



Product Overview

Integrating optical transport technology into routers enables the rapid rollout of new services while providing superior operational efficiency. Layer 3 intelligence ensures prompt responses to topology changes and extends DWDM capabilities to a router without requiring fixed DWDM termination equipment, allowing providers to offer on-demand services to their customers.

The 10-Gigabit Ethernet DWDM PIC uses a single tunable laser to access one of 45 possible International Telecommunication Union (ITU) grid wavelengths over a maximum distance of 80 km, in order to achieve customized compatibility with a multiplexed fiber network. Wavelengths are configured and reconfigured remotely through the Junos OS command-line interface (CLI) in response to network dynamics. Operators can dynamically streamline traffic patterns and reallocate wavelengths as bandwidth patterns change.

Product Description

DWDM continues to gain prominence in both metro and long haul networks by providing greater channel density onto the same fiber infrastructure. For maximum benefit, the provisioning of DWDM has to be flexible. Operators have been seeking ways to enhance the flexibility of wavelength services and they want optical bandwidth to be optimized for maximum revenue.

The tunable 10-Gigabit Ethernet DWDM PIC is a Type 3 PIC supported on the Juniper Networks® M320 Multiservice Edge Router, T320, T640, T1600 Core Routers, and TX Matrix. It enables 1024 VLANs and many other Ethernet features.

With this DWDM PIC, optical diagnostics are accessible through the Junos® operating system CLI and include numerous alarms that generate system logs that can be trapped through SNMP.

Application in the Metro Network

Juniper Networks M320, T320, T640, T1600, and TX Matrix platforms support DWDM with the addition of the 10-Gigabit Ethernet DWDM PIC. The DWDM PIC implements tunable optics technology, enabling customers to use the full ITU-grid by selecting from 45 different wavelengths (C-band with 100 GHz spacing). This is configurable through the Junos OS CLI and has a reach of up to 80 km (49.6 miles).

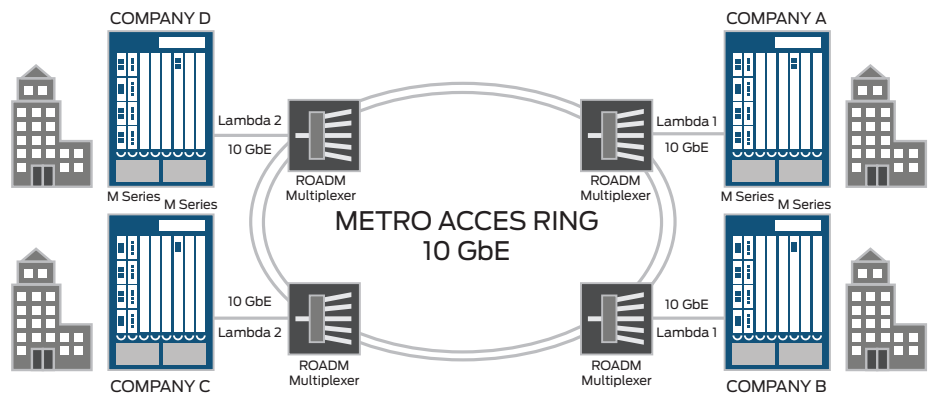


Figure 1: DWDM in the metro network

The diagram on the previous page shows Juniper routers with the tunable 10-Gigabit Ethernet DWDM PIC, controlling optical wavelengths across optical transport equipment. The tunable 10-Gigabit Ethernet DWDM PICs connect to a ring through either the passive multiplexers of DWDM line systems or on Reconfigurable Optical Add/Drop Multiplexers (ROADMs).

Companies A and B are connecting to ROADMs and communicating with each other with the tunable 10-Gigabit Ethernet DWDM PIC. Similarly, companies C and D connect to the ring using the passive multiplexers on DWDM line systems.

Features and Benefits

Routing Intelligence

Combining routing intelligence with tunable DWDM is imperative when creating Layer 3 Transmission (L3T) solutions. Operators can leverage the IP intelligence of Junos Software in routers to determine new paths to destination networks in response to topology changes.

Investment Protection and Cost of Sparring

The 10-Gigabit Ethernet DWDM PIC allows cost savings by enabling a single dynamically tuned 10 Gbps optical transponder to support any of the 45 wavelengths available in a single PIC with one 10-Gigabit Ethernet optical interface (a 1:N sparing model). Other vendors have a different sparing model, such as 1:1, for every DWDM wavelength in the network. This creates an operational burden since operators must match the right optical interface with the right module in the right location, as well as locking customers into a single vendor solution.

Extended Reach to 80 km

The 10-Gigabit Ethernet DWDM PIC is ideally suited for metro network configurations that require both longer spans and the ability to leverage installed fiber. Supporting transmission distances of up to 80 km (49.6 miles), this Juniper solution delivers maximum flexibility for intra-point of presence (POP), inter-POP, and more distributed mesh configurations.

High Density Configurations

Each 10-Gigabit Ethernet DWDM PIC supports up to 10 Gbps data transmission and, as the following table demonstrates, Juniper can support up to 128 DWDM PICs in a single system (TX Matrix).

Table 1: Juniper Platform 10-Gigabit Ethernet DWDM PIC Density

PLATFORM	PER CHASSIS	PER RACK
M320	16	32
T320	16	48
T640	32	64
T1600	64	128
TX Matrix	N/A	128 (per TX-4)

Scalability

Using DWDM, providers can scale services equivalent to the number of ITU-defined channels. Scaling services that support new services or customers means using an available wavelength on existing fiber, thereby reducing or eliminating the need for major network reconfigurations. Multiple end user networks may be connected to different channels in a single strand of fiber, leaving unused channels available for future expansion and scalability.

Specifications

General Specifications

General specifications are provided below.

Software release

- Junos OS 7.5 and later

Description

- One 10-Gigabit Ethernet port
- Power requirements: 0.55 A/48 V @ 26.6 W
- Supports large Ethernet frame sizes for more efficient throughput across the intra-POP network
- Optical interface support (see Table 2)

Hardware features

- C-band ITU-grid with 100 GHz spacing
- High-performance throughput at speeds up to 10 Gbps
- Full-duplex mode
- Maximum transmission units (MTUs) up to 9192 bytes
- 64 source Media Access Control(MAC) address filters
- 960 destination MAC filters
- 45 individual wavelengths in nanometers (nm)

Software fetures

- Enhanced optical monitoring capabilities
- Command-line interface (CLI) configurable wavelength support
- Virtual Router Redundancy Protocol (VRRP) support
- 802.1Q VLANs support
- 802.3ae link aggregation support
- RMON EtherStats

Cables and connectors

- Duplex SC/PC connector (Rx and Tx)

LEDs

Status LEDs, one bicolor:

- Off – PIC is not enabled
- Green – PIC is operating normally
- Red – PIC has an error or failure

Port LEDs, one pair:

- Link – If green, the port is online. If there is no light, the port is down
- Rx – If flashing green, the port is receiving data. If there is no light, the port might be on but is not receiving data

Table 2: Optical Interface Support for 10-Gigabit Ethernet DWDM PICs

Parameter	Extra Long Wavelength Serial DWDM, LAN Rate
Optical interface	Single-mode
Maximum distance	9/125 SMF cable: 49.6 miles/80 km
Transmitter wavelength	1528.77 through 1563.86 nm, 100GHz ITU grid
Average launch power	0 to +4 dBm
Transmit extinction ratio	9 dBm
Average receive power	-7 dBm to -24 dBm
Receiver saturation	-7 dBm
Receiver sensitivity	-24 dBm

Compliance

Communications

- ITU-T G.694.1 (DWDM)
- ITU-T G.694.2 (CWDM)
- 802.3ae (10-Gigabit Ethernet: Receiver Bandwidth Measurement)

Safety Approvals

- CAN/CSA-C22.2 No. 60950-1-03 - UL 60950-1 Safety of Information Technology Equipment
- EN 60950-1 Safety of Information Technology Equipment
- EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EN 60825-2 Safety of Laser Products - Part 2: Safety of Optical Fibre Communication Systems

EMC

- AS 3548 Class A (Australia)
- EN55022 Class A (Europe)
- FCC Part 15 Class A (USA)
- VCCI Class A (Japan)
- BSMI Class A (Taiwan)

EMI

- AS/NZS 3548 Class A (Australia)
- EN55022 Class A (Europe)
- FCC Class A (USA)
- VCCI Class A (Japan)
- BSMI Class A (Taiwan)

Immunity

- EN-61000-3-2 Power Line Harmonics
- EN-61000-4-2 ESD
- EN-61000-4-3 Radiated Immunity
- EN-61000-4-4 EFT
- EN-61000-4-5 Surge
- EN-61000-4-6 Low Frequency Common Immunity
- EN-61000-4-11 Voltage Dips and Sags

NEBS

- SR-3580 NEBS Criteria Levels (Level 3 Compliance)
- GR-63-CORE: NEBS, Physical Protection
- GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment

ETSI

- ETSI EN-300386-2 Telecommunication Network Equipment. Electromagnetic Compatibility Requirements

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services and support, which are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to bring revenue-generating capabilities online faster so you can realize bigger productivity gains and faster rollouts of new business models and ventures. At the same time, Juniper Networks ensures operational excellence by optimizing your network to maintain required levels of performance, reliability, and availability. For more details, please visit www.juniper.net/us/en/products-services/.

Ordering Information

MODEL NUMBER	DESCRIPTION	PLATFORMS
10-Gigabit Ethernet Type 3 PIC		
PC-1XGE-DWDM-CBAND	45 wavelengths, ITU-grid	M320, T320, T640, TX Matrix

About Juniper Networks

Juniper Networks, Inc. is the leader in high-performance networking. Juniper offers a high-performance network infrastructure that creates a responsive and trusted environment for accelerating the deployment of services and applications over a single network. This fuels high-performance businesses. Additional information can be found at www.juniper.net.

Corporate and Sales Headquarters

Juniper Networks, Inc.
1194 North Mathilda Avenue
Sunnyvale, CA 94089 USA
Phone: 888.JUNIPER (888.586.4737)
or 408.745.2000
Fax: 408.745.2100
www.juniper.net

APAC Headquarters

Juniper Networks (Hong Kong)
26/F, Cityplaza One
1111 King's Road
Taikoo Shing, Hong Kong
Phone: 852.2332.3636
Fax: 852.2574.7803

EMEA Headquarters

Juniper Networks Ireland
Airside Business Park
Swords, County Dublin, Ireland
Phone: 35.31.8903.600
EMEA Sales: 00800.4586.4737
Fax: 35.31.8903.601

To purchase Juniper Networks solutions, please contact your Juniper Networks representative at 1-866-298-6428 or authorized reseller.

Copyright 2010 Juniper Networks, Inc. All rights reserved. Juniper Networks, the Juniper Networks logo, Junos, NetScreen, and ScreenOS are registered trademarks of Juniper Networks, Inc. in the United States and other countries. All other trademarks, service marks, registered marks, or registered service marks are the property of their respective owners. Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.