# EEE control protocol proposal

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# EEE objective…

Define one communications mechanism to negotiate and control rapid speed change for an EEE capable point-to-point network (approved 3/15/07)

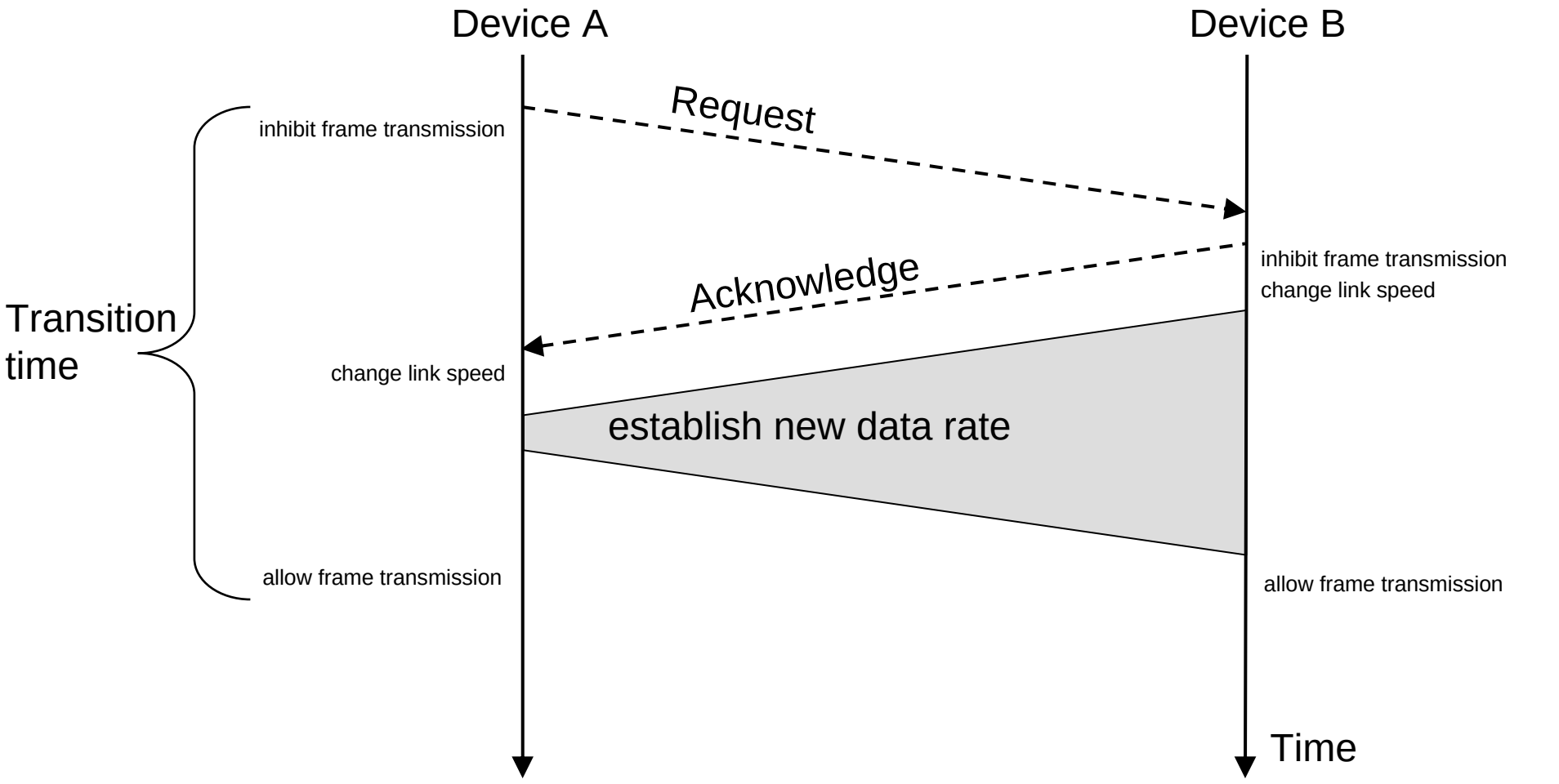
Apart from all the discussions about how the PHYs might work

- Needs method for capability exchange and change initiation

Multiple possible solutions highlighted during CFI…

- LLDP; Eth-OAM; new slow protocol; MAC control; Physical layer; etc.
- Each has merits, clear advantages for LLDP

# How it works – from the CFI




Most important function of communications mechanism – request / acknowledge transfer

# Some requirements – general and specific

- The transition time must be “short”
  - In absolute terms – service interruption for some applications
  - In relative terms – buffer requirement at higher speeds
  - Primarily concerned with Tx inhibit time
- “one” communication mechanism
  - Must work across multiple PHY families
  - Flexibility for as yet undefined parametric support (maybe)
  - Widely implemented standard, consider related applications
  - Extensibility for system (non-PHY) power savings a possibility
  - Either h/w or s/w implementations
- Examine architectural approaches in these terms
  - Physical layer vs packet communication

# Physical layer vs packet-based communication (i)

- Physical layer means coded directly into signaling
- Packet-based could be LLDP; Eth-OAM; new protocol; etc.
  - Assume that PHY-layer is handled by PCS only
  - Assume that packet based handled above the MAC
- PHY-layer is “much” faster
- Packet must get through CRC check – minimum 512 bit times
  - Absolute time = ~50uS @ 10Mbps - insignificant
- PHY-layer may also interrupt packet in flight – further 16,000 BT advantage
  - Earlier communication reduces data inhibit time at initiator
  - Potential saving of 10 x max packet buffering – if interrupt allowed
  - Less significant for higher bit rate PHYs (flight time dominates)
- Overall PHY-layer advantage is not compelling
  - Transitions at lower rates still within absolute time
  - Transitions at higher rates dominated by PHY re-sync time

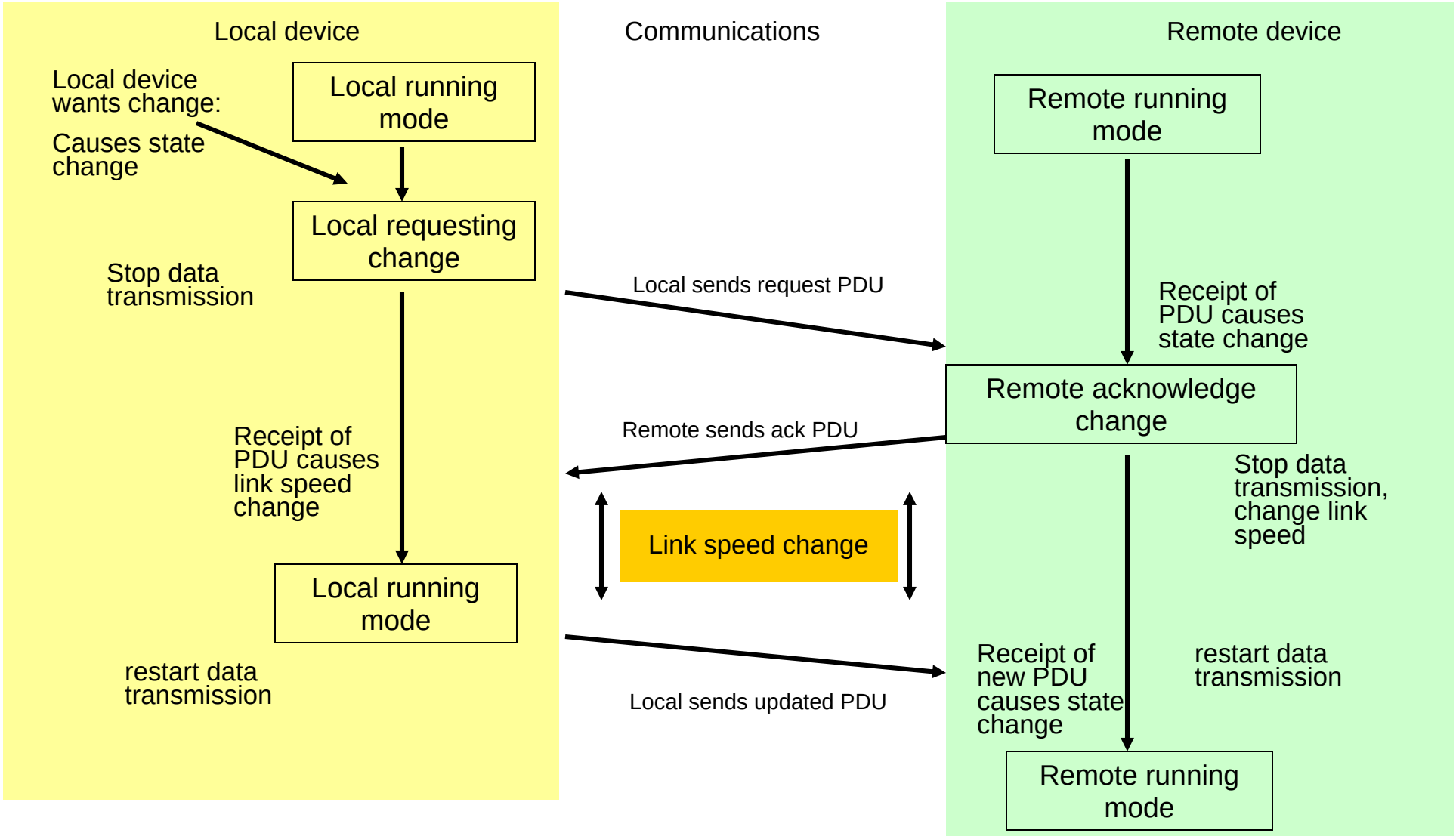
# Physical layer vs packet-based communication (ii)

- Packet layer is identical for all PHY types
- Assume that transition handling is in hardware / firmware
  - Reaction time is similar to PHY-layer (~ uS response)
  - Other architectures may be considered if appropriate
  - v. slow transitions acceptable for v. simple applications
- Packet flexibility may be important
  - Up to 64 bytes of parameters – easy to be flexible
- Compatibility / co-existence with other important protocols
  - PoE plus uses LLDP frames to manage power states
  - Very small incremental effort to add energy saving TLVs
- Transition state machine can mimic other project
  - Similar requirements, similar behavior
  - Increases implementation confidence (& saves effort!)

# Communication protocol

- 802.1AB LLDP
  - Published 2005
  - Currently under revision (will allow burst usage)
  - Defined protocol frames
    - Very small impact on data b/w (1 per 30 second regularly)
    - Not forwarded by bridges (needs definition in TPMR)
  - Define new TLVs code (maybe add to Annex G)
- Use a heart-beat communication mechanism…
  - Periodically send state & capabilities – advertise EEE available
  - Mode change via request and acknowledge states
  - Needs burst of messages for state change
- Use the same approach as 802.3at
  - Some issues being worked on
  - Define objects, MIB & corresponding TLVs
  - Also define Clause 22 / 45 register access for PHY changes

# General state change procedure



# Next steps

- Adopt LLDP-based control protocol, modeled after 802.3at state change
  - In principle – not the details yet
- Make detailed baseline with state and object definitions
  - Could leave some TBDs for parameterization
- Significant dependency on PHY transition proposals for details
  - PHY control requirements for register access (Clause 22 / 45)
  - Parameter flexibility for transition
  - Capabilities listing and exchange (e.g. transition time advertisement)
  - Definition of system power states or other items possible
- Aim for baseline on same timescale as PHY definitions

# Questions…

… or comments

# Baseline adoption motion

Move that the Task Force adopt a control protocol based on LLDP and modeled after 802.3at

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S:

Y: nn N: n A: n (tech >75%)

(802.3) Y: nn N: n A: n