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Nortel

Optical Multiservice Edge 6130

Planning Guide

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About this document

This planning guide describes the applications and functionality provided by the software and hardware of Nortel Optical Multiservice Edge 6130 (OME6130) Release 1.0.

This planning guide covers the following topics:

- Introduction
- Features overview
- Configurations and interworking
- Hardware description
- User interface description
- Operations, administration, maintenance and provisioning (OAM&P) description
- Technical specifications
- Ordering information and system engineering rules
- Technical assistance
- Appendix A: Data communications planning

Supported software release

This document supports the software release for OME6130 Release 1.0.

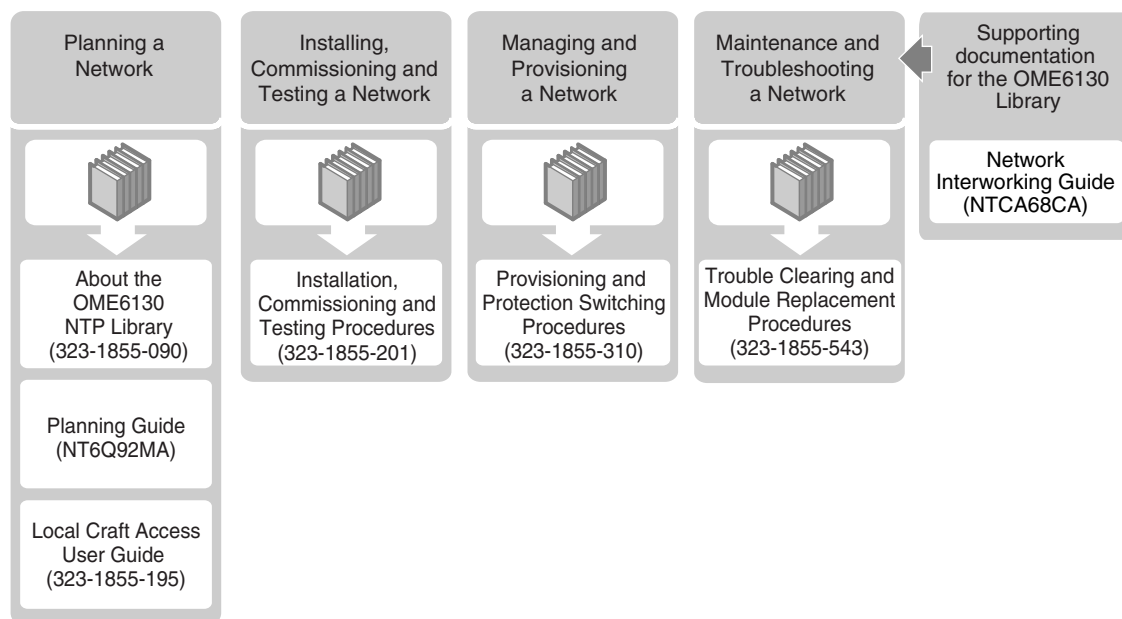
Audience

The following members of your company are the intended audience of this Nortel technical publication (NTP):

- planners
- provisioners
- network administrators
- transmission standards engineers
- maintenance personnel

Optical Multiservice Edge 6130 NTP library

This roadmap identifies the OME6130 library structure and the use of application guides and NTPs.



References

This document refers to the following Optical Multiservice Edge 6130 NTPs:

- *About the OME6130 NTP Library*, 323-1855-090
- *Local Craft Access User Guide*, 323-1855-195
- *Installation, Commissioning and Testing Procedures*, 323-1855-201
- *Provisioning and Protection Switching Procedures*, 323-1855-310
- *Trouble Clearing and Module Replacement Procedures*, 323-1855-543

This document refers to the following OME6130 supporting documentation:

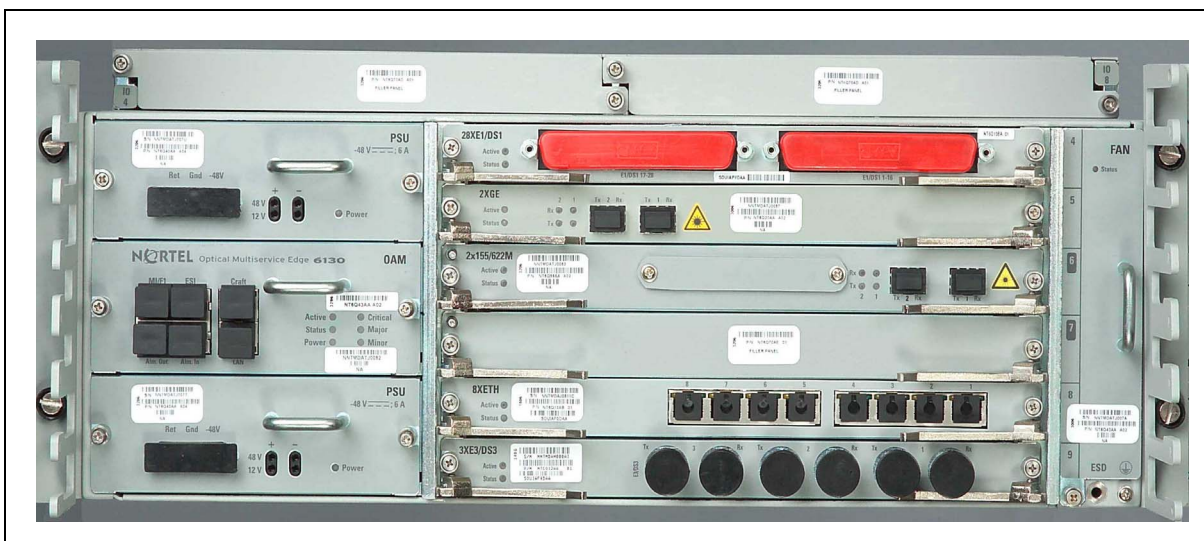
- *Data Communications Network Planning Guide*, NTR710AM
- *Network Interworking Guide*, NTCA68CA

Introduction

The Optical Multiservice Edge 6130 (OME6130) is a compact-MSPP (Multi-Service Provisioning Platform) offering very cost effective transport of Ethernet and TDM services over SDH network. The OME6130 is designed for use in customer sites and in collector networks where multi-service capability is required and compact footprint is paramount.

The OME6130 Release 1.0 supports SDH networking. SONET support will be provided in the next release. [Figure 1-1](#) displays the OME6130 network element.

Figure 1-1
OME6130 network element



The OME6130 provides dramatic cost savings over currently deployed solutions and offers deployment flexibility at multiple levels, including:

- **Service flexibility:** Full mix of services including 10/100BT (Base-T) Ethernet, Gigabit Ethernet, E1/DS1, E3/DS3 and STM-1o/e.
- **Reach flexibility:** Small Form-Factor Pluggable (SFPs) optics are used, allowing each shelf to be configured for the distance and wavelength required.
- **Protection flexibility:** Can be deployed with or without line protection. Both 1+1 MSP and SNCP network protection protocols are supported.
- **Interoperability flexibility:** Can be networked either with other OME6130 or OME6110 network elements, or subtended from other Nortel optical products, such as OM4000 or OME6500.
- **Management flexibility:** The OME6130 is fully integrated into Nortel's Optical Application Platform with OMEA. The OME6130 can also be managed from an HTTP web-based craft user interface running on the network element. In addition, SNMP alarm traps are supported, enabling OME6130 fault management from SNMP management systems.
- **Data communications flexibility:** The OME6130 can be managed over either OSI or IP DCN networks. Path DCC capabilities are also provided for extending management reach over third-party networks.

The OME6130 is a carrier grade platform that builds upon the solid reputation for dependability of Nortel Networks' widely deployed optical networking products. The various protection options offered by the OME6130 further enhance the dependability of service transport. For access head end applications, service traffic can either be connected via sub-network connection protection (SNCP) or via protected point-to-point 1+1 connections.

OME6130 applications

The OME6130 offers significant value across a range of network applications. The principal OME6130 applications are:

- **Feeder for Metro Optical networks:** The OME6130 can be subtended from Nortel's larger Optical platforms to collect 10/100BT Ethernet, Gigabit Ethernet, E1/DS1, E3/DS3 and STM-1o/e traffic from the Access Edge. Its compact footprint and low price make it well suited for smaller customer locations. The OME6130 can be subtended either in a SNCP or 1+1 MSP configuration. The capability to manage OME6130 using path DCC bytes also allows it to be managed remotely over leased STM-1/STM-4 circuits. The Regenerator Section and Multiplexer Section overhead tunnel capability provides further flexibility in managing other SDH equipment within the same ring.
- **Private Enterprise Networks:** The OME6130 can be deployed in smaller private networks providing transport of 10/100BT Ethernet, Gigabit Ethernet, E1/DS1, E3/DS3 and STM-1o/e services between sites. A light weight management solution is available for such applications consisting of a web-based craft interface running on the OME6130 for NE provisioning and SNMP north bound interface for reporting alarms to a generic SNMP alarm browser.
- **Wireless Backhaul:** The OME6130 is also well suited for wireless backhaul applications where both space and cost are paramount. The OME6130 can be used as a cost-effective backhaul of today's E1/DS1s and will support the 3G network transition to Ethernet.

OME6130 service interfaces

OME6130 offers transport and aggregation of asynchronous private lines, SDH, and Ethernet. The OME6130 shelf has four (4) universal tributary slots and supports a full mix of tributary interfaces. The OME6130 supports three basic categories of interface:

- 10/100BT (Base-T) Ethernet and Gigabit Ethernet
 - The tributary slots can be equipped with the 8x10/100BT L1 Ethernet and 2xGE L1 circuit packs. The 8x10/100BT L1 Ethernet circuit pack supports 8 10/100 Base-T Ethernet Private Line (EPL) ports and the 2xGE L1 circuit pack supports 2 Gigabit Ethernet (GE) EPL ports.
- PDH
 - The tributary slots can be equipped with the 28xE1/DS1 and 3xE3/DS3 circuit packs. The 28xE1/DS1 circuit pack supports 28 E1/DS1 ports and the 3xE3/DS3 circuit pack supports 3 E3/DS3 ports.
- SDH
 - The tributary slots can be equipped with the 2x155M circuit pack. The 2x155M circuit pack supports 2 STM-1 optical / electrical (o/e) ports.

Small form-factor pluggable interfaces

The OME6130 uses small form-factor pluggable (SFP) interfaces to deliver optical rate and reach flexibility on a per port basis for the line interface. The OME6130 also supports electrical SFP for the STM-1e interface.

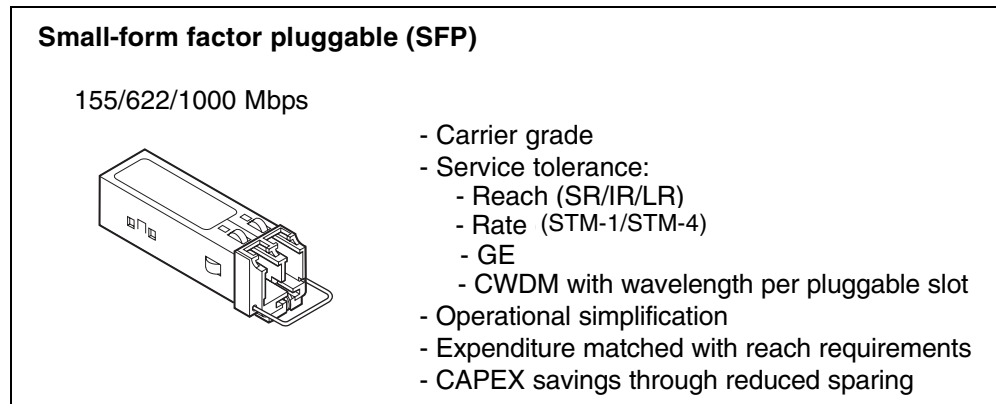
The OME6130 offers the following SFP interface types:

SR-0, I-1.1/I-4.1, S-1.1/S-4.1, L-1.1/L-4.1, L-1.2/L-4.2, CWDM, STM-1 BX, STM-1e, GE SX and GE LX.

Nortel Networks has been collaborating closely with leading SFP vendors to improve the reliability, robustness and manageability of SFPs. The use of such carrier-grade SFP technology enables service providers to enjoy the flexibility of provisioning the interfaces per the requirements of the specific application.

SFPs also reduce the cost of sparing by enabling an upgrade of the optical line interfaces as they become readily available.

Figure 1-2
Pluggable optical modules summary



Point-to-point optical broadband services

The OME6130 uses GFP, VCAT and LCAS standards for the mapping and transport of Ethernet services.

GFP provides an efficient mechanism for Ethernet transport over a SDH core network via efficiently mapping varying client signals into SDH VC-12, VC-3 and VC-4 frames. GFP mapping enables efficient network resource utilization with low overhead requirements, and limited over-provisioning with VCAT. End-to-end framing provides demarcation for the Ethernet signal, and enables consistent SDH based PMs through the network. Since the Ethernet is mapped into SDH frames, the existing core network can transport the Ethernet frames transparently.

The OME6130 also supports Virtual Concatenation (ITU-T G.707 compliant) with support at the VC-12-nv, VC-3-nv and VC-4-nv SDH rates. A maximum of 48 ms of differential delay is supported.

Along with VCAT the OME6130 also supports value added capabilities such as soft protection via Link Capacity Adjustment Scheme (LCAS - G.7042). LCAS has been specifically developed to overcome static link provisioning. It enables service providers to efficiently offer dynamically-allocated bandwidth as well as hitless throttling of the capacity of a VCAT link (or Virtual Concatenated Group) by adding or removing VCs as required.

LCAS provides a soft protection and load-sharing mechanism to automatically decrease the link capacity if a VC path experiences a failure and automatically increases the link capacity when the network fault is repaired. This capability provides an extra level of network and service resiliency by facilitating the support of SLAs through graceful service degradation when necessary. In particular, during network and service restoration LCAS can support hitless bandwidth expansion and contraction thereby reducing service interruptions in the event of network failure and easing network operations and maintenance actions.

TDM switching

In the OME6130 architecture, traffic is switched between working and protection line interfaces via the switch matrix in the 2x155/622M aggregate circuit pack.

All ingress service traffic is mapped into VC-11, VC-12, VC-3 or VC-4 containers and directed towards the switch matrix which is configured to switch the incoming traffic to the appropriate line interface. The switch matrix allows any input channel to be connected to any output channel. Hairpinning is also supported between client ports.

Network management

The OME6130 is managed as an integral part of Nortel Networks' market proven end-to-end optical portfolio management capabilities. This framework supports a sophisticated and highly customizable desktop providing centralized topology view and fault management, centralized launch pad for a full suite of management applications, easy to use nodal managers and seamless network element reach-through for Nortel Networks' complete optical networks portfolio. These network management capabilities are supported by the Optical Manager and Optical Application Platform, such as OMEA and Optical Network Manager (*formerly known as Preside*), in alignment with Nortel Networks overall optical networks portfolio.

The OME6130 local craft access terminal, which is an HTTP web-based graphical interface running on the network element, provides complete nodal management that can be integrated into a centralized network wide view through the Optical Application platform.

Key features and benefits

The OME6130 multi-services access platform provides customers with the flexibility, scalability and management capabilities they need in a compact cost effective package. The key benefits to customers of deploying the OME6130 can be summarized as follows:

- support of a broad set of services (Ethernet, PDH/Async and SDH)
- switching granularity and flexibility for service grooming and connection management, such as unconstrained VC-11 and VC-12 level switching
- cost-efficient service deployment through
 - low cost entry configuration for E1/DS1 and E3/DS3 services
 - in-service expansion to support new services
 - dynamically pluggable optical and electrical SFP interfaces (lowers sparing costs)
 - flexible, complete and easy to use network and service management leading to simplified operations for rolling out and maintaining services

Feature overview

This chapter provides an overview of the Optical Multiservice Edge 6130 (OME6130) Release 1.0 supported features. Release 1.0 supports SDH optical interfaces (STM-1/STM-4), electrical STM-1e interface as well as transport of 10/100 BT (Base-T) Ethernet, Gigabit Ethernet and PDH/DSn services. OME6130 Release 1.0 supports the following features:

- SDH support
- hardware:
 - chassis
 - 2x155/622M aggregate circuit pack
 - service interface circuit packs:
 - 8x10/100BT L1 circuit pack
 - 2xGE L1 circuit pack
 - 28xE1/DS1 circuit pack
 - 3xE3/DS3 circuit pack
 - 2x155M circuit pack
 - pluggable modules:
 - SR-0, I-1.1/I-4.1, S-1.1/S-4.1, L-1.1/L-4.1, L-1.2/L-4.2 SFPs
 - CWDM SFPs (8 wavelengths, 1470 nm to 1610 nm)
 - STM-1 BX, STM-1e
 - GE SX, LX
 - redundant DC power supply units
 - OAM circuit pack
 - fan module
 - filler faceplate
- System Line-Up and Test (SLAT) procedure

- configuration for the STM-1/STM-4 optical and STM-1e interfaces:
 - 1+1 MSP
 - SNCP
 - unprotected
- connection management:
 - VC-11, VC-12, VC-3, VC-4 cross-connects
- service mappings:
 - 10/100BT Ethernet GFP-F to VC-12, VC-3
 - 10/100BT Ethernet GFP-F to VC-12-nv (n = 1 to 63), VC-3-nv (n = 1 to 3)
 - Gigabit Ethernet GFP-F to VC-3, VC4
 - Gigabit Ethernet GFP-F to VC-3-nv (n = 1 to 12) and VC-4-nv (n = 1 to 4)
 - E1 to VC-12
 - E3 to VC3
 - DS1 to VC-11
 - DS3 to VC3

Note: Only low order VC3/TU3/AU4 mapping is supported

- synchronization:
 - SSM
 - E1 BITS synchronization
 - line timing
 - port (E1 facility)
- fault management:
 - alarm reporting control
 - regenerator section alarms
 - multiplex section alarms
 - high order path alarms
 - low order path alarms
 - E1/E3/DS1/DS3 alarms
 - 10/100BT Ethernet and Gigabit Ethernet alarms
- performance monitoring:
 - SDH regenerator section, multiplex section PM parameters
 - high order path PM parameters

-
- low order path PM parameters
 - E1/E3/DS1/DS3 PM parameters
 - 10/100BT Ethernet and Gigabit Ethernet PM parameters
 - DCN:
 - OA&M over D1-D3 and F1 RS bytes
 - OA&M over D4-D9 MS bytes
 - OA&M over F2, F3 & F2F3 path overhead bytes
 - overhead tunnel with RS, MS, E1, E2, F1 bytes
 - E1/VC12 management channel
 - F1 byte user channel access
 - PPP/LAPD over DCC
 - OSPF routing
 - iISIS routing
 - Auto GRE tunnels
 - Proxy ARP
 - web user interface (WUI):
 - Microsoft Internet Explorer 6.0 or higher
 - Mozilla 1.6 & 1.7 on Red Hat Linux, HP-UX and Solaris
 - FireFox 1.0 on Red Hat Linux 7.x
 - SNMP v1 and v2 trap monitoring
 - interworking:
 - subtending 1+1 MSP or multi-node SNCP from:
 - Optical Metro 4100/4150/4200
 - Optical Multiservice Edge 6500
 - Optical Multiservice Edge 6110
 - co-existing on rings:
 - TN-1C/1X

[Table 2-1](#) lists the features available in the Optical Multiservice Edge 6130. For more information about these features, refer to the appropriate reference in this planning guide. The following sections in this chapter give a brief description of the main features.

Table 2-1
Summary of features for current releases

Topic	OME6130 R1.0	Reference
OME6130 hardware		
Chassis	Yes	Chassis on page 4-3
2x155/622M Aggregate circuit pack	Yes	2x155/622M aggregate circuit pack on page 4-8
Single feed DC power supply unit	Yes	DC Power supply unit on page 4-4
Fan module	Yes	Fan module on page 4-5
OAM unit	Yes	OAM circuit pack on page 4-6
Filler faceplate	Yes	Filler faceplate on page 4-18
75 ohm termination panel	Yes	E1 75 ohm termination panel on page 4-18
Tributary interface circuit packs		
8x10/100BT L1	Yes	Tributary interface circuit pack descriptions on page 4-10
2xGE L1	Yes	
28xE1/DS1	Yes	
3xE3/DS3	Yes	
2x155M	Yes	
SFP modules		
STM-1 SR-0 1310 nm	Yes	Small form-factor pluggable (SFP) modules on page 8-10
STM-1/4 S-1.1/S-4.1 1310 nm	Yes	
STM-1/4 L-1.1/L-4.1 1310 nm	Yes	
STM-1/4 L-1.2/L-4.2 1550 nm	Yes	
STM-1/4 CWDM, STM-1 BX, STM-1e	Yes	
GE SX, LX	Yes	
Configurations		
1+1 MSP	Yes	1+1 MSP on page 3-1
SNCP	Yes	SNCP on page 3-1
Unprotected	Yes	Unprotected configuration on page 3-2

Table 2-1 (continued)
Summary of features for current releases

Topic	OME6130 R1.0	Reference
Equipment and facility management		
Equipment management	Yes	Equipment management on page 6-3
Facility Management	Yes	Facility management on page 6-4
Connection management		
VC11, VC12, VC3 and VC4 cross-connects	Yes	Connection management on page 6-13
Service Mapping		
10/100BT Ethernet GFP-F to VC12, VC3	Yes	Generic Framing Procedure on page 6-14
10/100BT Ethernet GFP-F to VC12-nv, VC3-nv (virtual concatenation)	Yes	
Gigabit Ethernet GFP-F to VC3, VC4	Yes	
Gigabit Ethernet GFP-F to VC3-nv, VC4-nv (virtual concatenation)	Yes	
E1 to VC12	Yes	Connection management application on page 6-15
DS1 to VC11	Yes	
E3 to VC3	Yes	
DS3 to VC3	Yes	
Traffic protection		
MSP - STM-1/4	Yes	1+1 MSP traffic protection on page 6-18
SNCP	Yes	SNCP Traffic Protection on page 6-20
Unprotected - STM-1/4	Yes	Unprotected connections on page 6-21
Synchronization		
Internal, BITS, line, port	Yes	Synchronization management on page 6-7
Timing generation hierarchy	Yes	
Timing distribution hierarchy	Yes	
SDH SSM generation/termination	Yes	
2 MHz and 2 Mbits/s ESI/ESO with SSM	Yes	

Table 2-1 (continued)
Summary of features for current releases

Topic	OME6130 R1.0	Reference
Alarms and events		
LEDs indication of shelf and circuit pack status	Yes	Alarm and event management on page 6-27
Alarm and event reporting	Yes	
Alarm reporting control	Yes	
RS, MS, HO path, LO path alarms	Yes	
STM-1/4, E1/DS1, E3/DS3 alarms	Yes	
Performance monitoring		
SDH RS, MS and path	Yes	Performance monitoring on page 6-32
Transceiver (physical PM for SFPs)	Yes	
Ethernet and VCG	Yes	
E1/DS1/E3/DS3 PM parameters	Yes	
System lineup and testing		
SLAT (commissioning tool)	Yes	System Line-up and Test (SLAT) on page 6-2
Loopbacks		
Facility and Terminal Loopbacks (STM-1/4, E1, DS1, E3, DS3, GE)	Yes	Loopbacks on page 6-6
Terminal Loopback (10/100 BT Ethernet)	Yes	
Data management		
NE data backup and restore	Yes	Backing up and restoring the network element database on page 6-42
Security and administration		
Local user account/password management	Yes	Security and administration on page 6-38
Network element naming, date and time	Yes	
Topology Adjacency		
Topology adjacency provisioning and discovery	Yes	Topology adjacency on page 6-41
Data communication network		

Table 2-1 (continued)
Summary of features for current releases

Topic	OME6130 R1.0	Reference
LAN, DCC physical interfaces	Yes	Data communications on page 6-22 and Appendix A: Data communications planning on page 10-1
IP addressing	Yes	
OSI addressing	Yes	
Enable/disable OSPF per network interface	Yes	
IP over OSI GRE tunnel (auto or static)	Yes	
PPP/LAPD over DCC	Yes	
iISIS routing	Yes	
Proxy ARP	Yes	
F1 user channel access	Yes	
OAM via Path DCC (F2/F3 bytes)	Yes	
E1/VC12 management channel	Yes	
OME6130 management		
Web User Interface	Yes	User interface description on page 5-1
SNMP v1 and v2 trap monitoring	Yes	
Interworking		
Nortel portfolio	Yes	Interworking with Nortel portfolio on page 2-16
non-Nortel portfolio	Yes	Interoperating with non-Nortel portfolio on page 2-16

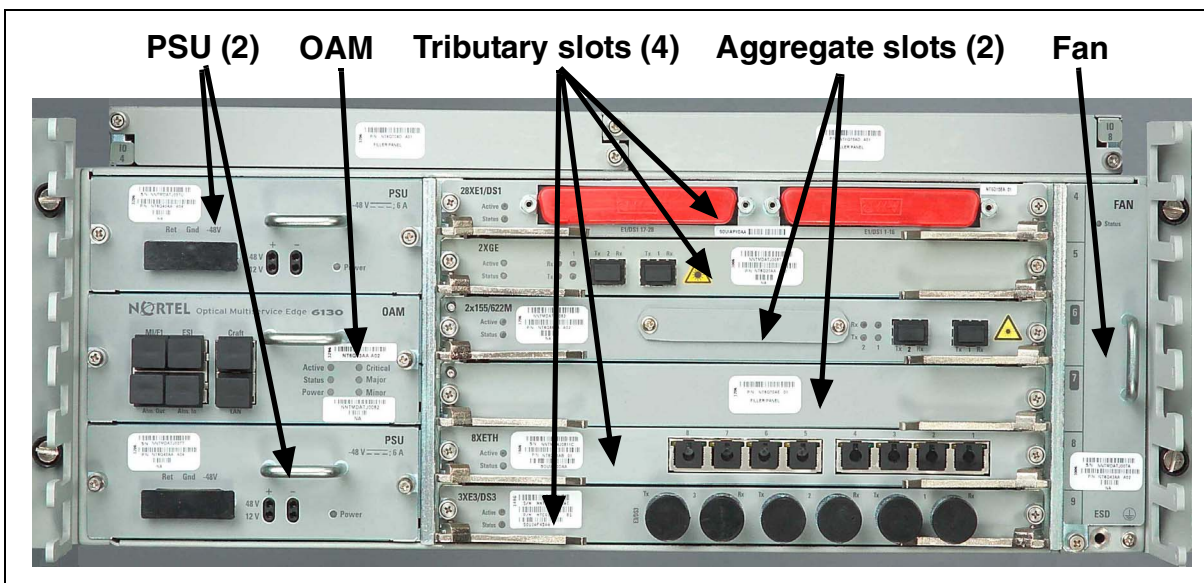
Physical description

The OME6130 hardware platform consists of a chassis which fits in a standard 19 in., 21 in., or 23 in. rack. The chassis is equipped with the following circuit packs:

- one 2x155/622M aggregate circuit pack
- up to 4 service interfaces:
 - 8x10/100BT L1 circuit pack
 - 2xGE L1 circuit pack
 - 28xE1/DS1 circuit pack
 - 3xE3/DS3 circuit pack
 - 2x155M circuit pack
- two single feed DC power supply unit
- OAM circuit pack
- fan module
- filler faceplate

Figure 2-1 provides an overview of the OME6130 chassis layout.

Figure 2-1
OME6130 chassis layout



For more information, refer to “[Hardware description](#)” on page 4-1 and “[OME6130 network element configuration rules](#)” on page 8-2.

Interface circuit packs

The OME6130 Release 1.0 supports one 2x155/622M aggregate circuit pack where two STM-1 or STM-4 line interfaces are present. The OME6130 also supports four tributary slots that can be equipped with the following circuit packs:

- 8x10/100BT L1 circuit pack
- 2xGE L1 circuit pack
- 28xE1/DS1 circuit pack
- 3xE3/DS3 circuit pack
- 2x155M circuit pack

Note: When the tributary slots are not equipped with a circuit pack, a filler panel must be installed.

[Table 2-2](#) provides a summary of the tributary circuit packs supported in OME6130 Release 1.0.

Table 2-2
OME6130 tributary circuit pack summary

Circuit pack	Port density/ circuit pack	Notes
8x10/100BT L1	8	• GFP-F mapped (ITU-T G.7041 compliant)
2xGE L1	2	• GFP-F mapped (ITU-T G.7041 compliant)
28xE1/DS1	28	• unframed E1 • CRC4 framed E1 • unframed DS1 • ESF DS1
3xE3/DS3	3	• unframed E3 • G.832 framed E3 • unframed DS3 • ASYNC framed DS3
2x155M	2	• STM-1 optical and electrical SFPs supported

For more information about the tributary circuit packs, refer to [Tributary interface circuit pack descriptions on page 4-10](#). For more information about slot equipping rules, refer to [Chassis layout on page 8-2](#).

System Line-up and Test (SLAT)

This release supports the ability to configure the system when it is being commissioned for the first time. The user is given an option to initialize the system with a configuration compatible with the NE.

The node capability is provisioned to either STM-1 or STM-4 during initial commissioning. The two SFP interfaces of the 2x155/622M aggregate circuit pack are operating at the rate of the node capability value.

For more information, refer to [System Line-up and Test \(SLAT\) on page 6-2](#)

Configurations

OME6130 currently supports the following configurations for the STM-1/4 line interfaces.

1+1 MSP protection

OME6130 supports 1+1 Multiplex Section Protection (MSP) configurations. For more information, refer to [1+1 MSP on page 3-1](#).

SNCP

OME6130 supports Sub-network connection protection (SNCP) ring configurations.

In a SNCP configuration, traffic is transmitted simultaneously on two separate ports. The traffic is transmitted via different routes through the network to the destination node which selects one of the two paths based on the quality of the received signal. For example, in a ring configuration, the traffic can be transmitted simultaneously on the working fiber in the clockwise direction and on the protection fiber in the counter-clockwise direction.

For more information, refer to [SNCP on page 3-1](#).

Unprotected

OME6130 supports unprotected configurations. For more information, refer to [Unprotected configuration on page 3-2](#).

Connection management

OME6130 supports nodal port-to-port connection management. OME6130 supports the ability to provision bidirectional and unidirectional connections at VC11, VC12, VC3, and VC4 rates.

OME6130 Release 1.0 supports various bandwidth management models that include the following;

- bidirectional connections
- unidirectional connections
- port to port (hair-pinning)
- drop and continue

Note: Only bidirectional connection type is supported for WAN ports corresponding to the 10/100BT Ethernet and Gigabit Ethernet ports.

For more information, refer to [Connection management on page 6-13](#).

Service mapping

All services (Ethernet, E1, DS1, E3, and DS3) are mapped to appropriate SDH containers.

The OME6130 uses Generic Framing Procedure (GFP) as its standards based SDH mapping for Ethernet services. GFP is an ITU standard (G.7041) which describes a flexible mapping technique for transparent transport of multiple protocols in SDH. GFP-Framed (GFP-F) is used for mapping Ethernet to SDH tributaries and containers.

[Table 2-3](#) provides a summary of the service mappings supported in this release.

Table 2-3
OME6130 service mapping

Services	Circuit Pack	Mapping/connection level supported
10/100BT Ethernet	• 8x10/100BT L1	• GFP-F to VC12, and VC3
Gigabit Ethernet	• 2xGE L1	• GFP-F to VC3, and VC-4
E1/DS1	• 28xE1/DS1	• VC12, VC11
E3/DS3	• 3xE3/DS3	• VC3

For more information, refer to [Connection management on page 6-13](#).

Traffic protection

OME6130 supports 1+1 MSP and SNCP traffic protection. The system monitors the traffic facilities for performance degradation and failure and performs protection switching when these conditions are present. [Table 2-4](#) provides a summary of the protection schemes supported in this release.

Table 2-4
Traffic protection summary

Protection scheme	Supported interfaces or circuit packs
1+1 MSP	• STM-1/4 interfaces
SNCP	• STM-1/4 interfaces • 8x10/100BT L1 circuit pack • 2xGE L1 circuit pack • 28xE1/DS1 circuit pack • 3xE3/DS3 circuit pack
Unprotected (default for all supported interfaces)	• STM-1/4 interfaces • 8x10/100BT L1 circuit pack • 2xGE L1 circuit pack • 28xE1/DS1 circuit pack • 3xE3/DS3 circuit pack

For more information, refer to [Traffic protection on page 6-17](#).

Synchronization

Synchronization is a network level application that ensures all nodes across a network can trace back to the same clock source. Within a single node, synchronization prevents buffer overflow or underflow which avoids bit errors.

For more information, refer to [Synchronization management on page 6-7](#).

Alarms and events

The OME6130 provides several mechanisms to identify and localize faults and events.

- light-emitting diodes (LEDs) on the faceplate of a circuit pack indicate the status of the functionality supported on the equipment
 - circuit pack failed on all circuit packs
 - loss of signal on interface circuit packs
 - power LED on the OAM circuit pack provides the power status

- visual alarms interface on the OAM circuit pack provides a summary of active alarms at the shelf level

The OME6130 stores active alarms and events which can be viewed from the local craft access terminal.

The following alarm reporting control features are supported: profile based path alarm control, alarm filter, and facility alarm reporting. The user has the option to enable or disable alarm reporting to the management system, on a per alarm type and per port basis.

For more information, refer to [Alarm and event management on page 6-27](#).

Performance monitoring

Performance monitoring (PM) refers to the continuous collection, analysis and reporting of the performance data of a monitored entity. This monitoring allows early detection of service degradations and facilitates preventive maintenance without interruption of service. PMs can also be used to facilitate trouble and fault isolation. Performance monitoring is performed on all in-service optical and electrical interface ports.

This release supports the following PMs:

- regenerator section (RS) near-end PMs
- multiplex section (MS) near-end and far-end PMs
- High Order (HO) near-end and far-end path PMs
- Low Order (LO) near-end and far-end path PMs
- physical layer PMs for all SFP interfaces
- Ethernet (client facing) and WAN (GFP-F mapped - line facing) PMs
- PDH/DSn line PMs and near-end path PMs

The OME6130 allows the user to retrieve:

- current PM values (15 minute and 1-Day values in progress)
- recent history (32 previous 15 minute and previous day values stored on the network element)

The OME6130 supports threshold crossing alerts (TCA) to advise the user when a PM parameter threshold has been exceeded. The user can enable or disable the TCAs for the RS, MS, and SDH path parameters and when enabled, the PM thresholds are user-provisionable.

For more information, refer to [Performance monitoring on page 6-32](#).

Loopbacks

The OME6130 supports facility loopbacks on the STM-1/4, PDH/DSn and GE ports, and terminal loopbacks on all ports, including the 10/100 Ethernet ports on the 8x10/100BT L1 circuit pack. The loopbacks provide a quick and reliable way to sectionalize connections during testing and troubleshooting.

For more information, refer to [Loopbacks on page 6-6](#).

Data management

The OME6130 is responsible for the resilience of its provisioning data and ensures that a copy is preserved on flash.

The OME6130 provides the capability to backup and/or restore the provisioning data to/from an external storage device.

For more information, refer to [Backing up and restoring the network element database on page 6-42](#).

Security and administration

The OME6130 provides the following security and administration capabilities managed from the Local Craft Access Terminal:

- Network element security
 - security levels
 - login sessions
 - local password management
 - local user authentication
- Network element administration
 - network element naming
 - date and time setting

For more information, refer to [Security and administration on page 6-38](#).

Topology Adjacency

Through OMEA management, the topology adjacency feature on the OME6130 provides the capability to manually provision the neighbor status information or to automatically discover it.

For more information, refer to [Topology adjacency on page 6-41](#).

Data communication network

OME6130 uses an IP-based data communications infrastructure for network element management and for interworking with IP-based network elements. OME6130 also supports IP over OSI via GRE for interworking with OSI-based network elements. iISIS is supported as the internal DCN routing protocol and can be enabled on the DCC interfaces.

The OME6130 supports the following types of management interfaces:

- LAN port for interface to a data communications network (DCN). Proxy ARP is supported on the LAN port.
- M1/F1 port for modem and user data channel access.
- RS, MS and Path (F2, F3 and F2-F3) DCC for OAM&P access to remote network elements
- management channel via VC12 circuit or E1 channel
- overhead tunnel provisioning for DCC transparency (for interoperability with other vendors' equipment)

For more information, refer to [Data communications on page 6-22](#). For more information on DCN planning, refer to [Appendix A: Data communications planning on page 10-1](#).

OME6130 management

Local Craft Access Terminal

The OME6130 supports a comprehensive suite of OAM&P functionality which can be managed through a web-based local craft access user interface. The local craft user interface is a graphical, nodal management tool that is inherent on the network element software load and can be launched via a web browser.

The local craft access user interface is launched from a web browser which can be running on Windows, UNIX or Solaris workstations ensuring field technicians and NOC operators are operating with the same view.

For more information, refer to [User interface description on page 5-1](#).

SNMP traps

The OME6130 system events can be monitored through SNMP traps raised by the NE, based on the MIB tables.

For more information, refer to [SNMP traps on page 5-2](#).

Interworking with Nortel portfolio

The OME6130 interworks with the following products:

- Nortel Optical Manager and Optical Applications Platform
- Nortel products through STM-1/4 interfaces

OME6130 Release 1.0 will operate with the following network management software:

- Optical Manager Element Adapter (OMEA) Release 4.0 Patch A Bundle and OMEA Release 5.0

In this release, the OME6130 interworks with:

- the Optical Metro 4000-series, the TransportNode TN-1C/1X, and the Optical Multiservice Edge 6500 products through STM-1/4 interfaces.

For more information, refer to [OME6130 interworking with other products on page 3-2](#).

Interoperating with non-Nortel portfolio

The OME6130 is a standards compliant product that can operate with subtending products that support standard compliant STM-1/4 interfaces. You must note that multi-vendor mid span meet applications depend on the configuration and MSP mode of interest.

Configurations and interworking

This chapter describes how the Optical Multiservice Edge 6130 (OME6130) Release 1.0 fits in a network and interworks with other Nortel Networks products. [Table 3-1](#) lists the topics in this chapter.

Table 3-1
Topics in this chapter

Topic	Page
1+1 MSP	3-1
SNCP	3-1
Unprotected configuration	3-2
OME6130 interworking with other products	3-2

For an overview of the OME6130 applications supported by this release, refer to [OME6130 applications on page 1-3](#).

1+1 MSP

1+1 Multiplex Section Protection (MSP) configuration is a line level traffic protection scheme and consists of a point-point configuration with two optical fiber pairs carrying the traffic (one for working and the other for protection). The 1+1 MSP protection is also supported for STM-1e interface. Traffic is carried on both working and protection STM-1/4 lines and the receiving interfaces determine which line to select based on signal quality or user-initiated actions. The OME6130 supports 1+1 MSP protection switching on the STM-1/4 line interfaces.

For more information about 1+1 MSP protection configuration rules, refer to [Shelf equipping rules on page 8-4](#). For more information about the 1+1 MSP protection scheme, refer to [1+1 MSP traffic protection on page 6-18](#).

SNCP

A Sub-network connection protection (SNCP) is a path level traffic protection scheme. In SNCP configuration, the destination node selects one of the two paths based on the quality of the received signal.

The OME6130 supports SNCP protection switching on all optical, electrical and service interfaces on the network element.

For more information about SNCP protection configuration rules, refer to [Shelf equipping rules on page 8-4](#). For more information about the SNCP protection scheme, refer to [SNCP Traffic Protection on page 6-20](#).

Unprotected configuration

OME6130 unprotected configuration on the STM-1/4 line interface ports has a single pair of optical fibers interconnecting network elements. The unprotected configuration is supported for STM-1e interface. Unprotected connection configuration is also supported on all tributary circuit packs available in this release:

- 8x10/100BT L1 circuit pack
- 2xGE L1 circuit pack
- 28xE1/DS1 circuit pack
- 3xE3/DS3 circuit pack
- 2x155M circuit pack

For more information about the unprotected protection scheme, refer to [Unprotected connections on page 6-21](#).

OME6130 interworking with other products

OME6130 is compliant with SDH standards and therefore enables interworking with other SDH compliant network elements.

As shown in [Table 3-2](#), OME6130 Release 1.0 operates with the following network management software.

Table 3-2
Network management software that operates with OME6130 Release 1.0

Product	Releases	Functionality
Optical Application Platform	10 / 11	• Fault • Reach through to NE Craft UI
Optical Manager Element Adaptor	4.0 Patch A Bundle	• Fault • Reach through to NE Craft UI
Optical Manager Element Adaptor	5.0	• Fault • Reach through to NE Craft UI • Connection Services with OSP • PM • Back-up & restore • Software delivery • Topology discovery

In order to be able to launch the Craft UI from the Optical Network Manager (ONM AP) platform, a file needs to be installed on the ONM AP server. Refer to the *Optical Manager Element Adapter NTP Library, Installation and Configuration Guide*, 450-3121-201 for more information.

As shown in [Table 3-3](#), OME6130 Release 1.0 interworks with Nortel Networks products through STM-1/4 interfaces or Ethernet/PDH/DSn interfaces. For more information on OME6130 interworking rules and guidelines, refer to the *Network Interworking Guide*, NTCA68CA.

Table 3-3
Nortel Networks products that interwork with OME6130 Release 1.0

Product	Release
TN-1C	7
TN-1X	9
Optical Metro 4100	4.9
Optical Metro 4150	8
Optical Metro 4200	5
Optical Multiservice Edge 6110	2.0, 2.1
Optical Multiservice Edge 6130	1.0
Optical Multiservice Edge 6500	1.2, 2.0, 2.1, 3.0

Note: See [Interoperating with non-Nortel portfolio on page 2-16](#) for more details.

Hardware description

This chapter provides an overview of the Optical Multiservice Edge 6130 (OME6130) hardware. This chapter describes the OME6130 chassis, modules and circuit packs, as listed in [Table 4-1](#).

Table 4-1
Topics in this chapter

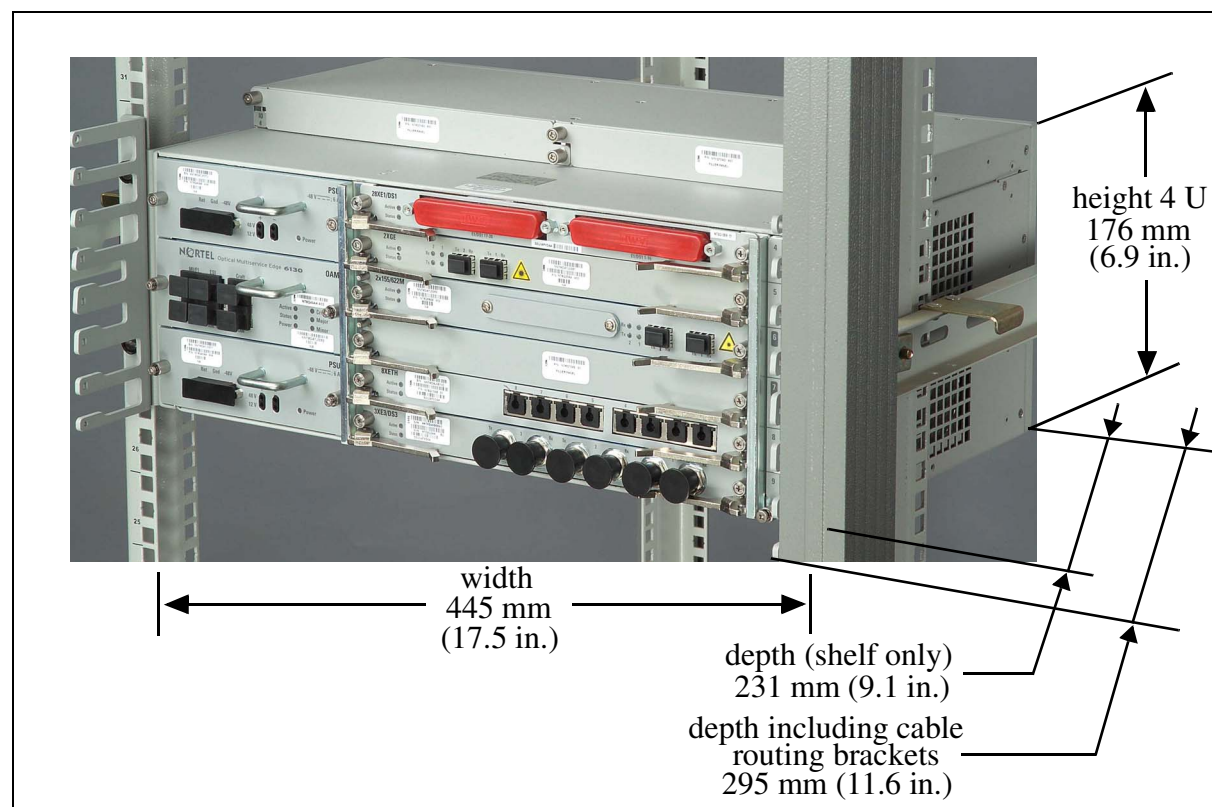
Topic	Page
Hardware architecture	4-2
Chassis	4-3
DC Power supply unit	4-4
Fan module	4-5
OAM circuit pack	4-6
2x155/622M aggregate circuit pack	4-8
Tributary interface circuit pack descriptions	4-10
Filler faceplate	4-18
E1 75 ohm termination panel	4-18
Cable routing	4-19

Hardware architecture

The OME6130 platform, as shown in [Figure 4-1](#), consists of a chassis which can be equipped with the following cards:

- 2x155/622M aggregate circuit pack
- Tributary interface circuit packs:
 - 8x10/100BT L1 circuit pack
 - 2xGE L1 circuit pack
 - 28xE1/DS1 circuit pack
 - 3xE3/DS3 circuit pack
 - 2x155M circuit pack
- single feed DC power supply unit
- OAM circuit pack
- fan module

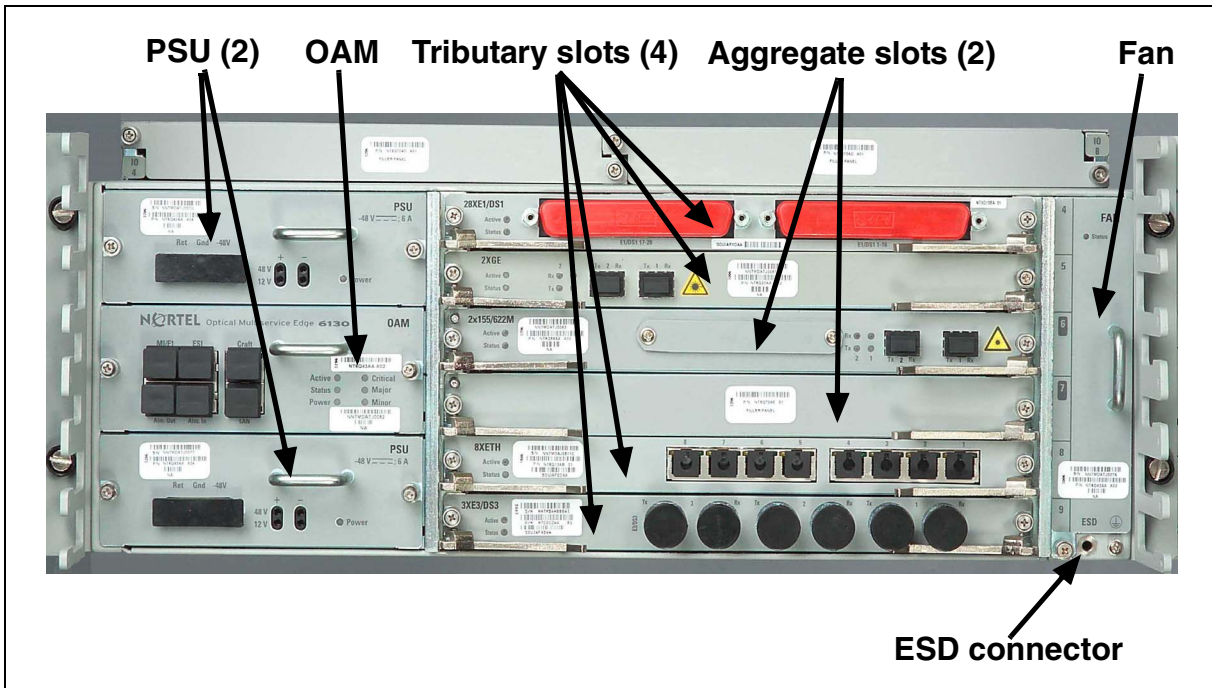
Figure 4-1
OME6130 chassis dimensions



Chassis

Figure 4-2 provides an overview of the OME6130 chassis layout.

Figure 4-2
OME6130 chassis layout



The Table 4-2 provide the PEC for the OME6130 chassis.

Table 4-2
OME6130 chassis

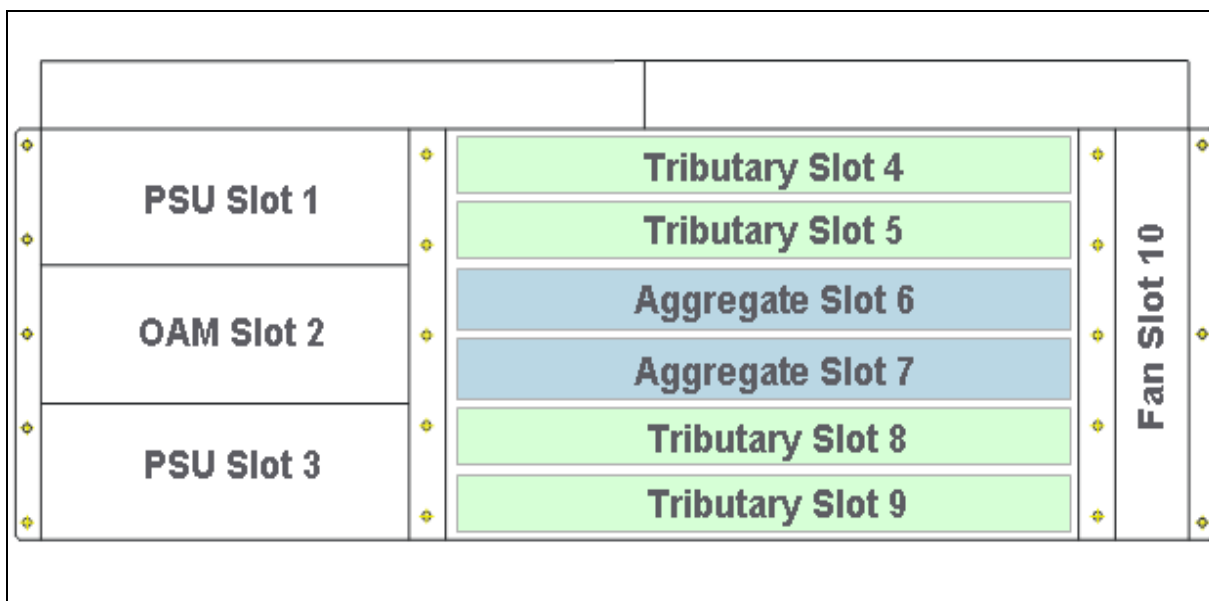
Chassis	OME6130 System PEC
OME6130 Release 1.0	NT6Q60AA

Refer to [Ordering information and system engineering rules on page 8-1](#) for more information.

Slot numbers

Figure 4-3 shows the slot numbers for the OME6130 chassis.

Figure 4-3
OME6130 slot numbers



DC Power supply unit

DC PSU 150W single feed

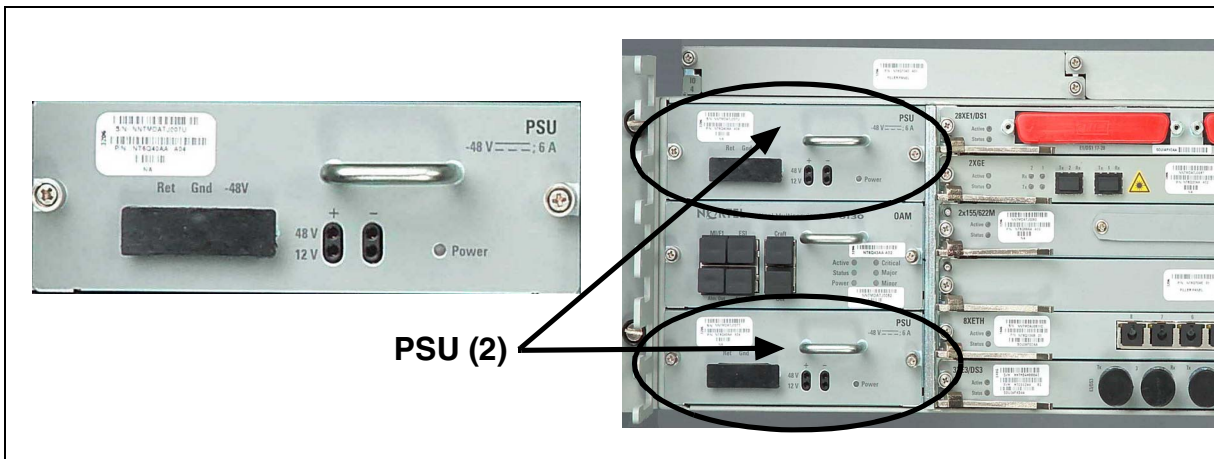
The OME6130 supports a power supply unit with single -48 V dc power feed. The chassis is equipped in normal operation with two DC PSU circuit packs for redundancy.

The DC power supply unit, as shown in Figure 4-4, is located at the left of the chassis and provides the following functionality:

- operates over the range -40 V to -57.5 V dc
- 150 W capacity
- single power input
- local safety ground point
- monitors voltage on input power feed and the value displayed on the user interface can be used as general guidance
- low and high voltage thresholds for voltage alarms to the user interface

Refer to [Ordering information and system engineering rules on page 8-1](#) for the PEC information. Two DC PSUs come equipped with the chassis, but can also be ordered separately for sparing.

Figure 4-4
OME6130 DC power supply unit



Fan module

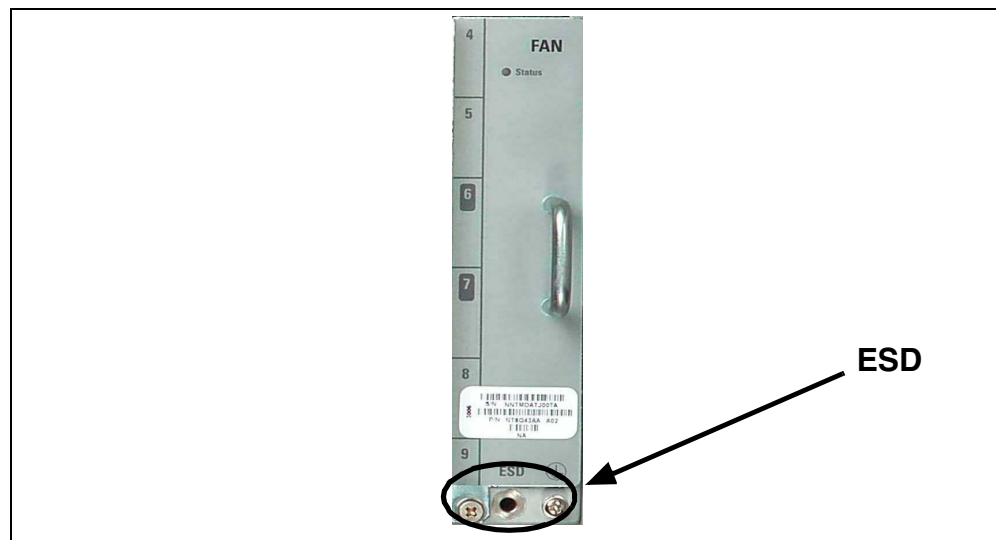
The OME6130 chassis is equipped with a fan module that is located on the right side of the chassis, as shown in [Figure 4-2 on page 4-3](#). Four fans are integrated within the module and are continuously being monitored for failures.

The air filter is field replaceable and it can be ordered separately for sparing or replacement.

ESD interface

The ESD interface is located below the fan module and is used to connect an antistatic wrist strap required when handling circuit packs to avoid damage as a result of electrostatic discharge. [Figure 4-5 on page 4-6](#) shows the location of the ESD interface below the fan module of the OME6130.

Figure 4-5
OME6130 fan module



Refer to [Ordering information and system engineering rules on page 8-1](#) for the PEC information. The fan module comes equipped with the chassis, but can also be ordered separately for sparing.

OAM circuit pack

The OAM circuit pack provides a Craft port which allows for local craft Web User Interface (WUI) access and LAN port which allows for remote access to the network element via the data communications network. The OAM circuit pack is equipped with six ports:

- Craft
- LAN
- external synchronization input (ESI)
- alarm output
- alarm input
- M1/F1

[Figure 4-6](#) shows the OAM circuit pack. [Table 4-3](#) provides a description of the OAM interfaces.

Figure 4-6
OAM circuit pack

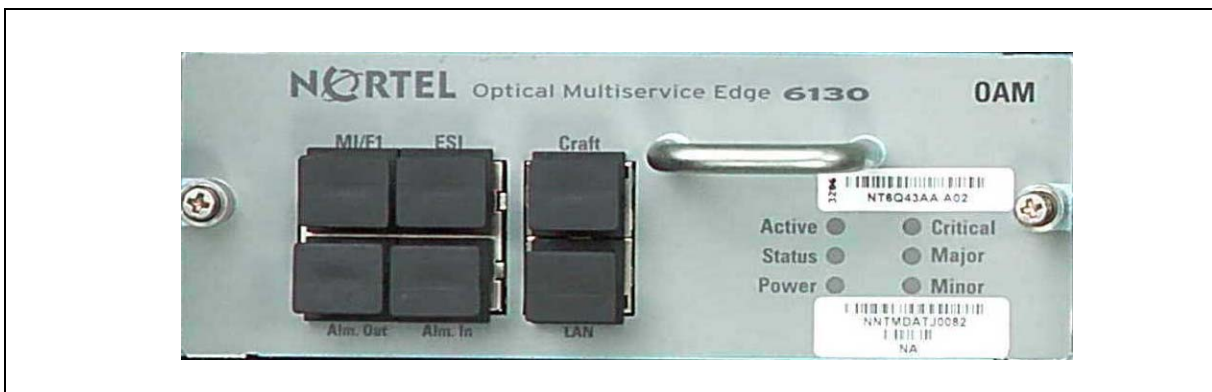


Table 4-3
OAM port descriptions

Port	Physical interface	Description
Craft	• RJ-45 connector	• 10/100Base-T connectivity between the local craft PC and the OME6130.
LAN	• RJ-45 connector	• Central office LAN provides switched 10/100Base-T connectivity between the carrier's DCN and the OME6130.
ESI	• RJ-45 connector	• Two external synchronization inputs for timing generation references which enable the OME6130 to be timed from an external timing reference of G.813 Option 1 or better quality. Both clock and data formats are supported. • External synchronization outputs for timing distribution references which enable other network elements to be timed from the OME6130.
Alarm output	• RJ-45 connector	• Alarm output port enables the customer to monitor the shelf level alarms (Critical, Major and minor) onto external equipment, such as lights or sirens. • These contacts are normally open.
Alarm input	• RJ-45 connector	• Seven telemetry inputs enable the customer to connect external environmental monitoring equipment to the OME6130 (for example, door open indicator, fire alarm, and flood alarm). • The alarm inputs are operating as follows: open circuit = no alarm closed circuit = alarm
M1/F1	• RJ-45 connector	• Remote dial-in access through modem to the OME6130. • F1 user byte access (for clear channel access)

Refer to [Connector pinouts on page 7-5](#) for details on the connector pinouts for the OAM ports.

2x155/622M aggregate circuit pack

The 2x155/622M aggregate circuit pack must be installed in the slot 6 on the OME6130 chassis. [Figure 4-7](#) shows the faceplate of a 2x155/622M aggregate circuit pack.

The 2x155/622M aggregate circuit pack is the main circuit pack of the OME6130 NE and it provides the following functionality:

- Cross-connect matrix: refer to [Connection management on page 6-13](#) for more details
- Shelf control: refer to [OAM&P description on page 6-1](#) for more details
- Synchronization: refer to [Synchronization management on page 6-7](#) for more details
- Two STM-1 or STM-4 interfaces: see below for more details

The STM-1 or STM-4 rate for the line interfaces is provisioned by the user during the commissioning of the OME6130 network element. The two line interfaces of the 2x155/622M aggregate circuit pack are operating with the same rate.

The 2x155/622M aggregate circuit pack supports pluggable optical transceivers for the two STM-1/4 line interfaces. The STM-1 and STM-4 optical interfaces use small form-factor pluggable (SFP) interfaces to deliver optical rate and reach flexibility on a per port basis. The STM-1/4 optical interfaces use SFP modules for short reach, intermediate reach and long reach, and CWDM access applications. [Figure 4-7](#) shows the STM-1/4 optical interface ports on the right side of the 2x155/622M aggregate circuit pack.

The STM-1 ports of the 2x155/622M aggregate circuit pack can be equipped with electrical SFP modules for intra office applications when the OME6130 NE is commissioned with STM-1 line rate.

The PEC for the 2x155/622M aggregate circuit pack is listed in [Table 4-4](#).

Table 4-4
2x155/622M aggregate circuit pack

2x155/622M aggregate circuit pack	PEC code
2x155/622M aggregate	NT6Q45AA

Note: The NT6Q45AA PEC cannot be ordered. The NT6Q66AA PEC should be used to order the 2x155/622M aggregate circuit pack with Release 1.0 software.

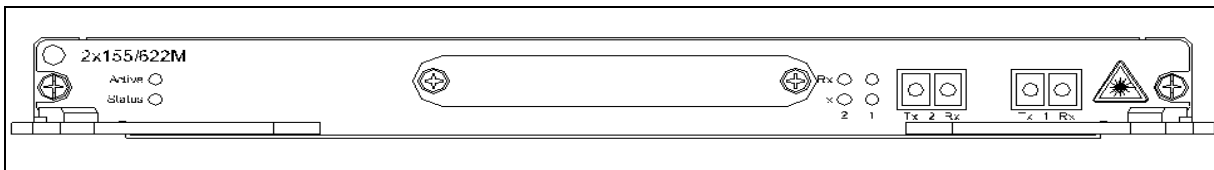
The PEC for the 2x155/622M aggregate circuit pack with Release 1.0 software is listed in [Table 4-5](#).

Table 4-5
2x155/622M aggregate circuit pack with Release 1.0 software

2x155/622M aggregate circuit pack	PEC code
2x155/622M aggregate with Release 1.0 software	NT6Q66AA

Note: The NT6Q66AA PEC should be used to order the 2x155/622M aggregate circuit pack with Release 1.0 software. The NT6Q66AA PEC includes one NT6Q45AA 2x155/622M aggregate circuit pack and one NT6Q87AA OME6130 Release 1.0 software.

Figure 4-7
2x155/622M aggregate circuit pack



STM-1/4 functionality overview

The STM-1/4 interfaces provide the following functionality:

- supports STM-1 or STM-4 (SDH) services
- auto-detection of SFP modules, which are hot pluggable
- auto provisioning of STM-1 or STM-4 specific SFPs
- supports optical SFPs at the STM-4 rate
- supports optical and electrical SFPs at the STM-1 rate
- supports single fiber working (SFW) SFPs at the STM-1 rate
- terminates RS and MS overhead
 - terminates RS and MS overhead bytes in Rx direction
 - inserts RS and MS overhead bytes in Tx direction
- RS DCC selectable (default is Off)
- MS DCC selectable (default is Off)
- supports RS DCC or MS DCC transparency for pass through functionality on overhead tunnels
- supports RS, MS, path and tributary unit (TU) PMs
- monitors transceiver values, such as optical received and transmit powers
- selectable automatic laser shutdown controlled by software

- supports unprotected, 1+1 MSP, and SNCP traffic protection schemes
- line timing synchronization support (provides the handover between the line timing and the shelf)

Refer to [Optical specifications on page 7-23](#) for specifications of the SFPs and the sections in [OAM&P description on page 6-1](#) for more details on functionality supported.

Tributary interface circuit pack descriptions

This section provides an overview of the tributary interface circuit packs. The circuit packs can be equipped in the tributary slots 4, 5, 8, and 9 of the chassis (see [Figure 4-2 on page 4-3](#)).

OME6130 Release 1.0 supports the circuit packs listed in [Table 4-6](#).

Table 4-6
OME6130 service modules

Interface circuit pack	Page
8x10/100BT L1 circuit pack	4-11
2xGE L1 circuit pack	4-13
28xE1/DS1 circuit pack	4-15
3xE3/DS3 circuit pack	4-16
2x155M circuit pack	4-17

8x10/100BT L1 circuit pack

The 8x10/100BT L1 circuit pack can be installed in the tributary slots on the OME6130 chassis to offer 10/100BT Ethernet services. [Figure 4-8](#) shows the faceplate of a 8x10/100BT L1 circuit pack.

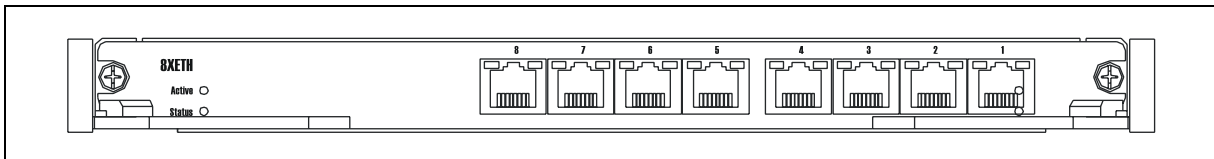
The PEC for the 8x10/100BT L1 circuit pack is listed in [Table 4-7](#).

Table 4-7

8x10/100BT L1 circuit pack

8x10/100BT L1 circuit pack	PEC code
8x10/100BT L1	NT6Q13AB

Figure 4-8
8x10/100BT L1 circuit pack



8x10/100BT L1 functionality overview

The 8x10/100BT L1 circuit pack consists of two entities (client facing and line facing):

- client facing interfaces referred to as 10/100BT Ethernet ports
- line facing (mapped for transport via SDH containers) interfaces referred to as WAN ports

The 8x10/100BT L1 circuit pack supports the following:

- supports the transport of up to eight (8) 10/100BT services ports
- mapping of 10/100BT Ethernet to/from SDH containers via Framed GFP at following levels:
 - VC12 and VC3 operating granularity
 - virtual concatenation (VC12-nv, where n=1 to 63 and VC3-nv, where n = 1 to 3)
- the total bandwidth available for connections on the 8x10/100BT L1 circuit pack is STM-1 (155 Mb/s). The bandwidth is shared between the 8 10/100BT ports of the circuit pack
- The maximum bandwidth is 10 Mb/s for the 10BT ports and 100 Mb/s for the 100BT ports
- supports provisionable Ethernet link integrity (Enabled or Disabled)
- supports provisionable Ethernet auto-negotiation (Enable or Disable) with the local Ethernet link partner as per clause 37 of IEEE 802.3-2000

- supports half or full duplex mode
 - 64 byte to 9600 byte Ethernet frame support
 - supports provisionable Ethernet maximum transfer unit (MTU) between 64 and 9600 (default) bytes
 - supports Ethernet flow control capabilities
 - Manual Tx-Rx (default), Manual Tx-Only, Manual Rx-Only
 - None (advertises flow control not supported)
 - Both (advertises asymmetric or symmetric flow control toward the local device)
 - Asymmetric (advertises asymmetric flow control toward the link partner)
 - Symmetric (advertises symmetric flow control toward the link partner)
- Note:** This attribute is ignored when auto-negotiation is disabled.
- supports provisionable Link Capacity Adjustment Scheme (LCAS) (Enabled or Disabled) as per G.7402/Y.1305
 - Ethernet and WAN PMs

Note 1: 10/100BT Ethernet services map to SDH containers and are assigned as WAN associations to the STM-1/4 interfaces. They can therefore use the traffic protection schemes supported by the STM-1/4 interfaces to provide a protected 10/100BT Ethernet service without the requirement of a redundant handoff from the subtending Ethernet equipment.

Note 2: Ethernet shielded twisted pair (STP) cables must be used to connect to 10/100BT Ethernet ports on the 8x10/100BT L1 circuit pack.

Refer to [Ordering information and system engineering rules on page 8-1](#) for the associated PEC and the sections in [OAM&P description on page 6-1](#) for more details on functionality supported.

2xGE L1 circuit pack

The 2xGE L1 circuit pack can be installed in the tributary slots on the OME6130 chassis to offer Gigabit Ethernet services. [Figure 4-9](#) shows the faceplate of a 2xGE L1 circuit pack.

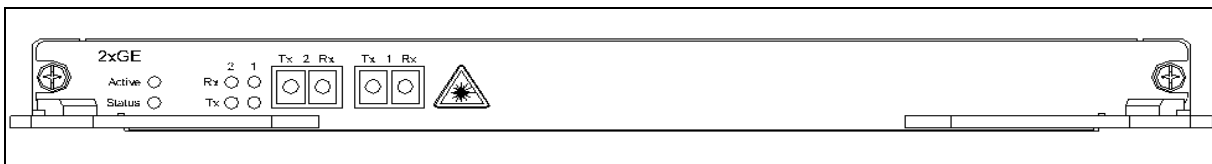
The 2xGE L1 circuit pack supports pluggable optical transceivers for the two GE interfaces. The GE optical interfaces use small form-factor pluggable (SFP) interfaces to deliver optical rate and reach flexibility on a per port basis. The GE optical interfaces use SFP modules for short reach (SX) and intermediate reach (LX) applications. [Figure 4-9](#) shows the GE optical interface ports on the 2xGE L1 circuit pack.

The PEC for the 2xGE L1 circuit pack is listed in [Table 4-8](#).

Table 4-8
2xGE L1 circuit pack

2xGE L1 circuit pack	PEC code
2xGE L1	NT6Q20AA

Figure 4-9
2xGE L1 circuit pack



2xGE L1 functionality overview

The 2xGE L1 circuit pack consists of two entities (client facing and line facing):

- client facing interfaces referred to as Gigabit Ethernet ports
- line facing (mapped for transport via SDH containers) interfaces referred to as WAN ports

The 2xGE L1 circuit pack supports the following:

- supports the transport of up to two (2) Gigabit Ethernet services ports
- mapping of Gigabit Ethernet to/from SDH containers via Framed GFP at following levels:
 - VC3 and VC4 operating granularity
 - contiguous concatenation at VC4
 - virtual concatenation (VC3-nv, where n = 1 to 12 and VC4-nv, where n = 1 to 4)

- the total bandwidth available for connections on the 2xGE L1 circuit pack is 4 x STM-1 (622 Mb/s). The bandwidth is shared between the two GE ports of the circuit pack
 - supports provisionable Ethernet link integrity (Enabled or Disabled)
 - supports provisionable Ethernet auto-negotiation (Enable or Disable) with the local Ethernet link partner as per clause 37 of IEEE 802.3-2000
 - supports full duplex mode
 - 64 byte to 9600 byte Ethernet frame support
 - supports provisionable Ethernet maximum transfer unit (MTU) between 64 and 9600 (default) bytes
 - supports Ethernet flow control capabilities
 - None (advertises flow control not supported)
 - Both (advertises asymmetric or symmetric flow control toward the local device)
 - Asymmetric (default) (advertises asymmetric flow control toward the link partner)
 - Symmetric (advertises symmetric flow control toward the link partner)
- Note:** This attribute is ignored when auto-negotiation is disabled.
- supports provisionable Link Capacity Adjustment Scheme (LCAS) (Enabled or Disabled) as per G.7402/Y.1305
 - Ethernet and WAN PMs

Note: Gigabit Ethernet services map to SDH containers and are assigned as WAN associations to the STM-1/4 interfaces. They can therefore use the traffic protection schemes supported by the STM-1/4 interfaces to provide a protected Gigabit Ethernet service without the requirement of a redundant handoff from the subtending Gigabit Ethernet equipment.

Refer to [Optical specifications on page 7-23](#) for specifications of the SFPs. Refer to [Ordering information and system engineering rules on page 8-1](#) for the associated PEC and the sections in [OAM&P description on page 6-1](#) for more details on functionality supported.

28xE1/DS1 circuit pack

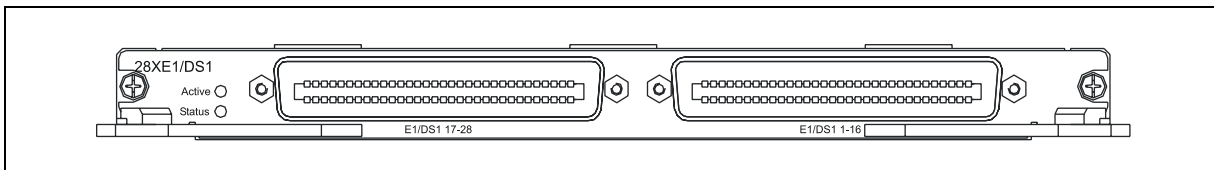
The 28xE1/DS1 circuit pack can be installed in the tributary slots of the OME6130 chassis. [Figure 4-10](#) shows the faceplate of a 28xE1/DS1 circuit pack.

The PEC for the 28xE1/DS1 circuit pack is listed in [Table 4-9](#).

Table 4-9
28xE1/DS1 circuit pack

28xE1/DS1 circuit pack	PEC code
28xE1/DS1	NT6Q10AA NT6Q10AB

Figure 4-10
28xE1/DS1 circuit pack faceplate



28xE1/DS1 functionality overview

The 28xE1/DS1 circuit pack supports the following:

- supports up to 28 E1/DS1 services (120/100 ohm balanced)
- mapping of E1/DS1 signals to VC12/VC11 containers
- support for framed E1 (CRC4) / DS1 (ESF) or unframed signals monitoring
- supports E1/DS1 line PMs
- supports unprotected and SNCP traffic protection schemes
- supports NE synchronization on any of 1, 4, 7, 10, 13, 16, 19, 22, 25 or 28 E1 ports
- can be configured to carry either E1 traffic or DS1 traffic on all 28 ports of the circuit pack, independent of the NE mode (SDH). A mix of E1 and DS1 traffic services is not supported.

Refer to the sections in [OAM&P description on page 6-1](#) for more details on functionality supported.

3xE3/DS3 circuit pack

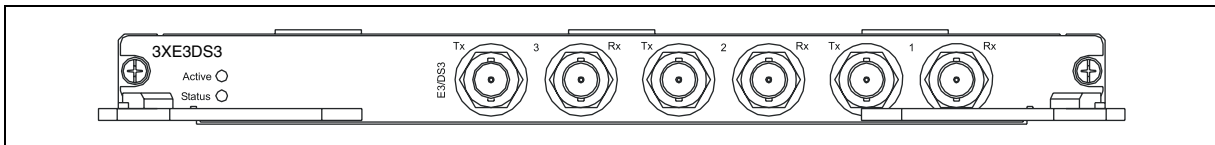
The 3xE3/DS3 circuit pack can be installed in the tributary slots of the OME6130 chassis. [Figure 4-11](#) shows the faceplate of a 3xE3/DS3 circuit pack.

The PEC for the 3xE3/DS3 circuit pack is listed in [Table 4-10](#).

Table 4-10
3xE3/DS3 circuit pack

3xE3/DS3 circuit pack	PEC code
3xE3/DS3	NT6Q12AA

Figure 4-11
3xE3/DS3 circuit pack faceplate



3xE3/DS3 functionality overview

The 3xE3/DS3 circuit pack supports the following:

- supports up to 3 E3/DS3 services (75 ohm)
- mapping of E3/DS3 signals to VC3 containers
- support for framed E3 (G.832) / DS3 (M13) or unframed signals monitoring
- supports E3/DS3 line and path PMs
- supports unprotected and SNCP traffic protection schemes
- each port can be independently configured to carry E3 or DS3 traffic. A mix of E3 and DS3 services is supported.

Refer to the sections in [OAM&P description on page 6-1](#) for more details on functionality supported.

2x155M circuit pack

The 2x155M circuit pack can be installed in the tributary slots of the OME6130 chassis. [Figure 4-12](#) shows the faceplate of a 2x155M circuit pack.

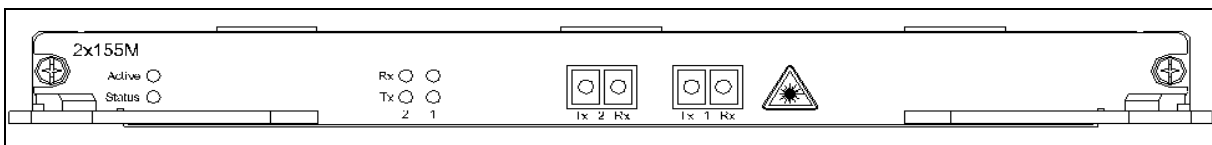
The 2x155M circuit pack supports pluggable optical and electrical transceivers for the two STM-1 line interfaces. The STM-1 optical and electrical interfaces use small form-factor pluggable (SFP) interfaces to deliver optical and electrical rate and reach flexibility on a per port basis. The STM-1 optical interfaces use SFP modules for short reach, intermediate reach and long reach, and CWDM access applications. The STM-1 electrical interfaces use SFP modules for intra office applications. [Figure 4-7](#) shows the STM-1 interface ports on the center of the 2x155M circuit pack.

The PEC for the 2x155M circuit pack is listed in [Table 4-11](#).

Table 4-11
2x155M circuit pack

2x155M circuit pack	PEC code
2x155M	NT6Q17AA

Figure 4-12
2x155M circuit pack faceplate



2x155M functionality overview

The 2x155M circuit pack supports the following:

- supports up to 2 STM-1 optical (o) or electrical (e) services
- auto-detection of SFP modules, which are hot pluggable
- auto provisioning of STM-1 specific optical and electrical SFPs
- supports single fiber working (SFW) SFPs at the STM-1 rate
- terminates RS and MS overhead
 - terminates RS and MS overhead bytes in Rx direction
 - inserts RS and MS overhead bytes in Tx direction
- RS DCC selectable (default is Off)
- MS DCC selectable (default is Off)
- supports RS DCC or MS DCC transparency for pass through functionality on overhead tunnels
- supports RS, MS, path and tributary unit (TU) PMs

- monitors transceiver values, such as optical received and transmit powers
- selectable automatic laser shutdown controlled by software
- supports unprotected, 1+1 MSP, and SNCP traffic protection schemes
- line timing synchronization support (provides the handover between the line timing and the shelf)

Refer to [Optical specifications on page 7-23](#) for specifications of the SFPs and the sections in [OAM&P description on page 6-1](#) for more details on functionality supported.

Filler faceplate

The filler faceplate is required to cover the unused tributary slots 4, 5, 8 and 9. The slot 7 will be used in a future release for the protection aggregate circuit pack but in OME6130 Rel 1.0, the slot 7 must be equipped with a filler faceplate. If no additional tributary circuit packs are required a filler faceplate must be used to cover the empty slots to ensure proper airflow through the chassis and to ensure EMI compliance. [Figure 4-2 on page 4-3](#) displays the chassis with a filler faceplate installed over the slot 7.

Refer to [Ordering information and system engineering rules on page 8-1](#) for the associated PEC. The filler faceplate must be ordered separately.

E1 75 ohm termination panel

The conversion from 120 ohm to 75 ohm E1 service interfaces can be achieved for the 28xE1/DS1 circuit pack.

The conversion is achieved by connecting the Telco connectors of the 28xE1/DS1 circuit pack to a 1U high 16-channel termination panel. The termination panel is equipped with 16 BNC connectors. This 75 ohm termination panel can only be used for E1 services.

Note: The 75 ohm termination panel is labeled from 1-16 by default, but includes an additional overlay label which can be installed by the user when connecting the ports 17-28 of the 28xE1/DS1 circuit pack.

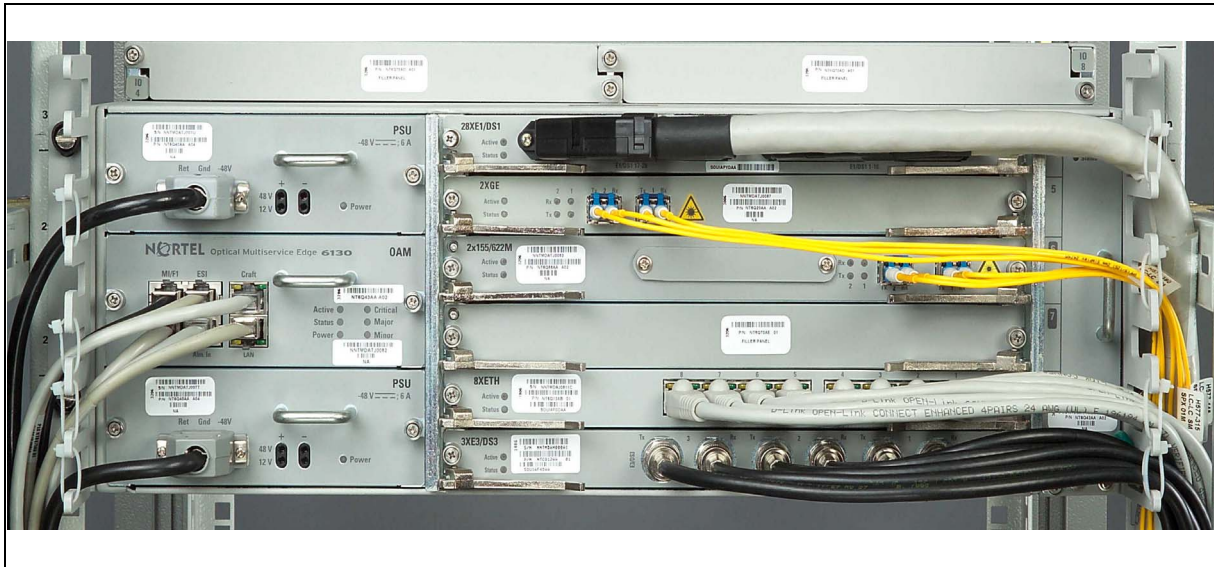
A 64-pin to 64-pin male connector cable must be used to connect to the termination panel. For more information regarding the 75 ohm termination panel and the cable pinout information, refer to [E1/DS1 cable pinouts and assemblies on page 7-18](#)

Cable routing

The cable routing brackets which are installed at either side of the OME6130 shelf allows for the management of the power cables, OAM cables, optical fibers and the Ethernet/PDH/DSn service cables. The cable routing brackets are placed over the mounting brackets during the installation of the OME6130 shelf. [Figure 4-13](#) shows the mounting and cable routing brackets for OME6130.

For more information on the installation of the cable routing brackets, refer to *Installation, Commissioning and Testing Procedures*, 323-1855-201. The cable routing brackets come as part of the OME6130 shelf assembly kit. Refer to [Ordering information and system engineering rules on page 8-1](#) for ordering details of the OME6130 shelf assembly kit.

Figure 4-13
OME6130 mounting and cable routing brackets



OME6130 Shelf assembly kit

It is recommended to order one OME6130 shelf assembly kit for each NE.

The PEC for the OME6130 shelf assembly kit is listed in [Table 4-12](#).

Table 4-12

OME6130 Shelf assembly kit

OME6130 Shelf assembly kit	PEC code
OME6130 Shelf assembly kit	NT6Q70CA

The OME6130 shelf assembly kit contains the following components:

- cable routing brackets
- rack mounting screws
- 21” and 23” flange
- cage nuts
- earthing cable

Note: The 19” shelf mounting brackets are included in the OME6130 Release 1.0 System Kit (NT6Q60AA) so they do not need to be ordered separately.

Refer to [Ordering information and system engineering rules on page 8-1](#) for ordering details of the OME6130 shelf assembly kit.

User interface description

This chapter provides an overview of the craft user interface available for the Optical Multiservice Edge 6130 (OME6130) Release 1.0. [Table 5-1](#) lists the topics in this chapter.

Table 5-1
Topics in this chapter

Topic	Page
OME6130 local craft access terminal	5-1
SNMP traps	5-2

OME6130 local craft access terminal

The OME6130 local craft access user interface is a graphical, nodal management tool that is available inherently on the network element software. The local craft access user interface is launched via an HTTP web-browser that runs on any computing platform. [Table 5-2](#) provides a list of minimum requirements for various web browsers. The craft user interface provides full access to the OME6130 network element across TCP/IP and to other OME6130 network element visible across DCC or locally across the network element's Craft port.

Table 5-2
OME6130 local craft access terminal requirements

Web browser	Supported version	OS platform
Microsoft Internet Explorer	6.x	• Win2K • WinXp
Mozilla	1.6 and 1.7	• Red Hat Linux • HP-UX • Solaris 9.0
FireFox	1.0	• Red Hat Linux 7.x

The local craft access terminal provides support for the following functions:

- fault and alarm management
- equipment and facility management
- PM viewing and threshold setting
- synchronization management
- upgrades and software download
- backup and restore
- protection status and control
- nodal security management
- nodal connection management
- DCN communications management

Refer to [Chapter 6, OAM&P description](#) for more information about the operations, administration, maintenance and provisioning (OAM&P) capabilities supported by the OME6130 Release 1.0.

For more information on the Local Craft Access Terminal and the supported applications, refer to the *Local Craft Access User Guide*, 323-1855-195.

SNMP traps

The OME6130 supports autonomous forwarding of system events through SNMP traps for consolidated alarm reporting. The SNMP traps are sent to an SNMP manager, such as HP Open View, where they can be used to alert a system operator.

Up to eight SNMP trap managers can be provisioned for each OME6130 network element. For each trap destination, the IP address and the SNMP version (v1 or v2) are provisioned.

For more information on how to provision the SNMP trap destinations, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

OAM&P description

This chapter provides the operations, administration, maintenance and provisioning (OAM&P) description for the Optical Multiservice Edge 6130 network element. [Table 6-1](#) lists the topics in this chapter.

Table 6-1
Topics in this chapter

Topic	Page
SDH Configuration	6-2
System Line-up and Test (SLAT)	6-2
Network element management	6-3
Equipment management	6-3
Facility management	6-4
Loopbacks	6-6
Synchronization management	6-7
Connection management	6-13
Traffic protection	6-17
1+1 MSP traffic protection	6-18
SNCP Traffic Protection	6-20
Unprotected connections	6-21
Data communications	6-22
Alarm and event management	6-27
Performance monitoring	6-32
Security and administration	6-38
Topology adjacency	6-41
Backing up and restoring the network element database	6-42

SDH Configuration

Optical Multiservice Edge 6130 Release 1.0 is a platform that can be deployed in a SDH environment.

System Line-up and Test (SLAT)

System Line-up and Test (SLAT) is a two part process consisting of commissioning an OME6130 network element and system testing. Commissioning brings a newly installed OME6130 network element to an in-service state ready to carry traffic. System testing consists of performing a traffic continuity and performance test of the network.

Commissioning process

The commissioning process starts after completion of the installation of the OME6130 chassis into a 19", 21" or 23" rack, circuit packs in the aggregate and tributary slots, service cables and optical fibers routed but not connected, and power cables connected but power switched off.

The commissioning process can be broken down into the following phases:

- network element powering up

In this phase, the user verifies the network element equipment and the power supply, and then powers up the shelf.

- network element commissioning

In this phase, the user logs in to the OME6130 network element by connecting to the Craft port on the OAM circuit pack. The user uses the SLAT WUI page to either restore a saved configuration onto the new network element or manually enter the network element commissioning data and DCN parameters.

The node capability is provisioned to either STM-1 or STM-4 during initial commissioning from the Configure Node application. The two SFP interfaces of the 2x155/622M aggregate circuit pack are operating at the rate of the node capability value.

Note: You cannot change the node capability from STM-1 to STM-4 or vice versa while in-service. To change the node capability of the network element, you must first use the "Restore factory default" application to delete all configuration, events, and PM data. Power cycle the network element and then use the Configure Node page to enter the required commissioning information and node capability or to restore from a saved configuration.

Testing process

The testing process occurs after the user has completed the powering up and commissioning of the OME6130 network element. The testing process consists of a system level test as follows:

- system testing

The user performs system testing after all the network elements for a system are physically connected into a linear or ring configuration. In this phase, the user sets up and verifies the system configuration, connects the test equipment, establishes a loopback, provisions a traffic connection, and performs a traffic continuity and performance test on the system.

Refer to *Installation, Commissioning and Testing Procedures*, 323-1855-201, for detailed installation, commissioning, and system testing procedures.

Network element management

NE information page is an application that allows you to retrieve general information for the network element. You can display and/or edit different network element parameters (general, IP provisioning,).

Equipment management

In OME6130, equipment is a logical entity and is the software representation of a circuit pack. The user provisioned data about a circuit pack is stored in the corresponding equipment object and the equipment object is not deleted from the node inventory list when a circuit pack is removed. The equipment entities for the OME6130 platform are as follows:

- chassis
- 2x155/622M aggregate circuit pack
- 8x10/100BT L1 circuit pack
- 2xGE L1 circuit pack
- 28xE1/DS1 circuit pack
- 3xE3/DS3 circuit pack
- 2x155M circuit pack
- power supply unit
- OAM circuit pack
- fan module
- SFP modules

The OME6130 supports automatic detection of new circuit packs in the tributary slots. After insertion of a circuit pack in a previously unprovisioned tributary slot, the system autoprovisions the circuit pack with default values and places the circuit pack in-service. The circuit packs are immediately

visible in the OAM&P management system through applications such as **Node inventory** and **Node slot view**. Similarly, the SFP modules inserted into the STM-1/4 and GE ports are automatically detected and are auto-provisioned in-service. The SFP status and details are presented in the **Node inventory** application.

Before you can delete the equipment from the inventory, you must physically remove the module from its slot. For more information, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Facility management

A facility represents an equipment's OAM&P capabilities that allows the user to provision, inspect, and control that interface. For the OME6130, a facility represents an optical, electrical or service interfaces, such as:

- STM-4 optical interfaces and STM-1 optical and electrical interfaces on the 2x155/622M aggregate circuit pack
- STM-1 optical and electrical interfaces on the 2x155M circuit pack
- 10/100BT Ethernet interface ports on the 8x10/100BT L1 circuit pack
- Gigabit Ethernet optical interfaces on the 2xGE L1 circuit pack
- WAN ports associated to 10/100BT Ethernet and Gigabit Ethernet interface ports
- E1/DS1 interface ports on the 28xE1/DS1 circuit pack
- E3/DS3 interface ports on the 3xE3/DS3 circuit pack

For a complete list of editable and retrievable facility parameters, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Managing facilities

Facility provisioning is a nodal function that allows you to query and edit facility attributes on a specific interface.

The user manages facilities from the corresponding application menu in the **Provisioning** main menu:

- **STM**
- **Ethernet**
- **WAN**
- **E1/E3/DS1/DS3**

By default, the facility is Admin down. When a cross-connect is provisioned with a PDH/DSn facility, its Admin status is automatically changed to Admin Up. When you change a facility from Admin Up to the Admin Down state, the following occurs:

- STM facility
 - traffic will not be carried on the port
 - Tx laser is shut off
 - alarms present on the port are cleared
 - alarm conditions are not declared
 - performance monitoring is terminated
 - DCC will be disabled
- E1/E3/DS1/DS3 facility
 - traffic will not be carried on the port
 - alarms present on the port are cleared
 - alarm conditions are not declared
 - performance monitoring is terminated
- 10/100BT Ethernet facility
 - traffic will not be carried on the port
 - Client Signal Fail will be sent on the WAN facility
 - alarms present on the port are cleared
 - alarm conditions are not declared
 - performance monitoring is terminated
- Gigabit Ethernet facility
 - traffic will not be carried on the port
 - Tx laser is shut off
 - Client Signal Fail will be sent on the WAN facility
 - alarms present on the port are cleared
 - alarm conditions are not declared
 - performance monitoring is terminated

Note: The WAN state follows the state of the associated 10/100BT Ethernet or Gigabit Ethernet port. If a 10/100BT Ethernet or Gigabit Ethernet facility is placed in admin down state, the corresponding WAN state will automatically be placed to admin down.

Loopbacks

The OME6130 supports loopbacks on STM-1/4, 10/100BT Ethernet, Gigabit Ethernet, E1/DS1 and E3/DS3 ports:

- Facility - the received signal is looped back towards the transmitter port immediately on entering the interface port. AIS is inserted in the signal towards the cross-connect on the 2x155/622M aggregate circuit pack.
- Terminal - the signal is looped back towards the cross-connect on the 2x155/622M aggregate circuit pack just before reaching the interface transmitter.

Figure 6-1 provides an overview of terminal and facility loopbacks.

Figure 6-1
Facility and terminal loopbacks

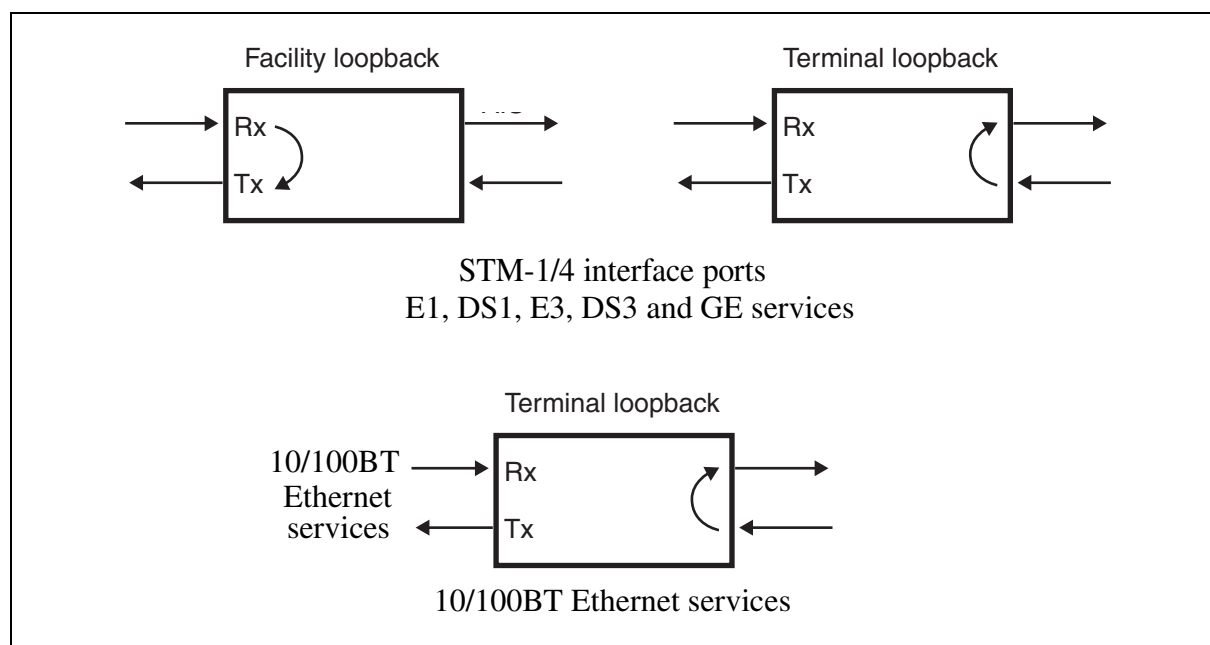


Table 6-2 on page 6-6 summarizes the supported loopback types for the different ports and the appropriate AIS alarm conditioning.

Table 6-2
Loopbacks and AIS alarm conditioning

Port type	Facility loopback	AIS injection on facility loopback	Terminal loopback	AIS injection on terminal loopback
STM-n	Yes	Yes	Yes	No
E1/DS1	Yes	Yes	Yes	Yes

Table 6-2
Loopbacks and AIS alarm conditioning

Port type	Facility loopback	AIS injection on facility loopback	Terminal loopback	AIS injection on terminal loopback
E3/DS3	Yes	No	Yes	Yes
10/100BT Ethernet	No	No	Yes	No
Gigabit Ethernet	Yes	No	Yes	No

The user performs loopbacks on an STM-1/4, 10/100BT Ethernet, Gigabit Ethernet, E1/DS1 and E3/DS3 ports from the **Maintenance** application in the main menu of the local craft access terminal. A facility and a terminal loopback cannot be performed on the same interface port at the same time.

For complete procedures, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Synchronization management

Synchronization is a network level application that ensures all nodes across a network can trace back to the same clock source. Within a single node, synchronization prevents buffer overflow or underflow which avoids bit errors.

Synchronization provisioning on the OME6130 is nodal based. However synchronization must be planned at a network level to avoid hierarchy violations and timing loops that cause excessive jitter and can result in traffic loss.

A network level synchronization plan must take into consideration the requirements for synchronization sources to be used for timing generation and timing distribution. A detailed plan must be available to define how to provision the synchronization parameters on the OME6130 network element at each site.

Timing generation

Timing generation is the ability of the OME6130 to extract and use the synchronization reference from any of the defined synchronization inputs. The OME6130 generates shelf timing signals based on external, line or internal (freerun or holdover) references. The OME6130 supports a timing generation hierarchy for two timing references.

The OME6130 is capable of generating a 4.6 ppm quality clock internally. This clock is the default synchronization reference. The OME6130 supports synchronizing to a reference clock signal derived from the following sources (provisioned by the user as defined by the network synchronization plan):

- internal timing

When the internal clock is provisioned as a timing reference, the network element goes to internal freerun mode rather than holdover mode, when the internal clock becomes the active timing reference. See [Figure 6-2 on page 6-9](#) example (a).

- external timing

As shown in [Figure 6-2 on page 6-9](#) example (b), from the external synchronization input (ESI) port on the OAM circuit pack, the OME6130 supports external timing reference inputs. The supported BITS signals are detailed in [Table 6-3 on page 6-8](#) below:

Table 6-3
Supported BITS signals

BITS-1-2-1		BITS-1-2-2		NE mode
In	Out	In	Out	
2 MHz	2 MHz	E1 (2 Mb/s)	E1 (2 Mb/s)	SDH

The following needs to be considered when using an external source to provide the timing reference for the OME6130:

- the external timing source and its quality
- the signal format of the external timing source (E1 or 2.048 MHz for SDH)
- the connector type/impedance of the ESI port (120 ohm balanced or 75 ohm unbalanced)
- line timing

Line timing is a clock derived from an STM-1/4 interface or an E1 port from the 28xE1/DS1 circuit pack. See [Figure 6-2 on page 6-9](#) example (c).

When using line timing to provide the timing reference for the OME6130, you may consider one of the following sources:

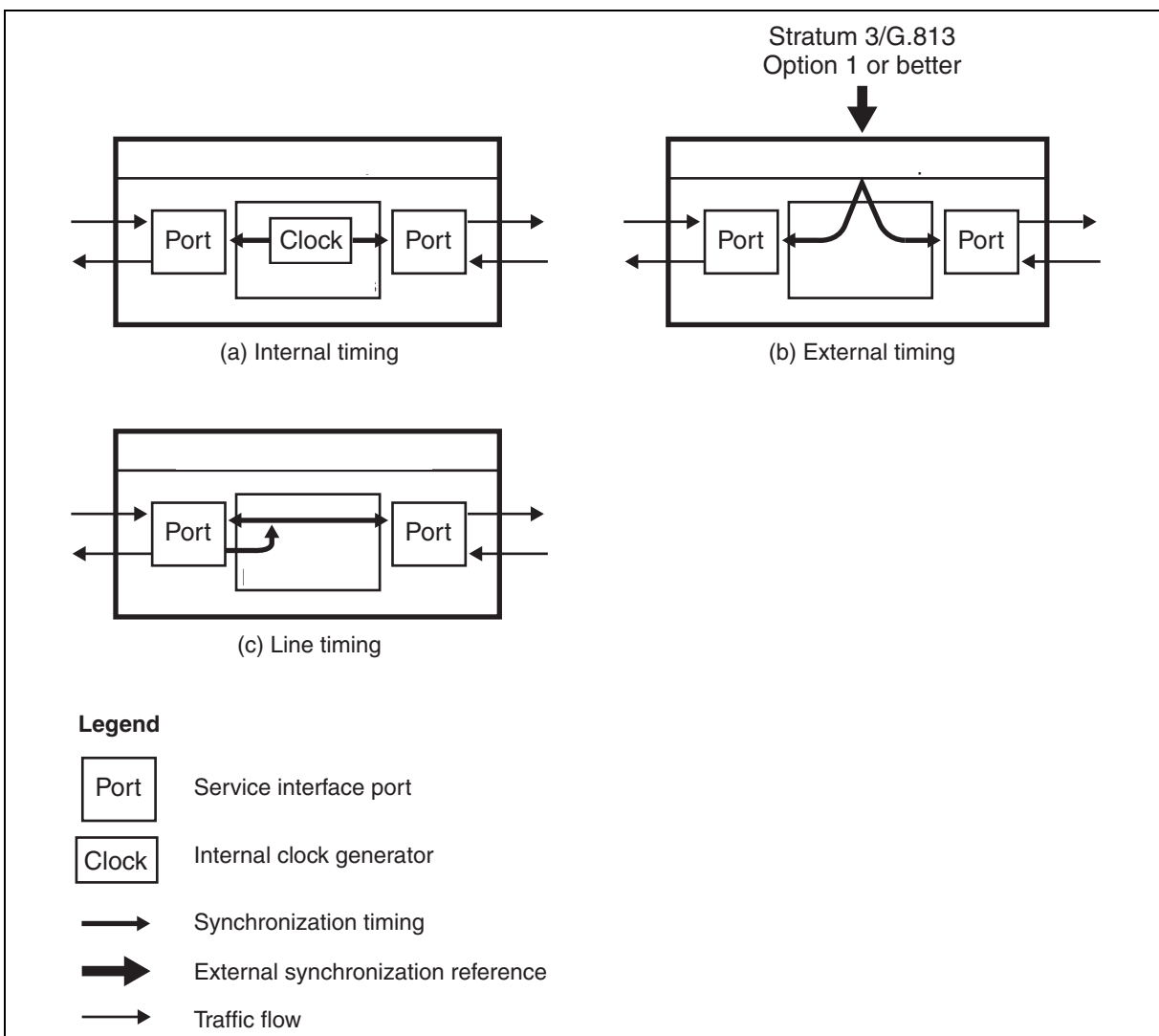
 - one or two STM-1/4 ports on the 2x155/622M aggregate circuit pack
 - one or two STM-1 ports on the 2x155M circuit pack
 - any of 1, 4, 7, 10, 13, 16, 19, 22, 25, 28 E1 ports of the 28 x E1/DS1 circuit pack

The OME6130 can identify a faulty synchronization source and switch to the next highest quality source as defined in the input hierarchy. When all synchronization sources (external or line) are unavailable (caused by faulty

sources or lockouts), the OME6130 falls into holdover mode. In the holdover mode, the internal clock operates at a fixed frequency according to the last known frequency reference for a minimum of 24 hours followed by freerun mode (internal stratum 3 [ST3]/G.813 Option 1 compliant 4.6ppm clock). See [Figure 6-2 on page 6-9](#) example (a).

Refer to [Viewing and management on page 6-12](#) for information about the **Synchronization** application in the **Configuration** main menu of the local craft access terminal for the OME6130.

Figure 6-2
Flow of synchronization timing signals



Timing distribution

Timing distribution is the ability of the OME6130 to provide a synchronization reference to external devices. The OME6130 supports the following timing distribution reference signals:

- CLKOUT and DATAOUT ports on the ESI port located on the faceplate of the OAM circuit pack
- one or two STM-1/4 ports on the 2x155/622M aggregate circuit pack
- one or two STM-1 ports on the 2x155M circuit pack

The following items need to be considered when using the OME6130 as a timing source.

- the signal format of the external timing source (E1 or 2.048 MHz for SDH)
- the connector type/impedance of the ESI port (120 ohm balanced or 75 ohm unbalanced)
- the reference sources to be used for timing distribution and the hierarchy

Synchronization operating modes

The OME6130 synchronization operating modes describe the state that the synchronization hardware is operating in. These modes are not provisionable by the user and consists of the following:

- freerun
- locked
- holdover

Freerun mode

In freerun mode, the system clock is not locked to a timing reference and runs at its natural frequency. The synchronization hardware on the 2xSTM-1/4 aggregate circuit pack provides timing references quality as specified in internal G.813 Option 1 (4.6 ppm). The OME6130 is in this mode if the user has provisioned the shelf timing as internal or the holdover period has expired in which case a warning condition is raised to advise the user.

Locked mode

In locked mode, the system clock is locked to a timing reference. The OME6130 is in this mode when a timing reference is active and working during trouble free operations.

Holdover mode

The synchronization hardware enters holdover mode automatically if the target mode is locked but all timing references have become unavailable. The system clock in the synchronization hardware holds within a certain frequency range of the last locked-in timing reference in which case a warning condition is raised to advise the user.

When a timing reference becomes available again, the synchronization hardware automatically transitions to locked mode. The synchronization hardware remains in holdover mode for a minimum of 24 hours. After holdover mode, the synchronization hardware enters the freerun mode.

Synchronization status messages

Synchronization status messages (SSM) indicate the quality of the timing signals currently available to a network element. The timing sources that can be provisioned in a network element include external timing (ESI), line timing (timing derived from STM-1/4 interfaces or E1 signals), and the internal clock of the network element.

A network element can select the best of the two timing signals provided by the timing sources provisioned by the user. The selection is based on the quality values carried in the SSMs if the quality mode is enabled, otherwise, the selection is based on the priority level set by the user. As the timing passes from one network element to the next, each network element sends SSMs. If the quality of the timing changes, the SSMs inform the next network element of the change.

If a timing reference is not to be used for synchronization, the SSM will contain a do not use for synchronization (DNU) message. See [Table 6-4 on page 6-11](#) for an overview of SSM designations supported by OME6130 in SDH mode.

Table 6-4
Synchronization status messages in SDH mode

Description	Designation	Quality Level	S1 bits (5-8)
Traceable to Primary Reference Clock	PRC	2	0010
Traceable to Transit Clock	SSU-A	4	0100
Traceable to Local Clock	SSU-B	8	1000
Traceable to SDH Equipment Clock	SEC	11	1011
Do Not Use for Synchronization	DNU	15	1111

Note 1: If the incoming quality level is not recognized by the OME6130, the quality level is displayed as invalid. To use a timing source with an invalid quality level as a timing reference, the user must override the invalid quality level.

Note 2: The incoming quality level can not be overwritten if the timing source is an STM-1/4 interface port.

Quality level overrides

A user can specify or override the SSM quality level of an outgoing timing source.

The outgoing override can be used when a remote network element expects a particular SSM value.

Viewing and management

The network element provides all required synchronization source information from the local craft access terminal. The **Synchronization** application in the **Configuration** main menu allows users to view and provision synchronization parameters for an OME6130 network element.

For complete procedures, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Synchronization protection

Synchronization protection deals with the protection of the timing references. The OME6130 supports the protection of the timing reference used for timing generation. The timing generation reference for the system is selected from the pool of provisioned reference sources.

From the local craft access terminal, the **Synchronization** application in the **Configuration** main menu displays the protection status of the provisioned synchronization hierarchies for the network element. The application shows the source state, current quality level, and any active synchronization protection switches on the sources for each hierarchy. Synchronization protection switches include the following:

- automatic switch
- manual switch
- forced switch
- lockout

For more information synchronization protection, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Connection management

In the OME6130 architecture, traffic is switched between interface ports on the circuit packs through the cross-connect matrix located on the 2x155/622M aggregate circuit pack.

OME6130 supports the following connection management capabilities:

- fully non-blocking cross-connects at VC11, VC12, VC3, and VC4 granularity
- contiguous concatenated connections for VC4 rates
- virtual concatenated connections for VC12-nv, where n = 1 to 63 or VC3-nv, where n = 1 to 3 for the 10/100BT Ethernet ports
 - the total bandwidth available for connections on the 8x10/100BT L1 circuit pack is STM-1 (155 Mb/s). The bandwidth is shared between the 8 10/100BT ports of the circuit pack
- virtual concatenated connections for VC3-nv, where n = 1 to 12 and VC4-nv, where n = 1 to 4 for the Gigabit Ethernet ports
 - the total bandwidth available for connections on the 2xGE L1 circuit pack is 4 x STM-1 (622 Mb/s). The bandwidth is shared between the two GE ports of the circuit pack
- In OME6130 Release 1.0, the total bandwidth available for connections on the NE is 16 x STM-1 (2.5 Gb/s) if the NE is commissioned with the node capacity parameter set to STM-4 rate.
 - half of the bandwidth (8 x STM-1 or 1.25 Gb/s) is dedicated to the two STM-4 interfaces of the 2x155/622M aggregate circuit pack
 - half of the bandwidth (8 x STM-1 or 1.25 Gb/s) is shared between the four tributary circuit packs.
 - the granularity of the bandwidth distribution among the tributary circuit pack is STM-1. That is, the 8 x STM-1 are distributed to the tributary circuit packs with a granularity of STM-1.
 - For example, if slot 4 is using one STM-1, slot 5 is using four STM-1 and slot 8 is using two STM-1, then the remaining bandwidth available for slot 9 is limited to one STM-1
- PDH/DSn signals mapping:
 - E1 to VC12
 - DS1 to VC11
 - E3 to VC3
 - DS3 to VC3

- bandwidth management models:
 - bidirectional connection type
 - unidirectional connection type
 - hair-pinning
 - drop and continue

Note: Only bidirectional connection type is supported for WAN ports corresponding to the 10/100BT Ethernet and Gigabit Ethernet ports.

All services (Ethernet, E1/DS1 and E3/DS3) are mapped to the appropriate VC containers. The OME6130 uses Generic Framing Procedure (GFP) as its standards based SDH mapping for Ethernet services.

Generic Framing Procedure

GFP is an ITU standard (G.7041) which describes a flexible mapping technique for transparent transport of multiple protocols in SDH. GFP provides an efficient mechanism for Ethernet data services to be transported over an SDH network via efficiently mapping varying client signals into VC containers with a virtual concatenation group (VCG). OME6130 supports:

- Framed-mapped GFP (GFP-F), which maps one frame or packet of client signal in one GFP frame. GFP-F processes client signal data streams on a protocol data unit (PDU) basis and maps these streams into GFP-F frames one packet at a time. GFP-F is recommended for Ethernet services as it provides flow control capability and performance monitoring.

In GFP-F, idle frames are inserted as necessary to fill the transport payload. Multiple GFP-F frames can be aggregated in a single SDH payload.

[Table 6-5](#) provides a summary of the service mappings and interconnection type supported in OME6130 Release 1.0.

Table 6-5
OME6130 service mapping

Service	Mapping	Interconnection type
STM-1	• VC11, VC12, VC3, VC4	• non-concatenated at VC11, VC12, VC3, VC4 level
STM-4	• VC11, VC12, VC3, VC4	• non-concatenated at VC11, VC12, VC3, VC4 level
10/100BT L1 Ethernet	• SDH mode: — GFP-F to VC12, and VC3 — GFP-F to VC12-nv (n=1 to 63) and VC3-nv (n=1 to 3)	• SDH mode: — non-concatenated at VC12, and VC3 level — virtual concatenation at VC12-nv (n=1 to 63) and VC3-nv (n=1 to 3) for the VCG

Table 6-5
OME6130 service mapping

Service	Mapping	Interconnection type
Gigabit Ethernet L1	• SDH mode: — GFP-F to VC3, and VC4 — GFP-F to VC3-nv (n=1 to 12) and VC4-nv (n=1 to 4)	• SDH mode: — non-concatenated at VC3, and VC4 level — virtual concatenation at VC3-nv (n=1 to 12) and VC4-nv (n=1 to 4) for the VCG
E1	• VC12/TU12/AU4 (SDH mode)	• non-concatenated at VC12 level
DS1	• VC11/TU11/AU4 (SDH mode)	• non-concatenated at VC11 level
E3/DS3	• VC3/TU3/AU4 (SDH mode)	• non-concatenated at VC3 level

10/100BT Ethernet, Gigabit Ethernet and PDH services are mapped to SDH containers and assigned as SDH level connections to STM-1/4 interfaces. The traffic protection schemes supported by the STM-1/4 interfaces can therefore be used to provide a protected Ethernet, E1/DS1 or E3/DS3 service without the requirement of a redundant handoff from the subtending 10/100BT Ethernet, Gigabit Ethernet, E1/DS1 or E3/DS3 equipment. See [Traffic protection on page 6-17](#) for more information.

Hair-pinning

The OME6130 provides the ability to provision hairpin connections for PDH services.

- E1-to-E1
- DS1-to-DS1
- E3-to-E3
- DS3-to-DS3

Connection management application

OME6130 connection management is based on a nodal, port-to-port connection management philosophy that takes protection schemes into account to rearrange connections at the physical level to implement traffic protection. See [Traffic protection on page 6-17](#) for more details.

The **Cross-connect** application in the local craft access terminal allows the user to perform the following:

- filter, and display nodal connections
- provision nodal connections from any E1/E3/DS1/DS3 interface port to any available timeslot of an STM-1/4 interface or of another E1/E3/DS1/DS3 interface port on the same OME6130 network element. Each cross-connect can have a Circuit Identifier which allows the user to label the cross-connect.

Note 1: The system blocks any cross-connects that are illegal. For example, if a low-order VC12 cross-connect is provisioned, the system blocks cross-connects of the corresponding VC3/VC4.

- operate or release user-initiated switch commands on SNCP connections.
- delete a nodal connection (supports multiple deletes)

The **WAN** application in the local craft access terminal allows the user to perform the following:

- provision VC associations within a WAN from any 10/100BT Ethernet or Gigabit Ethernet interface port to any available timeslot of an STM-1/4 interface on the same OME6130 network element.
- operate or release user-initiated switch commands on SNCP VC connections.
- delete a VC association within a WAN (supports multiple deletes)
- click on hyperlink to **Cross-connect** application to filter, display or delete nodal connections.

SDH payload instance numbering

In the local craft access terminal, SDH payload instances are displayed using J, K, L, and M format where:

- J is the AU-4 payload number (1 to 4 for STM-4 line rate and fixed at 1 for STM-1 line rate)
- K is the TUG-3 payload number (1 to 3)
- L is the TUG-2 payload number (1 to 7)
- M is the TU-12 payload number (1 to 3) or TU-11 payload number (1 to 4)

For example, a format of J = 3, K = 2, L = 6, M = 2 identifies:

- AU-4 number 3
- TUG-3 number 2
- TUG-2 number 6
- TU-12/TU-11 payload number 2

For detailed procedures and associated rules, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Traffic protection

Traffic protection is a mechanism to enhance the dependability of a transport service. The OME6130 provides a variety of protection mechanisms which can be deployed to tailor the resilience of the platform to that required by the customer. The system monitors the traffic facilities for performance degradation and failure and performs protection switching when these conditions are present. The following traffic protection configurations are currently available:

- 1+1 Multiplex Section Protection (MSP)
- Sub-Network Connection Protection (SNCP)
- unprotected

[Table 6-6](#) provides an overview of the supported traffic protection schemes.

The OME6130 can be provisioned to support a mix of MSP and SNCP protection and unprotected configurations on the STM-1/4 interfaces on a single network element. Refer to [Shelf equipping rules on page 8-4](#) for more information.

Table 6-6
Traffic protection summary

Protection scheme	Interfaces	Notes
1+1 MSP	STM-1/4 interfaces	When MSP is provisioned, SNCP connections are not supported on this protection group.
SNCP	STM-1/4 interfaces 10/100BT Ethernet Private Line (EPL) services GE EPL services E1/DS1 services E3/DS3 services	STM-1/4 interfaces must be provisioned in Unprotected mode.
Unprotected	STM-1/4 interfaces 10/100BT EPL services GE EPL services E1/DS1 services E3/DS3 services	A mix of unprotected and SNCP connections can be provisioned.

Traffic Protection application

The user performs provisioning of traffic protection by selecting the **MSP groups** application in the **Configuration** main menu of the local craft access terminal. The protection provisioning application displays the protection provisioning data and allows the user to perform the following actions:

- view the protection switch scheme and protection switch mode for the STM-1/4 interfaces
- change the protection scheme from 1+1 MSP to unprotected for the STM-1/4 interfaces. This operation can be performed only when no connection is provisioned on the 1+1 MSP protection group.
- change the protection scheme from unprotected to 1+1 MSP for the STM-1/4 interfaces. This operation can be performed only when no connection is provisioned on the ports that will be used in 1+1 MSP protection group.
- change the protection switching mode from unidirectional (1WAY) to bidirectional (2WAY) and vice versa for the STM-1/4 interfaces of the 1+1 MSP protection group
- operate or release a user-initiated switch request on the 1+1 MSP group for the STM-1/4 interfaces

The SNCP protection configuration is provisioned upon creation of the nodal cross-connect or the VC association for Ethernet services. For more details on the local craft access terminal applications used to provision SNCP traffic protection, refer to [Connection management application on page 6-15](#)

Note: The default traffic protection mode on the OME6130 network element is unprotected.

1+1 MSP traffic protection

1+1 MSP traffic protection is supported for the STM-1/4 interfaces to provide line traffic protection. 1+1 MSP traffic protection uses the 1+1 MSP protocol to handshake between adjacent network elements to determine when a protection switch should occur. All of the paths within the line are protected together.

Provisioning MSP protected connections

The user performs protection group provisioning from the **MSP groups** application in the **Configuration** main menu of the local craft access terminal. The user creates the **1+1MSP** protection group for the STM-1/4 interfaces located on the 2x155/622M aggregate circuit pack or the 2x155M tributary circuit packs.

The working and protection ports of the 1+1 MSP traffic protection group must be provisioned on the same slot (i.e. slot 6 ports 1 and 2) for the STM-1/4 interfaces of the 2x155/622M aggregate circuit pack.

The working and protection ports of the 1+1 MSP traffic protection groups can be provisioned on the same slot or on different slots for the STM-1 interfaces of the 2x155M tributary circuit packs.

Example 1: Working and protection ports on same slot

The user can provision a 1+1 MSP traffic protection group with the STM-1 slot 4 port 1 as the working port and the STM-1 slot 4 port 2 as the protection port.

Example 2: Working and protection ports on different slots

The user can provision a 1+1 MSP traffic protection group with the STM-1 slot 4 port 1 as the working port and the STM-1 slot 5 port 1 as the protection port.

The user provisions the **Protection switching mode** as either **2WAY** (bidirectional where both transmit and receive directions switch together) or **1WAY** (unidirectional where only the transmit or receive directions switched based on the fault or user initiated action). The **Admin reversion mode** can be set to either **revertive** or **non-revertive**. By default, the non-revertive mode is set. When revertive mode is selected, the user must also specify the **WTR Time** period for the MSP group.

The user provisions the **Route Diversity** for the 1+1 MSP traffic protection group. The route diversity can be set to enable or disable for the STM-1/4 of the 2x155/622M aggregate circuit pack. By default, the route diversity is set to enable. The route diversity must be set to enable for the STM-1 of the 2x155 tributary circuit pack.

For detailed procedures for 1+1 MSP protection, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

1+1 MSP protection switch criteria

1+1 MSP protection switch request can occur automatically by the system or by user initiated actions.

Note: User-initiated 1+1 MSP switching commands are signaled via MSP channels (K1 and K2 bytes).

[Table 6-7](#) summarizes the hierarchy of protection commands.

Table 6-7

1+1 MSP protection - command hierarchy

Switch request	Priority
Lockout of protection	1 (highest)
Auto switch (Signal Fail) on protection	2
Forced switch	3

Table 6-7 (continued)
1+1 MSP protection - command hierarchy

Switch request	Priority
Auto switch (Signal Fail) on working	4
Auto switch (Signal Degrade) (Working or protection)	5
Manual switch to protection	6
Manual switch to working	7
Wait-to-Restore	8 (lowest)

For a complete procedures, see *Provisioning and Protection Switching Procedures*, 323-1855-310.

SNCP Traffic Protection

SNCP traffic protection is defined as a 1 + 1 dedicated path protection scheme where the transmit end is permanently bridged to both the working and protection of the subnetwork connections (SNC). At the receive end of the SNC, a protection switch is performed by selecting one of the signals based on the path status. No 1+1 MSP protocol is required as SNCP is defined as a unidirectional protection scheme.

Provisioning SNCP connections

The user performs SNCP connection provisioning from the **Cross-connect** application in the **Configuration** main menu of the local craft access terminal. The user selects the source and destination port interfaces for the SNCP connection and specifies the appropriate protection requirements for each end-point of the end-to-end connection.

The working and protection paths of the SNCP connections can be provisioned on the same slot or on different slots for the STM-1/4 interfaces of the 2x155/622M aggregate and 2x155M tributary circuit packs. The timeslots for the working and protection paths of the SNCP connections can be different.

Example 1: Working and protection paths on same slot

The user can provision a SNCP connection with the TU12-1-6-1-1-1-1-1 as the working path and the TU12-1-6-2-1-1-1-1 as the protection path.

Example 2: Working and protection paths on different slots

The user can provision a SNCP connection with the TU12-1-4-1-1-1-1-1 as the working path and the TU12-1-5-1-1-1-1-1 as the protection path.

When protection is provisioned for the source or destination end-points of the SNCP connection, the user must also provision the **revertive mode** and the **WTR Time** period when applicable.

Note: The OME6130 supports nodal provisioning. When provisioning an end-to-end circuit, you must ensure that the traffic protection as well as cross-connections are performed at the end-points as well as any passthrough nodes that make up the end-to-end circuit.

For detailed procedures for SNCP protection, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

SNCP protection switch criteria

A SNCP protection switch request can occur automatically by the system or by user initiated actions.

Table 6-8 summarizes the hierarchy of protection commands.

Table 6-8:
SNCP protection - command hierarchy

Switch request	Priority
Lockout of protection	1 (Highest)
Forced switch	2
Auto switch (P-AIS, P-LOP, P-UNEQ)	3
Auto switch (P-SF)	4
Auto switch (P-SD)	5
Manual switch on protection path	6
Manual switch on working path	7
Wait-to-Restore	8 (lowest)

For a complete description and procedures, see *Provisioning and Protection Switching Procedures*, 323-1855-310.

Unprotected connections

Unprotected configurations consists of end-to-end paths that do not have an alternate path. In the case of the a fault on the unprotected path, traffic is lost.

Note: Unprotected is the default traffic protection configuration for the port interfaces in OME6130.

Provisioning unprotected connections

As unprotected is the default traffic protection configuration, unless the user has already provisioned the STM-1/4 interfaces for 1+1 MSP protection scheme, the user can simply provision cross-connects.

The user performs cross-connect provisioning from the **Cross-connect** application in the **Configuration** main menu of local craft access terminal for E1/DS1 and E3/DS3 services, while VC associations are provisioned from the **WAN** application in the **Facilities** menu.

Note: The OME6130 supports nodal provisioning. When provisioning an end-to-end circuit, you must provision the cross connections at the end points and at any pass-through nodes that make up the end-to-end circuit.

For a complete procedures for provisioning unprotected connections, see *Provisioning and Protection Switching Procedures*, 323-1855-310.

Data communications

The OME6130 supports data communication features to provide the capabilities for local and remote management of the OME6130 network element and for interworking with other network elements to provide a cohesive network management solution. The OME6130 OAM interfaces provided are as follows:

- STM-1/4 interfaces using RS DCC (D1-D3 bytes), RS F1 byte, MS DCC (D4-D12 bytes), or HO Path (F2, F3 and F2-F3 bytes) for OAM&P access to remote network elements
- LAN port for interface to a data communications network (DCN).
- Craft port for interface to a local craft terminal PC.
- M1/F1 port for modem access or for user byte access
- Management channel via physical E1 port
- Management channel via VC12 payload

Interfaces

The interfaces/protocols are configured from various applications available from the local craft access terminal. For DCN provisioning procedures, see *Provisioning and Protection Switching Procedures*, 323-1855-310.

LAN interface

The LAN interface provides a mechanism to connect the OME6130 network element to the office DCN for connectivity to a management system for remote management of the OME6130 network and subtending network elements. The LAN interface consists of a 10/100Base-T RJ-45 port located on the front of the OAM circuit pack.

The LAN port can be enabled or disabled with the default being enabled.

Proxy ARP is supported on the LAN interface when the OME6130 NE is used as a gateway NE. The gateway OME6130 NE responds to ARP requests for the subtending NEs when Proxy ARP is enabled. The subtending NEs need to be added as Proxy ARP neighbours at the gateway OME6130 NE.

The LAN interface can be configured from the **Network interface** application available from the **Configuration/DCN** menu item in the local craft access terminal. For a detailed procedures, see *Provisioning and Protection Switching Procedures*, 323-1855-310. To know how to provision the IP address for the LAN port, refer to *Installation, Commissioning and Testing Procedures*, 323-1855-201.

Craft interface

The Craft interface provides a mechanism to connect a local craft terminal PC directly to the OME6130 network element for local access to the OME6130 network and subtending network elements. The Craft interface consists of a 10/100Base-T RJ-45 port located on the front of the OAM circuit pack.

The Craft port can be enabled or disabled with the default being enabled.

The Craft interface can be configured from the **Network interface** application available from the **Configuration/DCN** menu item in the local craft access terminal. For a detailed procedures, see *Provisioning and Protection Switching Procedures*, 323-1855-310. To know how to provision the IP address for the Craft port, refer to *Installation, Commissioning and Testing Procedures*, 323-1855-201.

M1/F1 interface

The M1/F1 interface provides a mechanism to connect a PC or a modem to the OME6130 network element for user byte clear channel access or remote management. The RS-232 serial port is exposed as a RJ-45 connector located on the front of the OAM circuit pack.

The M1/F1 interface can be provisioned for two applications:

- point-to-point protocol (ppp) - modem connectivity to the network element through the RS-232 serial port based on IP over PPP
- user data channel (udc) - F1 byte user data channel limited to asynchronous mode at 9600 kbps. The F1 byte user data channel is supported only for the STM-1/4 interfaces of the 2x155/622M aggregate circuit pack.

The serial port can be configured from the **Serial Port** application available from the **Configuration/DCN** menu item in the local craft access terminal. For more details, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

E1/VC12 management channel

The OME6130 supports up to two management channels that can be provisioned over an E1 or VC12 channel. The management channel provides a means to connect to isolated clusters over an E1 or VC12 channel.

An E1 management channel allows management data to be transmitted and received over the first E1 port of the 28xE1/DS1 circuit pack to manage remote network element.

Note: Only the first E1 port of the 28xE1/DS1 circuit pack can be used for the E1 management channel.

A VC12 management channel allows for management data to be transmitted and received over one VC12 channel on the STM-1/4 interfaces to manage remote network element.

Note: In this release, the management channel is supported only over E1 or VC12 channels in SDH mode.

The E1/VC12 management channel can be configured from the **Management channel** application available from the **Configuration/DCN** menu item in the local craft access terminal. For more details, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

DCC interface

The DCC interfaces provide a mechanism for OME6130 network elements and subtending network elements to communicate and exchange OAM messages using the RS, MS or HO Path overhead bytes. The embedded communication channel (ECC) for the STM-1/4 interfaces can be configured to use any of the following byte groups:

- D1-D3 bytes of the Regenerator Section overhead
- F1 byte of the Regenerator Section overhead
- D4-D12 bytes of the Multiplex Section overhead
- F2, F3 or F2-F3 bytes of the HO path overhead

The OME6130 supports both IP and OSI based DCC interfaces and can operate as a single point of entry for access to remote or subtending network elements using IP or OSI based DCC interfaces. In this release, one IP or OSI based DCC interface can be provisioned for each STM-1/4 interface on the OME6130 network element.

The generic routing encapsulation (GRE) protocol is used for OSI based DCC interfaces. The GRE tunnels can be provisioned statically or dynamically (auto-GRE tunneling).

[Table 6-9](#) describes the maximum number of RS and MS DCC interfaces supported on the STM-1/4 interfaces for each OME6130 NE.

Table 6-9

Maximum number of RS and MS DCC interfaces per OME6130 NE

Number of MS DCC interfaces	Number of RS DCC interfaces
None	up to ten (10)
one (1)	up to seven (7)
two (2)	up to four (4)
three (3)	up to one (1)

Each STM-1/4 interface is capable of supporting one DCC interface. The default setting for the DCC interface is set to off. The DCC interfaces can be configured from the Network Interface application available from the **DCN** menu item in the local craft access terminal. For more details on how to provision the DCC interfaces, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310. For more information on DCN planning, refer to [Appendix A: Data communications planning on page 10-1](#).

DCC Transparency

The OME6130 supports DCC transparency via overhead tunnel provisioning. This feature allows two STM-1/4 interfaces to be connected together so the network element appears transparent to subtending network elements (NEs connected to the OME6130 via the STM-1/4 interfaces).

The overhead tunnel allows DCC bytes to be forwarded transparently between the two STM-1/4 interfaces. This feature offers advantages such as, allowing interoperability with other vendor's equipment that do not support a standard-based OSI stack.

The user can select the bytes on which the overhead tunnel should be passing through. The available values are:

- E1
- E2
- F1
- DCC_R
- DCC_M

The DCC transparency can be configured from the **Overhead Tunnel** application available from the **Configuration** main menu item in the local craft access terminal. For more details on how to provision the DCC interfaces, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

OAM comms management

The OME6130 uses an IP-based comms infrastructure for network element management and interworking with IP-based DCC network elements. However, OME6130 also supports OSI-based DCC for interworking with OSI-based network elements.

For more information about provisioning the communication parameters, see *Provisioning and Protection Switching Procedures*, 323-1855-310.

OAM comms routing

Support of IP-based and OSI-based DCC requires support of several routing protocols. OME6130 supports the following routing protocols:

- Integrated ISIS (iISIS)

iISIS can be used as the internal DCN routing protocol and is available on all DCC interfaces. iISIS is not available on the LAN, Craft and RS232 ports.

The iISIS settings for the OME6130 NE can be provisioned using the **iISIS** application available from the **Configuration/DCN** menu item in the local craft access terminal. The iISIS settings for the embedded channel interfaces can be configured using the **Network interface** application also available from the **Configuration/DCN** menu. For more details on how to provision iISIS, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310. For more information on DCN planning, refer to [Appendix A: Data communications planning on page 10-1](#).

- OSPF

The OSPF feature enables monitoring neighboring network elements and retrieving routing information for In Band Communication (IBC). The OSPF feature can be enabled or disabled for the embedded communication channel interfaces or for the LAN access to the public DCN.

The OSPF area can be provisioned using the **OSPF** application available from the **Configuration/DCN** menu item in the local craft access terminal. The OSPF settings for the embedded channel interface or the LAN port can be configured using the **Network interface** application also available from the **Configuration/DCN** menu. For more details on how to provision OSPF, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310. For more information on DCN planning, refer to [Appendix A: Data communications planning on page 10-1](#).

Alarm and event management

Active alarms are indicated on the OME6130 equipment and are visible from the local craft access terminal. Alarm history and events are stored on the OME6130 network element. Login sessions using craft user interface, and Optical Application Platform provide details of network element alarms.

The severity of an alarm is indicated by the following designations: Critical, Major, minor, warning. Critical alarms have the highest priority and are reported before Major, minor or warning alarms. Major alarms are reported before minor alarms and minor alarms are reported before warnings.

OME6130 local alarm indications

Trouble conditions present on the OME6130 network element are indicated locally by light-emitting diodes (LEDs) on the front of the faceplate of the circuit packs, or the SFP interfaces.

For more information about the local alarm indications, refer to *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Alarm management / surveillance

The local craft access terminal provides the user with the ability to view and manage alarms and events for the OME6130 as follows:

- view summary of active alarms
- view active alarms
- view suppressed alarms
- view/provision alarm filters
- view event history
- view/provision alarm severities
- alarm reporting control
 - view/provision STM port profiles
 - view/provision path alarm profiles
 - enable/disable facility alarm reporting
- view/provision environmental alarms input

Viewing summary of active alarms

The WUI provides the user with an alarm banner which summarizes the active alarms on the network element. The alarm banner is continuously displayed in the WUI to provide the user with an accurate of the current state of the system while navigating through the different menus of the WUI. The alarm banner has auto refresh enabled by default and is time-stamped, and it can be disabled.

For more information about the alarm banner, refer to *Local Craft Access User Guide*, 323-1855-195.

Viewing active alarms

The network element user interface provides the user with a list of active alarms on the OME6130 shelf by selecting the **Active alarms** application in the **Faults** menu of the local craft access terminal. The current active alarms list is set to auto refresh by default, and it can be disabled.

For more information about the active alarm and alarm clearing procedures, refer to *Local Craft Access User Guide*, 323-1855-195 and *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Viewing/provisioning alarm filters

The **Alarm Filters** application in the **Faults** menu of the local craft access terminal provides the ability for users to create alarm filter rules whereby selected alarms on chosen entities are not displayed in the active alarm list. The application gives the user the ability to view, add or delete an alarm filter rule.

An alarm filter rule can be created for an object type against only one object instance, where a selected alarm or all alarms are filtered out. When an alarm filter is created, any active alarm which matches the filter rule are no longer displayed in the active alarm list, and the filtered alarm is displayed in the suppressed alarm list. An alarm filter can be deleted at any time.

For more information about the alarm filter and detailed procedures on managing alarm filters, refer to *Local Craft Access User Guide*, 323-1855-195 and *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Viewing suppressed alarms

The **Suppressed alarms** application in the **Faults** menu of the WUI allows the user to view any alarms that have been suppressed by the Alarm Filter or by the Alarm Reporting Control feature.

For more information about the suppressed alarms and alarm clearing procedures, refer to *Local Craft Access User Guide*, 323-1855-195 and *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Viewing event history

The user views the events on an OME6130 shelf by selecting the **Event history** application in the **Faults** menu of local craft access terminal. The Events history application supports the viewing of historical (current and cleared) alarms and events for the OME6130 network element.

The OME6130 network element stores a minimum of 7500 events in non-volatile storage.

For more information about the event history and alarm clearing procedures, refer to *Local Craft Access User Guide*, 323-1855-195 and *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Viewing/provisioning alarm severities

The **Alarm severity** application in the **Faults** menu of the local craft access terminal provides the ability for users to view or edit the severity of an alarm for the OME6130 network element. The severity changes are applied to the alarm type, but is not provisionable on an entity basis.

For more information about the alarm severities and detailed procedures on managing alarm severities, refer to *Local Craft Access User Guide*, 323-1855-195 and *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Alarm Reporting Control

The ARC feature provides a toolset to control the declaration of alarms from the network element to the EMS/NMS applications. There are three components of this feature:

- port profiles
- path alarm profiles
- facility alarm reporting

Viewing/editing port profiles

The **STM Port Profile** application in the **Profiles** menu of the local craft access terminal provides the ability for users to define the appropriate port profiles for the STM interfaces. The following are the two default port profiles:

- internal-NNI - use within an EMS domain
- external-NNI - use between management domains

The port profile is a global setting and allows the user to assign the appropriate path alarm profile to each of the eight individual connection types:

- terminating and unprotected TU
- terminating and protected TU
- passthrough and unprotected TU
- passthrough and protected TU
- terminating and unprotected AU
- terminating and protected AU
- passthrough and unprotected AU
- passthrough and protected AU

The provisioned path alarm profile is automatically assigned to any cross-connect that is created using the STM interface.

For detailed procedures on managing port profiles, refer to *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Viewing/provisioning path alarm profiles

The **Path Alarm Profiles** application in the **Profiles** menu of the local craft access terminal provides the ability for users to view the eight default path alarm profiles, or create/edit/delete a user defined path alarm profile. The path alarm profile is then assigned and applied to the eight connection types according to the STM Port Profile.

The path alarm profile specifies the consequent actions upon TIM, PLM and UNEQ conditions. The path alarm profile also specifies the path level alarms that should be masked. The eight default path alarm profiles can not be deleted and their defined actions can not be modified, while the user can create or delete the user defined path profiles and edit the defined actions.

Once a connection is created with the path alarm profile assigned according to the STM Port Profile, the path alarm profile can be manually changed at the AU/TU levels.

For detailed procedures on managing path alarm profiles, refer to *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Enable/disable facility alarm reporting

User can enable or disable all alarm reporting associated to the following facilities / alarm object instances:

- STM-n
- AU / TU
- 10/100BT Ethernet
- Gigabit Ethernet
- PDH / DSn

Once the alarm reporting is disabled for the facility / alarm object instance, any active alarm will be suppressed and listed in the suppressed alarms application.

Viewing/provisioning environmental alarms

The OME6130 network element has 7 parallel telemetry input points. The input points allow remote monitoring of other equipment in the office in which the network element is located. For example, the input points can monitor room temperature alarms or office door open alarms. Specific external alarm must be set up during provisioning and are assigned to a specific contact pin. The alarm input points are connected to the ALM.IN RJ-45 connector on the front of the OAM circuit pack.

The **Environmental alarm input** application in the **Configuration** menu of the local craft access terminal supports the provisioning of alarm for an alarm input point.

The OME6130 also supports the capability of displaying the network element summary alarms onto an external device. The Critical, Major, and Minor alarms can be reported to an external control device by connecting to the ALM.OUT RJ-45 connector on the front of the OAM circuit pack.

For more information on environmental alarms, refer to *Local Craft Access User Guide*, 323-1855-195 and detailed procedures, refer to *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

PDH / DS_n alarm monitoring

Alarm monitoring support is limited for framed E1/DS1 ports. The level of alarm monitoring depends on the PDH/DS_n path monitoring mode assigned to the unframed/framed PDH/DS_n ports.

Below are the three provisionable modes of operations:

- no monitoring mode (NMM)
Alarm and performance monitoring is disabled for all ports and is the default mode.
- alarm monitoring mode (AMM)
Path alarms are monitored in a round-robin basis. Under normal operating condition, each port is polled at least 2-3 times in a 2.5 seconds interval.
- alarm and performance monitoring (APMM)
Only the nominated framed E1/DS1 port is monitored for path alarms and performances.

The path alarm monitoring modes of operation are not applicable to framed E3/DS3 ports. Each unframed/framed E3/DS3 port has full alarm and performance monitoring support.

[Table 6-10 on page 6-31](#) summarizes the PDH/DS_n alarms for the different circuit packs.

For detailed procedures, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Table 6-10
PDH / DS_n alarm monitoring

Card type	Line alarm	Path alarm (near-end)	Path alarm (far-end)
28xE1/DS1 (see Note1)	LOS	AIS, <u>LOF</u> , <u>LOM</u>	<u>RAI</u>
3xE3/DS3 (see Note2)	LOS	AIS, LOF, LOM	RAI
Note 1: The underlined path alarms have limited monitoring support and the non-underlined path alarms have full monitoring support			
Note 2: All line and path alarms have full monitoring support			

Performance monitoring

Performance monitoring (PM) refers to the continuous collection, analysis, and reporting of the performance data of a monitored entity. This monitoring allows early detection of service degradations and facilitates preventive maintenance without interruption of service. PMs can also be used to facilitate trouble/fault isolation.

The OME6130 monitors the following entities for PM collection:

- STM performance monitoring parameters
- 10/100BT Ethernet performance monitoring parameters
- Gigabit Ethernet performance monitoring parameters
- WAN performance monitoring parameters
- E1/E3/DS1/DS3 performance monitoring parameters

The OME6130 craft user interface **Performance** application allows the user to retrieve:

- current PM values (15 minute and 1-Day values in progress)
- recent history (32 previous 15 minute and previous day values stored on the network element)

PM functions

PM functions include:

- count binning
- thresholding

Count binning

Each monitored entity generates a set of PM parameter counts based on raw data from hardware and other systems. These counts can be retrieved or reset through user commands.

Thresholding

Performance thresholds are values associated with specific performance error statistics. Aside from the physical PMs, each SDH performance parameter has two thresholds which can be applied to either the current 15 minute or day counts. When a PM parameter value exceeds its threshold settings, the system generates a threshold crossing alert (TCA). TCAs are cleared when the PM counts have been reset or the particular timed accumulation bin has terminated.

PM thresholds management for the STM-1/4 interfaces is available from the **STM** application in the **Facility** menu of the local craft access terminal.

STM PM parameters

STM PM parameters are accumulated for the STM-1/4 interfaces on the circuit packs. [Table 6-11](#) provides a summary of the supported STM PM parameters.

Table 6-11
SDH PM parameters summary

Facility	PM parameter
Regenerator Section (RS)	SDH: ES, SES, UAS, SEP, EB, BBE, ESR, SESR, BBER, SEPI
Multiplex section (MS)	SDH: ES, SES, UAS, SEP, EB, BBE, ESR, SESR, BBER, SEPI, ES-FE, SES-FE, BBE-FE, UAS-FE, SEP-FE
Path (HO AU)	SDH: ES, SES, UAS, SEP, EB, BBE, PPJE, NPJE, ESR, SESR, BBER, SEPI, ES-FE, SES-FE, BBE-FE, UAS-FE, SEP-FE
Tributary Unit (LO TU)	SDH: ES, SES, UAS, SEP, EB, BBE, ESR, SESR, BBER, SEPI, ES-FE, SES-FE, BBE-FE, UAS-FE, SEP-FE
Tranceiver (physical)	Received Power, Transmit Power, Laser Bias, Laser Voltage, Laser Temperature

PDH / DS_n performance monitoring

Path performance monitoring for E1/DS1 port is limited and dependant on the PDH/DS_n path monitoring mode assigned to the unframed/framed PDH/DS_n ports as described in the [PDH / DS_n alarm monitoring on page 6-31](#).

Path performance parameters are monitored when the path monitoring mode for the selected framed port is set to Alarm and Performance Monitoring. Path performance parameters are also counted for unframed E1/DS1 ports only based on AIS condition.

Line performance monitoring is fully supported on all PDH/DS_n ports. Path performance monitoring is fully supported on all E3/DS3 ports.

PDH / DS_n PM parameters

PM parameters are accumulated for the E1/E3/DS1/DS3 facilities on the:

- 28xE1/DS1 circuit pack
- 3xE3/DS3 circuit pack

[Table 6-12](#) provides a summary of the supported PDH PM parameters.

Table 6-12**PDH / DS_n PM parameters summary**

Facility	PM parameter	Location
E1	Line: CV-L, ES-L, SES-L Path: EB-P, BBE-P, ES-P, SES-P, UAS-P (see Note)	Near end
DS1	Line: CV-L, ES-L, SES-L Path: CV-P, ES-P, SES-P, UAS-P, SAS-P, AISS-P (see Note)	Near end
E3	Line: CV-L, ES-L, SES-L Path: ES-P, SES-P, UAS-P	Near end
DS3	Line: CV-L, ES-L, SES-L Path: CV-P, ES-P, SES-P, UAS-P, SAS-P, AISS-P	Near end
Note: Limited path PM support for E1/DS1 facilities		

10/100BT Ethernet and Gigabit Ethernet PM parameters

Ethernet PM parameters are accumulated for the 10/100BT Ethernet interfaces on the 8x10/100BT L1 circuit pack and the Gigabit Ethernet interfaces on the 2xGE L1 circuit pack. [Table 6-13](#) provides a summary of the supported 10/100BT Ethernet and Gigabit Ethernet PM parameters.

Table 6-13
10/100BT Ethernet and Gigabit Ethernet PM parameters summary

Facility	PM parameter
10/100BT Ethernet	• Alignment Errors • Broadcast Frames Received • Broadcast Frames Transmitted • Collisions • ES • Ethernet Interval Valid • Frame Too Long Errors • Frame Too Short Errors • Frames Aborted Due To Excessive Collisions • FCS Errors • Frames Dropped Rx • Frames Dropped Tx • Frames Received • Frames Transmitted • Frames With Deferred Transmissions • Idle Seconds • Late Collisions • Multicast Frames Received • Multicast Frames Transmitted • Multiple Collision Frames • Octets Received • Octets Transmitted • Pause Frames Received • Pause Frames Transmitted • SES • Single Collision Frames • UAS

Table 6-13 (continued)
10/100BT Ethernet and Gigabit Ethernet PM parameters summary

Facility	PM parameter
Gigabit Ethernet	• ES • Ethernet Interval Valid • Frame Too Long Errors • Frame Too Short Errors • FCS Error Bytes • FCS Error Frames • Frames Dropped Rx • Frames Dropped Tx • Frames Received • Frames Transmitted • Idle Seconds • Octets Received • Octets Transmitted • Pause Frames Received • Pause Frames Transmitted • SES • UAS

WAN PM parameters

WAN PM parameters are accumulated for the 10/100BT Ethernet interfaces on the 8x10/100BT L1 circuit pack and the Gigabit Ethernet interfaces on the 2xGE L1 circuit pack. [Table 6-14](#) provides a summary of the supported VCG PM parameters.

Table 6-14
WAN PM parameters summary

Facility	PM parameter
WAN for 10/100BT Ethernet ports	• Core Header CRC Errors • Core Header Single Error Corrections • ES • Frames Dropped • Idle Seconds • Payload FCS Errors • SES • Type Header CRC Errors • Type Header Single Error Corrections • UAS • Valid Bytes Received • Valid Bytes Transmitted • Valid Frames Received • Valid Frames Transmitted • VCG Interval Valid
WAN for Gigabit Ethernet ports	• Core Header CRC Errors • Core Header Single Error Corrections • ES • Idle Seconds • Payload FCS Errors • SES • Type Header CRC Errors • Type Header Single Error Corrections • UAS • Valid Bytes Received • Valid Bytes Transmitted • Valid Frames Received • Valid Frames Transmitted • VCG Interval Valid

PM time intervals

For PM parameters, the following PM counts are stored and can be retrieved:

- current 15-minute interval
- last 32 15-minute intervals
- current day
- previous day

PM enable/disable

The 15-minutes and 1-Day Threshold Cross Alerts for the STM-1/4/PDH/DSn facilities are disabled by default. The system does not generate TCAs if the port/facility is in the admin down state.

PM inhibition

The system inhibits the collection of PMs when the associated facility is in the admin down state and for some parameters during various trouble conditions.

For more details on performance layer parameters, refer to *Trouble Clearing and Module Replacement Procedures*, 323-1855-543.

Security and administration

The OME6130 provides the following security and administration capabilities managed from local craft access terminal:

- Network element security
 - security levels
 - login sessions
 - local password management
 - local user authentication
- Network element administration
 - network element naming
 - date and time setting

For details of the procedures associated with security and administration, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Local account user authentication

Local account user authentication uses a user ID and password and is the default method on OME6130 network elements. A user ID and password is managed individually at each network element.

Security levels

OME6130 network elements support multiple security access levels. This feature reduces accidental or intrusive interruption of service. As defined in, there are 3 user access classes that allow a range of task execution capabilities.

Table 6-15
User access classes for OME6130

User Access Classes	Privileges
USER	The user has read-only access to all the management information including configuration, faults and performance.
OPERATOR	The operator can: • configure interfaces and cross connections • reset performance statistics • maintain operations such as software/configuration backup/restore, loopbacks
ADMIN	The administrator can: • create and delete login access for the network element • access network element configurable parameters like mode, location, contact as well as management parameters like Ethernet/router IP address/masks, OSPF parameters

The OME6130 has a default ADMIN level account named ADMIN with ADMIN password. Nortel Networks recommends that the default passwords be changed. See [“Local password management” on page 6-40](#) for more information.

There is no restriction on the number of user account per user access class, as long as the total number of local user accounts does not exceed nine (9).

Login sessions

To manage an OME6130 network element and issue commands, the user must be logged in on that node which creates a login session. The maximum number of login sessions to a network element is ten.

Multiple login sessions

Several user accounts can be active at the same time as long as the maximum number of ten login sessions is not exceeded. When several sessions are active, commands can be sent to the network element simultaneously from each active session.

Local password management

The user performs local password management from the **Security** menu of the local craft access terminal.

Password restrictions

For the OME6130 network element, a valid password must be used in order to activate a login session. The password is a confidential code to qualify the authorized system user's access to the account specified by the user name. The password must be exactly 8 characters in length. The OME6130 uses a security based on the Linux operating systems password encryption scheme.

Table 6-16
User ID and password details

User ID	• is unique • can be alphabetic/numeric/alphanumeric • supports special characters except space • supports up to 32 characters • is case sensitive
Password	• is unique • must be exactly eight characters long • can be alphabetic/numeric/alphanumeric • supports special characters except space • is case sensitive • and the user ID cannot be identical

Network element name

The user can edit the network element name assigned during the commissioning phase from the **NE Information** application in the **System** main menu on the local craft access terminal.

The network element name can be alphabetic/numerical/alphanumeric consisting of 1-18 characters. Special characters can also be used, except space. Quotes are added automatically in the TL1 interface for the network element name (TID).

Date and time setting

The user can edit the network element date and time settings provisioned during the commissioning phase from the **System Time application** on the local craft access terminal. This application provides the following time of day synchronization features:

- Date and time setting
- Time zone setting

- Time server setting

Date and time setting

The network element date and time can be provisioned using the **Set Time** application in the **System Time** menu.

Time zone setting

The time zone of the OME6130 network element can be provisioned to correspond to the local settings using the **Set time zone** application in the **System Time** menu.

Time server setting

The OME6130 network element can be provisioned to synchronize its time off of NTP servers:

- up to 5 NTP servers can be provisioned (no servers set as default)
- synchronization frequency of the network element can be provisioned in units of seconds (default is 1024 seconds)
- the synchronization to NTP server feature can be enabled or disabled by user (default is disabled).

When NTP server synchronization is enabled, the network element time is automatically adjusted after a restart of the network element or shelf power failures. If no NTP server is available, the network element time is based on an internal clock.

Note: When managing the OME6130 network element using OMEA, the first two NTP servers will automatically be provisioned by the OMEA server. If additional time servers are desired, these should be provisioned against other than the first two sources.

The user can provision TOD synchronization from the **Set time server** application in the **System Time** menu of the local craft access terminal.

For a complete description of the security and network element administration features and procedures, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Topology adjacency

The topology adjacency feature on the OME6130 is used by the network management to build the network topology for end-to-end connection management. The network topology is built based on the neighbour status information, which can be manually provisioned by the user or set to be automatically discovered upon establishing connectivity to neighbour nodes.

For detailed procedures for provisioning the topology adjacency parameters, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

Backing up and restoring the network element database

The OME6130 network element is responsible for the resilience of its provisioning data. A primary and backup copy of the configuration and provisioning data is stored on the flash disk on the 2x155/622M aggregate circuit pack. This ensures that in the event of a failure, the system can still recover on its own.

The user manages database backups from the **Backup configuration** and **Restore configuration** applications in the **Maintenance/Configuration Management** menu of the local craft access terminal. The applications allow the user to manage backup copies of the network element database for each network element within a network and restore the network element database to an operational state following a system initialization.

Backup and restore operations can be performed remotely or locally from a machine (server or PC). The remote operation uses FTP to move configuration data between network elements and external backup repositories via a DCN. A FTP server is required in order to perform remote backup and restore operations onto the OME6130 network element. The local operation uses HTTP to move configuration between the network element and an external backup repository (laptop or desktop) locally connected to the Craft port.

Refer to *Installation, Commissioning and Testing Procedures*, 323-1855-201, for more information.

Technical specifications

This chapter provides technical specifications, as listed in [Table 7-1](#), for the Optical Multiservice Edge 6130 (OME6130) network element.

Table 7-1
Topics in this chapter

Topic	Page
Physical specifications	7-2
Power specifications	7-3
Connector pinouts	7-5
E1/DS1 cable pinouts and assemblies	7-18
Optical specifications	7-23
Electrical specifications	7-33
Environmental specifications	7-35
Electromagnetic specifications	7-36
Safety specifications	7-37
Power and grounding specifications	7-38

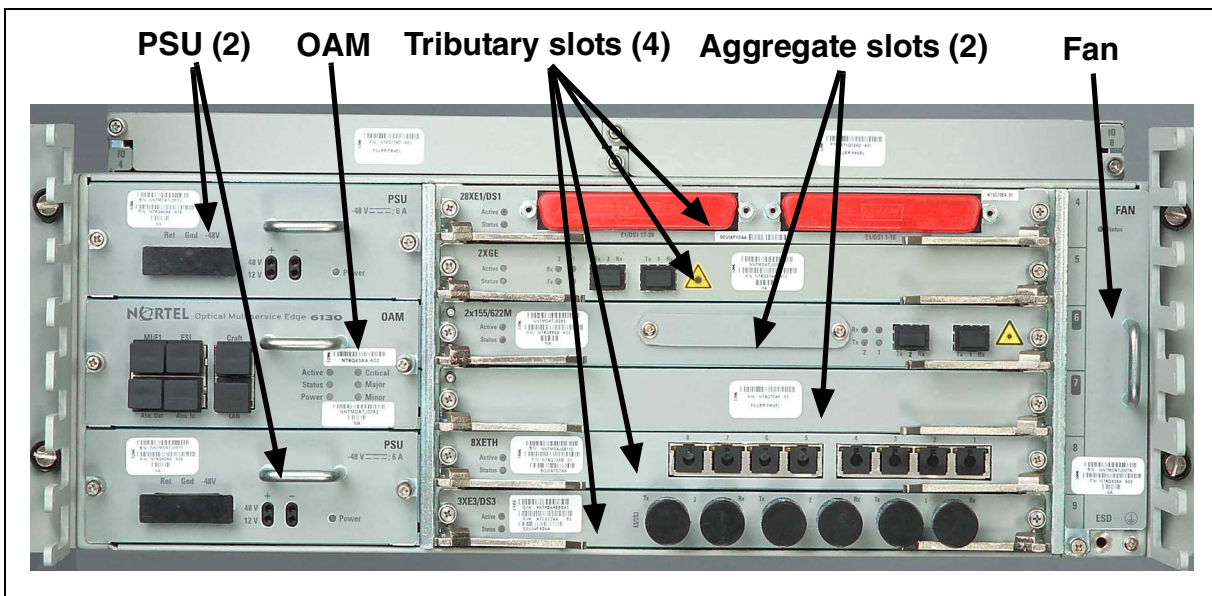
Physical specifications

[Table 7-2](#) lists the following physical specifications for OME6130 network elements.

Table 7-2
Physical specifications for OME6130 platform

Equipment	Physical specification	Notes
Circuit packs		
2x155/622M aggregate	2 ports/circuit pack (2 ports/shelf)	Refer to OME6130 network element configuration rules on page 8-2 .
8x10/100BT L1 Ethernet	8 ports/circuit pack (maximum of 32 ports/shelf)	
2xGE L1	2 ports/circuit pack (maximum of 8 ports/shelf)	
3xE3/DS3	3 ports/circuit pack (maximum of 12 ports/shelf)	
28xE1/DS1	28 ports/circuit pack (maximum of 112 ports/shelf)	
2x155M	2 ports/circuit pack (maximum of 8 ports/shelf)	
OME6130 chassis		
Height	4U (176.0 mm / 6.9 in.)	Refer to: • Figure 7-1 on page 7-3 for an overview of the OME6130 chassis • OME6130 network element configuration rules on page 8-2 for more information about physical specifications
Width	445.0 mm / 17.5 in.	
Depth	231.0 mm / 9.1 in. (shelf only) 295.0 mm / 11.6 in. (including cable routing brackets)	

Figure 7-1
OME6130 chassis - physical specifications



Power specifications

The OME6130 equipped with the DC PSU operates from -40 V dc to -57.5 V dc measured at the input terminals of the network element. The following tables list the estimated power consumption for the different modules:

- [Table 7-3](#) lists the estimated power requirement for the common equipment at -54 V dc
- [Table 7-4](#) lists the estimated power requirement for each interface circuit pack -54 V dc
- [Table 7-5](#) lists the estimated power requirement for each small form-factor pluggable (SFP) module at -54 V dc
- [Table 7-6](#) lists the recommended feeders for the chassis

Table 7-3
Power consumption for common equipment at -54 V dc

Common equipment	Typical (W)
2x155/622M aggregate circuit pack	20
Single feed DC Power Supply Unit	18
OAM circuit pack	6
Fan module	13
Chassis	0

Table 7-4
Power consumption for each circuit pack at -54 V dc

Circuit pack	Typical (W)
8x10/100BT L1	7.6
2xGE L1	8
3xE3/DS3	8
28xE1/DS1	7.2
2x155M	8

Table 7-5
Power consumption for each SFP at -54 V dc

STM-1/4 and GE SFP modules	Typical (W)
STM-1 SR0 (multimode)	0.7
STM-1/4 S1.1/4.1	0.7
STM-1/4 L1.1/4.1	0.7
STM-1/4 L1.2/4.2 XCT	0.7
STM-1/4 CWDM	0.7
STM-1 (100Base) Bidirectional at 1310nm	0.7
STM-1 (100Base) Bidirectional at 1550nm	0.7
STM-1e (electrical)	0.7
GE SX	0.7
GE LX	0.7

Table 7-6
Recommended feeders

Configuration	Feeders per shelf
OME6130 chassis with DC PSU	A feed (6 A) and redundant B feed (6 A)

Refer to [Table 8-20 on page 8-18](#) for a list of power cables assemblies available and the *Installation, Commissioning and Testing Procedures*, 323-1855-201 for details on installing and connecting power to an OME6130 shelf.

Connector pinouts

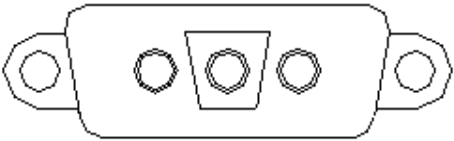
[Table 7-7](#) lists the connectors and the respective tables providing the details of their pin assignments and front views.

Table 7-7
Connector pin assignment details

Connector	Details
DC power connector	Table 7-8
OAM circuit pack connector pinouts	
Alarm input connector	Table 7-9
Alarm output connector	Table 7-10
M1/F1 connector	Table 7-11
ESI connector	Table 7-12
LAN, Craft and 8x10/100BT port connector	Table 7-13
28xE1/DS1 connector pinouts	
E1 connector (port 1 -16) on 28xE1/DS1 circuit pack	Table 7-14
DS1 connector (port 1 -16) on 28xE1/DS1 circuit pack	Table 7-15
E1 connector (port 17-28) on 28xE1/DS1 circuit pack	Table 7-16
E1 connector (port 17-28) on 28xE1/DS1 circuit pack	Table 7-17

DC power connector**Table 7-8**

DC power connector - pin assignment (in NT6Q59CA, NT6Q59DA, NT6Q59PA and NT6Q59QA)

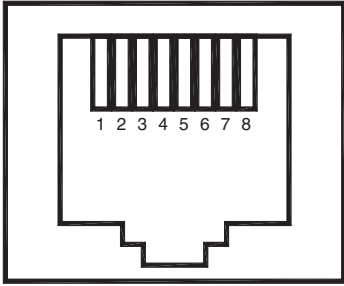
	Pin	Connector
	1	RET
	2	GND
	3	-48V

OAM circuit pack connector pinouts

Figure 7-1 on page 7-3 shows the interfaces available on the OAM circuit pack. Table 7-9 to Table 7-14 provide the details on the RJ-45 OAM ports.

Alarm input connector**Table 7-9**

Alarm input connector - pin assignment (in NT6Q59AB)

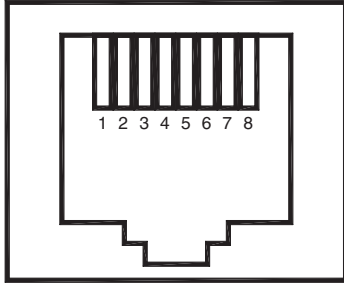
	Pin	Description
	1	ALARMIN_1
	2	ALARMIN_7
	3	ALARMIN_6
	4	ALARMIN_5
	5	ALARMIN_4
	6	ALARMIN_3
	7	ALARMIN_2
	8	COMMON

Note: The alarm inputs are operating as follows:
 open circuit = no alarm
 closed circuit = alarm

Alarm output connector

Table 7-10

Alarm output connector - pin assignment (in NT6Q59AB)

	Pin	Description	Usage
	1	ALARMOUT_4_RET	Unused
	2	ALARMOUT_4	
	3	ALARMOUT_3_RET	Minor
	4	ALARMOUT_3	
	5	ALARMOUT_2_RET	Major
	6	ALARMOUT_2	
	7	ALARMOUT_1_RET	Critical
	8	ALARMOUT_1	

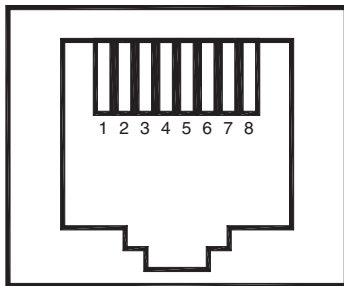
Note 1: Those contacts are normally open.

Note 2: For each alarm output, a relay is present between the signal pin and the return pin. The maximum voltage is 30 VDC for the monitoring equipment connected to the output.

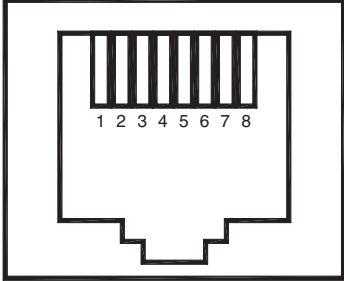
M1/F1 connector

Table 7-11

M1/F1 connector - pin assignment (NT6Q71AG/NT6Q71AF)

	Pin	Signal (M1)	Signal (F1)
	1	DSR	
	2	CD	
	3	DTR	
	4	GND	GND
	5	RD	RD
	6	TD	TD
	7	CTS	
	8	RTS	

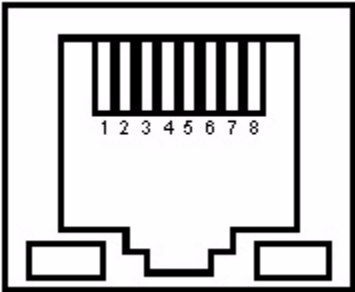
ESI connector**Table 7-12****ESI connector - pin assignment (NT6Q71AC/NT6Q71AE)**

	Pin	Signal
	1	CLKIN+
	2	CLKIN-
	3	DATAIN+
	4	CLKOUT-
	5	CLKOUT+
	6	DATAIN-
	7	DATAOUT+
	8	DATAOUT-

Note 1: BITS-1-2-1 (IN) uses pins 1 & 2 and BITS-1-2-2 (IN) uses pins 3 & 6

Note 2: BITS-1-2-1 (OUT) uses pins 4 & 5 and BITS-1-2-2 (OUT) uses pins 7 & 8

LAN, Craft and 8x10/100BT port connector**Table 7-13****LAN, Craft and 8x10/100BT port connector - pin assignment (NTUC58Px and NTTC09C/Dx)**

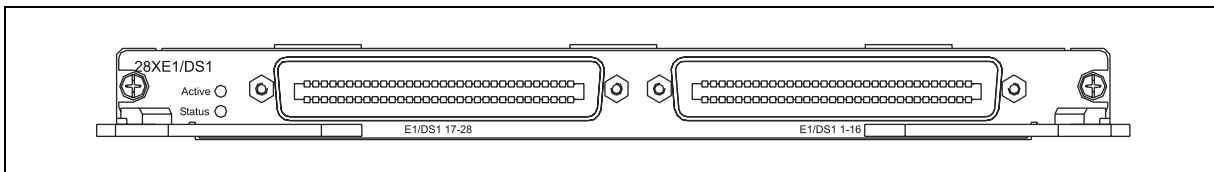
	Pin	Signal
	1	RX+
	2	RX-
	3	TX+
	4	
	5	
	6	TX-
	7	
	8	

Note: The Ethernet cables connecting to the 10/100BT ports on the 8x10/100BT L1 circuit pack must be shielded twisted pair. Refer to [Ethernet service cable assemblies on page 8-14](#) for ordering information.

28xE1/DS1 connector pinouts

Figure 7-2 on page 7-9 shows the faceplate of the 28xE1/DS1 circuit pack. The first 64-pin Telco connector is used for ports 1 to 16 of the circuit pack and the pinout is presented in Table 7-14 for E1 services and Table 7-15 for DS1 services. The second 64-pin Telco connector is used for ports 17 to 28 and the pinout information is presented in Table 7-16 for E1 services and Table 7-17 for DS1 services.

Figure 7-2
28 x E1/DS1 circuit pack faceplate



E1 connector (port 1 -16) on 28xE1/DS1 circuit pack**Table 7-14****E1 connector - pin assignment (NT6Q73BA, NT6Q73CA, NT6Q73DA and NT6Q73EA)**

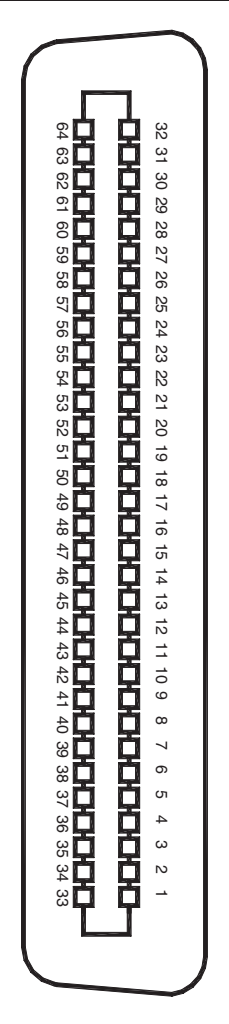
	Pin	Signal	Group	Color	Pin	Signal	Group	Color (White/)	Pair
	1	TX1+	1	Orange	33	TX1-	1	Orange	P1
	2	RX1+	1	Green	34	RX1-	1	Green	P2
	3	TX2+	1	Blue	35	TX2-	1	Blue	P3
	4	RX2+	1	Brown	36	RX2-	1	Brown	P4
	5	TX3+	2	Orange	37	TX3-	2	Orange	P5
	6	RX3+	2	Green	38	RX3-	2	Green	P6
	7	TX4+	2	Blue	39	TX4-	2	Blue	P7
	8	RX4+	2	Brown	40	RX4-	2	Brown	P8
	9	TX5+	3	Orange	41	TX5-	3	Orange	P9
	10	RX5+	3	Green	42	RX5-	3	Green	P10
	11	TX6+	3	Blue	43	TX6-	3	Blue	P11
	12	RX6+	3	Brown	44	RX6-	3	Brown	P12
	13	TX7+	4	Orange	45	TX7-	4	Orange	P13
	14	RX7+	4	Green	46	RX7-	4	Green	P14
	15	TX8+	4	Blue	47	TX8-	4	Blue	P15
	16	RX8+	4	Brown	48	RX8-	4	Brown	P16
	17	TX9+	5	Orange	49	TX9-	5	Orange	P17
	18	RX9+	5	Green	50	RX9-	5	Green	P18
	19	TX10+	5	Blue	51	TX10-	5	Blue	P19
	20	RX10+	5	Brown	52	RX10-	5	Brown	P20
	21	TX11+	6	Orange	53	TX11-	6	Orange	P21
	22	RX11+	6	Green	54	RX11-	6	Green	P22
	23	TX12+	6	Blue	55	TX12-	6	Blue	P23
	24	RX12+	6	Brown	56	RX12-	6	Brown	P24
	25	TX13+	7	Orange	57	TX13-	7	Orange	P25
	26	RX13+	7	Green	58	RX13-	7	Green	P26

Table 7-14 (continued)
E1 connector - pin assignment (NT6Q73BA, NT6Q73CA, NT6Q73DA and NT6Q73EA)

	27	TX14+	7	Blue	59	TX14-	7	Blue	P27
	28	RX14+	7	Brown	60	RX14-	7	Brown	P28
	29	TX15+	8	Orange	61	TX15-	8	Orange	P29
	30	RX15+	8	Green	62	RX15-	8	Green	P30
	31	TX16+	8	Blue	63	TX16-	8	Blue	P31
	32	RX16+	8	Brown	64	RX16-	8	Brown	P32
Note: Right routing E1 cables connecting to the 28xE1/DS1 circuit pack must have a shielded connector. Refer to Table 7-21 on page 7-21 for details on the shielded connector specifications.									

DS1 connector (port 1 -16) on 28xE1/DS1 circuit pack**Table 7-15****DS1 connector - pin assignment (NT6Q73QA and NT6Q73TA)**

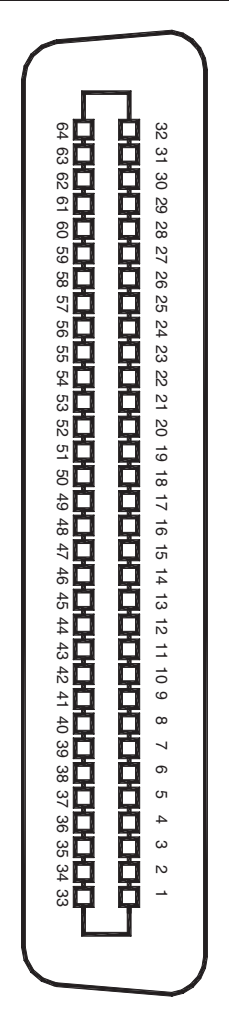
	Pin	Signal	VTG	Color	Pin	Signal	VTG	Color	Pair
	1	TX1(tip)	1	White (WH/BU)	33	TX1(ring)	1	Blue (WH/BU)	P1
	2	RX1(tip)	1	White (WH/OR)	34	RX1(ring)	1	Orange (WH/OR)	P2
	3	TX2(tip)	1	White (WH/GN)	35	TX2(ring)	1	Green (WH/GN)	P3
	4	RX2(tip)	1	White (WH/BR)	36	RX2(ring)	1	Brown (WH/BR)	P4
	5	TX3(tip)	1	White (WH/GR)	37	TX3(ring)	1	Gray (WH/GR)	P5
	6	RX3(tip)	1	Red (RD/BU)	38	RX3(ring)	1	Blue (RD/BU)	P6
	7	TX4(tip)	1	Red (RD/OR)	39	TX4(ring)	1	Orange (RD/OR)	P7
	8	RX4(tip)	1	Red (RD/GN)	40	RX4(ring)	1	Green (RD/GN)	P8
	9	TX5(tip)	2	Red (RD/BR)	41	TX5(ring)	2	Brown (RD/BR)	P9
	10	RX5(tip)	2	Red (RD/GR)	42	RX5(ring)	2	Gray (RD/GR)	P10
	11	TX6(tip)	2	Black (BK/BU)	43	TX6(ring)	2	Blue (BK/BU)	P11
	12	RX6(tip)	2	Black (BK/OR)	44	RX6(ring)	2	Orange (BK/OR)	P12
	13	TX7(tip)	2	Black (BK/GN)	45	TX7(ring)	2	Green (BK/GN)	P13
	14	RX7(tip)	2	Black (BK/BR)	46	RX7(ring)	2	Brown (BK/BR)	P14
	15	TX8(tip)	2	Black (BK/GR)	47	TX8(ring)	2	Gray (BK/GR)	P15
	16	RX8(tip)	2	Yellow (YL/BU)	48	RX8(ring)	2	Blue (YL/BU)	P16

Table 7-15 (continued)
DS1 connector - pin assignment (NT6Q73QA and NT6Q73TA)

	17	TX9(tip)	3	Yellow (YL/OR)	49	TX9(ring)	3	Orange (YL/OR)	P17
	18	RX9(tip)	3	Yellow (YL/GN)	50	RX9(ring)	3	Green (YL/GN)	P18
	19	TX10(tip)	3	Yellow (YL/BR)	51	TX10(ring)	3	Brown (YL/BR)	P19
	20	RX10(tip)	3	Yellow (YL/GR)	52	RX10(ring)	3	Gray (YL/GR)	P20
	21	TX11(tip)	3	Purple (PU/BU)	53	TX11(ring)	3	Blue (PU/BU)	P21
	22	RX11(tip)	3	Purple (PU/OR)	54	RX11(ring)	3	Orange (PU/OR)	P22
	23	TX12(tip)	3	Purple (PU/GN)	55	TX12(ring)	3	Green (PU/GN)	P23
	24	RX13(tip)	3	Purple (PU/BR)	56	RX13(ring)	3	Brown (PU/BR)	P24
	25	TX13(T)	4	Purple (PU/GR)	57	TX13(R)	4	Gray (PU/GR)	P25
	26	RX13(T)	4	Wh/Blue (WH-BU/BU)	58	RX13(R)	4	Blue (WH-BU/BU)	P26
	27	TX14(T)	4	Wh/Blue (WH-BU/OR)	59	TX14(R)	4	Orange (WH-BU/OR)	P27
	28	RX14(T)	4	Wh/Blue (WH-BU/GN)	60	RX14(R)	4	Green (WH-BU/GN)	P28
	29	TX15(T)	4	Wh/Blue (WH-BU/BR)	61	TX15(R)	4	Brown (WH-BU/BR)	P29
	30	RX15(T)	4	Wh/Blue (WH-BU/GR)	62	RX15(R)	4	Gray (WH-BU/GR)	P30
	31	TX16(T)	4	Wh/Or (WH-OR/BU)	63	TX16(R)	4	Blue (WH-OR/BU)	P31
	32	RX16(T)	4	Wh/OR (WH-OR/OR)	64	RX16(R)	4	Orange (WH-OR/OR)	P32
Note: Right routing DS1 cables connecting to the 28xE1/DS1 circuit pack must have a shielded connector. Refer to Table 7-21 on page 7-21 for details on the shielded connector specifications.									

E1 connector (port 17-28) on 28xE1/DS1 circuit pack**Table 7-16****E1 connector (port 17-28) - pin assignment (NT6Q73BA, NT6Q73CA, NT6Q73DA and NT6Q73EA)**

	Pin	Signal	Group	Color	Pin	Signal	Group	Color (White/)	Pair
	1	TX17+	1	Orange	33	TX17-	1	Orange	P1
	2	RX17+	1	Green	34	RX17-	1	Green	P2
	3	TX18+	1	Blue	35	TX18-	1	Blue	P3
	4	RX18+	1	Brown	36	RX18-	1	Brown	P4
	5	TX19+	2	Orange	37	TX19-	2	Orange	P5
	6	RX19+	2	Green	38	RX19-	2	Green	P6
	7	TX20+	2	Blue	39	TX20-	2	Blue	P7
	8	RX20+	2	Brown	40	RX20-	2	Brown	P8
	9	TX21+	3	Orange	41	TX21-	3	Orange	P9
	10	RX21+	3	Green	42	RX21-	3	Green	P10
	11	TX22+	3	Blue	43	TX22-	3	Blue	P11
	12	RX22+	3	Brown	44	RX22-	3	Brown	P12
	13	TX23+	4	Orange	45	TX23-	4	Orange	P13
	14	RX23+	4	Green	46	RX23-	4	Green	P14
	15	TX24+	4	Blue	47	TX24-	4	Blue	P15
	16	RX24+	4	Brown	48	RX24-	4	Brown	P16
	17	TX25+	5	Orange	49	TX25-	5	Orange	P17
	18	RX25+	5	Green	50	RX25-	5	Green	P18
	19	TX26+	5	Blue	51	TX26-	5	Blue	P19
	20	RX26+	5	Brown	52	RX26-	5	Brown	P20
	21	TX27+	6	Orange	53	TX27-	6	Orange	P21
	22	RX27+	6	Green	54	RX27-	6	Green	P22
	23	TX28+	6	Blue	55	TX28-	6	Blue	P23
	24	RX28+	6	Brown	56	RX28-	6	Brown	P24
	25	NC			57	NC			P25
	26	NC			58	NC			P26

Table 7-16 (continued)
E1 connector (port 17-28) - pin assignment (NT6Q73BA, NT6Q73CA, NT6Q73DA and NT6Q73EA)

	27	NC			59	NC			P27
	28	NC			60	NC			P28
	29	NC			61	NC			P29
	30	NC			62	NC			P30
	31	NC			63	NC			P31
	32	NC			64	NC			P32
Note: Right routing E1 cables connecting to the 28xE1/DS1 circuit pack must have a shielded connector. Refer to Table 7-21 on page 7-21 for details on the shielded connector specifications.									

DS1 connector (port 17-28) on 28xE1/DS1 circuit pack**Table 7-17****DS1 connector (port 17-28) - pin assignment (NT6Q73QA and NT6Q73TA)**

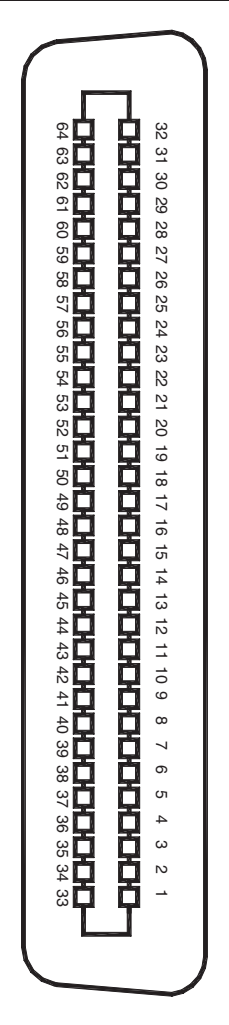
	Pin	Signal	VTG	Color	Pin	Signal	VTG	Color	Pair
	1	TX17(tip)	1	White (WH/BU)	33	TX17(ring)	1	Blue (WH/BU)	P1
	2	RX17(tip)	1	White (WH/OR)	34	RX17(ring)	1	Orange (WH/OR)	P2
	3	TX18(tip)	1	White (WH/GN)	35	TX18(ring)	1	Green (WH/GN)	P3
	4	RX18(tip)	1	White (WH/BR)	36	RX18(ring)	1	Brown (WH/BR)	P4
	5	TX19(tip)	1	White (WH/GR)	37	TX19(ring)	1	Gray (WH/GR)	P5
	6	RX19(tip)	1	Red (RD/BU)	38	RX19(ring)	1	Blue (RD/BU)	P6
	7	TX20(tip)	1	Red (RD/OR)	39	TX20(ring)	1	Orange (RD/OR)	P7
	8	RX20(tip)	1	Red (RD/GN)	40	RX20(ring)	1	Green (RD/GN)	P8
	9	TX21(tip)	2	Red (RD/BR)	41	TX21(ring)	2	Brown (RD/BR)	P9
	10	RX21(tip)	2	Red (RD/GR)	42	RX21(ring)	2	Gray (RD/GR)	P10
	11	TX22(tip)	2	Black (BK/BU)	43	TX22(ring)	2	Blue (BK/BU)	P11
	12	RX22(tip)	2	Black (BK/OR)	44	RX22(ring)	2	Orange (BK/OR)	P12
	13	TX23(tip)	2	Black (BR/GN)	45	TX23(ring)	2	Green (BK/GN)	P13
	14	RX23(tip)	2	Black (BK/BR)	46	RX23(ring)	2	Brown (BK/BR)	P14
	15	TX24(tip)	2	Black (BK/GR)	47	TX24(ring)	2	Gray (BK/GR)	P15
	16	RX24(tip)	2	Yellow (YL/BU)	48	RX24(ring)	2	Blue (YL/BU)	P16

Table 7-17 (continued)
DS1 connector (port 17-28) - pin assignment (NT6Q73QA and NT6Q73TA)

17	TX25(tip)	3	Yellow (YL/OR)	49	TX25(ring)	3	Orange (YL/OR)	P17
18	RX25(tip)	3	Yellow (YL/GN)	50	RX25(ring)	3	Green (YL/GN)	P18
19	TX26(tip)	3	Yellow (YL/BR)	51	TX26(ring)	3	Brown (YL/BR)	P19
20	RX26(tip)	3	Yellow (YL/GR)	52	RX26(ring)	3	Gray (YL/GR)	P20
21	TX27(tip)	3	Purple (PU/BU)	53	TX27(ring)	3	Blue (PU/BU)	P21
22	RX27(tip)	3	Purple (PU/OR)	54	RX27(ring)	3	Orange (PU/OR)	P22
23	TX28(tip)	3	Purple (PU/GN)	55	TX28(ring)	3	Green (PU/GN)	P23
24	RX28(tip)	3	Purple (PU/BR)	56	RX28(ring)	3	Brown (PU/BR)	P24
25	NC			57	NC			P25
26	NC			58	NC			P26
27	NC			59	NC			P27
28	NC			60	NC			P28
29	NC			61	NC			P29
30	NC			62	NC			P30
31	NC			63	NC			P31
32	NC			64	NC			P32

Note: Right routing DS1 cables connecting to the 28xE1/DS1 circuit pack must have a shielded connector. Refer to [Table 7-21 on page 7-21](#) for details on the shielded connector specifications.

E1/DS1 cable pinouts and assemblies

Cable details

The 28xE1/DS1 circuit pack supports 64-pin Telco connectors to offer the E1/DS1 services. By default, the ports are 120/100 ohm balanced E1/DS1 electrical ports. A termination panel can be used to convert the 120 ohm balanced E1 ports to 75 ohm unbalanced E1 ports.

The following sections detail the pinouts and port mappings for the 120/100 ohm cable assemblies and for the 75 ohm termination panel. The E1/DS1 cables come with right routing.

These cable assemblies can be ordered from Nortel (see [E1/DS1 cable assemblies on page 8-12](#)) or produced locally to the specifications provided:

- [Table 7-14 on page 7-10](#) provides the 120 ohm cable connector pin assignment, which applies for E1 services on the first connector on the 28xE1/DS1 circuit pack.
- [Table 7-15 on page 7-12](#) provides the 100 ohm cable connector pin assignment, which applies for DS1 services on the first connector on the 28xE1/DS1 circuit pack.
- [Table 7-16 on page 7-14](#) provides the 120 ohm E1 cable connector pin assignment for the second connector on the 28xE1/DS1 circuit pack.
- [Table 7-17 on page 7-16](#) provides the 100 ohm DS1 cable connector pin assignment for the second connector on the 28xE1/DS1 circuit pack.
- [Figure 7-3 on page 7-19](#) shows the 75 ohm BNC termination panel for 16 channels. Using the termination panel, the 120 ohm balanced E1 services can be converted to 75 ohm unbalanced.
- [Table 7-18 on page 7-19](#) lists the physical specifications for the 75 ohm BNC termination panel
- [Table 7-19 on page 7-20](#) lists the cable specifications for connecting the E1 ports of the 28xE1/DS1 circuit pack.
- [Table 7-20 on page 7-21](#) lists the cable specifications for connecting the DS1 ports of the 28xE1/DS1 circuit pack.
- [Table 7-21 on page 7-21](#) lists the connector specifications for the shield connector required for the right routing E1 and DS1 cables for use with the 28xE1/DS1 circuit pack.
- [Figure 7-4 on page 7-22](#) shows the 120 ohm twisted pair E1 cable bundle.
- [Figure 7-5 on page 7-23](#) shows the 64-pin 100 degree right routing cable connector.

Note: The color codes and pinout provided apply to the suggested E1/DS1 cables. Color codes and pinout may vary by manufacturer.

Figure 7-3
75 ohm termination panel - 16 channel



Note: The 75 ohm termination panel is labeled from 1-16 by default, but includes an additional overlay label which can be installed by the user when connecting the ports 17-28 of the 28xE1/DS1 circuit pack.

Table 7-18
Physical specifications for 75 ohm BNC termination panel

Feature	Physical specification	Notes
Data rate	2.048 Mbps	
75 ohm connector	Dual coax female BNC	
120 ohm connector (for interconnection with OME6130 shelf)	64-pin Telco	See Table 7-14 on page 7-10 for pinout information on 64-pin connector.
Power supply	none required	
Link-to-data isolation	500 volts AC/DC	
Temperature range	0-50°C	
Height	1U (44.0 mm / 1.9 in.)	
Width	483.0 mm / 19 in.	
Depth	89.0 mm / 3.5 in.	

[Table 7-19](#) lists the E1 cable specifications and [Table 7-20](#) lists the DS1 cable specifications for connecting E1 and DS1 ports respectively, on the 28xE1/DS1 circuit pack.

Table 7-19
Cable specifications for connecting E1 ports

Feature	Physical specification
Conductor	26 AWG solid tin plated copper
Insulation	Solid polyolefin
Pairs	Two conductors twisted into pairs with varying lay length
Pair groups	Four twisted pairs are cabled together
Jacket	Four pair groups are jacketed with PVC and each group is numbered
Cable Groups	8 four pair groups are cabled together
Colour Code	• Pair 1: Orange-White/Orange • Pair 2: Blue-White/Blue • Pair 3: Green-White/Green • Pair 4: Brown-White/Brown
Shield	Overall Aluminum/Mylar foil shield with aluminum side facing out. 26 AWG tinned copper drain wire over the foil with a 34 AWG tin plated copper braid, 65% coverage.
Jacket	Gray PVC jacket. Overall dimension 15,6 mm Nom.
Electrical Characteristics	
Impedance	120+/- Ohms Nom.
Capacitance	13.3 pF/ft Nominal
Velocity of propagation	65% Nominal
Near End Cross Talk (NEXT) pair to pair	53 dB at 20 MHz
Dielectric Strength	
Conductor to Conductor	2.5 KV DC
Core to Sheath	2.3 KV DC

Table 7-20
Cable specifications for connecting DS1 ports

Feature	Physical specification
Conductor	24 AWG solid tin plated copper
Insulation	Solid polyolefin or solid Polyethylene
Pairs	Two conductors twisted into pairs with varying lay length
Pair groups	32 twisted pairs are cabled together
Jacket	32 pair groups are jacketed with PVC
Colour Code	Refer to Table 7-15 on page 7-12 for colour coding information
Shield	24 AWG tinned copper drain wire over the foil with a 34 AWG tin plated copper braid, 65% coverage.
Jacket	Gray PVC jacket. Overall dimension 14.0 mm Nom.
Electrical Characteristics	
Impedance	100 +/- 15 Ohms Nom.
Capacitance	13.3 pF/ft Nominal
Velocity of propagation	65% Nominal
Near End Cross Talk (NEXT) pair to pair	53 dB at 20 MHz
Dielectric Strength	
Conductor to Conductor	2.5 KV DC
Core to Sheath	2.3 KV DC

For applications with the 28xE1/DS1 circuit pack, right routing E1 or DS1 cables must be used. The cable connectors for the right routing cables must comply to the specifications provided in [Table 7-21](#). Refer to [Figure 7-5 on page 7-23](#) for more details.

Table 7-21
Connector specifications for right routing E1/DS1 cables

Feature	Physical specification
Connector	
Connector type	64 POS Male AMP Champ (0.085) or equivalent 'key telephone' connector
Latching hardware	4-40 screws - 2 places
Component	Minimum 30uin Au over 50uin Ni plating on contacts

Table 7-21 (continued)
Connector specifications for right routing E1/DS1 cables

Feature	Physical specification
Hood	
Hood exit	Angled exit recommended at 100 degrees. Close proximity of connector positions on OME6110 faceplate prevents the user of many low profile right angle exit hoods. (See Figure 7-5 on page 7-23)
Depth	60 mm maximum connector hood and cable depth from connector mating face
Component	Metal plated plastic (100% coverage) or fully metal shielded connector hood
Terminations	Shielded hood terminated to cable shield and to both hood mounting screws via the cable drain wires (both mounting screws must attach to the drain wire through Y'd arrangement, or two drain wires) and interference contact to exposed braid at the exit of the cable from hood.

Figure 7-4
E1 coaxial cable bundle specification

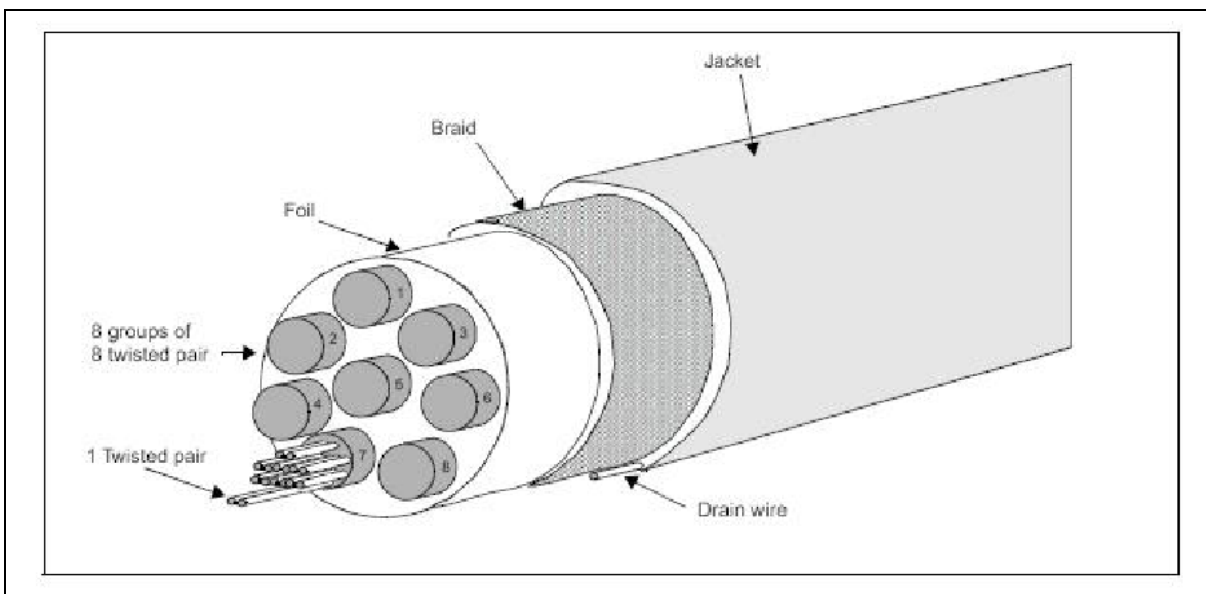
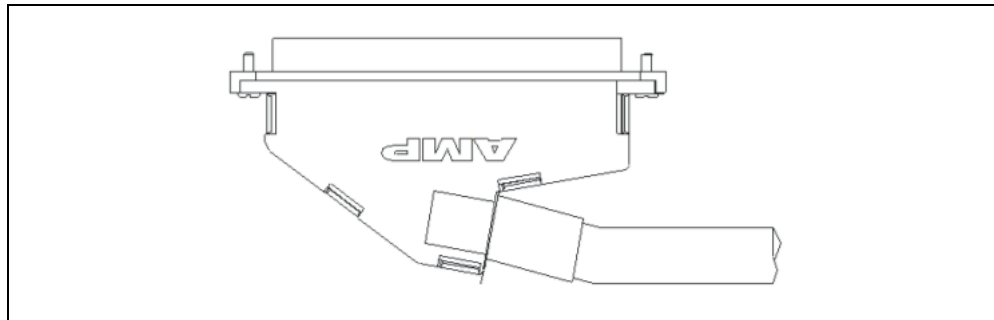


Figure 7-5
64-pin E1/DS1 100 degree right routing cable connector



Optical specifications

The following sections provide details of the optical specifications. All the optical SFPs for the OME6130 are equipped with LC type connectors.

The following assumptions were made when calculating the dispersion and attenuation limited distances quoted in the optical specifications:

- NSDF fiber plant is being used
- dispersion and attenuation coefficient are as listed in [Table 7-22](#).

Table 7-22
Optical specifications - assumed dispersion and attenuation coefficient

	Wavelength		
	1310 nm	1550 nm + C-band	
Dispersion coefficient (ps/nm/km)	6.0	17.0	
Attenuation coefficient (dB/km)	0.35	0.25	

ATTENTION

The dispersion and attenuation limited distances quoted in the optical specifications are based on the dispersion and attenuation coefficients detailed in [Table 7-22](#) and are for guidance only and must be verified by a full link budget calculation. The actual limiting distance is the lower of the dispersion limited or attenuation limited distances.

STM-1/4 and GE SFP optical specifications

[Table 7-23](#) lists the optical specifications for the STM-1 optical SFPs.

Table 7-23**Optical specifications for STM-1 SFPs**

Classification	SR0	IR1/S1.1	LR1/L1.1	LR2/L1.2
PEC	NTTP02AD	NTTP02CD	NTTP02ED	NTTP02FD/ NTTP02FF
Transmitter				
Transmitter type	LED	FP laser	DFB laser	DFB laser
Nominal wavelength	1270 nm to 1380 nm	1310 nm	1310 nm	1550 nm
Transmit output power (max)	-14 dBm	-8 dBm	0 dBm	0 dBm
Transmit output power (min)	-20 dBm	-15 dBm	-5 dBm	-5 dBm
Spectral width	200 nm (FWHM)	7.7 nm (RMS)	1 nm (-20 dB)	1 nm (-20 dB)
Minimum side mode suppression ratio	-	-	30 dB	30 dB
Minimum extinction ratio	10 dB	8.2 dB	10 dB	10 dB
Power monitor accuracy (see Note 2)	+/- 2 dB	+/- 2 dB	+/- 2 dB	+/- 2 dB
Receiver				
Receiver type	PIN photodiode	APD	APD	APD
Wavelength range	1100 nm to 1600 nm	1261 nm to 1580 nm	1261 nm to 1580 nm	1260 nm to 1580 nm
Nominal wavelength	1310 nm	1310 nm	1310 nm	1550 nm
Receiver sensitivity	-30 dBm	-28 dBm	-34 dBm	-34 dBm
Receiver overload	-14 dBm	-8 dBm	-10 dBm	-10 dBm
Path penalty	-	1 dB	1 dB	1 dB
Maximum receive reflectance	-	-	-	-25 dB
Power monitor accuracy (see Note 2)	+/- 2 dB	+/- 2 dB	+/- 2 dB	+/- 2 dB
Optical path				
Attenuation range	0 dB to 10 dB	0 dB to 12 dB	10 dB to 28 dB	10 dB to 28 dB

Classification	SR0	IR1/S1.1	LR1/L1.1	LR2/L1.2
Nominal reach (see Note 3)	2 km	15 km	40 km	80 km
Maximum dispersion	-	96 ps/nm	-	-
Minimum optical return loss	-	-	-	20 dB
Dispersion limited distance (see Note 4)	-	16 km	-	-
Attenuation limited distance (see Note 4)	2 km	34.3 km	80 km	112 km
Note 1: All parameter values in the above table achieve an optical system BER better than 1×10^{-10} when used over G.652 specified SMF-28 fiber. The exception is SR0 where the values are for use over 62.5 μm core, 500 MHz-km modal bandwidth MMF as specified in ANSI T1.416.01-1999. Note 2: Power monitor accuracy figures are for normal operating range (minimum to maximum transmit power, receiver sensitivity to overload). Note 3: Nominal reach figures are for classification purposes only as defined in the appropriate standards. Note 4: The dispersion and attenuation limited distances are based on the dispersion and attenuation coefficients detailed in Table 7-22 on page 7-23 and are for guidance only and must be verified by a full link budget calculation. The actual limiting distance is the lower of the dispersion limited or attenuation limited distances.				

[Table 7-24](#) lists the optical specifications for the STM-4 optical SFPs.

Table 7-24
Optical specifications for STM-4 SFPs

Classification	L4.1	L4.2
PEC	NTTP05EF	NTTP05FF
Transmitter		
Transmitter type	DFB laser	DFB laser
Nominal wavelength	1310 nm	1550 nm
Transmit output power (max)	+2 dBm	+2 dBm
Transmit output power (min)	-3 dBm	-3 dBm
Spectral width	1 nm (-20 dB)	1 nm (-20 dB)
Minimum side mode suppression ratio	30 dB	30 dB
Minimum extinction ratio	10 dB	10 dB
Power monitor accuracy (see Note 2)	+/- 2 dB	+/- 2 dB
Receiver		
Receiver type	APD	APD

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Classification	L4.1	L4.2
Wavelength range	1260 nm to 1580 nm	1260 nm to 1580 nm
Nominal wavelength	1310 nm	1550 nm
Receiver sensitivity	-28 dBm	-28 dBm
Receiver overload	-8 dBm	-8 dBm
Path penalty	1 dB	1 dB
Maximum receive reflectance	-14 dB	-27 dB
Power monitor accuracy (see Note 2)	+/- 2 dB	+/- 2 dB
Optical path		
Attenuation range	10 dB to 24 dB	10 dB to 24 dB
Nominal reach (see Note 3)	40 km	80 km
Minimum optical return loss	20 dB	24 dB
Dispersion limited distance (see Note 4)	-	-
Attenuation limited distance (see Note 4)	68.6 km	96 km
Note 1: All parameter values in the above table achieve an optical system BER better than 1×10^{-10} when used over G.652 specified SMF-28 fiber. Note 2: Power monitor accuracy figures are for normal operating range (minimum to maximum transmit power, receiver sensitivity to overload). Note 3: Nominal reach figures are for classification purposes only as defined in the appropriate standards. Note 4: The dispersion and attenuation limited distances are based on the dispersion and attenuation coefficients detailed in Table 7-22 on page 7-23 and are for guidance only and must be verified by a full link budget calculation. The actual limiting distance is the lower of the dispersion limited or attenuation limited distances.		

[Table 7-25](#) lists the optical specifications for the STM-1/4 optical SFP.

Table 7-25
Optical specifications for STM-1/4 SFPs

Classification	IR1/S1.1_S4.1
PEC	NTTP04CF
Transmitter	
Transmitter type	FP laser
Nominal wavelength	1310 nm
Transmit output power (max)	-8 dBm
Transmit output power (min)	-15 dBm
Spectral width	2.5 nm (RMS)
Minimum extinction ratio	8.2 dB
Power monitor accuracy (see Note 2)	+/- 2 dB
Receiver	
Receiver type	APD
Wavelength range	1274 nm to 1580 nm
Nominal wavelength	1310 nm
Receiver sensitivity	-28 dBm
Receiver overload	-8 dBm
Path penalty	1 dB
Power monitor accuracy (see Note 2)	+/- 2 dB
Optical path	
Attenuation range	0 dB to 12 dB
Nominal reach (see Note 3)	15 km
Maximum dispersion	74 ps/nm

Table 7-25 (continued)
Optical specifications for STM-1/4 SFPs

Classification	IR1/S1.1_S4.1
Dispersion limited distance (see Note 4)	12.3 km
Attenuation limited distance (see Note 4)	34.3 km
Note 1: All parameter values in the above table achieve an optical system BER better than 1×10^{-10} when used over G.652 specified SMF-28 fiber. Note 2: Power monitor accuracy figures are for normal operating range (minimum to maximum transmit power, receiver sensitivity to overload). Note 3: Nominal reach figures are for classification purposes only as defined in the appropriate standards. Note 4: The dispersion and attenuation limited distances are based on the dispersion and attenuation coefficients detailed in Table 7-22 on page 7-23 and are for guidance only and must be verified by a full link budget calculation. The actual limiting distance is the lower of the dispersion limited or attenuation limited distances.	

[Table 7-26](#) lists the optical specifications for the STM-1/4 CWDM optical SFPs.

Table 7-26
Optical specifications for STM-1/4/16 SFPs

Classification	2.5G NRZ CWDM (S-C8L1-1Dx)
PEC	NTK590xH (see Note 6)
Transmitter	
Transmitter type	DFB laser
Nominal wavelength	1471 nm to 1611 nm @ 20 nm +/-6.5 nm
Transmit output power (max)	+5 dBm
Transmit output power (min)	0 dBm
Spectral width	1 nm (-20 dB)
Minimum side mode suppression ratio	30 dB
Minimum extinction ratio	8.2 dB
Power monitor accuracy (see Note 2)	+/- 2 dB
Receiver	
Receiver type	APD

Table 7-26 (continued)
Optical specifications for STM-1/4/16 SFPs

Classification	2.5G NRZ CWDM (S-C8L1-1Dx)
Wavelength range	1260 nm to 1620 nm
Nominal wavelength	1471 nm to 1611 nm @ 20 nm
Receiver sensitivity	-28 dBm
Receiver overload	-9 dBm
Path penalty	2.5 dB
Maximum receive reflectance	-27 dB
Power monitor accuracy (see Note 2)	+/- 2 dB
Optical path	
Attenuation range	14 dB to 25.5 dB
Nominal reach (see Note 3)	See Note 4
Maximum dispersion	1600 ps/nm
Minimum optical return loss	24 dB
Dispersion limited distance (see Note 5)	See Note 4
Attenuation limited distance (see Note 5)	See Note 4
Note 1: All parameter values in the table achieve an optical system BER better than 1×10^{-10} when used over G.652 specified SMF-28 fiber except for the CWDM value which is for an optical system BER better than 1×10^{-12}. Note 2: Power monitor accuracy figures are for normal operating range (minimum to maximum transmit power, receiver sensitivity to overload). Note 3: Nominal reach figures are for classification purposes only as defined in the appropriate standards. Note 4: CWDM reach is consistent with Appendix II of ITU-T G.695 (refer to G.695 Table II.2 for parameter values and G.695 Table II.1 for attenuation values). Dispersion limits are based on 21.1 ps/nm-km. Note 5: The dispersion and attenuation limited distances are based on the dispersion and attenuation coefficients detailed in Table 7-22 on page 7-23 and are for guidance only and must be verified by a full link budget calculation. The actual limiting distance is the lower of the dispersion limited or attenuation limited distances. Note 6: Refer to Ordering information and system engineering rules on page 8-1 for a list of supported wavelengths and PECs.	

[Table 7-27](#) lists the optical specifications for the STM-1 (100Base) Bidirectional SFPs.

Table 7-27
Optical specifications for STM-1 (100Base) Bidirectional SFPs

Classification	100Base BX10-U (see Note 3)	100Base BX10-D (see Note 3)
PEC	NTTP09BD	NTTP10BD
Transmitter		
Transmitter type	FP laser	FP laser
Nominal wavelength	1310 nm	1530 nm
Transmit output power (max)	-8 dBm	-8 dBm
Transmit output power (min)	-14 dBm	-14 dBm
Spectral width	7.7 nm (RMS)	4.4 nm (RMS)
Minimum extinction ratio	6.6 dB	6.6 dB
Receiver		
Receiver type	PIN photodiode	PIN photodiode
Wavelength range	1480 nm to 1580 nm	1260 nm to 1360 nm
Nominal wavelength	1530 nm	1310 nm
Receiver sensitivity	-28.2 dBm	-28.2 dBm
Receiver overload	- 8 dBm	- 8 dBm
Path penalty	4.5 dB	4.5 dB
Maximum receive reflectance	-12 dB	-12 dB
Optical path		
Reach	10 km (see Note 2)	10 km (see Note 2)
Note 1: All parameter values in the above table achieve an optical system BER better than 1×10^{-12} .		
Note 2: 0.5 m to 10 km over G.652 SMF.		
Note 3: Used for a bidirectional link over a single fiber with an upstream SFP fitted at one end of the link and an downstream SFP fitted at the other end of the link. The upstream SFP transmits at 1310 nm and receives at 1530 nm, the downstream SFP transmits at 1530 nm and receives at 1310 nm.		

Table 7-28 lists the optical specifications for the GE optical SFPs.

Table 7-28
Optical specifications for GE SFPs

Classification	SX (see Note 2)	LX
PEC	NTTP01AF	NTTP01CF
Transmitter		
Transmitter type	VCSEL	FP laser
Nominal Wavelength	850 nm	1310 nm
Transmit output power (max)	<0 dBm (see Note 3)	-3 dBm
Transmit output power (min)	-9.5 dBm	-9.5 dBm
Spectral width	0.85 nm (RMS)	4 nm (RMS)
Minimum side mode suppression ratio	-	-
Minimum extinction ratio	9 dB	9 dB
Receiver		
Receiver type	PIN photodiode	PIN photodiode
Wavelength range	770 nm to 860 nm	1270 nm to 1355 nm
Nominal wavelength	850 nm	1310 nm
Receiver sensitivity	-17 dBm	-20 dBm
Receiver overload	0 dBm	-3 dBm
Path penalty	-	-
Maximum receive reflectance	-12 dB	-12 dB
Optical path		
Attenuation range	-	-
Nominal reach (see Note 4)	2 m to 550 m (see Note 5)	10 km (see Note 6)
Maximum dispersion	-	-

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Classification	SX (see Note 2)	LX
Dispersion limited distance (see Note 7)	see Note 5	see Note 6
Attenuation limited distance (see Note 7)	see Note 5	see Note 6
Note 1: All parameter values in the above table achieve an optical system BER better than 1×10^{-12}. Note 2: Parameter values for SX SFP are characterized for 62.5 μm 160 MHz-km MMF. Note 3: The maximum transmit power is the lesser of Class 1 safety limits (CDRH and EN 60825) or the receiver overload. Note 4: Nominal reach figures are for classification purposes only as defined in the appropriate standards. Note 5: 2 m to 220 nm over 62.5 μm core, 160 MHz-km MMF; 2 m to 550 m over 50 μm core, 500 MHz-km MMF. Note 6: 2 m to 10 km over 10 μm core SMF; 2 m to 550 m over MMF. Note 7: The dispersion and attenuation limited distances are based on the dispersion and attenuation coefficients detailed in Table 7-22 on page 7-23 and are for guidance only and must be verified by a full link budget calculation. The actual limiting distance is the lower of the dispersion limited or attenuation limited distances.		

Electrical specifications

Table 7-29 to Table 7-33 lists the electrical specifications for the E1, E3, DS3, DS1, and STM-1e interfaces.

Table 7-29
E1 electrical specifications

Parameter	Value
Line rate	2048 kbit/s +/- 50 ppm
Line code	HDB3
Framing application	CRC4
Impedance	75 ohm or 120 ohm (see Note)
Output voltage (nominal)	75 ohm: 2.37 V (mark), 0 ± 0.237 V (space) 120 ohm: 3.00 V (mark), 0 ± 0.300 V (space)
Minimum output return loss	6 dB (51 kHz to 102 kHz), 8 dB (102 kHz to 3072 kHz)
Cable loss to input	0 dB to 6 dB at 1024 kHz
Minimum input return loss	12 dB (51 kHz to 102 kHz), 18 dB (102 kHz to 2048 kHz), 14 dB (2048 kHz to 3072 kHz)
Note: A termination panel must be used for 75 ohm E1 applications.	

Table 7-30
E3 electrical specifications

Parameter	Value
Line rate	34368 kbit/s +/- 20 ppm
Line code	HDB3
Framing application	G.832
Impedance	75 ohm
Output voltage (nominal)	75 ohm: 1.0 V (mark), 0 ± 0.1 V (space)
Cable loss to input	0 dB to 12 dB at 17184 kHz
Minimum input return loss	12 dB (860 kHz to 1720 kHz), 18 dB (1720 kHz to 34368 kHz), 14 dB (34368 kHz to 51550 kHz)

Table 7-31
DS1 electrical specifications

Parameter	Value
Line rate	1544 kbit/s +/- 50 ppm
Line code	B8ZS
Framing application	Extended Super Frame (ESF)
Impedance	100 ohm $\pm$ 5%

Table 7-31 (continued)
DS1 electrical specifications

Parameter	Value
Pulse amplitude	2.4 V to 3.6 V
Power level	In a band not wider than 3 kHz, the power level is less than 19 dBm.
Cable distances	Maximum 200 m (655 ft)
Line build-out (LBO) ranges	Using NT6Q72QA/TA or NT6Q73QA/TA cables: 0 to 133 ft (40.5 m), 133 ft (40.5 m) to 266 ft (81.1 m), 266 ft (81.1 m) to 399 ft (121.6 m), 399 ft (121.6 m) to 533 ft (162.5 m), 533 ft (162.5 m) to 655 ft (200 m)

Table 7-32
DS3 electrical specifications

Parameter	Value
Line rate	44736 kbit/s +/- 20 ppm
Line code	B3ZS
Framing application	ASYNCR
Impedance	75 ohm $\pm$ 5%, unbalanced
Pulse amplitude	0.36 V to 0.85 V peak
Power level	-4.7 dBm to +3.6 dBm
Cable distances	Maximum 450 ft (137.1 m)
Line build-out (LBO) ranges	Using 735A cables (recommended) (NTTC03xx): 0 to 255 ft (77.7 m), 255 ft (77.7 m) to 450 ft (137.1 m)

Table 7-33
STM-1e electrical specifications

Parameter	Value
Line rate	155520 kbit/s +/- 20 ppm
Line code	CMI
Impedance	75 ohm
Peak output voltage	1.00 V $\pm$ 0.1 V
Minimum output return loss	15 dB (8 MHz to 240 MHz)
Cable loss to input	0 dB to 12.7 dB at 78 MHz
Minimum input return loss	15 dB (8 MHz to 240 MHz)

Environmental specifications

The following section outlines the environmental specifications including:

- operating environment specifications
- storage and transportation specifications

Operating environment specifications

Table 7-34 outlines the OME6130 operating environment specifications.

Table 7-34

Operating environmental specifications for OME6130 system

Attribute	Condition	Test method and specification
Normal operating temperature	0°C to 50°C	• Telcordia GR-63 CORE (NEBS) • ETSI EN 300 019-2-3 Class 3.1 (E)
Short term operating temperature	-5°C to 55°C (not more than 96 consecutive hours and a total of not more than 15 days in a year)	• Telcordia GR-63 CORE (NEBS)
Normal operating humidity	5% to 90% RH (for Telcordia GR-63-CORE, this also meets the short term relative humidity specification)	• Telcordia GR-63 CORE (NEBS) • ETSI EN 300 019-2-3 Class 3.1 (E)
Operational vibration	0.1 g from 5 to 100 Hz and return to 5 Hz at a rate of 0.1 octave/minute	• Telcordia GR-63 CORE (NEBS)
Storage temperature	-40°C to 70°C	• ETSI EN 300 019-1-1 Class 1.2 • Telcordia GR-63 CORE (NEBS)
Handling shock	Packaged and unpackaged criteria (by weight) per specification	• Telcordia GR-63 CORE (NEBS) • ETSI EN 300 019-2-2 Class 2.2 and Class 2.3
Transportation vibration	Sinusoidal, random, and non-stationary per respective specifications	• Telcordia GR-63 CORE (NEBS) • ETSI EN 300 019-2-2 Class 2.3

Electromagnetic specifications

Table 7-35 lists the electromagnetic compatibility of the OME6130 network element.

Table 7-35
Electromagnetic specifications for OME6130

Electromagnetic topic	Attribute	Test method and specification
Electromagnetic interference	Radiated emissions: "Class A" E-field: 10 kHz to 40 GHz H-field: 10 Hz to 30 MHz	• ICES-003 (Industry Canada), Iss.3 • EN 300 386 V1.3.3 • EN 55022:1998+A1:2000+A2:2003 • FCC Part 15 Subpart B • Telcordia GR-1089-CORE, Iss.3
	Conducted emissions 10 Hz to 100 MHz power and signal cables	• EN 300 386 V1.3.3 • EN 55022:1998+A1:2000+A2:2003 • Telcordia GR-1089-CORE, Iss.3 • ETS 300 132-2 V2.1.2 • Bellcore GR-499-CORE, Iss.2
RF Immunity	Radiated RFI E-field: 10 kHz to 10 GHz 10V/m	• EN 300 386 V1.3.3 • Telcordia GR-1089-CORE, Iss.3 • EN 55024:1998+A1:2001+A2:2003
	Conducted RFI 10 Hz to 80 MHz power and signal cables • 3 Vrms (voltage) • 89 dBμA_{rms} (current) • 56 dBrc (voice-band)	• EN 300 386 V1.3.3 • EN 55024:1998+A1:2001+A2:2003 • ETS 300 132-2 V2.1.2 • Telcordia GR-1089-CORE, Iss.3 • Bellcore GR-499-CORE, Iss.2
	Operational Condition: no effect occurs when the system is exposed to the RF levels described in the specifications above.	
Direct and indirect electrostatic discharge (ESD)	Direct and indirect ESD air discharge up to 15 kV contact discharge up to 8 kV	• EN 300 386 V1.3.3 • Telcordia GR-1089-CORE, Iss.3 • Telcordia GR-78-CORE • EN 55024:1998+A1:2001+A2:2003
	Operational Condition: no effect occurs when the system is exposed to the RF levels described in the specifications above.	

Table 7-35 (continued)
Electromagnetic specifications for OME6130

Electromagnetic topic	Attribute	Test method and specification
Electrical fast transient (EFT)	power and signal cables 4 kV - ground 1 kV - power 0.5 kV - signal	• EN 300 386 V1.3.3 • Telcordia GR-1089-CORE, Iss.3 • EN 55024:1998+A1:2001+A2:2003
	Operational Condition: No effect occurs when the system is exposed to the EFT levels described in the specifications above.	
Surge (lightning)	signal cables 1.5 kV, 2/10 μ s pulse 0.5 kV, 1.2/50 μ s pulse	• EN 300 386 V1.3.3 • Telcordia GR-1089-CORE, Iss.3 • EN 55024:1998+A1:2001+A2:2003
	Operational Condition: the system will continue to operate as intended immediately after exposure to the surge levels described in the specifications above.	

Safety specifications

The following section outlines the safety specifications, including:

- general commercial and regulatory
- laser emissions

General commercial and regulatory

The OME6130 complies with the safety requirements of the following specifications:

- IEC/EN 60950-1:2001+A11:2004
- Telcordia GR-1089-CORE, Iss.3

Laser emission

The OME6130 meets the requirements of the following specifications:

- IEC/EN 60825-1:1994+A11:1996+A2:2001+A1:2002
- IEC/EN 60825-2:2004
- FDA 21 CFR 1040.10

The OME6130 is a class 1 laser product/optical fiber communications system.

Power and grounding specifications

The following section outlines the power and grounding specifications

DC input voltage range

The operational input voltage range for the OME6130 is -40 V dc to -57.5 V dc with DC feed. The OME6130 is not damaged when an input voltage of correct polarity, with a value between zero and -40 V dc (minimum voltage), is applied for any period of time. The system is not damaged by a reversed polarity voltage supply, for example, zero to +57.5 V dc (the system does not function with a reversed polarity supply).

The OME6130 automatically recovers when the input voltage returns to a value exceeding the minimum voltage within an acceptable period of time and without any manual intervention.

The OME6130 meets the specifications listed in [Table 7-36](#).

Table 7-36
Power, grounding, and noise references

Topic	References
Power	• ANSI T1.315-2001, Voltage Levels for DC Powered Equipment Used in the Telecommunications Environment, 2001. • ETS 300 132-2, Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc) • DS8171, Issue 2, 60 Hz and -48 V dc Power for DC Powered Telecommunication Equipment, Bell Canada
Grounding	• ITU-T K.27, Bonding Configurations and Earthing Inside a Telecommunication Building), May 1996 • TR-NWT-000295, Bellcore Technical Reference, Isolated Ground Planes: Definition and Application to Telephone Central Offices. July 1992 • ETSI EN 300 253, Equipment Engineering (EE); Earthing and bonding of telecommunication equipment in telecommunication centres, January 1995 • NFPA70, (US National Electrical Code) • CSA 22.1, (Canadian Electrical Code) • Telecordia: GR-1089-CORE, Electromagnetic Compatibility and Electrical Safety, Issue 2, Revision 1, February 1999, Section 9

Table 7-36 (continued)
Power, grounding, and noise references

Topic	References
Noise	• ANSI T1.315-2001, Voltage Levels for DC Powered Equipment Used in the Telecommunications Environment, November 2001 • DS8171, Issue 2, 600 Hz and -48 V dc Power for DC Powered Telecommunication Equipment, Bell Canada • ETS 300 132-2, Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc), September 1996 • Telecordia: GR-63-CORE, Network Equipment Building System (NEBS) Requirements (Bellcore, October 1995), Section 4.6

Ordering information and system engineering rules

This chapter provides the ordering information and engineering rules for the Optical Multiservice Edge 6130 (OME6130) network element. [Table 8-1](#) lists the topics in this chapter.

Table 8-1
Topics in this chapter

Topic	Page
OME6130 network element configuration rules	
Chassis layout	8-2
Bay equipping rules	8-4
Shelf equipping rules	8-4
Site engineering recommendations	8-6
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Table 8-1 (continued)
Topics in this chapter

Topic	Page
Right to use licenses	8-19
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Ordering procedures	
Ordering OME6130 chassis, circuit packs, and software	8-22
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OME6130 network element configuration rules

This section documents the OME6130 network element configuration rules, including slot numbering, bay equipping rules, shelf equipping rules, and site engineering recommendations.

Chassis layout

[Table 8-2](#) lists the circuit packs or components that can be inserted into the OME6130 chassis and the corresponding slot numbers. [Figure 8-1](#) shows the OME6130 chassis layout.

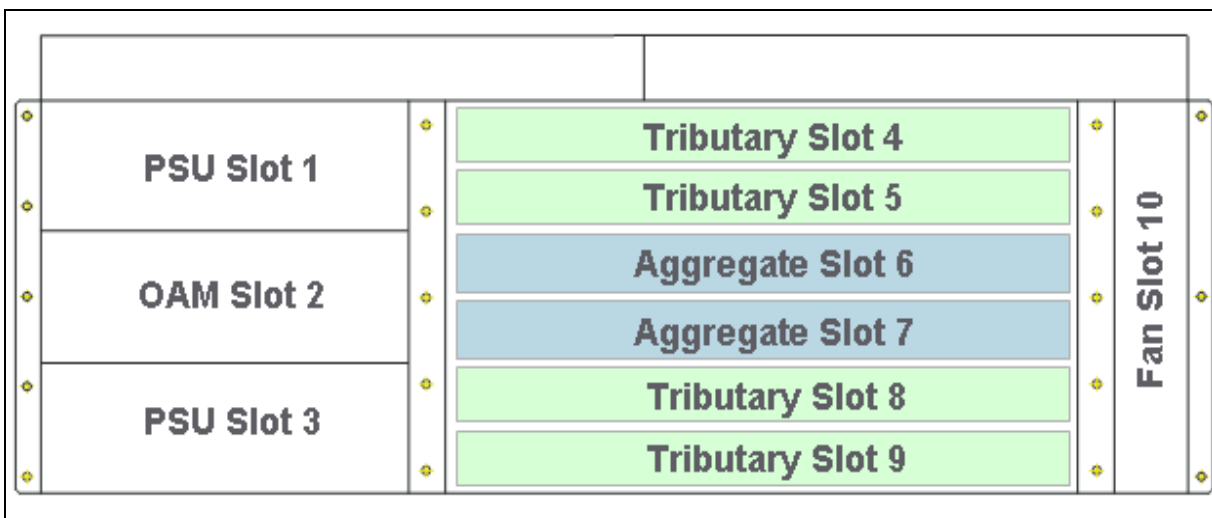
Table 8-2
Chassis components

Circuit pack or component	Slot number	Note
2x155/622M aggregate circuit pack	Slot 6	1 , 3 , 5
8x10/100BT L1 circuit pack	Slots 4, 5, 8, 9	2 , 3
2xGE L1 circuit pack	Slots 4, 5, 8, 9	2 , 3 , 5
28xE1/DS1 circuit pack	Slots 4, 5, 8, 9	2 , 3
3xE3/DS3 circuit pack	Slots 4, 5, 8, 9	2 , 3
2x155M circuit pack	Slots 4, 5, 8, 9	2 , 3 , 5
Power supply unit (DC)	Slots 1, 3	3 , 4
OAM circuit pack	Slot 2	3

Table 8-2 (continued)
Chassis components

Circuit pack or component	Slot number	Note
Fan module	Slot 10	3
SFP interfaces	Slots 4, 5, 6, 8, 9	3, 5
Note 1: The 2x155/622M aggregate circuit pack is only supported in slot 6 in Release 1.0. The support of the protection aggregate circuit pack in slot 7 will be introduced in a future release. Note 2: This circuit pack is supported in tributary slots 4, 5, 8, 9. Note 3: This is a field replaceable unit. Note 4: Two PSU circuit packs are equipped in the shelf in normal operation for equipment redundancy and DC power feed redundancy. Note 5: SFP modules must be ordered separately.		

Figure 8-1
OME6130 chassis layout



Bay equipping rules

This section provides equipping rules for OME6130 installation in a bay. The OME6130 shelf can be mounted in a variety of telecommunications equipment bays, including 19", 21", and 23" standard bays.

Refer to [Table 8-3](#) for OME6130 equipment rack space requirements.

Table 8-3
OME6130 equipment rack space requirements

Equipment	Rack units required
OME6130 shelf with dual DC power feeds (NT6Q60AA)	4U
75 ohm BNC Termination Panel (NT6Q71EA)	1U

Shelf equipping rules

This section lists the equipping rules for the OME6130 shelf.

For more information on the OME6130 chassis, refer to [Chassis on page 4-3](#).

Engineering rules

- 1 Each shelf at an OME6130 site is a stand-alone network element.
- 2 The node capability is provisioned to either STM-1 or STM-4 during initial commissioning. The two SFP interfaces of the 2x155/622M aggregate circuit pack are operating at the rate of the node capability value. The appropriate SFPs (i.e. STM-1 or STM-4 rate) must be selected for the 2x155/622M aggregate circuit pack.
- 3 Each shelf requires the following components:
 - two power supply units (one in slot 1 and one in slot 3)
 - one OAM circuit pack in slot 2
 - one 2x155/622M aggregate circuit pack in slot 6
 - one filler panel in slot 7 (slot reserved for future release)
 - one filler panel for each slots 4, 5, 8 and 9 (if no tributary circuit packs are used)
 - one fan module in slot 10

Note: The SFPs interfaces must be ordered separately.

- 4 Each shelf is capable of supporting up to four tributary circuit packs (slots 4, 5, 8 and 9).
- 5 No fiber slack storage is provided for fibers terminating on the OME6130 shelf. Cable relief off the shelf can be handled using the routing brackets provided with the OME6130 Assembly Kit.

- 6 You can only replace (spare) a circuit pack with a circuit pack with the same product engineering code (PEC).
- 7 1+1 MSP, SNCP, and unprotected traffic protection schemes are available. The STM-1/4 interfaces must be provisioned in a MSP group for 1+1 MSP protection, or in unprotected mode for SNCP or unprotected configuration.
- 8 Only the 8x10/100BT L1, 2xGE L1, 28xE1/DS1, 3xE3/DS3 and 2x155M circuit packs can be inserted in the tributary slots (slots 4, 5, 8, 9).
Note: When the tributary slots are not equipped with a circuit pack, a filler panel must be installed.
- 9 The STM-1/4 and GE interfaces use small form-factor pluggable (SFP) modules. Each active port requires a SFP module, which are ordered separately. Dust covers for the SFP positions are included with the circuit packs, therefore, dust covers do not need to be ordered for unequipped ports. A maximum of 2 SFP modules are required for each STM-1/4 and GE circuit pack.
- 10 The 2x155/622M aggregate and 2x155M tributary circuit packs support optical (o) and electrical (e) SFP interfaces at the STM-1 line rate. The 2x155/622M aggregate circuit pack supports only optical SFP interfaces at the STM-4 line rate.
- 11 The 28xE1/DS1 circuit pack require the appropriate I/O interface cabling. The default impedance for the E1/DS1 interfaces is 120/100 ohm. The E1/DS1 interface uses a 64-pin Telco connector. Conversion for E1 services to 75 ohm unbalanced interface can be achieved using the 75 ohm BNC termination panel.
- 12 In a rack mount installation, it is recommended to install the 75 ohm BNC termination panel directly below the OME6130 shelf. If more than one termination panel is required (for converting impedance of ports on the 28xE1/DS1 circuit packs), stack the termination panels below the OME6130 shelf.

Site engineering recommendations

Consider the following site engineering recommendations when planning a network deployment.

- 1 Breaker interface panels or fuse panels should be installed at the top of the bay.
- 2 Recommendation is to use 2x6 Amp breakers or fuses for the dual DC power feeds for each OME6130 chassis.
- 3 Recommendation is to leave 1U space between OME6130 shelves when installed in the same rack to provide added air flow through the equipment.
- 4 Optical fiber cables should be routed on the right side of the bay.

Note: No fiber slack storage is provided for fibers terminating on the OME6130 shelf. Use external fiber management drawers to store excess fiber cable.

- 5 E1/DS1 electrical interface cable should be routed on the right side of the bay for the 28xE1/DS1 circuit pack.
- 6 Install power cables on the left side of the OME6130 bay.
- 7 Install OAM cables (for Alarm Input, Alarm Output, M1/F1 and ESI ports) on the left side of the OME6130 bay.
- 8 The Ethernet cables should be routed on the right side of the bay for the 8xETH circuit pack, and on the left side of the bay for the LAN and Craft ports for DCN access.

List of parts

This section provides the orderable codes available for the OME6130 product. Use these tables with the ordering procedures ([Procedure 8-1 on page 8-22](#) through [Procedure 8-2 on page 8-29](#)) to make sure that a complete and accurate bill of material is created.

OME6130 chassis and components

[Table 8-5](#) lists the ordering codes for the chassis and components. For rules on equipping the OME6130 chassis, refer to [Shelf equipping rules on page 8-4](#).

Table 8-5
OME6130 chassis and components

Description	Order code	Notes
OME6130 System Kit		
OME6130 R1.0 DC System; Chassis, Dual PSU, OAM circuit pack, Fan, two top I/O Fillers and 19" flange	NT6Q60AA	1
Aggregate circuit pack Kit		
2x622M Aggregate circuit pack with Rel 1.0 software	NT6Q66AA	2, 3
Power Supply Unit and OAM circuit pack		
OME6130 DC Power Supply Unit 150W single-feed	NT6Q40AA	4, 5
OAM circuit pack	NT6Q43AA	6
Fillers and Fan modules		
OME6130 Fan Tray with Filter	NT6Q42AA	7
Filler Panel for tributary circuit pack slot	NT6Q70AA	8
Filler Panel for top I/O slot	NT6Q70AD	9
Filler Panel for aggregate circuit pack slot	NT6Q70AE	10
Air Filter	NT6Q70DA	11

Table 8-5 (continued)
OME6130 chassis and components

Description	Order code	Notes
Note 1: The OME6130 system kit contains a chassis equipped with two DC power supply unit, one OAM circuit pack, one fan module with filter, two top I/O filler panels and 19" flange. Note 2: The NT6Q66AA code includes one 2x155/622M aggregate card (NT6Q45AA) and one OME6130 Release 1.0 software (NT6Q87AA). Note 3: SFPs for the STM-1/4 interfaces need to be ordered separately. Note 4: The DC PSU provides a single-feed OME6130 shelf power termination up to 6 A. Note 5: The PSU can be ordered as spare or replacement. Note 6: The OAM circuit pack can be ordered as spare or replacement. Note 7: Each fan module consists of four fans. This module can be ordered as spare or replacement. Note 8: An empty tributary circuit pack slot must be covered with a tributary filler panel. The tributary filler panel must be ordered separately. Note 9: The two top I/O slots must be covered with top I/O filler panels. Two top I/O filler panels come equipped with the chassis, but can be ordered separately as spare or replacement. Note 10: In Release 1.0, the aggregate circuit pack slot 7 must be covered with a aggregate filler panel. The aggregate filler panel must be ordered separately. Note 11: The air filter is part of the fan module which is included with the OME6130 system kit. The air filter can be ordered as spare or replacement.		

OME6130 shelf assembly kit

The OME6130 system kits described in [Table 8-5 on page 8-7](#) include shelf mounting brackets for a 19 in. rack. For 21 in. or 23 in. standard bay installations, separate brackets can be obtained with the OME6130 shelf assembly kit. It is recommended to order one OME6130 shelf assembly kit, as listed in [Table 8-6](#), for each NE.

Table 8-6
OME6130 shelf assembly kit

Description	Order code	Notes
OME6130 shelf assembly kit - cable routing brackets, rack mounting screws, 21" and 23" flange, cage nuts, earthing cable	NT6Q70CA	1 , 2
Note 1: This shelf assembly kit provides installation brackets for the OME6130 chassis. Included in the kit are cable routing brackets, rack mounting screws, 21" and 23" flange, cage nuts and earthing cable. Note 2: It is recommended to have an OME6130 shelf assembly kit for each OME6130 shelf installation.		

Circuit packs

[Table 8-7](#) provides a list of all the circuit packs that can be inserted into the tributary slots of the OME6130 chassis.

For rules on equipping the shelf, refer to [Shelf equipping rules on page 8-4](#).

Table 8-7
Circuit packs for optional service slot

Description	Order code	Notes
8x10/100BT L1 Circuit Pack	NT6Q13AB	1
2xGE L1 Circuit Pack	NT6Q20AA	1 , 2
28xE1/DS1 Circuit Pack	NT6Q10AA NT6Q10AB	1
3xE3/DS3 Circuit Pack	NT6Q12AA	1
2x155M Circuit Pack	NT6Q17AA	1 , 2
Note 1: Up to four tributary circuit packs can be inserted into the OME6130 chassis. Note 2: SFPs for the STM-1 and GE interfaces need to be ordered separately.		

Small form-factor pluggable (SFP) modules

Table 8-8 lists the small form-factor pluggable modules.

Table 8-8
Small form-factor pluggable (SFP) modules

Description	Order Code	Notes
STM-1 SFPs		
STM-1 SR-0 (Multimode) 1310 nm Enhanced SFP Module	NTTP02AD	1, 2
STM-1 S1.1 1310 nm XCT Enhanced SFP Module	NTTP02CD	1, 2
STM-1 L1.1 1310 nm XCT Enhanced SFP Module	NTTP02ED	1, 2
STM-1 L1.2 1550 nm XCT Enhanced SFP Module	NTTP02FD	1, 2
STM-1 L1.2 1550 nm XCT Enhanced SFP Module	NTTP02FF	1, 2
STM-4 SFPs		
STM-4 L4.1 1310 nm XCT Enhanced SFP Module	NTTP05EF	1, 2
STM-4 L4.2 1550 nm XCT Enhanced SFP Module	NTTP05FF	1, 2
STM-1/4 SFPs		
STM-1/4 S1.1_S4.1 1310 nm XCT Enhanced SFP Module	NTTP04CF	1, 2
STM-1/4 CWDM SFPs		
STM-1/4 CWDM (1471 nm) XCT Enhanced SFP Module	NTK590LH	1, 2
STM-1/4 CWDM (1491 nm) XCT Enhanced SFP Module	NTK590MH	1, 2
STM-1/4 CWDM (1511 nm) XCT Enhanced SFP Module	NTK590NH	1, 2
STM-1/4 CWDM (1531 nm) XCT Enhanced SFP Module	NTK590PH	1, 2
STM-1/4 CWDM (1551 nm) XCT Enhanced SFP Module	NTK590QH	1, 2
STM-1/4 CWDM (1571 nm) XCT Enhanced SFP Module	NTK590RH	1, 2
STM-1/4 CWDM (1591 nm) XCT Enhanced SFP Module	NTK590SH	1, 2
STM-1/4 CWDM (1611 nm) XCT Enhanced SFP Module	NTK590TH	1, 2
100-Base SFPs (Bi-directional)		
100-Base-BX10-U Bidirectional upstream, 1310nm Tx, 10 km SFP Module	NTTP09BD	1, 2, 3
100-Base-BX10-D Bidirectional downstream, 1530 nm Tx, 10 km SFP Module	NTTP10BD	1, 2, 3
GE SFPs		
GE SX SFP Module	NTTP01AF	2, 4
GE LX SFP Module	NTTP01CF	2, 4

Table 8-8 (continued)
Small form-factor pluggable (SFP) modules

Description	Order Code	Notes
STM-1e electrical SFPs		
STM-1e Enhanced SFP Module	NTTP60AE	5
Note 1: This module is used with the STM-1/4 optical interface ports. Note 2: This SFP module comes with LC connectors. Note 3: Used for a bidirectional link over a single fiber with an upstream SFP fitted at one end of the link and an downstream SFP fitted at the other end of the link. The upstream SFP transmits at 1310 nm and receives at 1530 nm, the downstream SFP transmits at 1530 nm and receives at 1310 nm. Note 4: This module is used with the GE optical interface ports. Note 5: This SFP module comes with coax connectors and is supported for the 2x155/622M aggregate and 2x155M tributary circuit packs at the STM-1 line rate only.		

Electrical interface hardware

[Table 8-9](#) lists the hardware associated to the 28xE1/DS1 circuit pack, when conversion for 75 ohm ports is required for E1 services. For rules on equipping the shelf, refer to [Shelf equipping rules on page 8-4](#).

Table 8-9
E1 interface conversion hardware

Description	Order code	Notes
75 ohm BNC Termination Panel (16 channel)	NT6Q71EA	1, 2
Telco to Telco 1M Cable - Right Routing	NT6Q75AA	3
Telco to Telco 5M Cable - Right Routing	NT6Q75CA	3
Note 1: This panel provides conversion from 120 ohm to 75 ohm for E1 service only. The unit is a 1U high rack-mountable panel. Note 2: This termination panel can be used to convert E1 services from the 28xE1/DS1 circuit pack. An additional overlay sticker is provided for proper labeling when converting the 17-28 E1 ports of the 28xE1/DS1 circuit pack. Note 3: This cable is required for connecting the E1 ports on the 28xE1/DS1 circuit pack to the 75 ohm termination panel.		

E1/DS1 cable assemblies

[Table 8-10](#) and [Table 8-11](#) lists the available E1/DS1 interface cables respectively. These cables are used to provide E1 (input and output) connectivity for 120 ohm applications, where no termination panel is required and DS1 connectivity for 100 ohm applications.

Note: Refer to [E1/DS1 cable pinouts and assemblies on page 7-18](#) for the cable requirements if the cables are to be sourced locally.

Table 8-10
E1 cable assemblies

Description	Order code	Notes
120Ohm Telco 5M Cable - Right Routing	NT6Q73BA	1 , 2
120Ohm Telco 10M Cable - Right Routing	NT6Q73CA	1 , 2
120Ohm Telco 15M Cable - Right Routing	NT6Q73DA	1 , 2
120Ohm Telco 20M Cable - Right Routing	NT6Q73EA	1 , 2
Note 1: This cable provides 64-pin balanced 120 ohm for the E1 services on the 28xE1/DS1 circuit pack.		
Note 2: This cable has a shielded connector to connect to the 28xE1/DS1 circuit pack.		

Table 8-11
DS1 cable assemblies

Description	Order code	Notes
100Ohm Telco 15M Cable - Right Routing	NT6Q73QA	1 , 2
100Ohm Telco 30M Cable - Right Routing	NT6Q73TA	1 , 2
Note 1: This cable provides 64-pin balanced 100 ohm for the DS1 services on the 28xE1/DS1 circuit pack.		
Note 2: This cable has a shielded connector to connect to the 28xE1/DS1 circuit pack.		

E3/DS3 cable assemblies

[Table 8-12](#) lists the available E3/DS3 coaxial cables for the 3xE3/DS3 circuit pack. These cables are used to provide E3/DS3 (input and output) connectivity to the OME6130 network element.

Table 8-12
E3/DS3 cable assemblies

Description	Order code	Notes
BNC Connector (735A)	A0609866	1
DS3 735A Coaxial Cable - 10M BNC	NT7E43BB	2 , 3

Table 8-12
E3/DS3 cable assemblies

Description	Order code	Notes
DS3 735A Coaxial Cable - 30M BNC	NT7E43BD	2, 3
DS3 735A Coaxial Cable - 60M BNC	NT7E43BG	2, 3
Note 1: Use this connector to terminate the E3/DS3 cabling at the customer interface equipment. Note 2: Two cable assemblies are required per E3/DS3 port (for receive and transmit). Note 3: This cable is terminated with a BNC at one end only. A BNC connector (A0609866) should be ordered to connect to the customer interface equipment.		

STM-1e cable assemblies

Table 8-13 lists the available STM-1 coaxial cable forms used to provide STM-1e connectivity to the STM-1e SFP modules.

Table 8-13
STM-1e cable assemblies

Description	Order code	Notes
STM-1e cables		
Cable Assembly, Co-axial, DIN 1.0/2.3, RG179DT cable, single, 10 m	NTTC04AA	1
Cable Assembly, Co-axial, DIN 1.0/2.3, RG179DT cable, single, 20 m	NTTC04AB	1
Cable Assembly, Co-axial, DIN 1.0/2.3, RG179DT cable, single, 30 m	NTTC04AC	1
Cable Assembly, Co-axial, DIN 1.0/2.3, RG179DT cable, single, 40 m	NTTC04AD	1
Cable Assembly, Co-axial, DIN 1.0/2.3, RG179DT cable, single, 50 m	NTTC04AE	1
Cable Assembly, Co-axial, DIN 1.0/2.3, RG179DT cable, single, 60 m	NTTC04AF	1
Single connectors		
Connector Coax, BNC 75 ohm, Male, Straight Plug for use with RG179DT Cable	A0360953	2
Connector Coax, BNC 75 ohm, Female Straight, Bulkhead, Jack, Crimp/Crimp, for use with RG179DT Cable	A0678277	2
Connector Coax, BT43 75 ohm, Male, Straight, Bulkhead DDF, Crimp/Crimp, for use with RG179DT Cable	A0620780	2
Connector Coax, HDC43 Bulkhead Plug (Male) Crimp/Crimp, RG179/U, DDF Mount, Single PC. Body	N0032563	2
Connector Coax, DIN 1.0/2.3 mm, Straight Cable Plug (Male) Crimp/Crimp 75 ohm RG179/U	N0032582	2
Note 1: This cable provides a single STM-1e co-axial connector. The cable uses RG179DT coaxial cable. You must order an appropriate connector for the open end of each cable assembly. Two cable assemblies are required for every STM-1e SFP module. Note 2: These are single field terminable connectors for the STM-1e cable assemblies (NTTC04Ax).		

Ethernet service cable assemblies

Table 8-14 lists the available Ethernet cableforms used to provide connectivity to the 10/100BT interfaces associated with the 8x10/100BT L1 circuit packs. Shielded twisted pair (STP) cables are required to connect to the Ethernet ports on the 8x10/100BT L1 circuit pack.

Note: LAN ports on the 8x10/100BT circuit packs are wired as MDI/MDI-X, and auto-detect the type of cable connected to it (straight or crossover).

Table 8-14
Ethernet service cable assemblies

Description	Order code	Notes
Ethernet service (STP) cables		
Cable Assembly, STP Cat 5E, RJ45, TIA568, Crossover, Single, 5 m	NTTC09CAE6	1
Cable Assembly, STP Cat 5E, RJ45, TIA568, Crossover, Single, 15 m	NTTC09CCE6	1
Cable Assembly, STP Cat 5E, RJ45, TIA568, Crossover, Single, 30 m	NTTC09CEE6	1
Cable Assembly, STP Cat 5E, RJ45, TIA568B, Straight, Single, 5 m	NTTC09DAE6	1
Cable Assembly, STP Cat 5E, RJ45, TIA568B, Straight, Single, 15 m	NTTC09DCE6	1
Note 1: This cable provides an Ethernet connection for the 10/100BT interfaces on the 8x10/100BT L1 circuit pack. Each cable has two RJ45 connectors and uses shielded twisted pair Category 5E cable.		

Optical fiber patch cords

Table 8-15 lists the available optical fiber patch cords.

Table 8-15
Optical fiber patch cords

Description	Order code	Notes
Optical patchcords, LC-LC, SM, Simplex	NTTC50Ax	1,2
Optical patchcords, LC-SC, SM, Simplex	NTTC50Bx	1,2
Optical patchcords, LC-FC, SM, Simplex	NTTC50Cx	1,2
Optical patchcords, LC-ST, SM, Simplex	NTTC50Dx	1,2
Optical patchcords, LC-LC, SM, Duplex	NTTC53Ax	1,2
Optical patchcords, LC-SC, SM, Duplex	NTTC53Bx	1,2
Optical patchcords, LC-FC, SM, Duplex	NTTC53Cx	1,2
Optical patchcords, LC-ST, SM, Duplex	NTTC53Dx	1,2
Optical patchcords, LC-LC, MM 50 micron, Simplex	NTTC56Ax	1,3
Optical patchcords, LC-SC, MM 50 micron, Simplex	NTTC56Bx	1,3

Table 8-15 (continued)
Optical fiber patch cords

Description	Order code	Notes
Optical patchcords, LC-FC, MM 50 micron, Simplex	NTTC56Cx	1,3
Optical patchcords, LC-ST, MM 50 micron, Simplex	NTTC56Dx	1,3
Optical patchcords, LC-LC, MM 50 micron, Duplex	NTTC59Ax	1,3
Optical patchcords, LC-SC, MM 50 micron, Duplex	NTTC59Bx	1,3
Optical patchcords, LC-FC, MM 50 micron, Duplex	NTTC59Cx	1,3
Optical patchcords, LC-ST, MM 50 micron, Duplex	NTTC59Dx	1,3
Note 1: The optical patchcords are available in different lengths. The last digit of the order code defines the length as shown in Table 8-16 on page 8-15. Note 2: The singlemode fibers are used to transmit 1310 nm, 1550 nm and DWDM frequency signals on singlemode fiber plant. Note 3: The 50 micron multimode fibers are used to transmit 850 nm frequency signals on 50 micron multimode fiber plant.		

[Table 8-16](#) lists the available lengths of optical fiber patchcords.

Table 8-16
Lengths of optical fiber patchcords

Length	Last digit of order code
1 meter	A
2 meters	B
3 meters	C
5 meters	D
7 meters	E
10 meters	F
13 meters	G
15 meters	H
20 meters	J
25 meters	K
30 meters	L
Note: This table defines the length and last digit of the order codes shown in Table 8-15 on page 8-14. For example, an NTTC50AD is an optical patchcord, LC-LC, SM, Simplex, 5 meters.	

OAM cable assemblies

Table 8-17 through Table 8-19 list the available OAM cable assemblies. These cables are used to provide synchronization, alarm, user interface and network element connectivity. Refer to Procedure 8-2 on page 8-29 for ordering instructions.

Note: The LAN and Craft ports on the OAM circuit pack are wired as MDI. Use crossover cables to connect the LAN and Craft ports to other MDI ports (such as those on workstations). Use straight-through cables to connect the LAN and Craft ports to MDI-X ports (such as those on switches).

Table 8-17
DCN and craft access cables

Description	Order code	Notes
F1 cable	NT6Q71AF	1
Modem Cable	NT6Q71AG	2
Ethernet cable RJ-45 to RJ-45 crossover (1.5 m)	NTUC58PW	3
Ethernet cable RJ-45 to RJ-45 crossover (5 m)	NTUC58PL	3
Ethernet cable RJ-45 to RJ-45 crossover (10m)	NTUC58PM	3
Ethernet cable RJ-45 to RJ-45 crossover (20 m)	NTUC58PP	3
Ethernet cable RJ-45 to RJ-45 crossover (25 m)	NTUC58PQ	3
Ethernet cable RJ-45 to RJ-45 crossover (40 m)	NTUC58PN	3
Ethernet cable RJ-45 to RJ-45 straight (10m)	NTUC58PS	4
Ethernet cable RJ-45 to RJ-45 straight (20 m)	NTUC58PU	4
Ethernet cable RJ-45 to RJ-45 straight (25 m)	NTUC58PV	4
Ethernet cable RJ-45 to RJ-45 straight (40 m)	NTUC58PR	4
Ethernet cable RJ-45 to RJ-45 straight (60 m)	NTUC58PT	4
Note 1: This F1 interface cable connects to the serial port on the OAM circuit pack and supports an asynchronous interface. Note 2: This modem cable has the DSR pin isolated. Note 3: This cable provides an Ethernet connection between the Craft port on the OAM circuit pack to a PC directly connected. Note 4: This cable provides an Ethernet connection between the LAN port on the OAM circuit pack to the DCN network.		

Table 8-18
Alarm and telemetry cables

Description	Order code	Notes
OME6130 - Environmental alarm cable kit	NT6Q59AB	1
Note 1: This environmental alarm cable kit provides a pair of alarm cables for the ALMIN and ALMOUT ports. These cables provide the 7 alarm inputs or the critical, major, minor alarm outputs of the shelf to a cross connect location.		

Table 8-19
Synchronization cable

Description	Order code	Notes
Clock (BITS) Cable (120 ohm)	NT6Q71AC	1, 3
Clock (BITS) Cable (inc 75 ohm convertor)	NT6Q71AE	2, 3
Note 1: This clock cable supports 120 ohm impedance with RJ-45 connector for connection to the RJ-45 ESI port on the OAM circuit pack. Note 2: This clock cable supports 75 ohm impedance and comes with a balun converter for connection to the RJ-45 ESI port on the OAM circuit pack. Note 3: This clock cable supports 4 synchronization signals, (2 input and 2 output).		

Power and earthing cable assemblies

[Table 8-20](#) lists the available power and earthing cable assemblies for the OME6130 chassis. For OME6130 NEs equipped with two single-DC feed PSUs, two DC cables must be ordered for each network element installation.

For more information on the PSU, refer to [DC Power supply unit on page 4-4](#). Refer to [Procedure 8-2 on page 8-29](#) for ordering instructions.

Table 8-20
Power and earthing cable assemblies

Description	Order code	Notes
OME6130 - DC cable - 3M	NT6Q59CA	1
OME6130 - DC cable - 10M	NT6Q59DA	2
OME6130 - DC Cable Kit - 3M North America	NT6Q59PA	3
OME6130 - DC cable kit - 10M North America	NT6Q59QA	4
Earthing cable	NT6Q71AA	5
Note 1: This DC cable provides a 3 meter BL/BK/GR power cable. Note 2: This DC cable provides a 10 meter BL/BK/GR power cable. Note 3: This DC cable provides a 3 meter RD/BK/GR power cable for North American standards. Note 4: This DC cable provides a 10 meter RD/BK/GR power cable for North American standards. Note 5: One earthing cable is included in the NT6Q70CA installation kit.		

Software load

This section provides the information for ordering OME6130 software, as shown in [Table 8-21](#).

Table 8-21
Software superset

Description	Order code	Notes
OME6130 R1.0 CD-ROM	NT6Q83AA	1
Note 1: This code provides one copy of the OME6130 Release 1.0 software load on a CD-ROM. The local craft access terminal load is imbedded in the network element software load.		

Right to use licenses

The right to use licences are listed in [Table 8-22](#).

Table 8-22
Right to use licenses

Description	Order Code	Notes
OME6130 R1.0 SW Certificate 1/NE	NT6Q85AA	1
OME6130 Base SW RTU 1/NE	NT6Q82AA	2
Note 1: One OME6130 software certificate is required for each OME6130 network element.		
Note 2: One OME6130 Base RTU is required for each OME6130 network element.		

Engineering and support services

Nortel offers the following engineering and support services for the OME6130. In addition to the services described below, Nortel offers a selection of services to help you plan, deploy, operate, and maintain your optical networks. For more information about these services, contact your Nortel representative or visit www.nortel.com/services.

Table 8-23
Engineering and support services

Description	Order code	Notes
Hot staging service for OME6130	NTYY99CJ	1
Note 1: Nortel staging services are designed to prepare network components for integration into a customer's network. By centralizing the execution of services typically performed in the field at a staging facility, the product can be delivered to the customer in its most simplified, cost effective, and integrated form. Hot staging services for the OME6130 product consist of system testing validation prior to delivery to the customer site.		

OME6130 documentation

This section provides documentation ordering information and a brief overview of the Nortel technical publication (NTPs) libraries and individual documents that can be ordered for OME6130 network elements.

Documentation is available on paper and on CD-ROM. [Table 8-24](#) lists the ordering information for NTP packages.

Table 8-24
OME6130 documentation

Description	Order code
Release 1.0 documentation	
OME6130 R1.0 NTP (Paper)	NT6Q65BA

Table 8-24
OME6130 documentation

Description	Order code
OME6130 R1.0 NTP (CD-ROM)	NT6Q64BA
OME6130 R1.0 Planning Guide	NT6Q92MA
Note: Refer to table Table 8-25 for a list of documents included in the NTP suite.	

[Table 8-25](#) lists the OME6130 NTP Library Suite.

Table 8-25
OME6130 NTP Library Suite

NTPs	Document code
About the OME6130 NTP Library	323-1855-090
Local Craft Access User Guide	323-1855-195
Installation, Commissioning and Testing Procedures	323-1855-201
Provisioning and Protection Switching Procedures	323-1855-310
Trouble Clearing and Module Replacement Procedures	323-1855-543

RoHS compliant equipment

Nortel is fully committed to meeting the requirements of the European Union Environmental Directives (EUED) and in particular the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC. The RoHS Directive becomes law for customers within the EU from 1st July 2006.

As a consequence of this, equipment for the OME6130 is being made RoHS compliant. To help differentiate between the compliant and non-compliant equipment, Nortel has adopted a policy for equipment that has been updated to become for RoHS compliant of either:

- adding “E5”, “E6” or “L6” as a suffix to the existing product equipment code (PEC). E5 indicates that it is RoHS 5/6 compliant, E6 indicates that it is RoHS 6/6 compliant, and L6 indicates that it is Low Smoke Zero Halogen (LSZH) and RoHS 6/6 compliant.
- changing a single digit in the PEC (for example, ‘NTRU0501’ changes to ‘NTRU6501’ where the 5th digit is changed to ‘6’ to indicate that it is RoHS 6/6 compliant)

The PEC for equipment that is already RoHS compliant remains the same.

Customers who operate within the EU must order the RoHS compliant version of OME6130 equipment for equipment being supplied after 1st July 2006.

There is no change to the behavior or functionality of equipment that has been

updated to become RoHS compliant, nor is there any change required to the software deployed - the revised RoHS compliant equipment is backward compatible with the non-RoHS compliant version. Thus, customers outside the EU may order the standard equipment but may receive a RoHS compliant version.

RoHS compliant equipment include labels which indicate the RoHS compliance level.

Further information on the Nortel RoHS strategy will be made available on the appropriate product pages on the Nortel web site (www.nortel.com).

Ordering procedures

Use the following procedures to order equipment, software, documentation, and services for an OME6130 network deployment.

Procedure 8-1

Ordering OME6130 chassis, circuit packs, and software

Use this procedure to order OME6130 chassis, circuit packs, and software. Repeat this procedure for each network element at a site in the OME6130 network.

Before you start

- Complete a network design.
- Read [OME6130 network element configuration rules on page 8-2](#).
- Photocopy [Table 8-26 on page 8-28](#) and [Table 8-28 on page 8-33](#) (if required).

Procedure tasks

- Record requirements ([step 1](#)).
- Order chassis ([step 15](#)).
- Order circuit packs ([step 16](#)).
- Order OME6130 assembly kit ([step 22](#)).
- Order small form-factor pluggable (SFP) modules ([step 24](#)).
- Order the 75 ohm termination panel ([step 25](#)).
- Order E1/DS1 cables ([step 26](#)).
- Order software and RTU licences ([step 29](#)).

Expected results

- You have a complete list of chassis, circuit packs, and software for an OME6130 site.
- If the expected results do not occur:
 - Review the network design and repeat the procedure.
 - Contact your next level of support.

Procedure 8-1 (continued)

Ordering OME6130 chassis, circuit packs, and software

Action

Step	Action
	Note: Use a photocopy of Table 8-26 on page 8-28 for this procedure. All line number references are to this table unless noted otherwise.
1	Determine the number of 10/100BT Ethernet Private Line (EPL) services that are required, record the number in Line 3. If no 10/100BT EPL services are required, enter 'none' on Line 3. Note: A maximum of 32 10/100BT EPL ports can be provisioned per OME6130 shelf (8 ports for each 8x10/100BT L1 tributary circuit pack).
2	Determine the number of 8x10/100BT L1 tributary circuit pack that are required. Divide the number recorded on Line 3 by 8 and record the round up integer value on Line 4. Enter 'none' if no 8x10/100BT L1 tributary circuit pack is required.
3	Determine the number of GE EPL services that are required, record the number in Line 5. If no GE EPL services are required, enter 'none' on Line 5. Note: A maximum of 8 GE EPL ports can be provisioned per OME6130 shelf (2 ports for each 2xGE L1 tributary circuit pack).
4	Determine the number of 2xGE L1 tributary circuit pack that are required. Divide the number recorded on Line 5 by 2 and record the round up integer value on Line 6. Enter 'none' if no 2xGE L1 tributary circuit pack is required.
5	Determine the number of E1/DS1 services that are required, record the number in Line 7. If no E1/DS1 services are required, enter 'none' on Line 7. Note: A maximum of 112 E1/DS1 ports can be provisioned per OME6130 shelf (28 ports for each 28xE1/DS1 tributary circuit pack).
6	Determine the number of 28xE1/DS1 tributary circuit pack that are required. Divide the number recorded on Line 7 by 28 and record the round up integer value on Line 8. Enter 'none' if no 28xE1/DS1 tributary circuit pack is required.
7	Determine the number of E3/DS3 services that are required, record the number in Line 9. If no E3/DS3 services are required, enter 'none' on Line 9. Note: A maximum of 12 E3/DS3 ports can be provisioned per OME6130 shelf (3 ports for each 3xE3/DS3 tributary circuit pack).
8	Determine the number of 3xE3/DS3 tributary circuit pack that are required. Divide the number recorded on Line 9 by 3 and record the round up integer value on Line 10. Enter 'none' if no 3xE3/DS3 tributary circuit pack is required.

Procedure 8-1 (continued)

Ordering OME6130 chassis, circuit packs, and software

Step	Action										
9	Determine the number of STM-1o/e services that are required, record the number in Line 11. If no STM-1o/e services are required, enter 'none' on Line 11. Note: A maximum of 8 STM-1o/e ports can be provisioned per OME6130 shelf (2 ports for each 2x155M tributary circuit pack).										
10	Determine the number of 2x155M tributary circuit pack that are required. Divide the number recorded on Line 11 by 2 and record the round up integer value on Line 12. Enter 'none' if no 2x155M tributary circuit pack is required.										
11	Add the number of tributary circuit packs recorded on Line 4, Line 6, Line 8, Line 10 and Line 12. <table> <tr> <th>If you need</th><th>Then</th></tr> <tr> <td>4 tributary circuit packs or less</td><td>go to step 12</td></tr> <tr> <td>5 tributary circuit packs or more</td><td>more than one OME6130 shelf needs to be ordered. Re-assign some of the services to another OME6130 shelf and ensure that up to 4 tributary circuit pack is required per shelf, then go to step 1 on page 8-23</td></tr> </table> Note: The OME6130 chassis has four tributary slots for services. Up to four circuit packs can be added to the chassis. Refer to Shelf equipping rules on page 8-4 for more details.	If you need	Then	4 tributary circuit packs or less	go to step 12	5 tributary circuit packs or more	more than one OME6130 shelf needs to be ordered. Re-assign some of the services to another OME6130 shelf and ensure that up to 4 tributary circuit pack is required per shelf, then go to step 1 on page 8-23				
If you need	Then										
4 tributary circuit packs or less	go to step 12										
5 tributary circuit packs or more	more than one OME6130 shelf needs to be ordered. Re-assign some of the services to another OME6130 shelf and ensure that up to 4 tributary circuit pack is required per shelf, then go to step 1 on page 8-23										
12	Determine the type of E1/DS1 cables required. <table> <tr> <th>If you require</th><th>Then</th></tr> <tr> <td>E1 electrical interfaces at 75 Ohm</td><td>Enter '75 ohm' in Line 13.</td></tr> <tr> <td>E1 electrical interfaces at 120 Ohm</td><td>Enter '120 ohm' in Line 13.</td></tr> <tr> <td>DS1 electrical interfaces at 100 Ohm</td><td>Enter '100 ohm' in Line 13.</td></tr> <tr> <td>no electrical E1/DS1 services</td><td>Enter 'none' in Line 13.</td></tr> </table>	If you require	Then	E1 electrical interfaces at 75 Ohm	Enter '75 ohm' in Line 13 .	E1 electrical interfaces at 120 Ohm	Enter '120 ohm' in Line 13 .	DS1 electrical interfaces at 100 Ohm	Enter '100 ohm' in Line 13 .	no electrical E1/DS1 services	Enter 'none' in Line 13 .
If you require	Then										
E1 electrical interfaces at 75 Ohm	Enter '75 ohm' in Line 13 .										
E1 electrical interfaces at 120 Ohm	Enter '120 ohm' in Line 13 .										
DS1 electrical interfaces at 100 Ohm	Enter '100 ohm' in Line 13 .										
no electrical E1/DS1 services	Enter 'none' in Line 13 .										

Procedure 8-1 (continued)

Ordering OME6130 chassis, circuit packs, and software

Step	Action																				
13	Determine the number of 64-pin Telco cables for E1/DS1 interface requirements: <table> <tr> <th>If Line 7 is in the range</th><th>Then</th></tr> <tr> <td>from 1 to 16</td><td>Enter '1' in Line 14. Go to step 14</td></tr> <tr> <td>from 17 to 28</td><td>Enter '2' in Line 14. Go to step 14</td></tr> <tr> <td>from 29 to 44</td><td>Enter '3' in Line 14. Go to step 14</td></tr> <tr> <td>from 45 to 56</td><td>Enter '4' in Line 14. Go to step 14</td></tr> <tr> <td>from 57 to 72</td><td>Enter '5' in Line 14. Go to step 14</td></tr> <tr> <td>from 73 to 84</td><td>Enter '6' in Line 14. Go to step 14</td></tr> <tr> <td>from 85 to 100</td><td>Enter '7' in Line 14. Go to step 14</td></tr> <tr> <td>from 101 to 112</td><td>Enter '8' in Line 14. Go to step 14</td></tr> <tr> <td>none</td><td>Enter 'none' on Line 14. Go to step 15</td></tr> </table>	If Line 7 is in the range	Then	from 1 to 16	Enter '1' in Line 14. Go to step 14	from 17 to 28	Enter '2' in Line 14. Go to step 14	from 29 to 44	Enter '3' in Line 14. Go to step 14	from 45 to 56	Enter '4' in Line 14. Go to step 14	from 57 to 72	Enter '5' in Line 14. Go to step 14	from 73 to 84	Enter '6' in Line 14. Go to step 14	from 85 to 100	Enter '7' in Line 14. Go to step 14	from 101 to 112	Enter '8' in Line 14. Go to step 14	none	Enter 'none' on Line 14. Go to step 15
If Line 7 is in the range	Then																				
from 1 to 16	Enter '1' in Line 14. Go to step 14																				
from 17 to 28	Enter '2' in Line 14. Go to step 14																				
from 29 to 44	Enter '3' in Line 14. Go to step 14																				
from 45 to 56	Enter '4' in Line 14. Go to step 14																				
from 57 to 72	Enter '5' in Line 14. Go to step 14																				
from 73 to 84	Enter '6' in Line 14. Go to step 14																				
from 85 to 100	Enter '7' in Line 14. Go to step 14																				
from 101 to 112	Enter '8' in Line 14. Go to step 14																				
none	Enter 'none' on Line 14. Go to step 15																				
14	Determine the length for E1/DS1 cables. <table> <tr> <th>If Line 13 is</th><th>Then determine the length of cable</th></tr> <tr> <td>75 ohm</td><td>Enter 1 or 5 for the length of the required cable in Line 15.</td></tr> <tr> <td>120 ohm</td><td>Enter 5, 10, 15 or 20 for the length of the required cable in Line 15.</td></tr> <tr> <td>100 ohm</td><td>Enter 5 or 30 for the length of the required cable in Line 15.</td></tr> <tr> <td>none</td><td>Enter 'none' in Line 15.</td></tr> </table>	If Line 13 is	Then determine the length of cable	75 ohm	Enter 1 or 5 for the length of the required cable in Line 15.	120 ohm	Enter 5, 10, 15 or 20 for the length of the required cable in Line 15.	100 ohm	Enter 5 or 30 for the length of the required cable in Line 15.	none	Enter 'none' in Line 15.										
If Line 13 is	Then determine the length of cable																				
75 ohm	Enter 1 or 5 for the length of the required cable in Line 15.																				
120 ohm	Enter 5, 10, 15 or 20 for the length of the required cable in Line 15.																				
100 ohm	Enter 5 or 30 for the length of the required cable in Line 15.																				
none	Enter 'none' in Line 15.																				
15	Order one (1) NT6Q60AA, OME6130 R1.0 DC system.																				
16	Order one (1) NT6Q66AA, 2x155/622M aggregate circuit pack with OME6130 Release 1.0 software.																				
17	The number of 8x10/100BT L1 tributary circuit pack(s) required is recorded on Line 4. Order this quantity of NT6Q13AB, 8x10/100BT L1 tributary circuit pack(s).																				
18	The number of 2xGE L1 tributary circuit pack(s) required is recorded on Line 6. Order this quantity of NT6Q20AA, 2xGE L1 tributary circuit pack(s).																				
19	The number of 28xE1/DS1 tributary circuit pack(s) required is recorded on Line 8. Order this quantity of NT6Q10AA, 28xE1/DS1 tributary circuit pack(s).																				
20	The number of 3xE3/DS3 tributary circuit pack(s) required is recorded on Line 10. Order this quantity of NT6Q12AA, 3xE3/DS3 tributary circuit pack(s).																				
21	The number of 2x155/622M tributary circuit pack(s) required is recorded on Line 12. Order this quantity of NT6Q17AA, 2x155M tributary circuit pack(s).																				
22	Order one (1) NT6Q70CA, OME6130 assembly kit.																				

Procedure 8-1 (continued)

Ordering OME6130 chassis, circuit packs, and software

Step	Action										
23	Order one (1) NT6Q70AE, Filler Panel for aggregate slot 7.										
24	Order the small form-factor pluggable (SFP) modules. Note: Refer to Table 8-8 on page 8-10 and Shelf equipping rules on page 8-4 for orderable part numbers and application rules for the small form-factor pluggable modules.										
25	Order the 75 ohm termination panel: <table> <tr> <th>If Line 13 is</th><th>Then</th></tr> <tr> <td>75 ohm</td><td>Order the number of NT6Q71EA, 75 ohm BNC termination panel as specified on Line 14. Go to step 26.</td></tr> <tr> <td>120 ohm</td><td>Go to step 27</td></tr> <tr> <td>100 ohm</td><td>Go to step 28</td></tr> <tr> <td>none</td><td>Go to step 29</td></tr> </table>	If Line 13 is	Then	75 ohm	Order the number of NT6Q71EA, 75 ohm BNC termination panel as specified on Line 14 . Go to step 26 .	120 ohm	Go to step 27	100 ohm	Go to step 28	none	Go to step 29
If Line 13 is	Then										
75 ohm	Order the number of NT6Q71EA, 75 ohm BNC termination panel as specified on Line 14 . Go to step 26 .										
120 ohm	Go to step 27										
100 ohm	Go to step 28										
none	Go to step 29										
26	Order the E1 cables for the 75 ohm termination panel for the 28xE1/DS1 circuit pack: <table> <tr> <th>If Line 15 is</th><th>Then order the number obtained at step 13 times of</th></tr> <tr> <td>1</td><td>one (1) NT6Q75AA (Right routing - 1 meter cable)</td></tr> <tr> <td>5</td><td>one (1) NT6Q75CA (Right routing - 5 meter cable)</td></tr> </table> Go to step 29 .	If Line 15 is	Then order the number obtained at step 13 times of	1	one (1) NT6Q75AA (Right routing - 1 meter cable)	5	one (1) NT6Q75CA (Right routing - 5 meter cable)				
If Line 15 is	Then order the number obtained at step 13 times of										
1	one (1) NT6Q75AA (Right routing - 1 meter cable)										
5	one (1) NT6Q75CA (Right routing - 5 meter cable)										
27	Order the E1 cables for the 120 ohm application for the 28xE1/DS1 circuit pack: <table> <tr> <th>If Line 15 is</th><th>Then order the number obtained at step 13 times of</th></tr> <tr> <td>5</td><td>one (1) NT6Q73BA (Right routing - 5 meter cable)</td></tr> <tr> <td>10</td><td>one (1) NT6Q73CA (Right routing - 10 meter cable)</td></tr> <tr> <td>15</td><td>one (1) NT6Q73DA (Right routing - 15 meter cable)</td></tr> <tr> <td>20</td><td>one (1) NT6Q73EA (Right routing - 20 meter cable)</td></tr> </table> Go to step 29 .	If Line 15 is	Then order the number obtained at step 13 times of	5	one (1) NT6Q73BA (Right routing - 5 meter cable)	10	one (1) NT6Q73CA (Right routing - 10 meter cable)	15	one (1) NT6Q73DA (Right routing - 15 meter cable)	20	one (1) NT6Q73EA (Right routing - 20 meter cable)
If Line 15 is	Then order the number obtained at step 13 times of										
5	one (1) NT6Q73BA (Right routing - 5 meter cable)										
10	one (1) NT6Q73CA (Right routing - 10 meter cable)										
15	one (1) NT6Q73DA (Right routing - 15 meter cable)										
20	one (1) NT6Q73EA (Right routing - 20 meter cable)										
28	Order the DS1 cables for the 28xE1/DS1 circuit pack: <table> <tr> <th>If Line 15 is</th><th>Then order the number obtained at step 13 times of</th></tr> <tr> <td>15</td><td>one (1) NT6Q73QA (Right routing - 15 meter cable)</td></tr> <tr> <td>30</td><td>one (1) NT6Q73TA (Right routing - 30 meter cable)</td></tr> </table>	If Line 15 is	Then order the number obtained at step 13 times of	15	one (1) NT6Q73QA (Right routing - 15 meter cable)	30	one (1) NT6Q73TA (Right routing - 30 meter cable)				
If Line 15 is	Then order the number obtained at step 13 times of										
15	one (1) NT6Q73QA (Right routing - 15 meter cable)										
30	one (1) NT6Q73TA (Right routing - 30 meter cable)										

Procedure 8-1 (continued)

Ordering OME6130 chassis, circuit packs, and software

Step	Action
29	Order one (1) NT6Q83AA CD-ROM copy of Release 1.0 software for each site.
30	Order RTU licences. Order one NT6Q82AA for each OME6130 shelf.
31	Order software certificates. Order one NT6Q85AA for each OME6130 shelf.
32	Repeat this procedure for each network element at this site. When all network elements have been ordered for this site, continue the ordering process with Procedure 8-2 on page 8-29 .

—end—

Table 8-26
OME6130 shelf ordering worksheet

Line	Description	Value
Line 1	Software release required	Rel 1.0
Line 2	Power configuration required	DC PSU
Line 3	Number of 10/100BT Ethernet Private Line (EPL) services	
Line 4	Number of 8x10/100BT L1 circuit pack(s)	
Line 5	Number of GE EPL services	
Line 6	Number of 2xGE L1 circuit pack(s)	
Line 7	Number of E1/DS1 services	
Line 8	Number of 28xE1/DS1 circuit pack(s)	
Line 9	Number of E3/DS3 services	
Line 10	Number of 3xE3/DS3 circuit pack(s)	
Line 11	Number of STM-1o/e services	
Line 12	Number of 2x155M circuit pack(s)	
Line 13	Impedance of electrical E1/DS1 interfaces (75 Ohm, 120 Ohm, 100 Ohm)	
Line 14	Number of 64-pin Telco cables for E1/DS1 services (1, 2, 3, 4, 5, 6, 7, 8, none)	
Line 15	Length for the E1/DS1 cables	

Procedure 8-2

Ordering cables, documentation, and services

Use this procedure to order cables, documentation, and services for the OME6130 equipment ordered in [Procedure 8-1 on page 8-22](#). Repeat this procedure for each site in the OME6130 network.

Before you start

- Complete a network design, including a DCN and a synchronization plan.
- Read [OME6130 network element configuration rules on page 8-2](#).
- Photocopy [Table 8-27 on page 8-32](#) and [Table 8-28 on page 8-33](#) (if required).

Procedure tasks

- Record site specific information ([step 1](#)).
- Order power cables ([step 2](#)).
- Order optical fiber patch cords ([step 3](#)).
- Order OAM and LAN cables (DCN, user interface, alarm and synchronization) ([step 4](#)).
- Order documentation ([step 10](#)).
- Order services ([step 11](#)).

Expected results

- You have a complete list of cables, documentation, and services for an OME6130 site.
- If the expected results do not occur:
 - Review the network design and repeat the procedure.
 - Contact your next level of support.

Action

Step	Action
	Note: Use a photocopy of Table 8-27 on page 8-32 for this procedure. Line references in this procedure refer to this table unless otherwise noted.
1	Record site specific information on Line 1 through Line 8 of Table 8-27 on page 8-32 .
2	Order DC power cables for the number of OME6130 NEs specified in Line 2. Order the appropriate DC cable for the region, as specified in Line 1, and for the length required, as shown on Line 3. Note: Refer to Table 8-20 on page 8-18 and Bay equipping rules on page 8-4 for orderable codes and application rules.

Procedure 8-2 (continued)

Ordering cables, documentation, and services

Step	Action						
3	Order fiber patchcords. Refer to Table 8-15 on page 8-14 and Table 8-16 on page 8-15 for orderable codes and application rules. Note: The STM-1/4 optical SFP modules on the OME6130 support duplex LC connections. Nortel Networks recommends the use of duplex patchcords wherever allowed by the subtending equipment.						
4	Order environmental alarm kits. Order one environmental alarm kit for the number OME6130 network elements specified on Line 4. Note: Refer to Table 8-18 on page 8-17 for orderable part numbers and application rules.						
5	Order the number of LAN 10/100BT Ethernet cables specified in Line 5 to connect to the OME6130 network elements to the DCN. Note: A regular straight 10/100BT Ethernet cable (RJ-45 to HUB RJ-45) will accommodate this connection. Refer to Table 8-17 on page 8-16 for orderable part numbers and application rules.						
6	Determine the next step: <table> <tr> <th>If Line 6 is</th><th>Then go to</th></tr> <tr> <td>Yes</td><td>step 7</td></tr> <tr> <td>No</td><td>step 8</td></tr> </table>	If Line 6 is	Then go to	Yes	step 7	No	step 8
If Line 6 is	Then go to						
Yes	step 7						
No	step 8						
7	Order one modem cable, NT6Q71AG, for each site. Note: Refer to Table 8-17 on page 8-16 for orderable part numbers and application notes.						
8	Determine the next step: <table> <tr> <th>If Line 7 is</th><th>Then go to</th></tr> <tr> <td>Yes</td><td>step 9</td></tr> <tr> <td>No</td><td>step 10</td></tr> </table>	If Line 7 is	Then go to	Yes	step 9	No	step 10
If Line 7 is	Then go to						
Yes	step 9						
No	step 10						
9	Order the synchronization cable required. <table> <tr> <th>If Line 8 is</th><th>Then order</th></tr> <tr> <td>75 ohm</td><td>one (1) NT6Q71AE, Clock (BITS) Cable (inc 75 ohm convertor)</td></tr> <tr> <td>120 ohm</td><td>one (1) NT6Q71AC, Clock (BITS) Cable (120 ohm)</td></tr> </table> Note: Refer to Table 8-19 on page 8-17 for orderable part numbers and application notes.	If Line 8 is	Then order	75 ohm	one (1) NT6Q71AE, Clock (BITS) Cable (inc 75 ohm convertor)	120 ohm	one (1) NT6Q71AC, Clock (BITS) Cable (120 ohm)
If Line 8 is	Then order						
75 ohm	one (1) NT6Q71AE, Clock (BITS) Cable (inc 75 ohm convertor)						
120 ohm	one (1) NT6Q71AC, Clock (BITS) Cable (120 ohm)						
10	Order documentation. Nortel Networks recommends that one CD-ROM be ordered for each site. Alternatively, a paper library is available. Note: Refer to Table 8-24 on page 8-19 for orderable codes and application notes.						

Procedure 8-2 (continued)

Ordering cables, documentation, and services

Step	Action
11	Staging services are available to simplify installation of OME6130 equipment. Note: Refer to Engineering and support services on page 8-19 for a description of this service. Note: Nortel Networks offers a selection of services to help you plan, deploy, operate, and maintain your optical networks. For more information about these services, contact your Nortel Networks representative or visit www.nortel.com/services.
12	Repeat this procedure for the next site in the network deployment, until all sites have been completed.

—end—

Table 8-27**Worksheet for ordering cables, documentation and services for OME6130 network elements**

Line	Description	Value
Line 1	Region of deployment for OME6130 shelves (North America or other)?	
Line 2	Total number of OME6130 shelves using DC PSUs at this site?	
Line 3	Length required for the DC power cables (3M or 10M)?	
Line 4	Total number of OME6130 shelves requiring environmental alarm cables?	
Line 5	Total number of OME6130 shelves connected to the DCN directly via 10/100BT Ethernet at this site?	
Line 6	Is a remote access dial-up modem connection required at this site?	
Line 7	Are external synchronization interfaces required at this site?	
Line 8	Are 75 ohm or 120 ohm interfaces required for ESI connector at this site?	

Table 8-28 (continued)
RoHS codes and ordering summary

Description	Code	RoHS Code	Quantity
Pluggable modules			
• STM-1 SFPs			
— STM-1SR-0 (multimode) 1310 nm enhanced SFP module (Ext Temp)	NTTP02AD	NTTP02AD	
— STM-1 IR1/S1.1 1310 nm XCT enhanced SFP module (Ext Temp)	NTTP02CD	NTTP02CD	
— STM-1 LR1/L1.1 1310 nm XCT enhanced SFP module (Ext Temp)	NTTP02ED	NTTP02ED	
— STM-1 LR2/L1.2 1550 nm XCT enhanced SFP module (Ext Temp)	NTTP02FD	NTTP02FD	
— STM-1 LR2/L1.2 1550 nm XCT enhanced SFP module	NTTP02FF	NTTP02FF	
• STM-1/4 SFPs			
— STM-1/4 IR1/S1.1_S4.1 1310 nm XCT enhanced SFP module	NTTP04CF	NTTP04CF	
• STM-4 SFPs			
— STM-4 LR1/L4.1 1310 nm XCT enhanced SFP module	NTTP05EF	NTTP05EF	
— STM-4 LR2/L4.2 1550 nm XCT enhanced SFP module	NTTP05FF	NTTP05FF	
• STM-1e (electrical) SFPs			
— STM-1e enhanced SFP module	NTTP60AE	NTTP60AE	
• GE SFPs			
— GE SX SFP module	NTTP01AF	NTTP01AF	
— GE LX SFP module	NTTP01CF	NTTP01CF	
• 100Base SFPs			
— 100-Base-BX10-U bidirectional-upstream, 1310 nm Tx, 10 km SFP module	NTTP09BD	NTTP09BD	
— 100-Base-BX10-U bidirectional-downstream, 1490 nm Tx, 10 km SFP module	NTTP10BD	NTTP10BD	
• STM-1/4/16 CWDM SFPs			
— STM-1/4/16 CWDM 1471 nm SFP module	NTK590LH	NTK590LH	
— STM-1/4/16 CWDM 1491 nm SFP module	NTK590MH	NTK590MH	
— STM-1/4/16 CWDM 1511 nm SFP module	NTK590NH	NTK590NH	
— STM-1/4/16 CWDM 1531 nm SFP module	NTK590PH	NTK590PH	
— STM-1/4/16 CWDM 1551 nm SFP module	NTK590QH	NTK590QH	
— STM-1/4/16 CWDM 1571 nm SFP module	NTK590RH	NTK590RH	
— STM-1/4/16 CWDM 1591 nm SFP module	NTK590SH	NTK590SH	
— STM-1/4/16 CWDM 1611 nm SFP module	NTK590TH	NTK590TH	

Table 8-28 (continued)
RoHS codes and ordering summary

Description	Code	RoHS Code	Quantity
Electrical interface hardware			
• E1 interface conversion hardware			
— 75 ohm BNC Term Panel, 16 channel	NT6Q71EA	NT6Q71EAE5	
— Telco to Telco 1M Cable - Right Routing	NT6Q75AA	NT6Q75AAE6	
— Telco to Telco 5M Cable - Right Routing	NT6Q75CA	NT6Q75CAE6	
• E1 cable assemblies			
— 120Ohm Telco 5M Cable - Right Routing	NT6Q73BA	NT6Q73BAE6	
— 120Ohm Telco 10M Cable - Right Routing	NT6Q73CA	NT6Q73CAE6	
— 120Ohm Telco 15M Cable - Right Routing	NT6Q73DA	NT6Q73DAE6	
— 120Ohm Telco 20M Cable - Right Routing	NT6Q73EA	NT6Q73EAE6	
• DS1 cable assemblies			
— 100Ohm Telco 15M Cable - Right Routing	NT6Q73QA	-	
— 100Ohm Telco 30M Cable - Right Routing	NT6Q73TA	-	
• E3/DS3 cable assemblies			
— BNC Connector (735A)	A0609866	A0609866	
— DS3 735A Coaxial Cable - 10M BNC	NT7E43BB	NT7E43BBE6	
— DS3 735A Coaxial Cable - 30M BNC	NT7E43BD	NT7E43BDE6	
— DS3 735A Coaxial Cable - 60M BNC	NT7E43BG	NT7E43BGE6	
Software/licences			
• OME6130 R1.0 CD-ROM	NT6Q83AA	N/A	
• Right to use licences			
— OME6130 R1.0 SW Certificate 1/NE	NT6Q85AA	N/A	
— OME6130 Base SW RTU 1/NE	NT6Q82AA	N/A	
Engineering and support services			
• Hot staging for OME6130	NTYY99CJ	N/A	
Documentation			
• OME6130 R1.0 NTP (Paper)	NT6Q65BA	N/A	
• OME6130 R1.0 NTP (CD-ROM)	NT6Q64BA	N/A	
• OME6130 R1.0 Planning Guide	NT6Q92MA	N/A	

Table 8-28 (continued)
RoHS codes and ordering summary

Description	Code	RoHS Code	Quantity
Cables			
Optical fiber patch cords (add length and code as appropriate, see Table 8-16 on page 8-15 for details). E6 codes are RoHS compliant, L6 codes are Low Smoke Zero Halogen (LSZH) and RoHS compliant.			
— Optical patchcords, LC-LC, SM, Simplex	NTTC50Ax	NTTC50AxE6 NTTC50AxL6	
— Optical patchcords, LC-SC, SM, Simplex	NTTC50Bx	NTTC50BxE6 NTTC50BxL6	
— Optical patchcords, LC-FC, SM, Simplex	NTTC50Cx	NTTC50CxE6 NTTC50CxL6	
— Optical patchcords, LC-ST, SM, Simplex	NTTC50Dx	NTTC50DxE6 NTTC50DxL6	
— Optical patchcords, LC-LC, SM, Duplex	NTTC53Ax	NTTC53AxE6 NTTC53AxL6	
— Optical patchcords, LC-SC, SM, Duplex	NTTC53Bx	NTTC53BxE6 NTTC53BxL6	
— Optical patchcords, LC-FC, SM, Duplex	NTTC53Cx	NTTC53CxE6 NTTC53CxL6	
— Optical patchcords, LC-ST, SM, Duplex	NTTC53Dx	NTTC53DxE6 NTTC53DxL6	
— Optical patchcords, LC-LC, MM 50 micron, Simplex	NTTC56Ax	NTTC56AxE6 NTTC56AxL6	
— Optical patchcords, LC-SC, MM 50 micron, Simplex	NTTC56Bx	NTTC56BxE6 NTTC56BxL6	
— Optical patchcords, LC-FC, MM 50 micron, Simplex	NTTC56Cx	NTTC56CxE6 NTTC56CxL6	
— Optical patchcords, LC-ST, MM 50 micron, Simplex	NTTC56Dx	NTTC56DxE6 NTTC56DxL6	
— Optical patchcords, LC-LC, MM 50 micron, Duplex	NTTC59Ax	NTTC59AxE6 NTTC59AxL6	
— Optical patchcords, LC-SC, MM 50 micron, Duplex	NTTC59Bx	NTTC59BxE6 NTTC59BxL6	
— Optical patchcords, LC-FC, MM 50 micron, Duplex	NTTC59Cx	NTTC59CxE6 NTTC59CxL6	
— Optical patchcords, LC-ST, MM 50 micron, Duplex	NTTC59Dx	NTTC59DxE6 NTTC59DxL6\	

Table 8-28 (continued)
RoHS codes and ordering summary

Description	Code	RoHS Code	Quantity
• DCN and craft access cables — F1 cable — Modem cable — Ethernet cable RJ-45 to RJ-45 crossover (1.5 m) — Ethernet cable RJ-45 to RJ-45 crossover (5 m) — Ethernet cable RJ-45 to RJ-45 crossover (10 m) — Ethernet cable RJ-45 to RJ-45 crossover (20 m) — Ethernet cable RJ-45 to RJ-45 crossover (25 m) — Ethernet cable RJ-45 to RJ-45 crossover (40 m) — Ethernet cable RJ-45 to RJ-45 straight (10 m) — Ethernet cable RJ-45 to RJ-45 straight (20 m) — Ethernet cable RJ-45 to RJ-45 straight (25 m) — Ethernet cable RJ-45 to RJ-45 straight (40 m) — Ethernet cable RJ-45 to RJ-45 straight (60 m) • Alarm and telemetry cables — OME6130 - Environmental alarm cable kit • Synchronization cables — Clock (BITS) Cable (120 ohm) — Clock (BITS) Cable (inc 75 ohm convertor) • Power and earthing cable assemblies — OME6130 - DC Cable Kit - 3M — OME6130 - DC Cable Kit - 10M — OME6130 - DC Cable Kit - 3M North America — OME6130 - DC Cable Kit - 10M North America — Earthing Cable	NT6Q71AF NT6Q71AG NTUC58PW NTUC58PL NTUC58PM NTUC58PP NTUC58PQ NTUC58PN NTUC58PS NTUC58PU NTUC58PV NTUC58PR NTUC58PT NT6Q59AB NT6Q71AC NT6Q71AE NT6Q59CA NT6Q59DA NT6Q59PA NT6Q59QA NT6Q71AA	NT6Q71AFE6 NT6Q71AGE6 NTUC58PW NTUC58PL NTUC58PM NTUC58PP NTUC58PQ NTUC58PN NTUC58PS NTUC58PU NTUC58PV NTUC58PR NTUC58PT NT6Q59ABE6 NT6Q71ACE6 NT6Q71AEE5 NT6Q59CAE6 NT6Q59DAE6 - - NT6Q71AAE6	

Table 8-28 (continued)
RoHS codes and ordering summary

Description	Code	RoHS Code	Quantity
• STM-1e cable assemblies and connectors — Cable assembly, co-axial, DIN 1.0/2.3, RG179DT cable, single, 10 m — Cable assembly, co-axial, DIN 1.0/2.3, RG179DT cable, single, 20 m — Cable assembly, co-axial, DIN 1.0/2.3, RG179DT cable, single, 30 m — Cable assembly, co-axial, DIN 1.0/2.3, RG179DT cable, single, 40 m — Cable assembly, co-axial, DIN 1.0/2.3, RG179DT cable, single, 50 m — Cable assembly, co-axial, DIN 1.0/2.3, RG179DT cable, single, 60 m — Connector coax, BNC 75 ohm, male, straight plug for use with RG179DT cable — Connector coax, BNC 75 ohm, female straight, bulkhead, jack, crimp/crimp, for use with RG179DT cable — Connector coax, BT43 75 ohm, male, straight, bulkhead DDF, crimp/crimp, for use with RG179DT cable — Connector coax, HDC43 bulkhead plug (male) crimp/crimp, RG179/U, DDF mount, Single PC. body — Connector coax, DIN 1.0/2.3 mm, straight cable plug (male) crimp/crimp 75 ohm RG179/U • Ethernet service cable assemblies (Shielded Twisted Pair -STP) — Cable assembly, STP Cat 5E, RJ45, TIA568, crossover, single, 5 m — Cable assembly, STP Cat 5E, RJ45, TIA568, crossover, single, 15 m — Cable assembly, STP Cat 5E, RJ45, TIA568B, crossover, single, 30 m — Cable assembly, STP Cat 5E, RJ45, TIA568B, straight, single, 5 m — Cable assembly, STP Cat 5E, RJ45, TIA568B, straight, single, 15 m	- NTTC04AA - NTTC04AB - NTTC04AC - NTTC04AD - NTTC04AE - NTTC04AF - A0360953 - A0678277 - A0620780 - N0032563 - N0032582 - NTTC09CAE6 - NTTC09CCE6 - NTTC09CEE6 - NTTC09DAE6 - NTTC09DCE6	- NTTC04AAE6 - NTTC04ABE6 - NTTC04ACE6 - NTTC04ADE6 - NTTC04AEE6 - NTTC04AFE6 - N0104109 - N0104115 - N0104112 - N0107154 - N0104121 - NTTC09CAE6 - NTTC09CCE6 - NTTC09CEE6 - NTTC09DAE6 - NTTC09DCE6	

Technical assistance

This chapter includes information on how to contact Nortel Networks for technical assistance.

Table 9-1
Topics in this chapter

Technical assistance topics	Page
Technical support and information	9-2
Nortel Networks web site	9-3
CE mark	9-3
Field return information	9-4

Technical support and information

For technical support and information from Nortel Networks, refer to the following table.

Technical Assistance Service	
For service-affecting problems: For 24-hour emergency recovery or software upgrade support, that is, for: • restoration of service for equipment that has been carrying traffic and is out of service • issues that prevent traffic protection switching • issues that prevent completion of software upgrades	North America: 1-800-4NORTEL (1-800-466-7835) International: 001-919-992-8300
For non-service-affecting problems: For 24-hour support on issues requiring immediate support or for 14-hour support (8 a.m. to 10 p.m. EST) on upgrade notification and non-urgent issues.	North America: 1-800-4NORTEL (1-800-466-7835) Note: You require an express routing code (ERC). To determine the ERC, see our corporate Web site at www.nortel.com. Click on the Express Routing Codes link. International: Varies according to country. For a list of telephone numbers, see our corporate Web site at www.nortel.com. Click on the Contact Us link.
Global software upgrade support:	North America: 1-800-4NORTEL (1-800-466-7835) International: Varies according to country. For a list of telephone numbers, see our corporate Web site at www.nortel.com. Click on the Contact Us link.

Nortel Networks web site

You can also contact us through the Nortel Networks web site at: **www.nortel.com**. Select the link **Support**.

CE mark

The following is an example of the Conformité Européenne (CE) mark indicating that all electromagnetic compatibility (EMC) and other electrotechnical requirements are met and that the product complies with all applicable standards.



This product/product family complies with the provisions of the Low Voltage Directive 73/23/EEC, and with the essential protection requirements of the EMC Directive 89/336/EEC as amended by 92/31/EEC, when it is properly installed and maintained and when it is used for the purposes for which it is intended.

Field return information

Complete the following Field Return Information Form and include the form when returning any damaged circuit packs to the factory. Insert the completed form into an anti-static bag. Attach this bag to the failed circuit pack.

Note: Some of the information that you must provide (such as alarms raised) require you to log in to the network element.

Field Return Information Form
Customer Identification
Customer name:
Site location:
Originator name:
Originator phone number:
Originator pager number:
Project manager name:
Project manager phone number:
Circuit pack description
PEC:
Release:
Serial number:
NE physical slot number (shelf # and slot #):
Network element
NE name:
NE number:
NE type:
NE configuration:
NE application load release:
Failure symptoms
List of raised alarms related to the failed circuit pack:

Field Return Information Form (continued)	
Failure data	
LED status:	
Optical input power at the receive interface: __ dBm	
Optical output power at the transmit interface: __ dBm	
Failure time	
Troubleshooting data	
Visual inspection of the backplane pins:	
Tested against other positions:	
Slot #:__ Results:__	Slot #:__ Results:__
Slot #:__ Results:__	Slot #:__ Results:__
Actions performed to clear problems:	
Internal pigtail cleaned:	
External pigtail cleaned:	
Special instructions:	
General comments:	
Tracking information	
Change request (CR) number:	
Emergency recovery (ER) contact name:	
Emergency recovery (ER) contact telephone number:	

Appendix A: Data communications planning

This chapter provides an overview of Optical Multiservice Edge 6130 (OME6130) network data communications. [Table 10-1](#) lists the topics covered in this chapter.

Table 10-1
Topics in this chapter

Topic	Page
Introduction	10-2
OAM&P Ports	10-3
Network Interface	10-4
STM-1/4 Data Communication Channel	10-7
IP communication	10-11
OSI data communications	10-16
Application protocols	10-21
Diagnostic commands	10-22
Firewall considerations	10-22
Engineering guidelines	10-23
Supported DCN design examples	10-25
IP networks, addressing, and masks	10-93
IP routing protocols	10-97

This Appendix provides information on typical DCN configurations/models and provides some examples and guidance on provisioning different configurations. For general information about the OME6130 data communication architecture and features, refer to [OAM&P description on page 6-1](#).

The *Data Communications Network Planning Guide*, NTR710AM provides information on DCN planning for some OSI-based Nortel Networks products. This guide includes general information on OSI data communications and addressing and can be used as a reference for OSI data communications information.

Introduction

OME6130 is an IP managed optical network element (NE), which has the capabilities to communicate through both TCP/IP Internet Protocol (IP) and OSI Connectionless Network Protocol (CLNP) based networks.

Connectivity of the OME6130 network element to its management system can be achieved through:

- the LAN port (10/100Base-T, RJ-45) located along the OAM port interfaces on the OAM circuit pack.
- the M1/F1 port via modem.
- SDH Regenerator Section (RS) 192 kbps DCC (D1-D3 bytes) of the optical line interfaces.
- SDH Regenerator Section (RS) 64 kbps user channel (F1 byte) of the optical line interfaces.
- SDH Multiplexor Section (MS) 576 kbps DCC (D4-D12 bytes) of the optical line interfaces.
- SDH Path DCC (F2, F3, or F2-F3 bytes) of the optical line interfaces.
- SDH VC12 management channel of the optical line interfaces.
- SDH E1 management channel on the first E1 port of the 28xE1/DS1 circuit pack.

Depending on the network topology, the OME6130 can be configured to operate as either:

- an IP router: IP communications are routed using static and/or dynamic routing protocol to subtended NEs
- an IP host: IP communications are not forwarded to other NEs with static routing entries providing default routing to the connected IP router.

The OME6130 can use integrated IS-IS (iIS-IS) protocol with auto-tunneling in order to establish communications with OSI based network elements.

OME6130 supports Generic Routing Encapsulation (GRE) which can tunnel IP management communications into OSI Protocol Data Units (PDU). The GRE tunnel can be terminated on an OME6130, other GRE capable NE, or a dedicated router to extract the IP management communications before being forwarded to the management system.

OME6130 supports transparent DCC capabilities which allows the NE to pass-through DCC bytes (E1, F1, D1-D3, E2, D4-D12) used by other network elements. This functionality provides additional integration capabilities into an existing network without affecting the current DCN configuration.

Remote access to an OME6130 NE can be achieved through asynchronous RS-232 modem connection through the serial M1/F1 communication port.

OAM&P Ports

This section describes the ports which can be used to perform OAM&P operations on an OME6130 network element.

M1/F1 port

OME6130 shelf supports a serial communication port which can operate under the following applications:

- Point-to-point (PPP) - asynchronous RS232 communication with external modem.
- User Data Channel (UDC) - asynchronous 64 kbps clear channel using the F1 byte of the regenerator section/section overhead. The F1 byte user data channel is supported only for the STM-1/4 interfaces of the 2x155/622M aggregate circuit pack.

LAN port (LAN-1-6)

The OME6130 shelf supports a 10/100BT Ethernet port on the OAM circuit pack to interface with the external DCN.

It auto-senses the operating speed (10 Mbit/s or 100 Mbit/s), but operates only at half-duplex mode.

The LAN port is a Medium Dependent Interface (MDI), which requires a straight-through cable for connection to a hub or switch, and a crossover cable to a DCN router.

The provisionable IP subnet mask is in prefix notation which indicates the number of binary 1s in the mask, preceded by the “/”.

Table 10-2
Subnet mask

Mask	Dotted equivalent
/24	255.255.255.0
/25	255.255.255.128
/26	255.255.255.192
/27	255.255.255.224
/28	255.255.255.240
/29	255.255.255.248
/30	255.255.255.252
/32	255.255.255.255

Network Interface

The network interfaces of the OME6130 network element are logical representation of the management channels for OAM&P. Each network element has a minimum of one network interface (eth0) for the LAN port. A maximum of ten DCC in-band channels can be provisioned per network element. Besides the eth0 network interface, ten additional DCC network interfaces can be a combination of the E1/VC12 management channel (mgmt1 or mgmt2) and the embedded communication channel of the SFP interfaces. Static and dynamic (Auto) GRE tunnels are also represented as network interface entities.

The eth0 network interface is created by default and can not be deleted.

The mgmt1 and mgmt2 network interfaces are created when the E1/VC12 management channels are provisioned via the DCN/Management Channel application, and they are deleted when the E1/VC12 management channels are unprovisioned from the application. Only IP/PPP is supported over the E1/VC12 management channels (and it supports only OSPF as routing protocols).

The ecc network interfaces are created by selecting the appropriate RS or MS overhead bytes (F1, F2, F3, F2F3, D1-D3, or D4-D12) for the embedded communication channel in the Provision ECC page. These ECC network interfaces are deleted from the network interface page. Either IP/PPP or OSI/LAPD is supported over the embedded communication channels.

The static and Auto GRE tunnels are also created as network interfaces. When iIS-IS is enabled at the nodal level on the network element, the Auto GRE tunnel (AGRE) network interface is automatically created and will be deleted upon disabling the iIS-IS nodal parameter. Upon enabling nodal iIS-IS on the NE, a static GRE tunnel (SGRE) network interface can be created by specifying the remote manual area address, remote system ID (MAC address) and the NSAP selector byte.

See [Table 10-3](#) for a summary of the provisionable parameters applicable to each type of network interfaces. Refer to [Table 10-4](#) for more information on the parameters supported for OSPF and iISIS routing protocols.

Table 10-3
Network interface provisionable parameters summary

Network interface	Admin Status	Layer 2 parameters	Layer 3 parameters	OSPF support	iISIS support
eth0 (LAN port)	<Up/Down> (see Note 1)	Layer 2 Protocol=MAC	- Layer3 Protocol=IP - MTU=<1518> bytes	Yes	No
mgmt1 mgmt2 (E1/VC12)	<Up/Down>	- Layer2 Protocol= <Standard PPP, RFC1661 / PPP, HDLC framing> - Magic Number= <Disable/Enable>	- Layer3 Protocol=IP - MTU=<1518> bytes	Yes	No
ecc (STM-1/4 ports)	<Up/Down>	- Layer2 Protocol= <Standard PPP, RFC1661 / PPP, HDLC framing> (see Note 3) - Magic Number= <Disable/Enable>	- Layer3 Protocol=IP - MTU=<1518> bytes	Yes (see Note 2)	Yes (see Note 2)
		Layer2 Protocol=<Datalink LAPD>	- Layer3 Protocol=OSI - MTU=<512> bytes	No	Yes

Table 10-3
Network interface provisionable parameters summary

Network interface	Admin Status	Layer 2 parameters	Layer 3 parameters	OSPF support	iISIS support
AGRE (see Note 4)	<Up>	Layer2 Protocol=GRE	- Layer3 Protocol=IP - MTU=446 bytes	No	No
SGRE-1 (see Note 5)	<Up/Down>	- Layer2 Protocol=GRE - Remote MAA=<490000> - Remote SID=<000000000000> - NSAP Selector Byte=<2F>	- Layer3 Protocol=IP - MTU=<446> bytes	Yes	No
Note 1: It is recommended to leave the Eth0 network interface port in Admin Up state. Note 2: OSPF and iISIS cannot be simultaneously enabled for a network interface. Note 3: E1/VC12 management communication between OME6130 and OME6110 (Release 1, Release 2.0, Release 2.01 software) should use Layer 2 Protocol as Standard PPP, RFC1661. Note 4: The Auto GRE tunnel is automatically created when iISIS is enabled at the nodal level on the NE. The AGRE network interface parameters are not user-provisionable. Note 5: The Static GRE tunnel can only be created if iISIS is enabled at the nodal level.					

Table 10-4
Dynamic routing protocol parameters

Routing Protocol	Status	Provisionable parameters	Network Interface support
OSPF	<Enable / Disable>	- Hello Interval=<10> - Router Dead Interval=<40> - OSPF Authentication Mode=<Disable authentication / Simple password> - Password/Key=<>	- eth0 - mgmt1, mgmt2 - ecc_x_x - SGRE-x
iISIS (see Note 1)	<Enable / Disable>	- L1 Default Metric=<4> - L2 Default Metric =<4> - L2 Routing Only=<Disable / Enable>	ecc_x_x
Note 1: In this release, the L2 Default Metric and L2 Routing Only parameters are not supported for iISIS routing protocol.			

For more information on the detail procedures, refer to *Provisioning and Protection Switching Procedures*, 323-1855-310.

STM-1/4 Data Communication Channel

Each line optical port can support communications on the selected regenerator section (RS) or the multiplexer section (MS) overhead byte(s).

Each DCC interface supports High-Level Data Link Control (HDLC), Point-to-Point Protocol (PPP), or Link Access Procedure D-Channel (LAPD). HDLC and PPP are IP-based datalink layer and LAPD is an OSI-based datalink layer. PPP is the default datalink layer.

The OME6130 uses an IP-based data communications infrastructure for network element management and interworking with IP-managed network elements. OME6130 also supports Open Systems Interconnection (OSI) based infrastructures for interoperability with OSI-managed network elements.

Data link layer protocols

The following are the supported data link layer 2 protocols used with OME6130 network element through the DCC channels:

LAPD

Link Access Procedure D-Channel (LAPD) is a data link layer 2 protocol used by OME6130 for interworking with OSI networks over DCC.

The OME6130 network element supports LAPD layer 2 protocol on all STM-n/OC-n ports terminating the layer 1 channel using the over-head bytes. The OME6130 network supports at least as many LAPD instances as the number of STM-n ports in the OME6130 network element.

Note 1: The OME6130 network element can support presentation of either LAPD or PPP to the layer 1 interface. Each layer 1 interface can only terminate either LAPD or PPP protocol, but not both simultaneously.

Note 2: It is possible to configure layer 2 protocol for each layer 1 interface independently, on a per layer 1 interface basis.

LAPD detects and reports to higher layers the up or down status of the physical interface. An alarm to indicate link failure shall be supported.

Standard PPP, RFC1661

Point-to-point protocol (PPP) is a data link layer 2 protocol used to pass data between two systems on behalf of the network layer 3 protocol such as TCP/IP Internet Protocol (IP). OME6130 uses the standard PPP as per RFC1661.

Note 1: PPP uses IP Control Protocol (IPCP) over OSI Network Layer Control Protocol (OSINLCP) to pass data between layer 2 and layer 3 protocols. Recommended for standard implementation.

Note 2: Use this option for interworking with any Nortel equipment which supports IP/PPP over DCC channel.

Note 3: Operates in an un-numbered IP mode, using the Router ID (refer to as circuitless IP for Nortel routers and loopback address for Cisco routers).

Note 4: The DCN interface that is configured to operate on IP over Standard PPP does not support configuration of the interface IP address through IP Control Protocol (IP CP) negotiation. The OME6130 network element while sending IPCP IP Address Configure-Ack packet (which is sent in response to the IPCP IP Address Configure-Req packet) will send the Router-ID as its IP address.

PPP, HDLC framing

High-Level Data Link Control (HDLC) is a data link layer 2 protocol used to pass data between two systems on behalf of the network layer 3 protocol such as TCP/IP Internet Protocol (IP).

Note 1: The OME6130 uses the proprietary cHDLC encapsulation and will not interwork with any Nortel equipment.

Note 2: Operates in an un-numbered IP mode, using the Router ID (refer to as circuitless IP for Nortel routers and loopback address for Cisco routers).

Note 3: Use for interworking with other cHDLC DCC network element.

Note 4: When iISIS is selected as the routing protocol, PPP with HDLC framing cannot be selected as a Layer 2 Protocol.

STM-1/4 DCC operation mode

The DCC operation depends on the implemented protection scheme.

1+1 MSP system

The route diversity is provisionable and can either be Route-Diversity-Enabled (ON) or Route-Diversity-Disabled (OFF) while configuring 1+1 MSP for the STM-1/4 ports of the 2x622M aggregate circuit pack. The route diversity must be set to Route-Diversity-Enabled (ON) while configuring 1+1 MSP for the STM-1 ports of the 2x155M tributary circuit pack. On the OME6130 network element, the route diversity is disabled by default.

In the Route-Diversity-Disabled option, the DCN operation bridges transmit and select receiver based on the MSP state machine. The layer 2 and above are presented with only one network interface:

- In the receiver direction, only one of the two layer 1 interfaces (from among the configured working and configured protected belonging to the MSP pair) will be presented to the layer 2 termination protocol. The presented interface shall follow the active path as defined by the MSP state machine.
- In the transmit direction, both layer 1 interfaces (configured working and configured protected port of the MSP pair) transmit the same information sent from the layer 2 protocol (bridge).

Note: In the Route-Diversity-Disabled option, no DCN configuration is allowed on the configured protected port of the MSP pair.

“Route diversity disabled” mode uses a single DCC channel which is switched with the traffic for management, which is unlike the “route diversity enabled” mode where each interface of the 1+1 MSP link has a separate DCC channel that is not switched with the MSP protected traffic.

In the Route-Diversity-Enabled option, the DCN operation on the configured working and configured protected ports belonging to MSP are treated independently. The transmit and receive data of the two layer 1 interfaces (belonging to the configured working and configured protected ports belonging of MSP pair) is independently presented to the layer 2 termination protocol as two independent interfaces. The layer 2 and above are presented with two independent network interfaces.

Note: In the Route-Diversity-Enabled option, DCN configuration is allowed on the configured protected port of the MSP pair.

If OME6130 NE is interworking with another network element (e.g OM4000) which has its interface set to bi-directional MSP switching mode, route diversity should be provisioned to the same at the OME6130 NE and the far-end NE. Otherwise, DCC alarms may be raised on the non-OME6130 NE which can be ignored or disabled.

When an OME6130 NE, which has its DCC route diversity disabled, is interworking in a 1+1 MSP uni-directional switching mode with other NE (e.g. OM4000) with route diversity enabled, a single fibre break in the Rx direction of the non-OME6130 NE in working path can result in lost of communication between the two NEs because the OME6130 NE can still receive traffic on the working interface which the transmit has failed, therefore bi-directional LAPD adjacency can not be established on neither the working path nor the protection path, and hence loss of communication. There will no loss of communication if both fibres (Tx and Rx) on the working path fail at the same time so that bi-directional LAPD adjacency can be establish on the protection path.

Bi-directional switching mode is the recommended protection scheme used for 1+1 MSP in order to guarantee full data communication between interworking network elements.

SNCP or unprotected system

In this configuration, each STM-1/4 link is considered as an individual port, allowing the DCC to be configured independently. The following are the supported combinations for each DCC:

- STM port with DCC disabled
- STM port with PPP/IP or cHDLCLP

- STM port with LAPD/CLNP (OSI)

Overhead transparency

OME6130 supports overhead bytes transparency via overhead tunnel provisioning, by specifying the source and destination optical port, and selecting the passthrough RS or MS overhead byte(s). This feature provides the following capabilities:

- Designated byte(s) from the interworking or subtending networking elements are passed transparently through the OME6130 network elements.
- Allows interoperability with other vendors' equipment that do not support a standard-based OSI communication stack.
- Using transparent DCC to forward OSI packets.
- The same overhead bytes cannot be used for provisioning overhead transparency and a DCC channel.

The following are the overhead bytes which are allowed to pass transparently:

- Regenerator Section overhead:
 - E1: 64 kbps orderwire channels
 - F1: 64 kbps user channel
 - D1-D3: 192 kbps OA&M data
- Multiplexer Section overhead
 - E2: 64 kbps orderwire channels
 - D4-D12: 576 kbps OA&M data

STM-1/4 DCC implementation rules

You must observe the following rules when you implement the DCC:

- Only one regenerator section (RS) or multiplex section (MS) DCC can be enabled per optical port.
- Each DCC can support HDLC, PPP or LAPD. The default is PPP.
 - When using DCC to connect to an OME6130 (or any network element that supports IP based DCC datalink layer), select PPP as the protocol.
 - When using DCC to connect to an OSI-based DCC datalink layer, select LAPD as the protocol.
- Set the LAPD IP MTU size to 446 when interworking with Optical Cross Connect DX/ HDXc/ HDX, and Optical Multiservice Edge 6500. The user has to manually configure the connected SDH interfaces to 512 bytes for the LAPD MTU. The OME6130 LAPD MTU is set to 512 by default.

- Set the LAPD IP MTU size to 446 when interworking with Optical Metro 4000 and TN-1C family of products which has a fixed LAPD MTU of 512 bytes. The OME6130 LAPD MTU is set to 512 by default.
- On a DCC interface over SDH overhead bytes, both OSPF and iISIS routing protocols cannot be enabled simultaneously.

IP communication

TCP/IP Internet Protocol (IP) is a network layer protocol and the OME6130 uses IPv4. Each OME6130 shelf must have one IP address assigned to it for management purposes. Typically, the IP address used to manage the OME6130 is the circuitless IP address. The circuitless IP is designated as **Router ID**.



CAUTION

Circuitless IP (Router ID) address

The circuitless IP has a non-provisionable default subnet mask of 255.255.255.255.

The LAN (LAN-1-6) Ethernet interface can be assigned with a single IP address and subnet mask. A gateway network element requires an IP address on a different subnet to the Router ID for the Ethernet interface connected to the external DCN.

For general information on assigning IP addresses in a network, see [IP networks, addressing, and masks on page 10-93](#).

IP addressing implementation rules

You must observe the following rules when you implement the IP addresses:

- Each network element must be assigned with an IP address and subnet mask for the LAN port, and an IP address for the circuitless IP (Router ID) address.
- For a gateway network element, you must provision an IP address for the LAN port on a different subnet to the Router ID IP address. The LAN interface must be assigned an IP address in the same subnet of the external router port connected to the LAN interface of the gateway network element.
- A node reset (warm restart) on the NE is required after changing the Router ID or Ethernet IP address in order for the new IP addresses to take effect.
- Overlapping IP addresses cannot be assigned.
- When assigning private IP addresses, it is recommended that the IP addresses in the range of 10.1.1.0 to 10.4.255.255 are not used. These IP addresses are used by the OM5000 network elements for internal data communications so should not be used in any OME6130 network that will contain OM5000 network elements.

- The LAN port has a default IP address of 192.168.1.254/24 which allows a local craft PC with an IP address configured in the same subnet as the LAN interface to access the network element. It is recommended that the IP addresses in the range of 192.168.1.1 to 192.168.1.255 are not used.
- The last octet of the router ID and LAN-1-6 IP addresses can not be 0 or 255.
- For a remotely managed NE, for example, via the DCC of the optical line interface, the LAN port can be left as default IP address of 192.168.1.254/24 for local craft access.

Note: OSPF routing should always be disabled on the LAN port if it is provisioned with default IP address.

Static routing

As with standard routers, the OME6130 supports configuration of static routes.

Static route implementation rules

You must observe the following rules when you implement a static route:

- Static routes can be provisioned on any of the network interfaces up to a maximum of 10.
- Static routes on valid PPP interfaces, such as STM-1/4 ports, SGRE, AGRE, E1 or VC12 management channels, should be provisioned with next hop IP address 0.0.0.0.
- Set the **OSPF** parameter to **Disable** and provision the static route for the appropriate PPP network interface.

Note: The static routes can be configured in the NE for redistribution (advertising over routing protocols over to other NEs). The redistribution is applied to the routing protocol that is provisioned on the NE: OSPF only, iISIS only or both simultaneously. It is not possible to redistribute a static route only over OSPF or only over iISIS, if both routing protocols are enabled on the network element.

Dynamic routing - OSPF

Open Shortest Path First (OSPF) Protocol is an Interior Gateway Protocol (IGP) that distributes routing information between routers belonging to a single autonomous system (AS). Intended for use in large networks, OSPF is a link-state protocol which supports IP subnetting and the tagging of externally-derived routing information.

OME6130 provides OSPF v2 routing functionalities and acts as a standard non-backbone OSPF router, interworking with an external customer OSPF DCN.

Note: OSPF routing is always active on the OME6130 network element, and therefore does not need to be enabled at the nodal level. It must only be provisioned on the network interface for which it is required.

The OME6130 supports enabling and disabling of OSPF routing protocol per IP-carrying interface, including Eth0, PPP/cHDLC DCC, and SGRE interfaces.

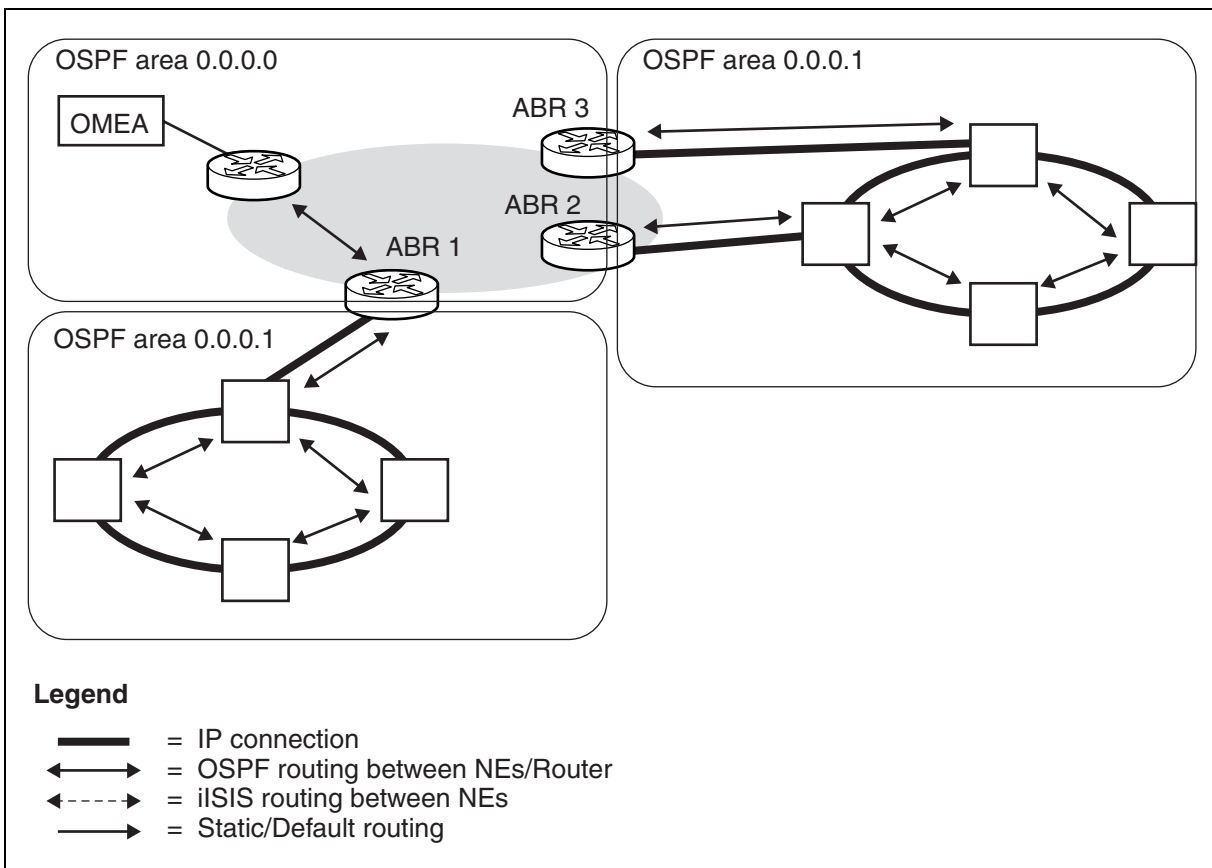
For more information about OSPF, see [IP routing protocols on page 10-97](#).

OSPF routing implementation rules

You must observe the following rules when you implement the OSPF routing:

- Default user configurable OSPF area of 0.0.0.1 for all network interfaces for which the OSPF parameter is enabled.
- Set the **OSPF** parameter to **Enable** to use dynamic routing over the network interfaces.
- When OSPF is enabled on the eth0 network interface (LAN port), the provisioned Ethernet sub-network is advertised as part of the OSPF link state advertisement (LSA).
- The Router ID IP address is used only in OSPF hello packets to form OSPF adjacencies. This allows multiple different OSPF areas of 0.0.0.1 to exist in the customer network as long as the OME6130 NEs are connected to different Area Border Routers (ABRs). See [Figure 10-1 on page 10-14](#).
- It is recommended to use the Ethernet IP address as the Router ID IP address if the NE has only direct LAN connectivity.
- It is recommended to use a different Router ID IP address other than the Ethernet IP address if the NE has DCC enabled.
- When OSPF is enabled on the Ethernet port and DCC is being used to provide OA&M, the Router ID IP address should be in a different sub-network other than the Ethernet IP address sub-network.
- Re-distribution of static route into OSPF routing table is supported. By default, static route re-distribution is disabled.
- Route redistribution between OSPF and iISIS routing protocols is not supported.

Figure 10-1
Multiple OSPF 0.0.0.1 areas



Dynamic routing - Integrated IS-IS

Integrated ISIS (iISIS) is a routing protocol based on the OSI Intra-domain routing protocol with IP specific extensions as specified in ISO/IEC10589 and RFC1195. iISIS allows IP and OSI to co-exist in a single routing domain, allowing IP-only routers, OSI-only routers, and dual IP/OSI routers to be effective in routing in a single network.

OME6130 network elements support nodal level enabling and disabling of iISIS routing protocol. When enabled at a nodal level, it is possible to enable iISIS routing on a per layer 2 PPP interface or on a per LAPD interface. iISIS is able to communicate with layer 2 protocols to forward OSI-NPDU packets over the LAPD and PPP layer 2 links.

iISIS routing protocol allows the creation of a Link State Packet (LSP) database of all OSI only, IP only, and Dual Stack network elements within its level 1 area. iISIS routing protocol creates IP Routing Information Base (RIB) that contains route information for all network elements that have at least one

IP address configured and is in the same level 1 area. iISIS routing protocol also creates CLNP forward information base (FIB) updates based on LSP database for all reachable OSI network elements.

iISIS routing implementation rules

You must observe the following rules when you implement the iISIS routing:

- Support provisioning of three manual area addresses:
 - MAA1 default value of 490000
 - MAA2, blank with 3 to 13 bytes long
 - MAA3, blank with 3 to 13 bytes long
- Level 1 routing is supported
- Enabling and disabling of iISIS routing protocol is done on a per PPP, LAPD based DCN interface. The default value is iISIS-Disabled.
- The iISIS routing protocol will support only configuration of default metric as the routing metric for each circuit. The range of the default metric shall be [1 - 63] and the default value is 4.
- Route redistribution between OSPF and iISIS routing protocols is not supported.

Routing protocol configuration

OME6130 supports nodal level configuration of enabling or disabling of Integrated Intermediate System Intermediate System (iISIS) routing protocol. By default, iISIS routing protocol is disabled. OSPF routing protocol is always enabled at the nodal level, but must be provisioned per network interface.

OME6130 supports enabling of iISIS at a nodal level, while OSPF is also enabled on the NE. The routing protocols must be specified for each network interface individually. iISIS and OSPF routing can not be simultaneously provisioned on the same network interface.

Proxy ARP

Proxy ARP allows a gateway network element to respond to address resolution protocol (ARP) requests for subtending network elements that are within the same subnet as the customer DCN address range. The proxy ARP feature removes the need for customers to provision static routes on their routers and routing protocols (OSPF) between the gateway network elements and the customer DCN.

Proxy ARP is only supported on the LAN interface of the OME6130 network element. At the gateway OME6130 network element, the IP address of neighbouring network elements can be provisioned for Proxy ARP. The GNE will perform proxy ARP for IP addresses of neighbouring NEs that are on the same subnet as the DCN router connected to the LAN interface.

For more information about ARP, see [ARP on page 10-96](#).

Proxy ARP implementation rules

You must observe the following rules when you implement proxy ARP. At gateway network elements, you must:

- assign a subnet on the DCN router port that connects to the LAN port of the gateway network element that is large enough to support the LAN port and the router ID address of every network element for which the gateway network element will proxy ARP
- provision the IP addresses of the proxy ARP neighbours for which the gateway network element will respond for. The IP addresses should be of the hosts, not the network.
- provision a maximum of 14 proxy ARP neighbours
- ensure that the DCN router interfaces connected to the LAN interface will ARP for the specified ARP neighbours
- provision a static route to the DCN network. At the remote/neighbouring NEs, static routes do not need to be provisioned to the router

OSI data communications

The *Data Communications Network Planning Guide*, NTR710AM provides information on DCN planning for some OSI-based Nortel products. This guide includes general information on OSI data communications and addressing and can be used as a reference for OSI data communications information.

CLNP

OSI Connectionless Network Protocol (CLNP) is a network layer 3 protocol which provides services to the upper transport layer, similar to the Internet Protocol (IP) in the a TCP/IP environment. CLNP is often referred to as ISO-IP. CLNP uses NSAP addresses to identify network devices. The OME6130 supports CLNP protocol as specified in ISO/IEC 8473-1.

Note: OME6130 supports a maximum CLNP packet size of 512 bytes.

The OME6130 provides the ability to tunnel IP communications over OSI. The OME6130 will route (forward) only IP packets and OSI (CLNP) PDUs (support of reassembly of segmented DPDUs).

In order to communicate to the OME6130 NE in an OSI network, the OME6130 can use iISIS routing protocol with auto-tunneling to allow the OSI route to the OME6130 NE to be learnt through the OSI network. Once iISIS routing is provisioned, static (SGRE) or dynamic (AGRE) IP over OSI tunnels can be provisioned on the network element.

In order to provide communications through the OSI network, the following items need to be performed:

- Configure the OME6130 NE to communicate to the OSI area it is connected to.
- Enable iISIS routing protocol at the nodal level, as well as the applicable network interface. The AGRE interface will be automatically created once iISIS is enabled at the nodal level. If required, a SGRE interface can also be provisioned on GRE tunnel terminating equipment, such as OME6130, OME6500 or external routers. A static or dynamic routing protocol must also be provisioned for the SGRE interface.

CLNP and layer 2 protocols using SNDCF

Sub-Network Dependent Convergence Function (SNDCF) interfaces are used for multiplexing and demultiplexing packets between layer 3 modules (CLNP, GRE, ESIS, and ISIS) and layer 2 interfaces (LAPD, PPP or MAC).

The OME6130 provides a SNDCF interface that allows layer 2 protocols such as LAPD and PPP to interface with CLNP, ESIS, and ISIS routing protocols. The GRE layer module will interact with CLNP via the addition of Network Service User of CLNP.

Configure OSI connection

You must observe the following rules when you configure the OSI data communication:

- OME6130 requires an OSI local manual area address to interop with other OSI products. The local manual area addresses are used to form the NSAP address of each network element in the OSI level 1 area.
- The default manual area address is 490000.
- Up to three local manual area address can be provisioned for iISIS. The OME6130 NE can be part of up to 3 areas.
- All NSAP formats are supported:
 - ISO Local Addressing Format - e.g. 490000
 - ISO DCC Addressing Format - e.g. 39xxxxxxxxxxxxxxxxxx
- In order to communicate with an Intermediate System (IS) network element, provision the **Local Manual Area Address** to be the same as the Manual Area Address of the connected IS NE. The iISIS protocol will establish adjacency between NEs in an area if they have one Manual Area Address common.
- For communication to network elements in different OSI area, the Local Manual Area Address has to be the unique area address used in the networks which use both the default 490000 Manual Area Address and a unique 39xxxxxxxxxxxxxxxxxx Manual Area Address.

Configure GRE tunnel

TCP/IP Generic routing encapsulation (GRE) is a standard transport layer encapsulation protocol which provides a standard method for transporting one arbitrary network layer protocol over another arbitrary network layer protocol (tunneling). A tunnel is effectively a point-to-point connection which allows packets to be enclosed/encapsulated within another packet.

GRE tunnel

Two GRE types are supported:

- **Static GRE tunnel :** Static tunnels are user defined point-to-point tunnels used to pass packets from one node to another. Static tunnels are ideal for bridging sections of a network which do not support a protocol (for example, routing IP packets through an OSI network). The user creates a static tunnel by specifying a protocol (OSI or IP) and a tunnel termination point (MAC address).

Note: Creating a static tunnel to a specific destination only allows packets to be sent to that destination. You must configure a tunnel in the opposite direction for packets to be returned.

- **Auto GRE tunnel:** Auto-tunnels are dynamically created and removed as required by a dual router. Auto-tunnels do not require user intervention but only operate between iISIS capable nodes where OSI communications can be reached between the nodes. Auto-tunnels configure multiple tunnels to multiple destinations depending upon the best route through multi-protocol networks that support iISIS.

Note: Static GRE and Auto GRE tunnels support only IP over OSI tunnelling.

Static GRE tunnel

OME6130 supports only one instance of static GRE tunnel per network element. The user creates a static tunnel by specifying a protocol (IP) and a tunnel termination point (OSI address). The static GRE supports only IP over OSI tunneling.

Note 1: The static GRE tunnel is user provisionable. For optimal performance the static GRE tunnel should be provisioned provided there is a LAPD or PPP interface on which iISIS is enabled. If there is no interface with iISIS enabled then all packets into static GRE shall be dropped.

Note 2: Creating a static tunnel to a specific destination only allows packets to be sent to that destination. You must configure a tunnel in the opposite direction for packets to be returned.

Note 3: The OME6130 supports enabling of OSPF routing protocol on a static GRE tunnel interface. When enabled, OSPF exchanges packets over the GRE interface and treats the NE of the other end of the GRE tunnel as its neighbor.

Auto GRE tunnel

OME6130 supports auto GRE tunneling with iISIS routing protocol to provide seamless integration of OSI only networks with Dual or IP only networks elements.

The auto GRE tunnel is automatically configured and enabled when iISIS routing protocol is enabled at the nodal level. There is no specific user configuration required. The IP over OSI tunnel creation is done automatically on a per packet basis over all the packets forwarded to the auto GRE interface by IP. A default static route shall be provisioned automatically on the auto GRE (called agre0) interface that is presented to the IP protocol stack. In this scenario, the IP protocol stack shall forward packets that are not routable by any other IP routing table entry to the auto GRE tunnel for further processing. The default route shall have the last priority, as any user provisioned specific static route shall have higher priority than default route when routing packets.

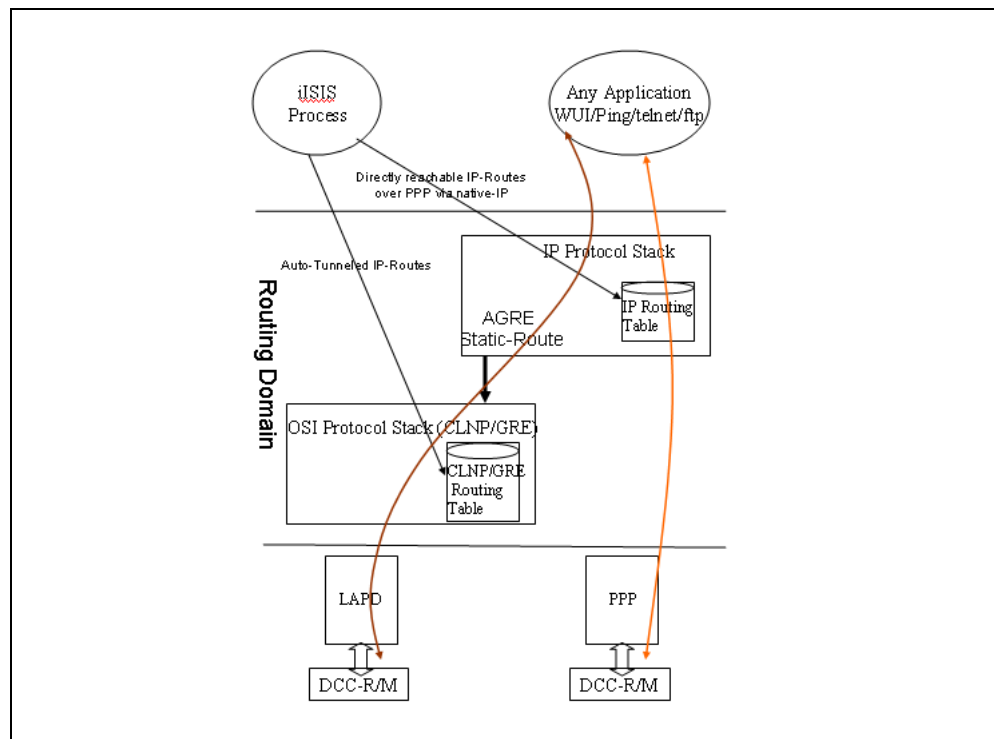
Note 1: If an NE contains 0.0.0.0/0 and 10.0.0.0/8 as two routes already present, then auto-GRE creation can cause packets reaching through one of the routes to be dropped. It is better to reconfigure the 0.0.0.0/0 and/or 10.0.0.0/8 routes to another suitable route so that the automatic creation of auto GRE interface route functions seamlessly.

Note 2: Static routes can be added by the user other than the default route that points to the Auto-GRE tunnel. Then, the packets that did not find a match in the IP routing table will be routed to the Auto-GRE tunnel.

AGRE IP/OSI routing interactions

Figure 10-2 presents a diagram describing the IP packet routing when iISIS routing protocol is enabled. The OME6130 supports an IP routing table, which is updated with the least cost route for each IP destination from Static IP routes, OSPF learnt routes and iISIS routes learnt over PPP interfaces, such as connection to IP-capable network elements. IP routes learnt over CLNP are not stored in the native IP routing table, but they are added to the OSI/GRE routing table as part of the OSI routing function. The AGRE interface when provisioned with appropriate static routes, allows for packets to be pushed from the native IP routing domain to the iISIS routing domain (with IP routes that communicate through OSI network elements). At each network element, the AGRE interface must be properly provisioned with static routes covering all destinations which will need to be auto-tunnelled. Once in the OSI routing domain, the IP destinations of a received IP packet are looked up against the OSI/GRE forwarding table to determine the NSAP (OSI address) that provides most specific and least cost route to that IP destination. If a match is found then GRE encapsulation of the IP packet into a CLNP (OSI) PDU with this NSAP as the destination is performed. This CLNP PDU is then routed to this NSAP by looking it up in the OSI routing table.

Figure 10-2
IP Packet Routing



Generic GRE implementation rules

You must observe the following rules when you implement auto or static GRE:

- OME6130 supports presentation of both auto and static GRE interfaces to IP layer protocol. The auto GRE interface presented to the IP protocol layer is called `agre0`. The static GRE interface presented to the IP protocol layer is called `sgre1`.
- OME6130 supports presentation of both auto and static GRE interfaces to CLNP protocol layer.
- The MTU of the GRE network interface presented to the IP must be 446 bytes. The MTU presented to CLNP must be 512 bytes. This is valid for both auto and static GRE interfaces.

Static GRE implementation rules

You must observe the following rules when you implement static GRE:

- Provision the **Remote Manual Area address** of the tunnel destination. The tunnel can be either in the same or remote OSI area. The default is `0x490000`.
- Provision the **Remote System ID** of the tunnel destination node. The MAC address of the tunnel destination node can be used as the Remote System ID. When the MAC address is entered for static GRE provisioning, remove the colon characters. The default is `0x000000000000`.

- Provision the **NSAP Selector Byte** of the tunnel destination node. Use hexadecimal **2F** (47 in decimal) for GRE protocol.

Note: When provisioning a static GRE tunnel between the OME6130 and OME6500, a mismatch of the NSAP selector bytes provisioned at the OME6500 and the OME6130 is expected. The NSAP Selector Byte provisioned at the OME6130 WUI should be set to 2F, and the network selector (NSEL, last 2 bytes of NSAP) provisioned from the OME6500 craft interface must be set to 00. The OME6500 automatically sets the NSEL internally to support the required transport service.

Auto GRE implementation rules

You must observe the following rules when you implement Auto GRE:

- Rule 1: The default route of 0.0.0.0/0 should not be configured over the LAN port (eth0) and should not be advertised over iISIS on the GNE. This route may interfere with the static route that needs to be configured on the AGRE interface on every OME6130 network element.
- Rule 2: On all OME6130 network elements (GNE and remote NEs), it is recommended to manually provision a non-advertised static route for the AGRE to be within the network element DCN subnet.
- Rule 3: On all remote network elements, in addition to the manually provisioned static route in Rule 2, a non-advertised default route of 0.0.0.0/0 must also be provisioned over the AGRE interface.

Configure IP routing

Configure the interface to use either static or dynamic routing scheme. Refer to [IP communication on page 10-11](#) for more details.

Application protocols

This section lists out the supported application protocols and commands which can be useful while working and troubleshooting an OME6130 network element.

ftp

TCP/IP File transfer protocol (FTP) is a standard application layer protocol used for transferring files across a network. This protocol uses a client/server architecture. Both the FTP client and server are enabled on the OME6130. The OME6130 supports active FTP.

The FTP protocol is used mainly during firmware, software, or on-line documentation upgrade to handle all file transfers between the source (server) of the image files and the network elements (clients). The FTP protocol is also used for database backup and restore operations.

telnet

TCP/IP Telnet is a standard application layer terminal protocol used for accessing remote computers, in a text based communications session between a client and a host.

Both the Telnet client and server are enabled on the OME6130.

Diagnostic commands

This section lists the diagnostic commands which can be used on an OME6130 network element in a telnet session.

arp

Address resolution protocol utility

ifconfig

Displays status information for all interfaces.

ping

ICMP echo request and reply to test IP layer 3 connectivity. This command requires root privilege.

route

Displays the kernel IP routing table.

tcpdump

Prints out headers of packets on all or specified interface. This command requires root privilege.

Firewall considerations

The following ports must be passed through any firewall between the management systems and the OME6130 network:

- TCP
 - 20 (data), 21 (control) - FTP ports used for upgrades, or backup and restore configurations.
 - 2023 - Telnet port used for troubleshooting.
 - 10001 - Used by TL-1 without prompt and character echo
 - 10002 - Used by TL-1 with prompt and character echo
 - 20080 - Used by HTTP for Web User Interface (WUI)
- UDP
 - None used

Engineering guidelines

The following are DCN engineering guidelines:

ATTENTION

For configurations that exceed the following guidelines, contact Nortel for assistance.

- STM-1/4 DCC
 - Maximum of 10 DCCs per network element
 - Maximum of 1 Regenerator section (RS) or Multiplex section (MS) DCC per optical interface
 - Regenerator section (RS) DCC using D1-D3 bytes at 192 kbps
 - Multiplex section (MS) DCC using D4-D12 bytes at 576 kbps
- LAPD
 - MTU frame size of 240 to 512 bytes (default is 512)
 - Metric: The DCC default metric is set to 4. When interworking with legacy network elements, use the following DCC metrics:
 - MS DCC: 5
 - RS DCC: 6
 - CLNP supported over LAPD (Default MTU frame size of 512 bytes when presented to CLNP. The MTU size is user configurable and should be in the range [240-512] bytes).
- PPP
 - MTU frame size of 1518 bytes
 - Non-configurable default parameters:
 - Maximum receive unit: no limitation
 - Note:** Does not perform negotiation for MRU and accepts packets of any size
 - Authentication protocol: disabled
 - Quality protocol: None
 - Protocol field compressed: Disabled
 - Address and control field compressed: Disabled
 - FCS alternatives: 16 bit FCS
 - Configurable default parameter:
 - Magic number: <Disable>

- OSPF
 - Configurable default area of 0.0.0.1
 - Maximum of 150 routers in the same OSPF area as the OME6130 NE
 - Supports non-stub area
 - Configurable parameters:
 - Hello Interval: 10 seconds. The range is [1-65535] seconds.
 - Dead Interval: 40 seconds. The range is [1-65535] seconds.
 - Non-configurable default parameters:
 - Retransmit Interval: 5 seconds
 - Transmit Delay: 1 second
 - OSPF Ethernet Cost: 1
 - OSPF DCC Cost: 1
 - OSPF GRE Costs: 1
 - OSPF LAN priority: 1
 - OSPF Authentication mode : disabled (default) or Simple Password:
 - Enabling and disabling of password based authentication for OSPF on a per layer 2 interface level. If password based authentication is enabled, then password is configurable.
 - OSPF Authentication key: String configurable by the user if the OSPF Authentication mode is set to Simple Password.
- Note:** For maximum network performance, the external DCN intervals should be aligned with OME6130.
- IP
 - Maximum of 4096 IP routes (static and dynamic). But for optimal performance it is recommended that not more than 512 entries be added in the IP routing table. (Note that the IP routing table entries include the routing entries added by OSPF or iISIS or Static Route into the IP routing protocol domain).
 - Maximum of 10 static routes per NE
 - Use Destination Network IP address of 0.0.0.0/0 with next hop IP address for default route
 - MTU packet size of 240 to 512 bytes for OSI CLNP/LAPD
 - MTU packet size of 1518 bytes for IP/PPP
- GRE
 - Tunnels between different OSI areas are supported

- MTU packet size should be 66 bytes less than the MTU for LAPD
- Telnet session
 - on the number of concurrent sessions per network element
 - Session timeout is not supported
- TL-1 sessions
 - maximum of 4 concurrent sessions per network element

DCN performance

This section details the guidelines for DCN performance.

- Native IP forwarding capability:
 - 400 kbps for typical management messages without OSI interworking
 - 320 kbps with IP tunnelling through OSI with GRE
- Maximum MS DCC throughput for IP packets is 400 kbps.
- DCN Loading:
 - Minimum link required for OMEA management is 128 kbps
 - Minimum link for Craft only connection is 15kbps under normal conditions
 - Average native IP traffic per NE is 4 kbps
 - Average resulting OSI traffic per NE with GRE is 6-8 kbps for the core DCN
 - Maximum number of IP DCC hops is 15

Supported DCN design examples

In order to have a complete understanding of the DCN for OME6130 and to ensure that the DCN has the proper level of resiliency and connectivity for all the network elements in the configuration, the following needs to be reviewed while designing the DCN:

- Physical and logical connectivity - Ethernet LAN port, DCC ports, and IP via OSI tunnels usage and provisioning.
- IP network design - IP class, subnets, and IP routing scheme (static or dynamic OSPF).

Note: For configurations using OSPF routing in the examples below, the default OSPF area 0.0.0.1 is used. In actual network implementations, the OSPF area may be changed, along with the other interfaces, to a unique value.

- OSI network design (if applicable) - Area addresses, IS-IS or iIS-IS routing.

Different options are available for designing a data communications network containing OME6130 network elements. The following are examples describing the physical and logical implementations:

- [DCN example 1 - Using static routing with direct LAN connections to OME6130 network elements.](#)
- [DCN example 2 - Using single OME6130 GNE with static routing to external DCN. OSPF is used in between OME6130 network elements.](#)
- [DCN example 3 - Using single OME6130 GNE with OSPF to external DCN. OSPF is used in between OME6130 network elements.](#)
- [DCN example 4 - Using OSPF with dual OME6130 GNEs to external OSPF backbone.](#)
- [DCN example 5 - Using single OM4000 GNE with GRE tunnels through OM4000 network to reach remote OME6130 network elements in linear spurs off OM4000 NE.](#)
- [DCN example 6 - Using single OM4000 GNE with GRE tunnels through OM4000 network to reach remote OME6130 network elements in SNCP ring with an OM4000 network element.](#)
- [DCN example 7 - Using dual OM4000 GNEs with GRE tunnels through OM4000 network to reach remote OME6130 network elements in SNCP ring with generic SDH network elements.](#)
- [DCN example 8 - Using single OME6130 GNE with iISIS through OM4000 network to reach remote OME6130 network elements in SNCP/UPSR rings with OM4000 network elements. Proxy ARP used at OME6130 GNE for access to remote OME6130 NEs.](#)
- [DCN example 9 - Using single OME6500GNE with iISIS through OME6500 network to reach remote OME6130 network elements.](#)
- [DCN example 10 - Using single OME6500 GNE with iISIS to reach remote OME6130 network elements in a SNCP ring configuration with generic SDH equipment.](#)
- [DCN example 11 - Using VC12 management channels through OM4000 network to reach remote OME6130 network elements in SNCP ring with OM4000 and legacy OSI network elements. Transparent DCC used to provided resilient OSI communications.](#)
- [DCN example 12 - Using E1 and VC12 management channels to reach remote OME6130 network elements in SNCP ring with OM4000 and legacy OSI network element. Transparent DCC used to provided resilient OSI communications.](#)

DCN example 1 - Using static routing with direct LAN connections to OME6130 network elements.

In this example (see [Figure 10-3 on page 10-28](#) and [Figure 10-4 on page 10-29](#)), each OME6130 is directly connected to external DCN via the LAN ports.

Routing protocol (static or dynamic) is not required from the DCN router to each of the OME6130 network element. The external router and the OME6130 LAN interfaces are in the same subnet. A static route is required from each of the network element to the DCN router interface.

No DCC is used in between the network elements.

This example does not provide redundant access to any of the OME6130 network elements because each OME6130 NE is connected to the external DCN with one Ethernet port (i.e. LAN port).

DCN provisioning details

[Table 10-5 on page 10-29](#) and [Table 10-6 on page 10-30](#) detail the DCN parameters for the DCN example 1 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-3

DCN example 1 - Static routing with direct LAN connections to OME6130 network elements

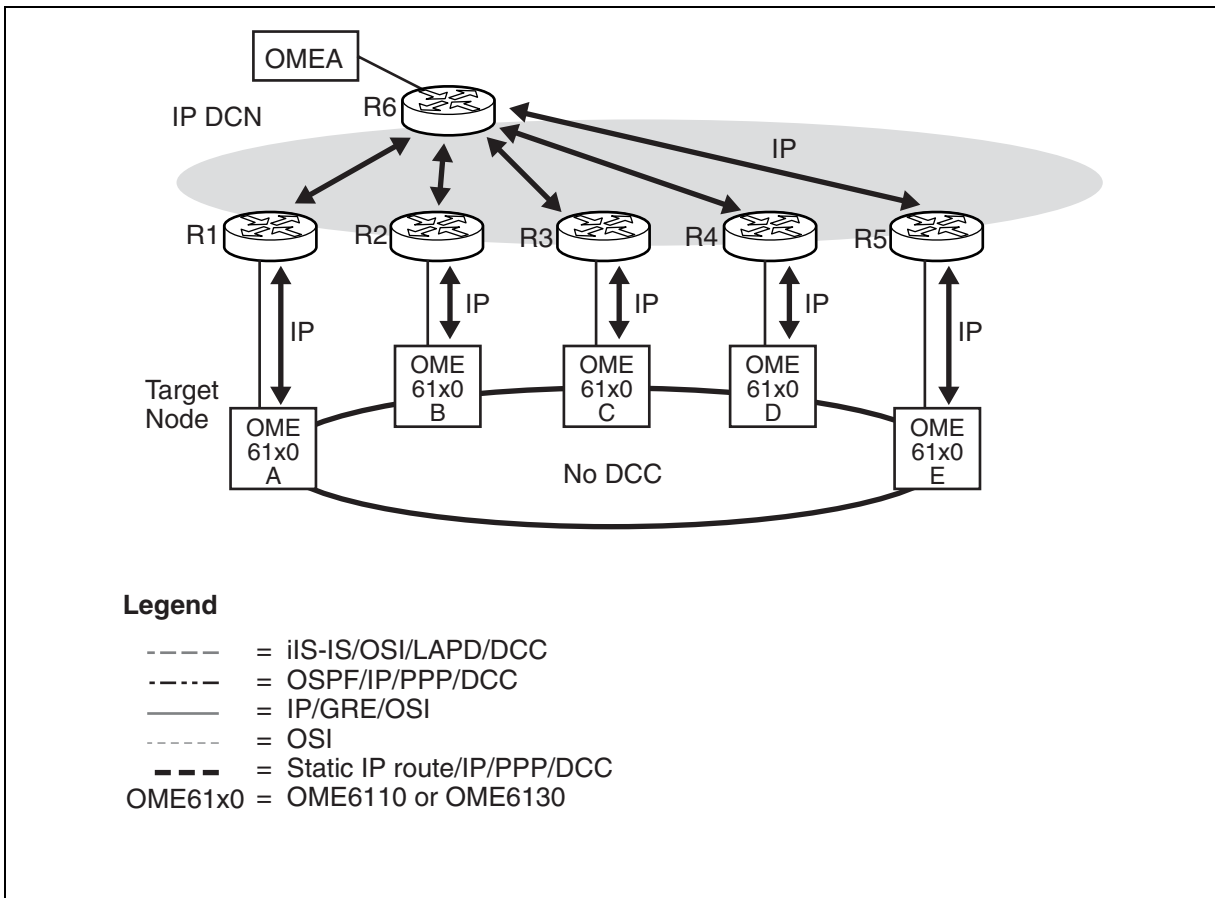


Figure 10-4
DCN example 1 - IP logical view

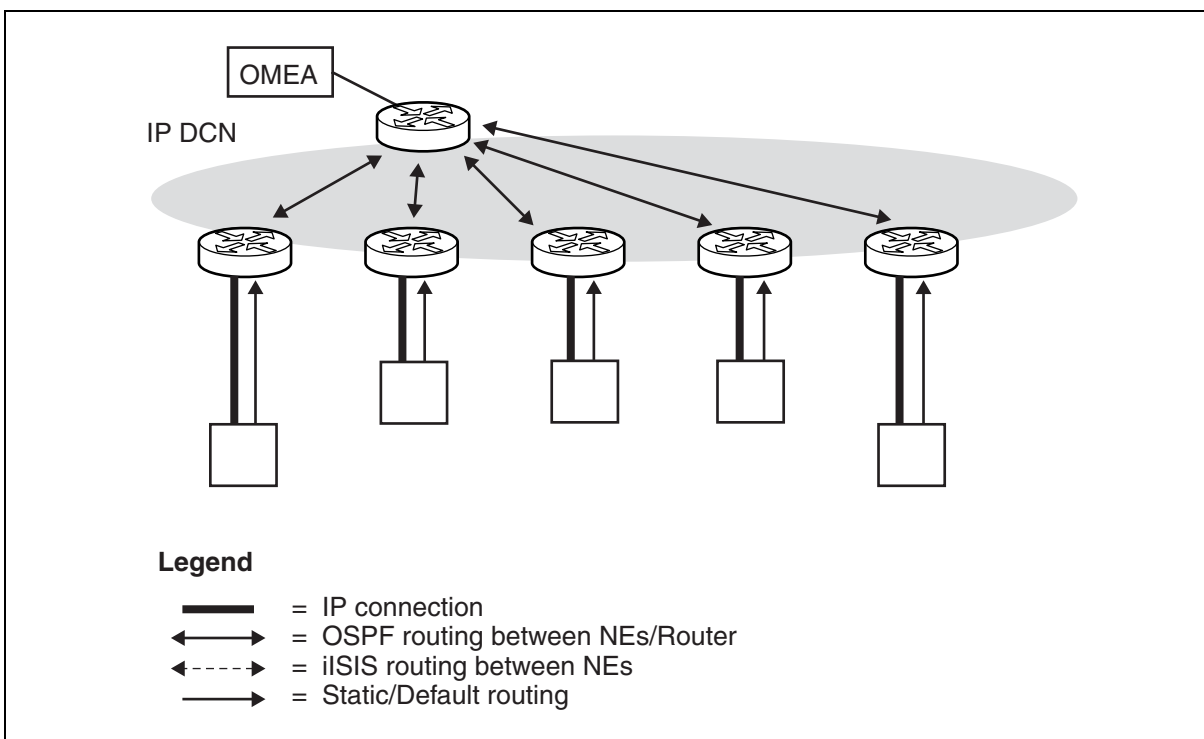


Table 10-5
DCN example 1 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C	OME6130 D	OME6130 E
1 Set up IP address					
LAN-1-6 port:					
IP address	47.1.3.5	47.1.3.12	47.1.4.5	47.1.4.18	47.1.4.26
Netmask	/29	/29	/29	/29	/29
Default gateway	-	-	-	-	-
Router ID:					
IP address	-	-	-	-	-
Netmask	-	-	-	-	-

Table 10-5 (continued)
DCN example 1 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C	OME6130 D	OME6130 E
2 Set up IP routing					
Ethernet OSPF enable	No	No	No	No	No
OSPF area	-	-	-	-	-
Static routing 1:					
Address	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Netmask	/0	/0	/0	/0	/0
Next hop IP address	47.1.3.1	47.1.3.9	47.1.4.1	47.1.4.17	47.1.4.25
Next hop interface	LAN-1-6	LAN-1-6	LAN-1-6	LAN-1-6	LAN-1-6
Advertise	Disable	Disable	Disable	Disable	Disable
3 Set up DCC					
STM1/4-x-1:					
Protocol	Disabled	Disabled	Disabled	Disabled	Disabled
MTU	-	-	-	-	-
STM1/4-x-2					
Protocol	Disabled	Disabled	Disabled	Disabled	Disabled
MTU	-	-	-	-	-

Table 10-6
DCN example 1 - Router and OMEA provisioning details

Parameters	Router 1	Router 2	Router 3	Router 4	Router 5	Router 6	OMEA
1 Set up IP address							
Ethernet interface:							
IP address	47.1.3.1	47.1.3.9	47.1.4.1	47.1.4.17	47.1.4.25	47.1.1.1	47.1.1.5
Netmask	/29	/29	/29	/29	/29	/29	/29
Default gateway	-	-	-	-	-	-	47.1.1.1
2 Set up IP routing							

DCN example 2 - Using single OME6130 GNE with static routing to external DCN. OSPF is used in between OME6130 network elements.

In this example (see [Figure 10-5 on page 10-32](#) and [Figure 10-6 on page 10-33](#)), a single OME6130 network element is used as the GNE to establish communication between the external DCN and the OME6130 sub-system.

Static routes are used on both the OME6130 and the connected external DCN router. The static route provisioned on the external DCN router is redistributed inside the external DCN by the external DCN routing protocol so that the proper route is available for the management system to reach the OME6130 sub-system.

OSPF routing protocol is used in between the OME6130 network elements using IP over DCC.

This example does not provide redundant access to the OME6130 sub-system from the external DCN because only one OME6130 NE is connected to the external DCN. However, the DCC between the OME6130 NEs is redundant.

DCN provisioning details

[Table 10-7 on page 10-33](#) and [Table 10-8 on page 10-34](#) detail the DCN parameters for the DCN example 2 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-5
DCN example 2 - Single OME6130 GNE with static routing

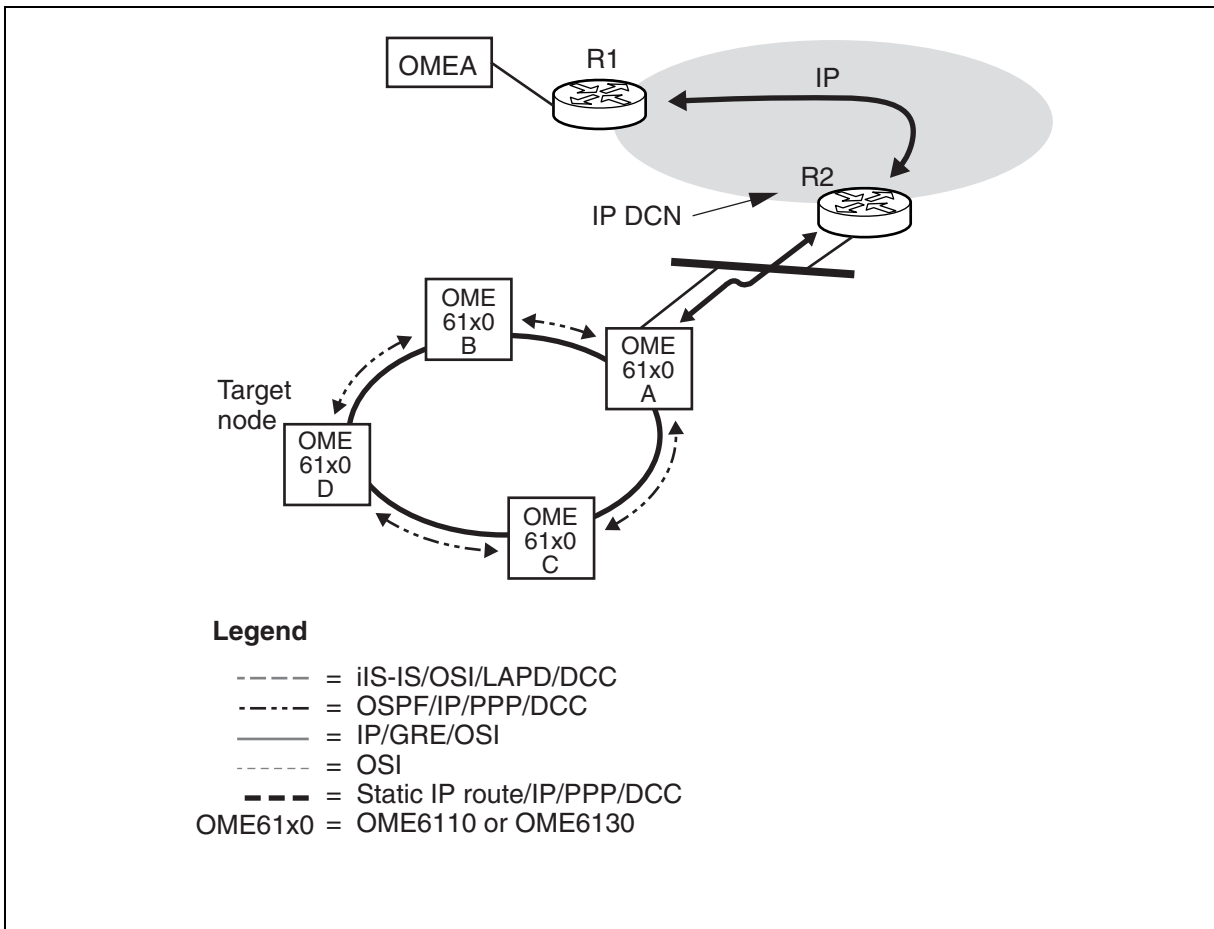


Figure 10-6
DCN example 2 - IP logical view

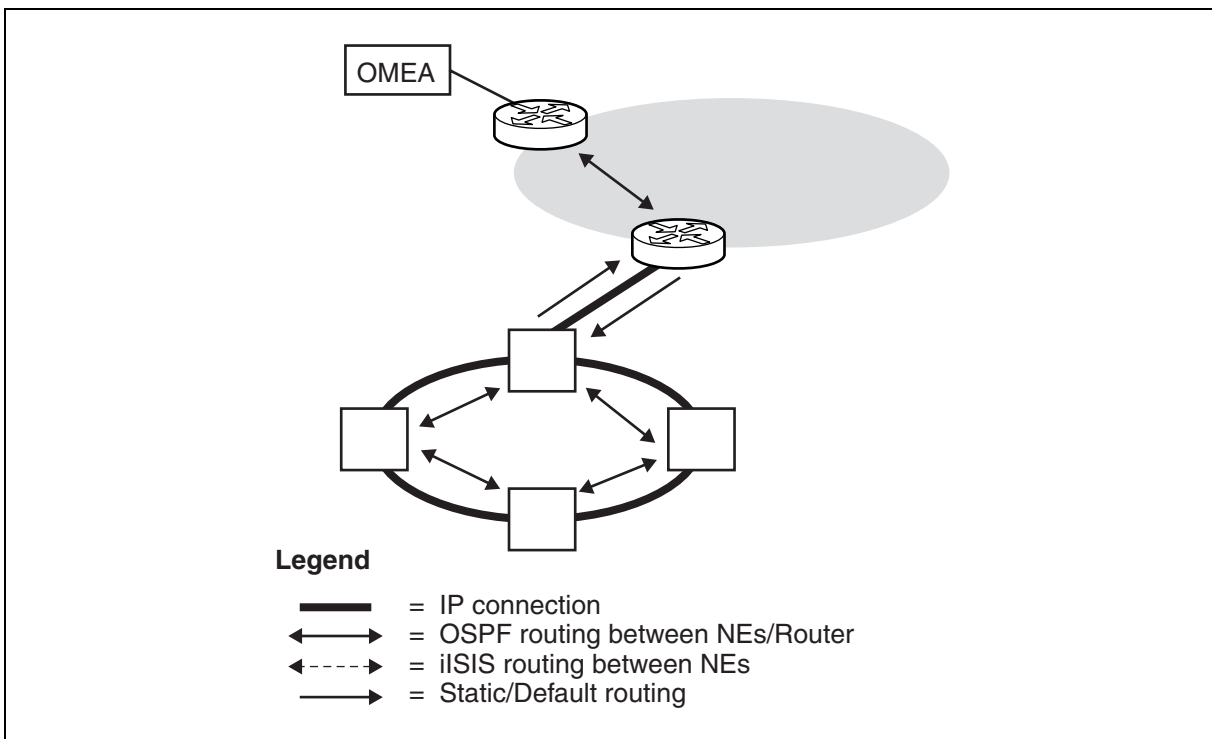


Table 10-7
DCN example 2 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C	OME6130 D
1 Set up IP address				
LAN-1-6 port:				
IP address	47.1.3.6	192.168.1.254	192.168.1.254	192.168.1.254
Netmask	/29	/24	/24	/24
Default gateway	-	-	-	-
Router ID:				
IP address	47.1.3.66	47.1.3.67	47.1.3.68	47.1.3.69
Netmask	/32	/32	/32	/32

Table 10-7 (continued)
DCN example 2 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C	OME6130 D
2 Set up IP routing				
Ethernet OSPF enable	No	No	No	No
OSPF area	-	-	-	-
Static routing 1:				
Address	0.0.0.0	-	-	-
Netmask	/0	-	-	-
Next hop IP address	47.1.3.1	-	-	-
Next hop interface	LAN-1-6	-	-	-
Advertise	Enable	-	-	-
3 Set up DCC				
STM1/4-x-1:				
Protocol	PPP	PPP	PPP	PPP
MTU	1518	1518	1518	1518
OSPF	Enable	Enable	Enable	Enable
STM1/4-x-2				
Protocol	PPP	PPP	PPP	PPP
MTU	1518	1518	1518	1518
OSPF	Enable	Enable	Enable	Enable

Table 10-8
DCN example 2 - Router and OMEA provisioning details

Parameters	Router 1	Router 2	OMEA
1 Set up IP address			
Ethernet interface:			
IP address	47.1.1.1	47.1.3.1	47.1.1.5
Netmask	/29	/29	/29
Default gateway	-	-	47.1.1.1
Circuitless IP/ Loopback			
IP Address	47.1.1.128	47.1.1.129	-
Netmask	/32	/32	-
2 Set up IP routing			
Static routing 1:			OSPF Enable
Address	-	47.1.3.65	-
Netmask	-	/29	-
Next hop IP address	-	47.1.3.6	-
Next hop interface	-	Ethernet	-
Advertise	-	Yes	-

DCN example 3 - Using single OME6130 GNE with OSPF to external DCN. OSPF is used in between OME6130 network elements.

In this example (see [Figure 10-7 on page 10-36](#) and [Figure 10-8 on page 10-37](#)), a single OME6130 network element is used as the GNE to establish communication between the external DCN and the OME6130 sub-system.

OSPF routing protocol is used in between the OME6130 GNE and the external DCN router, and in between the OME6130 network elements using IP over DCC.

The external DCN router connected to the OME6130 GNE is acting as an Area Border Router (ABR) which can use the route summarization feature to group the IP routes for the OME6130 sub-network into a single route covering all the OME6130 Router ID IP addresses.

This example does not provide redundant access to the OME6130 sub-system from the external DCN because only one OME6130 NE is connected to the external DCN. However, the DCC between the OME6130 NEs is redundant.

DCN provisioning details

[Table 10-9 on page 10-37](#) and [Table 10-10 on page 10-38](#) detail the DCN parameters for the DCN example 3 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-7
DCN example 3 - Single OME6130 GNE with OSPF

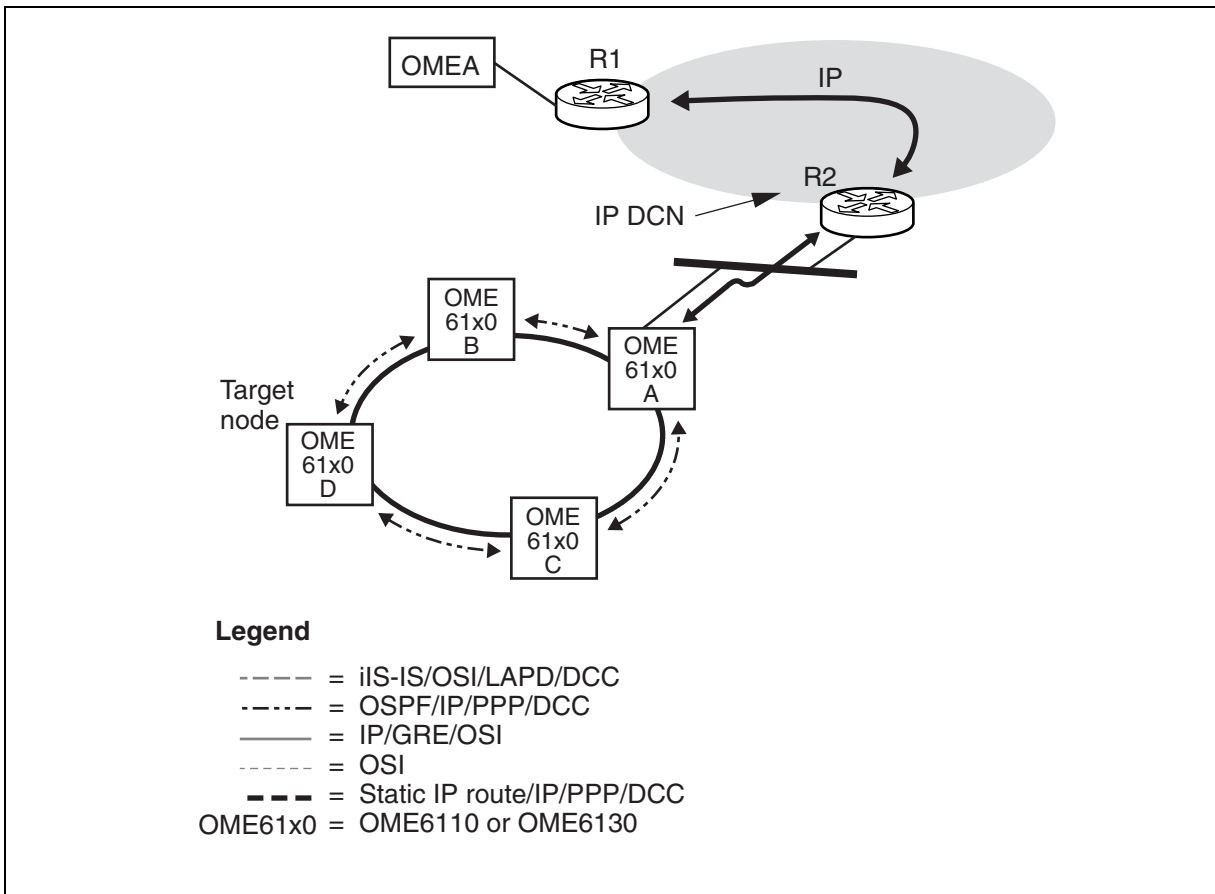


Figure 10-8
DCN example 3 - IP logical view

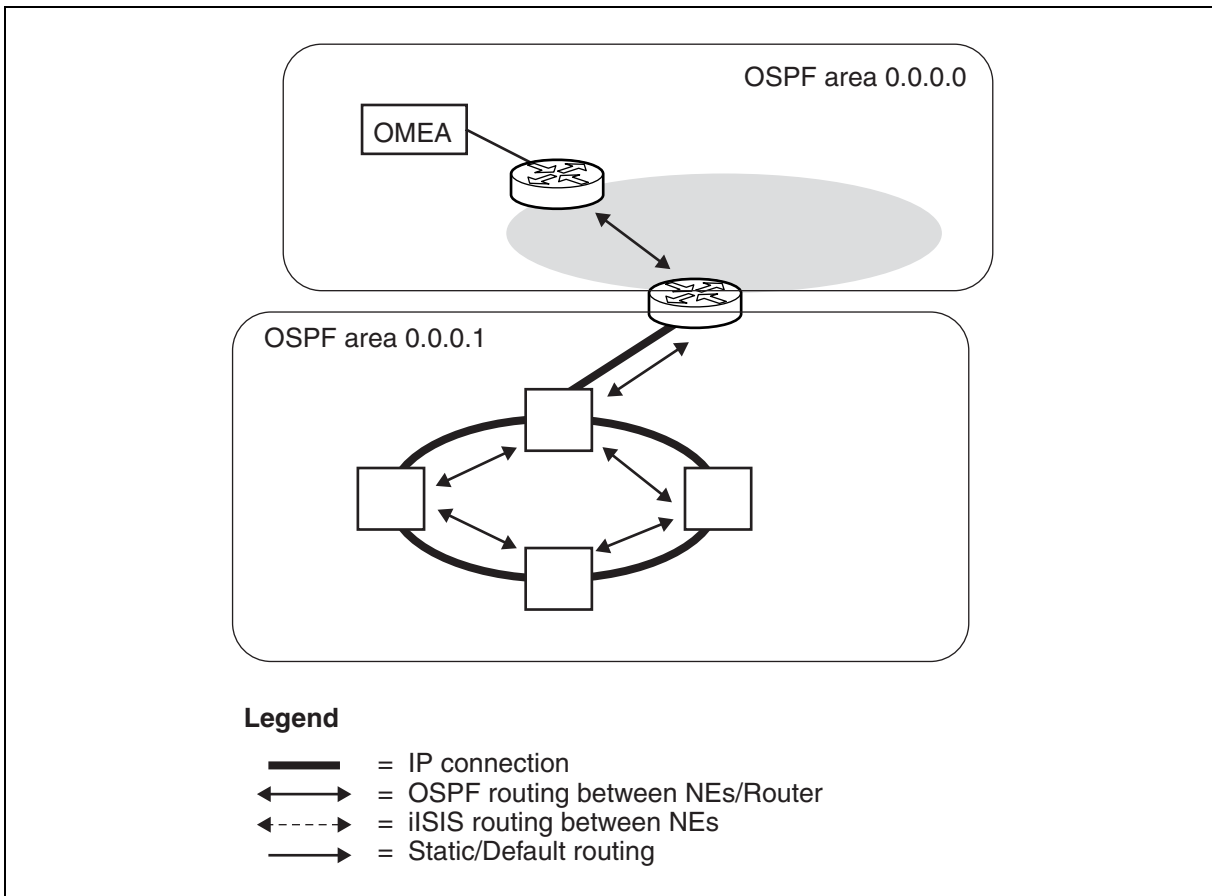


Table 10-9
DCN example 3 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C	OME6130 D
1 Set up IP address				
LAN-1-6 port:				
IP address	47.1.3.6	192.168.1.254	192.168.1.254	192.168.1.254
Netmask	/29	/24	/24	/24
Default gateway	-	-	-	-
Router ID:				
IP address	47.1.3.65	47.1.3.66	47.1.3.67	47.1.3.68
Netmask	/32	/32	/32	/32
2 Set up IP routing				
Ethernet OSPF enable	Yes	No	No	No
OSPF area	0.0.0.1	-	-	-

Table 10-9 (continued)
DCN example 3 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C	OME6130 D
3 Set up DCC				
STM1/4-x-1:				
Protocol	PPP	PPP	PPP	PPP
MTU	1518	1518	1518	1518
OSPF	Enable	Enable	Enable	Enable
STM1/4-x-2				
Protocol	PPP	PPP	PPP	PPP
MTU	1518	1518	1518	1518
OSPF	Enable	Enable	Enable	Enable

Table 10-10
DCN example 3 - Router and OMEA provisioning details

Parameters	Router 1	Router 2	OMEA
1 Set up IP address			
Ethernet interface:			
IP address	47.1.1.1	47.1.3.1	47.1.1.5
Netmask	/29	/29	/29
Default gateway	-	-	47.1.1.1
Circuitless IP/ Loopback			
IP Address	47.1.1.128	47.1.1.129	-
Netmask	/32	/32	-
2 Set up IP routing			
Global OSPF enable	Yes	Yes	
OSPF area	0.0.0.0	0.0.0.0	
Ethernet OSPF enable	Yes	Yes	
OSPF area	0.0.0.0	0.0.0.1	

DCN example 4 - Using OSPF with dual OME6130 GNEs to external OSPF backbone.

In this example (see [Figure 10-9 on page 10-40](#) and [Figure 10-10 on page 10-41](#)), two OME6130 network elements are used as dual GNEs to establish communication between the external DCN and the OME6130 sub-system. Typically, the two gateway NEs are located in two different sites and subnets to maximize the network resilience.

Multiple OME6130 sub-systems can be connected using Ethernet in between the LAN ports to minimize the number of DCN sites required and to extend the DCN coverage within the engineering limits.

When the OME6130 sub-system provides a resilient internal DCN structure (e.g. ring with DCC) so that any link failure inside the ring will not result in losing any connectivity to either of the gateway network elements, the external DCN router, which is acting as the Area Border Router (ABR), can then be configured to use the route summarization feature to group the IP routes for the OME6130 sub-network into a single route covering all the OME6130 Router ID IP addresses.

When the OME6130 sub-system does not provide a resilient internal DCN structure (e.g. linear chain), route summarization should not be used at the ABR or resilient communications will be lost.

Note: Two or more GNEs can be used within the engineering limits.

DCN provisioning details

[Table 10-11 on page 10-42](#), [Table 10-12 on page 10-42](#) and [Table 10-13 on page 10-43](#) detail the DCN parameters for the DCN example 4 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-9
DCN example 4 - Dual OME6130 GNEs with OSPF

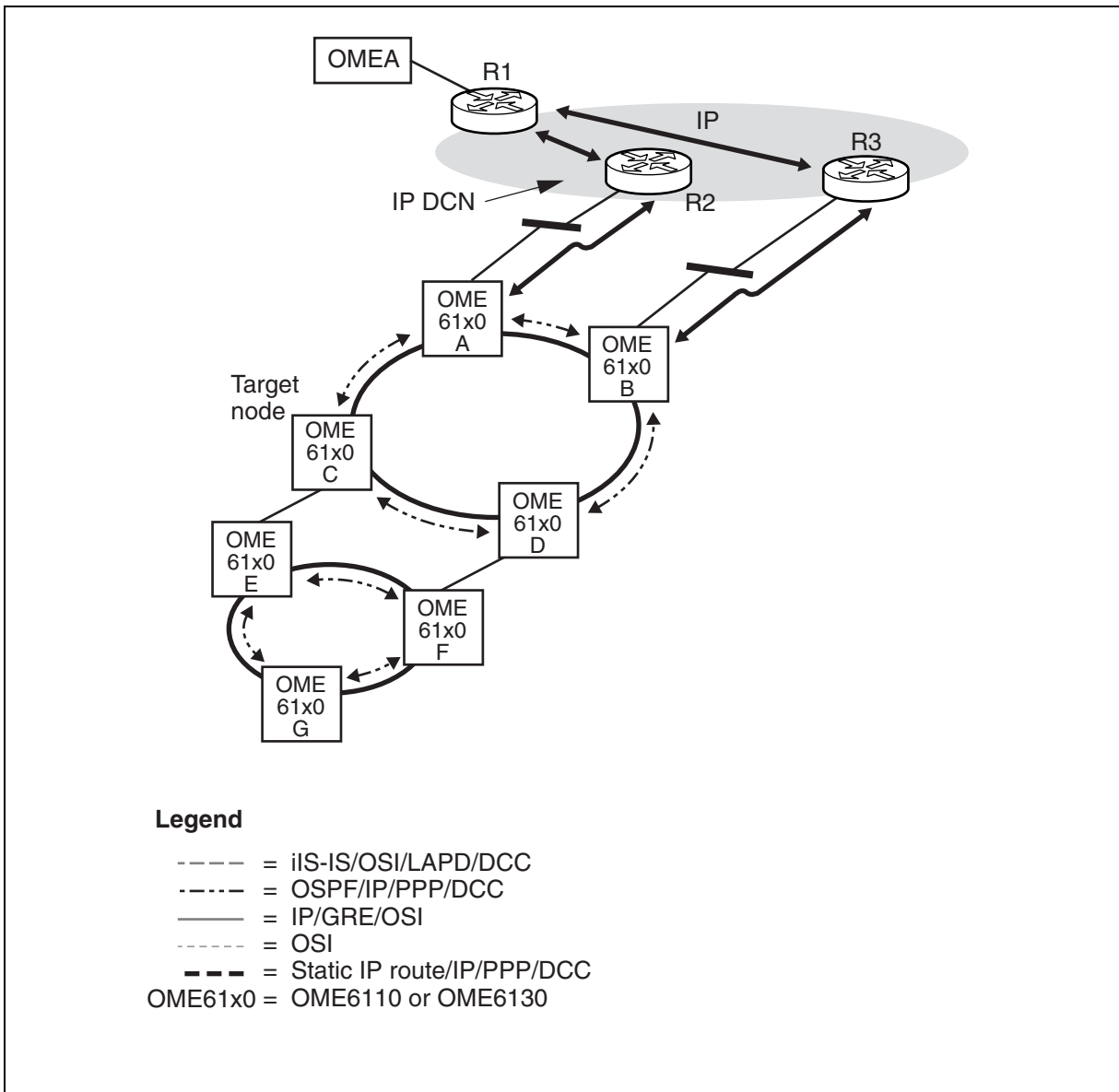


Figure 10-10
DCN example 4 - IP logical view

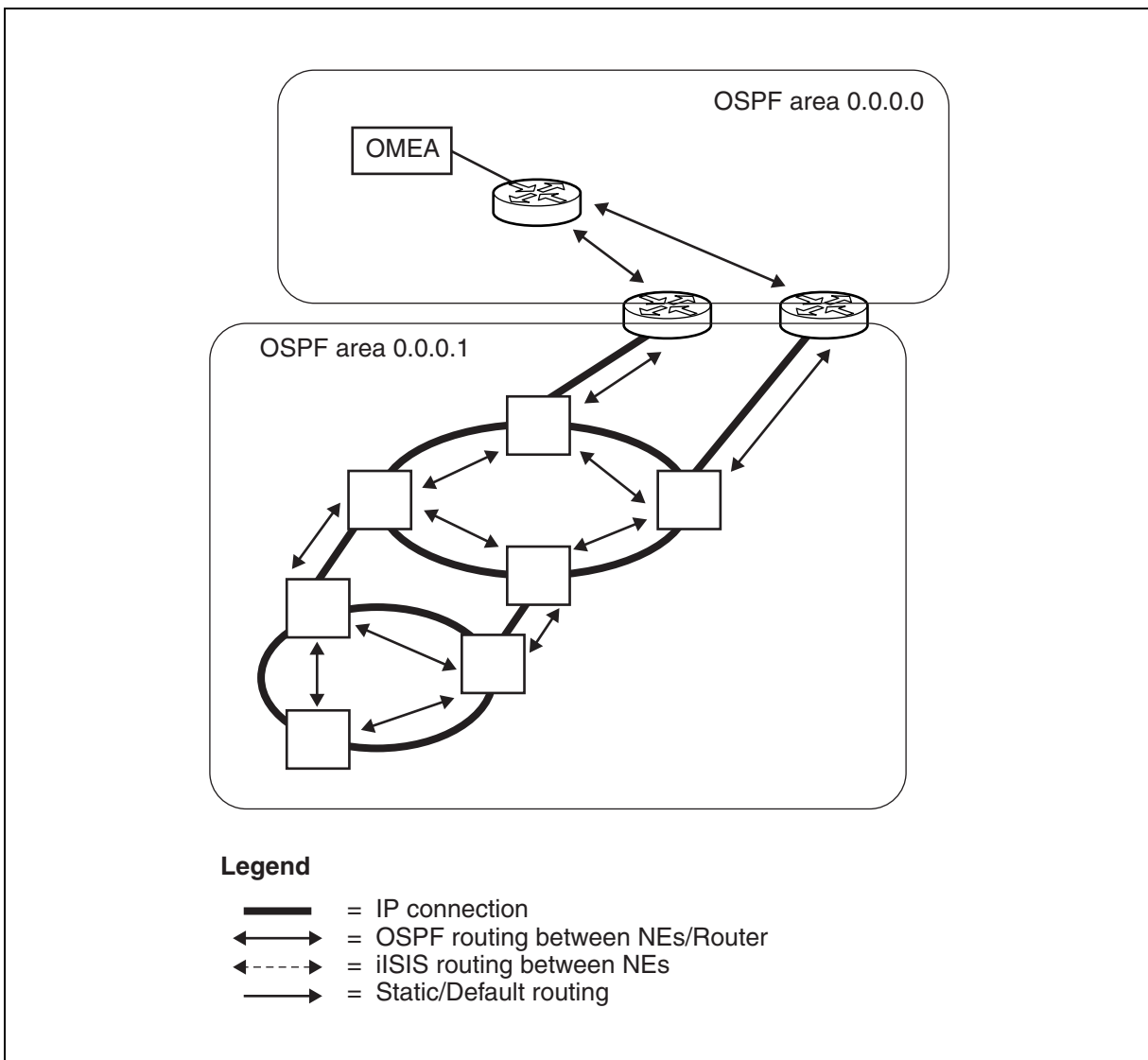


Table 10-11
DCN example 4 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C	OME6130 D
1 Set up IP address				
LAN-1-6 port:				
IP address	47.1.3.6	47.1.3.18	47.1.3.81	47.1.3.85
Netmask	/29	/28	/30	/30
Default gateway	-	-	-	-
Router ID:				
IP address	47.1.3.65	47.1.3.66	47.1.3.67	47.1.3.68
Netmask	/32	/32	/32	/32
2 Set up IP routing				
Ethernet OSPF enable	Yes	Yes	Yes	Yes
OSPF area	0.0.0.1	0.0.0.1	0.0.0.1	0.0.0.1
3 Set up DCC				
STM1/4-x-1:				
Protocol	PPP	PPP	PPP	PPP
MTU	1518	1518	1518	1518
OSPF	Enable	Enable	Enable	Enable
STM1/4-x-2				
Protocol	PPP	PPP	PPP	PPP
MTU	1518	1518	1518	1518
OSPF	Enable	Enable	Enable	Enable

Table 10-12
DCN example 4 - OME6130 DCN provisioning details

Parameters	OME6130 E	OME6130 F	OME6130 G
1 Set up IP address			
LAN-1-6 port:			
IP address	47.1.3.82	47.1.3.86	192.168.1.254
Netmask	/30	/30	/24
Default gateway	-	-	-
Router ID:			
IP address	47.1.3.69	47.1.3.70	47.1.3.71
Netmask	/32	/32	/32
2 Set up IP routing			
Ethernet OSPF enable	Yes	Yes	Yes
OSPF area	0.0.0.1	0.0.0.1	0.0.0.1

Table 10-12 (continued)
DCN example 4 - OME6130 DCN provisioning details

Parameters	OME6130 E	OME6130 F	OME6130 G
3 Set up DCC			
STM1/4-x-1:			
Protocol	PPP	PPP	PPP
MTU	1518	1518	1518
OSPF	Enable	Enable	Enable
STM1/4-x-2			
Protocol	PPP	PPP	PPP
MTU	1518	1518	1518
OSPF	Enable	Enable	Enable

Table 10-13
DCN example 4 - Router and OMEA provisioning details

Parameters	Router 1	Router 2	Router 3	OMEA
1 Set up IP address				
Ethernet interface:				
IP address	47.1.1.1	47.1.3.1	47.1.3.17	47.1.1.5
Netmask	/29	/29	/28	/29
Default gateway	-	-	-	47.1.1.1
Circuitless IP/ Loopback				
IP Address	47.1.1.128	47.1.1.129	47.1.1.130	-
Netmask	/32	/32	/32	-
2 Set up IP routing				
Global OSPF enable	Yes	Yes	Yes	-
OSPF area	0.0.0.0	0.0.0.0	0.0.0.0	-
Ethernet OSPF enable	Yes	Yes	Yes	
OSPF area	0.0.0.0	0.0.0.1	0.0.0.1	

DCN example 5 - Using single OM4000 GNE with GRE tunnels through OM4000 network to reach remote OME6130 network elements in linear spurs off OM4000 NE.

In this example (see [Figure 10-11 on page 10-45](#) and [Figure 10-12 on page 10-46](#)), the OME6130 is subtended as 1+1 MSP link with OM4000 and IP static routing between the router and OME6100 is possible using GRE tunnel. The router has a static route over the GRE tunnel to the router ID IP address of the OME6100 NE and the OME6100 NE has a static route over the GRE tunnel to the router.

Note 1: In some configurations, static route is recommended over OSPF routing on the GRE tunnel to the router, as route redistribution between iISIS and OSPF is not currently supported on OME6130.

Note 2: If the Ethernet IP of the OME6130 NEs are provisioned with different subnets, then dynamic routing (i.e. OSPF or iISIS) or static routing is required between the OME6130 NEs and the DCN routers.

For resiliency, a separate OSI GRE tunnel is needed from the external router to each of the OME6130 network elements (allowing use of static routing or OSPF routing over SGRE). If resiliency is not required, then only one static IP over OSI GRE tunnel can be provisioned from the router to one of the OME6130 NEs. In this configuration, only static routing can be used over the SGRE). Communication to the other OME6130 NE is established using iISIS routing through the OM4000 NE.

The external router redistributes the static IP route into a dynamic routing protocol, in order to advertise the OME6130 router IP addresses to the external DCN.

The router on which the IP over OSI GRE tunnels terminate can only be a Cisco router that supports ISO CLNS, with an IOS which has the “IP over CLNS tunnel (CTunnel)” using **GRE encapsulation** feature. Some older versions of IOS support IP over OSI tunnels using Cisco proprietary encapsulation which is not suitable in this application.

DCN provisioning details

[Table 10-14 on page 10-46](#) and [Table 10-15 on page 10-48](#) detail the DCN parameters for the DCN example 5 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-11

DCN example 5 - Single OM4K GNE with GRE tunnels to remote OME6130 NEs in linear 1+1 MSP with OM4K

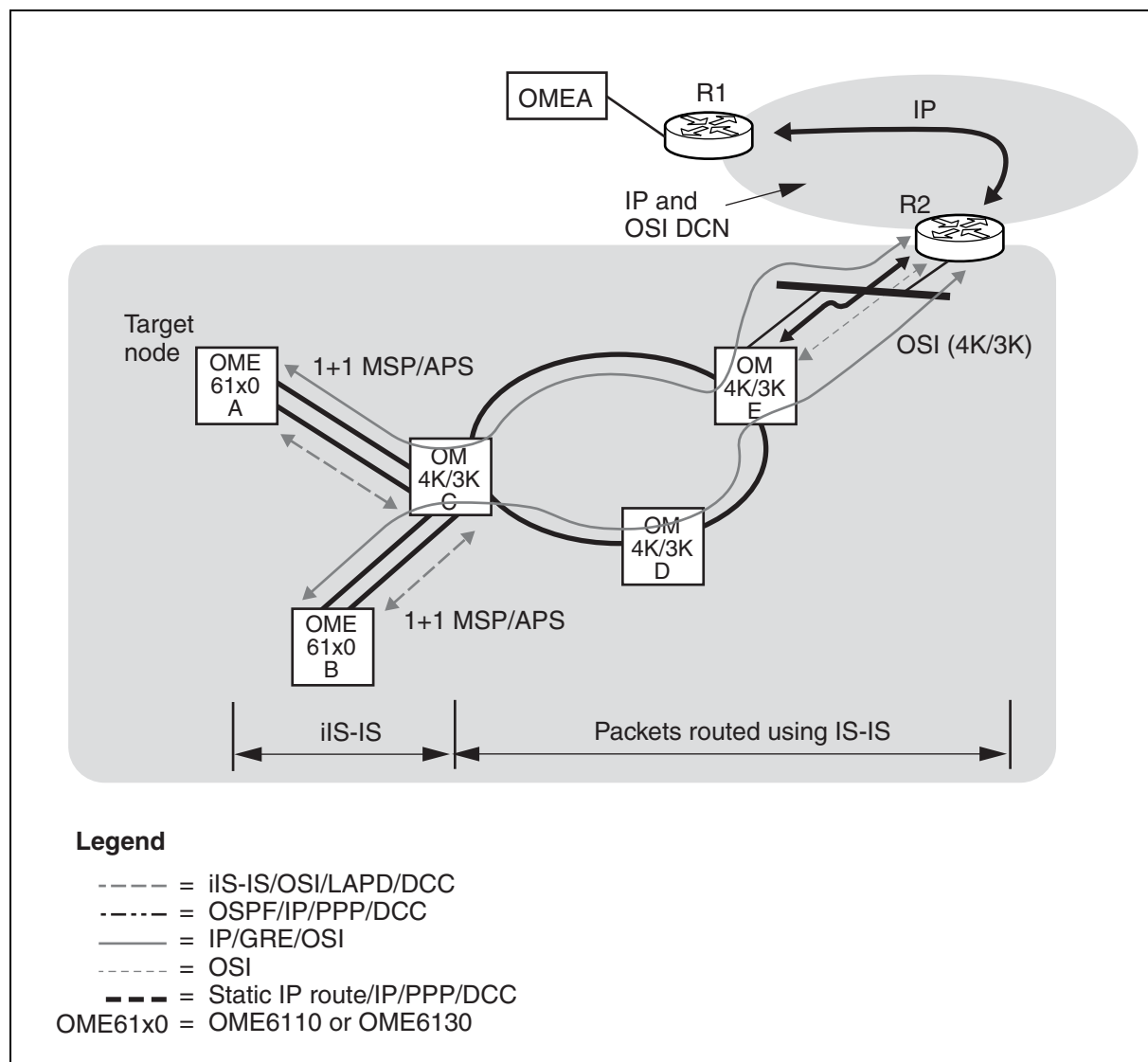


Figure 10-12
DCN example 5 - IP logical view

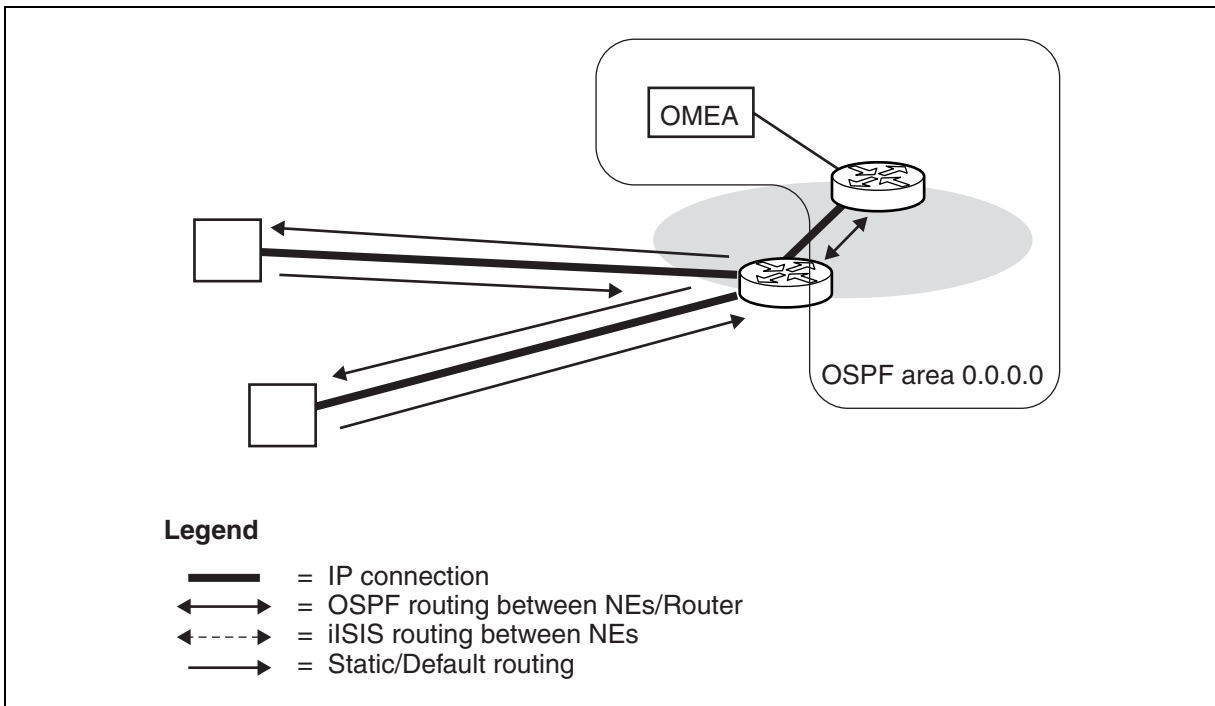


Table 10-14
DCN example 5 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B
1 Set up IP address		
LAN-1-6 port:		
IP address	192.168.1.254	192.168.1.254
Netmask	/24	/24
Default gateway	-	-
Router ID:		
IP address	47.1.3.65	47.1.3.66
Netmask	/32	/32

Table 10-14 (continued)
DCN example 5 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B
2 Set up IP routing		
Ethernet OSPF enable	No	No
OSPF area	-	-
Static routing 1:		
Address	47.1.1.0	47.1.1.0
Netmask	/29	/29
Next hop IP address	0.0.0.0	0.0.0.0
Next hop interface	SGRE-1	SGRE-1
Advertise	No (see Note)	No (see Note)
Static routing 2:		
Address	47.1.1.129	47.1.1.129
Netmask	/32	/32
Next hop IP address	0.0.0.0	0.0.0.0
Next hop interface	SGRE-1	SGRE-1
Advertise	No (see Note)	No (see Note)
3 Set up iISIS (Nodal level)		
iISIS Enable:	Enable	Enable
MAA 1	490000	490000
MAA 2	-	-
MAA 3	-	-
4 Set up DCC		
STM1/4-x-1:		
Protocol	LAPD	LAPD
MTU	512	512
iISIS	Enable	Enable
STM1/4-x-2		
Protocol	-	-
MTU	-	-
5 Set up static GRE tunnel		
OSI Local MAA:		
MAA 1	490000	490000
MAA 2	-	-
MAA 3	-	-
Remote MAA	490000	490000
Remote system ID	Router 2 MAC	Router 2 MAC
NSAP selector	2F	2F
OSPF	Disable	Disable

Table 10-14 (continued)
DCN example 5 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B
Note: The IP static route can be set to Advertise = No, when a static GRE tunnel is provisioned from the router to each of the OME6130 network element. If only one tunnel is provisioned, then the static route should be set to Advertise= Yes.		

Table 10-15
DCN example 5 - Router, OMEA, and OM4K DCN provisioning details

Parameters	Router 1	Router 2	OM4K E	OM4K C	OMEA
1 Set up IP address					
Interface:	-	-	-	-	-
IP address	47.1.1.1	-	-	-	-
Netmask	/29	-	-	-	-
Interface:	-	-	-	-	-
IP address	-	-	-	-	47.1.1.5
Netmask	-	-	-	-	/29
Default gateway	-	-	-	-	47.1.1.1
Circuitless IP/ NE-IP:					
IP address	47.1.1.128	47.1.1.129	-	-	-
Netmask	/32	/32	-	-	-
2 Set up IP routing					
Global routing	-	-	iIS-IS	iIS-IS	-
Global OSPF Enable	Yes	Yes	-	-	-
OSPF area	0.0.0.0	0.0.0.0	-	-	-
Ethernet OSPF enable	Yes	No	-	-	-
OSPF area	0.0.0.0	-	-	-	-
Static routing 1:					
Address	-	47.1.3.65	-	-	-
Netmask	-	/32	-	-	-
Next hop IP address	-	47.1.3.65	-	-	-
Next hop interface	-	GRE-1	-	-	-
Redistribute	-	Yes	-	-	-
Static routing 2:					
Address	-	47.1.3.66	-	-	-
Netmask	-	/32	-	-	-
Next hop IP address	-	47.1.3.66	-	-	-
Next hop interface	-	GRE-2	-	-	-
Redistribute	-	Yes	-	-	-

Table 10-15 (continued)
DCN example 5 - Router, OMEA, and OM4K DCN provisioning details

Parameters	Router 1	Router 2	OM4K E	OM4K C	OMEA
3 Set up DCC					
Interface 1:			S-5-1	S-5-1	
Protocol	-	-	LAPD	LAPD	-
MTU	-	-	512	512	-
Interface 2:			S-6-1	S-6-1	
Protocol	-	-	LAPD	LAPD	-
MTU	-	-	512	512	-
Interface 3:				S-1-1	
Protocol	-	-	-	LAPD	-
MTU	-	-	-	512	-
Interface 4:				S-2-1	
Protocol	-	-	-	LAPD	-
MTU	-	-	-	512	-
4 Set up static GRE tunnel					
OSI Local MAA:					
MAA 1	39xxx...xx1	39xxx...xx2	490000	490000	-
MAA 2	490000	490000	-	-	-
MAA 3	-	-	-	-	-
GRE tunnel 1:					
Remote MAA	-	490000	-	-	-
Remote system ID	-	NE A MAC	-	-	-
NSAP selector	-	2F	-	-	-
GRE tunnel 2:					
Remote MAA	-	490000	-	-	-
Remote system ID	-	NE B MAC	-	-	-
NSAP selector	-	2F	-	-	-

DCN example 6 - Using single OM4000 GNE with GRE tunnels through OM4000 network to reach remote OME6130 network elements in SNCP ring with an OM4000 network element.

In this example (see [Figure 10-13 on page 10-51](#) and [Figure 10-14 on page 10-52](#)), a single ABR is used at the DCN gateway site to establish communication between the external DCN and the OME6130/OM4000 sub-systems.

A single OM4K is connected to the external DCN via an OSI only enabled port and acts as the GNE for the other OM4K network elements.

For configurations with fully robust (meshed/ring) internal DCN connectivity
Data communication to the remote subtending OME6130 network elements is achieved using IP over OSI GRE tunnels through the OM4K network and these tunnels are terminated directly on the ABR. In order to provide resilient data communication against any fiber breaks in the OME6130 system, two tunnels are required from the ABR through the OM4KGNE. iISIS routing is used to establish communication to all OME6130 within the ring.

Note 1: Static route is recommended over OSPF routing on the GRE tunnel to the router, if iISIS routing is used between OME6130 network elements.

Note 2: If the Ethernet IP of the OME6130 NEs are provisioned with different subnets, then dynamic routing (i.e. OSPF or iISIS) or static routing is required between the OME6130 NEs and the DCN routers.

For configurations with non-redundant (linear) internal DCN connectivity
Data communication to the remote subtending OME6130 network elements is achieved using IP over OSI GRE tunnels through the OM4K network and these tunnels are terminated directly on the ABR. In order to provide resilient data communication against any fiber breaks in the OME6130 system, two tunnels are required from the ABR through the OM4K GNE. OSPF routing is used to establish communication to all OME6130 within the subtending ring.

Note: OSPF routing on the GRE tunnel to the router, and OSPF routing is used between OME6130 network elements can be used.

The ABR on which the IP over OSI GRE tunnels terminate can only be a Cisco router that supports ISO CLNS, with an IOS which has the “IP over CLNS tunnel (CTunnel)” using **GRE encapsulation** feature. Some older versions of IOS support IP over OSI tunnels using Cisco proprietary encapsulation which is not suitable in this application.

DCN provisioning details

[Table 10-16 on page 10-52](#) and [Table 10-17 on page 10-54](#) detail the DCN parameters for the DCN example 6 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-13

DCN example 6 - Single OM4K with GRE tunnels to remote OME6130 NEs in SNCP ring with OM4K

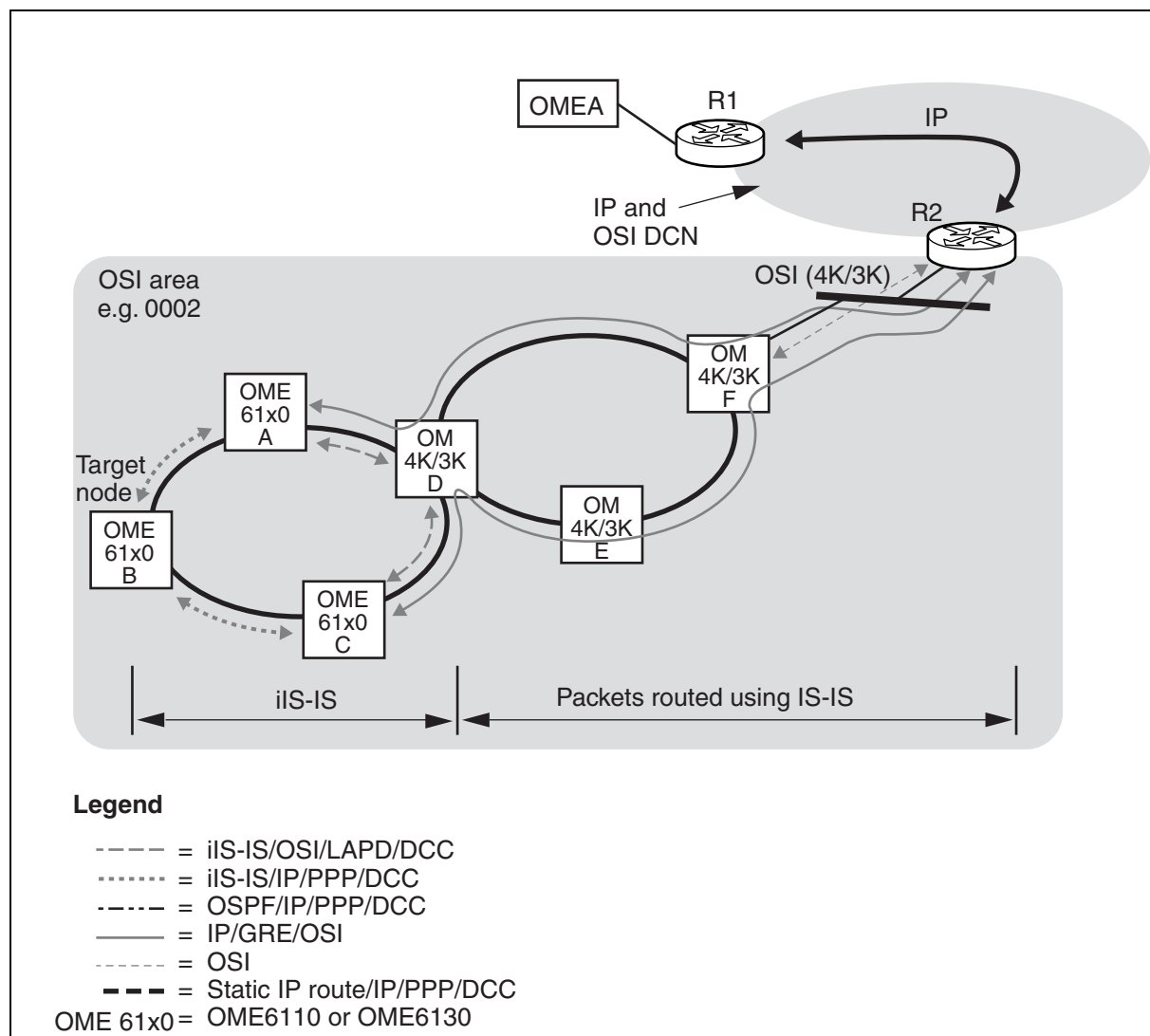


Figure 10-14
DCN example 6 - IP logical view

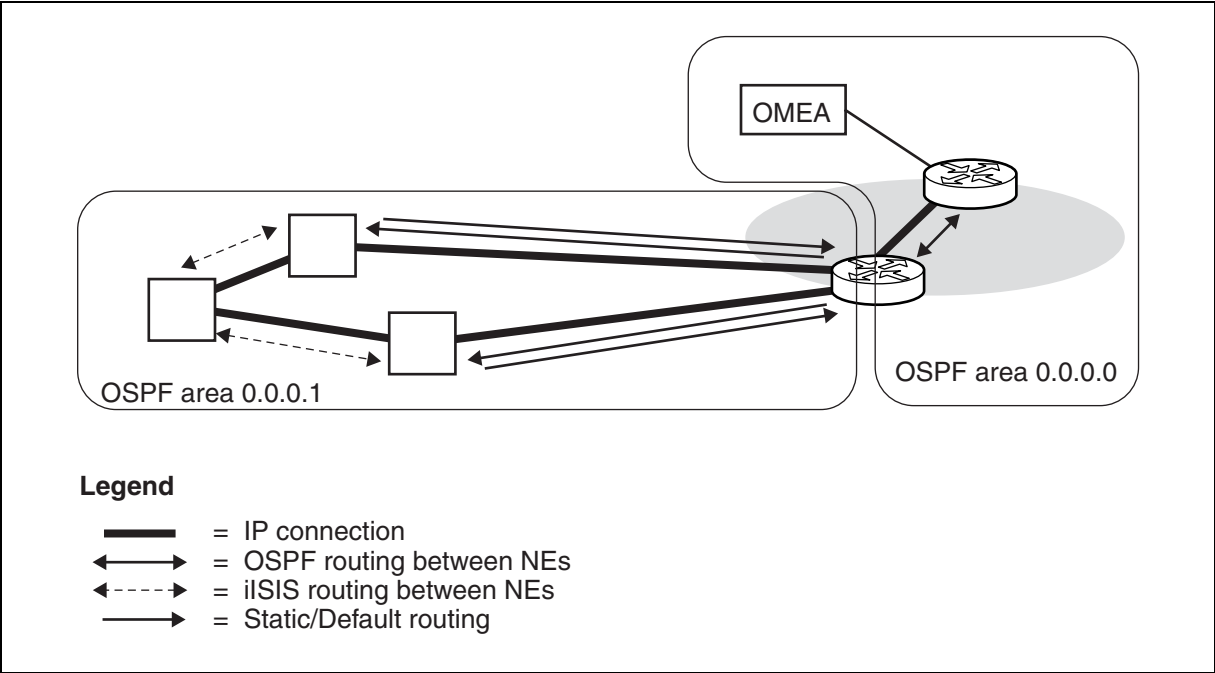


Table 10-16
DCN example 6 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
1 Set up IP address			
LAN-1-6 port:			
IP address	192.168.1.254	192.168.1.254	192.168.1.254
Netmask	/24	/24	/24
Default gateway	-	-	-
Router ID:			
IP address	47.1.3.65	47.1.3.66	47.1.3.67
Netmask	/32	/32	/32

Table 10-16 (continued)
DCN example 6 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
2 Set up IP routing			
Ethernet OSPF enable	No	No	No
OSPF area	-	-	-
Static routing 1:			
Address	47.1.1.0		47.1.1.0
Netmask	/29		/29
Next hop IP address	0.0.0.0		0.0.0.0
Next hop interface	SGRE-1		SGRE-1
Advertise	Yes (see Note)		Yes (see Note)
Static routing 2:			
Address	47.1.1.129		47.1.1.129
Netmask	/32		/32
Next hop IP address	0.0.0.0		0.0.0.0
Next hop interface	SGRE-1		SGRE-1
Advertise	Yes (see Note)		Yes (see Note)
3 Set up iISIS (Nodal level)			
iISIS Enable:	Enable	Enable	Enable
MAA 1	490000	490000	490000
MAA 2	-	-	-
MAA 3	-	-	-
4 Set up DCC			
STM1/4-x-1:			
Protocol	LAPD	PPP	PPP
MTU	512	1518	1518
iISIS	Enable	Enable	Enable
STM1/4-x-2			
Protocol	PPP	PPP	LAPD
MTU	1518	1518	512
iISIS	Enable	Enable	Enable
5 Set up static GRE tunnel			
OSI Local MAA:			
MAA 1	490000	-	490000
MAA 2	-	-	-
MAA 3	-	-	-
Remote MAA	490000	-	490000
Remote system ID	Router 2 MAC	-	Router 2 MAC
NSAP selector	2F	-	2F
OSPF	Disable	-	Disable

Table 10-16 (continued)
DCN example 6 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
Note: The IP static route can be set to Advertise = No if each OME6130 network element has a static GRE tunnel to the router.			

Table 10-17
DCN example 6 - Router, OMEA, and OM4K DCN provisioning details

Parameters	Router 1	Router 2	OM4K F	OM4K D	OMEA
1 Set up IP address					
Interface:	-	-	-	-	-
IP address	47.1.1.1	-	-	-	-
Netmask	/29	-	-	-	-
Interface:	-	-	-	-	-
IP address	-	-	-	-	47.1.1.5
Netmask	-	-	-	-	/29
Default gateway	-	-	-	-	47.1.1.1
Circuitless IP/ NE-IP:					
IP address	47.1.1.128	47.1.1.129	-	-	-
Netmask	/32	/32	-	-	-
2 Set up IP routing					
Global Routing	-	-	IS-IS	IS-IS	-
Global OSPF enable	Yes	Yes	-	-	-
OSPF area	0.0.0.0	0.0.0.0	-	-	-
Ethernet OSPF enable	Yes	No	-	-	-
OSPF area	0.0.0.0	-	-	-	-
Static routing 1:					
Address		47.1.3.64			
Netmask		/29			
Next hop IP address		47.1.3.65			
Next hop interface		GRE Tunnel			

Table 10-17 (continued)
DCN example 6 - Router, OMEA, and OM4K DCN provisioning details

Parameters	Router 1	Router 2	OM4K F	OM4K D	OMEA
3 Set up DCC					
Interface 1:			S-5-1	S-5-1	
Protocol	-	-	LAPD	LAPD	-
MTU	-	-	512	512	-
Interface 2:			S-6-1	S-6-1	
Protocol	-	-	LAPD	LAPD	-
MTU	-	-	512	512	-
Interface 3:				S-1-1	
Protocol	-	-	-	LAPD	-
MTU	-	-	-	512	-
Interface 4:				S-2-1	
Protocol	-	-	-	LAPD	-
MTU	-	-	-	512	-
4 Set up GRE tunnel					
OSI Local MAA:					
MAA 1	39xxx...xx1	39xxx...xx2	490000	490000	-
MAA 2	490000	490000	-	-	-
MAA 3	-	-	-	-	-
GRE tunnel 1:					
Remote MAA	-	490000	-	-	-
Remote system ID	-	NE A MAC	-	-	-
NSAP selector	-	2F	-	-	-
GRE tunnel 2:					
Remote MAA	-	490000	-	-	-
Remote system ID	-	NE C MAC	-	-	-
NSAP selector	-	2F	-	-	-

DCN example 7 - Using dual OM4000 GNEs with GRE tunnels through OM4000 network to reach remote OME6130 network elements in SNCP ring with generic SDH network elements.

In this example (see [Figure 10-15 on page 10-57](#) and [Figure 10-16 on page 10-58](#)), similar to previous configuration, but with multiple gateway locations with GNEs and routers to maximize the resilience of this solution.

The ABR on which the IP over OSI GRE tunnels terminate can only be a Cisco router that supports ISO CLNS, with an IOS which has the “IP over CLNS tunnel (CTunnel)” using **GRE encapsulation** feature. Some older versions of IOS support IP over OSI tunnels using Cisco proprietary encapsulation which is not suitable in this application.

Note: If the Ethernet IP of the OME6130 NEs are provisioned with different subnets, then dynamic routing (i.e. OSPF or iISIS) or static routing is required between the OME6130 NEs and the DCN routers.

DCN provisioning details

[Table 10-18 on page 10-58](#) and [Table 10-19 on page 10-60](#) detail the DCN parameters for the DCN example 7 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-15

DCN example 7 - Dual OM4K GNEs with GRE tunnels to remote OME6130 NEs in SNCP ring with OM4K

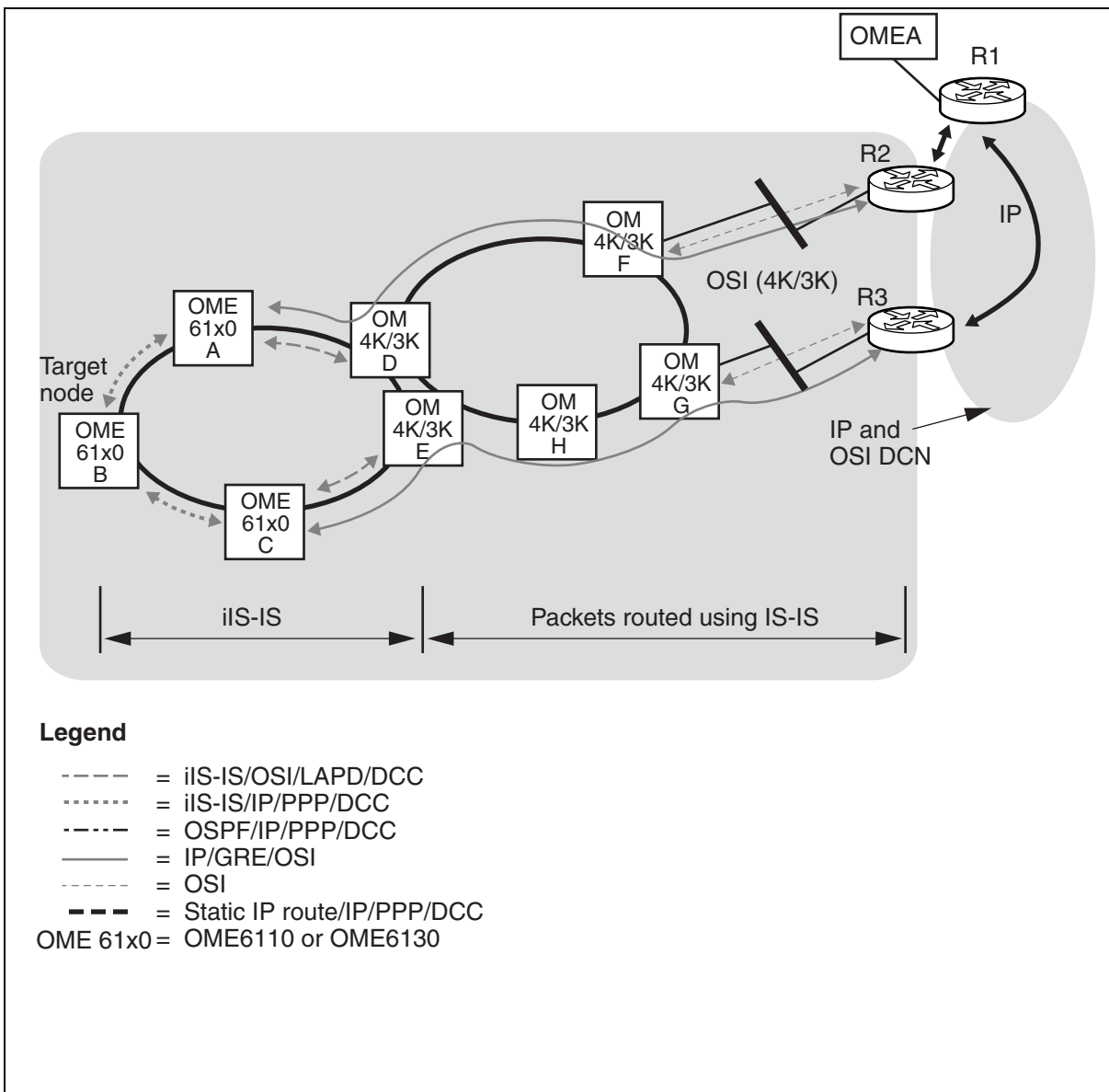


Figure 10-16
DCN example 7 - IP logical view

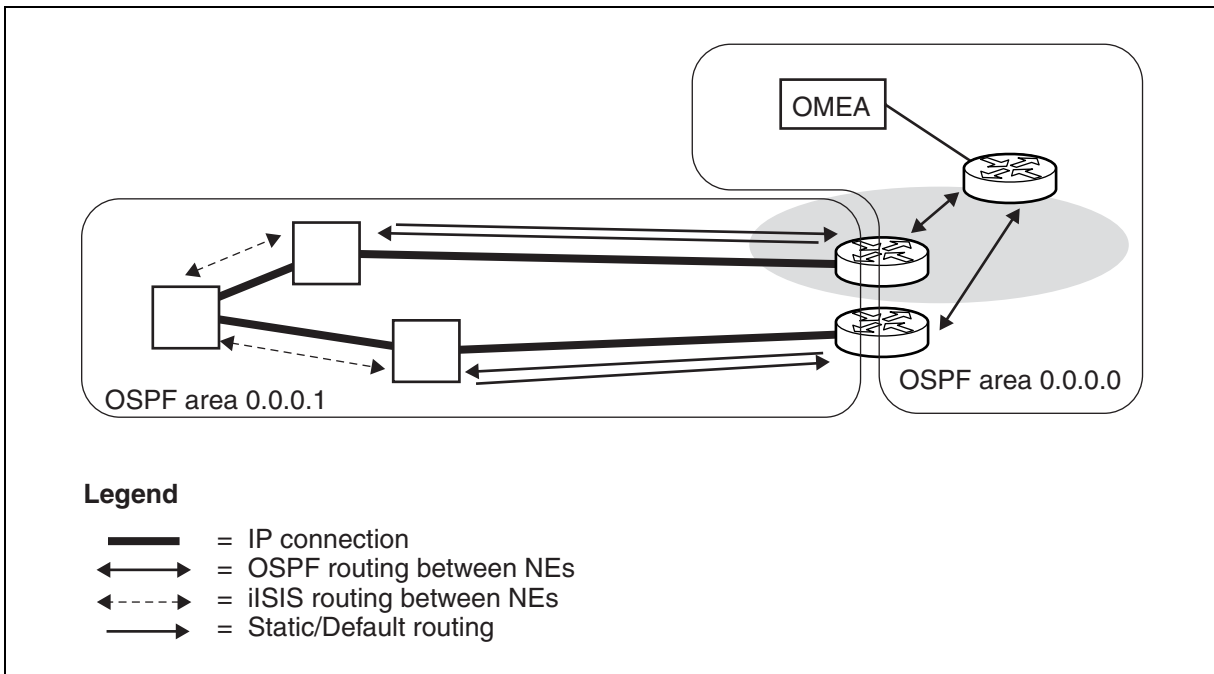


Table 10-18
DCN example 7 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
1 Set up IP address			
LAN-1-6 port:			
IP address	192.168.1.254	192.168.1.254	192.168.1.254
Netmask	/24	/24	/24
Default gateway	-	-	-
Router ID:			
IP address	47.1.3.65	47.1.3.66	47.1.3.67
Netmask	/32	/32	/32

Table 10-18 (continued)
DCN example 7 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
2 Set up IP routing			
Ethernet OSPF enable	No	No	No
OSPF area	-	-	-
Static routing 1:			
Address	47.1.1.0		47.1.1.0
Netmask	/29		/29
Next hop IP address	0.0.0.0		0.0.0.0
Next hop interface	SGRE-1		SGRE-1
Advertise	Yes (see Note)		Yes (see Note)
Static routing 2:			
Address	47.1.1.129		47.1.1.130
Netmask	/32		/32
Next hop IP address	0.0.0.0		0.0.0.0
Next hop interface	SGRE-1		SGRE-1
Advertise	Yes (see Note)		Yes (see Note)
3 Set up iISIS (Nodal level)			
iISIS Enable:	Enable	Enable	Enable
MAA 1	490000	490000	490000
MAA 2	-	-	-
MAA 3	-	-	-
4 Set up DCC			
STM1/4-x-1:			
Protocol	LAPD	PPP	PPP
MTU	512	1518	1518
iISIS	Enable	Enable	Enable
STM1/4-x-2			
Protocol	PPP	PPP	LAPD
MTU	1518	1518	512
iISIS	Enable	Enable	Enable
5 Set up GRE tunnel			
OSI Local MAA:			
MAA 1	490000	-	490000
MAA 2	-	-	-
MAA 3	-	-	-
Remote MAA	490000	-	490000
Remote system ID	Router 2 MAC	-	Router 3 MAC
NSAP selector	2F	-	2F
OSPF	Disable	-	Disable

Table 10-18 (continued)
DCN example 7 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
Note: The IP static route can be set to Advertise = No if each OME6130 network element has a static GRE tunnel to the router.			

Table 10-19
DCN example 7 - Router, OMEA, and OM4K DCN provisioning details

Parameters	Router 1	Router 2	Router 3	OM4K F, G & H	OM4K D & E	OMEA
1 Set up IP address						
Interface:	-	-	-	-	-	-
IP address	47.1.1.1	-	-	-	-	-
Netmask	/29	-	-	-	-	-
Interface:	-	-	-	-	-	-
IP address	-	-	-	-	-	47.1.1.5
Netmask	-	-	-	-	-	/29
Default gateway	-	-	-	-	-	47.1.1.1
Circuitless IP/ NE-IP:						
IP address	47.1.1.128	47.1.1.129	47.1.1.130	-	-	-
Netmask	/32	/32	/32	-	-	-
2 Set up IP routing						
Global Routing	-	-	-	IS-IS	IS-IS	-
Global OSPF enable	Yes	Yes	Yes	-	-	-
OSPF area	0.0.0.0	0.0.0.0	0.0.0.0	-	-	-
Ethernet OSPF enable	Yes	No	No	-	-	-
OSPF area	0.0.0.0	-	-	-	-	-
Static routing 1:						
Address		47.1.3.64	47.1.3.64			
Netmask		/29	/29			
Next hop IP address		47.1.3.65	47.1.3.67			
Next hop interface		GRE Tunnel	GRE Tunnel			

Table 10-19 (continued)
DCN example 7 - Router, OMEA, and OM4K DCN provisioning details

Parameters	Router 1	Router 2	Router 3	OM4K F, G & H	OM4K D & E	OMEA
3 Set up DCC						
Interface 1:				S-5-1	S-5-1	
Protocol	-	-	-	LAPD	LAPD	-
MTU	-	-	-	512	512	-
Interface 2:				S-6-1	S-6-1	
Protocol	-	-	-	LAPD	LAPD	-
MTU	-	-	-	512	512	-
Interface 3:					S-1-1	
Protocol	-	-	-	-	LAPD	-
MTU	-	-	-	-	512	-
Interface 4:					S-2-1	
Protocol	-	-	-	-	LAPD	-
MTU	-	-	-	-	512	-
4 Set up GRE tunnel						
OSI Local MAA:						
MAA 1	39xxx...xx1	39xxx...xx2	39xxx...xx2	490000	490000	-
MAA 2	490000	490000	490000	-	-	-
MAA 3	-	-	-	-	-	-
GRE tunnel 1:						
Remote MAA	-	490000	490000	-	-	-
Remote system ID	-	NE A MAC	NE C MAC	-	-	-
NSAP selector	-	2F	2F	-	-	-

DCN example 8 - Using single OME6130 GNE with iISIS through OM4000 network to reach remote OME6130 network elements in SNCP/UPSR rings with OM4000 network elements. Proxy ARP used at OME6130 GNE for access to remote OME6130 NEs.

In this example (see [Figure 10-17 on page 10-63](#) and [Figure 10-18 on page 10-64](#)), OME6130 network elements use iISIS routing to establish communication to the remote OME6130 through the OM4K network.

Connection between OME6130 and OM4K is over SDH with DCC enabled, with iISIS between various sub-tending OME6130 NEs in SNCP/UPSR rings to provide resilience without the need for additional OME6130 GNEs. The auto-tunnel interface (AGRE) should have a static route provisioned within the subnet of the OME6130 network elements. The remote OME6130 NEs are provisioned as proxy ARP neighbours at the OME6130 GNE.

An OSI enabled router can be used for the OSI communication for the OM4K to the DCN network.

Note: If the Ethernet IP of the OME6130 NEs are provisioned with different subnets, then dynamic routing (i.e. OSPF or iISIS) or static routing is required between the OME6130 NEs connected to the LAN and the DCN routers.

DCN provisioning details

[Table 10-20 on page 10-64](#), [Table 10-21 on page 10-65](#), [Table 10-22 on page 10-67](#) and [Table 10-23 on page 10-67](#) detail the DCN parameters for the DCN example 8 configuration.

Note: For parameters not listed, use the default settings.

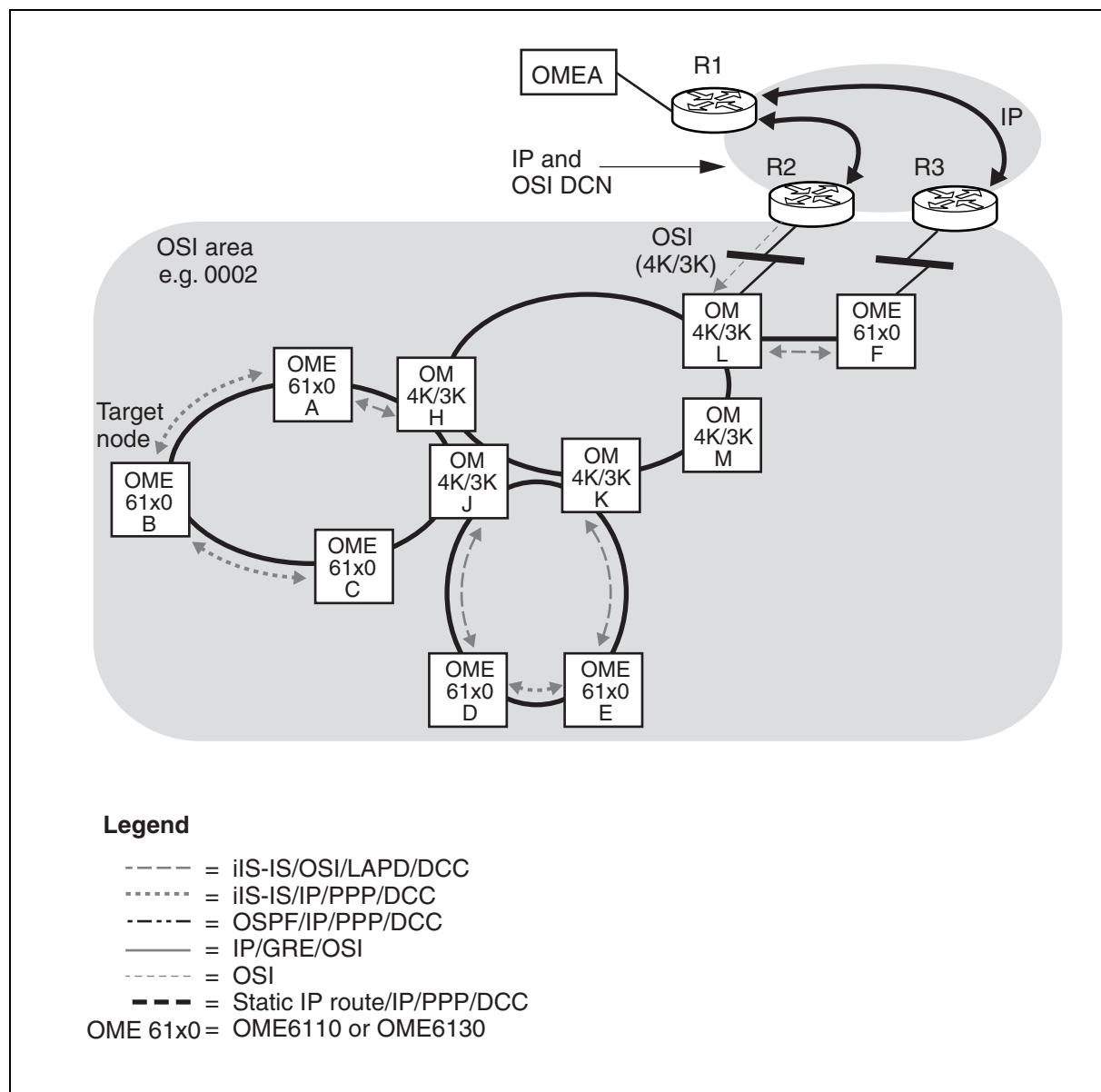
Figure 10-17**DCN example 8 - Single OME6130 GNE with iISIS routing in SNCP/UPSR rings with OM4K**

Figure 10-18
DCN example 8 - IP logical view

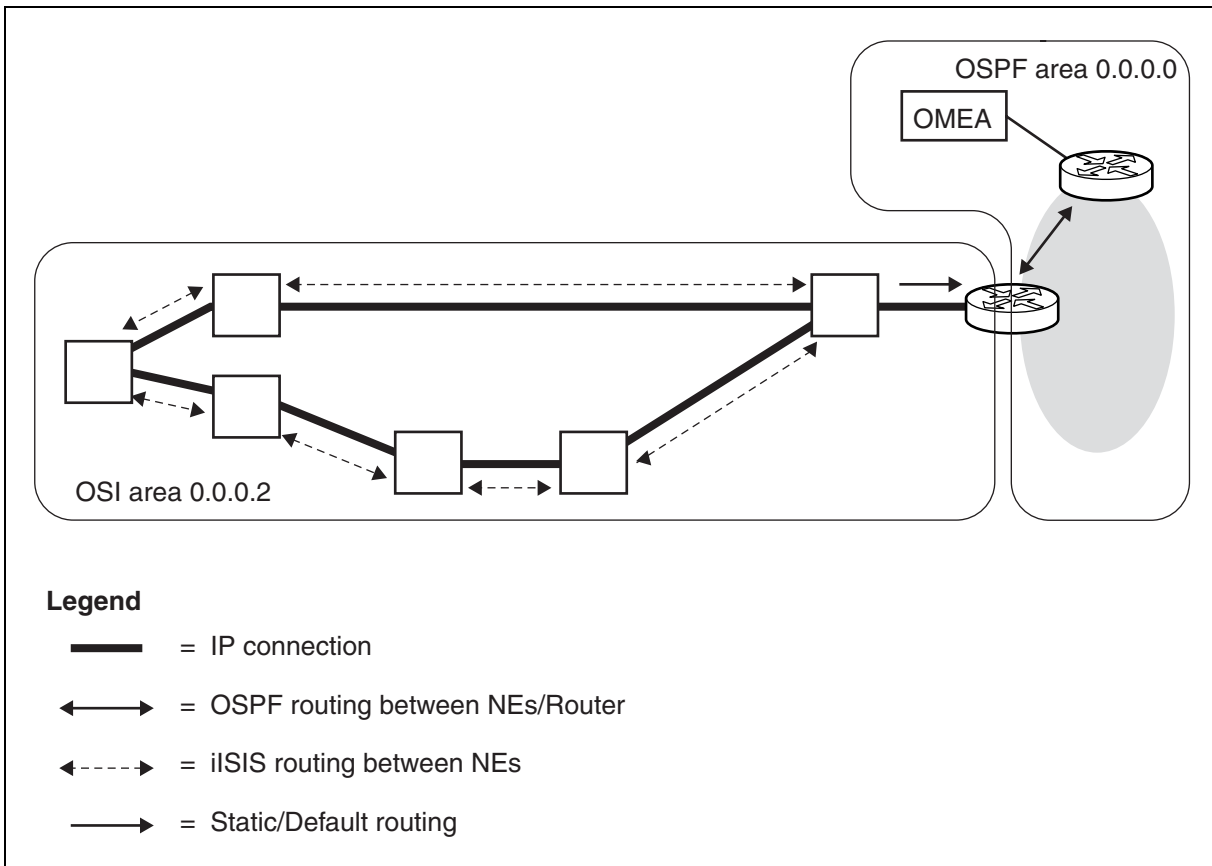


Table 10-20
DCN example 8 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
1 Set up IP address			
LAN-1-6 port:			
IP address	192.168.1.254	192.168.1.254	192.168.1.254
Netmask	/24	/24	/24
Default gateway	-	-	-
Router ID:			
IP address	47.1.3.65	47.1.3.66	47.1.3.67
Netmask	/32	/32	/32

Table 10-20 (continued)
DCN example 8 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
2 Set up IP routing			
Ethernet OSPF enable	No	No	No
OSPF area	-	-	-
Static routing 1			
Address	0.0.0.0	0.0.0.0	0.0.0.0
Netmask	/0	/0	/0
Next hop IP address	0.0.0.0	0.0.0.0	0.0.0.0
Next hop interface	AGRE	AGRE	AGRE
Advertise	No	No	No
3 Set up iISIS (Nodal level)			
iISIS Enable:	Enable	Enable	Enable
MAA 1	490000	490000	490000
MAA 2	-	-	-
MAA 3	-	-	-
4 Set up DCC			
STM1/4-x-1:			
Protocol	LAPD	PPP	PPP
MTU	512	1518	1518
iISIS	Enable	Enable	Enable
STM1/4-x-2			
Protocol	PPP	PPP	LAPD
MTU	1518	1518	512
iISIS	Enable	Enable	Enable

Table 10-21
DCN example 8 - OME6130 DCN provisioning details

Parameters	OME6130 D	OME6130 E	OME6130 F (see Note)
1 Set up IP address			
LAN-1-6 port:			
IP address	192.168.1.254	192.168.1.254	47.1.3.64
Netmask	/24	/24	/29
Default gateway	-	-	-
Router ID:			
IP address	47.1.3.68	47.1.3.69	47.1.3.70
Netmask	/32	/32	/32

Table 10-21 (continued)
DCN example 8 - OME6130 DCN provisioning details

Parameters	OME6130 D	OME6130 E	OME6130 F (see Note)
2 Set up IP routing			
Ethernet OSPF enable	No	No	No
OSPF area	-	-	-
Static routing 1	-	-	-
Address	0.0.0.0	0.0.0.0	47.1.3.0
Netmask	/0	/0	/24
Next hop IP address	0.0.0.0	0.0.0.0	0.0.0.0
Next hop interface	AGRE	AGRE	AGRE
Advertise	No	No	No
Static routing 2			
Address			47.0.0.0
Netmask			/8
Next hop IP address			47.1.3.1
Next hop interface			Eth0
Advertise			Yes
3 Set up DCC			
STM1/4-x-1:			
Protocol	LAPD	PPP	LAPD
MTU	512	1518	512
iISIS	Enable	Enable	Enable
STM1/4-x-2			
Protocol	PPP	LAPD	-
MTU	1518	512	-
iISIS	Enable	Enable	-
4 Set up iISIS (Nodal level)			
iISIS Enable:	Enable	Enable	Enable
MAA 1	490000	490000	490000
MAA 2	-	-	-
MAA 3	-	-	-
5 Set up Proxy ARP Neighbours			
Proxy ARP Neighbour IP addresses:	-	-	
Neighbour 1			47.1.3.65
Neighbour 2			47.1.3.66
Neighbour 3			47.1.3.67
Neighbour 4			47.1.3.68
Neighbour 5			47.1.3.69
Note: The OME6130 F (GNE) is being managed via the Eth0 IP address.			

Table 10-22
DCN example 8 - OM4K DCN provisioning details

Parameters	OM4K H	OM4K J	OM4K K	OM4K L	OM4K M
1 Set up IP routing					
Global Routing	IS-IS	IS-IS	IS-IS	IS-IS	IS-IS
Global OSPF enable	-	-	-	-	-
OSPF area	-	-	-	-	-
Ethernet OSPF enable	-	-	-	-	-
OSPF area	-	-	-	-	-
2 Set up DCC					
Interface 1:	S-5-1	S-5-1	S-5-1	S-5-1	S-5-1
Protocol	LAPD	LAPD	LAPD	LAPD	LAPD
MTU	512	512	512	512	512
Interface 2:	S-6-1	S-6-1	S-6-1	S-6-1	S-6-1
Protocol	LAPD	LAPD	LAPD	LAPD	LAPD
MTU	512	512	512	512	512
Interface 3:	S-1-1	S-1-1	S-1-1	S-1-1	-
Protocol	LAPD	LAPD	LAPD	LAPD	-
MTU	512	512	512	512	-
Interface 4:	S-2-1	S-2-1	S-2-1	-	-
Protocol	LAPD	LAPD	LAPD	-	-
MTU	512	512	512	-	-

Table 10-23
DCN example 8 - Router and OMEA DCN provisioning details

Parameters	Router 1	Router 2	Router 3	OMEA
1 Set up IP address				
Interface:	-	-	-	-
IP address	47.1.1.1	-	-	-
Netmask	/29	-	-	-
Interface:	-	Eth0: VLAN1	Eth0: VLAN1	-
IP address	-	47.1.3.72	47.1.3.73	47.1.1.5
Netmask	-	/28	/28	/29
Default gateway	-	-	-	47.1.1.1
Circuitless IP/ NE-IP:				
IP address	47.1.1.128	47.1.1.129	47.1.1.130	-
Netmask	/32	/32	/32	-

Table 10-23 (continued)**DCN example 8 - Router and OMEA DCN provisioning details**

Parameters	Router 1	Router 2	Router 3	OMEA
2 Set up IP routing				
Global OSPF enable	Yes	Yes	Yes	-
OSPF area	0.0.0.0	0.0.0.0	0.0.0.0	-
Ethernet OSPF enable	Yes	No	No	-
OSPF area	0.0.0.0	-	-	-
Static routing 1				
Address		47.1.3.64	47.1.3.64	
Netmask		/28	/28	
Next hop IP address		47.1.3.72	47.1.3.72	
Next hop interface		Eth0	Eth0	
Advertise		Yes	Yes	

DCN example 9 - Using single OME6500GNE with iISIS through OME6500 network to reach remote OME6130 network elements.

In this example (see [Figure 10-19 on page 10-70](#) and [Figure 10-20 on page 10-71](#)), a single OME6500 network element is used as the GNE to establish communication between the external DCN and the OME6130 and the OME6500 network elements.

iISIS routing protocol is used with auto-tunneling to establish communication from the OME6500 GNE to the remote OME6130 through the OME6500 network.

The remote OME6130 NEs are provisioned as proxy ARP neighbours at the OME6500 GNE.

DCN provisioning details

[Table 10-24 on page 10-71](#), [Table 10-25 on page 10-72](#) and [Table 10-26 on page 10-74](#) detail the DCN parameters for the DCN example 9 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-19
DCN example 9 - Single OME6500 GNE with iISIS to remote OME6130 NEs

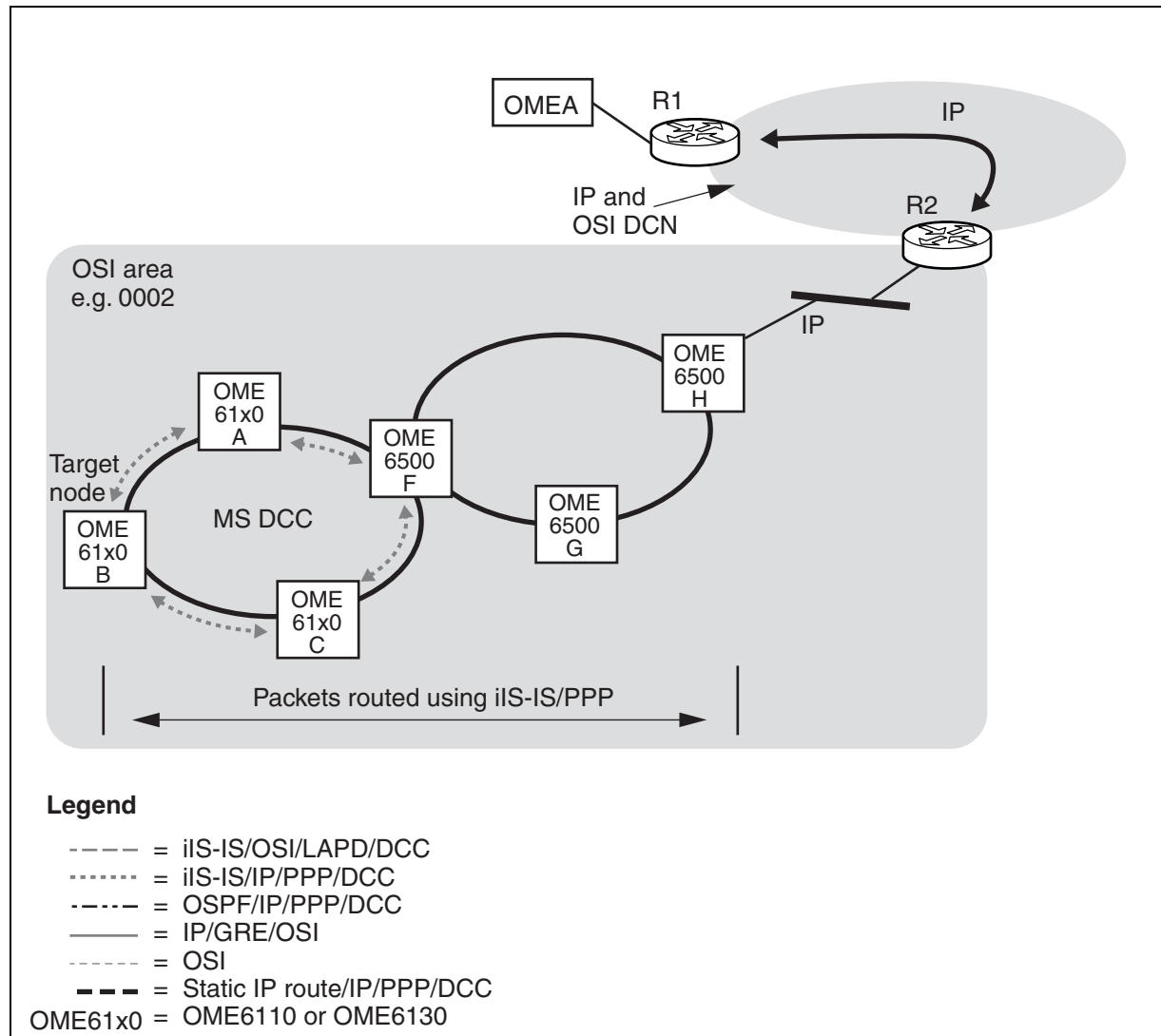


Figure 10-20
DCN example 9 - IP logical view

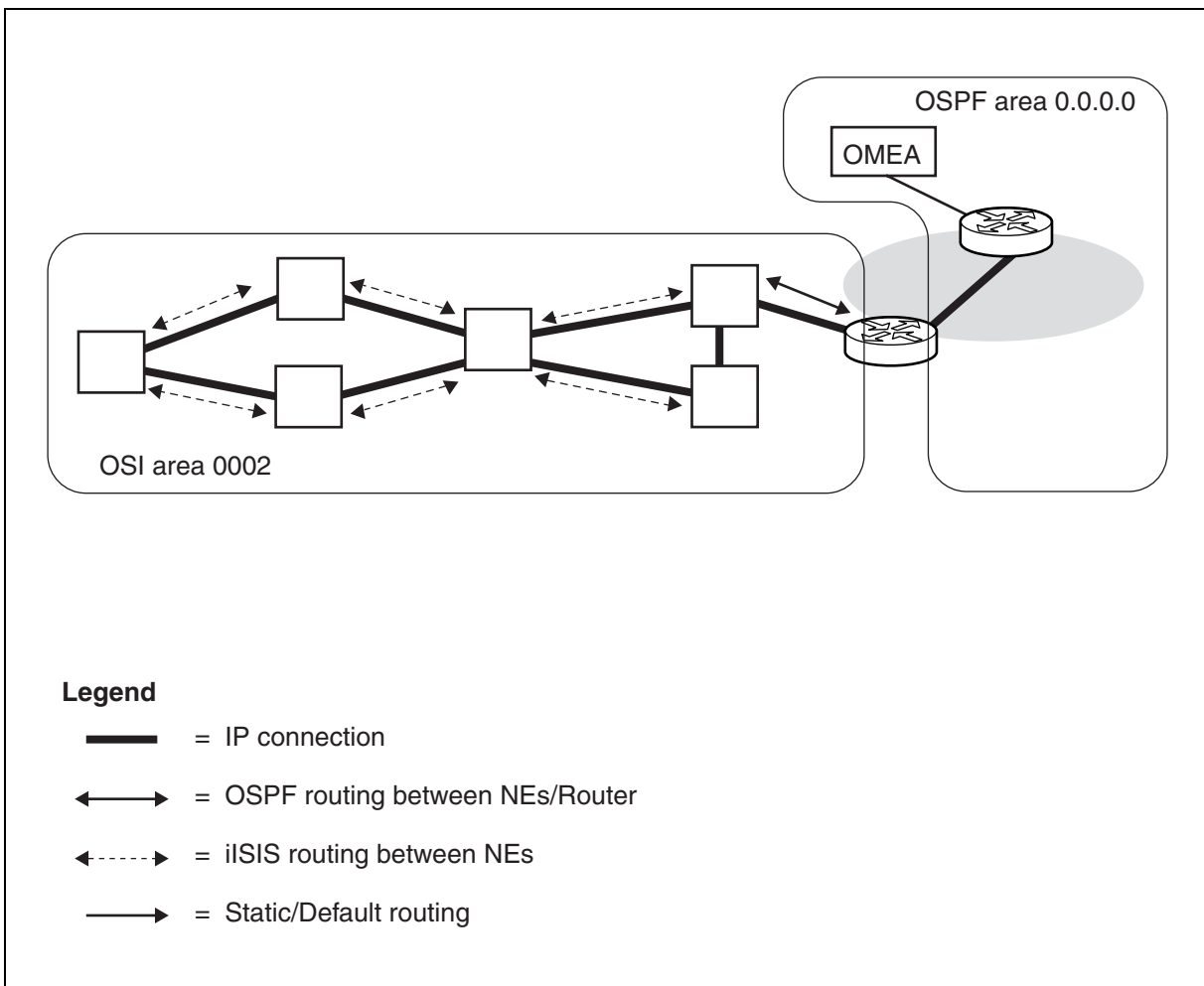


Table 10-24
DCN example 9 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
1 Set up IP address			
LAN-1-6 port:			
IP address	192.168.1.254	192.168.1.254	192.168.1.254
Netmask	/24	/24	/24
Default gateway	-	-	-
Router ID:			
IP address	47.1.3.65	47.1.3.66	47.1.3.67
Netmask	/32	/32	/32

Table 10-24 (continued)
DCN example 9 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
2 Set up IP routing			
Ethernet OSPF enable	No	No	No
OSPF area	-	-	-
3 Set up iISIS (Nodal level)			
iISIS Enable:	Enable	Enable	Enable
MAA 1	490000	490000	490000
MAA 2	-	-	-
MAA 3	-	-	-
4 Set up DCC			
STM1/4-x-1:			
Protocol	PPP	PPP	PPP
MTU	1518	1518	1518
iISIS	Enable	Enable	Enable
STM1/4-x-2			
Protocol	PPP	PPP	PPP
MTU	1518	1518	1518
iISIS	Enable	Enable	Enable

Table 10-25
DCN example 9 - OM6500 DCN provisioning details

Parameters	OM6500 H	OM6500 G	OM6500 F
1 Set up IP address			
Interface:	COLANX	-	-
IP address	47.1.3.11	-	-
Netmask	/29	-	-
Interface:	-	-	-
IP address	-	-	-
Netmask	-	-	-
Default gateway	-	-	-
Circuitless IP/ NE-IP:			
IP address	47.1.3.92	47.1.3.93	47.1.1.94
Netmask	/32	/32	/32
2 Set up IP routing			
Global Routing	iIS-IS	iIS-IS	iIS-IS
Route redistribution	OSPF redistribution	-	-
Ethernet OSPF enable	COLANX	-	-
OSPF area	0.0.0.0	-	-

Table 10-25 (continued)
DCN example 9 - OM6500 DCN provisioning details

Parameters	OM6500 H	OM6500 G	OM6500 F
3 Set up DCC			
Interface 1:	S-5-1	S-5-1	S-1-1
Protocol	PPP	PPP	PPP
MTU	1500	1500	1500
Interface 2:	S-6-1	S-6-1	S-2-1
Protocol	PPP	PPP	PPP
MTU	1500	1500	1500
Interface 3:	-	-	S-5-1
Protocol	-	-	PPP
MTU	-	-	1500
Interface 4:	-	-	S-6-1
Protocol	-	-	PPP
MTU	-	-	1500
4 Set up MAA			
OSI Local MAA:			
MAA 1	490000	490000	490000
MAA 2	-	-	-
MAA 3	-	-	-
5 Set up Proxy ARP			
Proxy ARP Neighbour IP addresses:		-	-
Neighbour 1	47.1.3.65		
Neighbour 2	47.1.3.66		
Neighbour 3	47.1.3.67		
Neighbour 4	47.1.3.93		
Neighbour 5	47.1.3.94		

Table 10-26**DCN example 9 - Router and OMEA DCN provisioning details**

Parameters	Router 1	Router 2	OMEA
1 Set up IP address			
Interface:	-	-	-
IP address	47.1.1.1	47.1.3.1	-
Netmask	/29	/29	-
Interface:	-	-	-
IP address	-	-	47.1.1.5
Netmask	-	-	/29
Default gateway	-	-	47.1.1.1
Circuitless IP/ NE-IP:			
IP address	47.1.1.128	47.1.1.129	-
Netmask	/32	/32	-
2 Set up IP routing			
Global OSPF enable	Yes	Yes	-
OSPF area	0.0.0.0	0.0.0.0	-
Ethernet OSPF enable	Yes	Yes	-
OSPF area	0.0.0.0	0.0.0.0	-

DCN example 10 - Using single OME6500 GNE with iISIS to reach remote OME6130 network elements in a SNCP ring configuration with generic SDH equipment.

In this example (see [Figure 10-21 on page 10-76](#), [Figure 10-22 on page 10-77](#) and [Figure 10-23 on page 10-78](#)), a single OME6500 network element is used as the GNE to establish communication between the external DCN and the OME6130 within a SNCP ring with generic SDH equipment (such as OM4000 and TN-1C network elements).

iISIS routing protocol is used with auto-tunneling to establish communication from the OME6500 GNE to the remote OME6130 network elements.

The remote OME6130 NEs are provisioned as proxy ARP neighbours at the OME6500 GNE.

DCN provisioning details

[Table 10-27 on page 10-79](#) and [Table 10-28 on page 10-80](#) detail the DCN parameters for the DCN example 10 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-21

DCN example 10 - Single OME6500 with iISIS to reach remote OME6130 NEs in SNCP with generic SDH equipment

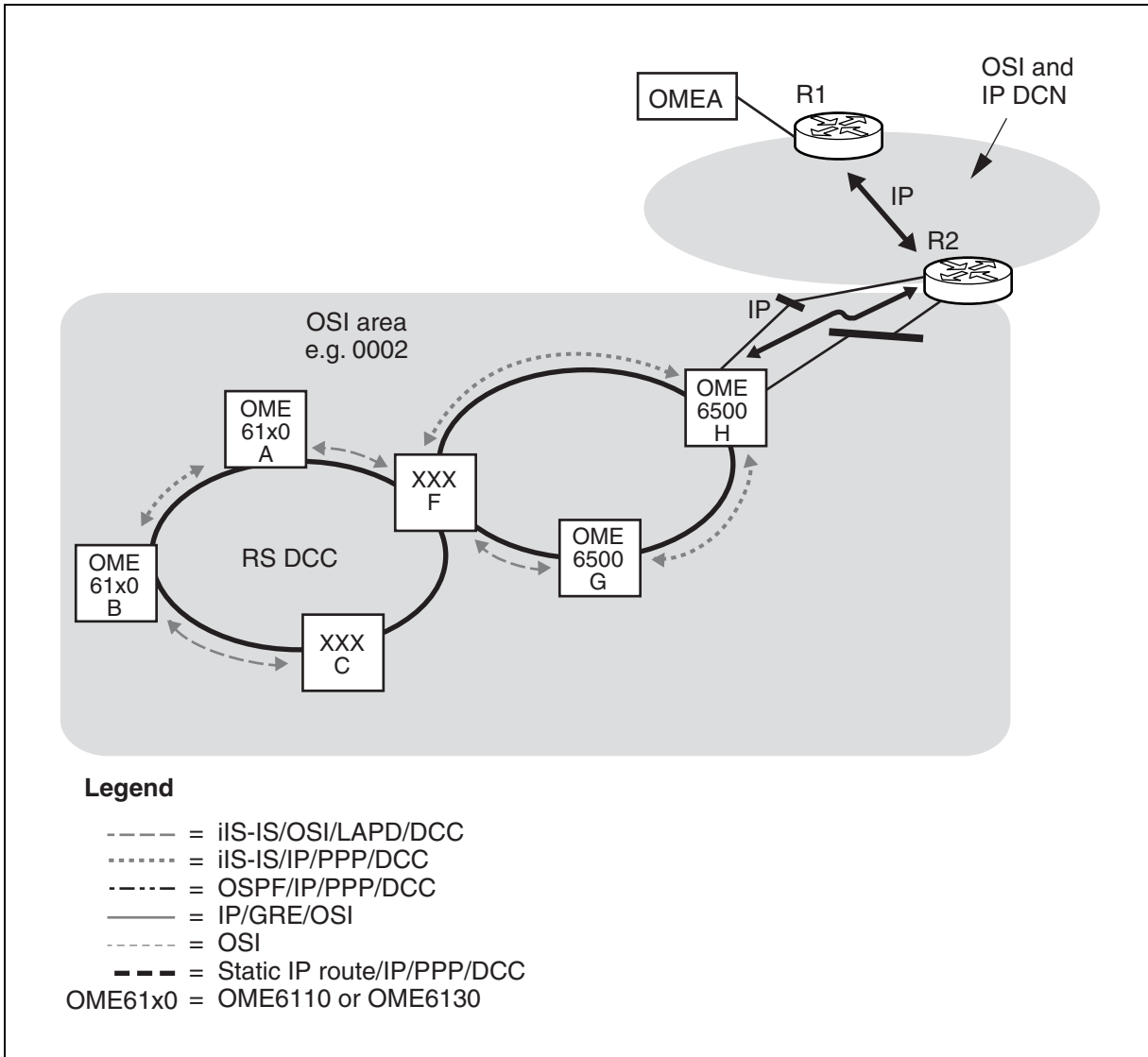


Figure 10-22
DCN example 10 - IP logical view

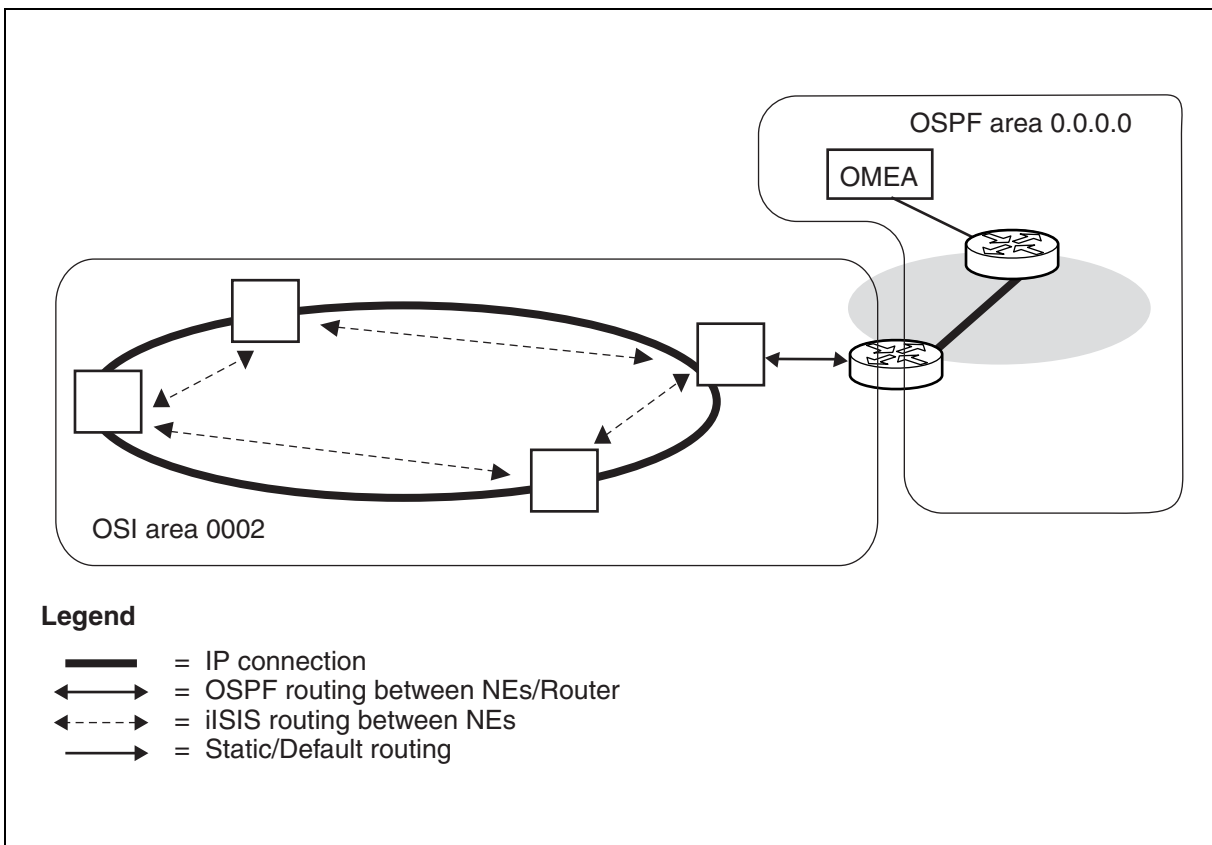


Figure 10-23
DCN example 10 - iIS-IS / IS-IS logical view

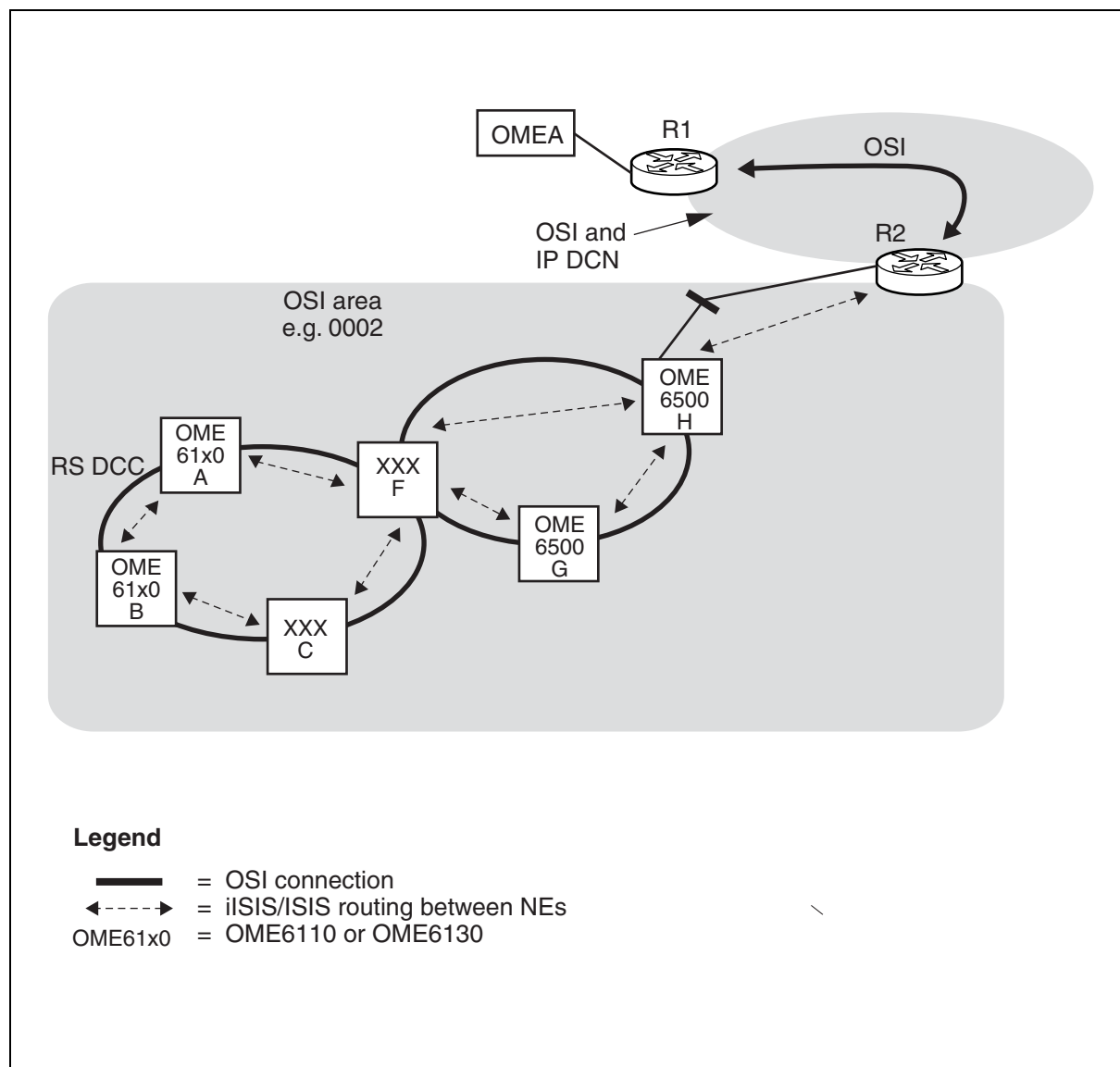


Table 10-27**DCN example 10 - OME6130, OME6500, and OSI NE DCN provisioning details**

Parameters	OME6130 A	OME6130 B	NE C	NE F	OME6500 G	OME6500 H
1 Set up IP address						
LAN-1-6 port:						COLANX
IP address	192.168.1.254	192.168.1.254	-	-	-	47.1.3.2
Netmask	/24	/24	-	-	-	-
Default gateway	-	-	-	-	-	-
Router ID:						
IP address	47.1.3.65	47.1.3.66	-	-	47.1.3.93	47.1.3.92
Netmask	/32	/32	-	-	/32	/32
2 Set up IP routing						
Global Routing	-	-	IS-IS	IS-IS	iIS-IS	iIS-IS
Route redistribution	-	-	-	-	-	OSPF redistribution
Ethernet OSPF enable	Disable	Disable	-	-	-	Yes
OSPF area	-	-	-	-	-	0.0.0.2
Static routing 1						
Address	0.0.0.0	0.0.0.0				
Netmask	/0	/0				
Next hop IP address	0.0.0.0	0.0.0.0				
Next hop interface	AGRE	AGRE				
Advertise	No	No				
3 Set up iISIS (Nodal level)						
iISIS Enable:	Enable	Enable				
MAA 1	490000	490000				
MAA 2	-	-				
MAA 3	-	-				

Table 10-27 (continued)**DCN example 10 - OME6130, OME6500, and OSI NE DCN provisioning details**

Parameters	OME6130 A	OME6130 B	NE C	NE F	OME6500 G	OME6500 H
4 Set up DCC						
Interface 1:	STM1/4-x-1	STM1/4-x-1	S-5-1	S-5-1	S-5-1	S-5-1
Protocol	LAPD	PPP	LAPD	LAPD	LAPD	PPP
MTU	512	1518	512	512	512	1500
iISIS	Enable	Enable			Yes	Yes
Interface 2	STM1/4-x-2	STM1/4-x-2	S-6-1	S-6-1	S-6-1	S-6-1
Protocol	PPP	LAPD	LAPD	LAPD	PPP	LAPD
MTU	1518	512	512	512	1500	512
iISIS	Enable	Enable			Yes	Yes
Interface 3	-	-	-	S-1-1	-	-
Protocol	-	-	-	LAPD	-	-
MTU	-	-	-	512	-	-
Interface 4	-	-	-	S-2-1	-	-
Protocol	-	-	-	LAPD	-	-
MTU	-	-	-	512	-	-
5 Set up Proxy ARP						
Proxy ARP Neighbour IP addresses:	-	-	-	-	-	
Neighbour 1						47.1.3.65
Neighbour 2						47.1.3.66
Neighbour 3						47.1.3.93

Table 10-28**DCN example 10 - Router and OMEA DCN provisioning details**

Parameters	Router 1	Router 2	OMEA
1 Set up IP address			
Interface:			-
IP address	47.1.1.1	47.1.3.1	-
Netmask	/29	/29	-
Interface:	-	-	-
IP address	-	-	47.1.1.5
Netmask	-	-	/29
Default gateway	-	-	47.1.1.1
Circuitless IP/ NE-IP:			
IP address	47.1.1.128	47.1.1.129	-
Netmask	/32	/32	-

Table 10-28 (continued)**DCN example 10 - Router and OMEA DCN provisioning details**

Parameters	Router 1	Router 2	OMEA
2 Set up IP routing			
Global OSPF enable	Yes	Yes	-
OSPF area	0.0.0.0	0.0.0.0	-
Ethernet OSPF enable	Yes	Yes	-
OSPF area	0.0.0.0	0.0.0.0	-

DCN example 11 - Using VC12 management channels through OM4000 network to reach remote OME6130 network elements in SNCP ring with OM4000 and legacy OSI network elements. Transparent DCC used to provided resilient OSI communications.

In this example (see [Figure 10-24 on page 10-83](#) and [Figure 10-25 on page 10-84](#)), VC12 management channels are used to establish communication between the external DCN and the OME6130 network element in a SNCP ring of OME6130, OM4000 and legacy OSI network elements.

Note: This example is only applicable to SDH networks, as VC12 management channels are currently supported only for OME6130 network elements provisioned in SDH mode.

Dual OM4000 network elements are connected to the external DCN via an OSI only enabled port and act as the GNEs for the other OM4000 and legacy OSI network elements.

Data communication to the remote subtending OME6130 network elements is achieved using VC12 management channels through the OM4000 network and are directly terminated on the routers. In order to provide resilient data communication against any fiber breaks in the OME6130 system, two VC12 management channels are required from the routers to two OME6130 network elements on the ring. Transparent DCC is provisioned on the OME6130 network elements to provide resilient data communications between the OM4000 and the OSI legacy equipment.

Note: OSPF routing protocol will be used on the VC12 management channels to the DCN routers.

The VC12 management channel can be terminated on a physical E1 interface on the external DCN router. An E1 connection must be provisioned from the OM4000 GNE to the router.

DCN provisioning details

[Table 10-29 on page 10-84](#), [Table 10-30 on page 10-85](#) and [Table 10-31 on page 10-86](#) detail the DCN parameters for the DCN example 11 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-24

DCN example 11 - VC12 management channels to remote OME6130 NEs in SNCP ring with OM4K and legacy OSI network elements

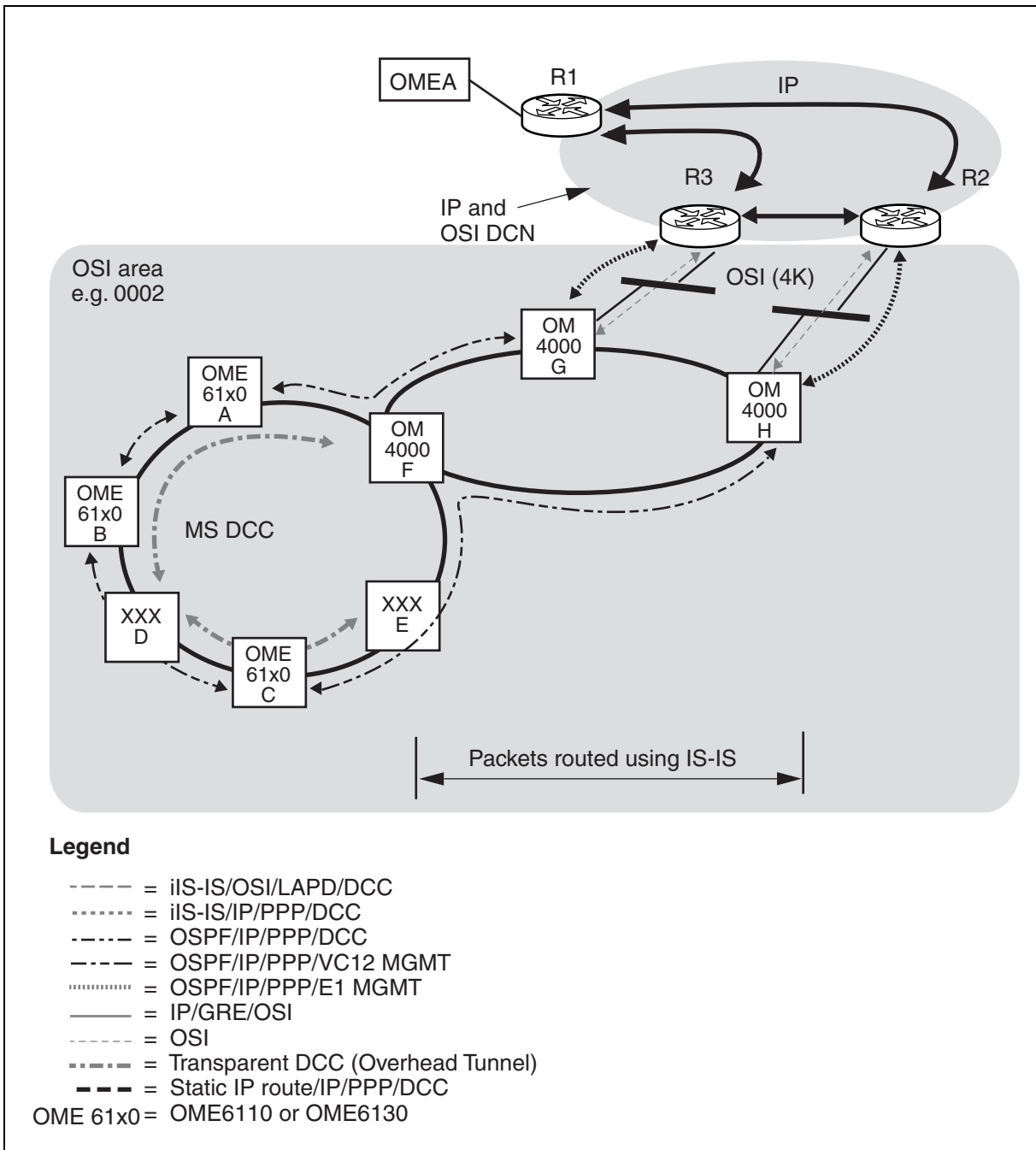


Figure 10-25
DCN example 11 - IP logical view

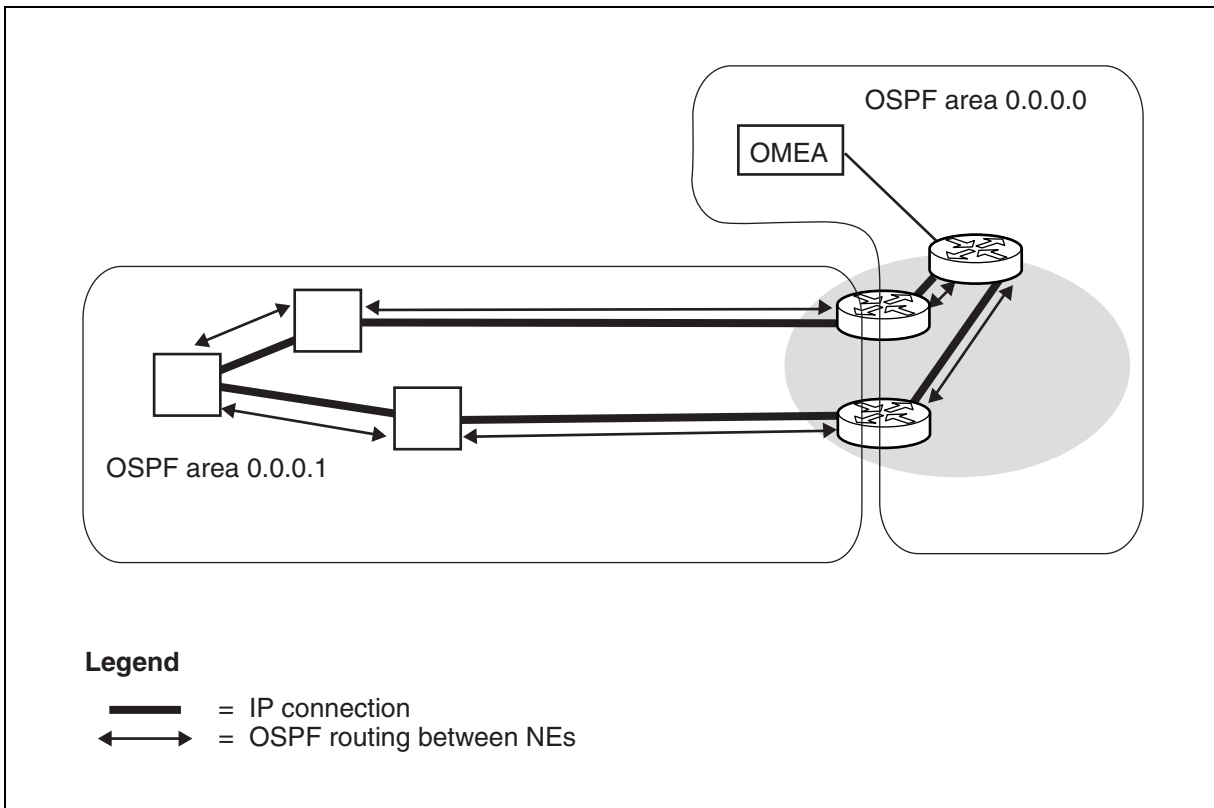


Table 10-29
DCN example 11 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
1 Set up IP address			
LAN-1-6 port:			
IP address	192.168.1.254	192.168.1.254	192.168.1.254
Netmask	/24	/24	/24
Default gateway	-	-	-
Router ID:			
IP address	47.1.3.65	47.1.3.66	47.1.3.67
Netmask	/32	/32	/32
2 Set up IP routing			
Ethernet OSPF enable	No	No	No
OSPF area	-	-	-

Table 10-29 (continued)
DCN example 11 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B	OME6130 C
3 Set up VC12 Management Channels			
MGMT-1:			
Type	VC12	VC12	VC12
MTU	1500	1500	1500
Layer 2 Protocol	PPP, HDLC Framing	PPP, HDLC Framing	PPP, HDLC Framing
OSPF	Enable	Enable	Enable
OSPF area	0.0.0.1	0.0.0.1	0.0.0.1
MGMT-2			
Type	VC12	VC12	VC12
MTU	1500	1500	1500
Layer 2 Protocol	PPP, HDLC Framing	PPP, HDLC Framing	PPP, HDLC Framing
OSPF	Enable	Enable	Enable
OSPF area	0.0.0.1	0.0.0.1	0.0.0.1
4 DCC Overhead Tunnel			
Source Port:	STM1/4-x-1	STM1/4-x-1	STM1/4-x-1
Destination Port:	STM1/4-x-2	STM1/4-x-2	STM1/4-x-2
Overhead Byte	DCC_M	DCC_M	DCC_M

Table 10-30
DCN example 11 - OSI NE and OM4000 DCN provisioning details

Parameters	NE D	NE E	OM4000 F	OM4000 G	OM4000 H
1 Set up IP address					
Interface:	-	-	-	-	-
IP address	-	-	-	-	-
Netmask	-	-	-	-	-
Interface:	-	-	-	-	-
IP address	-	-	-	-	-
Netmask	-	-	-	-	-
Default gateway	-	-	-	-	-
Circuitless IP/ NE-IP:					
IP address	-	-	-	-	-
Netmask	-	-	-	-	-
2 Set up IP routing					
Global OSPF enable	IS-IS	IS-IS	IS-IS	IS-IS	IS-IS
OSPF area	-	-	-	-	-
Ethernet OSPF enable	-	-	-	-	-
OSPF area	-	-	-	-	-

Table 10-30 (continued)**DCN example 11 - OSI NE and OM4000 DCN provisioning details**

Parameters	NE D	NE E	OM4000 F	OM4000 G	OM4000 H
3 Set up DCC					
Interface 1:	S-5-1	S-5-1	S-5-1	S-5-1	S-5-1
Protocol	LAPD	LAPD	LAPD	LAPD	LAPD
IP MTU	512	512	512	512	512
Interface 2:	S-6-1	S-6-1	S-6-1	S-6-1	S-6-1
Protocol	LAPD	LAPD	LAPD	LAPD	LAPD
IP MTU	512	512	512	512	512
Interface 3:			S-1-1		
Protocol	-	-	LAPD	-	-
IP MTU	-	-	512	-	-
Interface 4:			S-2-1		
Protocol	-	-	LAPD	-	-
IP MTU	-	-	512	-	-
4 E1 Connection					
E1 Connection to Router	No	No	No	Yes	Yes

Table 10-31**DCN example 11 - Router and OMEA DCN provisioning details**

Parameters	Router 1	Router 2 (see Note)	Router 3 (see Note)	OMEA
1 Set up IP address				
Interface:				
IP address	47.1.1.1	47.1.3.1	47.1.3.17	47.1.1.5
Netmask	/29	/29	/28	/29
Default gateway	-	-	-	47.1.1.1
Circuitless IP/ loopback:				
IP address	47.1.1.128	47.1.1.129	47.1.1.130	
Netmask	/32	/32	/32	
2 Set up IP routing				
Global OSPF enable	Yes	Yes	Yes	-
OSPF area	0.0.0.0	0.0.0.0	0.0.0.0	-
Ethernet OSPF enable	Yes	No	No	
OSPF area	0.0.0.0	-	-	

Table 10-31 (continued)

DCN example 11 - Router and OMEA DCN provisioning details

Parameters	Router 1	Router 2 (see Note)	Router 3 (see Note)	OMEA
3 Set up E1 interface				
Interface 1:		E1 interface	E1 interface	
OSPF	-	Enable	Enable	-
MTU	-	1500	1500	-
OSFP area	-	0.0.0.1	0.0.0.1	-
Note: This solution was validated with a Cisco Router.				

DCN example 12 - Using E1 and VC12 management channels to reach remote OME6130 network elements in SNCP ring with OM4000 and legacy OSI network element. Transparent DCC used to provided resilient OSI communications.

In this example (see [Figure 10-26 on page 10-89](#) and [Figure 10-27 on page 10-90](#)), E1 and VC12 management channels are used to establish communication between the external DCN and the OME6130 network element in a SNCP ring of OME6130, OM4000 and legacy OSI network elements.

Note: This example is only applicable to SDH networks, as E1 and VC12 management channels are currently supported only for OME6130 network elements provisioned in SDH mode.

The OM4000 network element is connected to the external DCN via two paths. An OSI connection to the OSI router, and an E1 connection to the IP router. The OM4000 acts as the GNE for the legacy OSI network element.

Data communication to the OME6130 GNE is achieved using direct E1 management channel to the external DCN router. Connectivity to the remote OME6130 is achieved using a mix of E1 and VC12 management channels through the OM4000 and legacy OSI network elements. In order to provide resilient data communication against any fiber breaks in the OME6130 system, management channels are required from the routers to both OME6130 network elements on the ring. Transparent DCC is provisioned on the OME6130 network elements to provide resilient data communications between the OM4000 and the OSI legacy equipment.

Note 1: OSPF routing protocol will be used on the E1 and VC12 management channels.

Note 2: If the iISIS protocol is used between the OME6130 NEs for DCC communication, then OSPF cannot be used on the E1 management channel. In this case, static routes need to be provisioned between the router and the gateway OME6130 NE.

The VC12 management channel can be terminated on a physical E1 interface on the OSI network element. An E1 connection must be provisioned from the OM4000 GNE to the router.

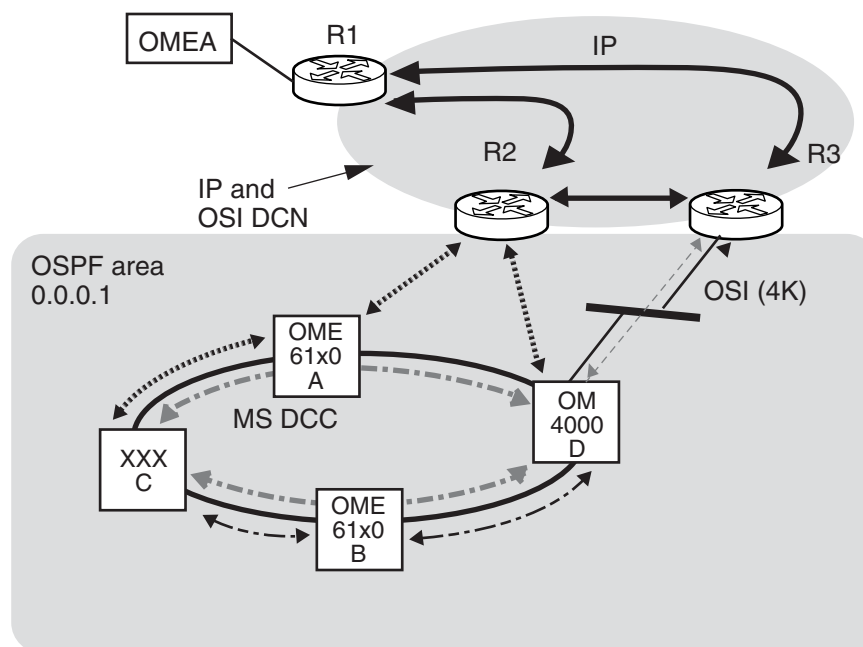
DCN provisioning details

[Table 10-32 on page 10-90](#), [Table 10-33 on page 10-91](#) and [Table 10-34 on page 10-92](#) detail the DCN parameters for the DCN example 12 configuration.

Note: For parameters not listed, use the default settings.

Figure 10-26

DCN example 12 - E1 and VC12 management channels to remote OME6130 NEs in SNCP ring with OM4K and legacy OSI network elements



Legend

- = iIS-IS/OSI/LAPD/DCC
- = iIS-IS/IP/PPP/DCC
- = OSPF/IP/PPP/DCC
- = OSPF/IP/PPP/VC12 MGMT
- = OSPF/IP/PPP/E1 MGMT
- = IP/GRE/OSI
- = OSI
- = Transparent DCC (Overhead Tunnel)
- = Static IP route/IP/PPP/DCC
- OME 61x0 = OME6110 or OME6130

Figure 10-27
DCN example 12 - IP logical view

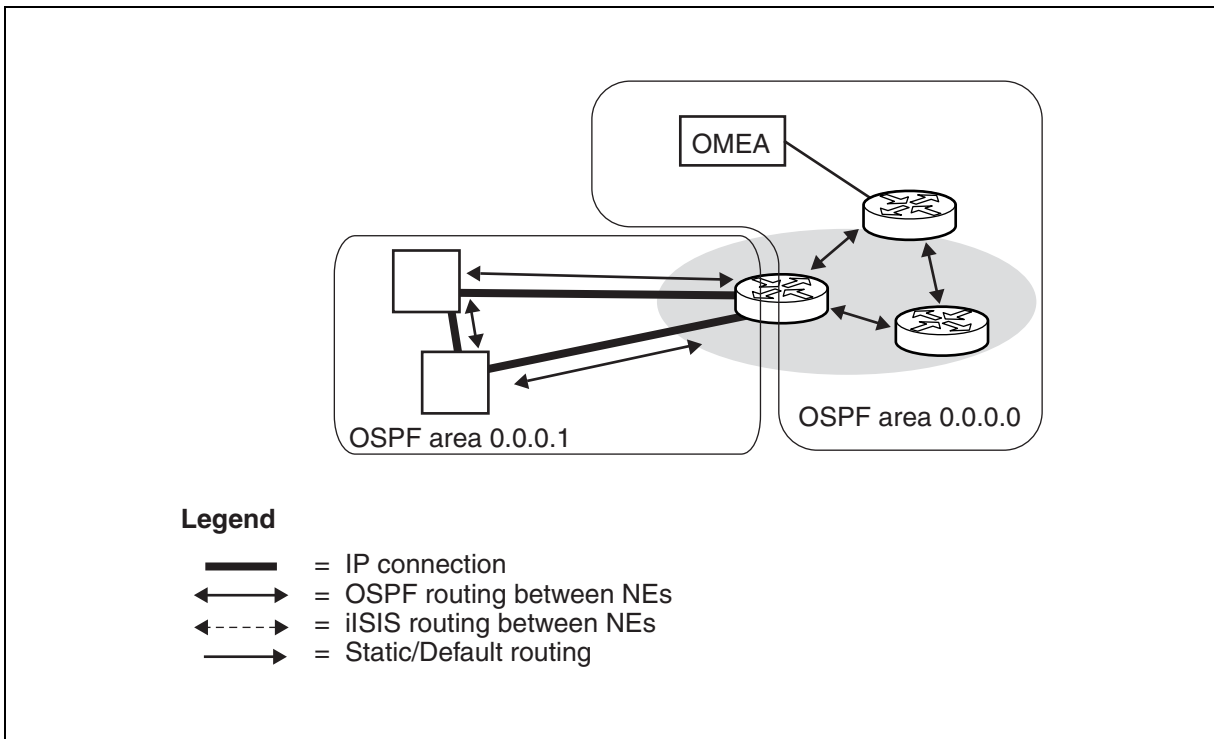


Table 10-32
DCN example 12 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B
1 Set up IP address		
LAN-1-6 port:		
IP address	192.168.1.254	192.168.1.254
Netmask	/24	/24
Default gateway	-	-
Router ID:		
IP address	47.1.3.65	47.1.3.66
Netmask	/32	/32
2 Set up IP routing		
Ethernet OSPF enable	No	No
OSPF area	-	-

Table 10-32 (continued)
DCN example 12 - OME6130 DCN provisioning details

Parameters	OME6130 A	OME6130 B
3 Set up E1 and VC12 Management Channels		
MGMT-1:		
Type	E1	VC12
MTU	1500	1500
Layer 2 Protocol	Standard PPP, RFC 1661	PPP, HDLC Framing
Magic Number	Enable	Disable
OSPF	Enable	Enable
OSPF area	0.0.0.1	0.0.0.1
MGMT-2		
Type	E1	VC12
MTU	1500	1500
Layer 2 Protocol	Standard PPP, RFC 1661	PPP, HDLC Framing
Magic Number	Enable	Disable
OSPF	Enable	Enable
OSPF area	0.0.0.1	0.0.0.1
4 DCC Overhead Tunnel		
Source Port:	STM1/4-x-1	STM1/4-x-1
Destination Port:	STM1/4-x-2	STM1/4-x-2
Overhead Byte	DCC_M	DCC_M

Table 10-33
DCN example 12 - OSI NE and OM4000 DCN provisioning details

Parameters	NE C	OM4000 D
1 Set up IP address		
Interface:	-	-
IP address	-	-
Netmask	-	-
Interface:	-	-
IP address	-	-
Netmask	-	-
Default gateway	-	-
Circuitless IP/ NE-IP:		
IP address	-	-
Netmask	-	-
2 Set up IP routing		
Global OSPF enable	IS-IS	IS-IS
OSPF area	-	-
Ethernet OSPF enable	-	-
OSPF area	-	-

Table 10-33 (continued)**DCN example 12 - OSI NE and OM4000 DCN provisioning details**

Parameters	NE C	OM4000 D
3 Set up DCC		
Interface 1:	S-5-1	S-5-1
Protocol	LAPD	LAPD
IP MTU	512	512
Interface 2:	S-6-1	S-6-1
Protocol	LAPD	LAPD
IP MTU	512	512
4 E1 Connection		
E1 Connection to Router	No	Yes

Table 10-34**DCN example 12 - Router and OMEA DCN provisioning details**

Parameters	Router 1	Router 2 (see Note)	Router 3 (see Note)	OMEA
1 Set up IP address				
Interface:				
IP address	47.1.1.1	47.1.3.1	47.1.3.17	47.1.1.5
Netmask	/29	/29	/28	/29
Default gateway	-	-	-	47.1.1.1
Circuitless IP/ loopback:				
IP address	47.1.1.128	47.1.1.129	47.1.1.130	
Netmask	/32	/32	/32	
2 Set up IP routing				
Global OSPF enable	Yes	Yes	Yes	-
OSPF area	0.0.0.0	0.0.0.0	0.0.0.0	-
Ethernet OSPF enable	Yes	No	No	
OSPF area	0.0.0.0	-	-	
3 Set up E1 interface				
Interface 1:		E1 interface	E1 interface	
OSPF	-	Enable	Enable	-
IP MTU	-	1500	1500	-
	-	0.0.0.1	0.0.0.1	-
Note: This solution was validated with a Cisco Router.				

IP networks, addressing, and masks

This section briefly explains the concepts of IP (Internet Protocol, version 4) addressing and uses examples from DCN to illustrate.

- Every interface within an IP system must have a unique IP address (four bytes expressed in decimal and separated by dots [for example, 192.168.12.43]). For more information on this notation, refer to [Dotted decimal notation for IP addresses on page 10-94](#).
- The IP addresses available for the system are divided into networks and further subdivided into subnetworks.
- Devices must be grouped together such that they are directly connected only to other devices with IP addresses conforming to the same subnetwork addresses.
- There are two groups of networks: public and private networks.
 - Public networks are those networks which can be connected to the Internet; therefore they are accessible from any device outside that network, as long as this device is also connected to the Internet.
 - Private networks are isolated from the outside world; therefore they cannot be connected to the Internet, and as such they are not accessible by any device that does not belong to the same network. Well-defined ranges of addresses are reserved for private networks.
 - One of the address ranges available for private networks is 192.168.x.y (x = 0 to 255, y = 0 to 255, which is the decimal representation of an 8-bit binary number); ‘x’ is the part of the IP address which is available for the network address. For example, 192.168.1.0, 192.168.2.0, and 192.168.3.0 are three different network addresses. Every device or interface connected to network 192.168.1.0 must have an IP address that is 192.168.1.y, where ‘y’ is the part of the IP address which is available for both the subnetworks and the host ID (identifier).
- The subnetwork mask identifies the number of bits allocated to the host ID and the number allocated to the subnetwork.
- When subnetting a network, two addresses are not available: those identified by all ones (used as a broadcast address), and all zeros (reserved by convention as it is used to identify the network).
- As for subnets, host addresses of all ones (broadcast) and all zeros (by convention) are not available.
- The network designer will decide how many bits define the subnetwork and how many define the host ID, according to the actual and possible future network architecture.

It is important to note that the original distinction of addresses between classes A, B, and C did not allow the network designer to vary the length of the subnetwork mask once an IP address was assigned. In fact, classes A, B, and C defined a rigid scheme for assigning the number of bits which identify the networks, and those which identify the host ID, regardless of the network designer's needs. For its intrinsic limits, the notation for classes A, B, and C is no longer used.

The next section of this information shows the bit significance of the dotted decimal notation.

Dotted decimal notation for IP addresses

An IP address is 32 bits long. To aid memory of this string of digits, the address is split into 4 groups of 8 bits each. These are represented by a decimal number between 0 and 255 for ease of display. The decimal number has no other significance.

The decimal number represented by the eight bits can be determined by looking up the decimal value of each bit and then simply adding them up:

- 00000001 is represented by 1
- 00000010 is represented by 2
- 00000100 is represented by 4
- 00001000 is represented by 8
- 00010000 is represented by 16
- 00100000 is represented by 32
- 01000000 is represented by 64
- 10000000 is represented by 128

Example: 10010001

- 10000000 is represented by 128
- 00010000 is represented by 16
- 00000001 is represented by 1
- Total 145

An IP address contains a 32-bit address field and a 32-bit subnet mask. The mask defines which part of the address is a network address and which is a device address. The mask thus allows a router to decide whether the address of the packet is destined for one of the subnets to which it is connected. For example:

An address of 47.9.64.172 has a mask of 255.255.240.0; the mask is AND'ed with the address:

Address of packet is:

00101111.00001001.01000000.10101100

Mask is:

11111111.11111111.11110000.00000000

This means that the network part of the address is:

00101111.00001001.01000000.00000000

The device part of the address is:

00000000.00000000.00000000.10101100

occupying the last 12 bits.

CIDR (Classless Inter-Domain Routing) addresses represent masks in a different way. A CIDR address is defined by a starting address and a mask which defines the size of the address allocation. For example:

An allocation of addresses in the range 196.0.16.0 to 196.0.31.255 can be represented by:

196.0.16.0/20 (see note)

where the 20 is a mask of 20 contiguous 1 bits.

Start address is:

11000100.00000000.00010000.00000000

End address is:

11000100.00000000.00011111.11111111

And the mask is:

11111111.11111111.11110000.00000000

The last 12 bits are available to the user to use as subnet address and device address.

Note: This notation is conventional for CIDR addresses. However, the method in which an IP address is configured can vary according to the router where it is performed. For example, the IP address notation 196.0.16.0/20 can be used to configure a Cisco router, whereas Nortel Networks routers require the full notation 196.0.16.0 with the subnetwork mask 255.255.240.0. There is no substantial difference between these two methods.

Circuitless IP interface

A circuitless IP interface is a virtual interface that exists in software only. The special property of this interface is that it always exists and is therefore always included in the routing tables. Ethernet and serial interfaces cease to exist if a connector falls out, or if the device at the other end of the cable fails for any reason. The interface then shuts down and is removed from the routing tables.

Note that circuitless IP is a Bay term; Cisco uses the term ‘loopback’ for these interfaces. Having an interface that always exists within a router is very useful for the following reasons:

- 1 If a tunnel is set up between two router interfaces and one of the interfaces fails, the tunnel fails. However, when the tunnel is set up between two circuitless IP interfaces, if the normal route fails, the tunnel is re-routed if another route exists and does not fail.
- 2 If during a Telnet session on a router the interface to which the session is connected goes down, then the session is lost. Another connection via the IP address of an alternative interface must be made. If Telnet sessions are set up to connect to the router using the circuitless IP interface, then loss of one interface is not a problem, providing the router has at least one working IP interface.
- 3 Other interfaces can be referenced to the circuitless IP interface. This is known as an unnumbered interface. This applies only to point-to-point interfaces (that is, not an Ethernet port). This reduces the number of IP addresses needed.

Note: It is more difficult to find faults in a network with an unnumbered link, and topologies from some network management systems are easier to follow with unnumbered serial links. The use of unnumbered links is still permissible where sufficient IP addressing space is not available.

- 4 The circuitless IP interface identifies a router for OSPF (Open Shortest Path First), tunnelling, and management.

ARP

ARP (Address Resolution Protocol) is used to map IP addresses to LAN (Local Area Network) hardware addresses. When a host wishes to send a packet to a host on another network, it sends the packet to its gateway for forwarding. It can also do the same for a packet destined for a host within the same network but it leads to excessively high traffic levels, especially if a large number of hosts are on the LAN. Therefore, in order to reduce the traffic on a LAN, a node uses ARP with another node when it determines that the destination address is on a directly attached network. The node can determine if the host is local by comparing the network portion of its own IP address (including the subnet) with the target address.

Therefore, in order to avoid using the gateway, the originating host needs to determine the destination host’s local data link layer address. It achieves this by sending out an ARP request message containing its own IP address and data link layer address, and the IP address of the destination host. This message is sent via the gateway. The destination host then responds with an ARP reply message containing its own data link layer address and uses the originating host’s data link layer address as the destination address. Thus the reply does not need to go via the gateway. The originating host and destination host store

the learned network and data link layer address pairing in their ARP caches for future use, thus avoiding the use of the gateway altogether. The rest of the hosts on the LAN build up similar caches, thus reducing LAN traffic.

IP routing protocols

The primary function of IP, which resides at the network layer (3) of the OSI (Open Systems Interconnect) model, is to receive data from the higher layer protocols (TCP [Transmission Control Protocol] or UDP [User Datagram Protocol] layers) on a source host, create a datagram and route the datagram through a network to a destination host. Secondary functions of IP include fragmentation and reassembly of the datagram, and packet lifetime control. The most important IP routing protocols are explained in the following sections.

OSPF

OSPF (Open Shortest Path First) is an open protocol, as defined in *Request For Comments (RFC) 1247*. It is based on the Dijkstra's 'Shortest Path First' algorithm, which is a link state routing mechanism.

In an OSPF network, each router maintains a *link-state database* that describes the topology of the autonomous system (AS). The database contains the *local state* for each router in the AS, including the router's usable interfaces and reachable neighbors. Each router periodically checks for changes in its local state and shares any changes detected by flooding *link-state advertisements* (LSAs) throughout the AS. Routers synchronize their topological databases based on the sharing of information from LSAs.

From the topological database, each router constructs a *shortest-path tree*, with itself as the root. The shortest-path tree gives the optimal route to each destination in the AS. Routing information from outside the AS appears on the tree as leaves. OSPF routes IP traffic based solely on the destination IP address and subnet mask, and IP Type of Service (TOS) contained in the IP packet header.

OSPF is designed specifically for use on larger networks, providing several features to reduce the amount of traffic and processing overhead associated with the routing protocol. Amongst these features are the ability to segment a large network into a number of areas, and **route summarization**, a technique which greatly reduces the volume of route advertisement traffic where the addressing scheme is hierarchical.

The manner in which a network is segmented into areas is governed by strict rules. There is a core area—known as the **backbone** area—which is area 0.0.0.0, sometimes referred to as area 0. All other areas are connected directly to the backbone area, or, where this is not possible, connected indirectly using a 'virtual link' or tunnel. See [Figure 10-28 on page 10-101](#).

The topology of each OSPF area is invisible to entities outside the area. This area partitioning system speeds up routing, because all packets with destinations within an area are contained within that area; packets destined for another area are sent to the backbone area for redirection.

The rules for area use within OSPF networks contrast with the way areas are implemented in OSI in the following ways:

- There is no requirement for a backbone area within OSI.
- The border between OSI areas is between routers (that is, a OSI router can only reside in one area), whereas the border between OSPF areas runs through a router (that is, an OSPF router may be in more than one area).

Interfacing OSPF networks with non-OSPF networks

The DCN design does not support running other IP routing protocols within the OSPF network. However, there are applications where non-OSPF is the only protocol available and these networks must be able to send to and receive packets from the OSPF network.

There are two ways in which this can be done:

- 1 static routes (see [Figure 10-30](#))
- 2 redistribution.

Redistribution

Redistribution gives visibility of both networks using dynamic routing. Routes from one area to subnets in the other are costed within limitations. There is no easy way for non-OSPF to interpret OSPF metrics and vice versa.

- The boundary router advertises all OSPF routes into the non-OSPF network with a cost of one hop.
- Redistributing non-OSPF routes into the OSPF network is more complex. To a router within the OSPF network, networks in the non-OSPF network within one hop of the boundary router have the same cost as the cost of reaching the boundary router. To a router within the OSPF network, networks in the non-OSPF network beyond one hop of the boundary router have a cost equal to the number of hops required in the non-OSPF network. The cost to reach the boundary router within the OSPF area is considered to be zero. How this is implemented varies between router manufacturers.

A router (boundary router) must always be used as the interface between the two networks. There may be more than one router performing this role.

Implementing OSPF in a network

This section covers issues that the implementer of an OSPF network needs to be aware of.

Terms

Some terms associated with OSPF are:

- **Costs** Routes have a cost associated with them. The higher the cost the less favourable the route. OSPF has a number of metrics which are converted with algorithm into a cost.
- **Policy filters** This parameter only applies when an OSPF network uses external routes. An announce filter acts on the outward advertisements from the OSPF area and the accept filter acts on inward advertisements. As the LSPs are modified by the filter and the resultant used to produce a routing table, it follows that policy filters need to be applied to all routers in the OSPF network and not just to the boundary router.
- **Link state** is the status of a link between two routers.
- **Cost of a link** is computed from bandwidth, real cost, availability, reliability and other link metrics.
- **OSPF area** is a collection of connected routers which exchange link state updates.
- **Adjacencies database** lists all a router's neighbours.
- **Link State Database** is a list of link states from all other routers in the OSPF area. All routers have identical link state databases.
- **OSPF routing table** is produced from the OSPF link state database.
- **Routing table (forwarding table).** The best routes are chosen from all protocol routing tables. Note that each router has a different routing table.
- **Backbone area** Area to which all other OSPF areas are connected, either directly or via a virtual link. It is referred to as area 0.0.0.0 or area 0.
- **Standard area** Area which is not the backbone area but which receives all link state updates from external networks.
- **Stub areas** These are areas which can have more than one interface, but by definition do not carry transit data and do not receive link state updates from external networks. All routers in a stub area must be set to be stub routers. How this is implemented varies between router manufacturers.
- **Totally stubby areas** Stub areas which do not receive summary LSAs.
- **NSSA (Not So Stubby Areas)** Stub areas which receive certain link state updates from external networks.
- **Router ID** This is the number by which each router is known to OSPF. On a Bay router the default is the IP address of the first configured interface. On Cisco the default is the highest configured IP address. On both routers it should be manually configured to be the same as the circuitless IP/loopback address.
- **Border router** A router which is in the backbone area and one or more other OSPF areas.

- **Boundary router** (or ASBR—Autonomous System Boundary Router) A router which is the gateway between an OSPF network and another network which uses a separate routing mechanism, including static routes.
- **Designated router** Link state routing protocols have an inherent problem when a number of routers exist on the same LAN. The solution is for a router to be elected as a proxy for all the routers on the LAN, this is known as a designated router (DR). The DR creates a dummy routing entity with which all routers on the LAN form an adjacency. There are no other adjacencies formed on the LAN. Thus, routers on a LAN will have only one link on the LAN, rather than one for each of the other routers on the LAN. This means that the number of links on a LAN with n routers is reduced from $n * (n - 1)$ to $n * 2$:
 - A router with a priority of 0 never becomes DR.
 - If a router with a higher priority connects to the network there is no re-election.
 - Changing router priorities does not cause a re-election.
 - Changing router IDs does not cause a re-election.
- **OSPF multicasts.** Packets sent out with 224.0.0.5 are sent to all OSPF routers. Packets sent out with 224.0.0.6 are sent to all OSPF designated routers.

Topology considerations

An OSPF network has to be planned out in areas to take full advantage of the protocol.

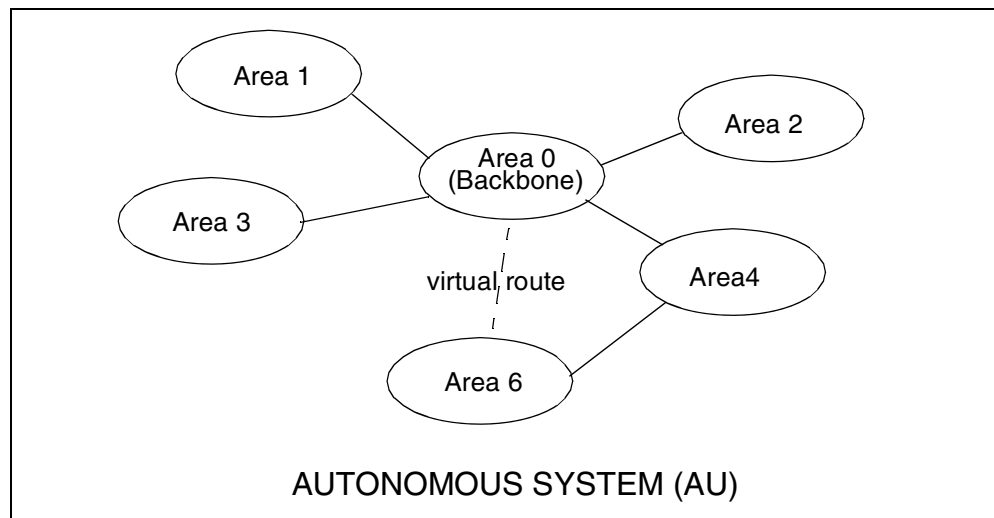
With OSPF packets destined for an area outside the current area are sent to area 0. Thus it may be inferred that all areas must have a connection to area 0. There may be more than one connection between an area and area 0 but there must be no inter-area connections.

It can be concluded that OSPF networks are tree structures which lend themselves to hierarchical addressing schemes using variable length subnet masks.

OSPF places demands upon a routing processor. It is recommended that no more than 50 OSPF routers be placed within an OSPF area.

The designated router on a LAN in a network running OSPF has a very high processor utilization. It may be that some routers are unsuitable for this role and so should be allocated a priority of 0. If it is not possible to have an area connected directly to area 0, a virtual route may be used as in [Figure 10-28](#) (dashed line).

Figure 10-28
OSPF areas



Wherever possible the DCN network should be fitted into one area (area 0). This gives the benefit of OSPF speed and versatility without the restrictions on topology.

Basic OSPF configuration steps for each interface are:

- 1 Enable OSPF.
- 2 Define an OSPF area.
- 3 Define interface type.
- 4 Define interface metrics.

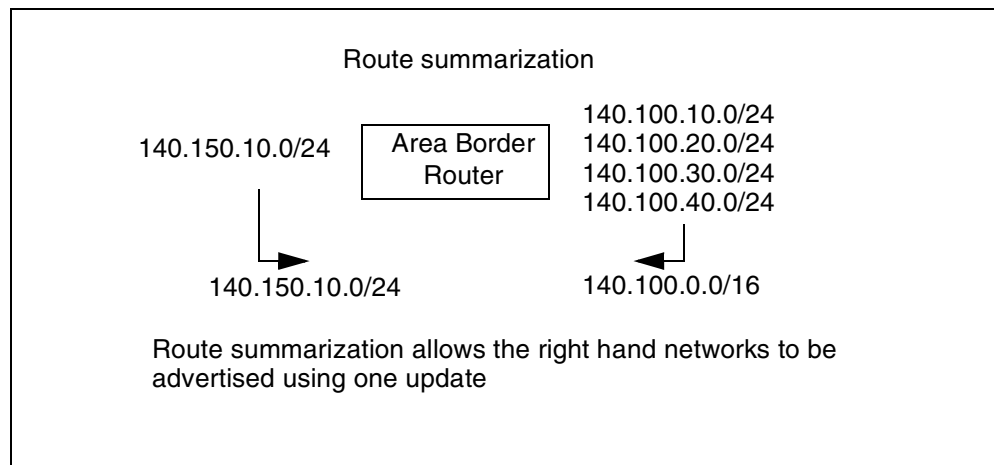
Other parameters may need to be changed.

Advantages of OSPF

OSPF is link state technology as opposed to the distance vector technology and OSPF addresses the requirements of large scalable networks. Issues addressed by OSPF are:

- **Speed of convergence** With OSPF convergence is quicker because routing changes are flooded throughout the network and new routing tables computed in parallel.
- **Variable length subnet masks** OSPF supports variable subnet masking and advertises varying levels of subnets.
- **Route summarization** OSPF supports route summarization which is the consolidation of multiple routes into one single advertisement. It requires a hierarchical network but has the advantage of confining topology changes to within an area and so significantly reduces the workload on routers in other areas.

Figure 10-29
Route summarization



- **Supernetting** Supernetting comes from the introduction of CIDR. Address space is allocated without class as a contiguous number of class C addresses. For example, an allocation of addresses in the range 196.0.16.0 to 196.0.31.255 could be represented by 196.0.16/20. Such an entry in a routing table is referred to as a supernet. Subnetting is used to achieve route summarization and cannot be used with routing protocols such as RIP which categorize IP addresses by class.
- **Network reachability** There is no path limit with OSPF.
- **Bandwidth considerations** OSPF just sends out link state updates when they occur, with a maximum interval of 30 minutes.
- **Route selection** OSPF determines a best route using the concept of cost. Each interface configured with OSPF has a metric parameter, whose value has been derived from the formula $10^8/\text{interface speed}$ (however, it is at the discretion of the engineer to change it, if required—for example when the link is busy). According to the formula, some values are:
 - Ethernet 100BaseTX: **1**
 - Ethernet 10BaseT: **10**
 - Serial at 2 Mbit/s: **48**
 - Serial at 64 kbit/s: **1562**

Route preference

All routing protocols are assigned a preference which allows the router to select routes when different protocols each report a path to the same network. It could be considered as a measure of believability. The exact ranking of protocols depends on the router manufacturer, but link state routing protocols (for example, OSPF) are considered more reliable than distance vector

routing protocols (for example, RIP). A static route should be assigned a high preference and a default route a low one.

Static and default routes

Static routes are manually configured on a router in contrast to routes learned via a routing protocol. Static routes are permanent and remain in the routing table even though an interface associated with the route goes down. They are most commonly used for:

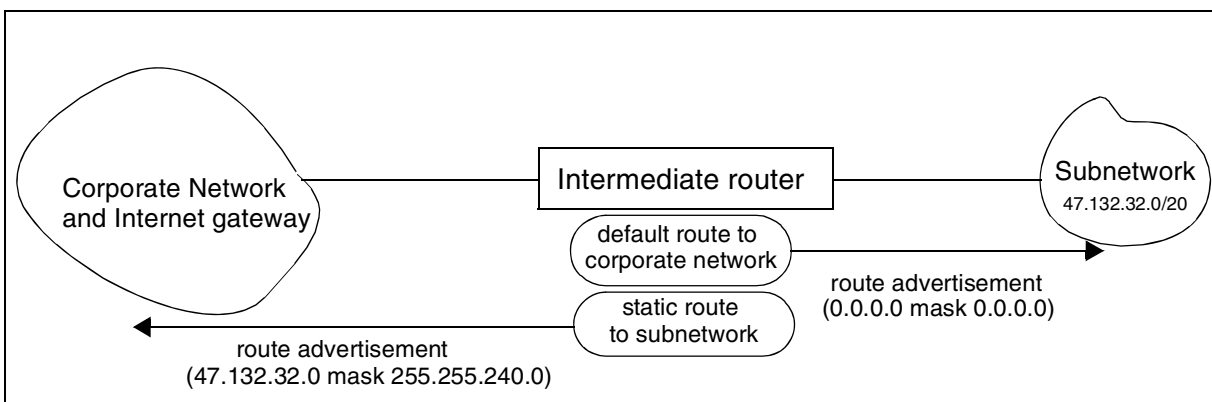
- Defining routes to use when two autonomous systems must exchange routing information, rather than having entire routing tables exchanged. Often subnetworks linked to a corporate network do not wish to receive routing updates but require some facilities provided by the corporate network. The intermediate router on the border would advertise to the corporate network that it had a route to the subnetwork.
- A network which has dial-on-demand links. Routing updates passing over this link would keep the link up permanently. A static route ensures that the link is only enabled when traffic data requires the link to reach its destination.

Routers must be configured to listen to and redistribute static routes.

Default routes are a form of static routes in that they provide a catch-all for destinations not contained in routing tables. In effect they provide a static route to a large network rather than a specific IP address or subnetwork. In the case of the subnetwork attached to a corporate network, the intermediate router on the border has a default route to the corporate network advertised into the subnetwork.

Figure 10-30 shows an example of the way that static routes and default routes are used.

Figure 10-30
Default and static routes



Nortel

Optical Multiservice Edge 6130

Planning Guide

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