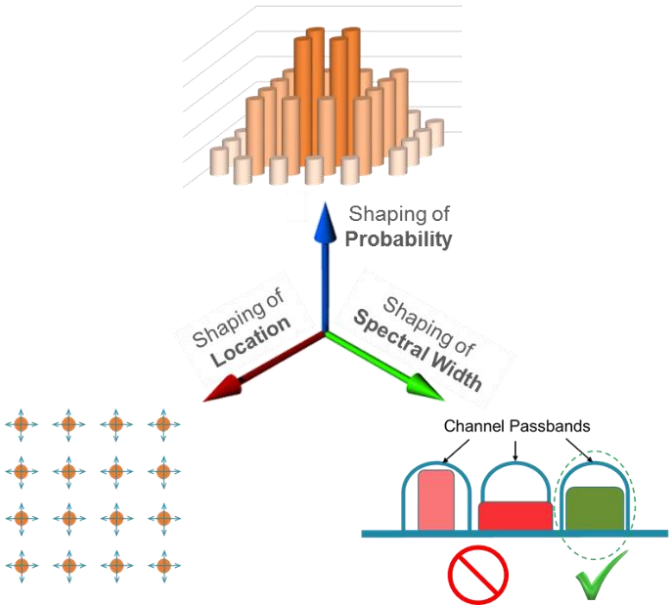
Optimize Network Utilization with 3D Shaping

Introduction

Optical innovation and investment over the years have delivered higher capacity networks with significantly decreased cost-per-bit transmitted. As technological advances enable solutions approaching the theoretical Shannon capacity limit, gains are becoming more incremental, and reducing cost-per-bit is becoming more challenging. Acacia's innovative technology and feature set enables a path to breaking through the optical terabit barrier allowing users of the technology to deliver optical networks with high performance while lowering cost and power for various network applications including long haul, metro, and DCI-edge.

Push optical transmission closer to the Shannon limit with 3D Shaping

3D shaping is a technology solution that pushes optical transmission capacity closer to the Shannon limit in a very power-efficient manner. 3D Shaping enables fine-tune adjusting of the line-side coherent modulation characteristics helping network operators optimize capacity and reach for their network.

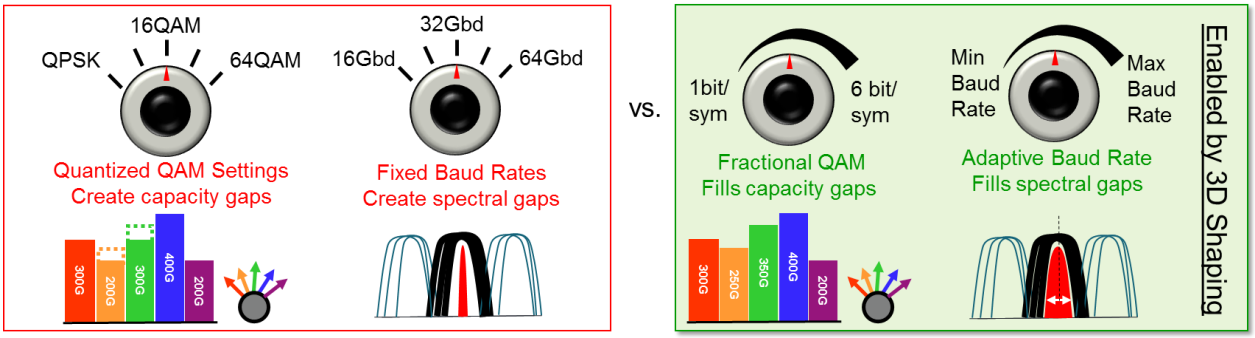


3D Shaping:

- Increases capacity by shaping constellation points' probability with Acacia's patented Fractional QAM
- Increases reach by shaping constellation points' location
- Maximizes channel passband usage by shaping spectral width with Adaptive Baud Rate

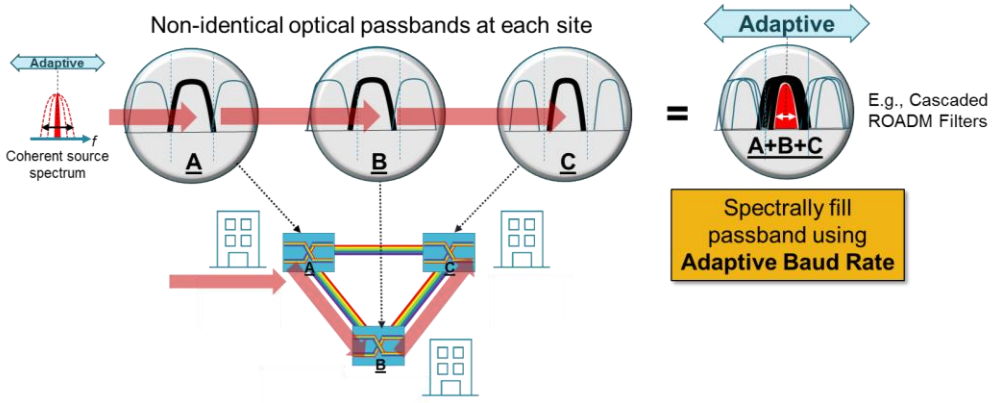
Shape the constellation and increase capacity—Fractional QAM Modulation

Typical coherent modulation modes such as QPSK, 8QAM, and 16QAM utilize integer bits/symbol steps (e.g., QPSK = 2 bits/symbols, 16QAM = 4 bits/symbols). Higher modulation-order modes (higher bits/symbols) provide higher capacity at the expense of reach, while lower modulation-order modes (lower bits/symbols) provide lower capacity with farther reach. Integer (quantized) bits/symbol steps may result in sub-optimal capacity utilization due to gaps in link margin. Fractional QAM Modulation enables *non-integer* steps, supporting many small increments between the integer steps. With this feature, the link margin can be optimized with much greater resolution than traditional interconnect technology.



Shape spectral width to optimize passband utilization—Adaptive Baud Rate

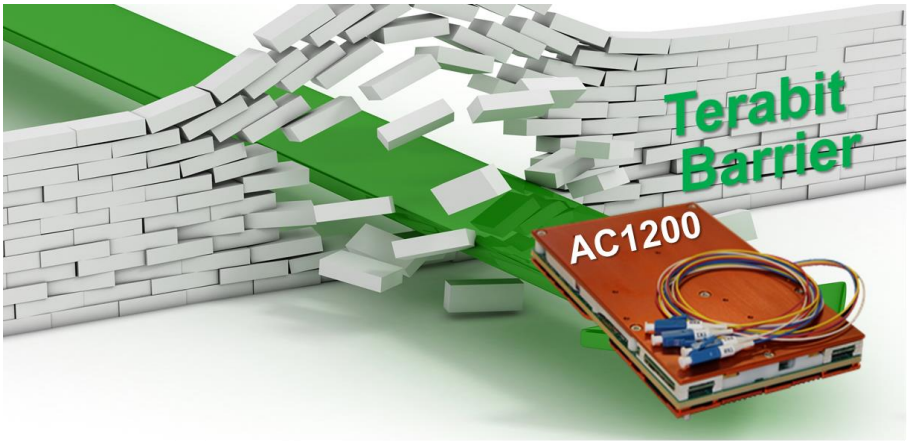
In general, optimal transmission performance is achieved by operating at the highest baud rate that fits within a given channel passband. Channel passbands can vary between networks and even between links in the same network. In most implementations, the baud rate of the coherent interconnect is either fixed or can be selected between a small number of settings. Adaptive Baud Rate allows flexible control of the baud rate over a wide range, giving network operators the ability to reduce regeneration stages and increase network margin.



Overcome Implementation Barriers

As stated in the introduction, gains made by pursuing the theoretical capacity limit are becoming increasingly incremental. As part of closing the gap to the theoretical limit, focus should also be on overcoming the practical implementation impairments to achieve full optimization in an actual network. Factors such as non-ideal forward error correction (FEC), fiber non-linearities, fixed-point/finite effective number of bits (ENOB), production variation and aging all are practical barriers that must be addressed in closing the gap to the Shannon limit. Acacia's practical and power-conscious approach to overcome these barriers use not only 3D shaping but also additional technology solutions such as enhanced Turbo Product Code soft-decision (SD) FEC. Addressing the implementation impairments can result in up to 3dB of additional system margin, resulting in higher performance and longer reach.

Break through the Terabit Barrier with the AC1200 Coherent Module

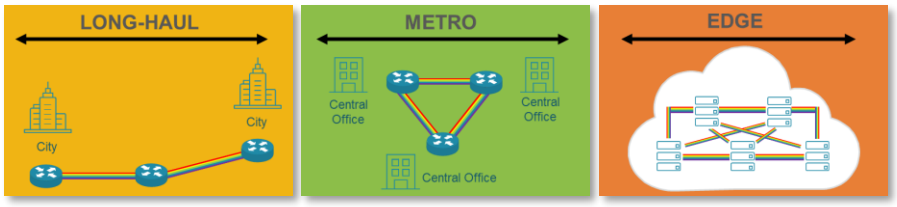


The Acacia AC1200 embedded module features a powerful combination of 3D shaping, 1.2T high-capacity, and flexible client support in a compact form-factor.

In addition to 3D shaping, the AC1200 module features:

- **Client Interfaces** to support a wide range of applications with 100GbE, 400GbE and FlexE interfaces to the host card
- **Internal crossbar/interconnection switch fabric** to enable increased traffic flexibility, including mapping of 3x400GbE client traffic on to two line-side wavelengths carrying 600Gbps each
- **Enhanced Turbo Product Code SD-FEC** for ultra-high net coding gain (NCG) to extend reach, while maintaining low power dissipation.

Leverage the AC1200 to Increase the Efficiency of Key Applications



The robust feature set of the AC1200 provides many advantages to increase the efficiency of long haul, metro, and DCI-edge applications. For more information about the AC1200, please visit the product page on the Acacia website.

Additional Acacia Products

In addition to the AC1200, Acacia offers numerous other solutions to address different applications and approaches such as digital coherent optics (DCO) and analog coherent optics (ACO), as well as different form factors such as CFP and CFP2 pluggable modules. Visit our website for more information.




About Acacia Communications

Acacia's innovative silicon-based high speed optical interconnect products accelerate network scalability through advancements in performance, capacity, and cost. Our silicon photonic PICs, DSP ASICS, and coherent modules inside a variety of network equipment products empower cloud and service providers to meet the fast growing consumer demand for data.

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