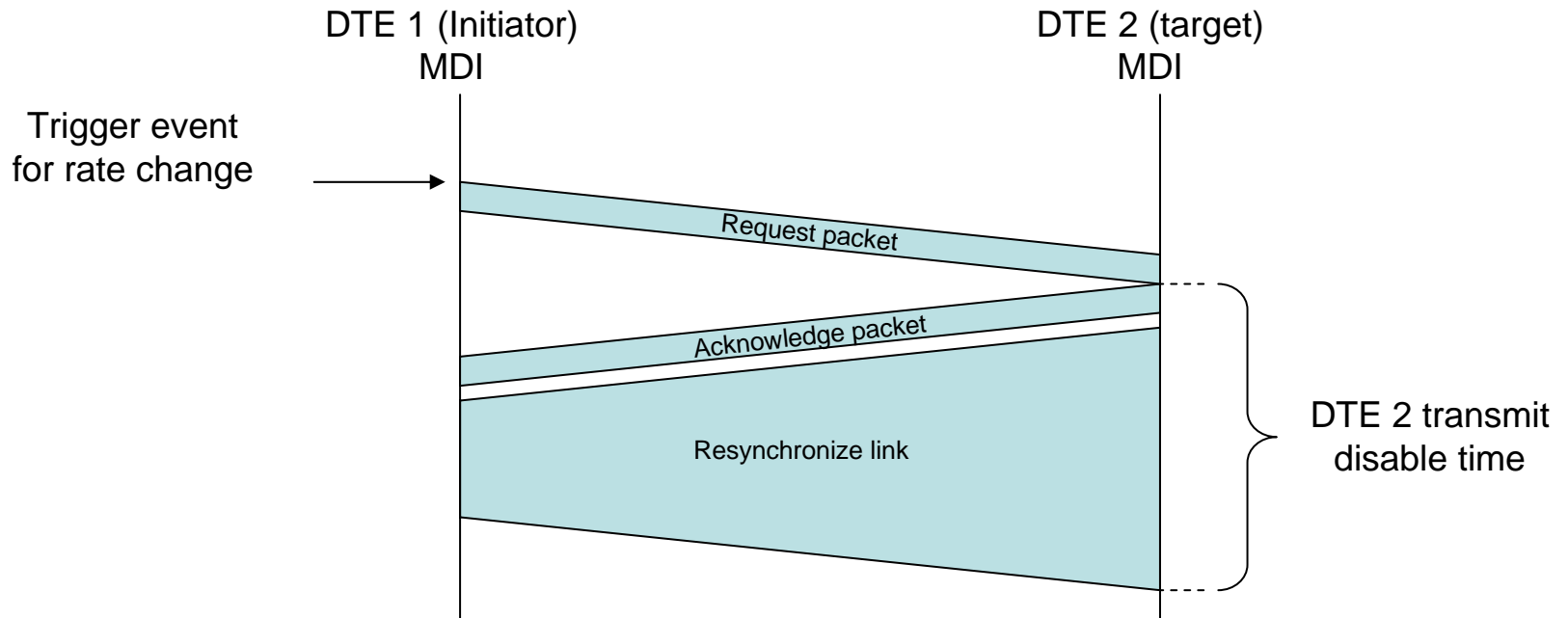


# Transmit disable time in a packet based speed change protocol Impact on objectives

David Law  
3Com

David\_Law@3Com.com

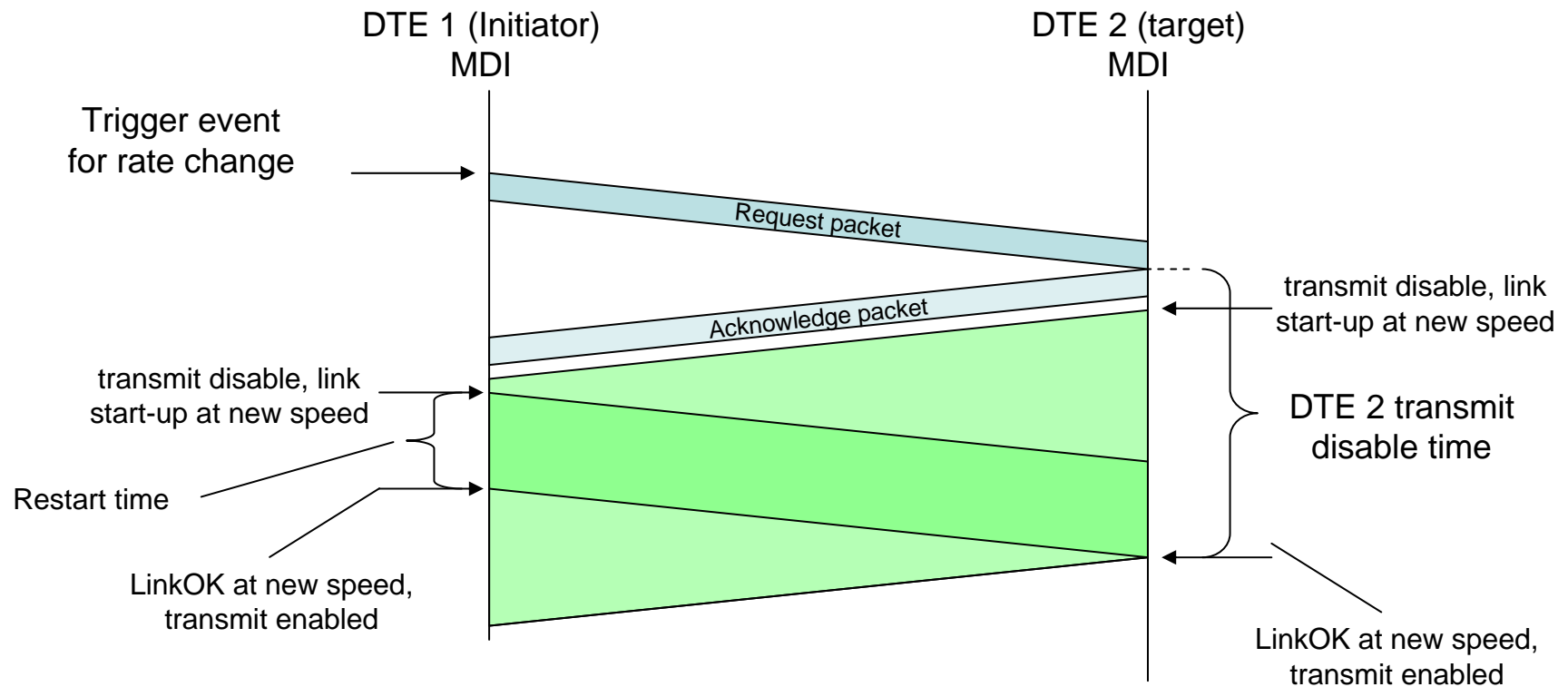
# Link disable time – model so far



Notes:

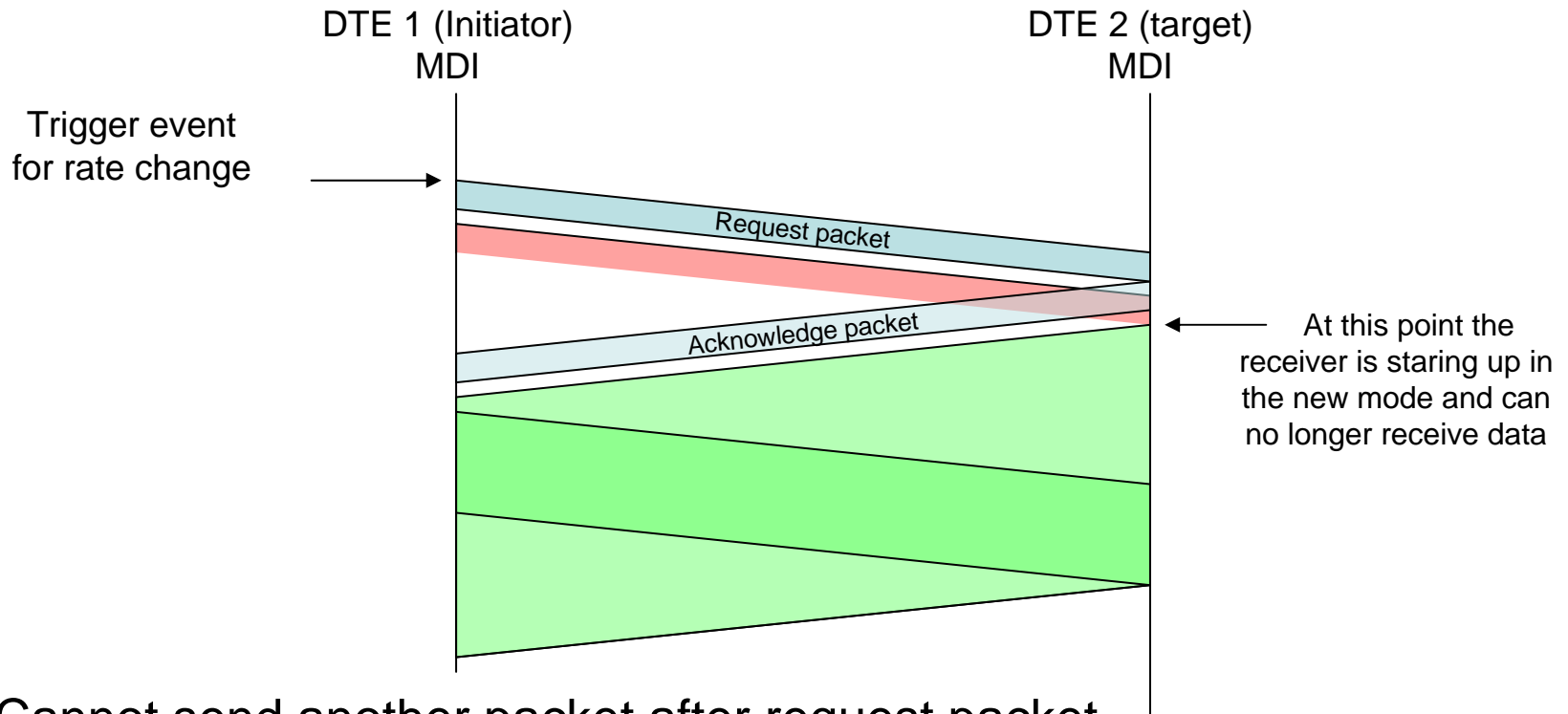
1 - Ignores error recovery such as Acknowledge packet being lost

# Link disable time – more detail



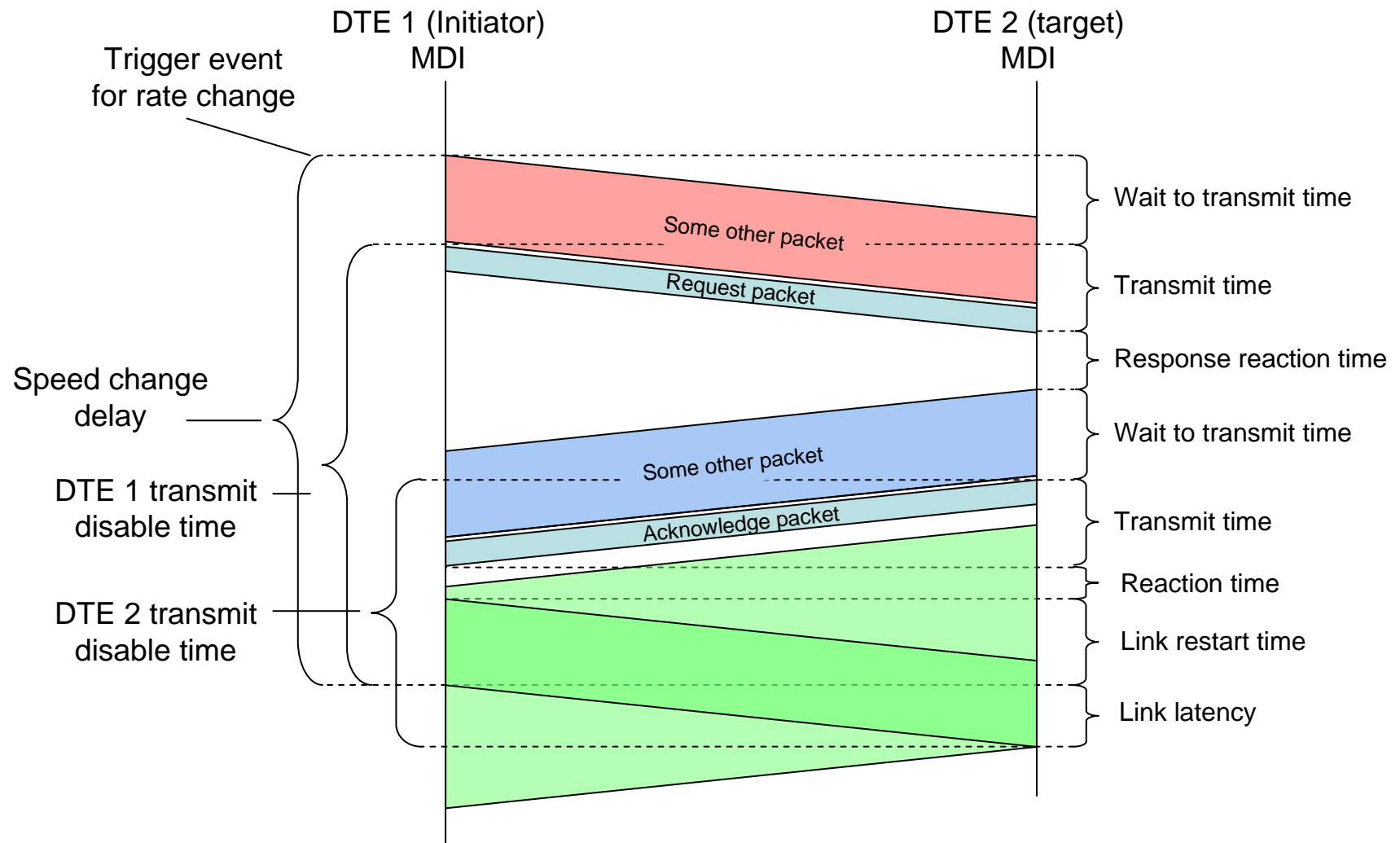
- What is transmit disable time for DTE 1 ?

# Link disable time






- Cannot send another packet after request packet
  - Soon after receiving Request packet the receiver will drop link to start new mode
- DTE 1 additional delay
  - Trigger event may be just after transmission starts of maximum length packet
- DTE 2 additional delay
  - Request packet may arrive just after transmission starts of maximum length packet

# Transmit disable calculation



# Example calculation – worst case

Parameter	Calculation	Bits	10Mb/s	100Mb/s	1Gb/s	10Gb/s
			us	us	us	us
Wait to transmit time <sup>Note 1</sup>	(Max Packet + IPG) x 8 x BT	16160	1616	161.6	16.16	1.616
Transmit time <sup>Note 2</sup>	Min Packet x 8 x BT + link delay	576	58.17	6.33	1.146	0.627
Response reaction time	Same as required for pause	Note 3	57.6	5.76	1.024	3.072
Wait to transmit time	(Max Packet + IPG) x 8 x BT	16160	1616	161.6	16.16	1.616
Transmit time	Min Packet x 8 x BT + link delay	576	58.17	6.33	1.146	0.627
Reaction time <sup>Note 4</sup>	(Same as required for pause)/2	Note 3	28.8	2.88	0.512	1.536
Link restart time	Link speed increase	Note 5	2500	2500	1000	n/a
	Link speed decrease	Note 5	n/a	1	2500	2500
<b>Totals for link speed increase</b>						
Speed change delay during link speed increase			5934.7	2844.5	1036.0	
DTE 1 (initiator) transmit disable time during link speed increase			4318.7	2682.9	1020.0	
DTE 2 (target) transmit disable time during link speed increase			2587.6	2509.8	1002.2	

Notes:

- Maximum packet size = Envelope frame + SFD + Preamble = 2008 Bytes
- Minimum packet size = Minimum frame + SFD + preamble = 72 Bytes; Link delay = 5.7ns/meter x 100 = 0.57 us
- For operating speeds of 100 Mb/s or less response time = pause\_quantum + 64 = 512 + 64 = 576 Bits  
For an operating speeds of 1000 Mb/s response time = two pause\_quantum = 2 x 512 = 1024 Bits  
For an operating speeds of 10 Gb/s response time = sixty pause\_quantum = 60 x 512 = 30,720 Bits
- This delay could be included in link restart time but some delay has to be allocated for PHY latency and packet processing that is discrete from PHY restart
- Based on data in chadha\_1\_0407.pdf, suggestion EEE 1000BASE-T mode in woodruff\_01\_0307.pdf and nominal value for 10BASE-T of 1us.

# Some observations

- Transmit disable time on single link can be a number of milliseconds
  - Is this acceptable for upper layer protocols
- Transmit disable time asymmetric
  - Longer for the requesting end
- Transmit disable time packet size dependant at slower speeds
  - Average time will be less than maximum
- Transmit disable time PHY restart dependant at higher speeds
  - Average time very similar to maximum
- Assuming EEE 10BASE-T is lowest power by significant margin
  - 10/100/1000BASE-T ports will have broad market potential
    - 1000BASE-T to provide best performance for cost
    - EEE 10BASE-T to provide lowest power operation
- Hence 10BASE-T to 1000BASE-T speed change will be important
  - 10BASE-T to 1000BASE-T via 100BASE-T
    - 10BASE-T to 100BASE-T
      - 6 ms maximum, 3ms min
    - 100BASE-T to 1000BASE-T
      - 2.5 ms minimum (no packets other than request to increase to 1000BASE-T)
    - Total 8.5ms maximum, 5.5ms minimum
  - 10BASE-T to 1000BASE-T direct
    - 6 ms maximum, 3ms min

# Thoughts on objectives

- Add objective to allow multi-decade change
  - Increase more important than decrease
  - At minimum from 10BASE-T to 1000BASE-T
- And while we are considering that ..
  - Add objective to support full duplex only
    - Have we really not stated that already ?