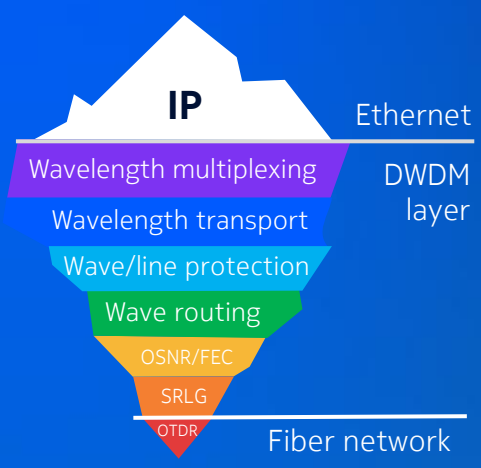
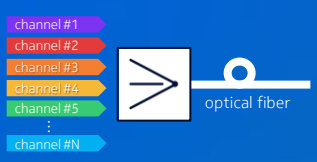
Coherent routing and the evolution to IP over DWDM

Relentless demand for more network capacity is driving service providers and cloud builders to look at new approaches to scale IP and optical network infrastructure more efficiently. Nokia Coherent Routing addresses this need by combining the power of digital coherent optics (DCOs) with carrier-grade IP service routers, optical transport systems and network automation expertise. When considering the evolution to IP over DWDM, there is often a strong focus on the IP layer, but DWDM optical line systems are essential building blocks for cost-efficient scaling of coherent routing applications in metro-regional carrier networks.



1. Efficient use of available fiber capacity
2. Maximize DCO performance and reach
3. Minimize impact of fiber cuts on IP layer
4. Dynamically size/provision wavelengths
5. Determine most economic DCO option
6. Avoid single points of failure in IP links
7. Easily locate and repair fiber impairments

The building blocks of DWDM transport networks

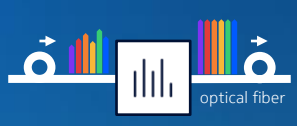


WDM multiplexer

Combines wavelengths from multiple coherent optics into a single optical fiber, thus increasing the total data-carrying capacity of an optical fiber one hundredfold compared to single-wavelength operation.

Optical amplifier

Monitor and boost power levels of coherent wavelengths travelling across an optical fiber, increasing reach in a highly cost and power efficient manner over distances up to 1000 kilometers and more.



Dynamic gain equalizer

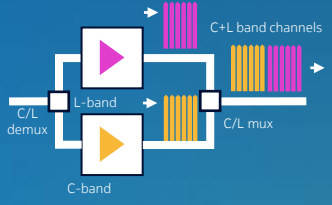
Integrated into optical amplifiers and ROADMs to ensure that the power levels of all WDM channels operate within optimized limits to maximize application performance.

Optical Protection Switch

Offers 1+1 traffic protection of wavelengths against fiber cuts or line-side equipment failure, while reducing network cost by avoiding the need for duplicate 1:1 transport interfaces.

Optical Time Domain Reflectometer (OTDR)

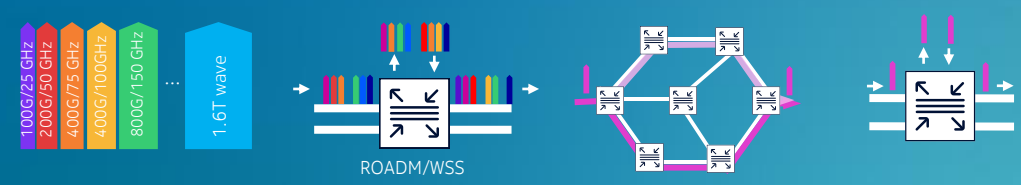
Real-time monitoring of fiber plant to detect signal degradation due to fiber impairments and to locate fiber cuts with <10m accuracy.



C+L band operation

Expands the optical fiber spectrum available to double the total WDM capacity of an optical network with continuous operation across both C+L bands.

C/D/C/-F ROADMs with Wavelength Selective Switching (WSS) complement WDM multiplexing with the ability to selectively add/drop any wavelength of any speed and spectral width, and switch wavelengths between multiple optical fibers and directions. Pluggable 400ZR+ DCOs with a launch power of +0 dBm are well suited for metro-regional IP transport applications over interconnected fiber rings and mesh topologies with ROADMs.



Flex grid (grid-less)
Wavelengths can use variable modulation/speed (eg. ZR+)

Colorless
Add or drop wavelengths of any color on any port

Directionless
Dynamic wavelength routing across any path

Contention-less
Reuse same wavelength on same add-drop port

C-F ROADMs
Fiber ring topologies
2 degrees

CDC-F ROADMs
Fiber mesh topologies
N degrees

Nokia ROADM and wavelength switching solutions

Nokia's provides an industry-leading portfolio of compact and application-optimized ROADMs. Our ROADM solutions integrate multiple functions including wavelength switches, optical amplifiers, optical channel monitors (OCM) and dynamic gain equalization, all in a single line-card. This integration enables greater nodal automation and simplifies deployment and sparing. Visit www.nokia.com/networks/optical-networks/1830-optical-line-systems to learn more.

CID: 213934