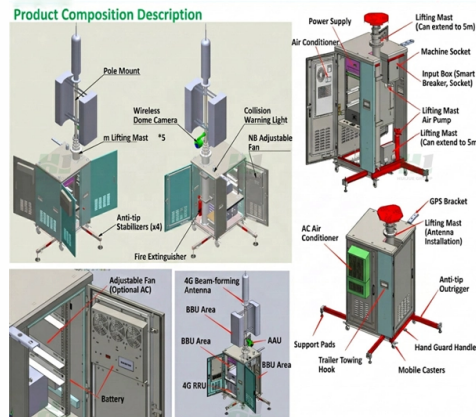


Wavelength Division Multiplexing Process



Overview

What is Wavelength Division Multiplexing? WDM enables bi-directional communication and multiplies signal capacity.

Key Takeaways

WDM combines multiple optical signals of different wavelengths onto a single fiber using a multiplexer, transmits them simultaneously, and separates them at the receiver using a demultiplexer. Step-by-Step Process of WDM

1. Signal Generation: Each data source generates an optical signal at a specific wavelength using a laser. These signals are independent and carry separate data streams.
2. Multiplexing (MUX): The optical signals are combined using a multiplexer, which acts as an optical combiner. The MUX ensures that each signal maintains its unique wavelength while merging them into a single optical fiber for transmission.
3. Transmission through Fiber: The combined optical signal travels through a single optical fiber. WDM allows multiple channels to coexist without interference because each channel uses a distinct wavelength.
4. Optional Optical Amplification: For long-distance transmission, optical amplifiers may be used to boost signal strength without converting it to electrical form, maintaining the integrity of all wavelengths.
5. Demultiplexing (DEMUX): At the receiving end, a demultiplexer separates the combined signal back into individual wavelengths. Each separated signal is then directed to its corresponding receiver for data processing.
6. Data Reception: Each receiver converts the optical signal back into electrical form and processes the data stream independently, completing the WDM communication cycle.

Types of WDM

- Coarse WDM (CWDM): Uses fewer channels (typically 8) with wider spacing (20 nm) between wavelengths. It is cost-effective and consumes less energy .
- Dense WDM (DWDM): Supports many more channels (up to 160 or more) with narrow wavelength spacing, enabling very high data capacity over a single fiber .

Summary

WDM effectively increases the capacity of optical fibers by allowing multiple data streams to share the same physical medium. The key steps—signal generation, multiplexing, transmission, demultiplexing, and reception—ensure that each wavelength carries independent information without interference, making WDM a cornerstone of modern high-speed fiber-optic networks .

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Wavelength Division Multiplexing (WDM) is a fiber-optic transmission technique that enables the use of multiple light wavelengths (or

3.5 Wavelength multiplexing and demultiplexing

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