Lucent Technologies
Bell Labs Innovations

Navis™ Optical Network Management System (NMS)

Applications and Planning Guide

365-309-261R7.0
Issue 1
July 2002

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- From the United States, call 888-LUCENT8, prompt 1.

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Technical support

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Outside the continental United States, contact your Local Customer Support (LCS) or the support organization designated by your Lucent customer team representative. If you are unsure of who to call, contact the Global TSS Contact Center at 630-224-4672.

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Contents

About this information product

Purpose

This preface provides an overview of this information product, which is *Navis™ Optical NMS Applications and Planning Guide*.

The purpose of this Applications and Planning Guide is to provide an overview of *Navis™* Optical Network Management System (NMS), explain its capabilities, and describe the planning activities that must be done before a system can be installed.

Reason for reissue

Issue 1 of this Applications and Planning Guide is a revised document that supports Navis™ Optical NMS.

Safety labels

This information product does not use safety labels.

Intended audience

This information product is written primarily for network planners, engineers, and sales teams. It may be used by anyone desiring specific information about the features, applications, and operations of the Navis™ Optical NMS.

How to use this information product

This information product contains:

- ***Conceptual*** information, which consists of explanations of different aspects of the product

This information is presented within the chapters of this Applications and Planning Guide.

Chapter descriptions

The following table describes the information in each chapter of this Applications and Planning Guide.

Section	Title	Description
Preface	About this information product	Explains this document's purpose, its intended audience, and how to use the document
Chapter 1	Chapter 1, "System Overview"	Provides a high-level description of the product and its features
Chapter 2	Chapter 2, "Features"	Describes the features of this product
Chapter 3	Chapter 3, "Applications"	Describes applications for this product in the network and provides a brief description of the network elements it manages
Chapter 4	Chapter 4, "Hardware Platforms"	Describes the supported hardware platforms for Navis™ Optical NMS
Chapter 5	Chapter 5, "System Planning and Engineering"	Describes system planning issues that should be considered before purchasing the product
Chapter 6	Chapter 6, "Ordering"	Explains how to order Navis™ Optical NMS
Chapter 7	Chapter 7, "Product Support"	Describes the support and services available from Lucent Technologies for this product, including technical assistance, training courses, and user documentation
Index	Index	Enables the user to quickly find information on specific topics.

Conventions used

This information product uses the following typographical conventions to distinguish between computer input and output.

- When describing the Navis™ Optical NMS software, fields in windows and field entries are identified with **this font**.
- When describing the *UNIX*® environment, text and numbers that the user inputs to the computer are identified with `boldface type`.
- In the UNIX environment, text and numbers that the computer outputs to the user are identified with `monospace type`.

Related documentation

This information product is part of a set of information products that supports Navis™ Optical NMS.

List of documents

The documents that support the Navis™ Optical NMS Release 7.0 application are the following:

- *Navis™ Optical NMS Getting Started Guide* instructs users how to begin using the product to provision and manage a network. This document includes tasks and conceptual information.
- *Navis™ Optical NMS Applications and Planning Guide* describes the Navis™ Optical NMS features and applications, provides a product description and the hardware platforms for the product, and describes system planning and engineering, ordering, and product support. This document contains conceptual information only.
- *Navis™ Optical NMS Provisioning Guide* instructs users how to use the product to provision and manage a network. This document includes tasks and conceptual information.
- *Navis™ Optical NMS Maintenance Guide* instructs users on how to maintain the product and the network. This document includes tasks and conceptual information.
- *Navis™ Optical NMS Administration Guide* instructs users on how to administer the product and the network. This document includes tasks and conceptual information.

Glossary

The *Navis™ Optical NMS Administration Guide* contains a glossary that will be helpful to users of Navis™ Optical NMS.

On-line documentation

The Navis™ Optical NMS documentation set is provided in HTML format and is available on CD-ROM with the Navis™ Optical NMS software. A separate CD-ROM, which is titled *Navis™ Optical NMS User Documentation CD-ROM* can be ordered. This CD-ROM includes the full set of documents listed previously.

Screen help

The Navis™ Optical NMS software includes screen help for each form, which describes the purpose of the form, each of the fields, and each of the buttons.

How to comment

To comment on this information product, go to the Online Comment Form (http://www.lucent-info.com/comments) or email your comments to the Comments Hotline (ctiphotline@lucent.com).

Customer satisfaction is extremely important to Lucent Technologies. All users are encouraged to provide feedback on the Navis™ Optical NMS information products.

How to order

To order Navis™ Optical NMS information products, contact Lucent Technologies at:

- From the United States, call 888-LUCENT8, prompt 1.
- From Canada, call 317-322-6615.
- From Europe, the Middle East, and Africa, call 317-322-6416.
- From Asia, the Pacific Region, China, the Caribbean, and Latin America, call 317-322-6416.

1 System Overview

Overview

Purpose

This chapter provides a system overview of the *Navis*™ Optical Network Management System (NMS) application.

Contents

Product definition

Overview

Today's transport networks contain a variety of network elements, including digital cross-connect systems, add/drop multiplexers, optical line systems, and optical cross-connect systems. Navis™ Optical NMS is a part of a telecommunications management network that provides comprehensive and integrated management of an entire transport network.

Navis™ Optical NMS provides provisioning and maintenance management for a range of network elements supporting the following connections:

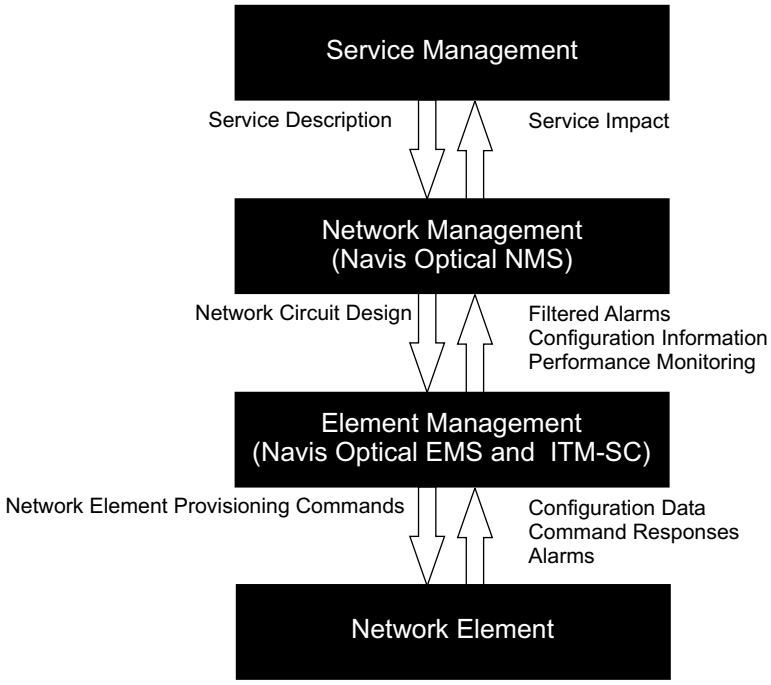
- Synchronous Digital Hierarchy (SDH) links and trails
- Synchronous Optical Network (SONET) links
- Plesiochronous Digital Hierarchy (PDH) links
- Optical layer (optical links, OCH trails, and optical multiplex sections [OMSs])

SONET is only supported as ports at the edge of the network. PDH is supported as ports at the edge of the network, and as digital links.

Lucent's family of management products

Lucent's family of management products includes service management products, network management products, and element management products.

The following figure describes the correlation between Lucent's management products and the telecommunications management network building blocks.



Capabilities

From a single operator seat, an entire network can be managed using Navis™ Optical NMS. Navis™ Optical NMS is designed to manage different numbers of network elements and features on a cost-effective combination of hardware platforms.

For a description of the network elements in the network, see Chapter 3, "Applications"

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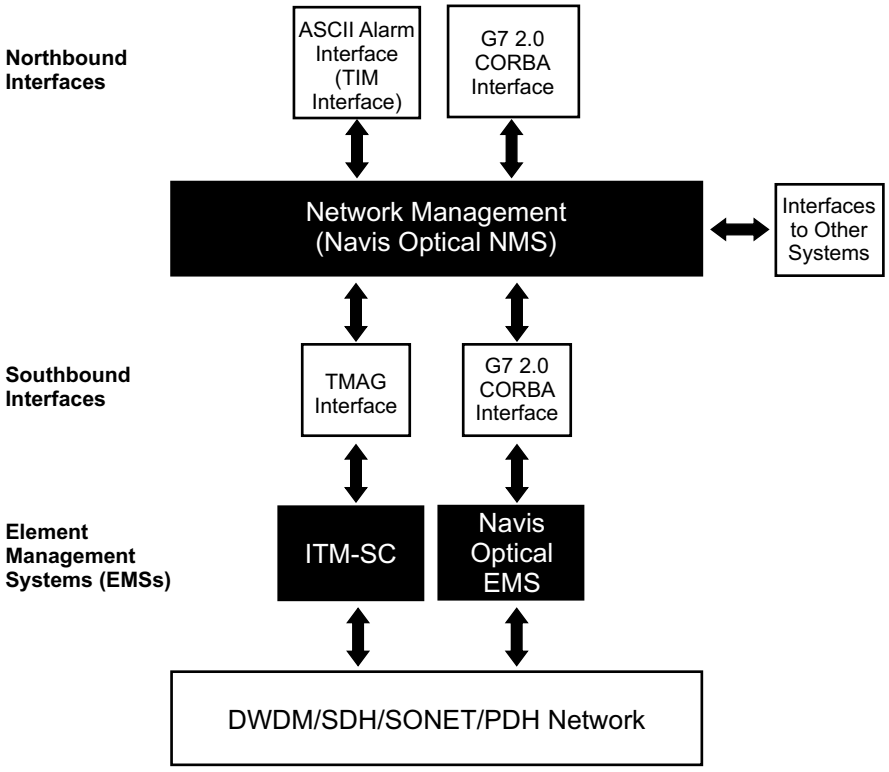
External interfaces

Introduction

The Navis™ Optical NMS interfaces are shown in the following figure.



Northbound interfaces

The following sections describe the northbound interfaces.

ASCII northbound alarm interface (TIM interface)

The ASCII northbound alarm interface is used to integrate with other-vendor and customer systems. The ASCII northbound alarm interface is also known as the TMN Integration Module (TIM) interface.

G7 2.0 CORBA interface

An interface based upon a subset of the G7 2.0 CORBA interface is used to interface to Network Fault Monitor (NFM), WaveStar® TMS, and TCM-E.

- NFM collects alarms from Navis™ Optical NMS.
- WaveStar® TMS is a transport management system that requests connection management service from Navis™ Optical NMS.
- TCM-E is Tandem Connection Monitoring Emulation system, which collects data about connections from Navis™ Optical NMS.

Southbound interfaces

Navis™ Optical NMS manages network elements through southbound interfaces to EMSs. The following sections describe the southbound interfaces.

Transport Management Application Group (TMAG)

This interface uses the Lucent proprietary TMAG information/operations messaging protocol. The communication across the interface is by G2-encoded CCP-based messages over TCP/IP.

TMAG is the interface to the following TMAG-based EMSs:

- Integrated Transport Manager-Subnetwork Controller (ITM-SC)

G7 2.0 CORBA interface to Navis™ Optical EMS

A G7 2.0 CORBA interface is provided to the following CORBA-based EMSs:

- *Navis*™ Optical Element Management System (EMS) (formerly WaveStar® SNMS)

Interfaces to other systems

Navis™ Optical NMS interacts with some other systems that supply information used to manage the network. The following sections describe the interfaces to other systems.

Performance Monitoring (PM) Export

Performance monitoring data can be exported in files periodically. The file transfer uses FTP over TCP/IP to copy files from the EMSs to a designated workstation.

Dynamic Network Analyzer (DNA)

DNA accesses the databases of Navis™ Optical NMS and the EMSs to collect data and provide reports on the network.

The applications for this product are:

- Trend analysis based on historical alarm and performance monitoring data
- Feed of inventoried resources to external inventory management system

□

Supported element management systems (EMSs)

Introduction

The networks that can be managed with Navis™ Optical NMS include a number of element management systems (EMSs).

List of supported EMSs

Navis™ Optical NMS, interacts with the following Lucent Technologies element management systems (EMSs):

- Navis™ Optical EMS, Releases 8.0 and 9.0
- Integrated Transport Manager-Subnetwork Controller (ITM-SC), 9.1 and 10.0

Important! Navis™ Optical EMS is the new name for the product formerly known as WaveStar SNMS.

Navis™ Optical EMS

Navis™ Optical EMS manages the following Lucent Technologies network elements:

- WaveStar® BandWidth Manager
- WaveStar® TDM 2.5/10G
- WaveStar® OLS 1.6T (formerly 400G)
- LambdaExtreme™ Transport
- LambdaUnite™ MultiService Switch (MSS)
- LambdaRouter™ All Optical Switch (AOS) 256
- LambdaRouter™ AOS 128
- LambdaRouter™ 1024
- Metropolis™ Enhanced Optical Networking (EON)

Important! Navis™ Optical EMS is the new name for the product formerly known as WaveStar® SNMS.

ITM-SC

ITM-SC manages the following Lucent Technologies network elements:

- WaveStar® ADM 155E
- WaveStar® ADM 4/1 STM-1 and WaveStar® ADM 4/1 STM-4
- WaveStar® ADM 16/1 and WaveStar® ADM 16/1 Compact
- WaveStar® AM 1
- WaveStar® AM 1 Plus

- WaveStar® TM 1
- WaveStar® OLS 80G
- WaveStar® DACS
- ISM-1, ISM-4, and ISM-5E
- SLM (ADM or Terminal), including regenerators
- PHASE network elements, including regenerators

About EMS cut-throughs

"Cut-through" interfaces exist to each EMS GUI. There are two types of cut-through interfaces:

- Whole EMS cut-through- The whole EMS is launched in order to perform general EMS operations. (This case is known as the Virtual Craft Interface Terminal [VCIT].)
- Specific form cut-throughs - Navis™ Optical NMS invokes specific forms provided by the EMS. These forms appear to the user as a part of Navis™ Optical NMS. An example is the available ports forms used by a Navis™ Optical NMS user to choose termination points for a connection.

Releases of network elements

Important! The information in the following table is related to Navis™ Optical NMS Release 7.0. For information on a more recent release, contact your Local Customer Support (LCS) or the support organization designated by your Lucent customer team representative. If you are unsure of who to call, contact the Global TSS Contact Center at (630)-224-4672.

The releases of the Lucent Technologies network elements that are supported by Navis™ Optical NMS are shown in the following table, and are correlated to the EMS through which they are managed:

	ITM-SC, Rel. 9.1	ITM-SC, Rel. 10.0	Navis™ Optical EMS, Rel. 8.0	Navis™ Optical EMS, Rel. 9.0
ADM 155E	V5 Maint. Release	V5 Maint. Release		
WaveStar® ADM 4/1 STM-1	V5 Maint. Release	V5 Maint. Release		
WaveStar® ADM 4/1 STM-4	V5 Maint. Release	V5 Maint. Release		
WaveStar® ADM 16/1	Release 5.1	Release 6.0		

	ITM-SC, Rel. 9.1	ITM-SC, Rel. 10.0	Navis™ Optical EMS, Rel. 8.0	Navis™ Optical EMS, Rel. 9.0
WaveStar® ADM 16/1 Compact	Release 2.0.1	Release 3.0		
WaveStar® AM 1	Release 3.1	Release 3.1		
WaveStar® AM 1 PLUS	Releases 2.1 & 2.2	Release 3.0		
WaveStar® TM 1	Release 2.2	Release 2.2		
WaveStar® OLS 80G	Release 6.0	Release 6.0		
WaveStar® DACS	Release 3.0.4	Release 3.1		
ISM-1	Releases 1.1, 2.5, 3.5	Releases 1.1, 2.5, 3.5		
ISM-4	Releases 1.1, 2.5, 3.5	Releases 1.1, 2.5, 3.5		
ISM-5E	Releases 1.1, 2.5, 3.5	Releases 1.1, 2.5, 3.5		
SLM-16	Release 5.0	Release 5.0		
SLM-4	Release 5.0	Release 5.0		
PHASE ADM 16/4	Release 5.0	Release 5.0		
PHASE ADM 4/4	Release 5.0	Release 5.0		
PHASE LXC 16/1	Release 5.0	Release 5.0		
PHASE LXC 4/1	Release 5.0	Release 5.0		
PHASE TM 16/4	Release 5.0	Release 5.0		
PHASE TM 4/4	Release 5.0	Release 5.0		
Phase LRs (Regenerators)	Release 5.0	Release 5.0		
WaveStar® BandWidth Manager			Release 4.1.2	Release 4.1.2
WaveStar® TDM 2.5/10G			Release 4.0.5	Release 4.0.5
WaveStar® OLS 1.6T (formerly 400G)			Releases 6.1, 6.0	Release 6.2

	ITM-SC, Rel. 9.1	ITM-SC, Rel. 10.0	Navis™ Optical EMS, Rel. 8.0	Navis™ Optical EMS, Rel. 9.0
LambdaUnite™ MSS			Releases 2.0 Release 2.1 (limited northbound support for EMS)	Release 2.1
LambdaRouter™ 256			Release 3.0 (GA) Release 2.0	Release 3.0
LambdaRouter™ 128			Release 2.0	Release 3.0
LambdaRouter™ 1024			-	-
Metropolis™ EON			Release 8.0.2 & 8.2	R8.0.2 After August 2002, Release 8.2/8.2
LambdaXtreme™ Transport			-	Release 1.1 (after August 2002)

Supported digital transmission rates

Overview This section discusses the digital transmission rates supported by Navis™ Optical NMS.

Table The following table shows the digital transmission rates supported by Navis™ Optical NMS.

Designation	Description	Facility Type	Transmission Rate Mb/s	Notes
STM-256	Digital Link	256S (40,000 LN)	39,813.12	
STM-64	Digital Link	64S (10,000LN)	9,953.28	
STM-16	Digital Link	16S (2500LN)	2,488.32	
STM-4	Digital Link	4S (620LN)	622.0	
STM-1	Digital Link	1S (155LN)	155.52	
STM-0	Digital Link	0S (52LN)	51.84	
VC-4	Path	VC4S	150.336	
VC-3	Path	VC3S	48.960	
VC-12	Path	VC12S	2.240	
CEPT-4	Digital Link	E4 (140LN)	139.264	
CEPT-3	Digital Link	E3 (34LN)	34.368	
CEPT-1	Digital Link	E1 (2LN)	2.048	
CEPT-4	Facility	1920N	139.264	Similar to CEPT-4 Circuit
CEPT-3	Facility	480N	34.368	Similar to CEPT-3 Circuit
CEPT-4	Circuit	1920N	139.264	
CEPT-3	Circuit	480N	34.368	
CEPT-1	Circuit	30N	2.048	
DS3	Digital Link	45LN	44.736	
DS3	Circuit	672N	44.736	
DS1	Digital Link	1.6LN	1.544	
DS1	Circuit	24N	1.544	
LAN8	Digital Link		up to 4 VC-12s	Digital Link

Designation	Description	Facility Type	Transmission Rate Mb/s	Notes
E-link	Includes Digital Link, Fast Ethernet, Gb Ethernet, 10Gb Ethernet, LSBB, HSBB, UBB, ELSBB			WaveStar ADM 16/1, WaveStar® ADM 16/1C, WaveStar® AM 1, WaveStar® AM 1 Plus, WaveStar® TDM 10G, LambdaUnite MultiService Switch
X.21	Digital Link		2 Mb/s	WaveStar® AM 1, Black Boxes only

Supported digital links

Introduction

The networks that can be managed with Navis™ Optical NMS include a variety of digital links.

About digital links

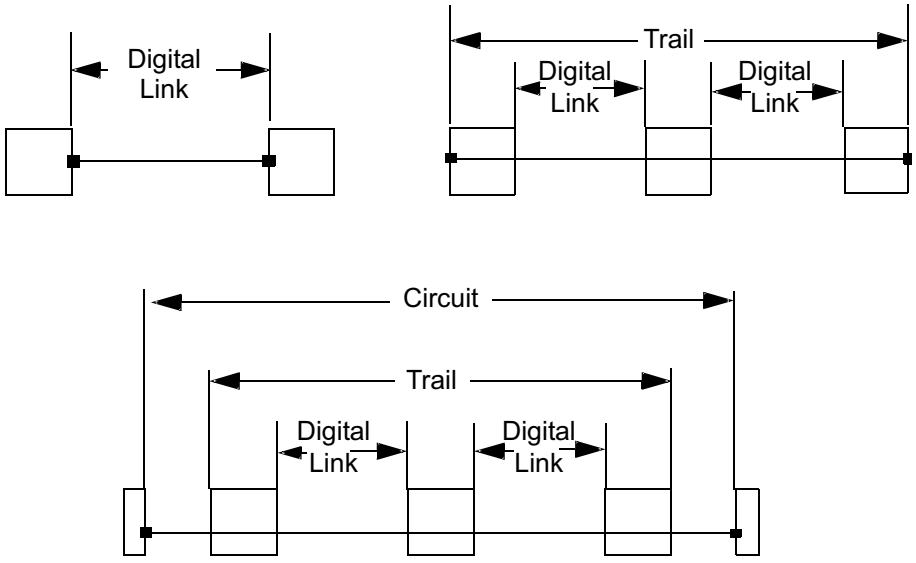
Digital links are fiber or electrical connections between two points. These transport facilities are assignable to high-order and low-order circuits to carry customer services. Digital links can be of two types: SDH digital links or PDH digital links.

SDH digital links connect two SDH network elements or an SDH network element and a black box or equipment.

PDH digital links are either of the following:

- Asynchronous connections between two PDH ports of the network elements assignable to the PDH circuits
- Asynchronous connections between an SDH network element and a black box or equipment

The following figure shows an example of the relationship among digital links, trails, and circuits.



List of supported digital links

The supported digital links for each Lucent Technologies network element supported by Navis™ Optical NMS are shown in the following table.

NE	STM256	STM64	STM16	STM4	STM1	STM0	2.5G18	E4	E3	E1	DS3	DS1	LAN8[a] (a.k.a. TransLAN)	E_LINK[d]	X.21	FCT
WaveStar® ADM155E	-	-	-	-	Y	-	-	-	Y	Y	Y	-	-	-	-	-
WaveStar® ADM4/1STM-1	-	-	-	-	Y	-	-	-	Y	Y	Y	-	-	-	-	-
WaveStar® ADM4/1STM4	-	-	-	Y	Y	-	-	-	Y	Y	Y	-	-	-	-	-
WaveStar® ADM16/1	-	-	Y	Y	Y	-	-	Y	Y	Y	Y	Y	Y	Y	-	-
WaveStar®ADM 16/1 Compact	-	-	Y	Y	Y	-	-	-	Y	Y	Y	-	-	Y	-	-
WaveStar® AM1	-	-	-	-	Y	-	-	-	Y	Y	Y	-	Y	Y	Y[b]	-
WaveStar® AM1 PLUS - STM1	-	-	-	-	Y	-	-	-	Y	Y	Y	Y	-	Y	Y[c]	-
WaveStar® AM1 PLUS - STM4	-	-	-	Y	Y	-	-	-	Y	Y	Y	Y	-	Y	Y[c]	-
WaveStar® TM1	-	-	-	-	Y	-	-	-	-	Y	-	-	-	-	-	-
WaveStar® BWM	-	Y	Y	Y	Y	-	-	-	-	-	Y	-	-	-	-	-
WaveStar® TDM10G	-	Y	Y	Y	Y	-	-	-	-	-	-	-	-	Y	-	-
LambdaUnite™ MSS	-	Y	Y	Y	Y	-	-	-	-	-	-	-	-	Y	-	-
WaveStar®D&CS (via SC)	-	-	Y	Y	Y	-	-	-	-	-	-	-	-	-	-	-
Black Box/EQPT	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ISM-1	-	-	-	-	Y	-	-	-	Y	Y	-	-	-	-	-	-
ISM-4	-	-	-	Y	Y	-	-	Y	Y	Y	-	-	-	-	-	-
ISM-5E	-	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	Y
SLM-16	-	-	Y	-	Y	-	-	Y	-	-	-	-	-	-	-	-
SLM-4	-	-	-	Y	Y	-	-	Y	-	-	-	-	-	-	-	-
PHASE ADM-16/4	-	-	Y	Y	Y	-	-	Y	Y	Y	Y	-	-	-	-	-
PHASE ADM-4/4	-	-	-	Y	Y	-	-	Y	Y	Y	Y	-	-	-	-	-
PHASE LXC-16/1	-	-	Y	Y	Y	-	-	Y	Y	Y	Y	-	-	-	-	-
PHASE LXC-4/1	-	-	-	Y	Y	-	-	Y	Y	Y	Y	-	-	-	-	-
PHASE TM-16/4	-	-	Y	Y	Y	-	-	Y	Y	Y	Y	-	-	-	-	-
PHASE TM-4/4	-	-	-	Y	Y	-	-	Y	Y	Y	Y	-	-	-	-	-
CityLink (a.k.a. NERA Radio)	-	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	-

a. Back-to-back LAN8 digital link is not supported. That is LAN8 digital link between ADM16/1 or AM1 network element with a LAN card is not allowed. The only LAN8 digital link supported is between a network element a Black Box.
b. Back-to-back X.21 digital links are not supported. The only X.21 digital link supported is between a AM1 and a Black Box.
c. Back-to-back X.21 digital links are not supported. The only X.21 digital link supported is between a AM1 plus and a Black Box.
d. E_LINK includes Gb Ethernet and TransLAN+ [14]. Back-to-back E_LINK digital links are not supported. The only E_LINK digital link supported is between a supported NE and a Black Box .

Supported SDH cross-connect types and rates

Introduction

The networks that can be managed with Navis™ Optical NMS include a variety of SDH cross-connect types and rates.

List of supported SDH cross-connect types and rates

The following table lists rates at which the cross-connect types are supported for one-way (O), two-way (T), and broadcast (B) circuits by Navis™ Optical NMS. The network element by itself may support more rates than are supported with Navis™ Optical NMS.

The SDH cross-connect types and rates for each network element supported by Navis™ Optical NMS are shown in the following table:

	VC4-64c	VC4-16c	VC4-4c	VC-4	VC-3	VC-2	VC-12	AU-3
WaveStar®ADM 155E	-	-	-	T	O, T, B	-	T	-
WaveStar® ADM 4/1 STM-1	-	-	-	T	O, T, B	-	T	-
WaveStar® ADM 4/1 STM-4	-	-	-	T	O, T, B	-	T	-
WaveStar® ADM 16/1	-	-	T	T	T	-	T	-
WaveStar® ADM 16/1 Compact	-	-	T	T	T	-	T	-
WaveStar® AM 1	-	-	-		T	-	T	-
WaveStar® AM 1 PLUS	-	-	-	T	T	-	T	-
WaveStar® TM 1	-	-	-	-	-	-	T (fixed)	-
WaveStar® BandWidth Manager	-	O, T, B	O, T, B	O, T, B	-	-	-	O, T, B
WaveStar® TDM 2.5/10G	-	O, T, B	O, T, B	O, T, B	-	-	-	O, T, B
LambdaUnite™ MSS (Release 2.1)	O, T, B	O, T, B	O, T, B	O, T, B	-	-	-	O, T, B
WaveStar® DACS	-	-	O, T, B	O, T, B	O, T, B	-	O, T, B	O, T, B
Black Box	O, T, B	O, T, B	O, T, B	O, T, B	O, T, B	T	O, T, B	O, T, B

	VC4-64c	VC4-16c	VC4-4c	VC-4	VC-3	VC-2	VC-12	AU-3
Equipment	O, T, B	O, T, B	O, T, B	O, T, B	O, T, B	T	O, T, B	O, T, B
ISM-1	-	-	-	T	O, T, B	-	T	-
ISM-4	-	-	-	T	O, T, B	-	T	-
ISM-5E	-	-	-	-	-	-	T	-
SLM-16	-	-	-	T	-	-	-	-
SLM-4	-	-	-	T (fixed)	-	-	-	-
PHASE ADM 16/4	-	-	O, T, B	O, T, B	-	-	-	-
PHASE ADM 4/4	-	-	-	O, T, B	-	-	-	-
PHASE LXC 16/1	-	-	-	O, T, B	O, T, B	T	O, T, B	-
PHASE LXC 4/1	-	-	-	O, T, B	O, T, B	T	O, T, B	-
PHASE TM 16/4	-	-	O, T, B	O, T, B	-	-	-	-
PHASE TM 4/4	-	-	-	O, T, B	-	-	-	-

Supported SNCP protection

Introduction

The networks that can be managed with Navis™ Optical NMS include a variety of SNCP protection.

List of supported SNCP protection

The following table lists the rates at which SNCP protection is supported for one-way (O), two-way (T), and broadcast (B) circuits in Navis™ Optical NMS. The network element by itself may support more rates than are supported with Navis™ Optical NMS.

The rates at which the SNCP cross-connects are supported by Navis™ Optical NMS are shown in the following table:

	VC4-64c	VC4-16c	VC4-4c	VC-4	VC-3	VC-2	VC-12	AU-3
WaveStar® ADM 155E	-	-	-	T	O, T, B	-	T	-
WaveStar® ADM 4/1 STM-1	-	-	-	T	O, T, B	-	T	-
WaveStar® ADM 4/1 STM-4	-	-	-	T	O, T, B	-	T	-
WaveStar® ADM 16/1	-	-	T	T	T	-	T	-
WaveStar® ADM 16/1 Compact	-		T	T	T	-	T	-
WaveStar® AM 1	-	-	-	-	T	-	T	-
WaveStar® AM 1 PLUS	-	-	-	T	T	-	T	-
WaveStar® TM 1	-	-	-	-	-		T (fixed)	-
WaveStar® BandWidth Manager	-	O, T, B	O, T, B	O, T, B	-	-	-	O, T, B
WaveStar® TDM 2.5/10G	-	O, T, B	O, T, B	O, T, B	-	-	-	O, T, B
LambdaUnite MSS	O, T, B	O, T, B	O, T, B	O, T, B	-	-	-	O, T, B
WaveStar® DACS	-	-	O, T, B	O, T, B	O, T, B	-	O, T, B	O, T, B
Black Box	O, T, B	O, T, B	O, T, B	O, T, B	O, T, B	T	O, T, B	O, T, B

	VC4-64c	VC4-16c	VC4-4c	VC-4	VC-3	VC-2	VC-12	AU-3
Equipment	-	-	-	-	-	-	-	-
ISM-1	-	-	-	T	O, T, B	-	T	-
ISM-4	-	-	-	T	O, T, B	-	T	-
ISM-5E	-	-	-	-	-	-	T	-
SLM-16	-	-	-	T	-	-	-	-
SLM-4	-	-	-	T (fixed)	-	-	-	-
PHASE ADM 16/4	-	-	O, T, B	O, T, B	-	-	-	-
PHASE ADM 4/4	-	-	-	O, T, B	-	-	-	-
PHASE LXC 16/1	-	-	-	O, T, B	O, T, B	T	O, T, B	-
PHASE LXC 4/1		-	-	O, T, B	O, T, B	T	O, T, B	-

Benefits

Introduction

The benefits delivered by Navis™ Optical NMS include fast service activation, state-of-the-art provisioning, reduced operating and equipment costs, accurate record keeping, fault and performance monitoring, and fast problem resolution.

These benefits enable service providers to capture market share and offer an improved level of service to customers, and to efficiently manage their resources.

List of benefits

Navis™ Optical NMS provides service providers with the ability to:

- Manage multi-technology SDH equipment
- Perform end-to-end SDH circuit provisioning (using automatic, partial, and manual routing)
- Perform end-to-end DWDM optical channel provisioning (using automatic, partial, and manual routing)
- Assure service survivability with ring management and Preplan Restoration
- “Single-seat” control of the network
- Management of all EMSs in the network
- Protect network circuits using service protection and Preplan Restoration
- Simplify operational complexity using the user-friendly graphical user interface (GUI)
- Maximize bandwidth utilization with flexible provisioning options and scheduled path provisioning features
- Monitor and maintain service quality using performance monitoring
- Engineer cost-effectiveness by using scalable platforms to effectively support different network sizes
- Maintain access security and establish a hierarchy of access levels
- Activate flexible network partitioning by establishing service domains and geographic domains
- Implement various levels of hardware redundancy

Customer support

Navis™ Optical NMS customers are provided with responsive field support, effective user documentation, and high-quality product training.

□

What's new in this release of Navis™ Optical NMS?

Introduction

Each release of Navis™ Optical NMS includes a number of new features and feature enhancements.

Highlights of releases

The list of what is new in each release of Navis™ Optical NMS can be displayed from the product software. To display this list, follow this access path:

- From the Network Map, select,
  Help > Feature Content
  A browser window opens and the list of new features for the current release of Navis™ Optical NMS displays.

□

2 Features

Overview

Purpose

This chapter describes the features of Navis™ Optical NMS, broken down by functional area. The chapter also describes the Navis™ Optical NMS interfaces.

Contents

Features per functional area

Overview

Purpose

The features of Navis™ Optical NMS are classified into several functional areas. This chapter gives a description of these features within each functional area.

Contents

User support facilities

Introduction

Navis™ Optical NMS provides a number of capabilities to facilitate the task of managing network elements.

Graphical user interface (GUI)

Navis™ Optical NMS supports the user in his/her daily operations with an easy-to-use graphical user interface (GUI).

Network Map

The main feature of the GUI is a Network Map on which all the network elements and links within the domain of Navis™ Optical NMS are displayed. Network elements and links are colored to show the highest severity alarm occurring. The country map that is the background of the Network Map can be changed by the system administrator.

Other user support facilities

Navis™ Optical NMS has the following user support facilities:

- Navis™ Optical NMS is capable of handling up to 64 simultaneous user logins.
- Screen help is provided for each form.
- On-line access to the product documentation set is integrated into the Navis™ Optical NMS software.
- Help facilities (context-sensitive) are supported. Help texts contain context-sensitive hyperlinks.
- A user log provides a record of all operations made by a user. It can be viewed by that user and by the administrator.

□

Security issues

Introduction

Navis™ Optical NMS security management allows authorized users to have different levels of access.

For each user, Navis™ Optical NMS stores a login ID, password, user type, and user profile.

Controlling access

Only authorized users with correct login ID/password combinations are able to access Navis™ Optical NMS.

User type

Every user is assigned a user type.

The user type is one of the following:

- Service domain user: For users that are using the optional feature service domain partitioning
- Geographic domain user: For users that are using the optional feature geographic domain partitioning
- Regular user: For all other users

User profile

The user profile controls which of the task groupings a user is allowed to perform. A user can be assigned more than one user profile.

Task groupings

There are 12 task groupings that can be assigned to a user profile.

1. Fault Management
2. Configuration Management
3. Performance Monitoring
4. NE Management
5. Sys Admin
6. Pre-plan Management
7. Fault Management (View Only)
8. Configuration Management (View Only)
9. Performance Monitoring (View Only)
10. Pre-plan Management (View Only)
11. Service Domain Admin
12. Geo Domain Admin

Predefined user profiles

There are six predefined user profiles:

User profile	Allowed task groupings
Service Domain User	This profile provides user-level access to the aspects of the following task groupings that relate to service domains: • Fault Management • Performance Monitoring • Pre-plan Management
Geo Domain User	This profile provides user-level access to the aspects of the following task groupings that relate to geographic domains: • Fault Management • NE Management • Performance Monitoring • Pre-plan Management
Initial	This profile provides access to the following task groupings: • Fault Management • Configuration Management • Performance Monitoring • NE Management • Pre Plan Management
Alarm Management	This profile provides access to the following task groupings: • Fault Management
Provisioning (View Only)	This profile provides access to the following task groupings: • Configuration Management (View Only)
Combined	This profile provides access to the following task groupings: • All Tasks

Customized user profiles

The system administrator can create and assign additional user profiles that are customized to meet the specific needs of their network.

Default behavior

By default, all new users are assigned to the Initial user profile.

Other security features

Features and tasks that are not available to a user are grayed-out.

If a terminal with an active Navis™ Optical NMS session experiences a period of inactivity, the terminal is locked. It can be unlocked by entering the password of the current user.

□

Configuration management

Introduction

Navis™ Optical NMS provides configuration management capabilities and features that are supported by a user-friendly GUI. From the Network Map, a user can complete all the steps needed for end-to-end provisioning, implementation, and record keeping of optical channels, and SDH digital links, paths, and circuits. In addition, automatic circuit/path provisioning using a powerful auto-router algorithm is provided.

Digital link provisioning

Using Navis™ Optical NMS, digital links are provisioned using a form accessed from the Network Map.

Digital link provisioning is accomplished by providing the following information on the form:

1. The desired transmission rate of the digital link
2. The two endpoint nodes of the digital link
3. The two endpoint port address of the digital link (Port address information can either be entered manually or it can be obtained using a context-sensitive cut-through to the appropriate EMS where the user can graphically select the desired ports.)

Path and circuit provisioning

Using Navis™ Optical NMS, paths and circuits are provisioned using a form accessed from the Network Map.

Path and circuit provisioning can only be done after digital links are in place.

Path and circuit provisioning is accomplished by providing the following information on the form:

1. The desired path level (for example, VC-12 or VC-4). Navis™ Optical NMS displays only those path levels that can be supported by all the digital links involved.
2. The two endpoint nodes of the path or circuit

Three modes for path and circuit provisioning

Navis™ Optical NMS provides three modes for path and circuit provisioning: Automatic, Partial, or Manual. The default is Automatic.

For one-way and broadcast paths, only manual route selection is allowed .

- Automatic: The automatic mode provides the most assistance to the user. The user specifies the A-Port and the Z-Port. The system finds the route automatically, based on the available spare capacity between specified points. For auto-ring-protected paths, it is a requirement that the same channels must be used on all of the segments of the path. For line-switched rings, the system attempts to fill up lower channels around the ring first before attempting to use the next channels within a segment. The user can modify the system's recommendations before the route is committed and implemented. Nothing is changed in the network until the user has provided confirmation.
- Partial: The partial mode allows the user to select the link along the path, and optionally, to additionally specify a channel along the path. At a minimum, each link along the path must be specified. In this case, the system selects the channel on each facility.
- Manual: The manual mode provides the most flexibility and works best for Open_Ended_Z paths that are provisioned using one PDH port and two SDH ports on the same network element. In addition to specifying the A/Z Location and the port, the user specifies each link and channel along the path.

One-Step Combo Circuit Provisioning of SDH paths terminating on PDH ports

Traditionally, circuit provisioning of SDH paths terminating on PDH ports involves two operations:

1. provisioning of the SDH cross-connects
2. provisioning a CEPT circuit

One-Step Combo Circuit Provisioning allows a Navis™ Optical NMS user to select a combo circuit, create a path, apply the PDH parameters, and put PDH ports in-service, all in one operation.

This feature allows a 24N, 30N, 480N, 672N, or 1920N circuit/path to be provisioned without an explicit provisioning of a TU12-VC11S, VC-12, VC-3, AU3S, or VC-4 path, respectively.

Scheduled Provisioning

The Navis™ Optical NMS Scheduled Provisioning feature provides the capability to accept customer requests for services to be turned up at a

future date. Order and layout data are entered into Navis™ Optical NMS at the time the request is received from the customer. At this time, Navis™ Optical NMS validates the order and layout data and stores the information in the database, but it does not “reserve” the requested resources. At the designated date and time, the system automatically implements the circuit/facility (that is, sets up the port parameters and/or cross-connections). After the completion of the implementation, the user is able to perform required testing.

□

Network-level facilities

Introduction

The network-level facilities include:

- Network element control and resource management
- Reports management

Network element control and resource management

Support of all Lucent Technologies SDH/SONET and optical DWDM network elements is provided through the EMSs.

All network elements are managed with synchronized network element equipage and status information.

Resource management of ITM-SC-controlled and Navis™ Optical EMS-controlled network elements is provided through a “cut-through” from the Navis™ Optical NMS to the ITM-SC and Navis™ Optical EMS interfaces.

Reports management

Navis™ Optical NMS can provide on-demand, predefined reports containing summary and analysis data. These reports complement the information that is presented on the Network Map, on the forms, and in the dialog boxes.

□

Fault management

Introduction

The status together of all components in the network must be closely monitored to anticipate possible degradation of the services, and to react as quickly and adequately as possible to failures. Fault management encompasses the handling of alarms and events.

Navis™ Optical NMS includes powerful alarm handling tools that provide alarm notification, fault isolation, failed-facility and affected circuit identification, and alarm logs.

Two modes

The fault management system may be set to operate in one of two modes: alarm mode and service mode.

- Alarm mode focuses on management from the Alarm List.
- Service mode focuses on management from Traffic Correlated Alarm List.

The mode used is set as an installation option.

Alarm filtering by domains

In a network that uses geographic domain partitioning or service domain partitioning, alarms are filtered so that only the alarms for the user's domain are presented on the Alarm List.

Network event summaries

Network event summaries provide:

- A summary of alarms for the network, including counts of events by alarm state and other breakdowns
- Alerts for new alarms
- Display of most recently received alarms at base of window

Different network event summaries are provided for the alarm mode and for the service mode.

The network event summaries offer these features:

- A versatile presentation that can be customized by hiding and expanding counts and alarm displays
- Filtered access to Alarm List and Traffic Correlated Alarm List
- Access to complete Alarm List and Traffic Correlated Alarms List

Alarm List

The Alarm List provides:

- A combined list of all network, EMS, and network element alarms
- The ability to filter the Alarm List manually or automatically
- A record of instantaneous, as well as persistent, alarms
- Details of each alarm

The user may:

- Acknowledge one or more selected alarms
- Create trouble ticket(s) for selected alarm(s)
- Attach an additional alarm to an existing trouble ticket
- Configure on-line suppression of secondary alarms

In the service mode, correlated alarms cannot be acknowledged or assigned to a trouble ticket.

Traffic Correlated Alarms List

The Traffic Correlated Alarms List provides the following information:

- Alarms that affect traffic are correlated to network objects.
- Alarms are classified as internal or external to management domain.
- In addition to trails, alarms may be correlated to:
  - network element and port (failure on network boundary)
  - network element and card (equipment failure with traffic impact)
- For each alarm, both Fault State and Service Impact are provided.
- Users may configure on-line suppression of secondary faults.
- Customer priority field shows highest priority of the failed client services, and alarms can be sorted by customer priority.

Fault state determination

If an alarm correlates to a trail, a fault state for that trail and its client trails (trails carried by the alarmed trail) is calculated. Fault state is determined using a real-time calculation.

Fault state has the following characteristics:

- Takes account of protection (Multiplex Section Protection [MSP], Multiplex Section-Shared Protection Ring [MS-SPRING], and Subnetwork Connection Protection [SNCP])
- Assumes protection switching is successful and uses end port alarms to identify unsuccessful attempts
- A failed fault state is propagated to client trails, and a degraded fault state is not. For example, if the fault state of a trail becomes failed, the fault states of all of its client trails also become failed. However, if the fault state of a trail becomes "degraded," the fault states of its client trails remain working (unless affected by another failure).
- Propagates from optical to SDH layers

Fault state values are: Failed, Degraded, and Working.

Service impact

Service impact is assessed based on the fault state of all client services.

Where there are failed client services, the service impact is the worst-case fault state value.

Service Impact values are: Failed, Degraded, No Services, and Calculating

Calculating value is possible where there are many clients.

Where the failed connection in the Traffic Correlated Alarms List is itself, the fault state and service impact values are the same.

Repeated Alarm List

Repeated alarms are marked on the Alarm List with a repeat alarm flag. The Repeated Alarm List is accessed by clicking on this flag.

The Repeated Alarm List does the following:

- Shows details of previous occurrences with the same probable cause and source
- Allows identification of transient alarms

Trouble ticket

Trouble ticketing is available for alarms (in addition to Traffic Correlated Alarms List records).

Trouble tickets have the following characteristics:

- Multiple alarms can be associated with a single trouble ticket.
- An owner can be assigned to resolve the trouble ticket.
- The trouble ticket exists until the associated alarms or Traffic Correlated Alarms List records are deleted (made historic).
- Users may delete trouble tickets.

Generic filtering and sorting

The following filtering options are provided:

- There is an unlimited number of filter keys.
- Filtering is provided for any value of most displayed fields.
- Filtering is provided on user-entered search string.

The following sorting options are provided:

- There is an unlimited number of sort keys.
- Any field may be selected for sorting.
- Sorting may be in ascending or descending order, as specified by the user.

Alarm log

The Alarm Log displays historic records of alarms.

The Alarm Log includes:

- Two views: service and alarm
- Options to print, export, and archive
- Full filtering and sorting facilities (However, there is a restriction on the number of records that can be displayed.)
- Configurable size for alarm storage

When the number of historic records approaches the limit, an alarm is raised.

□

Performance monitoring

Introduction

Performance monitoring specifies continuous monitoring of termination points within SDH equipment. This enables the system administrator to:

- initiate proactive maintenance by spotting performance degradation
- precisely monitor the quality of the end-to-end paths

Monitored events

The different events that can be distinguished are described in the following table.

Event	Indicates that ...
Errored Seconds (ES)	A one second period with one or more errored blocks
Severely errored seconds (SES)	A one second period with more than 30% errored blocks
Unavailability seconds (UAS)	Seconds of unavailability time (10 or more consecutive SES gives UAS)
Background Block Errors (BBE)	An errored block not occurring as part of an SES

Performing monitoring features

The performance monitoring features include:

- The user can specify which counts (15-minute bins or 24-hour bins) are to be taken from which transport facilities (for example, VC-12 or MS) for which network element.
- In case the association between Navis™ Optical NMS and the network element fails, Navis™ Optical NMS regains information about the lost time by reading the network element's bins for the relevant interval.
- Navis™ Optical NMS supports performance monitoring as provided by the particular SDH network elements. This includes ES, SES, UAS and BBE parameters for VC-12, VC-3, VC-4, MS, and RS termination points.
- The Navis™ Optical NMS performance data log provides a minimum capacity of up to 31 days for the 24-hour bins and 24 hours for the 15-minute bins.
- Performance collecting can be enabled/disabled by the user.

- Inspection of snapshots of counts can be done via current registers.
- The user can print completed performance monitoring reports in tabular and graphical format. In this way, the user may easily spot trends in performance behavior.
- The user may select one or two termination points for viewing or printing. Depending on the termination point type, the user may select up to a maximum of four counters (the counters available depend on the termination point type). The information can be displayed in a tabular form or in a graphical form. The display/print covers 31 days for the 24-hour bins and 24 hours for the 15-minute bins.
- Performance monitoring data can be written to tape in ASCII form.
- Navis™ Optical NMS stores historical performance monitoring data only, although it can retrieve and present current bin performance monitoring data in user reports. The historical performance monitoring data is retrieved periodically from the network element.

Performance monitoring measurements

Performance monitoring is based on measurements taken on blocks being transported through the network (where a block is a number of consecutive bits). An error event inside a block can be discovered by applying inherent Error Detection Code (for example, Bit Interleaved Parity [BIP]). If an error event occurs in the block, an errored block will be counted.

□

Other features

Introduction

This section describes some of the other features of Navis™ Optical NMS.

Improper disconnects and uncorrelated cross-connects

This feature identifies improper disconnects and uncorrelated cross-connects in the network. Navis™ Optical NMS does not initiate any action against improper disconnects and uncorrelated cross-connects, but identifies them in case the user would like to correct them.

Improper disconnects

Improper disconnect occurs when a channel associated with an in-effect cross-connect is disconnected or rearranged outside of Navis™ Optical NMS. The Navis™ Optical NMS layout does not match the actual cross-connects on the network element. This is detected in the Navis™ Optical NMS when one of the channels associated with cross-connect in the layout has been disconnected.

Uncorrelated cross-connects

Uncorrelated cross-connects occur when a cross-connection is found on the network element that was not requested by Navis™ Optical NMS. Navis™ Optical NMS, therefore, does not know of the existence of this new cross-connection that was established.

Multiplex Section Protection (MSP)

Multiplex Section Protection (MSP) consists of two types of digital link protection schemes:

- 1x1 MSP
- 1+1 MSP

1x1 MSP

1x1 MSP provides a dedicated protection line. This protection line remains idle until it is needed, and it can be assigned to carry extra, unprotected traffic which is preempted in the event of a fault and the MSP switching takes place.

1x1 MSP is primarily used as part of a span in a 4-fiber MS-SPRING. The Protection Digital Link must be created first and associated with the Protection Group ID before any of the service digital links are created.

1+1 MSP

1+1 MSP provides a dedicated protection line that carries a duplicated traffic signal. The ports terminating the service traffic line and the protection line carrying the duplicated signal have a provisioned relationship on the node.

□

Optional features

Overview

Purpose

The Navis™ Optical NMS application has optional features that can be enabled when the system is initially installed, or they can be enabled at a later date. Optional features are also known as “licensable features,” because they are sold separately and each have their own license key.

This section describes the optional features.

Contents

Simplified geographic redundancy

Definition

Geographic redundancy provides site protection by maintaining a primary server and a standby server in separate locations and ensuring that the two servers are far enough apart so that natural disasters or adverse weather conditions cannot affect the primary and standby servers at the same time. The database of the standby server is maintained as a copy of the primary server. If the primary server fails, the standby server automatically starts Navis™ Optical NMS to restore the availability of the application.

There are two types of geographic redundancy:

- simplified
- full

The two types of geographic redundancy differ in the frequency of database updates from the primary server to the standby server.

Functional description

Simplified Geographic Redundancy uses nightly backups to update the database of the standby server.

□

Full geographic redundancy

Definition

Geographic redundancy provides site protection by maintaining a primary server and a standby server in separate locations and ensuring that the two servers are far enough apart so that natural disasters or adverse weather conditions cannot affect the primary and standby servers at the same time. The database of the standby server is maintained as a copy of the primary server. If the primary server fails, the standby server automatically starts Navis™ Optical NMS to restore the availability of the application.

There are two types of geographic redundancy:

- simplified
- full

The two types of geographic redundancy differ in the frequency of database updates from the primary server to the standby server.

Functional description

Full Geographic Redundancy uses a dedicated link between the primary and standby servers to update the database of the standby server every 30 minutes.

□

Preplan Restoration

Definition Preplan Restoration allows a dedicated backup route to be specified for paths and circuits.

When Preplan Restoration is used, a disrupted circuit is temporarily rerouted on an alternate route to restore service. The restoration process is triggered manually or automatically by an alarm. Once the alarm situation is resolved, the restored circuit can be manually reinstated to its original route.

□

Performance Monitoring (PM) Export

Definition Performance Monitoring (PM) Export allows performance-monitoring information to be stored in a predefined data file. Users with the appropriate privileges can remotely access this data file and use it for a variety of purposes.

□

Geographic domain partitioning

Definition Geographic Domain Partitioning allows a network to be partitioned into geographic domains. A geographic domain is a partition of the network that is defined to include a group of network elements.

Access to the geographic domains can be controlled on a per-user basis.

□

Service domain partitioning

Definition Service Domain Partitioning allows a network to be partitioned into service domains. A service domain is a partition of the network that is defined to include a subset of a network's link connections (channels) and physical ports and their derived connectivity.

Access to the service domains can be controlled on a per-user basis.

□

ASCII Northbound Alarm Interface

Definition The ASCII northbound alarm interface is an optional interface.

The ASCII northbound alarm interface is used to integrate with other-vendor and customer systems. The ASCII northbound alarm interface is also known as the TMN Integration Module (TIM) interface.

□

Northbound G7 2.0 CORBA interface

Definition An interface based upon a subset of the G7 2.0 CORBA interface is used to interface to NFM, WaveStar® TMS, and TCM-E.

- NFM is Network Fault Monitor, which collects alarms from the Navis™ Optical NMS.
- WaveStar® TMS is a transport management system that requests connection management service from Navis™ Optical NMS.
- TCM-E is Tandem Connection Monitoring Emulation system, which collects data about connections from Navis™ Optical NMS.

□

Local redundancy

Definition Local redundancy protects against failure of a server.

For Navis™ Optical NMS, the form of local redundancy that is offered is MC/ServiceGuard.

MC/ServiceGuard is a Hewlett-Packard software package that provides a standby for a primary server. The database is maintained in a dual-ported disk system so that it is available to both the primary and standby servers. The primary server and the standby server are identically configured. If the primary server fails, the standby server automatically boots up and takes over.

□

Strategies for ensuring high-availability

Overview

Purpose

Many customers use Navis™ Optical NMS in a network where a high degree of system availability is a necessity. This section describes the high-availability strategies that can be used with Navis™ Optical NMS to protect against system downtime.

Four high-availability strategies

There are four high-availability strategies:

- Uninterruptible Power Supply (UPS)
- Mirrored disks
- Local redundancy
- Geographic redundancy

Contents

Uninterruptible Power Supply (UPS)

Description An Uninterruptible Power Supply (UPS) protects against power failures. It is used to protect the server hardware, client hardware, and their essential peripherals from minutes of power failure. In the case of a longer power loss, the UPS enables the system to shut down gracefully.

When to use The use of UPS is recommended in all cases. However, due to the site-specific nature of power requirements, it is not a mandatory requirement.

□

Mirrored disks

Description

Mirrored disks protect against disk failures. When mirrored disks are used, all data is written to two disk systems. In the event of a disk failure, no data is lost and there is no interruption of system operation at the time of the disk failure. The damaged disk will need to be replaced, which may require a system shutdown, but this can be done as part of scheduled maintenance and will not cause any unexpected downtime.

When to use

Mirrored disks are mandatory when the following server hardware configurations are used:

- Local redundancy
- Geographic redundancy

□

Local redundancy

Description

Local redundancy protects against failure of a server.

For Navis™ Optical NMS, the form of local redundancy that is offered is MC/ServiceGuard.

MC/ServiceGuard is a Hewlett-Packard software package that provides a standby for a primary server. The database is maintained in a dual-ported disk system so that it is available to both the primary and standby servers. The primary server and the standby server are identically configured. If the primary server fails, the standby server automatically boots up and takes over.

When to use

Local redundancy is only used in networks supporting the “large” application. The standard applications for Navis™ Optical NMS are described in Chapter 3, “Applications”.

□

Geographic redundancy

Description Geographic redundancy is an optional software feature that provides site protection by allowing for use of a primary and a standby server in separate locations.

When to use Geographic redundancy is an optional software feature that can be used in networks supporting the “small,” “medium,” or “large” applications. The standard applications for Navis™ Optical NMS are described in Chapter 3, “Applications”.

For more information For more information about geographic redundancy in Navis™ Optical NMS, see “Optional features” (2-20), in Chapter 2, “Features”.

□

Using high-availability strategies in combination

Introduction Multiple high-availability strategies can be used in combination.

Guidelines Consider the following guidelines before implementing high-availability strategies:

- UPS used together with Local Redundancy is supported. However, UPS-initiated system shutdown is disabled since it could interfere with the MC/ServiceGuard protection.
- Systems using Local Redundancy or Geographic Redundancy must also use Mirrored Disks. This relatively inexpensive and simple measure will deal with many failed cases without interruption of system operation.
- Local redundancy used together with Geographic Redundancy (either type) is not supported in this release.

□

3 Applications

Overview

Purpose

This chapter describes the applications for Navis™ Optical NMS in the network.

Contents

Standard applications

Overview

Purpose

This section describes the applications for Navis™ Optical NMS.

Since Navis™ Optical NMS is a network management system, it is always deployed in connection with communicating element management systems; particularly those of Lucent Technologies, that is, Navis™ Optical EMS and ITM-SC.

Contents

Standard applications

Introduction

Standard applications have been defined for Navis™ Optical NMS.

These applications are used to define the hardware platforms for each application.

The hardware platforms for each application are described in Chapter 4, “Hardware Platforms”.

List of applications

The standard applications are:

- Small: The small application is a small-scale application.
- Medium: The medium application is a medium-scale application.
- Large: The large application is a large-scale application.

Applications hardware solutions

The following table lists the hardware solutions for the types of applications.

Type of Application	Maximum NEQ	Maximum Physical Network Elements	Maximum EMSs	Maximum Concurrent NMS Users
Small	500	750	5	32
Medium	2000	2500	20	32
Large	5000	5000	40	64

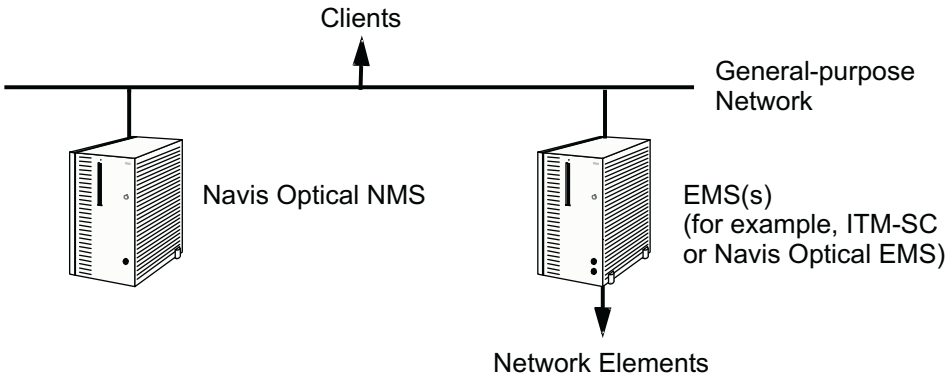
The hardware required for a Navis™ Optical NMS server depends upon the size of the network to be managed. The network size is measured using a unit called Network Element Equivalents (NEQ), which considers the number of network elements and the relative “weight” of each of the network elements. (One NEQ equals the loading of an ISM-4.) The network element weight is significant because some network elements require more hardware resources for management than others.

For a list of NEQ values for each network element, seeAppendix A, “Network Element Equivalence (NEQ) values”.

Network topology

In all of the applications, each instance of Navis™ Optical NMS and the EMSs is loaded on its own server. Navis™ Optical NMS can communicate with all of the EMSs in the network, and with the network elements they manage.

The three applications have the same network topology, but vary in the number of users, EMSs, and network elements that are supported. The following figure illustrates the network topology used by all three applications.



□

Supported topology management techniques

Overview

Purpose

This section describes the topology management techniques that are supported for Navis™ Optical NMS. These techniques allow a large network to be organized using a hierarchical approach. The hierarchical approach allows the network to be managed efficiently.

Contents

Subnet management (Rings)

Introduction

Subnet management is performed through the Network Map.

Subnets can be created either manually or automatically. These processes each use a different method for selecting the network elements to be included in the subnet.

Definition: subnet

A subnet is a collection of interconnected network elements that has a certain behavior. The subnet concept allows the Navis™ Optical NMS to manage fixed cross-connect systems and rings through SDH multiplexers.

Manually created subnets

Because of the selection process, subnets created using the manual process can consist of different types of network elements.

Automatically created subnets

Because of the selection process, subnets created using the automatic process, generally consist of the same type of network element.

The automatic process can only be used with network elements that are capable of working with this feature.

□

Aggregates

Introduction

Nodes can be grouped into aggregates. Grouping nodes into aggregate reduces clutter on the Network Map when numerous network elements are present.

Definition: aggregate

An aggregate is a collection of one or many network elements collapsed into a single node display on the network map.

Number of network elements in an aggregate

There is no restriction on the number of network elements that can be included in an aggregate.

Aggregates within aggregates

Aggregates can also contain other aggregates.

Who creates aggregates?

Only a system administrator can create aggregates.

□

Areas

Introduction

Networks managed by Navis™ Optical NMS can be subdivided into smaller, manageable networks called areas.

Definition: area

An area is a collection of nodes, aggregates, and their associated links. By subdividing the network into areas, the problem of overcrowding the display is reduced and the system performance is improved as smaller amounts of information are exchanged by the subsystems.

Areas can be defined for any purpose. Examples of potentially useful areas are:

- a set of nodes/aggregates dedicated to a subscriber
- a set of nodes/aggregates, which are or are not connected
- a set of nodes/aggregates in a geographic location or building

Purpose

Once a network is subdivided into areas containing a limited set of nodes/aggregates and associated links, users can choose to view only the areas they are interested in. This reduces the problem of overcrowding on the display and improves the system performance because a smaller amount of information is exchanged by the subsystems.

Number of network elements in an area

There is no restriction on the number of network elements that can be included in an area, but a limit of 300 network elements in an area is recommended to avoid display clutter and performance problems.

Areas within areas

Areas cannot contain other areas.

Who creates areas?

Only a system administrator can create areas.

□

Controlled network elements

Overview

Purpose This section describes controlled network elements.

Contents

Definition of controlled network elements

Definition

Controlled network elements are network elements that can be controlled by Navis™ Optical NMS.

Characteristics

Controlled network elements have the following characteristics:

- They are displayed on the network maps as nodes (physical locations) interconnected by digital links. A unique icon represents each network element type.
- They are in constant communication with their EMS.
- They are controlled by commands sent from the EMS. (The EMS receives and processes the responses from the controlled network element.)
- They report and show alarms.

Control techniques

Controlled network elements are controlled indirectly, through the ITM-SC or Navis™ Optical EMS.

□

ADM 155E

Definition

The ADM 155E (Extended Shelf - 17 slots) is a synchronous access multiplexer capable of multiplexing the PDH and SDH tributary signals into one or two 155-Mb/s STM-1 aggregate signals.

The ADM 155E is an earlier version of the WaveStar® ADM 4/1, and its functionality is identical to that of the ADM 4/1. The only difference between the two is in the shelf configurations and MSP configurations for grouping ports. Therefore, different port addressing schemes are used in the Navis™ Optical NMS.

How it is controlled

The ADM 155E is controlled by the ITM-SC EMS.

Multiplexing configurations

The ADM 155E can be used in several multiplexing configurations:

- Add/Drop multiplexer (sometimes referred to as Ring Drop Insert [RDI] mode) — Lower-order components of the STM-1 aggregate frames can be cross-connected as required between two STM-1 aggregate ports. Additionally, the PDH tributaries can be multiplexed into the STM-1 aggregate signal.
- Terminal Multiplexer — PDH tributaries are multiplexed into the STM-1 aggregate signal.
- Terminal Multiplexer — Lower-order components of the STM-1 tributary signals can be assigned to any position in the STM-1 aggregate signal.

Tributary ports

The ADM 155E, there is only one unit per slot. It can be equipped with one of the following:

- 16 2-Mb/s ports per slot
- 34 Mb/s (TPU34) - 1 port per slot
- 155-Mb/s (STM-1) - 1 port/slot

□

WaveStar® ADM 4/1

Definition

The WaveStar® ADM 4/1 is a synchronous multiplexer able to multiplex the PDH and SDH tributary signals into one or two aggregate signals.

How it is controlled

The WaveStar® ADM 4/1 is controlled by the ITM-SC EMS.

Important! The WaveStar® ADM 4/1 STM-4 has three VC-4s available for pass-through traffic, but has only one VC-4 available for add/drop cross-connections.

Multiplexing configurations

The WaveStar® ADM 4/1 can be used in several multiplexing configurations:

- Add/Drop multiplexer (sometimes referred to as Ring Drop Insert [RDI] mode) — Lower-order components of the STM-1 aggregate frames can be cross-connected as required between two STM-1 aggregate ports. Additionally, the PDH tributaries can be multiplexed into the STM-1 aggregate signal.
- Terminal Multiplexer — PDH tributaries are multiplexed into the STM-1 aggregate signal.
- Terminal Multiplexer — Lower-order components of the STM-1 tributary signals can be assigned to any position in the STM-1 aggregate signal.

Tributary ports

The WaveStar® ADM 4/1 can be equipped with the following tributary ports:

- 2-Mb/s (TPU-2) -16 2-Mb/s +1 STM-1 port or 32 2-Mb/s ports per slot
- 34/45-Mb/s (TPU34) - 3 34-Mb/s + 1 STM-1 port per slot (always clear channel)
- 155-Mb/s (STM-1) - 1 port/slot (Tributary Unit Group [TUG] structured or clear)

□

WaveStar® ADM 16/1 and WaveStar® ADM 16/1 Compact

Definition

The WaveStar® ADM 16/1 is a 15-slot synchronous multiplexer able to multiplex the PDH and SDH tributary signals into one or two aggregate signals.

Although the WaveStar® ADM 16/1 can be dynamically configured from an MS-SPRING model to a non-MS-SPRING model from the Craft Interface Terminal (CIT), Navis™ Optical NMS does not support dynamic model interfaces. It is highly recommended that you do not change the model at the CIT after the network element has been created by Navis™ Optical NMS.

The WaveStar® ADM 16/1 Compact is a compact model of the WaveStar® ADM 16/1 that contains less slots.

How it is controlled

The WaveStar® ADM 16/1 and WaveStar® ADM 16/1 Compact are controlled by the ITM-SC EMS.

Provisioning LAN card

The four VC-12s to be used for the LAN connection can be provisioned individually using the proper ports. The VC-12s used for the LAN connection are like any other VC-12s except that their port addresses tie them to the LAN card and they can only be two-way VC-12s. It is the user's responsibility to ensure that all VC-12s used for the LAN connection are provisioned as two-way.

All the VC-12s that make up a single LAN connection have to originate from the same port of a LAN card and terminate on a single port of another LAN card. Different VC-12 of the same LAN connection cannot originate from different LAN card or ports or end up either on different LAN card or different LAN card ports of the same LAN card.

However, if the VC-12 used for the LAN connection terminates on a port other than the LAN card port, it does not have to terminate on the same network element.

VC12S-30N can be used for the LAN connection.

Optical layer

WaveStar® ADM 16/1 can be equipped with an STM-16 optical line interface unit for interworking with WaveStar® OLS 80G and WaveStar® OLS 400G.

LAN8 digital link

The LAN8 digital link is supported between WaveStar® ADM 16/1s and black boxes.

The LAN8 digital link does not carry any circuit or path.

DS1 provisioning

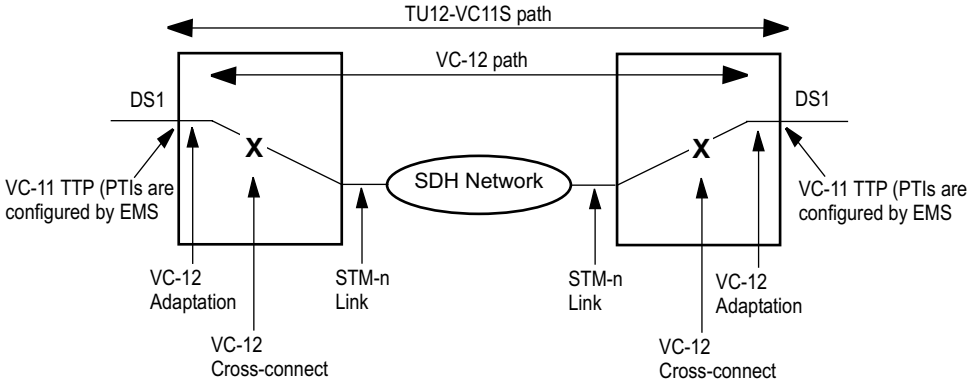
The following digital link and circuit types are supported for a WaveStar® ADM 16/1 equipped with the DS1 option card:

- Digital link - DS1
- Path - TU12-VC11S
- Circuit - 24N
- Combo Circuit - TU12-VC11S-24N

With a PI-DS1/63 card, a WaveStar® ADM 16/1 can support 63 DS1 (1.544 Mb/s) interfaces. Navis™ Optical NMS provides a new path TU12-VC11S externally to the user, but internally the path is mapped to VC-12.

Note that support of the DS1 port is in parity with the support of the existing 2-Mb/s port. Any network elements that support VC-12s can be included as intermediate nodes.

Figure 3-1 DS1 circuit provisioning



Provisioning is supported for the 1.544-Mb/s digital link (DS1), path TU12-VC11S which terminates on a 1.544-Mb/s port, circuit (24N), and for the simple combo circuit (TU12-VC11S-24N).

TU12-VC11S path or TU12-VC11S-24N circuit terminated on a DS1 port

A TU12-VC11S path or TU12-VC11S-24N “combo” circuit may terminate on 1.5-Mb/s (DS1) ports. The following combinations are supported: both ports are 1.5 Mb/s or one is 1.5 Mb/s and the other is a logical VC-12 port derived from an STM-n port.

A TU12-VC11S path or TU12-VC11S-24N combo circuit cannot terminate on a 1.5-Mb/s port at one end and a 2-Mb/s port at the other end.

A TU12-VC11S path shall carry a D1 (1.5 Mb/s) channel. A D1 channel is valid for a TU12-VC11S path only if the path terminates either on both DS1 ports or on a DS1 port and on a logical VC-12 port derived from a SDH port. A TU12-VC11S path with D1 channel shall carry a 24N circuit.

ITU-T G.707 section 10.1.4 specifies how a 2-Mb/s signal can be mapped into a VC-12. Sections 10.1.5 and 10.1.6 specify how a DS1 signal can be transported over VC-12. First the DS1 signal is mapped to VC-11 and then adapted to VC-12 to be carried as regular VC-12 over SDH network preserving end-to-end integrity of the real VC-11 path. Navis™ Optical NMS uses a TU12-VC11S path externally to support DS1 circuits although internally it is mapped to VC-12.

A TU12-VC11S path terminating on a DS1 port, in general, can be protected or unprotected. If the TU12-VC11S path is protected, then all the existing protection types are supported. The following are applicable: Automatic Path Selection, Path Trace Identifiers (PTIs), and PTI mismatch detection.

MSP WaveStar® ADM 16/1 supports 1+1 MSP for the following digital links: STM-1, STM-4, and STM-16.

□

WaveStar® AM 1

Definition The WaveStar® AM 1 is a compact and cost-effective STM-1 SDH multiplexer designed to be installed at the customer's premises or street cabinets for fiber-to-the-business, fiber-to-the curb and fiber-to-the office applications. The system can be used as an add/drop multiplexer or a terminal multiplexer.

How it is controlled The WaveStar® AM 1 is controlled by the ITM-SC EMS.

□

WaveStar® AM 1 PLUS

Definition The WaveStar® AM 1 PLUS is a multiplexer and transport system that multiplexes a broad range of plesiochronous and data signals into 620 Mb/s (STM-4) or 155 Mb/s (STM-1) signals. The system can be used as an add/drop multiplexer or a terminal multiplexer. It provides built-in cross-connect facilities and can accept one extension board. The WaveStar® AM 1 PLUS can be used in the access part of the network in Local Loop applications (Fiber To The Business) or for intra-office applications.

How it is controlled The WaveStar® AM 1 PLUS is controlled by the ITM-SC EMS.

□

WaveStar® TM 1

Definition

The WaveStar® TM 1 is a one-card STM-1 SDH Terminal Multiplexer that multiplexes 16 X 2 Mb/s tributary circuits into the first 16 slots of the VC-4 of the STM-1. It uses a fixed mapping structure. It has no hardware protection, and it does not support line protection.

How it is controlled

The WaveStar® TM 1 is controlled by the ITM-SC EMS.

Key features

The key features of WaveStar® TM 1 are:

- 1 STM-1 1310-nm Short Haul
- 16 X 2 Mb/s tributary ports
- Fixed mapping (asynchronous in slot 1-16)
- Timing: on-line port or free running
- Local software download
- ITM-SC support via DCC (Release 1.0 does not support ITM-SC)
- Performance monitoring according to G.826 of VC-12/VC-4 and Multiplex Section (MS). 15-minute/24-hour current counters and history logs, unavailable period logs, up to 70 monitoring points at a time for each WaveStar® TM 1. Only 15-minute and 24-hour data are applicable to Navis™ Optical NMS.

Although all WaveStar® TM 1 ports are physically located in a single motherboard, it is logically represented in the ITM-SC (GUI for provisioned network element subrack) as consisting of three “logical” slots.

Supported rates

The WaveStar® TM 1 supports an AU-4<->VC-4-TUG-3<->TU-12-TUG-2<->VC-12 fixed mapping scheme for each VC-12 terminated in the system. Since the WaveStar® TM 1 supports fixed connections for lower-order VC-12s, no cross-connect provisioning is required. The WaveStar® TM 1 supports port and VC-4/VC-12 termination points provisioning only. The fixed VC-12 connections are filled in the VC-4 in logical order according to the logical KLM numbering of the TU-12s in the VC-4.

Important! One WaveStar® TM 1 by itself forms a fixed cross-connect system.

□

WaveStar® OLS 80G

Definition

The WaveStar® OLS 80G is a flexible, high-capacity, lightwave system that transports digitally encoded information contained in up to 16 different wavelengths of optical signals through standard single-mode or TrueWave® optical fibers. Dense Wave Division Multiplexing (DWDM) is used to combine up to 16 STM-16 signals.

WaveStar® OLS 80G is an optical line system comprised of end terminals that multiplex digitally encoded information (contained in up to 16 different wavelengths) on one end, transmit the resulting combined signal through the optical fibers, and then demultiplex the information at the other end.

Repeater terminals are used to reamplify the optical signal on an optical line between adjacent end terminal and repeater sites or between adjacent repeater sites.

The WaveStar® OLS 80G is offered in three models:

- WaveStar® OLS 80G Single-Ended Terminal
- WaveStar® OLS 80G Dual-Facing Terminal
- WaveStar® OLS 80G Repeater

How it is controlled

The WaveStar® OLS 80G is controlled by the ITM-SC EMS.

Interfaces

The WaveStar® OLS 80G is capable of transporting the following rates on the same system:

- STM-16/OC-48
- STM-4/OC-12
- STM-1/OC-3
- low-speed broadband data channels (150 Mb/s to 750 Mb/s)
- Gigabit Ethernet (GbE) signal

□

WaveStar® DACS

Definition

The WaveStar® DACS is a Lucent Technologies wideband and broadband digital cross-connect system for support of SDH networks.

How it is controlled

The WaveStar® DACS is controlled by the ITM-SC EMS.

Cross-connect capacity

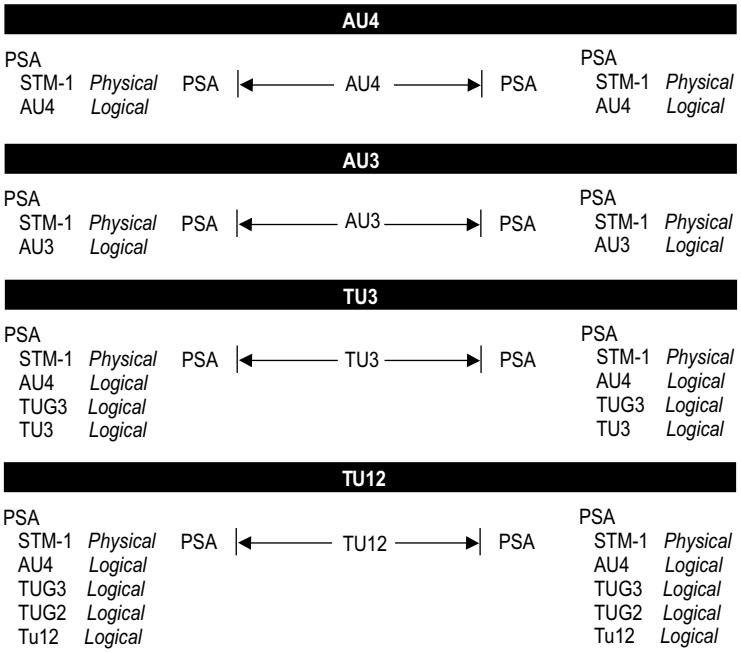
The WaveStar® DACS Release 2.0 has a cross-connect capacity equivalent to 1024 STM-1s.

The WaveStar® DACS Release 2.1 and Release 3.0 has a cross-connect capacity equivalent to 2048 STM-1s.

Cross-connections

The following figure illustrates the WaveStar® DACS STM-1 cross-connections.

Figure 3-2 WaveStar® DACS Cross-Connections



Optional MSP Protection

Optional MSP protection switching is available for STM-1 optical ports, and 1:8 equipment protection is available for STM-1 electrical ports.

□

Intelligent Synchronous Multiplexer (ISM) Family

Definition

The ISM is a family of network multiplexer primarily designed to flexibly multiplex plesiochronous tributaries into STM-1 or STM-4 aggregate signals. The ISM is provided with built-in cross-connect facilities, flexible tributary configurations and optical line terminations.

The ISM can be used in two different modes:

- Terminal mode
- Add/drop mode

The ISM family includes the following models:

- ISM-1
- ISM-4
- ISM-5E

How it is controlled

The ISM is controlled by the ITM-SC EMS.

□

SLM-2000 family

Definition

The SLM-2000 Family is a family of synchronous line multiplexers that terminates STM-1, STM-4, and STM-16 signals in a terminal mode or (for STM-16 SLMs only) in an add/drop configuration (line-switched ring). The electronic cross-connections are at the VC-4 level.

The SLM-2000 family includes the following models:

- SLM-4
- SLM-16

How it is controlled

The SLM-2000 family is controlled by the ITM-SC EMS.

Line ports and tributary ports

The SLM-4 and SLM-16 each have two line ports that terminate STM-4 signals (for an SLM-4) or STM-16 signals (for an SLM-16). The tributary ports terminate G.702 CEPT-4 signals and SDH STM-1 signals.

Figure 3-3 SLM-16

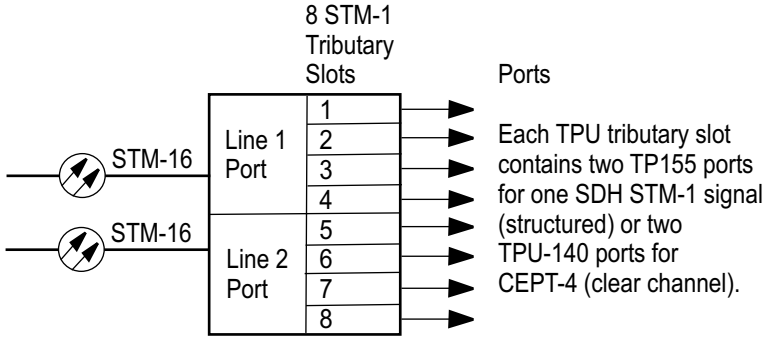
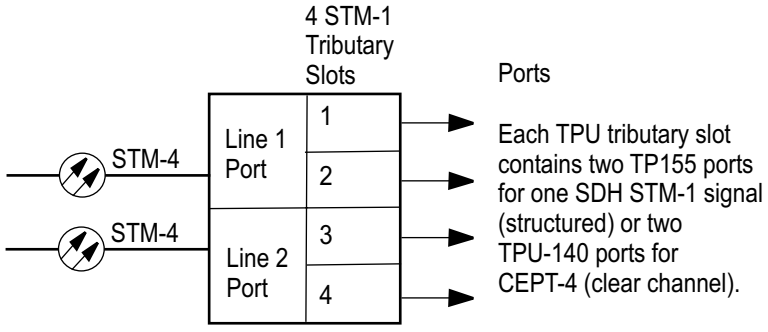


Figure 3-4 SLM-4



PHASE network elements

Definition

PHASE network elements include:

- Terminal Multiplexer (TM)
- Add/Drop Multiplexer (ADM)
- Local Cross Connect (LXC)
- Line Regenerator (LR)

The most important feature of the PHASE network elements is their modular structure, which permits various types of network elements to be configured using the same basic hardware units. This principle is supported by the network element software, which is also arranged in units.

The type and features of the PHASE network elements are determined by the type and number of the hardware and software modules used.

How it is controlled

PHASE network elements are controlled by the ITM-SC EMS.

Types

There are eight types of PHASE network elements:

- PHASE TM 4/4 and PHASE TM 16/4. The PHASE TMs allow VC-4 cross-connections from the low-speed and high-speed sides. The ADMs 16/4 also allow line-to-line VC-4 cross-connections.
- PHASE ADM 16/4 and PHASE ADM 4/4
- PHASE LXC 16/1 and PHASE LXC 4/1. The PHASE LXCs are the most flexible because they support TU12/TU2/TU3/AU4 cross-connections irrespective of high-speed or low-speed port terminations.
- PHASE LR 4 and PHASE LR 16

□

WaveStar® BandWidth Manager

Definition

The WaveStar® BandWidth Manager system is a modular networking cross-connect switch that can integrate multiple numbers of interoffice transport and broadband digital cross-connect facilities into a single network element. The WaveStar® BandWidth Manager system provides duplicated switching, control, and synchronization.

> **Important!** WaveStar® BandWidth Manager is sometimes abbreviated as BWM in the Navis™ Optical NMS software.

How it is controlled

The WaveStar® BandWidth Manager is controlled by Navis™ Optical EMS.

Rings and protection

The WaveStar® BandWidth Manager can be part of multiple line-switched rings. These rings are Bidirectional Line Switched Rings (BLSRs) and can be two-fiber or four-fiber. Once a protection group is discovered (or created by Navis™ Optical NMS), and the MS-SPRING is completed by other WaveStar® BandWidth Manager's or other network elements that can interwork with WaveStar® BandWidth Manager, a BLSR is created using the physical ports of the links.

Auto routing is managed through the connectivity between the nodes. The subnet route is found using the two-fiber or four-fiber ring to find the path.

1x1 MSP protection

WaveStar® BandWidth Manager supports 1x1 MSP protection for STM-16 and STM-64 digital links.

VC-4 logical connections

For the VC-4 path, the WaveStar® BandWidth Manager can be either an intermediate node or an end node. If it is an end node, then this is a non-assignable (non-structured) VC-4 port.

Transoceanic protocol

The Transoceanic Protocol (TOP) is supported for line-switched rings formed by WaveStar® BandWidth Manager.

The TOP is used for very long paths (such as when the distances between network elements are greater than 1500 kilometers) in which a purely multiplex section shared protection scheme results in excess signal delay and degradation.

In a transoceanic application, the ring switching at a network element is augmented so that the bridging from the working channels to the protection channels is performed at the source network element in the event of a failure.

□

WaveStar® TDM 2.5/10G

Definition The WaveStar® TDM 2.5/10G multiplexer provides high-capacity, self-healing transport by means of 10-Gb/s line-rate signal. It can efficiently interconnect multiple 2.5-G and 10-G rings using a single network element.

How it is controlled The WaveStar® TDM 2.5/10G is controlled by Navis™ Optical EMS.

□

WaveStar® OLS 1.6T

Definition

The WaveStar® OLS 1.6T is a family of modular optical transmission systems. This product was formerly known as WaveStar® OLS 400G.

The WaveStar® OLS 1.6T Family includes three products:

- WaveStar® OLS 1.6T
- WaveStar® OLS 800G
- WaveStar® OLS 400G

The WaveStar® OLS 1.6T is built upon the technology platform of the WaveStar® OLS 400G.

- The WaveStar® OLS 1.6T offers up to 160 10-Gb/s (gigabit per second) wavelengths, for a total capacity of 1.6 Tb/s (terabits per second) over a single strand of fiber, using both the C-band and the L-band.
- The WaveStar® OLS 800G offers up to 80 10-Gb/s wavelengths, for a total capacity of 800 Gb/s over a single strand of fiber.
- The WaveStar® OLS 400G offers up to 40 10-Gb/s wavelengths, for a total capacity of 400 Gb/s over a single strand of fiber.

The WaveStar® OLS 1.6T architecture provides a scalable, flexible solution for long-haul applications. For the WaveStar® OLS 1.6T, the initial installation is a system with the capacity of 800 Gb/s (up to 80 10-Gb/s wavelengths) that includes a combiner/splitter that makes it terabit-ready. Service providers can double their network capacity to 1.6 Tb/s without interrupting traffic, when bandwidth requirements call for such a capacity boost.

WaveStar® OLS 1.6T is an optical line system comprised of end terminals that multiplex digitally encoded information on one end, transmit the resulting combined signal through the optical fibers, and then demultiplex the information at the other end.

Repeater terminals are used to reamplify the optical signal on an optical line between adjacent end terminal and repeater sites or between adjacent repeater sites.

How it is controlled

The WaveStar® OLS 1.6T is controlled by Navis™ Optical EMS.

Interfaces

The WaveStar® OLS 1.6T is capable of transporting the following rates on the same system:

- STM-64/OC-192
- STM-16/OC-48
- high-speed broadband data channels (100 Mb/s to 2.5 Gb/s)
- low-speed broadband data channels (45 Mb/s to 750 Mb/s)

□

LambdaUnite MultiService Switch

Definition

The LambdaUnite MultiService Switch (MSS) is a 10G and 40G optical switch.

LambdaUnite MSS enables service providers to support a variety of different applications while keeping the network flexible, cost-effective, and easy to maintain.

LambdaUnite MSS is a global product that supports highest capacity services up to 40G, as well as Ethernet services, from one network element both in ring and meshed topologies. The product acts as a fully flexible optical switch, and offers a superior solution compared to traditional central office solutions like dedicated high-speed TDM multiplexers or cross-connects.

The applications for LambdaUnite MSS include undersea and terrestrial backbone and metro core networks.

How it is controlled

The LambdaUnite MSS is controlled by the Navis™ Optical EMS.

□

LambdaRouter All Optical Switch (AOS) 128/256

Definition

The LambdaRouter All Optical Switch (AOS) 128/256 is an all-optical cross-connect system that is rate- and format-independent. It is implemented using the Micro-Electromechanical (MEM) Systems technology. The LambdaRouter AOS 128/256 operates purely in the optical domain.

How it is controlled

The LambdaRouter AOS 128/256 is controlled by Navis™ Optical EMS.

Interfaces

Navis™ Optical NMS supports provisioning of an optical link between:

- A DWDM network element and a LambdaRouter AOS 128/256
- An SDH network element and a LambdaRouter AOS 128/256
- A black box and a LambdaRouter AOS 128/256

LambdaRouter AOS 128/256 supports 128/256 input ports and 128/256 output ports.

□

Metropolis Enhanced Optical Networking (EON)

Definition

Metropolis Enhanced Optical Networking (EON) is a 16/32-channel Dense Wave Division Multiplexing (DWDM) system that delivers up to 160/320 gigabits per second (Gbps) capacity over a single strand of fiber. This enhanced system boosts transport capacity of metro/regional (rings) and point-to-point (linear) networks bandwidth management and connectivity via a cost-effective, scalable transport architecture.

The applications for Metropolis Enhanced Optical Networking (EON) include metro regional networks.

How it is controlled

The Metropolis Enhanced Optical Networking (EON) is controlled by the Navis™ Optical EMS.

□

Noncontrolled network elements

Overview

Purpose This section describes noncontrolled network elements.

Contents

Definition of noncontrolled network elements

Definition

Noncontrolled network elements are network elements that cannot be controlled by Navis™ Optical NMS.

Characteristics

Noncontrolled network elements:

- Support only manual provisioning
- Do not report alarms
- Are listed in the database as part of provisioning records

List of noncontrolled network elements

There are two noncontrolled network elements:

- Black box
- Customer equipment

□

Black box

Definition

A black box is a network element that is not controlled and is not monitored. Black boxes are displayed on the network map, but they cannot be automatically provisioned.

An example of a black box is a non-Lucent multiplexer that is not managed.

Interfaces

The user is only able to provision digital links or circuits that terminate on a black box. The digital links can connect two black boxes, or a black box and any controlled network element. The digital link hierarchy corresponds to the controlled network element.

In the case where the digital link connects a black box and a controlled network element, the digital link hierarchy corresponds to the controlled network element. In the case where the digital link connects two black boxes, all link types and link channels are applicable. The user must use the manual path selection method to provision circuits over digital links that connect two black boxes or a black box and a controlled network element. In this method, the user is able to select the channels on the link that terminate on the black box node.

Additionally, the user can start and stop performance monitoring collection with a black box on one side of the path. However, performance monitoring data will only be reported for the network element side, not for the black box side of the path.

□

Customer equipment

Definition Customer equipment is a network element that will never be controlled.

It is used only as a termination point for digital links; it cannot be used as an intermediate point on a digital link.

Customer equipment does not report alarms and the Navis™ Optical NMS does not send provisioning commands to customer equipment. Customer equipment does not appear on the network map, but does appear on the Graphical Layout form for the provisioned digital link, path, and/or circuit. Although customer equipment is not displayed on the network map, it can be a placeholder for end lines.

□

4 Hardware Platforms

Overview

Purpose

This chapter describes the supported hardware platforms for Navis™ Optical NMS.

Since Navis™ Optical NMS is a network management system, it is always deployed in connection with communicating EMSs; particularly those of Lucent Technologies, that is, Navis™ Optical EMS and ITM-SC. For this reason, this chapter also describes the hardware architectures used in integrated product offerings of Navis™ Optical NMS with Navis™ Optical EMS and ITM-SC.

Contents

About the client-server architecture

Introduction

Navis™ Optical NMS and its communicating EMS systems are each based upon a client-server architecture that works in the following way:

- "Client" software components provide graphical user interfaces (GUIs).
- "Server" software components support the clients and interface with similar components of peer management systems.

The architecture of the system is such that each software component is capable of being hosted separately on distributed networked platforms. This architecture provides scalability, since each user has access to their own Navis™ Optical NMS and EMS GUIs, which may be widely distributed on relatively lightweight client software platforms. At the same time, the architecture ensures that each user remains connected to centralized information on a powerful, protected server platform.

Server configurations

A number of server configurations are supported. The different server configurations provide scalability and degrees of high availability. The server configurations are described in the next section, "Supported server hardware configurations" (4-3). Each server configuration is capable of interworking with any of the supported client configurations.

Client configurations

A number of client configurations are supported. The different client configurations provide scalability, consolidation with EMSs, and multi-platform support. The client configurations are described in "Supported client hardware configurations" (4-5), later in this chapter. Each client configuration is capable of interworking with any of the supported server configurations.

□

Supported server hardware configurations

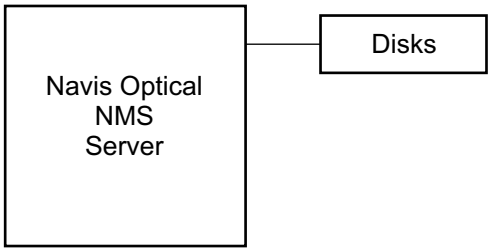
Introduction

The following server hardware configurations are supported for Navis™ Optical NMS:

- single server
- single server with disk mirroring
- local redundancy
- geographic redundancy

Single server

The following figure illustrates the single server hardware configuration.

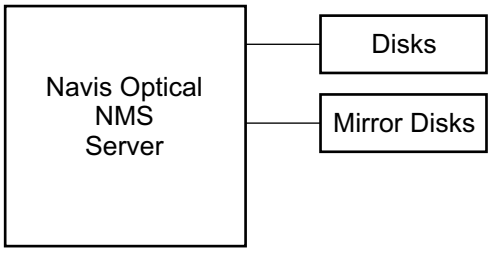


This configuration is an entry-level solution for customers without stringent high-availability requirements.

The Navis™ Optical NMS server is an HP server running the HP-UX operating system.

Single server with disk mirroring

The following figure illustrates the single server hardware configuration.

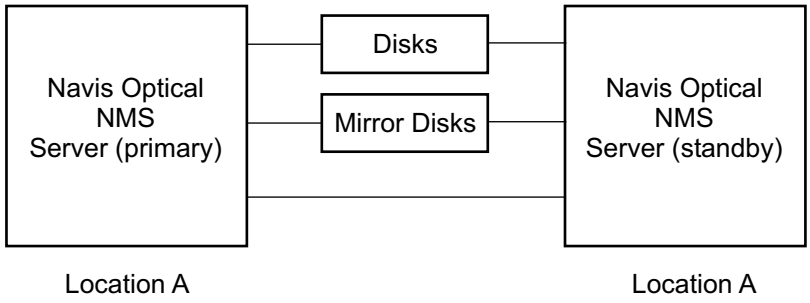


This configuration is an entry-level solution that provides automatic disk failure detection and recovery of all functionality following a disk failure.

The Navis™ Optical NMS server is an HP server running the HP-UX operating system.

Local redundancy

The following figure illustrates the local redundancy hardware configuration.

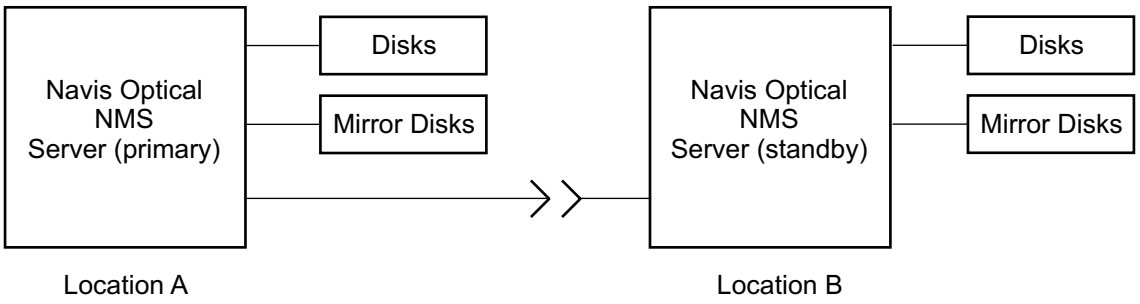


This configuration provides automatic server failure detection and recovery of all functionality following a failure of a complete server platform. This configuration makes use of Hewlett-Packard's MC/ServiceGuard high-availability package for HP-UX.

The Navis™ Optical NMS server is an HP server running the HP-UX operating system.

Geographic redundancy

The following figure illustrates the geographic redundancy hardware configuration.



This configuration provides automatic failure detection and recovery of all data and functionality following a major failure at the site of the primary server. The site of the standby server may be geographically distant from the site of the primary server.

The Navis™ Optical NMS server is an HP server running the HP-UX operating system.

□

Supported client hardware configurations

Introduction

The following client hardware configurations are supported for Navis™ Optical NMS:

- Desktop workstation
- Terminal server

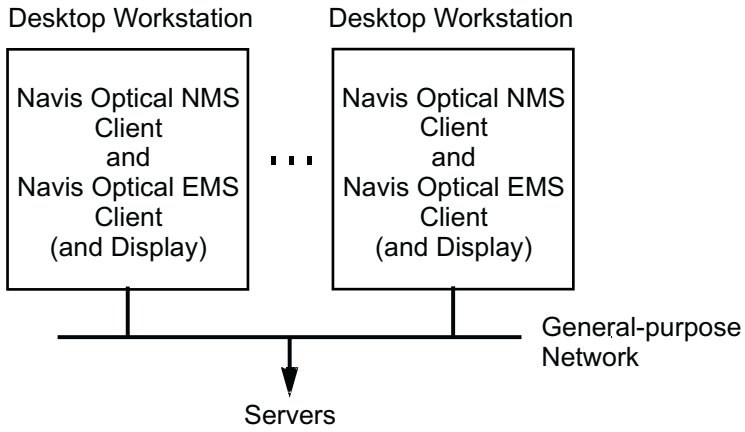
Desktop workstation

The desktop workstation hosts client software. It is used directly by the user to view the display.

The desktop workstation can also:

- Launch Navis™ Optical NMS via SAGE
- Co-host and co-display the GUI of other Lucent EMSs alongside the Navis™ Optical NMS GUI

The following figure illustrates the desktop workstation hardware configuration.



This configuration provides a solution that uses a minimum amount of hardware and is easy to administer and deploy. It also reserves processing power for the individual user.

The Navis™ Optical NMS desktop workstation is one of the following:

- an HP workstation running the HP-UX operating system
- a PC running the Windows NT or Windows 2000 operating system

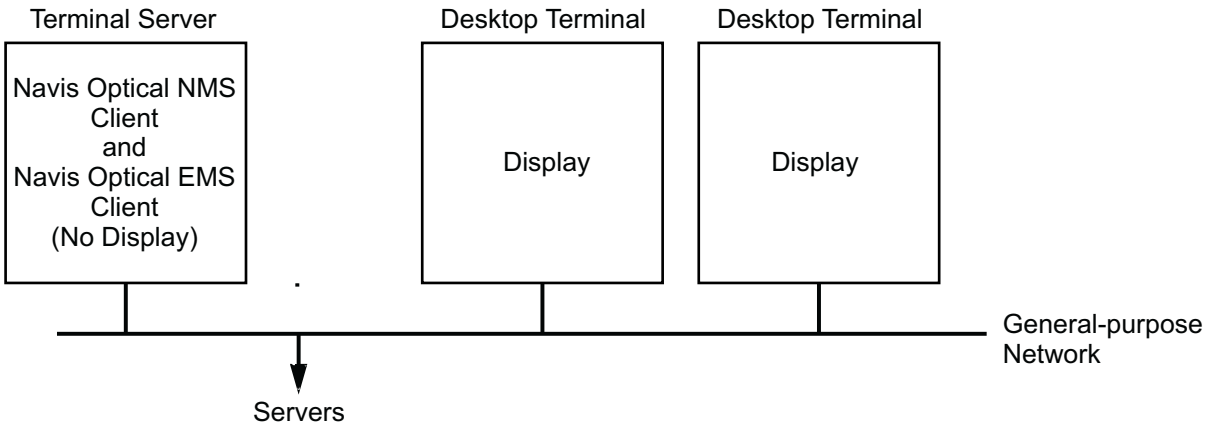
Terminal server

The terminal server hosts client software, but exports the display to a separate machine known as a “desktop terminal.” The terminal server is not used by a user to view the display.

The desktop workstation can also:

- Launch Navis™ Optical NMS via SAGE
- Co-display the GUI of other Lucent EMSs alongside the Navis™ Optical NMS GUI

The following figure illustrates the terminal server hardware configuration.



This configuration allows multi-platform integration with existing preferred desktop platforms. It also provides a simple upgrade path. (Growth in system or user requirements may be addressed by upgrading a single terminal server without upgrading each desktop terminal.)

The Navis™ Optical NMS terminal server may be one of the following:

- an HP workstation running the HP-UX operating system
- an HP server running Windows NT or Windows 2000

□

Supported server platforms

Introduction

The supported server platforms are designed to cost-effectively support each Navis™ Optical NMS application and hardware configuration.

The hardware required for a Navis™ Optical NMS server depends upon the size of the network to be managed. The network size is measured using a unit called Network Element Equivalents (NEQ), which considers the number of network elements and the relative "weight" of each of the network elements. (One NEQ equals the loading of an ISM-4.) The network element weight is significant because some network elements require more hardware resources for management than others.

For a list of NEQ values for each network element, seeAppendix A, "Network Element Equivalence (NEQ) values".

Table

Important! The information in the following table is related to Navis™ Optical NMS Release 7.0. For information on a more recent release, contact your Local Customer Support (LCS) or the support organization designated by your Lucent customer team representative. If you are unsure of who to call, contact the Global TSS Contact Center at (630)-224-4672.

As of Release 6.1 of Navis™ Optical NMS support has been added for the L3000 (rp5470) server.

The following table shows the different Navis™ Optical NMS server platforms that are orderable for this release.

Server architecture	Component role	Current or Legacy	Supported model	#CPUs	Memory	Disks[a]	#users	#EMSs	#NEQs
Dedicated	NMS/XM server software host	Current	rp5470	4	4Gb	5x 9Gb	64	40	5000
			rp5470	2	2Gb	5x 9Gb	32	30	2000
			rp5470	1	2Gb	5x 9Gb	32	20	500
		Legacy	L2000	4	4 Gb	5x 9Gb	64	40	5000
			L2000	2	2 Gb	5x 9Gb	32	30	2000[b]
			L2000	1	2 Gb	5x 9Gb	32	20	500
			L2000	3	2 Gb	5x 9Gb	32	40	5000
			K580	2	2 Gb	5x 9Gb	32	20	4000[b.]
			K460	2	2 Gb	5x 9Gb	32	20	2000
			K380	1	2 Gb	5x 9Gb	16	20	1500
			K370	1	2 Gb	5x 9Gb	16	20	1500
			K260	1	2 Gb	5x 9Gb	15	20	1500
			D390	1	2 Gb	5x 9Gb	8	5	400
			D380	1	2 Gb	5x 9Gb	8	5	400
			D230	1	2 Gb	5x 9Gb	8	5	300

a. 9 Gb disks are not current but they are supported. Disks with larger capacities may be used (N.B. the smallest disk should be installed as the root disk)

b. The system may experience reduced performance in this configuration.

Supported client platforms

Introduction

The supported client platforms are designed to cost-effectively support each Navis™ Optical NMS application, client-side operating system, and hardware configuration.

The supported client platforms permit consolidation of the client software of the following products onto the same platform:

- Navis™ Optical NMS
- Navis™ Optical EMS
- ITM-SC

Table

Important! The information in the following table is related to Navis™ Optical NMS Release 7.0. For information on a more recent release, contact your Local Customer Support (LCS) or the support organization designated by your Lucent customer team representative. If you are unsure of who to call, contact the Global TSS Contact Center at (630)-224-4672.

The following table shows the maximum number of physical network elements required to be supported by the Navis™ Optical NMS on each supported user-facing client workstation, given hardware

specifications and the types of client software that the workstation is expected to simultaneously host.

Client types hosted	OS	Current or Legacy	CPU speed	Memory	Disks	# NEs (phys)
Navis™ Optical NMS + Navis ™ Optical EMS + ITM-SC	HP-UX 11.0	Current	500 MHz	1 Gb	9Gb	5,000
		Legacy	400 MHz	768 Mb	9 Gb	5,000
			400 MHz	512 Mb	9 Gb	5,000
Navis™ Optical NMS + Navis ™ Optical EMS	HP-UX 11.0	Current	500 MHz	1 Gb	9Gb	5,000
		Legacy	400 MHz	768 Mb	9 Gb	5,000
			400 MHz	512 Mb	9 Gb	5,000
	NT 4.0 Wkstn or Windows 2000 Prof	Current	1.4 GHz	512 Mb	9 Gb	5,000
		Legacy	800 MHz	512 Mb	9 Gb	5,000
			500 MHz	768 Mb	9 Gb	5,000
			500 MHz	512 Mb	8 Gb	2,500
Navis™ Optical NMS + ITM-SC	HP-UX 11.0	Current	500 MHz	1 Gb	9Gb	5,000
		Legacy	400 MHz	768 Mb	9 Gb	5,000
			400 MHz	512 Mb	9 Gb	5,000
			300 MHz	512 Mb	9 Gb	5,000[a]
Navis™ Optical NMS only	HP-UX 11.0	Current	500 MHz	1 Gb	9Gb	5,000
		Legacy	400 MHz	768 Mb	9 Gb	5,000
			400 MHz	512 Mb	9 Gb	5,000
			300 MHz	512 Mb	9 Gb	5,000[a]
	NT 4.0 Wkstn or Windows 2000 Prof	Current	1.4 GHz	512 Mb	9 Gb	5,000
		Legacy	800 MHz	512 Mb	9 Gb	5,000
			500 MHz	512 Mb	9 Gb[b]	5,000
			500 MHz	384 Mb	9 Gb[b]	2,500

a. The system may experience some performance degradation in this configuration.
b. 8Gb disks are acceptable here also (as exist on some legacy systems with otherwise identical specification).

□

Supported server architectures for integrated product offerings

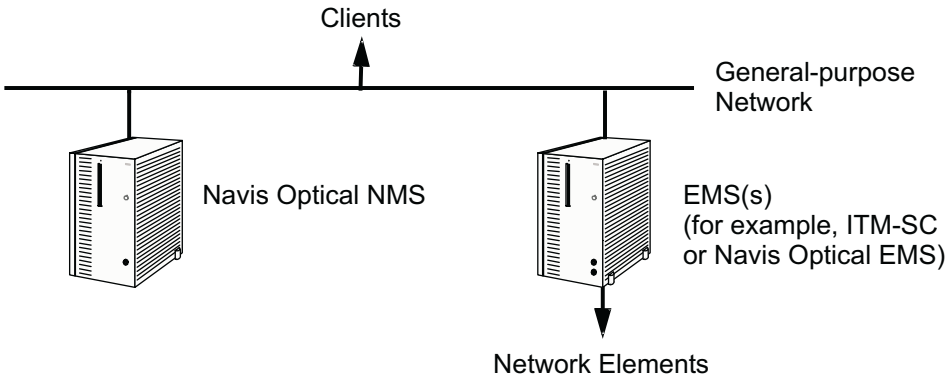
Introduction

In this section, diagrams are presented outlining the supported server architectures for integrated product offering deployments of the Navis™ Optical NMS. Integrated product offering deployments are deployments that include Navis™ Optical NMS and Navis™ Optical EMS or ITM-SC.

The LAN interconnections drawn are for illustration only and do not represent complete information on supported hardware interconnections. Also, Local Redundancy and Geographic Redundancy hardware platforms are not covered in this section.

Single server

Each instance of Navis™ Optical NMS and an EMS has a dedicated server.



Important! The dedicated server hosting the ITM-SC server software may also host ITM-SC client software if the ITM-SC is installed in its “Combined server/terminal-server” configuration.

□

Supported client architectures for integrated product offerings

Introduction

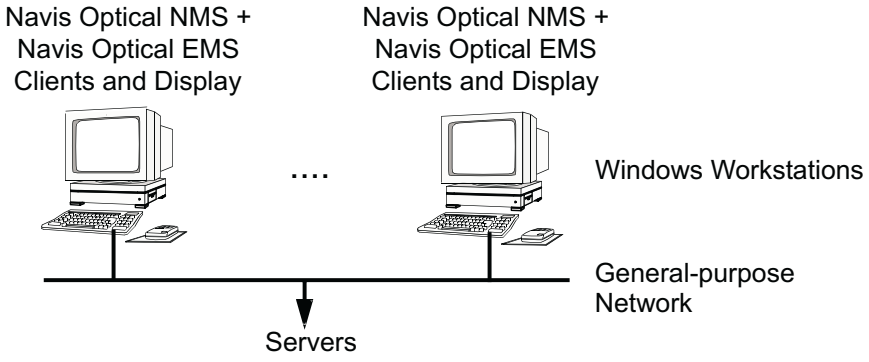
In this section, diagrams are presented outlining the supported client architectures for integrated product offering deployments of the Navis™ Optical NMS. Integrated product offering deployments are deployments that include Navis™ Optical NMS and Navis™ Optical NMS and/or ITM-SC.

The LAN interconnections drawn are for illustration only and do not represent complete information on supported hardware interconnections.

Navis™ Optical NMS with Navis™ Optical NMS only

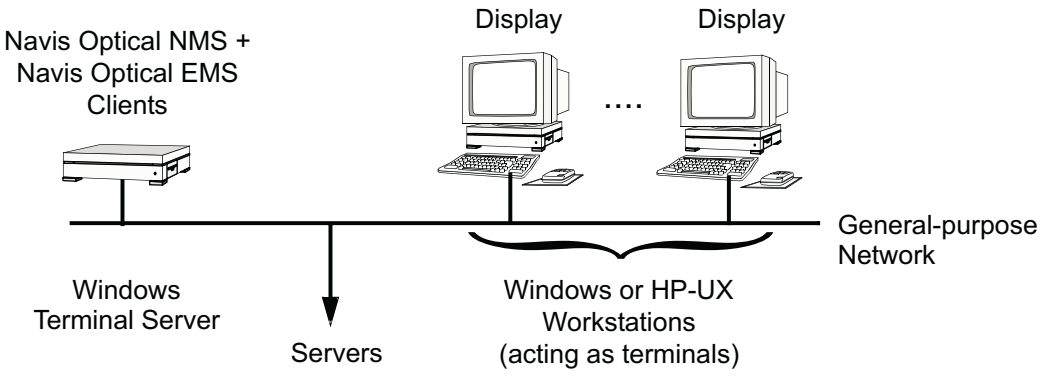
The following diagrams show the supported client architectures for deployments with Navis™ Optical NMS and Navis™ Optical EMS only.

Desktops host everything



This configuration is the minimum configuration for cases with very few users or incremental extension of a larger deployment.

Desktops fully served by terminal server

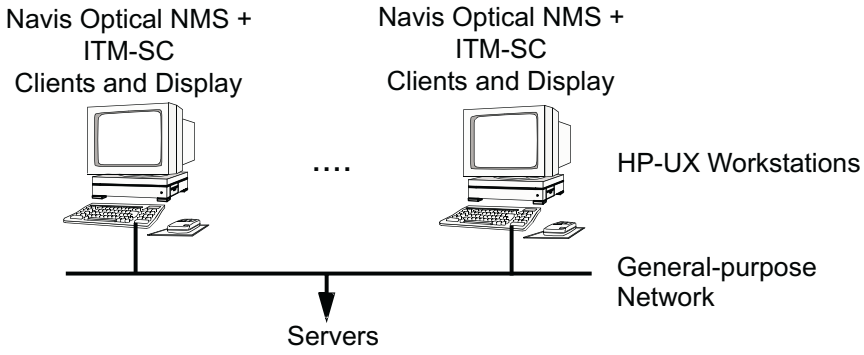


This configuration is recommended for reuse of legacy low-end PCs or HP-UX workstations, or for maximum scalability, or where multiple Navis™ Optical NMSs must be accessible from the same desktop platform.

Navis™ Optical NMS with ITM-SC only

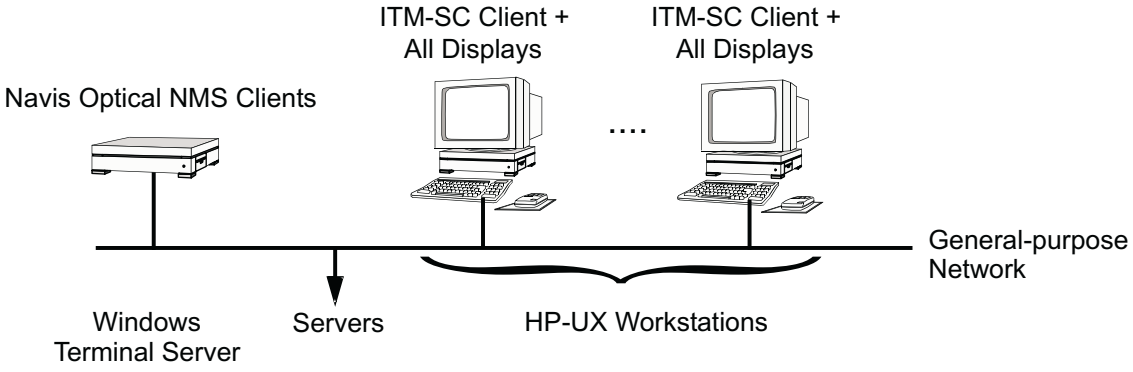
The following diagrams show the supported client architectures for deployments with Navis™ Optical NMS and ITM-SC only.

Desktops host everything



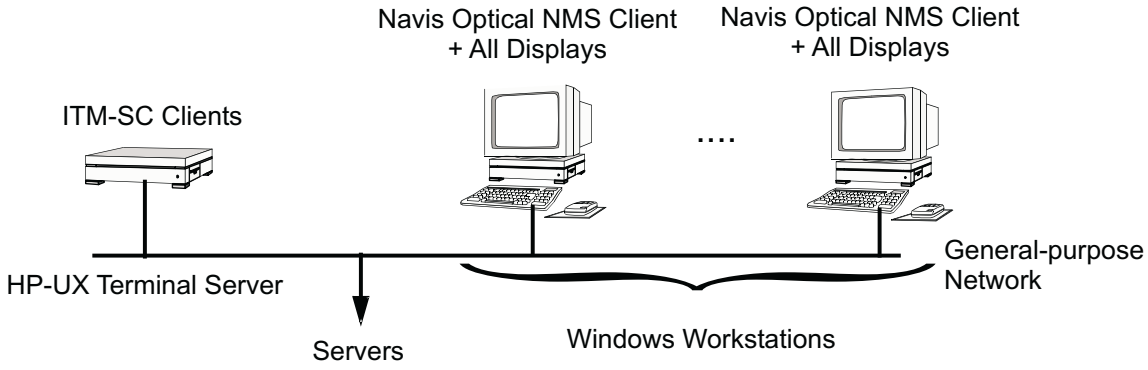
This configuration is the minimum configuration for cases with very few users or cases that are an incremental extension of a larger deployment, or where UNIX platforms are preferred by customers.

HP-UX desktops partially supported by Windows terminal server



This configuration is recommended where Windows terminal servers or ITM-SC workstations have already been deployed.

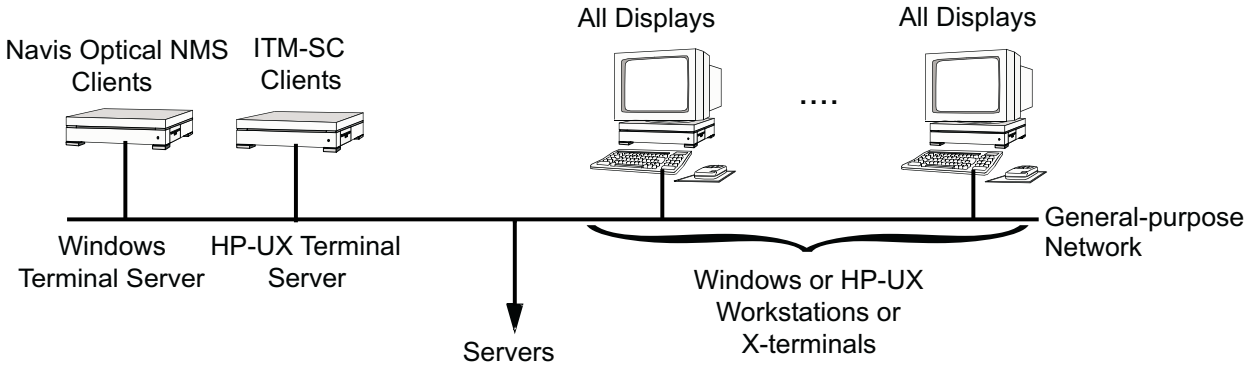
Windows desktops partially supported by HP-UX terminal server



This configuration is recommended where Windows workstations have already been deployed.

> **Important!** The HP-UX Terminal server hosting the ITM-SC clients may be omitted if the ITM-SC clients are cohosted with the ITM-SC server software on their own dedicated server platform (that is, where the ITM-SC is installed in its “Combined server/terminal-server” configuration).

Desktops fully served by HP-UX and Windows terminal servers

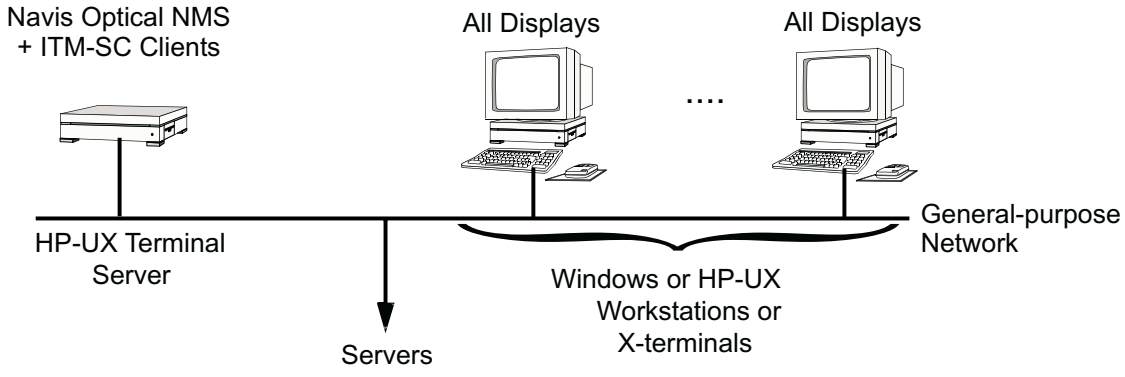


This configuration is recommended for reuse of legacy low-end PCs or HP-UX workstations, or for maximum scalability, or where multiple Navis™ Optical NMSs must be accessible from the same desktop platform.

Important! The HP-UX terminal server hosting the ITM-SC clients may be omitted if the ITM-SC clients are cohosted with the ITM-SC server software on their own dedicated server platform (that is, where the ITM-SC is installed in its "Combined server/terminal-server" configuration).

Important! Where X-terminals are used with a Windows-hosted Navis™ Optical NMS client (as above), the Windows terminal server exports its displays to the HP-UX terminal server, which then exports the display on to the X-terminals.

Desktops fully served by HP-UX terminal server only

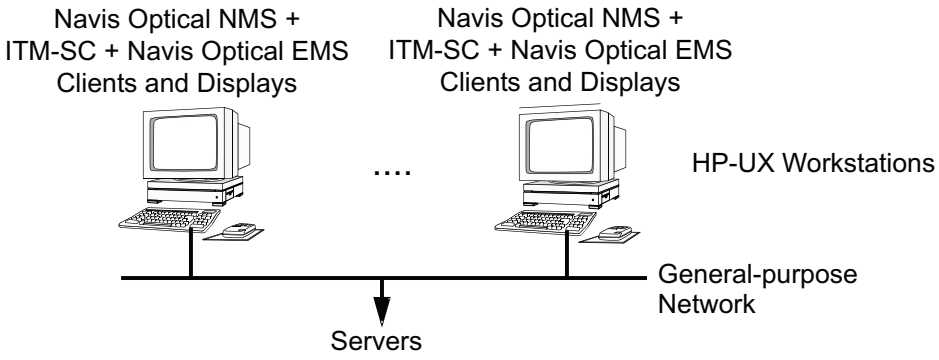


This configuration is recommended for reuse of legacy low-end PCs or HP-UX workstations, or for maximum scalability. Also, this may be useful for customers wishing to avoid using Windows.

Navis™ Optical NMS with ITM-SC and Navis™ Optical EMS

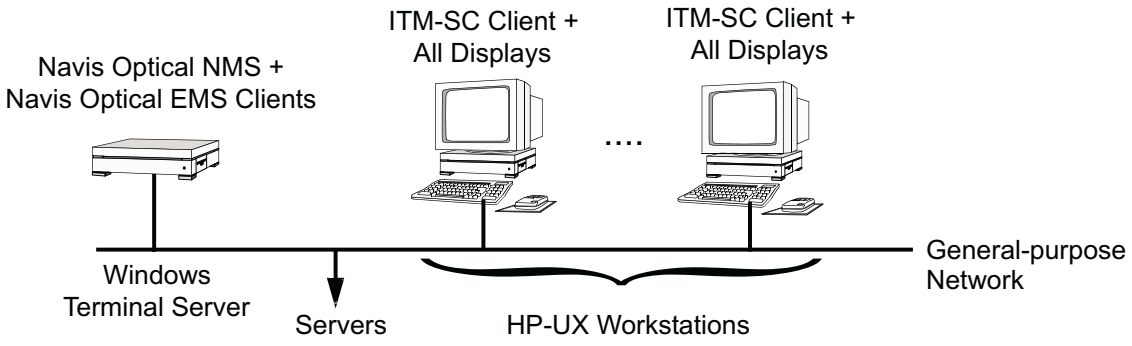
The client hardware architectures where all three management systems are combined are identical to those where Navis™ Optical NMS and ITM-SC are deployed on their own, except the Navis™ Optical NMS client host also must host Navis™ Optical EMS client hosts. The capacities of such configurations (in terms of numbers of users, network complexity, etc.) are significantly reduced.

Desktops host everything



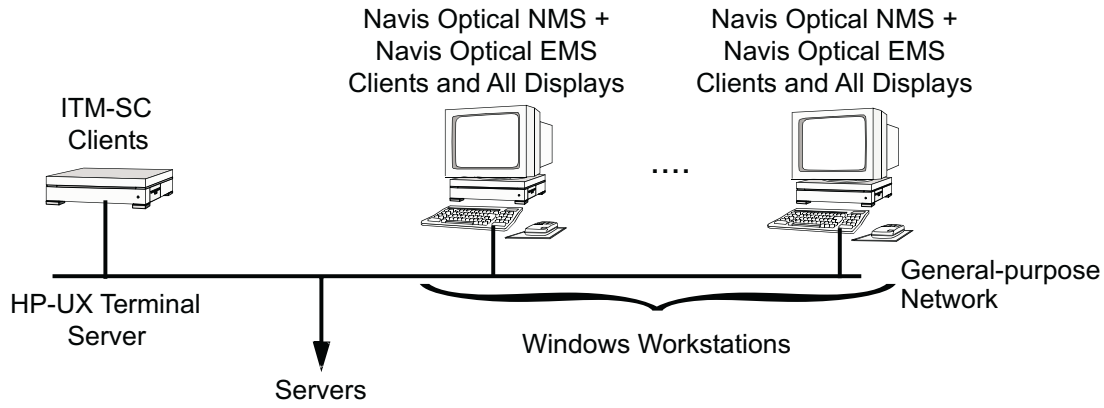
This configuration is the minimum configuration for cases with very few users or cases that are an incremental extension of a larger deployment, or where UNIX platforms are preferred by customers.

HP-UX Desktops partially supported by Windows terminal server



This configuration is recommended where Windows terminal servers or ITM-SC workstations have already been deployed.

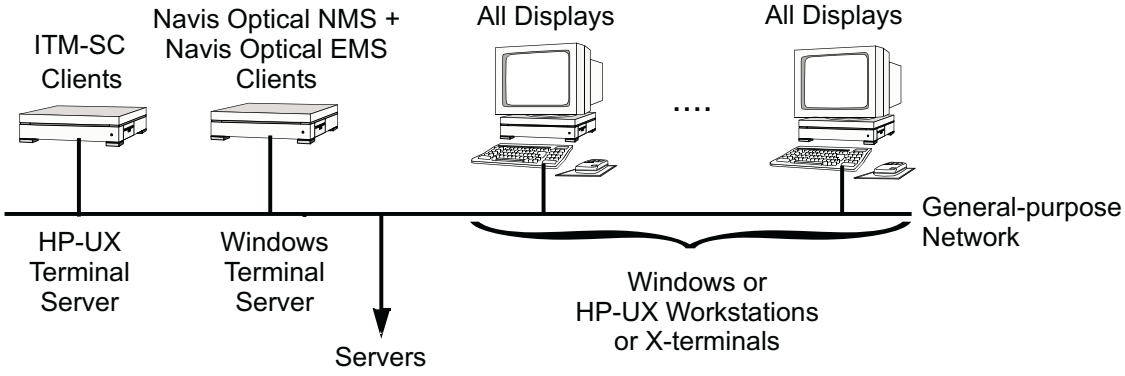
Windows Desktops partially supported by HP-UX terminal server



This configuration is recommended where Windows workstations have already been deployed.

> **Important!** The HP-UX terminal server hosting the ITM-SC clients may be omitted if the ITM-SC clients are cohosted with the ITM-SC server software on their own dedicated server platform (that is, where the ITM-SC is installed in its "Combined server/terminal-server" configuration).

Desktops fully served by HP-UX and Windows terminal servers



This configuration is recommended for reuse of legacy low-end PCs or HP-UX workstations, or for maximum scalability.

Notes Take note of the following:

- The HP-UX terminal server hosting the ITM-SC clients may be omitted if the ITM-SC clients are cohosted with the ITM-SC server software on their own dedicated server platform (that is, where the ITM-SC is installed in its “Combined server/terminal-server” configuration).
- Where X-terminals are used with a Windows-hosted Navis™ Optical NMS client (as above), the Windows terminal server exports its display to the HP-UX terminal server, which then exports the display to the X-terminals.

□

5 System Planning and Engineering

Overview

Purpose

This chapter describes system planning and engineering for Navis™ Optical NMS.

Contents

Hardware requirements

Specification

The Navis™ Optical NMS server component is to be installed on standard Hewlett-Packard hardware platforms.

The HP L3000 is the supported hardware platform for all new deployments. Some Hewlett-Packard K- and D-class servers that were deployed by customers for use with previous releases of Navis™ Optical NMS are also supported by this release. These servers are referred to as “legacy servers.”

Different configurations possible

Different deployment schemes are possible and depend on the size of the network.

The hardware platforms are designed to provide sufficient processing power and memory to allow the software to function efficiently, and to provide a cost-effective hardware solution.

For more information

The specific hardware platforms required for each of the supported applications are fully described in Chapter 4, “Hardware Platforms”.

□

Software requirements

Introduction

The required operating system is HP-UX Version 11.0, which is supplied with the hardware. In order to guarantee that the same patches of HP-UX are used throughout the network, a customized version of HP-UX is delivered by Lucent Technologies with Navis™ Optical NMS.

Description of HP-UX

HP-UX offers a robust, standards-based open computing environment. It provides a solid foundation for key applications needing high availability, distributed computing, and systems and network management. HP-UX is Hewlett-Packard's implementation of the UNIX operating system.

□

Engineering

Configuring the general-purpose network

The term “general-purpose network” is used to refer to the network (LAN or WAN) that interconnects the management systems, servers, and clients. This network is expected to be highly site-specific, since the general-purpose network often must be integrated into existing networks serving customer specific requirements and applications. This section, therefore, is limited to offering guidance for the organization of the general-purpose network.

> **Important!** The general-purpose network is always separate from the “management” network, which connects EMSs to network elements. These may be OSI- or IP-based. There are additional rules related to the design of these networks.

Basic rules

Observe the following basic rules about the general-purpose network:

- Do not connect the general-purpose network to other networks (for example, a general intranet), since this will reduce the access security of the system. Although the system is designed to prevent access by unauthorized users, it may not be able to withstand an attack by a skilled and persistent attacker.
- Do not route general-purpose network traffic through other data networks unless the required bandwidth is guaranteed. At critical times, the management data traffic can be high and performance will be affected if there is congestion caused by other network users.
- Do not use the general-purpose network to carry communication from the EMSs to network elements (for example, the Q-LAN).

Minimum specifications

Each server and workstation component of the deployed Navis™ Optical NMS system is specified to support a Fast Ethernet (100BASE-T) LAN interface capable of transferring data at 100 Mb/s. This represents the maximum possible data bandwidth between any two hardware components of the system.

In practice, the true data bandwidth available between any two hardware components of the system is significantly reduced by a number of factors. These include the topology of the network, the networking equipment used to connect components such as hubs, bridges, and routers. Also the “shared bandwidth” nature of data networking over a LAN means that the true bandwidth available at

any one time between hardware components on a LAN is determined by the level of data transfer occurring between other hardware components on the same LAN.

The general-purpose network should be engineered with enough total bandwidth to ensure that a minimum “logical bandwidth” of 64 Kb/s exists between any two hardware components of the deployed system.

Users of performance monitoring require a “logical bandwidth” of 2 Mb/s between the user and the EMS server.

Packet loss should be less than 1%. Communication latency should ideally be < 10 ms to avoid degrading performance more than 10% (compared to a direct LAN connection), and in all cases < 3 sec to avoid system failure.

Any form of WAN may be used (for example, a packet-switched network or a VPN) provided that the required bandwidth, packet loss, and latency specification is guaranteed.

To ensure maximum availability, single points of failure should be avoided, including router and data connections. Therefore, multiple connections via LANs and WANs are recommended.

Server high availability schemes also require additional LAN connections.

WaveStar® DACS CIT

The WaveStar® DACS CIT uses a PC workstation. It is possible to use a general Windows workstation for this if an additional LAN is provided for the connection to the WaveStar® DACS.

□

Connectivity of server architecture components

Introduction

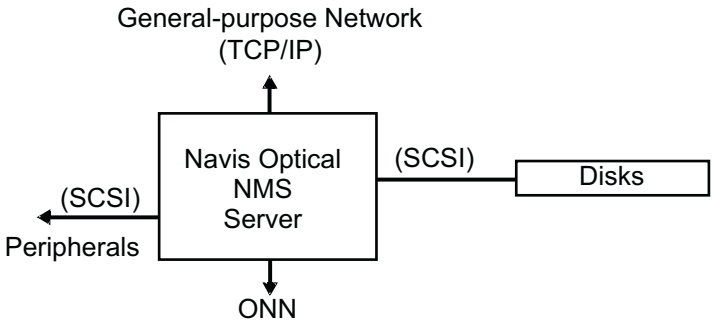
The following diagrams outline the connectivity required between the hardware components that make up each server hardware configuration. This is helpful for doing the following:

- Understanding the connectivity constraints on hardware components for the release (Note that one I/O interface card may support multiple connections independently without loss of performance, however no primary connection should share an interface card with its "standby" connection.)
- Eliminating single points of failure in deployments that use the one or more of the high-availability strategies

Note that "peripherals" refers to external devices such as tape drives, external writable CD-ROMs, and/or printer connections.

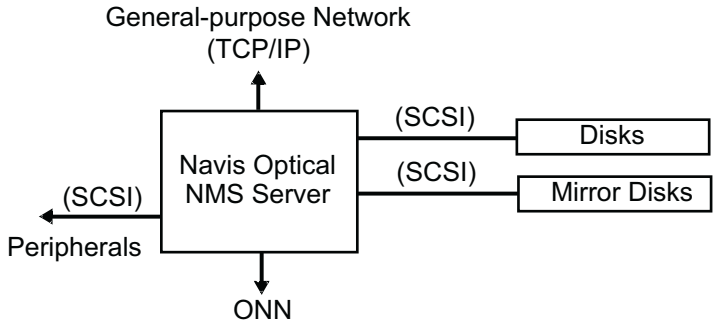
Single server

The following figure shows the connectivity of the single server hardware configuration being used for the small, medium, and large applications.



Single server with disk mirroring

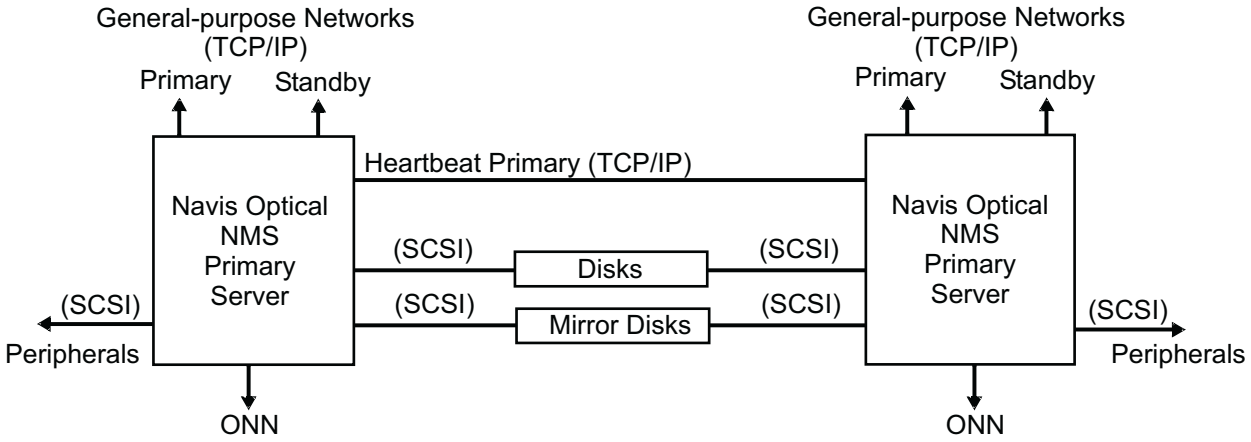
The following figure shows the connectivity of the single server with disk mirroring hardware configuration being used for the Small, Medium, and Large applications.



Local redundancy

The local redundancy hardware configuration can be used for the Small, Medium, and Large applications.

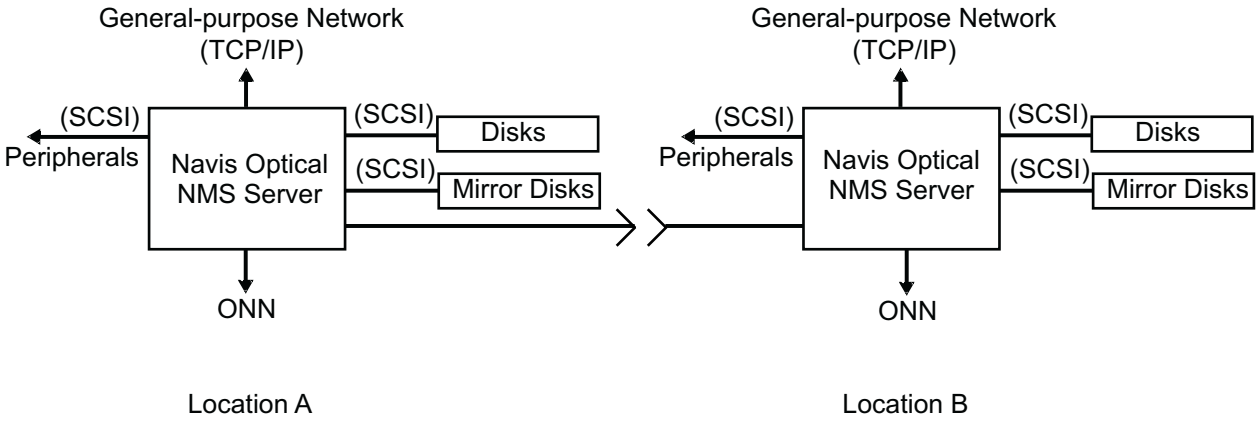
The following figure shows the connectivity of the local redundancy hardware configuration.



Geographic redundancy

The geographic redundancy hardware configuration can be used for the Small, Medium, and Large applications of Navis™ Optical NMS.

The following figure shows the connectivity of the geographic redundancy hardware configuration.



Connectivity of client architecture components

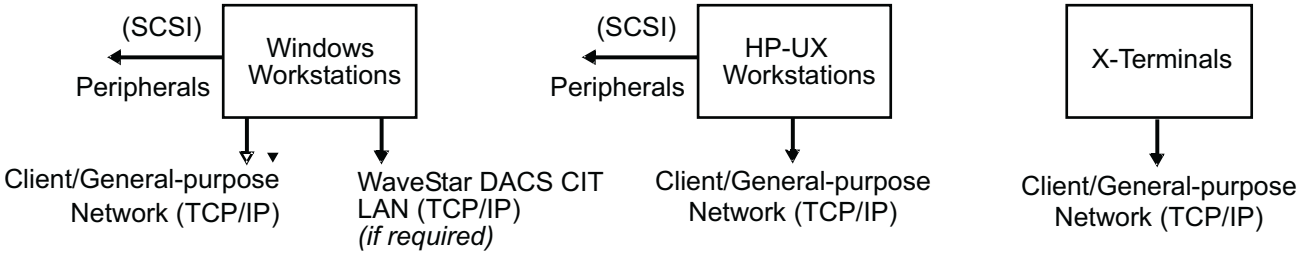
Overview

This section describes the connectivity of client architecture components.

Note that the whole network is not specified in the figures in this section.

Desktop workstations

The following figure shows the desktop workstations and their LAN connections.

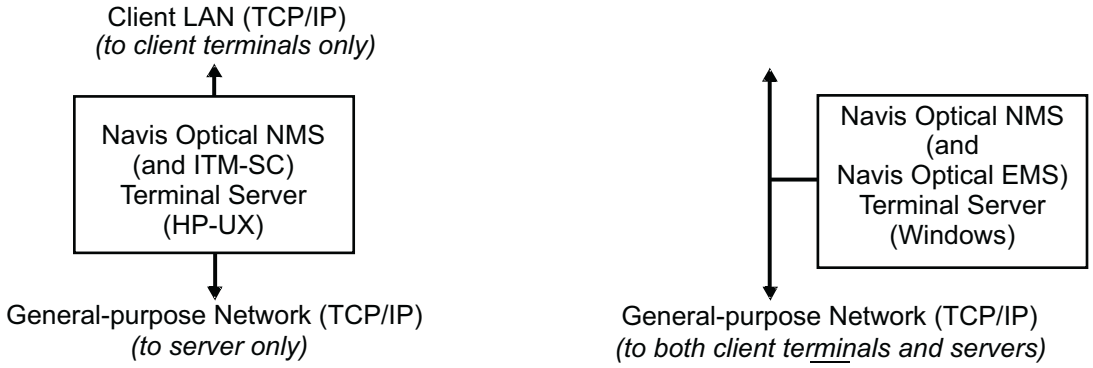


Terminal servers

The ITM-SC terminal server is equipped with two LAN cards so that traffic to and from the client terminals and server can be separated.

The Navis™ Optical NMS (and Navis™ Optical EMS) Windows terminal servers currently supported do not permit a similar two-LAN configuration. Traffic to and from both the client terminals and the server are carried on the same general-purpose LAN.

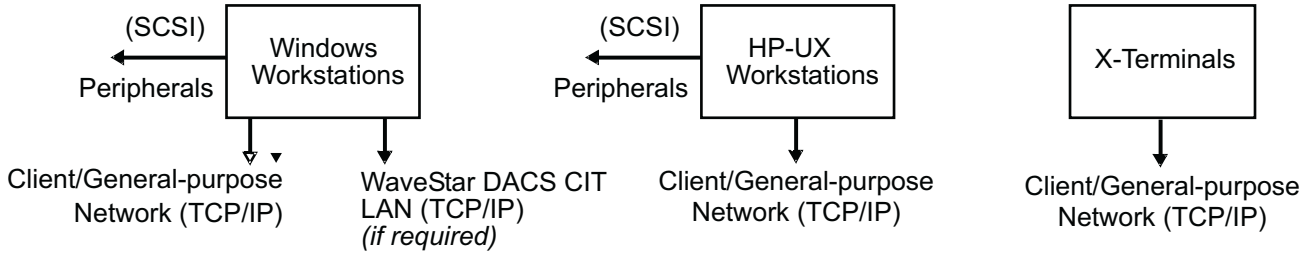
The following figure shows the terminal servers and their LAN connections.



Where both terminal servers shown in the figure above are deployed together, the client LAN required by the ITM-SC terminal server must be connected to the general-purpose LAN with the introduction of a router or a hub (see the examples in the following section).

Desktop terminals

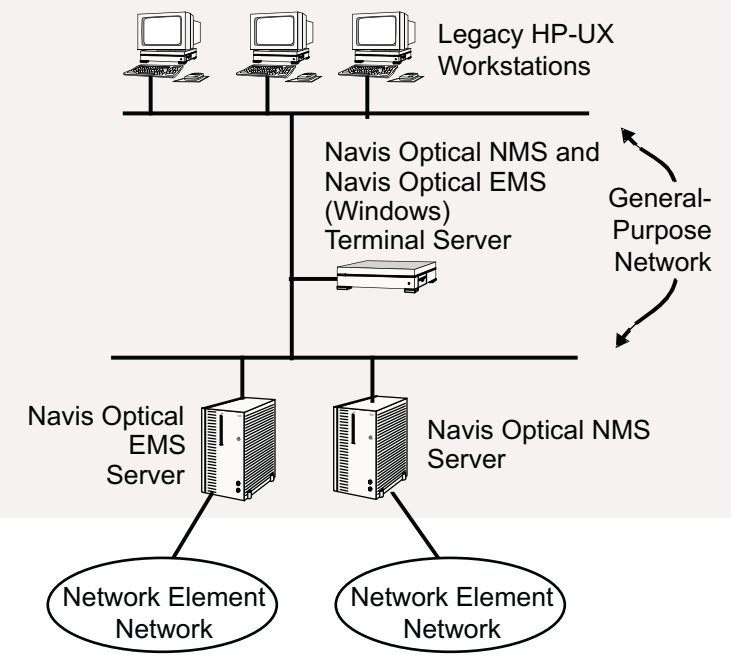
The following figure shows the desktop terminals and their LAN connections.



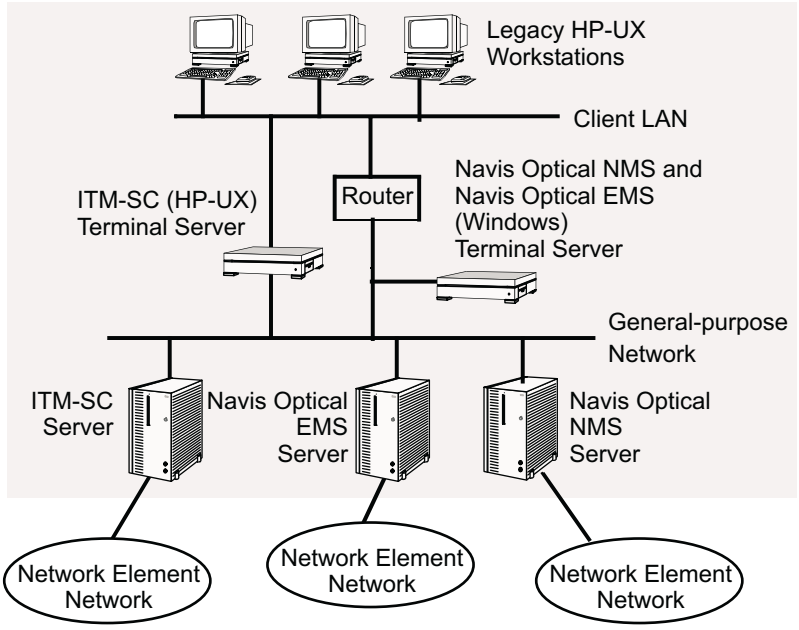
Examples

Overview The following figure illustrates some examples of a variety of these configurations.

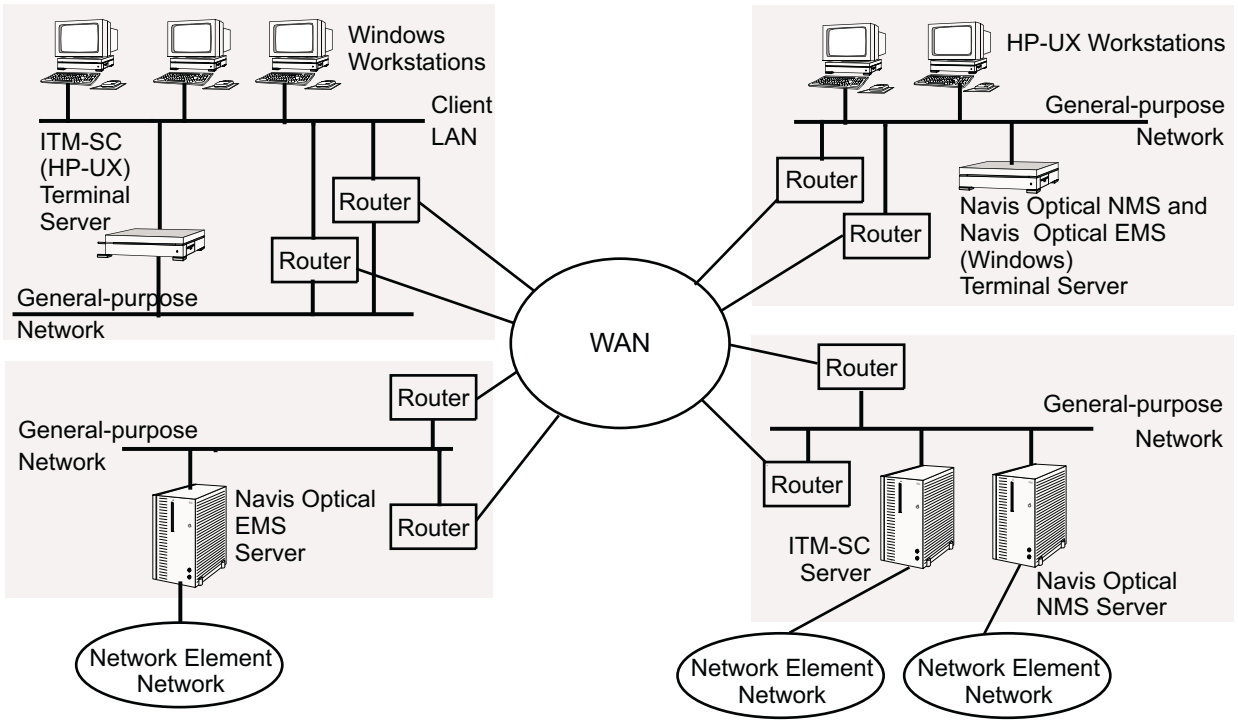
Example A Example A shows a simple configuration with a terminal server serving Navis™ Optical NMS and Navis™ Optical EMS for legacy HP-UX workstations.



Example B Example B shows the addition of an ITM-SC whose terminal server forces the need to bridge between the general-purpose LAN and a new client LAN.



Example C Example C shows a more complex, multi-site example with redundant Wide-Area Network (WAN) interconnections.



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Network growth

Overview

If a network grows beyond the limits originally planned for when the existing Navis™ Optical NMS was installed, the following strategies allow Navis™ Optical NMS to support network growth:

- Upgrade the hardware platform
- Add additional server machines
- Add additional client machines
- Add EMSs

Upgrade the hardware platform

An existing legacy platform may be replaced with the currently recommended cost-effective platform for the new size of network.

A currently recommended platform can be upgraded with extra processors, memory, etc. to support a greater network application.

Add additional server machines

In the future, the main server will be assisted by adding additional servers.

Add additional client machines

The main server is assisted by adding additional client platforms for terminals. The terminal server configuration can be used to increase the number of users, though only to the capacity of the main server.

Add EMSs

Additional EMSs will support more network elements at the element level, but only up to the limit of the integration layers, that is, Navis™ Optical NMS.

□

6 Ordering

Overview

Purpose

This chapter describes product support available for Navis™ Optical NMS.

Contents

How to order Navis™ Optical NMS

Overview This section describes how to order Navis™ Optical NMS.

Ordering Navis™ Optical NMS is ordered by calling a Lucent sales representative.

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Orderable items

Overview

This section lists the items that are orderable. The lists in this section should be used to help prepare an order before it is actually placed.

> **Important!** The information in this chapter is related to Navis™ Optical NMS Release 7.0. For information on a more recent release, contact your Local Customer Support (LCS) or the support organization designated by your Lucent customer team representative. If you are unsure of who to call, contact the Global TSS Contact Center at (630)-224-4672.

Application Software: Core

The following table contains the comcodes for the application software core.

Description	Comcode
Navis™ Optical NMS Release 7.0 Upgrade Release 6.x RTU DVD (upgrade from last release - no customization; no third party software)	109250829
Navis™ Optical NMS Release 7.0 Upgrade Release 6.x RTU DAT (upgrade from last release - no customization; no third party software)	109250837
Navis™ Optical NMS Release 7.0 Core Basic DVD: NL R7.0	109228601
Navis™ Optical NMS Release 7.0 Core Basic DAT: NL R7.0	109228593

Application Software: Optional Features

The following table contains the comcodes for the application software options.

Description	Comcode
Navis™ Optical NMS Release 7.0 Option: Service Domain Partitioning	109225169
Navis™ Optical NMS Release 7.0 Option: Geographic Domain Partitioning	109225177
Navis™ Optical NMS Release 7.0 Option: Simplified Geographic Redundancy	109225185
Navis™ Optical NMS Release 7.0 Option: Full Geographic Redundancy	109225193

Description	Comcode
Navis™ Optical NMS Release 7.0 Option: Local Redundancy (MC/ServiceGuard)	109225201
Navis™ Optical NMS Release 7.0 Option: Preplan Restoration	109225219
Navis™ Optical NMS Release 7.0 Option: ASCII Northbound Alarm Interface	109225235
Navis™ Optical NMS Release 7.0 Option: PM Data Export	109225243
Navis™ Optical NMS Release 7.0 Option: CORBA Northbound interface	109225250
Navis™ Optical NMS Release 7.0 Option: ONN	109225268

Application Software: Network Element RTU

The following table contains the comcodes for the network element Right to Uses (RTUs).

Description	Comcode
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® AM 1	109225060
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® AM 1 Plus	109225078
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® TM 1	109225086
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® ADM 4/1	109225094
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® ADM 16/1	109225102
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® ADM 16/1 Compact	109225110
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® TDM 2.5/10G (SDH)	109224128
Navis™ Optical NMS Release 7.0 Network Element RTU: ADM 155E	109225136
Navis™ Optical NMS Release 7.0 Network Element RTU: PHASE 16/4	109225144

Description	Comcode
Navis™ Optical NMS Release 7.0 Network Element RTU: PHASE 4/1	109225151
Navis™ Optical NMS Release 7.0 Network Element RTU: PHASE LXC 16/1	109224915
Navis™ Optical NMS Release 7.0 Network Element RTU: ISM	109224923
Navis™ Optical NMS Release 7.0 Network Element RTU: SLM	109224931
Navis™ Optical NMS Release 7.0 Network Element RTU: NERA Radio	109224949
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® BandWidth Manager	109224956
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® DACS 4/4/1	109225964
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® EON (formerly known as WaveStar® OLS 80G)	109224972
Navis™ Optical NMS Release 7.0 Network Element RTU: WaveStar® OLS 1.6T (formerly known as WaveStar® OLS 400G) (SDH)	109224980
Navis™ Optical NMS Release 7.0 Network Element RTU: Lambda Router	109224998
Navis™ Optical NMS Release 7.0 Network Element RTU: LambdaUnite MSS (SDH)	109225003
Navis™ Optical NMS Release 7.0 Network Element RTU: Black Box (unmanaged object)	109224840

Third-party element management systems

The following table contains the comcodes for the third-party EMSs.

Description	Comcode
Navis™ Optical NMS Release 7.0 Nera EMS	109224899

Third-party software

The following table contains the comcodes for the third-party software.

Description	Comcode
Oracle RDMS Enterprise Edition 8.0 Run-time License and first year of software support (per CPU)	108150822
IONA Orbix C++ R3.3.2 (formerly called IONA Orbix MT) + IONA Orbix Java Edition (formerly called IONA Web server) (per CPU)	108854563
IONA Orbix Notification 2000 R2 Windows (only required for Northbound CORBA Interface option) (per CPU)	109261008
Upgrade from IONA Orbix 3.0.3 to IONA Orbix Notification 2000 R2 Windows (only required for Northbound CORBA Interface option) (per CPU)	109261065
Roguewave Source Pro Core (v13) (per CPU)	109149666
Roguewave Source Pro DB (v13) (per CPU)	109149674
BEA Tuxedo 6.5 per server RTU for 32 users and first year of software support	109295956
BEA Tuxedo 6.5 per server RTU for 64 users and first year of software support	109295964
Upgrade BEA Tuxedo 32 users to 64 users + support	109295972

Documentation

The following table contains the comcodes for the Navis™ Optical NMS user documentation.

Description	Comcode
Navis™ Optical NMS Release 7.0 Getting Started Guide - English (365-309-260R7.0)	109231860
Navis™ Optical NMS Release 7.0 Applications and Planning Guide - English (365-309-261R7.0)	109231845
Navis™ Optical NMS Release 7.0 Provisioning Guide - English (365-309-262R7.0)	109231878
Navis™ Optical NMS Release 7.0 Maintenance Guide - English (365-309-263R6.1)	109231886
Navis™ Optical NMS Release 7.0 Administration Guide - English (365-309-264R7.0)	109231894

Description	Comcode
Navis™ Optical NMS Release 7.0 User Documentation CD-ROM - English (365-309-265R7.0)	109231902
Navis™ Optical NMS Release 7.0 Managing the Nera CityLink with Navis™ Optical NMS - English (365-309-258R6.1)	109198168

Maintenance

The following table contains the comcodes for maintenance.

Description	Comcode
Navis™ Optical NMS Release 7.0 Maintenance Fee (with upgrades, maximum of one per year)	109231928
Navis™ Optical NMS Release 7.0 Maintenance Fee (without upgrades)	109231936

Installation

The following table contains the comcodes for maintenance.

Description	Comcode
Navis™ Optical NMS Release 7.0 New Installation (per installation)	108998329
Navis™ Optical NMS Release 7.0 Upgrade Installation (per installation)	109086173

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7 Product Support

Overview

Purpose

This chapter describes product support available for Navis™ Optical NMS.

Contents

Technical Assistance

Introduction

Lucent Technologies is committed to providing excellence in technical support for its products.

A support structure is ready and available to resolve any technical issue related to Navis™ Optical NMS.

Getting help

In the continental United States, when you need additional technical assistance, the Lucent Technologies Global TSS Contact Center is your first point of contact. Technical assistance is available 24 hours a day, 7 days a week. Contact the Global TSS Contact Center at 866-LUCENT8 (866-582-3688).

Outside the continental United States, contact your Local Customer Support (LCS) or the support organization designated by your Lucent customer team representative. If you are unsure of who to call, contact the Global TSS Contact Center at 630-224-4672.

Local support procedures

Some customers have established their own support procedures that involve escalation within their own companies. In these cases, be sure to follow the procedures established by your company.

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Training

Introduction

Lucent Technologies offers training courses that support Navis™ Optical NMS.

Curriculum

The Navis™ Optical NMS training curriculum currently includes the following courses:

- *Navis™ Optical NMS User Training,* TR4512
- *Navis™ Optical NMS System Administrator Training,* TR4513

Schedules and information

Course descriptions, schedules, and general information about Navis™ Optical NMS training can be found on the Lucent Technologies product training web site at:

- *http://www.lucent-product-training.com*

Registering for courses

To register for Navis™ Optical NMS training courses, do one of the following:

- Enroll on-line at: *http://www.lucent-product-training.com*
- In the United States, contact Lucent Technologies Customer Training at 888-LUCENT8 (888-582-3688), prompt 2.
- Outside of the United States, call the Lucent Technologies product training telephone number for your region. The product training web site provides a list of telephone numbers to be used outside of the United States.
- Contact your Lucent Technologies customer team representative.

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User documentation

Introduction

This information product is part of a set of documents that supports Navis™ Optical NMS.

List of documents

The document set that supports Navis™ Optical NMS includes:

1. *Navis™ Optical NMS Getting Started Guide* provides information needed when you are learning how to use the Navis™ Optical NMS software. It describes how to start and stop Navis™ Optical NMS, how to use the software, and how to interpret the graphical user interface.
   This document includes tasks and conceptual information.
2. *Navis™ Optical NMS Applications and Planning Guide* designed to help users understand Navis™ Optical NMS applications, use of the product, and the product components needed for a specific application.
   This document contains conceptual information only.
3. *Navis™ Optical NMS Provisioning Guide* instructs users how to use Navis™ Optical NMS to provision and manage a network.
   This document includes tasks and conceptual information.
4. *Navis™ Optical NMS Maintenance Guide* instructs users on how to maintain Navis™ Optical NMS and the network.
   This document includes tasks and conceptual information.
5. *Navis™ Optical NMS Administration Guide* instructs users on how to administer Navis™ Optical NMS and the network.
   This document includes tasks and conceptual information.

On-line documentation

On-line documentation for Navis™ Optical NMS is provided in two formats:

1. An on-line version, in HTML format, of this document set is provided as part of theNavis™ Optical NMS software.
2. An on-line version, in HTML format, of this document set is available on CD-ROM.
   Navis™ Optical NMS User Documentation CD-ROM includes the full set of documents listed above.

Screen help

The Navis™ Optical NMS software includes on-line help for each window, which describes the purpose of the window, each of the fields, and each of the buttons.

How to order

To order Navis™ Optical NMS information products, do one of the following:

- Contact your Lucent Technologies customer team representative.
- Contact the Lucent Technologies at:
  - From the United States, call 888-LUCENT8 (888-582-3688), prompt 1.
  - From Canada, call 317-322-6615.
  - From Europe, the Middle East, and Africa, call 317-322-6416.
  - From Asia, the Pacific Region, China, the Caribbean, and Latin America, call 317-322-6416.

□

Appendix A: Network Element Equivalence (NEQ) values

Overview

Purpose

This appendix describes the Network Element Equivalence (NEQ) values for Navis™ Optical NMS.

Contents

What is a Network Element Equivalence (NEQ) value?

Definition: NEQ

The Network Element Equivalence (NEQ) value provides a weighting for each network element in terms of network level loading.

How NEQ is calculated

NEQ considers the following factors:

- Processing of network provisioning on the network element
- Processing of alarms relating to the network element
- Processing performance monitoring information
- Resynchronization of network element information on system start-up

An accurate calculation of NEQ values for each network element depends on the network element type, the level of provisioning of termination points, cross-connects and performance monitoring points on the network element.

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Listing of NEQ values

Purpose

This section provides the minimum and maximum NEQ value associated with each network element.

NEQ values

Important! The information in the following table is related to Navis™ Optical NMS Release 6.0 and 7.0. For information on a more recent release, contact your Local Customer Support (LCS) or the support organization designated by your Lucent customer team representative. If you are unsure of who to call, contact the Global TSS Contact Center at (630)-224-4672.

The following table provides the minimum and maximum NEQ value associated with each network element. All values have been rounded up to a single decimal place.

Network Element Type	Releases	Minimum Loading	Maximum Loading
WaveStar™ ADM 155E, WaveStar® ADM 4/1	V5 (Maintenance Release)	0.2	1.1
WaveStar® ADM 16/1 (16 x 16 cross connects)	R4.0.1	0.2	3.1
WaveStar® ADM 16/1 (32 x 32 cross connects)	R4.0.1	0.2	4.4
WaveStar® ADM 16/1 Compact	R1.1	0.2	3.6
WaveStar® AM 1	R3.1	0.2	0.3
WaveStar® AM 1 Plus	R2.0	0.2	0.4
WaveStar® TM 1	R2.2	0.2	0.4
WaveStar® BandWidth Manager (1536)	R3.1	0.2	5.3
WaveStar® TDM 2.5G	R5.0	0.2	2.2
WaveStar® TDM 10G	R2.1	0.2	1.8
WaveStar® DACS 4/4/1	R3.0	0.7	68.4
WaveStar OLS 400G (end terminal	R3.0	0.2	2.2

Network Element Type	Releases	Minimum Loading	Maximum Loading
WaveStar OLS 400G (repeater)	R3.0	0.2	1.2
WaveStar OLS 800G (end terminal	R5.0	0.2	4.2
WaveStar OLS 800G (repeater)	R5.0	0.2	2.0
WaveStar® OLS 80G (end terminal)	R6.0	0.2	0.6
WaveStar® OLS 80G (repeater)	R3.0	0.2	0.3
WaveStar® OLS 16T (formerly known as WaveStar® OLS 400G		0.2	2.2
LambdaRouter™ 128		0.2	0.8
LambdaRouter™ 256	R1.0	0.2	1.4
LambdaRouter™ 1024		0.2	4.8
LambdaUnite™ MSS	R2.0	0.2	8.9
ISM-1	R1.10, R2.5, R3.0	0.2	1.0
ISM-4	R1.10, R2.5, R3.0	0.2	1.0
ISM-5E	R1.10, R2.5, R3.0	0.2	1.0
SLM-16	R5.0	0.2	0.4
SLM-4	R5.0	0.2	0.4
NERA Radio	R2A	0.2	0.3
PHASE TM 16/4 and 4/4	R5.0	0.2	1.3
PHASE LR 16 and LR 4	R5.0	0.2	0.3
PHASE ADM 16/4 and 4/4	R5.0	0.2	1.1
PHASE LXC 4/1	R5.0	0.2	2.7

Network Element Type	Releases	Minimum Loading	Maximum Loading
PHASE LXC 16/1	R5.0	0.2	6.2

Index