Capability Negotiation Considerations

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Backplane Objectives

- **Need and Want auto-negotiation among**

  - 1 G 1 lane SerDes (TBD, but presumed to be 1000BASE-X based)
  - 10 G 4 line SerDes (XAUI/CX4 based)
  - 10 G 1 lane SerDes (TBD scheme)

- **Desirable**

  - Future proof the scheme – 40G?, 100G? # of lanes? what else?
  - Deal w/ anticipated 10G 1 lane problems (equalization, training, etc)
  - Protect the legacy use (or mis-use) of 1 G SerDes, SGMII, etc.
  - Faster convergence
  - Faster fault indication (that allows for faster fail-over).

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AN Specification Content

- **Technology Identification**
  - If Common MDI

- **PHY Identification/Capability**
  - Speed
  - Fault Indication (RF)
  - Equalization (if any, not yet used).

- **MAC Identification/Capability**
  - Full/Half Duplex
  - Pause (and Asymmetric Pause)

- **Consideration for legacy technology**
  - Parallel Detect support

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Original Auto-negotiation –Clause 28

- **Solve The Common RJ45 (MDI-dependent) Constraint**
  - IEEE 802.3
    - 10BASE-T
    - 100BASE-TX, 100BASE-T4
    - CSMA/CD (HD), and Full-Duplex
  - IEEE 802.5 Token Ring
  - IEEE 802.9 Isochronous LAN (10BASE-T + ISDN)

- **Proactive**
  - Auto-negotiation of capability within compatible MAC/PHY
  - Prevent damage
    - 802.5 connected to 802.3 would cause 802.3 network disruption.

- **Embrace Legacy**
  - parallel detect capability built right into the state machines

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Another Auto-Negotiation - 1000Base-X Clause 37

- **Solve Common Fiber MDI/PHY**

  - practically MDI, i.e. connector, independent
  - PHY dependent (850 nm/1300 nm), PCS dependent.

- **Not Future looking**

  - Built on top of PCS
  - Built on the work of Clause 28
  - No Speed negotiation (did not consider SerDes being upgraded to full PHY status in BP Ethernet).

- **No Legacy Issues.**

  - 850 nm (SX) and 1300 nm (LX) optically cannot communicate in practical terms.
  - 10/100 Mb/s not considered

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Clause 28 Functional Model

The functional reference diagram (Figure 28–13) provides a generic example, illustrated with initial PMA implementations and showing the mechanism for expansion. New PMAs are documented in Annex 28D.
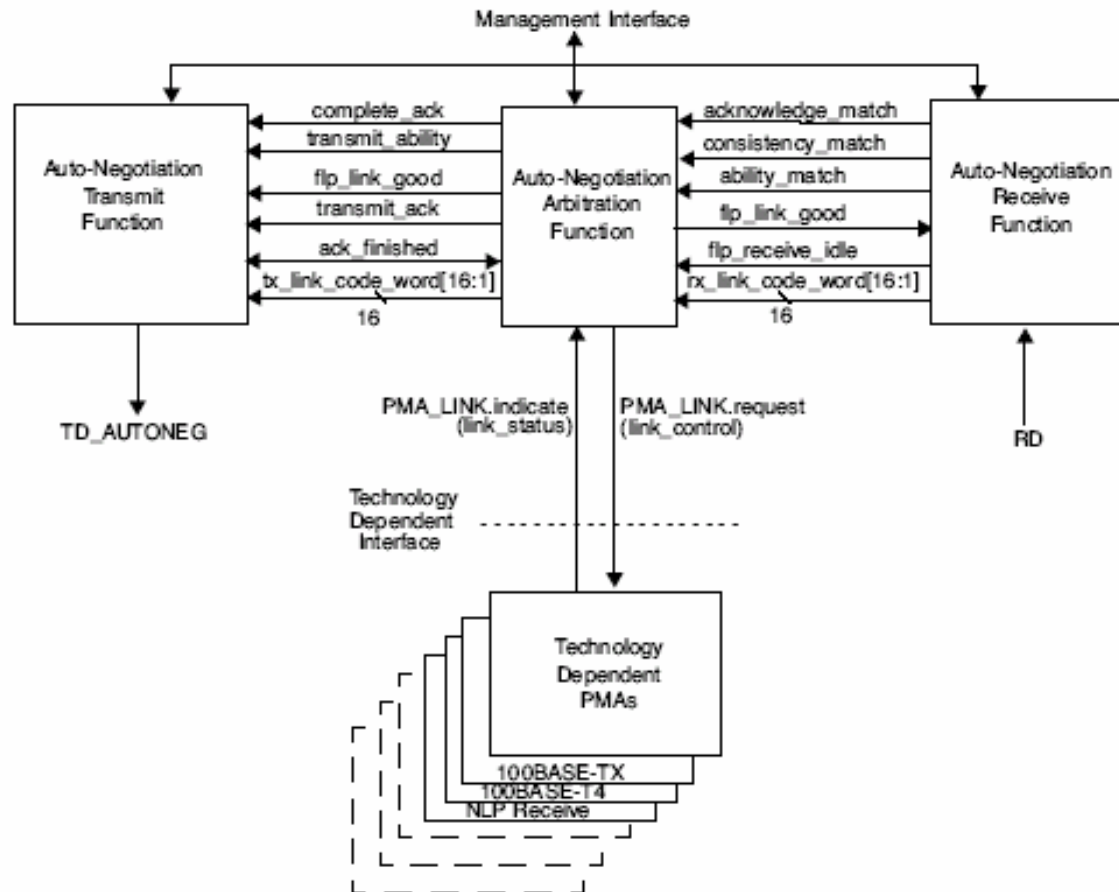

Figure 28–13—Functional reference diagram

Observations

- **Auto-negotiation at the MDI**
  - NOT PHY/PMA specific.

- **MDI for Copper**
  - RJ45
  - Negotiate all electrical signaling methods.
    - Justification: prevent damage/disruption

- **MDI for Fiber**
  - Various connectors
    - Recognize that fiber based LAN does not enforce connector type for practical conformance.
  - Negotiate among common technologies
    - Single Mode, Multimode, 850/1300 nm wavelength specific
    - Justification: no damage/disruption - 1300 nm receivers do not receive 850 nm very well (or at all). Not the same extent, but true for single/multimode

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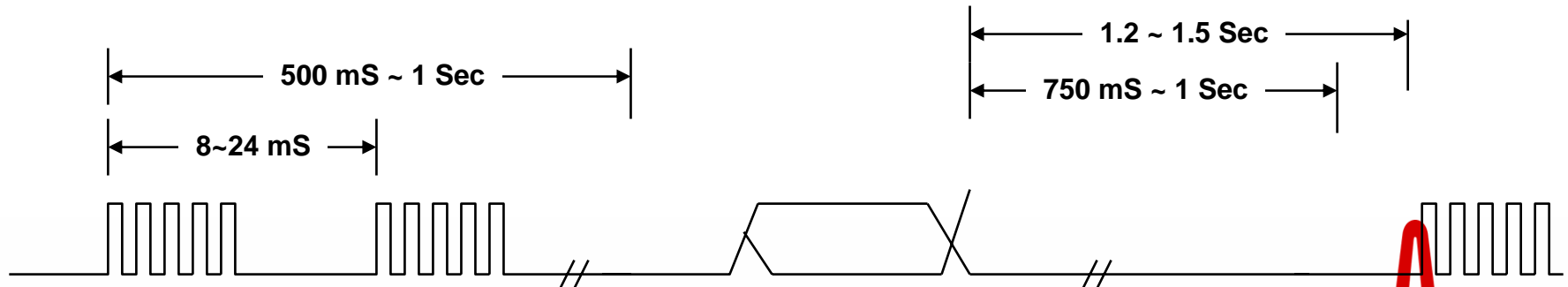**BROADCOM**®

Clause 28 Timers and Processes

- ## Link Signaling

  - Uses FLP

    - Auto-negotiation Timer: 500 mS ~ 1 Sec.
    - Break Link Timer: 1.2 ~ 1.5 Sec.

- ## Information Content

  - Base Page (codes all used up by 10/100), repeat until confirmed.
  - Message Page ➔ Next Page ➔ Next Page (1000BASE-T), repeat
  - MP ➔ NP ➔ NP, …, for every new information to be sent/received.

Clause 37 Timers and Processes

- **Link Signaling**
  - Uses 8B/10B /C/ ordered set (Table 36-3)
  - Uses Clause 36 PCS TX/RX state machines
  - Link Timer of 0~20 mS.

- **Information Content**
  - Similar to Clause 28
    - i.e. Base Page, repeat until confirmed. Message ➔ Next ➔ etc.
  - But, the base page coding enough for 1000BASE-X

  Personal Note: Clause 37 is significantly under-specified – not user friendly.

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Observations

- **Clause 28 Signaling (State machines, Timers) is not optimal for backplane**

  – Takes too long without any gain (e.g. no further robustness)

  – Complexity again without any gain.

- **Clause 28 Information (i.e. base page, msg page, etc) carry too much legacy information.**

- **Clause 37 signaling uses specific PCS (i.e. 8B/10B)**

  – The clause needs updates (not user-friendly today)

- **Clause 37 Information has limited future SerDes.**

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Recommendation

- **Both existing Clauses have issues.**

- **Recommend Clause 37 based auto-negotiation**
  - Why should AN be slower than the slowest speed considered for BP?
  - BP effort is legitimizes SerDes to a full PHY status. Why not use PCS-friendly method.
  - Non-8B/10B PCS only needs to support /C/ ordered sets + Idle.
  - Next page complexity is not anticipated for other SerDes addition.

  Otherwise,

- **Recommend a new auto-negotiation method that is truly optimized for the backplane Ethernet standard**

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Backup, Unused Slides

AN Background

	Signaling	Base Page
Clause 28 + Clause 40	Fast Link Pulse Below PHY/MDI	Multiple Message and Next Page required for new technology
Clause 37	/C/ ordered set Above PCS	Base Page has enough room for three new capabilities.

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