CTF-capable (E)ISS

Support for CTF-capable forwarding process functions

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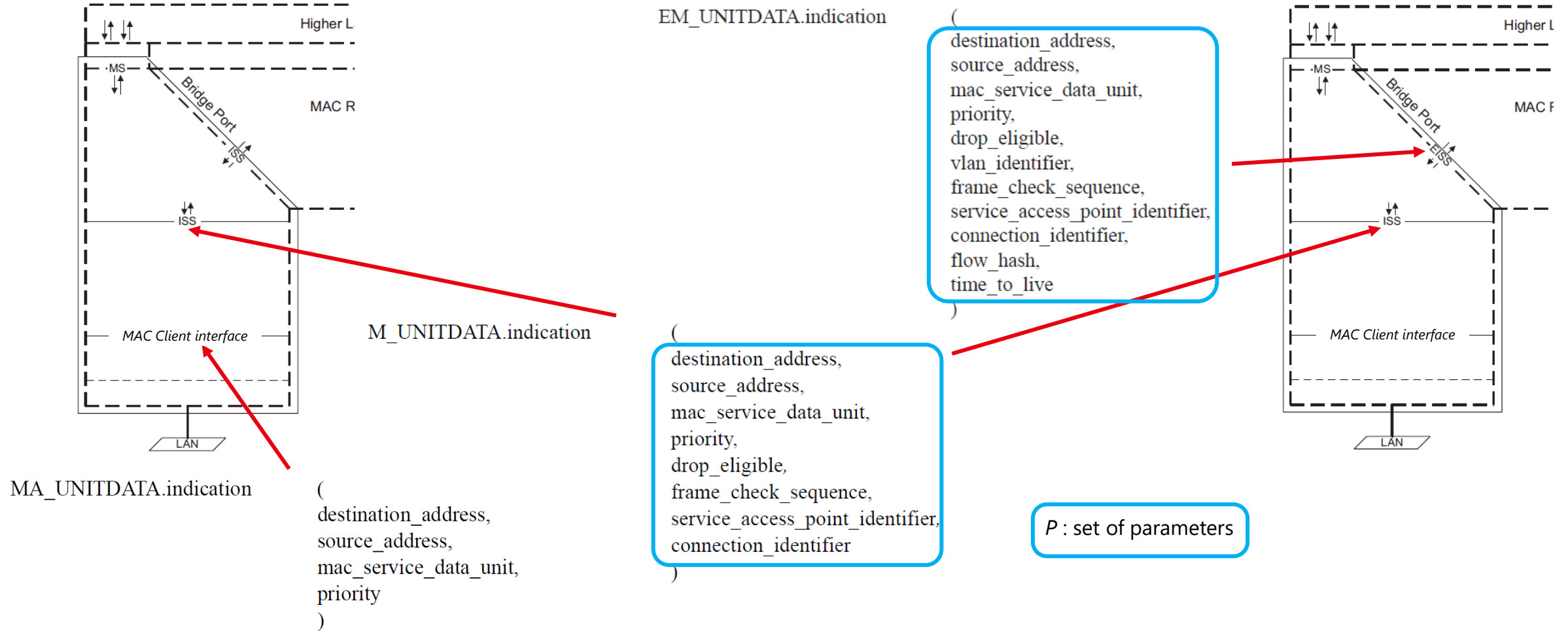
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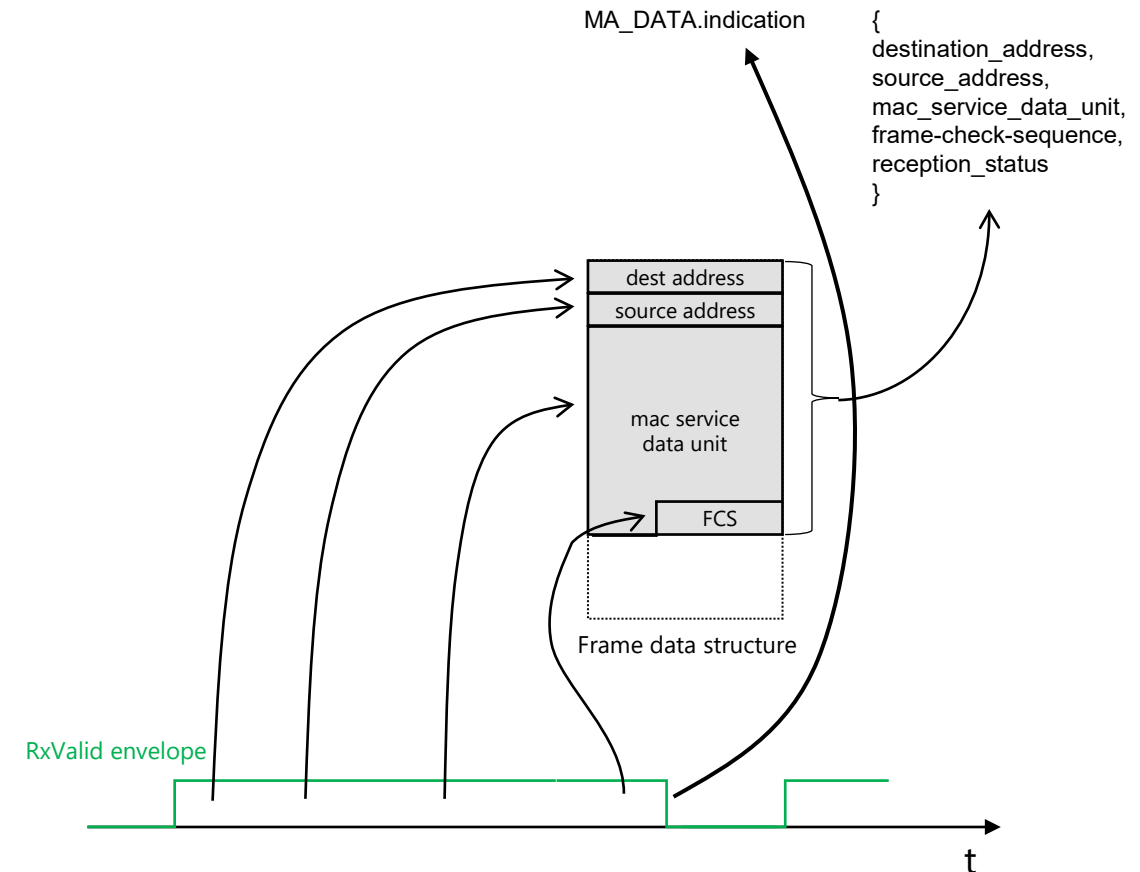
1 introduction

- Reception path

  - From the MAC client interface up to the EISS

EM_UNITDATA.indication (
destination_address,
source_address,
mac_service_data_unit,
priority,
drop_eligible,
vlan_identifier,
frame_check_sequence,
service_access_point_identifier,
connection_identifier,
flow_hash,
time_to_live
)

M_UNITDATA.indication (
destination_address,
source_address,
mac_service_data_unit,
priority,
drop_eligible,
frame_check_sequence,
service_access_point_identifier,
connection_identifier
)

MA_UNITDATA.indication (
destination_address,
source_address,
mac_service_data_unit,
priority
)

P : set of parameters

- 802.3 MAC as an example
  - Rx operation
    - The PHY layer delineates the frame thanks to physical signalling indicating the presence of successive bit belonging to a frame (RxValid active)
    - Successively received bits of a frame are accumulated in a structure
    - Upon reception of the last bit of a frame (when RxValid transitions to inactive), a set of operations are performed
      - Discarding of the frame if it is too short (the only reason for discard)
      - Identification of the different parameters/fields of the frame structure
        - Addresses, type/length, msdu, FCS
      - Determination of the frame reception status
        - Frame too long, octets misalignment, FCS validity, …
    - If the frame is not discarded, the MA_DATA.indication primitive is sent to the MAC client, including the following parameters:
      - Received frame structure
      - Frame reception status
      - The size of the structure is implicitly known
    - The M_DATA.indication signals the availability of received frame structure to the MAC client

MA_DATA.indication

{
destination_address,
source_address,
mac_service_data_unit,
frame-check-sequence,
reception_status
}

dest address

source address

mac service data unit

FCS

Frame data structure

RxValid envelope

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- The ISS primitives are transformations of the MAC client interface primitives

- The EISS primitives are transformations of the ISS primitives

- If the MAC is Store-and-Forward so is the (E)ISS

2 CTF-capable (E)ISS modelling proposal

- MAC relay entity's forwarding process in Store-and-Forward bridges

  - Performed by a series of functions taking actions on a given frame (totally) received on a given port

    - Function invoked upon reception of the (E)M_UNITDATA.indication primitive

    - Function decision : forward or discard

  - Function's decision = $f(p_F, t, L)$

    - p_F : the subset of P, provided by the (E)M_UNITDATA.indication primitive, that is necessary to establish the function decision

    - t : the time the frame is received at

    - L: the length of the frame, L = $f(P)$
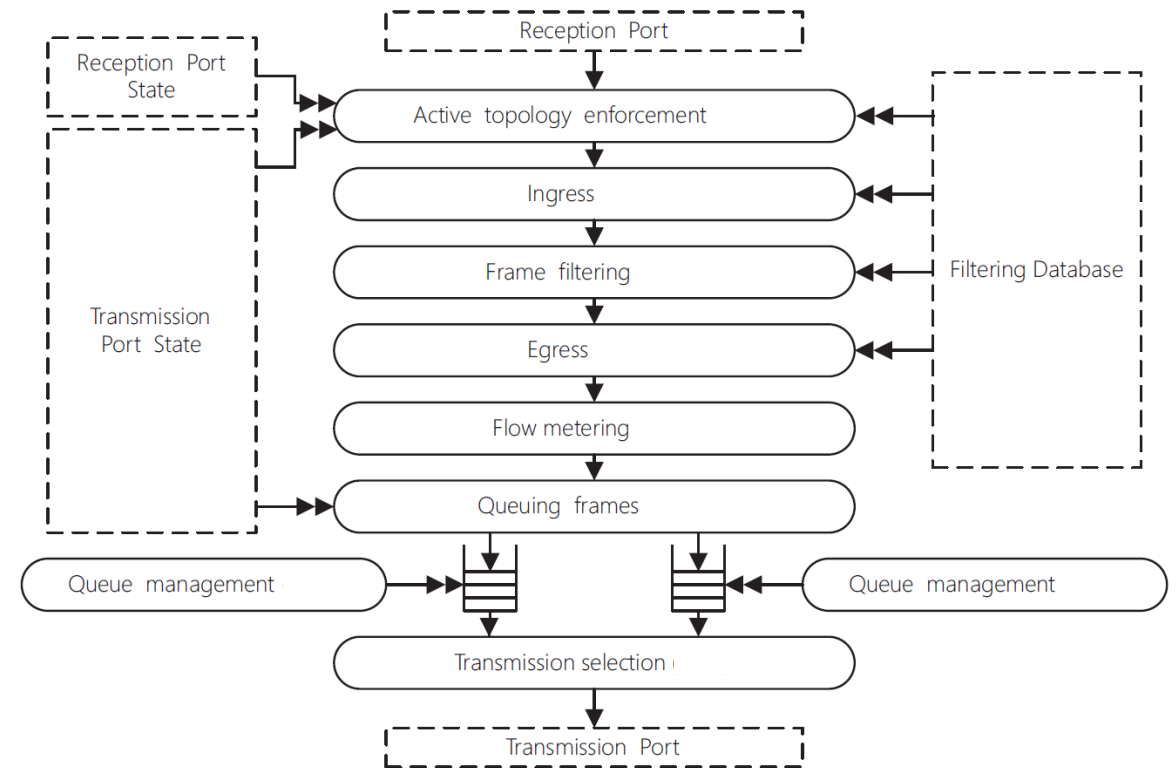
Forwarding process functions (802.1Q-2022)

- MAC relay entity's forwarding process in Cut-Through bridges
  - Performed by the same series of functions (or a subset thereof)
    - Some functions can possibly not support CTF
  - Cut-Through :
    - Invocation of each function occurs at a time when the frame is not totally received
    - Function's action = result of an early/interim decision
      - Missing or incomplete function input at the time of function invocation
    - Function's action can be corrected once the missing or incomplete function's input is available or completed.
  - Function's input that is incomplete until the end of the frame reception
    - L: does not prevent from taking some decisions
    - msdu: partial info is enough to take a decision
    - FCS : considered valid until it can be checked
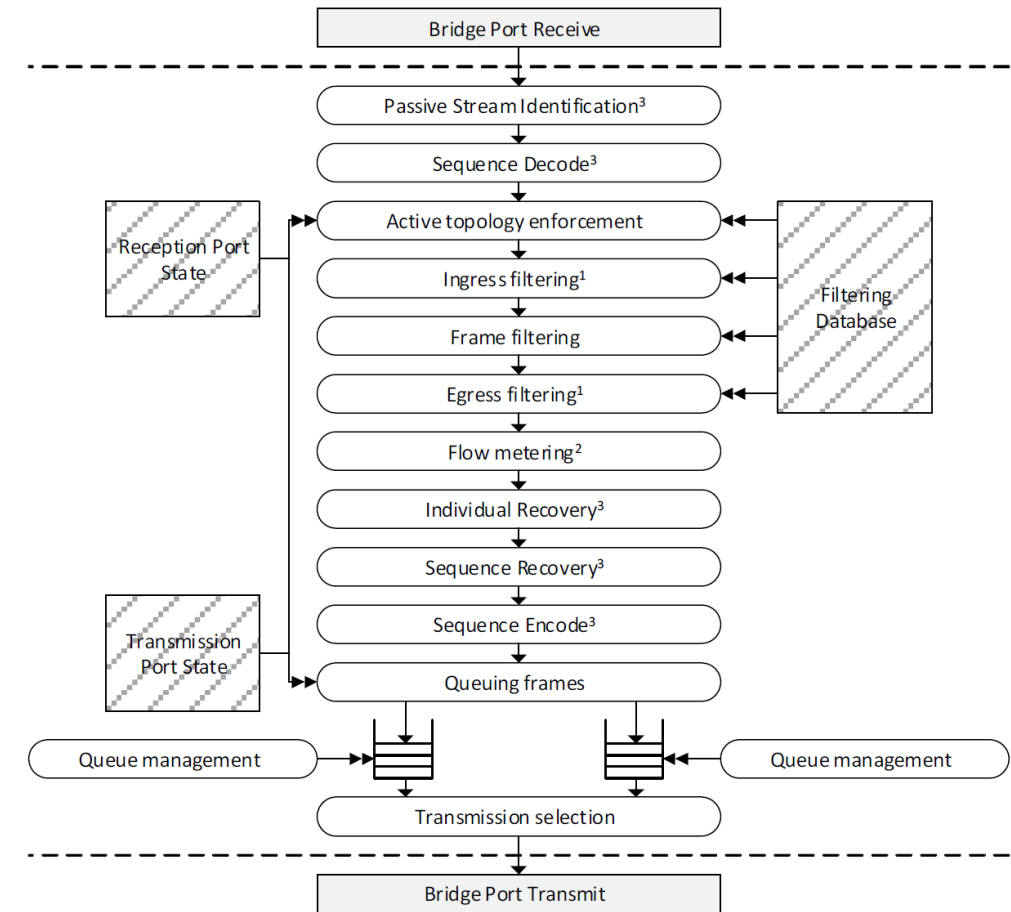
Forwarding process functions (802.1DU D0.2)

incl. 802.1CB's stream identification and FRER

- The CTF-capable (E)ISS is compatible with the legacy (E)ISS (802.1AC and 802.1Q)
  - The MAC relay entity of a CTF-capable bridge can support legacy (S&F) (E)ISS providers
  - The MAC relay entity of a legacy (S&F) bridge can support CTF-capable (E)ISS providers

- The primitives of the CTF-capable (E)ISS are designed so that the MAC relay entity functions do not have to perform functions that are « normally » performed in other layers
  - Invalid frame format detection (length, alignment, …)
  - MAC parameter delineation
  - FCS checking

- The set of CTF-capable (E)ISS primitives is a superset of the set of legacy (E)ISS primitives

- « Fall-back to S&F » just consists in:
  - Stopping current CTF processing of the frame being received and « wait for » an indication primitive marking the end of the frame reception to resume the execution of the forwarding functions

- (E)M_JUST-ENOUGH_UNITDATA.indication
  - Generated when the greatest common set of frame parameters required by any of the MAC Relay Entity functions, supported for a given port, can be made available over the (E)ISS interface.
    - e.g. Stream filtering is implemented and IP Stream identification is one of the Stream identification functions used to determine the Stream handle
      - Required frame parameters : destination address, vlanid, set of initial msdu octets used by the IP Stream identification function
  - Triggers continuous provision, over the (E)ISS, of the data of the remaining incomplete parameters along the reception of the frame by the lower layers
  - L*: partial length of the frame at the time (E)M_JUST-ENOUGH_UNITDATA.indication is generated
    - L* increases along the continuous provision of the remaining part of the frame
  - FCS check is unavailable at the time (E)M_JUST-ENOUGH_UNITDATA.indication is generated

- (E)M_INVALID_UNITDATA.indication
  - Only generated if an (E)M_JUST-ENOUGH_UNITDATA.indication was previously generated
  - Generated at an instant of time corresponding to the end of the frame reception by the lower layers
    - i.e. at the instant of time the (E)M_UNITDATA.indication would be generated
  - 1 parameter : reason
    - Runt frame, invalid FCS, ...

- (E)M_UNITDATA.indication

  - Invoked at the end of an error-free frame reception

  - When generated after an (E)M_JUST-ENOUGH_UNITDATA.indication

    - Validates the frame

    - Allows determination of L

    - Determines the time of frame reception completion

  - When not preceeded by an (E)M_JUST-ENOUGH_UNITDATA.indication

    - the (E)ISS only supports Store-and-Forward

- (E)M_UNITDATA.indication and (E)M_INVALID_UNITDATA.indication are exclusive

  - One or the other signals the end of the frame over the CTF-capable (E)ISS

- (E)M_JUST-ENOUGH_UNITDATA.request
  - Generated when partial data of a Cut-Through-forwarded frame is available in a queue selected for transmission
    - Typically the partial set of parameters that are passed with the (E)M_JUST-ENOUGH_UNITDATA.indication
  - The remaining (parts of the) parameters are progressively provided over the (E)ISS when they are made available by the MAC relay entity
    - The queue selected for transmission is continuously filled up by the CTF-capable MAC relay entity's frame queueing function

- (E)M_DISCARD.request
  - Generated when :
    - An (E)M_INVALID_UNITDATA.indication was received
    - A frame discard condition is detected by one of the MAC relay entity's functions
      - Can be generated before the end of the frame reception
  - 1 parameter : reason
    - Runt frame, invalid FCS, discard(relaying function), ...
  - Indicates that actions must be taken by the lower layers to :
    - Discard the frame
    - Signal the frame as invalid to downstream network elements

- (E)M_UNITDATA.request

  - Invoked at the end of an error-free frame transmission

  - When generated after an (E)M_JUST-ENOUGH_UNITDATA.indication

    - Signals the end of the continuous provision of data over the (E)ISS

    - Validates the frame

  - When not preceeded by an (E)M_JUST-ENOUGH_UNITDATA.request

    - signals a (whole) frame transmission to the lower layers supporting Store-and-Forward only

- (E)M_UNITDATA.request and (E)M_DISCARD.request are exclusive

  - One or the other signals the end of the frame over the CTF-capable (E)ISS

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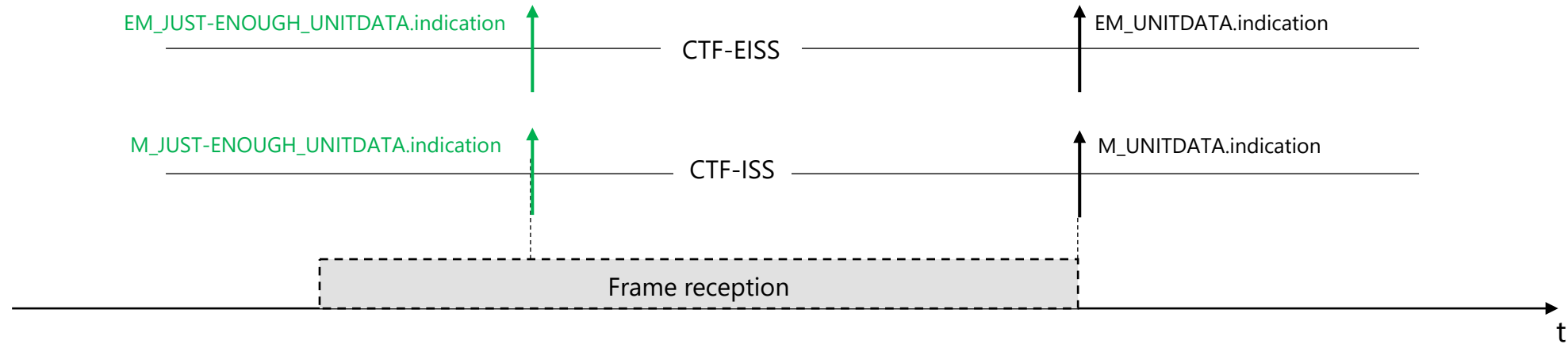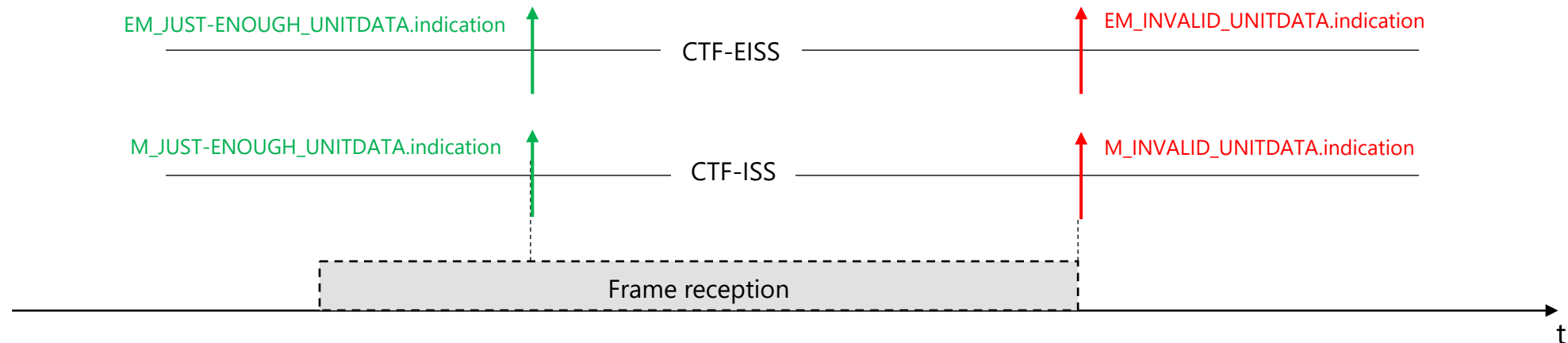
CTF-(E)ISS primitives timeline (reception)
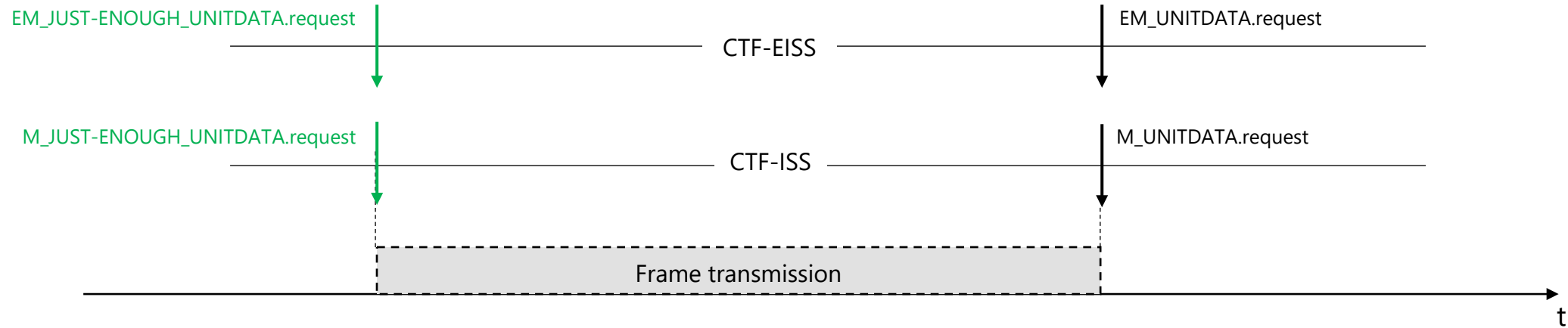
- Valid frame reception

EM_JUST-ENOUGH_UNITDATA.indication — CTF-EISS — EM_UNITDATA.indication

M_JUST-ENOUGH_UNITDATA.indication — CTF-ISS — M_UNITDATA.indication

Frame reception

t

- Invalid frame reception

EM_JUST-ENOUGH_UNITDATA.indication — CTF-EISS — EM_INVALID_UNITDATA.indication

M_JUST-ENOUGH_UNITDATA.indication — CTF-ISS — M_INVALID_UNITDATA.indication

Frame reception

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Non-confidential

Examples

- Valid frame transmission

- Invalid frame transmission

CTF-(E)ISS compatibility with (E)ISS (transmission)
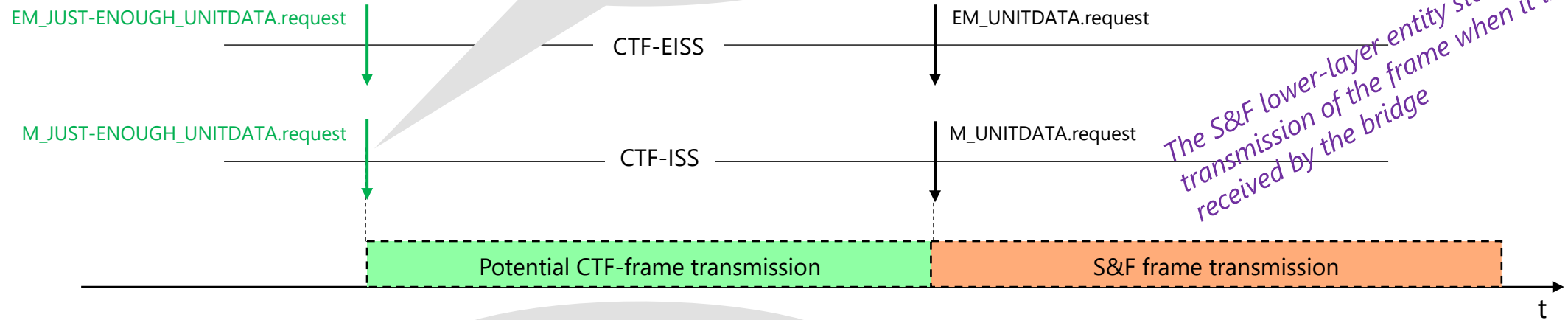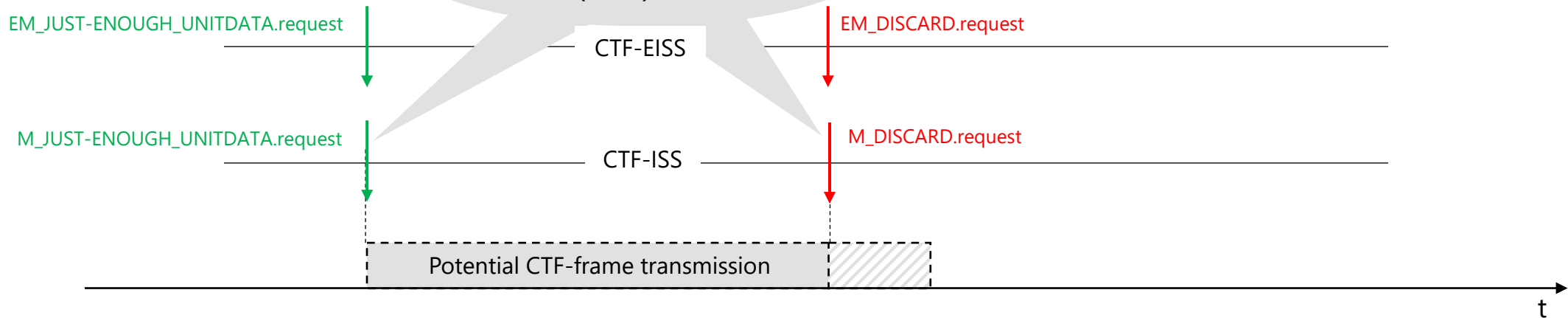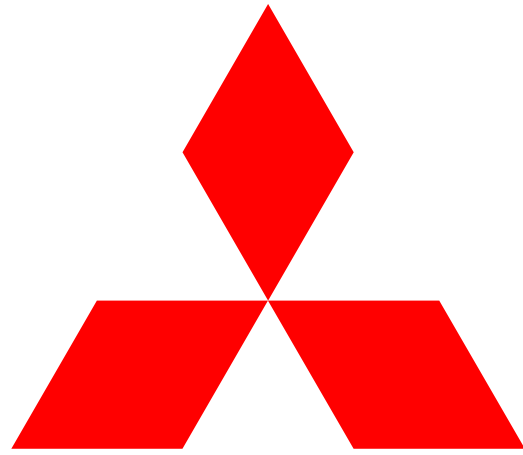
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