**IEEE P802.15**

**Wireless Personal Area Networks**

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| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) |
| Title | Draft text of one-to-many and many-to-many peering and de-peering procedure |
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| Re: | TG8 draft text for peering and de-peering procedue for 802.15.8 |
| Abstract | This is the work in progress text of the MAC component for IEEE 802.15.8 group for PAC. |
| Purpose | This document provides the details of draft text to IEEE 802.15.8 |
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# [This is draft text for subclause of Peering related command for TG8]

Black = existing text

Blue = proposed text

# MAC Layer

1. 1. Peering

MAC shall support the following procedures:

* Peering
* Re-peering
* De-peering

Peering is the procedure to establish a link between a pair of PDs or links among multiple PDs discovered during the discovery procedure.

Re-peering is the procedure to re-establish a link between a pair of PDs or links among multiple PDs which peered previously. In the re-peering procedure, peering may be simplified.

De-peering is the procedure to disconnect the link established by peering.

* + 1. Peering procedure

Peering procedure may include the following:

* Optional: Authentication & Authorization (full validation)
* Communication link parameters **are TBD**, such as link ID, device capability (i.e. number of antennas, MIMO), QoS, channel band, transmission power, round trip delay, etc.
* Establish the link.

The peering procedure is initiated by sending a peering request message including requested peering information. Responder may send a peering response message to requestor for indicating if the peering request is accepted or not. The response message may include peering information if the request is accepted.

* + - 1. One-to-one peering procedure

One-to-one peering occurs between a pair of PDs, the initiator PD (I-PD) and the responder PD (R-PD). The result of one-to-one peering is that the I-PD and the R-PD are peered each other. As illustrated in Figure 26, a one-to-one Peering procedure shall contain the following steps.

1. A PD’s Higher Layer (i.e. PD1’s Higher Layer) triggers Peering procedure with an MLME-PEERING.request to its MAC (i.e. PD1’s MAC).
2. The MAC receiving the Higher Layer’s MLME-PEERING.request (i.e. PD1’s MAC) sends the Peering Request command to the targeted PD’s MAC (i.e. PD2’s MAC).
3. The targeted PD’s MAC (i.e. PD2’s MAC) receives the Peering request command and sends an Immediate ACK message to the PD requesting peering (i.e. PD1’s MAC*).*
4. The targeted PD’s MAC (i.e. PD2’s MAC), sends the MLME-PEERING.indication to its Higher Layer (i.e. PD2’s Higher Layer).
5. The Higher Layer receiving the Peering Request (i.e. PD2’s Higher Layer) conducts Authentication and Authorization if required.
6. The Higher Layer receiving the Peering Request (i.e. PD2’s Higher Layer) decides either to accept the Peering Request or not and indicates it to the MAC (i.e. PD2’s MAC) accordingly.
7. The targeted PD’s MAC (i.e. PD2’s MAC) sends Peering Response message to the PD requesting peering (i.e. PD1’s MAC) as directed by the Higher Layer.
8. The PD’MAC receiving the Peering Response message (i.e. PD1’s MAC) sends ACK/NACK message to the target PD (i.e. PD2’s MAC).
9. The PD’MAC receiving the Peering Response message (i.e. PD1’s MAC) sends the Peering Response message to its Higher Layer (i.e. PD1’s Higher Layer).
10. A link between PD1 and Pd2 is established is the peering request is accepted.



Figure 26—One-to-one peering procedure message sequence chart

* + - 1. One-to-many peering procedure

One-to-many peering occurs between an initiator PD (I-PD) and a number of responder PDs (R-PDs). The result of one-to-many peering is that the I-PD is peered with each one of the R-PDs. One-to-many peering doesn’t deal with peering between R-PDs. As illustrated in Figure 26\_x, a one-to-many peering procedure shall contain the following steps.

1. An I-PD’s higher layer triggers one-to-many peering procedure with an MLME-PEERING.request to its MAC layer (i.e. I-PD’s MAC layer).
2. I-PD’s MAC receiving the Higher Layer’s MLME-PEERING.request broadcasts the Peering request command with an empty list of peered PDs.
3. Each of the targeted R-PDs’ MAC layers (i.e. the MAC layers of #*i* R-PD, #*j* R-PD, and #*k* R-PD), that receives the Peering request command, sends Enhanced ACK to the I-PD’s MAC layer*.*
4. I-PD’s MAC broadcasts the Peering request command with a list of the peered R-PDs’ IDs. Upon receiving the Peering request command, a R-PD that sent an Enhanced ACK at step c) but is not appear in the list of peered R-PDs sends an Enhanced ACK as of step c).
5. Step d) is repeated up to three times before proceeding to next step. However, the repeat is omitted if I-PD has received Enhanced ACK from all targeted R-PDs.
6. Each of the targeted R-PDs that are in the peered R-PD list, respectively, sends the MLME-PEERING.indication to its higher layer
7. Each of the higher layers receiving the MLME-PEERING.indication, respectively, conducts Authentication and Authorization if requested.
8. Each of the higher layers receiving MLME-PEERING.indication, respectively, decides either to accept the peering request or not and indicates it to its MAC layer accordingly with an MLME-PEERING.response.
9. Each of the targeted R-PDs’ MAC layers, respectively, sends Peering response command to the I-PD’s MAC layer as directed by its higher layer.
10. The I-PD’s MAC layer receives the peering response and sends an Immediate ACK.
11. The I-PD’s MAC layer sends the MLME-PEERING.confirm to its higher layer.

As a result of the above procedure, the one-to-many group is formed.

 



**Figure 26\_x—One-to-many peering procedure message sequence chart**

* + - 1. Many-to-many peering procedure

Many-to-many peering occurs among an initiator PD (I-PD) and a number of responder PDs (R-PDs). The result of many-to-many peering is that any two PDs including the I-PD and all R-PDs get peered with each other. As illustrated in Figure 26\_y, a number of N PDs are used to show many-to-many peering procedure which shall contain the following steps.

1. The I-PD performs one-to-many peering procedure as of subclause 5.5.1.2 with (N-1) PDs. As a result,N1 (N1≤N-1) out of N-1 PDs are peered with I-PD.
2. Set *i*=1.
3. Next PD in the peered PDs’ list performs one-to-many peering as of subclause 5.5.1.2 with PDs following in the list. As a result, this PD is peered with Ni+1 (Ni+1≤Ni) including PDs ahead of it in the list. The updated peered PDs’ list is in the same sequence order as that of step a).
4. Increase *i* by 1 and repeat step c), if the current PD is not the final PD in the peered PDs’ list. Otherwise, conclude the many-to-many procedure.

 

**Figure 26\_y—Many-to-many peering procedure chart**

* + 1. De-peering procedure

De-peering procedure may include the following:

* Disconnect the link
* Release the link resources if needed.

De-peering procedure starts with a de-peering request, which is replied by a de-peering response message. De-peering response may be optional

* + - 1. One-to-one de-peering procedure

As illustrated in Figure 28, a one-to-one De-peering procedure may contain the following steps.

1. A PD’s Higher Layer (i.e. PD1’s Higher Layer) triggers De-peering procedure with a De-peering Request to its MAC (i.e. PD1’s MAC).
2. The MAC receiving the Higher Layer’s De-peering Request (i.e. PD1’s MAC) sends the De-peering Request message to the targeted PD’s MAC (i.e. PD2’s MAC).
3. The targeted PD’s MAC (i.e. PD2’s MAC) receives the De-peering Request message and sends ACK/NACK message to the PD requesting de-peering (i.e. PD1’s MAC*).*
4. The targeted PD’s MAC (i.e. PD2’s MAC), sends the received De-peering Request message to its Higher Layer (i.e. PD2’s Higher Layer).
5. *Optional*: the Higher Layer receiving the De-peering Request (i.e. PD2’s Higher Layer) decides either to accept the De-peering Request or not and indicates it to the MAC (i.e. PD2’s MAC) accordingly.
6. *Optional*: the targeted PD’s MAC (i.e. PD2’s MAC) sends De-peering Response message to the PD requesting de-peering (i.e. PD1’s MAC) as directed by the Higher Layer.
7. *Optional*: the PD’MAC receiving the De-peering Response message (i.e. PD1’s MAC) sends ACK/NACK message to the target PD (i.e. PD2’s MAC).
8. *Optional*: the PD’MAC receiving the De-peering Response message (i.e. PD1’s MAC) sends the De-peering Response message to its Higher Layer (i.e. PD1’s Higher Layer).
9. *Optional:* the link between PD1 and Pd2 is disconnected.



Figure 28—One-to-one de-peering procedure message sequence chart

* + - 1. One-to-many De-peering procedure

One-to-many De-peering means that the I-PD in a one-to-many peered group starts the De-peering procedure. The result of the one-to-many De-peering is the breakup of the one-to-many peered group. As illustrated in Figure 28\_x, the one-to-many De-peering procedure shall contain the following steps.

1. The I-PD’s higher layer triggers De-peering procedure with an MLME-DE-PEERING.request to its MAC layer.
2. The MAC layer receiving the higher layer’s MLME-DE-PEERING.request multicasts the De-peering notification command to all the other PDs’ MAC layers.





Figure 28\_x—One-to-many de-peering procedure message sequence chart

A R-PD in a one-to-many peered group may require to De-peering with this one-to-many peered group. The result of this De-peering is that the required R-PD leaves the one-to-many peered group. As illustrated in Figure 28\_y, the R-PD required De-peering procedure may contain the following steps.

1. The R-PD’s higher layer (i.e., the #*i* R-PD’s higher layer) triggers De-peering procedure with an MLME-DE-PEERING.request to its MAC layer (i.e., the #*i* R-PD’s MAC layer).
2. The MAC layer receiving the higher layer’s MLME-DE-PEERING.request (i.e. the #*i* R-PD’s MAC layer) unicasts a De-peering notification command to the I-PDs’ MAC layer.

 



Figure 28\_y—One-to-many de-peering procedure message sequence chart

* + - 1. Many-to-many De-peering procedure

The many-to-many De-peering is simply done as the following. That is, any PD that intends to de-peer performs the one-to-many de-peering procedure as of subclasue 5.5.2.2.

* + 1. Access scheme in Peering Period

A PD shall transmit management messages for peering, re-peering, and de-peering in Peering Period using *p*-EIED protocol described in 5.6.1. A PD shall maintain and update independent *TM* and *p*basic for Peering Period separate from *TM* and *p*basic for CAP. See 5.6.1 for the detailed description of *p*-EIED.