Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Amendment to EAP Security Primitives in 14.2.2.1**
Date Submitted	**2007-03-14~~08~~**
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Re:	Contribution on comments to IEEE 802.16g/D8
Abstract	Re-definition of EAP primitives in 14.2.2.1
Purpose	Adoption
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Amendment to EAP Security Primitives in 14.2.2.1

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ETRI

1. Motivation

IEEE 802.16g Network reference model defines an NCMS and an 802.16 entity on an SS and a BS side. However, section 14.2.2.1 only describes EAP-based authentication procedures on a BS side. Therefore, EAP-based security primitives on an SS side are also needed for consistency. They shall be used as an interface between an EAP authentication application and an 802.16 entity(SS).

This contribution adds EAP-based security primitives on an SS~~M~~S side and changes some texts which are related to them.

We propose to modify section 14.2.2.1 as follows.

1. Modification of figure 473 to illustrate EAP-based security primitives on SS side.
2. Modification of each subsection to clarify and describe on each side (SS and BS side)

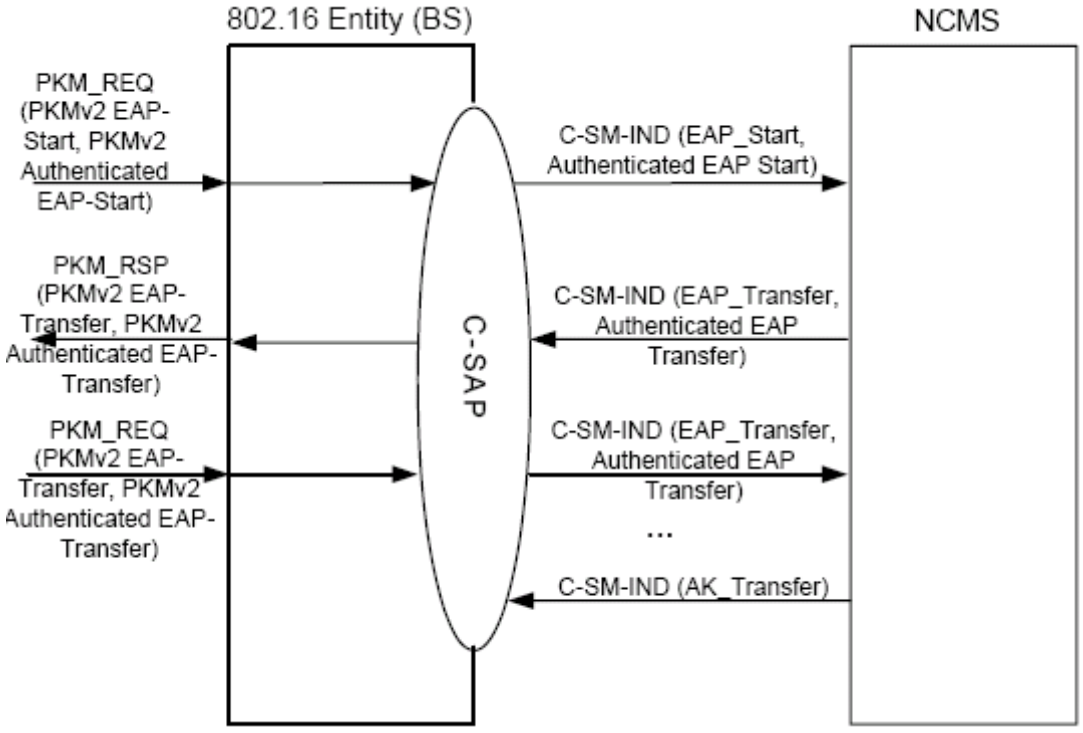
2. Proposed Text Changes

[*Modify Subclause 14.2.2.1 as follows*]

14.2.2.1 EAP-based authentication procedure

When an SS tries to initiate an EAP-based authentication or re-authentication procedure with a BS, an NCMS(SS) sends C-SM_IND/EAP_Start primitive to the 802.16 entity(SS) and the 802.16 entity(SS) ~~it~~ sends a PKMv2 EAP_Start message. The BS informs the AAA Services entity in NCMS (i.e. the authenticator) by sending the C-SM-IND/EAP_Start primitive. If the SS receives EAP-Request/Identity messages, then it sends the EAP-Response/Identity message with SS MAC Address to the AAA Services entity. After the EAP-Response/Identity message, the EAP methods are negotiated between the SS and the AAA server and the EAP messages are exchanged several times. The EAP encapsulated messages are exchanged between the SS and the AAA Services entity. If the EAP authentication procedure is finished successfully and also yields an MSK (Master Session Key), the BS which does not know EAP protocols receives the AK and a key lifetime from the authenticator, which is part of the AAA Services entity, in the C-SM-IND/AK_Transfer primitive. The MSK is already shared between the AAA server and the SS through the EAP exchanges. The MSK is used by the SS and authenticator for derivation of the PMK (Pairwise Master Key) and optional EIK (EAP Integrity Key).

Figure 473 shows EAP-based authentication procedures between an ~~BS~~ 802.16 entity and an NCMS on SS and BS sides ~~and an AAA Services entity in NCMS~~ as follows:



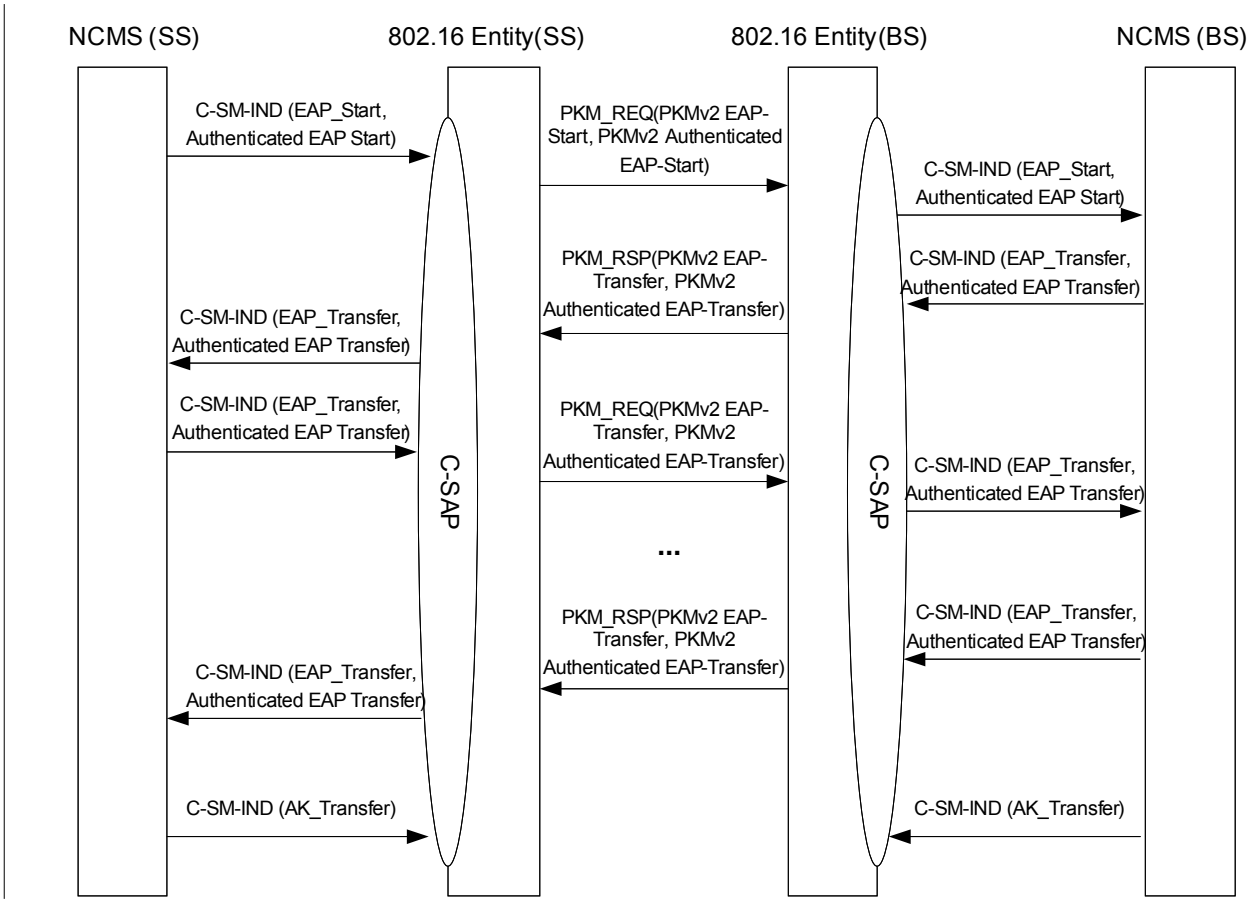


Figure 473 – EAP based Authentication Procedure

14.2.2.1.1 C-SM-IND

This primitive is used by an 802.16 entity or NCMS to notify security procedures. The Event_Type included in this primitive defines the type of security operation in Authentication and Re-authentication procedure to be performed. The possible Event_Types for this primitive are listed in the following table:

Table 450—C-SM-IND Event_Types

Event_Type	Description
EAP_Start	EAP Start
Authenticated EAP_Start	Authenticated EAP Start
AK Transfer	AK Transfer notification
EAP_Transfer	Transfer EAP Payload
Authenticated EAP_Transfer	Authenticated EAP Transfer

[***Modify Subclause 14.2.1.1.1 as follows***]

14.2.2.1.1.1 C-SM-IND (Event_Type = EAP_Start)

Function

This primitive informs ~~the authenticator in the NCMS~~an 802.16 entity(SS) or an NCMS(BS) that an SS is going to start an EAP-based authentication. The PKMv2 EAP_Start is sent by the SS to initiate either an initial EAP authentication or EAP re-authentication exchange.

Semantics of the service primitives

The parameters of the primitives are as follows:

C-SM-IND

(
Event_Type: EAP_Start,
Destination: NCMS, ~~M~~SS,
Attribute_List:
~~SM~~S MAC Address,
BSID
)

~~SM~~S MAC Address

48-bit unique identifier used for user identification between BS and NCMS

BSID

48-bit unique identifier used for BS

When generated

- NCMS(SS) -> 802.16 Entity(SS) :
  This primitive is issued by an ~~BS~~ NCMS (SS) ~~-~~when an SS wants to initiate EAP-based authentication procedure.
- 802.16 entity(BS) -> NCMS(BS) :
  This primitive can be issued by an ~~NCMS(BS)~~ 802.16 entity(BS) in EAP procedure to transfer EAP Message included in PKMv2 PKM-REQ message.

Effect of receipt

- ~~EAP payloads are forwarded for the authentication between the BS and the AAA NCMS entity (authenticator).~~
-
- NCMS(SS) -> 802.16 Entity(SS) :
  When received by the SS, the SS forwards EAP payload to BS via PKM-REQ message.
- 802.16 entity(BS) -> NCMS(BS) :
  When received by NCMS(BS), the NCMS(BS) forwards EAP payloads to AAA Authenticator.

[*Modify Subclause 14.2.2.1.1.2 as follows*]

14.2.2.1.1.2 C-SM-IND (Event_Type = Authenticated EAP_Start)

Function

This primitive informs an 802.16 entity(SS) or an NCMS(BS) ~~the authenticator in the NCMS~~ that an SS is starting a second round of EAP during double EAP authentication and authorization.

Semantics of the service primitives

The parameters of this primitive are as follows:
C-SM-IND
(
Event_Type: Authenticated_EAP_Start,
Destination: NCMS, SMS,
Attribute_List:
MS SS MAC Address,
BSID

)
SMS MAC Address
48-bit unique identifier used for user identification between BS and NCMS
BSID
48-bit unique identifier used for BS

When generated

~~The BS shall send a notification message with this event type to the NCMS whenever it received from the MS a PKMv2 Authenticated EAP_Start message, equipped with a valid "HMAC digest/CMAC digest" attribute value.~~

- NCMS(SS) -> 802.16 entity (SS):
  The NCMS(SS) shall send a notification message with this event type to the 802.16 entity(SS) whenever an SS is starting a second round of EAP during double EAP authentication and authorization
- 802.16 entity(BS) -> NCMS(BS) :
  The 802.16 entity(BS) shall send a notification message with this event type to the NCMS(BS) whenever it received from the 802.16 entity(SS) a PKMv2 Authenticated EAP_Start message, equipped with a valid "HMAC digest/CMAC digest" attribute value.

Effect of receipt

~~BS informs the NCMS of the MS having initiated second round EAP by means of a PKMv2 Authenticated EAP_Start message with a valid "HMAC digest/CMAC digest" attribute value. This triggers the NCMS to send Authenticated EAP_Transfer primitives to the BS carrying EAP payloads for second round EAP~~

- NCMS(SS) -> 802.16 entity (SS) :
  When the 802.16 entity(SS) receives Authenticated_EAP_Start primitive from NCMS(SS), the 802.16 entity(SS) transfers PKM_REQ with PKMv2 Authenticated EAP-Start to the 802.16 entity(BS).

- 802.16 entity(BS) -> NCMS(BS) :
  When the NCMS(BS) receives an Authenticated_EAP_Start primitive from the 802.16 entity(BS), the NCMS(BS) informs the NCMS(BS) of the MS having initiated second round EAP by means of a PKMv2 Authenticated EAP_Start message with a valid "HMAC digest/CMAC digest" attribute value. This triggers the NCMS(BS) to send Authenticated EAP_Transfer primitives to the 802.16 entity(BS) carrying EAP payloads for second round EAP

[*Modify Subclause 14.2.2.1.1.3 as follows*]

14.2.2.1.1.3 C-SM-IND (Event_Type = AK Transfer)

Function

An ~~SS~~ NCMS ~~derives~~ the key from the EAP payloads, yields PMK from the MSK, then yields AK from the PMK, and ~~the NCMS entity~~ informs the 802.16 entity~~ies~~~~BS~~ of ~~it~~ the AK when the EAP exchanges are successfully completed by the AAA service entities. ~~and yield PMK from the MSK, then yield AK from the~~

~~PMK~~.

Semantics of the service primitives

The parameters of the primitives are as follows:

C-SM-IND

(
Event_Type: AK_Transfer,
Destination: BS, ~~SM~~S,
Attribute_List:
~~SM~~S MAC Address,
AK,
AK Lifetime,
AK Sequence Number,
AKID
)

~~SM~~S MAC Address
48-bit unique identifier used for user identification between BS and NCMS

AK
AK is the product of PMK after successful EAP exchanges. It is used for protecting air interface messages and KEK.

AK Lifetime
AK Lifetime shall be set in accordance with PMK and MSK Lifetime. PMK and MSK Lifetime shall be transferred from the EAP method and could also be configured by the AAA Services.

AK Sequence Number
AK Sequence Number shall be derived from PMK Sequence Number.

AKID
It should be derived according to subclause 7.2.2.4.1 of the IEEE 802.16e-2005 specification

When generated

~~This primitive is issued by the NCMS (the AAA Services entity, i.e. Authenticator) when the EAP exchange finishes.~~

- NCMS(SS) -> 802.16 entity(SS) :
  This primitive is issued by the NCMS (SS) when the EAP exchanges are finished.
- NCMS(BS) -> 802.16 entity(BS) :
  This primitive is issued by the NCMS(BS) (the AAA Services entity, i.e. Authenticator) when the EAP exchanges are finished.

Effect of receipt

~~The BS could derive other AK context (HMAC/CMAC_KEY_U, HMAC/CMAC_KEY_D, HMAC/CMAC_PN_U, HMAC/CMAC_PN_D, KEK).~~

- NCMS(SS) -> 802.16 entity(SS) :
  The 802.16 entity(SS) could derive other AK context (HMAC/CMAC_KEY_U, HMAC/CMAC_KEY_D, HMAC/CMAC_PN_U, HMAC/CMAC_PN_D, KEK).

- NCMS(BS) -> 802.16 entity(BS) :
  The 802.16 entity(BS) could derive other AK context (HMAC/CMAC_KEY_U, HMAC/CMAC_KEY_D, HMAC/CMAC_PN_U, HMAC/CMAC_PN_D, KEK).

[*Modify Subclause 14.2.2.1.1.4 as follows*]

14.2.2.1.1.4 C-SM-IND (Event_Type = EAP_Transfer)

Function

After the C-SM-IND/EAP_Start primitive, EAP payloads are exchanged between an SS and an AAA server ~~an SS and NCMS~~. The EAP payloads are encapsulated in the C-SM-IND/EAP_Transfer because it is not interpreted in the MAC. C-SM-IND/EAP_Transfer is used between the NCMS and the 802.16 entity~~BS~~.

Semantics of the service primitives

The parameters of the primitives are as follows:

C-SM-IND

(
Event_Type: EAP TRANSFER,
Destination: S~~M~~S, BS or NCMS,
Attribute_list:
SS MAC Address,
EAP Payload
)

S~~M~~S MAC Address

48-bit unique identifier used for user identification between BS and NCMS.

EAP Payload

~~Contains t~~The EAP authentication data.

When generated

This primitive can be issued by an 802.16 entity ~~BS~~ in EAP procedure to transfer EAP Message included in PKMv2 PKM-REQ message. This primitive can also be issued by a NCMS in EAP procedure to transfer EAP Message to an 802.16 entity~~BS~~.

- NCMS(SS) -> 802.16 entity(SS) :
  This primitive can be issued by a NCMS(SS) in EAP procedure to transfer EAP Message to an 802.16 entity.
- 802.16 entity(BS) -> NCMS(BS) :
  This primitive can be issued by 802.16 entity(BS) in EAP procedure to transfer EAP Message included in PKMv2 PKM-REQ message.
- NCMS(BS) -> 802.16 entity(BS) :
  This primitive can be issued by a NCMS(BS) in EAP procedure to transfer EAP Message to an 802.16 entity(SS).
- 802.16 entity(BS) -> NCMS(BS) :
  This primitive can be issued by 802.16 entity(B~~S~~S) in EAP procedure to transfer EAP Message included in PKMv2 PKM-REQ message.

Effect of receipt

When received by NCMS, the NCMS could derive PMK and optional EIK from the MSK , then AK context from PMK after a successful authentication procedure.
When received by an 802.16 entity~~BS~~, ~~the BSit~~the 802.16 entity forwards EAP payload to ~~SS~~ the other in PKM-REQ or PKM-RSP message.

- NCMS(SS) -> 802.16 entity(SS) :
  When received by an 802.16 entity(SS), the ~~B~~SS forwards EAP payload to the other in PKM-REQ or PKM-RSP message
- 802.16 entity(BS) -> NCMS(BS) :
  When received by NCMS(BS), the NCMS(BS) could derive PMK and optional EIK from the MSK , then AK context from PMK after a successful authentication procedure.
- NCMS(BS) -> 802.16 entity(BS) :
  When received by an 802.16 entity(BS), the BS forwards EAP payload to the other in PKM-REQ or PKM-RSP message
- 802.16 entity(SS) -> NCMS(SS) :
  When received by NCMS(SS), the NCMS(SS) could derive PMK and optional EIK from the MSK , then AK context from PMK after a successful authentication procedure.

[*Modify Subclause 14.2.2.1.1.5 as follows*]

14.2.2.1.1.5 C-SM-IND (Event_Type = Authenticated EAP_Transfer)

Function

After the C-SM-IND/Authenticated_EAP_Start primitive, EAP payloads are exchanged between an SMS and an AAA server ~~SS and NCMS~~. The EAP payloads are encapsulated in C-SM-IND/Authenticated_EAP_Transfer because they are not interpreted in the MAC and because they are exchanged during second round EAP in double EAP authentication and authorization. C-SM-IND/Authenticated_EAP_Transfer is used between the NCMS and the 802.16 entity~~BS~~.

Semantics of the service primitives

The parameters of this primitive are as follows:

C-SM-IND

(
Event_Type: Authenticated_EAP_Transfer,
Destination: SMS, BS~~ID~~ or NCMS,
Attribute list:
SMS MAC Address,
EAP Payload
)

SMS MAC Address

48-bit unique identifier used for user identification between BS and NCMS, may be SMS MAC Address

EAP Payload

~~Contains t~~The EAP authentication data.

When generated

~~The BS shall send a notification message with this event type to the NCMS whenever it received from the MS a PKMv2 Authenticated EAP_Transfer message, equipped with a valid "HMAC digest/CMAC digest" attribute value. This way, the BS shall relay the EAP payload contained in the PKMv2 Authenticated EAP_Transfer message to the NCMS.The NCMS shall send a notification message with this event type to the BS in order to response to an Authenticated_EAP_Transfer primitive received from the BS.~~

- NCMS(SS) -> 802.16 entity(SS) :
  An NCMS(SS) shall send a notification message with this event type to an 802.16 entity after successful initial authentication procedure.
- 802.16 entity(BS) -> NCMS(BS) :
  The 802.16 entity(BS) shall send a notification message with this event type to the NCMS(BS) whenever it received from the MS a PKMv2 Authenticated EAP_Transfer message, equipped with a valid "HMAC digest/CMAC digest" attribute value. This way, the 802.16 entity(BS) shall relay the EAP payload contained in the PKMv2 Authenticated EAP_Transfer message to the NCMS(BS).
- 802.16 entity(SS) -> NCMS(SS) :
  The 802.16 entity(SS) shall send a notification message with this event type to the NCMS(SS) whenever it received from the MS a PKMv2 Authenticated EAP_Transfer message, equipped with a valid "HMAC digest/CMAC digest" attribute value. This way, the 802.16 entity(SS) shall relay the EAP payload contained in the PKMv2 Authenticated EAP_Transfer message to the NCMS(SS).
- NCMS(BS) -> 802.16 entity(BS) :
  An NCMS(BS) shall send a notification message with this event type to an 802.16 entity(BS) after successful initial authentication procedure.

Effect of receipt

When received by an 802.16 entity~~BS~~: When the 802.16 entity ~~BS~~ receives a Authenticated_EAP_Transfer primitive from NCMS, it generates a PKMv2 Authenticated EAP_Transfer message carrying the EAP contained in the primitive to the ~~MS~~other.

When received by NCMS: When the NCMS receives an Authenticated_EAP_Transfer primitive, it generates either a response primitive of the same type and sends it to the 802.16 entity~~BS~~, or - after successful completion of the second EAP round - derives PMK2 from MSK2, then AK from PKM and PMK2, and an AK context.

- NCMS(SS) -> 802.16 entity(SS) :
  When the 802.16 entity(SS) receives a Authenticated_EAP_Transfer primitive from NCMS(SS), it generates a PKMv2 Authenticated EAP_Transfer message carrying the EAP contained in the primitive to the other.
- 802.16 entity(BS) -> NCMS(BS) :
  When the NCMS(BS) receives an Authenticated_EAP_Transfer primitive, it generates either a response primitive of the same type and sends it to the 802.16 entity, or - after successful completion of the second EAP round - derives PMK2 from MSK2, then AK from PKM and PMK2, and an AK context.
- 802.16 entity(SS) -> NCMS(SS) :
  When the NCMS(SS) receives an Authenticated_EAP_Transfer primitive, it generates either a response primitive of the same type and sends it to the 802.16 entity, or - after successful completion of the second EAP round - derives PMK2 from MSK2, then AK from PKM and PMK2, and an AK context.
- NCMS(BS) -> 802.16 entity(BS) :
  When the 802.16 entity(BS) receives a Authenticated_EAP_Transfer primitive from NCMS(BS), it generates a PKMv2 Authenticated EAP_Transfer message carrying the EAP contained in the primitive to the other.