IEEE P802.11
Wireless LANs

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| 802.11bi – Resolution to CIDs 1091 and 1092 |
| Date: November 12, 2024 |
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| 1091 | Julien Sevin | "A CPE non-AP MLD may request to join a group EDP epoch by sending an EDP epoch setting protected action request frame, containing the group ID that the non-AP MLD wishes to join. The EDP epoch setting protected action request frame is not specified | Please clarify the "EDP epoch setting protected action request frame" | REVISEDImplement changes in 1844r0~~Addressed in 24/1426 and 24/1623~~  |
| 1092 | Julien Sevin | "The AP MLD responds with an EDP epoch setting protected action response frame, accepting or rejecting the request". The EDP epoch setting protected action response frame is not specified | Please clarify the " EDP epoch setting protected action response frame" | REVISEDImplement changes in 1844r0 ~~Addressed in 24/1426 and 24/1623~~  |
| 1026 | Chaoming Luo | Many duplicate text in 10.71.2.2, 10.71.2.3 and 10.71.2.4 | Suggest to merge them into one subclause. | REVISED As per discussion below |

## Discussion

* We need to conclude on a naming for the epoch. I have used group EDP epoch.
	+ Agreed EDP group and EDP epoch.
* We need to conclude if the epoch is managed per MLD or per affiliated AP/link
	+ Management of Epoch is done at MLD level
* The information about the group EDP epoch parameters can be sent by the MLDs using the EDP Group Parameter frames (or this is sent by the affiliated?).
	+ Sent by MLD, it will pop up in any link depending on the implementation
* The info may also be sent in the beacons by the MLD? Or the affiliated?
	+ Same as above
* The EDP Epoch Request/Response frames are sent in any link, or it does not matter?
	+ Sent on any link and applied to the whole MLD

## Proposed solution

***-- Editor please make the following changes in clause 10.71.2.1 –***

* EDP epoch operation
* General

Support of EDP epoch operation is optional for a CPE AP MLD and a CPE non-AP MLD.

EDP epoch operation allows the AP MLD to schedule sequences to anonymize MLDs’ (1109,1166) selected OTA fields (e.g., STA address, AID, PN, SN, etc.) of individually addressed frames.

At any given time, an AP MLD shall not assign an associated non-AP MLD to more than one EDP group. A non-AP MLD belongs to at most one EDP group at a time. A non-AP MLD shall not request to be assigned to more than one EDP group at a time.

A non-AP MLD that is a member of an EDP group and its associated AP MLD shall anonymize the selected fields of the individually addressed frames according to the group epoch settings as defined in 10.71.3 (Establishing frame anonymization parameter sets), 10.71.4 (MAC Header anonymization and transmitting functions), 10.71.5 (MAC header anonymization and receiving functions) and 10.71.6 (Frame anonymization and AID).

* EDP Group ~~Initial Setup~~ Operations

A CPE AP MLD advertises the support of EDP groups in Beacon and Probe Response frames by setting value 1 to the Group EDP Epoch Supported field of the Extended RSN Capabilities field of the RSNXE element.

A non-AP MLD advertises the support of EDP epoch group in (Re)Association Request frames by setting value 1 to the Group EDP Epoch Supported field of the Extended RSN Capabilities field of the RSNXE element.

The non-AP MLD may include in encrypted (Re)Association Request frame an EDP element indicating the parameters for the EDP group it requests to join.

If no EDP element is included in the encrypted (Re) Association Request frame, or if the EDP element does not include information defining the parameters for the EDP group, the CPE non-AP MLD is assigned to the default group. The first assigned EDP epoch, the default group, is defined with iteration number 0 and it is referred to as EDP epoch 0.

Within the EDP element sent in (Re) Association Request frames, the CPE non-AP MLD shall include a Minimum Epoch Pacing Parameters field (#1328), indicating the minimum epoch interval length supported by the CPE non-AP MLD. If the value of the Group Epoch Interval Duration field included in the Minimum Epoch Pacing field is greater than the value of the Group Epoch Interval Duration field for the default EDP group (group 0) or of any other EDP group already created, then (#1063) the CPE non-AP MLD is not assigned to (#1020) any EDP group (#1063) at (re)association. (#1026).

Note: The CPE non-AP MLD might remain associated without FA and might request the creation of a new EDP group (through the EDP Epoch Request frame).

The CPE AP MLD, upon reception of the EDP element in an encrypted (Re)Association Request frame may assign the CPE non-AP MLD to the EDP group with parameters that best match the parameters requested. In all cases, the assigned EDP epoch interval length shall not be shorter than indicated in the Minimum Epoch Pacing Parameters field.

The parameters of the assigned EDP group are returned to the CPE non-AP MLD through an EDP element in the (Re)Association Response frame. (#1093, 1343) (#1065)(#1344). If no EDP element is included in the (Re)Association Response frame, the CPE non-AP MLD is not assigned to any EDP group.

The CPE non-AP MLD may request to create a new EDP group by sending an EDP Request frame with Epoch Request field indicating “Create” and indicating the parameters for the EDP group to be created in the EDP Epoch Setting field.

The CPE AP MLD may create the new EDP group with the received parameters. Alternatively, the CPE AP MLD may allocate the CPE non-AP MLD to an already existing EDP group with similar parameters. This may be signalled to the CPE non-AP MLD in an EDP Response frame indicating in the Status field, SUCCESS\_SIMILAR\_EPOCH, and providing the EDP Epoch Setting field with the parameters of the EDP group. *(#*1013, 1014, 1015, 1062, 1066, 1115, 1167, 1170)

Note: In this context, an EDP group with “similar parameters” refers to an existing EDP group whose whose epoch duration is equal or smaller than the one requested by the CPE non-AP MLD (i.e., most privacy-preserving). This choice is made while ensuring adherence to any pacing limits indicated in the Minimum Epoch Pacing Parameters field that the non-AP MLD has specified in (Re) Association Request frame.

Once the CPE non-AP MLD is associated (#1172) and has been assigned an EDP group, it may request to join a different EDP group. Information on the available EDP group(s) may be distributed periodically by the CPE AP MLD transmitting EDP Group Parameter frames (#1345). To join a different EDP group, the CPE non-AP MLD sends an EDP Epoch Request frame, indicating “Join” in the Epoch Request field and providing the EDP Epoch Setting field indicating the parameters of the EDP group it requests to join. *(#*1013, 1014, 1015, 1062, 1066, 1115, 1167, 1170)

If the CPE AP MLD can fulfil the request, it will include the CPE non-AP MLD in the new EDP group and remove it from the previous EDP group. The result of the operation is indicated to the CPE non-AP MLD through an EDP Response frame. This frame includes a Status field, “SUCCESS”, indicating the operation result and an optional EDP Epoch Setting field to indicate the parameters of the newly joined group.

At any point in time, the CPE AP MLD may request the associated CPE non-AP MLD to transition to a different EDP group, by sending an EDP Request frame to the associated CPE non-AP MLD with EDP request field set to “Join” and including the EDP Epoch Setting field with the parameters of the suggested EDP group. The CPE non-AP MLD may report the status of the operation by responding with an EDP Response frame. This operation allows the CPE AP MLD to reorganize the EDP groups in use. Following this reorganization, the resulting EDP groups should maintain the same level of restrictiveness or be even more restrictive, i.e., shorter epoch durations, while also respecting any pacing limits indicated in the Minimum Epoch Pacing Parameters field that the non-AP MLD has specified in (Re) Association Request frame.

A CPE non-AP MLD may leave an EDP group at any time by sending an EDP Request frame indicating “Leave” in the Epoch Request field. Upon reception of this message, the CPE AP MLD shall remove the CPE non-AP MLD from the EDP group. *(CIDs* 1013, 1014, 1015, 1062, 1066, 1115, 1167, 1170)

***Note to editor: the following two sections do not have any change in technical text, we just provide a new organization of the content in current clause 10.***

* EDP epoch Transitions operations

Each EDP Epoch starts with a transition period.

During the transition period of an EDP Epoch, the EDP parameters assigned to a STA during the preceding EDP Epoch, shall remain valid only for the following operations:

* Retransmission of a frame.
* Reception of a retransmitted frame.
* Frame acknowledgement.

A transition period terminates at the end of a transition timeout interval or before the end of the transition timeout interval, after the completion of the successful transmissions or retransmissions initiated during the preceding EDP Epoch, whichever comes first.



* Example of EDP Epoch timeline

Figure 10-167 (Example of EDP Epoch timeline) shows an example EDP Epoch sequence of consecutive EDP Epochs with their associated EDP Epoch start times tn and transition period tpn.



* Overview of group EDP epoch

(#1347, #1348)The next epoch boundary is derived (as described in 10.71.2.6 (EDP epoch(#Ed) start time(#1116))) from the value of the next epoch start time(#1349, #1095, #1116) defined in the EDP Epoch Setting field of the Group Enhanced Privacy element of the (Re)Association Response frame or the EDP epoch setting action response frame. The Epoch Interval Duration field of the same fields and frames defines the interval of the following Group EDP epochs sequence.

(#1096, #1353)

A CPE non-AP MLD belonging to an EDP group(#1096) and the CPE AP MLD may calculate the new OTA values to be used for the non-AP MLD in the next(#1354) group EDP epoch(#1030).

At the start of the new group(#1030) EDP epoch, the new anonymization parameters are used to anonymize the selected OTA fields of all new(#1175) individual frames transmitted during the epoch(#1355).

To account for clock drifts, the CPE non-AP MLD and CPE AP MLD shall begin to accept individually addressed frames that use the new anonymization parameters for a dot11EpochStartTimeMargin before the start of new epoch. The CPE non-AP MLD and CPE AP MLD shall accept individually addressed frames with the old anonymization parameters for dot11EpochTransitionTime after the start of the new epoch. The rules of 10.71.2.1 (Introduction) apply for frame retransmissions and acknowledgments.

At any point of time, for the current EDP Epoch of iteration number n in the sequence, the start time GETn+1 of the next EDP Epoch of the sequence, is computed according to the formula:

GETn+1 = GTn+1 + ΔIT

ΔIT = PRF-128\64(PGTK, "ERCM", GTn+1) mod (RandTR)

With:

GTn+1 =GTn+ GEI

Or

n = ⌊(TSF - GT0) / GEI⌋

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

and where:

 n is the current iteration of the EDP Epoch sequence.

 GT is the reference start time of the EDP Epoch.

 GEI is the value indicated in the Epoch Interval Duration of the EDP Epoch Settings

 field

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

 PRF-Length is the pseudorandom function defined in 12.7.1.2

 GT0 is the value indicated in the Next Epoch Start Time field of EDP Epoch Settings

 field

 RandTR is the value indicated in the Time Range field of the EDP Epoch Settings field

PGTK (for Privacy GTK) is the cryptographic key assigned by an EDP AP MLD that is used to manage the group EDP Epoch, distributed to the EDP non-AP MLDs associated with the EDP AP MLD.

The generation and the distribution of the PGTK is TBD.

If the effective start time GET of an EDP Epoch occurs during an ongoing TXOP, the Epoch starts at the end of this TXOP.

* + - 1. OTA MAC address collision avoidance(#1010)

A CPE AP and CPE STA anonymizes selected OTA MAC Header fields of individually addressed frames of the CPE STA within EDP epochs.

A CPE AP MLD may calculate that the OTA MAC address that a CPE non-AP MLD is anticipated(#1359) to use in a subsequent epoch may cause a collision with the OTA MAC address of another(#1360) CPE non-AP MLD(s) or another STA in the ESS(#1361). When such a(#Ed) collision is detected, the CPE AP MLD(#Ed) shall send to the CPE non-AP MLD(#Ed) an OTA MAC Collision Warning(#1010) action frame before the epoch where the collision is anticipated(#1359) and indicated in the Colliding Epoch field, instructing the non-AP MLD to apply the non-AP MLD specific epoch(#Ed) offset signaled in the AP MLD OTA MAC Collision Warning action frame (#1177, 1029) to avoid address collision.(#1293)

(#1141)Thus, if the Colliding Epoch value is m, indicating that the collision is expected to occur m epochs after the current epoch(#1294), and if the non-AP MLD Specific Epoch Number Offset is n, then for the epoch occurring m epochs later(#1293), the CPE AP MLD is requesting the CPE non-AP MLD to use the CPE non-AP MLD OTA MAC address(#1295) that the CPE non-AP MLD had planned to use for the epoch occurring(#1296) m+n epochs later(#1293). In the subsequent epoch, the CPE non-AP MLD is expected to use the CPE non-AP MLD OTA MAC address that the CPE non-AP MLD had planned to use m+n+1 epochs later(#1293), unless the CPE AP MLD also signals a collision warning for that epoch(#1293). The CPE non-AP MLD shall respond with an OTA MAC Collision Warning action frame acknowledging the CPE AP MLD warning, and either accepting the CPE AP MLD(#Ed) proposed remediation(#1178, #1366), thus applying the offset requested by the CPE AP MLD, or rejecting the CPE AP MLD(#Ed) proposed remediation, and thus using the CPE non-AP MLD OTA MAC address that the CPE non-AP MLD had planned to use for that epoch before receiving the CPE AP MLD OTA MAC Collision Warning action frame(#1178).

(#1120)