PLCA burst mode

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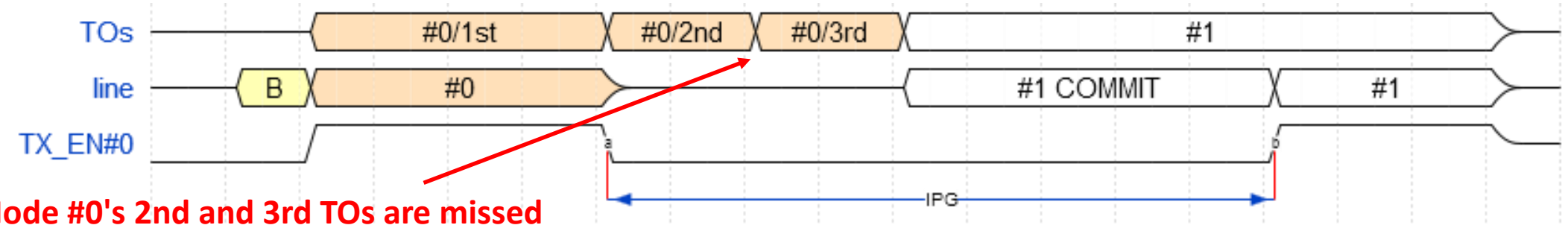
Outline

- PLCA in d2.0 supports a single TO per node (per PLCA cycle)
  - This provides basic packet-fairness
- In some cases, weighing the share of the media among the nodes is desirable
  - 802.3cg d2.0 comments:
    - #371, #372 (Kirsten Matheus, BMW)
    - #503, #504, #505 (Peter Jones, Cisco)
- This is a new feature request for PLCA: burst mode
- This presentation shows possible ways forward but does not propose text changes
  - More work is needed

The problem

- Simply allocating multiple IDs to a single node is not sufficient, because that would require the RS to know **in advance** whether the local MAC has subsequent messages to send
  - There is no such primitive at MAC/PLS
  - The MAC is not going to send a packet before IPG expires (after the previous transmission)
  - The IPG (96 bits) is greater than TO timer (20 bits)
- As a consequence, a node with multiple IDs would always miss its subsequent TOs

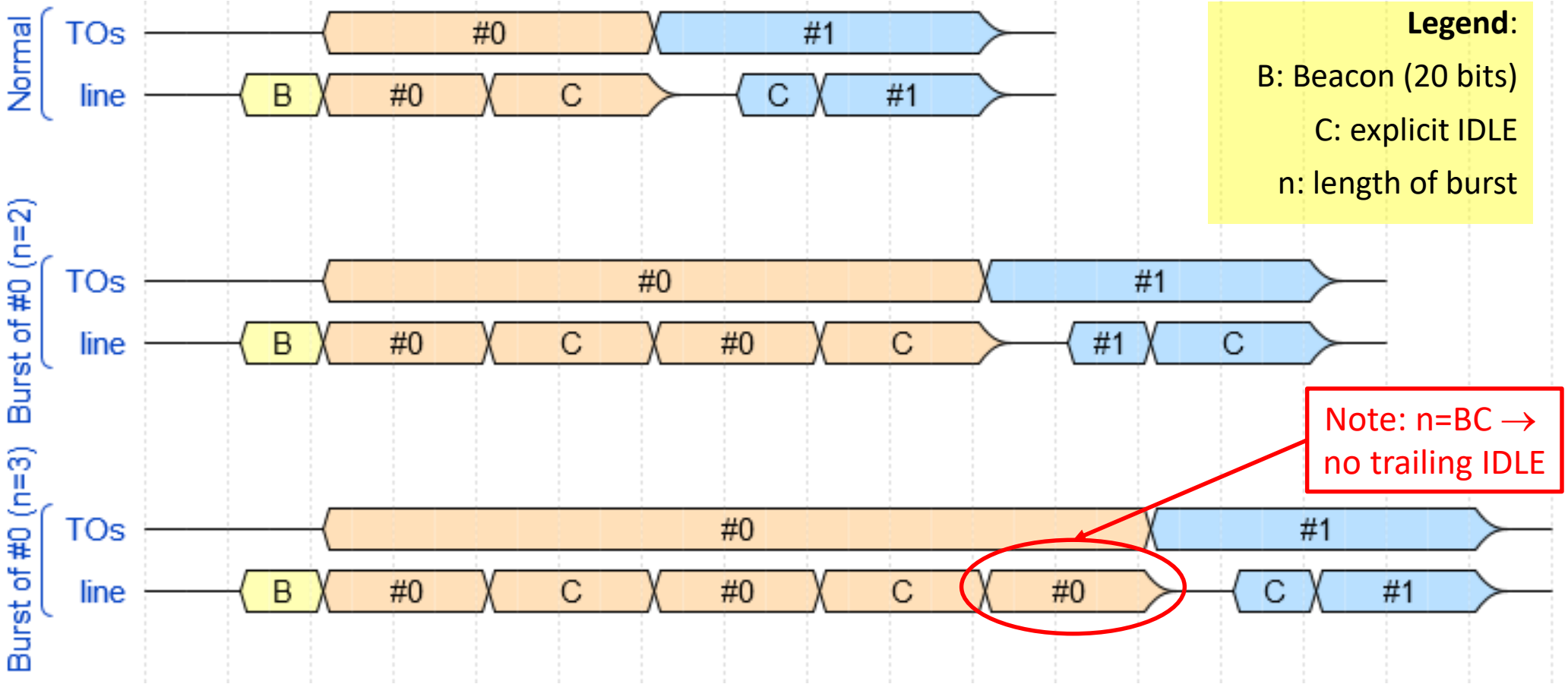


Solution #1: Longer TOs

- Explanation:
  - Make TO longer than IPG (TO is configurable already)
  - Permitting a PHY to have multiple IDs
- Advantages:
  - Direct (simple) solution to the base problem
  - Requires:
    - no changes to clause 148 (PLCA)
    - minimal changes to clause 45 (registers)
- Disadvantage:
  - PLCA delay line increase (≈ +140 bits / node) → increases relative IC cost
  - Some negative impact on Bandwidth Utilization (BWU) [early estimation]
    - ≈ 15% with 72 bytes packet in typical situation
    - ≈ 1% with 1530 bytes packet in typical situation
    - Increases latency when the network is not under load

#2: Filling IPG with IDLE

- Explanation:
  - Nodes allowed to burst transmit additional (possibly empty) COMMIT after any transmission
- In the following example only PHYs #0 is configured for burst (BC = 3)

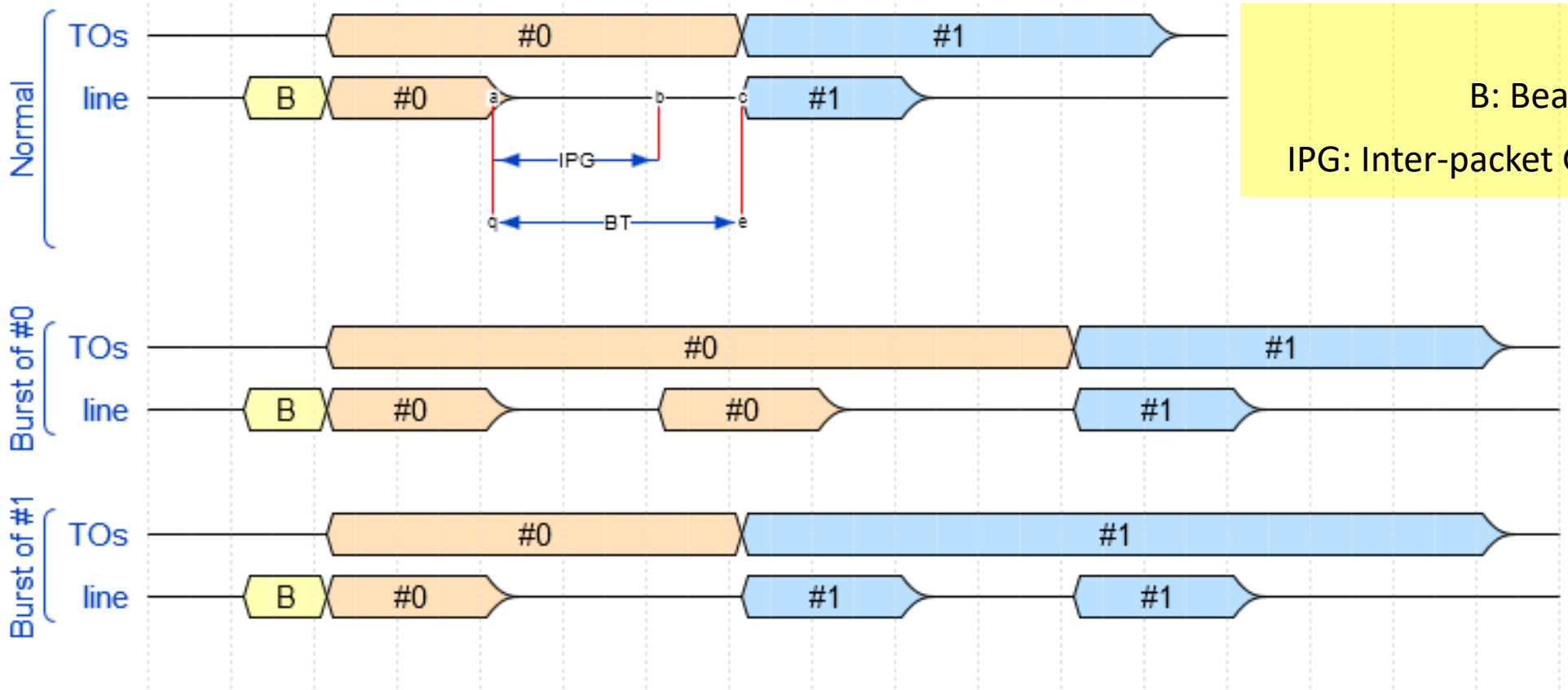


#2: Explicit IDLE during IPG

- Advantages:
  - Requires no cross-node consistent configuration
  - BWU scales with number of nodes configured to burst
  - Requires no complex management registers (c45)
    - Global (per mixing segment) enable
    - One new register for BC (default value 1)
- Disadvantage:
  - Requires more changes to the draft (c45, c148, c147?) compared to other solutions
  - Some negative impact on Bandwidth Utilization (BWU) [early estimation]
    - ≈ 5% with 72 bytes packet in typical situation
    - < 1% with 1530 bytes packet in typical situation
    - Depends on the actual number of nodes configured for bursting
- TBD items:
  - EMI impact to be estimated: IDLE may be scrambled

#3: Implicit idle during IPG

- Explanation:
  - Add a burst timer (BT), greater than IPG, after each packet being transmitted or received
    - TO timer / counting frozen during this time (on every node)
    - Allows MAC to transmit again before TO ends
    - Lets BT expire when preconfigured maximum Burst Count (BC) is exhausted



Legend:

B: Beacon (20 bits)

IPG: Inter-packet Gap (96 bits)

#3: Implicit idle during IPG

- Advantages:
  - Simple to implement
  - Requires no complex management registers (c45)
- Disadvantage:
  - Some negative impact on Bandwidth Utilization (BWU) [early estimation]
    - ≈ 10% with 72 bytes packet in typical situation
    - ≈ 1% with 1530 bytes packet in typical situation
  - Basically, this is what you get in solution #2 when all nodes are allowed to burst
- TBD items:
  - Duration of Burst Timer

Conclusions

- Adding burst feature to PLCA is feasible
  - at least three possible solutions exist
- More work is required to work out the details and text changes
- Solutions #3 sounds like to be the most promising

BACKUP SLIDES

Industrial example use cases

Burst mode may be used…

- as a reaction to growing downlink queues (to flush them) as a response to asynchronous external stimuli (emergency series of actions of a controller)
  - Example: delivery of multiple messages to different peers, to reach safe state
- to send control messages that achieve required effect only if delivered consecutively (within bounded Δt)
  - Example: LED blinking
- by a node that – by design – serves such dispatching or control functions
  - Example: master polling multiple nodes in unicast