3GPP TSG SA WG3 Security — S3#30 **S3-030586**
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Povoa de Varzim, Portugal

Agenda Item:	**MBMS**
Source:	**Siemens**
Title:	**MBMS Key distribution**
Document for:	**Discussion**

1. Introduction

For MBMS, a traffic encryption key (TEK) needs to be distributed from the BM-SC to many UE's. This distribution needs to be secured and only authorized UE's may be able to receive a TEK. This paper takes a look at how the key distribution flow may relate to the flows described within TS 23.246 [1] and to the use of an Authentication Proxy. The use of MIKEY is also analysed as key distribution protocol. It is proposed that an Authentication proxy shall not be used for MBMS key distribution. A similar paper (S3z030010) was discussed at the Adhoc in Antwerp but no decision was taken.

2. Key distribution discussion

2.1 Key distribution flows

Previous SA3-discussion have highlighted that ***'the UE needs to be able to trigger a key distribution'***. Due to the mobile specific environment, the UE could have been unreachable for some time and therefore this requires that the UE recognizes key mismatches as well as key lifetime expiration. Depending of the (Re-)keying model that will be chosen by SA3 this could be a TEK or a key that is used to encrypt or derive a TEK from. Within this contribution the terminology TEK' is used to denote these possibilities.

This TEK' distribution may be needed urgently in certain circumstances, so this requires a *guaranteed short-delay message delivery* between the UE and the BM-SC. Within the Mobile network, a PDP context need to be set-up by the UE towards the GGSN that can reach the selected BM-SC. The BM-SC is not able to set-up a PDP context to a selected UE, so therefore the UE shall be able to trigger the TEK' distribution after reserving the necessary routing resources within the mobile core and radio network.

This would suggest following key distribution flow.

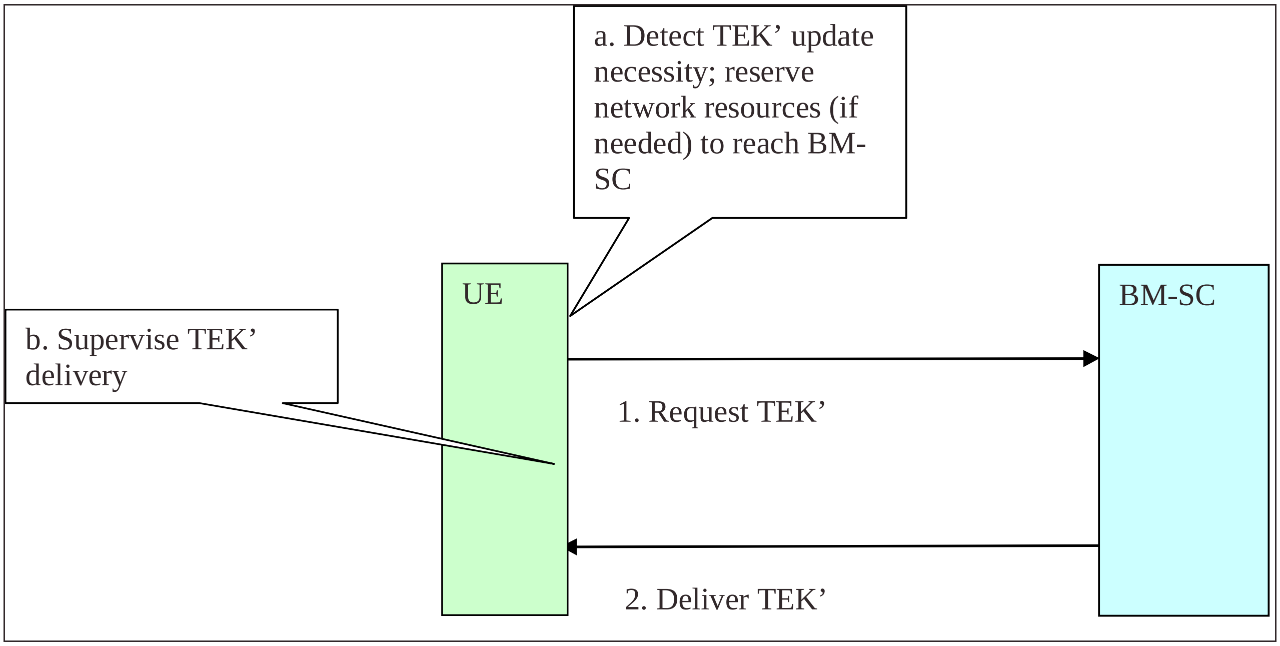

a. Detect TEK' update necessity; reserve network resources (if needed) to reach BM-SC
UE
BM-SC
b. Supervise TEK' delivery
1. Request TEK'
2. Deliver TEK'

Figure 1: Simplified key distribution flow

State-a in figure 1 may be triggered by various events e.g. The BM-SC could have sent a TEK' update message on some broadcast channel or the UE detected that the TEK lifetime is about to expire. While the UE has to supervise the key delivery in any case, there is no strong necessity for having a reliable transport channel between the UE and the BM-SC. The use of UDP might be favourable over TCP transport while the latter requires extra handshake messages, and so adds load to the network and adds delays to the key delivery. Bursts of TEK' requests can be smoothened by implementing random timers on the UE. The decision to go over TCP versus UDP may affect the selection of the possible application layer protocols for key distribution. A TEK' request message over http would be out of scope if UDP is favourised.

Ericsson have already several times proposed to use MIKEY for TEK' distribution. The flow[1] that was suggested in the Ericsson papers [3] was basically similar with figure 1. Figure 2 contains the details from [2] section 3.1.

[1] Message flow based on the existence of a pre-shared secret in BM-SC and UE. This pre-shared secret can be delivered by the GAA to both entities before the TEK distribution. (see section 2.4)

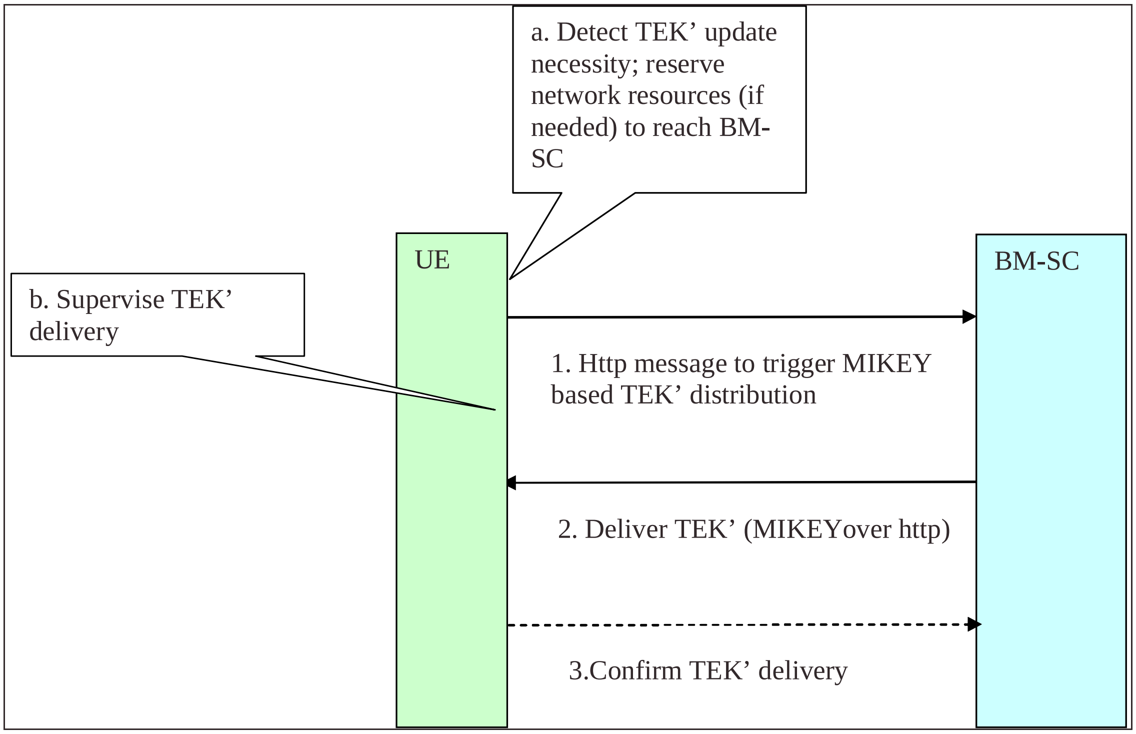

a. Detect TEK' update necessity; reserve network resources (if needed) to reach BM-SC
UE
BM-SC
b. Supervise TEK' delivery
1. Http message to trigger MIKEY based TEK' distribution
2. Deliver TEK' (MIKEYover http)
3.Confirm TEK' delivery

Figure 2: Use of MIKEY for key delivery [3]

Message 1 is not a MIKEY message. The use of http is taken as an example from [3] but other protocols could be used as well, as long as it delivers the necessary data to the BM-SC to be able to deliver the right TEK' to the UE.

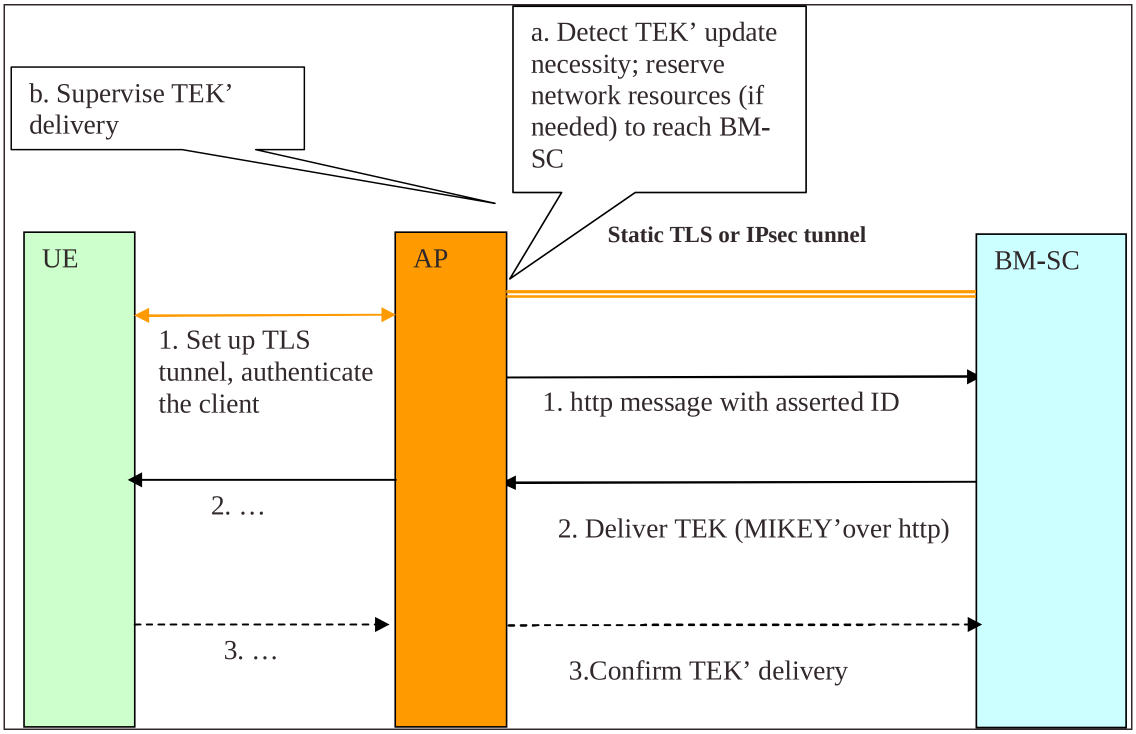
Message 2 and 3 can be detailed as follows (from Section 3.1 of [2])

> Message 2 (MIKEY I_MESSAGE) = HDR, T, RAND, [IDi], {SP}, KEMAC
>
> Where the TEK' is contained within KEMAC, encrypted and authenticated, T is a time-stamp, IDi is the BM-SC identification.
>
> Message 3 (MIKEY R_MESSAGE)= HDR, T, [IDr], V
>
> The responder message 3 is optional, and serves to obtain mutual authentication [2]. When the UE is assigned to have the TEK' retrieval responsibility, then it also can be argued that the R_MESSAGE is not really necessary. If message 2 does not arrive on time then the UE has to reinitiate the retrieval. The key delivery can be handled completely stateless at the BM-SC when leaving out message 3. If message 3 would be used for charging purpose, then what if the UE does not reply ?

From this detailed flow it becomes also clear that MIKEY has been designed to be initiated by the BM-SC (serving as TEK' distributor), therefore an out of band message (with respect to MIKEY) is needed to be able to trigger the TEK' delivery. This message 1 needs to carry the right information to be able to select the right pre-shared key (e.g. UE-identity, BM-SC service id, pre-shared secret id) at the BM-SC. **The UE has to assure that the pre-shared secret (KEK') is in place before the delivery of TEK' is started, but it may still happen that the key KEK is not in place at the required time (e.g. due to BSF or HSS unavailability), so message 2 needs to be able to transport error causes, or the UE simply repeats message 1 a specified number of times**.

2.2 The use of an Authentication Proxy for MBMS

In [4] Ericsson suggested to use client authentication via an http authentication proxy (AP) whereas the MIKEY protocol is used to carry the TEK'. MIKEY also has the capabilities to provide authentication between the UE and BM-SC, but this feature of MIKEY was not used in [4]. In addition, the MIKEY capabilities to encrypt the key where not used, rather encryption was assumed to be provided by hop-by-hop tunnels between UE and AP, and between AP and BM-SC. But it may be desirable, in later 3GPP releases, to have end-to-end security between UE and BM-SC, e.g. for the purposes of UICC support (see below). If AP and MIKEY key distribution encryption/authentication were used, this would require two pre-shared secrets to be installed (one between UE and BM-SC, and one between the UE and the AP).



b. Supervise TEK' delivery
a. Detect TEK' update necessity; reserve network resources (if needed) to reach BM-SC
Static TLS or IPsec tunnel
UE
AP
BM-SC
1. Set up TLS tunnel, authenticate the client
1. http message with asserted ID
2. …
2. Deliver TEK (MIKEY'over http)
3. …
3.Confirm TEK' delivery

Figure 3: The use of an Authentication Proxy

Using the pre-shared secrets (KEK) directly between the BM-SC and the UE, avoids setting up a TLS tunnel to the AP. The disadvantage that an AP can read out the KEK, goes away. In addition, there is no need for a TLS tunnel when all authentication and encryption is done at the key distribution protocol itself. The necessity for setting up a TLS-tunnel for each ptp key distribution was criticized at SA3#29. The availability of https-stack can be expected in Rel-6 terminals due to the presence-feature, but NOT the availability of a TLS tunnel to the AP at the time of TEK' delivery, as the management of data on the presence server by the user is a relatively rare event, so that even when a user is using presence, **one cannot assume that a TLS tunnel is in place for reuse in MBMS.**

The TLS stack is expected to be implemented within the ME as it has to be shared by other access towards the AP. Consequently the TEK' drops out at the ME. **Such a solution based on AP is therefore not extensible towards UICC based MBMS applications in future.** When making a decision for MBMS, SA3 has to consider the consequences of this decision.

2.3 Possible optimizations to MIKEY based key distribution.

The analysis in section 2.2 suggests solutions with encryption and authentication provided by the key distribution protocol itself. Message 1 and 2 of figure 2 could also be optimized i.e. the MIKEY draft could be adapted for MBMS as alternative to the use of http/TLS to trigger the TEK' delivery.

Message 1 and messages 2 of figure 1 would then translate into[2]:

Message 1 (MIKEY I_MESSAGE) = HDR, T, IDi, Key-Ref ,V

Where the V is a MAC on the previous data based on the pre-shared key (that is derived from the GAA/BSF). IDi and Key-Ref are needed for the BM-SC to look up the right pre-shared key.

Message 2 (MIKEY R_MESSAGE)= HDR, T, IDr, {SP}, [Error Code], KEMAC

Where the TEK' is contained within KEMAC, encrypted and authenticated, T is a time-stamp, IDr is the BM-SC identification.

Within the above flow the client authentication takes place a MIKEY level and not at http level as suggested by [4].

2.4 Installation of the pre-shared secret (KEK) before running the TEK' distribution.

Section 8.2 of [2] Stage-2 MBMS specification specifies a MBMS service activation flow that requires a PDP context to the BM-SC.

[2] This is roughly sketched. Other fields or changes might be required.

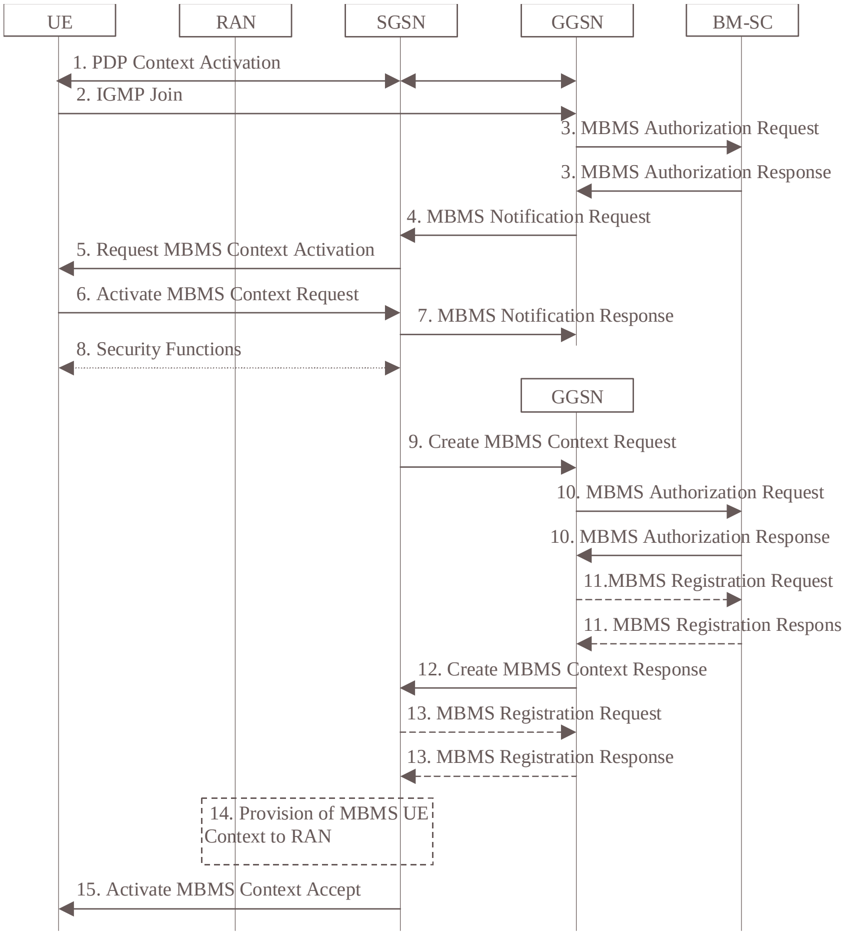

UE
RAN
SGSN
GGSN
BM-SC
1. PDP Context Activation
2. IGMP Join
3. MBMS Authorization Request
3. MBMS Authorization Response
4. MBMS Notification Request
5. Request MBMS Context Activation
6. Activate MBMS Context Request
7. MBMS Notification Response
8. Security Functions
GGSN
9. Create MBMS Context Request
10. MBMS Authorization Request
10. MBMS Authorization Response
11.MBMS Registration Request
11. MBMS Registration Respons
12. Create MBMS Context Response
13. MBMS Registration Request
13. MBMS Registration Response
14. Provision of MBMS UE Context to RAN
15. Activate MBMS Context Accept

Figure 4. The activation of an MBMS multicast service

The first TEK’ distribution could be attached to that flow in order to take advantage of an available PDP context towards the BM-SC.

Within Figure 5 a possible flow is drafted. The detailed procedures will depend on the GAA-discussion.

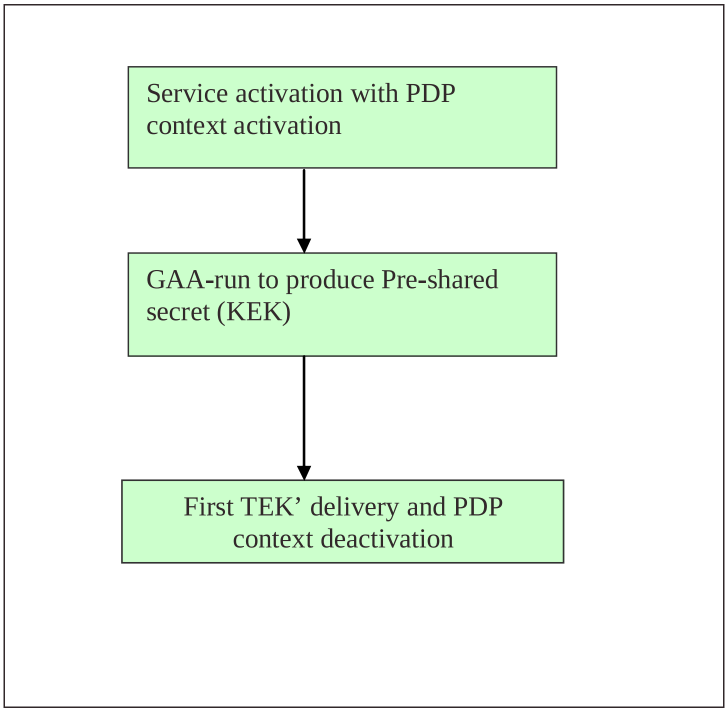

Service activation with PDP context activation
GAA-run to produce Pre-shared secret (KEK)
First TEK' delivery and PDP context deactivation

Figure 5: First TEK' delivery attached to the Service activation

3. Conclusions

Siemens proposes that SA3 adopt the working assumption that an authentication proxy with shared TLS tunnel shall not be used for MBMS key distribution. Following reasons were given in this paper:

- The use of TLS for key distribution is heavy. It cannot be expected that a tunnel is available at the moment it is required for MBMS key distribution.
- A shared TLS tunnel cannot be used for UICC-based solutions.
- The use of a TLS tunnel will result in double ciphering when MIKEY encryption is used to prevent the AP of getting knowledge of the MBMS Keys.

With respect to the use of MIKEY, Siemens also asks to clarify

- If MIKEY can be further optimized for use in MBMS as suggested by section 2.3
    - Use UDP or TCP to transport MIKEY ? Should the SA3 decision be guided by CN1 knowledge ?
    - Initiate MIKEY messages from the UE or use an unmodified MIKEY protocol preceded by a trigger message from the UE ?

4. References

[1] S3-033207: 3GPP TS 23.246 V2.0.0 (2003-09): Broadcast/Multicast Service (MBMS); Architecture and Functional Description; *Version to be presented for approval at SA#21, September 2003*

[2] draft-ietf-msec-mikey-07.txt: MIKEY: Multimedia Internet KEYing Internet Engineering INTERNET-DRAFT Expires: December 2003

[3] S3-030368: Introducing SRTP and MIKEY in TS 33.246, Ericsson, SA3#29, San Francisco, July 2003

[4] S3-030367: Access to Application Servers using HTTP in MBMS, Ericsson, SA3#29, San Francisco, July 2003