Generic Serial Convergence Function (GSCF)

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See also

- *Ambiguity in the MAC Service*
  - Roger Marks, 2022-06-15
- *CSD Compatibility Criterion for Cut-Through Forwarding*
  - Roger Marks, 2022-06-22

802.3 NEA on CTF

- *IEEE 802.3 NEA Conclusion from the joint NEA / 802.1 Nendica meetings on cut-through forwarding (CTF).*
  - *The IEEE 802.3 Ethernet Media Access Control (MAC) and MAC Client service interface specified in IEEE Std 802.3-2022 only supports store and forward operation and is unable to support cut-through operation. To provide cut-through capability, a new definition of the IEEE 802.3 MAC is required.*
  - Source: IEEE 802.3 New Ethernet Applications (NEA) Ad Hoc Closing Report, 2022-07-15

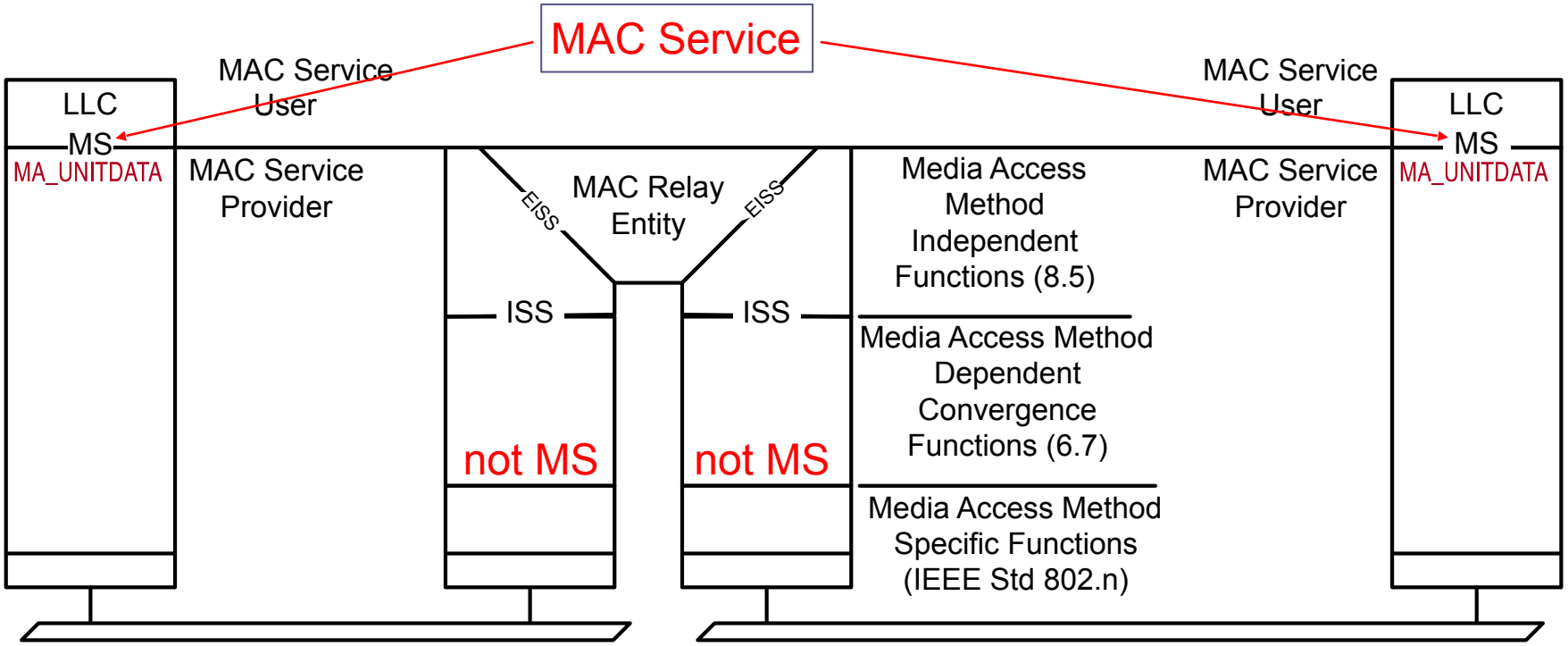
802.1 on CTF

- *IEEE 802.1 Conclusion from the joint NEA / 802.1 Nendica meetings on cut-through forwarding (CTF).*
  - *No consensus on what supporting MAC an 802.1 Cut-Through Forwarding standard would use and, if needed, where to specify it.*
  - Source: Cut-Through Forwarding status update from Nendica perspective

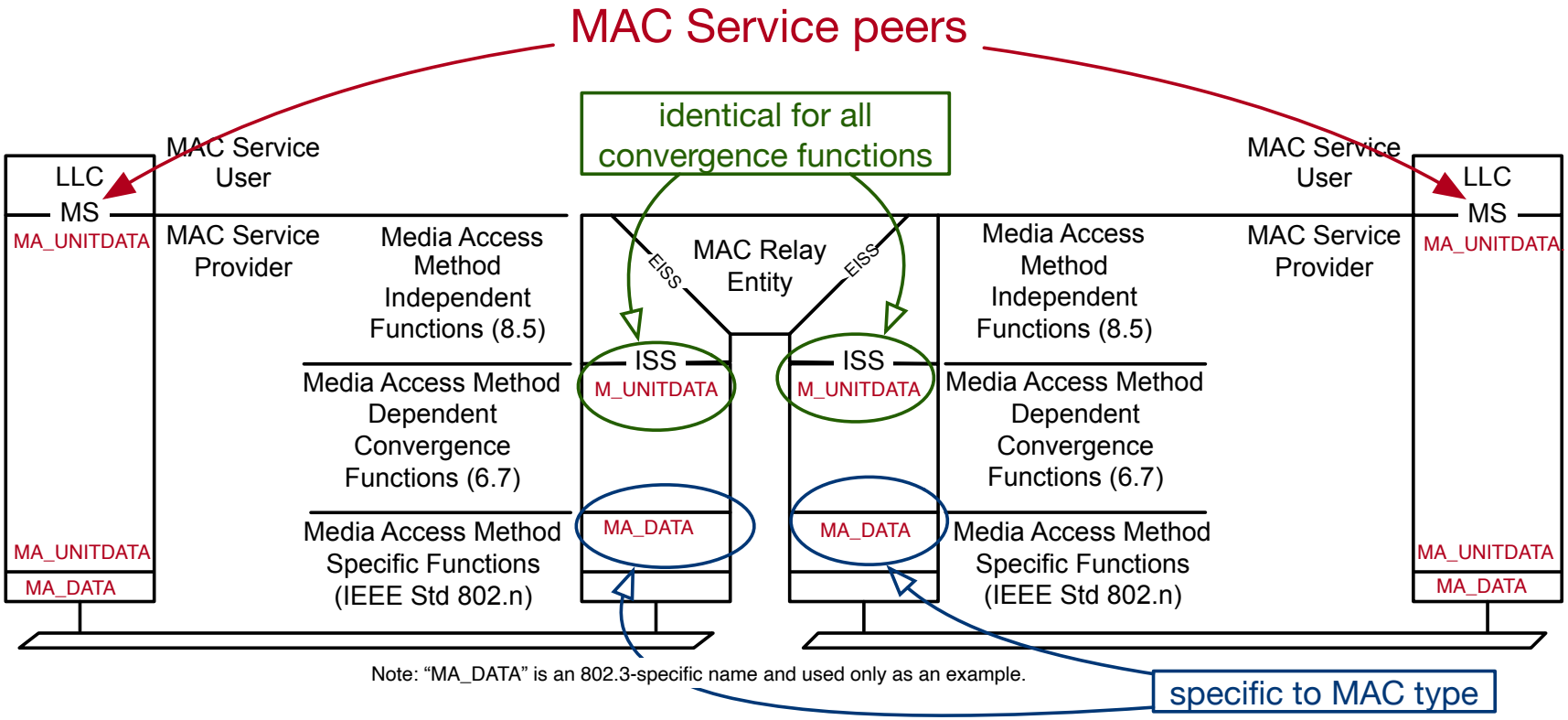
Addressing the MAC Roadblock

- Approach:
  - Bypass the MAC roadblock by eliminating the MAC.
    - This could help enable cut-through forwarding (CTF).
    - Perhaps other advantages might also result.
- Presumption
  - collision-free LAN
    - support for only for full-duplex
    - medium access needs no control

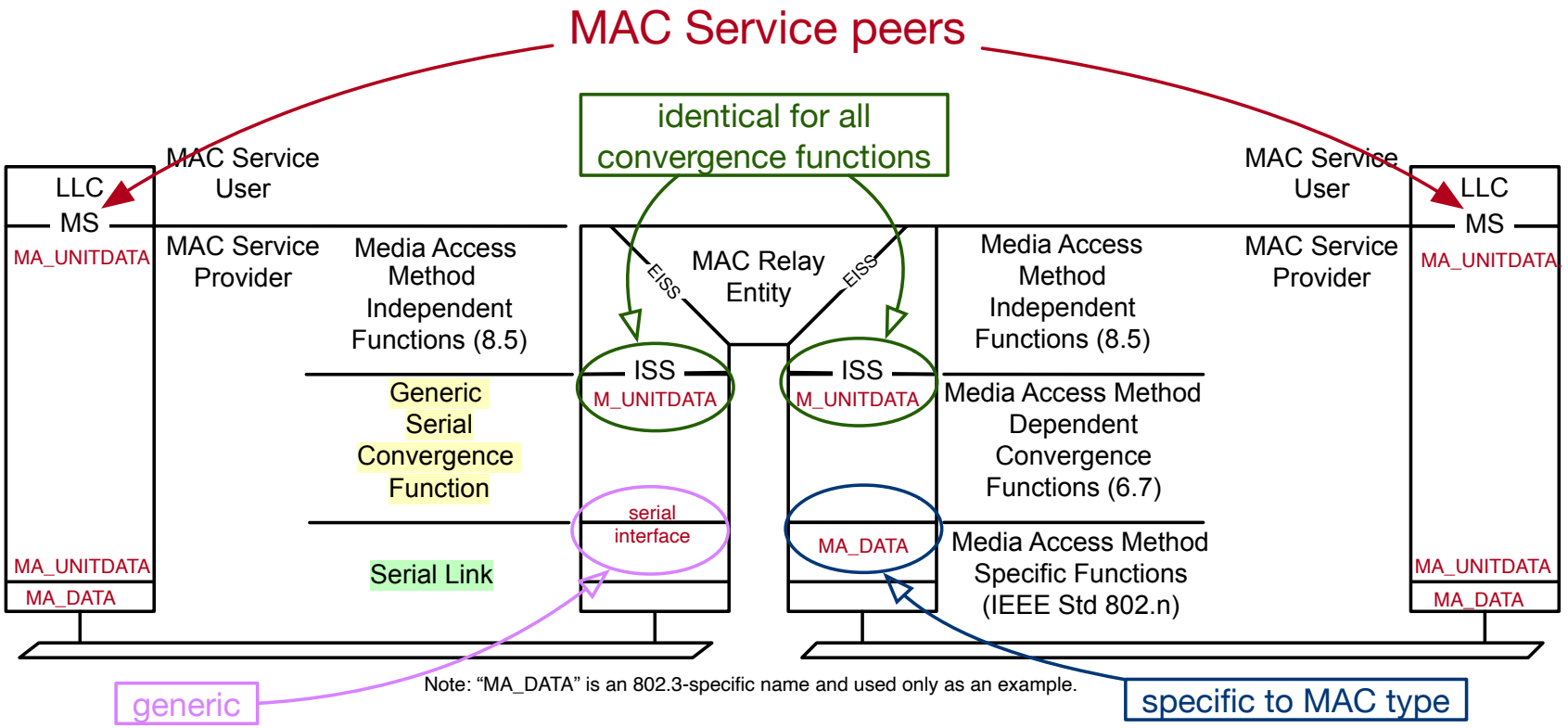
Architectural Model per 802.1Q



Architectural Model per 802.1Q – interface details



Architectural Model with GSCF



GSCF can look, to the ISS, just like every Media Access Method Dependent Convergence Function.

802.1Q §6.15 *The ISS may be supported by other technologies that provide either an IEEE 802 MAC Service or an emulated IEEE 802 MAC Service. The technology is responsible for invoking an M_UNITDATA.indication with appropriate parameters (IEEE Std 802.1AC) for each received frame, and transmitting a frame in response to each M_UNITDATA.request.*

802.3 generic Reconciliation Sublayer

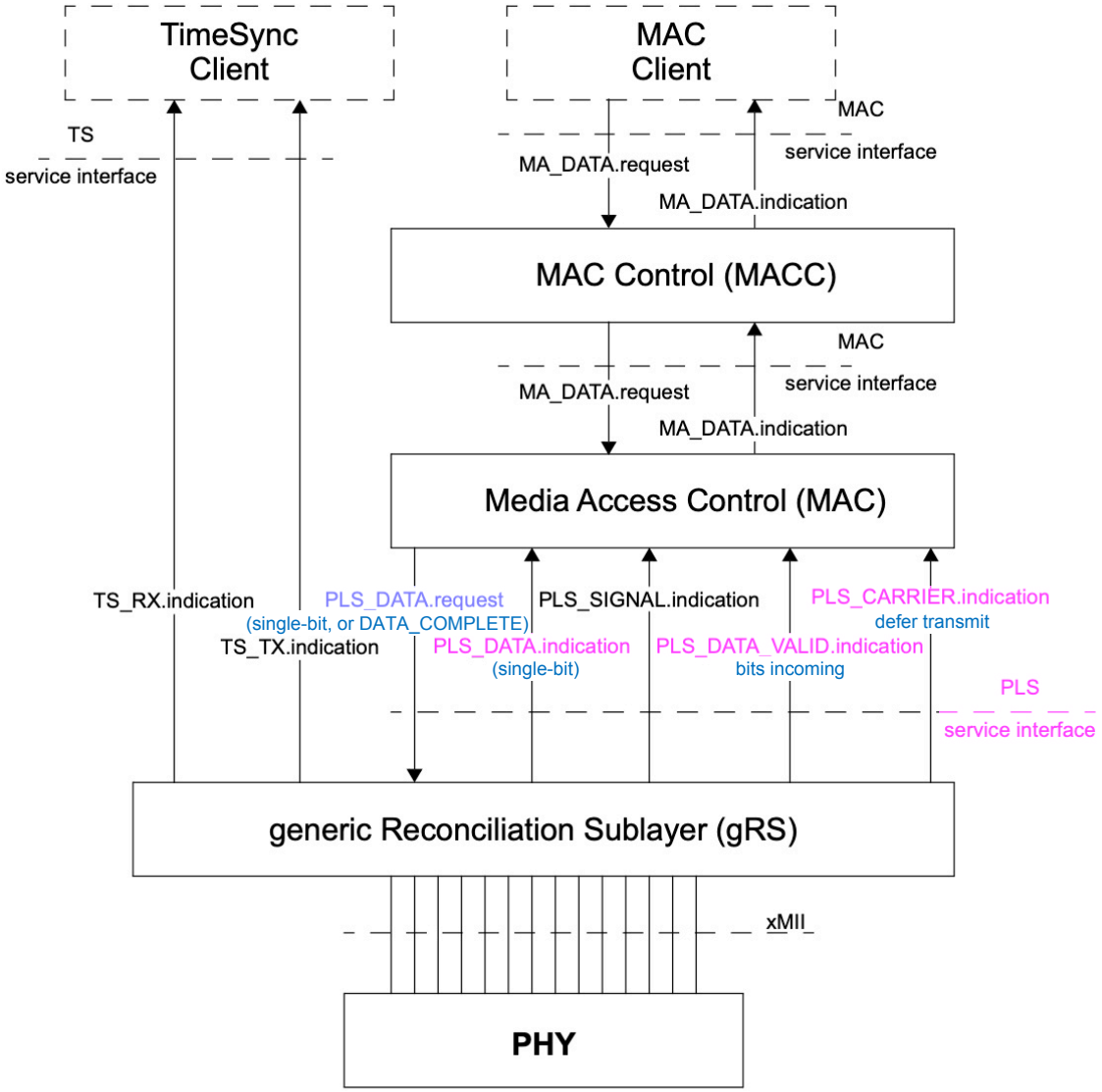


Figure 90–1—Relationship of the TimeSync Client, TSSI and gRS sublayer relative to MAC and MAC Client and associated interfaces

- See 802.3 §90:
  - "Ethernet support for time synchronization protocols"
- *optional Time Synchronization Service Interface (TSSI)… can be used to support protocols that require knowledge of packet egress and ingress time*
- *(gRS) is used to denote any IEEE 802.3 Reconciliation Sublayer (RS) used to interface a MAC with any PHY supporting the TimeSync capability*
- "PLS" represents "Physical Signaling"

gRS to GSCF Interface: use PLS

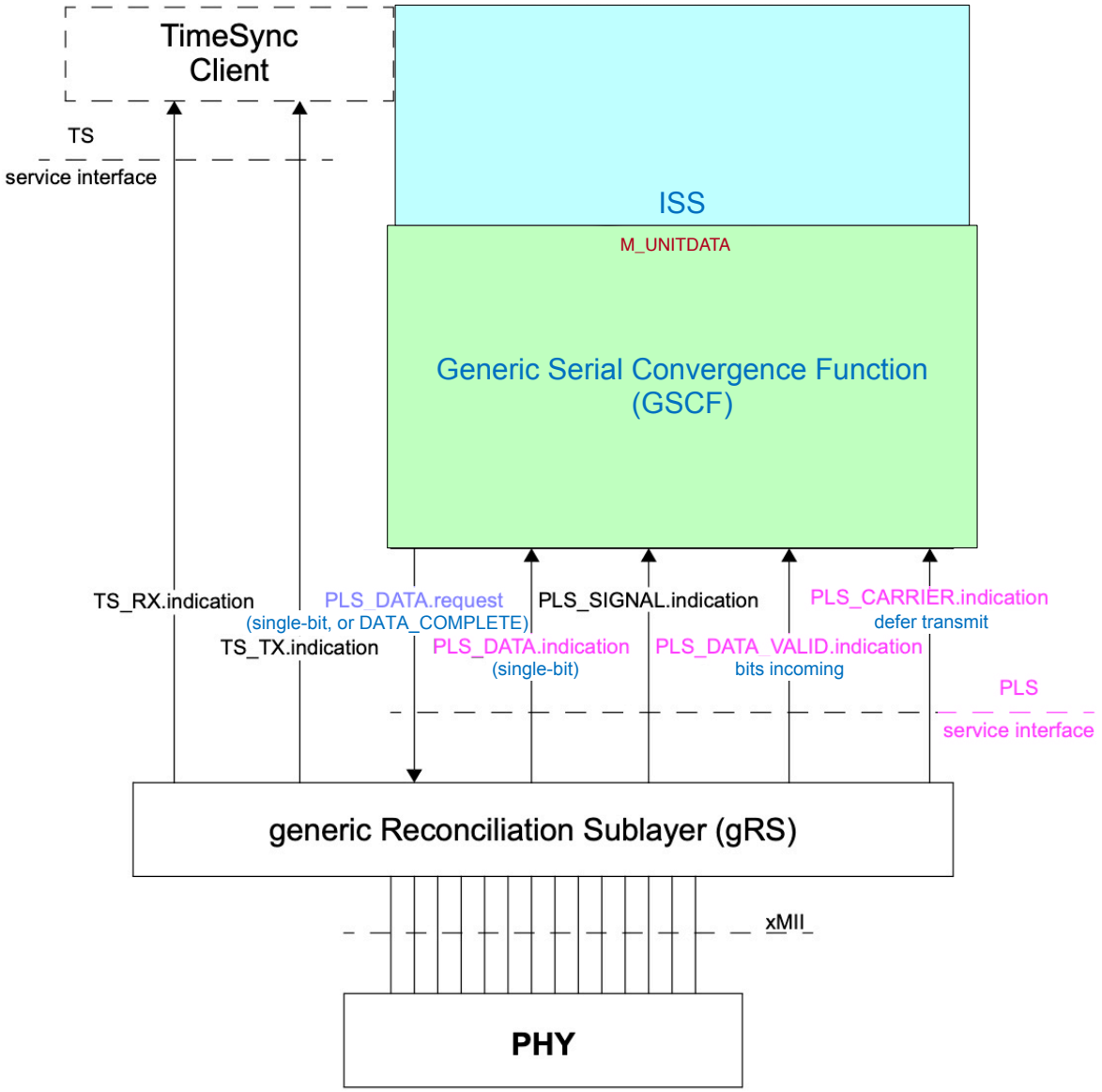
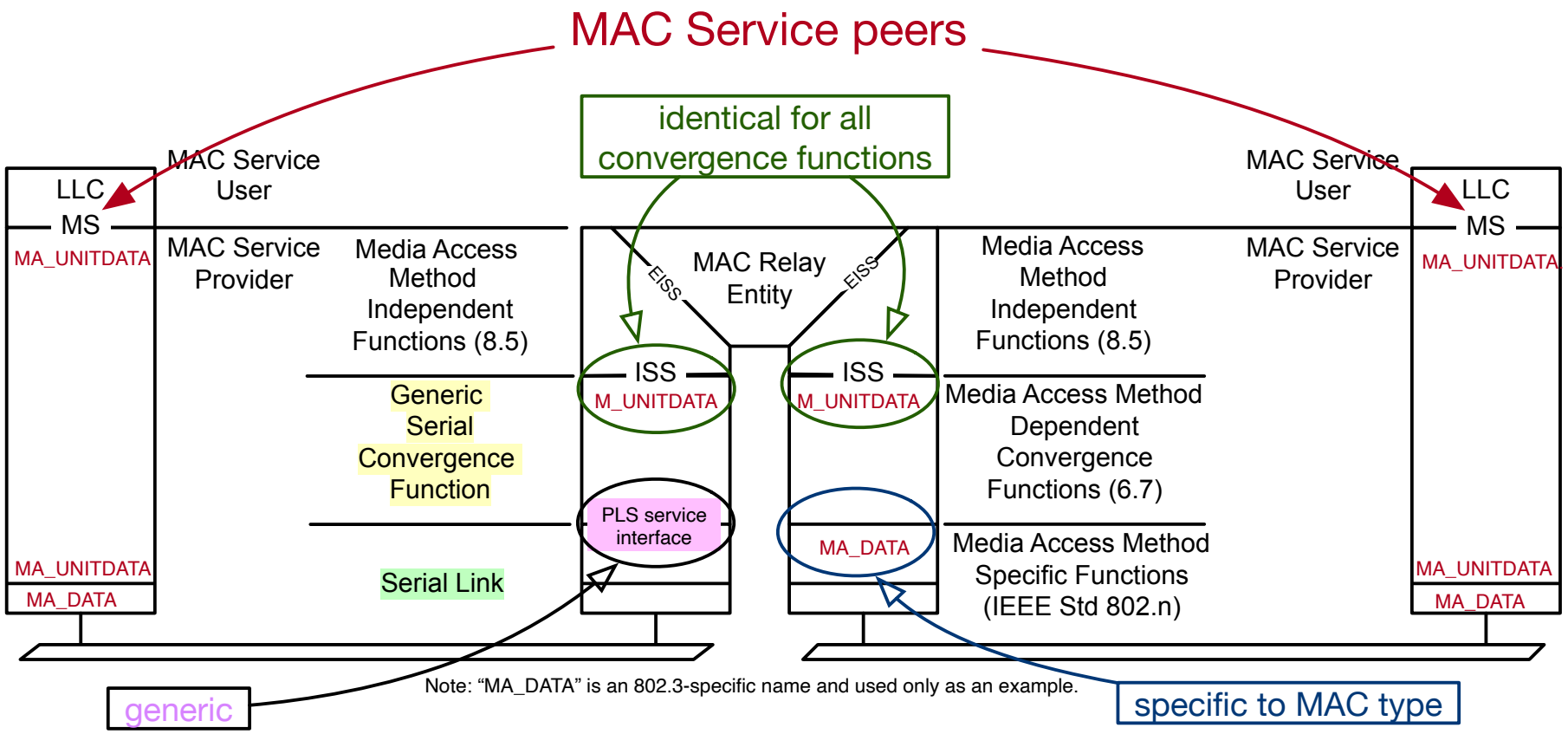


Figure 90–1—Relationship of the TimeSync Client, TSSI and gRS sublayer relative to MAC and MAC Client and associated interfaces

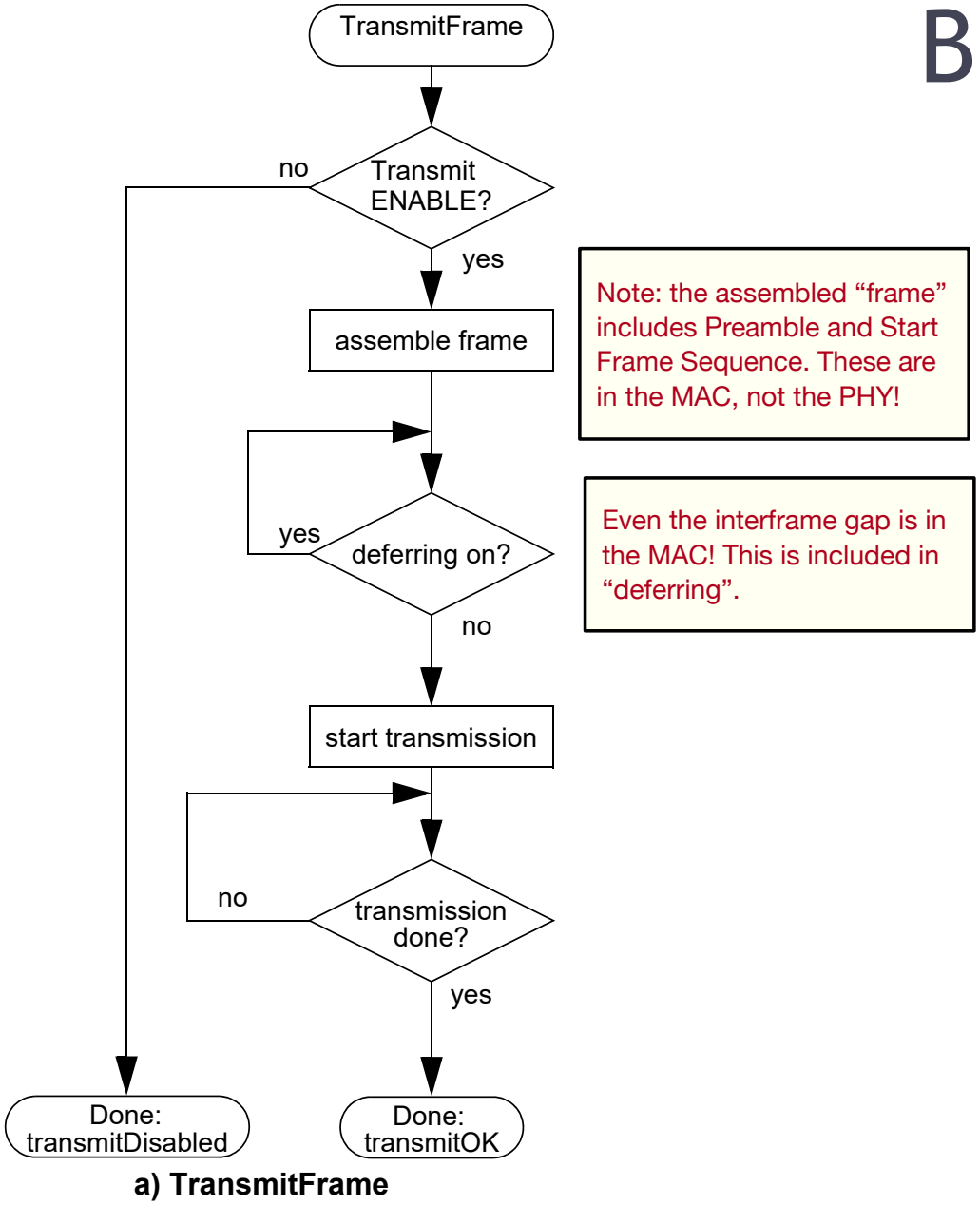
- Specify the lower GSCF interface to match PLS interface.
- Then GSCF interfaces to gRS, or anything behaving the same at PLS interface.

Architectural Model with GSCF & PLS



All Ethernet LANs support the PLS interface.
Other LANs might, in principle, also support "reconciliation" to PLS.

Building a GSCF: transmit

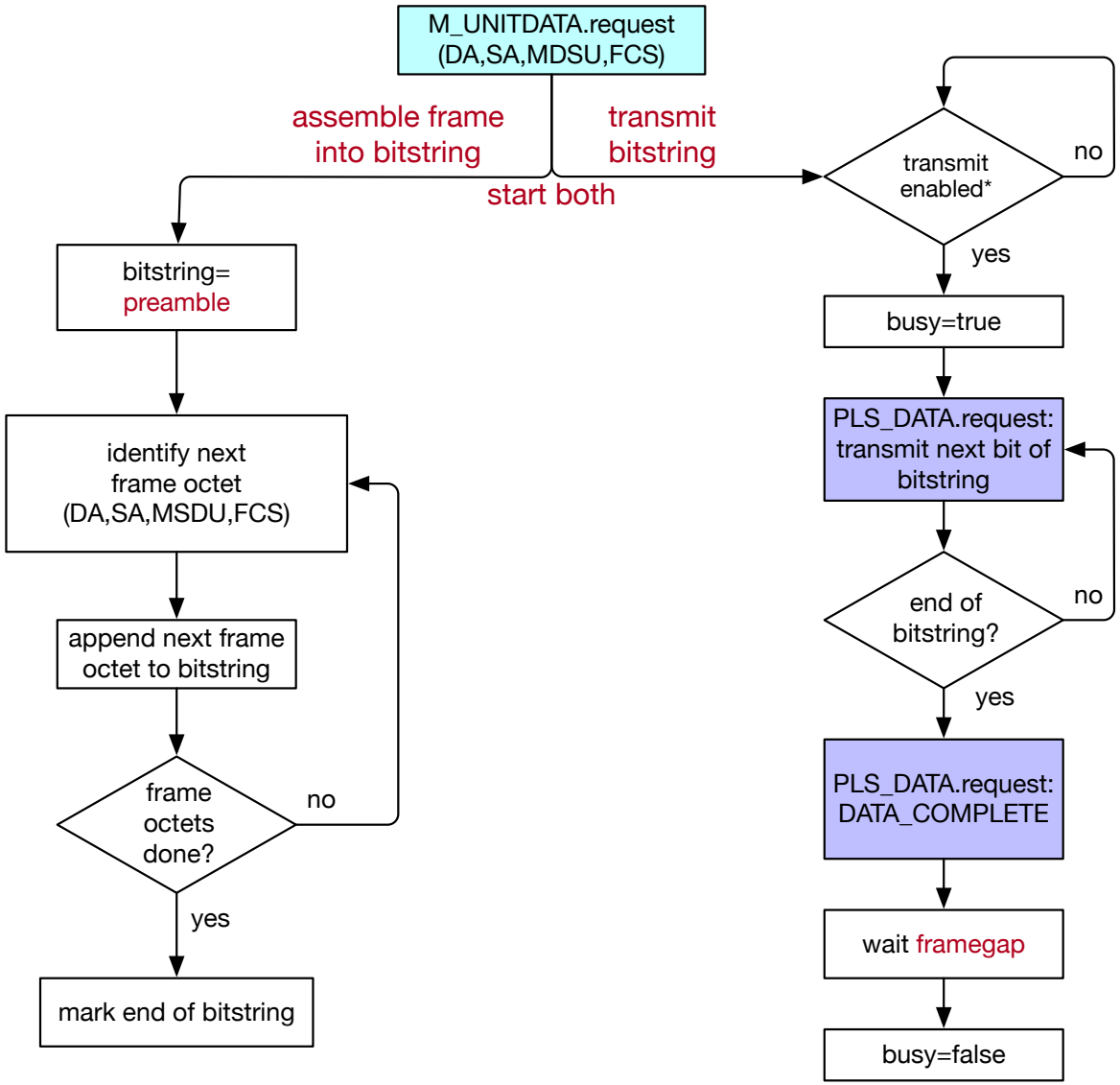


a) TransmitFrame

Figure 4A–2a—Control flow summary

- On the transmit side, what CSCF functions are needed?
- Consider as an example the 802.3 full-duplex MAC transmit functions.

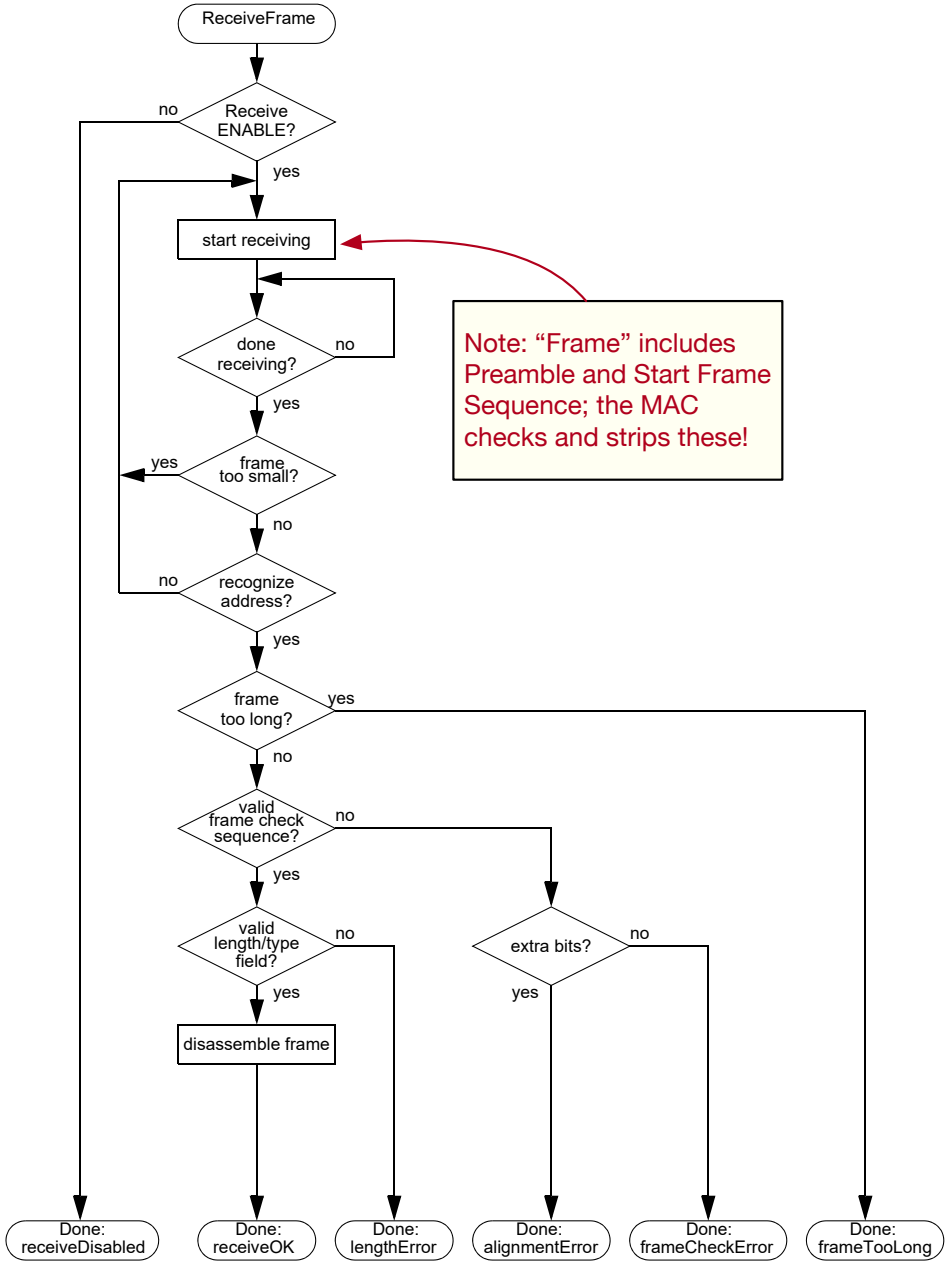
GSCF Transmit to LAN – schematic



*PLS_CARRIER.indication= CARRIER_OFF AND busy=false

Fixed parameters:
- preamble
- framegap

Building a GSCF: receive

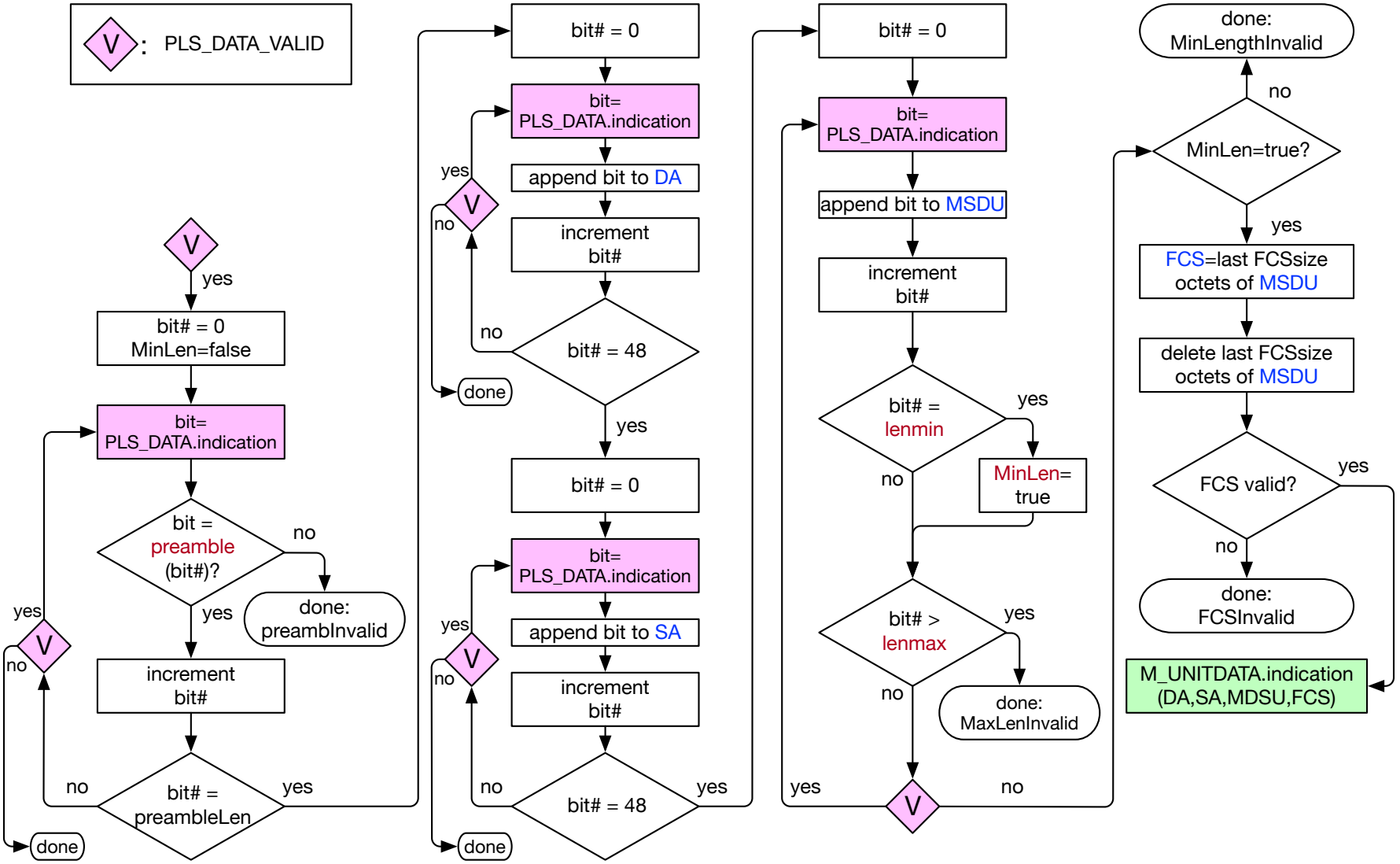


b) ReceiveFrame

Figure 4A–2b—Control flow summary

- On the receive side, what CSCF functions are needed?
- Consider as an example the 802.3 full-duplex MAC receive functions.

GSCF Receive from LAN – schematic

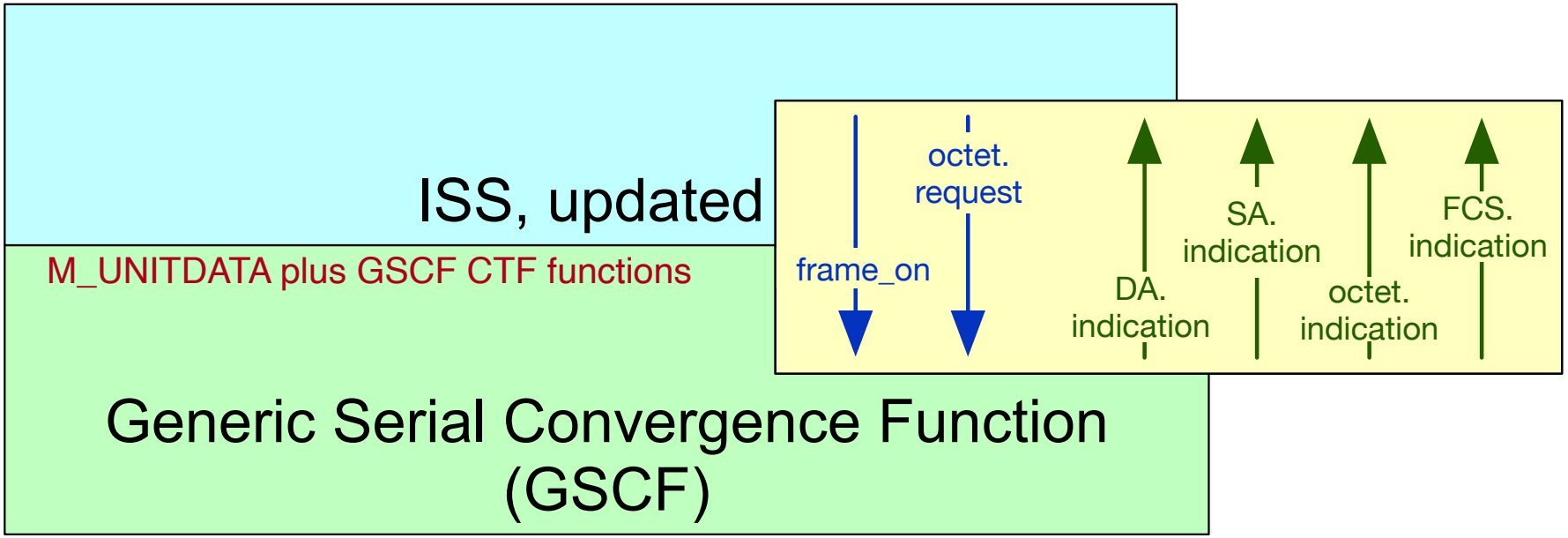


Sufficient to support CTF?

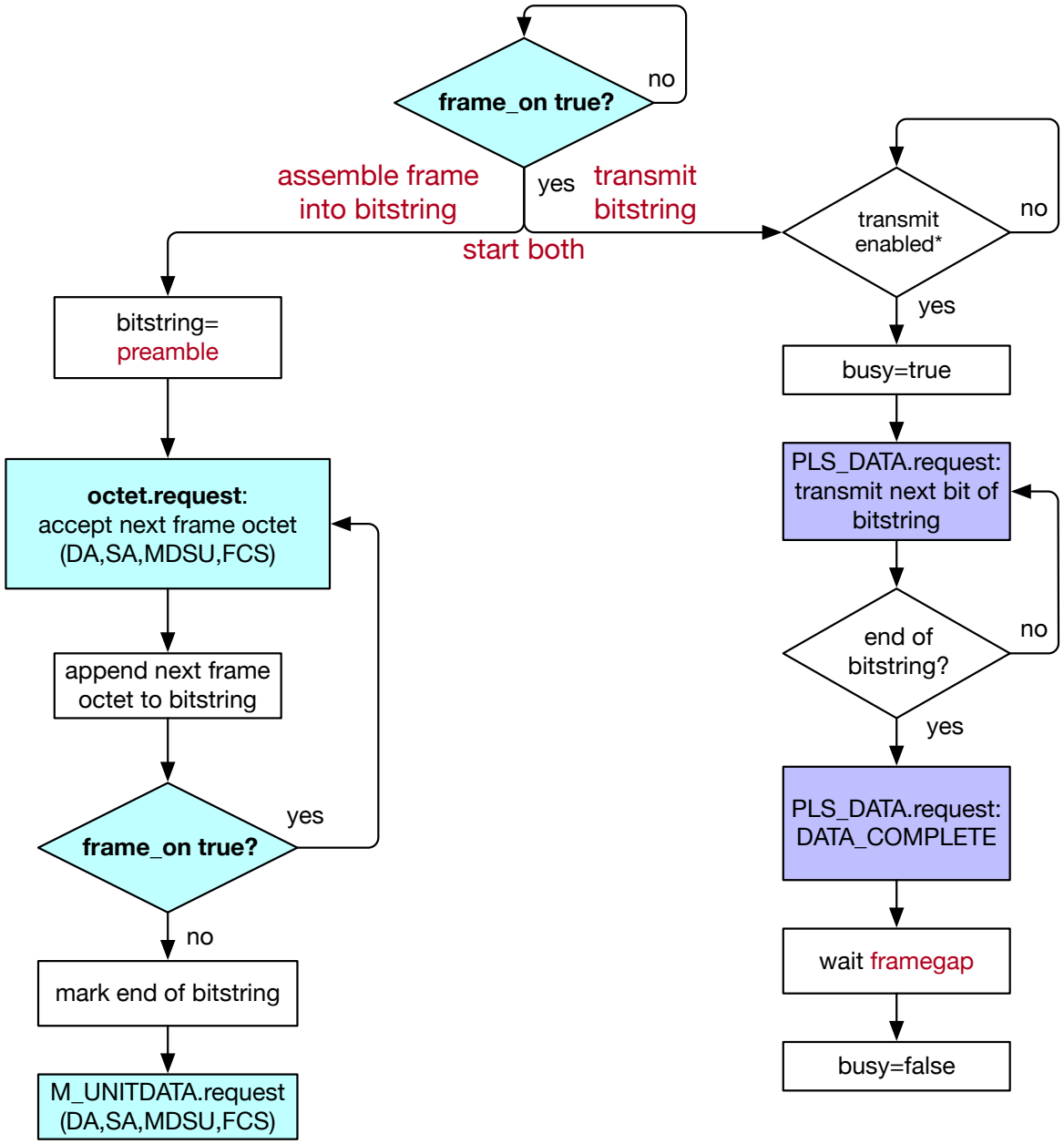
- GSCF Receive transfers frame in M_UNITDATA.indication
  - assembles bitstring a bit at a time
  - identifies frame fields as they are completed
    - Does it matter to the standards if the indication to ISS is expressed as a sequence of frame fields and frame field octets? Seems not.
- GSCF Transmit transfers frame in M_UNITDATA.request
  - assembles bitstring an octet at a time
  - transmits bits while bitstring is loaded
    - Does it matter to the standards if the request to GSCF is expressed as a sequence of octets? Seems not.
- The sequential expression of M_UNITDATA.request and M_UNITDATA.indication appears consistent with the relevant existing standards (i.e. 802, 802.1Q, 802.1AC).
  - However, the sequential processes can also be formalized.

New GSCF/ISS Messages for CTF

- To more formally support CTF, could add primitives at the ISS/GSCF interface:
  - frame_on: TRUE when ISS is transferring frame octet data to GSCF
    - octet.request transfers an octet
    - frame_on FALSE when sequence of frame octet data ends
  - DA.indication, SA.indication, and FCS.indication transfer entire DA, SA, and FCS, respectively, to ISS
  - octet.indication transfers an MSDU octet from GSCF to ISS
    - begins after SA.indication; ends with FCS.indication



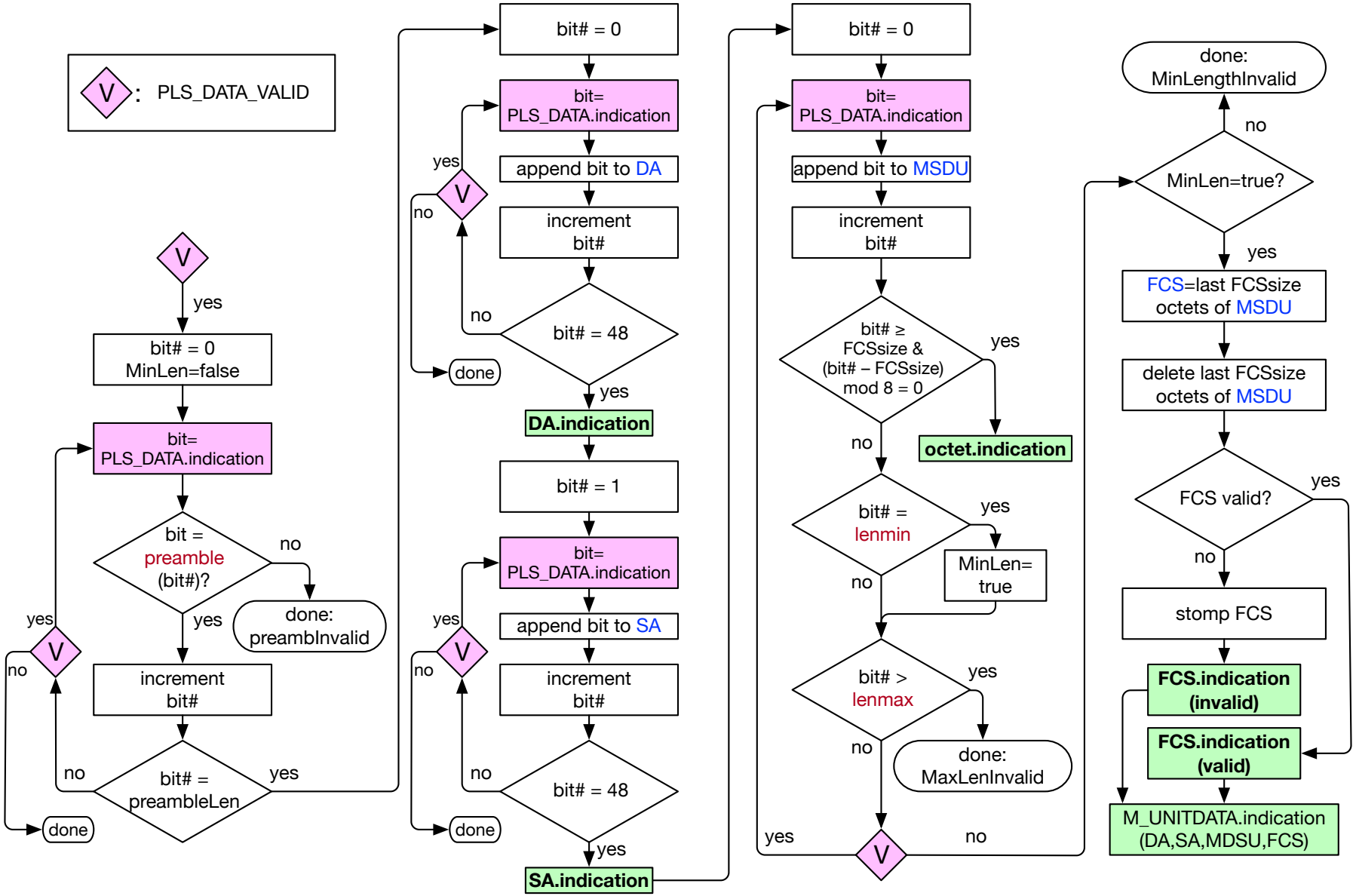
GSCF Transmit with CTF – schematic



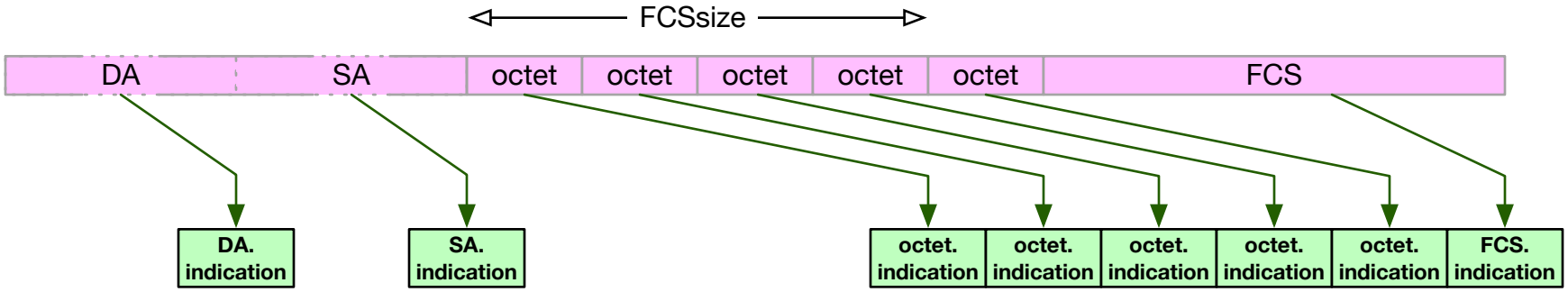
*PLS_CARRIER.indication= CARRIER_OFF AND busy=false

Fixed parameters:
- preamble
- framegap

GSCF Receive with CTF – schematic



GSCF Receive timing



Bridge Behavior

- Not all frames can be forwarded with CTF by bridge.
  - Port may be busy.
  - In some scenarios, the bridge may be assigned to selectively cut-through or store-and-forward frames based on specified characteristics.
  - This would need to be specified separately from GSCF.
- GSCF Receive and GSCF Transmit do not need to know how frame is forwarded.
  - If the bridge receives **FCS.indication (invalid)** before transmitting lenmin bits:
    - Drop and stop transmission; receiver will discard frame as a runt.
  - Otherwise, if the bridge receives **FCS.indication (invalid)** before completing GSCF Transmit, then:
    - Stop transmission but add a stomp FCS covering transmission
      - transmitted frame will still be errored, but at least it will be shorter.

How Generic is GSCF?

- 802.3 needs
  - interframe gap inserted on transmit
  - 8 octets of preamble inserted on transit
    - technically, 7 of preamble plus 1-octet start frame delimiter
  - lenmin, lenmax
- GSCF is “Generic” to the extent that these parameters are customized to the LAN
  - Alternatively, a sublayer under the GSCF could be introduced.
    - This would add complexity to the description.
- If translation between LLC Encoding and Length/Type Encoding is necessary, it could be handled as an adaptation sublayer below the GSCF
- other custom scenarios could be included
  - e.g., exceptional bit ordering, postamble, etc.

Summary

- GSCF can be a basis for a CTF architecture
  - may be useful without CTF
- GSCF can interwork with PLS interface
  - already supported by every 802.3 PHY
    - no amendment to 802.3 needed
  - non-Ethernet PHYs can adapt to it also

Recommendations

- Future CTF project proposals could consider GSCF as a basis of documenting feasibility
  - Should determine whether the existing ISS M_UNITDATA primitive specifications are compatible with using GSCF for CTF
    - If not, should consider supplementing ISS with the additional primitives based on transferring octets, DA, SA, and FCS
- Specification of GSCF could be developed as an amendment to IEEE Std 802.1AC.
  - That's where the "Media Access Method Dependent Convergence Functions" are specified.
    - Although the title is "Media Access Control (MAC) Service Definition," the scope includes much more, including ISS specifications.
- CTF functionality at the bridge would be better specified elsewhere.