Project	IEEE 802.16 Broadband Wireless Access Working Group <**http://IEEE 802.org/16**>	
Title	Distributed Authentication Model for the .16j Relay network	
Date Submitted	2007-05-04	
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Re:	A response to a Call for Technical Proposal, http://wirelessman.org/relay/docs/80216j-07_007r1.pdf
Abstract	Security elements and mechanisms for .16j MMR control plane
Purpose	To incorporate the proposed text into the P802.16j Baseline Document (IEEE 802.16j-06/026r2)
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Distributed authentication hierarchy in MMR relay network

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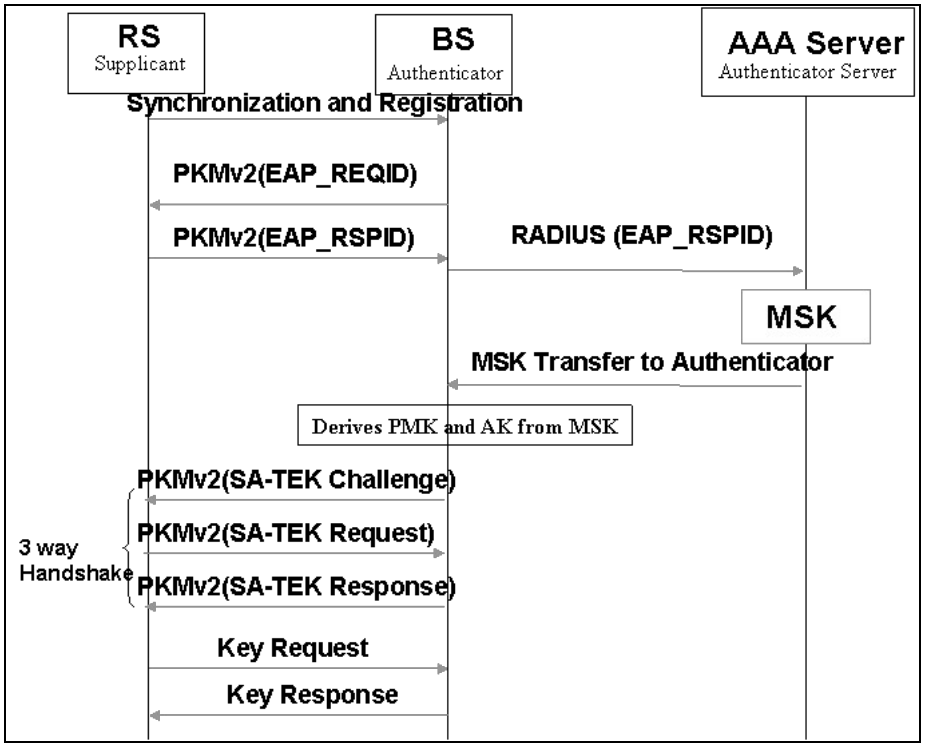
Introduction

In IEEE 802.16e PKMv2 specification, MS uses the PKM protocol to obtain authentication and traffic keying material from BS, and to support periodic re-authentication and key refresh.. Two authentication mechanisms are supported by PKM v2, namely RSA and Extensible Authentication Protocol (EAP). Either mechanism is applicable to the RS authentication within the MMR relay network as depicted in the following diagram.

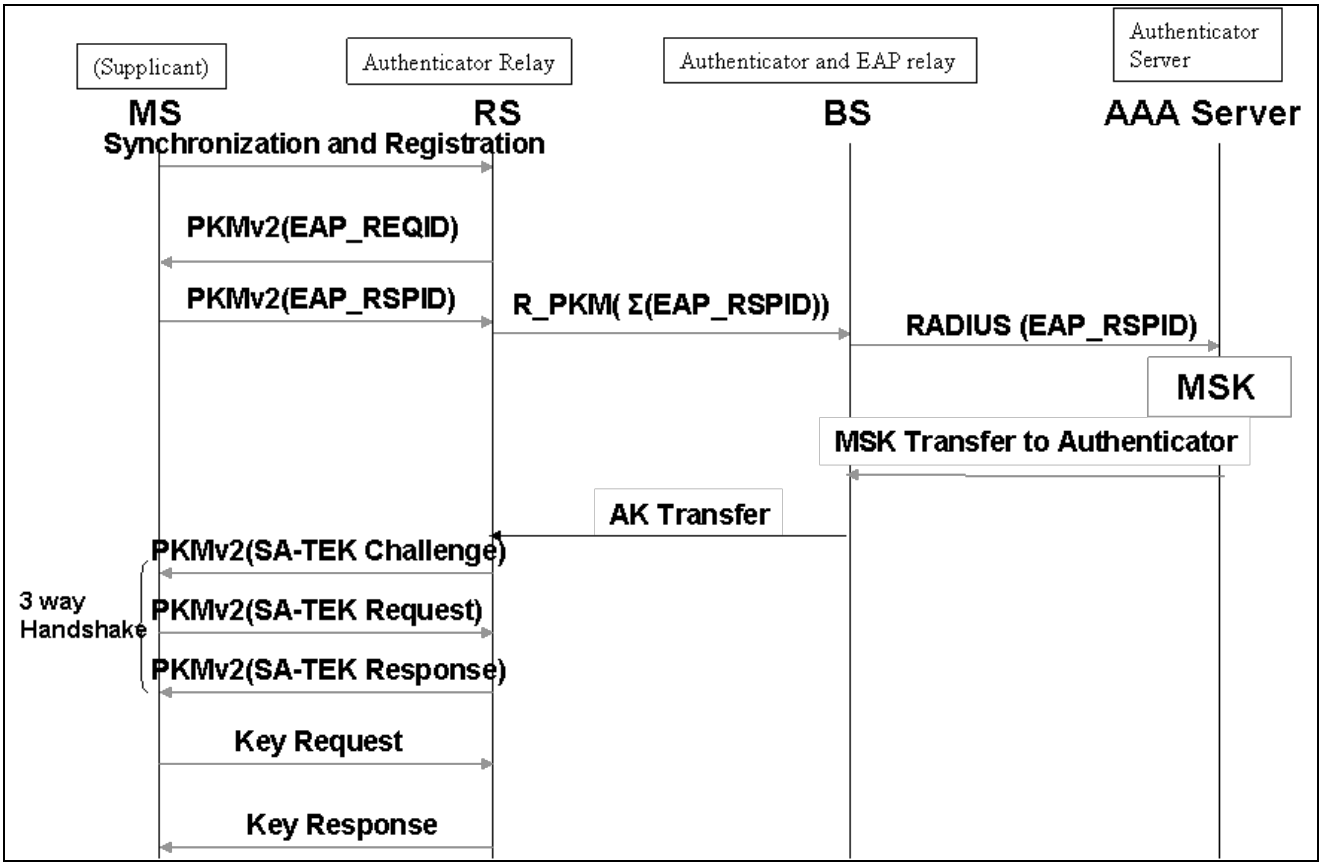


During the registration process, RS could be registered as Authenticator Relay(AR) RS based on its capability and willingness to become the AR RS as indicated in the bit 3 and 7 of the authorization policy support field (section 11.8.4.2 IEEE 802.16e-2005)

Type	Length	Value
25.2	1	Bit 3 Authentication Relay indicator Bit 7 Authentication Relay indicator at re-entry

Bit 3 & 7 default value is set to 0, meaning not capable of or not configured to be the Authentication Relay (AR), 1 means the RS is capable of and willing to be the Authenticator Relay(AR).

When a downstream RS or a MS imitates its authentication request to the AR RS, each RS/MS presents its credentials which will be an unique X.509 certificates issued by manufacturer or by external authority(if RSA PCKS#1 is chosen) or an operator specific credentials(in the case of EAP based authentication. The AR RS will intercept the downstream MS/RS's authentication request and envelop the PKM request to Aggregated PKM messages and send towards the authenticator BS. It's optional for the AR RS to aggregate the PKM Req/Rsp from multiple downstream RSs or MSs for more efficient transmission. The PKM messages transmitted between RS and the BS will be protected by the HMAC / CMAC tuple calculated from AR RS's MAC_KEY_U/D or CMAC_KEY_U/D.



When the MSK for the downstream RS/MS is granted and sent to the authenticator BS, where the PMK and AK will be derived from MSK. Thereafter the AK will be sent over the relay link to RS, the AK will be encrypted by the secret between AR RS and BS

Aggregation of Authentication Relay Protocol

According to the specifications in NWG [], the end-to-end authentication structure is depicted as that the authentication protocols between Supplicant (i.e., MS) and Auth. Relay (AR, i.e., BS) is Extended Authentication Protocol/Privacy Key Management version 2 (EAP/PKMv2) protocol, between BS and ASN-GW is the EAP/Auth.Relay protocol, and between ASN-GW and Authentication Server (AS) is EAP/AAA protocol. By inheriting from legacy end-to-end authentication structure, access RS shall be acted like an AR. In other words, access RS shall perform the transformation between EAP/PKMv2 and EAP/Auth.Relay protocols, whereas the BS need not do the transformation again.
transmitting authentication message flow for each RS or MS will consume bandwidth resource and even block the MR network due to precious radio resource for relaying. Therefore, in this contribution, we propose to aggregate authentication messages for several MSs or RSs. As shown in Fig. 7, the access RS (RS_1) acts as an aggregator, whereas the ASN-GW acts like a deaggregator and vice versa. The access RS can collect some PKMv2 messages from several different MSs or RSs within a given period T and aggregate them for forwarding to ASN-GW. Here the period T shall be less than the re-authentication interval defined for each MS or RS. The aggregations are done as following ways.

EAP/PKMv2 (MS <-> AR)	Aggregation	Aggregated EAP/Auth. Relay (AR <-> ASN-GW)
PKMv2 EAP Start	---------->	Aggregated Authentication Relay EAP Start
PKMv2 EAP Transfer	---------->	Aggregated Authentication Relay EAP Transfer

PKMv2 Authenticated EAP Start	---------->	Aggregated Authentication Relay Authenticated EAP Start
PKMv2 Authenticated EAP Transfer	---------->	Aggregated Authentication Relay Authenticated EAP Transfer

Fig 7. Authentication Message flow with Aggregated EAP/Auth. Relay

2.2 The Aggregation Message Formats

According to the messages defined in EAP/Auth.Relay protocol, we extend the TLV from single TLV to multiple TLVs and add "# of TLVs" filed to indicate the number of TLVs follows. Below messages are the formats for aggregations.

Fig. 8 Aggregated Authentication Relay EAP Start

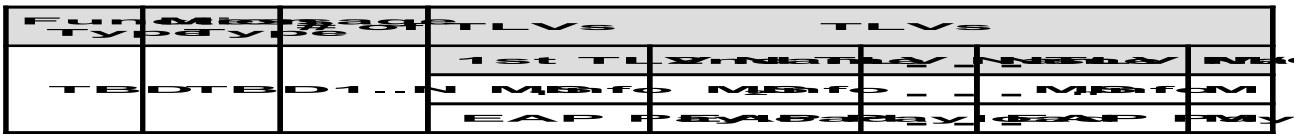


Fig. 9 Aggregated Authentication Relay EAP Transfer

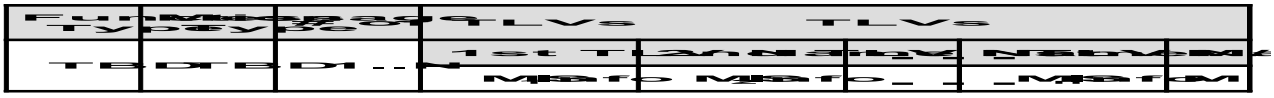


Fig. 10 Aggregated Authentication Relay Authenticated EAP Start

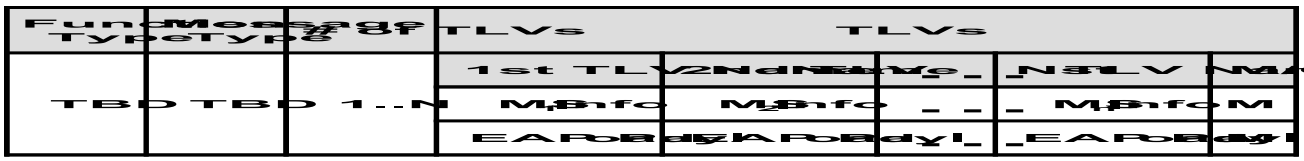
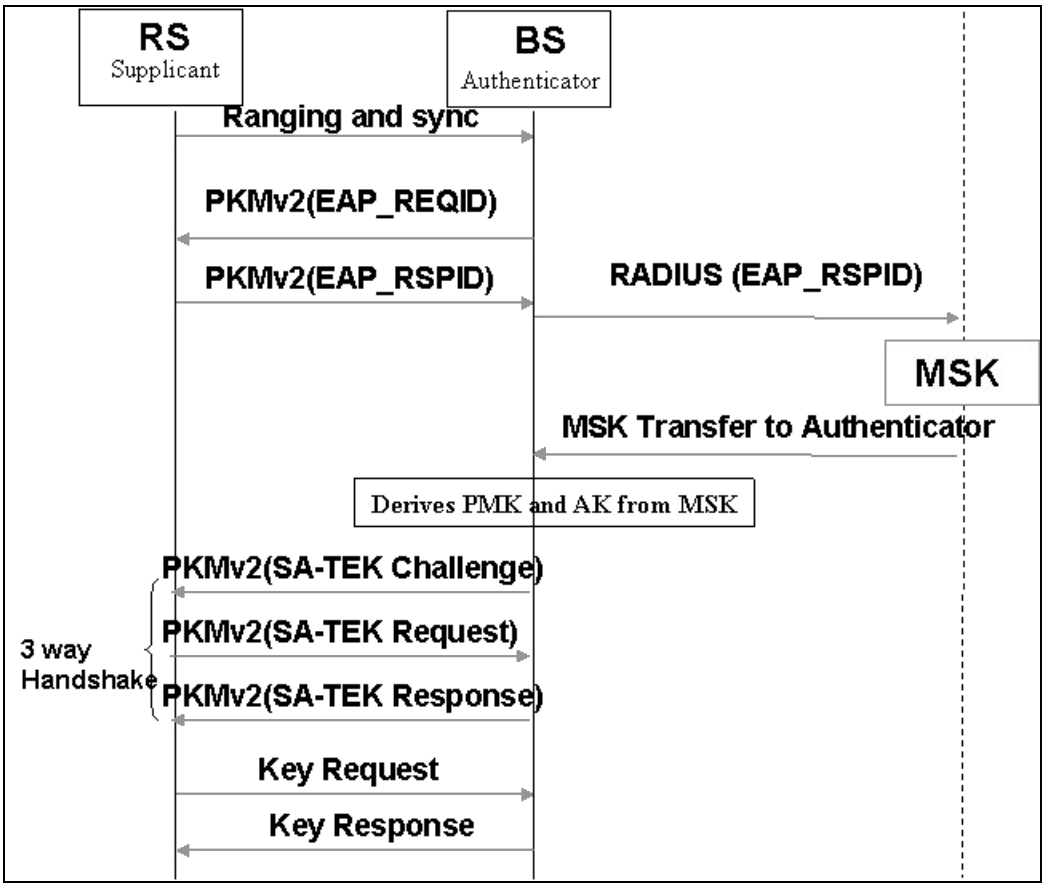


Fig. 11 Aggregated Authentication Relay Authenticated EAP Transfer

2. Proposed text changes

++++++++++++ start text proposal ++++++++++++++++++++++++++++++++++++
[Insert the followings after the end of section 7.1]
In IEEE 802.16e PKMv2 specification, MS uses the PKM protocol to obtain authentication and traffic keying material from BS, and to support re-authentication and key refresh. Either mechanism is applicable to the RS authentication within the MMR relay network as depicted in the following diagram.



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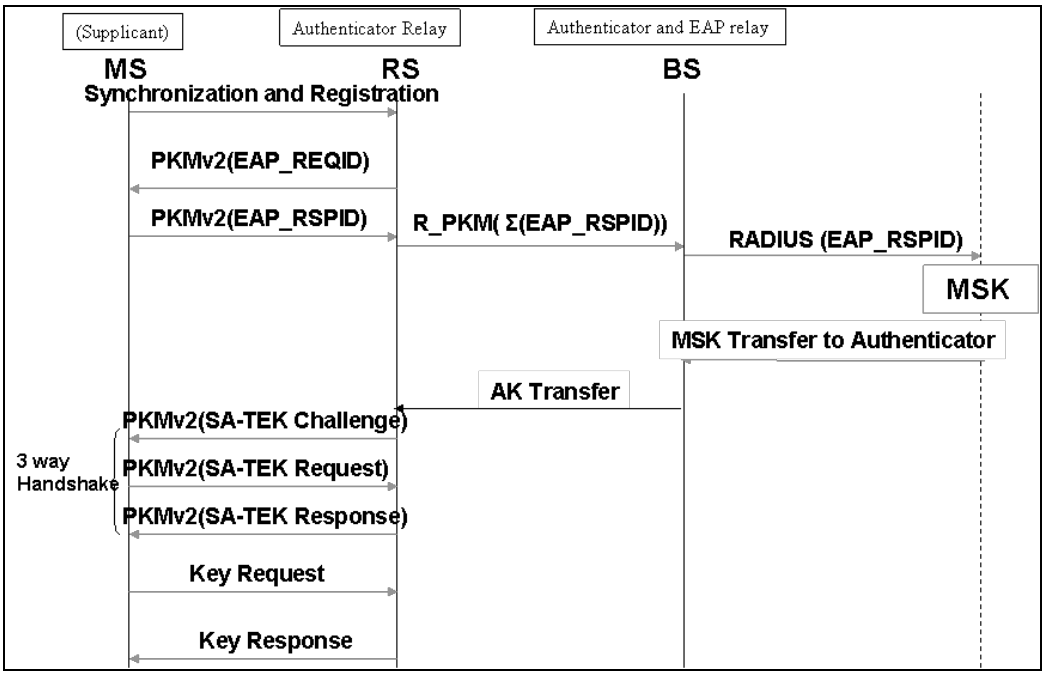

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transmitting authentication message flow for each RS or MS will consume bandwidth resource and even block the MR network due to precious radio resource for relaying. Therefore, in this contribution, we propose to aggregate authentication messages for several MSs or RSs. As shown in Fig. 7, the access RS (RS_1) acts as an aggregator, whereas the ASN-GW acts like a deaggregator and vice versa. The access RS can collect some PKMv2 messages from several different MSs or RSs within a given period T and aggregate them for forwarding to ASN-GW. Here the period T shall be less than the re-authentication interval defined for each MS or RS. The aggregations are done as following ways.

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PKMv2 EAP Start	---------->	Aggregated Authentication Relay EAP Start

PKMv2 EAP Transfer	---------->	Aggregated Authentication Relay EAP Transfer
PKMv2 Authenticated EAP Start	---------->	Aggregated Authentication Relay Authenticated EAP Start
PKMv2 Authenticated EAP Transfer	---------->	Aggregated Authentication Relay Authenticated EAP Transfer

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Fig. 8 Aggregated Authentication Relay EAP Start

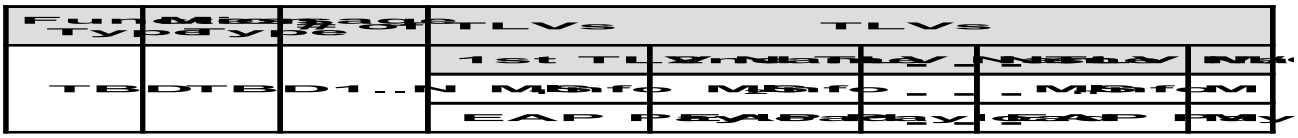

Fig. 9 Aggregated Authentication Relay EAP Transfer

Fig. 10 Aggregated Authentication Relay Authenticated EAP Start

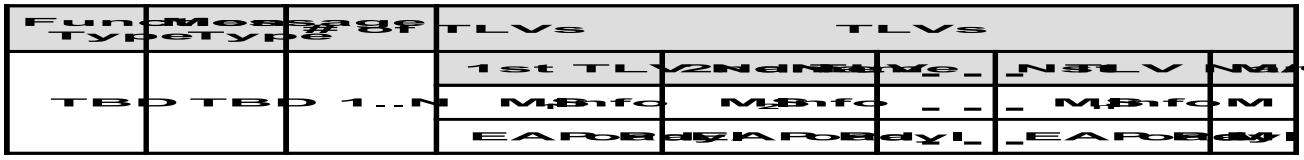

Fig. 11 Aggregated Authentication Relay Authenticated EAP Transfer

[Insert the followings after the end of section 11.8.4.2]

During the registration process, RS could be registered as Authenticator Relay(AR) RS based on its capability and willingness to become the AR RS as indicated in the bit 3 and 7 of the authorization policy support field (section 11.8.4.2 IEEE 802.16e-2005)

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++++++++++++++++++++ *End of text proposal* ++++++++++++++++++++