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NEC

NEC's Metro WDM TM-Series

Carrier Class Optical Transport Solutions
for Metro/Regional Networks





Platform Description

The TM-Series platform is a carrier grade optical networking solution covering transparent transport of services from 100Mbit/s to 40Gbit/s for metro, regional and long haul applications. Its unique characteristics support any network type within this environment:

- ✓ **Mobile backhaul networks**
- ✓ **Fixed broadband backhaul networks**
- ✓ **Carrier metro networks**
- ✓ **High-end enterprise networks**
- ✓ **Storage area networks**
- ✓ **Long haul networks**

The cornerstone of the TM-Series solution is a unique system architecture based on iWDM™ (intelligent WDM) technology that provides high flexibility, low capital investment and low operations costs.

The TM-Series is an integral part of the NEC family of optical transmission solutions which extends all the way from trans-oceanic cable systems to the last mile of the access network.



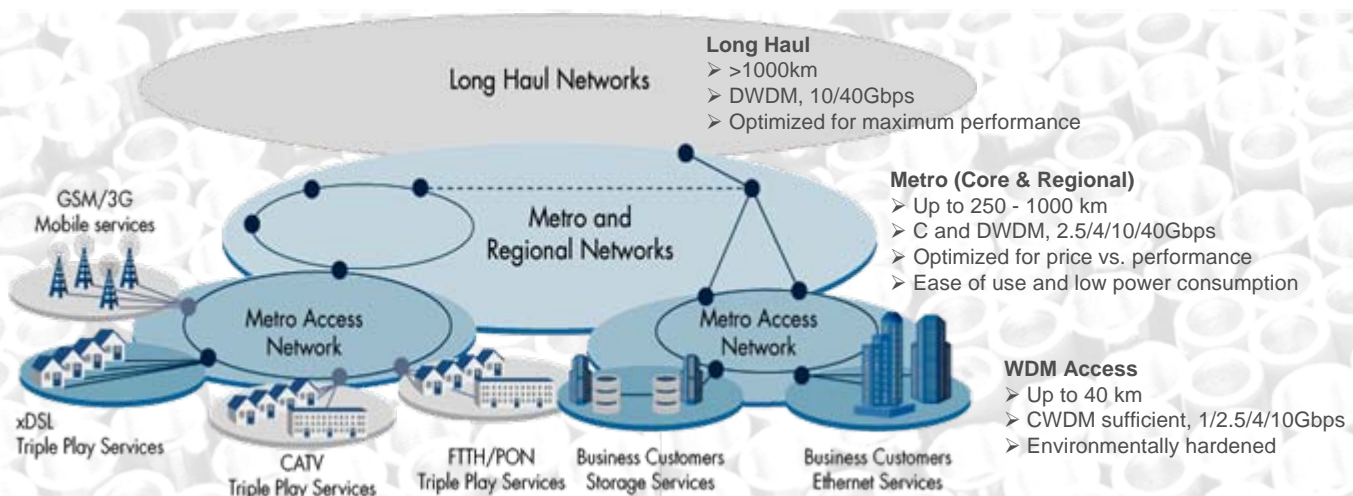
“All in one” system

The TM-Series gives unique advantages for any operator within the competitive metro/regional environment. Within a TM-Series network you can carry IP, SONET/SDH, SAN or Video services where each connection can be optimized from cost and functionality perspective without the limitations that are imposed by a stand-alone SONET/SDH or OTN systems.

The TM-Series solution combines iWDM™ multiplexing with CWDM, DWDM and SONET/SDH technologies into one product. It combines the capacity and scalability capabilities only found in DWDM systems, with the low equipment costs of CWDM systems and all managed by the same node and network management system.

Reconfigurable hardware, pluggable optics (C/DWDM SFPs and XFPs) combined with embedded management channels, 15min/24h Performance Monitoring (PM) statistics and Forward Error Correction (FEC) are just some of the carrier-class features that reside within the TM platform that make it into a powerful and flexible networking solution.

Furthermore, NEC's MS5000 network management solution integrates multiple technologies such as microwave radio links and Ethernet aggregation switches under the same management platform for true end-to-end control with minimal OpEx.





DWDM – for powerful applications

Some applications require the more powerful DWDM technology. This may be due to a number of reasons, such as:

- ✓ Need for high scalability in terms of wavelengths, e.g. 80λ on 50GHz spacing
- ✓ Need for high capacity per wavelength, e.g. 40Gbit/s
- ✓ Longer distances, high fiber losses, etc

The TM-Series DWDM supports two concepts of DWDM networking:

1. An un-amplified, single-fiber configuration utilizing optical add/drop filters that are perfect for metro networks with dynamic traffic patterns and a mix of small and larger access nodes.
2. Amplified fiber-pair configurations utilizing optical Mux/Demux units for long-haul point-to-point networks, up to ~1000km using multiple line amplifier sites that can be combined with passive add/drop filters or ROADM technology to create intermediate OADM nodes.

The iWDM™ technology enables building of networks where DWDM and CWDM solutions can be combined on the same fiber, both in single-fiber as well as fiber-pair configurations.

Network Management

More complex networks can be managed using Transmode Network Management (TNM). This is a client-server based solution that can be installed on computers using Windows or Solaris operating systems (i.e. PCs and Unix workstations). TNM provides a powerful graphical interface that gives users total control of the network, enabling automated alarm collection, performance management configuration management, security management, and software upgrade. Alarm notification can as an option be provided via SMS or email. Standardized management protocols (SNMP) are used to ease integration with other higher order management systems.

...and end-to-end (E2E)

In practical multi-service network applications spanning the core, metro and access, transport solutions are commonly constructed of a wide variety of elements, mixing fiber and wireless transmission, and making interconnections at all layers from Layer 0 to Layer 3.

The TM-Series is fully compatible with NEC's end-to-end higher layer network management solution, the MS-5000.

This feature-rich NMS platform integrates a diverse range of nodes under a common management layer to provide point-and-click provisioning of services and connectivity, along with a full range of fault and performance management functions. This minimizes OpEx even when the network calls for a multiplicity of client signals, transmission media and network layers.

CWDM – for lower capacity demands

The majority of the traffic units are based on pluggable transceivers and can thus be used for CWDM as well as DWDM applications. Even 10Gbit/s traffic can be applied on CWDM networks via XFPs that provide up to 8 CWDM channels in the 1470 to 1610nm range.

The TM-Series iWDM™ concept enables transport of C/DWDM signals running at a rate of 2.5Gbit/s, 4Gbit/s and 10Gbit/s enabling a more cost efficient transport solution as compared to other C/DWDM solutions.

The TM-Series CWDM application provides two concepts of CWDM networking:

- ✓ Single-fiber configuration is a low cost solution that provides high flexibility and utilization of the fiber infrastructure in point-to-point, bus and ring networks.
- ✓ Fiber-pair configuration for powerful CWDM solutions that easily can be combined with up to 80 DWDM channels, even amplified DWDM.



TM-3000



TM-301



TM-101/102

TM-Series specifications

CAPACITY

DWDM

Fiber-pair:	80ch@50GHz spacing 32ch@100GHz spacing
Single-fiber:	10ch@200GHz spacing (unamplified) 16ch@200GHz spacing (amplified)

CWDM

Fiber-pair:	8ch per fiber-pair (1470-1610nm)
Single-fiber:	8ch per single-fiber (1270-1610nm)

CHASSIS

TM-3000:

Unit slots:	17 full-sized / 10 half-sized units
Primary power:	115/230V AC or -48V DC, max 700W
Mounting:	ETSI, 19" or 23" racks
Size:	height: 10U/460mm

TM-301:

Unit slots:	4 full-sized / 4 half-sized units
Primary power:	115/230V AC or -48V DC, max 120W
Mounting:	ETSI, 19" or 23" racks
Size:	height: 3U/133mm

TM-101/102:

Unit slots:	1 full-sized & 1 half-sized / 3 half-sized units
Primary power:	115/230V AC or -48V DC, Max 90W
Size:	height: 1U/44mm

LINE CARDS

Transponders:

2.5G

TPMR25-V2	MultiRate FEC Transponder (1000km)
TPQMR	4x MultiRate (100Mb/s-2.7Gb/s Transponder) 4x Regenerator
TPDDGBE	2x(2xGbE) Transponder with dual line ports for 1+1 protection. 4x Regen Transponder

4G

TPQMS	Quad MultiService Transponder for 1/2/4G FC 4x Regen Transponder
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10G

TPD10G-Lite	2x MultiService Transponder (10G FC, 10GbE, STM-64/OC-192, OTU-2) 2x Regen Transponder
TPD10G FEC	2x Transponder for 10GbE, STM-64/OC-192 with FEC. 2x Regen Transponder
TP10GCLX/TC	1x Transponder for 10GbE, STM-64/OC-192 with FEC fixed/tunable line I/F
TP10G/TC-ER	1x Transponder for 10GbE, STM-64/OC-192 with EFEC fixed/tunable line I/F

Note that TM-3000, TM-301 and TM-101/102 are generic chassis that can be used to create any NE-type using CWDM and/or DWDM units.

Muxponders:

2.5G

GFP Muxponder	10-port GFP Muxponder on STM-16/OC-48 (GbE/1G, 2G FC, ESCON, DVB-ASI)
MXP8	8-port STM-16 Muxponder for STM-1/STM-4

4G

MS-MXP	10-port reconfigurable unit for SDH/SONET, Ethernet, SAN etc. Multiple traffic images 4x Regen Transponder
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10G

9xGbE/10G	9x GbE on 10Gb/s line
9xGBE/10G FEC	9x GbE. Dual line ports with FEC for 1+1 protection
4x2G5/10G	4x STM-16/OC-48 on STM-64/OC-192 with FEC option
10G MS-MXP	10x SFP and 2x XFP port unit reconfigurable for SDH/SONET, Ethernet, SAN etc. Multiple traffic images. FEC on line
10G MS-MXP/ER	10x SFP and 1x fixed/tunable line port unit reconfigurable for SDH/SONET, Ethernet, SAN etc. Multiple traffic images. EFEC on line

Layer-2

EDU/6PGBE	Ethernet Demarcation unit (MEF9/14) with 4x UNI and 2x UNI ports 10/100/1000Mb Eth.
EDU/12PGBE	Ethernet Demarcation unit (MEF9/14) with 10x UNI and 2x UNI ports 100/1000Mb Eth.
12-port EMXP	Ethernet Muxponder. 2x XFP 10GBE-LAN ports
24-port EMXP	Ethernet Muxponder. 2x XFP 10GBE-LAN ports
Misc	
1x4ROADM	4-degree ROADM
OAR450	Raman Amplifier
OA26C	Power Extender
OCM/2P	2-port Optical Channel Monitoring unit
VOA units	8-port and 2-port Variable Optical Attenuators

MANAGEMENT SYSTEM

TNM Server:

HW platform:	IBM PC compatible for small networks or Sun UltraSparc for medium to large networks
Interfaces:	Performance Management: proprietary XML/ftp interface Physical inventory export: proprietary XML/ftp interface End-to-end circuit export: TMF 854 compliant XML/ftp interface, Interface to Radius, TACACS SNMPv3 (TM-series)
Protocol:	ES, SES, BBE, UAS acc to G.826
PM:	Up to 1500
No of nodes:	Up to 20 simultaneous
No of clients:	Up to 20 simultaneous

TNM Client:

HW platform:	IBM PC Compatible or Sun UltraSparc
Operate system:	Windows system or Sun Solaris, web access is supported

ENM:

Protocol:	SNMP v3
Interface:	CLI, Browser, SNMP, FTP
Browsers:	Internet Explorer
MIB:	RFC1213, RFC2573

NEC Corporation and Transmode have a global partnership agreement under which NEC integrates and resells Transmode's Metro WDM optical networking equipment allowing NEC to provide a carrier class solution to its customers.



Combining NEC's recognized Microwave, Ethernet and long-haul WDM solutions, global presence, and outstanding support with Transmode's well respected Metro WDM portfolio, the TM-Series equipment transparently meshes with NEC's transport portfolio, providing a comprehensive and competitive End-to-End solution unified under NEC's network management system.

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