

Q&A: PAM4 Single Lambda Addresses Today's Ethernet Challenges

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[AppliedMicro](#) developed the world's first 100G PAM4 single-wavelength solution for 100G and 400G Ethernet. I talked with [Omar Hassen](#), Associate Vice President of Connectivity Business, about the challenges associated with 100G Ethernet.

Wong: What are the current market challenges associated with 100G Ethernet?

Hassen: Data-center customers are demanding a steep downward trajectory in the cost of 100G pluggable transceivers, but existing 100G module multi-source agreements (MSAs) such as PSM4 and CWDM4 have limited capacity for cost reduction due to the cost of the fiber (PSM4) and the large number of components (both PSM4 and CWDM4).

Existing two-lambda PAM4 (2x50G) trades off some optical components for more expensive digital signal processing (DSP) and will struggle to improve upon the cost of CWDM4. While the dual-lambda PAM4 architecture (2x50G) currently uses components that appear to cost less, the lack of a "dual" ecosystem and the fact that the single-lambda ecosystem will mature quickly to support both 100GE and 400GE means that the volume for a 2x50G solution will never truly materialize.

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This means that dual-lambda PAM4 and existing 100G Ethernet (100GE) solutions such as PSM4 and CWDM4 will not be able to achieve the overall cost reductions demanded by data-center customers.

Wong: Can you talk about your solution announced at OFC (Optical Networking and Communication Conference & Exhibition) and how the product addresses these challenges?

Hassen: At OFC 2016, AppliedMicro showcased the world's first 100G PAM4 single-wavelength solution for 100G and 400G Ethernet. The low-power, 16-nm FinFET solution enables 100G PAM4 single-lambda solutions in QSFP28 form factors and serves as a key breakthrough for 400G PAM4 Ethernet. This solution is built upon our proven mixed-signal and DSP technology, and will fuel the upgrade cycle to 100GE and 400GE in data centers.

With its streamlined architecture, lower cost, and higher reliability, single-lambda 100GE PAM4—what we're calling "True 100G"—can be seen as the equivalent of SFI at 10GE. SFI and SFP+ enabled the cost reduction and

h density required to drive the growth of 10GE, and single-lambda 100GE will enable the cost reduction and
h density required to drive the growth of 100GE.

Wong: Why is PAM4 single lambda the answer?

Hassen: PAM4 makes more efficient use of electronic and optical components by packing two bits for every symbol sent over the fiber. Single-lambda 100G PAM4 offers the simplest architecture, the most streamlined data path, higher reliability, and an easy upgrade path to 400G Ethernet, and it enables the lowest-cost 100G transceiver.

Wong: When do you think we'll see 400G Ethernet?

Hassen: Based on the fact that there are 400GE standards in place already, along with component availability and that discussions are taking place with partners and customers, we believe we will see 400GE in the second half of 2017 or the early part of 2018.

Wong: What markets will be affected most by these developments?

Hassen: The data-center and cloud-networking markets will be affected most by the adoption of single-lambda PAM4. Amid the explosion in video, data, and mobile traffic for 100G, these developments will be necessary to ensure customer expectations can be met. The adoption of single-lambda PAM4 solutions will enable network operators to cost-effectively support traffic levels predicted for the zettabyte era.

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