

**Lucent Technologies**  
Bell Labs Innovations



# ***WaveStar*<sup>®</sup> Network Management System (NMS)**

**Release 4.2 (Topaz)**

Applications and Planning Guide

365-309-242  
Issue 1  
October 2001



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365-309-242 Issue 1 October 2001

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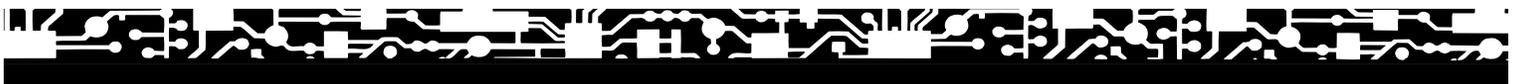
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# About this information product

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**Purpose** This chapter is a preface that provides an overview of this information product.

The purpose of this Applications and Planning Guide is to provide an overview of *WaveStar*<sup>®</sup> Network Management System (NMS) Release 4.2, explain its capabilities, and describe the planning activities that must be done before a system can be installed.

**Reason for reissue** This Applications and Planning Guide, Issue 1, is a revised document that supports WaveStar NMS, Release 4.2.

**Safety labels** This information product does not use safety labels.

**Intended audience** This guide 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 WaveStar NMS.

**How to use this information product** This section provides information that will help users of this guide.

## Chapter descriptions

The following table describes the information in each chapter of this guide.

Section	Title	Description
Preface	About this information product	Describes this document's purpose and intended audience, how to use the document, and how to comment on it
Chapter 1	<a href="#">Chapter 1, "System Overview"</a>	Provides a high-level description of the product and its features
Chapter 2	<a href="#">Chapter 2, "Features"</a>	Describes the features of this product
Chapter 3	<a href="#">Chapter 3, "Applications"</a>	Describes applications for this product in the network and provides a brief description of the network elements it manages
Chapter 4	<a href="#">Chapter 4, "Hardware Platforms"</a>	Describes the supported hardware platforms for WaveStar NMS.
Chapter 5	<a href="#">Chapter 5, "System Planning and Engineering"</a>	Describes system planning issues that should be considered before purchasing the product
Chapter 6	<a href="#">Chapter 6, "Ordering"</a>	Describes how to order WaveStar NMS
Chapter 7	<a href="#">Chapter 7, "Product Support"</a>	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 document uses the following typographical conventions to distinguish between computer input and output.
- When describing the WaveStar NMS software, fields in windows and field entries are identified with **this font**.
  - When describing the *UNIX*<sup>®</sup> 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 WaveStar NMS.

#### **List of documents**

The document set that supports WaveStar NMS includes:

1. *WaveStar NMS Getting Started Guide*, (365-309-241) - provides information needed when you are learning how to use the WaveStar NMS software. It describes how to start and stop WaveStar NMS, how to use the software, and how to interpret the graphical user interface. This document includes tasks and conceptual information.
2. *WaveStar NMS Applications and Planning Guide*, (365-309-242) - describes the WaveStar NMS features and applications, provides a product description, describes the hardware platforms for the product, and describes system planning and engineering, ordering, and product support. This document contains conceptual information only.
3. *WaveStar NMS Provisioning Guide*, (365-309-243) - instructs users how to use WaveStar NMS to provision and manage a network. This document includes tasks and conceptual information.
4. *WaveStar NMS Maintenance Guide*, (365-309-244) - instructs users on how to maintain WaveStar NMS and the network. This document includes tasks and conceptual information.
5. *WaveStar NMS Administration Guide*, (365-309-245) - instructs users on how to administer WaveStar NMS and the network. This document includes tasks and conceptual information.

**On-line documentation**

An on-line version, in HTML format, of this document set is provided with WaveStar NMS.

**Screen help**

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# 1 System Overview

## Overview

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**Purpose** This chapter provides a system overview of the *WaveStar*<sup>®</sup> Network Management System (NMS) application.

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## Product definition

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**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. WaveStar NMS is a part of a telecommunications management network that provides comprehensive and integrated management of an entire transport network.

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

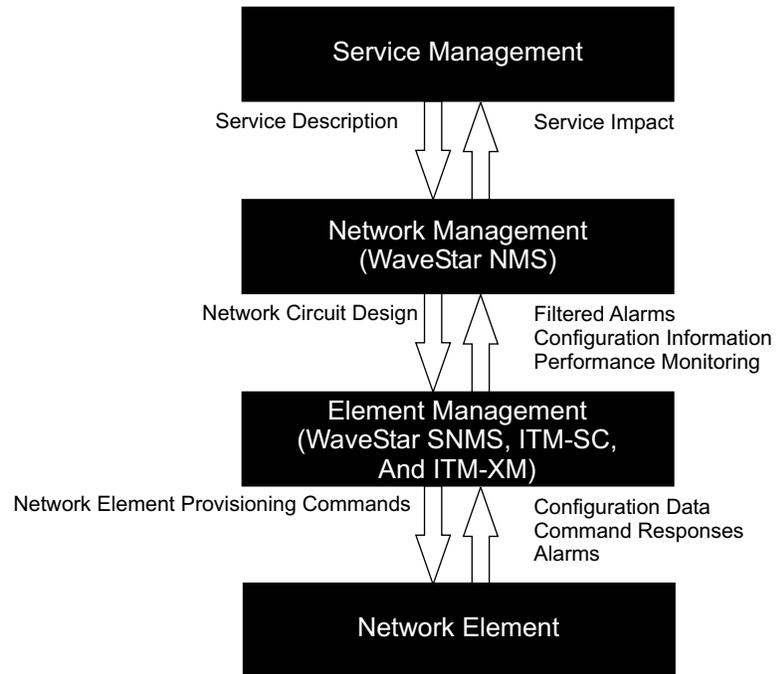
- Dense Wavelength Division Multiplexing (DWDM)
- Synchronous Digital Hierarchy (SDH)
- Synchronous Optical Network (SONET)
- Plesiochronous Digital Hierarchy (PDH)
- Optical cross-connect

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, trails, and circuits.

### **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.



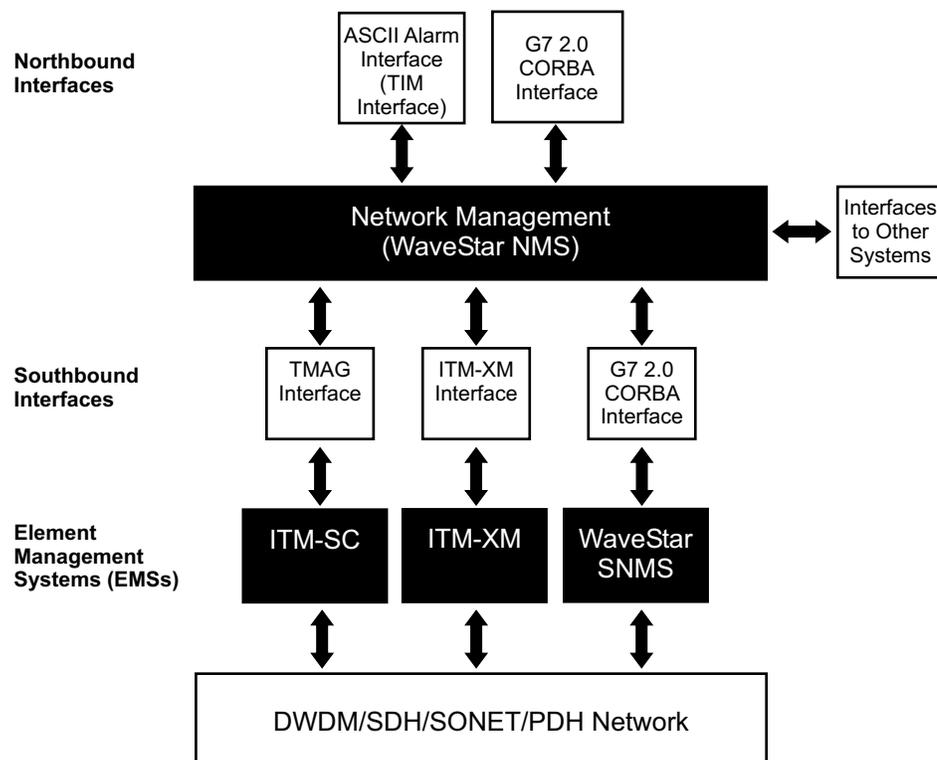
**Capabilities** From a single operator seat, an entire network can be managed using WaveStar NMS. WaveStar NMS is designed to manage different numbers of network elements and features on a cost-effective combination of hardware platforms.

For a description of the network elements in the network, see [Chapter 3, “Applications”](#)

□

## External interfaces

**Introduction** The WaveStar 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 NFM, WaveStar TMS, and TCM-E.

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

**Southbound interfaces**

WaveStar 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)

**ITM-XM interface**

The ITM-XM interface is not explicitly an interface because ITM-XM is part of the same platform as WaveStar NMS and no interface is required. WaveStar NMS has direct access to the following EMS:

- Integrated Transport Manager-Cross-connect Manager (ITM-XM)

**G7 2.0 CORBA interface to WaveStar SNMS**

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

- WaveStar Subnetwork Management System (SNMS)

**Interfaces to other systems**

WaveStar 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 WaveStar 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

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## Supported element management systems (EMSs)

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**Introduction** The networks that can be managed with WaveStar NMS include a number of element management systems (EMSs).

**List of supported EMSs** WaveStar NMS, Release 4.2 interacts with the following Lucent Technologies element management systems (EMSs):

- WaveStar Subnetwork Management System (SNMS), Releases 5.0 and 5.1.2
- WaveStar Subnetwork Management System (SNMS), Releases 6.0 for WaveStar LambdaRouter only
- Integrated Transport Manager-Subnetwork Controller (ITM-SC), Releases 6.1 and 8.0.3
- Integrated Transport Manager-Cross-connect Manager (ITM-XM), Release 6.0

**WaveStar SNMS** WaveStar SNMS manages the following Lucent Technologies network elements:

- WaveStar BandWidth Manager
- WaveStar TDM 10G
- WaveStar OLS 400G Family
- WaveStar LambdaRouter 256

**ITM-SC** ITM-SC manages the following Lucent Technologies network elements:

- WaveStar ADM 16/1 and WaveStar ADM 16/1 Compact
- WaveStar ADM 4/1
- WaveStar TM 1
- WaveStar AM 1
- WaveStar AM 1 Plus
- WaveStar OLS 80G
- WaveStar DACS (Releases 2.1 and 3.0)
- WaveStar ADM 155E
- ISM-1, ISM-4, and ISM-5E
- NERA Radio

- SLM (ADM or Terminal), including regenerators
- PHASE network elements, including regenerators

**ITM-XM** The ITM-XM EMS is a co-resident module of WaveStar NMS. ITM-XM manages the following Lucent Technologies network elements:

- WaveStar DACS, Release 2.0 (Later releases are managed by ITM-SC.)
- DACS VI

**About EMS cut-throughs**

“Cut-through” interfaces allow the WaveStar NMS GUI to invoke some or all of an EMS GUI for the following purposes:

- to launch the EMS for general EMS operations (This case is known as the Virtual Craft Interface Terminal [VCIT].)
- to access an EMS screen that provides further detail or supports operations not provided by WaveStar NMS (for example, adding and deleting network elements)
- to get data not available from WaveStar NMS but required to perform a WaveStar NMS operation (for example, selecting endpoint termination points for path provisioning)

**Releases of network elements**

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

	ITM-SC, Rel. 8.0.3	ITM-SC, Rel. 6.1	WaveStar SNMS, Rel. 5.1.2	WaveStar SNMS, Rel. 5.0	WaveStar SNMS, Rel. 6.0	ITM-XM, Rel. 6.0
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 4.0.1	Release 4.2				
WaveStar ADM 16/1 Compact	Release 1.1	Release 1.1				

	<b>ITM-SC, Rel. 8.0.3</b>	<b>ITM-SC, Rel. 6.1</b>	<b>WaveStar SNMS, Rel. 5.1.2</b>	<b>WaveStar SNMS, Rel. 5.0</b>	<b>WaveStar SNMS, Rel. 6.0</b>	<b>ITM-XM, Rel. 6.0</b>
WaveStar AM 1	Release 3.1	Release 3.1				
WaveStar AM 1 PLUS	Release 2.0	Release 1.1				
WaveStar TM 1	Release 2.2	Release 2.2				
WaveStar BandWidth Manager			Releases 3.0, 3.1, 4.0	Release 3.1		
WaveStar TDM 10G			Release 3.0	Release 2.1		
WaveStar DACS (managed by ITM-SC)	Release 3.0	Release 2.1				
WaveStar DACS (managed by ITM-XM)						Release 2.0
DACS VI						Releases 2.1.2, 2.1.3
WaveStar OLS 80G	Release 6.0					
WaveStar OLS 400G			Releases 4.0, 5.0, 6.0	Releases 3.0, 5.0		
WaveStar LambdaRouter 128/256			Release 2.0	Release 2.0	Release 2.0	
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					

	<b>ITM-SC, Rel. 8.0.3</b>	<b>ITM-SC, Rel. 6.1</b>	<b>WaveStar SNMS, Rel. 5.1.2</b>	<b>WaveStar SNMS, Rel. 5.0</b>	<b>WaveStar SNMS, Rel. 6.0</b>	<b>ITM-XM, Rel. 6.0</b>
SLM-4	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				



## Supported digital transmission rates

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**Overview** This section discusses the digital transmission rates supported by WaveStar NMS.

**Table** The following table shows the digital transmission rates supported by WaveStar NMS.

Designation	Description	Facility Type	Transmission Rate Mb/s	Notes
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	WaveStar AM 1 and WaveStar ADM 16/1 only

<b>Designation</b>	<b>Description</b>	<b>Facility Type</b>	<b>Transmission Rate Mb/s</b>	<b>Notes</b>
LSBB			45 Mb/s to 750 Mb/s	OLS
HSBB			100 Mb/s to 2.5 Gb/s	OLS
X.21	Digital Link		2 Mb/s	WaveStar AM 1, Black Boxes only



## Supported digital links

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**Introduction** The networks that can be managed with WaveStar NMS include a variety of digital links.

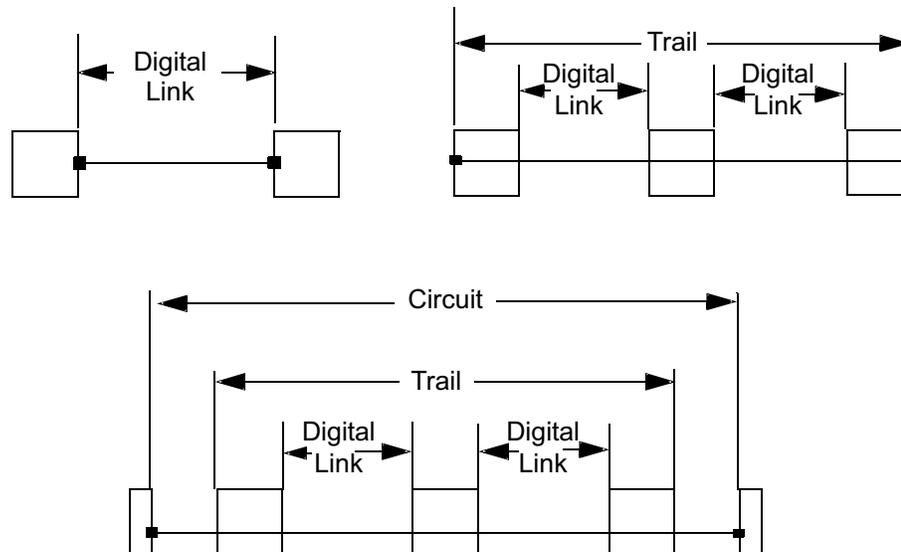
**About digital links** *Digital links* are fiber or electrical connections between two points. These transport facilities are assignable to high-order and low-order circuits to carry customer services. Digital links can be of two types: SDH digital links or PDH digital links.

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 WaveStar NMS are shown in the following table.

Network Element	STM-64	STM-16	STM-4	STM-1	STM-0	2.5 GB	E4	E3	E1	DS3	DS1	LAN <sup>8</sup> (TransLan)	GigaLan	X-21	PCT
ADM 15SE	-	-	-	Y	-	-	-	Y	Y	Y	-	-	-	-	-
WaveStar ADM 4/1 STM-1	-	-	-	Y	-	-	-	Y	Y	Y	-	-	-	-	-
WaveStar ADM 4/1 STM-4	-	-	-	Y	-	-	-	Y	Y	Y	-	-	-	-	-
WaveStar ADM 16/1	-	Y	Y	Y	-	-	Y	Y	Y	Y	Y	Y	-	-	-
WaveStar ADM 16/1 Compact	-	Y	-	Y	-	-	-	-	Y	-	-	-	-	-	-
WaveStar AM 1	-	-	-	Y	-	-	-	Y	Y	Y	-	Y	-	Y	-
WaveStar AM 1 PLUS	-	-	Y	Y	-	-	-	Y	Y	Y	Y	-	-	Y	-
WaveStar TM1	-	-	-	Y	-	-	-	-	Y	-	-	-	-	-	-
WaveStar BandWidth Manager	Y	Y	Y	Y	-	-	-	-	-	Y	-	-	-	-	-
WaveStar TDM 10G	Y	Y	Y	Y	-	-	-	-	-	-	-	-	-	-	-
WaveStar DACS (Rel. 2.1 and 3.0)	-	Y	Y	Y	-	-	-	-	-	-	-	-	-	-	-
WaveStar DACS (Rel. 2.0)	-	-	-	Y	Y	-	-	-	-	-	-	-	-	-	-
DACS VI (Rel. 2.1)	-	-	-	Y	Y	-	Y	Y	Y	-	-	-	-	-	-
Black Box	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	-	-	-	-	-
NERA Radio	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	-

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## Supported SDH cross-connect types and rates

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**Introduction** The networks that can be managed with WaveStar 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 WaveStar NMS. The network element by itself may support more rates than are supported with WaveStar NMS.

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

	VC4-64c	VC4-16c	VC4-4c	VC-4	VC-3	VC-2	VC-12	AU-3
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 10G		O, T, B	O, T, B	O, T, B				O, T, B
WaveStar DACS (managed by ITM-SC)			O, T, B	O, T, B	O, T, B		O, T, B	O, T, B
WaveStar DACS (managed by ITM-XM)				O, T, B	O, T, B		O, T, B	O, T, B
DACS VI				O, T, B	O, T, B		O, T, B	O, T, B

	<b>VC4-64c</b>	<b>VC4-16c</b>	<b>VC4-4c</b>	<b>VC-4</b>	<b>VC-3</b>	<b>VC-2</b>	<b>VC-12</b>	<b>AU-3</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
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				
NERA Radio								



## Supported SNCP protection

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**Introduction** The networks that can be managed with WaveStar 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 WaveStar NMS. The network element by itself may support more rates than are supported with WaveStar NMS.

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

	VC4-64c	VC4-16c	VC4-4c	VC-4	VC-3	VC-2	VC-12	AU-3
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 10G		O, T, B	O, T, B	O, T, B				O, T, B
WaveStar DACS (managed by ITM-SC)			O, T, B	O, T, B	O, T, B		O, T, B	O, T, B
WaveStar DACS (managed by ITM-XM)								
DACS VI				O, T, B	O, T, B		O, T, B	O, T, B

	<b>VC4-64c</b>	<b>VC4-16c</b>	<b>VC4-4c</b>	<b>VC-4</b>	<b>VC-3</b>	<b>VC-2</b>	<b>VC-12</b>	<b>AU-3</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
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				
NERA Radio								



# Benefits

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**Introduction** The benefits delivered by WaveStar 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** WaveStar 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** WaveStar NMS customers are provided with responsive field support, effective user documentation, and high-quality product training.

## What's new in this release of WaveStar NMS?

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**Introduction** Release 4.2 of WaveStar NMS includes a number of new features and feature enhancements.

**Highlights of Release 4.2** The highlights of Release 4.2 of WaveStar NMS include:

- Service domain partitioning enhancements (shared bandwidth)
- Preplan Restoration enhancements
- Ability to display selected routes on the Network Map from certain forms
- Support added for the following hardware platforms:
  - the B2600 HP-UX workstation
  - Pentium 4 PC workstations
- Support added for WaveStar SNMS, Release 6.0, for WaveStar LambdaRouter only
- Limited support added for WaveStar LambdaRouter 128/256, Release 2.0

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# 2 Features

## Overview

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**Purpose** This chapter describes the features of WaveStar NMS, broken down by functional area. The chapter also describes the WaveStar NMS interfaces.

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# Features per functional area

## Overview

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**Purpose** The features of WaveStar NMS are classified into several functional areas. This chapter gives a description of these features within each functional area.

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## User support facilities

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**Introduction** WaveStar NMS provides a number of capabilities to facilitate the task of managing network elements.

**Graphical user interface (GUI)** WaveStar 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 WaveStar 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** WaveStar NMS has the following user support facilities:

- WaveStar 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 WaveStar 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.

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## Security issues

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**Introduction** WaveStar NMS security management allows authorized users to have different levels of access.

For each user, WaveStar 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 WaveStar 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: <ul style="list-style-type: none"> <li>• Fault Management</li> <li>• Performance Monitoring</li> <li>• Pre-plan Management</li> </ul>
Geo Domain User	This profile provides user-level access to the aspects of the following task groupings that relate to geographic domains: <ul style="list-style-type: none"> <li>• Fault Management</li> <li>• NE Management</li> <li>• Performance Monitoring</li> <li>• Pre-plan Management</li> </ul>
Initial	This profile provides access to the following task groupings: <ul style="list-style-type: none"> <li>• Fault Management</li> <li>• Configuration Management</li> <li>• Performance Monitoring</li> <li>• NE Management</li> <li>• Pre Plan Management</li> </ul>
Alarm Management	This profile provides access to the following task groupings: <ul style="list-style-type: none"> <li>• Fault Management</li> </ul>
Provisioning (View Only)	This profile provides access to the following task groupings: <ul style="list-style-type: none"> <li>• Configuration Management (View Only)</li> </ul>
Combined	This profile provides access to the following task groupings: <ul style="list-style-type: none"> <li>• All Tasks</li> </ul>

### 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 WaveStar 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** WaveStar 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 WaveStar 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 WaveStar 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). WaveStar 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**

WaveStar 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 WaveStar 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 WaveStar 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 WaveStar NMS at the time the request is received from the customer. At this time, WaveStar 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 WaveStar SNMS-controlled network elements is provided through a “cut-through” from the WaveStar NMS to the ITM-SC and WaveStar SNMS interfaces.

Resource management of ITM-XM-controlled network elements is provided by the ITM-XM module of WaveStar NMS.

**Reports management**

WaveStar 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.

WaveStar 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 WaveStar NMS and the network element fails, WaveStar NMS regains information about the lost time by reading the network element's bins for the relevant interval.
- WaveStar 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 WaveStar 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.
- WaveStar 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

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**Introduction** This section describes some of the other features of WaveStar NMS.

### **Improper disconnects and uncorrelated cross-connects**

This feature identifies improper disconnects and uncorrelated cross-connects in the network. WaveStar 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 WaveStar NMS. The WaveStar NMS layout does not match the actual cross-connects on the network element. This is detected in the WaveStar 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 WaveStar NMS. WaveStar 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

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**Purpose** The WaveStar 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.

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<a href="#">Full geographic redundancy</a>	<a href="#">2-22</a>
<a href="#">Preplan Restoration</a>	<a href="#">2-23</a>
<a href="#">Performance Monitoring (PM) Export</a>	<a href="#">2-24</a>
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<a href="#">Local redundancy</a>	<a href="#">2-29</a>



## 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 WaveStar 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 WaveStar 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

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**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

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**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

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**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 WaveStar NMS.
- WaveStar TMS is a transport management system that requests connection management service from WaveStar NMS.
- TCM-E is Tandem Connection Monitoring Emulation system, which collects data about connections from WaveStar NMS.

□

## Local redundancy

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**Definition** Local redundancy protects against failure of a server.

For WaveStar 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 WaveStar 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 WaveStar 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

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<a href="#">Mirrored disks</a>	<a href="#">2-32</a>
<a href="#">Local redundancy</a>	<a href="#">2-33</a>
<a href="#">Geographic redundancy</a>	<a href="#">2-34</a>
<a href="#">Using high-availability strategies in combination</a>	<a href="#">2-35</a>



## 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 WaveStar 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 WaveStar 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 WaveStar NMS are described in [Chapter 3, “Applications”](#).

**For more information** For more information about geographic redundancy in WaveStar NMS, see [“Optional features” \(2-20\)](#), in [Chapter 2, “Features”](#).



## Using high-availability strategies in combination

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**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.

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# 3 Applications

## Overview

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**Purpose** This chapter describes the applications for WaveStar NMS in the network.

### Contents

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<u>Standard applications</u>	<u>3-4</u>
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# Standard applications

## Overview

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**Purpose** This section describes the applications for WaveStar NMS.  
Since WaveStar NMS is a network management system, it is always deployed in connection with communicating element management systems; particularly those of Lucent Technologies, that is, WaveStar SNMS and ITM-SC.

**Contents**

<a href="#">Standard applications</a>	<a href="#">3-4</a>
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## Standard applications

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**Introduction** Standard applications have been defined for WaveStar NMS.

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

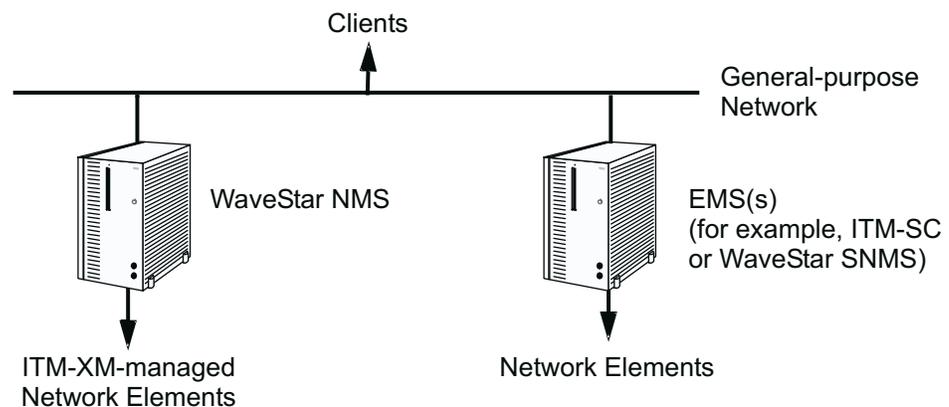
The hardware platforms for each application are described in [Chapter 4, “Hardware Platforms”](#).

**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.

**Network topology** In all of the applications, each instance of WaveStar NMS and the EMSs is loaded on its own server. WaveStar 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

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**Purpose** This section describes the topology management techniques that are supported for WaveStar 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**

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<a href="#">Aggregates</a>	<a href="#">3-7</a>
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## 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 WaveStar 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

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<b>Introduction</b>	Nodes can be grouped into aggregates. Grouping nodes into aggregate reduces clutter on the Network Map when numerous network elements are present.
<b>Definition: aggregate</b>	An aggregate is a collection of one or many network elements collapsed into a single node display on the network map.
<b>Number of network elements in an aggregate</b>	There is no restriction on the number of network elements that can be included in an aggregate.
<b>Aggregates within aggregates</b>	Aggregates can also contain other aggregates.
<b>Who creates aggregates?</b>	Only a system administrator can create aggregates.



## Areas

---

<b>Introduction</b>	Networks managed by WaveStar NMS can be subdivided into smaller, manageable networks called areas.
<b>Definition: area</b>	<p>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.</p> <p>Areas can be defined for any purpose. Examples of potentially useful areas are:</p> <ul style="list-style-type: none"><li>• a set of nodes/aggregates dedicated to a subscriber</li><li>• a set of nodes/aggregates, which are or are not connected</li><li>• a set of nodes/aggregates in a geographic location or building</li></ul>
<b>Purpose</b>	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.
<b>Number of network elements in an area</b>	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.
<b>Areas within areas</b>	Areas cannot contain other areas.
<b>Who creates areas?</b>	Only a system administrator can create areas.



# Controlled network elements

## Overview

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**Purpose** This section describes controlled network elements.

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## Definition of controlled network elements

---

**Definition** Controlled network elements are network elements that can be controlled by WaveStar 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 may be controlled:

- Directly, by ITM-XM
- Indirectly, through the ITM-SC or WaveStar SNMS



## ADM 155E

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**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 WaveStar 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

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**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), WaveStar 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 WaveStar 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.

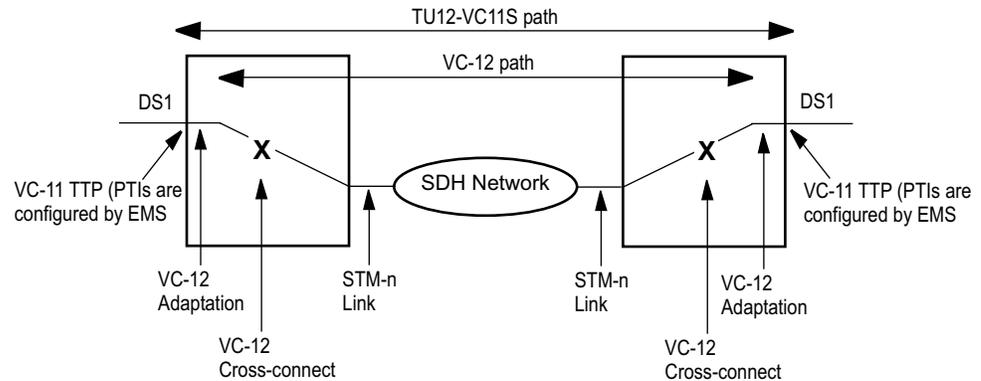
**DS1 provisioning** The following digital link and circuit types are supported for a WaveStar ADM 16/1 equipped with the DS1 option card:

- 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. WaveStar 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. WaveStar 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

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**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

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**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

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**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 WaveStar 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 BandWidth Manager

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- 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 WaveStar NMS software.
- How it is controlled** The WaveStar BandWidth Manager is controlled by WaveStar SNMS.
- 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 WaveStar 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 10G

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**Definition** The WaveStar TDM 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 10G is controlled by WaveStar SNMS.



# WaveStar DACS

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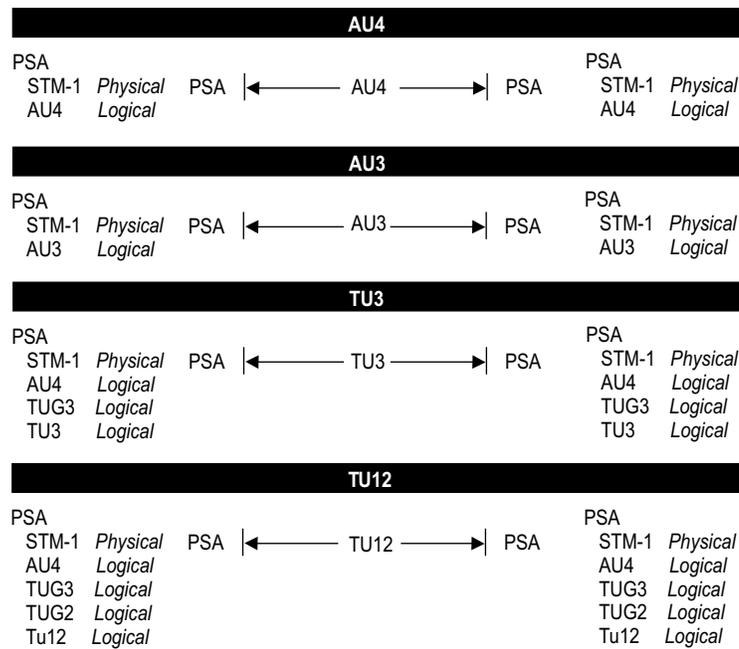
**Definition** The WaveStar DACS is a Lucent Technologies wideband and broadband digital cross-connect system for support of SDH networks.

**How it is controlled** The WaveStar DACS is controlled by the ITM-SC EMS. (Release 2.0 and earlier releases are controlled by the ITM-XM 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.



## DACS VI

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**Definition** The DACS VI is a synchronous wideband cross-connect system.

**How it is controlled** The DACS VI is controlled by the ITM-XM EMS.



## WaveStar OLS 400G Family

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**Definition** The WaveStar OLS 400G is a family of modular optical transmission systems.

The WaveStar OLS 400G Family includes three products:

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

The WaveStar OLS 400G Family 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 400G Family 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 400G Family 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 400G Family is controlled by WaveStar SNMS.

**Interfaces** The WaveStar OLS 400G 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)



## 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 LambdaRouter 128/256

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**Definition** The WaveStar LambdaRouter 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 WaveStar LambdaRouter 128/256 operates purely in the optical domain.

**How it is controlled** The WaveStar LambdaRouter 128/256 is controlled by WaveStar SNMS.

**Interfaces** WaveStar NMS supports provisioning of an optical link between:

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

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



## Intelligent Synchronous Multiplexer (ISM) Family

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**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.

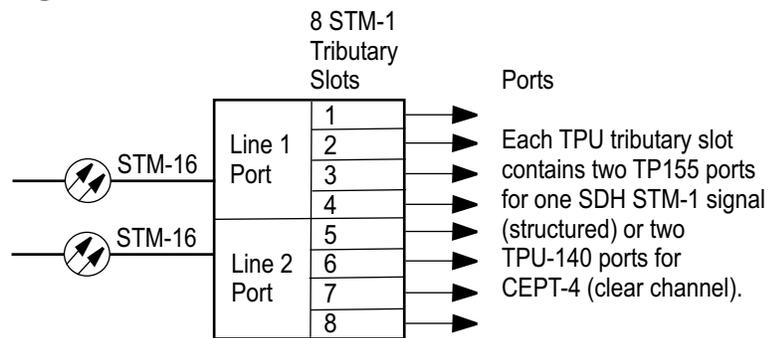
The SLM-2000 family includes the following models:

- SLM-4
- SLM-16

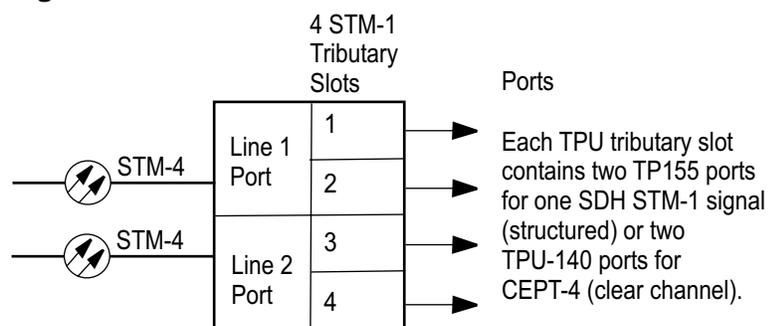
**How it is controlled** The SLM-2000 family is controlled by the ITM-SC EMS.

**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

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**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



## NERA Radio

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**Definition** NERA Radio is a digital radio transmitter/receiver that accepts up to seven electrical STM-1 signals. Only SDH Radio is supported by ITM-SC. Characteristics of NERA Radio include:

- No cross-connect commands sent
- 8 tributary slots (1:7 protection)
- Protection port can carry preemptable extra traffic

**How it is controlled** The NERA Radio is controlled by the ITM-SC EMS.

**Interfaces** The NERA Radio terminates STM-1 digital signals only.



# Noncontrolled network elements

## Overview

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**Purpose** This section describes noncontrolled network elements.

**Contents**

<a href="#">Definition of noncontrolled network elements</a>	<a href="#">3-33</a>
<a href="#">Black box</a>	<a href="#">3-34</a>
<a href="#">Customer equipment</a>	<a href="#">3-35</a>



## Definition of noncontrolled network elements

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**Definition** Noncontrolled network elements are network elements that cannot be controlled by WaveStar 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

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**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 WaveStar 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

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**Purpose** This chapter describes the supported hardware platforms for WaveStar NMS.

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

### Contents

<a href="#">About the client-server architecture</a>	<a href="#">4-2</a>
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## About the client-server architecture

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**Introduction** WaveStar 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 WaveStar 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” \(4-6\)](#), later in this chapter. Each client configuration is capable of interworking with any of the supported server configurations.

□

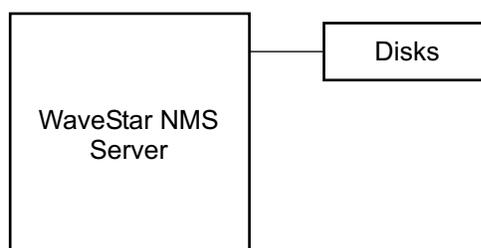
## Supported server hardware configurations

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**Introduction** The following server hardware configurations are supported for WaveStar NMS:

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

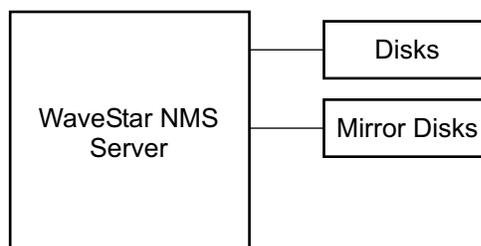
**Single server** The following figure illustrates the single server hardware configuration.



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

The WaveStar NMS server is an HP server running the HP-UX operating system.

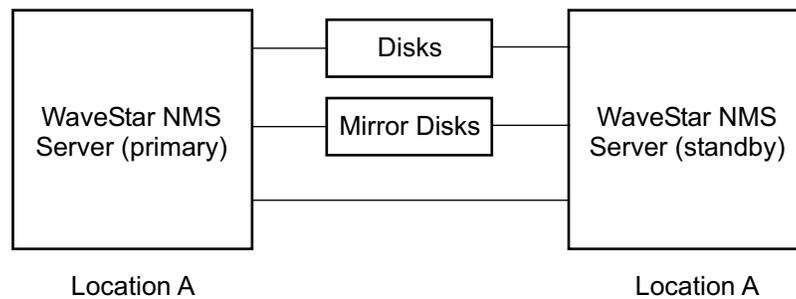
**Single server with disk mirroring** The following figure illustrates the single server hardware configuration.



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

The WaveStar NMS server is an HP server running the HP-UX operating system.

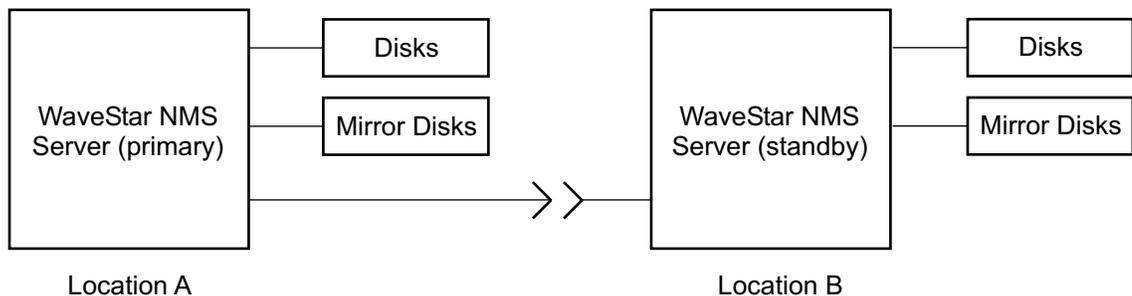
**Local redundancy** The following figure illustrates the local redundancy hardware configuration.



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 WaveStar 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 WaveStar 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 WaveStar NMS:

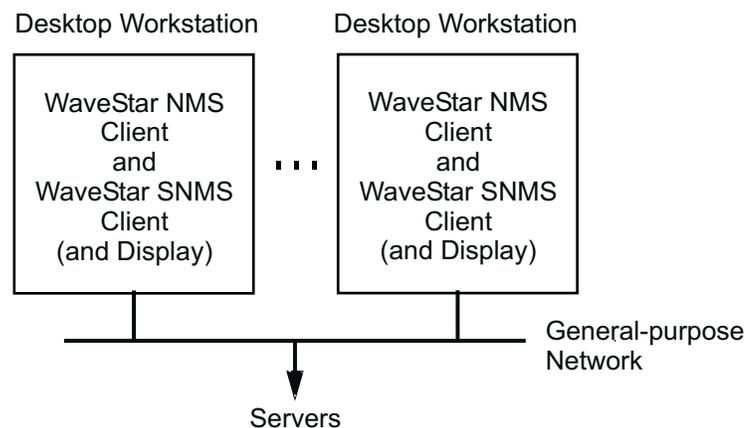
- Desktop workstation
- Terminal server

**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 WaveStar NMS via SAGE
- Co-host and co-display the GUI of other Lucent EMSs alongside the WaveStar 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 WaveStar NMS desktop workstation is one of the following:

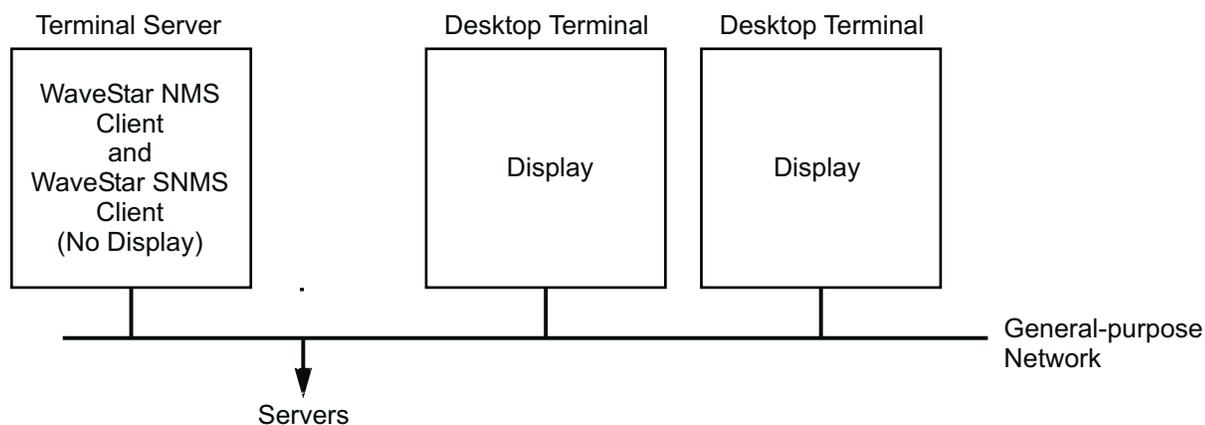
- an HP workstation running the HP-UX operating system
- a PC running the Windows NT or Windows 2000 operating system

**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 WaveStar NMS via SAGE
- Co-display the GUI of other Lucent EMSs alongside the WaveStar 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 WaveStar 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 WaveStar NMS application and hardware configuration.

The hardware required for a WaveStar 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, see [Appendix A, “Network Element Equivalence \(NEQ\) values”](#).

**Table** The following table shows the different WaveStar NMS server platforms that are orderable for this release.

Components hosted	Application			Configurations				Platform Title	Hardware		
	# of users	# of EMSs	# of NEQs <sup>a</sup>	Singleserver	Single server with disk mirroring	Geographic Redundancy	Local Redundancy		HP 9000 server model	# of CPUs	Memory
WaveStar NMS server	32	20	500	✓				Small WaveStar NMS server	L2000	1	1 Gb
					✓	✓		Small WaveStar NMS server with disk mirroring	L2000	1	1 Gb
				✓				Medium WaveStar NMS server	L2000	2	2 Gb
	32	30	2000		✓	✓		Medium WaveStar NMS server with disk mirroring	L2000	2	2 Gb
				✓				Large WaveStar NMS server	L2000	4	4 Gb
	64	40	5000		✓	✓		Large WaveStar NMS server with disk mirroring	L2000	4	4 Gb
							✓	Large WaveStar NMS server with Local Redundancy	L2000	4	4 Gb

a. This value is subject to a Network Fan-out scaling factor.

**Legacy servers** In addition to the platforms listed above, a number of legacy server platforms introduced in previous releases are also supported in this release.

Components Hosted	Hardware			Application		
	HP 9000 server model	# of CPUs	Memory	# of users	# of EMSs	# of NEQs
WaveStar NMS server	L2000	3	2 Gb	32	40	5000
	K580	2	2 Gb	32	20	4000
	K460	2	1 Gb	32	20	2000
	K380	1	1 Gb	16	20	1500
	K370	1	1 Gb	16	20	1500
	K260	1	1 Gb	15	20	1500
	D390	1	1 Gb	8	5	400
	D380	1	1 Gb	8	5	400
	D230	1	1 Gb	8	5	300

The system may experience reduced performance in the K580 configuration.



## Supported client platforms

---

**Introduction** The supported client platforms are designed to cost-effectively support each WaveStar 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:

- WaveStar NMS
- WaveStar SNMS
- ITM-SC

**Table** The following table shows the different WaveStar NMS client platforms that are supported, and the applications that are supported for each.

Components hosted	Application		Configurations			Platform Title	Hardware			
	# user sessions served	# Physical NEs	Desktop Workstation	Two-Tier			Operating System	Model	# CPUs	Memory
				Desktop Terminal	Terminal server					
WaveStar NMS client (& WaveStar SNMS & ITM-SC clients if required)	1	5000	X	X		HP-UX NMS Desktop Workstation	HP-UX	HP B2600	1	1 Gb
	8	5000			X	HP-UX NMS Terminal Server	HP-UX	HP A500	2	4 Gb
WaveStar NMS client (& WaveStar SNMS client if required)	1	5000	X	X		Windows PC NMS Desktop Workstation	Windows	HP X2000 (Pentium 4)	1	512 Mb
	4	5000			X	Small Windows NMS Terminal Server	Windows	HP LH6000	2	2 Gb
	8	5000			X	Large Windows NMS Terminal Server	Windows	HP LH6000	4	4 Gb

**Legacy client platforms** In addition to the platforms listed above, a number of legacy client platforms introduced in previous releases are also supported in this release.

The following table shows the legacy client platforms that are supported for this release.

Components hosted	Configurations			Hardware				Application	
	Desktop Workstation	Two-Tier		Operating System	Model	# CPUs	Memory	# user sessions served	# Physical NEs
		Desktop Terminal	Terminal server						
None		X		X-terminal	NCD NC900	1	48Mb	1	5000
WaveStar NMS client (& WaveStar SNMS & ITM-SC clients if required)	X	X		HP-UX	HP B2000	1	768 Mb	1	5000
	X	X		HP-UX	HP B2000	1	512 Mb	1	5000
	X	X		HP-UX	HP B1000	1	512 Mb	1	5000 <sup>a</sup>
WaveStar NMS client (& WaveStar SNMS client if required)	X	X		Windows	HP XU800 (Pentium III)	1	512 Mb	1	5000
			X	Windows	HP LH6000	4	2.5 Gb	4	5000
			X	Windows	HP LH6000	2	1 Gb	5	2500
			X	Windows	HP LH4	4	4 Gb	4	5000
			X	Windows	HP LH4	4	2.5 Gb	8	2500
			X	Windows	HP LH4	4	2.5 Gb	4	2000

a. The system may experience some performance degradation in this configuration.

Other models of PCs are also supported as legacy client platforms.



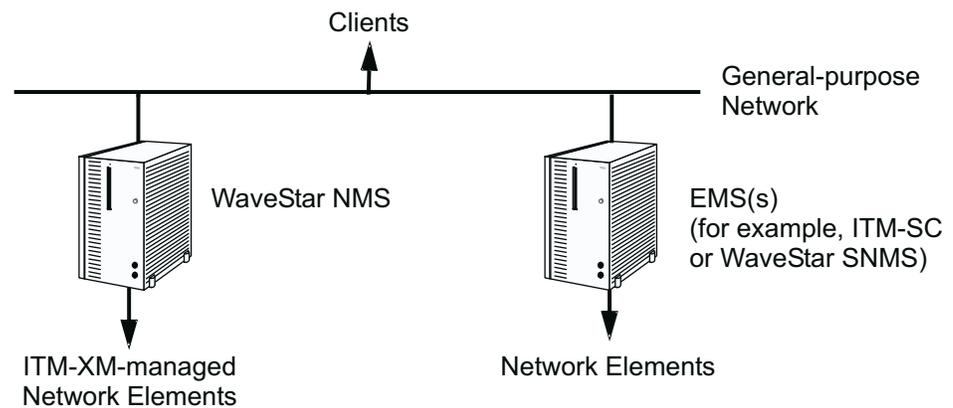
## Supported server architectures for integrated product offerings

---

**Introduction** In this section, diagrams are presented outlining the supported server architectures for integrated product offering deployments of the WaveStar NMS. Integrated product offering deployments are deployments that include WaveStar NMS and WaveStar SNMS 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 WaveStar 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

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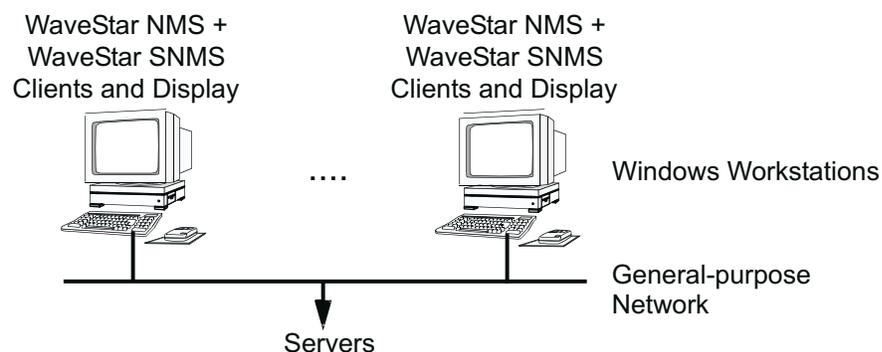
**Introduction** In this section, diagrams are presented outlining the supported client architectures for integrated product offering deployments of the WaveStar NMS. Integrated product offering deployments are deployments that include WaveStar NMS and WaveStar SNMS and/or ITM-SC.

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

### WaveStar NMS with WaveStar SNMS only

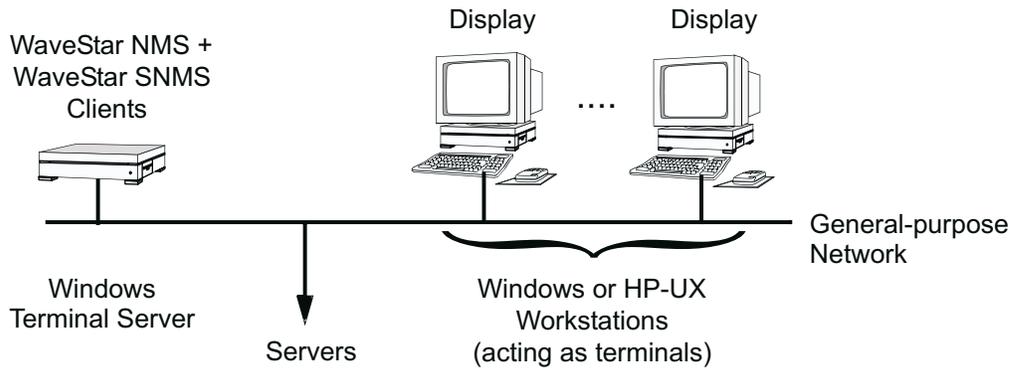
The following diagrams show the supported client architectures for deployments with WaveStar NMS and WaveStar SNMS only.

#### 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

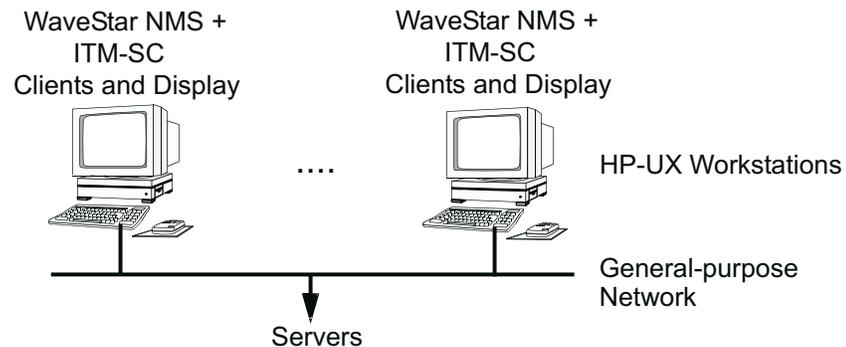


This configuration is recommended for reuse of legacy low-end PCs or HP-UX workstations, or for maximum scalability, or where multiple WaveStar NMSs must be accessible from the same desktop platform.

### WaveStar NMS with ITM-SC only

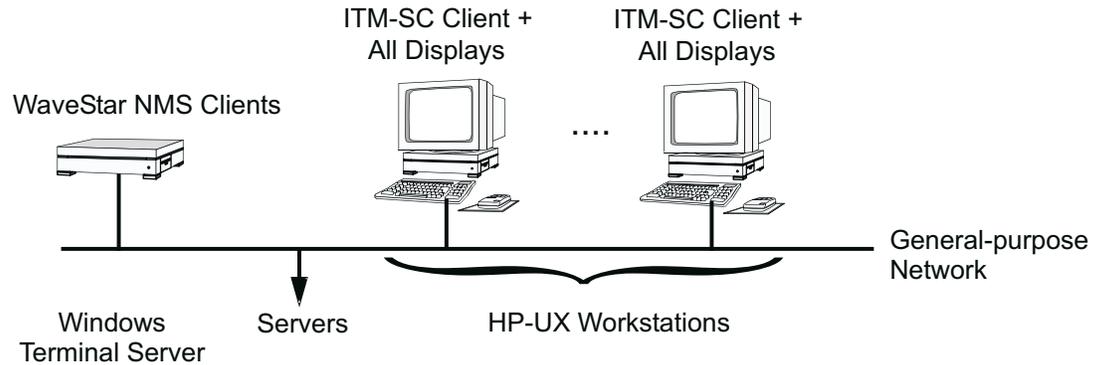
The following diagrams show the supported client architectures for deployments with WaveStar NMS and ITM-SC only.

### Desktops host everything



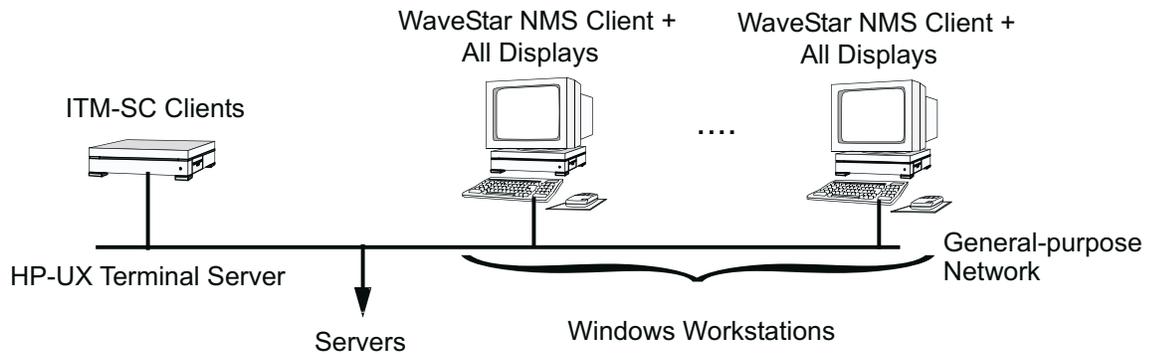
This configuration is the minimum configuration for cases with very few users or cases that are an incremental extension of a larger deployment, or where UNIX platforms are preferred by customers.

### 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.

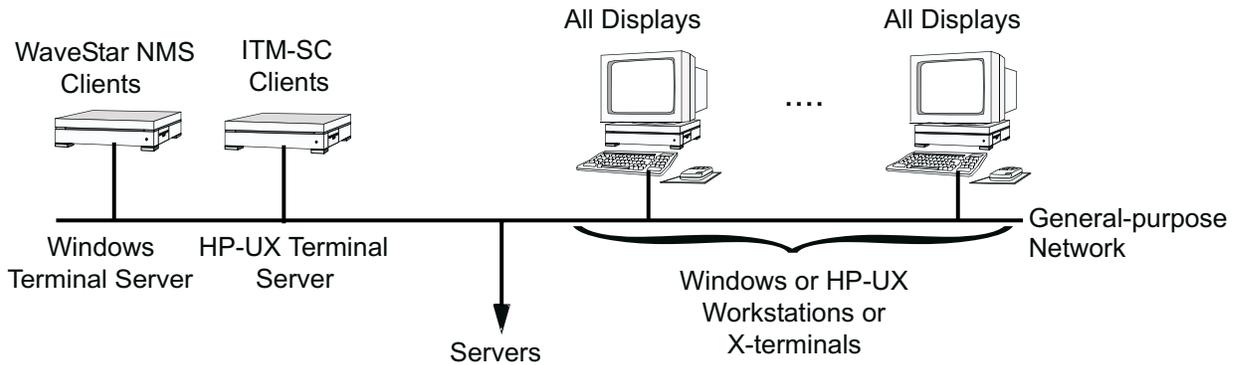
### Windows desktops partially supported by HP-UX terminal server



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

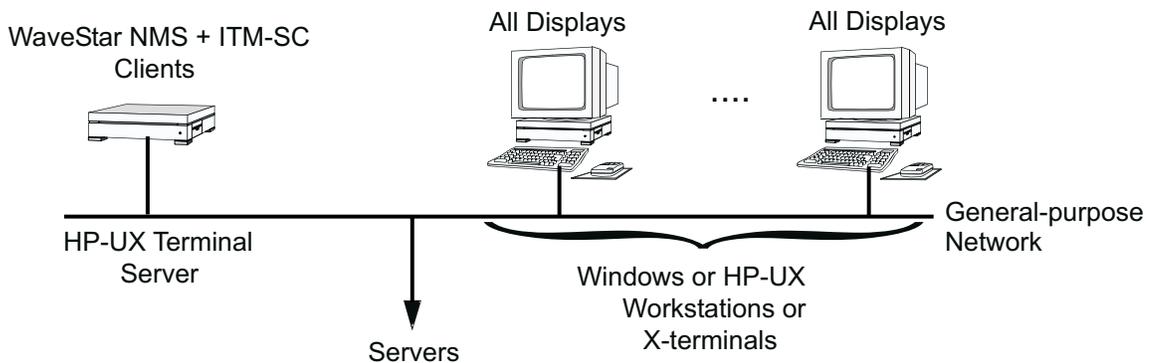


This configuration is recommended for reuse of legacy low-end PCs or HP-UX workstations, or for maximum scalability, or where multiple WaveStar NMSs must be accessible from the same desktop platform.

**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 WaveStar 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

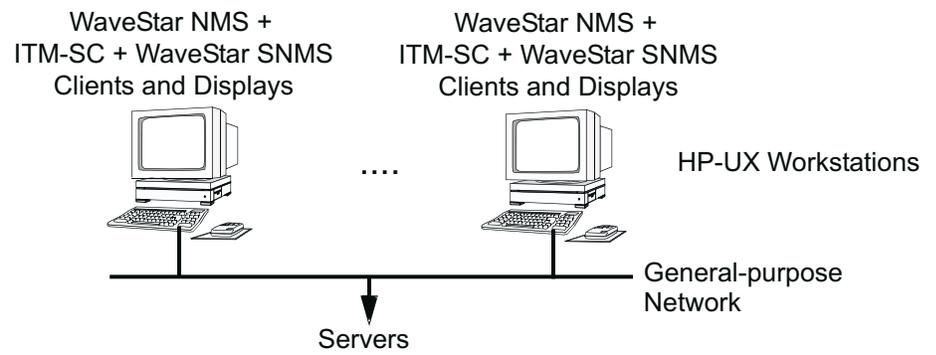


This configuration is recommended for reuse of legacy low-end PCs or HP-UX workstations, or for maximum scalability. Also, this may be useful for customers wishing to avoid using Windows.

**WaveStar NMS with ITM-SC and WaveStar SNMS**

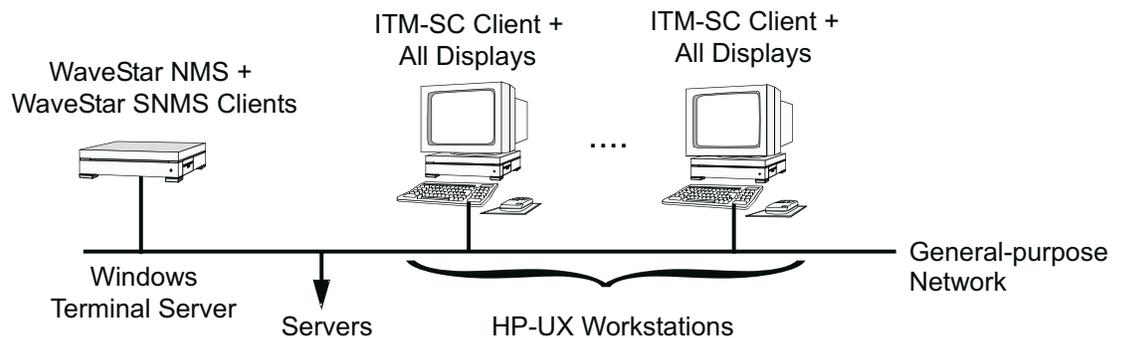
The client hardware architectures where all three management systems are combined are identical to those where WaveStar NMS and ITM-SC are deployed on their own, except the WaveStar NMS client host also must host WaveStar SNMS client hosts. The capacities of such configurations (in terms of numbers of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

**Desktops host everything**



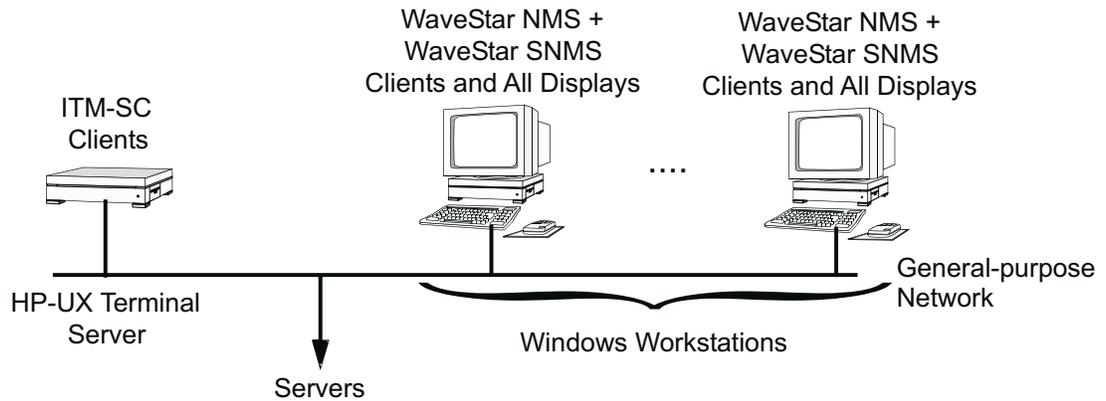
This configuration is the minimum configuration for cases with very few users or cases that are an incremental extension of a larger deployment, or where UNIX platforms are preferred by customers.

**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.

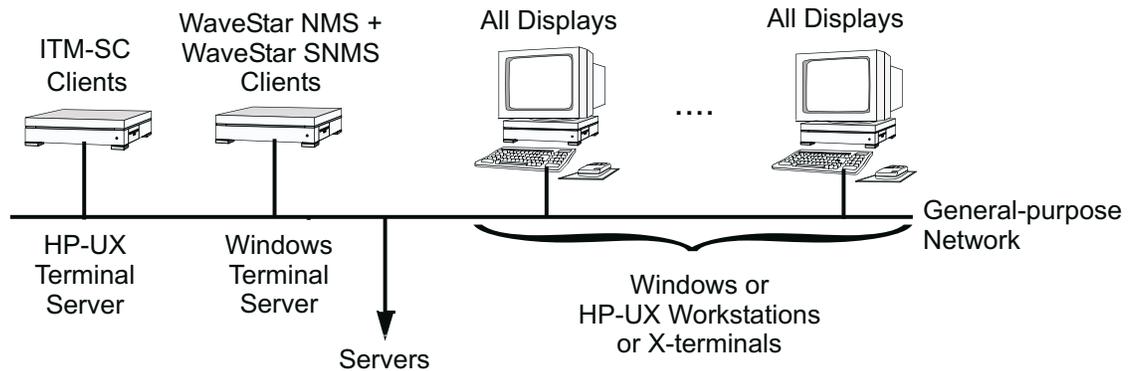
### Windows Desktops partially supported by HP-UX terminal server



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 WaveStar 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

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**Purpose** This chapter describes system planning and engineering for WaveStar NMS.

### Contents

<a href="#">Hardware requirements</a>	<a href="#">5-2</a>
<a href="#">Software requirements</a>	<a href="#">5-3</a>
<a href="#">Engineering</a>	<a href="#">5-4</a>
<a href="#">Connectivity of server architecture components</a>	<a href="#">5-6</a>
<a href="#">Connectivity of client architecture components</a>	<a href="#">5-9</a>
<a href="#">Examples</a>	<a href="#">5-11</a>
<a href="#">Network growth</a>	<a href="#">5-14</a>



## Hardware requirements

---

**Specification** The WaveStar NMS server component is to be installed on standard Hewlett-Packard hardware platforms.

The HP L2000 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 WaveStar 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

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**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 WaveStar 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

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## **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 WaveStar 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

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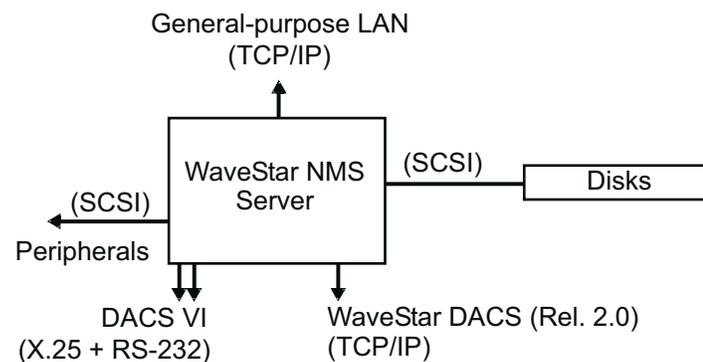
**Introduction** The following diagrams outline the connectivity required between the hardware components that make up each server hardware configuration. This is helpful for doing the following:

- 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 connectivity to DACS VI network elements is only required if DACS VI network elements exist in the managed network.

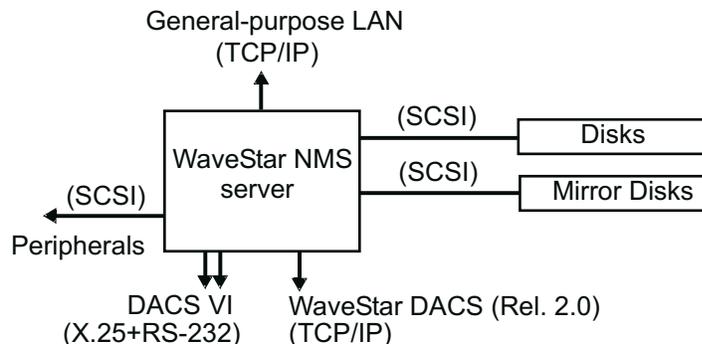
Also note that “peripherals” refers to external devices such as tape drives, external writable CD-ROMs, and/or printer connections.

**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**

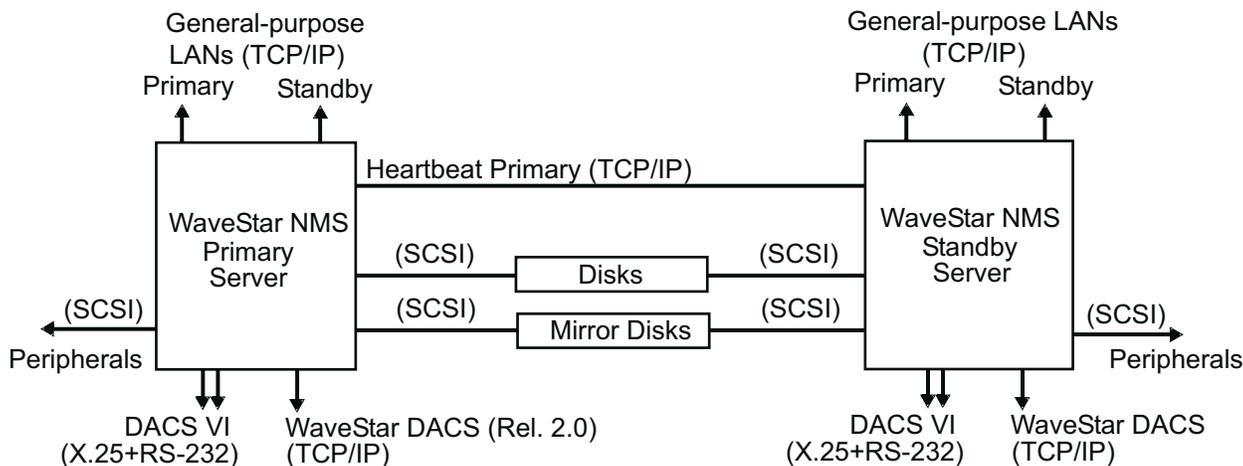
The following figure shows the connectivity of the single server with disk mirroring hardware configuration being used for the Small, Medium, and Large applications.



**Local redundancy**

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

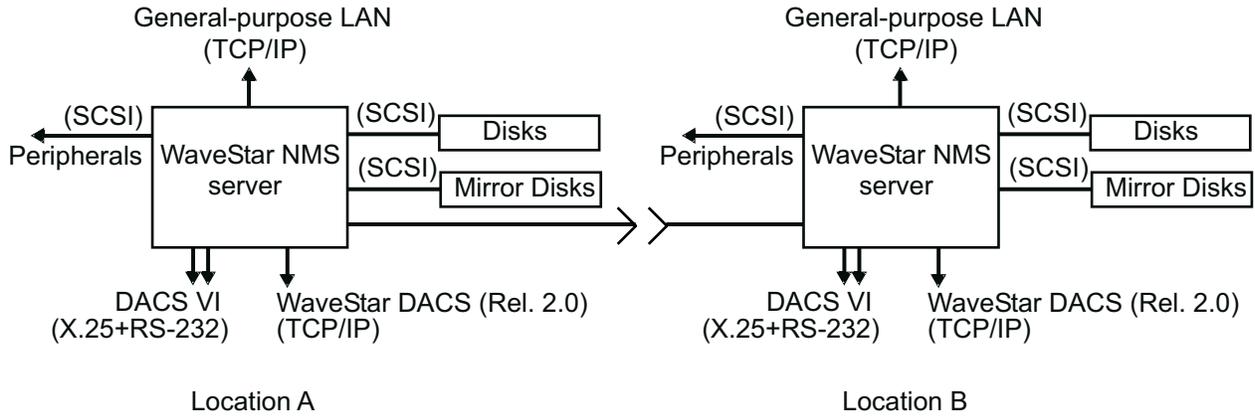
The following figure shows the connectivity of the local redundancy hardware configuration.



In this configuration, connections from both the primary and standby servers to the WaveStar DACS may be hubbed, forming a single TCP/IP subnet. Dual X.25 + RS-232 connections from the primary and standby servers to the DACS VI network element are achieved through use of multiplexer panels and modems.

**Geographic redundancy** The geographic redundancy hardware configuration can be used for the Small, Medium, and Large applications of WaveStar NMS.

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



□

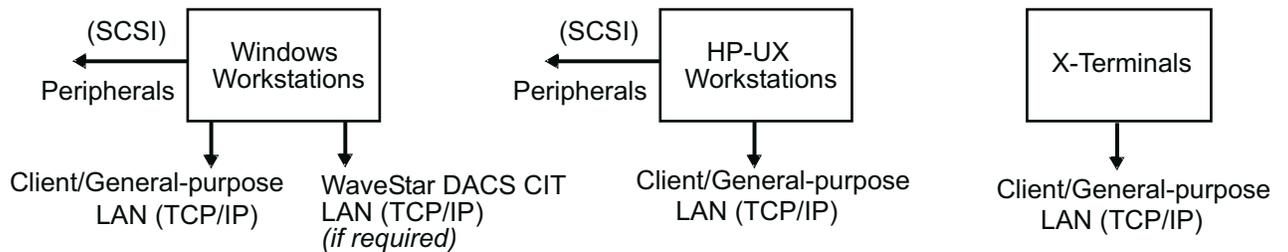
## Connectivity of client architecture components

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**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.



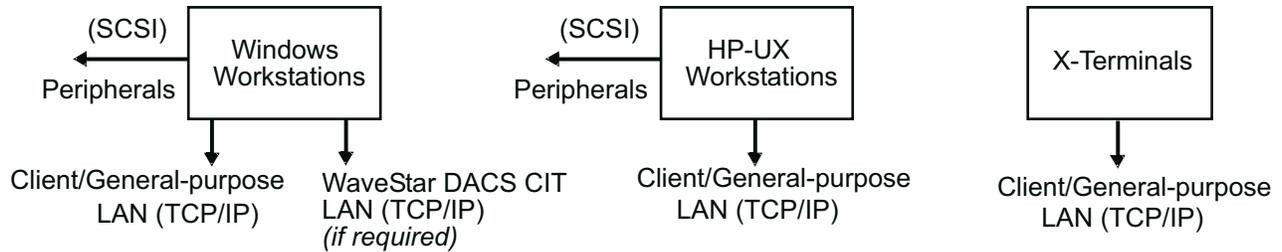
**Terminal servers** The ITM-SC terminal server is equipped with two LAN cards so that traffic to and from the client terminals and server can be separated. The WaveStar NMS (and WaveStar SNMS) Windows terminal servers currently supported do not permit a similar two-LAN configuration. Traffic to and 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.



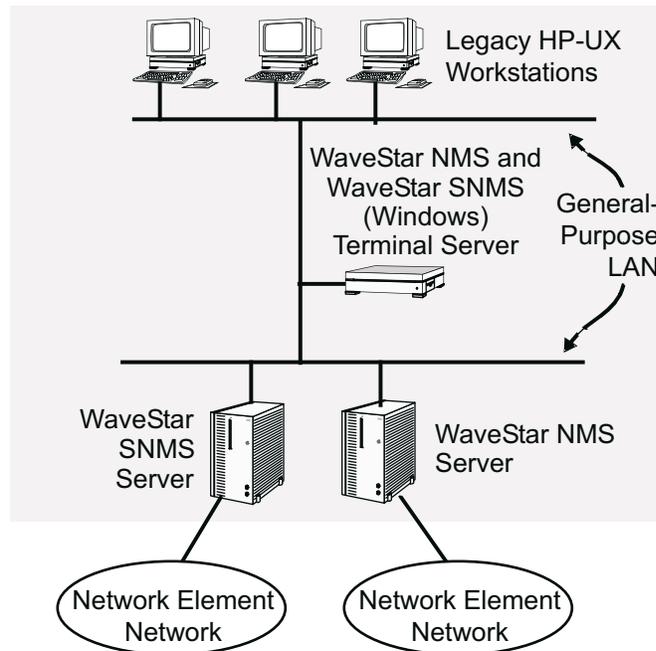
□

## Examples

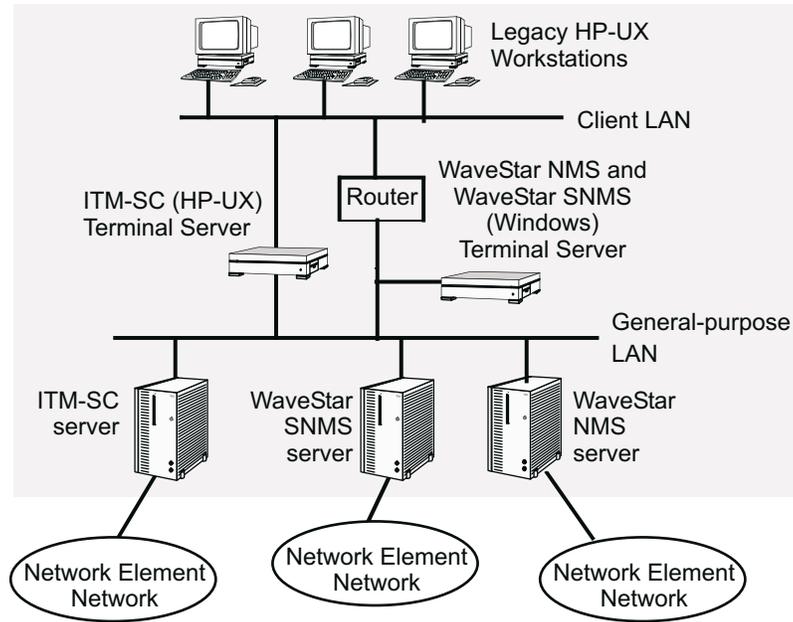
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**Overview** The following figure illustrates some examples of a variety of these configurations.

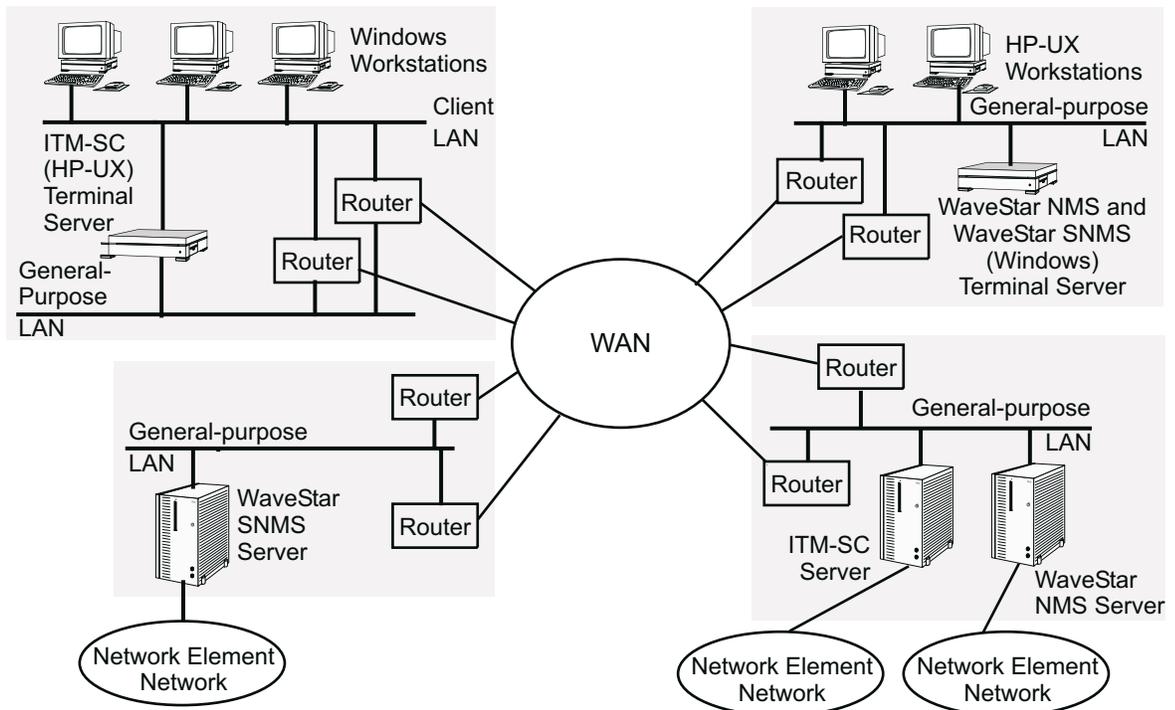
**Example A** Example A shows a simple configuration with a terminal server serving WaveStar NMS and WaveStar SNMS clients for legacy HP-UX workstations.



**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.



□

## Network growth

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**Overview** If a network grows beyond the limits originally planned for when the existing WaveStar NMS was installed, the following strategies allow WaveStar 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, WaveStar NMS.





# 6 Ordering

## Overview

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**Purpose** This chapter describes product support available for WaveStar NMS.

### Contents

<a href="#">How to order WaveStar NMS</a>	<a href="#">6-2</a>
<a href="#">Orderable items</a>	<a href="#">6-3</a>



## How to order WaveStar NMS

---

**Overview** This section describes how to order WaveStar NMS.

**Ordering** WaveStar NMS is ordered by calling a Lucent sales representative.



## Orderable items

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**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.

**Application Software: Core** The following table contains the comcodes for the application software core.

Description	Comcode
WaveStar NMS Release 4.2 Core DAT: NL R4.2	109160804
WaveStar NMS Release 4.2 Core DVD: NL R4.2	109160812
WaveStar NMS Release 4.2 Core Kit (includes both DAT and DVD): NL R4.2	109160820
WaveStar NMS Release 4.2 Core: Upgrade RTU	109160796

**Application Software: Optional Features** The following table contains the comcodes for the application software options.

Description	Comcode
WaveStar NMS Release 4.2 Option: Service Domain Partitioning	109127126
WaveStar NMS Release 4.2 Option: Geographic Domain Partitioning	109127134
WaveStar NMS Release 4.2 Option: Simplified Geographic Redundancy	109127142
WaveStar NMS Release 4.2 Option: Full Geographic Redundancy	109127159
WaveStar NMS Release 4.2 Option: Local Redundancy (MC/ServiceGuard)	109127167
WaveStar NMS Release 4.2 Option: Preplan Restoration	109127175
WaveStar NMS Release 4.2 Option: ASCII Northbound Alarm Interface	109127183
WaveStar NMS Release 4.2 Option: PM Data Export	109127191
WaveStar NMS Release 4.2 Option: CORBA Northbound interface	109136614

**Application Software:  
Network Element RTU**

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

<b>Description</b>	<b>Comcode</b>
WaveStar NMS Release 4.2 Network Element RTU: WaveStar AM 1	109127217
WaveStar NMS Release 4.2 Network Element RTU: WaveStar AM 1 Plus	109127225
WaveStar NMS Release 4.2 Network Element RTU: WaveStar TM 1	109127233
WaveStar NMS Release 4.2 Network Element RTU: WaveStar ADM 4/1	109127241
WaveStar NMS Release 4.2 Network Element RTU: WaveStar ADM 16/1	109127258
WaveStar NMS Release 4.2 Network Element RTU: WaveStar ADM 16/1 Compact	109150045
WaveStar NMS Release 4.2 Network Element RTU: WaveStar TDM 10G (SDH)	109127274
WaveStar NMS Release 4.2 Network Element RTU: ADM 155E	109127282
WaveStar NMS Release 4.2 Network Element RTU: PHASE 16/4	109127290
WaveStar NMS Release 4.2 Network Element RTU: PHASE 4/1	109127308
WaveStar NMS Release 4.2 Network Element RTU: PHASE LXC 16/1	109127019
WaveStar NMS Release 4.2 Network Element RTU: ISM	109127027
WaveStar NMS Release 4.2 Network Element RTU: SLM	109127035
WaveStar NMS Release 4.2 Network Element RTU: NERA Radio	109127043
WaveStar NMS Release 4.2 Network Element RTU: WaveStar BandWidth Manager	109027068
WaveStar NMS Release 4.2 Network Element RTU: WaveStar DACS 4/4/1	109127076

<b>Description</b>	<b>Comcode</b>
WaveStar NMS Release 4.2 Network Element RTU: DACS VI	109127084
WaveStar NMS Release 4.2 Network Element RTU: WaveStar OLS 80G	109127092
WaveStar NMS Release 4.2 Network Element RTU: WaveStar OLS 400G	109127100
WaveStar NMS Release 4.2 Network Element RTU: WaveStar Lambda Router	109127118
WaveStar NMS Release 4.2 Network Element RTU: Black Box	109127266

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

<b>Description</b>	<b>Comcode</b>
Oracle RDMS Enterprise Edition 8.0 Run-time License and first year of software support (per CPU)	108150822
BEA Tuxedo 6.4 per server RTU for 64 users and first year of software support	108169707
IONA Orbix MT 3.0.1 (per CPU)	108854563
IONA Orbix Notification (required for Northbound CORBA Interface) (per CPU)	109127936
Roguewave Source Pro Core (per CPU)	109149666
Roguewave Source Pro DB (per CPU)	109149674
HP-UX Version 11.0 (Required if upgrading from R1.x, R2.0, or R3.0 to R4.0 without upgrading the hardware to the L2000 series, and customer has no maintenance contract with HP)	109091405

**Documentation** The following table contains the comcodes for the WaveStar NMS user documentation.

<b>Description</b>	<b>Comcode</b>
WaveStar NMS Release 4.2 Getting Started Guide - English	109173989
WaveStar NMS Release 4.2 Applications and Planning Guide - English	109173997
WaveStar NMS Release 4.2 Provisioning Guide - English	109174003
WaveStar NMS Release 4.2 Maintenance Guide - English	109174011
WaveStar NMS Release 4.2 Administration Guide - English	109174029
WaveStar NMS Release 4.2 User Documentation CD-ROM - English	109174037





# 7 Product Support

## Overview

---

**Purpose** This chapter describes product support available for WaveStar NMS.

### Contents

<a href="#">Technical Assistance</a>	<a href="#">7-2</a>
<a href="#">Training</a>	<a href="#">7-3</a>
<a href="#">User documentation</a>	<a href="#">7-4</a>



## Technical Assistance

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**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 WaveStar 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.



# Training

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**Introduction** Lucent Technologies offers training courses that support WaveStar NMS.

**Curriculum** The WaveStar NMS training curriculum currently includes the following courses:

- *WaveStar NMS User Training*, TR4512
- *WaveStar NMS System Administrator Training*, TR4513

**Schedules and information** Course descriptions, schedules, and general information about WaveStar 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 WaveStar 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.

□

## User documentation

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**Introduction** This information product is part of a set of documents that supports WaveStar NMS.

- List of documents** The document set that supports WaveStar NMS includes:
1. *WaveStar NMS Getting Started Guide*, (365-309-241)- provides information needed when you are learning how to use the WaveStar NMS software. It describes how to start and stop WaveStar NMS, how to use the software, and how to interpret the graphical user interface.  
This document includes tasks and conceptual information.
  2. *WaveStar NMS Applications and Planning Guide*, (365-309-242) - designed to help users understand WaveStar NMS applications, use of the product, and the product components needed for a specific application.  
This document contains conceptual information only.
  3. *WaveStar NMS Provisioning Guide*, (365-309-243)- instructs users how to use WaveStar NMS to provision and manage a network.  
This document includes tasks and conceptual information.
  4. *WaveStar NMS Maintenance Guide*, (365-309-244) - instructs users on how to maintain WaveStar NMS and the network.  
This document includes tasks and conceptual information.
  5. *WaveStar NMS Administration Guide*, (365-309-245) - instructs users on how to administer WaveStar NMS and the network.  
This document includes tasks and conceptual information.

**On-line documentation** An on-line version, on CD-ROM, of this document set is available, and can be ordered.

An on-line version, in HTML format, of this document set is provided with WaveStar NMS.

**Screen help** The WaveStar 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 WaveStar NMS information products, do one of the following:

- Contact your Lucent Technologies customer team representative.
- Contact the Lucent Technologies Customer Information Center (CIC):
  - From the United States, call 888-LUCENT8 (888-582-3688), prompt 1.
  - From Canada, call 1-317-322-6619.
  - From Europe, the Middle East, and Africa, call 1-317-322-6416.
  - From Asia, the Pacific Region, China, the Caribbean, and Latin America, call 1-317-322-6411.







# Appendix A: Network Element Equivalence (NEQ) values

## Overview

---

**Purpose** This appendix describes the Network Element Equivalence (NEQ) values for WaveStar NMS.

### Contents

<a href="#">What is a Network Element Equivalence (NEQ) value?</a>	<a href="#">A-2</a>
<a href="#">Listing of NEQ values</a>	<a href="#">A-3</a>



## 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.



## Listing of NEQ values

---

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

**NEQ values** 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	Minimum Loading	Maximum Loading
ADM 155E	0.2	1.1
WaveStar ADM 4/1	0.2	1.1
WaveStar ADM 16/1 (16 x 16 cross connects)	0.2	3.1
WaveStar ADM 16/1 (32 x 32 cross connects)	0.2	4.4
WaveStar ADM 16/1 Compact	0.2	3.6
WaveStar AM 1	0.2	0.3
WaveStar AM 1 Plus	0.2	0.4
WaveStar TM 1	0.2	0.4
WaveStar BandWidth Manager (4608)	0.2	19.3
WaveStar BandWidth Manager (1152)	0.2	5.3
WaveStar TDM 10G	0.2	1.8
WaveStar DACS 4/4/1 Release 2.0 (Figures are the sum of network and element levels.)	0.7	58.6
WaveStar DACS 4/4/1 Releases 2.1 and 3.0 (Figures are network level only.)	0.7	34.8
DACS VI (Figures are the sum of network and element levels.)	0.7	26.7
WaveStar OLS 80G (end terminal)	0.2	0.6

<b>Network Element Type</b>	<b>Minimum Loading</b>	<b>Maximum Loading</b>
WaveStar OLS 80G (repeater)	0.2	0.3
WaveStar OLS 400G	0.2	2.2
WaveStar LambdaRouter 256	0.2	0.9
ISM-1	0.2	1.0
ISM-4	0.2	1.0
ISM-5E	0.2	1.0
SLM-16	0.2	0.4
SLM-4	0.2	0.4
NERA Radio	0.2	0.3
PHASE TM 16/4 and 4/4	0.2	1.3
PHASE LR 16 and LR 4	0.2	0.3
PHASE ADM 16/4 and 4/4	0.2	1.1
PHASE LXC 4/1	0.2	2.7
PHASE LXC 16/1	0.2	6.2

□



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