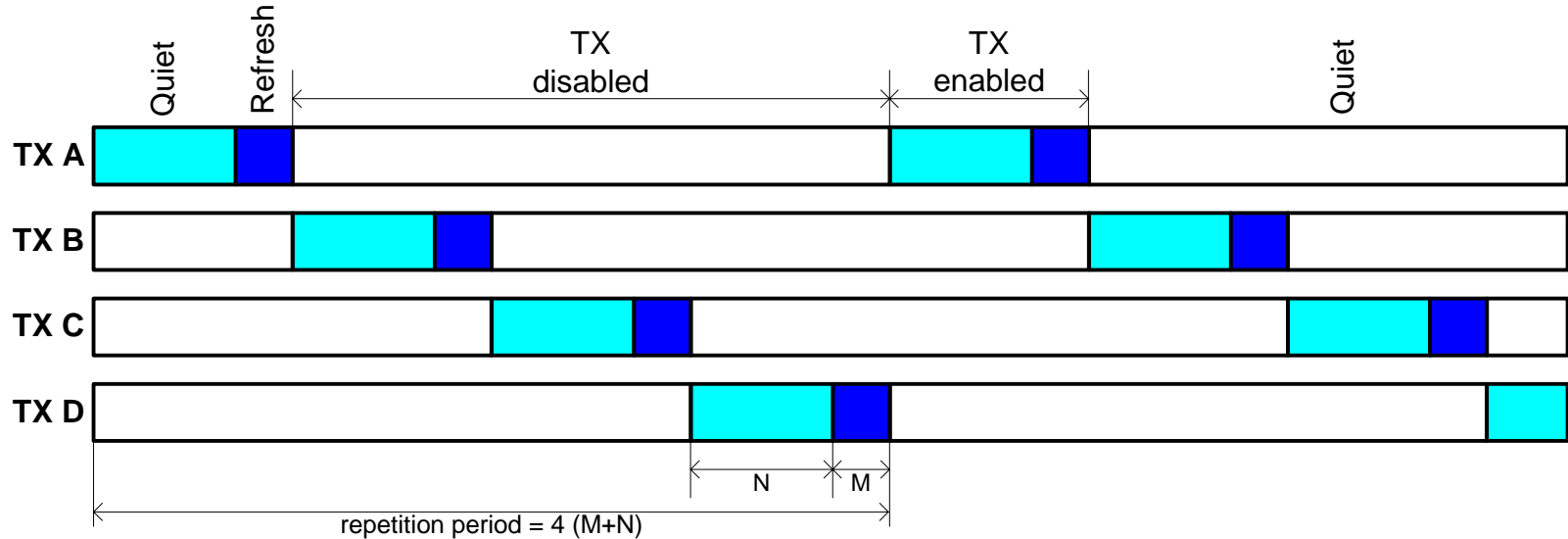# Refresh+

an option to ease 10GBASE-T LPI parameter selection

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Overview

- ➢ Imposing a fixed duration for Refresh is both suboptimal and inefficient
  - May cause contentious link-partner parameter negotiation
  - May limit power savings
- ➢ Refresh+ is intended to alleviate these problems by adding flexibility in the Refresh structure

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Parameter Selection

➢ Link-partners need to agree on parameters: M and N

➢ Main trade-offs:
  - To achieve larger power reduction: small M, large N
  - To track channels and timing: large M, small N

➢ The maximum value of N is more restricted by phase error and timing concerns

➢ The minimum value of M is more restricted by filter update engine

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Duration of Refresh

➢ The optimum duration of Refresh (M) depends on
  - The implementation of the filter update engines
  - The size of filter being updated
    - Longer duration may be desired to update larger filters such as echo and NEXT cancellers
    - Shorter duration may be adequate for equalizers and FEXT cancellers

➢ The ideal M may be different for different link-partners

➢ The ideal M may be different for transmit and receive paths

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Inefficiencies

➢ To enforce a common M, need to choose the maximum of the desired values for
  - the receive and transmit paths
  - the 2 link-partners

➢ The transmitter has to send M Refresh frames periodically even when there is no need for filter update

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Refresh+

➢ Split the M frames of Refresh interval into 2 segments of M1 and M2 frames

➢ An Enabled transmitter may remain Quiet or send Refresh frames, at its own discretion, during the first segment

➢ An Enabled transmitter shall send Refresh frames during the second segment

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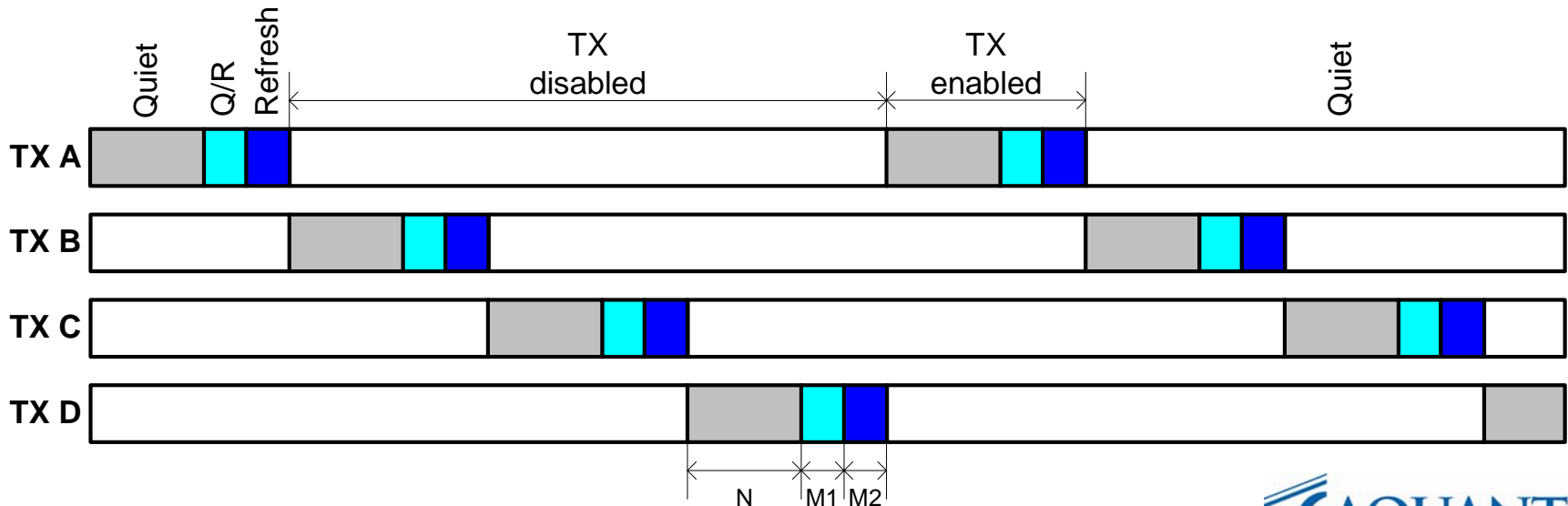
Benefits

➢ Decouples transmit and receive requirements
  - M1 is optimized for equalizers and FEXT cancellers
  - M2 is optimized for echo and NEXT cancellers

➢ Resolves contentions between link-partners
  - M1 is chosen by remote PHY
  - M2 is chosen by local PHY

➢ Power savings: the transmitter sends M2 Refresh frames only if and when they are needed

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Parameter Selection

- ➢ Choose a fix N
  - Based on restrictions due to phase error and timing recovery

- ➢ Choose a fix M=M1+M2
  - Maximum refresh period needed for any filter and any implementation

- ➢ M2 may be selected by link-partner during auto-negotiation from an acceptable (finite) range of values

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Summary

➢ Refresh+ is a more flexible form of Refresh

➢ Simplifies parameter negotiation/selection

➢ Increased efficiency and power savings

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