Remote Fault & Break Link Proposal for 10-Gigabit Ethernet

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Outline

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Introduction

- **This proposal provides a *robust* mechanism for supporting two (and exactly two) primitives**
  - **Remote Fault**
    - **Indicates that a problem has been detected by the remote receiver**
    - **The source of the fault could be at:**
      - **Local transmitter**
      - **Interconnecting channel**
      - **Remote receiver**
  - **Break Link**
    - **Intended to reset the channel and re-start the synchronization process**
- **Both primitives indicate the occurrence of serious problems**
  - **Totally preclude data exchange**

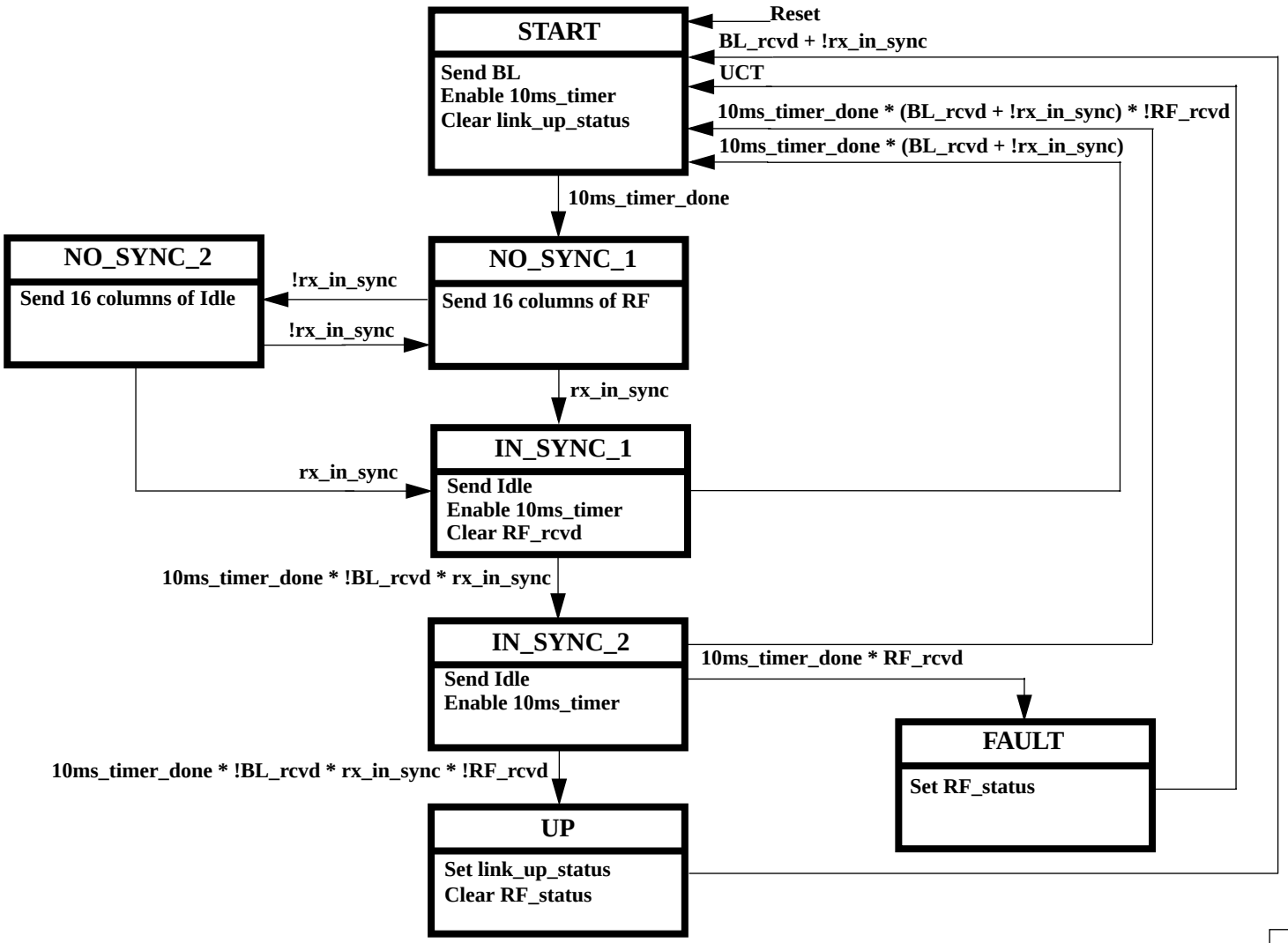
Concept

- **Break Link**
  - **Low-level continuous signaling**
    - **K28.7 across all four lanes on XAUI**
    - **No alignment required**
    - **Mapped to a “reserved0” 64b/66b Control Frame for UniPHY**
  - **Sent for the duration of ~10msec**
    - **During start up**
    - **When one end of the link loses synchronization**
  - **Effect of receipt**
    - **Set the link status bit to “down”**
    - **Reset the link synchronization state machine and the de-skew logic**

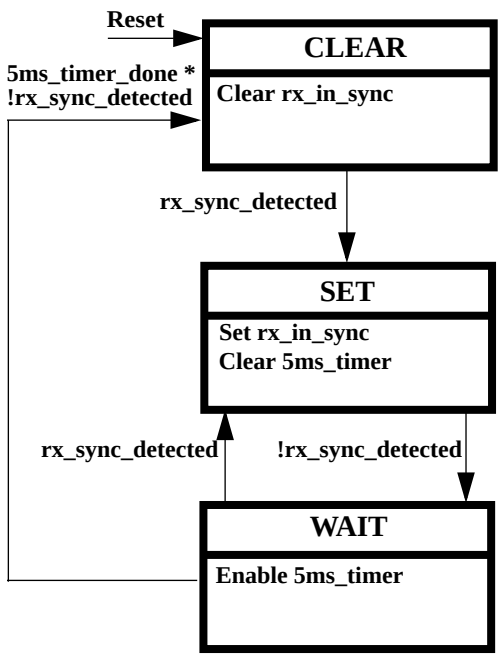
Concept (continued)

- **Remote Fault**
  - **Low-level continuous signaling**
    - **K28.1 interleaved with normal (randomized) Idle across all four lanes on XAUI**
    - **No alignment required**
    - **K28.1 is mapped to a “reserved1” 64b/66b Control Frame for UniPHY**
  - **Sent forever**
    - **Whenever the local receiver cannot achieve synchronization**
  - **Effect of receipt:**
    - **Keep the link status bit as “down”**
    - **Set the Remote Fault status bit when local receiver is in synch and it continues receiving RF signals**
    - **Once set, the Remote Fault status bit is only cleared when link status is “up”**

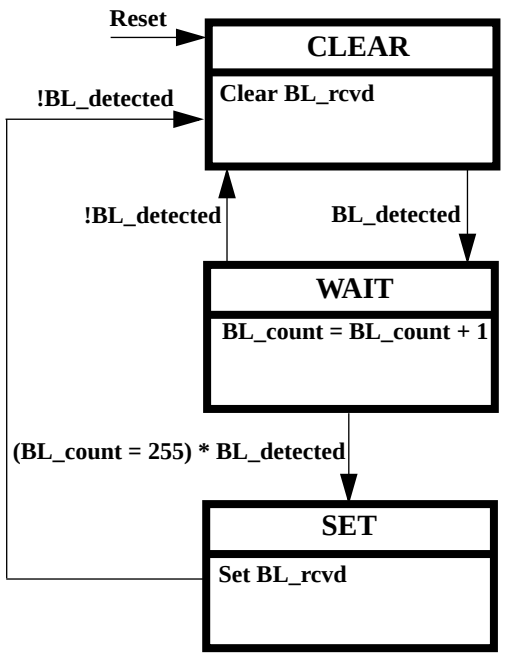
Transmit Synchronization State Machine



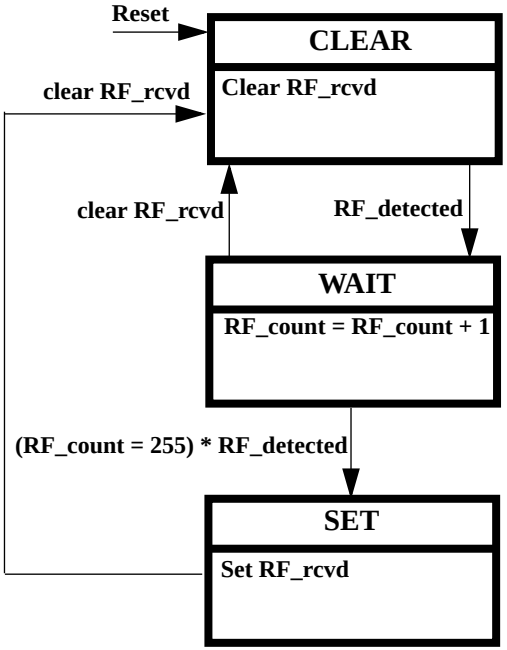
Receive Detection State Machines



RX Synch Detection S.M.



RX Break Link Detection S.M.



RX Remote Fault Detection S.M.

Notes:

*** rx_sync_detected = signal_detect * pll_lock * lane0_in_sync * lane1_in_sync * lane2_in_sync * lane3_in_sync**

*** BL_detected = (lane0 = K28.7) * (lane1 = K28.7) * (lane2 = K28.7) * (lane3 = K28.7)**

*** RF_detected = (lane0 = K28.1) * (lane1 = K28.1) * (lane2 = K28.1) * (lane3 = K28.1)**

What About OAM&P?

- There seems to be a wide consensus that OAM&P support in the WAN should be a mandatory function for 10 Gigabit Ethernet
- To date, it does not appear that the same level of consensus exists regarding the necessity of this function in LAN applications
- If 802.3ae decides to provide support for OAM&P in the LAN, such a solution should architecturally easily scale to higher speeds
  - LSS, as proposed, does not meet this requirement
    - Relies on the existence and a minimum duration of the IPG
      - What about 100 Gigabit Ethernet that uses 8-wavelength WDM?
- Potential solutions:
  - Use the WAN PHY in LAN applications
  - Frame-based approach
    - Very low overhead --- OAM&P information requires very little bandwidth
    - Can use high level management frames (SNMP)
    - Alternatively, a low level MAC frame can be defined (similar to 802.3x)

Summary

- **The proposed solution for Link Break and Remote Fault functions accomplishes the desired goals using a mechanism which is:**
  - **Robust**
    - **Continuous signaling**
    - **No alignment required**
    - **Predictable behavior**
  - **Simple and cheap**
    - **One state machine**
    - **Two timers**
    - **Two counters**
  - **Scalable**
    - **Does not rely neither on the existence nor the duration of an IPG**
    - **Will work for all speeds (100-Gigabit Ethernet,....)**
- **Support for OAM&P in the LAN is unrelated to LB/RF and should be considered on its own merits**
- ***We recommend that this proposal be adopted by 802.3ae as basis for further work for the 10-Gigabit Ethernet standard***