# Conditions for Backplane PHY EEE Transitions

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# Backplane Autoneg Refresher

- Prior to link, BP PHYs use Diff Manchester Encoded (DME) pages @ ~150MHz to exchange capabilities for AutoNeg prior to Link.

- Similar to Clause 28 Fast Link Pulses

- Info Exchanged includes:
  - Technology Ability:  KX, KX4, or KR
  - FEC: availability and requested
  - Pause, Remote Fault, Ack & Next Page similar to BASE-T.

# Post AutoNeg for BP PHYs

- If Speed negotiated to 1Gb-KX or 10Gb-KX4, link established similar to 1000BASE-X or XAUI init.
  - Relatively short time to sync & link (typically < 500 μsec)
- If speed negotiated to 10Gb-KR, must enter training sequence until rx_ready at both ends.
- Training Sequence => continuous Training Frames
- Training Frame => 548 Octets, (~440 nsec/frame):
  - Frame Marker
  - Coefficient Update (from local Rcvr to remote Xmitr)
  - Coefficient Status (Transmitter response & receiver status)
  - 512 Octet Pseudo Random training pattern.
- Training fails if not ready after 500msec

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# Rapid PHY selection: BP PHY Link

- Transition to 1Gb-KX or 10Gb-KX4

  – Idle symbols exchanged until synchronized.

  – Mostly dependant on Receiver Equalization convergence.

- Transition to 10Gb-KR

  – Receiver provides feedback to Link Partners 3-tap FIR transmit equalizer or equiv with coefficient +/- changes]

  – Sufficient time for CDR and equalizer confergence.

  – May take some # of iterations to optimize receiver initially for quality link.

# Possible Transition Sequence

0.  Save or update RX state (and KR-TX Tap) values.

1.  Disable backplane TX

2.  Stop forwarding RX data to xMII

3.  Reconfigure new speed on TX, RX, PHY logic, XAUI, etc.

4.  Restore previously stored RX state

5.  (KR only) Restore previously stored TX tap settings

6.  Wait for RX PCS sync to be detected

7.  Enable forwarding of RX data to xMII

8.  Indicate speed change complete

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**hp** invent

# A need to save RX States for all speeds

- RX state may include any variable within the PHY receiver depending greatly upon the specific implementation and may include gain settings, fixed or adaptive equalizer settings, and channel characteristics

- Sequence assumes RX State (and TX taps for 10Gb-KR) are save prior to agreeing to transitioning to them.

- Saving RX state for lower speed(s) would quicken convergence to lower speed also.

- To save RX state at lower speeds, need to have linked at least once at those speeds.

- Indicating valid RX State was saved at lower speed increases probability of reliable and quick transition.

# Saving RX States at all speeds

- Recommend that after Reset or Power-on, EEE PHYs
  - Temporarily link up at each link speed to train receivers and save their RX state prior to final Highest Common Denominator.
  - No data would be forwarded until final link reached.
- Need indicator that receiver state was saved for all possible link speeds.
- Recommend defining bit/signal like:
  - kx_rcvr_state_saved
  - kx4_rcvr_state_saved
  - kr_rcvr_state_saved & kr_tx_tap_saved.
  as a gating item for Rapid PHY Transition.
- If link does not resolve within some timer value, then full Autoneg maybe required or a return to previous speed.

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# KR re-training

- After KR RX state and TX tap coeff restored, still may require short re-training sequence for sanity check.

- Need contingency in case link cannot be re-established at KR rate within TBD time/frames.
  - Revert back to lower speed to keep data flowing.
  - or Restart autoneg process.

- Need estimates from several KR PHY Mfgrs on time for re-training from saved states/coeffs.

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# Summary

- This presentation:

  - covered some of the areas we should consider for BP EEE objectives

  - provides some ideas on how to move forward on BP EEE objectives

- Additional work needs to be done including BP timing estimates

- Be mindful of NIC or Switch buffer size implications of timing of either TP or BP PHYs.

# Thank you.