**IEEE P802.15**

**Wireless Personal Area Networks**

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| --- | --- | --- |
| Project | IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs) | |
| Title | Relaying Comment Resolution Text | |
| Date Submitted |  | |
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| Re: |  | |
| Abstract |  | |
| Purpose | Comment resolution | |
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**Legend:**

* Arial size 13 indicates subsections for individual comments
* Red underlined text needs to be adapted during the comment implementation (e.g. because it is a reference).
* ***Bold italic text*** is an instruction to the editor to implement the text

***REVISION HISTORY:***

MLME Primitives were removed.

“Relaying functionality is supported only for beacon enabled multiple access.” added in 4.7.2.4

“Relay Activation” element has been replaced by “Relay Configuration Request” and “Relay Configuration Response” elements

Enabling/Disabling relay function is added via “Relay Active” field in “Relay Configuration Request” element.

Sequence chart has been added.

Step by step relaying mechanism is summarized below as reference.

**STEP 1:** Relay sends *Association Request* element and receives *Association Response* element.

**STEP 2:** Relay obtains GTS (*GTS Descriptor* elements or *GTS Descriptor List* element.)

This allocation is required for relay to transmit *Reachable Address* element to coordinator.

**STEP 3:** Relay sends *Reachable Address* element to coordinator

**STEP 4:** Coordinator sends *Relay Configuration Request* to relay device

This is required for relay device to know which devices it will serve

**STEP 5:** Relay device sends *Relay Configuration Response* to coordinator

Relay device confirms the list of devices that it will serve

It will only forward the frames that are destined to those devices

**STEP 6:** Coordinator sends *Relay Configuration Request* to device

This is required for devices to use relay. They will set *Relayed Frame* bit to 1.

**STEP 7:** Device sends *Relay Configuration Response* to coordinator

Device confirms that it will use relaying by setting *Relayed Frame* bit to 1.

**STEP 8:** Relay device request additional GTS.

GTSs for the relay link in the superframe after the ones allocated for the direct link by *macRelayingOffset*.

Device does not request additional GTS since its receiver is enabled all the time.

***Add the following definitions under 3.1:***

**relay device:** A non-coordinator device that is used to forward data from a coordinator to a device and from a device to a coordinator.”

**relay link:** A relay link is an indirect connection between a device and the coordinator through a relay device.

***Remove the following sentence in P30L9:***

“Relay device is a non-coordinator device and is used to forward data from a coordinator to a device and from a device to a coordinator.”

***Insert the following sentence after P38L37****:*

GTS for relay devices shall not overlap with GTS allocated to other devices.

***Insert the following subclauses****:*

**5.10 Relay Operations**

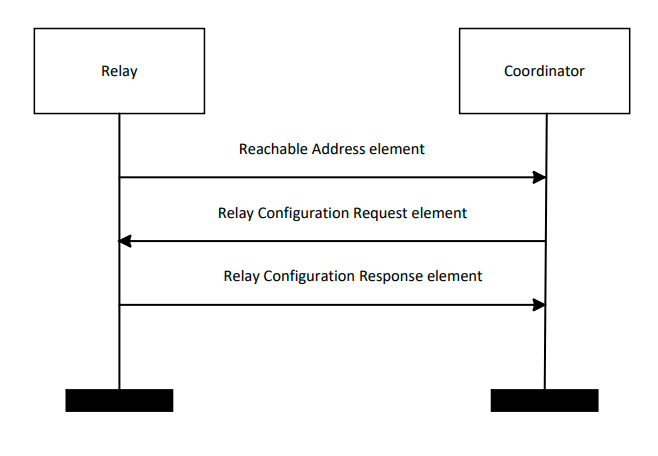
A relay device shall indicate *capRelay* during the association as described in 5.3.4.3. After receiving an *Association Response* element indicating successful association and confirming the use of *capRelay,* the relay device starts listening to its environment and collecting the transmitter addresses of observed MPDUs.

Due to the nature of wireless communications, a device in the OWPAN will be able to receive and decode transmissions from all other devices complying with this standard that are in the same coverage area.

The relay device obtains GTS for transmissions like any other device as described in 5.3.4. The relay device shall periodically transmit a *Reachable Address* element to the coordinator. The periodicity is implementation-specific. Fig. x shows the periodic message exchange between the relay device and coordinator.

Upon receiving a *Reachable Address* element, the coordinator shall decide whether to use relaying for communication with the devices in the *Reachable Address* element. The decision algorithm is out scope of this standard.

Once the coordinator decides which devices will be served by the relay device, it sends *Relay Configuration Request* element, as described in 6.6.29, to the relay device and another to the devices that will have a relay link. The *Relay Configuration Request* elements convey the address information of the device(s) to be served to the relay device and of the relay device to the devices. On the receipt of *Relay Configuration Request* element, both device and relay device shall send *Relay Configuration Response* element to the coordinator, as depicted in Figure X.



**Fig. x** Relay activation chart for relaying operation

In the presence of multiple relay devices in the environment, coordinator can choose more than one relay for a device.

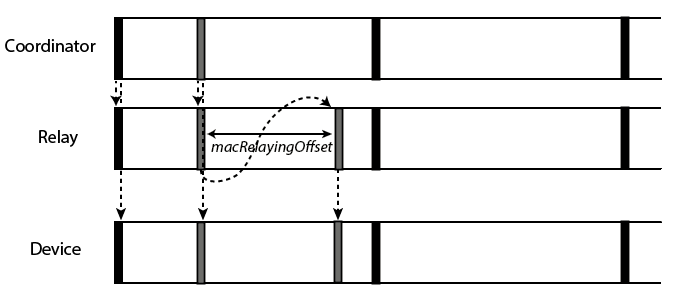
The frames that will be relayed shall be sent with *Relayed Frame* field set to 1 as described in 6.2.2. The frames, either sent from coordinator to device or from device to coordinator, are also received by the relay device. The relay device accepts and stores the frames with *Relayed Frame* field set to 1. If the frame is valid, its MAC sublayer then relays the frame as it is.

In order to perform relaying, the relay device shall request additional GTS, as described in 5.3.4.4, and await updated GTS allocations from the coordinator. The coordinator shall position the GTSs for the relay link in the superframe after the ones allocated for the direct link by *macRelayingOffset*. The algorithm for defining *macRelayingOffset* is out of scope of this standard.

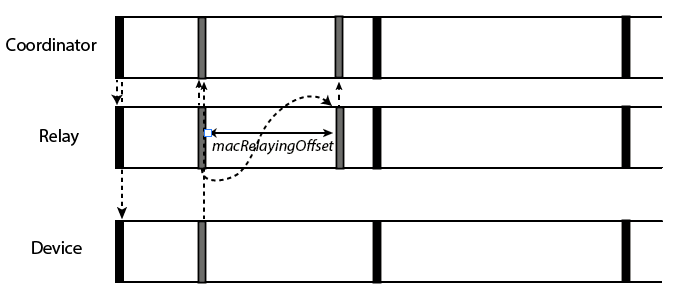
ACK frames are also relayed like other frames. Relay device does not acknowledge any frame sent to it.

A frame with a destination address equal to the broadcast address shall be handled and shall also be relayed.

If the *capFullDuplex* was agreed during association with the device, the relay device can perform relaying simultaneously to both directions without self-interference due to the directive nature of light propagation.



1. From coordinator to a device



1. From device to the coordinator

Fig. X Relaying frames for the beacon enabled OWPAN coordinator and a device

***This figure is optional***

If the relay device wants to leave the OWPAN, it initiates disassociation as in 5.5.7.

**7.5 Capabilities**

Add the row to the Table 37 MAC Capabilities

|  |  |  |  |
| --- | --- | --- | --- |
| Name | ID | Description | Required Capabilities |
| CapRelay | 7 | The device supports relaying procedure |  |

**6.6.28 Reachable Address element**

The format of the Reachable Address element is shown in

|  |  |  |
| --- | --- | --- |
| **6 Octets** | **1 Octet** | **Variable** |
| Initiator Address | Address Count | Reachable  Addresses |

Fig X – Reachable Address element

**Initiator Address:** The initiator Address field indicates the MAC address of the relay device that transmits the *Reachable Address* element.

**Address Count**: The Address Count field is an integer representing the number of addresses in the Reachable Addresses field.

**Reachable Addresses:** This field contains one or more Reachable Address subfields.

The Reachable Address subfields indicate the MAC addresses that can be reached through the relay device. The format of the Reachable Address subfield is shown in Figure X.

|  |  |  |
| --- | --- | --- |
| **Bit 0** | **Bit 1-7** | **6 Octets** |
| Add/Remove | Reserved | Address |

Fig X – Reachable Addresses subfield

**Add/Remove:** The Add/Remove subfield is set to 1 if the Address is the address of a new Device detected by the Relay Device. Add/Remove subfield is set to 0 if the Address is the address of a device has left the relay’s coverage.

**6.6.29 Relay Configuration Request element**

The format *Relay Configuration Request* element is depicted in Figure X.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Bit 0** | **Bit 1-2** | **Bit 3-7** | **1 Octet** | **6 Octets** | **…** | **6 Octets** |
| Relay Active | Direction | Reserved | Address Count (N) | Relay link Address 1 | Relay link Address N |

Figure X – Relay Configuration Request Element

**Relay Active:** The *Relay Active* field is set to one to indicate that relaying is active. The *Relay Active* field is set to zero to indicate that relaying is not active.

**Direction:** The *Direction* field set to 0b11 indicates that the *Relay Configuration Request* element is exchanged between coordinator and device. When it is 0b01, the *Relay Configuration Request* element is exchanged between coordinator and relay device. Values 0b00 and 0b10 are reserved.

**Address Count (N):** The address count field is an integer representing the number of addresses in the *Relay Link Addresses* field.

**Relay Link Address 1 … N:** The *Relay Link Addresses* field contains one or more address fields. If the *Relay Configuration Request* element is exchanged between the relay device and coordinator, the *Relay Link Addresses* are the addresses of the devices to be served by that relay. Similarly, if it is exchanged between the device and coordinator, the *Relay Link Addresses* are addresses of the relay device(s) that will serve that particular device.

**6.6.30 Relay Configuration Response element**

The format *Relay Configuration Response* element is depicted in Figure X.

|  |
| --- |
| **1 Octet** |
| Status  Code |

Figure X – Relay Configuration Request Element

**Status Code:** The status code indicates the result of the preceding relay configuration request. Status codes are listed in Table X.

**Table X Status codes of the Relay Configuration Response element**

|  |  |
| --- | --- |
| **Value** | **Description** |
| 0 | reserved |
| 1 | Denied |
| 2 | Success |
| 3-255 | reserved |

**Table 12 Element IDs**

***Append the following rows to Table 12***

|  |  |  |
| --- | --- | --- |
| ID | Element | Subclause |
| 17 | Reachable Address element | 6.6.28 |
| 18 | Relay Configuration Request element | 6.6.29 |
| 19 | Relay Configuration Response element | 6.6.30 |

**6.2.2 Frame Control Field**

***Change Bit10 Field name from “reserved” to “Relayed Frame”***

***Add the following paragraph:***

**Relayed Frame:** This field shall be set to 1 if relayed link is used and set to 0 otherwise.

**4.7.2.4 Data transfer through a relay device**

***Add the following paragraph at the end.***

Relaying functionality is supported only for beacon enabled multiple access mode.

When multiple OFEs are used by the coordinator, relaying functionality is not supported.