

# Precision Timing Protocol (PTP) Support on NCS 2000

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This is a solution on the NCS 2000 optical line system platform to support PTP timing signal.

## Product overview

The Cisco NCS 2000 is a next-generation optical line system that enables the DWDM layer of many customers' modern networks today. It allows customers to exploit fiber capacity intelligently and brings to fore the fundamental as well as advanced aspects of an optical network. Supporting the Precision Timing Protocol (PTP) signal is increasingly becoming a critical aspect of a network installations. In this regard, Cisco has devised a creative add-on solution to support the PTP signal over an existing NCS 2000 optical network installation.

## Components

The solution is a combination of different HW modules that come together to enable the PTP transmission over an NCS 2000 DWDM optical network.

1. There are two different pluggable optical modules, SFP (small form factor) optics.
2. A passive optical filter.
3. The PTP signal itself is sourced from a router capable of transmission of the PTP signal like the NCS 540 or the NCS 55xx.

The 2x pluggables specified above and the passive optical filter are new HW products, while the router itself is orderable separately since a while. The products come together to enable the PTP transmission as described in the solution overview below.



**Figure 1.**  
The PTP transmission SFP optical pluggable



**Figure 2.**  
The OSC-PTP passive optical filter module

## Solution overview

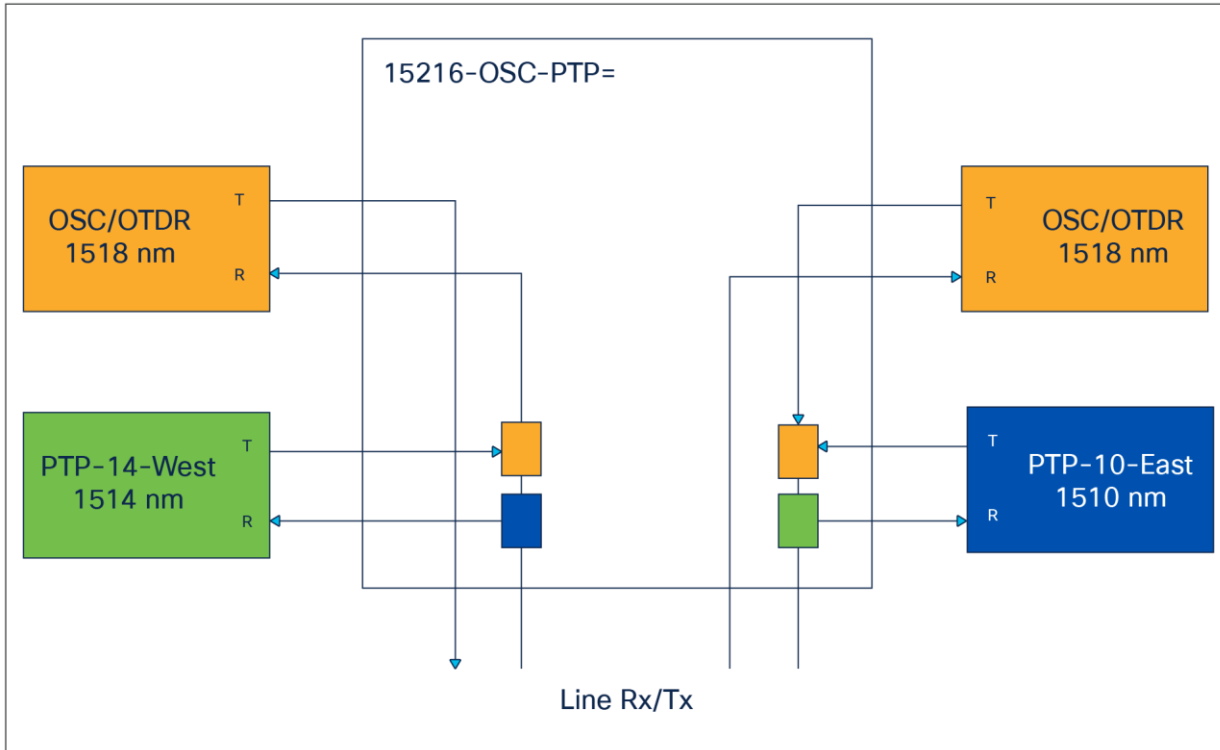
The solution is a combination of various aspects. The PTP optical SFP pluggable itself is hosted on a router like the NCS 540 or the NCS 55xx that are capable of transmitting and receiving the PTP signal. The PTP optical SFP pluggables come in two variants, both of which are capable of DWDM transmission at 1 Gbps. One pluggable is capable of transmission at the 1510-nm wavelength and the other at the 1514-nm wavelength of the optical spectrum.

The Optical Supervisory Channel (OSC) is a channel that runs across the entire NCS 2000 DWDM optical network. This is a DWDM optical signal generated by a DWDM pluggable that is hosted on the TNCS controller of the NCS 2000. This channel runs at the 1518-nm wavelength of the optical spectrum.

The crux of the solution is to combine, at an optical level, the OSC coming from the TNCS controller of the NCS 2000 and this PTP signal coming from the router, using a passive optical filter to send the composite OSC+PTP signal over the NCS 2000 network. At every node, we position a simple passive optical filter module that can do two things simultaneously:

1. Combine the OSC and PTP as OSC+PTP before entering the optical line and
2. Separate the OSC+PTP composite signals coming from the line into individual OSC and PTP signals

The graphical picture of the passive optical module is shown below, and it can be seen that the module can mix/separate the OSC (at 1518 nm) and the PTP (at 1510 nm) in one direction and the same function in the other direction with OSC (at 1518 nm) and the PTP (at 1510 nm).



**Figure 3.**  
Graphical representation of the passive optical filter module

Another critical aspect in PTP transmission is the need to minimize or negate phase delays, and that is ingeniously solved by this Cisco solution.

**The problem:**

If we have a single PTP pluggable, then the PTP signal will traverse on different fibers for the up and down communication line. This is how a typical optical transmission works with up and down fibers for full duplex communication. But the changes in the fiber distance or fiber characteristics in the up and down fiber could be very different. In reality, they are almost always different. This situation will introduce a delay/latency that could reflect on the clock and therefore seriously impact the validity of the PTP signal.

**The solution:**

To put an end to this problem, Cisco devised a “bidirectional” solution where both PTP signals (east to west and west to east) traverse on the same fiber, the up fiber, or the down fiber, and not on separate fibers. This is why there are two different pluggables for the PTP:

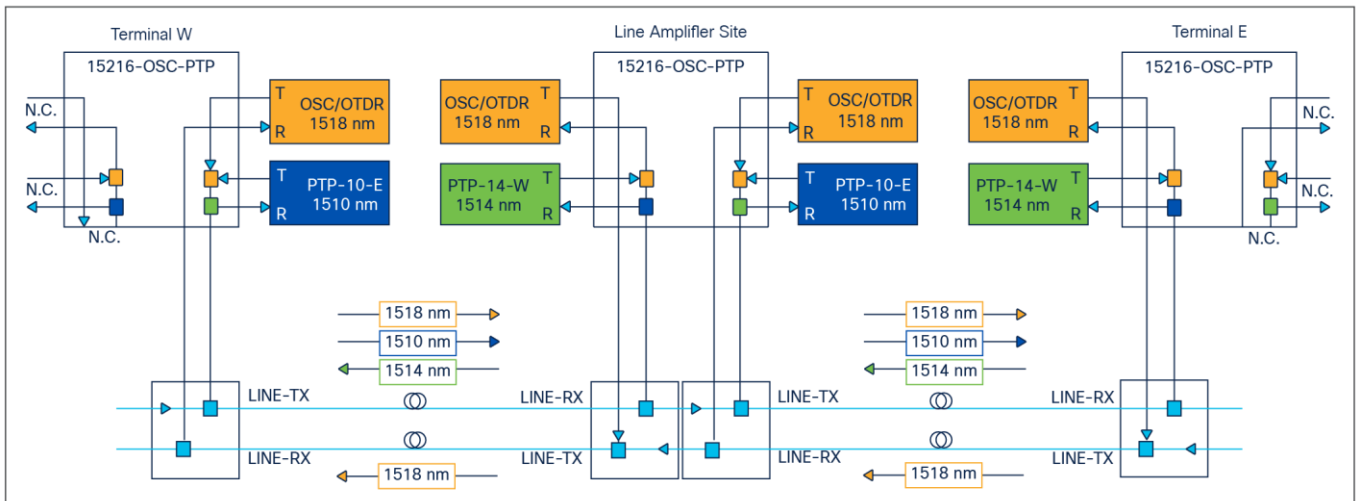
3. A PTP optical pluggable that transmits only at 1510 nm but can receive 1514-nm signals from the other end
4. Another PTP optical pluggable that transmits only at 1514-nm but can receive 1510-nm signals from the other end

The PTP signals will traverse in a “bidirectional” way on the same fiber strand. Since, the solution allows the PTP for both directions to traverse on the same fiber, it ensures that there is no relative latency or difference in clock. The PTP signal validity is intact protected from fiber path variations.



**Figure 4.**  
 Depiction of the bidirectional functioning PTP DWDM SFP pluggable optics

Now the overall solution is to have the passive optical filter positioned at every degree of the NCS 2000 node. This filter will mix/separate the OSC (from the NCS 2000 controller) and the PTP (from the router) into/from the same fiber line. In this fashion, one could have PTP running through every node of the NCS 2000 network, sinking or sourcing into a conveniently positioned router. The picture below depicts this architecture at a high level.



**Figure 5.**  
 OSC + PTP transmission architecture

In lieu of the solution employed here, there is a recommendation on the span reach and the configurations supported; listed below.

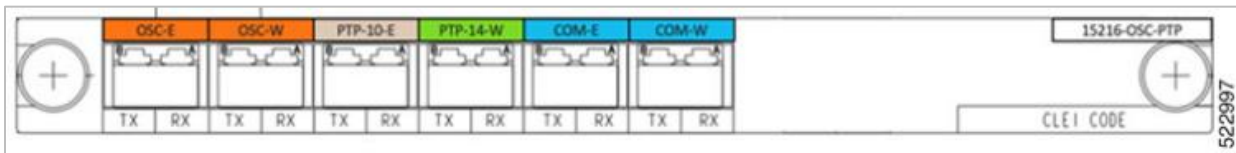
1. The solution is devised to work only when the OSC pluggable ONS-SC-OSC-18.0= pluggable is used, as this is the pluggable capable of transmitting at 1518 nm and at the stability and reach sought by this solution. The frame type will always be FE.
2. The solution itself is based on the NCS 2000 FS-SMR-based DWDM optical networks and not other ROADMs or F-OADMs.
3. The EDRA module of the NCS 2000 is not supported, as the module interferes with the functioning of this solution.
4. The recommended Raman amplifier (if used) in the solution is the NCS 2000 RAMAN-CTP for all fiber types.
5. The NCS 2000 RAMAN C+L amplifier could be used only with SMF fiber types and not with other variants.
6. The PTP pluggables can launch at a power of Minimum 4 dBm to Maximum 5.5 dBm. The reach is quoted in table 1 below.
7. The PTP filter specifications are mentioned in table 2 below.

The below table specifies the reach attainable in this solution under different conditions.

**Note:** Minimum 12-dB Raman Gain at PTP wavelengths is aimed for. So the fiber is expected to be good enough to allow that.

**Table 1.** Reach of the OSC+PTP solution

Signal Type	Span Reach Without Raman	Span Reach With Raman
<b>OSC @ 1518 nm - FE</b>	35 dB	38 dB (33 dB at Raman startup, 38 dB after Raman is ON)
<b>PTP @ 1510/1514nm - FE</b>	33 dB	37 dB (With Raman ON)
<b>PTP @ 1510/1514 nm - GE</b>	30 dB	37 dB (With Raman ON)



**Figure 6.** PTP filter faceplate with port labels

**Table 2.** PTP filter optical path specification

Parameter	Condition	Minimum	Maximum
<b>Isolation transmission path</b>		> 30 dB	
<b>Isolation reflection path</b>		> 13 dB	
<b>OSC-W-RX to COM-W-TX</b>	At 1518nm		< 0.3 dB
<b>COM-W-RX to OSC-W-TX</b>	At 1518nm		< 1.3 dB
<b>PTP-14-W-RX to COM-W-RX</b>	At 1514nm		< 1.0 dB
<b>COM-W-RX to PTP-14-W-TX</b>	At 1510nm		< 0.8 dB
<b>OSC-E-RX to COM-E-TX</b>	At 1518nm		< 1.3 dB
<b>COM-E-RX to OSC-E-TX</b>	At 1518nm		< 0.3 dB
<b>PTP-10-E-RX to COM-E-TX</b>	At 1510nm		< 1.0 dB

## Platform support

**Table 3.** List of platforms supported

Product Family	Platforms Supported	Products Supported	IOS Images (Feature Sets) Supported
<b>NCS</b>	2000	FS-SMR-20 & FS-SMR-9	Release 11.x and later
<b>NCS</b>	540	N540X-16Z4G8Q2C-D & N540X-16Z4G8Q2C-A	Release 7.8.1 and later
<b>NCS</b>	55xx	NCS55-MOD-S	Release 7.8.1 and later



## Product sustainability

Information about Cisco's environmental, social, and governance (ESG) initiatives and performance is provided in Cisco's CSR and sustainability [reporting](#).

**Table 4.** Cisco environmental sustainability information

Sustainability Topic		Reference
General	Information on product-material-content laws and regulations	<a href="#">Materials</a>
	Information on electronic waste laws and regulations, including our products, batteries, and packaging	<a href="#">WEEE Compliance</a>
	Information on product takeback and reuse program	<a href="#">Cisco Takeback and Reuse Program</a>
	Sustainability Inquiries	Contact: <a href="mailto:csr_inquiries@cisco.com">csr_inquiries@cisco.com</a>

## Product specifications

**Table 5.** Temperature and power specifications

Product	Temperature specification	Power consumption
PTP pluggable at 1510 nm	0 TO +70 C	1.6 W
PTP pluggable at 1510 nm	0 TO +70 C	1.6 W
OSC + PTP passive optical filter	-5 TO +55 C	NA

## Ordering information

**Table 6.** Ordering PIDs

Product	Cisco Part Number	Product Description
15216-OSC-PTP=	74-128354-01	Passive OSC-PTP coupler filter 1510, 14, 18
ONS-SC-PTP-1510=	10-3548-01	Multi-rate GE, FE pluggable optics, 1510 nm, C-temp
ONS-SC-PTP-1514=	10-3547-01	Multi-rate GE, FE pluggable optics, 1514 nm, C-temp

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## Warranty information

Find warranty information on Cisco.com at the [Product Warranties](#) page.

## Cisco and Partner Services

Customers can engage Cisco TAC (Technical Assistance Center) for any issues installing and using the solution described in this data sheet.

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## Document history

**Table 7.** Document history

New or Revised Topic	Described In	Date
<b>PTP solution for NCS 2000</b>	Entire document	Oct 13, 2022

**Americas Headquarters**  
Cisco Systems, Inc.  
San Jose, CA

**Asia Pacific Headquarters**  
Cisco Systems (USA) Pte. Ltd.  
Singapore

**Europe Headquarters**  
Cisco Systems International BV Amsterdam,  
The Netherlands

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