# DMT relative cost consideration

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# Background

- Huawei proposed the slide describing the relative cost for NRZ/PAM in Jan SG meeting.
（dove_400_01a_0114）

- This presentation will present DMT cost based on a rough estimation, using the same method of analysis, and  will clarify the relative position of DMT.

# Relative Cost comparison

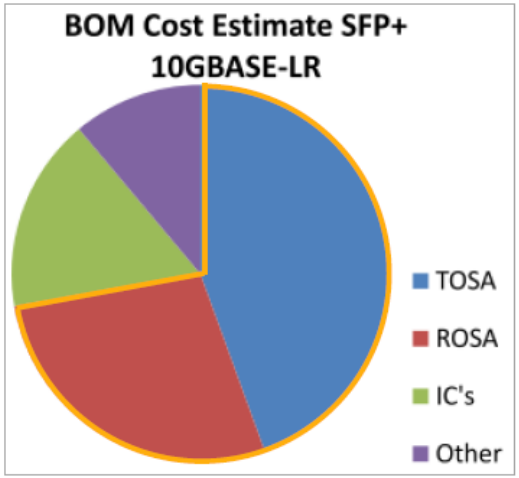
- ✓ 400GE Transceiver cost mainly depends on internal optical component cost
- ✓ Internal optical component cost is strongly dependent on the number of optical components, and the bandwidth of these components.
- ✓ **Discrete Multi-Tone (DMT) technology reduces both number of optical components as well as required component bandwidth, resulting in lowest cost.**

- ✓ Relative cost: 4x100G DMT < 8x25G PAM4 < 4x50G PAM4 < 8x50G NRZ

| | 100GbE | 400GbE | | | |
|---|---|---|---|---|---|
| | 4x25G NRZ | 8x25G PAM4 | 8x50G NRZ | 4x50G PAM4 | 4x100G DMT |
| Tx LD / Rx PD Number and Bandwidth | 4 pcs. | 8 pcs. | 8 pcs. | 4 pcs. 😊 | 4 pcs. 😊 |
| | For 25 Gbps (Limiting) | For 25 Gbps (Linear) 😊 | For 50 Gbps (Limiting) | For 50 Gbps (Linear) | For 25 Gbps (Linear) 😊 |
| Transmission distance | - | 10 km 😊 | 10 km 😊 | 2 km | 10 km 😊 |
| Cost | - | $$ | $$$$ | $$ | $ 😊 |

# 400G DMT cost potential

- ✓ The device cost ratio of 100G CFP LR4 is almost the same as that of 10G Transceiver shown below.
- ✓ DMT is the most cost effective solution from the view point of optics cost reduction.



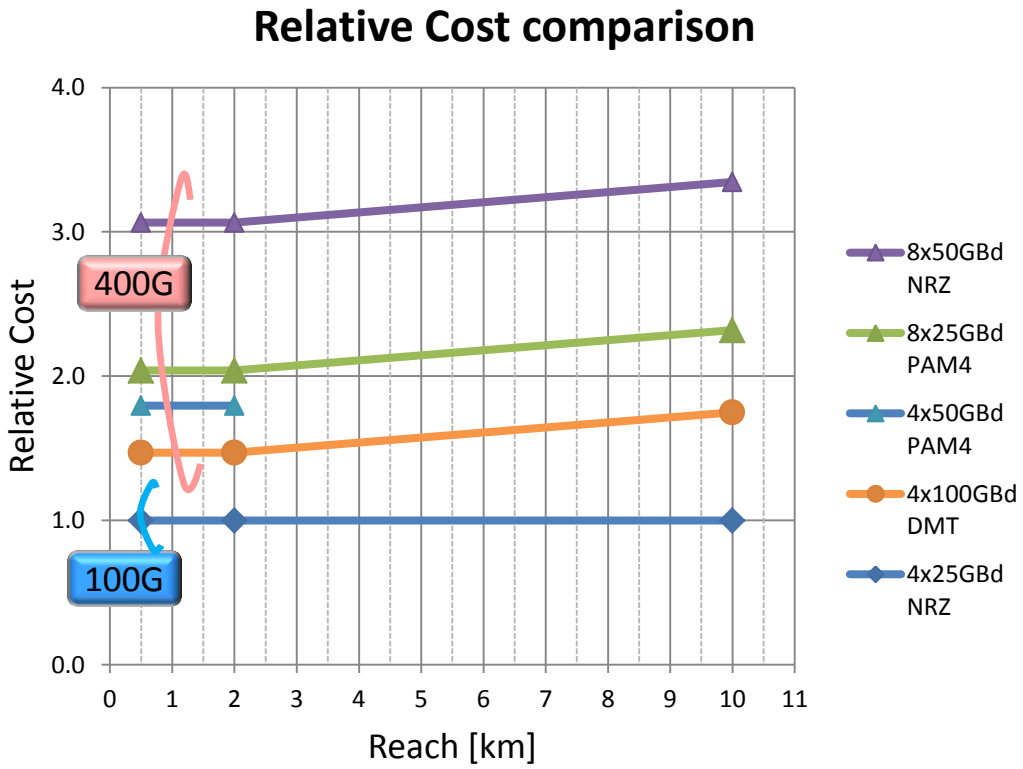

*Source: nowell_01_1111_NG100GOPTX*

| 2km | 100GbE | 400GbE | | | |
|---|---|---|---|---|---|
| | 4x25G NRZ | 8x25G PAM4 | 8x50G NRZ | 4x50G PAM4 | 4x100G DMT |
| Tx LD | 1.0 | 1.9 | 2.9 | 1.5 | 1.2 |
| Rx PD | 1.0 | 2.0 | 2.9 | 1.7 | 1.2 |
| IC's | 1.0 | 2.6 | 4.0 | 3.0 | 3.0 |
| Relative cost | 1.0 | 2.0 | 3.0 | 1.8 | 1.5 |

| 10km | 100GbE | 400GbE | | | |
|---|---|---|---|---|---|
| | 4x25G NRZ | 8x25G PAM4 | 8x50G NRZ | 4x50G PAM4 | 4x100G DMT |
| Tx LD | 1.0 | 1.9 | 2.9 | ?? | 1.2 |
| Rx PD | 1.0 | 2.8 | 3.7 | ?? | 2.0 |
| IC's | 1.0 | 2.6 | 4.0 | ?? | 3.0 |
| Relative cost | 1.0 | 2.3 | 3.3 | ?? | 1.8 |

Source of relative cost except DMT refers to http://www.ieee802.org/3/400GSG/public/14_01/dove_400_01a_0114.pdf

# 400G Cost potential




Source of relative cost except DMT refers to http://www.ieee802.org/3/400GSG/public/14_01/dove_400_01a_0114.pdf

- ✓ 4x100G baud DMT is the most cost effective solution for each reach compared with other modulation scheme.

# Summary

- DMT has a cost effective potential through the rough comparison with NRZ/PAM4.
  - The same level of optics as 100GBase-LR4, which is widely deployed in the industry, can be utilized to 4x100GBaud DMT.
  - LD/PD(optics parts) used for 100GBase-LR4 gradually becomes mature. As the result, the cost of 4x100G DMT transceiver will be decreasing.
- More precise estimation, with the examination of the detail configuration and its required performance, is to be continued.