

Optimizing DWDM Networks with Zero-Touch Provisioning for High-Capacity Data Transmission

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Abstract : The evolution of optical communication technologies is pivotal in meeting the growing data demand driven by emerging technologies such as 5G, IoT, and upcoming 6G networks. This paper presents advancements in Dense Wavelength Division Multiplexing (DWDM) systems, focusing on the integration of Zero Touch Provisioning (ZTP) for simplified deployment and the ability to scale data transmission over single fiber pairs. The proposed methodology leverages high-capacity DWDM channels capable of supporting data rates exceeding 800G, ensuring future-proof solutions for both residential and enterprise communication infrastructures. Moreover, this paper examines the impact of these technologies on operational efficiency by minimizing the need for manual configuration, leading to reduced costs and faster deployment timelines. We also explore how the integration of optical amplifiers, Optical Line Amplifier (OLA) alternatives, and optical control plane protocols (such as ASON, GMPLS, OpenFlow, and SDN) play a critical role in enhancing the flexibility, scalability, and energy efficiency of optical networks. By focusing on optical solutions, this paper seeks to address the future challenges of reducing fiber pair consumption and improving network performance without compromising on capacity or reliability.

Keywords : zero-touch provisioning (ZTP), dense wavelength division multiplexing (DWDM), optical networks, optical control plane (ASON, GMPLS, OpenFlow, SDN)

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