**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | **Proposed Comment Resolutions for the comments related to security** | |
| Date Submitted | 17 Aug 2015 | |
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| Re: | Proposed comment resolutions related to the 802.15.10 Consolidated Comment Entry Form, CID #118, #163, #165, #293, #297, #298, #302, #306, #307, #309, #336, #366, #367, #500, #514, #523, R63, R131, R139, R140, R141 and R165 | |
| Abstract | This document provides a proposed comment resolutions for the comments which are related to the security section of D1 of 802.15.10 | |
| Purpose | To propose | |
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1. **CID#163, 523**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 163 | Tero Kivinen | INSIDE Secure | 22 | 5.2.1 | 8 | The numbers in the description do not match. The range is 0x00-0x02 in HEX, and then there is vlaue 10 (in decimal as no 0x or 0b prefix) for KMP. | Change to refer Table 8 both in range and description. |
| 523 | Tero Kivinen | INSIDE Secure | 79 | 7.1.1.3 | 28 | SecurityMode is described here to be boolean? What does that mean. It is not matching Security Levels in 802.15.4, nor does it match the security modes in table 8. | I assume this is supposed to mean security modes as in table 8. |

**Resolution: Accept**

Remove the second ‘Security mode’ which appears in table 8 on l.8 in p.22 since there is ‘Security mode’ in table 8 on l.29 in p.21. The first one refers table 8.Put a text to refer table 8 in the range and description in table 18.

1. **CID #165, #293, #297, #298**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 165 | Don Sturek | SSN | 22 | 5.2.1 | 9 | What does a "security mode" of KMP mean? A KMP is a security establishment protocol that probably starts out with no security. | KMP is not a security mode |
| 293 | Don Sturek | SSN | 46 | 5.5.1.3 | 23 | 802.15.9 defines the MP-IE but it does NOT interface to the L2R Layer. I don't see why MP as it is scoped in 802.15.9 needs to interface to a layer 2 routing layer at all. 802.15.9 defines a one hop delivery of fragmented or unfragmented packets accompanied by a protocol dispatch which could be a KMP. The MP-IE uses the MCSP-DATA primitive. Surely we don't plan to propagate a non-one hop destination through MP-IE or MCPD-DATA. I would expect a standalone L2R-D-IE to carry the multihop delivery information. The MP-IE would then be set with the protocol dispatch of L2R (to be assigned) until the final hop to the actual destination where L2R would put back the original protocol dispatch. Anything other than this begs the question as to how MP-IE handles multihop acknowledgements, etc. | Re-evalute having L2R use MP-IE as a multhop protocol dispatch/fragmentation-reassembly mechanism. |
| 297 | Tero Kivinen | INSIDE Secure | 47 | 5.5.1.3 | 41 | What happens if the L2R Routing IE cannot be appended to the frame, as it gets too big? Is the intermediate device allowed to reassemble the fragments and fragment them again to smaller pieces. Or is it expected that joining device knows that it needs to leave enough space for the L2R Routing IE and KMP IE added by the relaying router? |  |
| 298 | Tero Kivinen | INSIDE Secure | 47 | 5.5.1.3 | 50 | Note, that KMP might be sending back multiple frames. i.e. it completely valid for joining node to send one KMP frame to the PAN coordinator, and PAN coordinator replaying with two KMP frames, and so on. i.e. the KMP protocols do not need to be strict request and reply protocols. | Explain how this is working, i.e. what happens if the PAN coordinator replies with multiple KMP frames (or zero KMP frames, which is also possible). |
| 331 | Brian Weis | Cisco Systems | 54 | 6.2.1.2 | 9 | What are "PAN Credentials"? These are not defined in this document, nor in 802.15.4. | Add a defintion and/or discussion defining what is meant by PAN credentials. |

**Resolution: AiP**

Almost for the CID#165, #331

* Replace ‘Security Mode’ to the ‘Key ExchangeMode’ and redefine descriptions in the Table 1 as follows.
  + 0b00: None, 0b01: Out-of-band, 0b10: With KMP, 0b11: Reserved
* Replace ‘Security Mode’ to the ‘Key Exchange Mode’
* Update the table 8 in section 6.2.1.1 not to use undefined word ‘PAN credential’. Just to use ‘Out-of-band’

Not having multi-hop delivery of the credential in the IEEE802.15.10 to address CID #293, #297 and #298 – update 5.5.1.3 to make it out of the scope

* Remove extended IEEE802.15.9 architecture with L2R (figure 24)

***Replace from 5.5.1 to 5.5.3 as follows to address CID#118, #293, #297 and #298.***

Replace

**5.5.1 Bootstrapping**

There are two types of bootstrapping: the cold start and the warm start. The cold start is performed when the

device is initially powered on. The warm start is performed when the device is reset and it may store some of

the running parameters and values in memory before it is reset.

L2R has 3 types of security modes each with its own boot strap procedure.

With

**5.5.1 Bootstrapping**

There are two types of bootstrapping: the cold start and the warm start. The cold start is performed when the device is initially powered on. The warm start is performed when the device is reset and it may store some of the running parameters and values in memory before it is reset.

The cold start L2R Bootstrapping is divided into 3 phases of step. First is the scanning to scan appropriate network to join in. Second is the association to let a node join to the network. The last is sharing routing information. These steps are illustrated in figure 25.

L2R has 3 types of key exchange modes each with its own boot strap procedure.

Replace

**5.5.1.2 Pre-shared mode bootstrapping**

For the pre-shared mode, there are no significant differences from non secured mode bootstrapping other

than the frame is secured. However, all nodes should know which frame should be secured and which key

shall be used. The pre-shared mode bootstrapping accomodates both out-of-band key exchang

with

**5.5.1.2 Pre-shared mode bootstrapping**

For the pre-shared mode, there are no significant differences from non secured mode bootstrapping other than the frame is secured. All L2R security related PIBs are set when the node starts or it finds new neighbor respectively. How the keys are shared is out of scope of this document and it is expected to be done by out-of-band mechanism or by pre-configured method.

Replace

**5.5.1.3 Boot strapping with KMP**

An L2R mesh tree may work with IEEE 802.15.9 [KMP] to use the key exchange funcitonality therein. IEEE 802.15.9 defines the key exchange transaction between two devices and is extended within this document to address a multi-hop environment in an L2R mesh tree. Figure 24 illustrates the system architecture when L2R is used in conjunction with IEEE 802.15.9. The MP layer accesses the L2R data services in order to carry the key exchange protocol between a joining device and the PAN coordinator. Key establishment may occur pair-wise (link based) or PAN-wide (Global) and is out of the scope of this specification.

with

**5.5.1.3 Boot strapping with KMP**

An L2R mesh tree may work with IEEE 802.15.9 [KMP] to use the key exchange functionality therein.

IEEE 802.15.9 defines the key exchange transaction between two devices. If the KMP bootstrapping is used, key exchanging is considered to be done in second phase of the bootstrap procedure described in 5.5.1. The credential is verified and keys are exchanged between the joiner and parent is considered as conjunction of this specification and IEEE802.15.9. The exchanged keys are set by the next higher layer of L2R into L2R security PIBs. In some use cases, the credential or KMP frame is forwarded to the PAN coordinator via secured L2R network to be verified. In another use case, the credential is verified by the coordinator which the joiner associates with. However, this specification doesn’t specify any process beyond the coordinator.

Add new section for CID#118

**5.5.1.4 Securing L2R-D IE**

The L2R-D IE is exchanged by EBR and EB in the first phase of bootstrap. Since L2R-D IE is used for detection of what network is running and what key exchanging mode is used for the network without context, it is considered to be without encryption. However, it may be encrypted or with digital signature when the nodes share the credential for securing L2R-D IE in some implementation. How the nodes share the credential for securing L2R-D IE is out of scope of this document.

New figure to replace figure 25 with is provided as vsdx file.

1. **CID #302, #307, #309**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 302 | Noriyuki Sato | OKI | 49 | 5.5.1.3 | 1 | Section should be updated by describing how the device manage secured frame during forwarding per keyID mode. | Describe how to process per keyID mode. |
| 307 | Tero Kivinen | INSIDE Secure | 49 | 5.5.1.3 | 50 | The enhanced beacons can also be unencrypted, but authenticated. i.e. joiner can see the IEs and join based on them, members of the network can also authenticate the information in IEs (for example the NLM information etc). | Add text describing that. |
| 309 | Noriyuki Sato | OKI | 50 | 5.5.1.3 | 1 | Section should be updated by describing how the device manage secured frame during forwarding per keyID mode. | Describe how to process per keyID mode. |

**Resolution: AiP**

Having a section to describe how the L2R layer manages key parameters – KeyIDMode, KeySourceID, KeyIndex, Security Level,

Having subsection which describes sending frame including:

* Data frame sent by L2R-Data.request
* Periodically broadcast - TC IE and NLM IE
* Periodically unicast – RA IE
* Address assignment related – AA-RQ IE, AA-RP IE,
* E2E ACK IE

Having a subsection to describe for forwarding frame:

* Frame with L2R Routing IE

Add new PIB related to the security parameter used in primitives which is invoked by L2R layer to send secured frame:

* Security Level
* KeyIDMode
* KeySource
* KeyIndex

Those PIBs shall be prepared for each IE – TC IE, RA IE, NLM IE, AA-RQ/RP IE (e.g. l2rTCSecurityLevel, l2rTCKeyIDMode..)

Common setting is useful to avoid complex setting. Having PIBs as follows:

* l2rSecurityCommonSettingIsUsed Boolean If true, Individual setting for each IE is not used
* l2rSecurityCommonSettingSecurityLevel Integer
* l2rSecurityCommonSettingKeyIDMode Integer
* l2rSecurityCommonSettingKeySource Set of octets
* l2rSecurityCommonSettingKeyIndex Integer

Note: Common setting is not used for securing L2R-D IE.

Key Parameters PIBs per neighbor is required for forwarding process:

* l2rListOfKeyPerNeighbor (List of KeyPerNeighbor)
  + KeyPerNeighbor
    - Neighbor address
    - KeyIDMode
    - KeySource not used when the KeyIDMode is 0x00 or 0x01
    - KeyIndex not used when the KeyIDMode is 0x00
* CommonKeyIndex only used when the KeyIDMode is 0x01

When a device is going to send a frame due to L2R-Data.reuqest invoked by higher layer, necessary parameters for securing frame are given by the primitive. When a device is going to send a frame to forward a received frame which final destination is not the device, the stored key parameters in PIB for that neighbor are used to send a frame to the next hop. When a device is going to send a frame due to a process in L2R layer (e.g. periodical TC IE broadcasting, sending frames related address assignment), related PIBs are used to set security parameters in MCPS-Data.request and MLME-Beacon.request primitive.

**The detail of change is shown as follows regarding to the outline of change above.**

***Removing security parameters from L2R-Data.request primitive:***

Since security setting is prepared for all of neighbors by PIBs, frame security for the first hop is also applied in same manner. (i.e. The next higher layer doesn’t know which node is chosen as next hop by L2R layer when it invokes L2R-Data.request) Thus, the security parameters including KeyIDMode, KeySource, KeyIndex and security level should be removed from L2R-Data.request primitive and PIBs shall be used for the encryption of the first hop.

***Adding new section:***

**5.5.1.2 Securing frames**

The next higher layer sets up L2R security PIBs when it starts up, when it finds a new neighbor, or during KMP secure association procedure in the case it uses L2R security described in 5.5.1.2 or in 5.5.1.3.

When a device is going to send a frame due to L2R-Data.request invoked by higher layer, all security parameters to invoke MCPS-Data.request are set by referring L2R security PIBs. If it is broadcast (or flooding), L2R layer refers l2rSecurityBroadcastCommonSettingLevel, l2rSecurityBroadcastCommonSettingKeyIDMode, l2rSecurityBroadcastCommonSettingKeySource and l2rSecurityBroadcastCommonSettingKeyIndex and set them to the MCPS-Data.request primitive when it invokes to send a frame. For the TC IE and NLM IE, individual setting shall be used to invoke MLME-Beacon.request when l2rSecurityBroadcastCommonSettingIsUsed is TRUE. If a frame to be sent is unicast, L2R layer looks for a l2rListOf KeySetting which has the same MAC address as the next hop to send to in l2rListOfKeySettings and it invokes MCPS-Data.request primitive with the L2R security unicast setting parameters in that l2rListOfKeySettings. When a node needs to forward a received frame to the next hop, its L2R layer refers the L2R security PIB to send a frame and invokes MCPS.Data.request with the security parameter according to the address of next hop found in the PIB. Securing E2E ACK is done in same manner. If the l2rSecurityUnicastCommonSettingIsUsed is TRUE, same settings are applied when RA IE, AA-RQ IE, AA-RP IE or ARel IE is sent. Otherwise, individual settings are applied for RA IE and AA related IEs referring PIB respectively.***Add following PIBs in clause 7:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** | **Default** |
| l2rSecurityBroadcastCommonSettingIsUsed | Boolean | TRUE /FALSE | If true, Individual setting for each IE is not used | True |
| l2rSecurityBroadcastCommonSettingSecurityLevel | Integer | As specified in [15.4] | Common Security Level for Broadcast and L2R IEs |  |
| l2rSecurityBroadcastCommonSettingKeyIDMode | Integer | As specified in [15.4] | Common Security Level for Broadcast and L2R IEs |  |
| l2rSecurityBroadcastCommonSettingKeySource | Set of octets | As specified in [15.4] | Common Security Level for Broadcast and L2R IEs |  |
| l2rSecurityBroadcastCommonSettingKeyIndex | Integer | As specified in [15.4] | Common Security Level for Broadcast and L2R IEs |  |
| l2rTCSecurityLevel | Integer | As specified in [15.4] | Individual security level setting for TC IE |  |
| l2rTCKeyIDMode | Integer | As specified in [15.4] | Individual Key ID Mode setting for TC IE |  |
| l2rTCKeySource | Set of octets | As specified in [15.4] | Individual Key Source setting for TC IE |  |
| l2rTCKeyIndex | Integer | As specified in [15.4] | Individual Key Index setting for TC IE |  |
| l2rNLMSecurityLevel | Integer | As specified in [15.4] | Individual Security Level setting for NLM IE |  |
| l2rNLMKeyIDMode | Integer | As specified in [15.4] | Individual Key ID Mode setting for NLM IE |  |
| l2rNLMKeySource | Set of octets | As specified in [15.4] | Individual Key Source setting for NLM IE |  |
| l2rNLMKeyIndex | Integer | As specified in [15.4] | Individual Key Index setting for NLM IE |  |

**Table bb—L2R Unicast Security PIB**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** | **Default** |
| l2rListOfKeySettings | l2rListOfKeySetting as specified in table cc | N/A | List of l2rListOfKeySetting per neighbor | N/A |

**Table cc—L2R Unicast Security PIB**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Attribute** | **Type** | **Range** | **Description** | **Default** |
| Neighbor address | EUI64 or short address | As specified in [15.4] | Security settings are for the frame to the owner of this address. |  |
| l2rSecurityUnicastSecurityLevel | Integer | As specified in [15.4] | Common Security Level for unicast |  |
| l2rSecurityUnicastKeyIDMode | Integer | As specified in [15.4] | Common Security Level for unicast |  |
| l2rSecurityUnicastKeySource | Integer | As specified in [15.4] | Common Security Level for unicast |  |
| l2rSecurityUnicastKeyIndex | Set of octets | As specified in [15.4] | Common Security Level for unicast |  |
| l2rSecurityUnicastCommonSettingIsUsed | Boolean | True /False | If true, Individual settings for RA IE and AA IE are not used but common settings for unicast are used | True |
| l2rRASecurityLevel | Integer | As specified in [15.4] | Individual security level setting for RA IE |  |
| l2rRAKeyIDMode | Integer | As specified in [15.4] | Individual Key ID Mode setting for RA IE |  |
| l2rRAKeySource | Set of octets | As specified in [15.4] | Individual Key Source setting for RA IE |  |
| l2rRAKeyIndex | Integer | As specified in [15.4] | Individual Key Index setting for RA IE |  |
| l2rAASecurityLevel | Integer | As specified in [15.4] | Individual security level setting for AA related IEs |  |
| l2rAAKeyIDMode | Integer | As specified in [15.4] | Individual Key ID Mode setting for AA related IEs |  |
| l2rAAKeySource | Set of octets | As specified in [15.4] | Individual Key Source setting for AA related IEs |  |
| l2rAAKeyIndex | Integer | As specified in [15.4] | Individual Key Index setting for AA related IEs |  |

1. **CID #306**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 306 | Don Sturek | SSN | 49 | 5.5.1.4 | 50 | Why is a draft addressing Layer 2 Routing defining pairwise security? This seems wildly out of scope. | Remove the section on pair-wise security and point to a draft where key management protocols are in scope (eg, why not use IEEE 802.15.9? And if that does not have the key management protocol you want to use, add it in a new Annex) |

**Resolution: Accept**

Remove the section 5.5.1.4. Intention was not to provide new key exchanging mechanism here. How to manage KMP is out of scope of this document

1. **CID #336, #366, #367, #500**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 336 | Tero Kivinen | INSIDE Secure | 54 | 6.2.1.5 | 36 | What is the meaning of the security level here? What does it tell to the recipient of the IE? Is this the expected security level of the frames or what? | Clarify why security level is here. |
| 366 | Tero Kivinen | INSIDE Secure | 57 | 6.2.2.9 | 47 | Security level is 3-bit field, and here it is stored in the one octet field. Either you need to define a format for this, or even better move this to be part of the Descriptor field and put it in bits 5-7 or 10-12 in it (depending whether it is needed for short format too or not)? |  |
| 367 | Tero Kivinen | INSIDE Secure | 57 | 6.2.2.9 | 47 | What is the meaning of the security level here? What does it tell to the recipient of the IE? Is this the expected security level of the frames or what? | Clarify why security level is here. |
| 500 | Tero Kivinen | INSIDE Secure | 77 | 7.1.1.2 | 13 | SecurityMode is described here to be boolean? What does that mean. It is not matching Security Levels in 802.15.4, nor does it match the security modes in table 8. | I assume this is supposed to mean security modes as in table 8. |

**Resolution: AiP**

Remove security level field from the L2R-D IE and TC IE.

1. **CID #514**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 514 | Tero Kivinen | INSIDE Secure | 78 | 7.1.1.2 | 20 | Security level on its own is not useful. You also need to have other security parameters, i.e. the KeyIdMode, KeyIndex and KeySource. | Add other security related parameters. |

**Resolution: Reject**

PANIDDescriptor in ScanResultList includes security parameters indicated by this comment.

1. **CID R63**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| R63 | Charlie Perkins | Futurewei | 17 | 5.1.2.2 | 33 | "unless the encryption key ... known to all the devices" | How can the devices tell? Is a bit needed in the beacon? |

**Resolution: Reject**

Auxiliary Security header defined in 15.4 provides what key ID is used. No need to provide by L2R.

1. **CID R131**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| R131 | Charlie Perkins | Futurewei | 45 | 5.5.1.3 | 24 | Last section said key exchange was out of scope | Reword to indicate whether KMP is normative |

**Resolution: AiP**

If the bootstrap mode with KMP is used, KMP is normative. Intention was to make the usage of KMP out of scope since it is up to higher layer implementation. The indicated sentence is going to be removed to address other comments. However, need to clearly

1. **CID R139**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| R139 | Charlie Perkins | Futurewei | 47 | 5.5.1.3 | 48 | "out of the scope of this document" | Either a citation is required, or it SHOULD be in scope |

**Resolution: Reject**

Basically if the PAN ID connectivity flag is 1 in the TC IE, the tree root is considered to be connected PAN ID since they are implemented in the same device or since they are communicated by out-of-scope method.

1. **CID R140, R141**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| R140 | Charlie Perkins | Futurewei | 48 | 5.5.1.3 |  | The figure is way too big. Should be decomposed. | Idea: one figure at functional module granularity, and other figures showing signaling with each functional module |
| R141 | Charlie Perkins | Futurewei | 48 | 5.5.1.3 | 39 | Text in procedure block is too long | Break down into multiple procedure blocks |

**Resolution: AiP**

Comments are accepted but the figure indicated by them will be removed to address other comments.

1. **CID R165**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| R165 | Charlie Perkins | Futurewei | 53 | 6.2.1.1 | 47 | "Security Level field is present in the TC IE." | Why not put the field here? |

**Resolution: AiP**

Security Level in TC IE is not used any more to address other comments.