Terminology Proposal for LPI EEE

March 2008

IEEE 802 Plenary, Orlando, FL

Robert Hays

Intel Corporation

Energy Efficient Ethernet

Supporters

- Brad Booth (AMCC)
- Joseph Chou (Realtek)
- Dan Dove (HP ProCurve)
- Bob Grow (Intel)
- Robert Hays (Intel)
- Adam Healey (LSI)
- David Law (3Com)
- Brian Murray (LSI)
- Aviad Wertheimer (Intel)
- George Zimmerman (Solarflare)

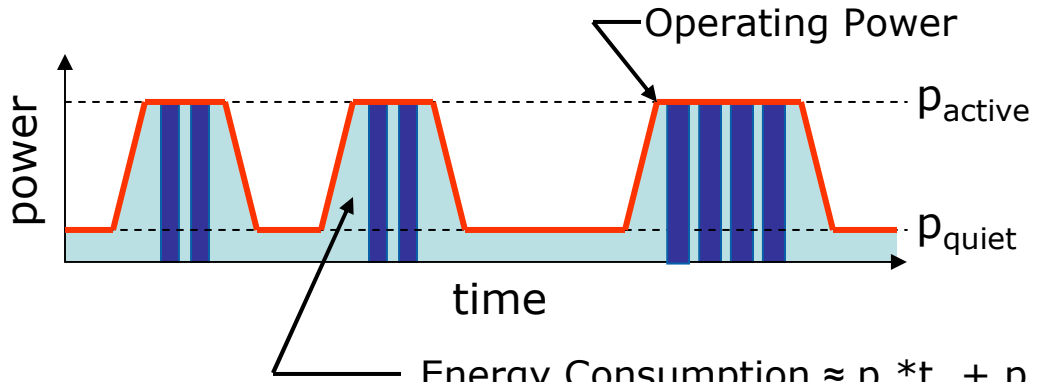
Purpose of This Presentation

- This proposal is intended to:
  - Provide a common framework for LPI-based EEE proposals with consistent terminology
    - Allow flexibility to optimize the solution for each PHY (e.g. unique signals or parameter values)
  - Distinguish between Operating States, Signals, and Parameters
    - Avoiding the use of existing terms for new purposes (e.g. "Idle")
    - Avoiding the use of the same term for multiple purposes (e.g. "LPI")

- This proposal is NOT intended to:
  - Define how to negotiate or derive parameter values
  - Capture every term or concept that may appear in EEE proposals

Electrical Energy Terms

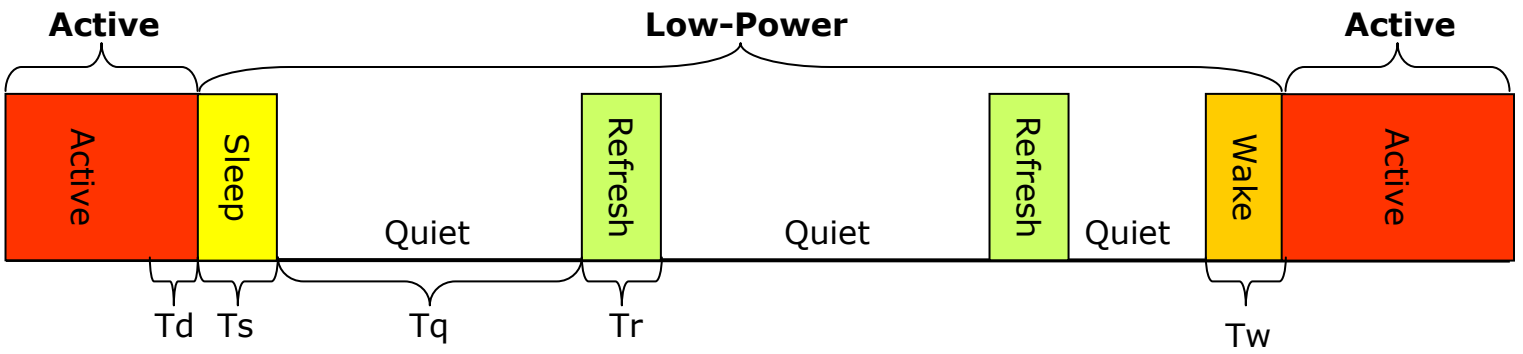
Term	Description
Operating Power	The rate at which electrical energy is delivered to a system at a given point in time, measured in Watts.
Energy Consumption	Aggregate power consumed by a system over a period of time, measured in Joules.
Energy Efficiency	Energy required to transmit/receive a unit of data, calculated in Joules/bit.
Average Power	Energy consumed by a system divided by the period of time measured, calculated in Watts.



Energy Consumption ≈ $p_a*t_a + p_q*t_q$
Energy Efficiency ≈ $(p_a*t_a + p_q*t_q)$ / data transmitted
Average Power ≈ $(p_a*t_a + p_q*t_q) / (t_a+t_q)$

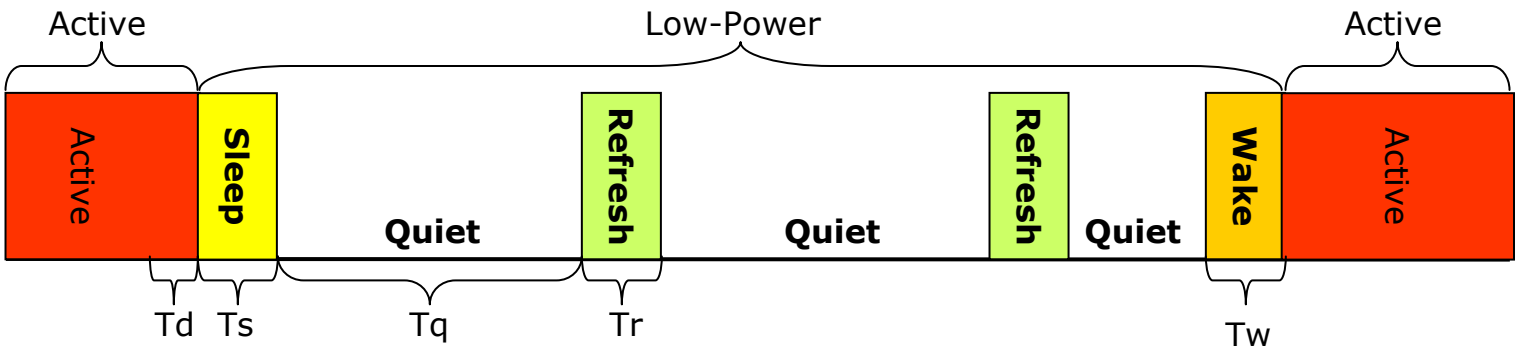
Operating States

Term	Description
Active state	Existing state used for data transmission where either data packets or IPG/Idle symbols are transmitted.
Low-Power state	New state used during periods of no data transmission to allow system power reduction between data packet bursts.



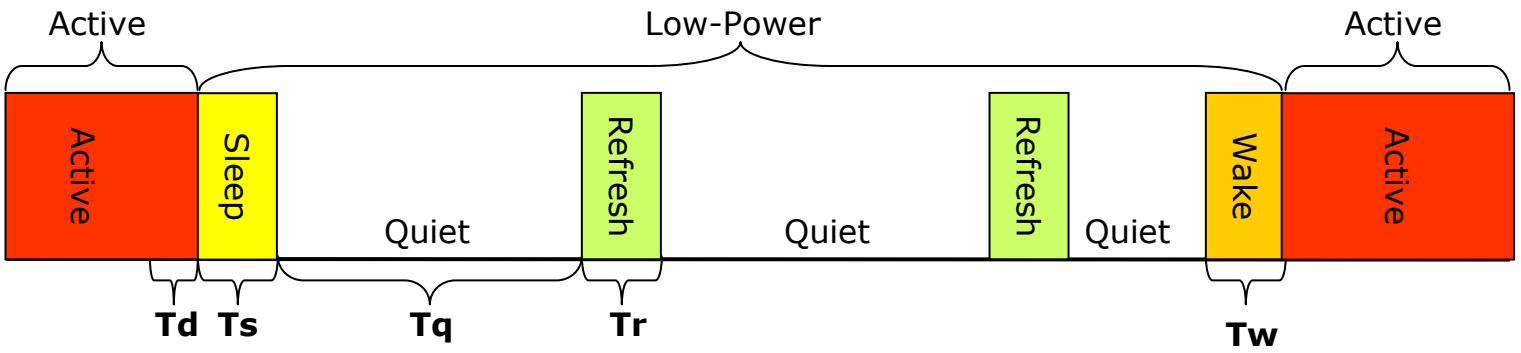
New Line Signals

Term	Description
Sleep	Signal to inform remote link partner of entry into Low-Power state.
Quiet	Minimal energy mode for PHY power reduction during Low-Power State.
Refresh	Signal periodically transmitted during Low-Power state for PHY to maintain timing recovery and/or coefficient sync.
Wake	Signal to inform remote link partner of entry back into Active state. Provides remote link partner sufficient time to turn ON and get ready to receive data.



New Timing Parameters

Term	Description
Decision Time (Td)	Time used by higher-layer control policy to decide when to enter Low-Power state. Out of scope for 802.3az spec.
Sleep Time (Ts)	Duration PHY sends Sleep symbols before going Quiet.
Quiet Duration (Tq)	Duration PHY remains Quiet before it must wake for Refresh period.
Refresh Duration (Tr)	Duration PHY sends Refresh symbols for timing recovery and coefficient synchronization.
Wake Time (Tw)	Wait period where no data is transmitted to give the receiving system time to wake up.
Propagation Delay (Tp)	Transmission delay of the media from the MDI of the local device to the MDI of the link partner. Not shown in diagram.



Thank You!

- Questions?