High Performance EPON

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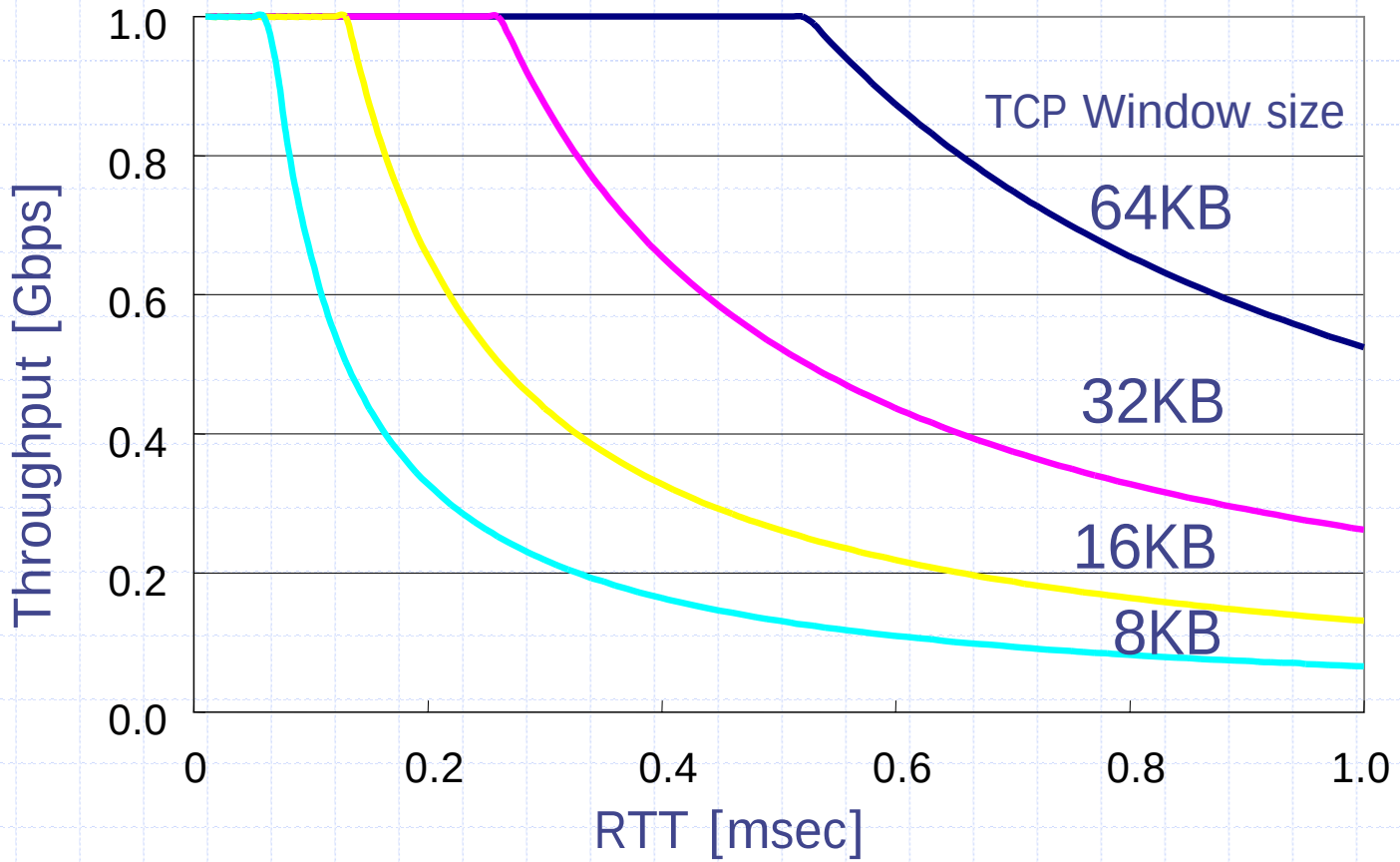
Outline

1. Requirements for High Performance
2. Possible Solution
3. Summary

Requirements for High Performance

- Should achieve high bandwidth efficiency
- Should achieve high throughput
  - Short RTT (Round Trip Time) is needed to yield high TCP throughput.

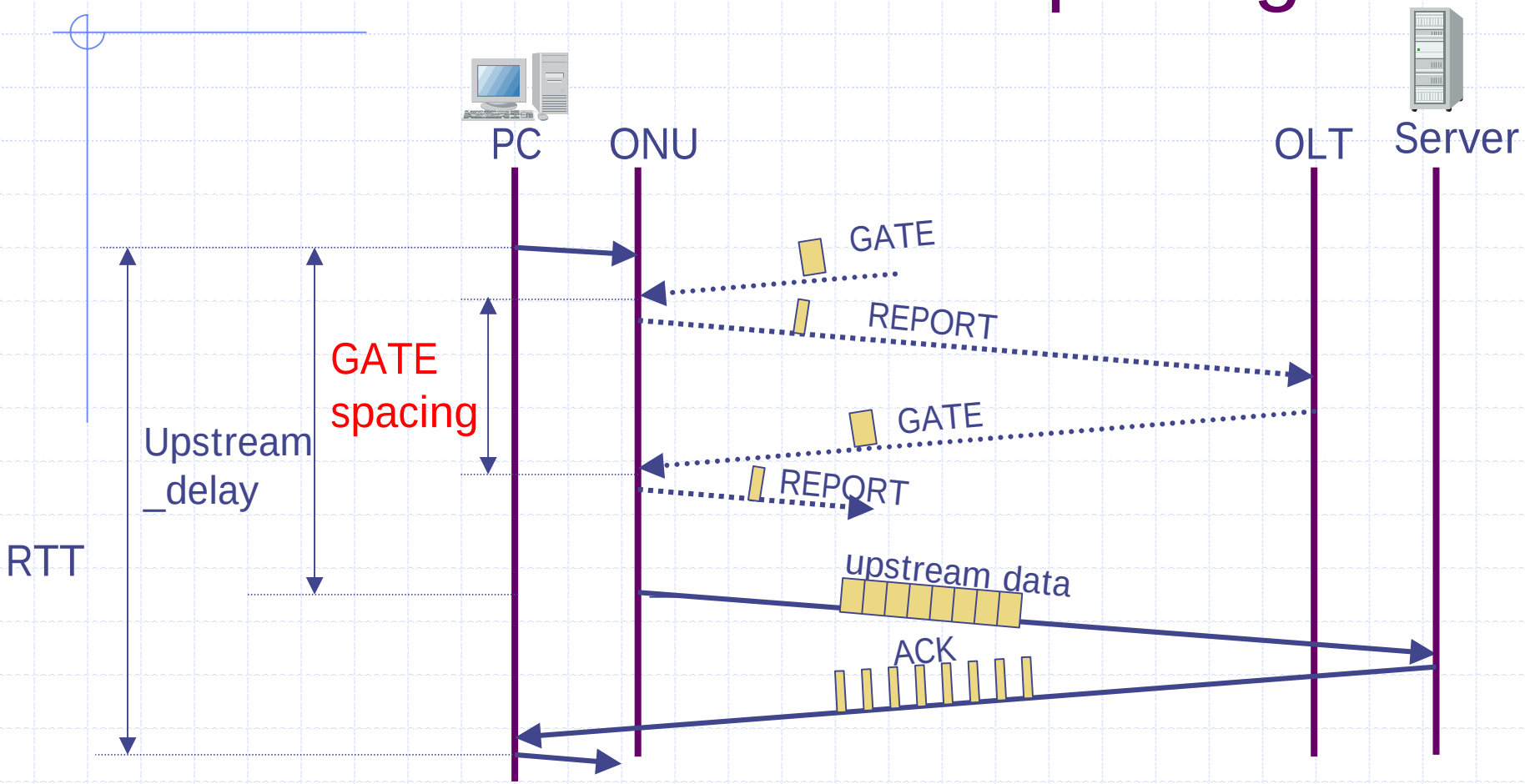
TCP Throughput vs. RTT



Short RTT realizes high TCP throughput.

$$\text{MaximumTCP\_throughput} = \frac{\text{Window\_size}}{\text{RTT}}$$

Need to shorten GATE spacing



Shorten GATE spacing to shorten RTT.

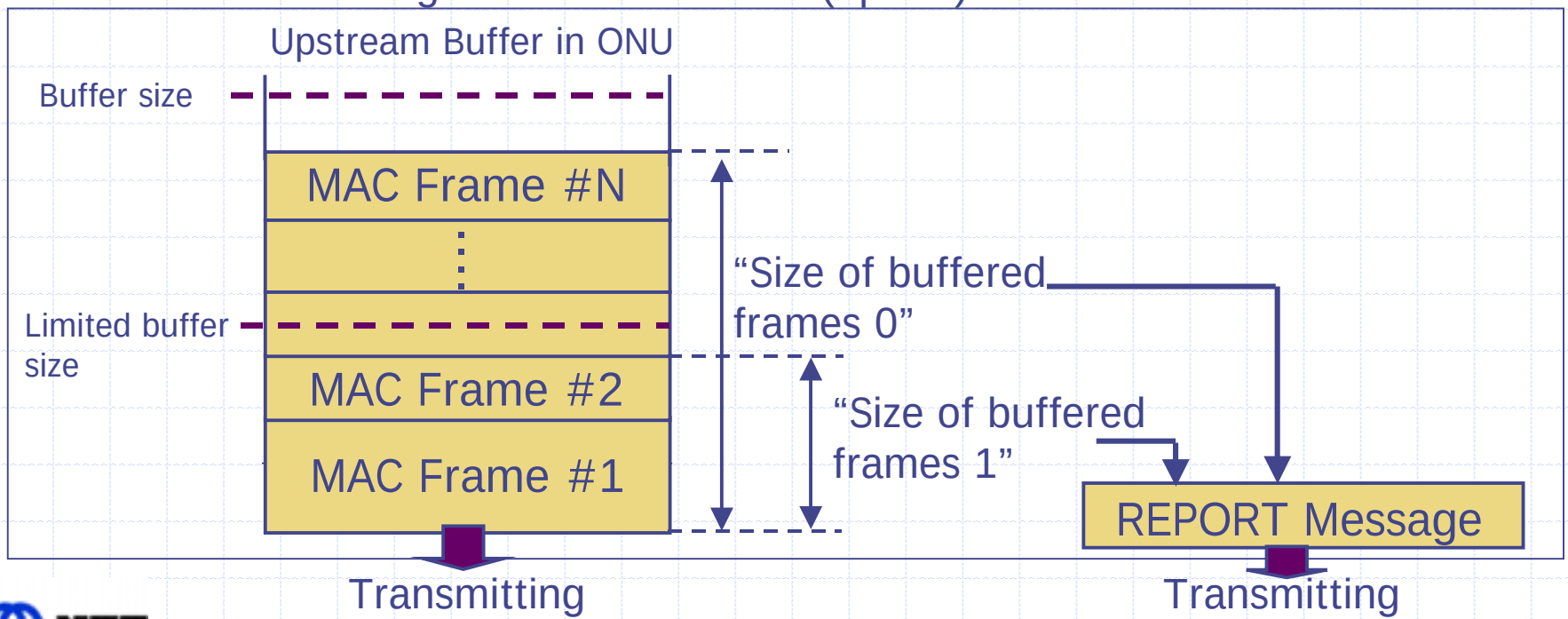
Possible Solution for High Performance

"Multiple Status Information"
to shorten GATE spacing
with keeping high efficiency.

- Short GATE spacing makes upstream delay low.
- ONU sends multiple buffering status information of logical port within a single REPORT message.

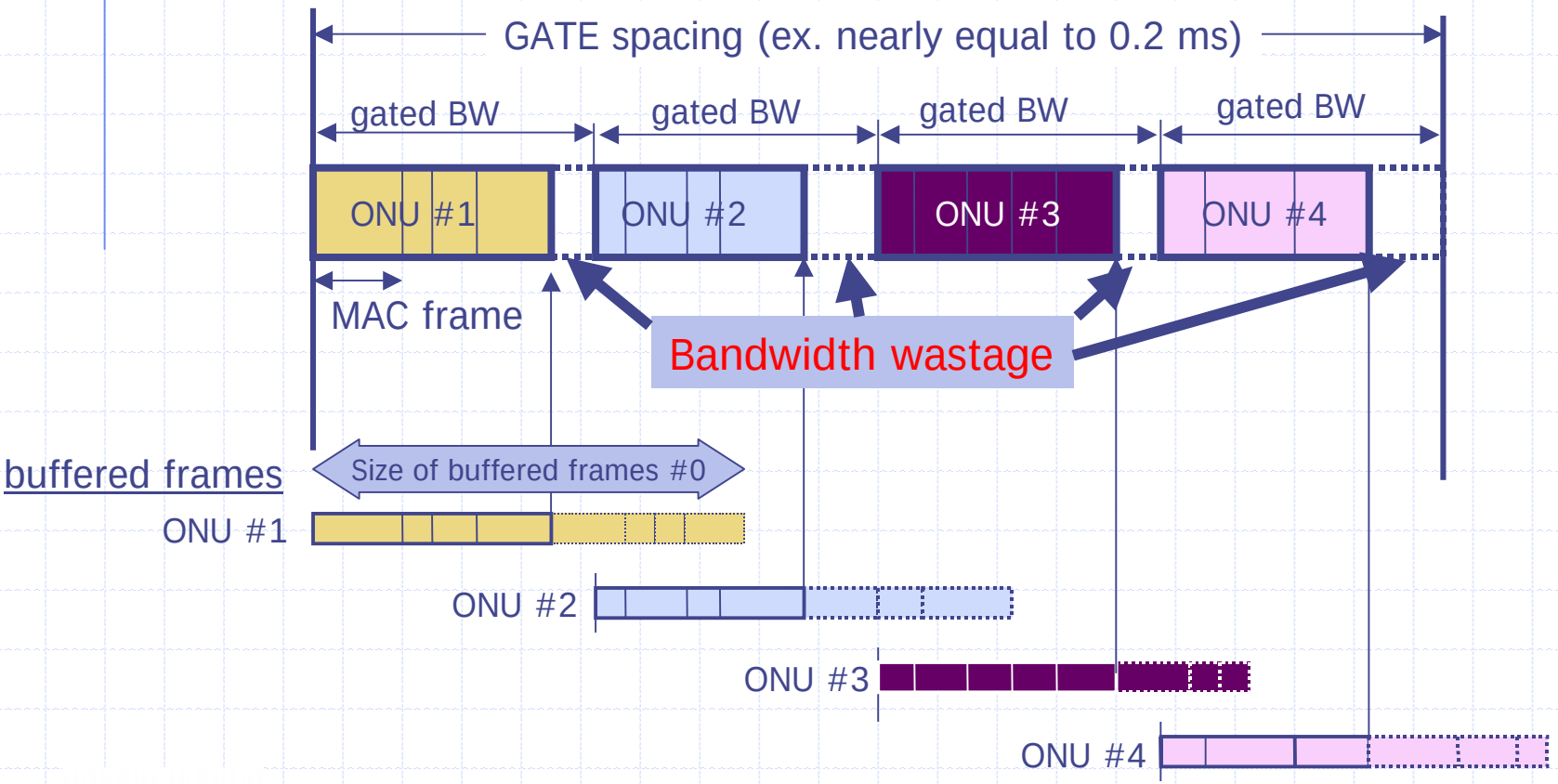
Multiple Status Information

- REPORT message holds multiple information on buffering status.
  - Total buffered size. (REPORT Type="Size of buffered frames #0")
  - Buffered size under limitation. (REPORT Type = "Size of buffered frames #1")
  - Other buffering status information. (option)



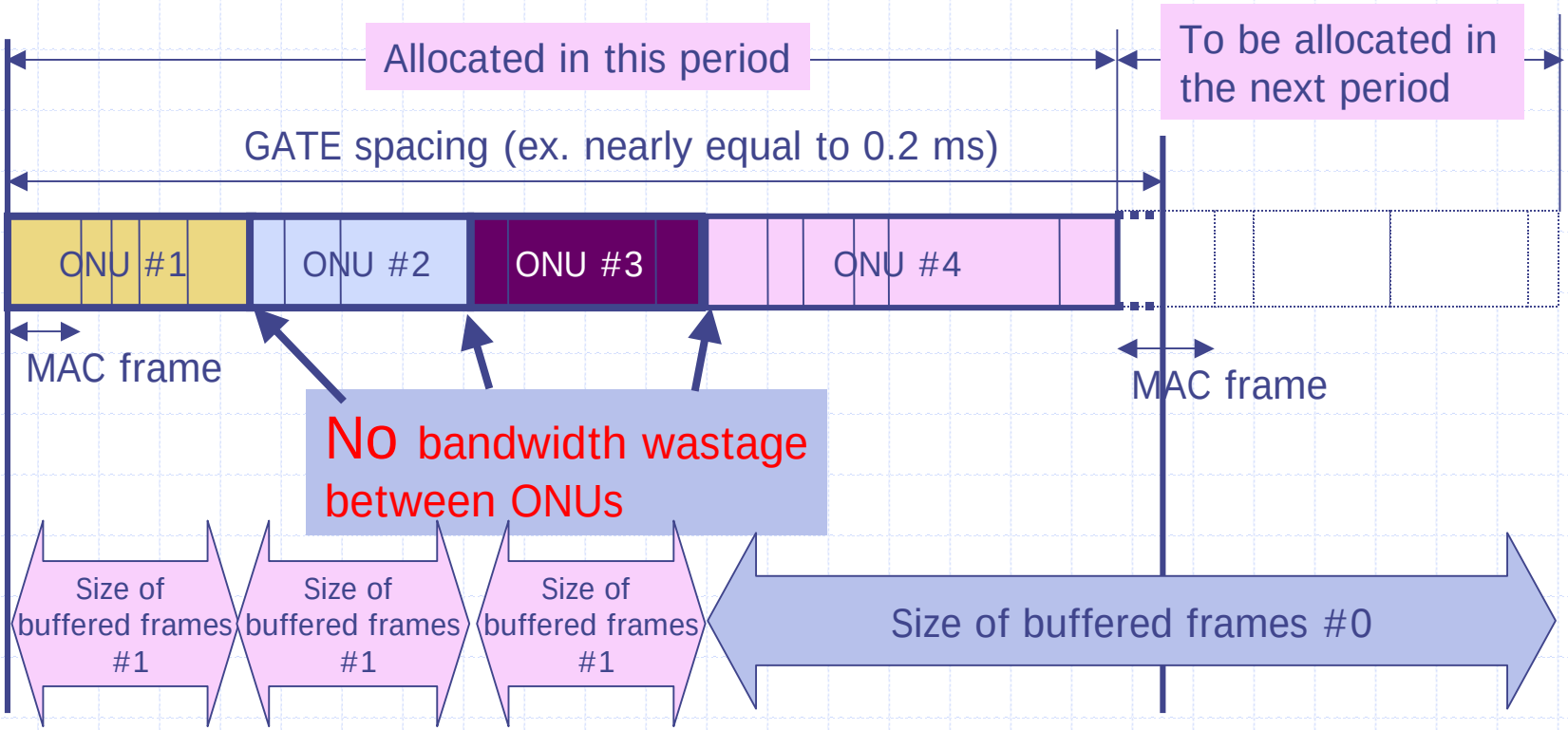
Upstream bandwidth allocation example : Single status information

- When “Single status information” is used, OLT doesn’t know the size of frames that will be transmitted.
  - → Bandwidth wastage between ONUs is inevitable.



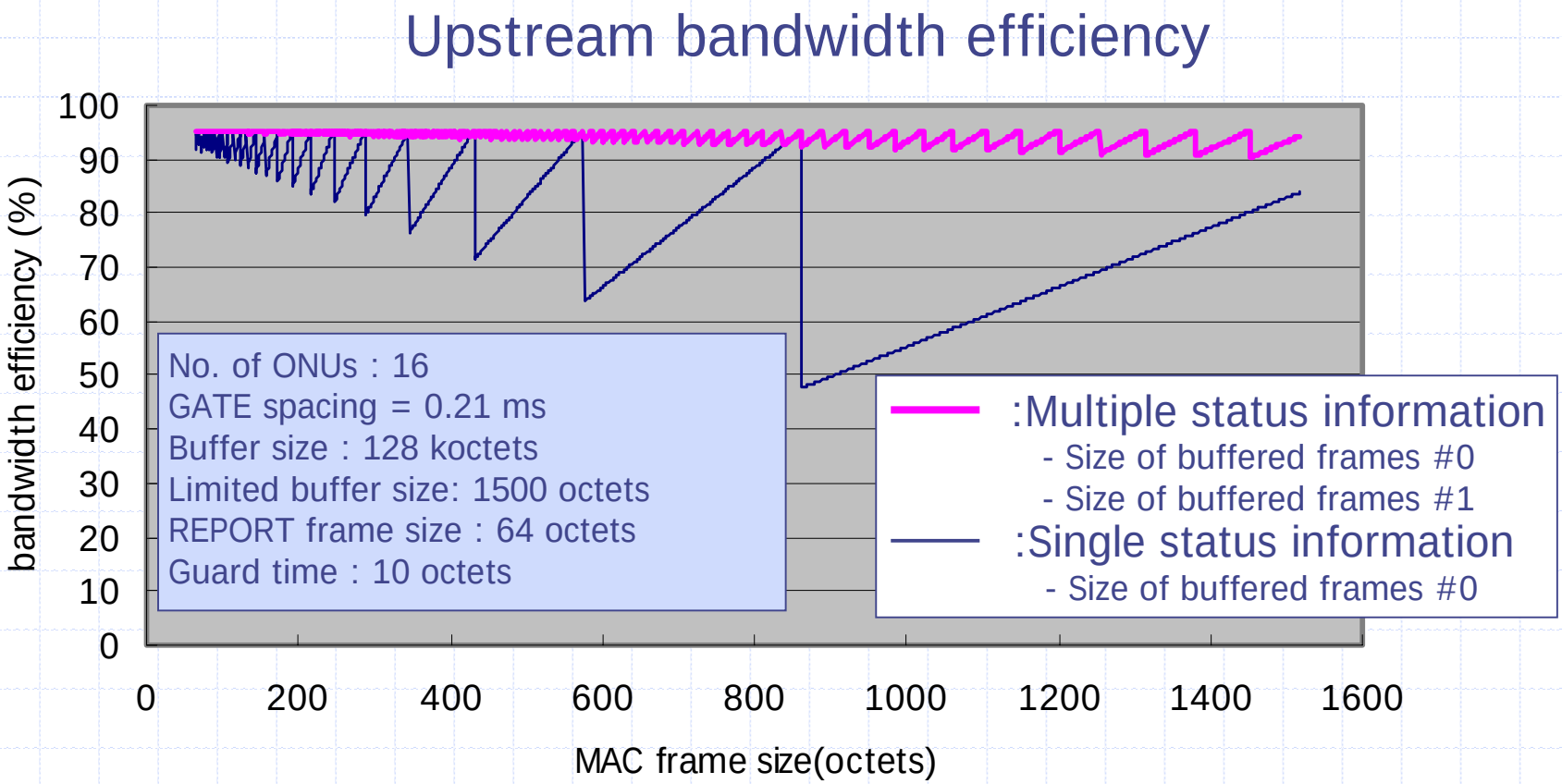
Upstream bandwidth allocation example : Multiple status information

- OLT knows the size of frames that will be transmitted as “Size of buffered frames #1”.
  - → No bandwidth wastage between ONUs.



Comparison

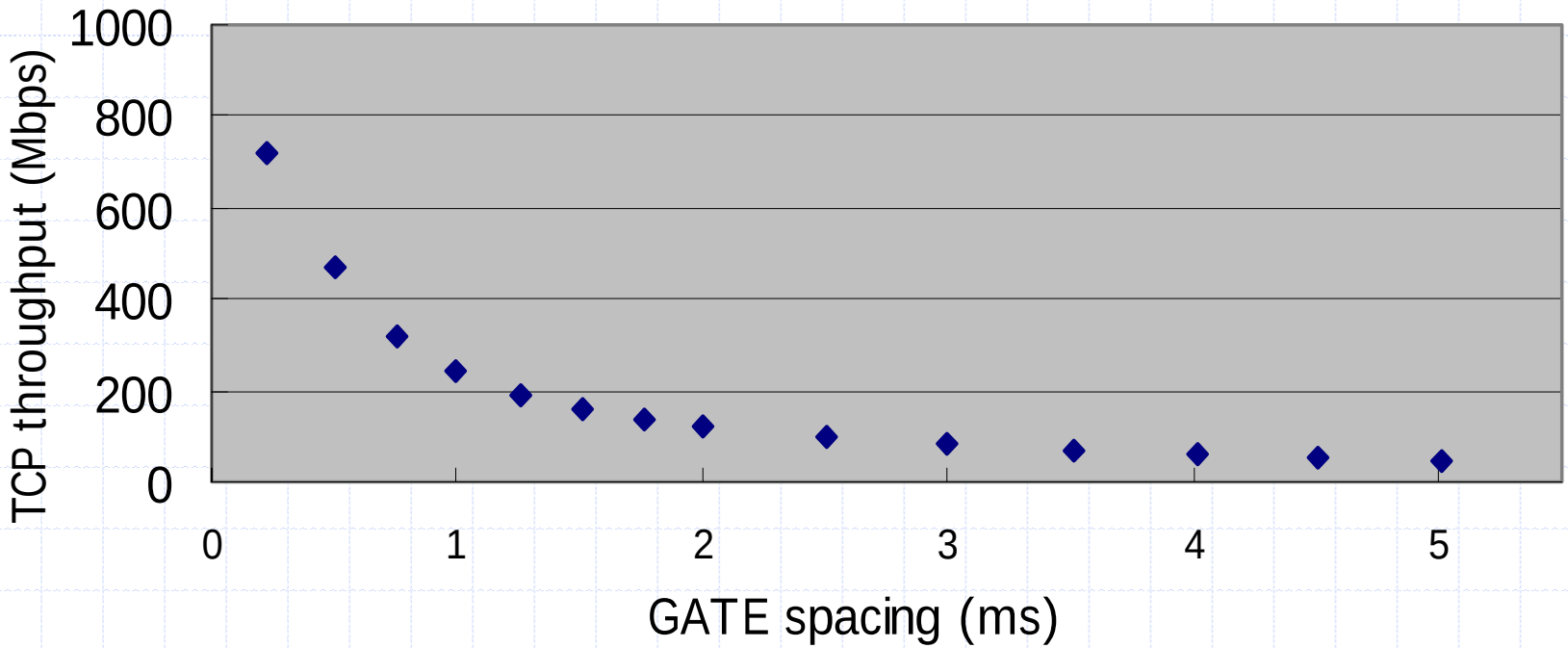
(Multiple status information vs. Single status information)



High efficiency can be achieved by “Multiple status information”

TCP Performance

Average TCP throughput (window size=60kbytes)



No. of ONU: 1

MAC Frame size: 1500octets
Propagation delay=0.1ms
(distance between OLT and ONU=20km)

Buffer size : 128 koctets
Limited buffer size : 1500 octets

High TCP throughput is achieved by keeping GATE spacing short.

Summary

- Requirements for high performance
  - High bandwidth efficiency
  - Short RTT for high throughput
- Possible solution for high performance is shown.
  - “Multiple status information” realizes short GATE spacing and high efficiency.
  - It makes TCP throughput high.