
S800-T Suspend Mode

Update: December 15, 2003

Overview of Scheme (Alternate Link Pulses)

- **Use a modified form of 802.3 Normal Link Pulses (“NLPs”) to signal transitions and maintenance of Standby mode**
- **802.3 specifies that NLPs are sent on pairs A and B of a four pair, 8 conductor channel**
 - Transmitted on conductors 1 and 2 (pair A), or on conductors 3 and 6 (pair B)
- **New scheme will use NLP signal on the alternative pairs C and D**
 - Transmitted on conductors 4 and 5 (pair C), or on conductors 7 and 8 (pair D)
 - Such signals will never appear in any legacy 802.3 application

INITIATION: Transition from Active to Standby

**Local PHY Sends NLP pattern on pair C or D
To Link Partner to Initiate Suspend
“Alternate Pair Link Pulses”, or APLPs**

**Link partner recognizes APLPs on pairs C, D
and responds with similar transmission of
APLPs on pair C or D**

Both ends enter Suspend mode

Suspend MODE

- **Both PHYs Enter Suspend**
 - Continue Transmitting APLPs on pairs C or D
- **Each PHY powers down critical circuitry**
 - 3 of 4 Transmitters are powered off
 - 3 of 4 Receivers are powered off almost completely
 - NEXT / FEXT cancellers, adaptive filters, ADCs are powered off
 - Pads and signal detect functions remain powered
 - Power reduced by >80%, to <100mW (implementation specific)
- **Suspend SIGNAL allows detection of physical disconnect**
 - e.g., cable pulled out of connector, link partner loses power

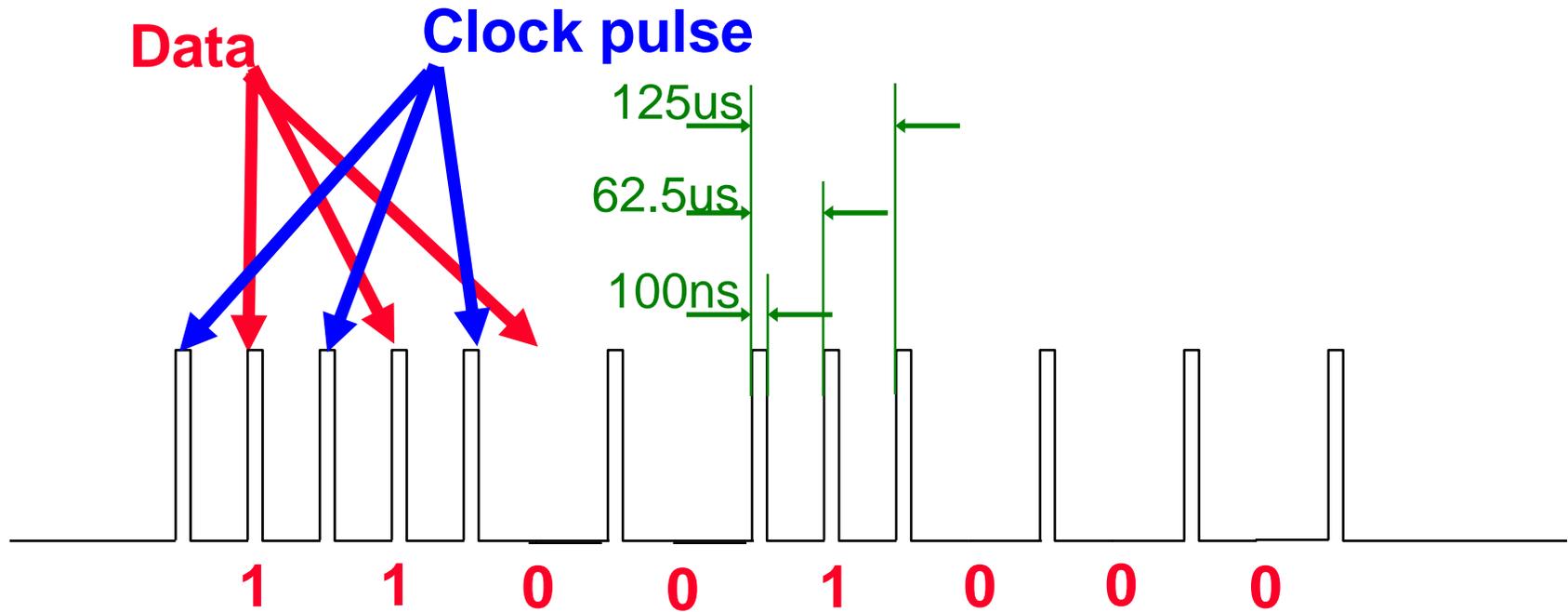
Suspend MODE Critique

- “Alternate Link Pulses” look just like 10BASE-T, but on the opposite pair
- Is it possible that any legacy device could get confused?
- There are cable installation that run 2 legacy links in parallel on a single 4 pair cable:
 - Link # 1 on pair A, B
 - Link # 2 on pair C, D
- When one end of link initiates Resume, it may take up to 750ms for other end to respond
 - Time for cable to be disconnected and reconnected to a legacy part
- Is there a way to avoid any confusion?

Enhancement

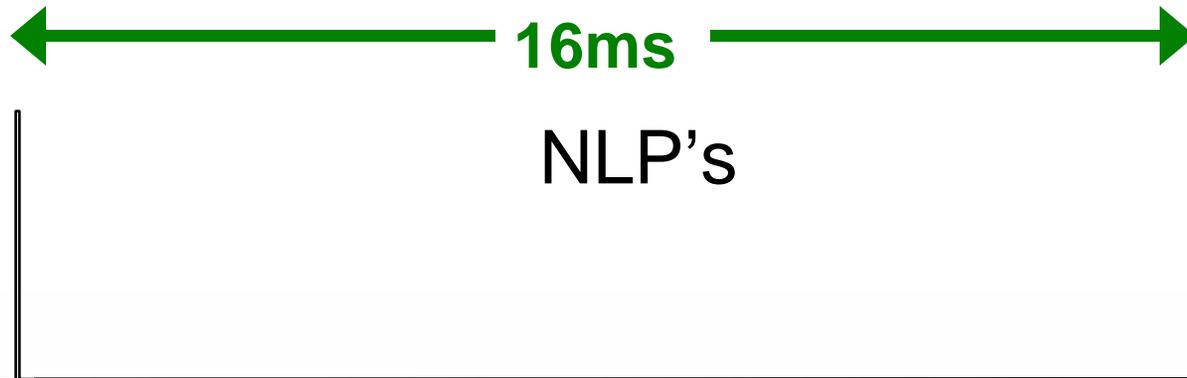
- **Make Alternate Link Pulses inherently unique.**
- **Leverage Fast Link Pulses, which allow information encoding**
- **Send Fast Link Pulse with all zeroes for data to initiate Suspend**
- **Send Fast Link Pulses with all ones for data to exit Suspend and initiate resume**
- **Power difference between NLPs and FLPs is negligible**

Fast Link Pulses



Not drawn to scale

Fast Link Pulses (100BASE-TX) VS Normal Link Pulses (10BASE-T)



Not drawn to scale

Disconnect

- If the cable is disconnected, or either end ceases functioning, then the APLPs will cease
- A PHY that no longer receives APLPs will disconnect and re-start Auto-negotiation
- Disconnection can be forced through software commands at either end, if desired to restart Auto-negotiation

RESUME:

Exiting Standby and Returning to Active Mode

- “Can we go straight to PAM-5 signaling on exit from suspend mode, or is an interim state required to make sure the master signals first?”
- Master node must initiate PAM-5 signalling before Slave.
- Master could exit by just starting PAM-5, but Slave should not
- Slave must send some “resume signal” prior to Master, and Master responds with PAM-5

RESUME:

Exiting Standby and Returning to Active Mode

- In Suspend mode, both ends retain their Master / Slave status
- If Master initiates Resume, it just starts sending PAM-5
 - Slave synchronizes and responds with PAM-5 idle
- If Slave initiates Resume, it send FLPs with all 1's in the data
 - Master responds by sending PAM-5
 - Slave synchronizes and responds with PAM-5 idle

Enhancement

- **Make Alternate Link Pulses inherently unique.**
- **Leverage Fast Link Pulses, which allow information encoding**
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Advantages

- **Allows entering and exiting Suspend mode**
- **Enables low power operation when data is not being transmitted**
- **Keeps physical connection active, allows cable disconnects to be detected**
- **Leverages existing signaling levels and timing of FLPs**
 - Allows 1000BASE-T PHY architecture to be used with only small modifications
- **Uses an alternate pair for signaling Suspend, to prevent any confusion with NLPs or with legacy 802.3**
- **Key concept: Use pairs C and D, which are normally “unused” for Link Pulse Signaling**