



# Cisco NCS 1010 Topologies

This appendix describes multidegree support on NCS 1010 and has examples of a few NCS 1010 topologies.

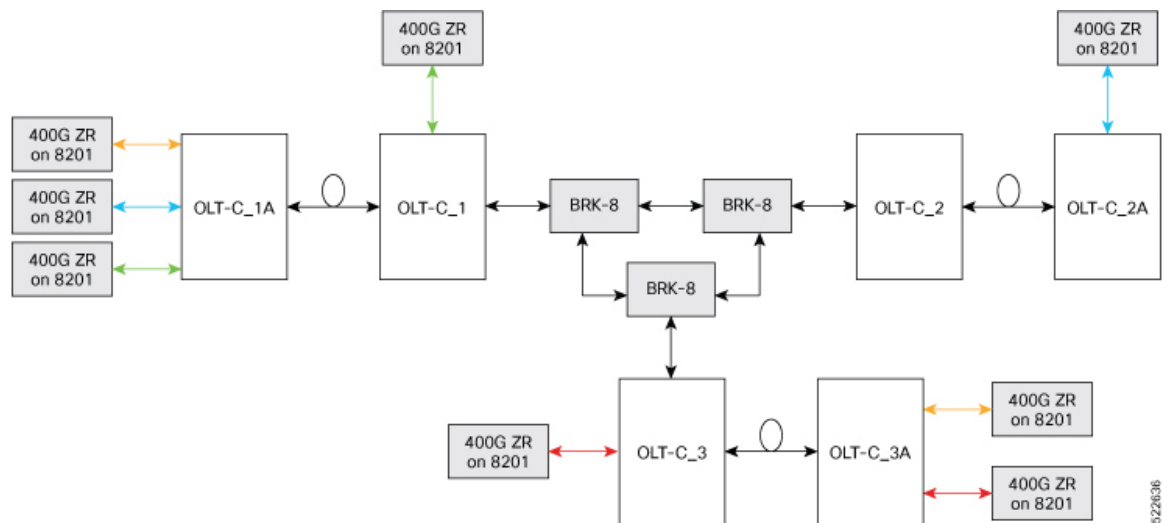
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## Multidegree Support

NCS1010 OLT devices support up to 8 degrees of ROADM express. You can set up multidegree connections using NCS1K-BRK-8 modules. Use BRK-8 modules for MPO breakout for express interconnect. For a multidegree topology, you must use as many BRK-8 modules and OLT devices as there are degrees. The BRK-8 modules help NCS 1010 nodes to achieve multidegree capability.

The following diagram represents a sample 3-degree topology. The diagram represents three point-to-point multispan optical networks - OLT-C\_1A to OLT-C\_1, OLT-C\_2A to OLT-C\_2, and OLT-C\_3A to OLT-C\_3. These multispan networks can have ILA nodes between the OLT endpoints. We connect OLT-C\_1, OLT-C\_2, and OLT-C\_3 to each other using three BRK-8 modules. Each BRK-8 module must have connections to each of the other BRK-8 modules. This express interconnect enables multidegree support. Configure the optical cross-connects on each OLT device such that the signal gets to the target OLT.

**Figure 1: Typical 3-Degree Topology**



## NCS 1010 Sample Topologies

The following section describes three sample topologies of specific hardware deployments.

- Point-to-point topology
- Multidegree topology: Colored solution
- Multidegree topology: Colorless solution
- Multidegree topology: Hybrid solution

### Point-to-point Topology

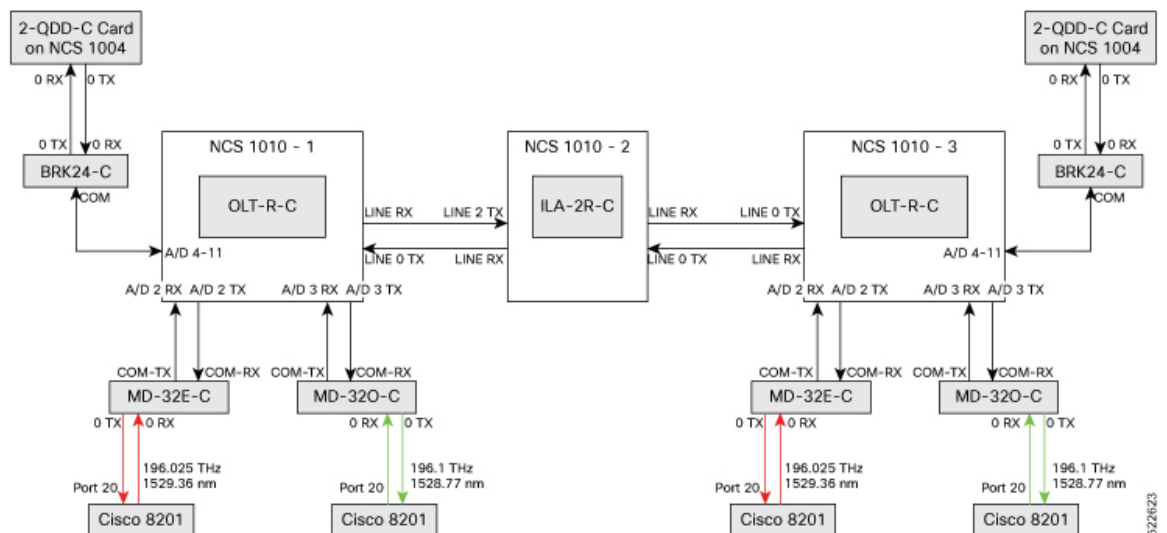
This sample topology is a simple point-to-point topology with no more than 2 degrees per site. You can use it for point-to-point optical links.

#### Topology Components

To build this topology, you need the following hardware:

- Cisco NCS 1010 devices
- NCS1K-MD32E-C modules
- NCS1K-MD32O-C modules
- NCS1K-BRK-24 modules
- QDD-400G-ZR-S transceiver
- LC/LC cables

**Figure 2: Point-to-point Topology**



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### **Multidegree Topology: Colored Solution**

This sample topology is a three-degree topology. You can use similar topologies for multidegree optical links that have:

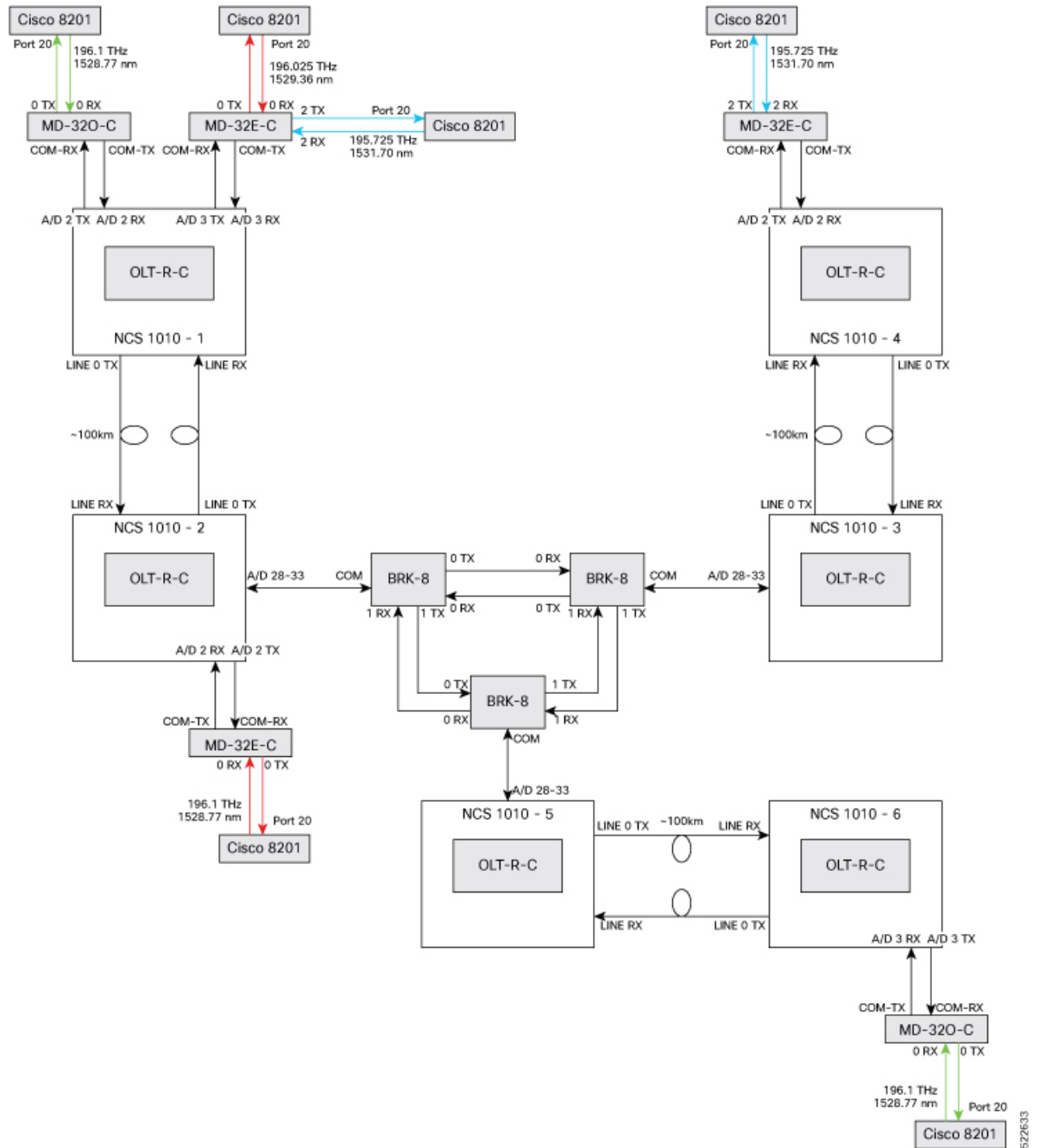
- Optical channels from low TX power transponders like the ZR or ZR+ pluggable optical modules
- Optical channels with TX power spectral density between -21dBm/12.5GHz and -14dBm/12.5GHz

### **Topology Components**

To build this topology, you need the following hardware:

- Cisco NCS 1010 devices
- NCS1K-MD32E-C modules
- NCS1K-MD32O-C modules
- NCS1K-BRK-8 modules
- Cisco 8201 routers
- QDD-400G-ZR-S transceivers
- LC/LC cables
- MPO cables

Figure 3: Colored Solution



### Multidegree Topology: Colorless Solution

This sample topology is a three-degree topology. You can use similar topologies for multidegree optical links that have:

- Optical channels from high TX power transponders like 1.2T line card on NCS 1004 or line cards with CFP2-400G-DCO as the trunk interface.

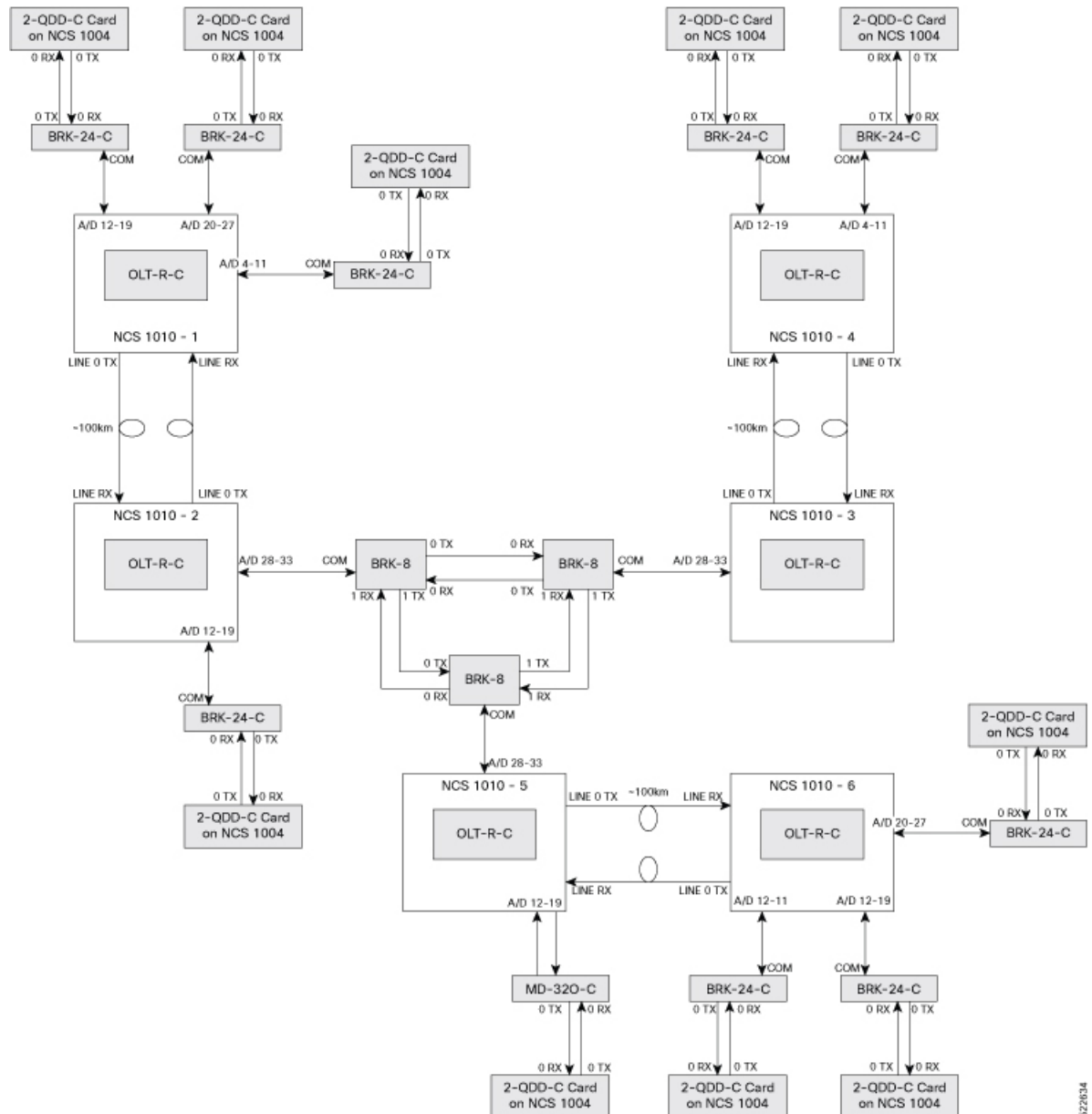
- Optical channels with TX power spectral density not lower than  $-7\text{dBm}/12.5\text{GHz}$

### **Topology Components**

To build this topology, you need the following hardware:

- Cisco NCS 1010 devices
- NCS1K-BRK-8 modules
- NCS1K-BRK-24 modules
- CFP2-400G-DCO transceivers
- Cisco NCS 1004 devices
- NCS1K4-2-QDD-C-K9 line card
- LC/LC cables
- MPO cables

Figure 4: Colorless Solution



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### Multidegree Topology: Hybrid Solution

This sample topology is a three-degree topology. You can use similar topologies for multidegree optical links that have

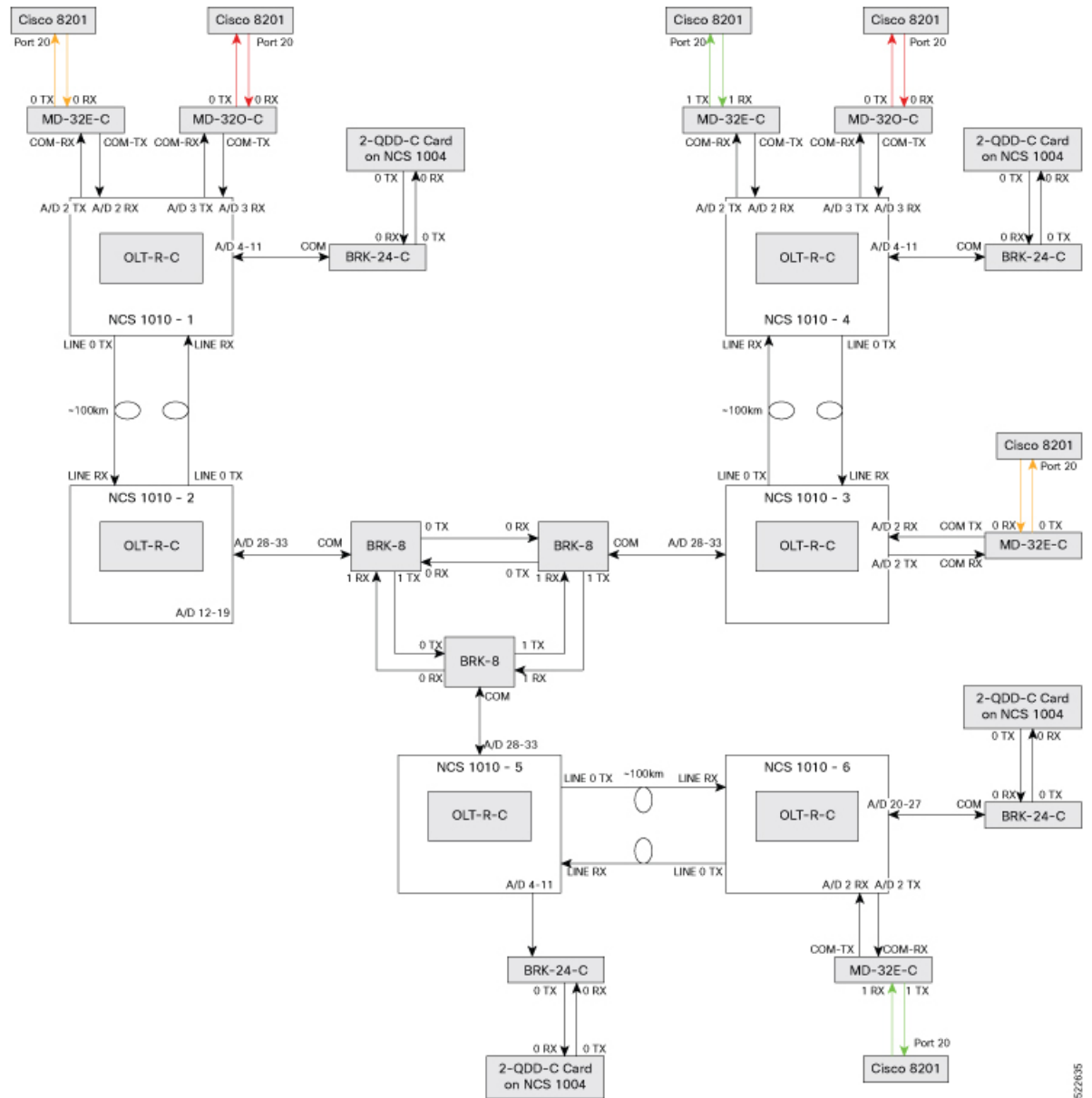
- Optical channels from both high and low TX power transponders
- Optical channels with TX power spectral density that you use in both colored and colorless solutions

### Topology Components

To build this topology, you need the following hardware:

- Cisco NCS 1010 devices
- NCS1K-MD32E-C modules
- NCS1K-MD32O-C modules
- NCS1K-BRK-8 modules
- NCS1K-BRK-24 modules
- Cisco 8201 routers
- QDD-400G-ZR-S transceivers
- CFP2-400G-DCO transceivers
- Cisco NCS 1004 devices
- NCS1K4-2-QDD-C-K9 line card
- LC/LC cables
- MPO cables

Figure 5: Colorless Solution



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# Omnidirectional Support

*Table 1: Feature History*

Feature Name	Release Information	Description
OLT Based Omnidirectional Add/Drop Topology	Cisco IOS XR Release 7.9.1	<p>You can now set up pure OLT-based omnidirectional add/drop topology. This topology is supported over the C+L band and scalable beyond 4-degree nodes. Dual omnidirectional add/drop can be implemented on a node to provide redundancy or increased add/drop capacity.</p> <p>The omnidirectional setup provides the flexibility to the multidegree topology to route channels through any of the optical degrees during fiber cut without the need for physical fiber reconnections.</p>

You can design multiple OLT-based omnidirectional add/drop stages. This configuration gives flexibility to the multidegree topology to route channels through any of the optical degrees during fiber cut without the need for changing the physical fiber connections.

## **NCS2K-MF-4x4-COFS Based Colorless Omnidirectional Topology**

In Release 7.7.1, the omnidirectional add/drop stage is designed using the NCS 2000 passive module, 4x4 colorless omnidirectional flex spectrum (COFS) add/drop module (NCS2K-MF-4x4-COFS) and NCS2K-MF-MPO-8LC. The channels from different degrees are aggregated at the MF-MPO-8LC. The MF-4x4-COFS adds the channels. Similarly, the channels from the MF-4x4-COFS can be routed to any of the degree through the MF-MPO-8LC, thus achieving the omnidirectional functionality. This colorless omnidirectional topology gives flexibility to retune the frequency or wavelength of the channel coming from the transponder or muxponder without any physical changes.

### **Topology Components**

To build this topology, you need the following hardware:

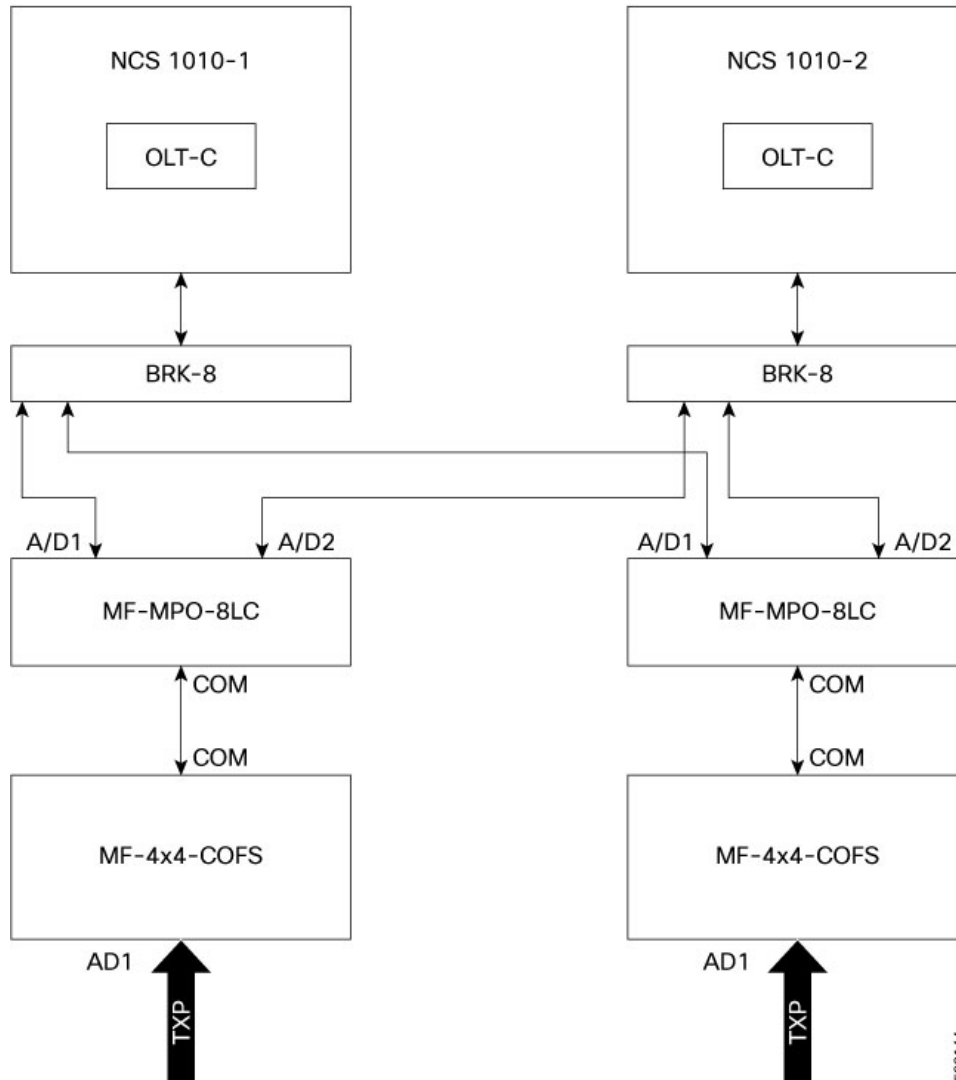
- NCS 1010 OLT devices
- NCS2K-MF-4x4-COFS modules
- NCS2K-MF-MPO-8LC modules
- NCS1K-BRK-8 modules

Following are the specific cable configurations for interconnecting the modules:

- The MF-4x4-COFS modules are interconnected using standard MPO 8 or 12 fibers (15454-MPO-MPO-x or ONS-12MPO-MPO-x )

- The MF-4x4-COFS modules and NCS1K-BRK-8 module are interconnected using standard LC-LC fibers.

**Figure 6: MF-4x4-COFS Based Colorless Omnidirectional Topology**



### Limitations

- This configuration is supported only for C-band ROADMs.
- This configuration is scalable only up to a maximum of 4 degrees. More OSNR penalty is induced by the MF-4x4-COFS as you add more degrees.
- One MF-4x4-COFS module can support up to only four channels. To scale up to 32 channels, you would require 8 MF-4x4-COFS modules.
- The terminal node in this configuration can be connected only to NCS 1004 line cards, line cards with CFP2-400G-DCO as a trunk interface, and DP04QSDD pluggable.

### OLT Based Omnidirectional Add/Drop Topology

From the Release 7.9.1, the omnidirectional add/drop stage is implemented using two OLT-C nodes interconnected back-to-back at the LINE-TX/RX ports. You can have more than one omnidirectional add/drop stages in one ROADM site. You can also include OLT-L devices in this topology. Multiple transponders can be connected to the terminal OLT node including the low-power ZR+. There are no additional restrictions on the transponder or interface types that can be connected to the terminal OLT-C.

#### Topology Components

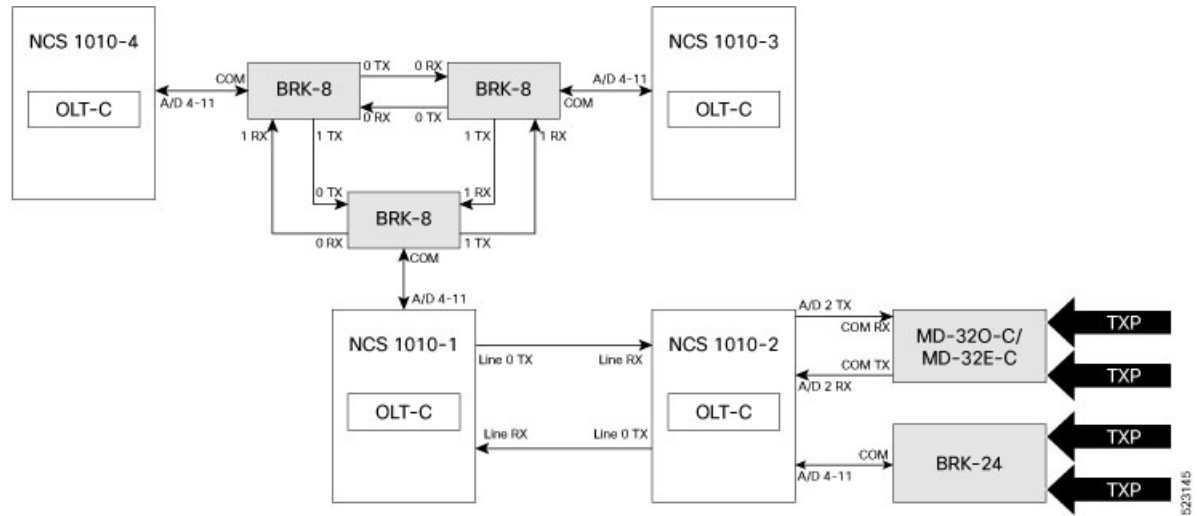
To build this topology, you need the following hardware:

- NCS 1010 OLT-C devices
- NCS 1010 OLT-L devices
- NCS1K-BRK-24 modules
- NCS1K-BRK-8 modules
- NCS1K-MD32-C modules

Following are the specific configurations and applications that are required for this configuration:

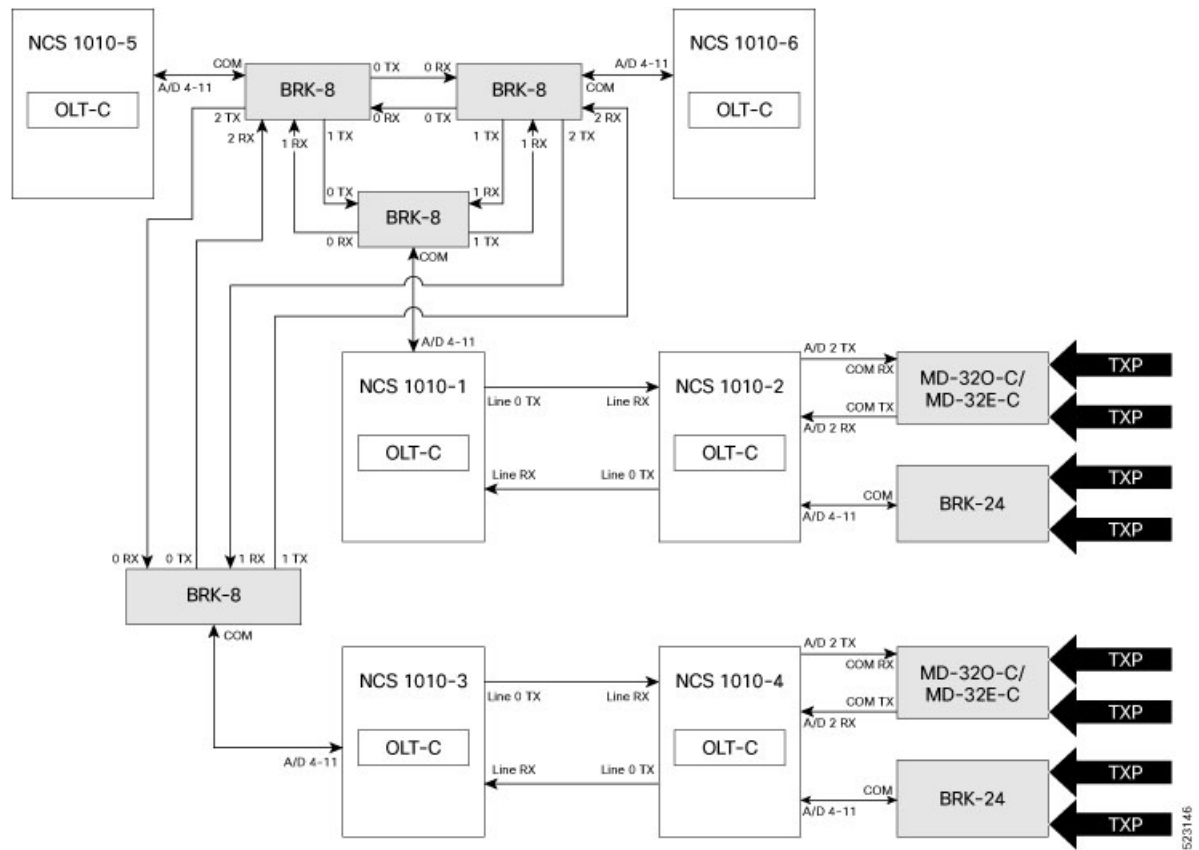
- The interconnection between the terminal OLT-C, where the traffic is terminated and the omnidirectional degree is managed as a 0dB span.
- OSC-C and OSC-L controllers can be used with unnumbered IP on OSC interfaces of the omni span.
- Link tuner and Gain estimator must be disabled on the Omni span.
- APC must be enabled on Omni span.
- ASE loading is enabled (both static and dynamic).
- Specific configuration for optical applications such as span length and fiber type are not required.
- To have the Pre-amplifier of OLT-C working in proper condition (minimum gain 12dB), the Line-Tx PSD must be set to  $-12.9$  dBm/12.5 GHz (considering 80% CH\_SD).

Figure 7: Omnidirectional Configuration with OLTs



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Figure 8: Dual Omnidirectional Configuration



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Figure 9: C+L Omnidirectional Configuration

