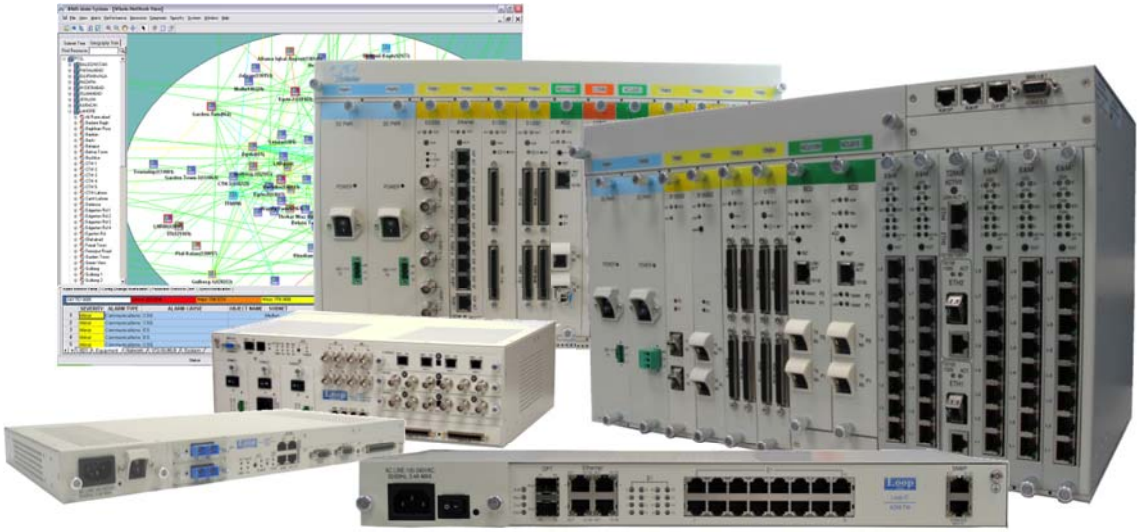
SDH/SONET Transport & Hybrid with PDH Access

O9100
O9150
O9170
O9400S
O9400R
O9500R
O9400R-PTN
O9500R-PTN
iNET EMS
iNMS NMS



Loop Telecom develops and produces a wide range of TDM and IP Transport or Access solutions. This document presents the range of Loop Telecom SDH (Synchronous Digital Hierarchy) or SONET (Synchronous Optical NETwork) equipment running from STM1 to STM16 or OC3 to OC48 and PTN 10G.
These high-quality solutions are used in Access or Aggregation Networks of Industries and Telco operator but also used to build Core Networks in many domains which require high reliability, high redundancy, low latency and a large mix of different circuits like in Power Companies, Oil & Gas, Air traffic Control, Railway, Military…

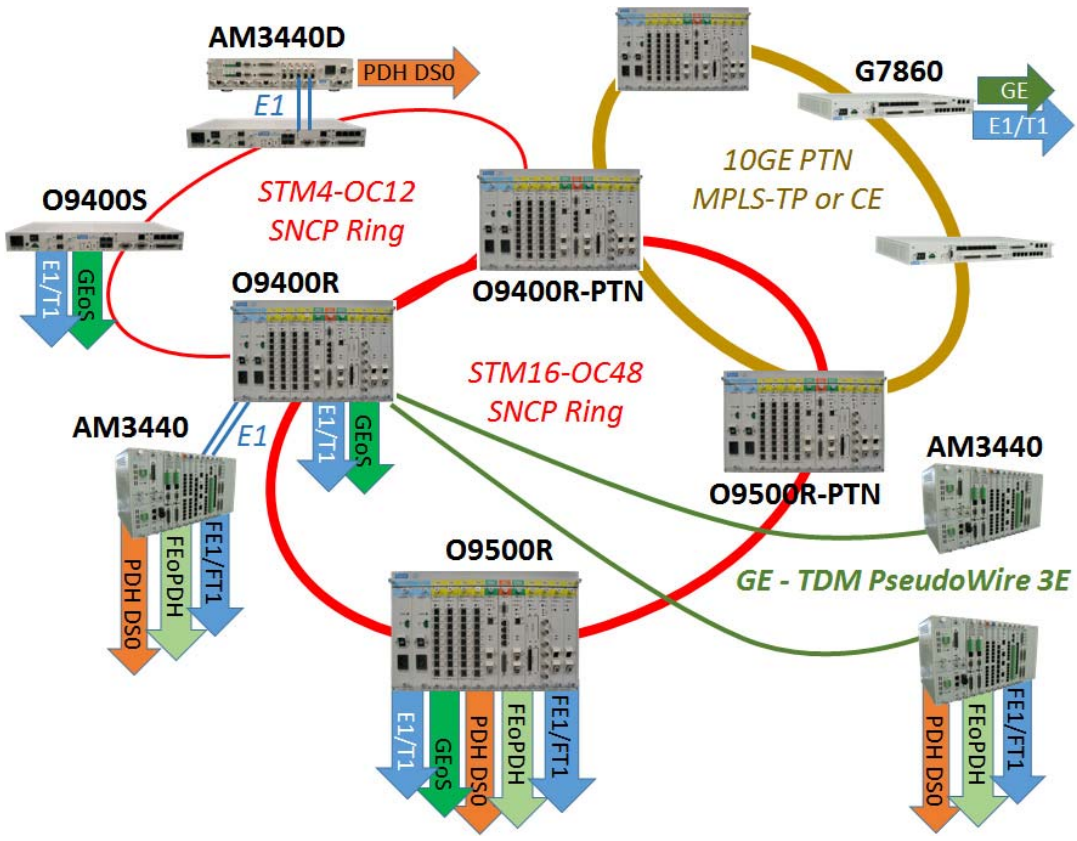
Beyond simple Transport of TDM, ATM and EoS (Ethernet over SDH/SONET), and clock, LoopTelecom devices are also available as :

- **Hybrid Solutions** by adding **PDH DACS** functions with all voice, analog, async/sync serial interfaces, dedicated utility interfaces, Ethernet over FE1/FT1 and all n.64kbps application.

- **TDM PseudoWire End-to-end Emulation** over Ethernet or IP concentrator with the TDMoG card connected over IP/Ethernet network support up to 1024 TDM-PW3E to SDH or PDH equipment with PW3E interfaces.

… and recently

- **PTN system running 10GE in CE or MPLS-TP Networks.** Loop Telecom has developed 100G PTN switch card to transform the O9400R and O9500R so to allow use in solutions connecting to SDH, PDH and to MPLS networks.



This range of economic SDH and SONET multiplexers is produced by Loop Telecom for simple Point to Point or low speed infrastructures.

Loop Telecom O9xxx series equipment are New Generation SDH/SONET equipment, which support ITU-T standards particularly the EoS transport of Ethernet over SDH/SONET, and the DCC communication. Our solutions are compatible with the majority of other devices to extend your existing networks even with old generations SDH or SONET nodes.



O9150S

1U SDH multiplexer supports:

- 2 STM1 in ADM SNCP or TM 1+1 modes
- 4 , 8 or 16 E1 ports and
- 4 x 10/100BaseT E-Line
- Option extended temperature -40 to +70°C



O9100-3U

3U Modular SDH multiplexer supports up to:

- 2 + 2 STM1 with ADM SNCP or TM 2+2 modes
- 4 to 28E1 or T1 main board

3 tributary slots for maximum:

- 112 E1 or T1
- 3 x 4 x 10/100BaseT E-Line
- Exist as 1U



O9400-S

1U SDH /SONET multiplexer supports:

- 2 STM1/STM4, ADM SNCP or TM modes,
- cross-connect of any VC11/VC12/VC3/VC4
- 4 to 16E1 or T1 main board

2 Factory fixed modules for:

- 2 x 16 E1 or T1
- 2 x 4 x 10/100BaseT, E-Line
- 2 x Gigabit Ethernet, E-Line
- 1 L2 switch 1GE +3 FE with E-Line and E-LAN
- WAN EoS up to 622Mbps

SDH/SONET Protection

The fiber interface availability is carried in the overhead of the STM-x/OC-x interface. This provides to each node the function to apply automatically the protection per circuit crossing the node.

MSP 1+1 APS (*Multiplexer Section Protection Automatic Protection Switching)*

This protection uses 2 pairs of fiber and provides the full protection of one pair (RX/TX) and transceivers by an other pair. The bidirectional optical signal is sent in both pairs (working and protection) and the system will switch to the protection pair only if working transceiver does not provide signal. The STM-x switch, then all VCxx circuits, is effective less than 50ms.

SNCP APS *(Sub-Network Connection Protection)* in SDH or ULSR APS *(Unidirectional Line Switching Ring)* in SONET

This protection is based on a single pair of fiber ring crossing up to 64 SDH nodes. A fiber ring carries the Working Path in unique sense and the other fiber ring the Protection Path in reverse sense. The protection is set up at the level of the fiber but the user will apply or not the protection per VCxx circuit. In the case of SNCP circuit VCxx circuit between two node the signal will be sent on both direction and selected at the end like the MSP 1+1. This protection gives the advantage to set up on the same fibers different point to point protection for circuits add and drop at different node of the network. The switch is also operated less than 50ms.

O9400R/S and O9500R support **SNC/I** (Sub Network Connection protection with Inherent monitoring) and **SNC/N** (Sub Network Connection protection with non-intrusive monitoring).

For all APS the return to original path is set as automatically or manually to avoid new switch.

SDH/SONET Synchronization

All Loop ranges O9100/O9400/O9500 support dual direction synchronization of optical line with SSM for indication of clock quality. They support multiple clock sources with settable priority from internal, fiber port, external input G703/G704 or E1 tributaries. They distribute clock to dedicate ports or tributaries. For more than 5 SDH devices it is recommended to use external clock source Stratum 1, 2 or 3.

SDH/SONET transport of TDM

This synchronous technology provides the transport of TDM circuits E1, T1, T3 or DS3 with different PDH synchronization inside the VC12, VC11 or VC3 containers. Then each TDM interface is synchronous clock independent and different PDH network can be carried with clock issue.

SDH/SONET transport of Ethernet - EoS

New Generation SDH mainly optimizes the transport of Ethernet with more bandwidth per circuit. VCxx with E1/T1/E3/DS3 and EoS circuits are mapped together. EoS circuits are optimized by the GFP and VCAT modes, or LAPS with VCAT mode, and the dynamic aggregation of SDH circuits is operated by LCAS protocol.

GFP-F Generic Framing Protocol - Framed (ITU G.7041) compacts Ethernet Frame or HDLC Frame and their overhead.

VCAT Virtual Concatenation slices the compacted GFP frame in multiple parallel VCxx.

LCAS Link Capacity Adjustment protocol (ITU G.7042) dynamically bounds the selected VCxx over one or multiple optical interfaces. This protocol can also be used as circuit protection.

According to MEF the Loop O9XXX EoS interfaces support E-Line and E-LAN by switch cards.

E-Line circuit is Point to Point set between 2 Ethernet interfaces of 2 nodes. We can apply the SNCP protection on such circuit.

E-LAN circuit is a LAN over multiple nodes. This circuit is supported by the EoS switch cards.

These Layer 2 cards support Protocol Flow Control (IEEE 802.3X), VLAN (802.1Q, 802.1P), QoS, RSTP (802.1W) and MSTP (802.1S), IGMP Snooping… These switch cards are available with 622Mbps or 2.48Gbps of WAN backplane.

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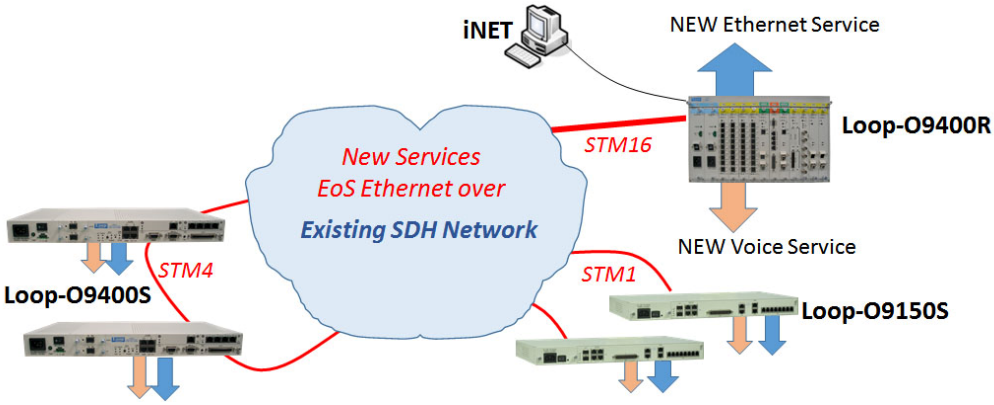
Point to Point SDH

Small SDH O9100/O9150S/9170 are used as point to point operation to carry voice with PBX interconnection and Ethernet over a fiber or a MicroWave.
This solution gives a full guaranty of the QoS for each application and can be deployed on standard STM1 connection optical electrical STM1e or dark fiber.



SDH Extension over existing network with support of New Ethernet/VoiP services

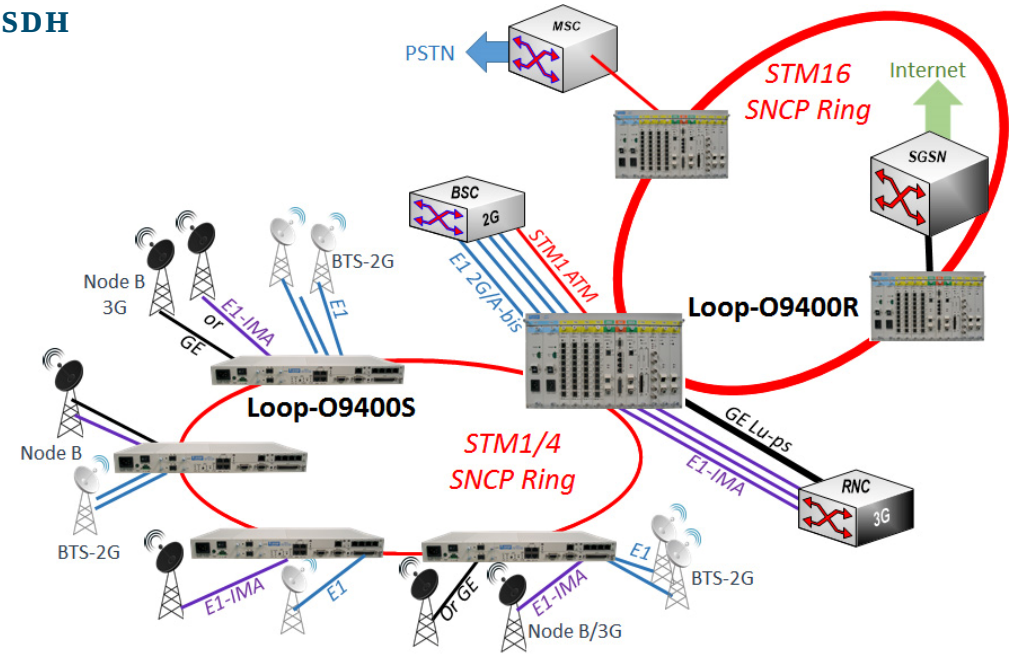
Some Telecom operators or important customers have deployed a large number of STM1 or STM1e in their SDH infrastructures but some are not used. With the O91xx or O9400S/R we can deploy Ethernet or Gigabit Ethernet (EoS) over existing networks. In case several E1/T1 are unused Loop Telecom proposes solutions to deploy Ethernet over n E1/T1 with IP6610 and IP6416.



2G/3G deployment over SDH

Several mobile operators maintain the deployment of 2G and 3G with E1 and E1-IMA and provide some local Internet traffic. The O9150S and O9400S are economic solutions to provide at each node the 2G E1 and 3G E1-IMA with the mandatory synchronization of the Base Transceiver Station (BTS) or Node-B and a local Ethernet access for BTS administration.

In the low density area the use of SDH for the high level of infrastructure is still a good solution. The O9400 carries also the ATM traffic from BSC/RNL to MSC over STM1 interfaces and to SGSn with GE link over SDH (EoS).

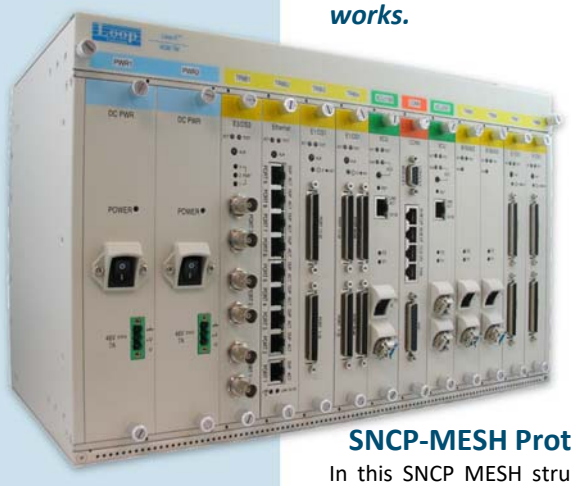


Loop SFP

Loop Telecom supplies large ranges of SFP+ for 10GE and multi-rate SFP as 2.5G for STM16/4/1, 1.25G for GE/FE, 155/622Mbps for STM1/4 and 155M/125M for STM1 and Fast-Ethernet or low rate applications.
The SFP/SFP+ modules are available as Multimode and Single Mode up to 240km in STM1, standard or bidirectional WDM and CWDM lambda to be used in multiple applications.
We supply standard and extended temperature from –40 to +85°C range.
SFP modules are delivered with or without DDM for remote management and all SFP/SFP+ are qualified with all ranges of Loop Telecom equipment.



These chassis are used in concentration nodes or to build high speed infrastructure networks.



O9400R

6U full Modular SDH /SONET multiplexer supports:

- Dual CPU and power supply
- 4 aggregate interfaces STM1/4/16 OC3/12/48
- ADM or TM modes,
- cross-connect VC11/VC12/VC3/VC4
- Circuit Protection MSP, SNCP, SNC/I, SNC/N, SNCP-MESH,MS-SPRing , Dual Node redundant

Maximum connections

- SNCP Rings : 2 STM16 + 8 STM1

This chassis supports 8 tributaries cards independent or redundant 1+1 per channel :

- 16, 32, 63 E1 or T1
- 7 x 4E1/T1 optical
- 3 T3 or 3 DS3 with M13
- 1GE + 8FE L2 switch, 8 WAN maxi 622Mbps,E-Line/E-LAN
- 4 GE SFP/Combo L2 switch, 48 WAN, E-Line/E-LAN
- TDMoG TDM PseudoWire card 2 Combo +2 GE

O9400R-PTN

Identical to O9400R, supports together SDH/Sonet and PTN

- PTN under MPLS-TP and CE
- SyncE and PTP-1588v2
- 2 PTN card 1+1, 200Gbps L2 switch, 6 x10GE and 16 xGE
- 4 aggregate interfaces STM1/4/16 OC3/12/48
- 6 slots for E1/T1, T3, DS3, Ethernet cards

The Loop Telecom O9400R is highly secured New Generation SDH/SONET multiplexer complying to ITU-T standards. This equipment supports not only the transport of TDM and Ethernet over 2.5G fibers but also over TDM PseudoWire in Ethernet or IP or the O9400R-PTN version is a 10GE PTN node in MPLS-TP or Carrier Ethernet Networks.

Fully secured SDH/SONET Node

This equipment is secured by redundant CPUs, redundant with load sharing power supplies, and all interfaces from tributary cards can be protected. TDM circuits can be protected by SDH mechanism but also TDM lines and tributary cards by using Y-boxes.

The SDH circuits can be protected with MSP 1+1, SNCP, SNC/I, SNC/N, SNCP-MESH, MS-SPRing with 2 fibers.

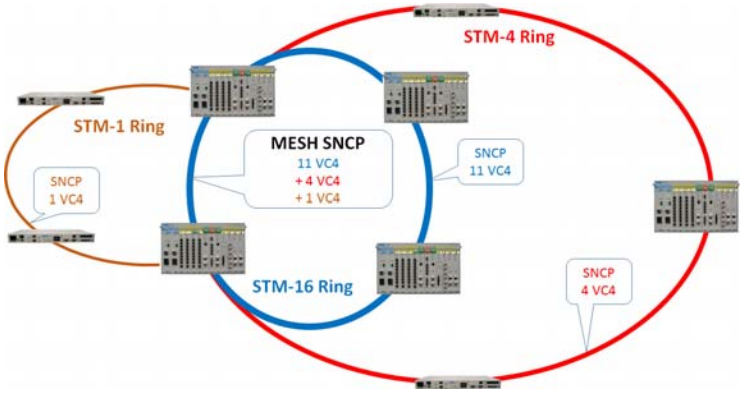
For highly secured networks Loop proposes a "Dual Homing" for double chassis in key sites and dual SNCP rings.

All protections could be easily configured per node and circuit by iNMS the powerful NMS from Loop Telecom.

SNCP-MESH Protection

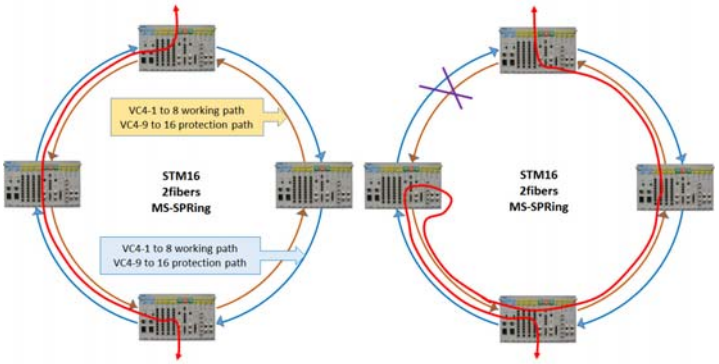
In this SNCP MESH structure all optical paths can be shared by several ring SNCP protections. This feature is available with O9400R and O9500R. SNCP rings can be set over aggregate, share Mesh aggregate or tributaries STM1/4/16 or OC3/12/48.

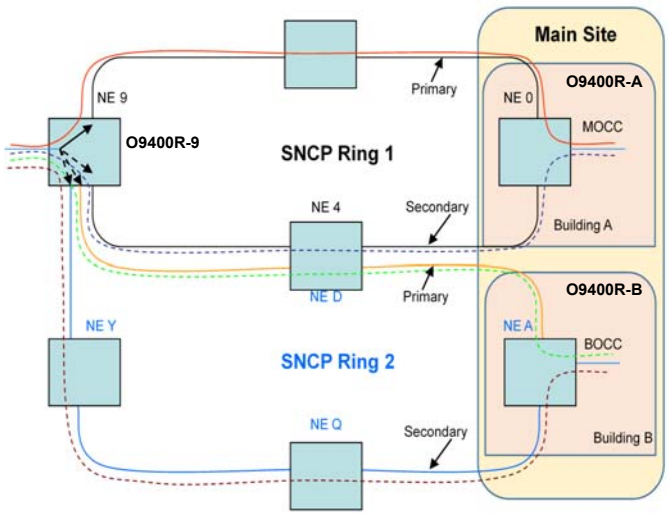
All SDH fibers are shared to support VC4-x, VC3 or VC12/VC11 circuits.



MS-SPRing with 2 fibers Circuit Protection

This mode gives the advantage to carry both codirectional circuits in the same dual fiber's section, it is not transmitting as unidirectional traffic and reverse protection. Each fiber TX or RX carries the working circuits and reserves the bandwidth to carry the protection of the codirectional circuit.



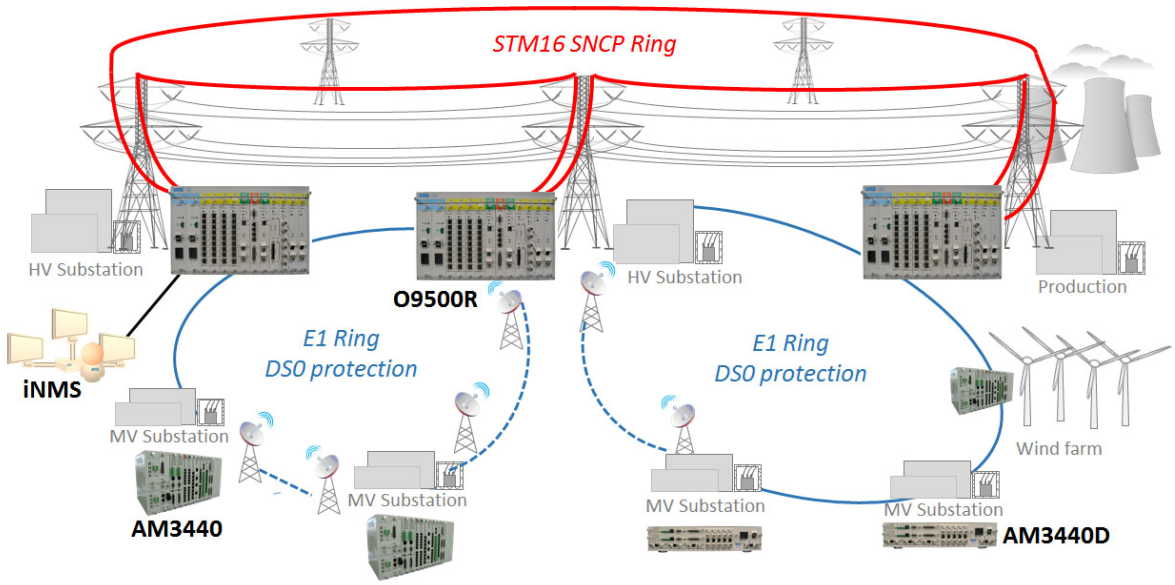


Dual Homing Chassis Protection

This highly secured application uses four optical paths and runs with two chassis located in separate building for safety reason, in the key sites.

Loop Telecom provides a sophisticate "Dual Homing" solution with automatic setup by iNMS system. This solution transports all circuits over 4 optical paths and the concentration node runs with 4 CPUs and 4 power supply equipment. This fully secured solution is used in central sites, in NOC or the main sites which require full redundancy access to all applications.

SDH Core infrastructure for Power Distribution and Utilities



Power companies require an ultra secured transmission to manage the power transport and the distribution at different levels of voltage. Each voltage level 380kV, 230kV, 110kV… 6kV use this transport network and teleprotection relays and all applications in substations must exchange information with a high level of security and very low latency for the transmission of teleprotection orders.

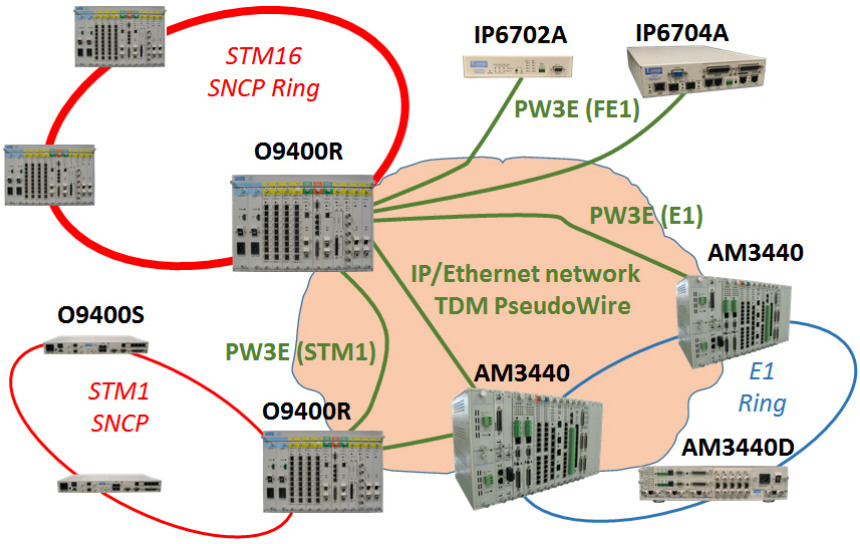
Loop Telecom supplies several main actors of this domain: National Grids , Power Collecting and Distribution companies in all continents of the world. We have develop interfaces for teleprotection and our PDH and SDH solutions support ESD and mechanical compliances as IEC61850-3 or strongest.

Thousands of PDH DACS AM3440, SDH or Hybrid O9400R/O9500R multiplexers are used by Power transport/distribution companies because of very low latency transmission, multiple adapted interfaces and high level of protection and reliability.

Extension of SDH/PDH network over Ethernet/IP links with TDM PseudoWires

When the TDM PDH/SDH networks need to be extended or we must add small site inside brand new infrastructures, it can be easier to transport Scada/Legacy/Analog… in TDM link over Ethernet network. With a TDMoG card fit inside the SDH O9400R, the system provides up to 1024 TDM PseudoWire-3E (End to End Emulation) over existing Ethernet or IP network. This gives solutions to connect another SDH/SONET STM1/4 network or a PDH equipment with E1/T1 or FE1/FT1.

The TDMoG can also synchronize the distant device with Automatic Clock Recovery from the local network. These solutions avoid installations of synchronous leased lines when the user owns a large IP/Ethernet infrastructure.



Loop's Universal Transport Networking Solutions: O9500R-PTN system is supporting PDH+SDH and PTN 10G Layer 2 & 3 with OTN Layer 1

Loop Telecom has developed PTN Layer 2 card to transform the TDM chassis (SDH or SDH+PDH) and give it the 10G PTN (Packet Transport Network) encapsulation and labeling for TDM and Ethernet over MPLS-TP or Carrier Ethernet networks and later we will implement Layer3 IP-MPLS network support.
The 9400R-PTN/9500R-PTN support SyncE and IEEE1588v2 synchronization for all applications and can guarantee a low latency transmission needed by utilities.

Loop Telecom proposed optical CWDM and an OTN DWDM multiplexing extensions to carry on same fiber PTN , SDH and standard GE/10GE links.
All equipment including OTN are managed and commissioned by the iNMS system.

These chassis include a TDM/PDH with DS0 DACS inside an SDH multiplexer and save one equipment to manage in the network.



O9170

1U SDH multiplexer supports with factory options:

- 2 STM1 ADM SNCP/TM 1+1
- 8 E1 ports, 4 FE1 n 64kbps
- 4 x 10/100BaseT E-Line
- FXS, FXO, E&M,



- RS232, RS485

O9500R

6U Hybrid Modular SDH / SONET and PDH multiplexer :

- Dual CPU and power supply
- 4 aggregate interfaces STM1/4/16 OC3/12/48
- ADM or TM modes,
- cross-connect VC11/VC12/VC3/VC4
- SDH Circuit Protection MSP, SNC/I, SNC/N, SNCP-MESH
- PDH Protection SNCP-64k

O9500R supports tributaries:

- 4 O9400R SDH cards: 16 to 63 E1/T1, T3, S3 , TDMoG and EoS: GE+ 8FE or 4 GE SFP
- 6 AM3440 PDH n 64k cards: FXS, FXO, E&M, Conference, RSxxx, X21/V35, C3794, FE1, FT1, G703 64K… and EoPDH

O9500R-PTN

Identical to O9500R, supports together SDH/Sonet and PTN

- PTN under MPLS-TP and CE
- SyncE and PTP1588v2
- 2 PTN cards 1+1, 200Gbps Layer 2 switch, 6 x 10GE and 16 x GE
- 4 aggregate interfaces STM1/4/16 OC3/12/48
- 2 slots for E1/T1, T3, DS3, Ethernet EoS cards

Loop Telecom produces Hybrid equipment that include a full SDH/SONET multiplexer for Transport of TDM VCxx and Ethernet EoS and for Access a PDH DS0 multiplexer DACS section. This PDH section with single clock is connected by a bus to SDH cross-connect. These solutions save installation, interconnexion and management of two equipments and save CAPEX and OPEX cost.

The **O9500R** Hybrid device supports:

Synchronous Transmission SDH/SONET of :

- WAN transmission up to STM16/OC48
- multiple E1/T1/T3/DS3 with independent clock,
- Ethernet (EoS) with GFP/VCAT and LCAS,
- All protections MSP, SNCP, SNCP-Mesh, MSSP…
- a high level cross-connect VC11/VC12/VC3/VC4

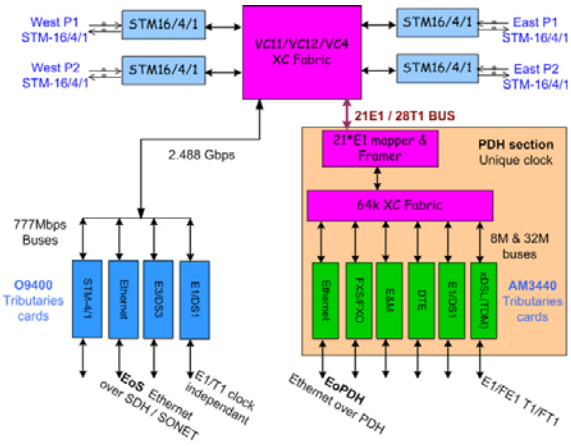
PDH section with multiservice multiplexer DACS:

- 32Mbps DACS DS0 non blocking cross-connect
- 6 low speed cards: analog, voice, serial, FE1, FT1, dry contacts, C3794 and Ethernet over n.E1 (EoPDH), terminal server
- a single clock for the PDH section

An internal 21E1 bus connects the PDH section to the SDH cross connect.

Over a single IP address and management all functions of the Hybrid device are under control.

Hybrid SDH and PDH



PDH/TDM service n.64kbps

The integrated PDH multiplexer supports 6 tributary cards each of which 4 x n.64Kbps bandwidth. The backplane support 24+21 E1 or 24+28 T1 with a full non-blocking TS0 cross-connect DACS.

PDH Synchronization

The clock of the PDH section is unique. Up to 6 clock sources can be selected with settable priority from internal, external input clock G703/G704 , E1/T1 tributaries or from SDH clock. The SSM messaging can be used to support bidirectional application.

1+1 Protection

This E1 or T1 protection is available per 2 E1/T1 interfaces from contiguous 4E1/4T1 cards. Each interface is independent and the full recovery is effective within 100ms including the interface's default detection.

PDH-SNCP-64K Protection

This protection is applied per TS or a group of TS over two E1/T1 paths crossing nodes that support this protection or over VC11/VC12 in the SDH. The recovering of the missing circuits is effective within 10ms. Different PDH-SNCP-64K circuits can be groomed in the same E1 or T1.

PDH interfaces

The O9500R supports 6 PDH cards from the large portfolio of DACS AM3440's cards.

Each card has a backplane of 4 x n.64K or 8Mbps. The 4 to 12 independent interfaces are set in each card. These cards own generally a processor and are controlled by the CPU of the chassis.

All interfaces are conformed to the recognized official standards IEEE, EN, RFC… Loop has also developed different WAN protocols (X50, V110, Raw TCP/UDP, Ethernet HDLC bridge…) to be compatible with many other vendors.



Voice/analog interfaces

Cards with 12 FXO, 12 FXS, 12 Magneto, 8 E&M and 2 Voice+Data Conference with many working modes selectable per software or on order.

WAN or Tributaries

Cards with 4 E1 or 4 T1 copper or fiber are supporting clear channel, G704 n.64K, CAS, transparent ATM-IMA, ISDN…

G703 64K codirectional or contra-directional card

Serial interfaces

Different cards with: 4 to 8 RS232, RS485, RS422, X21, V35, EIA530… asynchronous and synchronous with 64k to 2Mbps or low speed with X50 or V110 transport.

Special with data-bridge or analog bridge for multi-point, dual Scada server, buffer...

Terminal server interfaces

DSL / Fiber extension

2 or 4 wires G.SHDSL n 64K transmission

Power or industrial extensions

1 to 4 interfaces C37.94

8 dry contacts In and Out or SNMP Trap

4 interfaces for Electrical power switch

Bridge/Switch/Router EoPDH

8 Fast-Ethernet ports Layer 2 switch,

64 WAN from 64k to 8Mbps EoPDH over SDH

TDMoE TDM PseudoWire-3E

Supports 64 PW3E of 64 to 2048kbps with TDMoE, CESoPSN or SAT encapsulation

2 GE WAN and 2 GE LAN

iNET

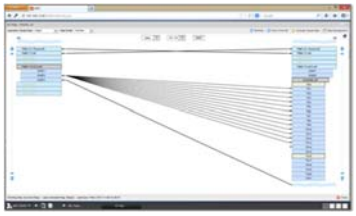
Loop-iNET, based on scalable and modularized architecture, is an intelligent network management software for Element Management Layer (EML) and Network Management Layer (NML) based on Telecommunications Management Network (TMN) model. It provides a GUI (graphical user interface) for the management of a communications network containing Loop Telecom products and 3rd-parties NE .

This solution is running:

- Web based application following design of thin client computing
- Supported server platform: MS Windows
- Database server: MySQL RDBMS
- Hot standby server redundancy option with automatic failover to provide high availability (HA)
- System access security with role-based user access control. The access privilege can be customized through any combination of operation functions and managed NEs, user access log
- Multi-hierarchical subnet structure allows users to provide multi -level network topology display
- SNMP based management system that supports SNMP functions including commands, alarms, and statistics gathering. Other protocol support includes Network Time Protocol (NTP).
- Up to 100,000 Network Elements (NEs)
- 3rd-party NE management capability

The robust and reliable design on distributed system architecture provides flexible and scalable solution for network expansions.





iNET-LCT

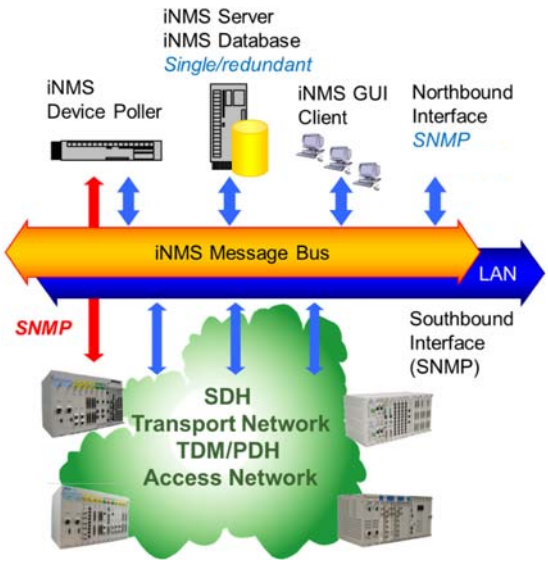
This light Window software is a Local Craft Interfaces.
This basic version of the iNET NMS is permitting to set-up node per node locally or over the network and gives the vison of all setting and cross-connects of the device.





iNMS-NMS

Loop-iNMS (Integrated/Intelligent Network Management System) is a set of software programs supporting the Loop equipment compliant to TMN. This system manage the device of Transport Network (SDH), Access Network (PDH), Ethernet with PseusoWire-3E and PTN over MPLS-TP.
This is a GUI, End-to-End commissioning with several services for small to very large infrastructure with a NBI to access to a head NMS.



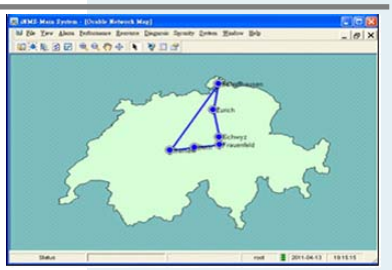
The iNMS system :
- The software runs Linux with
- Database Server: Oracle 10g,11g
- User-friendly GUI on MS Windows platform. Up to 50 GUI clients simultaneously are logged.
- iNMS support several thousand SNMP Loop nodes and 3rd-Party NE .

All servers, database, pollers can build with redundant with High Disaster Recovery option.

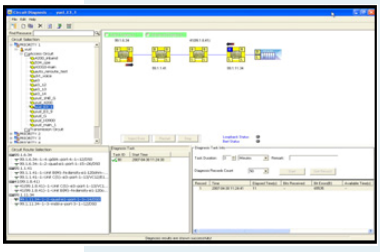
INMS provides to administrator:

- High Level NMS
- GUI of device and Network view
- End-to-end service management with automatic commissioning of nodes
- Full SNMP supports functions including commands, alarms, and statistics gathering
- Viewing and printing of all node statistics, alarm reports, configurable report design
- Enriched topology management with GIS geographic maps, zoom and drag-and-drop
- Views of optical cable connection, cross-connection, panel view, and resource trees
- Clock Distribution Map
- System Redundancy and Protection
- PseudoWire Circuit Management
- Efficient performance monitoring in real-time and history for PM, NE and circuits
- Alarm management with notification via e-mail, GSM message (SMS), with filtering
- Root Cause Analysis accurately diagnoses faults on NEs and managed circuits by status and severity levels
- System Access Security

And many options to customize your requirement.









Models	O9100	O9150	O9170	O9400S	O9400R	O9400R-PTN	O9500R	O9500R-PTN
System	SDH	SDH	HYBRID SDH & PDH	SDH/SONET	SDH/SONET	SDH/SONET and PTN MPLS	HYBRID SDH/SONET & PDH	HYBRID SDH/SONET & PDH PTN MPLS
	Modular 3U	Fix 1U	Fix 1U	Fix 1U	Modular 6U	Modular 6U	Modular 6U	Modular 6U
	1 CPU				2 redundant CPUs			
	1 AC or 2 DC48v redundant power supplies				2 AC or 2 DC48v redundant power supplies			
Aggregate interfaces and protection structure	2 + 2	2	2	2	4	4	4	4
	STM1	STM1	STM1	STM1/4	STM1/4/16		STM1/4/16	
	1 ring SNCP or 2 MSP	1 ring SNCP or 1 MSP	1 ring SNCP or 1 MSP	1 ring SNCP or 1 MSP	2 ring SNCP or 2 MSP		2 ring SNCP or 2 MSP	
SDH protection	MSP, SNCP	MSP, SNCP	MSP, SNCP	MSP, SNCP	MSP, SNCP, MESH SNCP, MS-SPRING, HOST PROTECTION		MSP, SNCP, MESH SNCP, HOST PROTECTION*	
PDH protection							SNCP 64K circuit	
SDH Tributaries					Maxi 1+1 STM16, 4+4 STM4, 16 STM1	Maxi 3+3 STM4, 12 STM1	Maxi 1+1 STM16, 2+2 STM4, 8 STM1	Maxi 1+1 STM4, 4 STM1
SDH cross-connect	Add & Drop VC11/ VC12/VC3	Add & Drop VC11/ VC12/VC3	Add & Drop VC11/ VC12/VC3	VC11/VC12/ VC3/V4	VC11/VC12/ VC3/V4/VC4-x	VC11/VC12/ VC3/V4/VC4-x	VC11/VC12/ VC3/V4/VC4-x	VC11/VC12/ VC3/V4/VC4-x
ETHERNET	E-Line, E-LAN	E-Line	E-Line	E-Line, E-LAN	E-Line, E-LAN, EVP-Line, EVP-LAN		E-Line, E-LAN, EVP-Line, EVP-LAN	
PTN version						6 x 10GE, 16 GE		6 x 10GE, 16 GE
EoSDH interfaces	3 x 4 FE	4 FE	4 FE	2 x GE, 2 x 4FE	8 x GE+8FE or 1 x 4 GE SFP	7 x GE+8FE	4 x GE+8FE or 1 x 4 GE SFP	2 x GE+8FE
BW selection	n VC11/12/3	n VC11/12/3	n VC11/12/3	n VC11/12/3/4	n VC11/12/3 or n VC4			
Nb of WAN per card, Maxi BW / WAN	4+4 WAN/card of 90Mbps	4 WAN of 90Mbps	4 WAN of 90Mbps	4+4 WAN 155 or 622Mbps	8 or 48 WAN of 2 to 622Mbps or 2.4Gbps/ card			
EoPDH interfaces							64 WAN of 64kbps to 8Mbps/card	
TDM TRANSPORT								
Maximum E1/T1	112 E1/T1	16 E1	8 E1	48 E1/T1	504 E1/T1 or 24 E3/DS3	378 E1/T1 or 18 E3/DS3	252 E1/T1 or 12 E3/DS3	126 E1/T1 or 6 E3/DS3
PDH services DACS			DS0/TS0				DS0/TS0 cross-connect	
FE1/FT1, G703 64k			optional cards				4 E1, 4 T1, 8 G703 64K cards	
Voice interfaces			FXS, FXO, E&M				FXS,FXO,E&M, Conference, Magneto	
Serial interfaces			RS232,RS485				RS232,RS485,RS422, X21, V35 cards	
Utilities interfaces							C.3794, Teleprotection	
PW3E and PTN					TDM PW3E IP or Ethernet	**PTN MPLS-TP or CE**		**PTN MPLS-TP or CE**
PTN with networks MPLS-TP or CE					TDMoGE card 1024 PW3E over 2 GE combo	200Gb switch 1588 v2 6 x 10GE SyncE		200Gb switch 1588 v2 6 x 10GE SyncE
Environment	With Fan	With Fan	With Fan	With Fan	Versions Fan, Fanless	Versions Fan, Fanless*	Versions Fan, Fanless	Versions Fan, Fanless*
Temperature w FAN	-5 to +55°c	-40 to +65°c	-10 to +55°c	-10 to +55°c	-20 to +55°c	-20 to +55°c	-20 to +55°c	-20 to +55°c
Standard compliances	FCC Part 15 Subpart B, Class A - CE - Safety IEC60950-1							
Other compliances					IEC61850-3 * EN50121-4 *		IEC61850-3 * EN50121-4 *	
Management	Telnet Craft	Telnet Craft	Telnet Craft	Telnet Craft	Telnet/SSH Craft	Telnet/SSH Craft	Telnet/SSH Craft	Telnet/SSH Craft
SNMP	v1	v1	v1	v1	v1, v3	v1, v3	v1, v3	v1, v3
LCT Interface					Node administration Windows GUI			
iNET (EMS)		Windows GUI , Graphic cross connect, vision of programed circuit						
iNMS (NMS)				Support Transport, Access, PW3R or MPLS-TP circuits, automatic nodes commissioning, synchronization,				

** in development or qualification*

LOOP TELECOMMUNICATION INTERNATIONAL, INC.
an ISO 9001 and ISO 14001 company

Worldwide	Europe	Americas	Australia & New Zealand
8F, No. 8, Hsin Ann Road	Rue du Culot, 13	8 Carrick Road	3,Imperial Ave,
Hsinchu Science Park	BE-1402 Nivelles	Palm Beach Gardens	Mount Waverley, Victoria 3149
Hsinchu, Taiwan 30078	Belgium	Florida 33418, U.S.A.	Autralia
+886-3-578-7696	**+32-496-54-27-44**	**+1-561-627-7947**	**+61-413-382-931**
sales@looptelecom.com	eu_sales@looptelecom.com	ncsa_sales@looptelecom.com	aus_sales@looptelecom.com

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