

## 7 FC-BB\_E Structure and Concepts

### 7.5a VN\_Port MAC addresses

ENodes may support Fabric Provided MAC Addresses (FPMAs) and/or Server Provided MAC Addresses as VN\_Port MAC addresses. The FIP protocol is used to negotiate between ENodes and FCFs which type of VN\_Port MAC addresses are used (see 7.7.3.1).

FPMAs are assigned by FCFs while assigning an N\_Port\_ID to a VN\_Port (see 7.7.3.1). A properly formed FPMA is one in which the 24 most significant bits equal the Fabric's FC-MAP value and the least significant 24 bits equal the N\_Port\_ID assigned to the VN\_Port by the FCF. This guarantees that FPMAs are unique within the Fabric. The FC-MAP value is checked by the FIP Discovery protocol (see 7.7.2) to ensure it is consistent across the Fabric. FPMAs should not be used for other protocols.

SPMAs are assigned by ENodes and validated by FCFs. SPMAs should be globally assigned, not locally generated (i.e., they should have the U/L bit set to zero, see IEEE 802.3-2008). SPMAs used for FCoE and FIP traffic should not be used for other protocols.

## 7.7 FC-BB\_E device initialization

### 7.7.1 FCoE Initialization Protocol (FIP) overview

The FCoE Initialization Protocol (FIP) is used to perform the ~~function~~ functions of FC-BB\_E device discovery, initialization, and maintenance. To perform these functions, encapsulated FIP operations (see 7.7.6.2) are specified.

The FIP ~~frame format~~ Ethertype (see 7.7.6.1) is different than the FCoE ~~frame format~~ Ethertype (see 7.6) to enable the ~~detection~~ distinction of discovery, initialization, and maintenance traffic from ~~normal~~ other FCoE traffic.

FIP messages are used to perform the following protocols:

- a) FIP ~~discovery~~ Discovery (see 7.7.2);
- b) FCoE Virtual Link instantiation (see 7.7.3);
- c) FCoE Virtual Link maintenance (see 7.7.4); and
- d) FIP VLAN Discovery (see 7.7.5).

All FIP protocols are performed on a per-VLAN basis. It is recommended to use the FIP VLAN Discovery protocol on the default VLAN (see IEEE 802.1Q-2005). All other FIP protocols shall be performed in each VLAN that provides FC-BB\_E services.

In order to provide FC-BB\_E services on a VLAN, FCoE and FIP protocols other than FIP VLAN Discovery shall be both performed on that VLAN. Support for multiple Fabrics per VLAN is outside the scope of this standard.

On ENodes, the ENode MAC address shall be used for all FIP messages, except the VN\_Port FIP Keep Alive message (see 7.7.7.5). On FCFs, the FCF-MAC address shall be used for all FIP messages.

ENode MACs shall listen to the All-ENode-MACs group address, FCF-MACs shall listen to the All-FCF-MACs group address, and both ENode MACs and FCF-MACs shall listen to the All-FCoE-MACs group address.

## 7.7.2 FIP ~~discovery~~ Discovery protocol

### 7.7.2.1 ENode/FCF ~~discovery~~ Discovery

The FCoE Controller ~~for~~ of a VF\_Port capable FCF-MAC shall periodically transmit multicast Discovery Advertisements (see 7.7.7.3) to the All-ENode-~~MACS~~ MACs group address every FKA\_ADV\_PERIOD. The FKA\_ADV\_PERIOD period shall be randomized with a random delay uniformly distributed between 0 and 100 ms to avoid large bursts of multicast traffic within the Ethernet network. The FCoE Controller of a VF\_Port capable FCF-MAC should begin transmitting unsolicited multicast Discovery Advertisements on completion of Fabric configuration (see FC-SW-5).

On receiving Discovery Advertisements, the FCoE Controller of an ENode MAC verifies the VN\_Port addressing capabilities of the advertising FCF-MAC (i.e., the values of the FP and SP flags, see table 28) against its VN\_Port addressing capabilities. The FCoE ~~Controllers~~ Controller of an ENode MAC shall discard incompatible Discovery Advertisements and create an entry per each compatible FCF-MAC in an internal FCF list, by default ordered on the basis of the value provided in the Priority descriptor in the Discovery Advertisements.

Each entry in the FCF list has the following flags:

- a) 'Max FCoE Size ~~verified~~ Verified' - set to zero for entries created from ~~unsolicited~~ unsolicited multicast Discovery Advertisements, set to one when a ~~solicited~~ solicited unicast ~~jumbo~~ Discovery Advertisement is received; and
- b) ~~Available for Login—set to one when the FCF is able to accept additional FIP FLOGI/FDISC requests, set to zero otherwise.~~

~~ENode FCoE Controllers select a subset of the Available FCF MACs for Login (i.e., the FCF Login Set) on the basis of a local policy, by default the one(s) with higher priority (i.e., lower priority value). Each FCF MAC in the FCF Login Set shall be verified for Max FCoE Size support before performing the FIP FLOGI by transmitting a unicast Discovery Solicitation to an FCF MAC and receiving a unicast Discovery Advertisement in response.~~

- b) 'Available for Login' - reflects the value of the A bit provided by the most recently received Discovery Advertisement from that VF\_Port capable FCF-MAC.

The FCoE Controller of an ENode MAC selects for Login a subset of the FCF-MACs in the FCF list having the 'Available for Login' flag set to one (i.e., the FCF Login Set) on the basis of a local policy, by default the one(s) with higher priority (i.e., lower priority value). A FIP FLOGI may be performed with an FCF-MAC in the FCF Login Set only if its 'Max FCoE Size Verified' flag is set to one. In order to perform a FIP FLOGI with an FCF-MAC in the FCF Login Set with the 'Max FCoE Size Verified' flag set to zero, the FCoE Controller of an ENode MAC shall transmit a unicast Discovery Solicitation (see 7.7.7.2) to that FCF-MAC address and receive a solicited unicast Discovery Advertisement in response.

The periodic reception of ~~unsolicited~~ unsolicited multicast Discovery Advertisements ~~allow~~ allows the FCoE Controller of ENode ~~FCoE Controllers~~ MACs to continuously verify FCF-MAC connectivity. The Available for Login (A) bit in received Discovery Advertisements provides the information that the transmitting FCF-MAC is available for FIP FLOGI/FDISC, and this information is updated in the FCF list and FCF Login Set on reception of Discovery Advertisements. ~~The A bit is informational and shall have no effect on existing logins.~~

~~When an ENode FCoE Controller becomes operational it discovers FCFs that it may perform FIP FLOGI with by transmitting a Discovery Solicitation (see 7.7.7.2) to the All-FCF-MACS group~~

~~address. In response to a Discovery Solicitation from an ENode, an FCF transmits a solicited unicast Discovery Advertisement (see 7.7.7.3) to the ENode if it is configured to allow a FIP FLOGI from that ENode.~~

~~The ENode MAC address is used for all FIP operations and shall remain valid.~~

When the FCoE Controller of an ENode MAC becomes operational it should discover VF\_Port capable FCF-MACs with which it may perform FIP FLOGI by transmitting a multicast Discovery Solicitation to the All-FCF-MACs group address. In response to a Discovery Solicitation from an ENode MAC, a VF\_Port capable FCF-MAC shall transmit a solicited unicast Discovery Advertisement to the soliciting ENode MAC if its VN\_Port addressing modes are compatible with the ones of the ENode MAC (see table 28) and if it is configured to allow a FIP FLOGI from that ENode. The solicited unicast Discovery Advertisement shall be transmitted to the MAC address field value specified in the MAC address descriptor in the received Discovery Solicitation. The solicited unicast Discovery Advertisement shall be transmitted within ADV\_TOV (see table 52) upon reception of the Discovery Solicitation. Discovery Advertisements transmitted in response to a multicast Discovery Solicitation should be delayed by a random time uniformly distributed between 0 and 100 ms to avoid large bursts of multicast traffic within the Ethernet network. This delay should not be applied to solicited unicast Discovery Advertisements sent in response to unicast Discovery Solicitations. Solicited unicast Discovery Advertisements should not be transmitted until Fabric configuration is completed (see FC-SW-5).

NOTE 1 – An ENode MAC may also wait to receive unsolicited multicast Discovery Advertisements and then send unicast Discovery Solicitation to the FCF-MACs selected for login from the FCF Login set.

A Discovery Solicitation shall carry in the Max FCoE Size descriptor the maximum size the ENode MAC intends to use for FCoE traffic (see 7.7.6.3.7). The Encapsulated FIP frame (see table 24) in a solicited unicast Discovery Advertisement shall be extended to have a length that matches the Max\_FCoE\_Size field value in the Max FCoE Size descriptor in the Discovery Solicitation to which the Discovery Advertisement is responding (see 7.7.7.3). An ENode MAC may generate multiple Discovery Solicitations.

NOTE 2 – As an example, an ENode MAC that does not receive a solicited unicast Discovery Advertisement in response to a Discovery Solicitation may generate additional Discovery Solicitations, unicast or multicast.

Receiving a solicited unicast Discovery Advertisement from an FCF-MAC sets to one the 'Max FCoE Size Verified' flag in the entry for that FCF-MAC in the FCF Login Set of an ENode MAC.

An FCF may receive a multicast Discovery Solicitation from the same ENode MAC on multiple FCF-MACs. In this case, a separate solicited unicast Discovery Advertisement shall be transmitted by each of the FCF-MACs that received the Discovery Solicitation. The ENode MAC that transmitted the multicast Discovery Solicitation may determine that it received multiple solicited unicast Discovery Advertisements from the same FCF since the value of the Name\_Identifier field in the Name\_Identifier descriptor is the same in each of the solicited unicast Discovery Advertisements (see 7.7.7.3). In this case the ENode MAC should select the FCF-MAC for Fabric login with that FCF based on the value of the Priority descriptor in the Discovery Advertisements.

An ENode MAC may receive multiple unsolicited multicast Discovery Advertisements from multiple FCF-MACs of the same FCF. The ENode MAC may determine that those unsolicited multicast Discovery Advertisements are from the same FCF since the value of the Name\_Identifier field in the Name\_Identifier descriptor is the same in each of the unsolicited multicast Discovery Advertisements (see 7.7.7.3). In this case the ENode MAC should select the FCF-MAC for Fabric login with that FCF based on the value of the Priority descriptor in the Discovery Advertisements.

An ENode MAC shall discard any received Discovery Solicitation. A VF\_Port capable FCF-MAC shall discard any Discovery Solicitation originated by a VE\_Port capable FCF-MAC (i.e., having the F bit set to one, see 7.7.6.2).

### 7.7.2.2 FCF/FCF ~~discovery~~Discovery

The FCoE Controller ~~for~~ of a VE\_Port capable FCF-MAC shall periodically transmit multicast Discovery Advertisements (see 7.7.7.3) to the All-FCF-~~MACS~~-MACs group address every FKA\_ADV\_PERIOD. The FKA\_ADV\_PERIOD period shall be randomized with a random delay uniformly distributed between 0 and 100 ms to avoid large bursts of multicast traffic within the Ethernet network.

On receiving Discovery Advertisements, the FCoE ~~Controllers for~~ Controller of a VE\_Port capable FCF-~~MACs create~~-MAC creates an entry per FCF-MAC in an internal FCF list, by default ordered on the basis of the value provided in the Priority descriptor in the Discovery Advertisements.

Each entry in the FCF list has the following flags:

- a) 'Max FCoE Size ~~verified~~-Verified' - set to zero for entries created from ~~unsolicited~~ multicast Discovery Advertisements, set to one when a ~~solicited~~ unicast ~~jumbo~~-Discovery Advertisement is received; and
- ~~b) Available for ELP—set to one when the FCF is able to accept additional FIP ELP requests, set to zero otherwise.~~

~~Each FCF-MAC in the FCF list shall be verified for Max FCoE Size support before performing a FIP ELP with that FCF-MAC by transmitting a unicast Discovery Solicitation to that FCF-MAC and receiving a unicast Discovery Advertisement in response.~~

- b) 'Available for ELP' - reflects the value of the A bit provided by the most recently received Discovery Advertisement from that VE\_Port capable FCF-MAC.

A FIP ELP may be performed with an FCF-MAC in the FCF list only if its 'Max FCoE Size Verified' flag is set to one. In order to perform a FIP ELP with an FCF-MAC in the FCF list with the 'Max FCoE Size Verified' flag set to zero, the FCoE Controller of a VE\_Port capable FCF-MAC shall transmit a unicast Discovery Solicitation (see 7.7.7.2) to that FCF-MAC address and receive a solicited unicast Discovery Advertisement in response.

The periodic reception of ~~unsolicited~~ multicast Discovery Advertisements allow the FCoE ~~Controllers for~~ Controller of VE\_Port capable FCF-MACs to continuously verify the FCF-MACs ~~reachability~~connectivity. The 'Available for ~~Login~~-Login' (A) bit in received Discovery Advertisements provides the information that the transmitting FCF-MAC is available for FIP ELP, and this information is updated in the FCF list on reception of Advertisements. ~~The A bit is informational and shall have no effect on existing VE\_Port to VE\_Port Virtual Links.~~

When the FCoE Controller for a VE\_Port capable FCF-MAC becomes operational it ~~discovers~~should discover other VE\_Port capable FCF-MACs by transmitting a ~~multicast~~ Discovery Solicitation to the All-FCF-~~MACS~~-MACs group address. In response to a Discovery Solicitation from an FCF-MAC, a VE\_Port capable FCF-~~MAC transmits~~-MAC shall transmit a solicited unicast Discovery Advertisement to the soliciting FCF-MAC if the FC-MAP value carried in the Solicitation is compatible with the FC-MAP configured on the FCF and if it is configured to allow a Virtual Link with that FCF. The solicited unicast Discovery Advertisement shall be transmitted to the MAC address field value specified in the MAC address descriptor in the received Discovery Solicitation. The solicited unicast Discovery Advertisement shall be transmitted within ADV\_TOV (see table 52) upon reception of the Discovery Solicitation. Discovery Advertisements transmitted in response to a multicast Discovery Solicitation

should be delayed by a random time uniformly distributed between 0 and 100 ms to avoid large bursts of multicast traffic within the Ethernet network. This delay should not be applied to solicited unicast Discovery Advertisements sent in response to unicast Discovery Solicitations.

A Discovery Solicitation shall carry in the Max FCoE Size descriptor the maximum size the VE\_Port capable FCF-MAC intends to use for FCoE traffic (see 7.7.6.3.7). The Encapsulated FIP frame (see table 24) in a solicited unicast Discovery Advertisement shall be extended to have a length that matches the Max\_FCoE\_Size field value in the Max FCoE Size descriptor in the Discovery Solicitation to which the Discovery Advertisement is responding (see 7.7.7.3). A VE\_Port capable FCF-MAC may generate multiple Discovery Solicitations.

Receiving a solicited unicast Discovery Advertisement from an FCF-MAC sets to one the 'Max FCoE Size Verified' flag in the entry for that FCF-MAC in the FCF list of the receiving VE\_Port capable FCF-MAC.

An FCF may receive multicast Discovery Solicitations from the same VE\_Port capable FCF-MAC on multiple FCF-MACs. In this case, a separate solicited unicast Discovery Advertisement shall be transmitted by each of the FCF-MACs that received the Discovery Solicitation. The VE\_Port capable FCF-MAC that transmitted the multicast Discovery Solicitation may determine that it received multiple solicited unicast Discovery Advertisements from the same FCF since the value of the Name\_Identifier field in the Name\_Identifier descriptor is the same in each of the solicited unicast Discovery Advertisements (see 7.7.7.3).

A VE\_Port capable FCF-MAC may receive multiple unsolicited multicast Discovery Advertisements from multiple FCF-MACs of the same FCF. The VE\_Port capable FCF-MAC may determine that those unsolicited multicast Discovery Advertisements are from the same FCF since the value of the Name\_Identifier field in the Name\_Identifier descriptor is the same in each of the unsolicited multicast Discovery Advertisements (see 7.7.7.3).

After receiving a Discovery Solicitation originated by an FCF (i.e., the F bit is set to one), an FCF-MAC shall perform the following verification steps:

- a) the Name\_Identifier field value in the Discovery Solicitation is different than the Switch\_Name of the recipient FCF (see 7.7.7.2.2); and
- b) either:
  - A) the FP bit is set to one (see 7.7.6.2) and the FC-MAP value in the FC-MAP descriptor in the Discovery Solicitation is the same as the FC-MAP value of the recipient FCF; or
  - B) the FP bit is set to zero, the SP bit is set to one (see 7.7.6.2), and the FC-MAP value in the FC-MAP descriptor in the Discovery Solicitation is zero.

If any verification step is false, then the Discovery Solicitation shall be discarded.

After receiving a Discovery Advertisement, an FCF-MAC shall perform the following verification steps:

- a) the Name\_Identifier field value in the Discovery Advertisement is different than the Switch\_Name of the recipient FCF (see 7.7.7.3); and
- b) either:
  - A) the FP bit is set to one (see 7.7.6.2) and the FC-MAP value in the Fabric descriptor in the Discovery Advertisement is the same as the FC-MAP value of the recipient FCF; or

- B) the FP bit is set to zero, the SP bit is set to one (see 7.7.6.2), and the FC-MAP value in the Fabric descriptor in the Discovery Advertisement is zero.

NOTE 3 – It is possible for an FCF to receive a multicast Discovery Solicitation or a multicast Discovery Advertisement that it originated because messages sent to the All-FCF-MACs group address may be forwarded to other ports on the same FCF by intermediate Ethernet bridges.

A VE\_Port capable FCF-MAC shall discard any Discovery Solicitation originated by an ENode (i.e., having the F bit set to zero, see 7.7.6.2).

### 7.7.3 FCoE Virtual Link instantiation protocol

#### 7.7.3.1 VN\_Port to VF\_Port Virtual Links

~~An~~The FCoE Controller ~~for~~ of an ENode MAC instantiates VN\_Port to VF\_Port Virtual Links ~~following~~ on successful completion of a FIP Fabric login request. Fabric login (i.e., FLOGI, NPIV FDISC) shall be performed using the FIP frame format (see table 24) and the associated FIP descriptor type (see ~~table 29~~table 30). Fabric login (i.e., FLOGI, NPIV FDISC) shall not be performed using the FCoE frame format.

In addition to providing Fabric login, the FIP Fabric login provides a method to assign a MAC address for the ~~VN\_Port~~VN\_Port (see 7.7.7.4.3).

When the FCoE Controller of an ENode MAC transmits a FIP FLOGI Request or FIP NPIV FDISC Request it shall indicate the addressing mode it intends to use (i.e., FPMA, SPMA, or both, see table 28). The MAC address returned by the FCF in a FIP FLOGI LS\_ACC or FIP NPIV FDISC LS\_ACC shall be used as the VN\_Port MAC address (see 7.5a).

If the SP bit is set to one in a FIP FLOGI Request or NPIV FDISC Request (see table 28) and the FCF selects to use SPMA, the FCF shall return the MAC address specified in the FIP FLOGI Request or NPIV FDISC Request in the FIP FLOGI LS\_ACC or FIP NPIV FDISC LS\_ACC, if that MAC address is valid (see 7.7.6.3.3).

If the FP bit is set to one in a FIP FLOGI Request or NPIV FDISC Request (see table 28) and the FCF selects to use FPMA, the FCF shall return a properly formed FPMA MAC address in the FIP FLOGI LS\_ACC or FIP NPIV FDISC LS\_ACC (see 7.5a).

If both the FCF and ENode support both SPMA and FPMA, the FCF may assign an address of either type.

Explicit VN\_Port to VF\_Port Virtual Link de-instantiation is performed by an ENode MAC by performing Fabric logout. Fabric logout (i.e., Fabric LOGO) shall be performed by an ENode using the FIP frame format (see table 24) and the associated FIP descriptor type (see ~~table 29~~table 30). Fabric logout shall not be performed using the FCoE frame format.

In addition to providing Fabric logout, the FIP Fabric logout provides a method to ~~deassign~~ de-assign a MAC address for the ~~VN\_Port~~VN\_Port (see 7.7.7.4.4).

#### 7.7.3.2 VE\_Port to VE\_Port Virtual Links

~~An~~The FCoE Controller ~~for~~ of a VE\_Port capable FCF-MAC instantiates VE\_Port to ~~VE\_Ports~~ VE\_Port Virtual Links ~~following~~ on successful completion of a FIP ELP request. ELP shall be performed using the FIP frame format (see table 24) and the associated FIP descriptor type (see ~~table 29~~table 30). ELP shall not be performed using the FCoE frame format.

In addition to providing ELP, the FIP ELP provides a method to ~~assign a~~ communicate the MAC address for the ~~VE\_Port~~VE\_Port (see 7.7.7.4.5).

#### 7.7.4 FCoE Virtual Link maintenance protocol

##### 7.7.4.1 VN\_Port to VF\_Port Virtual Links

As shown in figure 27, VN\_Port to VF\_Port Virtual Links overlay over a Lossless Ethernet network. The Virtual Link maintenance protocol specified in this subclause defines how to deal with faults that may happen in that Lossless Ethernet network.

To deal with local physical layer faults, an ENode MAC shall de-instantiate all its VN\_Ports to VF\_Port Virtual Links upon detecting that its physical layer is no more operational. This condition shall be handled as an implicit Fabric Logout (see FC-LS-2) for the involved VN\_Ports. A VF\_Port capable FCF-MAC shall de-instantiate all its VF\_Ports upon detecting that its physical layer is no more operational.

~~The~~To deal with non-local faults, the FCoE ~~Controller for~~Controllers of an ENode MAC and of a VF\_Port capable FCF--MAC shall continuously verify the state of the VN\_Port to VF\_Port Virtual Link by transmitting appropriate FIP messages and by verifying received FIP messages.

The FCoE Controller of an ENode MAC ~~FCoE Controller~~ shall transmit a unicast FIP Keep Alive message on behalf of the ENode MAC (i.e., with the ENode MAC address as source MAC address and without a Vx\_Port Identification descriptor in the FIP Descriptor list, see table 49) to each VF\_Port capable FCF-MAC ~~that with which~~ it has VN\_Ports logged in ~~in within~~. This ENode FIP Keep Alive message shall be transmitted every FKA\_ADV\_PERIOD. ~~In addition, The FKA\_ADV\_PERIOD is obtained from the ENode MAC FCoE Controller shall transmit, for each VN\_Port, a FIP Keep Alive message with the VN\_Port's MAC address as source MAC address to~~Discovery Advertisements received from the VF\_Port capable FCF-MACs with which the ENode MAC ~~that the VN\_Port is~~ has VN\_Ports logged in. ~~This FIP Keep Alive message shall be transmitted every 90 seconds.~~

~~The ENode MAC FCoE Controller shall monitor the status of a VF\_Port that it has VN\_Ports logged in with by verifying the FIP Discovery Advertisements from that VF\_Port capable FCF-MAC are received within every FKA\_ADV\_PERIOD. After three missing Discovery Advertisements, all the VN\_Port to VF\_Port Virtual Links associated with that VF\_Port shall be de-instantiated along with the associated VN\_Ports.~~

In addition, the FCoE Controller of an ENode MAC shall transmit a unicast FIP Keep Alive message on behalf of each VN\_Port (i.e., with the VN\_Port MAC address as source MAC address and containing a Vx\_Port Identification descriptor for that VN\_Port in the FIP Descriptor list, see table 49) to the VF\_Port capable FCF-MAC with which that VN\_Port is logged in. This VN\_Port FIP Keep Alive message shall be transmitted every FKA\_VN\_PERIOD.

The FCoE Controller of an ENode MAC shall monitor the status of a VF\_Port with which it has VN\_Ports logged in by verifying reception of unsolicited multicast Discovery Advertisements from that VF\_Port capable FCF-MAC. Unsolicited multicast Discovery Advertisements are expected to be received every FKA\_ADV\_PERIOD. If unsolicited multicast Discovery Advertisements are not received within  $2,5 * FKA\_ADV\_PERIOD$ , all the VN\_Port to VF\_Port Virtual Links with that VF\_Port shall be implicitly de-instantiated. This condition shall be handled as an implicit Fabric Logout (see FC-LS-2) for the involved VN\_Ports. That FCF-MAC shall be removed from the FCF Login Set (see 7.7.2.1). A subsequent FIP Fabric Login may be performed with an FCF-MAC in the current FCF Login Set as specified in 7.7.2.1.

The FCoE Controller ~~for~~ of a VF\_Port capable FCF-MAC shall transmit ~~a FIP~~ an unsolicited multicast Discovery Advertisement to the All-ENode-MACs group address every FKA\_ADV\_PERIOD.

The FCoE Controller ~~for~~ of a VF\_Port capable FCF-MAC shall monitor the status of an ENode ~~that MAC with which~~ it has active VN\_Port to VF\_Port Virtual Links ~~with~~ by verifying the reception of FIP Keep Alive messages from that ENode MAC and its VN\_Ports. VN\_Port FIP Keep Alive messages (i.e., those ~~having the VN\_Port MAC address as the source address~~ containing a Vx\_Port Identification descriptor) are expected to be received every ~~90 seconds~~ FKA\_VN\_PERIOD and ENode FIP Keep Alive messages (i.e., those ~~having the ENode MAC address as the source address~~ not containing a Vx\_Port Identification descriptor) are expected to be received ~~within~~ every FKA\_ADV\_PERIOD.

~~After three missing VN\_Port FIP Keep Alive messages, the associated VN\_Port to VF\_Port Virtual Link shall be de-instantiated. After three missing ENode FIP Keep Alive messages, all associated VN\_Port to VF\_Port Virtual Links shall be de-instantiated.~~

If VN\_Port FIP Keep Alive messages are not received within  $2,5 * FKA\_VN\_PERIOD$ , the associated VN\_Port to VF\_Port Virtual Link shall be explicitly de-instantiated (i.e., a FIP Clear Virtual Links message listing the unreachable VN\_Port shall be generated). This condition shall be handled as an implicit Fabric Logout (see FC-LS-2) for the involved VN\_Port. If ENode FIP Keep Alive messages are not received within  $2,5 * FKA\_ADV\_PERIOD$ , all associated VN\_Port to VF\_Port Virtual Links shall be explicitly de-instantiated (i.e., a FIP Clear Virtual Links message listing all the unreachable VN\_Ports shall be generated). This condition shall be handled as an implicit Fabric Logout (see FC-LS-2) for the involved VN\_Ports.

NOTE 4 – The use of a ~~fast~~ faster FKA\_ADV\_PERIOD ~~period~~ rate for ENode FIP Keep Alive messages allows fast response times against loss of connectivity in the Ethernet realm with limited overhead. The use of VN\_Port FIP Keep Alive messages transmitted at a slower FKA\_VN\_PERIOD rate allows the clearing of state associated with each individual VN\_Port when that VN\_Port becomes not operational.

~~Explicit VN\_Port to VF\_Port Virtual Link de-instantiation is performed by transmitting a FIP Fabric logout from an ENode MAC and by transmitting a FIP Clear Virtual Links message from a VF\_Port capable FCF-MAC.~~

~~A FIP Clear Virtual Links message transmitted to an ENode MAC provides the list of VN\_Ports to be removed. The size of a FIP Clear Virtual Links message should not exceed the standard Ethernet payload size (i.e., 1500 bytes). If the list of VN\_Ports to be removed does not fit in a single frame, multiple frames may be transmitted.~~

Explicit VN\_Port to VF\_Port Virtual Link de-instantiation is invoked by a VF\_Port capable FCF-MAC by transmitting a FIP Clear Virtual Links message (see 7.7.7.6). A FIP Clear Virtual Links message transmitted to an ENode MAC with logged in VN\_Ports provides the list of VN\_Ports to be removed. An ENode MAC shall de-instantiate the VN\_Ports listed in a FIP Clear Virtual Link message upon reception of the message. This condition shall be handled as an implicit Fabric Logout (see FC-LS-2) for the involved VN\_Ports.

The size of a FIP Clear Virtual Links message shall not exceed the standard Ethernet MAC Client Data size (i.e., 1 500 bytes for basic frames and 1 504 bytes for Q-tagged frames, see IEEE 802.3-2008). If the list of VN\_Ports to be removed does not fit in a single FIP message, multiple FIP messages may be transmitted.

On receiving a VN\_Port FIP Keep Alive message coming from a not logged in VN\_Port, the FCoE Controller of a VF\_Port capable FCF-MAC shall transmit a FIP Clear Virtual Links message listing that VN\_Port.

On receiving an ENode FIP Keep Alive message coming from a not logged in ENode MAC, the FCoE Controller of a VF\_Port capable FCF-MAC shall transmit a FIP Clear Virtual Links message listing no VN\_Ports. A FIP Clear Virtual Links message listing no VN\_Ports shall be handled by an ENode MAC by de-instantiating all VN\_Port to VF\_Port Virtual Links with that VF\_Port capable FCF-MAC. This condition shall be handled as an implicit Fabric Logout (see FC-LS-2) for the involved VN\_Ports.

FIP Clear Virtual Links messages may be generated by FCFs whenever appropriate to speed-up faults recovery.

NOTE 5 – As an example, in constrained configurations an FCF may generate a FIP Clear Virtual Links message to de-instantiate the VN\_Port to VF\_Port Virtual Links affected by a local physical layer fault on other ports upon detection of that fault.

The FKA\_ADV\_PERIOD value (see table 52) may be changed on a FCF under administrative control. When this happens, each VF\_Port capable FCF-MAC of the FCF shall advertise the updated FKA\_ADV\_PERIOD in subsequent unsolicited multicast Discovery Advertisements.

When the FKA\_ADV\_PERIOD value is decreased, a VF\_Port capable FCF-MAC shall transmit unsolicited multicast Discovery Advertisements at the interval specified by the updated value but shall not use the updated value for detection of missing ENode FIP Keep Alives until five times the old value has elapsed since the transmission of the first updated unsolicited multicast Discovery Advertisement.

When the FKA\_ADV\_PERIOD value is increased, a VF\_Port capable FCF-MAC shall transmit unsolicited multicast Discovery Advertisements at the interval specified by the old value until five times the updated value has elapsed since the transmission of the first updated unsolicited multicast Discovery Advertisement, but shall use the updated value for detection of missing ENode FIP Keep Alives.

On detecting the updated value, an ENode having VN\_Port to VF\_Port Virtual Links instantiated with that FCF shall transmit ENode FIP Keep Alive messages at the interval specified by the updated FKA\_ADV\_PERIOD value and shall use the updated value for detection of missing unsolicited multicast Discovery Advertisements.

#### 7.7.4.2 VE\_Port to VE\_Port Virtual Links

As shown in figure 28, VE\_Port to VE\_Port Virtual Links overlay over a Lossless Ethernet network. The Virtual Link maintenance protocol specified in this subclause defines how to deal with faults that may happen in that Lossless Ethernet network.

To deal with local physical layer faults, a VE\_Port capable FCF-MAC shall de-instantiate all its VE\_Port to VE\_Port Virtual Links upon detecting that its physical layer is no more operational.

~~The~~To deal with non-local faults, the FCoE Controllers for VE\_Port capable FCF-MACs shall continuously verify the state of a VE\_Port to VE\_Port Virtual Link by transmitting ~~FIP~~unsolicited multicast Discovery Advertisements and by verifying received ~~FIP~~unsolicited multicast Discovery Advertisements.

The FCoE Controller for a VE\_Port capable FCF-MAC shall transmit a ~~FIP~~Discovery Advertisement to the All-FCF-MACs group address every FKA\_ADV\_PERIOD.

The FCoE Controller for a VE\_Port capable FCF-MAC shall monitor the status of a VE\_Port to VE\_Port Virtual Link by verifying the reception of ~~FIP~~unsolicited multicast Discovery Advertisements. ~~FIP~~Unsolicited multicast Discovery Advertisements are expected to be received ~~within~~every FKA\_ADV\_PERIOD. ~~After three missing~~If unsolicited multicast Discovery AdvertisementsAdvertise-

ments are not received within  $2,5 * FKA\_ADV\_PERIOD$ , the VE\_Port to VE\_Port Virtual Links-Link associated with that FCF-MAC shall be explicitly de-instantiated along with the associated VE\_PortsVE\_Port. That FCF-MAC shall be removed from the FCF List (see 7.7.2.2).

Explicit VE\_Port to VE\_Port Virtual Link de-instantiation is performed by transmitting a FIP Clear Virtual Links message from a VE\_Port capable FCF-MAC. A FIP Clear Virtual Links message transmitted to a VE\_Port capable FCF-MAC provides the destination FCF-MAC addressaddress in the Vx\_Port Identification descriptor. A VE\_Port capable FCF-MAC shall de-instantiate the VE\_Port listed in a FIP Clear Virtual Link message upon reception of the message.

The FKA\_ADV\_PERIOD value (see table 52) may be changed on a FCF under administrative control. When this happens, each VE\_Port capable FCF-MAC of the FCF shall advertise the updated FKA\_ADV\_PERIOD in subsequent unsolicited multicast Discovery Advertisements and shall transmit them at the interval specified by the updated value.

On detecting the updated value in received unsolicited multicast Discovery Advertisements, a VE\_Port capable FCF-MAC shall use the updated value for detection of missing unsolicited multicast Discovery Advertisements.

### 7.7.5 FIP VLAN Discovery protocol

When becoming operational, an ENode's-ENode MAC or an FCF-MAC may invoke the FIP VLAN Discovery protocol to discover the VLANs in the Lossless Ethernet network that provide FC-BB\_E services.

An ENode's-ENode MAC may send a FIP VLAN Request message to the MAC address All-FCF-MACs over an available VLAN (e.g., the default VLAN). VF\_Port capable FCF-MACs that receive a FIP VLAN Request message shall respond with a unicast FIP VLAN Notification message over the same VLAN. The FIP VLAN Notification message carries the list of VLAN IDs over which the originating FCF offers FC-BB\_E services. The ENode's-ENode MAC that received a FIP VLAN Notification message may enable one or more of these VLANs for subsequent operations.

NOTE 6 – FCFs may limit the number of VLAN IDs listed in a FIP Notification message on a per-requester basis.

If the configuration of VLANs on which a VF\_Port capable FCF-MAC supports FC-BB\_E services changes, that FCF-MAC should send a unicast FIP VLAN Notification message to each ENode MAC address with which that FCF-MAC has established VN\_Port to VF\_Port Virtual Links. The unicast FIP VLAN Notification message shall carry the revised list of VLAN IDs over which the originating VF\_Port capable FCF-MAC offers FC-BB\_E services.

A VE\_Port capable FCF-MAC may send a FIP VLAN Request message to the MAC address All-FCF-MACs over an available VLAN (e.g., the default VLAN). VE\_Port capable FCF-MACs that receive a FIP VLAN Request message shall respond with a unicast FIP VLAN Notification message over the same VLAN. The FIP VLAN Notification message carries the list of VLAN IDs over which the originating FCF offers FC-BB\_E services. The VE\_Port capable FCF-MAC that received a FIP VLAN Notification message may enable one or more of these VLANs for subsequent operations.

FCF-MACs shall listen to the All-FCF-MACs group address in the default VLAN and in other VLANs that ENodes or FCFs may use to invoke this protocol.

If the configuration of VLANs on which a VE\_Port capable FCF-MAC supports FC-BB\_E services changes, that FCF-MAC should send a unicast FIP VLAN Notification message to each FCF-MAC address with which that FCF-MAC has established VE\_Port to VE\_Port Virtual Links. The unicast FIP

VLAN Notification message shall carry the revised list of VLAN IDs over which the originating VE\_Port capable FCF-MAC offers FC-BB\_E services.

**7.7.6 FIP messages**

**7.7.6.1 FIP frame format**

All Ethernet frames that carry FIP frames-operations shall be formatted in accordance with ~~802.3-2005, Part 3~~ IEEE 802.3-2008 and the MAC Client Data field within the IEEE 802.3 frame shall contain the encapsulated FIP operationframe. The use of an IEEE 802.1Q tag header is optional and additional IEEE 802.1 defined tags may be present in the Ethernet frame prior to the encapsulated FIP frame. The format of an encapsulated FIP frame is specified in table 24. An Ethernet frame carrying an FIP frameencapsulated FIP frame is called a FIP message. See Annex B for examples of FIP messages.

**Table 24 – Encapsulated FIP frame format**

Word	Bit	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0
0	Type = FIP_TYPE															Version			Reserved												
1	Encapsulated FIP operation (n words)																														
n	Encapsulated FIP operation (n words)																														

The format of a FIP frame is specified in table 24.

The Type field in the Ether Ethernet header shall be set to FIP\_TYPE (see table 52).

The Version field shall be set to FIP\_FRAME\_VER (see table 52).

The Encapsulated FIP operation field is shall be as specified in 7.7.6.2.

If a received FIP frame is received with message carrying no encapsulated FIP operation, the FIP frame-operation shall be discarded.

**7.7.6.2 Encapsulated FIP operation**

The format of the encapsulated FIP operation is specified in table 25.

**Table 25 – Encapsulated FIP operation format**

Word	Bit	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0
0	FIP Operation Protocol Code															Reserved			FIP Subcode												
1	FIP Descriptor List Length															F	S	Reserved										A	S	F	
2	FIP Descriptor Descriptor List (s) (n-m words)																														
n+m+2-1	FIP_Pad (m-n-m-2 words)																														

The FIP ~~Operation-Protocol~~ Code and FIP Subcode field values and operations are specified in ~~table 26~~table 26.

**Table 26 – FIP ~~Operation-Protocol~~ Code and FIP Subcode field ~~values and operations~~values**

FIP <del>Operation-Protocol</del> Code	FIP Subcode	FIP <del>Operation</del> Protocol Messages	Reference
0001h	01h	Discovery Solicitation	7.7.7.2
	02h	Discovery Advertisement	7.7.7.3
0002h	01h	Virtual Link Instantiation Request	7.7.7.4
	02h	Virtual Link Instantiation Reply	7.7.7.4
0003h	01h	FIP Keep Alive	7.7.7.5
	02h	FIP Clear Virtual Links	7.7.7.6
0004h	01h	FIP VLAN Request	7.7.7.7
	02h	FIP VLAN Notification	7.7.7.8
<del>FFF8h-FFF8h ..</del> FFFEh	<del>00h-00h ..</del> FFh	Vendor Specific	7.7.7.9
All others	All others	Reserved	

The FIP Descriptor List Length field shall be set to the length in words of all FIP descriptor(s) that follow. ~~A receiver shall ignore any data beyond the length specified in this field.~~

The Fabric Provided (FP) bit and Server Provided (SP) bit settings are dependent on the FIP operation and shall be set as specified in table 28.

**Table 27 – FP bit and SP bit setting**

Bit	FIP operation	Setting
FP	Discovery Solicitation Discovery Advertisement	Set to 1 if originating device supports FPMA. Set to 0 if originating device does not support FPMA.
	FLOGI Request <sup>a</sup> FDISC_NPIV Request <sup>a</sup>	Set to 1 if FPMA is requested. Set to 0 if FPMA is not supported.
	FLOGI LS_ACC FDISC_NPIV LS_ACC	Set to 1 if FPMA is granted. Set to 0 if SPMA is granted.
	SP	Discovery Solicitation Discovery Advertisement
FLOGI Request <sup>a</sup> FDISC_NPIV Request <sup>a</sup>		Set to 1 if SPMA is requested. Set to 0 if SPMA is not supported.
FLOGI LS_ACC FDISC_NPIV LS_ACC		Set to 1 if SPMA is granted. Set to 0 if FPMA is granted.
a Both the FP bit and SP bit may be set to 1 in a FLOGI Request or FDISC_NPIV Request, but at least one of the bits shall be set to 1.		

**Table 28 – FP bit and SP bit setting**

Bit	FIP Protocol	FIP Operation (see table 49)	Setting
FP	Discovery	Discovery Solicitation <sup>a</sup>	Set to one if the originating device supports FPMA.
		Discovery Advertisement <sup>a</sup>	Set to zero if the originating device does not support FPMA.
	Virtual Link Instantiation	FIP FLOGI Request <sup>b</sup>	Set to one if FPMA is requested.
		FIP NPIV FDISC Request <sup>b</sup>	Set to zero if FPMA is not requested.
		FIP FLOGI LS_ACC <sup>c</sup>	Set to one if FPMA is granted.
		FIP NPIV FDISC LS_ACC <sup>c</sup>	Set to zero if FPMA is not granted.
All others	All others	Reserved	
SP	Discovery	Discovery Solicitation <sup>a</sup>	Set to one if the originating device supports SPMA.
		Discovery Advertisement <sup>a</sup>	Set to zero if the originating device does not support SPMA.
	Virtual Link Instantiation	FIP FLOGI Request <sup>b</sup>	Set to one if SPMA is requested.
		FIP NPIV FDISC Request <sup>b</sup>	Set to zero if SPMA is not requested.
		FIP FLOGI LS_ACC <sup>c</sup>	Set to one if SPMA is granted.
		FIP NPIV FDISC LS_ACC <sup>c</sup>	Set to zero if SPMA is not granted.
All others	All others	Reserved	
<p><sup>a</sup> Solicitation or Advertisement messages with the FP and SP bits both set to zero should not be generated and such messages shall be ignored on reception.</p> <p><sup>b</sup> Both the FP bit and SP bit may be set to one in a FLOGI Request or NPIV FDISC Request, but at least one of the bits shall be set to one.</p> <p><sup>c</sup> Only one of the FP bit and SP bit shall be set to one in a FLOGI LS_ACC or NPIV FDISC LS_ACC. They shall not have the same value.</p>			

The Solicited (S) bit shall be set to ~~1~~one in ~~a-solicited unicast Discovery Advertisements~~ (i.e., Discovery ~~Advertisement that is Advertisements~~ transmitted in response to a Discovery Solicitation). The S bit shall be set to ~~0~~zero in ~~a-unsolicited multicast Discovery Advertisements~~ (i.e., Discovery ~~Advertisement that is Advertisements~~ not transmitted in response to a Discovery Solicitation). The S bit is reserved for all other FIP operations.

The FCF (F) bit shall be set to ~~1~~one in a Discovery Solicitation or Discovery Advertisement or ~~in a FIP VLAN Request~~ if the originating device is an FCF. The F bit shall be set to ~~0~~zero in a Discovery Solicitation or Discovery Advertisement or ~~in a FIP VLAN Request~~ if the originating device is not an FCF. The F bit is reserved for all other FIP operations.

The Available for Login (A) bit shall be set to ~~1~~one in a Discovery Advertisement if the originating FCF is available to process ~~Virtual Link instantiation requests~~FIP FLOGI, FIP NPIV FDISC, or FIP ELP Requests (see 7.7.2). The A bit shall be set to ~~0~~zero in a Discovery Advertisement if the origi-

nating FCF is not available to process ~~Virtual Link instantiation requests~~ FIP FLOGI, FIP NPV FDISC, or FIP ELP Requests. The A bit is reserved for all other FIP operations.

The FIP Descriptor(s) field ~~contains~~ shall contain one or more FIP descriptors (see ~~7.7.6.3~~ see 7.7.6.3).

~~The FIP\_Pad field is used in solicited Discovery Advertisements to extend the frame length to indicate the maximum frame length supported by the originator (see 7.7.7.3).~~

The FIP\_Pad field shall be used in solicited unicast Discovery Advertisements to extend the Encapsulated FIP frame (see table 24) to have a length that matches the Max\_FCoE\_Size field value in the Max FCoE Size descriptor in the Discovery Solicitation to which the Discovery Advertisement is responding (see 7.7.7.3). The FIP\_Pad field shall be of zero length (i.e., not present) for all other FIP operations.

Received FIP messages shall be checked for correct formatting before any FIP descriptor processing occurs. A malformed FIP message shall be discarded and should be reported in a vendor specific way. The checks for correct formatting include:

- a) The FIP Descriptor List Length value matches the sum of the descriptors' lengths in the FIP Descriptor List;
- b) The FIP operation code and subcodes are valid (see table 26);
- c) The critical descriptors (see 7.7.6.3.1) required by the operation code and subcode are present;
- d) No critical descriptors other than the ones required by the operation code and subcode are present; and
- e) Descriptors use valid values for MAC addresses (see 7.7.6.3.3), FKA\_ADV\_PERIOD (see table 52) and VLAN IDs (see 7.7.6.3.15).

### 7.7.6.3 FIP descriptors

#### 7.7.6.3.1 FIP descriptor overview

FIP descriptors are specified using a TLV format (i.e., ~~Type~~ Type, Length, Value). The length field value shall be specified as the number of words in the FIP descriptor including the TLV format. FIP descriptor type values are split into two ranges, critical and non-critical, as specified in table 29.

**Table 29 – FIP descriptor type value ranges**

Range	Value	Description
Critical	<del>0</del> 0 .. 127	An FCoE Controller that receives a FIP message with an unknown critical descriptor shall discard the FIP message.
Non-critical	<del>128-128</del> 128 .. 255	An FCoE Controller that receives a FIP message with one or more unknown non-critical <del>descriptors</del> descriptors shall ignore the unknown descriptors and continue to process the FIP message.

A descriptor with an invalid length value shall be considered invalid. If that descriptor is critical, the entire FIP operation shall be discarded. If that descriptor is not critical, the descriptor shall be ignored.

The FIP descriptor types are specified in table 30. See table 49 for how they are used.

**Table 30 – FIP descriptor types**

Range	Type	FIP Descriptor	Reference
Critical	0	Reserved	
	1	Priority	7.7.6.3.2
	2	MAC address	7.7.6.3.3
	3	FC-MAP	7.7.6.3.4
	4	Name_Identifier	7.7.6.3.5
	5	Fabric	7.7.6.3.6
	6	Max FCoE Size	7.7.6.3.7
	7	FLOGI <sup>a</sup>	7.7.6.3.8
	8	<del>FDISC_NPIV</del> NPIV <del>FDISC</del> <sup>a</sup>	7.7.6.3.9
	9	LOGO <sup>a</sup>	7.7.6.3.10
	10	ELP <sup>a</sup>	7.7.6.3.11
	11	<del>VN_Port</del> Vx_Port Identification	7.7.6.3.12
	12	FKA_ADV_Period	7.7.6.3.13
	13	Vendor_ID	7.7.6.3.14
	14	VLAN	7.7.6.3.15
Non-critical	<del>15-15</del> .. 127	Reserved	
	<del>128-128</del> .. 240	Reserved	
	<del>241-241</del> .. 254	Vendor Specific	7.7.6.3.16
	255	Reserved	

a The FC CRC, SOF, and EOF shall not be included in the FIP descriptor.

**7.7.6.3.2 FIP Priority descriptor**

The FIP Priority descriptor is used in FIP operations as shown in table 49. An ENode may use the value provided in the Priority descriptor of received Discovery Advertisements ~~originated by an FCF to select the FCF-MAC to indicate a priority which to an ENode when multiple Discovery Advertisements are received~~ perform FIP FLOGI. The default value for the Priority field is DEFAULT\_FIP\_PRIORITY (see table 52). The highest priority value is 0 and the lowest priority value is 255 (i.e., lower numerical values indicate higher priorities).

The FIP Priority descriptor format ~~is~~ shall be as specified in table 31.

**Table 31 – FIP Priority descriptor format**

Bit	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0	
Word	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
0	Type (4)= 01h				Length (4)= 01h								Reserved								Priority											

**Priority:** the Priority value associated with the sending FCF-MAC.

**7.7.6.3.3 FIP MAC address descriptor**

The FIP MAC address descriptor is used in ~~Discovery Solicitations, Discovery Advertisements, FIP Keep Alive messages, FIP Clear Virtual Links messages, and specific Virtual Link Instantiation Link Requests and Replies~~ operations as shown in table 49.

The FIP MAC address descriptor format ~~is~~ shall be as specified in table 33.

**Table 32 – ~~FIP MAC address descriptor format~~**

Bit	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0
Word	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
0	Type (2)				Length (2)								MAC address[0]								MAC address[1]											
1	MAC address[2]				MAC address[3]								MAC address[4]								MAC address[5]											

**Table 33 – FIP MAC address descriptor format**

Bit	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0																
Word	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0																
0	Type = 02h				Length = 02h								MSB																																			
1	MAC address																																LSB															

**MAC address:** the MAC address carried in the descriptor. Valid MAC addresses are unicast addresses.

**7.7.6.3.4 FIP FC-MAP descriptor**

The FIP FC-MAP descriptor is used in ~~Discovery Solicitations originated by an FCF~~FIP operations as shown in table 49.

The FIP FC-MAP descriptor format ~~is~~ shall be as specified in ~~table 33~~table 34.

**Table 34 – FIP FC-MAP descriptor format**

Bit	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0
Word	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
0	Type (3)= 03h				Length (2)= 02h								Reserved																			
1	Reserved				FC-MAP[0] MSB								FC-MAP[1]								FC-MAP[2] LSB											

**FC-MAP:** the value to be used as the most significant 24 bits in FPMAs (see 7.5a).

### 7.7.6.3.5 FIP Name\_Identifier descriptor

The FIP Name\_Identifier descriptor is used in ~~Discovery Solicitations originated by an ENode and Discovery Solicitations and Discovery Advertisements originated by an FCFFIP~~ operations as shown in table 49.

The FIP Name\_Identifier descriptor format ~~is shall be as~~ specified in table 35.

**Table 35 – FIP Name\_Identifier descriptor format**

Word	Bit 3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0	
0	Type (4)= 04h				Length (3)= 03h								Reserved																			
1	MSB																															
2	Name_Identifier																LSB															

**Name\_Identifier:** the Name\_Identifier (see FC-FS-3) carried in the descriptor.

### 7.7.6.3.6 FIP Fabric descriptor

The FIP Fabric descriptor is used in ~~Discovery Advertisements originated by an FCFFIP~~ operations as shown in table 49.

The FIP Fabric descriptor format ~~is shall be as~~ specified in table 36.

**Table 36 – FIP Fabric\_Name-Fabric descriptor format**

Word	Bit 3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0	
0	Type (5)= 05h				Length (4)= 04h								VF_ID																			
1	Reserved				FC-MAP[0] MSB								FC-MAP[1]								FC-MAP[2] LSB											
2	MSB																															
3	Fabric_Name																LSB															

**VF\_ID:** the VF\_ID (see FC-FS-3) associated with the Fabric, if any.

**FC-MAP:** the value to be used as the most significant 24 bits in FPMAs (see 7.5a).

**Fabric\_Name:** the Fabric\_Name (see FC-FS-3) identifying the Fabric.

### 7.7.6.3.7 FIP Max FCoE Size descriptor

The FIP Max FCoE Size descriptor is used in ~~Discovery Solicitations originated by an ENode or FCFFIP~~ operations as shown in table 49.

The FIP Max FCoE Size descriptor format ~~is~~ shall be as specified in table 37.

**Table 37 – FIP Max FCoE Size descriptor format**

Word	Bit	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0												
0	Type	(6)= 06h											Length (4)= 01h																Max_FCoE_Size															

**Max\_FCoE\_Size:** the size in bytes to which the Encapsulated FIP frame (see table 24) in a solicited unicast Discovery Advertisement is requested to be extended.

**7.7.6.3.8 FIP FLOGI descriptor**

The FIP FLOGI descriptor is used in FIP ~~Fabric login requests and replies~~ operations as shown in table 49.

The FIP FLOGI descriptor format ~~is~~ shall be as specified in table 38.

**Table 38 – FIP FLOGI descriptor format**

Word	Bit	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0												
0	Type	(7)= 07h											Length																Reserved															
1	MSB																																											
n	FLOGI Request or FLOGI LS_ACC/LS_RJT																LSB																											

~~The Length field value~~ **Length:** shall be set to 36 for a FLOGI Request and a FLOGI LS\_ACC, or to 9 for a FLOGI LS\_RJT.

**FLOGI Request or FLOGI LS\_ACC/LS\_RJT:** an encapsulated FLOGI Request, FLOGI LS\_ACC, or FLOGI LS\_RJT shall be a complete Fibre Channel frame content (see FC-FS-3) with a Fibre Channel Frame\_Header and an ELS payload but without the CRC field. In an FLOGI Request or FLOGI LS\_ACC, the Payload bit shall be set to zero (see FC-LS-2).

**7.7.6.3.9 FIP ~~FDISC\_NPIV~~ NPIV FDISC descriptor**

The FIP ~~FDISC\_NPIV~~ NPIV FDISC descriptor is used in FIP ~~NPIV-based Fabric login requests and replies~~ operations as shown in table 49.

The FIP ~~FDISC\_NPIV~~ NPIV FDISC descriptor format ~~is~~ shall be as specified in table 39.

**Table 39 – FIP ~~FDISC\_NPIV~~ NPIV FDISC descriptor format**

Word	Bit	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0												
0	Type	(8)= 08h											Length																Reserved															
1	MSB																NPIV FDISC Request or NPIV FDISC LS_ACC/LS_RJT																											
n	LS_ACC/LS_RJT																LSB																											

~~The Length field value~~ **Length:** shall be set to 36 for an FDISC Request and FDISC LS\_ACC, or to 9 for an FDISC LS\_RJT.

**NPIV FDISC Request or NPIV FDISC LS\_ACC/LS\_RJT:** an encapsulated FDISC Request, FDISC LS\_ACC, or FLOGI LS\_RJT shall be a complete Fibre Channel frame content (see FC-FS-3) with a Fibre Channel Frame\_Header and an ELS payload but without the CRC field. In an FLOGI Request or FLOGI LS\_ACC, the Payload bit shall be set to zero (see FC-LS-2).

**7.7.6.3.10 FIP LOGO descriptor**

The FIP LOGO descriptor is used ~~for in FIP Fabric logout requests and replies~~ operations as shown in table 49.

The FIP LOGO descriptor format ~~is shall be as~~ specified in table 40.

**Table 40 – FIP LOGO descriptor format**

Word	Bit 3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0
0	Type <del>(9)</del> = 09h										Length										Reserved										
1	MSB																														
n	LOGO Request or LOGO LS_ACC/LS_RJT															LSB															

~~The Length field value~~ **Length:** shall be set to 11 for a LOGO Request, ~~10-8~~ for a LOGO LS\_ACC, or to 9 for a LOGO LS\_RJT.

**LOGO Request or LOGO LS\_ACC/LS\_RJT:** an encapsulated LOGO Request, LOGO LS\_ACC, or LOGO LS\_RJT shall be a complete Fibre Channel frame content (see FC-FS-3) with a Fibre Channel Frame\_Header and an ELS payload but without the CRC field (see FC-LS-2).

**7.7.6.3.11 FIP ELP descriptor**

The FIP ELP descriptor is used in FIP ~~Exchange Link Parameter requests and replies~~ operations as shown in table 49.

The FIP ELP descriptor format ~~is shall be as~~ specified in table 41.

**Table 41 – FIP ELP descriptor format**

Word	Bit 3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0
0	Type <del>(10)</del> = 0Ah										Length										Reserved										
1	MSB																														
n	ELP Request or ELP SW_ACC/SW_RJT															LSB															

~~The Length field value~~ **Length:** shall be set to 33 for an ELP Request and ELP SW\_ACC, or to 9 for an ELP SW\_RJT.

**ELP Request or ELP SW\_ACC/SW\_RJT:** an encapsulated ELP Request, ELP SW\_ACC, or ELP SW\_RJT shall be a complete Fibre Channel frame content (see FC-FS-3) with a Fibre Channel Frame\_Header and an SW\_ILS payload but without the CRC field (see FC-SW-5).





The FIP Vendor Specific descriptor format ~~is shall be as~~ specified in table 47.

**Table 47 – FIP Vendor Specific descriptor format**

Bit	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	9	8	7	6	5	4	3	2	1	0		
Word	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
0	Type								Length								Reserved															
1	MSB																															
2	Vendor_ID																LSB															
3	MSB																															
n	Vendor Specific Information																LSB															

~~An FC-BB\_E device is not required to provide a FIP Vendor Specific descriptor for normal operation.~~

**Type:** the FIP Vendor Specific descriptors are identified by a type value in the range 241 .. 254, inclusive.

**Length:** shall be set to the length in words of the descriptor.

**Vendor\_ID:** the vendor's Vendor\_ID value.

**Vendor Specific Information:** defined by the vendor.

**7.7.7 FIP operations**

**7.7.7.1 FIP operations overview**

~~Each FIP operation shall contain one or more FIP descriptors with the payload and order as specified in table 49.~~ Table 49 specifies the FIP descriptors required in each FIP operation and the recommended order in ~~that which~~ they should be encapsulated by a transmitting FCoE Controller. ~~Additional descriptors (e.g. In certain cases, as indicated, FIP Vendor Specific descriptors) may be present~~ strict ordering is required. A receiving FCoE Controller shall process unknown descriptors according to the criticality of the FIP descriptor (see 7.7.6.3.1). Unless otherwise specified (e.g., for a FIP FLOGI Request), a receiving FCoE Controller shall be able to process the FIP descriptors in any order.

NOTE 7 – The ability to process FIP descriptors in any order is to provide flexibility for future protocol extensions,

**Table 48 – ~~FIP operation payload and order~~**

FIP Operation	Originator	Payload and order
Discovery Solicitation	ENode	1) MAC address 2) Name_Identifier 3) Max FCoE Size
Discovery Solicitation	FCF	1) MAC address 2) FC-MAP 3) Name_Identifier 4) Max FCoE Size
a) Strict ordering of the FIP descriptors is required.		

**Table 48 – FIP operation payload and order (Continued)**

FIP Operation	Originator	Payload and order
Discovery Advertisement	FCF	1) Priority 2) MAC address 3) Name_Identifier 4) Fabric 5) FKA_ADV_Period
FIP FLOGI Request <sup>a</sup>	ENode	1) FLOGI 2) MAC address
FIP FLOGI LS_ACC <sup>a</sup>	FCF	1) FLOGI 2) MAC address
FIP FLOGI LS_RJT <sup>a</sup>	FCF	1) FLOGI
FIP NPIV FDISC Request <sup>a</sup>	ENode	1) FDISC_NPIV 2) MAC address
FIP NPIV FDISC LS_ACC <sup>a</sup>	FCF	1) FDISC_NPIV 2) MAC address
FIP NPIV FDISC LS_RJT <sup>a</sup>	FCF	1) FDISC_NPIV
FIP Fabric LOGO <sup>a</sup>	ENode or FCF	1) LOGO 2) MAC address
FIP Fabric LOGO LS_ACC <sup>a</sup>	ENode or FCF	1) LOGO 2) MAC address
FIP Fabric LOGO LS_RJT <sup>a</sup>	ENode or FCF	1) LOGO
FIP ELP Request <sup>a</sup>	FCF	1) ELP 2) MAC address
FIP ELP SW_ACC <sup>a</sup>	FCF	1) ELP 2) MAC address
FIP ELP SW_RJT <sup>a</sup>	FCF	1) ELP
FIP Keep Alive	ENode	1) MAC address 2) Vx_Port Identification
FIP Clear Virtual Links	FCF	1) MAC address 2) Name_Identifier 3) Vx_Port Identification(s)
FIP VLAN Request	ENode or FCF	1) MAC address
FIP VLAN Notification	FCF	1) MAC address 2) List of VLAN
FIP Vendor Specific	ENode or FCF	1) Vendor_ID 2) Descriptor(s)
a) Strict ordering of the FIP descriptors is required.		

Two group addresses (see table 52) are used for Discovery Solicitations and Discovery Advertisements. The All ENode-MAGS group address is used to address all ENode devices and the All-FCF-MAGS group address is used to address all FCF devices.

A FIP operation shall contain the expected critical descriptors (see table 49) and may contain additional non-critical descriptors. If some critical descriptors are missing or unexpected, the FIP operation shall be discarded and it should be reported in a vendor specific way.

**Table 49 – FIP operation descriptors and order**

FIP Operation	FIP Protocol Code/Subcode <sup>a</sup>	Originator	Expected Descriptors and order
Discovery Solicitation (see 7.7.7.2.1)	0001h / 01h	ENode	1) MAC address 2) Name_Identifier 3) Max FCoE Size
Discovery Solicitation (see 7.7.7.2.2)	0001h / 01h	FCF	1) MAC address 2) FC-MAP 3) Name_Identifier 4) Max FCoE Size
Discovery Advertisement (see 7.7.7.2)	0001h / 02h	FCF	1) Priority 2) MAC address 3) Name_Identifier 4) Fabric 5) FKA_ADV_Period
FIP FLOGI Request <sup>b</sup> (see 7.7.7.4.3)	0002h / 01h	ENode	1) FLOGI 2) MAC address
FIP FLOGI LS_ACC <sup>b</sup> (see 7.7.7.4.3)	0002h / 02h	FCF	1) FLOGI 2) MAC address
FIP FLOGI LS_RJT <sup>b</sup> (see 7.7.7.4.3)	0002h / 02h	FCF	1) FLOGI
FIP NPIV FDISC Request <sup>b</sup> (see 7.7.7.4.3)	0002h / 01h	ENode	1) NPIV FDISC 2) MAC address
FIP NPIV FDISC LS_ACC <sup>b</sup> (see 7.7.7.4.3)	0002h / 02h	FCF	1) NPIV FDISC 2) MAC address
FIP NPIV FDISC LS_RJT <sup>b</sup> (see 7.7.7.4.3)	0002h / 02h	FCF	1) NPIV FDISC
FIP Fabric LOGO <sup>b</sup> (see 7.7.7.4.4)	0002h / 01h	ENode <sup>c</sup>	1) LOGO 2) MAC address
FIP Fabric LOGO LS_ACC <sup>b</sup> (see 7.7.7.4.4)	0002h / 02h	FCF <sup>c</sup>	1) LOGO 2) MAC address
<p><sup>a</sup> Virtual Link Instantiation requests are differentiated by the carried descriptors.</p> <p><sup>b</sup> Strict ordering of the FIP descriptors is required in transmission. A receiving FCoE controller is not required to be able to process these FIP operations in any order other than that specified here.</p> <p><sup>c</sup> FCFs are allowed to generate FIP LOGO, however a FIP Clear Virtual Link is the recommended way for an FCF to de-instantiate a Virtual Link, except for the specific cases where LOGO is required (see FC-SP).</p> <p><sup>d</sup> The Vx_Port Identification descriptor is present only in VN_Port FIP Keep Alive operations, it is not present in ENode FIP Keep Alive operations.</p> <p><sup>e</sup> A FIP Clear Virtual Links operation intended to de-instantiate VN_Port to VF_Port Virtual Links contains zero or more Vx_Port Identification descriptors. A FIP Clear Virtual Links operation intended to de-instantiate a VE_Port to VE_Port Virtual Link contains one Vx_Port Identification descriptor.</p>			

**Table 49 – FIP operation descriptors and order (Continued)**

FIP Operation	FIP Protocol Code/Subcode <sup>a</sup>	Originator	Expected Descriptors and order
FIP Fabric LOGO LS_RJT <sup>b</sup> (see 7.7.7.4.4)	0002h / 02h	FCF <sup>c</sup>	1) LOGO
FIP ELP Request <sup>a</sup> (see 7.7.7.4.5)	0002h / 01h	FCF	1) ELP 2) MAC address
FIP ELP SW_ACC <sup>a</sup> (see 7.7.7.4.5)	0002h / 02h	FCF	1) ELP 2) MAC address
FIP ELP SW_RJT <sup>a</sup> (see 7.7.7.4.5)	0002h / 02h	FCF	1) ELP
FIP Keep Alive (see 7.7.7.5)	0003h / 01h	ENode	1) MAC address 2) Vx_Port Identification <sup>d</sup>
FIP Clear Virtual Links (see 7.7.7.6)	0003h / 02h	FCF	1) MAC address 2) Name_Identifier 3) Vx_Port Identification(s) <sup>e</sup>
FIP VLAN Request (see 7.7.7.7)	0004h / 01h	ENode or FCF	1) MAC address
FIP VLAN Notification (see 7.7.7.8)	0004h / 02h	FCF	1) MAC address 2) VLAN(s)
FIP Vendor Specific (see 7.7.7.9)	FFF8h .. FFFEh / 00h .. FFh	ENode or FCF	1) Vendor_ID 2) Descriptor(s)
<p><sup>a</sup> Virtual Link Instantiation requests are differentiated by the carried descriptors.</p> <p><sup>b</sup> Strict ordering of the FIP descriptors is required in transmission. A receiving FCoE controller is not required to be able to process these FIP operations in any order other than that specified here.</p> <p><sup>c</sup> FCFs are allowed to generate FIP LOGO, however a FIP Clear Virtual Link is the recommended way for an FCF to de-instantiate a Virtual Link, except for the specific cases where LOGO is required (see FC-SP).</p> <p><sup>d</sup> The Vx_Port Identification descriptor is present only in VN_Port FIP Keep Alive operations, it is not present in ENode FIP Keep Alive operations.</p> <p><sup>e</sup> A FIP Clear Virtual Links operation intended to de-instantiate VN_Port to VF_Port Virtual Links contains zero or more Vx_Port Identification descriptors. A FIP Clear Virtual Links operation intended to de-instantiate a VE_Port to VE_Port Virtual Link contains one Vx_Port Identification descriptor.</p>			

## 7.7.7.2 FIP Discovery Solicitation

### 7.7.7.2.1 ENode FIP Discovery Solicitation

As shown in table 49, a Discovery Solicitation operation originated by the FCoE Controller of an ENode MAC contains a MAC address descriptor (see 7.7.6.3.3), a Name\_Identifier descriptor (see 7.7.6.3.5) and a Max FCoE Size descriptor (see 7.7.6.3.7).

~~ENode MACs may transmit Discovery Solicitations to VF\_Port capable FCF-MACs to request the FCF-MAC to reply with a solicited Discovery Advertisement. The A~~ Discovery Solicitation shall message may be unicast (i.e., addressed to a specific FCF-MAC-MAC) or multicast (i.e., unicast) or addressed to the All-FCF-MACS-MACs group address).

The MAC address field in the MAC address descriptor shall be set to the MAC address to use for subsequent solicited Discovery Advertisements from VF\_Port capable FCF-MACs.

The Name\_Identifier field in the Name\_Identifier descriptor shall be set to the Node\_Name of the ~~E~~Node or to zero.

NOTE 8 – The Name\_Identifier field may be set to zero if the Node\_Name is ambiguous ~~(e.g., multiple virtual ENodes are implemented at or not yet available when the FC-BB-E device)~~Solicitation is sent.

The Max\_FCoE\_Size field in the Max FCoE Size descriptor shall be set to the maximum ~~FCoE payload~~-size ~~that the ENode MAC is able to receive~~use for FCoE traffic. The Max\_FCoE\_Size value shall be specified as the number of octets starting ~~from with and including~~ the Version field, ~~inclusive, up to and including~~ the ~~FCS, exclusive~~ Reserved field following the EOF field (see table 21).

~~If an ENode receives a Discovery Solicitation, then the Discovery Solicitation shall be discarded.~~

### 7.7.7.2.2 FCF FIP Discovery Solicitation

As shown in table 49, a Discovery Solicitation operation originated by the FCoE Controller of a VE\_Port capable FCF-MAC contains a MAC address descriptor (see 7.7.6.3.3), an FC-MAP descriptor (see 7.7.6.3.4), a Name\_Identifier descriptor (see 7.7.6.3.5), and a Max FCoE Size descriptor (see 7.7.6.3.7).

~~VE\_Port capable FCF-MACs may transmit A Discovery Solicitations to VE\_Port capable FCF-MACs to request the FCF-MACs to reply with a solicited Discovery Advertisement. The Discovery Solicitation shall message may be unicast (i.e., addressed to a specific FCF-MAC-MAC) or multicast (i.e., unicast) or addressed to the All-FCF-MACs-MACs group address).~~

The MAC address field in the MAC address descriptor shall be set to the MAC address to use for subsequent solicited Discovery Advertisements from VE\_Port capable FCF-MACs.

For FCF-MACs that support FPMA, the FC-MAP field in the FC-MAP descriptor shall be set to the FC-MAP value the FCF-MAC is using. If the FC-MAP value is not administratively configured, then the FC-MAP value shall be set to DEFAULT\_FC-MAP (see table 52).

For FCF-MACs that only support SPMA, the FC-MAP field in the FC-MAP descriptor ~~is reserved~~shall be set to zero.

The Name\_Identifier field in the Name\_Identifier descriptor shall be set to the Switch\_Name of the FCF.

The Max\_FCoE\_Size field in the Max FCoE Size descriptor shall be set to the maximum ~~FCoE payload~~-size ~~that the VE\_Port capable FCF-MAC is able to receive~~use for FCoE traffic. The Max\_FCoE\_Size value shall be specified as the number of octets starting ~~from with and including~~ the Version field, ~~inclusive, up to and including~~ the ~~Reserved~~ field following the ~~FCS, exclusive~~ EOF field (see table 21).

~~After receiving a valid Discovery Solicitation originated by an FCF (i.e., the F bit is set to one), an FCF shall perform the following verification steps:~~

- a) ~~the Name\_Identifier field value in the Discovery Solicitation is different than the Switch\_Name of the recipient FCF; and~~

- b) ~~the FC-MAP field value in the Discovery Solicitation is zero or is the same as the FC-MAP value of the recipient FCF.~~

~~If any verification step is false, then the Discovery Solicitation shall be discarded.~~

~~NOTE 9—It is possible for an FCF to receive a Discovery Solicitation that it originated because Discovery Solicitations sent to the All-FCF-MACs group address may be forwarded to other ports on the same FCF by intermediate ethernet bridges.~~

### 7.7.7.3 FIP Discovery Advertisements

~~VF\_Port capable FCF-MACs shall periodically transmit unsolicited Discovery Advertisements to the All-ENode-MACs group address. The period shall be FKA\_ADV\_PERIOD and randomized with a random delay uniformly distributed between 0 and 100 ms to avoid large bursts of multicast traffic within the ethernet network.~~

~~VE\_Port capable FCF-MACs shall periodically transmit unsolicited Discovery Advertisements to the All-FCF-MACs group address. The period shall be FKA\_ADV\_PERIOD and randomized with a random delay uniformly distributed between 0 and 100 ms to avoid large bursts of multicast traffic within the network.~~

~~An FCF-MAC shall transmit a solicited Discovery Advertisement in response to a received Discovery Solicitation (see 7.7.7.2). A solicited Discovery Advertisement shall be transmitted to the MAC address field value specified in the MAC address descriptor in the received Discovery Solicitation. The solicited Discovery Advertisement shall be transmitted within D\_A\_TOV (see table 52) seconds upon reception of the Discovery Solicitation. Discovery Advertisements transmitted in response to a multicast Discovery Solicitation should be delayed by a random time uniformly distributed between 0 and 100 ms to avoid large bursts of multicast traffic within the network.~~

~~An FCF may receive Discovery Solicitations from the same FC-BB\_E device on multiple FCF-MACs. In this case, a separate solicited Discovery Advertisement shall be transmitted on each of the FCF-MACs that received the Discovery Solicitation. The FC-BB\_E device that transmitted the Discovery Solicitation may determine that it received multiple solicited Discovery Advertisements from the same FCF since the value of the Name\_Identifier field in the Name\_Identifier descriptor is the same in each of the solicited Discovery Advertisements.~~

~~As shown in table 49, a Discovery Advertisement operation contains a Priority descriptor (see 7.7.6.3.2), a MAC address descriptor (see 7.7.6.3.3), a Name\_Identifier descriptor (see 7.7.6.3.5), a Fabric descriptor (see 7.7.6.3.6), and a FKA\_ADV\_Period descriptor (see 7.7.6.3.13).~~

~~When a Discovery Advertisement message is solicited, it shall be unicast (i.e., addressed to a specific ENode MAC or FCF-MAC address). When a Discovery Advertisement message is unsolicited, it shall be multicast (i.e., addressed to the All-ENode-MACs or to the All-FCF-MACs group addresses).~~

~~The Priority field in the Priority descriptor shall be set to the value the **FCF-originating FCF-MAC** is using. If the priority value is not administratively configured, then the priority value shall be set to DEFAULT\_FIP\_PRIORITY (see table 52).~~

~~The MAC address field in the MAC address descriptor shall be set to the **originating FCF-MAC** address.~~

~~The Name\_Identifier field in the Name\_Identifier descriptor shall be set to the Switch\_Name of the **originating FCF**.~~

Discovery Advertisements shall only provide a single Fabric descriptor. **All Discovery Advertisements from an FCF in a certain VLAN shall provide the same single Fabric descriptor.** The VF\_ID field in the Fabric descriptor shall be set to the VF\_ID (see FC-FS-3) identifying the advertised FC Fabric. If a VF\_ID is not defined for the advertised FC Fabric, the VF\_ID field shall be set to zero. For FCFs that support FPMA, the FC-MAP field in the Fabric descriptor shall be set to the FC-MAP value the FCF is using. If the FC-MAP value is not administratively configured, then the FC-MAP value shall be set to DEFAULT\_FC-MAP (see table 52). For FCFs that only support SPMA, the FC-MAP field in the Fabric descriptor ~~is reserved and~~ shall be set to zero. The Fabric\_Name field in the Fabric descriptor shall be set to the Fabric\_Name for the **originating** FCF.

The FKA\_ADV\_PERIOD field in the FKA\_ADV\_Period descriptor shall be set to the FKA\_ADV\_PERIOD value the FCF is advertising (see table 52).

~~For a solicited Discovery Advertisement, the~~ The FIP\_Pad field shall be ~~set used to extend~~ the ~~length required Encapsulated FIP frame~~ (see table 24) to ~~create an 802.3 frame with have~~ a ~~payload~~-length that matches the Max\_FCoE\_Size field value in the Max FCoE Size descriptor in the ~~received Discovery Solicitation to which the~~ Discovery ~~Solicitation~~Advertisement is responding. The FIP\_Pad field ~~values value~~ shall be set to ~~reserved zero and not checked in reception~~. For an unsolicited Discovery ~~Advertisements~~Advertisement, the FIP\_Pad field shall be of zero length (i.e., not present).

#### 7.7.7.4 FIP Virtual Link Instantiation Requests and Replies

##### 7.7.7.4.1 FIP Virtual Link Instantiation Requests and Replies overview

~~FIP Virtual Link Instantiation Requests and Replies shall be transmitted:~~

- ~~a) using the FIP frame format (see 7.7.6.1);~~
- ~~b) as a single frame Sequence; and~~
- ~~c) without Login Extension Data (see FC-FS-3), if applicable.~~

##### 7.7.7.4.2 ~~Fabric login (FLOGI or NPIV FDISC)~~

~~When an ENode transmits a FIP FLOGI Request or NPIV FDISC Request it shall indicate the addressing mode it supports (i.e., FPMA, SPMA, or both).~~

~~For a Fabric login operation using FLOGI, the FLOGI descriptor shall contain a FLOGI Request, FLOGI\_LS\_ACC, or FLOGI\_LS\_RJT payload. The FIP Subcode field shall be set to 01h for an FLOGI Request and to 02h for an FLOGI\_LS\_ACC or FLOGI\_LS\_RJT.~~

~~For a Fabric login operation using NPIV FDISC, the FDISC\_NPIV descriptor shall contain a NPIV FDISC Request, NPIV FDISC\_LS\_ACC, or NPIV FDISC\_LS\_RJT payload. The FIP Subcode field shall be set to 01h for an NPIV FDISC Request and to 02h for an NPIV FDISC\_LS\_ACC or NPIV FDISC\_LS\_RJT.~~

~~If an ENode only supports SPMA or supports both SPMA and FPMA, the MAC address field in the MAC address descriptor shall be set to the proposed MAC address to use for subsequent FCoE frames.~~

~~If an ENode only supports FPMA, the MAC address field in the MAC address descriptor shall be set to the proposed MAC address to use for subsequent FCoE frames, or to all zeroes to indicate no MAC address is proposed.~~

~~If the ENode only supports SPMA, the MAC address specified in the FIP FLOGI Request or NPIV FDISC Request shall be returned in the FIP FLOGI Reply and shall be used as the VN\_Port MAC address for all subsequent FCoE frames.~~

~~If the ENode only supports FPMA, the MAC address specified in the FIP FLOGI Reply frame shall be used as the VN\_Port MAC address for all subsequent FCoE frames. The assigned MAC address shall be a properly formed FPMA MAC address. In this case, the assigned MAC address should be the MAC address proposed in the FIP FLOGI Request or NPIV FDISC Request, if the proposed MAC address is a properly formed FPMA MAC address.~~

~~If the ENode supports both FPMA and SPMA, the assigned MAC address shall be either the MAC address specified in the FIP FLOGI Request or NPIV FDISC Request, or a properly formed FPMA MAC address assigned by the FCF.~~

~~A properly formed FPMA MAC address is one in which the 24 most significant bits equal the Fabric's FC-MAP value and the least significant 24 bits equal the N\_Port\_ID assigned to the VN\_Port by the FCF. This guarantees that FPMAs are unique within the Fabric.~~

~~If both the FCF and ENode support both SPMA and FPMA, the FCF may assign an address of either form:~~

FIP Virtual Link Instantiation Requests and Replies encapsulates an ELS or an SW\_ILS. The encapsulated ELS or SW\_ILS shall be a single-frame Sequence. FIP Virtual Link Instantiation Requests and Replies are used to perform:

- a) Fabric login between ENode MACs and VF\_Port capable FCF-MACs (see 7.7.7.4.3);
- b) Fabric logout between ENode MACs and VF\_Port capable FCF-MACs (see 7.7.7.4.4);
- c) Exchange Link Parameters between VE\_Port capable FCF-MACs (see 7.7.7.4.5).

#### **7.7.7.4.3 Fabric login**

As shown in table 49:

- a) a FIP FLOGI Request operation contains a FLOGI descriptor (see 7.7.6.3.8) and a MAC address descriptor (see 7.7.6.3.3);
- b) a FIP FLOGI LS\_ACC operation contains a FLOGI descriptor (see 7.7.6.3.8) and a MAC address descriptor (see 7.7.6.3.3); and
- c) a FIP FLOGI LS\_RJT operation contains a FLOGI descriptor (see 7.7.6.3.8).
- d) a FIP NPIV FDISC Request operation contains a NPIV FDISC descriptor (see 7.7.6.3.9) and a MAC address descriptor (see 7.7.6.3.3);
- e) a FIP NPIV FDISC LS\_ACC operation contains a NPIV FDISC descriptor (see 7.7.6.3.9) and a MAC address descriptor (see 7.7.6.3.3); and
- f) a FIP NPIV FDISC LS\_RJT operation contains a NPIV FDISC descriptor (see 7.7.6.3.9).

The FLOGI or NPIV FDISC descriptor shall be the first descriptor in the operation.

NOTE 10 – In this way the encapsulated Fibre Channel ELS results at an offset in the FIP frame equal to the offset it would have if it was encapsulated in a FCoE frame.

The FLOGI or NPIV FDISC descriptor shall contain:

- a) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and an FLOGI Request payload or an NPIV FDISC Request payload (see FC-LS-2) but without

the CRC field (see FC-FS-3) for FIP FLOGI Request or NPIV FDISC Request operations. The Payload bit in the FLOGI Request payload or NPIV FDISC Request payload shall be set to zero (see FC-LS-2);

- b) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and an FLOGI LS\_ACC payload or an NPIV FDISC LS\_ACC payload (see FC-LS-2) but without the CRC field (see FC-FS-3) for FIP FLOGI LS\_ACC or FIP NPIV FDISC LS\_ACC operations. The Payload bit in the FLOGI LS\_ACC payload shall be set to zero (see FC-LS-2); and
- c) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and an FLOGI LS\_RJT payload or an NPIV FDISC LS\_RJT payload (see FC-LS-2) but without the CRC field (see FC-FS-3) for FIP FLOGI LS\_RJT or FIP NPIV FDISC LS\_RJT operations.

The MAC address field in the MAC address descriptor of a FIP FLOGI Request operation or a FIP NPIV FDISC Request operation shall contain:

- a) the proposed MAC address to use as VN\_Port MAC address if the ENode is requesting to use SPMA (see table 28);
- b) all zeroes to indicate no MAC address is proposed if the ENode is requesting to use FPMA (see table 28);
- c) the proposed MAC address to use as VN\_Port MAC address if the ENode supports both SPMA and FPMA and leaves the decision of which addressing scheme to use to the FCF (i.e., if both the FP and SP bits are set to one, see table 28).

The MAC address field in the MAC address descriptor of a FIP FLOGI LS\_ACC operation or a FIP NPIV FDISC LS\_ACC operation shall contain the MAC address that the FCF granted for use as VN\_Port MAC address. The FP and SP bits shall be set as shown in table 28. If the FCF granted an SPMA, the granted MAC address shall be the same as the one carried in the MAC address descriptor of the corresponding FIP FLOGI Request operation or FIP NPIV FDISC Request operation, if that MAC address is valid. If the FCF granted an FPMA, the granted MAC address shall be a properly formed FPMA (see 7.5a).

A FIP FLOGI or FIP NPIV FDISC operation shall be processed respectively as the FLOGI or FDISC with S\_ID = 000000h specified in FC-LS-2, ignoring the buffer to buffer flow control parameters. If no response to a FIP FLOGI Request or FIP NPIV FDISC Request is received within the ELS timeout value specified in FC-LS-2, the Exchange resources may be reused and the ABTS protocol (see FC-FS-3) shall not be used.

A successful FIP FLOGI operation instantiates a VF\_Port, a VN\_Port, and a Virtual Link between them. Subsequent FIP NPIV FDISC operations from the same ENode MAC Address as the FIP FLOGI operation associate additional VN\_Ports to the same VF\_Port that was instantiated by the FIP FLOGI operation. Subsequent FIP NPIV FDISC operations from the same ENode MAC address as the FIP FLOGI operation should request the same MAC address type (i.e., FPMA or SPMA) as the FIP FLOGI operation. A subsequent FIP FLOGI operation from the same ENode MAC Address is equivalent to an implicit logout of all the VN\_Ports followed by an FLOGI, as specified in FC-LS-2.

FCFs shall reject FIP FLOGI Requests and NPIV FDISC Requests ~~from ENodes that support only SPMA with the SP bit set to one and propose the FP bit set to zero~~ when the MAC address descriptor contains a MAC address that is not a unicast address. In addition, FCFs shall reject FIP FLOGI Requests and NPIV FDISC Requests for an addressing mode (i.e., SPMA or FPMA) not supported by the FCF. ~~Finally, if~~ If the FCF supports both FPMA and ~~SPMA and the ENode supports only SPMA~~, the FCF shall reject FIP FLOGI and NPIV FDISC ~~requests that contain~~ Requests with the SP bit set to one and the FP bit set to zero when the MAC address descriptor contains a ~~proposed~~ MAC address in which the 24 most significant bits match the FC-MAP in use by the FCF. ~~Rejections of FIP FLOGI~~

Requests and NPIV FDISC Requests are handled with the LS\_RJT Reason Codes and Reason Code Explanations shown in table 50.

**Table 50 – FIP Fabric Login Rejections**

Error Condition	Reason Code (see FC-LS-2)	Reason Code Explanation (see FC-LS-2)
The MAC addressing mode in the FIP FLOGI/FDISC Request is not supported	FIP Error (i.e., 20h)	MAC addressing mode not supported (i.e., 60h)
The MAC address proposed in the MAC address descriptor of a FIP FLOGI/FDISC Request is incorrect for the requested addressing mode	FIP Error (i.e., 20h)	Proposed MAC address incorrectly formed (i.e., 61h)

~~The 802.3 frame source address in a FIP NPIV\_FDISC Request shall be the same as the 802.3 frame source address of the prior FIP FLOGI Request associated with the FIP NPIV FDISC. A successful FIP FLOGI operation creates a VF\_Port. Subsequent FIP NPIV FDISCs with the same 802.3 frame source address as the FIP FLOGI associate additional VN\_Ports to the single VF\_Port.~~

**7.7.7.4.4 Fabric logout**

~~The LOGO descriptor shall contain a Fabric LOGO Request, Fabric LOGO LS\_ACC, or Fabric LOGO LS\_RJT payload. The FIP Subcode field shall be set to 01h for a Fabric LOGO Request and to 02h for a Fabric LOGO LS\_ACC or Fabric LOGO LS\_RJT.~~

As shown in table 49:

- a) a FIP Fabric LOGO Request operation contains a LOGO descriptor (see 7.7.6.3.10) and a MAC address descriptor (see 7.7.6.3.3);
- b) a FIP Fabric LOGO LS\_ACC operation contains a LOGO descriptor (see 7.7.6.3.10) and a MAC address descriptor (see 7.7.6.3.3); and
- c) a FIP Fabric LOGO LS\_RJT operation contains a LOGO descriptor (see 7.7.6.3.10).

The LOGO descriptor shall be the first descriptor in the operation.

NOTE 11 – In this way the encapsulated Fibre Channel ELS results at an offset in the FIP frame equal to the offset it would have if it was encapsulated in a FCoE frame.

The LOGO descriptor shall contain:

- a) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and a Fabric LOGO Request payload (see FC-LS-2) but without the CRC field (see FC-FS-3) for FIP Fabric LOGO Request operations;
- b) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and a Fabric LOGO LS\_ACC payload (see FC-LS-2) but without the CRC field (see FC-FS-3) for FIP Fabric LOGO LS\_ACC operations; and
- c) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and a Fabric LOGO LS\_RJT payload (see FC-LS-2) but without the CRC field (see FC-FS-3) for FIP Fabric LOGO LS\_RJT operations.

~~For a Fabric LOGO Request and Fabric LOGO LS\_ACC, the~~ The MAC address field in the MAC address descriptor of a FIP Fabric LOGO Request and a FIP Fabric LOGO LS\_ACC operation shall be set to the MAC address assigned to the VN\_Port that is being logged out.

A FIP Fabric LOGO operation shall be processed as the Fabric LOGO specified in FC-LS-2.

#### 7.7.7.4.5 Exchange Link Parameters

~~The ELP descriptor shall contain an ELP Request, ELP\_SW\_ACC, or ELP\_SW\_RJT payload. The FIP Subcode field shall be set to 01h for a ELP Request and to 02h for a ELP\_SW\_ACC or ELP\_SW\_RJT.~~

As shown in table 49:

- a) a FIP ELP Request operation contains a ELP descriptor (see 7.7.6.3.11) and a MAC address descriptor (see 7.7.6.3.3);
- b) a FIP ELP SW\_ACC operation contains a ELP descriptor (see 7.7.6.3.11) and a MAC address descriptor (see 7.7.6.3.3); and
- c) a FIP ELP SW\_RJT operation contains a ELP descriptor (see 7.7.6.3.11).

The ELP descriptor shall be the first descriptor in the operation.

NOTE 12 – In this way the encapsulated Fibre Channel SW\_ILS results at an offset in the FIP frame equal to the offset it would have if it was encapsulated in a FCoE frame.

The LOGO descriptor shall contain:

- a) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and a ELP Request payload specifying R\_RDY Flow Control (see FC-SW-5) but without the CRC field (see FC-FS-3) for FIP ELP Request operations;
- b) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and a ELP SW\_ACC payload (see FC-SW-5) but without the CRC field (see FC-FS-3) for FIP ELP SW\_ACC operations; and
- c) a complete Fibre Channel frame content with a Fibre Channel Frame\_Header (see FC-FS-3) and a ELP SW\_RJT payload (see FC-SW-5) but without the CRC field (see FC-FS-3) for FIP ELP SW\_RJT operations.

~~For an ELP Request and ELP\_SW\_ACC, the~~ The MAC address field in the MAC address descriptor of a FIP ELP Request and a FIP ELP SW\_ACC operation shall be set to the MAC address of the destination FCF-~~MAC address~~MAC.

A FIP ELP operation shall be processed as the ELP specified in FC-SW-5, ignoring the buffer to buffer flow control parameters.

#### 7.7.7.5 FIP Keep Alive

As shown in table 49, a FIP Keep Alive operation contains a MAC address descriptor (see 7.7.6.3.3) and zero or one Vx\_Port Identification descriptor (see 7.7.6.3.12).

ENode FIP Keep Alive operations (see 7.7.4.1) contains only a MAC address descriptor. VN\_Port FIP Keep Alive operations (see 7.7.4.1) contain a MAC address descriptor and a Vx\_Port Identification descriptor.

~~The FCoE Controller for ENode MACs that are logged in with one or more VF\_Port capable FCF-MACs shall generate a FIP Keep Alive message every FKA\_ADV\_PERIOD. These FIP Keep Alive~~

messages shall have the ~~ENode's originating~~ ENode MAC address as source ~~address and shall provide only the MAC address descriptor~~address. The MAC address field in the MAC address descriptor shall be set to the ~~ENode's originating~~ ENode MAC address. ~~The FKA\_ADV\_PERIOD timer is obtained from the Discovery Advertisements.~~

~~The FCoE Controller for ENode MACs that are logged in with one or more VF\_Port capable FCF-MACs shall also generate a FIP Keep Alive message on behalf of each logged in VN\_Port every 90 seconds. These FIP Keep Alive messages shall have the VN\_Port's VN\_Port MAC address as source address and shall provide both a MAC address descriptor and Vx\_Port Identification descriptor~~address. The MAC address field in the MAC address descriptor shall be set to the ~~ENode's originating~~ ENode MAC address. In the Vx\_Port Identification descriptor, the MAC address field shall be set to the ~~VN\_Port's VN\_Port~~ VN\_Port MAC address, the Address Identifier field shall be set to the ~~VN\_Port's VN\_Port~~ N\_Port\_ID, and the Port\_Name field shall be set to the ~~VN\_Port's VN\_Port Name~~ VN\_Port N\_Port\_Name.

### 7.7.7.6 FIP Clear Virtual Links

#### 7.7.7.6.1 FIP Clear Virtual Links to an ENode

The FCoE Controller of a VF\_Port capable FCF-MAC may de-instantiate one or more VN\_Port to VF\_Port Virtual Links by transmitting a FIP Clear Virtual Links to an ENode MAC. As shown in table 49, this FIP Clear Virtual Links message shall contain one MAC address descriptor (see 7.7.6.3.3), one Name\_Identifier descriptor (see 7.7.6.3.5), and a list of Vx\_Port Identification descriptors (see 7.7.6.3.12), one for each VN\_Port the Virtual Link with it is requested to be de-instantiated.

~~The FCoE Controller for a VF\_Port capable FCF-MAC may turn down one or more VN\_Port to VF\_Port Virtual Links by transmitting a FIP Clear Virtual Links to an ENode MAC. This FIP Clear Virtual Links message shall contain one MAC address descriptor, one Name\_Identifier descriptor, and a list of Vx\_Port Identification descriptors, one for each VN\_Port the Virtual Link with it is requested to be turned down. The MAC address field in the MAC address descriptor shall be set to the FCF-MAC address of the originating FCF. The Name\_Identifier field in the Name\_Identifier descriptor shall be set to the Switch\_Name of the originating FCF. For each Vx\_Port Identification descriptor, the MAC address field shall be set to the VN\_Port's VN\_Port MAC address, the Address Identifier field shall be set to the VN\_Port's VN\_Port N\_Port\_ID, and the Port\_Name field shall be set to the VN\_Port's VN\_Port Name VN\_Port N\_Port\_Name. The FCoE Controller of a receiving ENode MAC shall ignore a Vx\_Port Identification descriptor not matching any of its instantiated VN\_Ports.~~

#### 7.7.7.6.2 FIP Clear Virtual Links to an FCF

The FCoE Controller for a VE\_Port capable FCF-MAC may ~~turn down de-instantiate~~ a VE\_Port to VE\_Port Virtual Link by sending a FIP Clear Virtual Links to a VE\_Port capable FCF-MAC. ~~This As shown in table 49, this FIP Clear Virtual Links message contains shall contain~~ one MAC address ~~descriptor~~descriptor (see 7.7.6.3.3), one Name\_Identifier ~~descriptor~~descriptor (see 7.7.6.3.5), and one Vx\_Port Identification ~~descriptor~~. ~~The MAC address field in the MAC address descriptor shall be set to the FCF-MAC address. The Name\_Identifier field in the Name\_Identifier descriptor shall be set to the Switch\_Name of the FCF. In the Vx\_Port Identification descriptor, the MAC address field shall be set to the remote FCF-MAC address, the Address Identifier field shall be set to FFFFFFFDh, and the Port\_Name field shall be set to the remote VE\_Port Name (see 7.7.6.3.12).~~

~~The FCoE Controller for a VE\_Port capable FCF-MAC may turn down a VE\_Port to VE\_Port Virtual Link by sending a FIP Clear Virtual Links to a VE\_Port capable FCF-MAC. This FIP Clear Virtual Links message contains one MAC address descriptor, one Name\_Identifier descriptor, and one Vx\_Port Identification descriptor. The MAC address field in the MAC address descriptor shall be set~~

to the FCF-MAC ~~address~~address of the originating FCF-MAC. The Name\_Identifier field in the Name\_Identifier descriptor shall be set to the Switch\_Name of the originating FCF. In the Vx\_Port Identification descriptor, the MAC address field shall be set to the remote FCF-MAC address, the Address Identifier field shall be set to FFFFDh, and the Port\_Name field shall be set to the remote ~~VE\_Port\_Name~~E\_Port\_Name.

**7.7.7.7 FIP VLAN Request**

As shown in table 49, a FIP VLAN Request operation contains a MAC address descriptor (see 7.7.6.3.3). A FIP VLAN Request message may be generated by an ~~ENode's~~ENode MAC or by an FCF-MAC.

When generated by an ~~ENode's~~ENode MAC, the FIP VLAN Request message shall have the F flag set to zero and the MAC address field in the MAC address descriptor shall be set to the ~~ENode's~~originating ENode MAC address.

When generated by an FCF-MAC, the FIP VLAN Request message shall have the F flag set to one and the MAC address field in the MAC address descriptor shall be set to the originating FCF-MAC address.

**7.7.7.8 FIP VLAN Notification**

As shown in table 49, a FIP VLAN Request operation contains a MAC address descriptor (see 7.7.6.3.3) and one or more VLAN descriptors (see 7.7.6.3.15). A FIP VLAN Notification message is generated by an FCF-MAC.

~~The MAC address field in the MAC address descriptor shall be set to the FCF MAC address.~~

The MAC address field in the MAC address descriptor shall be set to the originating FCF-MAC address. The FCoE VID field of each of the FIP VLAN descriptors shall be set to a VID over which the FCF-MAC is offering FC-BB\_E services.

**7.7.7.9 FIP Vendor Specific messages**

FIP Vendor Specific messages may be transmitted by both ENodes and FCFs. ~~As shown in table 49, a FIP Vendor Specific message shall include a Vendor\_ID descriptor (see 7.7.6.3.14) as the first descriptor, followed by a list of one or more additional descriptors. An unknown received Vendor Specific message shall be discarded. An FC-BB\_E device is shall not required to transmit a require use of any Vendor Specific message for normal operation in order to operate in accordance with this standard.~~

**7.8 Timers and constants**

FC-BB\_E timers and constants are specified in table 52.

~~Table 51 – FC-BB\_E timers and constants~~

Timer/Constant	Value	Description	Reference
FIP_TYPE	8914h	The value specified in the 802.3 Type field for a FIP frame.	7.7.6.1

**Table 51 – FC-BB\_E timers and constants (Continued)**

Timer/Constant	Value	Description	Reference
FCoE_TYPE	8906h	The value specified in the 802.3 Type field for an FCoE frame.	7.6
FIP_FRAME_VER	0001b	The value specified in the Version field for an FIP frame.	7.7.6.1
FCoE_FRAME_VER	0000b	The value specified in the Version field for an FCoE frame.	7.6
All-FCoE-MACS	01-10-18-01-00-00	The group address for all FCoE devices.	
All-ENode-MACS	01-10-18-01-00-01	The group address for all ENodes.	
All-FCF-MACS	01-10-18-01-00-02	The group address for all FCFs.	
DEFAULT_FIP_PRIORITY	128	The default value specified in the FIP Priority descriptor.	7.7.6.3.2
DEFAULT_FC-MAP	0EFC00h	The default value for the FC-MAP field in a FIP FC-MAP descriptor.	7.7.6.3.4
D_A_TOV	4	The default value that specifies the number of seconds between discovery advertisements transmitted by FCFs. This value may be administratively configured to any value between 1 and 60, inclusive.	
FKA_ADV_PERIOD	8000	The default value in milliseconds for the periodicity of Discovery Advertisements and FIP Keep Alive messages.	

**Table 52 – FC-BB\_E timers and constants**

Timer/Constant	Value	Description	Reference
FIP_TYPE	8914h	The value specified in the IEEE 802.3 Type field for a FIP frame.	7.7.6.1
FCoE_TYPE	8906h	The value specified in the IEEE 802.3 Type field for an FCoE frame.	7.6
FIP_FRAME_VER	0001b	The value specified in the Version field for an FIP frame.	7.7.6.1
FCoE_FRAME_VER	0000b	The value specified in the Version field for an FCoE frame.	7.6
All-FCoE-MACs	01-10-18-01-00-00	The group address for all FCoE devices.	7.7.1
All-ENode-MACs	01-10-18-01-00-01	The group address for all ENodes.	7.7.1
All-FCF-MACs	01-10-18-01-00-02	The group address for all FCFs.	7.7.1
DEFAULT_FIP_PRIORITY	128	The default value specified in the FIP Priority descriptor.	7.7.6.3.2
DEFAULT_FC-MAP	0EFC00h	The default value for the FC-MAP field in a FIP FC-MAP descriptor.	7.7.6.3.4
ADV_TOV	2	The interval in seconds within which solicited Discovery Advertisements are transmitted, if the FCF chooses so, upon reception of a Discovery Solicitation.	7.7.2
FKA_ADV_PERIOD	-	The interval in milliseconds between periodic Discovery Advertisements and ENodes FIP Keep Alive messages. The default value is 8 000. Valid values are in the range 250 .. 90 000.	7.7.2, 7.7.4
FKA_VN_PERIOD	90 <sup>a</sup>	The interval in seconds between periodic VN_Ports FIP Keep Alive messages.	7.7.4
<sup>a</sup> This value has been chosen as appropriate to keep updated the forwarding tables of intermediate Lossless Ethernet bridges.			