Thoughts on Objectives and changing the PLCA RS



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What is latency?

- **Proposed definition:**
  Time from when a packet is presented by the MAC client until it is transmitted onto the network.

- **In PLCA, this latency is largely due to:**
  - Waiting for nodes transmit opportunity,
  - Waiting for all other nodes in the cycle to (possibly) transmit, and
  - Backoff due to logical collision

- **The maximum latency is bounded.**

Can we reduce this maximum latency for some traffic?

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Conservation of Latency?

- **Considering the Law of Conservation of Mass:**

In a closed system, mass is neither created nor destroyed in chemical reactions

- **Do we have something similar for latency in PLCA?**

Overall PLCA Latency cannot be eliminated, only removed from some traffic classes or nodes and transferred to others.

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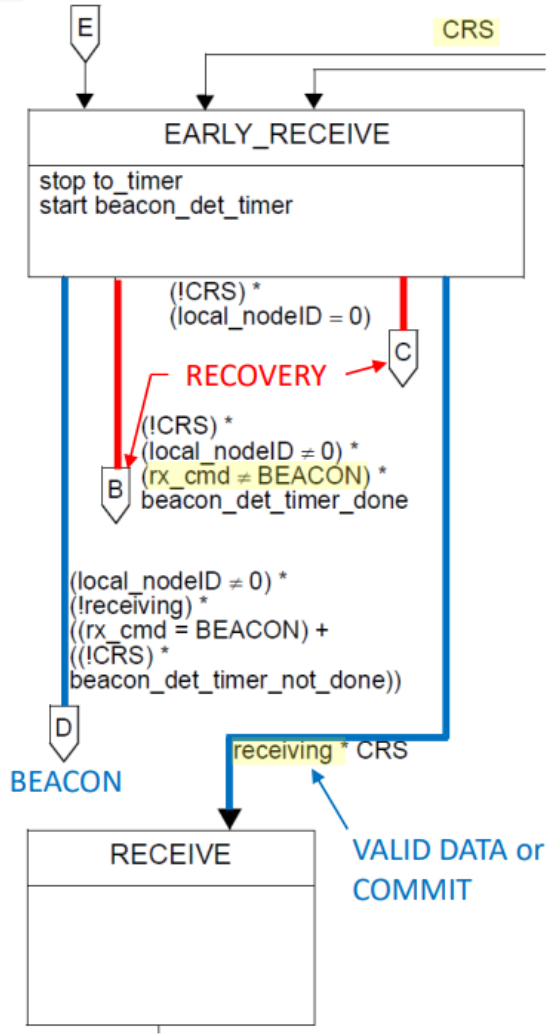
Interoperability and Compliance

- **Need an objective to support interoperability with existing 10BASE-T1S (Clause 147) and 10BASE-T1M (Clause 188) PHYs.**
  - This implies we shall support Clause 148 (PLCA) interoperability in adding a method for latency control.
- **Basic set of requirements:**
  - Do not make changes that would rule existing implementations non-compliant to Clause 148
    - New, optional features do not break compliance – see D-PLCA
  - Keep interoperability with non E-PLCA capable nodes as well as PLCA capable nodes
    - Mixed-node segment not achieve latency goals, but communication shall be retained
  - Preserve the existing layering structure
  - Improve existing

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Constraints to preserve 802.3cg compatibility

- We shall not rely on handling detected collisions
  - Collision detection belongs to the Physical Layer but collision **handling** does not
- Do not add any new physical layer signaling
  - Any signal other than a valid preamble, BEACON or COMMIT will be incompatible with Clause 148
  - That would make existing PLCA nodes go into a recovery/resync state →
- We should avoid **periodic** physical layer signaling on the line
  - PLCA nodes would react to that by signaling a collision in case of concurrent transmissions
  - non-PLCA enabled nodes will assert CRS at each transmission, causing deferral and possibly hampering media access fairness
  - may (likely) impact EMC/EMI performance

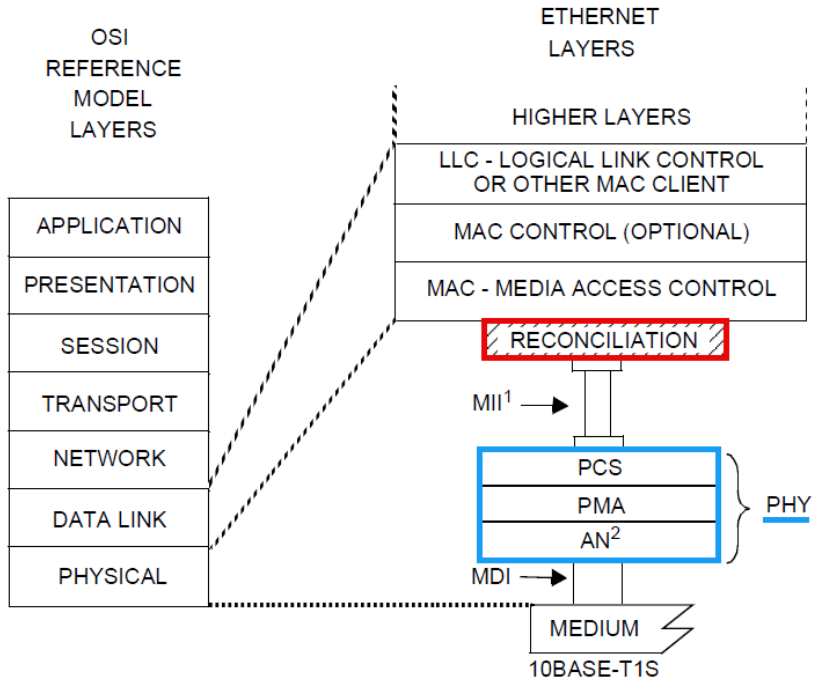


https://www.ieee802.org/3/da/public/0321/beruto_3da_01_031021.pdf

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The PLCA RS

- **PLCA is specified as a Reconciliation Sublayer**
  - An RS is defined as a box interfacing MII to the MAC Physical Layer Signaling (PLS) service
  - Separate from the PHY
- **There is, therefore, some very critical timing in the PLCA RS that is related to the PHY and communication over MII**



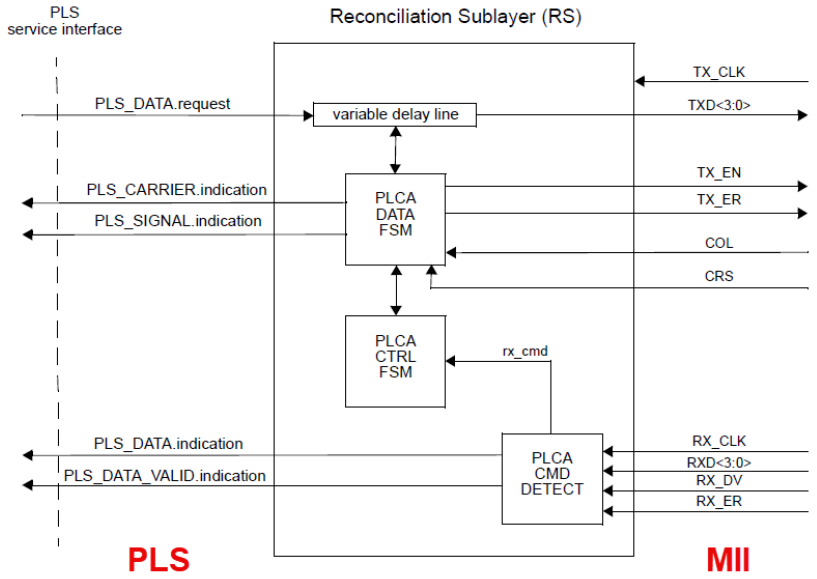


Figure 148–2—PLCA functions within the Reconciliation Sublayer (RS)

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The PLCA RS

- **Success will require changes to the PLCA RS state diagrams to be minimal and as self-contained as possible.**
  - The state diagrams are critical as they are normative
    - Any text is descriptive and informative
    - Where there is a discrepancy, the state diagrams are to be trusted

- **How was this accomplished when adding D-PLCA?**
  - Small updates to the PLCA Control and Data state diagrams
  - No changes to the PLCA Status state diagram
  - Addition of two new state diagrams for D-PLCA Control and Aging that are separate from the standard PLCA state diagrams.

Let's look at the D-PLCA changes

- **The following pages illustrate changes made in 802.3da to the PLCA state diagrams**
  - D-PLCA changes to existing PLCA state diagrams are highlighted in yellow
  - Fixes to the original PLCA state diagrams are highlighted in blue.

P. Beruto, "PLCA Corner-Case Fixes," Feb. 23, 2022.
https://www.ieee802.org/3/da/public/032322/beruto_3da_01_230222_plca_fixes.pdf

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PLCA Control State Diagram

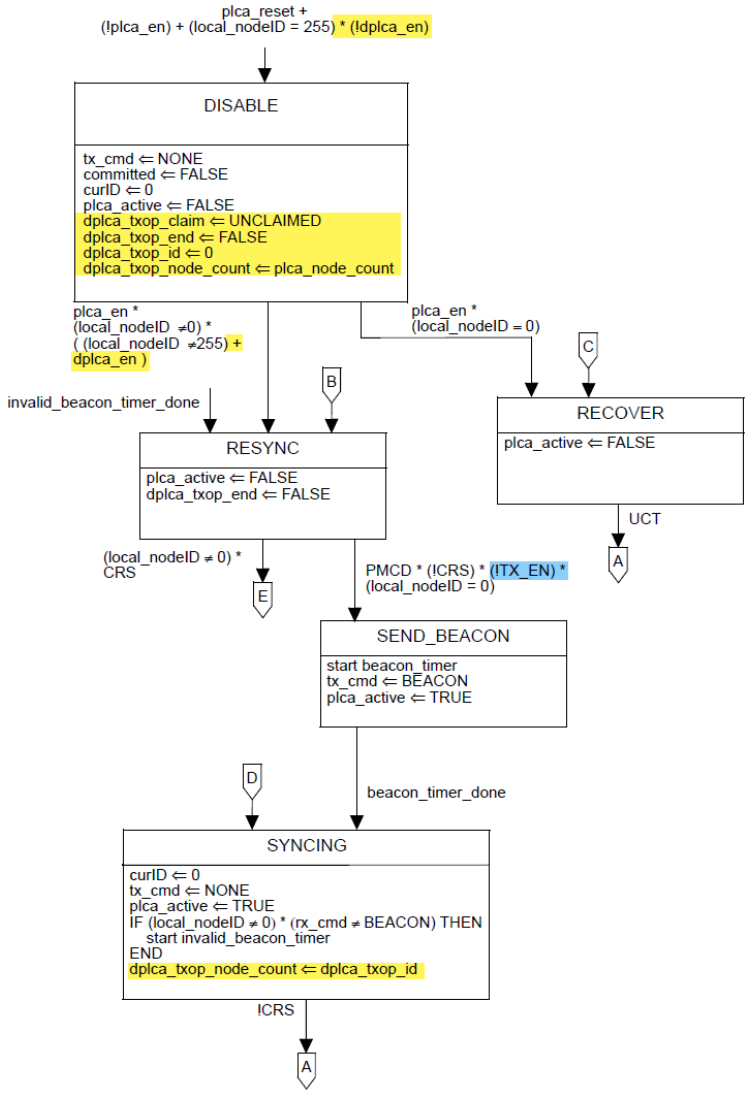


Figure 148–3—PLCA Control state diagram, part a

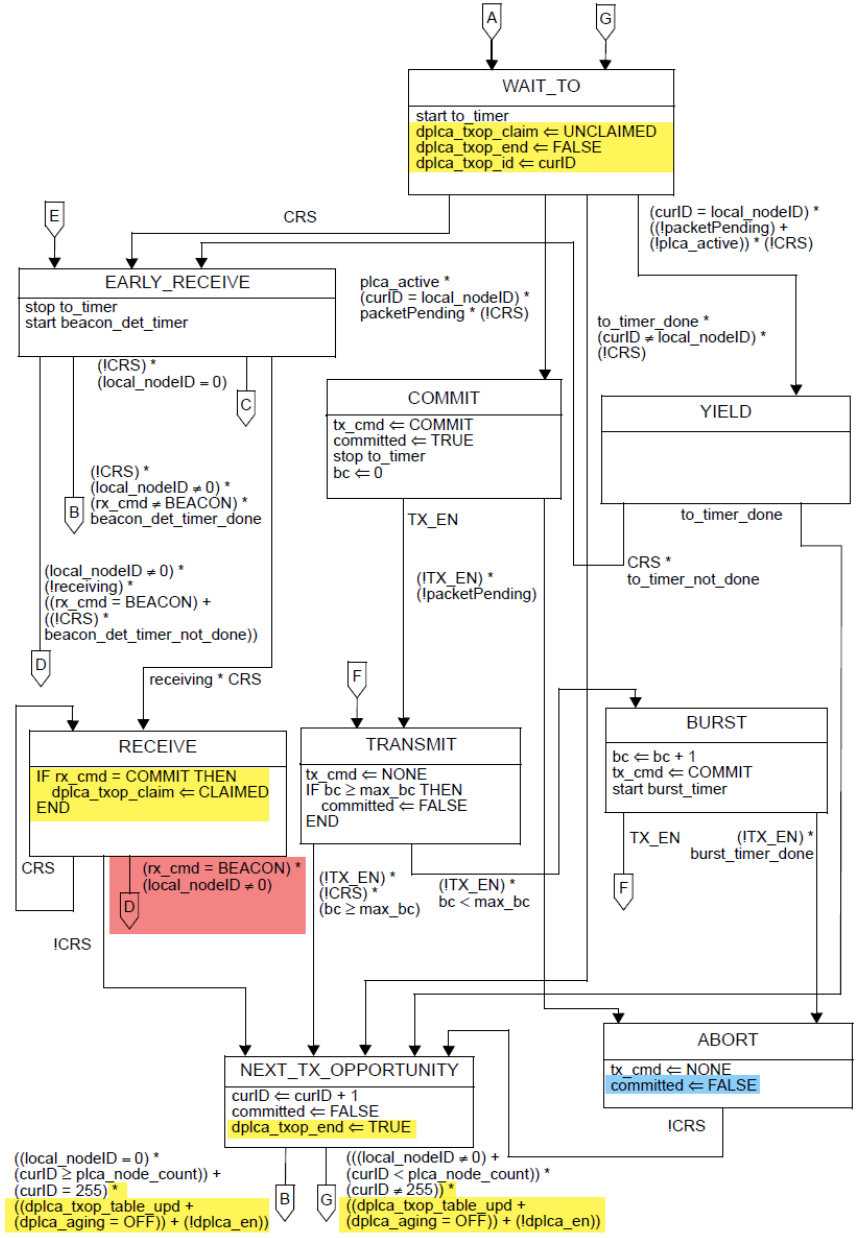


Figure 148–4—PLCA Control state diagram, part b

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PLCA Data State Diagram

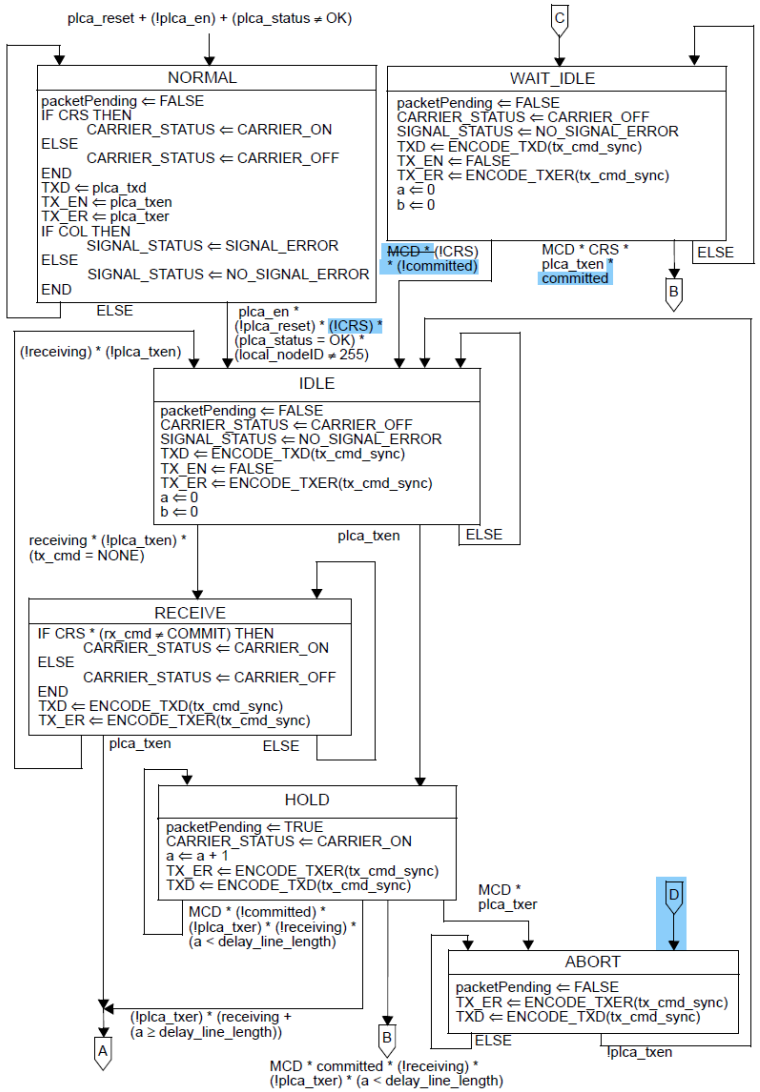


Figure 148–5—PLCA Data state diagram, part a

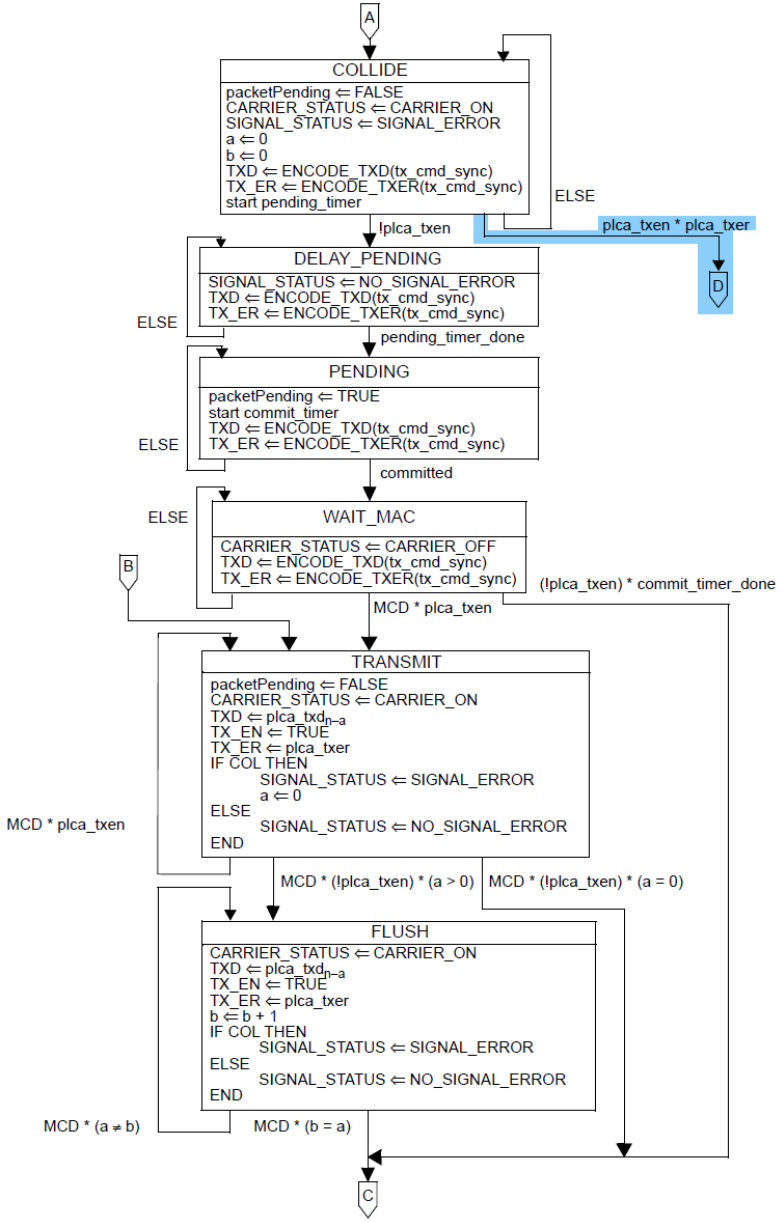


Figure 148–6—PLCA Data state diagram, part b

D-PLCA Aging State Diagram - New

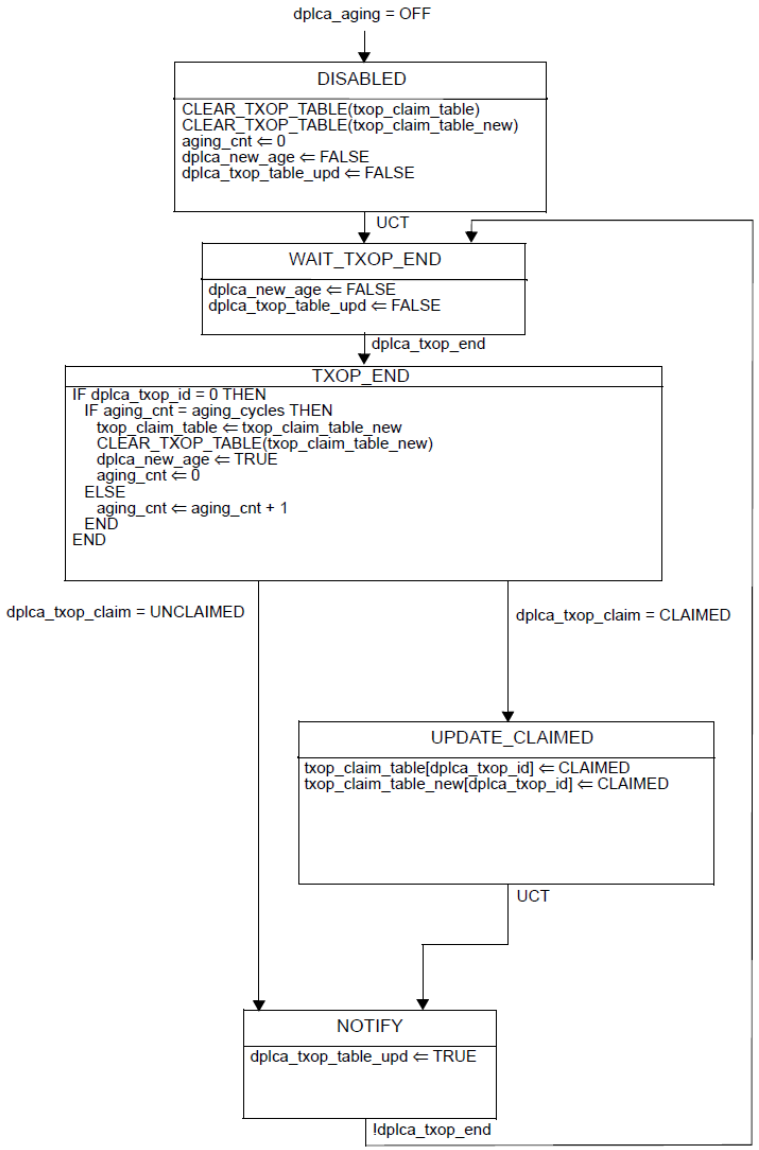


Figure 148–9—D-PLCA Aging state diagram

D-PLCA Control State Diagram - New

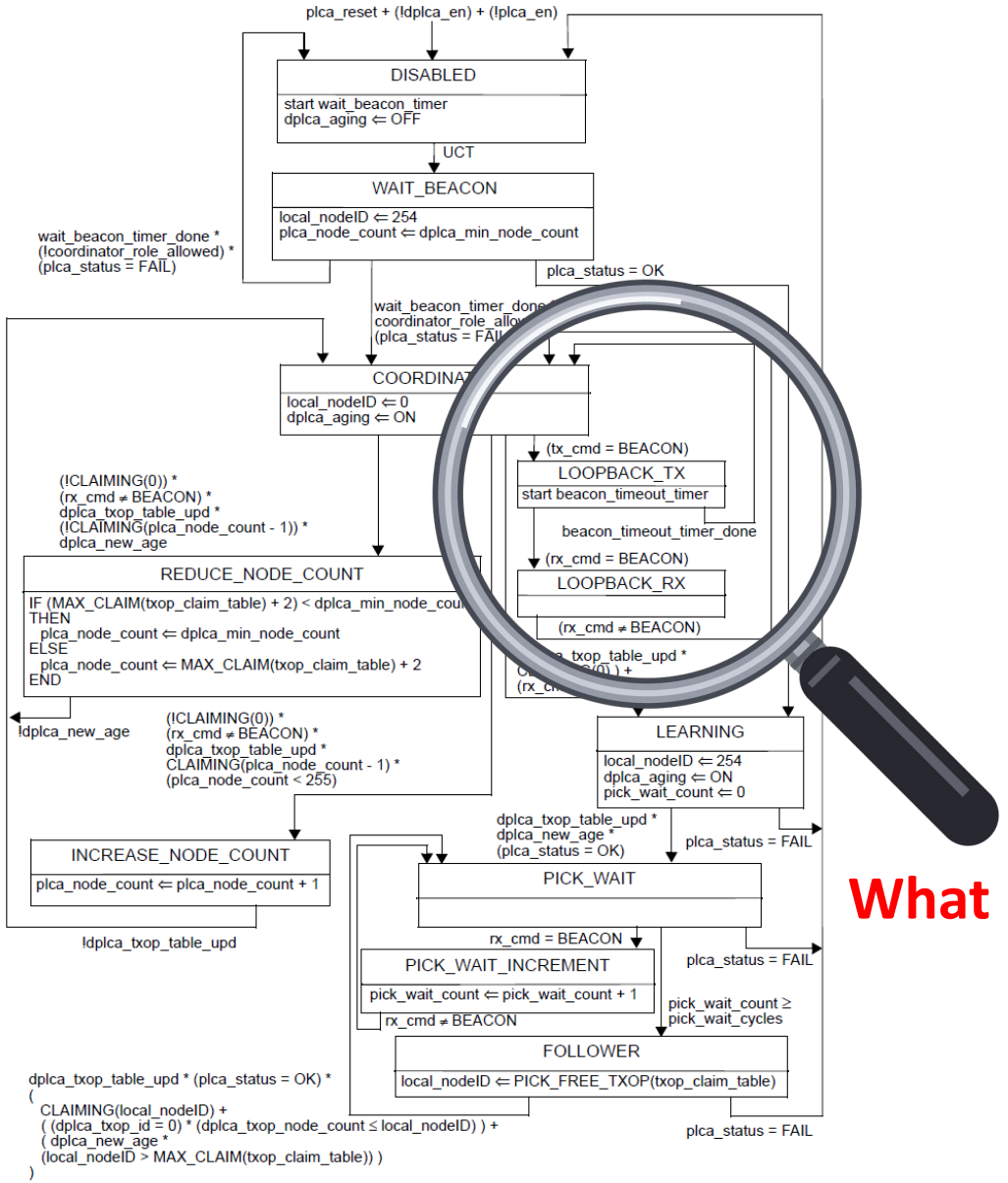


Figure 148–8—D-PLCA Control state diagram

What is all this in here?

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D-PLCA Control State Diagram - Oddities

This portion of the state diagram works around the fact that the PHY receives the BEACONs that it transmits and we had to account for variable MII/PHY latency to resolve.

These timing corners are common in the PLCA state diagrams

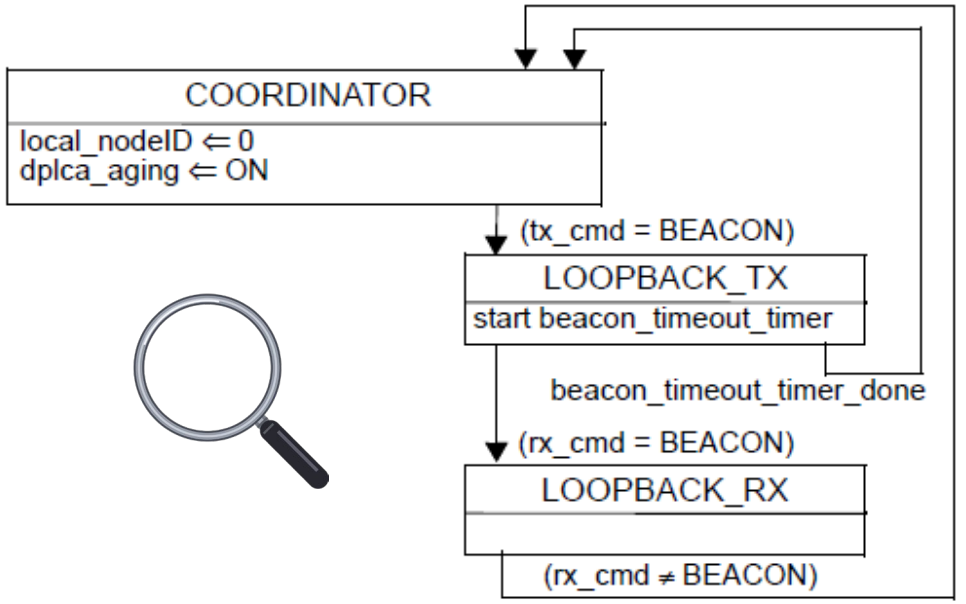
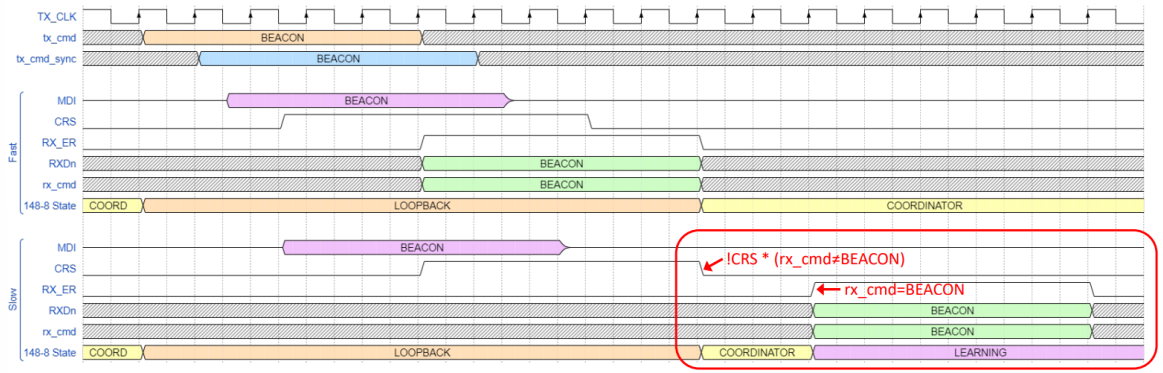
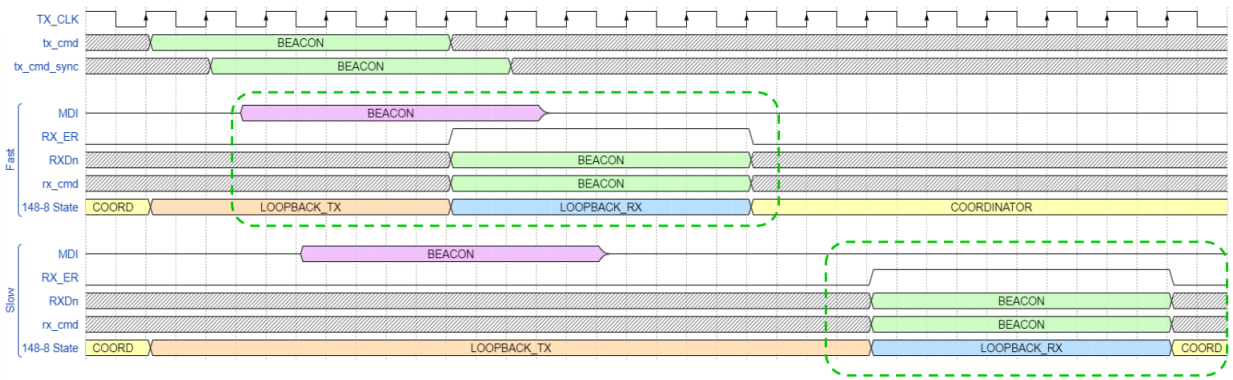


Figure 148–8—D-PLCA Control state diagram (excerpt)





https://www.ieee802.org/3/da/public/0525/Baggett_3da_Cmt47_DPLCA_Block_Own_BEACONs_v01.pdf

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Conclusions

- **Clause 147 and 188 PHYs only**
  - No changes, no new symbol encodings
  - No new PHYs in this task force
- **Constrain changes to Clause 148 (PLCA RS) and a service interface**
  - Don’t use MII to communicate priority class
  - Due to PLCA RS and timing complexity, we should follow the D-PLCA approach:
    - Keep changes to the existing PLCA state diagrams as minimal as possible.
    - Major changes should be kept as separate, new state diagrams.

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Thank You

Questions?