new Relay Message Option
Summary of change:	⌘	Reference to "draft-ietf-dhc-dhcpv6-28.txt" is replaced by RFC 3315. Some related, temporary text is removed. The Client Message Option and the Server Message Option are replaced by the Relay Message Option
Consequences if not approved:	⌘	Incorrect reference to an IETF draft. Incorrect options in DHCPv6 messages.

Clauses affected:	⌘	2, 11.2.1.3.1, 13.1, 13.2.1.2, 13.2.2

Other specs affected:	⌘	Y	N		⌘
			X	Other core specifications	
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be

downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

First Modified Section

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document.*

[1] Void.

[2] 3GPP TS 22.060: "General Packet Radio Service (GPRS); Service Description; Stage 1".

[3] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service Description; Stage 2".

[4] Void.

[5] Void.

[6] Void.

[7] Void.

[8] Void.

[9] Void.

[10] 3GPP TS 27.060: "Packet Domain; Mobile Station (MS) supporting Packet Switched services".

[11] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[12] Void.

[13] Void.

[14] Void.

[15] IETF RFC 768 (1980): "User Datagram Protocol" (STD 6).

[16] IETF RFC 791 (1981): "Internet Protocol" (STD 5).

[17] IETF RFC 792 (1981): "Internet Control Message Protocol" (STD 5).

[18] IETF RFC 793 (1981): "Transmission Control Protocol" (STD 7).

[19] IETF RFC 1034 (1987): "Domain names - concepts and facilities" (STD 7).

[20] Void.

[21a] IETF RFC 1661 (1994): "The Point-to-Point Protocol (PPP)" (STD 51).

[21b] IETF RFC 1662 (1994): "PPP in HDLC-like Framing".

[22] IETF RFC 1700 (1994): "Assigned Numbers" (STD 2).

[23] 3GPP TS 44.008: "Mobile radio interface layer 3 specification; Core Network protocols; Stage 3".

[24] 3GPP TS 29.060: "General Packet Radio Service (GPRS); GPRS Tunnelling Protocol (GTP) across the Gn and Gp interface".

[25] IETF RFC 2794 (2000): "Mobile IP Network Address Identifier Extension for IPv4", P. Calhoun, C. Perkins.

[26] IETF RFC 2131 (1997): "Dynamic Host Configuration Protocol".

[27] IETF RFC 1542 (1993): "Clarification and Extensions for the Bootstrap Protocol".

[28] IETF RFC 2373 (1998): "IP Version 6 Addressing Architecture".

[29] IETF RFC 2462 (1998): "IPv6 Stateless Address Autoconfiguration".

[30] IETF RFC 2002 (1996): "IP Mobility Support", C. Perkins.

[31] IETF RFC 2486 (1999): "The Network Access Identifier", B. Aboba and M. Beadles.

[32] IETF RFC 1112 (1989): "Host extensions for IP multicasting", S.E. Deering.

[33] IETF RFC 2236 (1997): "Internet Group Management Protocol, Version 2", W. Fenner.

[34] IETF RFC 2362 (1998): "Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification", D. Estrin, D. Farinacci, A. Helmy, D. Thaler, S. Deering, M. Handley, V. Jacobson, C. Liu, P. Sharma, L. Wei

[35] IETF RFC 1075 (1988): "Distance Vector Multicast Routing Protocol", D. Waitzman, C. Partridge, S.E. Deering.

[36] IETF RFC 1585 (1994): "MOSPF: Analysis and Experience", J. Moy.

[37] IETF RFC 2290 (1998): "Mobile-IPv4 Configuration Option for PPP IPCP", J. Solomon, S. Glass.

[38] IETF RFC 2865 (2000): "Remote Authentication Dial In User Service (RADIUS)", C. Rigney, S. Willens, A. Rubens, W. Simpson.

[39] IETF RFC 2866 (2000): "RADIUS Accounting", C. Rigney, Livingston.

[40] 3GPP TS 23.003: "Numbering, addressing and identification".

[41] IETF RFC 2882 (2000): "Network Access Servers Requirements: Extended RADIUS Practices", D. Mitton.

[42] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[43] Void.

[44] IETF RFC 2461 (1998): "Neighbor Discovery for IP Version 6 (IPv6)", T. Narten, E. Nordmark, W. Simpson

[45] IETF RFC 3118 (2001): "Authentication for DHCP Messages", R. Droms, W. Arbaugh.

[46] IETF RFC 3315 (2003) ~~Internet-Draft:~~ "Dynamic Host Configuration Protocol for IPv6 (DHCPv6)", R. Droms, J. Bound, B. Volz, T. Lemon, C. Perkins, M. Carney.~~draft-ietf-dhc-dhcpv6-28.txt, work in progress.~~

[47] 3GPP TS 24.229: "IP Multimedia Call Control Protocol based on SIP and SDP"

[48] IETF RFC 2710 (1999): "Multicast Listener Discovery (MLD) for IPv6", S. Deering, W. Fenner, B. Haberman.

[49] IETF RFC 2460 (1998): "Internet Protocol, Version 6 (IPv6) Specification", S.Deering, R.Hinden.

[50] IETF RFC 3162 (2001): "RADIUS and IPv6", B. Adoba, G. Zorn, D. Mitton.

[51] IETF RFC 2548 (1999): "Microsoft Vendor-specific RADIUS Attributes", G.Zorn.

[52] 3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2".

[53] 3GPP TS 29.207: "Policy control over Go interface".

[54] 3GPP TS 24.008: "Mobile radio interface layer 3 specification; Core Network protocols; Stage 3".

[55] Void.

[56] 3GPP TS 29.208: "End to end Quality of Service (QoS) signalling flows".

[57] Void.

[58] IETF RFC 1035 (1987): "Domain names - implementation and specification" (STD 13).

[59] Void.

[60] IETF RFC 1771 (1995): "A Border Gateway Protocol 4 (BGP-4)".

[61] IETF RFC 1825 (1995): "Security Architecture for the Internet Protocol".

[62] IETF RFC 1826 (1995): "IP Authentication Header".

[63] IETF RFC 1827 (1995): "IP Encapsulating Security Payload (ESP)".

[64] IETF RFC 2044 (1996): "UTF-8, a transformation format of Unicode and ISO 10646".

Next modified section

11.2.1.3.1 IPv6 PDP Context Activation

In this case:

- The GGSN provides the MS with an IPv6 Prefix belonging to the Intranet/ISP addressing space. A dynamic IPv6 address shall be given using either stateless or stateful address autoconfiguration. This IPv6 address is used for packet forwarding within the packet domain and for packet forwarding on the Intranet/ISP;
- the MS may send an authentication request at PDP context activation and the GGSN may request user authentication from a server, e.g. AAA, …, belonging to the Intranet/ISP;
- the protocol configuration options are retrieved (if requested by the MS at PDP context activation) from some server, e.g. AAA, …, belonging to the Intranet/ISP;
- in order to avoid any conflict between the link-local address of the MS and that of the GGSN, the Interface-Identifier used by the MS to build its link-local address shall be assigned by the GGSN. The GGSN ensures the uniqueness of this interface-identifier. The MT shall then enforce the use of this Interface-Identifier by the TE. This is valid for both stateless and stateful address autoconfiguration.
- the communication between the Packet Domain and the Intranet/ISP may be performed over any network, even an insecure e.g. the Internet. In case of an insecure connection between the GGSN and the Intranet/ISP there may be a specific security protocol over the insecure connection. This security protocol is defined by mutual agreement between PLMN operator and Intranet/ISP administrator.
- the MS may request for DNS server IPv6 addresses using the PCO IE in e.g. the PDP Context Request message. In that case the GGSN may return the IP address of one or more DNS servers in the PCO in the PDP Context Response message. The DNS address(es) shall be coded in the PCO as specified in 3GPP TS 24.008 [54]. If a list of servers is received, the MS shall adhere to the explicit prioritisation order of the list.

In the following signalling flow example, PPP is used as layer 2 protocol over the R reference point. The MT behaves as a PPP server and translates Protocol Configuration Options into SM message IEs. GTP-C carries this information unchanged to the GGSN which uses the information e.g. for RADIUS authentication. The result of the host

authentication is carried via GTP-C back to the SGSN, which then relays the result to the MT. The MT finalises the IPV6CP negotiation by sending an IPV6CP Configure-Ack message to the TE with the appropriate options included, e.g. Interface-Identifier. The Interface-Identifier shall be used in the TE to create a link-local address to be able to perform the IPv6 address autoconfiguration (see subclauses 11.2.1.3.2 and 11.2.1.3.3).

1) The TE sends an AT-command to the MT to set up parameters and enter PPP mode. The MT responds with an AT-response.

2) LCP negotiates Maximum-Receive-Unit and authentication protocol. The negotiated authentication protocol is either CHAP, PAP or 'none'. The MT shall try to negotiate for CHAP as first priority.

3) If the negotiated authentication protocol is either of CHAP or PAP, the TE authenticates itself towards the MT by means of that protocol. The MT stores the necessary authentication data and sends a forced positive acknowledgement of the authentication to the TE.

4) The TE requests IPv6 Interface-Identifier negotiation by sending the IPV6CP Configure-Request message to the MT.

5) The MT sends the Activate PDP Context Request message to the SGSN, including the Protocol Configuration Options. The Protocol Configuration Options IE may contain negotiated LCP options such as negotiated Authentication Protocol as well as any authentication data previously stored in the MT. It may also contain a request for dynamic configuration of DNS server IPv6 addresses. The MS shall for dynamic address allocation leave PDP Address empty and set PDP Type to IPv6. The SGSN sends the Create PDP context request message to the chosen GGSN including the unmodified Protocol Configuration Options.

6) The GGSN deduces from local configuration data associated with the APN:

   - IPv6 address allocation type (stateless or stateful);
   - the source of IPv6 Prefixes in the stateless case (GGSN internal prefix pool, or external address allocation server);
   - any server(s) to be used for address allocation, authentication and/or protocol configuration options retrieval (e.g. IMS related configuration, see 3GPP TS 24.229 [47]);
   - the protocol e.g. RADIUS, to be used with the server(s);
   - the communication and security feature needed to communicate with the server(s);

   As an example the GGSN may use one of the following options:

   - GGSN internal Prefix pool for IPv6 prefix allocation and no authentication;
   - GGSN internal Prefix pool for IPv6 prefix allocation and RADIUS for authentication. The AAA server responds with either an Access-Accept or an Access-Reject to the RADIUS client in the GGSN;
   - RADIUS for authentication and IPv6 prefix allocation. The AAA server responds with either an Access-Accept or an Access-Reject to the RADIUS client in the GGSN;

NOTE: DHCPv6 may be used for IPv6 prefix allocation ~~when an appropriate RFC becomes available~~.

IPv6 Prefixes in a GGSN internal Prefix pool shall be configurable and structured per APN.

The GGSN shall in the PDP Address IE in the Create PDP Context Response return an IPv6 address composed of a Prefix and an Interface-Identifier. The Interface-Identifier may have any value and it does not need to be unique within or across APNs. It shall however not conflict with the Interface-Identifier the GGSN has selected for its own side of the MS-GGSN link. The Prefix assigned by the GGSN or the external AAA server shall be globally or site-local unique, if stateless address autoconfiguration is configured on this APN. If, on the other hand, stateful address autoconfiguration is configured on the APN, the Prefix part of the IPv6 address returned in the PDP Address IE shall be set to the link-local prefix (FE80::/64).

The GGSN shall analyse the requested values of all the protocol options contained in the received Protocol Configurations Options IE. The contents of the Protocol Configurations Options IE sent in the GGSN response shall be in accordance with the relevant standards e.g. the PPP standard RFC 1661 [21a] and RFC 1662 [21b].

7) The GGSN sends back to the SGSN a Create PDP Context Response message, containing the PDP Address IE and the Protocol Configuration Options IE. The Protocol Configuration Options IE may contain configuration data such as a list of DNS server IPv6 addresses. The cause value shall be set according to the outcome of the host authentication and configuration.

8) Depending on the cause value received in the Create PDP Context Response, the SGSN either stores the PDP Address and sends an Activate PDP Context Accept to the MS or, sends an Activate PDP Context Reject, to the MS.

   If Protocol Configuration Options are received from the GGSN, the SGSN shall relay those to the MS.

9) The MT extracts the Interface-Identifier from the address received in the PDP Address IE and ignores the Prefix part. If this Interface-Identifier is identical to the tentative Interface-Identifier indicated in the IPV6CP Configure-Request message sent from the TE, the MT sends an IPV6CP Configure Ack packet, indicating this Interface-Identifier, to the TE.

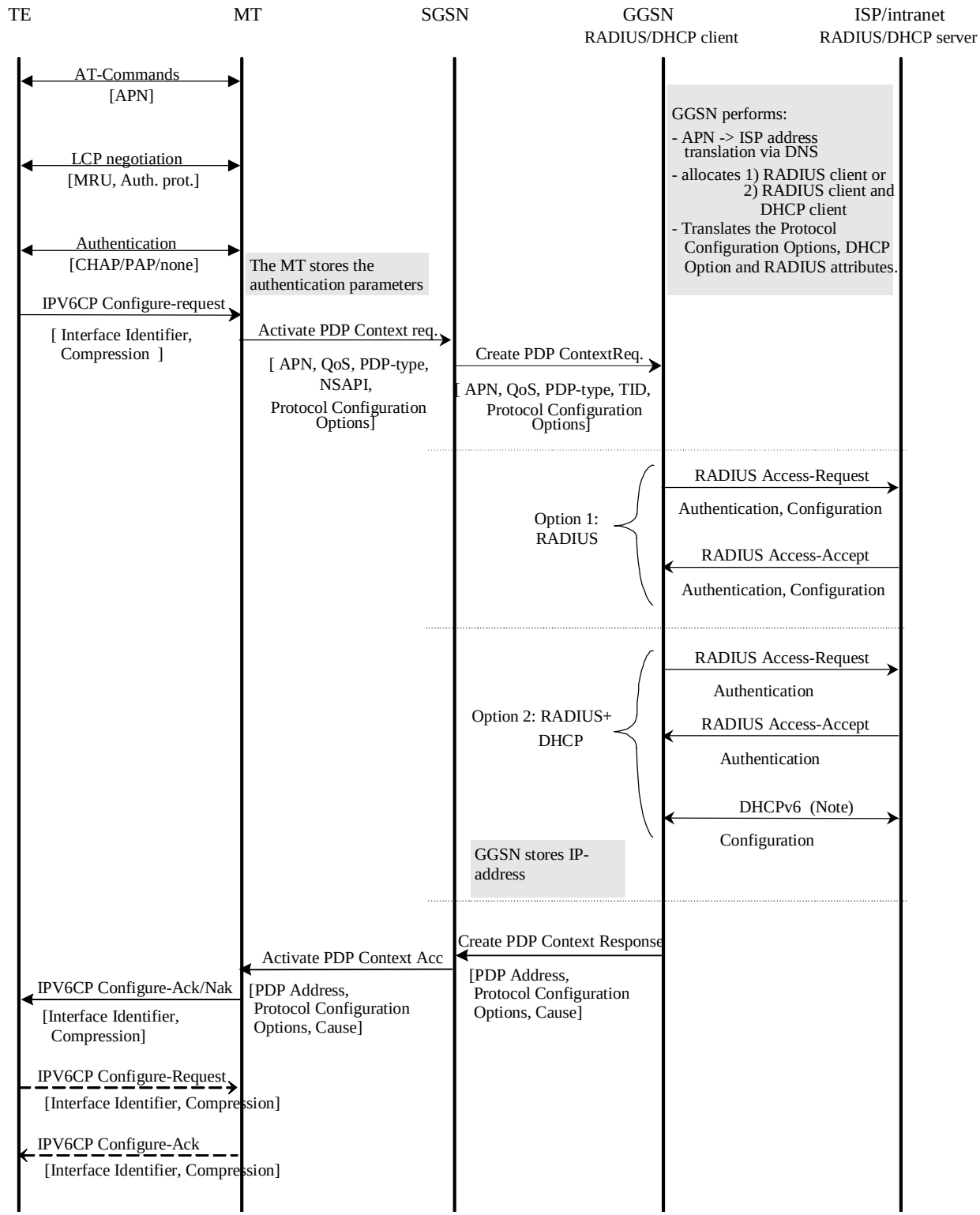
   If the Interface-Identifier extracted from the address contained in the PDP Address IE is not identical to the tentative Interface-Identifier indicated in the IPV6CP Configure-Request message sent from the TE, the MT sends an IPV6CP Configure-Nak packet, indicating the Interface-Identifier extracted from the address contained in the PDP Address IE, to the TE. The TE then sends a new IPV6CP Configure-Request message to the MT, indicating the same Interface-Identifier as was indicated in the received IPV6CP Configure Nak (as indicated by the dotted IPV6CP Configure-Request and Configure-Ack in the figure below). Finally the MT responds with a IPV6CP Configure Ack packet.

   In case a PDP Context Reject was sent to the MS the MT sends an LCP Terminate-Request to the TE.

10) When the TE has accepted the Interface-Identifier given by the MT, the user plane link from the TE to the GGSN and the external ISP/Intranet is established and the IPv6 address autoconfiguration may proceed.

    In case a link terminate request packet was sent to the TE, the TE and MT negotiates for link termination. The MT may then send a final AT-response to inform the TE about the rejected PDP Context activation.

    An LCP Terminate-request causes a PDP context deactivation.



NOTE: DHCPv6 may be used for IPv6 prefix allocation ~~when an appropriate RFC becomes available~~.

Figure 11ba: PDP Context Activation for the IPv6 Non-transparent case

Figure 11ba is valid for both Stateless and Stateful Address Autoconfiguration case. In the Stateful case though, option 2 does not apply and option 1 may only be used for authentication. The use of DHCPv6 above is different and used in a different context than when used for Stateful Address Autoconfiguration as in subclause 11.2.1.3.3.

11.2.1.3.3 IPv6 Stateful Address Autoconfiguration

For IPv6 the PDP Context Activation phase is followed by an address autoconfiguration phase. For APNs configured to use Stateful Address Autoconfiguration, the procedure may for example look like below. A more detailed description of Stateful Address Autoconfiguration is described in clause "Interworking with PDN (DHCP)". Support of DHCP is not mandatory in the MS.

1) After the first phase of setting up IPv6 access to an Intranet or ISP, the MS shall use the IPv6 Interface-Identifier, as provided by the GGSN, to create its IPv6 Link-Local Unicast Address according to RFC 2373 [28].

2) After the GGSN has sent a Create PDP Context Response message to the SGSN, it shall start sending Router Advertisements periodically on the new MS-GGSN link established by the PDP Context. The MS may issue a Router Solicitation directly after the user plane establishment. This shall trigger the GGSN to send a Router Advertisement immediately. This shall be consistent with what is specified in RFC 2461 [44]. For the MS-GGSN link however, some 3GPP specific protocol constants and default values shall apply (see subclause "IPv6 Router Configuration Variables in the GGSN").

   To indicate to the MS that Stateful Address Autoconfiguration shall be performed, the Router Advertisements shall not contain any Prefix-Information option and the M-flag ("Managed Address Configuration Flag") shall be set.

3) When the MS has received a Router Advertisement with the M-flag set, it shall start a DHCPv6 configuration as described in subclause "Address allocation using DHCPv6" including a request for an IPv6 address.

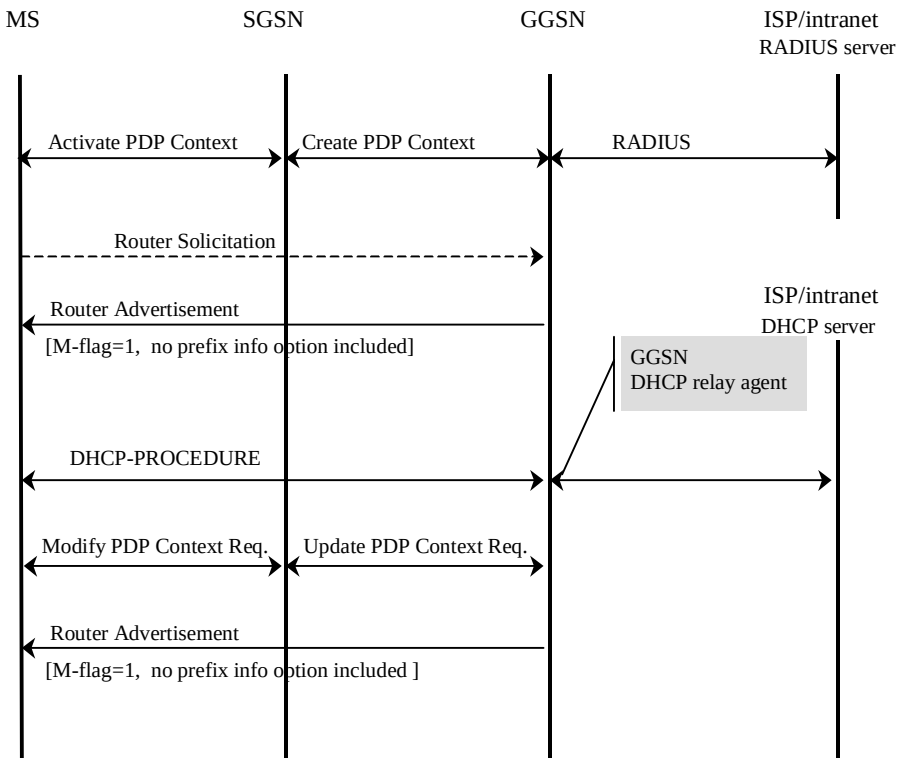


Figure 11bc: IPv6 Stateful Address Autoconfiguration

Next modified section

13.1 General

In current LAN environments the most commonly used configuration protocol is DHCP (Dynamic Host Configuration Protocol, RFC 2131 [26]) and DHCPv6 (Dynamic Host Configuration Protocol for IPv6, IETF RFC 3315 [46])~~when~~

~~the DHCPv6 IETF Internet-Draft [46] becomes an RFC standard~~. It provides a mechanism for passing a large set of configuration parameters to hosts connected to a TCP/IP network (IP address, sub-net mask, domain name, MTU, etc.) in an automatic manner. Moreover DHCP may assign IP addresses to clients for a finite lease time, allowing for sequential reassignment of addresses to different users.

The lease time is chosen by the administrator of the DHCP server (in the external network), and is therefore out of the scope of the present document.

The Packet Domain offers the end user the possibility to run DHCP end-to-end the same way as he does when connected directly to a LAN (e.g. an enterprise Intranet). No modifications should be required in common implementations of DHCP clients and servers. However a Packet Domain-specific DHCP relay agent RFC 1661 [21a] and RFC 1662 [21b] is needed in the GGSN so as to allow correct routing of DHCP requests and replies between the TE and the DHCP servers.

At PDP context activation no IP address is allocated, this is done afterwards through DHCP. After the TE's configuration has been completed by DHCP, the PDP context is updated by means of the GGSN-initiated PDP Context Modification Procedure in order to reflect the newly assigned IP address.

In the following cases the corresponding PDP context shall be deactivated and the whole procedure starting with PDP context activation shall be restarted by the MS

- if the DHCP lease expires;
- if the DHCP renewal is rejected by the DHCP server;
- if the IP address is changed during the renewal process. Usually when the lease is renewed, the IP address remains unchanged. However, if for any reason (e.g. poor configuration of the DHCP server), a different IP address is allocated during the lease renewal process the PDP Context shall be deactivated.

Next modified section

13.2.1.2 Address allocation using DHCPv6

The following description bullet items describe the signal flow. For a detailed description of the DHCPv6 messages refer to the DHCPv6 IETF ~~Internet-Draft~~RFC 3315 [46]. In the context of IPv6, address allocation through DHCP is also referred to as Stateful Address Autoconfiguration. The end-to-end protocol configuration is depicted in figure 16e.

The PDP Context activation part and the initial Router Advertisement that triggers the MS to do the Stateful Address Autoconfiguration is described in subclause "IPv6 Non Transparent access to an Intranet or ISP".

1) The TE sends a SOLICIT message with the IP destination address set to the All_DHCP_Relay_Agents_and_Servers multicast address defined in the DHCPv6 IETF ~~Internet-Draft~~ RFC 3315 [46]. The source address is the link local address created by the MS. The SOLICIT message shall contain one IA option.

2) The GGSN creates a RELAY-FORWARD message. The "Relay ~~Client~~ Message" option shall include the entire SOLICIT message. The GGSN sends the message to the DHCP server(s) configured for the APN using unicast addresses or All_DHCP_Servers multicast address. More details on the parameters for the RELAY-FORWARD are found in the DHCPv6 IETF ~~Internet-Draft~~ RFC 3315 [46]. The GGSN may store a PDP Context ID in the Interface-Id option if this aids it in handling the Relay-Reply (the DHCP server will echo the Interface-Id option).

3) DHCP servers receiving the RELAY-FORWARD message including the SOLICIT request reply by sending a RELAY-REPLY message. The "Relay ~~Server~~ Message" option includes the ADVERTISE message with an offered IP address.

4) GGSN extracts the ADVERTISE messages and forwards the messages to the proper MS.

5) The TE chooses one of the possibly several ADVERTISE messages and sends a REQUEST confirming its choice and requesting additional configuration information.

6) GGSN embeds the REQUEST in the "Relay ~~Client~~ Message" option of the RELAY-FORWARD and sends it as explained in step 2.

7) The selected DHCP server receives the RELAY-FORWARD and replies with a RELAY-REPLY. The "Relay ~~Server~~ Message" option includes the REPLY message containing the configuration information requested by the TE.

8) The GGSN extracts the REPLY message and forwards it to the proper MS. GGSN also extracts IA option information such as the allocated MS IPv6 address and its lifetime and stores it in the corresponding PDP context. The GGSN shall silently discard any Neighbour Solicitation message sent by the MS to perform Duplicate Address Detection (see 3GPP TS 23.060 [3]).

9) The GGSN initiates a PDP context modification procedure by sending an Update PDP Context Request to the appropriate SGSN with the End User Address information element set to the allocated IPv6 address.

10) The SGSN sends a Modify PDP Context Request to the MT with the allocated IPv6 address in the PDP Address information element.

11) The MT acknowledges by sending a Modify PDP Context Accept to the SGSN.

12) The SGSN sends an Update PDP Context Response to the GGSN. The PDP context has been successfully updated with the allocated IPv6 address.

13) In the Stateful Address Autoconfiguration, Router Advertisements sent by GGSN on the MS-GGSN link shall not contain any Prefix Information option, even when GGSN has knowledge of the Prefix of the MS through the DHCP relay agent. The Prefix need not be advertised since the MS is the only host on the link and Stateless Address Autoconfiguration shall not be performed concurrently to Stateful Address Autoconfiguration.

EXAMPLE: In the following example a successful PDP context activation with use of DHCPv6 from end to end is shown.

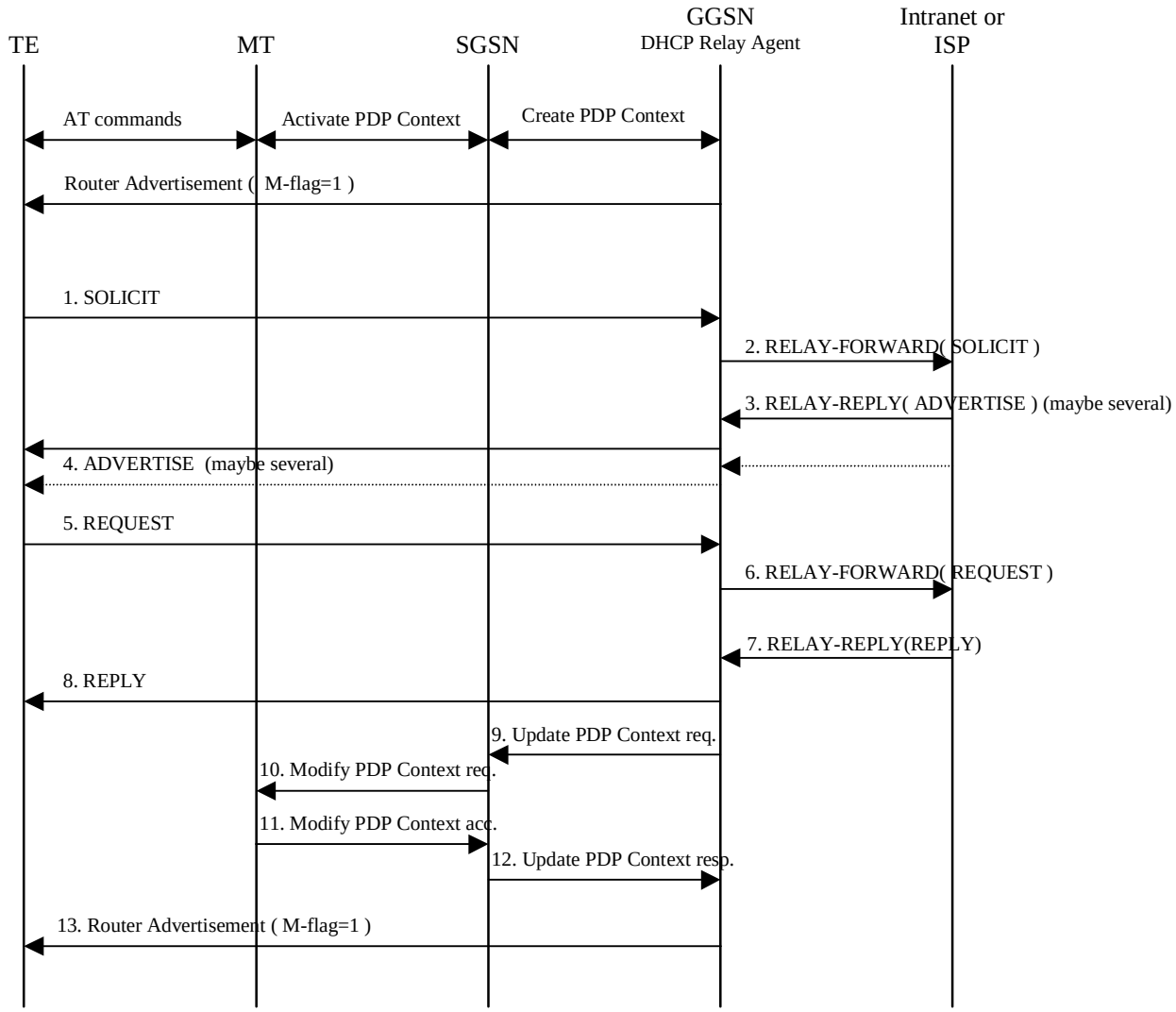


Figure 16e: DHCPv6 signal flow

Next modified section

13.2.2 Other configuration by the Intranet or ISP (IPv6 only)

When using IPv6, in some situations the MS may need additional configuration information from the Intranet or ISP besides the IP address. It may for example be IMS related configuration options (see 3GPP TS 24.229 [47]). If the MS is DHCP capable and the IPv6 address has been allocated using Stateless Address Autoconfiguration, the MS may use a procedure as in the example below to configure additional external network protocol parameters, or other parameters that apply to the Intranet or ISP. The GGSN shall in this case indicate to the MS that there is additional configuration information to retrieve by setting the O-flag in the Router Advertisements. This shall be configured per APN in the GGSN.

The following description bullet items describe an example of a signal flow, where the MS directs an Information-Request to the All_DHCP_Relay_Agents_and_Servers multicast address. The MS may also direct the message to a specific server instead of all servers. For a detailed description of the DHCPv6 messages refer to the DHCPv6 IETF ~~Internet-Draft~~ RFC 3315 [46]. The sequence is depicted in figure 16f.

1) A Router Advertisement with the O-flag set, is sent from GGSN to TE to indicate to it to retrieve other configuration information.

2) The TE sends an INFORMATION-REQUEST message with the IP destination address set to the All_DHCP_Relay_Agents_and_Servers multicast address defined in the DHCPv6 IETF ~~Internet Draft~~ RFC 3315 [46]. The source address shall be the link-local address of the MS. The DHCP relay agent in the GGSN shall forward the message.

3) DHCP servers receiving the forwarded INFORMATION-REQUEST message, reply by sending a RELAY-REPLY message, with the "Relay ~~server m~~Message" option including a REPLY message with the requested configuration parameters.

   The TE chooses one of the possibly several REPLY messages and extracts the configuration information.

EXAMPLE: In the following example a request for information with use of DHCPv6 from end to end is shown.

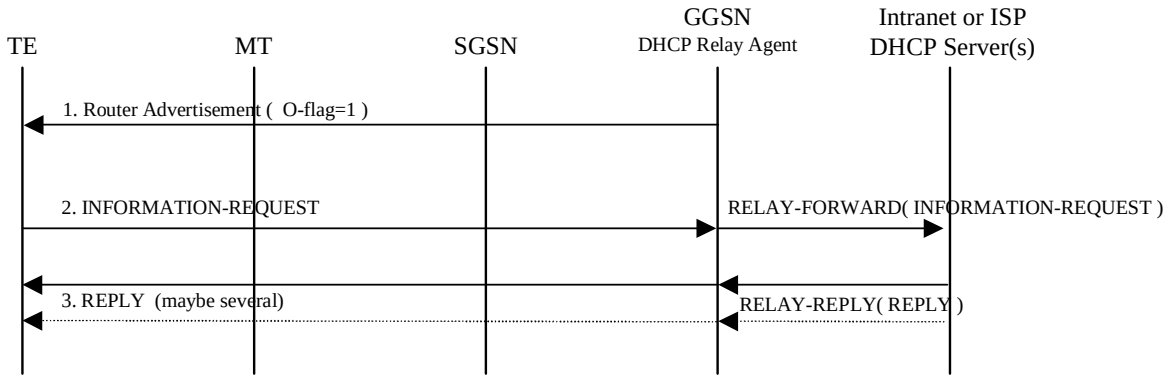


Figure 16f: DHCPv6 Other configuration signal flow

End of modifications