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Contents

Foreword

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1 Scope

This document specifies the Stage 2 system description for IP flow mobility between a 3GPP and a WLAN. The technical solution is based on the working principles of DSMIPv6 [2] and it is applicable to both the Evolved Packet System and the I-WLAN mobility architecture.

The specification covers the system description of seamless WLAN offload and IP flow mobility between 3GPP and WLAN as well as the respective interactions with the PCC and ANDSF frameworks. The system description for non seamless WLAN offload is covered in 3GPP TS 23.402 [3].

This document specifies also the detailed extensions to S2c [3] and H1 [4] reference points for IP flow mobility. The extensions to the PCC and to the ANDSF framework are specified respectively in 3GPP TS 23.203 [5] and in 3GPP TS 23.402 [3].

2 References

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

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[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] IETF RFC 5555 (June 2009): "Mobile IPv6 support for dual stack Hosts and Routers (DSMIPv6)".

[3] 3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[4] 3GPP TS 23.327: "Mobility between 3GPP-Wireless Local Area Network (WLAN) interworking and 3GPP systems".

[5] 3GPP TS 23.203: "Policy and Charging Control architecture".

[6] IETF RFC 4877 (April 2007): "Mobile IPv6 Operation with IKEv2 and the Revised IPsec Architecture".

[7] IETF RFC 5648 (October 2009): "Multiple Care-of Addresses Registration".

[8] IETF RFC 6089 (January 2011): "Flow Bindings in Mobile IPv6 and Network Mobility (NEMO) Basic Support".

[9] 3GPP TS 23.234: "3GPP System to Wireless Local Area Network (WLAN) Interworking; System Description".

[10] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[11] 3GPP TS 23.060: "General Packet Radio Service (GPRS); Service description; Stage 2".

[12] IETF RFC 6088 (January 2011): "Traffic Selectors for Flow Bindings".

[13] IETF RFC 5846 (June 2010): "Binding Revocation for IPv6 Mobility".

[14] IETF RFC 6275 (July 2011): "Mobility Support in IPv6".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply.

The following terms used in this Technical Specification are defined in RFC 6275 [14]: Home Address, Care-of Address, binding cache, binding cache entry.

The following terms used in this Technical Specification are defined in TS 23.402 [3]: Home network prefix.

Home Agent: The Home Agent functionality consists in the DSMIPv6 anchor point functionality described in RFC 5555 [2] and in RFC 4877 [6] and the extensions defined in RFC 5648 [7] and RFC 6089 [8]. As per TS 23.402 [3], the HA functionality is located in the PDN Gateway. As per TS 23.327 [4] the HA functionality can be either a standalone entity or co-located with the GGSN or with the PDG.

Local Operating Environment Information: This is a set of implementation specific parameters which describe the local environment in which the UE is operating.

routing address: A routable IP address. In DSMIPv6 this is either the CoA (visited link case) or the HoA (in home link case).

routing filter: A set of packet flow IP header parameter values/ranges used to identify one or more IP flows for routing purposes.

routing rule: The association of a routing filter with a routing address.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply.

BID	Binding Identifier
CoA	Care-of Address
DSMIPv6	Dual-Stack Mobile IPv6
EPC	Evolved Packet Core
ePDG	Evolved Packet Data Gateway
EPS	Evolved Packet System
FID	Flow Identifier
GW	Gateway
HA	Home Agent
HoA	Home Address
UE	User Equipment

4 Architecture model and concepts

4.1 General concepts

This document specifies a mechanism for a UE to simultaneously connect to 3GPP access and WLAN and exchange different IP flows belonging to the same PDN connection through different accesses. The mechanism also enables seamless IP flow mobility, with IP flows belonging to the same or different applications being moved seamlessly between a 3GPP access and WLAN.

The solution allows the operator to indicate how the IP flows are routed through the available access systems and to selectively offload some traffic (e.g. best effort traffic) to WLAN while using UTRAN or E-UTRAN for other traffic (e.g. traffic with specific QoS requirements). This is usually referred to as WLAN offload.

The technical solution is based on DSMIPv6, RFC 5555 [2] and is applicable to both the Evolved Packet System and the I-WLAN mobility architecture. Since the solution is based on DSMIPv6, IP address preservation and session continuity is provided when moving IP flows from one access to the other.

4.2 Architecture reference model

4.2.1 Non-roaming architecture

The baseline architecture reference model for IP flow mobility when EPS is deployed in the non roaming case is specified in TS 23.402 [3].

The baseline architecture reference model for IP flow mobility when I-WLAN mobility is deployed in the non roaming case is specified in TS 23.327 [4].

The baseline Non-roaming architecture for I-WLAN is specified in TS 23.234 [9].

The baseline Non-roaming architecture for ANDSF is specified in TS 23.402 [3].

4.2.1 Roaming architecture

The baseline architecture reference model for IP flow mobility when EPS is deployed in the roaming case is specified in TS 23.402 [3].

The baseline architecture reference model for IP flow mobility when I-WLAN mobility is deployed in the roaming case is specified in TS 23.327 [4].

The baseline roaming architecture for I-WLAN is specified in TS 23.234 [9].

The baseline roaming architecture for ANDSF is specified in TS 23.402 [3].

4.3 High level functions

4.3.1 S2c and H1 extensions for IP flow mobility

4.3.1.1 General

The granularity of access system connectivity and inter system mobility based on TS 23.402 [3] and TS 23.327 [4] is per PDN connection basis. This implies that when a handover occurs all the IP flows belonging to the same PDN connection are moved from the source access system to the target access system.

With IP flow mobility it is possible to have a finer granularity in access system connectivity and inter system mobility: the handover procedures can be applied to a single or multiple IP flows belonging to the same PDN connection. This implies that some IP flows of one PDN connection can be routed via one access system while simultaneously some IP flows of the same PDN connection can be routed via another access system.

To achieve IP flow mobility the inter-system mobility signalling is enhanced in order to carry routing filters. The extensions to DSMIPv6 mobility signalling needed to carry routing filters when the UE is connected to multiple accesses simultaneously are specified in RFC 5648 [7] and RFC 6089 [8] and are applicable to both S2c and H1.

4.3.1.2 DSMIPv6 enhancements

When a UE configures different IP addresses on multiple accesses, it can register these addresses with the HA as CoAs using multiple bindings as specified in IETF RFC 5648 [7].

To register multiple bindings, the UE generates a Binding ID (BID) for each CoA and stores the BID in the binding update list. The UE then registers its CoAs by sending a Binding Update (BU) with a Binding Identifier mobility option. The BID is included in the Binding Identifier mobility option. When the UE is on the home link in one of the access, the CoA field is set to the HoA in the respective BID.

When the HA receives the BU with a Binding Identifier mobility option, it copies the BID from the mobility option to the corresponding field in the Binding Cache entry. If there is an existing Binding Cache entry for the UE, and if the BID in the BU does not match the one with the existing entry, the HA creates a new Binding Cache entry for the new CoA and BID.

Based on this extension, a typical Binding Cache in HA according to this specification in case the UE is not on the home link is shown in Table 4.3.1.2-1.

NOTE: A BID is only unique for a given HoA, i.e. different mobile nodes can use the same BID value.

Table 4.3.1.2-1: Binding Cache in HA supporting multiple CoAs registration

Home Address	Care-of Address	Binding ID	Priority
HoA1	CoA1	BID1	x
HoA1	CoA2	BID2	y
…	…	…	…

In order to route IP flows through a specific access, the UE needs to request to store routing filters for that access at the HA: the UE includes the Flow Identification (FID) mobility option in the BU message as defined in RFC 6089 [8]. The FID option defines a routing rule which contains a routing filter and a routing address. The routing address (either CoA or HoA) is indicated by the BID. The routing filter is included in the DSMIPv6 signalling as described in RFC 6088 [12]. The routing filters are unidirectional and can be different for uplink and downlink traffic.

It is assumed that between UE and the Home Agent function there is always a default routing address via which packets not matching any specific routing filter are routed. The UE provides a relative priority with each BID, where the BID with the highest priority is the default route. The UE may update the priority of a BID during IP flow mobility procedures.

To install/remove/move an IP flow, the UE shall create a new IP flow binding or remove/update the IP flow binding at the HA by using DSMIPv6 signalling as specified in RFC 5555 [2], RFC 5648 [7] and RFC 6089 [8].

An example of a typical Binding Cache in HA with routing filters is shown in Table 4.3.1.2-2. Note that a FID is only unique for a given HoA, i.e. different PDN connections can use the same FID value. Each flow binding entry contains a relative priority.

Table 4.3.1.2-2: Binding Cache in HA supporting flow bindings

Home Address	Routing Address	Binding ID	BID Priority	Flow ID	FID Priority	Routing Filter
HoA1	CoA1	BID1	x	FID1	a	Description of IP flows…
				FID2	b	Description of IP flows…
HoA1	CoA2	BID2	y	FID3	…	…

NOTE: This clause shows only a conceptual representation of the binding cache. The actual format is implementation specific.

4.3.2 Policy provisioning for inter-system mobility and WLAN offload

In order to allow the operator to indicate to the UE through which access technology IP flows are expected to be routed, inter system routeing policies are introduced in TS 23.402 [3]. Such policies can be defined per APN, per IP flow class under any APN or per IP flow class under a specific APN and can be provided to the UE either through ANDSF or by means of static pre-configuration.

For IP flows that are routed over WLAN, the inter system routeing policies also specify whether the traffic should be routed through the HA or directly via the WLAN access, bypassing the HA.

The normative procedures for ANDSF and UE can be found in TS 23.402 [3].

4.3.3 Policy Control and Charging support

When IP flow mobility is used and PCC is deployed, the PCC architecture is enhanced to handle multiple simultaneous access connections for a single IP-CAN session. These enhancements require the PDN GW to keep the PCRF up to date about the current routing address for each IP flow.

The detailed description of the normative procedures for PCC enhancements can be found in TS 23.203 [5].

4.3.4 Local Operating Environment Information

In addition to operator policy and user preferences, the UE may take into account the Local Operating Environment Information when deciding which access to use for an IP flow.

The actual Local Operating Environment Information is implementation dependent and may comprise of such items as, radio environment information, quality of IP connection, application specific requirements, power considerations, etc.

5 IP Flow Mobility procedures and flows

5.1 General

This section describes the IP flow mobility procedures for different scenarios. The call flows are described in a common way for I-WLAN and EPS and the procedures which are applicable to EPS only are marked as optional and identified as not applicable to an I-WLAN mobility deployment. Furthermore the call flows do not differentiate between trusted or untrusted accesses as the IP flow mobility procedures are common as soon as the UE configures a Care-of Address.

5.2 PDN connection establishment over first access

5.2.1 General

This clause specifies the additional UE procedures when establishing a PDN connection through a 3GPP or through a WLAN access when the UE supports IP flow mobility. In these flows it is assumed that the UE has not established the PDN connection through any access yet.

NOTE: In the rest of the document the PDN connection establishment procedure is meant to be PDP context activation procedure in case of I-WLAN mobility architecture.

5.2.2 PDN connection establishment over 3GPP access

The UE performs the initial PDN connection establishment to a 3GPP access as shown in Figure 5.2.2-1. This procedure applies independently whether the UE attaches to EPS or GPRS.

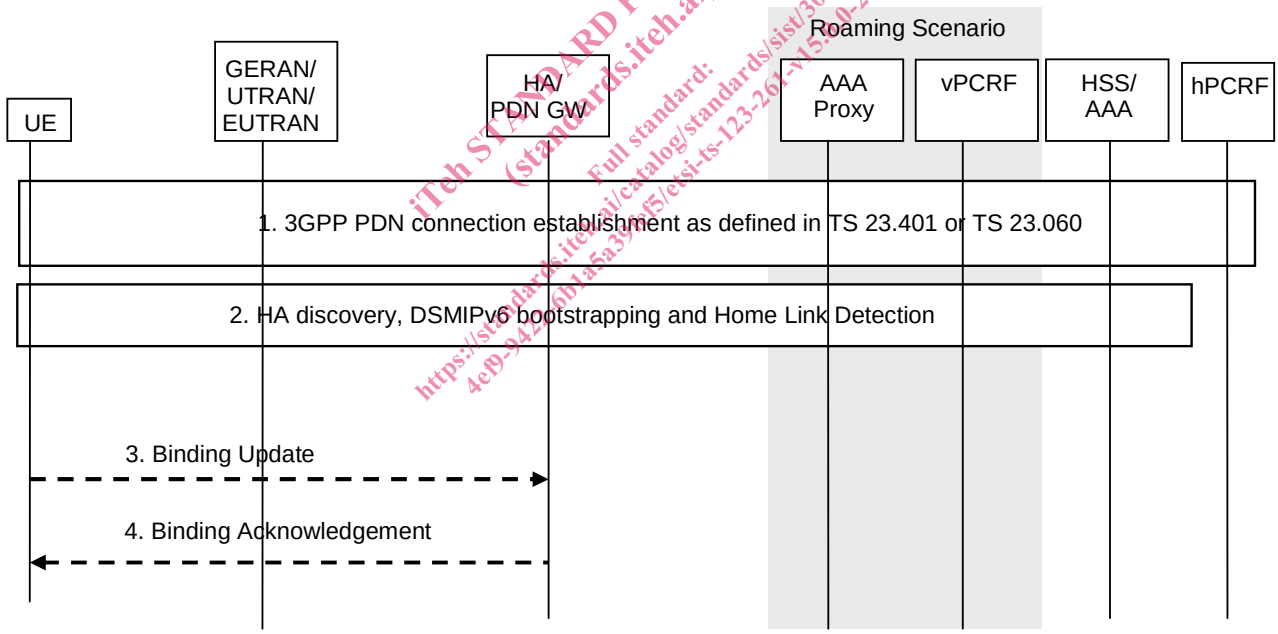

Figure 5.2.2-1: PDN connection procedure over 3GPP access

1. The initial PDN establishment procedure is performed by the UE according to TS 23.401 [10] or TS 23.060 [11], depending if the PDN connection establishment is to EPS or GPRS. During this step an IPv4 address and/or an IPv6 address/prefix is assigned to the UE.

2. The UE performs HA discovery, DSMIPv6 bootstrapping and the home link detection procedure as described in TS 23.402 [3] or TS 23.327 [4].

   If the UE requests the home network prefix in the Protocol Configuration Option (as in TS 23.402 [3]), the UE shall requests in the Protocol Configuration Option an indication of HA support of IP flow mobility.

   If the UE obtains the home network prefix using the IKEv2 procedure, the UE shall use IKEv2 signaling to indicate IFOM support. The HA supporting IFOM shall use IKEv2 signaling to confirm the IFOM support.