

# AN and ILT Timers, and Timeout Topic Update

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# Agenda

- Auto-Negotiation (AN) & PMD Control Function – 3ck/3df Era
- Inter-sublayer Link Training (ILT) – 3dj Era
- Use Cases without Retimers
- Use Cases with Retimers
- Summary

# Auto-negotiation and PMD Control Function

- AN is used only with electrical PMDs (“CR” and “KR”)
- AN has always been defined such that it restarts if PCS lock is not achieved after a specified time (link\_fail\_inhibit\_timer)
- As training became more important (and adaptation more complicated), the time allocated to the PMD control function (max\_wait\_timer) increased, and link\_fail\_inhibit\_timer increased with it
  - 10G/25G per lane: max\_wait\_timer=0.5 s ( $\pm 1\%$ ), link\_fail\_inhibit\_timer=0.5-0.51 s
  - 50G per lane: max\_wait\_timer=3 s ( $\pm 2\%$ ), link\_fail\_inhibit\_timer=3.1-3.2 s
  - 100G per lane: max\_wait\_timer=12 s (no range), link\_fail\_inhibit\_timer=12.3-12.4 s

# AN arbitration state diagram

- Note that this diagram has no “reset” condition; once “AN GOOD CHECK” is entered (training starts), there is no way to restart AN until the link\_fail\_inhibit\_timer expires
- If AN is enabled, the timer duration dictates the time to retry
- CRG adopted a 60 second duration for D1.4
  - This is likely going to require some change

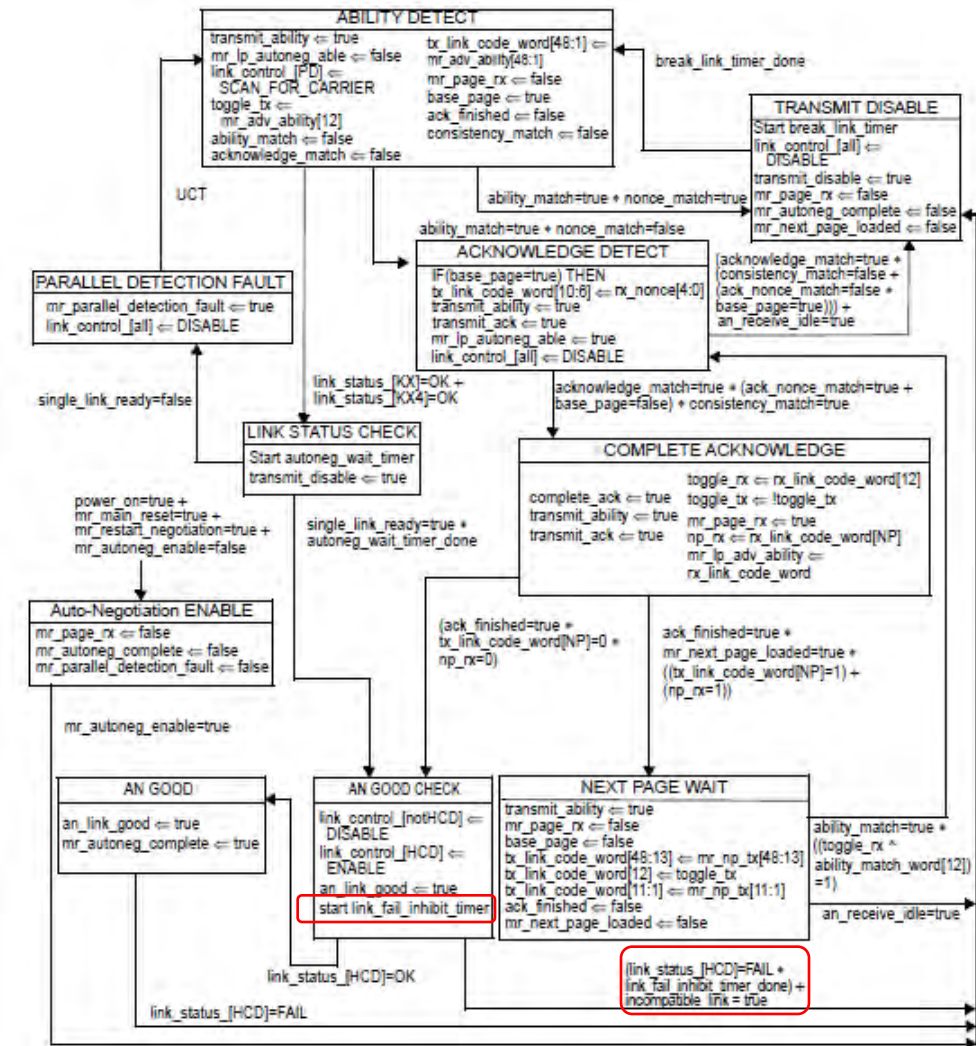
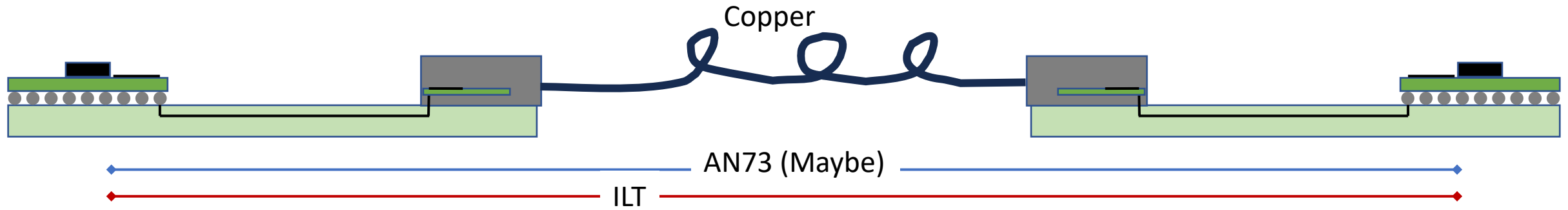


Figure 73–11—Arbitration state diagram

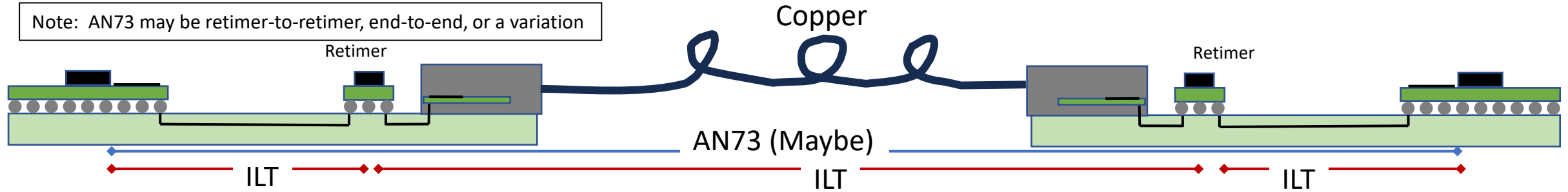
# ILT Added in 3dj

- ILT added in 802.3dj to facilitate training and well-defined startup procedures for 200 Gb/s per lane AUIs
  - And quickly extended to IM-DD PMDs

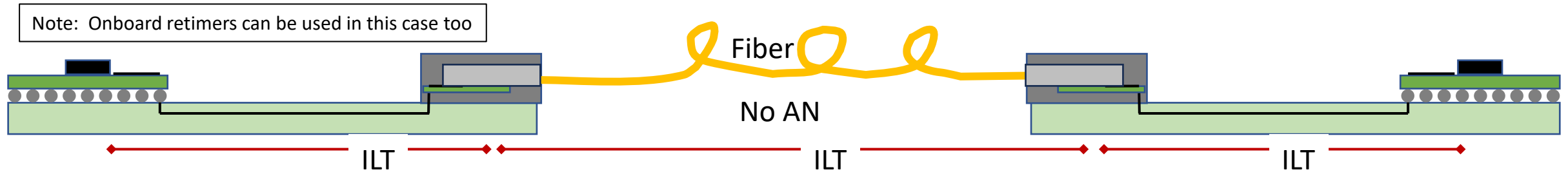
# 3dj Era Use Cases at High-level



Note: AN73 may be retimer-to-retimer, end-to-end, or a variation

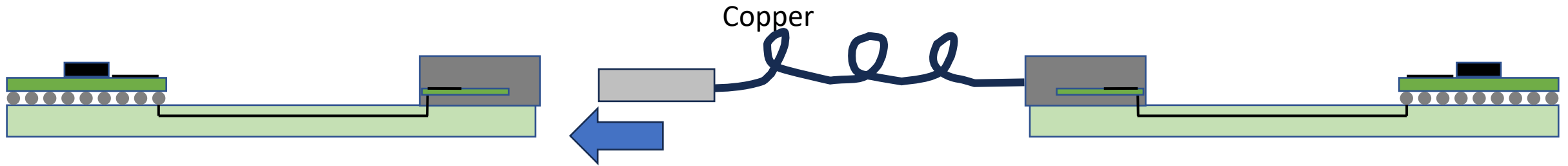


Note: Onboard retimers can be used in this case too



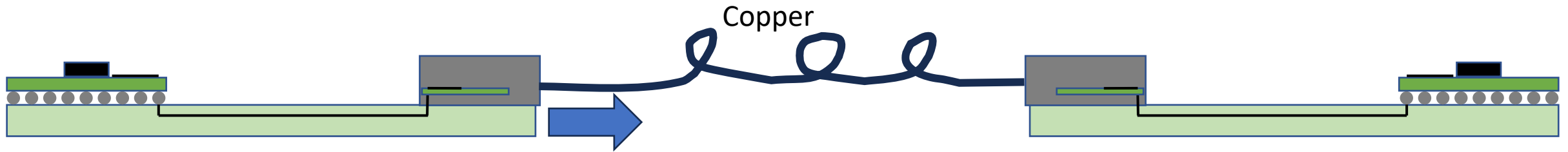
Note: This is simplified list of use cases. Many more exist

# Case 1P – AN73 + LT (Plug)



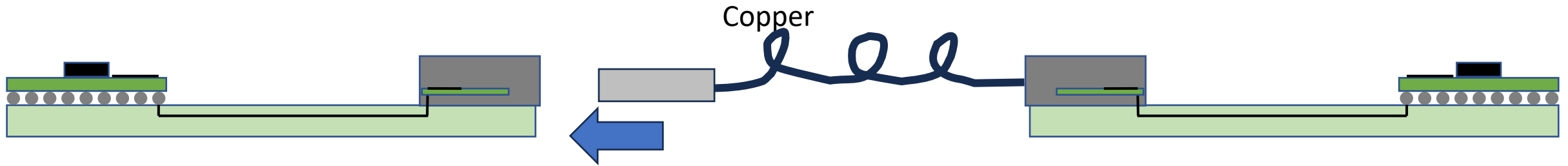
- Start with Link is unplugged
- Then cable is plugged in
- Flow:
  - AN73 starts
  - ILT runs
  - PCS locks

# Case 1U – AN73 + LT (Unplug)



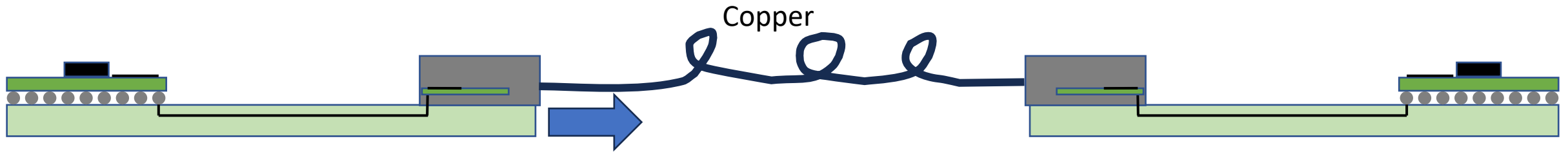
- Start with Link is up
- Then cable is unplugged
- Flow:
  - PCS fails
  - Line is squelched
  - AN73 is restarted after some time

# Case 2P – LT only (Plug)



- Start with Link is unplugged
- Then cable is plugged in
- Flow:
  - ILT runs
  - PCS locks

# Case 2U – LT only (Unplug)

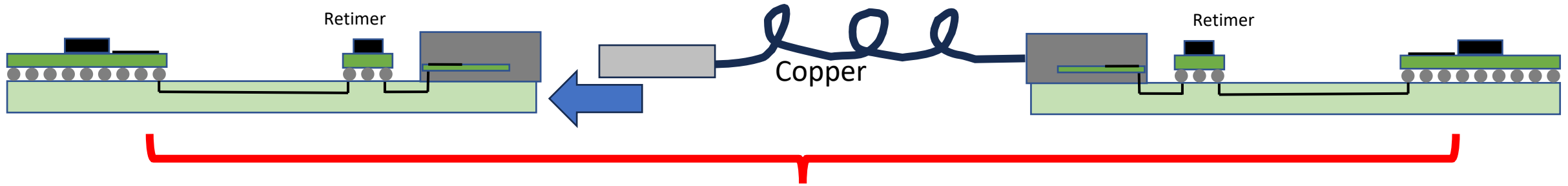


- Start with Link is up
- Then cable is unplugged
- Flow:
  - PCS fails
  - ILT restarts by mgmt
  - Line is squelched

# Adding Retimers w/ ILT

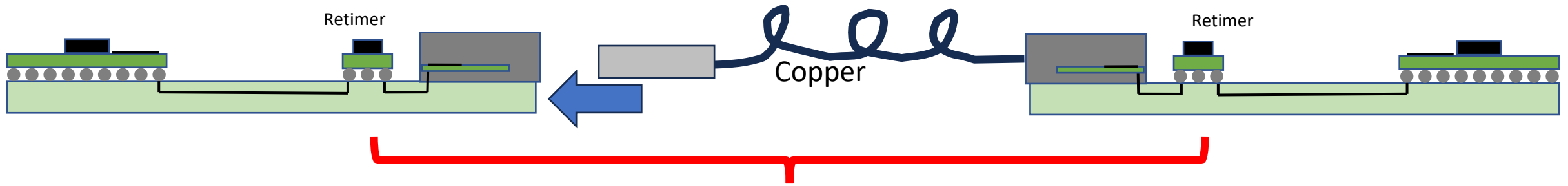
- The no-retimer cases were “easy”
- What happens when retimers are added into the link?

# Case 3P-h – AN73 + LT (Plug)



- The retimer is a AN73 transparent, the “host-to-retimer segment” contains AN73 pages

## Case 3P-r – AN73 + LT (Plug)



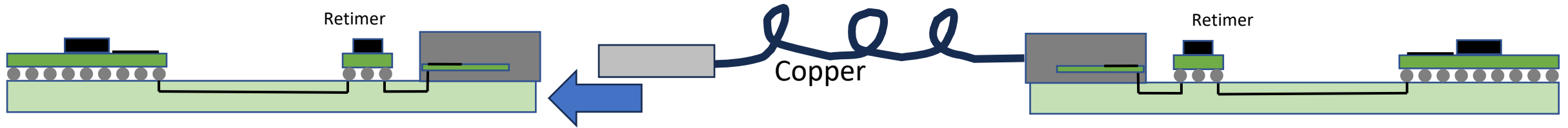
- The retimer handles AN73, the “host-to-retimer segment” could be either squelched or in ILT

# Case 4P-r – LT only (Plug)



- Provided for completeness

# Case 4P-r – LT only (Plug)



- Provided for completeness

# Unplug events with Retimers

- The unplug scenarios would be the same

# Summary

- Provided pictorial reference diagrams to use during the discussion of AN timers, etc.
- Following cases were shown:
  - Case 1P – AN73 + LT (Plug)
  - Case 1U – AN73 + LT (Unplug)
  - Case 2P – LT only (Plug)
  - Case 2U – LT only (Unplug)
  - Case 3P-h – AN73 + LT (Plug)
  - Case 3P-r – AN73 + LT (Plug)
  - Case 4P-r – LT only (Plug)
  - Case 4P-r – LT only (Plug)