

**Title:** Reply LS on Control of simultaneous accesses for WLAN 3GPP IP access  
**Response to:** LS (S2-050430) on LS on Control of simultaneous accesses for WLAN 3GPP IP access  
**Release:** Release 6  
**Work Item:** WLAN Interworking

**Source:** SA3  
**To:** SA2  
**Cc:** CN1, CN4

**Contact Person:**

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**Attachments:** S3-050151

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**1. Overall Description:**

SA3 thanks SA2 for the liaison related to Control of simultaneous accesses for WLAN 3GPP IP access (S2-050430).

SA2 asked SA3 to clarify the following issues:

**Question 1:** SA2 would like to ask for clarification on what type of "fraud" that SA3 would like to prevent in this case.

**SA3 answer:** SA3 aims to prevent potential fraud cases where an unlimited number of devices get simultaneous access to the 3GPP network using only one subscription. Limiting the number of simultaneous sessions can mitigate such fraud attempts.

**Question 2:** The approach in the liaison is to provide a simple Boolean flag to indicate if the W-APN tunnel is active. In our discussions in SA2, the idea was put forward that perhaps a simple counter could be used instead. In this approach, the same W-APN could be used more than once, but a limit would exist (as configured by the operator) which would not allow more than this number of IKE SAs. Such approach would be more future proof and allow for use cases as described above and still being under operator control. Would this modification be acceptable to SA3?

**SA3 answer:** The modification proposed by SA2 is acceptable for SA3. The approach of using a counter instead of a flag is implemented in S3-050151.

**2. Actions:**

**To SA2 group.**

**ACTION:** none.

**3. Date of Next SA3 Meetings:**

SA3 #38	26 - 29 April 2005	Switzerland
SA3 #39	28 June - 1 July 2005	Toronto, Canada

## CHANGE REQUEST

⌘ **33.234 CR 059** ⌘ rev **1** ⌘ Current version: **6.3.0** ⌘

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

<b>Title:</b>	<span>⌘</span> Clarification on the handling of simultaneous sessions		
<b>Source:</b>	<span>⌘</span> Ericsson		
<b>Work item code:</b>	<span>⌘</span> WLAN	<b>Date:</b>	<span>⌘</span> 02/02/2005
<b>Category:</b>	<span>⌘</span> <b>F</b>	<b>Release:</b>	<span>⌘</span> Rel-6
	Use <u>one</u> of the following categories: <b>F</b> (correction) <b>A</b> (corresponds to a correction in an earlier release) <b>B</b> (addition of feature), <b>C</b> (functional modification of feature) <b>D</b> (editorial modification) Detailed explanations of the above categories can be found in 3GPP <a href="#">TR 21.900</a> .		Use <u>one</u> of the following releases: <b>Ph2</b> (GSM Phase 2) <b>R96</b> (Release 1996) <b>R97</b> (Release 1997) <b>R98</b> (Release 1998) <b>R99</b> (Release 1999) <b>Rel-4</b> (Release 4) <b>Rel-5</b> (Release 5) <b>Rel-6</b> (Release 6) <b>Rel-7</b> (Release 7)

<b>Reason for change:</b>	<span>⌘</span> In SA3#36 the handling of simultaneous sessions in WLAN 3GPP IP access (formerly called scenario 3) was introduced in TS 33.234. However, the description of the actions to be taken by the 3GPP network were not clear enough, for example how the PDG shall behave. Furthermore, the mechanism currently described sets the maximum number of sessions to one, thus preventing it to be extended to more simultaneous sessions if the home operators decides it.
<b>Summary of change:</b>	<span>⌘</span> The 3GPP network procedures (behaviour of the PDG and AAA server) are explained in more detail. The mechanism is explained in a flexible way so that more than one simultaneous session is possible. The number of simultaneous sessions will be configured by the home operator.
<b>Consequences if not approved:</b>	<span>⌘</span> Lack of clear enough descriptions may lead to interoperability problems.

<b>Clauses affected:</b>	<span>⌘</span> 5.7, 6.1.5.1, 6.1.5.2										
<b>Other specs affected:</b>	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; text-align: center;">Y</td> <td style="width: 20px; text-align: center;">N</td> </tr> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;"></td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">X</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;">X</td> </tr> </table> Other core specifications Test specifications O&M Specifications	Y	N	X			X		X	<span>⌘</span> 29.234, 24.234	
Y	N										
X											
	X										
	X										
<b>Other comments:</b>	<span>⌘</span>										

\*\*\* BEGIN SET OF CHANGES \*\*\*

## 5.7 Simultaneous access control

The home network operator needs to be aware of how the user is accessing the WLAN network. If the user is making the SIM or UICC card available for several devices that have WLAN access capabilities, the home network operator may decide, at any time, to allow or bar t he access of two or more network devices simultaneously.

### WLAN direct IP access

The control of simultaneous sessions in WLAN direct IP access can be performed, under some circumstances, using the MAC address of the user's device.

After a number of successful authentications, if a subsequent authentication attempt is being performed by another device, the MAC address will be different and the AAA server will be able to detect it. However, this mechanism has some limitations. One of them is that if the two devices are accessing two different WLAN access points (assuming that a WLAN access point has a independent control of MAC address space), the MAC address of one of them can be spoofed and made equal to the other one. This is a fraud situation the home network should avoid. However, it may happen that the user is accessing other WLAN access point and a pre-authentication is performed in this new access point. In this case there is no fraud attempt. Then, in this situation (same MAC addresses, different WLAN radio networks) the AAA server will not be able to distinguish between a legal and a fraud situation and shall not reject the authentication process.

### WLAN 3GPP IP access

The control of simultaneous sessions in WLAN 3GPP IP access has to be performed in a different way than in WLAN direct IP access as in this case the MAC addresses cannot be trusted by the home network and may not be available.

The user gets connected to the 3GPP network using the W-APNs. When a W-APN is activated by the user, an IKEv2 exchange will be initiated and, if successful, an IKE SA and an IPsec SA will be established.

The IKEv2 procedure is authenticated using EAP SIM or EAP AKA, so the AAA server has to be contacted in order to perform this authentication. Then the AAA server will be aware of the fact that a new W-APN is going to be activated.

The mechanism to control simultaneous sessions is to limit the number of W-APNs to be activated by the user and ~~allow only one control the number of IKEv2 security associations per W-APN. The home operator shall configure, by subscription, the Maximum Number of IKE SAs per W-APN.~~ With this mechanism, it is ensured that only as many devices as defined by the Maximum Number~~avoided that two or more devices~~ make use of the same subscription to access the 3GPP network, because each device will have to activate a W-APN (and use a different IKE SA and IPsec SA). ~~The AAA server shall keep a flag (e.g. active yes/no) for every W-APN and check this flag when a IKE SA establishment attempt is received. If the W-APN is already active, the AAA server will instruct the PDG to delete the old IKE SA and proceed to establish the new IKE SA.~~

Since one IKE SA allows to establish multiple IPsec SAs, and the establishment of a new IPsec SA (under the same IKE SA) does not imply to contact the AAA server, the PDG shall reject more than one IPsec SA per IKE SA. This measure forces the WLAN UE to setup a new IKE SA if the WLAN UE wants to setup a new IPsec SA, hence making the AAA server aware of this establishment attempt and enforcing the authorization mechanism specified previously.

\*\*\* END SET OF CHANGES \*\*\*

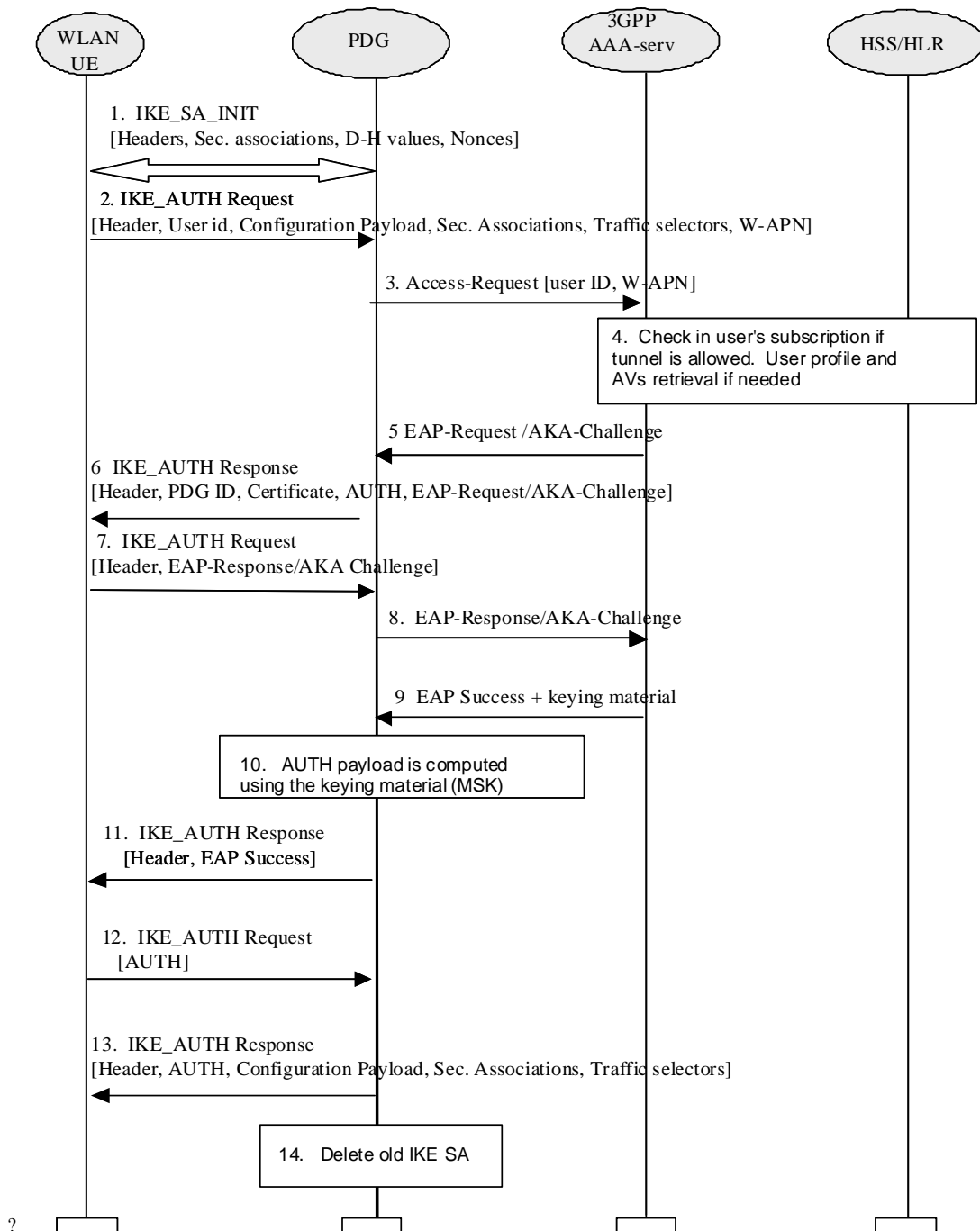
**\*\*\* BEGIN SET OF CHANGES \*\*\***

#### 6.1.5.1 Tunnel full authentication and authorization

The tunnel end point in the network is the PDG. As part of the tunnel establishment attempt the use of a certain W-APN is requested. When a new attempt for tunnel establishment is performed by the WLAN UE, the WLAN UE shall use IKEv2 as specified in ref. [29]. The EAP messages carried over IKEv2 shall be terminated in the AAA server, which communicates with the PDG via Wm interface, implemented with Diameter. Then the PDG shall extract the EAP messages received from the WLAN UE over IKEv2, and send them to the AAA server over Diameter (the opposite for messages sent from the AAA server). The WLAN UE shall use the Configuration Payload of IKEv2 to obtain the Remote IP address.

The sequence diagram is shown in figure 7A. The EAP message parameters and procedures regarding authentication are omitted since they are already described in this technical specification. Only decisions and processes relevant to this EAP-IKEv2 procedure are explained.

As the WLAN UE and PDG generated nonces are used as input to derive the encryption and authentication keys in IKEv2, replay protection is implemented as well. For this reason, there is no need for the AAA server to request the user identity again using the EAP AKA or EAP SIM specific methods (as specified in ref. [4] and ref. [5]), because the AAA server is certain that no intermediate node has modified or changed the user identity.



**Figure 7A: Tunnel full authentication and authorization**

1. The WLAN UE and the PDG exchange the first pair of messages, known as IKE\_SA\_INIT, in which the PDG and WLAN UE negotiate cryptographic algorithms, exchange nonces and perform a Diffie\_Hellman exchange.
2. The WLAN UE sends the user identity (in the Idi payload) and the W-APN information (in the Idr payload) in this first message of the IKE\_AUTH phase, and begins negotiation of child security associations. The WLAN UE omits the AUTH parameter in order to indicate to the PDG that it wants to use EAP over IKEv2. The user identity shall be compliant with Network Access Identifier (NAI) format specified in RFC 2486 [14], containing the IMSI or the pseudonym. The identity in NAI format generated from the IMSI is described in ref. [4] and ref. [5], depending on the type of EAP method to be used (EAP SIM or EAP AKA). The WLAN UE shall send the configuration payload (CFG\_REQUEST) within the IKE\_AUTH request message to obtain a Remote IP Address.

Editors note: The control of simultaneous sessions in the EAP authentication has to be possible as in WLAN access authentication. Nevertheless, it is needed to study in detail how the parameters to perform this control have to be transferred in EAP/IKEv2. For example, the VPLMN id could be included in the NAI (see TS 23.234 [13], section 5.3.4)

3. The PDG sends the Access Request message with an empty EAP AVP to the AAA server, containing the user identity and W-APN. The PDG shall include a parameter indicating that the authentication is being performed for tunnel establishment, as indicated in reference [37]. This will help the AAA server to distinguish between authentications for WLAN access and authentications for tunnel setup.
4. The AAA server shall fetch the user profile and authentication vectors from HSS/HLR (if these parameters are not available in the AAA server) and determines the EAP method (SIM or AKA) to be used, according to the user subscription and/or the indication received from the WLAN UE. The AAA server checks in user's subscription if he/she is authorized to establish the tunnel.

In this sequence diagram, it is assumed that the user has a USIM and EAP AKA will be used. For EAP SIM there is no difference from the IKEv2-EAP relationship point of view, but only for the EAP SIM mechanism itself, which is explained in this technical specification

5. The AAA server initiates the authentication challenge. The user identity is not requested again, as in a normal authentication process, because there is the certainty that the user identity received in the EAP Identity Response message has not been modified or replaced by any intermediate node. The reason is that the user identity was received via an IKEv2 secure channel which can only be decrypted and authenticated by the end points (the PDG and the WLAN UE).
6. The PDG responds with its identity, a certificate, and sends the AUTH parameter to protect the previous message it sent to the WLAN UE (in the IKE\_SA\_INIT exchange). It completes the negotiation of the child security associations as well. The EAP message received from the AAA server (EAP-Request/AKA-Challenge) is included in order to start the EAP procedure over IKEv2.
7. The WLAN UE checks the authentication parameters and responds to the authentication challenge. The only payload (apart from the header) in the IKEv2 message is the EAP message.
8. The PDG forwards the EAP-Response/AKA-Challenge message to the AAA server.
9. When all checks are successful, the AAA server sends an EAP success and the key material to the PDG. This key material shall consist of the MSK generated during the authentication process. When the Wm interface (PDG-AAA server) is implemented using Diameter, the MSK shall be encapsulated in the EAP-Master-Session-Key parameter, as defined in ref. [23].

If the counter of IKE SAs for that W-APN is not active stepped up. If the maximum number of IKE SAs for that W-APN is exceeded, the AAA server will mark it as "active" shall send an indication to the PDG that established the oldest active IKE SA (it could be the same PDG or a different one) to delete the oldest established IKE SA. The AAA server shall update accordingly the information of IKE SAs active for the W-APN.

~~—If the AAA server detects that the W-APN is active in other PDG, it will send an indication to that PDG requesting to delete the IKE SA of the W-APN.~~

Editor's note: Registration procedure, including transport of parameters needed to perform simultaneous access control, should be performed in order to update registration status in HSS and fetch the necessary data to the AAA server, but this still needs to be studied in detail.

10. The MSK shall be used by the PDG to generate the AUTH parameters in order to authenticate the IKE\_SA\_INIT phase messages, as specified in ref. [29]. These two first messages had not been authenticated before as there were no key material available yet. According to ref. [29], the shared secret generated in an EAP exchange (the MSK), when used over IKEv2, shall be used to generate the AUTH parameters.
11. The EAP Success message is forwarded to the WLAN UE over IKEv2.
12. The WLAN UE shall take its own copy of the MSK as input to generate the AUTH parameter to authenticate the first IKE\_SA\_INIT message. The AUTH parameter is sent to the PDG.
13. The PDG checks the correctness of the AUTH received from the WLAN UE and calculates the AUTH parameter which authenticates the second IKE\_SA\_INIT message. The PDG shall send the assigned Remote IP address in the configuration payload (CFG\_REPLY), if the WLAN UE requested for a Remote IP address through the

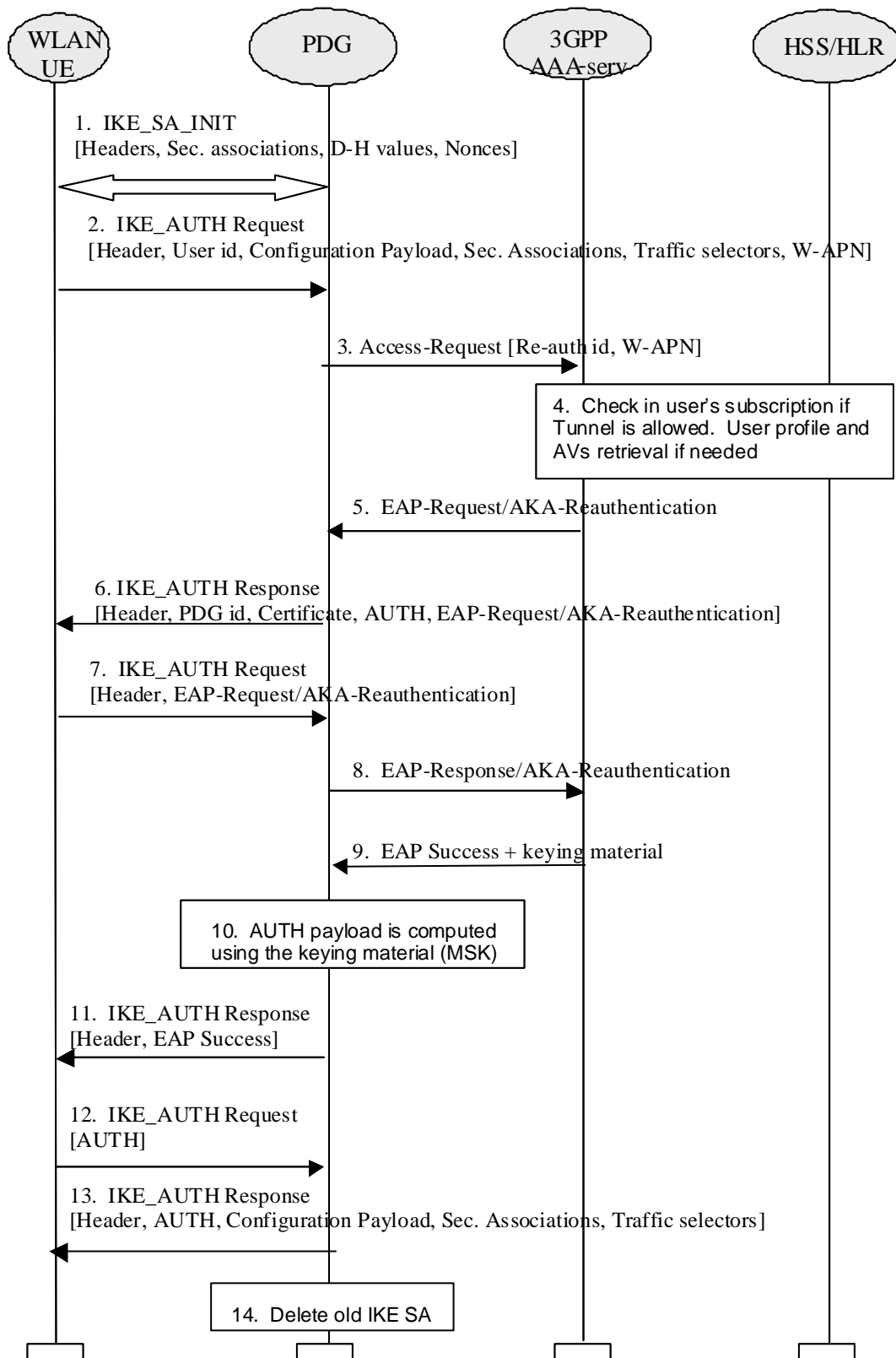
CFG\_REQUEST. Then the AUTH parameter is sent to the WLAN UE together with the configuration payload, security associations and the rest of the IKEv2 parameters and the IKEv2 negotiation terminates.

14. If the PDG detects that an old IKE SA for that W-APN already exists, it will delete the IKE SA and send the WLAN UE an INFORMATIONAL exchange with a Delete payload, as specified in reference [29], in order to delete the old IKE SA in WLAN UE.

### 6.1.5.2 Tunnel fast re-authentication and authorization

This process is very similar to the tunnel full authentication and authorization. The only difference is that EAP fast re-authentication is used in this case.

The sequence diagram is shown in figure 7B. The EAP message parameters and procedures regarding fast re-authentication are omitted since they are already described in this technical specification. Only decisions and processes relevant to this EAP-IKEv2 procedure are explained.



**Figure 7B: Tunnel fast re-authentication and authorization**

1. The WLAN UE and the PDG exchange the first pair of messages, known as IKE\_SA\_INIT, in which the PDG and WLAN UE negotiate cryptographic algorithms, exchange nonces and perform a Diffie\_Hellman exchange.
2. The WLAN UE sends the re-authentication identity (in the Idi payload) and the W-APN information (in the Idr payload) in this first message of the IKE\_AUTH phase, and begins negotiation of child security associations.



The WLAN UE omits the AUTH parameter in order to indicate to the PDG that it wants to use EAP over IKEv2. The re-authentication identity used by the WLAN UE shall be the one received in the previous authentication process. The WLAN UE shall send the configuration payload (CFG\_REQUEST) within the IKE\_AUTH request message to obtain a Remote IP Address.

3. The PDG sends the Access Request message with an empty EAP AVP to the AAA server, containing the re-authentication identity and W-APN. The PDG shall include a parameter indicating that the authentication is being performed for tunnel establishment, as indicated in ref. [37]. This will help the AAA server to distinguish between authentications for WLAN access and authentications for tunnel setup.
4. The AAA server shall fetch the user profile and authentication vectors from HSS/HLR (if these parameters are not available in the AAA server) and determines the EAP method (SIM or AKA) to be used, according to the user subscription. The AAA server checks in user's subscription if he/she is authorized to establish the tunnel.

In this sequence diagram, it is assumed that the user has a USIM and EAP AKA will be used. For EAP SIM there is no difference from the IKEv2-EAP relationship point of view, but only for the EAP SIM mechanism itself, which is explained in this technical specification.

5. The AAA server initiates the fast re-authentication challenge.
6. The PDG responds with its identity, a certificate, and sends the AUTH parameter to protect the previous message it sent to the WLAN UE (in the IKE\_SA\_INIT exchange). It completes the negotiation of the child security associations as well. The EAP message received from the AAA server (EAP-Request/AKA-Reauthentication) is included in order to start the EAP procedure over IKEv2.
7. The WLAN UE checks the authentication parameters and responds to the fast re-authentication challenge. The only payload (apart from the header) in the IKEv2 message is the EAP message.
8. The PDG forwards the EAP-Response/AKA-Reauthentication message to the AAA server.
9. When all checks are successful, the AAA server sends an EAP success and the key material to the PDG. This key material shall consist of the MSK generated during the fast re-authentication process. When the Wm interface (PDG-AAA server) is implemented using Diameter, the MSK shall be encapsulated in the EAP-Master-Session-Key parameter, as defined in ref. [23].

If the counter of IKE SAs for that W-APN is not active stepped up. If the maximum number of IKE SAs for that W-APN is exceeded, the AAA server will mark it as "active" shall send an indication to the PDG that established the oldest active IKE SA (it could be the same PDG or a different one) to delete the oldest established IKE SA. The AAA server shall update accordingly the information of IKE SAs active for the W-APN.

~~If the AAA server detects that the W-APN is active in other PDG, it will send an indication to that PDG requesting to delete the IKE SA of the W-APN.~~

10. The MSK shall be used by the PDG to generate the AUTH parameters in order to authenticate the IKE\_SA\_INIT phase messages, as specified in ref. [29]. These two first messages had not been authenticated before as there were no key material available yet. According to ref. [29], the shared secret generated in an EAP exchange (the MSK), when used over IKEv2, shall be used to generate the AUTH parameters.
11. The EAP Success message is forwarded to the WLAN UE over IKEv2.
12. The WLAN UE shall take its own copy of the MSK as input to generate the AUTH parameter to authenticate the first IKE\_SA\_INIT message. The AUTH parameter is sent to the PDG.
13. The PDG checks the correctness of the AUTH received from the WLAN UE and calculates the AUTH parameter which authenticates the second IKE\_SA\_INIT message. The PDG shall send the assigned Remote IP address in the configuration payload (CFG\_REPLY), if the WLAN UE requested for a Remote IP address through the CFG\_REQUEST. Then the AUTH parameter is sent to the WLAN UE together with the configuration payload, security associations and the rest of the IKEv2 parameters and the IKEv2 negotiation terminates.
14. If the PDG detects that an old IKE SA for that W-APN already exists, it will delete the IKE SA and send to the WLAN UE an INFORMATIONAL exchange with a Delete payload, as specified in reference [29], in order to delete the old IKE SA in WLAN UE.

\*\*\* END SET OF CHANGES \*\*\*