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 operating system CLI and include numerous alarms that generate system logs that can be trapped through SNMP.

Application in the Metro Network

Juniper Networks M Series and T Series 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).

The diagram above 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 Sparing

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>
<thead>
<tr>
<th>Platform</th>
<th>Per Chassis</th>
<th>Per Rack</th>
</tr>
</thead>
<tbody>
<tr>
<td>M120</td>
<td>16</td>
<td>64</td>
</tr>
<tr>
<td>M320</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>T320</td>
<td>16</td>
<td>48</td>
</tr>
<tr>
<td>T640</td>
<td>32</td>
<td>64</td>
</tr>
<tr>
<td>T1600/T4000</td>
<td>64</td>
<td>128</td>
</tr>
</tbody>
</table>

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 features

- 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

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

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

EMC
- AS 3548 Class A (Australia)
- EN55022 Class A (Europe)
- FCC Part 15 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-61000-4-1 1 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

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

Juniper Networks Services and Support
Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the 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
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PC-1XGE-DWDM-CBAND  45 wavelengths, ITU-grid  M120, M320, T320, T640, T1600, T4000

About Juniper Networks
Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.