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Corrections for CMAC/HMAC Tuple Usage

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Introduction

0.1 IEEE P802.16e/D9 Status and Problems

In general, the CMAC/HMAC-Digest is used to authenticate the PKM-related MAC messages and the CMAC/HMAC Tuple is used to authenticate the other MAC messages.

The CMAC/HMAC Tuple can be used, after both MS and BS share the valid AK sequence number and then have the CMAC/HMAC sequence number, because the CMAC/HMAC Tuple compound attributes contain the CMAC/HMAC sequence number.

There are several the PKM-related messages containing the CMAC/HMAC Tuple, such as a PKMv2 SA-TEK-Challenge message, a PKMv2 SA-TEK-Request message, and a PKMv2 SA-TEK-Response message. However, both MS and BS can't share the valid AK sequence number, before exchanging these messages. Therefore, these messages should not include the CMAC/HMAC Tuple but the CMAC/HMAC-Digest for message authentication.

0.2 Solutions

PKMv2 SA-TEK-Challenge, PKMv2 SA-TEK-Request, and PKMv2 SA-TEK-Response messages shall include the CMAC-Digest and the HMAC-Digest for message authentication.

Proposed Changes into IEEE P802.16e/D9

[Change sub-clauses 6.3.2.3.9.18 as follows]

6.3.2.3.9.18 PKMv2 SA-TEK-Challenge message

The BS transmits the PKMv2 SA-TEK-Challenge message as a first step in the 3-way SA-TEK handshake at initial network entry and at reauthorization. The BS shall send this message to the MS after finishing authorization procedure(s) selected by the negotiated Authorization Policy Support included in the SBC-REQ/RSP messages. It identifies an AK to be used for the Secure Association, and includes a random number challenge to be included returned by the MSS in its the PKMv2 SA-TEK-Request message

Code: 20

Attributes are shown in Table 37g

Table 37g – PKMv2 SA-TEK-Challenge message attributes

Attribute	Contents
BS_Random	A freshly generated random number of 64bits
Key Sequence Number	AK sequence number
AKID	BS transmits newly assigned AKID.
CMAC Tuple/HMAC Tuple	Message integrity tuple for this message
Key lifetime	PMK lifetime, this attribute shall include only follows EAP-based authorization or EAP-based re-authorization procedures.
HMAC-Digest/CMAC-Digest	Message authentication digest for this message

The CMAC key sequence number/HMAC key sequence number included in the OMAC Tuple/HMAC Tuple should be equal to the newly assigned RK sequence number.

The generation of the AK sequence number and the AKID is defined in 7.2.2.4.1.

The HMAC-Digest attribute or the CMAC-Digest attribute shall be the final attribute in the message's attribute list.

Inclusion of the HMAC-Digest or the CMAC-Digest allows the MS and BS to authenticate a PKMv2 SA-TEK-Challenge message. The HMAC or the CMAC authentication keys are derived from the AK.

[Change sub-clauses 6.3.2.3.9.19 as follows]

6.3.2.3.9.19 PKMv2 SA-TEK-Request message

The MS transmits the PKMv2 SA-TEK-Request message after receipt and successful ~~HMAC/CMAC~~ HMAC-Digest or CMAC value verification of ~~an SA-Challenge~~ a SA-challenge tuple or PKMv2 SA-TEK-Challenge message from the BS. The PKMv2 SA-TEK-Request ~~_Request~~ proves liveness of the MS and its possession of the AK to the BS. If this message is being generated during initial network entry, then it constitutes a request for SA-Descriptors identifying the primary and static SAs and GSAs the requesting MS is authorized to access and their particular properties (e.g., type, cryptographic suite).

If this message is being generated upon HO, then it constitutes a request for establishment (in the target BS) of TEKs, GTEKs and GKEKs at the MSS and renewal of active primary, static and dynamic SAs and associated SAIDs used by the MSS in its previous serving BS.

Code: 21

Attributes are shown in Table 37h.

Table 37h – PKMv2 SA-TEK-Request message attributes

Attribute	Contents
MS_Random	A 64-bit number chosen by the MS for every new handshake.
BS_Random	The 64-bit random number from the SA-Challenge used in the PKMv2 SA-TEK-Challenge message.or SA-Challenge Tuple
Key Sequence Number	AK sequence number

AKID	This identifies the AK to the BS that was used for protecting this message.
Security_Capabilities	Describes requesting MS's security capabilities
Security Negotiation Parameters	Describes requesting MS's security capabilities (see 11.8.4)
CMAC/HMAC	Message integrity code for this message
HMAC-Digest/CMAC-Digest	Message authentication digest for this message

[Change sub-clauses 6.3.2.3.9.20 as follows]

6.3.2.3.9.20 PKMv2 SA-TEK-Request message

The BS transmits the PKMv2 SA-TEK-Response message as a final step in the 3-way [SA-TEK](#) handshake.

Code: 22

Attributes are shown in Table 37i.

Table 37i – PKMv2 SA-TEK-Response message attributes

Attribute	Contents
MS_Random	The number received from the MS
BS_Random	The random number included in the PKMv2 SA-TEK-Challenge message or SA-Challenge TLV.
Key Sequence Number	AK sequence number
AKID	This identifies the AK to the BS that was used for protecting this message.

SA_TEK_Update	A compound TLV list each of which specifies an SA identifier (SAID) and additional properties of the SA that the MS is authorized to access. This compound field may be present at the reentry. Additionally, in case of HO, for each active SA in previous serving BS, corresponding TEK, GTEK and GKEK parameters are also included.
Frame Number	An absolute frame number in which the old PMK and all its associate AKs should be discarded.
(one or more) SA-Descriptor (s)	Each compound SA-Descriptor attribute specifies an SA identifier identifier (SAID) and additional properties of the SA. This attribute is present at the initial network entry.
CMAC Tuple /HMAC Tuple	Message integrity tuple for this message
HMAC Digest/CMAC Digest	Message authentication digest for this message