Avoiding Utilization Inefficiency in .1Qbv

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(preliminary version)

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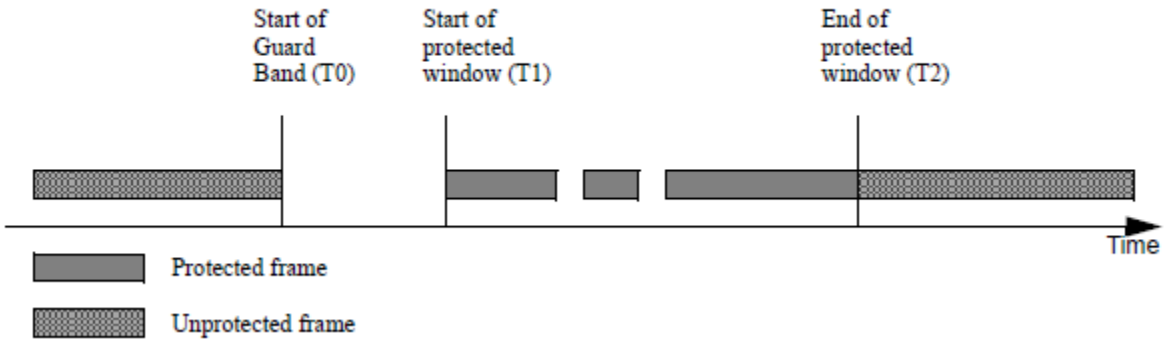
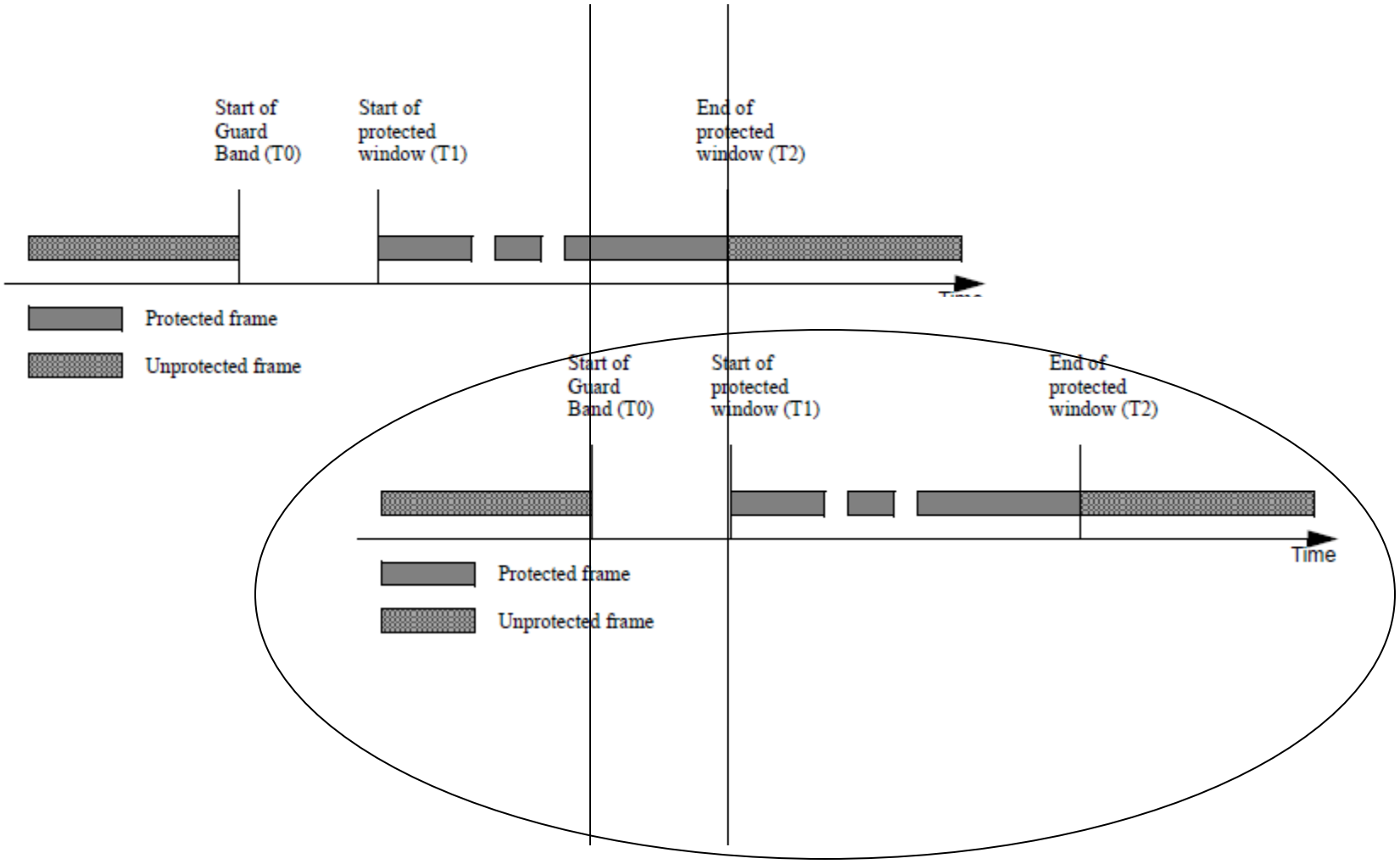
From 802.1Qbv-D1.2

In a Bridge that supports enhancements for scheduled traffic (8.6.8.4), a transmission gate is associated with each traffic class queue. In addition to the other checks carried out by the transmission selection algorithm, a frame on a traffic class queue is not available for transmission (as required for tests (a) and (b) in this clause) if the transmission gate is in the closed state or there is insufficient time available to transmit the entirety of that frame before the next gate-close event (3.1) associated with that queue.

From 802.1Qbv-D1.2 (cont.)

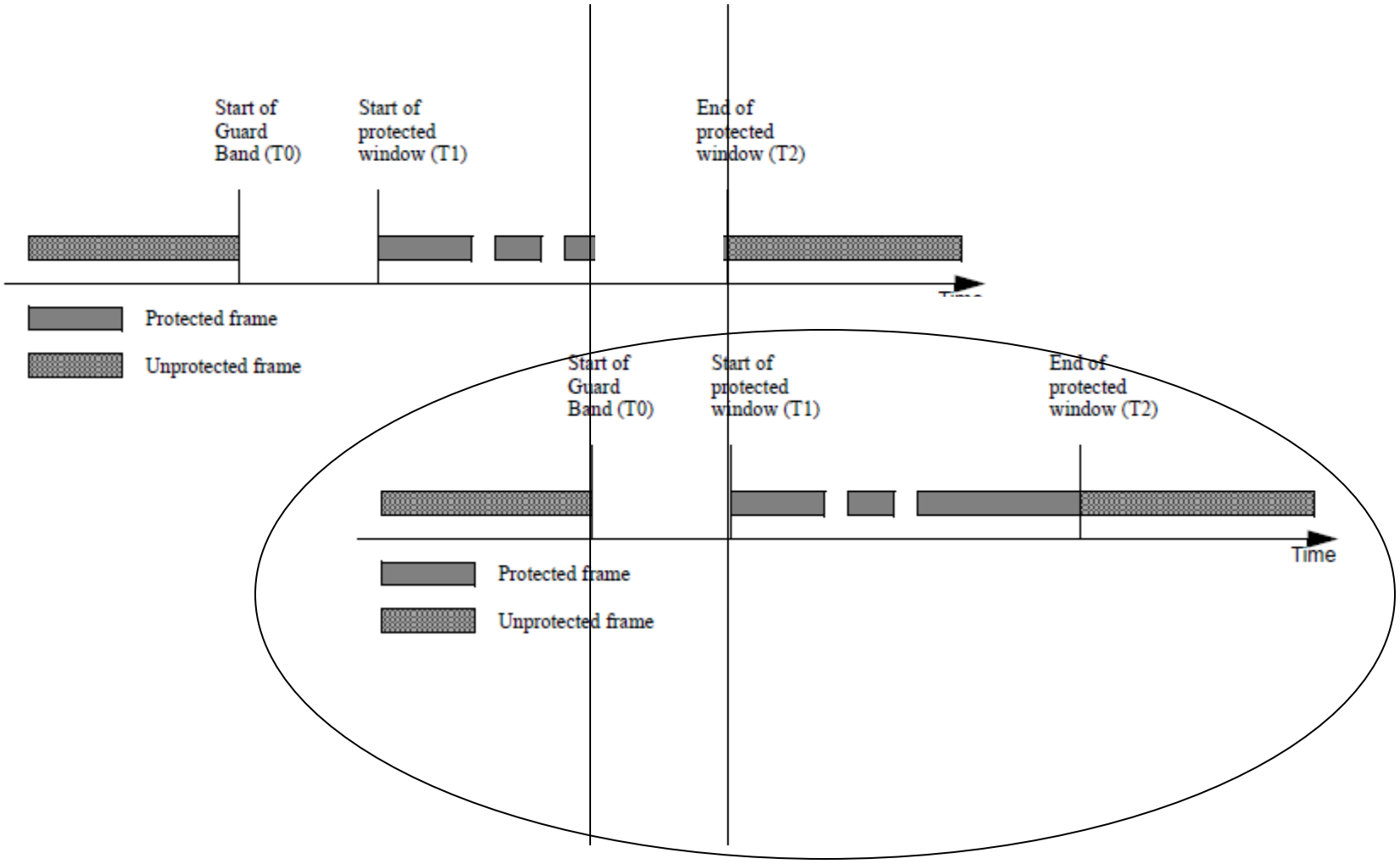


Bandwidth Inefficiency



Just duplicating the figure here to show the guard band before the end of T2

Bandwidth Inefficiency



Just duplicating the figure here to show the guard band before the end of T2

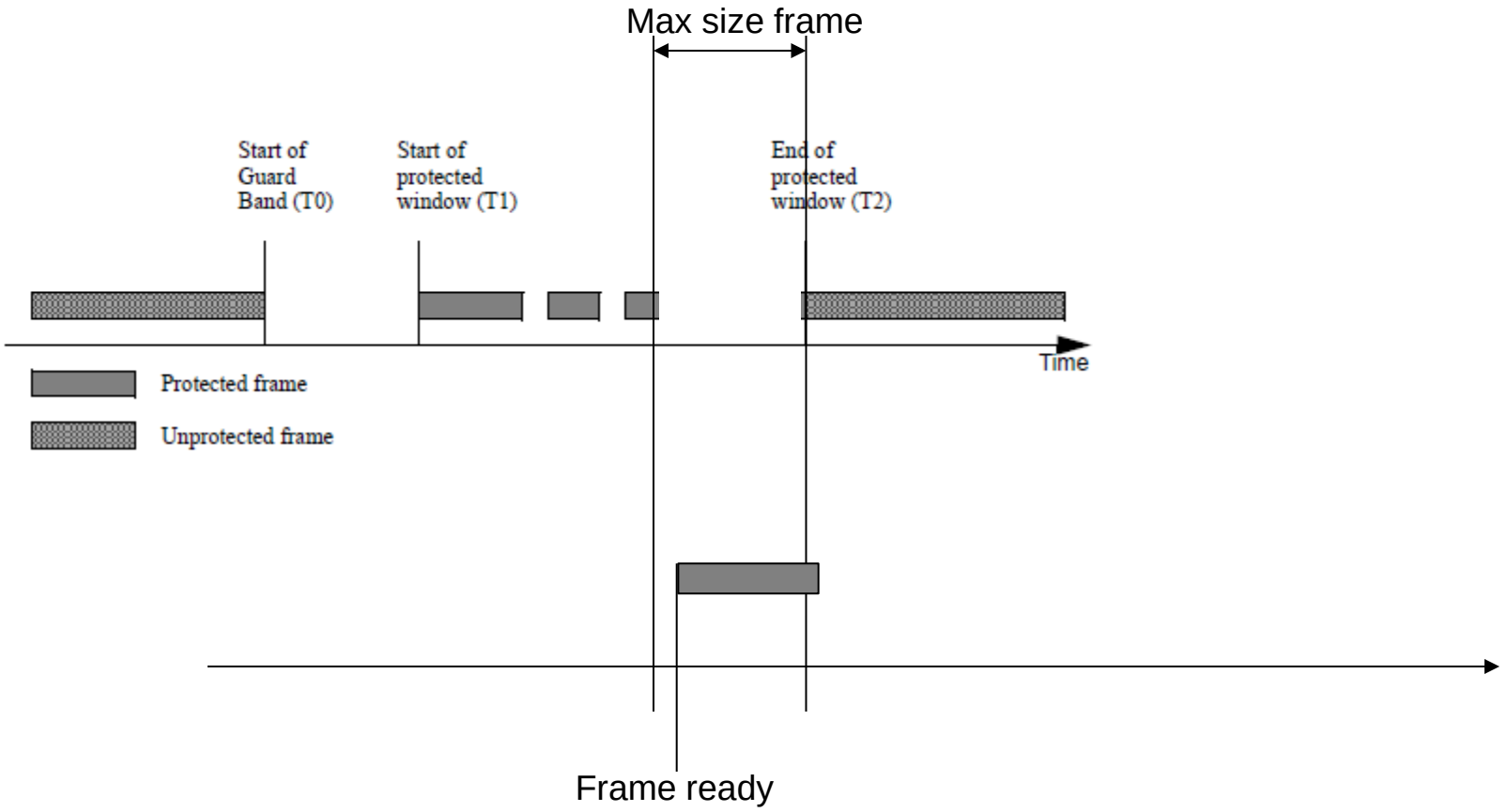
Bandwidth Inefficiency

Observation 1: the “guard band problem” occurs at every gate-closing event, not only before some “protected window”.

Conclusion 1: simple implementations need to block traffic for about a maximum sized frame before the end of each gate-closing event.

What about intelligent implementations (e.g., the ones that track frame lengths)?

Bandwidth Inefficiency – Intelligent GB Usage



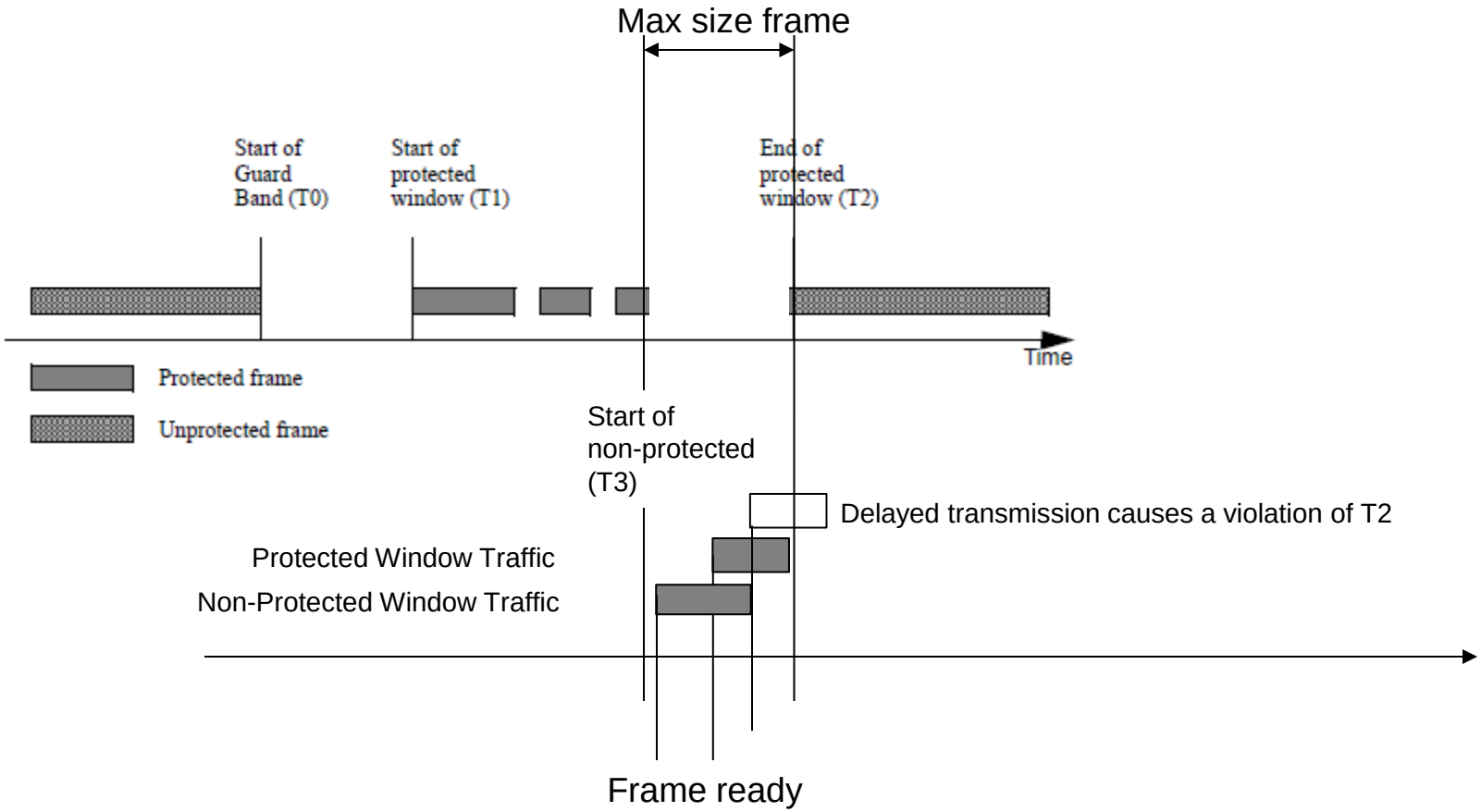
Bandwidth Inefficiency – Intelligent GB Usage

Observation 2: in the worst-case, a slightly smaller frame than the max sized frame becomes ready for relay at a time that is too late for complete transmission.

Conclusion 2: intelligent use of the guard band does not significantly improve the bandwidth utilization in the worst case.

How about using the bandwidth for other traffic classes?

Bandwidth Inefficiency – Intelligent GB Usage



Bandwidth Inefficiency – Intelligent GB Usage

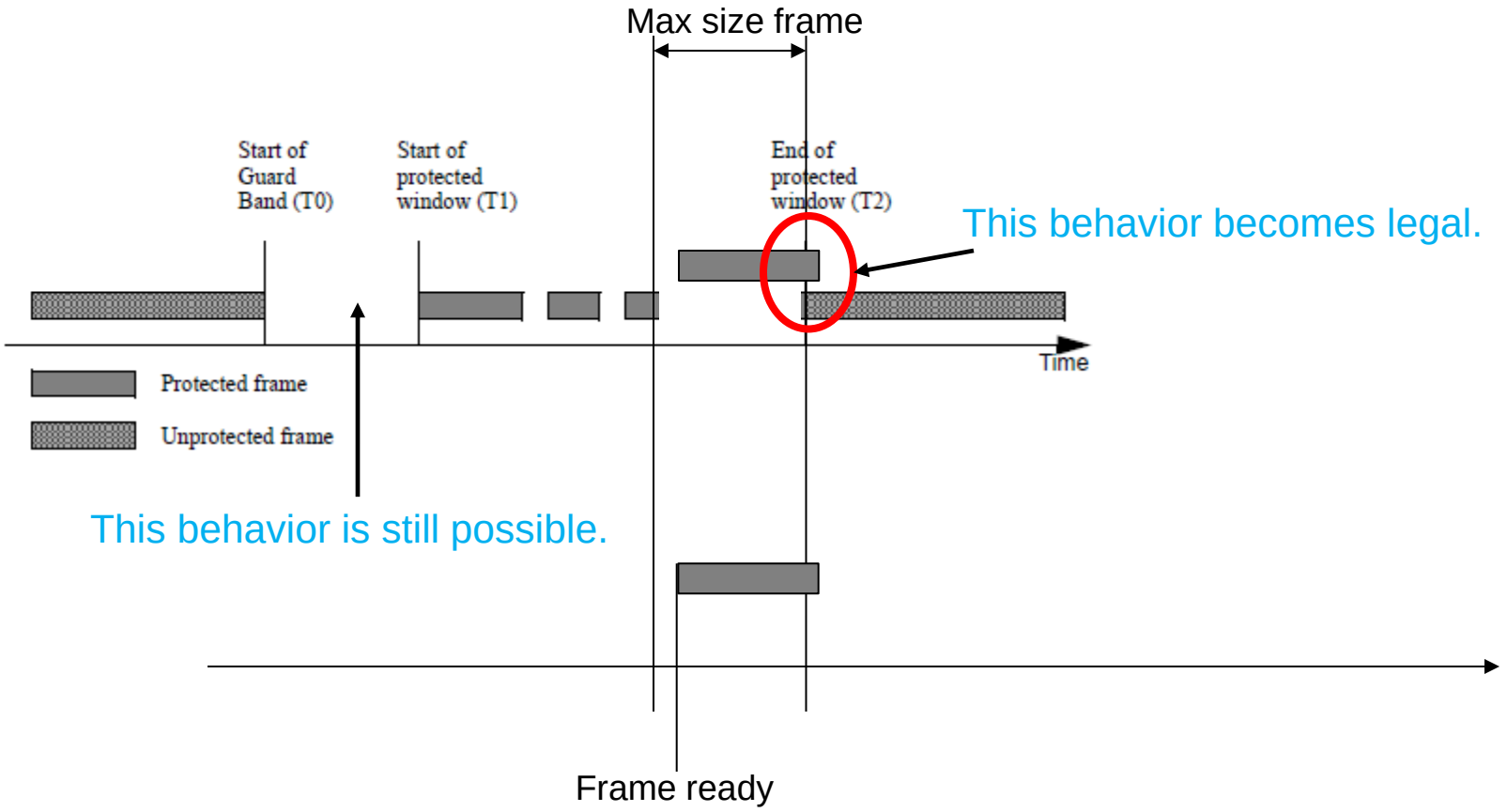
Observation 3: when overlapping windows, there is a threat that lower priority traffic will cause higher priority traffic not to fit into the window.

Conclusion 3: overlapping only at the size of a minimum frame at max.

Proposed Modification

In a Bridge that supports enhancements for scheduled traffic (8.6.8.4), a transmission gate is associated with each traffic class queue. In addition to the other checks carried out by the transmission selection algorithm, a frame on a traffic class queue is not available for transmission (as required for tests (a) and (b) in this clause) if the transmission gate is in the closed state. ~~or there is insufficient time available to transmit the entirety of that frame before the next gate close event (3.1) associated with that queue.~~

Proposed Solution



"or there is insufficient time available to transmit the entirety of that frame before the next gate-close event (3.1) associated with that queue."

… is replaced by additional constraints on the gate event list.

Main Conclusions

The current formulation is too restrictive and a source of bandwidth inefficiency.

Continuing frame transmission beyond the gate-closing event is more bandwidth efficient than the current proposal.

The schedule (i.e., the gate event list) can be constructed in a way that the current behavior (i.e., non-transmission beyond the gate-closing event) is maintained.

There are still worst-case boundaries for the minimum/maximum sizes of windows.

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