

20 Gb/s Aggregate Throughput



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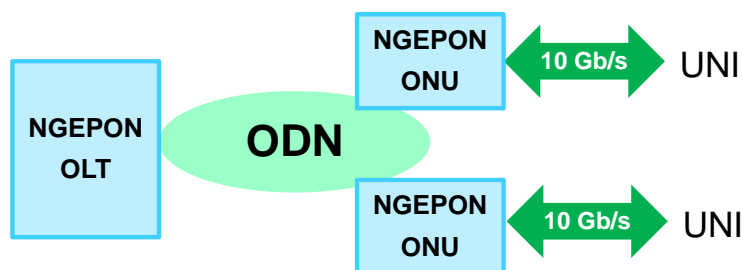
IEEE P802.3ca NGEAPON Interim Meeting – Vancouver, BC, Canada
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Introduction

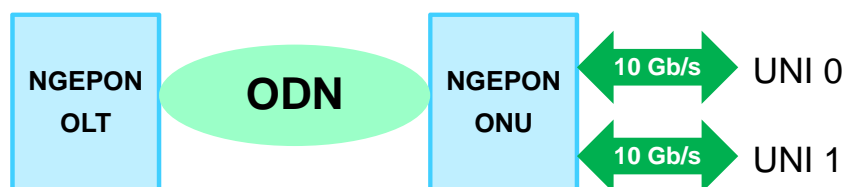
- At the January meeting, we presented FEC selection considerations ([laubach_3ca_01_0117.pdf](#)), that included a discussion of codeword sizes and FEC rates towards a 20Gb/s bidirectional “unobstructed” goal
- SP#2: same codeword ds & us: poll results: 14/4/9
- SP#3: codeword size between 2KB and 4KB: poll results: 2/5/21
 - Majority held by abstains – indicates more study needed
- SP#4: desired total overhead limited to support minimum bidirectional 20Gb/s “unobstructed” (at 25.78125 GBd signaling rate) : poll results: 12/1/15
 - Majority held by abstains – indicates more study needed
- This presentation presents a deeper study towards formalizing that goal.

Desired total overhead limited to support minimum bi directional 20Gb/s “unobstructed” (at 25.78125 GBd signaling rate)

- Example1: supporting full traffic load through two ONUs having 1 * 10 Gb/s UNI



- Example2: supporting full traffic load through single ONU having 2 * 10 Gb/s UNIs



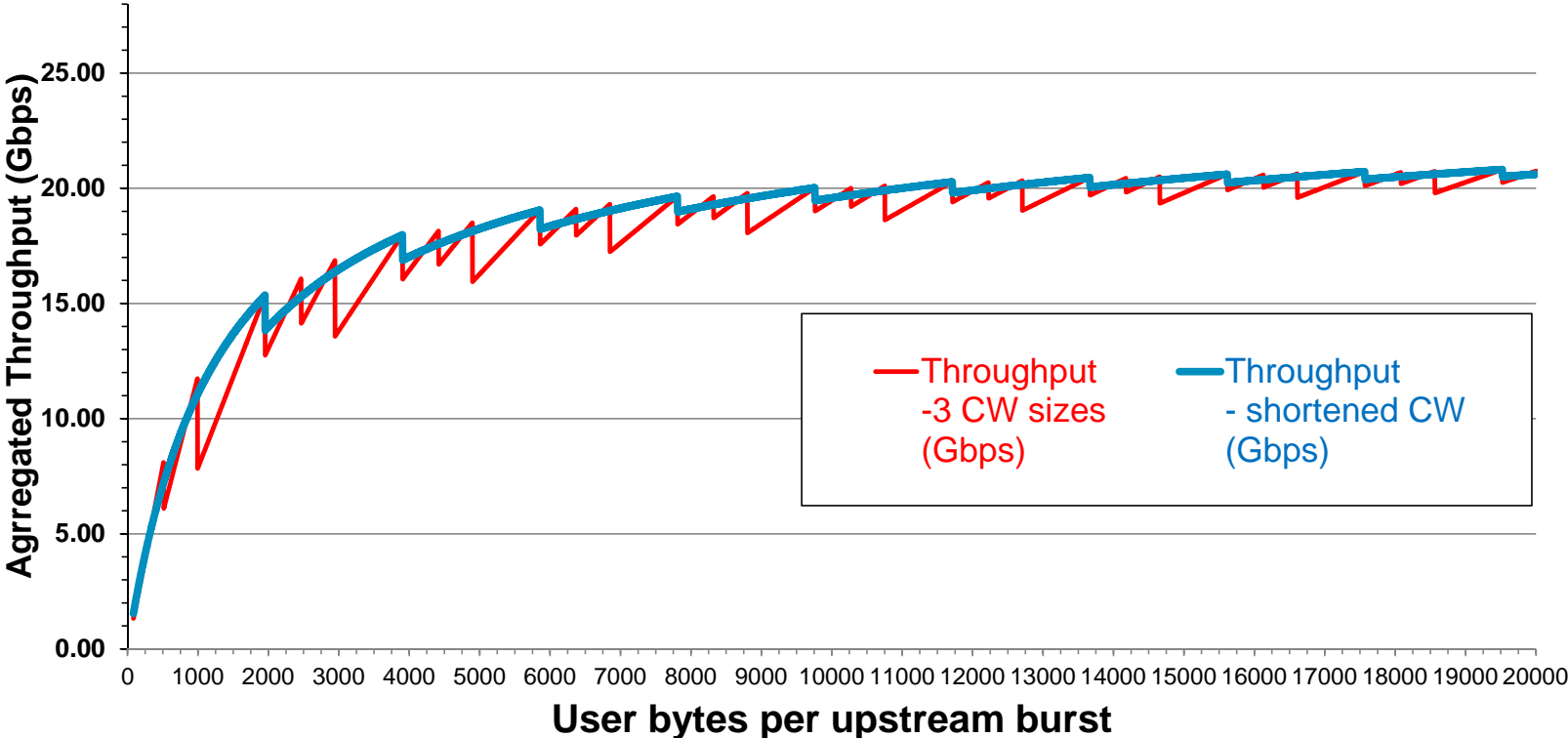
Study #1 question

- At what upstream burst size, would a codeword size at a given FEC rate attain 20 Gb/s?
 - Study compares two approaches
 - Single FEC codeword, shorten-able
 - Codeword size 18493 bits, 84.77% rate
 - Multiple FEC codewords (similar to EPoC)
 - Large codeword: size 18493 bits, 84.77% rate
 - Medium codeword: 9759 bits, 81.64% rate
 - Small codeword: 5392 bits, 76.3% rate
 - Assumption: a variety of FEC code selections can meet the performance objectives of BER 10^{-12} that are close to these sizes and these rates

Study #1 Assumptions (setup)

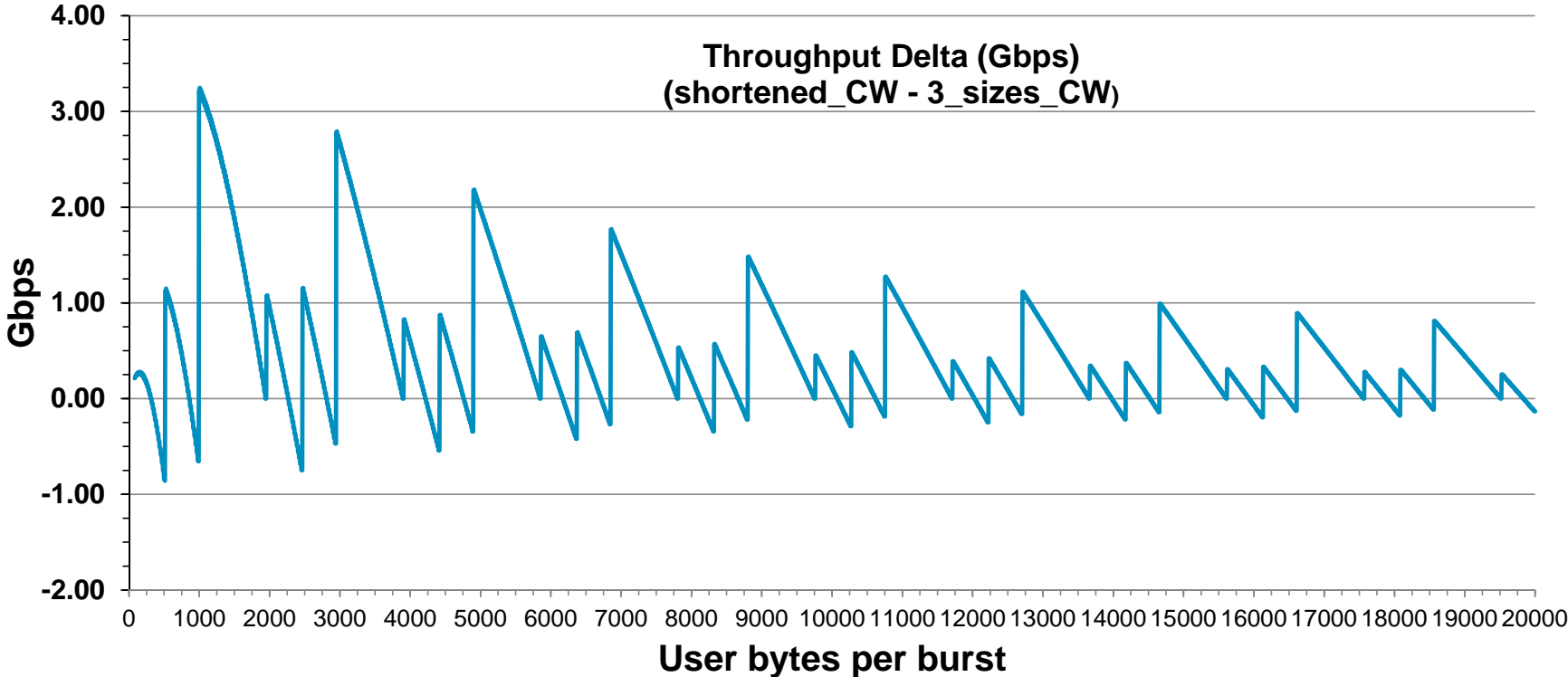
<u>Parameter</u>	<u>Value</u>
Line rate	25.78125 Gb/s
Laser ON time	32 ns
Laser OFF time	32 ns
Sync Time	200 ns
Burst Gap	32 ns
Line code	128b/129b

Upstream burst size to reach 20 Gb/s



- 20 Gb/s achieved at 12000 bytes burst size

Upstream burst size to reach 20 Gb/s



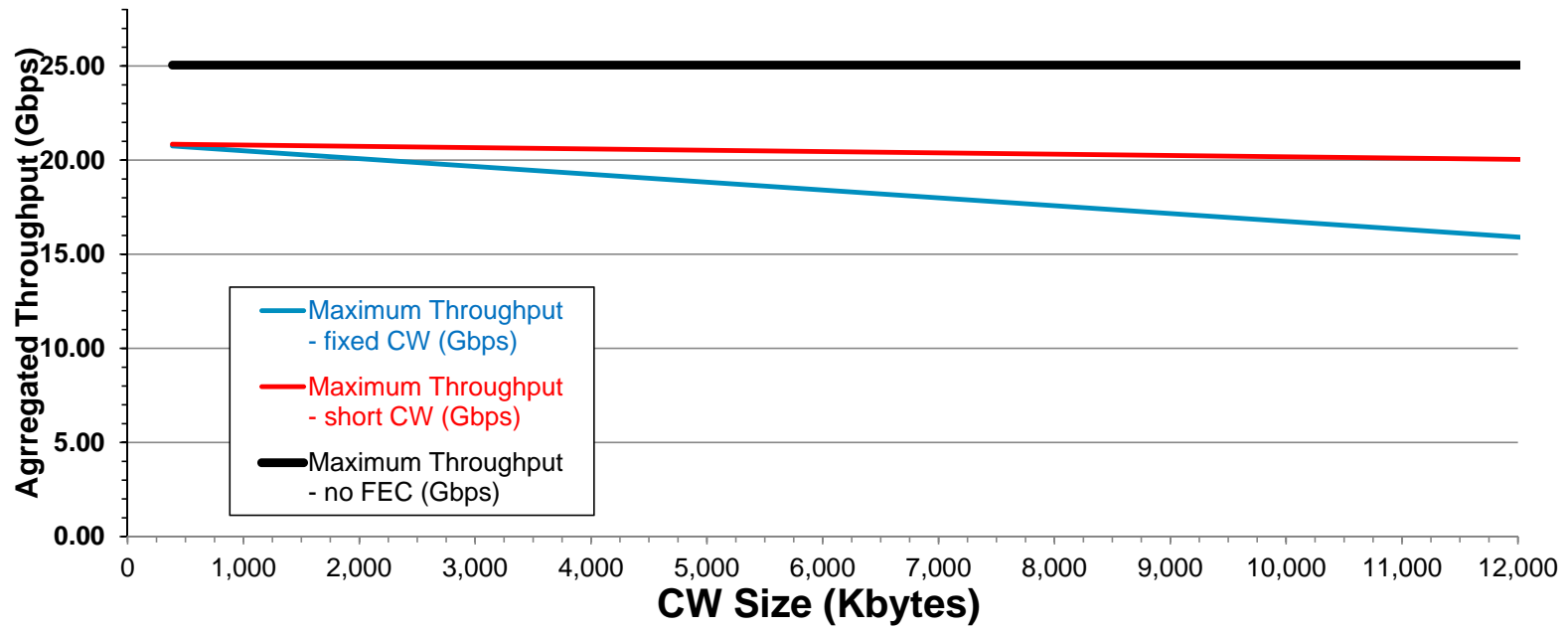
- Multiple codewords do not show clear advantage -> recommendation one codeword size

Study #2 Question

- What codeword sizes support 20 Gb/s with 2 active ONUs and 126 idle ONUs?
- Assumption / setup:

Parameter	Value	Unit	Notes
Line rate	25.78125	Gbps	Line rate
Total Number of ONUs	128		Registered ONUs
Number of Idle ONUs	126		Busy ONUs are granted for data; Idle ONUs are polled (1 FEC codeword per polling grant)
Polling/ Granting Cycle time	2	ms	The calculation assumes that every registered ONU transmits (polled or granted) once per cycle. This may give more conservative results than the real life implementations, because in real systems, some ONUs may be granted/polled less frequently.
Laser ON time	32	ns	
Laser OFF time	32	ns	This value includes END_OF_BURST delimiter
Sync Time	200	ns	This value includes BURST_DELIMITER
Burst Gap	32	ns	Gap between bursts
Block size	128	bits	Line coding block size (Xb/Yb) -raw data size
Block size	129	bits	Line coding block size (Xb/Yb) - encoded size
FEC parity overhead	17%	%	FEC overhead = 1- FEC information rate
Starting Parity Size	4	Xb/Yb block	Parity size and FEC information rate together determine the overall codeword size
Polling payload size	688	bits	One REPORT MPCPDU + 96b of Idle + 64 bit Preamble + 16 bits to resync the scrambler

Study #2 results



Summary

- The 20 Gb/s goal is attainable.
 - Under stated assumptions, 2KB codeword size and rate of 84.77% works
- Independent of actual FEC code selection
 - A variety of FEC codes that are close to 2KB in size and 84.77% meeting BER 10^{-12} and desired electrical coding gain should be available
- Two ONUs serving 20 Gb/s aggregate with 126 idle ONUs works
- Single FEC codeword size in upstream is sufficient

- Proposal: Adopt the 20 Gb/s goal as a Task Force Objective

Motion Proposal

- Move that the following objective be adopted:
Support at least 20Gb/s aggregate bidirectional throughput while servicing a minimum of two active ONUs.



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