**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 resolution for CID3109 from LB116** | |
| Date Submitted | 17 March 2016 | |
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| Re: | 802.15.10 Consolidated Comment Entry Form, CID3109 | |
| Abstract | Provides a proposed resolution to CID3109 | |
| Purpose | To be used by the technical editor to apply the necessary changes to the draft to resolve CID3109 | |
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**Comment**

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| **Commenter** | **Page** | **Clause** | **Line** | **Comment** | **Proposed change** |
| Don Sturek | 62 | 6.1.2 | 8 | What value does a service of "Data Collection" provide? I would have imagined that a device cares about what type of data is being collected. I would think every application would be looking for a specific data collection site and not a generic one. What if my device finds several meshes each advertising "data collection". How would it choose? | Is "data collection" adctually a viable service stand alone? |

**Resolution: Revise**

As discussed, we need a way to uniquely identify a mesh, to ensure that a device joins the appropriate mesh, especially if multiple meshes provide the same services. The services available are specific to the mesh and known to the higher layer of the joining device.

* ***Add new field "Mesh ID" in the L2R-D IE and in the TC IE formatted as:***

|  |  |  |
| --- | --- | --- |
| **Bits: 0-3** | **4-7** | **Octets: Variable** |
| Length | Reserved | ID |

The Length field indicates the length of the ID field in octets and is encoded as an unsigned integer.

The ID field is a string identifying the L2R mesh and is encoded in UTF-8.

* ***Modify the third paragraph of 6.1.1.1 as follows:***

When the Small Scale PAN field is set to 1, the PAN is an SSPAN. The Service List and the MeshID fields are omitted and the Number of Services field is set to 000. Otherwise, the Service List field is present.

* ***Insert a new “SSPAN” flag in Figure 36 with the following description:***

If the SSPAN field is set to 1, the Number of Services field is set to 000 and the Service List field is omitted. Otherwise, the Service List is present.

* ***Remove*** MeshRootAddress ***and*** MeshAddressMode ***from L2RLME-PAN-SCAN.request.***
* ***Insert a new parameter in the semantics of the L2RLME-PAN-SCAN.request defined as follows:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| MeshID | String | Any string | Identifies the mesh to discover |

If the MeshID is a NULL string, the device should discover and return all the existing meshes in the ScanResultList.

* If MeshID is not a NULL string, the device returns a Status of MESH\_NOT\_FOUND if the mesh specified by MeshID was not found, with an empty ScanResultList. Otherwise, Status is set to SUCCESS, and the ScanResultList contains one entry corresponding to the mesh of interest. ***In Table 20, replace “NO\_DESIGNATED\_MESH” with “MESH\_NOT\_FOUND”***
* ***Modify the second paragraph of p.85 as follows:***

If the L2R mesh indicated in the request primitive is not found, a MESH\_NOT\_FOUND Status is returned. A MESH\_NOT\_FOUND Status means that the mesh identified by MeshID was not found, but does not necessarily mean that there is no other mesh.

* ***Insert a new parameter in the scan result in Table 21 as follows:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| MeshID | String | Any string | Identifies the mesh from which the L2R-D IE was received. |

* Modify the discovery process in 5.1.2.1 based on the use of MeshID instead of MeshRootAdress as follows:

**5.1.2.1 Mesh discovery procedure**

A device wishing to join an L2R mesh should associate with the PAN upon which the L2R mesh is built beforehand. The association procedure to a PAN is described in IEEE Std 802.15.4.

The L2R mesh discovery procedure is summarized in Figure 5.



Figure 5—Message sequence chart to discover an L2R mesh

The next higher layer of a joining device invokes the L2RLME-PAN-SCAN.request primitive to request the broadcast of an enhanced beacon request (EBR) with an L2R Discovery (L2R-D) IE where the Content field is omitted. The L2R-D IE is defined in 6.1.1. The scan procedure is performed on the channels indicated in L2RLME-PAN-SCAN.request primitive. The next higher layer indicates which L2R mesh it wishes to join with the parameter MeshID of the primitive. The L2R-D IE is sent in an EBR with the Destination PAN Identifier and the Destination Address fields set to 0xffff. The L2RLME-PAN-SCAN.request primitive is described in 7.1.1.1.

When an FFD that can act as a coordinator and that belongs to an L2R mesh receives the EBR with the L2R-D IE, it replies with an EB with an L2R-D IE containing the information pertaining to the L2R mesh to which belongs.

During the discovery phase of a joining device in an SL2R, if an L2R router already part of the SL2R receives an L2R-D IE where the mesh root address does not match the mesh root address recorded in its MT, it informs the higher layers of the irregular behavior with an L2RLME-NOTIFY.indication primitive where Notification is set to ROOT\_CONFLICT. If the mesh root address matches that of the MT, the L2R router discards the L2R-D IE.5.1.2.1.1 Discovery of a specific mesh

If MeshID is a non-NULL string, the L2R sublayer should attempt to discover the L2R mesh identified by Mesh ID.

If the *macAutoRequest* MAC PIB attribute is set to FALSE, the L2R sublayer is notified with an MLME-BEACON-NOTIFY.indication primitive upon receiving each EB frame. If the L2R-D IE is received from a device belonging to the mesh corresponding to MeshID, the L2RLME-PAN-SCAN.confirm is returned with a Status SUCCESS and with one entry in the ScanResultList corresponding to the mesh of interest, and the scan is interrupted. Otherwise, the L2R-D IE is discarded.

If the L2R mesh matching MeshID is not found at the end of the scan, the L2RLME-PAN-SCAN.confirm is returned with a Status MESH\_NOT\_FOUND and with an empty ScanResultList.

If *macAutoRequest* is set to TRUE, the L2R sublayer is notified of all the scan results with the MLME-SCAN.confirm primitive from the MAC layer at the end of the scan. If at least one received EB contains a L2R-D IE from a device belonging to the L2R mesh identified by MeshID, the L2RLME-PAN-SCAN.confirm is returned with a Status SUCCESS and with one entry in the ScanResultList corresponding to the mesh of interest. Otherwise, the L2RLME-PAN-SCAN.confirm is returned with a Status MESH\_NOT\_FOUND and with an empty ScanResultList.

5.1.2.1.2 Discovery of all existing meshes

If MeshID is a NULL string, the L2R sublayer discovers all the existing meshes in the device’s vicinity.

If the *macAutoRequest* MAC PIB attribute is set to FALSE, the L2R sublayer is notified with an MLME-BEACON-NOTIFY.indication primitive upon receiving each EB frame. In this case, the L2R sublayer issues an L2RLME-PAN-SCAN.indication primitive to the next higher layer after receiving each MLME-BEACON-NOTIFY.indication primitive from the MAC layer. After the scan is completed the L2R sublayer invokes the L2RLME-PAN-SCAN.confirm primitive with an empty ScanResultList.

If *macAutoRequest* is set to TRUE, the L2R sublayer is notified of all the scan results with the MLMESCAN.confirm primitive from the MAC layer at the end of the scan. The L2R sublayer submits the L2RLME-PAN-SCAN.confirm primitive with the available coordinator candidates in the ScanResultList parameter. After the discovery, the device associates with a PAN containing at least one L2R mesh providing the desired service. The L2RLME-PAN-SCAN.confirm and the L2RLME-PAN-SCAN.indication are described in 7.1.1.2 and 7.1.1.3 respectively.

5.1.2.1.3 Discovery within a PAN

If a device is already associated with a PAN, it may also discover the L2R mesh(es) deployed within its PAN. In this case, the device sends the L2R-D IE on the channel of the current PAN within an EBR where the Destination PAN Identifier field is set to the current PAN ID and the Destination Address field is set to 0xffff to allow a response from all potential neighbors. This procedure is illustrated in Figure 6.

* ***Insert a new row in Table 21 after PanDescriptor as follows:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** |
| MeshID | String | Any string | Identifies the L2R mesh from which the L2R-D IE was received. |

* ***Insert a new row in Table 1 before Mesh address mode as follows:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** | **Condition to record** |
| MeshID | String | Any string | Identifies the L2R mesh. | M |

* ***Modify 5.1.2.2 as follows:***

**5.1.2.2 Procedure to join an L2R mesh**

Each device should join at least one L2R mesh with a PanC DC. A device may join several L2R meshes if it needs to access different services provided on different L2R meshes. However, it may join only one SL2R mesh.**5.1.2.2.1 Mesh selection by the L2R sublayer**

If *l2rMeshSelection* is TRUE, the mesh selection is handled by the L2R sublayer. When a device wishes to join a mesh, the next higher layer invokes the L2RLME-JOIN-MESH.request primitive to request the L2R sublayer to join a mesh with the MeshID and the MeshRootAddress indicated in the primitive. The MeshRootAddress is set to the broadcast address if the address of the desired mesh root is unknown by the higher layers. Upon reception of this primitive, the L2R sublayer initiates an enhanced active scan and broadcasts an EBR with a TC IE with an empty Content field. The TC IE is defined in 6.1.2. When an L2R router receives the TC IE, it immediately replies with an EB containing a TC IE then resumes its regular periodic TC IE transmissions. When the joining device receives the response TC IE, it computes its own depth and PQM as described in 5.2.1 and creates (regardless of the condition to record the parameters indicated in Table 1) or updates an MT entry related to the L2R mesh advertised in the TC IE. The device also creates (regardless of the condition to record the element indicated in Table 6) or updates a global NT entry for the neighbor transmitting the TC IE. If the device receives multiple TC IEs from different meshes within the same PAN, and if these TC IEs are not encrypted or are encrypted but can be decrypted, the device creates as many MTs as meshes. At the end of the scan, the L2R sublayer selects a mesh with the appropriate meshID providing the best PQM. If multiple meshes with different PQMs are available, the algorithm to select the L2R mesh is out of the scope of this document. The L2R sublayer adds a new L2R mesh descriptor to *l2rMeshDescriptorList* for the L2R mesh the device is joining. The attributes of the new L2R mesh descriptor are set to default values. At the end of the procedure to join the L2R mesh, the next higher layer may set different values to the attributes of the new mesh descriptor, with the exception of meshID, meshAddressMode and MeshRootAddress. The device is allowed to join an L2R mesh if its depth does not exceed the value in the L2R Max Depth field of the TC IE. The device deletes unnecessary MTs, MT entries or MT entry elements and global NT entries or elements according to the condition to record each element as described in 5.2.1. The device then transmits its own TC IE. The L2R sublayer sends an L2RLME-JOIN-MESH.confirm primitive with a SUCCESS Status to the next higher layer. This procedure is illustrated in Figure 7.

If no TC IE is received during the scan or if no mesh satisfies the requirements set by the L2RLME-JOIN-MESH.request primitve, the L2R sublayer may reattempt to trigger an enhanced active scan to find the desired L2R mesh up to *l2rMaxScanRetry* times. The L2RLME-JOIN-MESH.request and L2RLME-JOIN-MESH.confirm primitives are described in 7.1.1.8 and 7.1.1.9 respectively.

After joining an L2R mesh, if the MeshRootAddress indicated in the L2RLME-JOIN-MESH.request primitive was 0xffff or 0xffffffffffffffff, and if a device receives a TC IE that is not encrypted or that is encrypted but can be decrypted from another L2R mesh, with the same meshID and with a better PQM, the L2R sublayer may optionally disconnect from the current L2R mesh and join the new one.

If the joining device is an L2R router, the L2R sublayer starts the periodic transmission of EBs with a TC IE at an interval of *l2rTcIeInterval*. The value of *l2rTcIeInterval* may differ from device to device depending on their sleeping or duty cycling patterns. These patterns are determined by the low energy mechanism used at the MAC sublayer defined in IEEE Std 802.15.4.

If the RA IE Required field of the TC IE Descriptor field is set to 1, L2R routers and end devices should transmit MP frames with a route announcement IE (RA IE) or a short route announcement IE (SRA IE) periodically at an interval of l2rRaIeInterval to establish DS routes.

**5.1.2.2.2 Mesh selection by the next higher layer**

If *l2rMeshSelection* is FALSE, when a device wishes to join a mesh, the next higher layer invokes the L2RLME-MESH-DISCOVERY.request primitive to request the L2R sublayer to discover the L2R meshes around the joining device. Upon reception of this primitive, the joining device initiates an enhanced active scan and broadcasts an EBR with a TC IE with an empty Content field. When an L2R router receives the TC IE, it replies with an EB containing a TC IE. When the joining device receives the response TC IE, computes its own depth and PQM as described in 5.2.1. The device creates (regardless of the condition to record the parameters indicated in Table 1) or updates an MT entry related to the L2R mesh advertised in the TC IE. The device also creates (regardless of the condition to record the parameters indicated in Table 6) or updates a global NT entry for the neighbor transmitting the TC IE. If the device receives multiple TC IEs from different meshes that can be decrypted or that are not encrypted, the device creates as many MTs as meshes. At the end of the scan, the L2R sublayer sends an L2RLME-MESH-DISCOVERY.confirm primitive with a SUCCESS Status to the next higher layer. The next higher layer selects the L2R mesh to join based on the information in the MT stored in the L2R sublayer and informs the L2R sublayer by issuing the L2RLME-MESH-SELECT.request primitive. The device deletes unnecessary MTs, MT entries or MT entry elements, and global NT entries or elements according to the condition to record each element as described in 5.2.1. The L2R sublayer adds a new L2R mesh descriptor to *l2rMeshDescriptorList* for the joining L2R mesh. The attributes of a new L2R mesh descriptor are set to default values. At the end of the procedure to join the L2R mesh, the next higher layer may optionally set different values to the attributes of the new mesh descriptor, with the exception of meshID, meshAddressMode and meshRootAddress. The device then transmits its own TC IE. The L2R sublayer sends an L2RLME-MESH-SELECT.confirm primitive with a SUCCESS Status to the next higher layer. This procedure is illustrated in Figure 8.

Whenever the device receives and is able to decrypt a TC IE from an L2R mesh other than the current mesh with a better PQM, the L2R sublayer informs the next higher layer with the L2RLME-NOTIFY.indication primitive where the Notification is set to BETTER\_MESH\_DETECT. If the next higher layer decides whether or not to request the L2R to disconnect from the current L2R mesh and join to the new L2R mesh. The L2RLME-MESH-DISCOVERY.request, L2RLME-MESH-DISCOVERY.confirm, L2RLME-MESHSELECT.request and L2RLME-MESH-SELECT.confirm are described in 7.1.1.10, 7.1.1.11, 7.1.1.12 and 7.1.1.13 respectively.

If the joining device is an L2R router, the L2R sublayer starts the periodic transmission of EBs with a TC IE at an interval of *l2rTcIeInterval*. The value of *l2rTcIeInterval* may differ from device to device depending on their sleeping or duty cycling patterns.

If the RA IE Required field of the TC IE Descriptor field is set to 1, L2R routers and end devices transmit MP frames with an RA IE or an SRA IE periodically at an interval of *l2rRaIeInterval*.

* ***Modify the 2nd and 3rd paragraph of 5.1.2.3 as follows:***

The device may rediscover an L2R mesh according to the procedure described in 5.1.2.1.1 or 5.1.2.1.2 and associate with the appropriate PAN.

If the device wishes to remain within the same PAN, it may try to rediscover the L2R meshes within its PAN according to the procedure described in 5.1.2.1.3.

Then the device attempts to join the L2R mesh according to the procedure illustrated in Figure 7 if *l2rMeshSelection* is TRUE, or according to the procedure illustrated in Figure 8 if *l2rMeshSelection* is FALSE.

* ***Insert a new row in Table 52 before meshAddressMode as follows:***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Type** | **Valid range** | **Description** | **Default** |
| *meshID* | String | Any string | Identifies the L2R mesh. | \_ |