IEEE P802.11
Wireless LANs

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| EDP Epoch operation normative text for 11bi |
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Abstract

We propose the draft specification for the following requirements in contribution “11-23-0892-03-00bi-requirements-and-issues-tracking” for TGbi draft D0.1.

*Notes: this document handles the Epoch operation (definition, negotiation, initiation) to be used as a framework to handle change of CPE and BPE parameters.*

Revisions:

* Rev 0: Initial version of the document.

**Proposed spec text:**

The baseline for this text is 802.11 REVme D4.1, and 802.11 TGbi draft D0.3

***TGbi editor: Add the following chapter to 9.4.2***

9.4.2.XXX EDP Epoch Sequence Parameters element

The EDP Epoch Sequence parameters information element includes a set of parameters used to setup an EDP Epoch sequence

The format of the EDP Epoch Sequence parameters information element is shown in **Figure 9-aaa.**.

**Figure 9-aaa - EDP Epoch Sequence parameters element format**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Element ID | Length | Start Time | Interval | Duration | Time Range |
| Octets: | 2 | 2 | 8 | 2 | 1 | 2 |

The Element ID and Length are defined in Clause 9.4.2.1.

The Start Time field indicates the next reference TSF start time of the setup EDP epoch sequence. The length of the Start Time field is 1 octet.

The Interval field indicates the EDP epoch reference interval of the setup EDP epoch sequence. The length of the Interval field is 2 octets.

The Duration field indicates the number of EDP Epochs of the EDP epoch sequence. The length of the Duration field is 1 octet. The settings of the value in the Duration field are defined in Table 9-bbb

**Table 9-bbbb - Duration field values**

|  |  |
| --- | --- |
| Value | Meaning |
| 0 | Undetermined duration |
| 1 | The duration corresponds to one iteration  |
| N | The duration corresponds to N iterations between [1..255] |

The time range field is the range used by the stations to determine a random delay added to the EDP Epoch reference start time as defined in the subclause 10.71.2.2.

It is coded as unsigned integer in the range 0 to 65 535. The length of the Time Range field is 2 octets.

* EDP Action frame details(#0851r2)
* EDP Action field

An EDP Action field, in the octet immediately after the Category field, differentiates the EDP Action frame formats. The EDP Action field values associated with each frame format within the (#2217) EDP category are defined in EDP Action field values.

***TGbi editor: Apply the change to the 9.38.1***

* EDP Action field values

|  |  |
| --- | --- |
| Value | Meaning |
| 0 | Capabilities and Operation Parameters Request |
| 1 | Capabilities and Operation Parameters Response |
| 2 | Individual EDP Epoch Sequence Request  |
| 3 | Individual EDP Epoch Sequence Response  |
| 4 | Group EDP Epoch Sequence Indication  |
| ~~2-255~~ 5-255 | Reserved |

***TGbi editor: Add chapters 9.6.38.4 to 9.6.38.6 to the draft.***

9.6.38.4 Individual EDP Epoch Sequence Request

The Individual EDP Epoch Sequence Request frame is a protected Action frame and is transmitted by an EDP non-AP MLD to negotiate an individual EDP Epoch Sequence.

The Action field of an Individual EDP Epoch Sequence Request frame contains the information shown in Table 9-ccc.

**Table 9-ccc - Individual EDP Epoch Sequence Request Action field format**

|  |  |
| --- | --- |
| **Order** | **Meaning** |
| 0 | Category |
| 1 | EDP Action |
| 2 | Dialog Token |
| 3 | EDP Epoch Sequence parameters element |

The Category field is defined in 9.4.1.11 (Action field).

The EDP Action field is defined in Clause 9.6.38.1.

The Dialog Token field is set to a nonzero value to identify the request/response transaction.

The EDP Epoch Sequence parameters element is defined in 9.4.2.XXX (EDP Epoch Sequence parameters element).

9.6.38.5 Individual EDP Epoch Sequence Response

The Individual EDP Epoch Sequence Response frame is a protected Action frame and is transmitted by an EDP AP MLD to negotiate an individual EDP Epoch Sequence following the reception of an Individual EDP Epoch Sequence Request frame.

The Action field of an Individual EDP Epoch Sequence Response frame contains the information shown Table 9-ddd

**Table 9-ddd - Individual EDP Epoch Sequence Response Action field format**

|  |  |
| --- | --- |
| **Order** | **Meaning** |
| 0 | Category |
| 1 | EDP Action |
| 2 | Dialog Token  |
| 3 | Status Code |
| 4 | EDP Epoch Sequence parameters element |

The Category field is defined in 9.4.1.11 (Action field).

The EDP Action field is defined in Clause 9.6.38.1.

The Dialog Token field is a set to a nonzero value to identify the request/response transaction and corresponds to the value of the Dialog Token field of the corresponding EDP Epoch Sequence Request

The Status Code field is defined in 9.4.1.9 (Status Code field).

The EDP Epoch Sequence parameters element is defined in 9.4.2.XXX (EDP Epoch Sequence parameters element).

9.6.38.6 Group EDP Epoch Sequence

The Group EDP Epoch Sequence Indication frame is a protected Action frame and is transmitted by an EDP AP MLD to advertise a Group EDP Epoch Sequence

The Action field of a Group EDP Epoch Sequence Indication frame contains the information shown in Table 9-ffff

**Table 9-fff - Group EDP Epoch Sequence Indication Action field format**

|  |  |
| --- | --- |
| **Order** | **Meaning** |
| 0 | Category |
| 1 | EDP Action |
| 2 | EDP Epoch Sequence parameters element |

The Category field is defined in 9.4.1.11 (Action field).

The EDP Action field is defined in Clause 9.6.38.1.

The EDP Epoch Sequence parameters element is defined in 9.4.2.XXX (EDP Epoch Sequence parameters element).

* **EDP epoch**(#Ed) **operation**
* **Introduction**

***TGbi editor: Apply the change to the 10.71.2.1***

An EDP epoch(#Ed) is a time window in which a set of EDP parameters remain constant. EDP epoch(#Ed) operation is an EDP feature that is valid when MLO is supported.

An EDP epoch(#Ed) is either an individual(#Ed) EDP epoch(#Ed) or a group(#Ed) EDP epoch(#Ed):

* An individual(#Ed) EDP epoch(#Ed) sequence request is initiated by a non-AP MLD and the associated AP MLD shall send a response. The EDP epoch(#Ed) parameters of an individual EDP epoch(#Ed) are negotiated by a non-AP MLD with its associated AP MLD as defined in Individual EDP epoch(#Ed). The non-AP MLD applies the negotiated EDP epoch(#Ed) sequence parameters(#Ed) of the individual(#Ed) EDP epoch(#Ed) to determine the(#Ed) corresponding EDP epoch(#Ed) sequence of one or more EDP epoch(#Ed) start times.
* A group(#Ed) EDP epoch(#Ed) sequence is initiated by an AP MLD by advertising the EDP epoch(#Ed) sequence parameters to a set of non-AP MLDs as defined in Group EDP epoch(#Ed). Each non-AP MLD of the set of non-AP MLDs applies the advertised EDP epoch(#Ed) parameters of the group(#Ed) EDP epoch(#Ed) to determine the same EDP epoch(#Ed) sequence of one or more EDP epoch(#Ed) start times.

At any given time, an AP MLD has at most one EDP epoch(#Ed) assigned to a given associated non-AP MLD.

A non-AP MLD has at most one EDP epoch(#Ed).

* **EDP epoch**(#Ed) **setup**

An(#Ed) EDP epoch(#Ed) may be one time(#Ed) or periodic and there are two types of EDP epochs:(#Ed)

* Group EDP epoch(#Ed).
* Individual EDP epoch(#Ed).
* **Group EDP epoch**(#Ed)

***TGbi editor: replace the 10.71.2.2.1 content with the following text***

A Group EDP Epoch sequence is initiated by an AP MLD by transmitting EDP Epoch Sequence parameters element through a Group EDP Epoch Indication action frame or in any management frames on any enabled links.

After a successful (re)association, an EDP AP MLD may send a Group EDP Epoch Indication through an affiliated AP, on any enabled link, to the associated non-AP MLD that has indicated support of EDP features.

Upon the reception of EDP Epoch Sequence parameters element through a Group EDP Epoch Indication action frame or in any management frames, a non-AP MLD, that has indicated a support of EDP features, applies the advertised EDP Epoch sequence parameters to determine the effective start time of each EDP Epochs of the EDP Epoch sequence.

If the Duration field of the EDP Epoch Sequence parameters element is set to 0, the number of EDP Epoch is undetermined. Otherwise, it defines the number of EDP Epoch of the EDP Epoch sequence.

Upon the reception of EDP Epoch Sequence parameters element through a Group EDP Epoch Indication action frame or in any management frames, a non-AP MLD, that has indicated a support of EDP features, shall initiate a new Group EDP Epoch sequence using the reference start time GT0 of the EDP Epoch indicated in the “Start Time” subfield of the EDP Epoch Sequence parameters element.

The effective start time GET of the EDP Epoch is computed according to the formula:

GET = GT0 + ∆IT

where ∆IT = PRF-128\64(GTK\*, “ERCM”, GT0) mod (RandTR)

and where:

PRF-Length is the pseudorandom function defined in 12.7.1.2

GT0 is the value indicated in the Start Time field of the advertised EDP Epoch Sequence parameters element

RandTR is the value indicated in the Time Range field of the advertised EDP Epoch Sequence parameters element

GTK\* is a key derived from GTK

At any point of time, for the next EDP Epoch, the start time is computed according to the formula:

GETn+1 = GTn+1 + ∆IT

∆IT = PRF-128\64(GTK\*, “ERCM”, GTn+1) mod (RandTR)

With:

GTn+1 =GTn+ GEI

Or

n = ⌊(TSF – GT0) / GEI⌋

GTn+1 =GT0+ (n+1) x GEI

Where:

n is the current iteration of the sequence.

TSF is the current value of the internal TSF counter of the receiving link.

GT0 is the value indicated in the Start Time field of the advertised EDP Epoch Sequence parameters element

RandTR is the value indicated in the Time Range field of the advertised EDP Epoch Sequence parameters element

GEI is the value indicated in the Interval field of the advertised EDP Epoch Sequence parameters element

GTK\* is the key derived from GTK

* **Individual EDP epoch**(#Ed) **negotiation**

***TGbi editor: replace the 10.71.2.2.2 content with the following text***

During a ML (re)setup procedure, an EDP non-AP MLD may initiate an individual EDP epoch sequence negotiation by including an EDP Epoch Sequence parameters element in the (Re)Association Request frame if an AP MLD has indicated a support of EDP features. Otherwise, the non-AP MLD shall not include the EDP Epoch Sequence parameters element in the (Re)Association Request frame.

After the ML (re)setup is successful, to negotiate an individual EDP epoch sequence, an initiating EDP non-AP MLD shall send an Individual EDP Epoch Sequence Request through an affiliated non-AP STA, on any enabled link, to a responding EDP AP MLD that has indicated support of EDP features.

Upon receiving the Individual EDP Epoch Sequence Request, the responding EDP AP MLD shall send an Individual EDP Epoch Sequence Response through an affiliated AP, on any enabled link, to the initiating EDP non-AP MLD according to the following rules:

* If the responding EDP MLD AP accepts the requested EDP Epoch Sequence parameters in the EDP Epoch Sequence parameters element in the received Individual EDP Epoch Sequence Request, it shall set to 0 (SUCCESS) the Status Code field in the Individual EDP Epoch Sequence Response and not include the EDP Epoch Sequence parameters element in the frame.
* Otherwise, the responding AP MLD shall indicate rejection of the proposed EDP Epoch Sequence parameters by either:
	+ Setting to XXX (DENIED\_EDP\_EPOCH\_PARAMS) the Status Code in the Individual EDP Epoch Sequence Response. The responding AP MLD shall not include the EDP Epoch Sequence parameters element in the frame.
	+ Setting to XXX (PREFERRED\_EDP\_EPOCH\_PARAMS\_SUGGESTED) the Status Code field in the Individual EDP Epoch Sequence Response. The responding EDP AP MLD shall include a pre­ferred set of EDP Epoch Sequence parameters set in the EDP Epoch Sequence parameters element in the frame

When initiating an individual EDP epoch sequence negotiation with an EDP AP MLD, an EDP non-AP MLD should take into account the preferred EDP Epoch Sequence parameters of the EDP AP MLD if it has indicated one during the association procedure.

An individual EDP epoch sequence negotiation is successful if an MLD successfully transmits or receives Individual EDP Epoch Sequence Response with the value of the Status Code field equal to 0 (SUCCESS).

If the value indicated in the duration field of the negotiated EDP Epoch Sequence parameters element is more than 0, the number of Individual EDP epochs in an Individual EDP epoch sequence corresponds to the value indicated in the duration field of the negotiated EDP Epoch Sequence parameters element. Otherwise, the number of EDP epoch is undetermined.

Once an EDP non-AP MLD has successfully negotiated an individual EDP epoch sequence with an EDP AP MLD, both EDP non-AP MLD and EDP AP MLD shall initiate the negotiated individual EDP epoch by computing the start time IET of the Individual EDP epoch sequence.

IET = IT0 + ∆IT

∆IT = PRF-128\64(PTK\*, “ERCM”, IT0) mod (RandTR)

Where:

PRF-Length is the pseudorandom function defined in 12.7.1.2

IT0 is the value indicated in the Start Time field of the negotiated EDP Epoch Sequence parameters element

RandTR is the value indicated in the Time Range field of the negotiated EDP Epoch Sequence parameters element

PTK\* is a key derived from PTK.

The start time IETn of the nth subsequent Individual EDP epoch of the Individual EDP epoch sequence is computed as well:

IETn = IT + ∆IT

Where:

n = ⌊ (TSF – IET0) / IEI⌋

IT =IT0+ n x IEI

∆IT = PRF-128\64(PTK\*, “ERCM”, IT) mod (RandTR)

Where:

n is the current iteration of the sequence.

TSF is the local TSF counter value of the EDP non-AP station.

IET0 is the value indicated in the Start Time field of the negotiated EDP Epoch Sequence parameters element

RandTR is the value indicated in the Time Range field of the negotiated EDP Epoch Sequence parameters element

IEI is the value indicated in the Interval field of the negotiated EDP Epoch Sequence parameters element

PTK\* is the key derived from PTK