# 100G Coherent solutions – features and applications

The increased demands of usage of Internet, data, 4th generation mobile, high definition video, storage and digital television paves the way for advancements in optical transport networks. The 100G DWDM solution has matured rapidly with two leading edge technologies of direct modulation for metro distances and coherent technology for long haul applications. With this new technology carriers and service providers can easily expand their existing 10G and 40G networks and support new 100G applications to achieve higher throughput, better spectral efficiency and cover longer distances without changing the existing fiber infrastructure. The 100G DWDM provides cost effective spectral efficient optical network solution to accommodate the current and future needs of bandwidth demanding data and video applications.

The innovative 100G coherent solutions enable transport of 100G data rate capacity over a single wavelength across long distances with higher optical performance than 10G solutions. The coherent solution can operate over 2,500Km without the need for dispersion compensator. It is based on optical digital signal processing which enables the leap in the optical layer capabilities into a new era.

The Transceiver module is based on the DP-DQPSK (Dual-Polarization Quadrature Phase-Shift Keying technology). The optical signal is divided into two polarizations by BPS (Beam Polarization Splitter) each of which is modulated by a symbol that represents 2 bits. The phase varies from one symbol to the next depending upon the value of the symbol (I , Q).Therefore, the actual symbol baud rate is reduced by 4 to about 30GBaud rate.

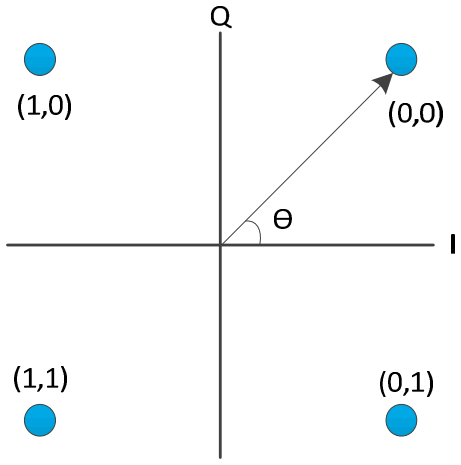



Figure 1.0 Mapping of bits to carrier phase

## Transmitter Path:

The host electrical side interface signal is built of 10 parallel lanes of 11.18Gbps rate each, according to the OTL4.10 standard. This electrical signal is multiplexed to 4 lanes of 31.75Gbps each by internal MUX inside the coherent optical module, including Soft Decision Forward Error Correction( SD FEC). The 4 Modulation Drivers (MDR) then drive 4 Mach-Zehnder Modulators (MZM). This finally generates DP-DQPSK signal, a single wavelength of 127.156Gbps line side bit rate.

## Transmitter Path:

On the receiver side, the signal is recovered using local tunable laser. Together with a Digital Signal Processor (DSP) and SD FEC (Soft Decision FEC), the DSP recovers the actual data, handles Chromatic Dispersion compensation and Polarization Mode Dispersion (PMD), and the SD-FEC applies error correction .The output of the DSP is 10 Lanes of 11.18Gbps each towards the host electrical interface with standard bases OTL4.10 interface.

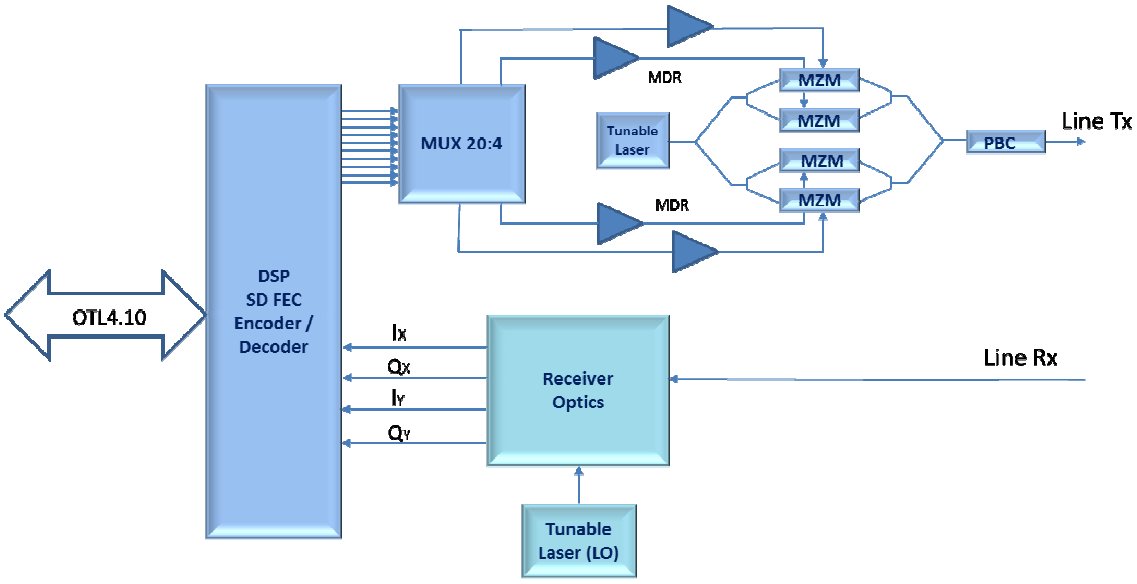


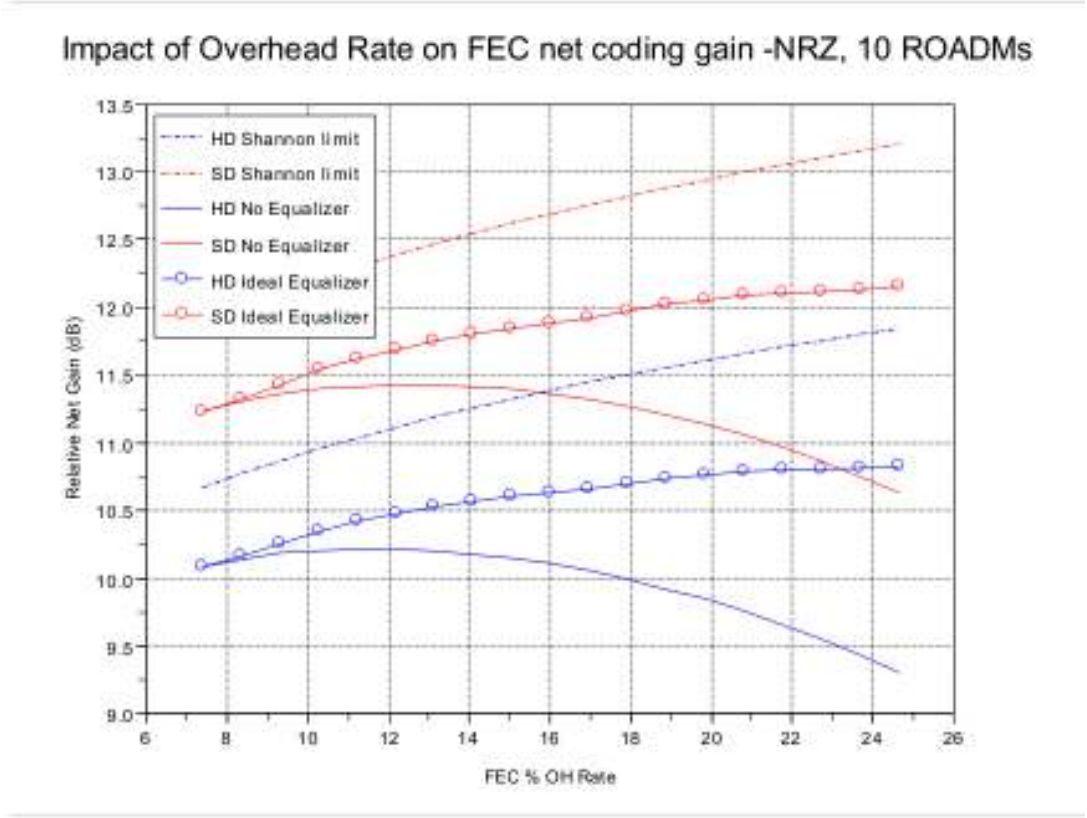

Figure 2 : 100G DP-DQPSK Transceiver Block Diagram

## Coherent SD-FEC:

PacketLight's solution is designed to implement 100Gb/s network over existing 10G networks. This presents several challenges, the most limiting factors, among is the OSNR which is the most significant one. By using advanced FEC technology built inside the Coherent module, PacketLight 100G transponder can improve the OSNR that was reduced due to the x10 times higher bit rate compared to the 10Gb/s signals.

The improvement of the OSNR is done using Soft Decision FEC that provides information regarding the likelihood of detecting '0' or '1' thus leads to more accurate "1" or "0" detection decision. It gives a level of confidence on this decision, by providing information of how far the signal level is from the threshold setting.

PL's Coherent transceivers are able to operate with 13% Soft Decision FEC which contributes ~1dB to Net Code Gain vs. the HD FEC. As can be seen from the SD, no equalized graph below the Net Code Gain has a peak in ~13% overhead (taken from the OIF-FEC-100G-01.0). Coupling the Coherent module SD FEC with the host board OTN standard G/EFEC guarantees Error free (1e-15) optical 100G transmission solution.

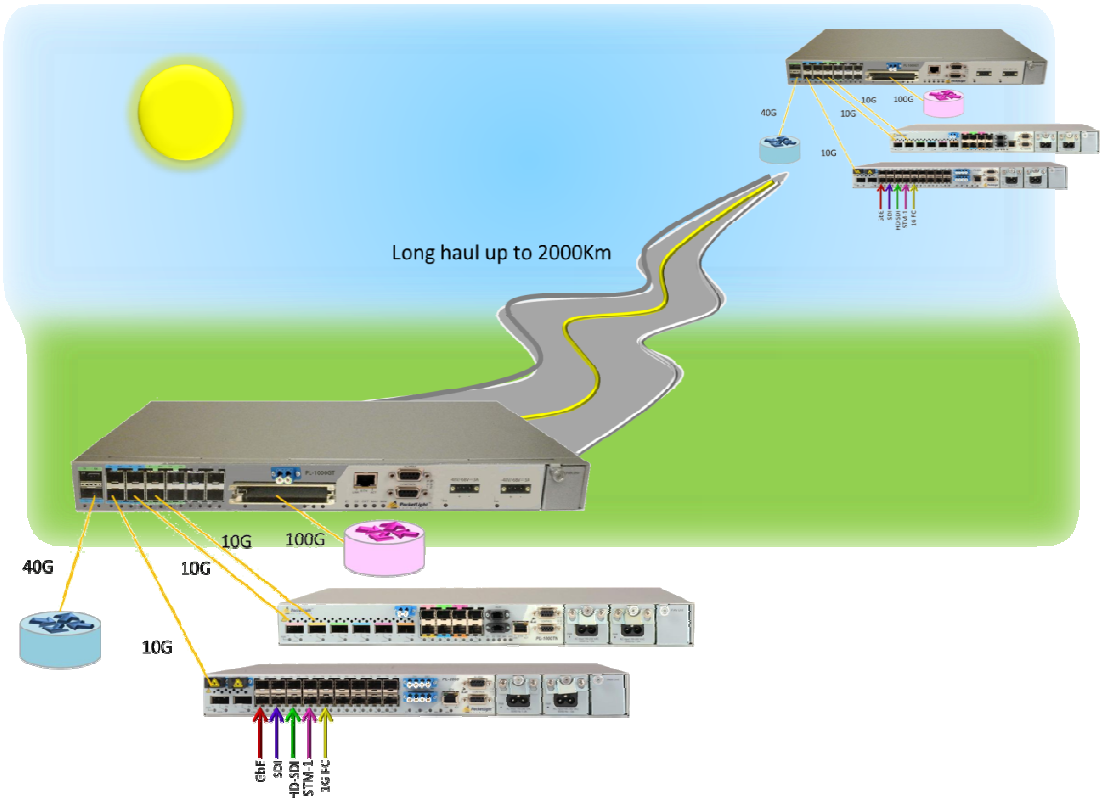



PacketLight 100G solutions are standards based ITU-T G.709 with Forward Error Correction (FEC) GFEC and are interoperable with any standards based 3rd party equipment of 10G or 40G networks. The optical transceivers are based on industry multi source agreement (MSA) opticsand can interface with any other third party equipment on both the optical layer and the OTN (Optical Transport Network) layer. The 100G optical solutions can operate on a green field solution as well as over existing 10G networks and seamlessly increase their capacity to 100G.

Coherent 100G Transponder/Muxponder supports both 10G/40G Multirate Muxponder and Transponder modes in the same product. This design enables a smooth transition from 10G/40G to 100G client interfaces without the need to replace the DWDM transport equipment each time the client interfaces change.

PacketLight's PL-1000GT series solves the 40G or 100G network expansion question by offering up to two 40G Ethernet service ports mapped over 100Gsingle wavelength in much more efficient cost and spectral wise way than any 40G Transponder solution. Each 100G Muxponder can unify either 2x40G client services and 2x10G services, or 1x40G and 6x10G services, or 10x10G services. Additionally, by integrating PacketLight's sub-10G MSSP muxponderPL-2000 with 100G products,

services providers can aggregate any protocol and service from 100Mb/GbE/10G Eth to up to 40G (including 8Gb FC) in a single 100G aggregated uplink.




The 100G technology is ready for mass deployment and already started its domination on the ever increasing data and video transport capacity demands. PacketLight's 100G product suite is designed with modularity and ease of use. Its small foot print of 1RU makes it an ideal solution for both long haul networks with high spectral efficiency and optical performance as well as for enterprise networks. PL's 100G DWDM OTN products allow service providers to make available 100G networks for enterprise needs such as connecting high capacity data centers within metro areas, connecting multiple offices and buildings to state of the art campus optical networks. It also enables carriers to add the 100G link over their existing networks or connecting to third party transport equipment using PacketLight as edge CPE device. PacketLight's100G feature set and capabilities give service providers the key to offering high throughput, connectivity solutions to all of their clients inside the metro areas as well as over long distances.
For pricing and other questions, please contact our sales department at info@packetlight.com

**About PacketLight Networks, Ltd.**
PacketLight Networks offers a suite of Leading 1U CWDM/DWDM and OTN based solutions, for transport of data, storage, voice and video applications, over dark fiber and WDM networks, featuring high quality, reliability and performance at affordable prices. Our products are distinguished with low power consumption ideal for CLE (Customer Located Equipment) allowing maximum flexibility as well as ease of maintenance and operation and providing real Pay-as-you-grow architecture. PacketLight customers are carriers, service providers, data centers, IT integrators and enterprises who are active in meeting the demands for metro Ethernet, business continuity, Triple Play solutions and enterprise data sharing applications. For product and reseller information, Please contact info@packetlight.com