

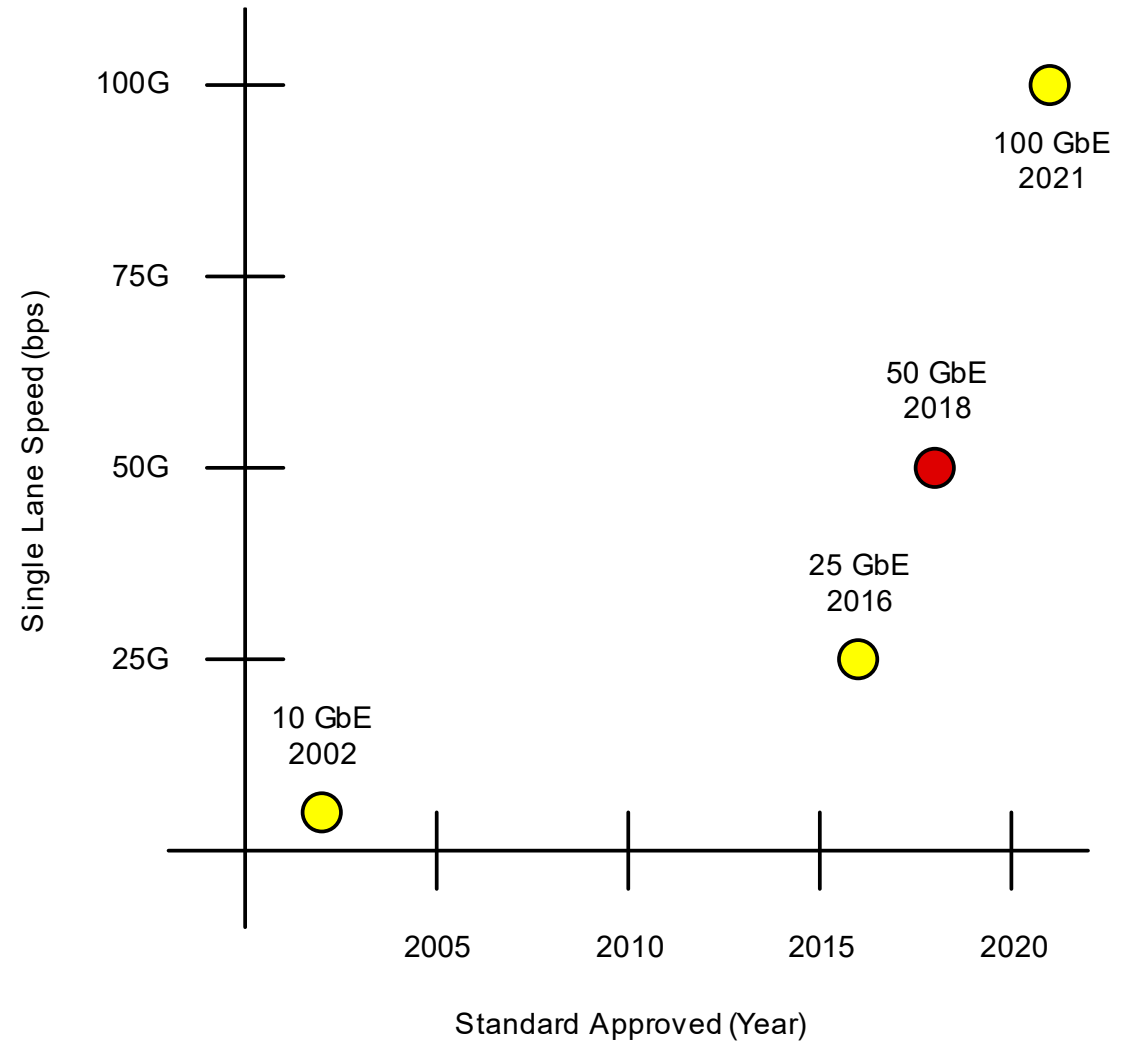
What is 50G Ethernet?

TI Precision Labs – Ethernet

Prepared and presented by Lucas Wolter

What is 50G Ethernet?

- Defined by IEEE 802.3cd standard.
 - Approved in December 2018.
 - **IEEE**: Institute of Electrical and Electronic Engineers.
 - **IEEE 802.3**: Set of standards which define wired Ethernet networks.
 - **IEEE 802.3cd**: Consists of Clauses 131 – 140 and Annexes 135A – 136D.



Comparison: 25G vs. 50G Ethernet

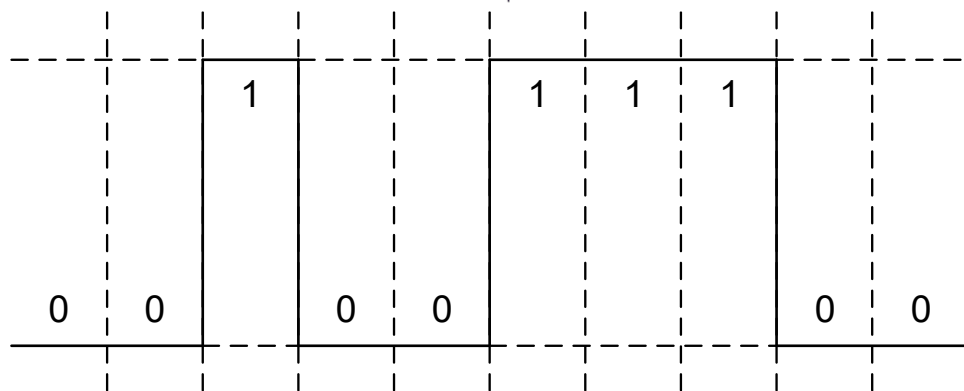
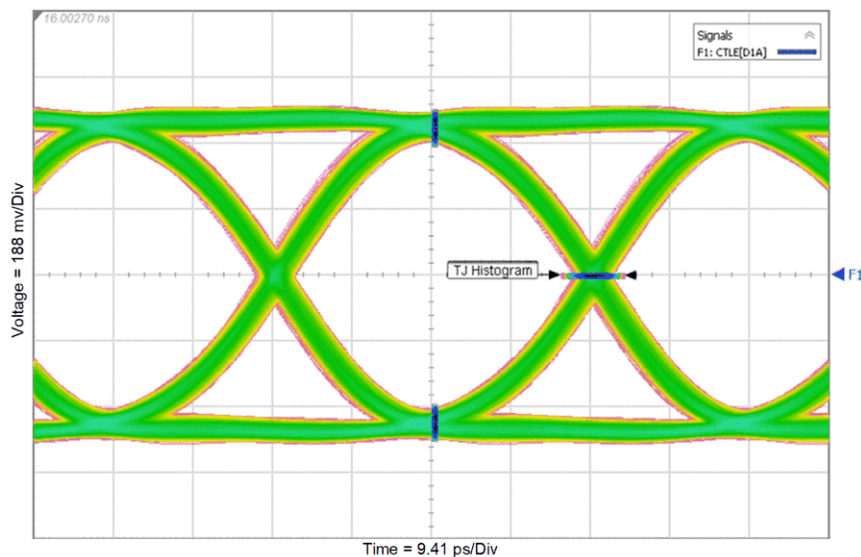
	25G Ethernet	50G Ethernet
Modulation	NRZ (Non-Return-to-Zero)	PAM-4 (Pulse Amplitude Modulation with 4 levels)
Encoding scheme	64b/66b	256b/257b x RS-FEC(544, 514) (Reed-Solomon Forward Error Correction)
Bit rate (Gbps)	25.78125 ¹	53.125 ²
Baud rate (GBd)	25.78125	26.5625

¹ (25 Gbps) * (66 b / 64 b) = 25.78125 Gbps

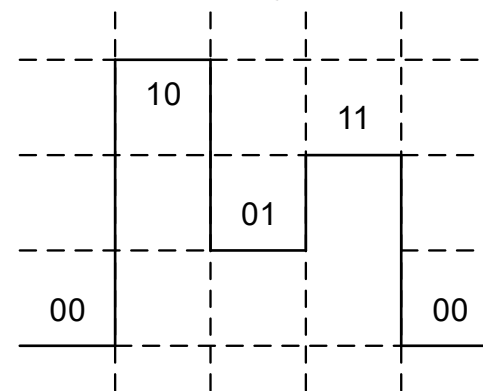
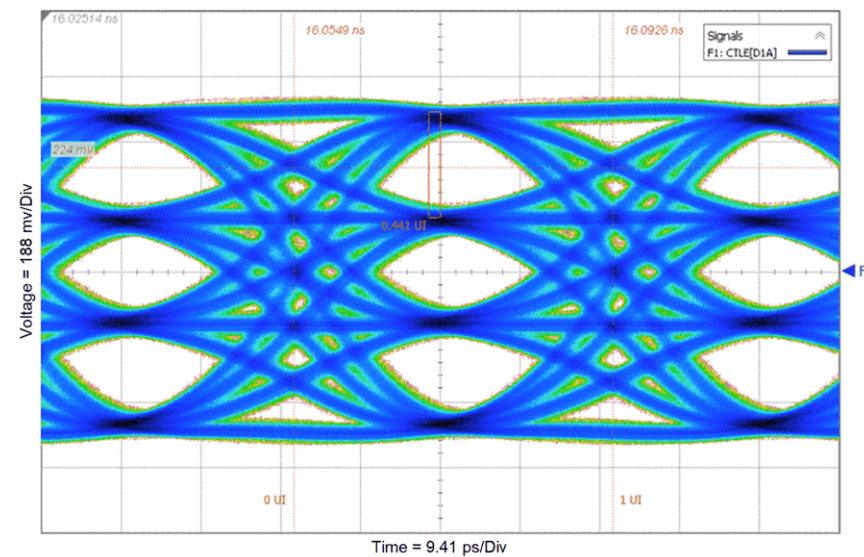
² (50 Gbps) * (257 b / 256 b) * (544 / 514) = 53.125 Gbps

Comparison: NRZ vs. PAM-4 modulation

NRZ

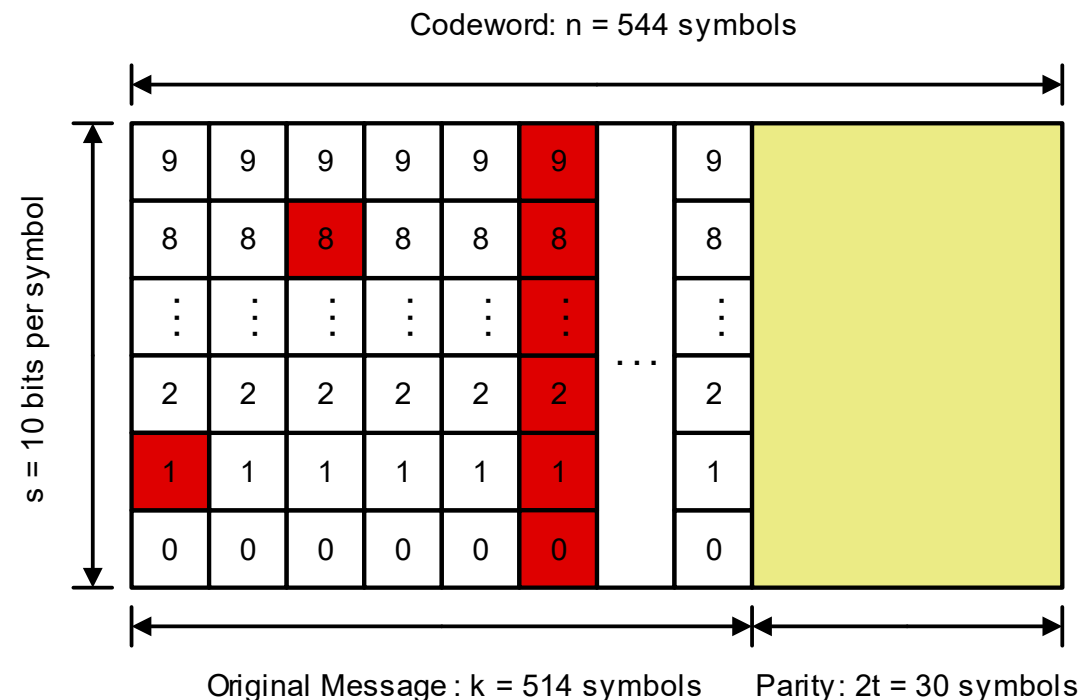


PAM-4 with Graycoding



Reed-Solomon Forward Error Correction (RS-FEC)

- Notation: RS-FEC(n , k)
 - The number of parity symbols is $2t = n - k$.
 - t symbol errors can be corrected per codeword.
 - A symbol error occurs if 1 bit or all s bits are corrupted.
- In 50G Ethernet, $n = 544$, $k = 514$, $s = 10$.
 - $2t = 544 - 514 = 30$
 - 15 symbol errors can be corrected per 544 symbol codeword.



Notable IEEE 802.3cd clauses

Clause 135: 50GBASE-R

- No specific medium

Clause 136: 50GBASE-CR

- Copper cable medium

Clause 137: 50GBASE-KR

- Backplane medium

Clause 138: 50GBASE-SR

- Multimode fiber medium

Clause 139: 50GBASE-FR, -LR, -ER

- Single-mode fiber medium

Annex 135F: 50GAUI-1 C2C

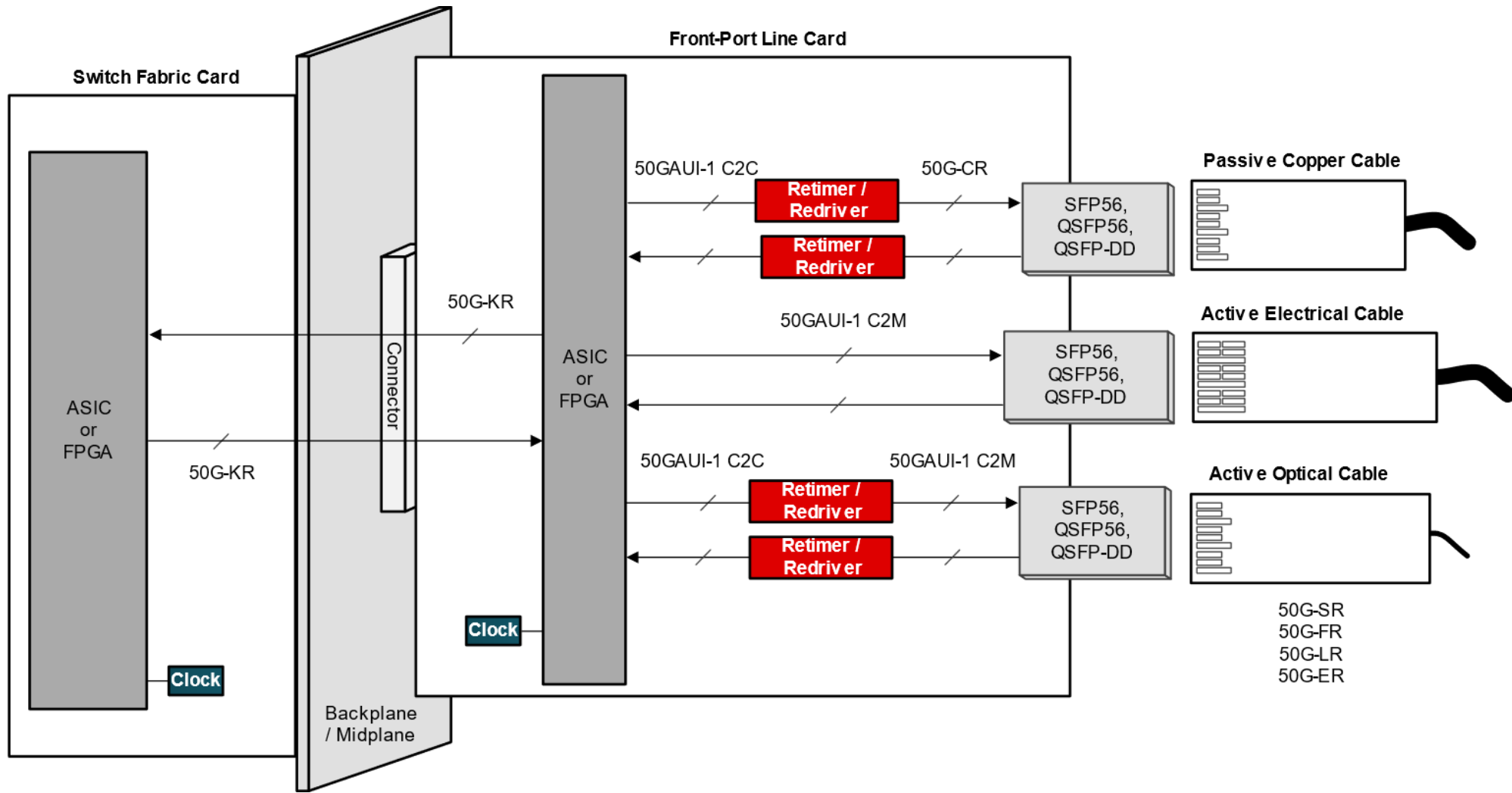
- Chip-to-chip attachment unit interface

Annex 135G: 50GAUI-1 C2M

- Chip-to-module attachment unit interface

Annex 136B: Test fixtures for 50GBASE-CR and 50GAUI-1 C2M

50G Ethernet application diagram



Short quiz

1. What is the baud rate of 50G Ethernet?
 - a. 25.78125 GBd
 - b. 26.5625 GBd
 - c. 53.125 GBd
2. How many error symbols can be corrected per codeword by RS-FEC(544, 514)?
 - a. 15
 - b. 30
 - c. 514
3. Which IEEE 802.3 clause defines 50G Ethernet with backplane medium?
 - a. 50GAUI-1 C2M
 - b. 50GBASE-CR
 - c. 50GBASE-KR

To find more Ethernet technical resources and search products, visit [ti.com/interface/ethernet/overview.html](https://www.ti.com/interface/ethernet/overview.html).