NORTEL

Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks

Product and Technology Basics

PT-AAL1/UA-AAL1/UA-IP/PT-IP

NN10028-111

Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks

Product and Technology Basics

PT-AAL1/UA-AAL1/UA-IP/PT-IP

Publication: NN10028-111
Document status: Preliminary
Document version: (I)SN09FF and up P1
Document date: April 2006

Printed in Canada

Contents

List of figures

List of tables

New in this release

The following sections detail what's new in the Multiservice Switch 15000, *Media Gateway 15000 and Multiservice Data Manager for* Carrier Voice over IP *Networks* Product and Technology Basics PT-AAL1/UA-AAL1/UA-IP/PT-IP *(*NN10028-111*)* for release SN09FF:

- "Features" (page 11)

Features

See the following sections for information about feature changes:

- "Channel associated signaling (CAS)" (page 11)
- "New MDM security features" (page 12)

Channel associated signaling (CAS)

Channel Associated Signaling (CAS), also known as Per-Trunk Signaling (PTS), allows CVoIP solutions to interface directly with a wide range of legacy switching systems which use CAS signaling. There is a large number of Per-Trunk Signaling systems that must access the Carrier VoIP network using legacy switching equipment. CAS allows the protocols required to access the Carrier VoIP network to continuously indicate their line state using a limited number of line state bits (A/B or A/B/C/D bits). These are either carried within the target bearer DS0 using Robbed Bit Signaling (as for DS1s) or are multiplexed together and are carried in the specific signaling channel, timeslot 16 (as for E1s).

MG acts as a relay point for CAS signaling. Incoming CAS signals on the TDM interface are extracted from their CAS variant waveform according to the profile associated with each TDM endpoint and they are signalled to the Media Gateway Controller (MGC) using H.248. In the reverse direction,

incoming CAS signals from MGC are applied to the designated TDM endpoints following the description indicated in the associated profile. The MGC controls a call upon received CAS signals and according to its switching capabilities as usual.

CAS has both signaling and bearer channel on the same channel for all timeslots, timeslot 16. CAS signaling involves two components, a MGC which is used to set up and tear down calls, and the MG15000 trunk gateway. The interface between both components is the H.248 signaling protocol. Signaling data and bearer data follow different paths.

New MDM security features

New security feature and procedures have been provided in the following areas.

MDM platform security

VoA networks can optionally restrict access to the UNIX ping and traceroute commands to prevent potentially service affecting events such as broadcast pings, routed broadcast ping denial of service (DOS) attacks, local ping DOS attacks and viruses.

Chapter 1
Overview of the solutions and components within the Carrier Voice over IP portfolio

The Nortel Carrier Voice over IP portfolio is a set of solutions designed to provide carriers with an evolutionary path from circuit-switching networks to packet networks. This portfolio connects multiple nodes that deliver both voice and data traffic over one network and provides for increased switching capacity because of the increased bandwidth and the off-loading of real time processing from the Communication Server 2000. In addition, it implements distributed switching because switching does not occur at one central location but is distributed to other nodes. As a result, the Carrier Voice over IP portfolio allows customers to take advantage of the cost-effectiveness and open standards of packet networks without sacrificing the value of traditional telephony.

Three solutions within this portfolio are:

- Packet Trunking - AAL1 (PT-AAL1), Described In “What is the Packet Trunking - AAL1 solution?” (page 14)
- Universal Access - AAL1 (UA-AAL1), Described In “What is the Universal Access - AAL1 solution?” (page 17)
- Universal Access - IP (UA-IP), Described In “What is the Universal Access - IP solution?” (page 20)
- Packet Trunking - IP (PT-IP), Described In “What is the Packet Trunking - IP solution” (page 38)

Note: A set of Nodal Provisioning templates is provided on MDM for configuration of MG15000 in a Packet Trunking - AAL2 (PT-AAL2) solution. For solution level documentation on PT-AAL2, refer to NN10441-100 *PT-AAL2 Solution-level Basics.*

For More Information On The Components Within These Solutions, See "What are the components in the Carrier Voice over IP Networks portfolio?" (page 23).

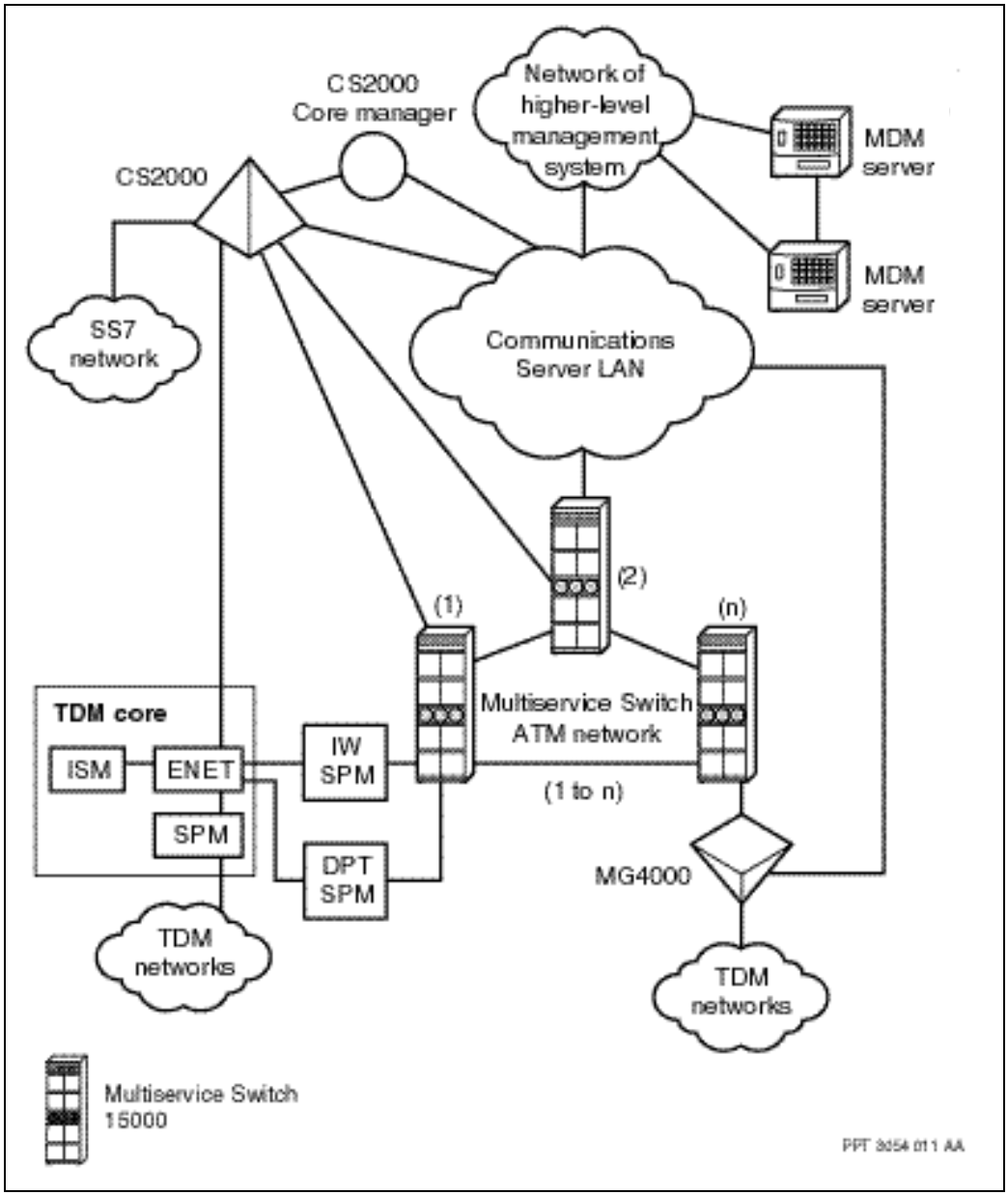
What is the Packet Trunking - AAL1 solution?

One of the solutions in the Carrier Voice over IP portfolio is the Packet Trunking - AAL1 (PT-AAL1) solution. PT-AAL1 provides a solution for the public switched telephone networks Class 4 tandem office by integrating voice and data networks through asynchronous transfer mode (ATM) broadband switching technology. As a result, voice calls being routed through a PT-AAL1 network can be routed over the ATM fabric instead of through the traditional time division multiplexing (TDM) equipment. Because ATM technology can support many different services on the same unified network, the transmission of calls over this technology facilitates the integration of service providers' voice and data networks. In addition, ATM, when used in conjunction with other equipment, reduces the equipment footprint and increases the Busy Hour Call Attempts (BHCA) throughput when compared to the throughput of the TDM equipment.

Refer to the figure "Packet Trunking - AAL1 solution" (page 15) to review the components involved in this solution. For more information on this solution, see NN10320-100 *ATM Solutions Basics*.

Note: This figure does not represent the redundant links between components. For more information about actual connection links and redundancy between links, see NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

Figure 1
Packet Trunking - AAL1 solution



The PT-AAL1 solution consists of the following components:

- “Communication Server 2000” (page 23)
- “Communications Server LAN” (page 25)
- “CS2000 Core Manager” (page 26)
- “Dynamic Packet Trunking Spectrum Peripheral Module” (page 26)
- “Interworking Spectrum Peripheral Module” (page 26)
- “Multiservice Gateway 4000” (page 30)
- “Multiservice Switch 15000” (page 30)
- “Multiservice Data Manager” (page 31)
- “TDM core” (page 38)

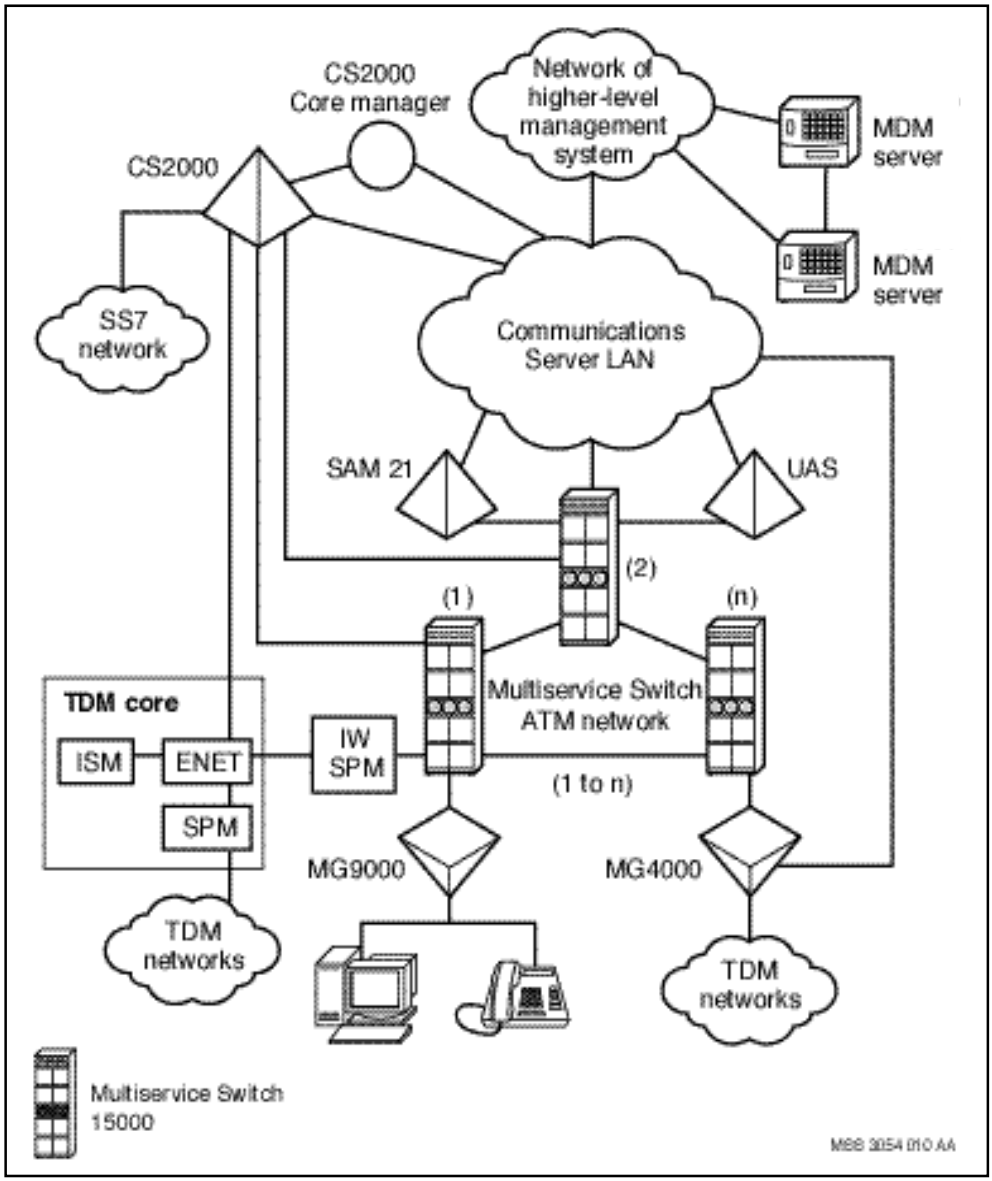
What is the Universal Access - AAL1 solution?

Another solution in the Carrier Voice over IP portfolio is the Universal Access - AAL1 (UA-AAL1) solution. This solution facilitates a Class 5 end office replacement program by integrating voice and data networks through ATM broadband switching technology. In this solution, the end office is built on a distributed ATM core network that provides end office voice services using UA-AAL1 for voice transmission. It supports interworking with legacy ENET-based line and trunk services and peripherals. Because ATM technology can support many different services on the same unified network, this solution is the first step to evolving a multi-service end office. In addition, ATM, when used in conjunction with other equipment, reduces the equipment footprint and increases the BHCA throughput when compared to the throughput of the TDM equipment.

Refer to the figure "Universal Access - AAL1 solution" (page 18) to review the components involved in this solution and their interconnectivity. For more information on this solution, see NN10320-100 *ATM Solutions Basics*.

Note: This figure does not represent the redundant links between components. For more information about actual connection links and redundancy between links, see NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

Figure 2
Universal Access - AAL1 solution



The UA-AAL1 solution consists of the following components:

- “Communication Server 2000” (page 23)
- “Communications Server LAN” (page 25)
- “CS2000 Core Manager” (page 26)
- “Interworking Spectrum Peripheral Module” (page 26)
- “Media Gateway 9000” (page 28)
- “Multiservice Gateway 4000” (page 30)
- “Multiservice Switch 15000” (page 30)
- “Multiservice Data Manager” (page 31)
- “TDM core” (page 38)
- “Universal Audio Server/MS2020” (page 38)

What is the Universal Access - IP solution?

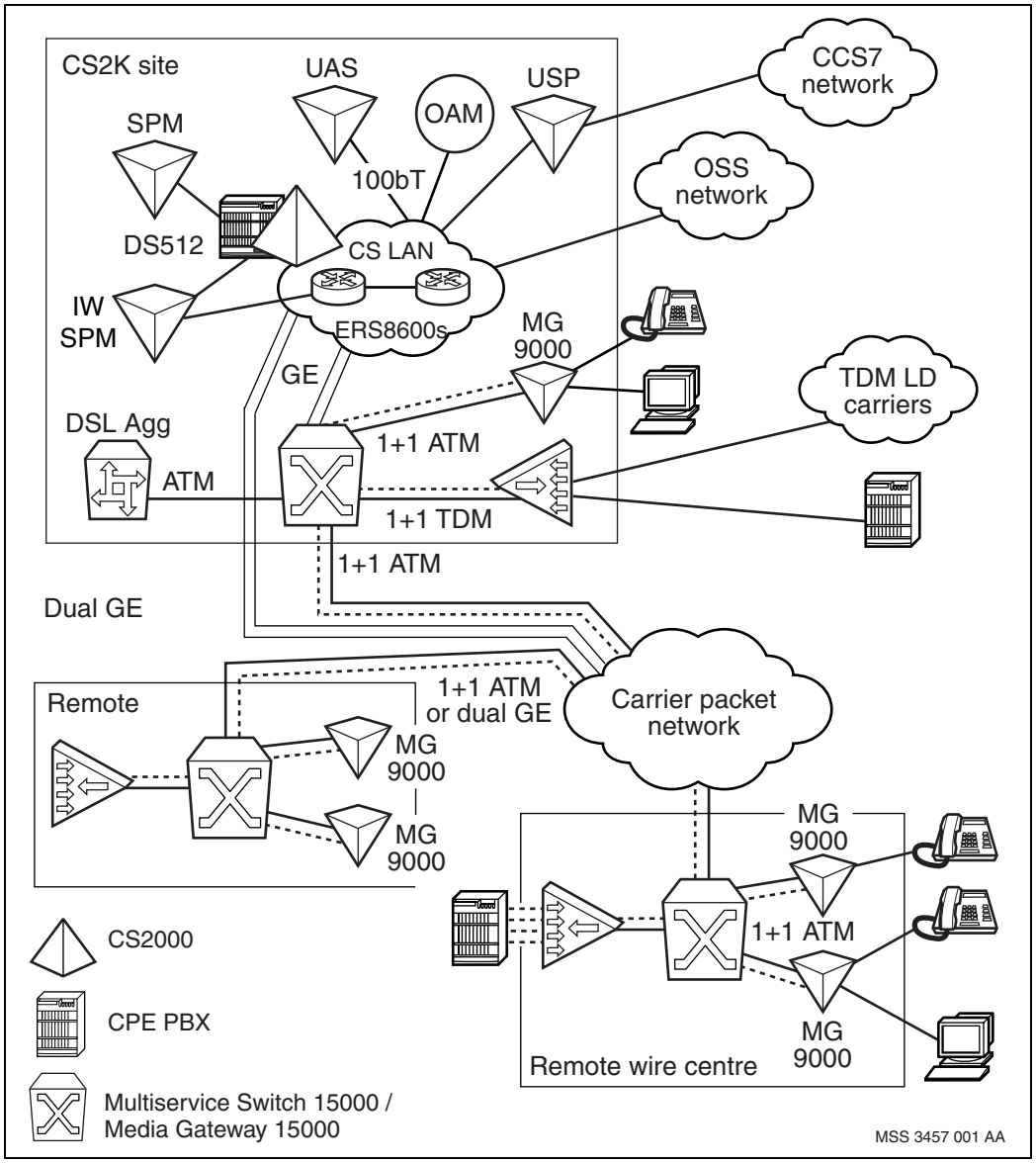
One of the solutions in Carrier Voice over IP portfolio is the Universal Access - IP (UA-IP) solution. UA-IP provides an end-office solution, including plain old telephone service (POTS) and other access services (for example, DSL) that use internet protocol (IP) as the packet technology. A Nortel Multiservice Switch 15000 is the IP aggregation router.

UA-IP technology retains the concept of a PSTN Central Office, while allowing several offices to be collapsed due to higher capacity and distributed architecture. The solution supports evolution to blended services, since wireline, wireless and data connections can all run on the same core network.

Refer to the figure "Universal Access - IP solution" (page 21) to review the components involved in this solution. For more information on this solution, see NN10300-100 *IP Solutions Basics*.

Note: This figure does not represent all the redundant links between components. For more information about actual connection links and redundancy between links, see NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

Figure 3
Universal Access - IP solution



The UA-IP solution consists of the following components:

- “Communication Server 2000” (page 23)
- “Communications Server LAN” (page 25)
- “CS2000 Core Manager” (page 26)
- “DSL aggregator” (page 26)
- “Interworking Spectrum Peripheral Module” (page 26)
- “IEMS” (page 27)
- “Media Gateway 9000” (page 28)
- “Media Gateway 15000” (page 29)
- “Multiservice Gateway 4000” (page 30)
- “Multiservice Switch 15000” (page 30)
- “Multiservice Data Manager” (page 31)
- “Multiservice Data Manager” (page 31)
- “Universal Audio Server/MS2020” (page 38)

What are the components in the Carrier Voice over IP Networks portfolio?

Refer to the following sections for more information about the components involved in the PT-AAL1, UA-AAL1, PT-AAL2, and UA-IP solutions:

Communication Server 2000

The Communication Server 2000 (CS2000) is the primary network intelligence component for these solutions. It processes all call requests within the network and provides centralized call control between the media gateways (MG4000, MG15000 and MG9000 nodes), the Time Division Multiplexing-based nodes, and the ATM core. It also provides service transaction logic, including translations, routing control, network signaling, and the creation of billing records. In addition, the CS2000 directs access gateways to establish and tear down switched virtual circuits for the delivery of packetized voice and data traffic across the ATM core network.

For more information on the CS2000 in the Packet Trunking - AAL1 (PT-AAL1) solution, see NN10206-111 *Communication Server 2000 Basics*. For more information on the CS2000 in the Universal Access - AAL1 (UA-AAL1) and Universal Access - IP (UA-IP) solutions, see NN10019-111 *Communication Server 2000 Basics*.

The CS2000 is composed of several sub-platforms:

- Extended Architecture Core (XA-Core), which is the computing platform for the CS2000 call processing and service logic. It provides signalling for the Peripheral Processor Virtual Machine (PPVM) network and call feature processing for the voice network.
- Gateway Controller (GWC), which acts as a call processing protocol converter between proprietary XA-Core messages and the open standard H.248 messages used by the MG9000 and MG15000 media gateways.
- Input/Output Module (IOM), which provides communication interfaces, storage media, and data interfaces to the voice messaging systems.
- Integrated Services Module (ISM), which provides conference circuits, Enhanced Digital Recorded Announcement Machine (EDRAM) announcements, and line test, trunk test, and office alarm unit interfaces.
- Link Peripheral Processor or Fiberized Link Peripheral Processor (LPP/FLPP), which serves as the signaling interface to the SS7 network.
- Message Switch (MS), which delivers messages between the XA-Core and the LPP/FLPP, Input/Output Module equipment, the Enhanced Network (ENET), and the CS2000 Core Manager.
- Service Application Module 21 (SAM21), which is the computing platform for the Gateway Controllers (GWCs) required by the MG9000s in the UA-AAL1 solution, and by the MG9000 and MG15000 nodes in the UA-IP solution. In the UA-AAL1 solution only, each SAM21 shelf has two redundant shelf controllers, each of which has a link into the Multiservice Switch 15000 ATM core network. The shelf controllers carry the H.248 Media Gateway Control Protocol to the MG9000 and MG15000 nodes.

  For more information, see NN10025-111 *SAM21 Shelf Controller Basics*.

The CS2000-Compact can be used in the UA-IP solution even though it does not support interworking with legacy TDM switches. It can be deployed only in a UA-IP network where such interworking is not required.

The principal components of the CS2000-Compact are:

- two Service Application Module 21 (SAM21) shelves
- one Service Application Module 16 (SAM16) shelf
- a Service Application Module 21 (SAM21), with the gateway controllers (GWCs) required by the MG9000 and MG15000 nodes in the UA-IP solution.

Communications Server LAN

The Communications Server (CS) LAN provides the backbone for the OAM&P network, and comprises a redundant pair of Ethernet Routing Switch 8600 nodes or (for the PT-AAL1 solution only) customer-supplied equipment.

The CS LAN provides connectivity:

- between the primary components in a solution and their element management platforms (for example, between Multiservice Switch 15000 / Media Gateway 15000 nodes and the Multiservice Data Manager servers)
- among subcomponents of the CS2000 / CS2000-Compact, the Core Packet Network and the media gateways for messaging and call signaling

Physical connectivity is provided either through 100-baseT or Gigabit Ethernet (LX or SX).

Separate virtual local area networks (VLANs) are configured for voice traffic, call processing, OAM&P traffic, OSS access, and for the Gigabit Ethernet links between the redundant pair of Ethernet Routing Switch 8600 nodes.

CS2000 Core Manager

The CS2000 Core Manager is another of the network management tools. It resides on the SuperNode Data Manager (SDM) platform and performs fault management, configuration management, data collection, performance management, and security management for the CS2000s, IW SPMs, and MG4000s.

You can engineer the network so that the CS2000 Core Manager receives Nortel Multiservice Switch log information from Multiservice Data Manager servers, as has been done in the PT-AAL1 solution.

DSL aggregator

A DSL aggregator (such as a Nortel Services Edge Router, formerly known as Nortel Shasta BSN) collects all of the ATM DSL traffic from Media Gateway 9000 nodes and maps it to the appropriate internet service provider (ISP).

The Multiservice Switch 15000 supports DS3 IMA, DS3 clear channel, OC-3c and OC-12c ATM interfaces for the DSL aggregator network interface. Only PVCs, PVPs, SPVCs or SPVPs are supported between the Media Gateway 9000 nodes and the DSL aggregator. SVCs are not supported and no IP forwarding is done by the Multiservice Switch 15000 nodes for DSL traffic.

Dynamic Packet Trunking Spectrum Peripheral Module

The Dynamic Packet Trunking Spectrum Peripheral Module (DPT SPM) is a high-speed platform in the PT-AAL1 solution that allows direct call routing from legacy equipment to the ATM core across a dynamic packet trunk (DPT). A DPT establishes on-demand virtual connections between end offices rather than using permanent connections.

For more information, see NN10016-111 *DPT SPM ATM Basics*.

Interworking Spectrum Peripheral Module

The Interworking Spectrum Peripheral Module (IW SPM) platform provides bearer traffic interconnection between the TDM-core ENET (using DS512 connections) and the ATM core (using OC-3c connections). This bridging capability provides end-to-end connectivity between the digital trunk controller (DTC) or the SPM TDM and the MG4000 trunks or MG9000 lines.

Bridging also provides the MG4000 trunks and MG9000 lines with the ability to connect to ENET-based integrated service modules (ISMs) for tones and digital recorder announcer module (DRAM) based announcements.

The primary functions of the IW SPM include collecting and grooming standard TDM trunk traffic for the ATM core, extending existing trunk services from the original DMS-200 or DMS-250 offices to the TDM trunks terminating at the CS2000, and providing tandem-level announcements to end-users.

For more information, see *NN10014-111 IW SPM ATM Basics*.

IEMS

IEMS is a next generation element management system (EMS) that provides a single point of data integration and network management for the Carrier Voice over IP office.

At the central office level, IEMS:

- provides graphical topology and inventory relationships between network elements and element management systems
- aggregates all fault, security audit logs, and performance data from network elements and element management systems
- provides integrated fault, security audit logs, and performance streams to the Network Management Layer
- provides customer choice of operations support system (OSS) interfaces
- provides extensible markup language (XML) aggregation of comma-separated value (CSV) files for performance
- provides centralized fault, security audit logs, and performance viewer with filtering capabilities
- provides context-sensitive launching of network management interfaces:
- provides enhanced security features by improving the centralization of authentication, authorization, and administration, while also providing interfaces to external security databases

In the UA-IP solution, IEMS acts as a central data collection and authentication, authorization, and accounting (AAA) system at the central office level. The network is engineered to have IEMS receive MSS15000/ MG15000 fault, security audit log, performance and security information from Multiservice Data Manager servers.

Media Gateway 9000

The Media Gateway 9000 (MG9000) is a multi-service media gateway in the UA-AAL1 and UA-IP solutions which supports switched lines and Digital Subscriber Line (DSL) service for voice and data services. The MG9000 has OC-3c, STS-1 or DS1-IMA interfaces to the packet core which it uses to carry call control and maintenance messaging to the SAM21 shelf controllers. The internal ATM switching fabric of the MG9000 allows calls that originate and terminate on the same MG9000 to intra-switch. For calls connecting to another gateway in the UA-AAL1 solution, the MG9000 establishes SVCs across the packet core.

In the UA-AAL1 and UA-IP solutions, a 12-port DS3 function processor (FP) can connect to the ATM backbone through an MG9000 interface without requiring an OC-3 infrastructure, but while still meeting carrier-grade bandwidth requirements. Only one DS3 channel is used between the MG9000 and a Multiservice Switch 15000 node. If that channel is lost, the MG9000 will be in Internode Emergency Stand Alone (ESA) until the channel is returned to service.

MG9000 inter-node ESA uses the MSS15000's flat VR with static routing (RFC 1483 AtmMpe) to route ESA signaling between MG9000s in an ESA group. In the UA-AAL1 solution, a new ATM PVC is setup between each MG9000 and the MSS15000 VR to carry ESA IP-traffic. In ESA mode each MG9000 is assigned a separate IP address that is dedicated to the ESA function. InterNodal ESA is supported in both the UA-AAL1 and the UA-IP solutions. It is designed to support a maximum of 15 MG9000 nodes. Refer to NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2* for more information.

The MG9000 digitizes voice using G.711 encoding and convert it to packets using the ATM Adaptation Layer 1 (AAL1) protocol. They convert data running across the DSL lines to packets using the ATM Adaptation Layer 5 (AAL5) protocol. The MG9000 supports the plain old telephone system (POTS), coin, ground start, Meridian Business Set and integrated DSL lines, a broad range of line class codes, and an industry-leading set of end-office residential, business, and network services.

For more information, see NN10011-111 *MG9000 Product and Technology Basics*.

Media Gateway 15000

In the UA-IP solution, the Media Gateway 15000 is the trunk gateway between the TDM-based network and the IP network. In the PT-AAL2 solution, the Media Gateway 15000 is the trunk gateway between the TDM-based network and the ATM network. The Media Gateway 15000 equipment is used to trunk calls between MG9000 nodes and the TDM network, or to provide PRI, SS7, or V5.2 access to large enterprises with their own private branch exchange (PBX) telephone switches.

Call signaling between the Media Gateway 15000 and the gateway controller (GWC) is performed using standards-based H.248. The call signaling and all voice traffic are carried by the core packet network.

The Media Gateway 15000 is deployed in the UA-IP solution as pairs of 1+1 VSP FP cards with the Multiservice Switch 15000 FP cards performing the IP aggregation function. In the PT-AAL2 solution only, the 4pOC3 FPs are deployed unprotected.

The VSP3 and VSP3-o types of VSP cards are supported for the UA-IP solution, however, only the VSP3-o type is supported in the PT-AAL2 solution as follows:

- VSP3
  TDM access is provided by a 1+1 pair of 4pOC3 TDM FP cards. The TDM OC-3 interfaces are typically connected through a channel bank to access individual DS1 circuits. Each pair of VSP3 cards supports 2016 DS0 trunks using G.711 with either 10 msec or 20 msec packetization, or 1512 DS0 trunks using G.729a.

- VSP3-o
  In the UA-IP or PT-AAL2 solution, this card provides an OC-3 TDM interface (which makes another a pair of slots available), and can generate 2016 voice calls into the network when configured for G.711 or G.729a. The card supports only H.248. In VoIP solutions, IPSec is used to secure the control connection traffic between this card and the Communications Server 2000 (CS2000).

For more information, see NN10600-780 *Nortel Media Gateway 7480/15000 Technology Fundamentals*.

Multiservice Gateway 4000

The Multi-Service Gateway 4000 (MG4000) is the trunk gateway between the TDM-based network and the ATM core. In the PT-AAL1 solution, the MG4000 collects TDM traffic from the TDM-based high-speed (OC-3) connections and carries it to the OC-3c interfaces in the ATM core. In the UA-AAL1 solution, the MG4000 trunks calls between the MG9000s and the TDM network. In both solutions, two permanent virtual circuit (PVC) connections are configured between a CS2000 and an MG4000 to provide for peripheral processor virtual machine (PPVM) control signalling. In addition, there are peer-to-peer switched virtual circuit (SVC) connections for control traffic.

For more information, see NN10013-111 *MG 4000 Basics*.

Multiservice Switch 15000

In the PT-AAL1 and UA-AAL1 solutions, the Nortel Multiservice Switch 15000 nodes are an ATM-based switching platform that can be used to build the ATM core of a network. When engineering the ATM core, you can include multiple Multiservice Switch 15000 nodes. The nodes provide the ATM core with general routing and ATM switching as well as connectivity for a variety of services including voice, multimedia, and data. They also offer multiprotocol routing services, intelligent traffic management, full redundancy, scalable high capacity, high-speed access and trunking, exceptional Quality of Service (QoS), SONET/SDH integration, and inverse multiplexing for ATM (IMA).

In the UA-IP solution, the Multiservice Switch 15000 switch is used as the edge router to aggregate the following kinds of MG9000 and MG15000 traffic within an office:

- voice bearer traffic between all intra- and inter-office gateways, and from line and trunk gateways to the universal audio server (UAS)
- voice signaling traffic, from each gateway to its respective gateway controller (GWC)
- management traffic from MG9000 line gateways and in-band managed Multiservice Switch 15000 and Media Gateway 15000 nodes, to their respective element managers
- multi-service traffic (DSL) carried as ATM traffic from MG9000 through the Core packet network to the DSL aggregator

The existing IP Core network is used to carry Dynamic Packet Trunk (DPT) calls between offices.

Multiservice Switch 15000 nodes can be engineered with any number of distributed Multiservice Switch 15000 nodes. The nodes are managed by Nortel Multiservice Data Manager servers that are connected to them through the Communications Server LAN.

For more information see “Multiservice Switch 15000 and Media Gateway 15000 hardware overview” (page 43) and “Multiservice Switch 15000 and Media Gateway 15000 software overview” (page 79).

Multiservice Data Manager

Nortel Multiservice Data Manager (MDM) is one network element management tool used by Carrier Voice over IP Networks. It performs fault management, configuration management, data collection, performance management, and security management for Multiservice Switch 15000 and Media Gateway 15000 nodes. In addition, Multiservice Data Manager servers can be configured to forward the performance management and fault management data directly to the OSS, or to the CS2000 Core Manager for aggregation of the fault, security audit log, and performance feeds for PT-AAL1 and UA-AAL1 networks, or to the IEMS for aggregation of the fault, security audit log, and performance feeds for UA-IP networks. In some UA-IP solutions, the performance feeds may be sent to the CS2000 Core Manager

for aggregation instead of the IEMS. Multiservice Data Manager servers can also be deployed in a hierarchical topology to consolidate network surveillance of Multiservice Switch 15000 and Media Gateway 15000 nodes into regional partitions and full network views.

For more information, see “Multiservice Data Manager software overview” (page 87).

Multiservice Data Manager software runs on the Sun Netra 240 hardware platform with Server Platform Foundation Software (SPFS). Netra 240 servers are used for all MDM server configurations deployed in the central office (CO). Netra 240 servers are recommended for new deployments of standalone, server-set, MDM Admin Server, MDM Server and consolidated management server configurations.

> ***Note:*** Multiservice Data Manager software does not co-reside with other Element Management Systems (EMS) on the Netra 240 platform. Multiservice Data Manager is the only EMS running on the Netra 240 server.

Multiservice Data Manager can be deployed on the legacy Sun Fire V480 hardware platform for configurations deployed outside a CO.

Multiservice Data Manager client-sets can be deployed on the Sun Fire V240 hardware platform.

For more information on the Sun Netra 240 server see “Sun Netra 240 server hardware and software” (page 66). For more information on SPFS, see “Server Platform Foundation Software (SPFS)” (page 36).

To access Multiservice Data Manager from the operator desktop using the MDM Toolset user environment, one of the following options may be used:

- Sun Netra 240 server with SPFS or Sun Fire V480 server running Solaris 9 operating system
- PC with X11 emulation software (Hummingbird Exceed version 6.2 on a PC with a minimum PIII 866 MHz with 256MB RAM)
- X11 terminal

Operator desktops using the MDM Toolset environment connect to a Multiservice Data Manager server using X11 R5 compatible interface software from Sun Microsystems. While Nortel does recommend Hummingbird Exceed X11 emulation software (because this software has been tested and engineered), any other X11 R5 Sun-compatible emulation software should work on a PC acting as a Multiservice Data Manager operator desktop. However, if you are using one of these other software packages, replicate any problems with the Multiservice Data Manager presentation on a Sun system prior to contacting Nortel. By replicating the problem on a Sun system you ensure that it is not the fault of the untested X11 R5 Sun-compatible X11 emulation software.

To access Multiservice Data Manager from the operator desktop using the Operator Client user environment, one of the following options may be used:

- Sun Netra 240 server with SPFS or Sun Fire V480 server running Solaris 9 operating system
- PC running Windows 2000 or XP operating systems

When the Operator Client environment is used, the Multiservice Data Manager tools are downloaded from the MDM Admin Server in VoA and from the MDM Server in VoIP and run on the operator desktop.

For more information on accessing the Multiservice Data Manager tools, refer to Summary of MDM and Operator Client tools in NN10180-611 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Security and Administration PT-AAL1/UA-AAL1/UA-IP*.

Two network management approaches, dedicated and centralized, are supported for deploying Multiservice Data Manager servers in your Carrier Voice over IP network. These network management approaches are deployed either during an initial installation of Multiservice Data Manager servers or as part of an in-service migration. In the dedicated network management approach, each office requires a pair of Multiservice Data Manager servers, while in the centralized network management approach a single pair of Multiservice Data Manager servers can manage the Multiservice Switch 15000 and Media Gateway 15000 nodes in several offices. It is no longer necessary that both servers running Multiservice Data Manager

servers be located in the same NOC. Both dedicated and centralized deployments are supported in PT-AAL1 and UA-AAL1 solutions. UA-IP solutions support the dedicated deployment only.

For task flows showing how to deploy the dedicated and centralized network management approaches, see "Overview of Multiservice Data Manager server configuration" in NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

There are different configurations for Multiservice Data Manager servers.

- Standalone server, which provides Multiservice Switch 15000 and Media Gateway 15000 node connectivity, higher level element manager or OSS interworking (fault, security audit log, and performance), operator desktop MDM Toolset environment for all fault, configuration, administration, performance and security (FCAPS) services
- Server-set server, which provides Multiservice Switch 15000 node connectivity, higher level element manager or OSS interworking (fault and optionally, performance), client-set support (fault, configuration, administration, and security)
- Client-set server, which provides access to the MDM Toolset environment from the operator desktop (connects to a server-set for Multiservice Switch 15000 node connectivity, optimally to PM server for performance)
- PM server, which provides Multiservice Switch 15000 node connectivity, higher level element manager or OSS interworking (performance), client-set or standalone server for performance management
- MDM Admin Server, which provides Multiservice Switch 15000 and Media Gateway 15000 node connectivity, central AAA, controlled operator access to tools for fault, configuration, some administration, performance and security (FCAPS) services, and user administration tools from the MDM Toolset for all fault, configuration, administration, performance and security (FCAPS) services.

- MDM Server, which provides Multiservice Switch 15000 and Media Gateway 15000 node connectivity, higher level element manager or OSS interworking (fault, security audit log, and performance), interface for central AAA via IEMS, controlled operator access to tools for fault, configuration, some administration, performance and security (FCAPS) services, and user administration tools from the MDM Toolset for all fault, configuration, administration, performance and security (FCAPS) services.
- MDM consolidated management server, which aggregates fault management data from an MDM server at a lower level in the consolidated management hierarchy partition, provides configuration management of MSS/MG15000 nodes in the consolidated management hierarchy partition, and provides controlled operator access to tools for fault, configuration and administration services. An MDM consolidated management server operates at a regional or full network level.

Multiservice Data Manager server-set servers, PM servers, and MDM Servers are deployed in pairs to provide redundancy in your management solution in case of failure. Multiservice Data Manager client-set servers, MDM Admin Servers, and consolidated management servers may be deployed as single units or as redundant pairs according to network needs.

For more information on MDM server configurations, see “MDM server configurations” (page 88)

Sun Netra 240 servers

The Sun Netra 240 server is a certified platform for Nortel Multiservice Data Manager (MDM) software. Multiservice Data Manager software is typically installed on redundant servers that communicate through IP connectivity to the Multiservice Switch 15000 and Media Gateway 15000 nodes that they are managing.

Sun Netra 240 DC-powered servers are used in locations where Network Equipment Building Systems (NEBS)-compliant hardware is required. Sun Netra 240 AC-powered servers are deployed in network operations centers (NOCs) where NEBS- compliant hardware is not required.

Sun Netra 240 servers are used for Multiservice Data Manager central office deployments and are recommended for all new deployments of standalone, server-set, MDM Admin Server and MDM Server deployments.

Sun Netra 240 servers must be obtained directly from Sun Microsystems.

Sun Fire V480 servers

The Sun Fire V480 server is a legacy certified platform for Nortel Multiservice Data Manager (MDM) software. Sun Fire V480 servers can continue to be used for MDM deployments outside the central office (CO).

For more information, see "Sun server hardware and software" (page 65).

Server Platform Foundation Software (SPFS)

The Server Platform Foundation Software (SPFS) is a high-performance, UNIX-based processing platform based on Sun Microsystem's Netra line of NEBS compliant servers.

The SPFS platform is intended to be used as the platform for OAM&P services in the Carrier VoIP Network. These services include, but are not limited to the various Element Management systems for the Network Elements. The CS2000 Core Manager, IEMS, and Multiservice Data Manager all run on Sun Netra 240 platforms with SPFS.

The SPFS package consists of the Sun Solaris 9 operating system and third-party common software. Service applications such as a resource monitor (RESMON), service application monitor (SERVMAN), and network patch manager (NPM) are also supplied. A Element Management profile is used to only include the software that the EMS requires to operate.

SPFS provides unified interfaces to common or complex functions, but still retains full access to UNIX commands. Ongoing Solaris operating system upgrade support and patch lineup is also provided.

Solaris operating system

The Sun Solaris 9 operating system is delivered as part of SPFS. Patches to the Solaris 9 operating system are managed through the Network Patch Manager.

Third party common software

Third party software is contained in SPFS through the use of Sun packages. This provides a consistent way of delivering all of the Solaris software, third party software and Nortel applications. Patches to the third party common software are managed through the Network Patch Manager.

Service application monitor

The Service application monitor (servman) is used to register, de-register, and query the state of registered applications. MDM does not register with servman and continues to start, stop and monitor its processes directly.

Resource monitor (RESMON)

The Resource monitor detects hardware and software faults for the Netra 240 hardware platform and the SPFS processing platform. Alarms are generated and logged locally, and can be directed to a higher-level management system such as CS2000 Core Manager or IEMS.

For more information on SPFS fault management for MDM servers, see NN10092-911 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Fault Management Overview PT-AAL1/UA-AAL1/UA-IP*.

Network Patch Manager (NPM)

The Network Patch Manager (NPM) is a patch management solution for Nortel network-based products. NPM manages patching of the Server Platform Foundation Software through the Patching Server Element (PSE).

Only one instance of the NPM can be installed and enabled in an office. The preferred location for enabling NPM is the IEMS. If IEMS is not present in the network, then the CS2000 Management Tools server is the preferred location of the NPM. In certain network configurations, the Multiservice Data Manager server can be used to host the NPM when neither of the other preferred servers is present in the network.

For more information on configuration of Server Platform Foundation Software for Multiservice Data Manager, see NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

TDM core

The Time Division Multiplexing (TDM) core consists of the Enhanced Network (ENET), which is a TDM switched network, and all of its peripheral devices. The ENET provides a TDM switching fabric for access to TDM line, trunk, and service circuit peripherals.

Universal Audio Server/MS2020

The Universal Audio Server (UAS) is a SAM16 shelf-based peripheral used in the UA-AAL1 solution to facilitate the lawful intercept of call content for MG9000-based targets in compliance with the Communications Assistance for Law Enforcement Act (CALEA). Under the direction of H.248 call control messages from the CS2000, targeted MG9000 call content is captured at the UAS and replicated for delivery to law enforcement. The MS2020 shares the same configuration attributes as the UAS.

The UAS provides an OC-3c network interface to the ATM core for AAL1 bearer path connections. In addition, a 100BaseT Ethernet connection to the CS LAN provides a path for H.248 protocol call control messaging with the CS2000 and for SNMP protocol OA&M messaging with the CS2000 Core Manager.

The UAS is also used in the UA-IP solution, where all H.248 signaling and voice traffic is carried through Ethernet interfaces connected to each Ethernet Routing Switch 8600 node in a redundant pair.

For more information, see NN10010-111 *Universal Audio Server Basics*.

What is the Packet Trunking - IP solution

The Packet trunking - IP (PT-IP) solution is a subset of the UA-IP solution that is configured on the Media Gateway 15000. It is configured with 2pOC3ChSmIrVsp3-o function processors (FPs) (NTHW77AA).

The MG15000 aggregates VoIP traffic from two sources in the PT-IP solution:

- MG15000 VSP cards: these trunk MG cards reside in the MG15000 shelf and connect to the Vr Pp via Virtual Media interface. Each VSP card has two or three of the following host interfaces:
  - bearer traffic: IpMConn component links to the Vm with a VrAP (Virtual Router Access Point)

  - — control traffic: H.248 messaging terminates on the Ctrl/mg component which is linked to the Vm by a VrAP sub-component.
  - — signaling backhaul: per-call signaling information from PRI and PTS trunks is backhauled to the GWC over the IP network. The Ctrl/sg component is used with a VrAP sub-component.
- IP Core/CS-LAN: The MG15000 connects to either the IP Core network (directly to two different edge routers) or a pair of ERS8600s. A pair of GE links are used for each VR linked through the LAN. These links carry the bearer, control, and signaling traffic from the MG15000 to the destination MG15000 (or other standards compliant gateway) or CS-LAN (for signaling and control). Each link requires two IP addresses; one for the Vr Pp end and another for the router. While the amount of traffic over the IP trunk links varies depending on the customer's deployment, the VRs are always engineered to be nonblocking to avoid any congestion scenarios.

In the PT-IP solution, the MG15000 media gateway provides tandem trunking. A set of Nodal Provisioning Templates (NP templates) is available from the MDM for nodal provisioning of MG15000 in a Packet Trunking - IP (PT-IP) solution. These templates define one configuration for the MG15000 when it is deployed in a Carrier VoIP PT-IP solution.

The MDM manages the MG15000s over IP and is usually connected to the CS-LAN or another management network which is connected to the CSLAN. The MG15000 cannot be managed through GE links, therefore, the CP Ethernet ports are connected to the CS-LAN (ERS8600s). In-band managed MG15000s are not used in the PT-IP solution.

A PT-IP configuration depends on the features configured in the feature list and the type of voice codec used to transmit bearer speech through the IP network. When VSP3-o FPs are deployed, G.711 and G.729 codecs are used. G.711-10ms, the most effective codec in terms of both bandwidth and packet forwarding, is used in the MG15000 shelf configuration. Configurations that meets G.711-10ms requirements, meet all codec requirements.The following codecs are supported on PT-IP templates and can appear in the defaultCodecList:

- G.711U or G.711A-20ms

- G.726 32K ITU(10ms)
- G.726 32K ITU (20ms)
- G.729a-10ms or 20ms
- EVRC0-20ms

In a PT-IP solution, the MDM is the Element Management System (EMS) for the MG15000. The MDM supplies the NP templates to support configuration of the following for MG15000:

- CP3 (NTHW06DA)
- VSP3-o (NTHW77)
- 4pGe (NTHW49)
- Basic security for OAM and enhanced H.248 signalling security
- IP through VrAP only
- ISUP, PRI, and PTS trunk types
- HSM, HEP, APS, and PDR hitless recovery from all single failures for Carrier Grade functionality
- Both local and remote subnet configurations
- IP routing via PDR, static routes
- G.711U and G.711A, G.726ITU, G.729, EVRC, TrFO and RTO
- Out-of-band management using the CP OamEnet ports
- periodic routine exercise (REX)
- hitless critical attribute (HCA)

When engineering the MG15000 in the PT-IP solution, determine the following:

- the required IP trunking for support of all the remote wire centres IP trunking. This determines the number of VSP3-o pairs required on the gateway. For every 2016 trunks, you must install one pair of VSP3-o cards.
- the required CS-LAN capacity based on the voice and control traffic

Note: For solution level documentation on PT-IP, refer to NN10442-100 PT-IP Solution Level Basics.

Chapter 2
Multiservice Switch 15000 and Media Gateway 15000 hardware overview

The Multiservice Switch 15000 and Media Gateway 15000 network elements share common hardware and software aspects. Hybrid systems can combine these network elements' capabilities. Unless otherwise indicated, the components apply to both network elements.

To review the base hardware components of a Multiservice Switch 15000 node, see "Base hardware components" (page 43). For more specific information about Multiservice Switch 15000 hardware used in the Carrier Voice over IP Network solutions, see "Multiservice Switch 15000 hardware in the PT-AAL1 and UA-AAL1 solutions" (page 60).

Base hardware components

Nortel Multiservice Switch 15000 nodes are housed in a single frame assembly that is compliant with the network equipment building system (NEBS). This frame assembly contains a breaker interface panel (BIP), up to two Multiservice Switch 15000 shelf assemblies, and cable management guides.

The figure "Multiservice Switch 15000 shelf (front view)" (page 45) displays the front view. The back view of the frame is displayed in the figure "Multiservice Switch 15000 shelf (back view)" (page 46).

For more information on the base hardware, see the following:

- "Shelf assembly" (page 47)
- "Multiservice Switch 15000 control processors" (page 48)
- "Multiservice Switch 15000 function processors" (page 49)
- "4-port DS3 sparing panel NTHR79" (page 52)
- "Breaker interface panel" (page 54)
- "Cable management guides" (page 54)

- “Cooling units” (page 54)
- “Multiplexor” (page 54)

Figure 4
Multiservice Switch 15000 shelf (front view)

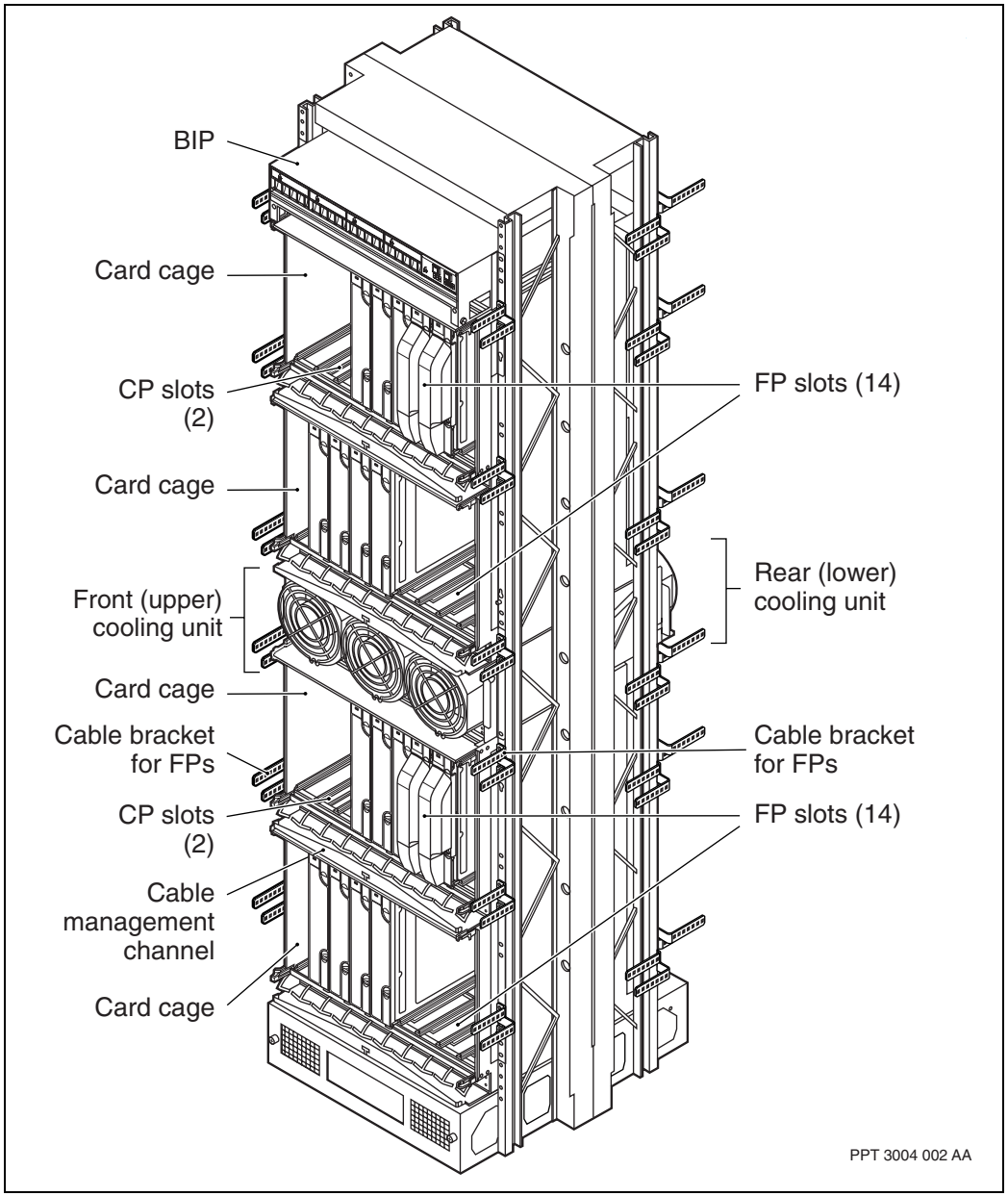
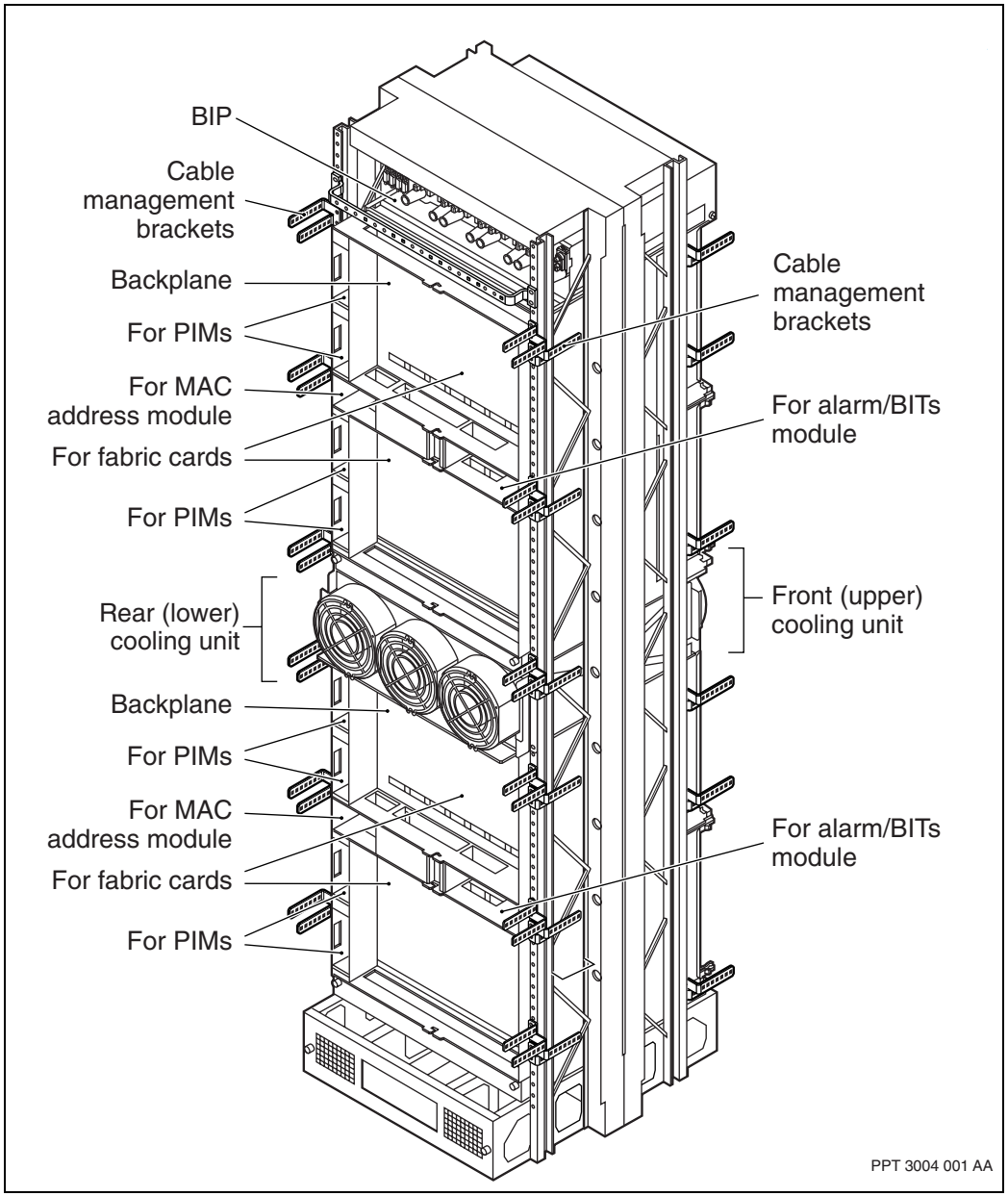


Figure 5
Multiservice Switch 15000 shelf (back view)



Shelf assembly

Nortel Multiservice Switch 15000 frames support two shelf assemblies: an upper and a lower. Each shelf assembly contains all the components that make up a single Multiservice Switch 15000 shelf.

The shelf assembly components include

- the media access control (MAC) address module

  The MAC address module provides the shelf with media access control (MAC) addresses for the control and function processors. The module also communicates the shelf type to the control processors.

- the backplane

  The backplane is the point across which all processor cards and fabric cards in a shelf intercommunicate. The backplane provides redundant serial links and power and signal distribution between processor cards and fabric cards.

- the card cages

  The shelf is divided into two card cages located one above the other. Each card cage holds a maximum of eight processor cards, which manage the node and provide interfaces for connection to high-speed data networks. There are two types of processor cards in the node: control processors (CP) and function processors (FP).

  The CP and FP cards are the processing elements for performing and managing node functions. For more information, see “Multiservice Switch 15000 control processors” (page 48) and “Multiservice Switch 15000 function processors” (page 49).

- power interface modules (PIMs)

  Each shelf assembly contains four PIMs: two for A power feeds and two for B power feeds. Each of the power cables from the BIP is connected to one of these PIMs. Each PIM also provides separate power filtering for the portions of the shelf it supports and terminates the shelf clocks and the secondary control bus.

- alarm/BITS module with wire-wrap terminal support

  The alarm/BITS module terminates cables carrying alarm signals from the cooling unit and the BIP, as well as cables carrying BITS signals. It passes this information over the shelf backplane to the control processors.

- fabric cards

  Fabric cards provide the shelf with two redundant 16x16 switching elements for interconnecting up to 16 processor cards. Both fabrics are used to carry traffic. Under normal circumstances, half the processors that each processor card transmits to and receives from are connected to the upper fabric (usually labeled the X fabric), while the other half of the processors that the processor card transmits to and receives from are connected to the lower fabric (the Y fabric). The fabrics normally loadshare the data traffic, but each is capable of handling full line capacity if one of them fails.

  The following versions of the fabric cards are supported in all solutions: NTHR16EA, NTHR16DA, and NTHR16CA.

Multiservice Switch 15000 control processors

Control processor (CP) cards control overall processing in the node. They connect to the shelf backplane, providing an interface to both fabric modules, while their hard disks store the Nortel Multiservice Switch software, configuration data, and spooled information. Some other functions they perform include sequencing function processor (FP) startup, downloading new software, collecting and maintaining shelf inventory, statistical data, and routing tables, providing system timing, and monitoring alarms and hardware status. As well, through their OAM Ethernet port, they provide an interface and out-of-band connectivity to Nortel Multiservice Data Manager servers.

Within the Carrier Voice over IP portfolio, CP3s are installed in slots 0 and 1 of the Multiservice Switch 15000 shelf. The supported version of CP3, CPeD, provides DS1 BITS timing in conjunction with the DS1-based Alarm/BITS card and a wire-wrap terminal block.

For more information on control processors, see the NN10600-120 *Nortel Multiservice Switch 15000/20000 Hardware Description*.

Multiservice Switch 15000 function processors

Function processor (FP) cards terminate the physical links and provide the interface ports that connect the network communications facilities and Nortel Multiservice Switch 15000 nodes. FPs support and execute real-time processes that impact service delivery. Up to fourteen FPs can be connected to two fabrics with redundant links enabling distributed and high-capacity scalable call processing. For all FPs, both the line and equipment are spared.

The following FPs are supported in the PT-AAL1 solution:

- NTHR21 (PQC2 technology) or NTHW15 (PQC12 technology), the 4-port OC-3/STM-1 single-mode intermediate reach ATM FP (with software name 4pOC3SmIrAtm)
- NTHW21, the 16-port OC-3/STM-1 ATM FP with MT-RJ connectors (with software name 16pOC3SmIrAtm)
- NTHW31, the 16-port OC-3c/STM-1 ATM FP with LC connectors (with software name 16pOC3SmIrAtm)
- NTHW11, the 4-port OC-12c/STM-4 ATM FP with PQC2 (PQC6v2) technology (with software name 4pOC12SmIrAtm)
- NTHW86, the 4-port OC-12c/STM-4 ATM FP with PQC12 technology (with software name 4pOC12SmIrAtm)

Note 1: The 4-port OC-3/STM-1, 4-port OC-12c/STM-4 come in two versions: PQC2 and PQC12. The PQC2-based FPs are not suitable for networks that may want to evolve to multi-services or to nodes configured with PNNI trunks using in-band OAM.

Note 2: Both types of 4-port OC-12c/STM-4 FP, NTHW11 and NTHW86, can be deployed in a mixed pair of redundant FPs. The *ipRoutesPoolCapacity* attribute needs to be configured with a value of zero before installing the NTHW11 FP as part of this deployment. For more details on the required configuration for this deployment, see NN10225-512 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Attribute Summary PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

Note 3: Both types of 4-port OC-12c/STM-4 FP, NTHW11 and NTHW86, can be deployed in a mixed pair of redundant FPs. The *ipRoutesPoolCapacity* attribute needs to be configured with a value of zero before installing the NTHW11 FP as part of this deployment. For more details on the required configuration for this deployment, see NN10225-512 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Attribute Summary PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

The following function processor (FP) cards are supported in the UA-AAL1 solution:

- NTHR23, the 12-port DS3 ATM FP (with software name 12pDS3Atm)
- NTHR31, the 4-port DS3 Channelized ATM FP with IMA (with software name 4pDS3ChAtm)
- NTHR21 (PQC2 technology) or NTHW15 (PQC12 technology), the 4-port OC-3/STM-1 single-mode intermediate reach ATM FP (with software name 4pOC3SmIrAtm)
- NTHW21, the 16-port OC-3/STM-1 ATM FP with MT-RJ connectors (with software name 16pOC3SmIrAtm)
- NTHW31, the 16-port OC-3c/STM-1 ATM FP with LC connectors (with software name 16pOC3SmIrAtm)
- NTHW11, the 4-port OC-12c/STM-4 ATM FP with PQC2 (PQC6v2) technology (with software name 4pOC12SmIrAtm)
- NTHW86, the 4-port OC-12c/STM-4 ATM FP with PQC12 technology (with software name 4pOC12SmIrAtm)

Note 1: The 4-port OC-3/STM-1 ATM FP have two versions: PQC2 and PQC12. The PQC2-based FP is not suitable for networks that may want to evolve to multi-services or to nodes configured with PNNI trunks using in-band OAM.

Note 2: The 16pOC3 FPs are the only FPs that support hitless software migration for unprotected SONET interface pairs.

The following function processor (FP) cards are supported in the UA-IP solution:

- NTHR23, the 12-port DS3 ATM FP (with software name 12pDS3Atm)
- NTHW15, the 4-port OC-3/STM-1 single-mode intermediate reach ATM FP with PQC12 technology (with software name 4pOC3SmIrAtm)
- NTHW86, the 4-port OC-12c/STM-4 ATM FP with PQC12 technology (with software name 4pOC12SmIrAtm)
- NTHW70, the 4-port OC-3 TDM FP (with software name 4pOC3ChSmIr)

  Note: This FP is specific to the Media Gateway 15000.

- NTHR31, the 4-port DS3 Channelized ATM FP with IMA (with software name 4pDS3ChAtm)
- NTHW49, the 4-port Gigabit Ethernet FP (with software name 4pGe)
- NTHW84, the 2-port Gigabit Ethernet VSP3 FP (with software name 2pGeMmSrVsp3).

  Note: This FP is specific to the Media Gateway 15000.

- NTHW77, the 2-port optical OC-3 TDM VSP3-o FP (with software name 2pOC3ChSmIrVsp3)

  Note: This FP is specific to the Media Gateway 15000.

The following function processor (FP) card is supported in the UA-IP solution in order to offer multiservice traffic on the UA-IP Multiservice Switch 15000 ATM core:

- NTHR23, the 12-port DS3 unchannelized ATM FP for DSL ISP handoff (with software name 12pDS3Atm)

The following function processor (FP) cards are supported in the PT-IP solution:

- NTHW49, the 4-port Gigabit Ethernet FP (4pGe)
- NTHW77, the 2-port optical OC-3 TDM VSP3-o FP (2pOC3ChSmIrVsp3)

For the description of the FPs, see NN10600-120 *Nortel Multiservice Switch 15000/20000 Hardware Description* and for the software configuration of the FPs, see NN10600-551 *Nortel Multiservice Switch 7400/15000/20000 FP Configuration Reference*.

4-port DS3 sparing panel NTHR79

In the UA-AAL1 and UA-IP solutions, a one-for-one 4-port DS3 sparing panel is installed. This enables equipment protection:

- between two 4-port DS3 function processors (FPs)
- between two 12-port DS3 FPs, using only ports 0 to 3 by connecting a single panel to P0 (data) and P3 (control)

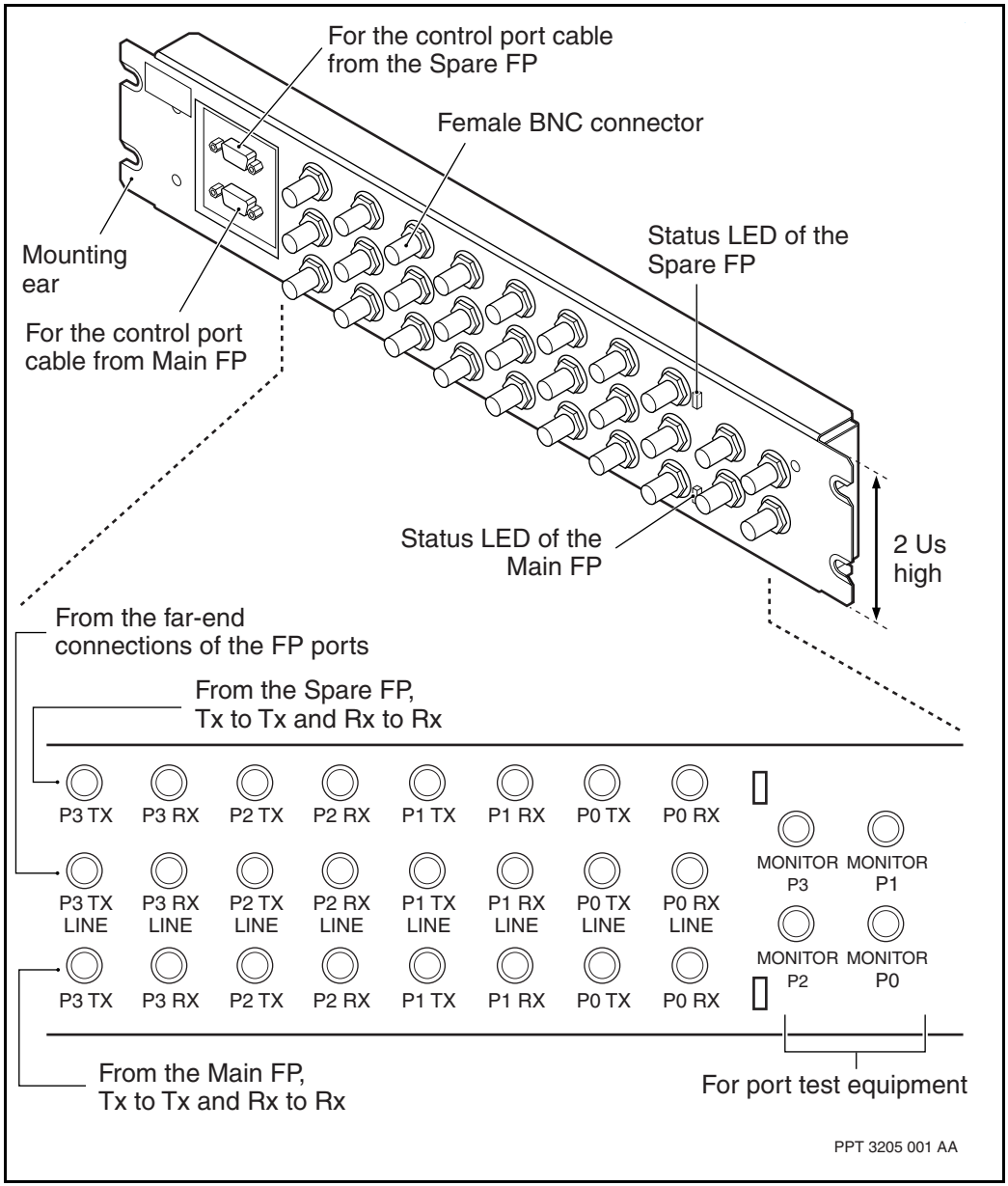
The product engineering code (PEC) of the sparing panel is NTHR79. For a view of its faceplate, see the figure "A 4-port DS3 one-for-one sparing panel NTHR79" (page 53).

The sparing panel transfers traffic between a main DS3 FP and a spare DS3 FP of the same type and compatible vintage. When the main FP connected to a sparing panel fails, the control processor (CP) detects that the FP has failed and instructs the panel to switch the relay contacts from the failed FP to the spare FP. Traffic then switches from the failed FP to the spare.

For information about:

- the behavior and specifications of sparing panels, see the chapter on termination panels in NN10600-120 *Nortel Multiservice Switch 15000/20000 Hardware Description*
- configuring the software to facilitate DS3 equipment protection (sparing), see NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures*
- installing the sparing panel and cabling it, see the section on installing a 19-inch sparing panel in the NEBS 2000 frame (NTRU04) in NN10600-130 *Nortel Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade*
- replacing the sparing panel or one of its cables, see NN10600-130 *Nortel Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade*

Figure 6
A 4-port DS3 one-for-one sparing panel NTHR79



Breaker interface panel

The breaker interface panel (BIP) provides single or dual (redundant) DC power and frame-level alarm indicators to the node. It is in a central location where redundant input dc power feeds are connected and routed to two or four breaker interface modules (BIMs). Power is then distributed from the BIMs to the shelves and cooling units.

Cable management guides

In the PT-AAL1, UA-AAL1 and UA-IP solutions, Nortel Multiservice Switch 15000 nodes use fiber and shielded twisted pair cables for carrying SONET and Ethernet. In addition, in the UA-AAL1 and UA-IP solutions, coaxial cable is used to carry DS3.

In general, these cables are routed in exclusive bundles on different paths against the frame of the node using specific hardware subassemblies for protecting, routing, and securing cables. Cable routing is located at the front of the shelf, while the wiring trough is located at the bottom of each card cage. Power and alarm cables are cabled at the rear.

Cooling units

The two cooling units are located in the middle of the frame, between the upper and lower shelf assemblies. The front cooling unit cools the upper shelf assembly, while the back cooling unit cools the lower shelf assembly. Each cooling unit consists of three fans and a cooling unit backplane, and each unit is controlled by temperature sensors located within the shelf assembly.

Multiplexor

In the UA-AAL1 and UA-IP solutions, the EdgeLink 100 multiplexor is a self-contained broadband multiplexor made by Telco Systems. This multiplexor

- provides multiplexing of up to 28 DS1 channels onto a single DS3 channel
- transmits and receives up to 28 DS1 signals on a DS3 interface using standard M13 or C-bit framing
- offers one-for-one sparing of its M13 multiplexor card

To install an EdgeLink100, refer to Telco Systems' documentation, starting with the document *EdgeLink 100 Digital Multiplexer General Description, section 825-102-001*.

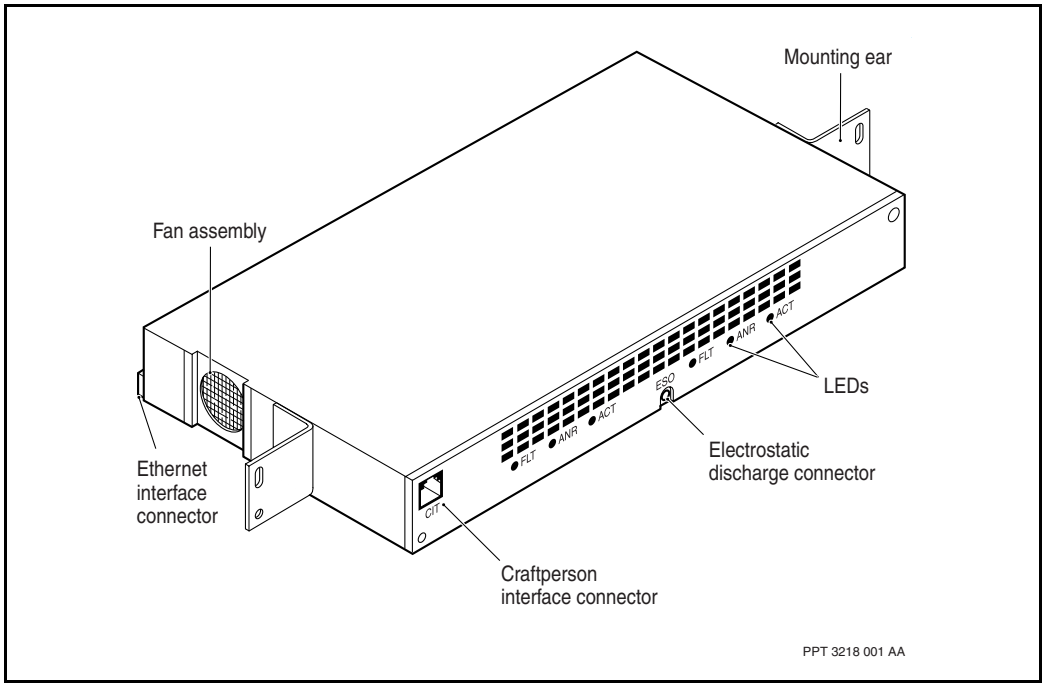
If you have DS-1 IMA interfaces using the Edgelink100 MUX, ensure that you use the Edgelink100 MUX software (R3.3). Contact Telco Systems to get the Edgelink100 MUX software and upgrade procedures:

- http://www.telco.com/products/Transport/M13Multiplexers/EdgeLink100/

For more information on connecting Multiservice Switch 15000 node to an EdgeLink 100, see:

- NN10600-130 *Nortel Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade*
- NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*

Figure 7
EdgeLink 100 multiplexor



Optional in-band OAM management topology

Two types of OAM management topologies exist: out-of-band OAM and in-band OAM.

An out-of-band topology is generally regarded as the typical management topology. Out-of-band management uses dedicated interfaces for management connectivity access via CP Ethernet links.

In an in-band management topology, a Nortel Multiservice Switch 15000 node can act as an OAM gateway node to other remote nodes for the purpose of sending or receiving OAM data. The key elements of an in-band topology are defined as follows:

- an OAM gateway node

  Multiservice Switch 15000 (GW-PP15000) has an out-of-band

connectivity path to Nortel Multiservice Data Manager servers, and is the OAM gateway to a set of “remote” Multiservice Switch 15000 nodes that are managed by way of in-band connectivity.

There are typically two gateways configured for each office for redundancy; one is designated as the preferred gateway and the other is designated as the alternate gateway.

- multiple remote nodes

  Remote nodes are managed via in-band connectivity to each other and to the preferred and alternate OAM gateways. Note that where multiple gateways exist for redundancy, one gateway can appear as a remote to another.

  In-band connectivity is supported using ATMMPE (ATM Multi-Protocol Encapsulation) to encapsulate the OAM IP traffic over PNNI trunks.

  Remote nodes have an in-band connectivity path to Multiservice Data Manager servers, accessible from one or more “gateway” nodes, and possibly by way of one or more “intermediate” nodes, if there is no direct PNNI link from the GW-nodes

- intermediate nodes

  An intermediate node is any node, gateway or remote, through which OAM management data must traverse to reach a destination node.

- at least two Multiservice Data Manager servers

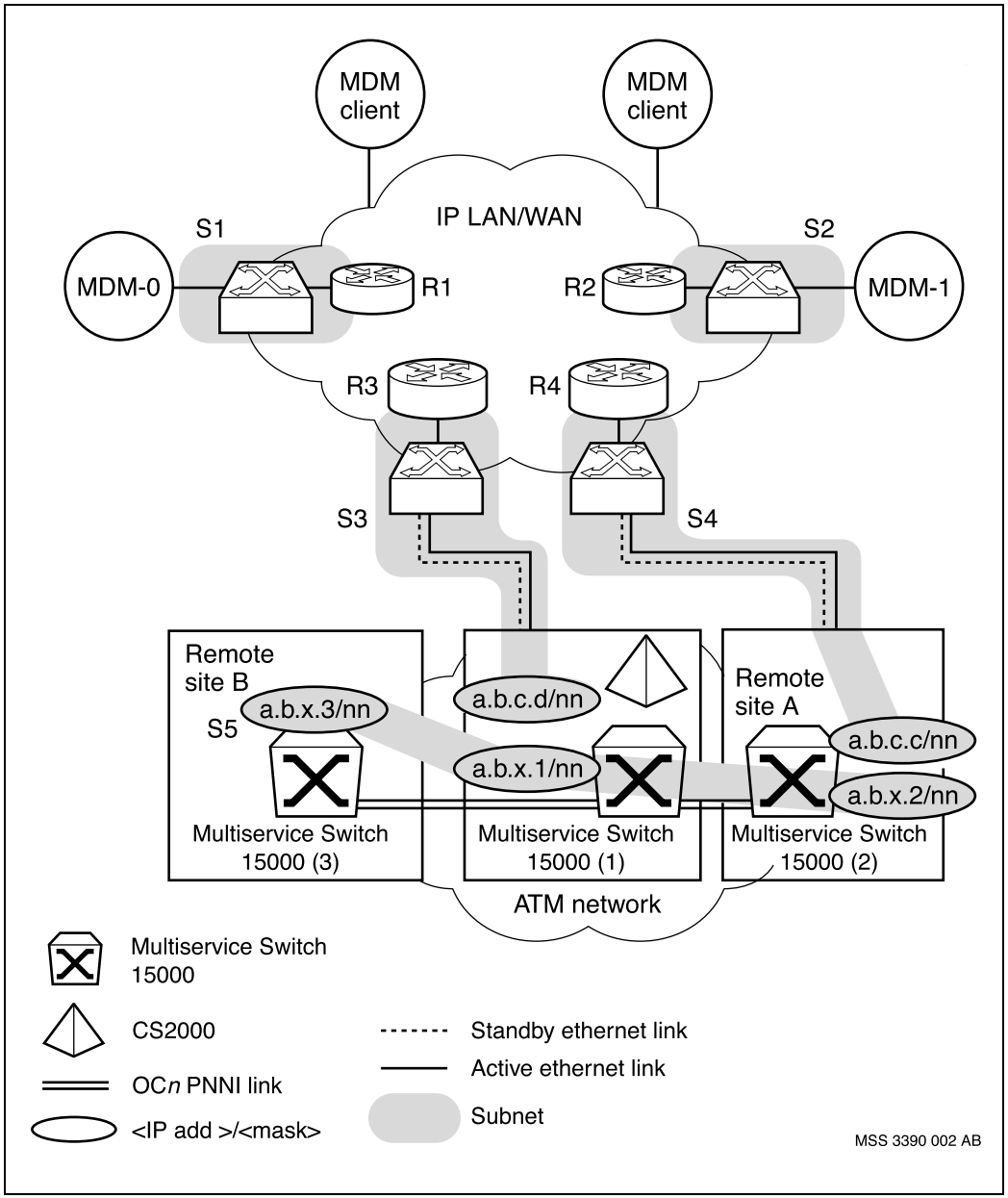
  Each Multiservice Data Manager server is capable of performing all aspects of element management for the Multiservice Switch network. For example, each node sends alarms to both servers, which are configured for the fault management function

  — The chosen server is the server that the operator uses as a launching point for Multiservice Data Manager applications, such as Succession ATM Software Migration (SASM) or Command Console.

  — The alternate server is another server that could have been used to perform the same set of tasks, but that wasn't chosen.

The figure “An in-band management topology” (page 59) illustrates a typical in-band OAM topology.

Figure 8
An in-band management topology



Multiservice Switch 15000 hardware in the PT-AAL1 and UA-AAL1 solutions

Within both the PT-AAL1 and UA-AAL1 solutions, you can engineer multiple Nortel Multiservice Switch 15000 nodes within the solutions and connect them to various components. Consider the following rules when deciding how to place the Multiservice Switch 15000 hardware for the PT-AAL1 and UA-AAL1 solutions:

- When only one Multiservice Switch 15000 device is installed, it goes in the lower half of the frame assembly with a filler panel installed in the top half. If two devices are installed, one is in the bottom half of the frame assembly and the other shelf is in the upper half of the frame assembly.

  Refer to the figures “Multiservice Switch 15000 equipment installed: single shelf installation (front view)” (page 61) and “Multiservice Switch 15000 equipment installed: dual shelf installation (front view)” (page 62) to see how the equipment is installed.

- The CS2000 Core Manager must be co-located with the CS2000.
- At least one Multiservice Switch 15000 node must be co-located with the CS2000 Core Manager, the CS2000, and the ENET.
- In a network using in-band OAM, the node with out-of-band connectivity to Nortel Multiservice Data Manager (MDM) server, which is co-located with the CS2000 does not connect to the CS LAN but rather, connects directly to the IP LAN/WAN.
- The nodes must be connected through the CS LAN to Multiservice Data Manager software servers.
- The Multiservice Data Manager software servers are located in the network operations centers (NOCs).

  The figures “Footprint for single shelf installation” (page 63) and “Footprint for a dual shelf installation” (page 64) provide you with the footprints for the installation of Multiservice Switch 15000 nodes and Multiservice Data Manager servers.

Figure 9
Multiservice Switch 15000 equipment installed: single shelf installation (front view)

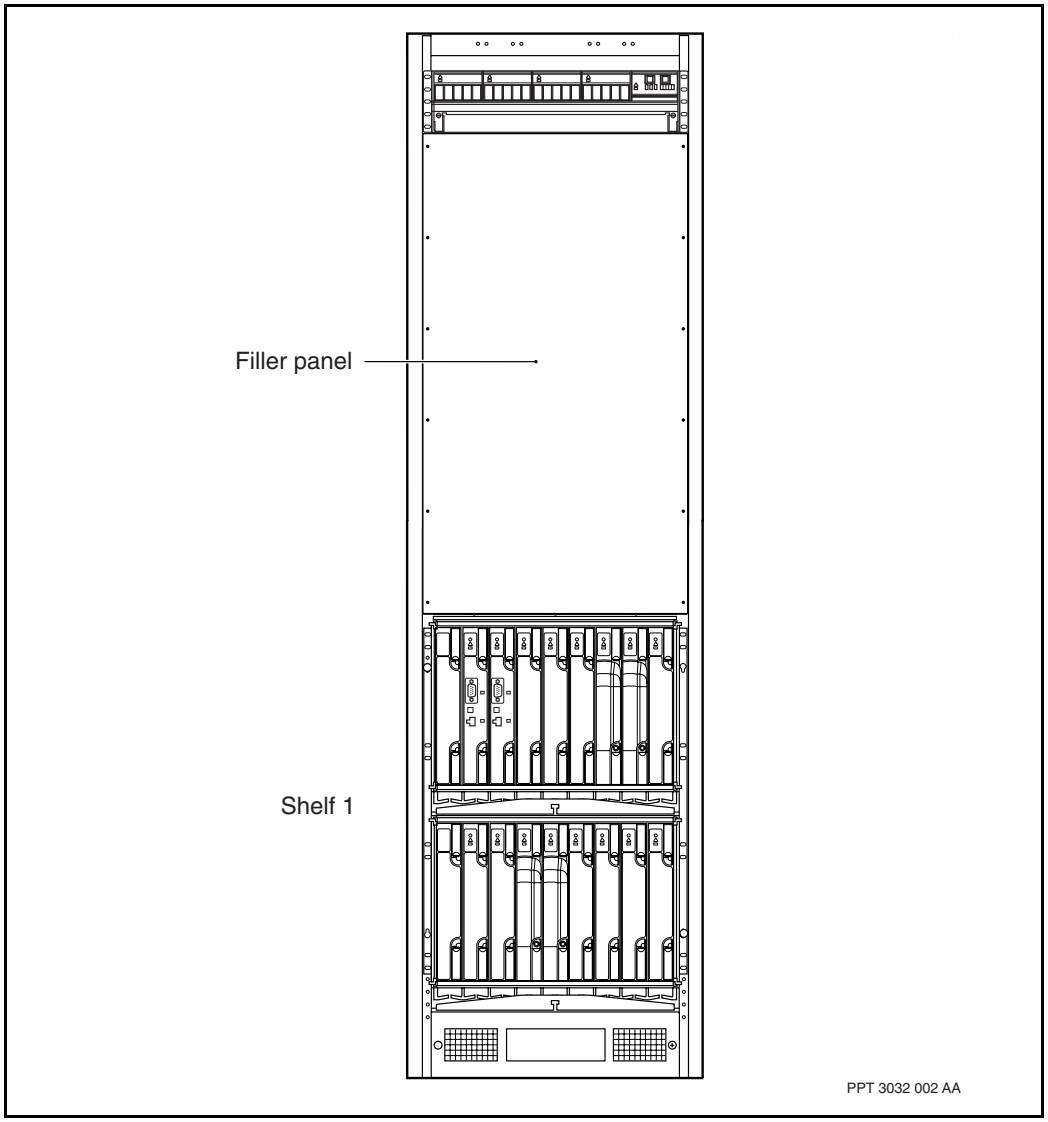


Figure 10
Multiservice Switch 15000 equipment installed: dual shelf installation (front view)

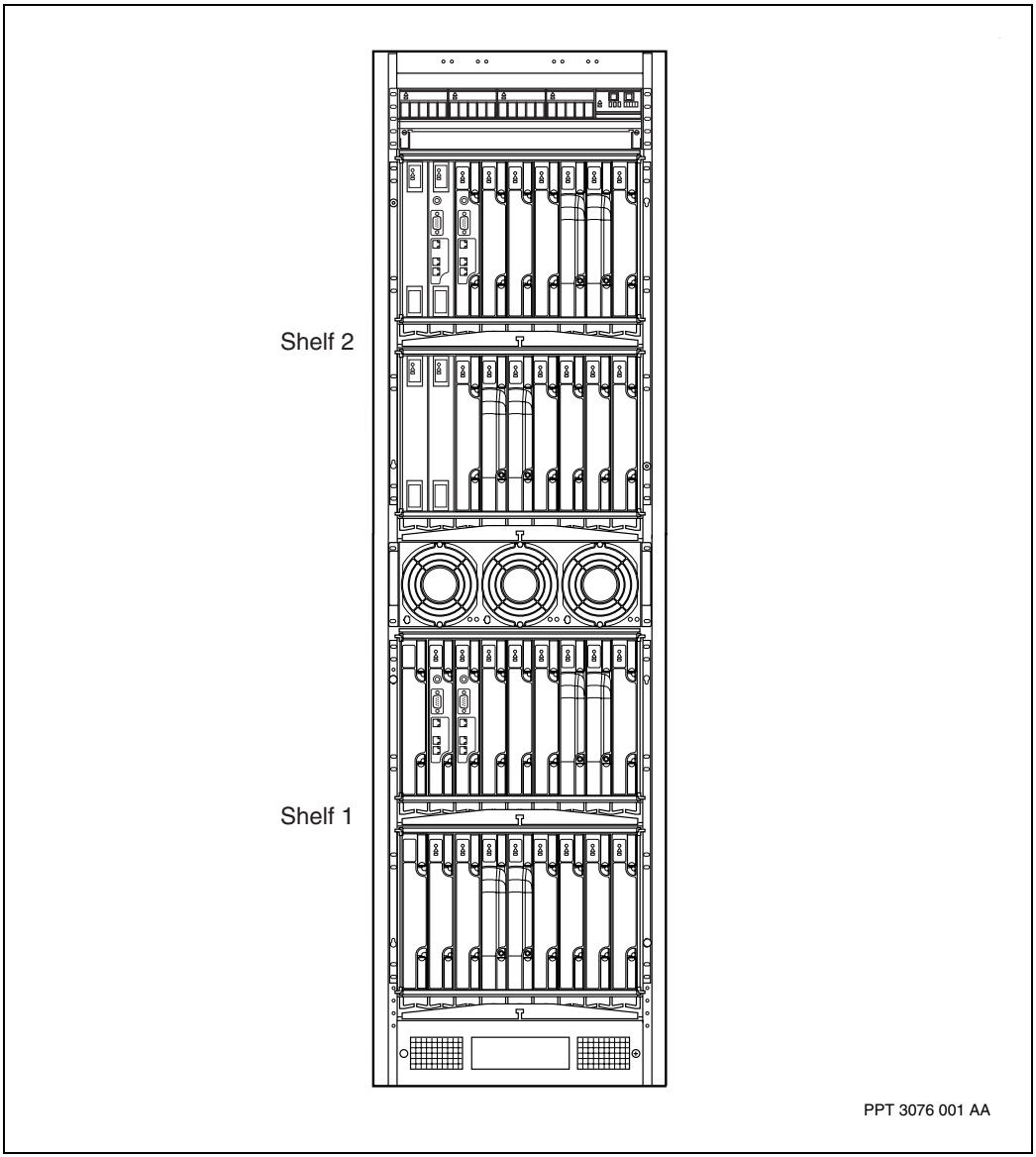


Figure 11
Footprint for single shelf installation

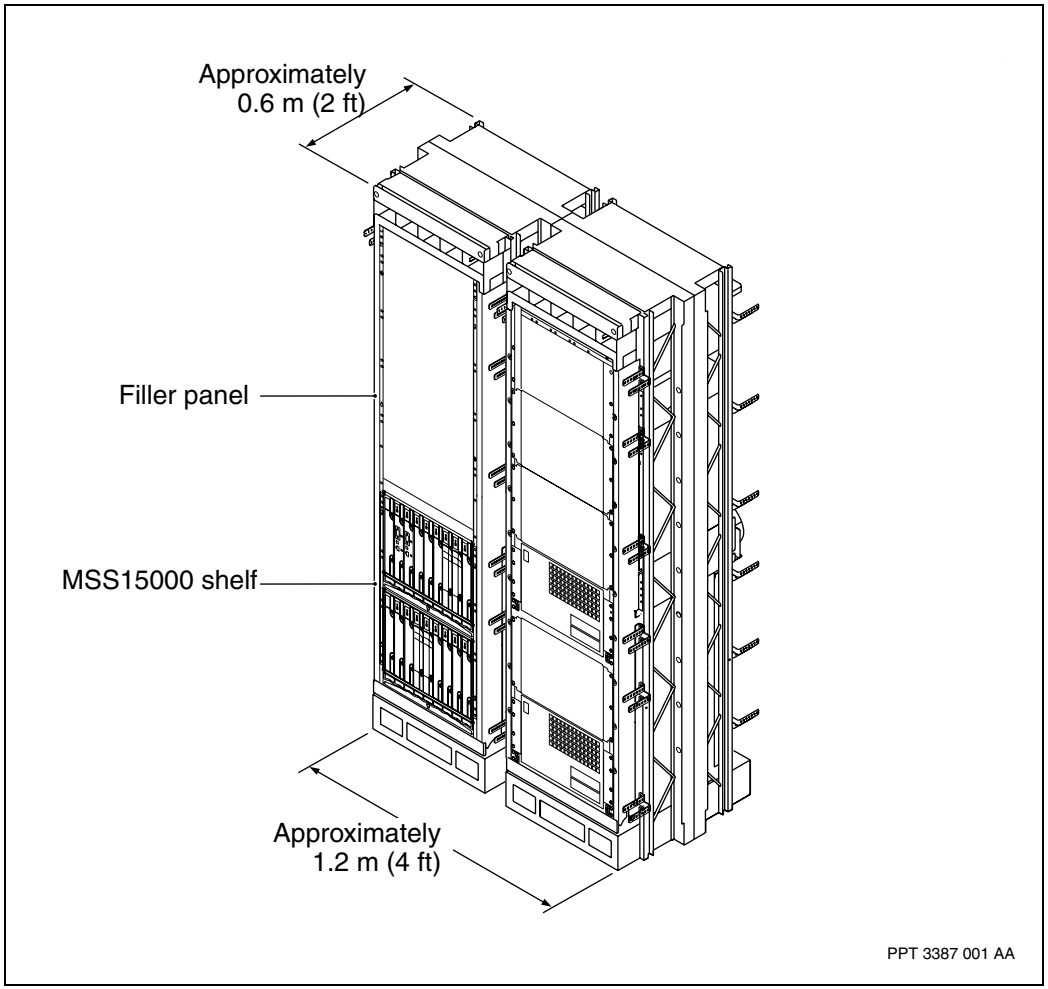
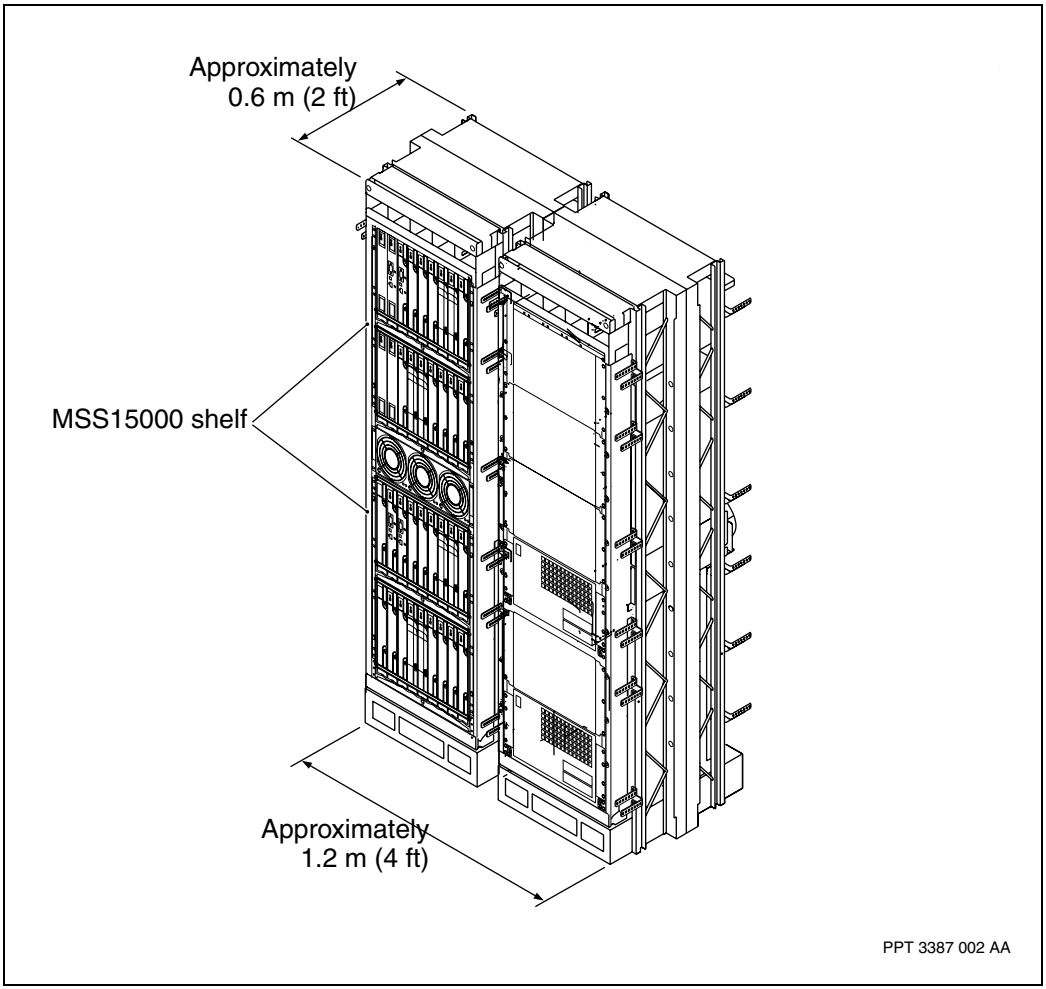


Figure 12
Footprint for a dual shelf installation



Chapter 3
Sun server hardware and software

The following sections describe hardware, software and disk partitioning requirements for the supported hardware configurations of Nortel Multiservice Data Manager (MDM) for the PT-AAL1, UA-AAL1 and UA-IP solutions described in this document:

Use this information to determine all hardware and software requirements you need to meet in order to run Multiservice Data Manager software on Sun Netra 240, Sun Fire V480 and Sun Fire V240 servers in the PT-AAL1, UA-AAL1 and UA-IP solutions. MDM can be deployed on the legacy Sun Fire V480 hardware platform but new MDM deployments must use Sun Netra 240 servers.

> ***Note:*** Sun Netra 240 servers, Sun Fire V240 servers and legacy Sun Fire V480 servers must be obtained directly from Sun Microsystems. For information about specific network configurations, see the Sun and Nortel Development Certified Platforms page (http://www.sun.com/oem/nortel/) at the Sun Microsystems website.

Sun Netra 240 server hardware and software

The Netra 240 server offers a NEBS-compliant DC-powered computing platform for deployment in the central office (CO) and an AC-powered version for deployment in a network operations center (NOC). The Sun Netra 240 hardware platform can be used to deploy all MDM server configurations.

The following sections describe hardware, software and disk partitioning requirements for the supported Sun Netra 240 hardware configurations of Nortel Nortel Multiservice Data Manager (MDM):

- "Sun Netra 240 hardware requirements" (page 66)
- "Sun Netra 240 software requirements" (page 67)
- "Sun Netra 240 disk partitions" (page 67)

Sun Netra 240 hardware requirements

For the hardware requirements for deploying Multiservice Data Manager on Sun Netra 240 servers, see the table "Sun Netra 240 (AC and DC powered) hardware requirements for standalone/server-set/MDM Admin Server/MDM Server/CM server" (page 66).

Table 1
Sun Netra 240 (AC and DC powered) hardware requirements for standalone/server-set/MDM Admin Server/MDM Server/CM server

Area	Requirement
Processors:	two UltraSPARC IIIi processors at 1.28 GHz each
Memory:	4 Gbytes of RAM
Disks:	two 73 Gbyte SCSI hot-swappable disk drives
Media access:	one DVD/RW drive
Network access:	four 10/100/1000 BaseT Ethernet ports. MDM uses 100BaseT.
Power:	two Power Supply Units

The Sun Netra 240 is also known as the Cabinetized Operations, Administration, and Maintenance (COAM) server. The maximum number of COAM servers in a COAM equipment cabinet is six. Two Sun Netra 240 servers are required to deploy an MDM server-set configuration.

Sun Netra 240 software requirements

For software requirements for deploying Multiservice Data Manager on Sun Netra 240 servers, see the table "Software requirements for the Netra 240 server" (page 67).

Table 2
Software requirements for the Netra 240 server

Software	Details
SN09 Server Platform Foundation Software (SPFS)	three CD set, ordered separately. This set of CDs contains: • Solaris operating system and required patches • Third party software required by MDM • Service applications
Netscape 4.78	The official version can be found on the Sun website at http://www.sun.com/software/solaris/netscape/getnetscape478.html

Sun Netra 240 disk partitions

The Netra 240 system is a disk mirrored system See "Disk partitioning for Netra 240, 73 Gbyte disks" (page 67) for the disk partitioning for each of the Netra 240 disks.

Table 3
Disk partitioning for Netra 240, 73 Gbyte disks

Partition	File system	Size	Type
0	swap	4 GB	hard partition
1	/	4 GB	hard partition
(Sheet 1 of 2)			

Table 3 (Continued)
Disk partitioning for Netra 240, 73 Gbyte disks

Partition	File system	Size	Type
3	/var	2 GB	hard partition
4	/opt	5 GB	hard partition
5	/data	3 GB	soft partition
	/opt/nortel	3 GB	soft partition
	/backup	4 GB	soft partition
	/opt/MagellanNMS	11 GB	soft partition
	/var/adm	1 GB	soft partition
	/var/log	1 GB	soft partition
	/export/home (for user directories)	20 GB	soft partition
	reserved for system use	8.5 GB	
	available for soft partition growth	1.8 GB	
7	metadevice state database for disk mirroring and disk layout	5 MB	hard partition

Note 1: A hard partition cannot be resized.

Note 2: swap uses /var/run (6.5 GB) as well as /tmp (512 MB).

Note 3: /var is a hard partition.

Note 4: /export/home is a soft link to /localdisk.

(Sheet 2 of 2)

Sun Fire V480/V240 server hardware and software

The following sections describe hardware, software and disk partitioning requirements for the supported legacy V480 hardware configurations of Nortel Multiservice Data Manager (MDM):

- “Solaris operating system” (page 69)
- “MDM standalone/server-set/MDM Admin Server/MDM Server/CM server with two 73 GB disks” (page 70)
- “MDM client-set” (page 74)

The Sun Fire V240 server is recommended for client-set deployments. The legacy Sun Fire V480 server can be used for deployments outside the central office.

Solaris operating system

Solaris version 9, 09-04 is the current operating system shipped on the Sun platform.All Multiservice Data Manager workstations must be upgraded to Solaris version 9 in all Carrier Voice over IP solutions.

> ***Note:*** The release of this document aligns with the Solaris version 9 (09-04) upgrade information provided by Sun Microsystems Inc. and is subject to change, see http://sun.com/oem/nortel/ for up to date information.

For information and procedures for the MDM Solaris upgrade, refer to NN10185-461 *Upgrading Nortel Multiservice Data Manager in Carrier Voice over IP Networks*.

MDM standalone/server-set/MDM Admin Server/MDM Server/ CM server with two 73 GB disks

Hardware requirements

For the hardware requirements for Multiservice Data Manager servers with two 73 GB disks configured in the standalone/server-set/MDM Admin Server/MDM Server/CM server deployment, see the table, “Sun FIre V480 hardware requirements for MDM standalone/server-set/MDM Admin Server/ MDM Server/CM server with two 73 GB disks” (page 70).

Table 4
Sun FIre V480 hardware requirements for MDM standalone/server-set/MDM Admin Server/ MDM Server/CM server with two 73 GB disks

Hardware	Details
Sun product number A37-WTPF2-04GRB	Sun Fire V480 Server 2 @ 2*1.05GHz Ultrasparc III Cu Processors with 8 MB Ecache
	4 GB memory (16*256 DIMMs)
	2 73 GB (10,000 RPM) FC-AL disks[1]
	1 DVDROM
	2 (N+1 redundant power) supplies
	2 10/100/1000Base-T Ethernet ports
	1 serial port
	2 USB ports
	6 PCI slots
Sun product number X311L	localized power cord kit North American/Asian
Note 1: Emergency dial up using a modem to access a serial port is an optional configuration and not part of the core solution.	
Note 2: The information in this table is subject to change. For the latest information on Carrier Voice over IP Network configurations including the Sun Fire V480 server, see http://sun.com/oem/nortel/.	

Software requirements

For the software requirements for Multiservice Data Manager servers with two 73 GB disks configured in the standalone/server-set deployment/MDM Admin Server/MDM Server/CM server, see the table, "Software requirements for MDM standalone/server-set/MDM Admin Server/MDM Server/CM server with two 73 GB disks" (page 71).

Note: Solaris 9 is installed in 64 bit mode.

Table 5
Software requirements for MDM standalone/server-set/MDM Admin Server/MDM Server/CM server with two 73 GB disks

Software	Details
Sun product number SOLZS-080B9AY9	Solaris 9 English only CD media kit (see http://sun.com/oem/nortel/ for up to date information on the Solaris version and issue).
Sun patches (patches can be found on the Sun website at http://www.sun.com)	Solaris 108528 (latest version)
Note: For a list of Solaris prerequisites, see the Multiservice Data Manager 15.3 Release Supplement.	
Netscape 4.78	The official version can be found on the Sun website at http://www.sun.com/software/solaris/netscape/getnetscape478.html
Note: The information in this table is subject to change. For the latest information on Carrier Voice over IP Network configurations including the Sun Fire V480 server, see http://sun.com/oem/nortel/.	

Partitioning two 73 GB disks for MDM standalone/server-set/MDM Admin Server/MDM Server/CM server

When you are partitioning your first disk, use the values in the table, "Disk partitioning for the first 73 GB disk (standalone/server-set/MDM Admin Server/MDM Server/CM server)" (page 72).

Table 6
Disk partitioning for the first 73 GB disk (standalone/server-set/MDM Admin Server/MDM Server/CM server)

Partition	File system	Size
0	/	11 GB (root OS partition)
1	swap	4 GB
2	overlap	default
3	/localdisk	49 GB (local user data)
4	/var	8 GB
7	MDDB State DB Replica (only if using mirrored disks)	256 MB

When you are partitioning your second disk, use the values in the table, "Disk partitioning for the second 73 GB disk (standalone/server-set/MDM Admin Server/MDM Server/CM server when not using disk mirroring)" (page 72).

Table 7
Disk partitioning for the second 73 GB disk (standalone/server-set/MDM Admin Server/MDM Server/CM server when not using disk mirroring)

Partition	File system	Size
0	/upgrade	11 GB (root OS partition)
1	swap	4 GB
2	overlap	default
3	/data /opt/MagellanNMS	58.0 GB
4		
(Sheet 1 of 2)		

Table 7 (Continued)
Disk partitioning for the second 73 GB disk (standalone/server-set/MDM Admin Server/MDM Server/CM server when not using disk mirroring)

Partition	File system	Size
7	MDDB State DB Replica (only if using mirrored disks)	256 MB
Note: /opt/MagellanNMS is a soft link to /data		
(Sheet 2 of 2)		

MDM client-set

Hardware requirements

For the hardware requirements for Multiservice Data Manager servers configured in the Multiservice Data Manager client-set deployment, see the table "Hardware requirements for MDM client-set" (page 74).

Table 8
Hardware requirements for MDM client-set

Hardware	Details
Sun product number N32-XUB2-9S-204AV2	Sun Fire V240 Server 2 @ 1.0GHz CPU
	2 GB memory (4*512 DIMMs)
	2 36 GB (10,000 RPM) disks
	ALOM Remote Manager
	3 PCI slots
	N+1 redundant power supply
	4 10/100/1000Base-T Ethernet ports
Sun product number X311L	localized power cord kit North American/Asian
Sun product number X7403A	2 1-GB memory expansion kits
Sun product number X7410A	X-Option - Internal DVD-ROM drive Slimline
Note 1: If you want emergency dial up access to your Multiservice Data Manager server, the PCI card is required and must be purchased directly from Sun Microsystems. Emergency dial up using a modem to access a serial port is an optional configuration and not part of the core solution.	
Note 2: The information in this table is subject to change. For the latest information on Carrier Voice over IP Network configurations including the Sun Fire V240 server, see http://sun.com/oem/nortel/. The information in this table aligns with version AB02 on the Sun website.	

Software requirements

For the software requirements for Multiservice Data Manager servers configured in the Multiservice Data Manager client-set deployment, see the table "Software requirements for MDM client-set" (page 75).

Note: Solaris 9 is installed in 64 bit mode.

Table 9
Software requirements for MDM client-set

Software	Details
Sun product number SOLZS-080B9AY9	Solaris 9 English only CD media kit (see http://sun.com/oem/nortel/ for up to date information on the Solaris version and issue).
Sun patches (patches can be found on the Sun website at http://www.sun.com)	Solaris 108528 (latest version)
Note: For a list of Solaris prerequisites, see the Multiservice Data Manager 15.3 Release Supplement.	
Netscape 4.78	The official version can be found on the Sun website at http://www.sun.com/software/solaris/netscape/getnetscape478.html
Note: The information in this table is subject to change. For the latest information on Carrier Voice over IP Network configurations including the Sun Fire V240 server, see http://sun.com/oem/nortel/.	

Partitioning two 36 GB disks for MDM client-set
When you are partitioning your first disk, use the values in the table, “Disk partitioning for the first 36 GB disk (client-set)” (page 75).

Table 10
Disk partitioning for the first 36 GB disk (client-set)

Partition	File system	Size
0	/	11 GB redundant (root OS partition)
1	/swap	4.0 GB
2	/overlap	default
3	/localdisk	13 GB (local user data)
(Sheet 1 of 2)		

Table 10 (Continued)
Disk partitioning for the first 36 GB disk (client-set)

Partition	File system	Size
4	/var	8 GB
7	MDDB State DB Replica (if using mirrored disks)	11 MB
(Sheet 2 of 2)		

When you are partitioning your second disk, use the values in the table,"Disk partitioning for the second 36 GB disk (client-set)" (page 76).

Table 11
Disk partitioning for the second 36 GB disk (client-set)

Partition	File system	Size
0	/root	11 GB
1	/swap	4 GB
2	/overlap	default
3	/data	21 GB (MagellanNMS and MagellanMDP installation)

Chapter 4
Multiservice Switch 15000 and Media Gateway 15000 software overview

The PT-AAL1 and UA-AAL1 solutions use Nortel Multiservice Switch software to manage Multiservice Switch 15000 nodes. This software is divided into several classes:

The PT-AAL1, UA-AAL1 and UA-IP solutions use Nortel Multiservice Switch software to manage Multiservice Switch 15000 and Media Gateway 15000 (MSS/MG15000) nodes. This software is divided into several classes:

Multiservice Switch 15000 and Media Gateway 15000 base software

Multiservice Switch 15000 and Media Gateway 15000 base software provides the basic system functions that support the remainder of the software. The base software can be divided into the following systems:

- command processing system

  The base software controls and processes commands and enables you to configure the node. Components represent the hardware, software, and services in Multiservice Switch and Media Gateway systems. Network operators and administrators use the base software commands to change the values of these components.

  When hitless activation of critical attributes (HCA) is enabled, it helps prevent operators from making provisioning changes that could cause service outages from occurring on MSS/MG nodes after a change to a critical attribute (CA) is activated. Operators can provision whether CA activation is permitted for an attribute and once HCA is enabled, a semantic check verifies if the conditions for a hitless activation have been met. If the conditions are not met, an alarm is generated and the HCA activation halted. If the conditions are met, the HCA activation proceeds.

- data collection system

  The data collection system collects real-time statistics and data before transferring it for analysis. The data collected by this system includes alarms and state change notifications, performance measurements, and security logs.

- file system

  The file system stores all the software and configuration files that run on the node, and stores all the data generated by the node.

- network management interface system

  The network management interface system (NMIS) enables you to access a node through a network management application, for example Nortel Multiservice Data Manager (MDM). The NMIS also provides network management access security. Multiservice Switch systems support three types of network management interfaces:

  The network management interface system (NMIS) enables you to access a node through a network management application, for example Nortel Multiservice Data Manager (MDM). The NMIS also provides network management access security. Multiservice Switch 15000 and Media Gateway 15000 systems support the following types of network management interfaces:

  — an FMIP interface, which is a Nortel proprietary management information protocol. An FMIP interface operates between Multiservice Switch nodes and Multiservice Data Manager servers.

  — a local operator serial interface, which allows an ASCII terminal to act as a local operator or allows emergency access by a terminal.

  — an FTP interface, which allows file transfers to and from local disks.

  — a RADIUS client interface, which supports authentication of user information with a central AAA service.

- processor control system

  The processor control system manages the processor cards. The processor control system sequences system start-up, determines when cards are available for service, loads the appropriate software, monitors cards for problems, and supports processor card sparing.

- software control system

  The software control system facilitates the download of software from a distribution site and manages the versions of software, applications, and patches on Multiservice Switch and Media Gateway nodes. After the software is loaded, this system allows you to configure software services and applications on the processor cards.

- backplane control system

  The backplane control system controls both of the Multiservice Switch 15000 and Media Gateway 15000 fabric cards. The backplane control system provides a fabric component interface that allows users to monitor and maintain the fabric cards. It also controls any operator commands that impact the fabric.

- port management system

  The port management system manages the ports and channels on each processor card.

Multiservice Switch 15000 ATM networking software

Nortel Multiservice Switch 15000 networking software provides the routing capabilities and congestion management necessary for forwarding a packet of information from its source to its destination. Multiservice Switch 15000 nodes support both connectionless and connection-oriented routing. In the PT-AAL1 and UA-AAL1 solutions, Multiservice Switch networking software includes the ATM routing system and private network-to-network interface (PNNI) networking.

The ATM routing system is a connection-oriented system that provides dynamic runtime connection setup between Multiservice Switch 15000 nodes and allows them to interwork with other ATM nodes. In Carrier Voice over IP Networks, Multiservice Switch 15000 ATM routing provides the addressing, signaling, and routing facilities to support permanent virtual connections (PVCs) and switched virtual connections (SVCs). These networking capabilities allow you to set up ATM connections in real time.

For more information on the ATM routing system, see the NN10600-700 *Nortel Multiservice Switch 7400/15000/20000 ATM Technology Fundamentals* and NN10600-702 *Nortel Multiservice Switch 7400/15000/ 20000 ATM Routing and Signalling Fundamentals*.

Multiservice Switch 15000 and Media Gateway 15000 IP networking software

Nortel Multiservice Switch 15000 and Media Gateway 15000 Virtual Router (VR) system supports industry-standard IP networking for connectionless networking.

The UA-IP solution supports static routing as well as the dynamic open shortest path first (OSPF) routing protocol. With OSPF, Multiservice Switch 15000 nodes learn dynamically, from neighboring routers, which routes through a network are available. A node therefore adapts to faults elsewhere in the network dynamically, and calculates the most efficient path for all IP packets.

The UA-IP solution also supports hitless OSPF for CP equipment protection. Hitless OSPF allows FP cards to continue forwarding, uninterrupted, over OSPF calculated routes, during any of the following:

- hitless software migration (HSM)
- CP equipment failure (including failure of the OAM Ethernet port or link)
- any maintenance actions resulting in a CP switchover

When provisioned, hitless OSPF for CP equipment protection continuously synchronizes the OSPF routing database of the standby CP with the routing database of the active CP.

Multiservice Switch 15000 and Media Gateway 15000 nodes support protected default routes. Using protected default routes, you can specify two next hops, reachable through two different 4pGE FP cards, as the default route. This allows a node to change packet forwarding from one next hop to the other in under a second if a 4pGE card, a link, or an adjacent router fails.

Multiservice Switch 15000 and Media Gateway 15000 nodes support IP Security (IPSec) protocols for management connections using the OAM Ethernet port. The following aspects of IPSec are supported:

- Encapsulating Security Payload (ESP) protocol, which provides both data authentication and confidentiality

- transport mode, which provides security between the endpoints of the connection
- authentication algorithms MD5 and SHA-1
- AES encryption algorithms
- ctrl/mg component with SecurityPolicyDatabase (SPD) attributes for MG15000 signalling on call connections to MGC

For more information, see NN10600-800 *Nortel Multiservice Switch 7400/ 15000/20000 IP Technology Fundamentals*

For more information, see NN10600-601 *Nortel Multiservice Switch 7400/ 15000/20000 Security Management*.

Multiservice Switch 15000 and Media Gateway 15000 access service software

Nortel Multiservice Switch access service software involves the services supported on Multiservice Switch 15000 and Media Gateway 15000 nodes. For the PT-AAL1 and UA-AAL1 solutions, the supported service is ATM. For more information, see “Multiservice Switch 15000 ATM service overview” (page 84) and “Multiservice Switch 15000 inverse multiplexing for ATM” (page 86).

Multiservice Switch 15000 ATM service overview

Asynchronous transfer mode (ATM) is a cell-based switching and multiplexing technology that is a general purpose, connection-oriented data transfer mode. Nortel Multiservice Switch 15000 ATM core is interoperable with the bearer services of other public ATM networks.

ATM on Multiservice Switch 15000 nodes support both static and dynamic networking. Static networking uses permanent virtual circuits (PVC) that you provision on a hop-by-hop basis from end-point to end-point. Dynamic networking uses switched virtual circuits (SVC), which are fully dynamic and require no end-point provisioning.

In Carrier Voice over IP Networks, Multiservice Switch 15000 nodes support the following ATM interfaces:

- User-to-network interface (UNI 4.0, user and network side).

  UNI uses an integrated local management interface (ILMI) for dynamic address registration, as well as for link and physical layer status, configuration, and control.

  Within the PT-AAL1 and UA-ALL1 solutions, Multiservice Switch UNIs provide dynamic address registration across the interface because of the use of ILMI control procedures. The address formats supported are network service access point (NSAP)-international code designator (ICD) and NSAP-data country code (DCC).

- Private network-to-network interface (PNNI 1.0).

  PNNI supplies the interface among ATM nodes.

The specific ATM service used is Multiservice Switch ATM bearer service. This service provides sequence-preserving, connection-oriented cell transfer between a source and destination with an agreed upon quality of service and throughput. An ATM bearer service connection can be part of a connection that extends into an external ATM core network.

An ATM virtual channel connection (VCC) provides the Multiservice Switch 15000 ATM bearer service between two external ATM users. The external connection can be made with a Multiservice Switch node or an external network.

For more information about ATM on Multiservice Switch 15000 nodes, see one of the following documents:

- NN10600-700 *Nortel Multiservice Switch 7400/15000/20000 ATM Technology Fundamentals*
- NN10600-702 *Nortel Multiservice Switch 7400/15000/20000 ATM Routing and Signalling Fundamentals*
- NN10600-710 *Nortel Multiservice Switch 7400/15000/20000 ATM Configuration Management*

- NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

Multiservice Switch 15000 inverse multiplexing for ATM

In the UA-AAL1 and UA-IP solutions, Nortel Multiservice Switch ATM bearer service includes inverse multiplexing for ATM (IMA). IMA supports the transparent transmission of ATM cells over a combination of multiple DS1 links (an IMA link group), which allows ATM to operate over lower speed connections. The link group uses the inverse multiplexing process to transmit a single stream of ATM layer traffic across multiple links. IMA then combines the traffic back into the original cell sequence at the remote end.

IMA on Multiservice Switch nodes supports the use of synchronized and non-synchronized links within an IMA link group. IMA link groups within a Multiservice Switch network provide access to external ATM networks. IMA is available to both private and public user-to-network (UNI) or private network-to-network (PNNI) interfaces. Also, Multiservice Switch system's traffic management capabilities apply to ATM connections served by IMA link groups.

IMA provides reliability and robustness of cell traffic. When you remove a link, if there is sufficient bandwidth on the remaining links, no traffic loss will occur. You can remove or add links without removing the link group or the ATM interface served by the IMA link group. If a link fails, Multiservice Switch nodes maintain ATM connections served by the link group at a reduced capacity.

Multiservice Switch software follows the ATM Forum *Inverse Multiplexing for ATM (IMA) Specification.* For more information about IMA, see NN10600-730 *Nortel Multiservice Switch 7400/15000/20000 Operations: Inverse Multiplexing for ATM*.

Chapter 5
Multiservice Data Manager software overview

Nortel Multiservice Data Manager (MDM) software is a workstation-based network management system that you can use to maintain and monitor a network. The system consists of a set of tools with graphical user interfaces (GUI) that can access data from multiple network elements simultaneously and present the operator with a unified view of the network. This view can either be a hierarchal view of the components in the network or an organizational view in which the network components are grouped by area or function.

Within the PT-AAL1, UA-AAL1 and UA-IP solutions, Multiservice Data Manager provides the network element management for Nortel Multiservice Switch nodes. Within the UA-IP solution, Multiservice Data Manager also provides the network element management for the Media Gateway 15000.

As the element manager, Multiservice Data Manager performs fault management, configuration management, data collection, performance management, and security management for the ATM core. In addition, all of the ATM core's operations, maintenance, administration, and provisioning data is routed through Multiservice Data Manager. Multiservice Data Manager servers can be configured to forward the performance management, fault management and security audit log information to higher level element managers such as IEMS and CS2000 Core Manager, or directly to the OSS.

MDM server configurations

MDM software can be configured in different ways to meet the needs of the size and configuration of the network and the processing capabilities of the workstations. “MDM server types and hosted software” (page 88) shows the different ways in which MDM software processes can be deployed.

Table 12
MDM server types and hosted software

MDM server configuration	Software processes
client-set	• provides access to the MDM Toolset user environment by means of X11 • depends on standalone/server-sets for acquisition of surveillance and network data, and for communication with the MSS15000/MG15000 nodes ***Note:*** Client-sets are not used in a VoA solution that uses the Operator Client application. However, you can re-deploy a client-set as an MDM Admin Server. See NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.
server-set	• usually runs without a monitor and keyboard; local access port provided for special needs • provides access to the MDM Toolset user environment in a VoA network by hosting the servers that allow operators to view the surveillance information and network data, and perform provisioning • supports the main server processes for performing surveillance, gathering network data (fault, security, and/or performance), and providing network data to higher level management systems • can be configured to host specific types of server processes according to network needs
PM server	• supports the main server processes for gathering network performance data and providing network performance data to higher level management systems • otherwise operates as a server-set

(Sheet 1 of 2)

Table 12 (Continued)
MDM server types and hosted software

MDM server configuration	Software processes
standalone	• provides X11 access from remote operator desktops to the MDM Toolset user environment • supports the main server processes for performing surveillance, gathering network data (fault, security, and/or performance), and providing network data to higher level management systems
MDM Admin Server (V0A only)	• provides web access to Operator Client environment from remote operator desktops and X11 access to MDM Toolset environment • supports the main server processes for performing surveillance, gathering network data (fault, security, and/or performance) • hosts the central AAA service and the Java Web Start (JWS) server for the optional Operator Client user environment
MDM Server (VoIP only)	• provides web access to Operator Client environment from remote operator desktops and X11 access to MDM Toolset environment • supports the main server processes for performing surveillance, gathering network data (fault, security, and/or performance), and providing network data to higher level management systems • provides an interface to the IEMS central AAA service • hosts the Java Web Start (JWS) server for the Operator Client user environment
consolidated management server	• provides web access to Operator Client environment from remote operator desktops and X11 access to MDM Toolset environment • supports the main server processes for aggregating fault management data and managing the network model for regional and full network views • acts as a configuration client for the MDM configuration servers managing the network elements • if Operator Client is installed (optional for VoA, required for VoIP), hosts the Java Web Start (JWS) server for the Operator Client user environment

(Sheet 2 of 2)

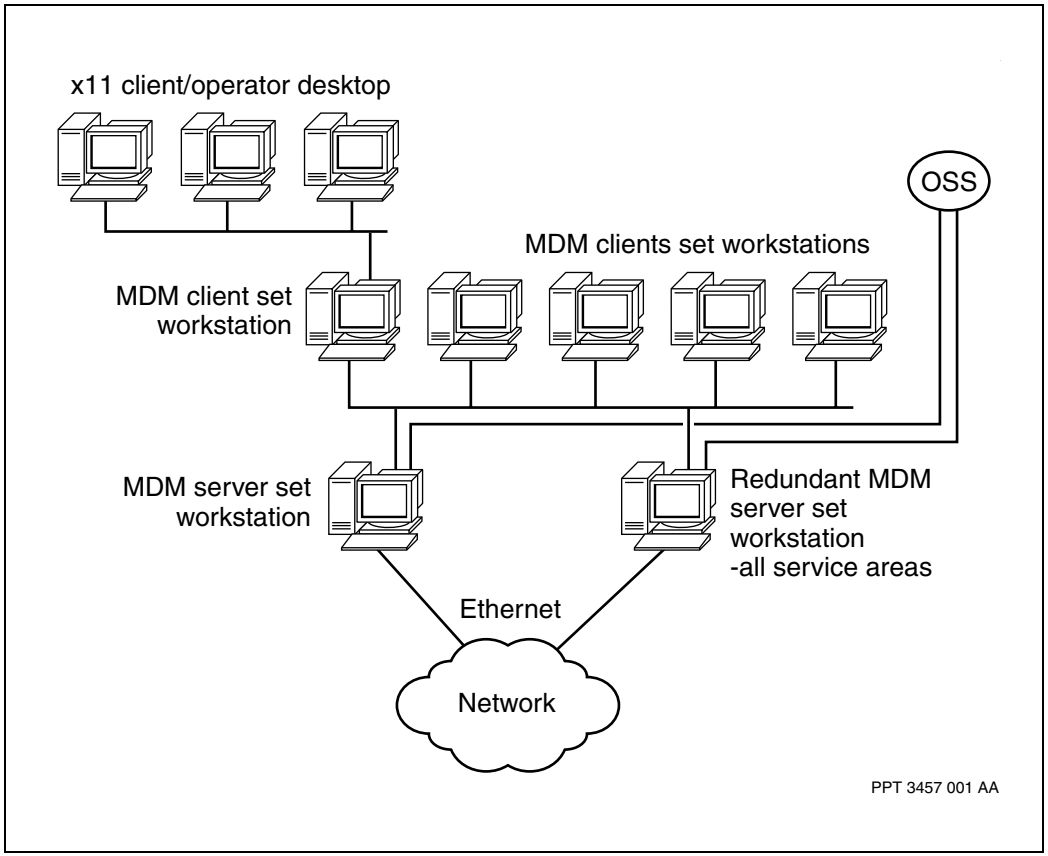
Client Server configuration

Deploying Multiservice Data Manager servers in a client-server arrangement provides the following advantages:

- reduces the amount of traffic crossing between your network operation centre, and the location of the Multiservice Data Manager server sets by deploying the GUIs locally to your operator base
- provides redundancy in your network workstations by having multiple client-set sessions running
- maintains the integrity of the server set, ensuring that the performance measures (PMs) and alarms feeds to a higher level element manager are not compromised

The figure "Typical Multiservice Data Manager client-set/server-set configuration" (page 91) shows a configuration with two server set workstations, and several client-set workstations. You must set up the server set workstations as redundant server-set workstations to provide client workstations with an alternate service source. See NN10185-461 *Upgrading Nortel Multiservice Data Manager in Carrier Voice over IP Networks* for the required migration procedures.

Figure 13
Typical Multiservice Data Manager client-set/server-set configuration



Operator Client configuration

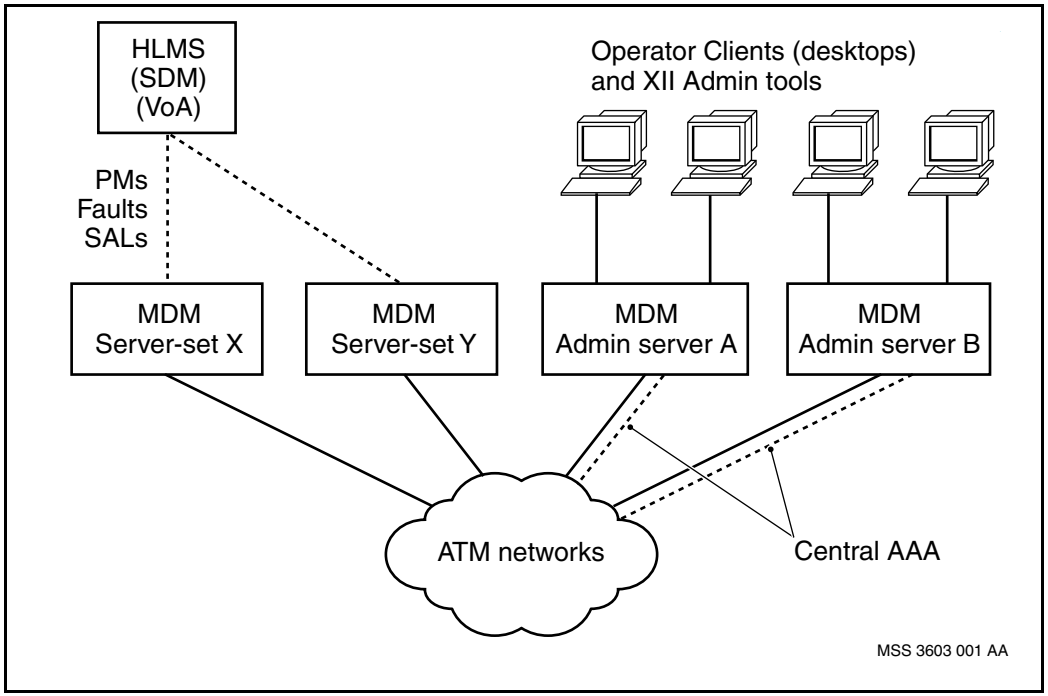
Deploying the Operator Client application on operator desktops has the following advantages:

- reduces the amount of traffic crossing between your network operation centre, and the location of the MDM Admin Servers by running the MDM tools on the operator desktop itself

- reduces the operator desktop processing load on the MDM Admin Servers, allowing the maximum capacity to be available for fault and performance management, node connectivity and higher level element manager or OSS data feeds.
- utilizes a central AAA service which controls the tools that an operator can use, and the actions within each tool that can be performed.

The figure “Typical Multiservice Data Manager VoA configuration using Operator Client” (page 92) shows a configuration using the Operator Client environment for operator desktop access with the MDM Admin Server providing the central AAA service.

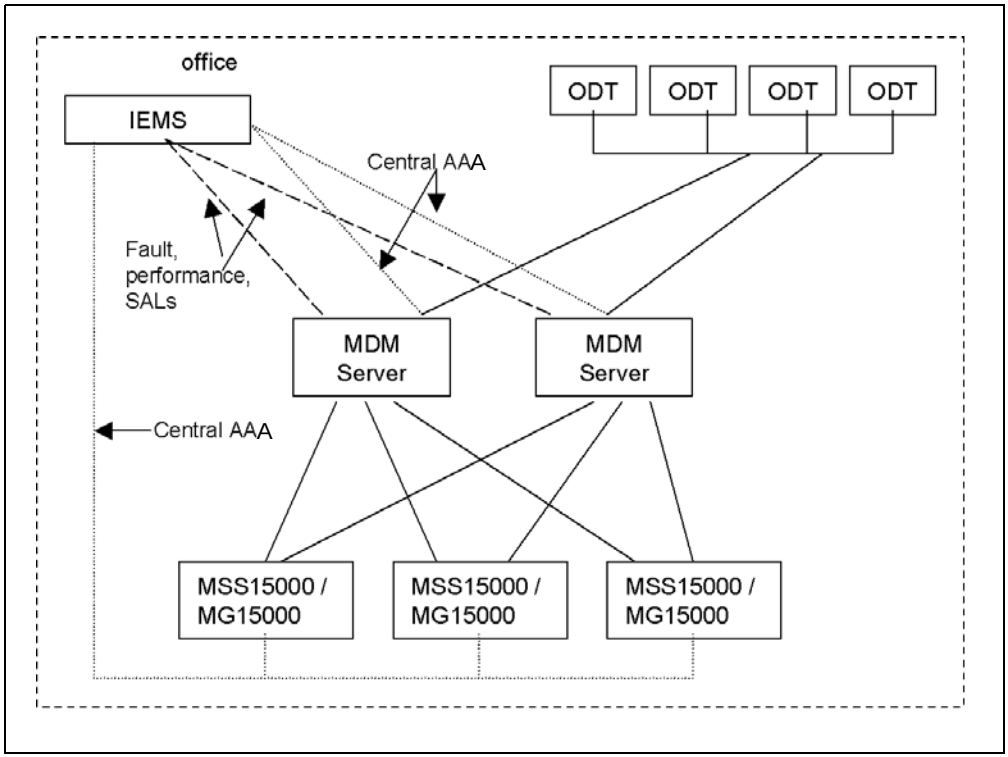
Figure 14
Typical Multiservice Data Manager VoA configuration using Operator Client



A client-set server can be re-deployed as an MDM Admin Server as part of the SN09 upgrade process. For more information, see NN10185-461 *Upgrading Nortel Multiservice Data Manager in Carrier Voice over IP Networks*.

The figure "Typical Multiservice Data Manager VoIP configuration using Operator Client" (page 93) shows a configuration using the Operator Client environment for operator desktop access with the IEMS providing central AAA service.

Figure 15
Typical Multiservice Data Manager VoIP configuration using Operator Client



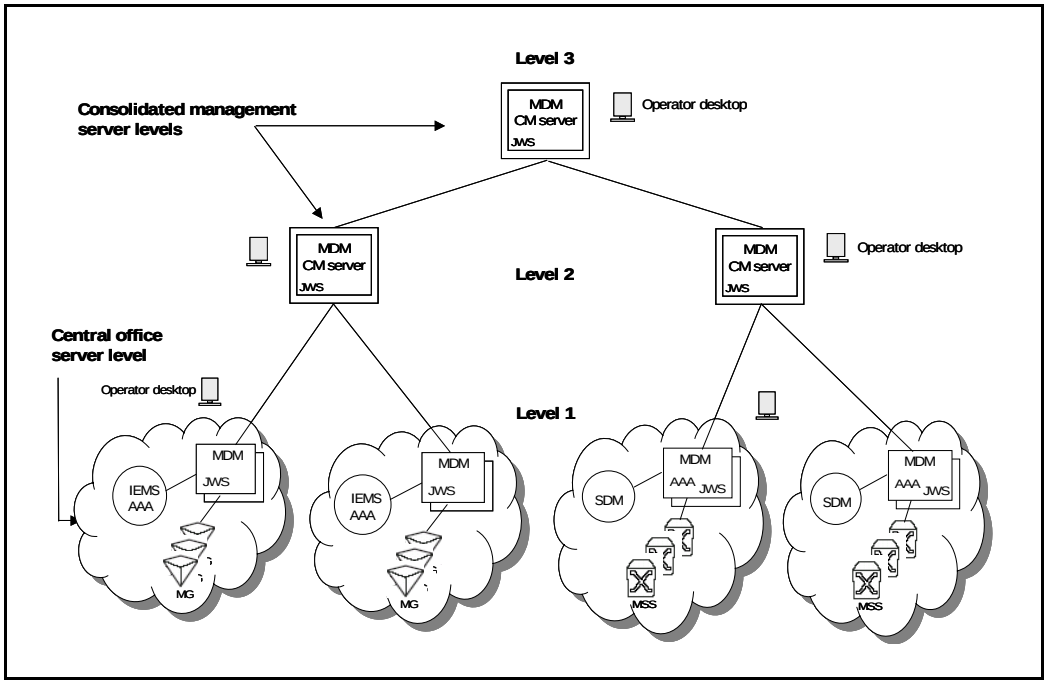
Consolidated management configuration

Deploying consolidated management servers provides the following benefits:

- Network information and access can be consolidated across specific regional partitions as well as at the national level to accommodate geographical and traffic needs of the network.
- Network security is enhanced as operator access can be restricted to the network level that they are responsible for.

Figure “Sample Multiservice Data Manager consolidated management server configuration” (page 94) shows a possible consolidated management configuration with level 1 consisting of the central office layer, level 2 consisting of regional views, and level 3 consisting of the full network view.

Figure 16
Sample Multiservice Data Manager consolidated management server configuration



The hierarchical topology of MDM consolidated management servers may contain as many levels as are required by the network organization. Consolidated management servers may be deployed as single servers, or as redundant pairs for additional reliability. Consolidated management servers can run on the Sun Fire V480 or the Sun Netra 240 hardware platform.

As the geographical area covered by a network can cross time zones, it is recommended that all MDM servers in the network are configured to use universal time.

Summary of Multiservice Data Manager tools

Users can access the MDM software through two user environments:

- MDM Toolset user environment. A GUI interface provides controlled user access to the complete set of MDM fault and performance management, configuration, configuration audit scheduling and system administration tools.

  User access to the MDM Toolset tools can be restricted by assigning users to specific user groups that are authorized to access subsets of the tools. The MDM Toolset application recognizes the user group of the user requesting access, and presents menus containing only those tools that the user group is authorized to use. The set of restricted access menus is installed from the Carrier VoIP SN09 Security Software CD.

  Restricting access to MDM Toolset tools is mandatory for VoIP networks and optional for VoA networks.

- Operator Client user environment. A GUI interface provides user access based on the Principle of Least Privilege (PLP) where an operator's access has been configured in policies and roles to control access to the fault, performance, configuration and configuration audit scheduling tools, and the ability to perform specific actions within a tool.

All system administration tasks must be performed using the MDM Toolset environment. Refer to Summary of MDM and Operator Client tools in NN10180-611 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Security and Administration PT-AAL1/UA-AAL1/UA-IP* for a listing of the tools available in each environment.

Chapter 6
OAM tasks and access for managing Multiservice Switch 15000 and Media Gateway 15000 nodes

OAM tasks and access for managing Multiservice Switch 15000 and Media Gateway 15000 nodes

The management of elements within the PT-AAL1, UA-AAL1 and UA-IP solutions is based upon the International Telecommunications Union (ITU) M.3400 specification Telecommunications Management Network (TMN) model (also known as FCAPS). This model describes the exchange of management data between network elements and consists of five functional areas:

- fault management, which is the process that detects, analyzes, and corrects network faults
- configuration and administration, which involves the configuration and maintenance of Multiservice Switch 15000 and Media Gateway 15000 nodes and their software and services
- accounting, which is the process of collecting accounting data
- performance monitoring, which is the process of planning, monitoring, and adjusting the performance of network devices
- security management, which is the process of controlling user access to network management functions, providing integrity and confidentiality of data transmitted across untrusted network connections, and controlling access to the MDM workstation and MSS15000/MG15000 node platforms.

Multiservice Data Manager tools organization

Nortel Multiservice Data Manager (MDM) toolset is organized and grouped according to the same model. In addition, multiple tools may be used within each of the functional areas. For more information, refer to Summary of MDM and Operator Client tools in NN10180-611 *Nortel Multiservice Switch*

15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Security and Administration PT-AAL1/UA-AAL1/ UA-IP for a listing of the tools available in each environment.

Within the context of the PT-AAL1, UA-AAL1 and UA-IP solutions, note the following sections about the exchange of management data between Multiservice Switch 15000 nodes, Media Gateway 15000 nodes, Multiservice Data Manager servers, and the higher level element managers.

Fault management

Fault management information is collected on Multiservice Switch 15000 and Media Gateway 15000 nodes. The fault management information collected includes alarms and state change notifications (SCNs). These events can be used for historical analysis, and the key variables can be used by troubleshooting personnel.

You can configure Multiservice Data Manager server to forward fault management information directly to the OSS.

Alarms can be transferred from the Multiservice Data Manager server to a higher level element manager, which can translate them into switch control center 2 (SCC2) formatted logs. SCC2 format is the format typically required by OSS fault applications.

For more information about SCC2-formatted logs, see NN10092-911 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Fault Management Overview PT-AAL1/UA-AAL1/UA-IP*.

For Netra 240 platforms with SPFS, platform hardware and software faults are detected by SPFS service applications. The fault logs are sent to IEMS using SNMPv2c or to CS2000 Core Manager using custlog V2.

MDM consolidated management servers, if present in the network, aggregate fault management data from lower level MDM servers in the network partition (either a central office MDM or a lower level consolidated management server). Using the Network Viewer tool, operators can monitor the network at regional or full network levels.

You can use the Query Historical Alarms GUI to display the node's historical alarms.

For more information on managing faults on Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager equipment in the PT-AAL1, UA-AAL1 and UA-IP solutions, see NN10198-912 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Fault Management Troubleshooting PT-AAL1/UA-AAL1/UA-IP*.

Configuration and administration

The majority of node configuration occurs during the initial hardware and software installation and commissioning. Additional configuration or changes to the configuration are not recommended. There are two exceptions. The first exception is in the UA-AAL1 and UA-IP solutions, where DSL links are configured on an ongoing basis after initial installation. The second is network growth when new nodes are added.

Multiservice Switch 15000 and Media Gateway 15000 components remain comparatively static from the perspective of daily operations and maintenance, with a primary focus on the administration and maintenance of the hardware and software. Additional installation and commissioning is required on an incremental basis only.

Configuration changes for MSS/MG15000 network elements can also be carried out from an MDM consolidated management server. The service selection feature is used to enable an operator logged in to a consolidated management server to access the MDM servers managing the MSS/MG15000 nodes in the partition. For more information on how service selection works, see the section "Service selection tool fundamentals" in NN10400-300 *Nortel Multiservice Data Manager Administration Tools*.

> ***Note:*** In order for operators on consolidated management servers to configure MSS/MG15000 switches in the partition, their userids and passwords must be replicated on all central AAA servers managing user access to the switches.

For more information on configuring consolidated management servers, see NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

The Configuration Audit Scheduler tool can also help locate problems with configuration data on the MSS/MG15000 nodes and report discrepancies in a non-intrusive way. The configuration data is compared against a template log and the discrepancies between the current configured view and the view represented by the template log are reported in the Service Audit report. If an in-service node does not have a template log, the template log can be generated with the option of not changing on-switch data when the templates are applied.

The audits can be run on a node level basis (every provisionable component in the network element) or a component basis (all the components included in, or components created as a result of applying, the service templates). They can be run in real time or scheduled, and they can be scheduled in batch mode.

> ***Note:*** Standard configurations are also defined for MSS15000 and MG15000 equipment in the PT-AAL2 solution, and supported through NP templates.

For more information on configuring Multiservice Switch 15000 nodes, Media Gateway 15000 and Multiservice Data Manager servers in the PT-AAL1, UA-AAL1 and UA-IP solutions, see NN10114-511 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2* and NN10225-512 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Attribute Summary PT-AAL1/UA-AAL1/UA-IP/PT-AAL2*.

For more information on how to upgrade Multiservice Switch 15000 nodes in a PT-AAL1 or UA-AAL1 solution, see NN10070-461 *Upgrading Nortel Multiservice Switch 15000 in Carrier Voice over IP Networks PT-AAL1/UA-AAL1*.

For more information on how to upgrade Multiservice Switch 15000 and Media Gateway 15000 nodes in a UA-IP solution, see NN10419-461 *Upgrading Nortel Multiservice Switch 15000 and Media Gateway 15000/ 20000 in Carrier Voice over IP Networks*.

For more information on how to upgrade Multiservice Data Manager servers in any solution, see NN10185-461 *Upgrading Nortel Multiservice Data Manager in Carrier Voice over IP Networks*.

Accounting

In these solutions, accounting activities are not supported on Multiservice Switch 15000 or Media Gateway 15000 nodes.

Performance monitoring

Network traffic management (NTM) statistics are collected from control and function processors on Multiservice Switch 15000 nodes and from VSP cards on Media Gateway 15000 nodes by the data collection system (DCS). This collection occurs at 5-minute intervals using the rtstats (real-time statistics) data stream. Each node forwards the records to Multiservice Data Manager servers where six 5-minute interval data records, are aggregated into a single 30-minute interval data record.

The Multiservice Data Manager Performance Measurement Stream Processor (PMSP) application converts the 5- and 30- minute data records into ASCII CSV-formatted records. These records can be viewed either on-switch using the Multiservice Data Manager Data Viewer tool, if they are required for troubleshooting purposes. You can configure Multiservice Data Manager to forward these records directly to the OSS.

For more information on performance management on Multiservice Switch 15000 nodes and Multiservice Data Manager servers in the PT-AAL1, UA-AAL1 and UA-IP solutions, see NN10158-711 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Performance PT-AAL1/UA-AAL1/UA-IP*.

Security management

Security management is provided in the areas listed below.

When a VoIP network is secured, all the indicated security features must be activated according to NN10180-612 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier VoIP Networks Security and Administration - Securing Network Elements*.

Some security management features can optionally be applied to VoA networks as indicated.

- User authentication and authorization

  Local user authentication and authorization requires that the userid, password and access authorization information for MDM tools and operating system functions be resident on the system to be accessed. Userids are configured on both Multiservice Switch 15000 and Media Gateway 15000 nodes, as well as the Multiservice Data Manager servers.

  In a central authentication, authorization, and accounting (AAA) configuration, a central repository of user information is used to provide authentication of userids and passwords and authorized access to tools and functions. In PT-AAL1 and UA-AAL1 solutions, the MDM Admin Server provides the central AAA service for Operator Client and MSS15000/MG15000 logins, while MDM Toolset logins use local authentication and authorization. In VoIP solutions, IEMS provides the central AAA service for MDM Toolset, Operator Client, and MSS15000/MG15000 logins.

  When requesting login to a Multiservice Data Manager workstation, the centrally defined userids are compared first. If no match is found, then the local userids are compared. At least one local userid with full system access should be maintained on the server in case the central AAA service is unavailable.

  When requesting login to a MSS15000/MG15000 node, the local userids are compared first. If no match is found, then the centrally defined userids will be compared. At least one local userid with full system access must be maintained on the node in case the central AAA service is unavailable.

If consolidated management servers are deployed in the network, access to the MDM Toolset on the consolidated management server requires local authentication. To use the Operator Client application to access the consolidated management server, the operator's userid and password must be defined on a single central AAA server in the partition (IEMS for VoIP networks or MDM Admin Server for VoA networks) that is selected to provide Operator Client authentication and authorization services. Typically, this is the IEMS in the office accessed most frequently by the operators.

Note: When installing MDM, only one central AAA server may

- Secure FTP authentication

  This optional feature can be used to encrypt passwords used during FTP communications between MSS15000/MG15000 nodes and MDM servers.

- Secure IP connections for VoIP solutions

  Secure Shell (SSH) protocols provide data authentication and data encryption over connections between an MDM workstation and an operator desktop running the MDM Toolset, and over connections between an MDM workstation and the IEMS workstation.

  IP Security (IPSec) protocols provide data authentication and data encryption over links between two MDM workstations, and over connections between an MDM workstation and an MSS15000/ MG15000 node.

-

- Controlled platform access

  Access to the MDM and MSS15000/MG15000 platforms can be optionally controlled to reduce the possibility of unauthorized access through the IP network to platform functions.

  On MDM workstations, this includes hardening the Solaris 9 operating system by removing unused userids, removing or restricting access to operating system functionssuch as ping and traceroute, restricting login retries, providing password protection on MDM tools where supported, and supporting good password practices.

  Platform access for MSS15000/MG15000 nodes is controlled by utilizing the IP Access control feature and enabling timeouts on idle connections.

  When a VoIP network is secured, full platform access control is applied. Restricting access to the ping and traceroute system functions on MDM servers is optional for VoA networks.

- Security audit logs

  Security audit logs track events on MDM workstations or MSS15000/MG15000 nodes that include, but are not limited to, logins, logouts, configuration changes, commands and permission changes. These logs are used to assist in monitoring configuration changes and detecting security issues such as unauthorized access attempts.

  MSS15000/MG15000 nodes log all non-passive commands executed on the node. These events are sent in real time to the MDM SALC server.

  The MDM SALC server collects the real-time logs from the nodes and MDM generated logs from the OAMC server. These logs can be sent via the syslog facility to a log host using either syslog format or using the custlog V2 format. The logs can also be stored as files on the MDM server for viewing through the Log Browser tool. In VoA solutions, CS2000 Core Manager can act as the log host. In VoIP solutions, IEMS acts as the log host.

MDM Solaris operating system and third party software applications generate security logs for MDM user access authentication. The security logs are stored as files on the MDM server and can be sent to the log host in syslog format. Depending on the network solution, these logs include authentication logs for MDM Toolset access and Operator Client access.

Security audit logs generated by consolidated management servers are stored as files on the server. They are not consolidated with security audit logs from other servers in the partition, nor are they sent to higher level management systems.

For more information on security on Multiservice Switch 15000, Media Gateway 15000 nodes and Multiservice Data Manager servers, see NN10180-611 *Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Security and Administration PT-AAL1/UA-AAL1/UA-IP*.

Types of access to perform OAM tasks

To undertake OAM tasks, users can access Multiservice Data Manager and Nortel Multiservice Switch 15000 nodes in the following ways:

- OSS access, which is the higher-level machine-to-machine access within the architecture of a node.
- craft access, which is human-to-machine interface, which is the subject of the Multiservice Switch for Carrier Voice over IP Network documentation suite.
- emergency access

OSS access

OSS access typically is a machine-to-machine type of interface, which consists of several sub-systems and is used to integrate many functions. OSS access comprises:

- the integration and consolidation of log delivery across the cluster of devices in the Carrier Voice over IP Networks portfolio.

  Events and alarms occurring within the cluster are gathered at the CS2000 Core Manager, converted to alarm logs in the NTSTD/SCC2 format, merged into a single stream, and delivered to the customer OSS (log sub-system).

- network surveillance or first alert management through the surveillance of the whole network and the operator notification of potential problems.

  An operator uses the element managers of the applicable components to correct the problem.

- the gathering of performance data from devices across the clusters in the Carrier Voice over IP Networks portfolio, and the presentation and delivery of this data to the OSS by the CS2000 Core Manager.

Craft access

Craft access is used for specialized functions that include the following:

- diagnostics
- tests that cannot be automated through another interface (for example, because the tests require tight supervision and frequent and timely interactions with a human operator)
- infrequent activities that lie outside the scope of daily activities and are expensive to integrate (for example, commissioning activities)

The craft access comprises:

- Multiservice Data Manager toolset
- Command Console CLI for Nortel Multiservice Switch 15000 nodes
- Multiservice Data Manager client set
- Multiservice Data Manager server set, if the client set is not available

- Multiservice Switch both the client set and server set are not available

Emergency access

If connectivity between Nortel Multiservice Switch 15000 and Nortel Multiservice Switch 15000 nodes and the Multiservice Data Manager server is severed, emergency access to the node is possible through the command line interface (CLI), which is accessible through the serial ports on the control processors (for example, using a terminal server).

- direct connection to the network element's serial port
- Telnet to the network element

OAM tasks and access for managing Ethernet Routing Switch 8600 nodes

Within the context of the PT-AAL1, UA-AAL1 and UA-IP solutions, please note the following about the exchange of fault management data between Nortel Ethernet Routing Switch 8600 nodes and Nortel Multiservice Data Manager (MDM) servers:

- Ethernet Routing Switch 8600 nodes generate SNMPv2c traps that are sent to Multiservice Data Manager servers. The information in these traps is then presented on the standard Multiservice Data Manager fault applications and northbound interfaces. It can also be forwarded to CS2000 Core Manager for conversion to SCC2 and subsequent forwarding to an OSS. For more information about SCC2-formatted logs, see 241-6003-110 *Preside, Passport 8600 Device Integration Cartridge User Guide*.
- The commands used to managed Ethernet Routing Switch 8600 nodes are issued from the Multiservice Data Manager Command Console tool.
- Ethernet Routing switch 8600 nodes are discovered using the IP Discovery tool on Multiservice Data Manager servers.
- Multiservice Data Manager servers need to be configured to communicate with Ethernet Routing Switch 8600 nodes. For information on how to configure Multiservice Data Manager servers for Ethernet Routing Switch 8600 fault management, see NN10114-511 *Nortel*

Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP/PT-AAL2.

Chapter 7
Call progressions through Multiservice Switch 15000 nodes

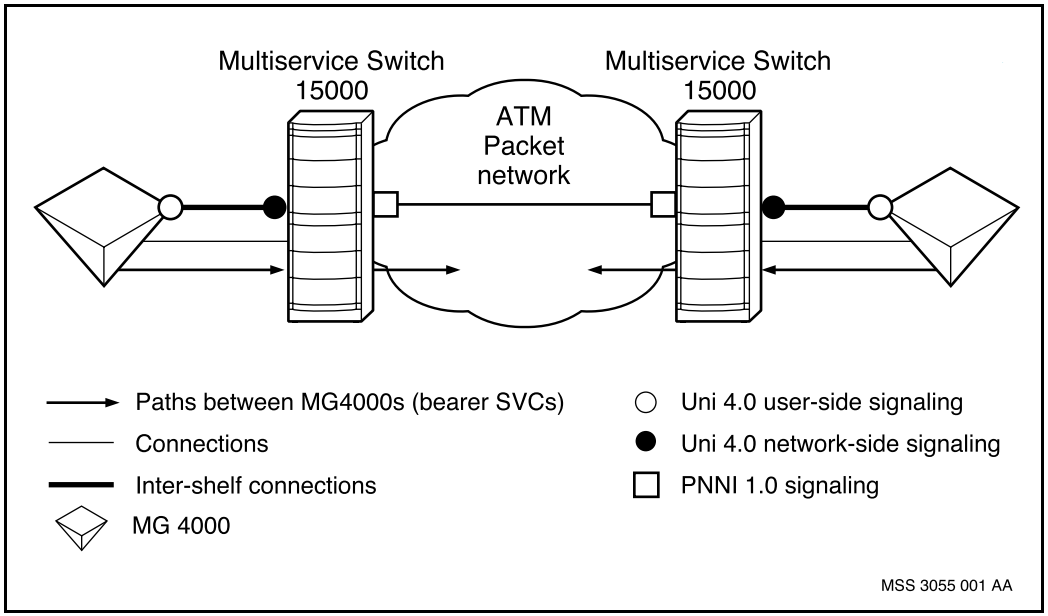
Refer to one of the following sections involving call progressions in the PT-AAL1, UA-AAL1 and UA-IP solutions:

- "Call progression in the PT-AAL1 solution" (page 109)
- "ISUP signaling in the PT-AAL1 solution" (page 113)
- "Call progression in the UA-AAL1 solution" (page 118)
- "Call progression in the UA-IP solution" (page 122)

Call progression in the PT-AAL1 solution

The figure "Example network: Multiservice Switch base configuration" (page 110) illustrates a configuration in which the terminating nodes are positioned at the network edge, with an MG4000 supported by each node. This configuration is characterized as MG4000s connected to different shelves in different nodes.

Figure 17
Example network: Multiservice Switch base configuration



At the originating node, the network directs the call through a backbone link on the Nortel Multiservice Switch 15000 node that supports the MG4000 that originates the call.

A walk-through of a successful call is illustrated in the figure “ATM call walk-through: success path for a base configuration” (page 112). This figure shows call progression of an ATM connection between two MG4000s, where the connection is established from node to node across the ATM backbone. Call progression assumes that the protocol is either UNI 4.0 or PNNI 1.0 as defined by the ATM Forum.

Characteristics: Multiservice Switch 15000 base call setup and tear down

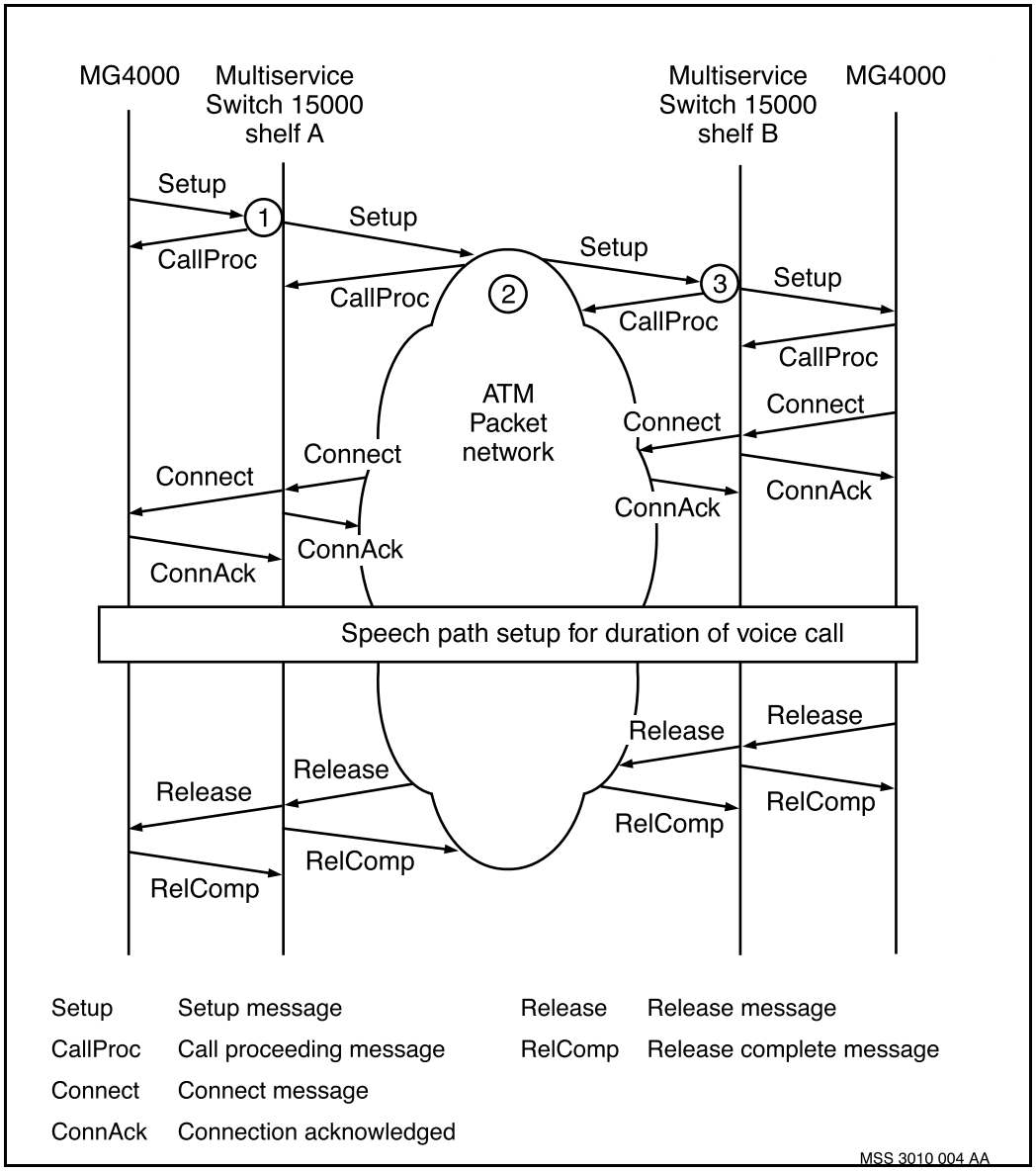
To establish any segment of the connection, the MG4000 or node sends a SETUP message to the adjacent node (or terminating MG4000 at the end point). When the adjacent node or MG4000 receives and correctly parses the SETUP message, and the network-side UNI allocates the VPI.VCI for the

call, the adjacent node or MG4000 replies with a CALL PROCEEDING message. The node or MG4000 has four seconds in which to generate the CALL PROCEEDING message otherwise the originator assumes that the call cannot be completed and clears the SVC.

When the terminating MG4000 accepts the call, it replies with a CONNECT message. This message is sent back through network along the call path. Each node activates the connection when it receives the CONNECT message and acknowledges with a CONNECT ACKNOWLEDGE message.

When the call is released, the MG4000 that originates the release sends a RELEASE message to the adjacent node on the call path. This node releases all resources associated with the call, acknowledges the RELEASE with a RELEASE COMPLETE message and sends a RELEASE message to the next node on the call path. When the terminating MG4000 receives the RELEASE message and returns a RELEASE COMPLETE message, call clearing is complete.

Figure 18
ATM call walk-through: success path for a base configuration



Call progression and signaling includes the following events and characteristics:

1 Multiservice Switch 15000 shelf A receives a SETUP message and complete PNNI route selection. The route selection process inserts the designated transit list (DTL) when the SETUP message is transmitted onto the selected PNNI link.

2 The ATM backbone routes the call to a terminating node based on the DTL, in this example shelf B.

3 Multiservice Switch 15000 shelf B matches the called party address in the SETUP message with the MG4000 attached to it.

ISUP signaling in the PT-AAL1 solution

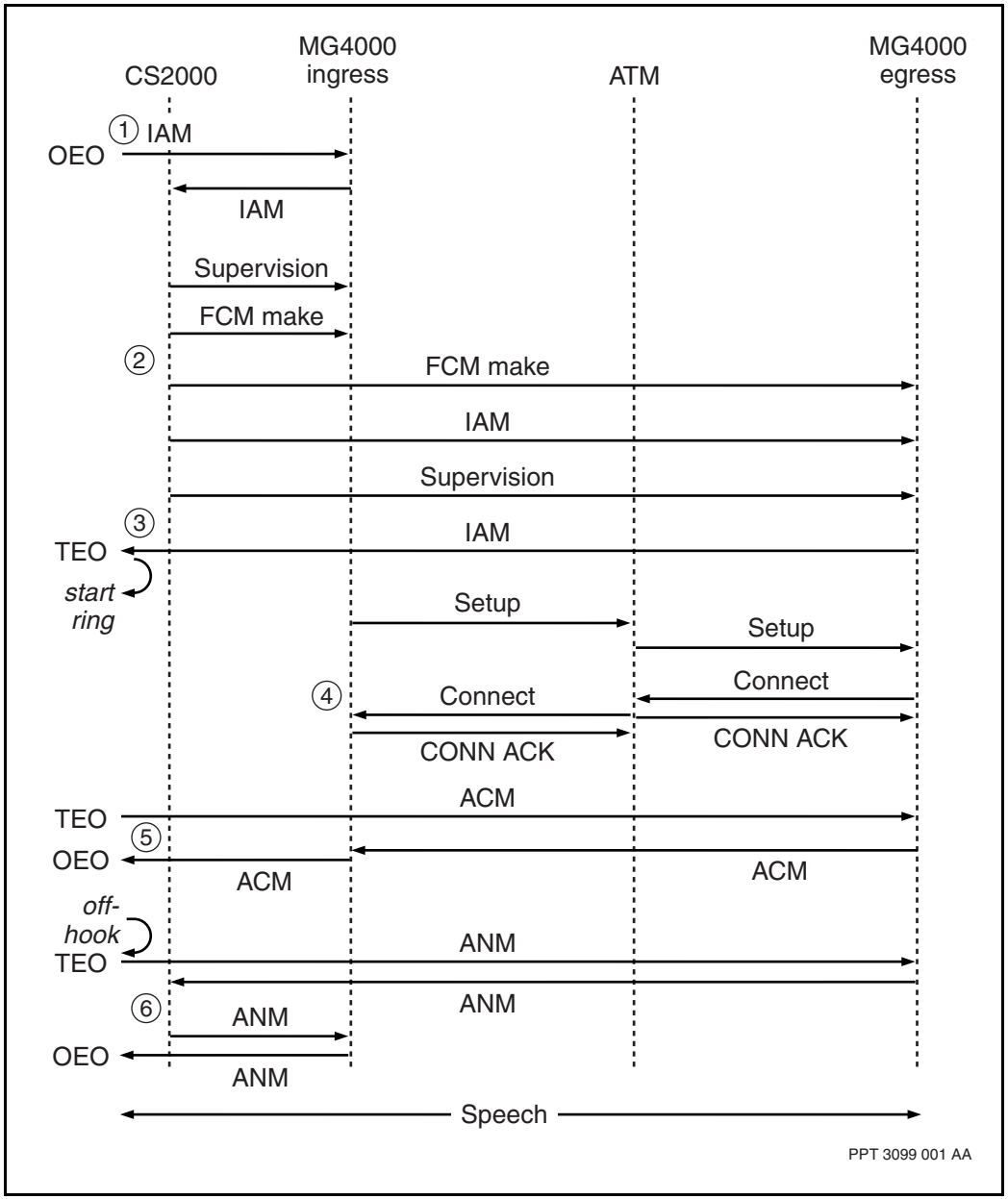
To setup a voice call between two end-offices, both legacy SS7 and ATM signaling are used. The interworking between the two is performed by the MG4000 gateways, under the control of the CS2000 Communication Server. The MG4000 and CS2000 use a proprietary Media Gateway Control Protocol to communicate control information.

The Carrier Voice over IP portfolio supports calls between many different trunk types, including PRI, ISUP, and PTS for calls between offices over an ATM packet network. Interworking is also provided through the IW SPMs so that calls can still use ATM trunks, even if they are brought into the Carrier Voice over IP tandem office on legacy tandem peripherals, such as Spectrum Peripheral Modules (SPMs), connected to the ENET.

Intra-Carrier Voice over IP office tandem calls

The following figure shows an example of an ISUP call between an originating end-office (OEO) and a terminating end-office (TEO). Both end-offices have MG4000 gateways connected to the same Carrier Voice over IP tandem office.

Figure 19
Call walk-through for an intra-CVoIP ISUP call



The call is established using the following signaling:

1 The IAM message is received from the OEO and is sent to the ingress MG4000, which in turn reports it to the CS2000. The CS2000 translates the incoming digits in the IAM message and selects the outgoing trunk and egress MG4000.

2 The CS2000 sends a Fabric Control Message (FCM) and supervision messages to the MG4000s, and forwards the IAM message to the egress MG4000.

3 The egress MG4000 sends the IAM message to the TEO, which will start ringing the called party's telephone.

4 A Q.2931 SETUP message is sent from the ingress MG4000 across the ATM core network to the egress MG4000. The two nodes complete the necessary Q.2931 signaling and establish an AAL1 bearer path between them.

5 The ACM message is sent by the TEO to the egress MG4000, which passes the ACM message to the ingress MG4000 by using the AAL5 peer connection between the two nodes. The ingress MG4000 sends the ACM message back to the OEO.

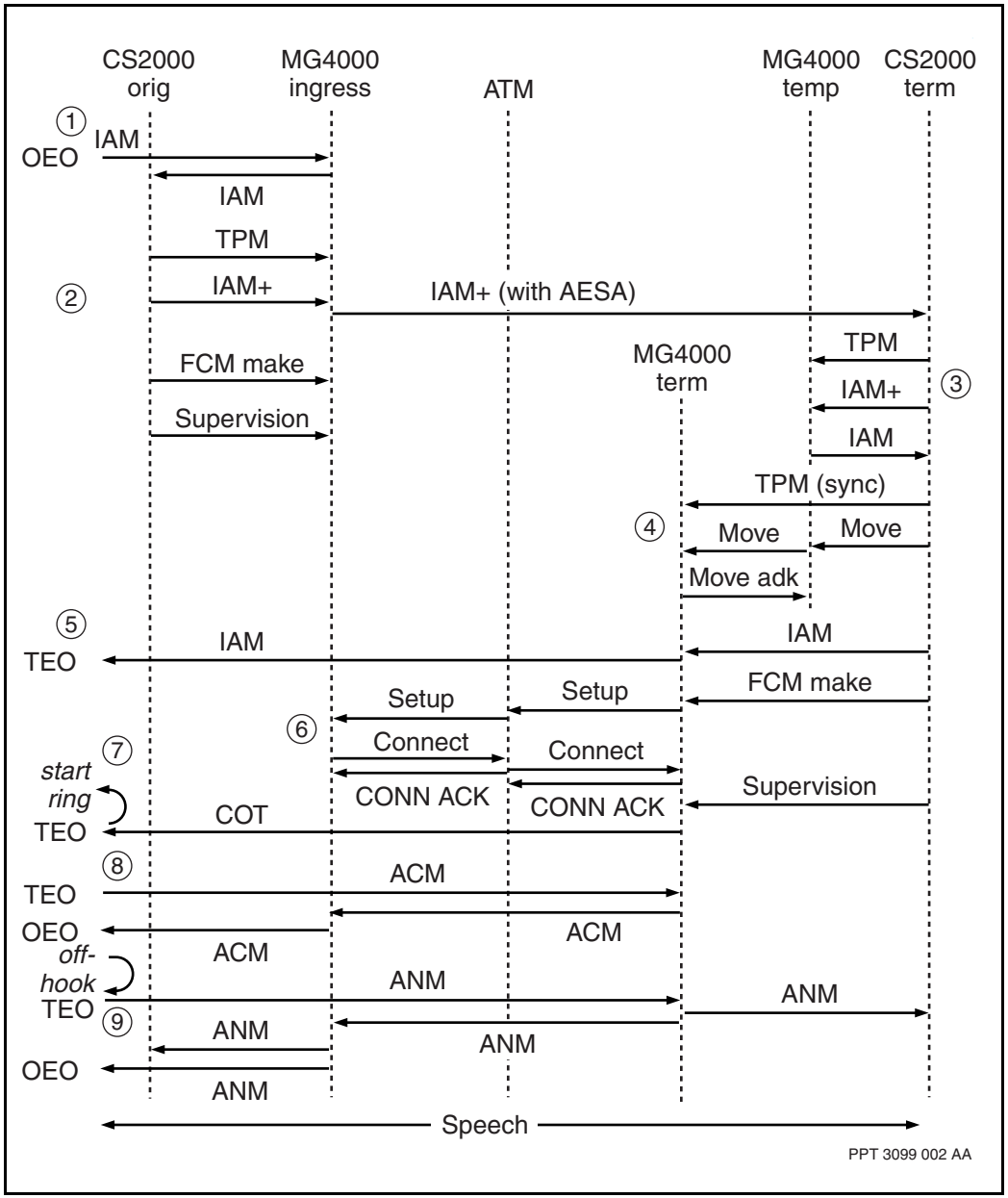
6 The ANM message is sent by TEO to the egress MG4000, which then sends the ANM message to the CS2000. The CS2000 marks the call as answered and begins billing the call. The CS2000 sends the ANM message to the ingress MG4000 which then sends the ANM message to the OEO.

Inter-Carrier Voice over IP office tandem calls

Calls through a Carrier Voice over IP network can also take place between an originating end-office (OEO) and a terminating end-office (TEO) connected to different CVoIP tandem offices.

The following figure show an example of a Dynamic Packet Trunk (DPT) call, where two CVoIP tandem offices use an ATM trunk to place a call between them. The offices use the Bearer Independent Call Control (BICC) extension to ISUP for signaling. BICC includes extra information, such as an ATM End System Address (AESA) in the IAM message, required to establish an ATM call between the two MG4000s.

Figure 20
Call walk-through for an inter-CVoIP ISUP call using a dynamic packet trunk (DPT)



The call is established using the following signaling:

1 The IAM message is received from the OEO through the SS7 network and is sent to the MG4000 with the incoming TDM trunk. The ingress MG4000 forwards the IAM message to the CS2000 for digits translations and routing.

2 The CS2000 translates the incoming digits and determines that the outgoing trunk is DPT. The CS2000 sends a Trunk Profile Message (TPM) to the ingress MG4000. The TPM message provides the MG4000 with DPT setup information. The MG4000 adds the BICC parameters to the IAM message plus AESA, BNC_ID, and ATM Trunk Information (ATI) and sends it through the SS7 network to the terminating CS2000.

3 Trunk selection on the CS2000 randomly picks a DPT. The CS2000 then sends a TPM message to a temporary MG4000 that corresponds to the selected DPT. The temporary MG4000 returns an IAM message to the CS2000 to start normal call processing.

4 After route selection is done, it is determined that the terminating TDM trunk is on a different MG4000 than the one picked at random. A new DPT is picked on the correct terminating MG4000 and the TPM message is forwarded to it. The CS2000 sends a Move message to the temporary MG4000 to tell it to move the context of the call to the correct terminating MG4000.

5 The CS2000 sends an asynchronous IAM message to the terminating MG4000. The terminating MG4000 sends the IAM message to the TEO. This IAM message informs the TEO to delay ringing until a COT message is received.

6 The terminating MG4000 initiates the ATM AAL1 call setup to the MG4000 in the originating office by sending a Q.2931 SETUP message. The two nodes complete the Q.2931 signaling and an AAL1 bearer path is created between the two nodes.

7 The terminating MG4000 sends a COT message to the TEO to inform it that the bearer path has been successfully established and tested. The TEO can start ringing the called party’s telephone.

8 The TEO returns an ACM message to the terminating MG4000. The terminating MG4000 then makes its time-switch connection and forwards the ACM message through the SS7 network to the originating MG4000. The originating MG4000 make its time-switch connection and forwards the ACM message to the OEO.

9 The terminating MG4000 receives an ANM message from the TEO and forwards it to the CS2000 for billing, and to the originating MG4000. The originating MG4000 forwards the ANM message to the CS2000 for billing and to the OEO.

Call progression in the UA-AAL1 solution

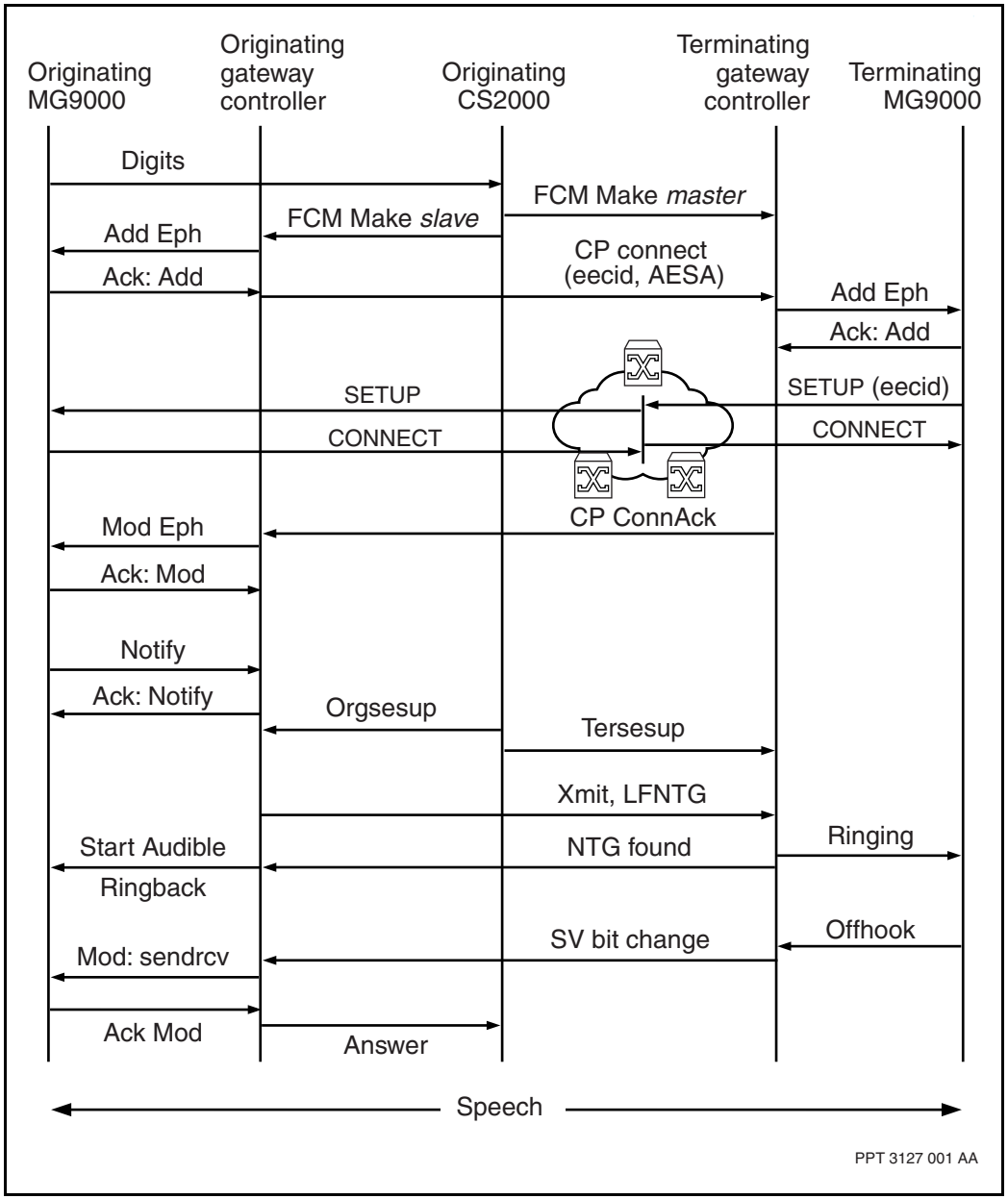
Refer to the following for information about how calls progress through Nortel Multiservice Switch 15000 nodes within the UA-AAL1 solution:

- “Intra-Carrier Voice over IP end office calls” (page 118)
- “Carrier Voice over IP end office trunk calls” (page 120)

Intra-Carrier Voice over IP end office calls

The following figure shows an example of a basic POTS to POTS call between two MG9000s in the same end office.

Figure 21
ATM call walk-through: UA-AAL1 intra-CVoIP end office call



Call progression and signaling includes the following events and characteristics:

1 The originating MG9000 provides the dial tone and collects digits. Digits are sent to the gateway controller (GWC) controlling the originating MG9000. This GWC then forwards them to the CS2000 for translation and routing.

2 The CS2000 sends a Fabric Control Message (FCM) to the GWC controlling the originating MG9000 and the GWC controlling the terminating MG9000. The originating GWC translates this into an H.248 “add ephemeral” message and sends it to the MG9000s. The originating GWC also forwards the originating MG9000’s AESA and call correlation information to the terminating GWC.

3 An ATM Setup message is sent from the terminating MG9000 across the ATM core network to the originating MG9000. The two nodes complete the necessary ATM signalling and establish an AAL1 bearer path between them.

4 The terminating MG9000 notifies its GWC of the successful completion of the “add ephemeral” message. The terminating GWC then notifies the originating GWC through a “mod ephemeral” message.

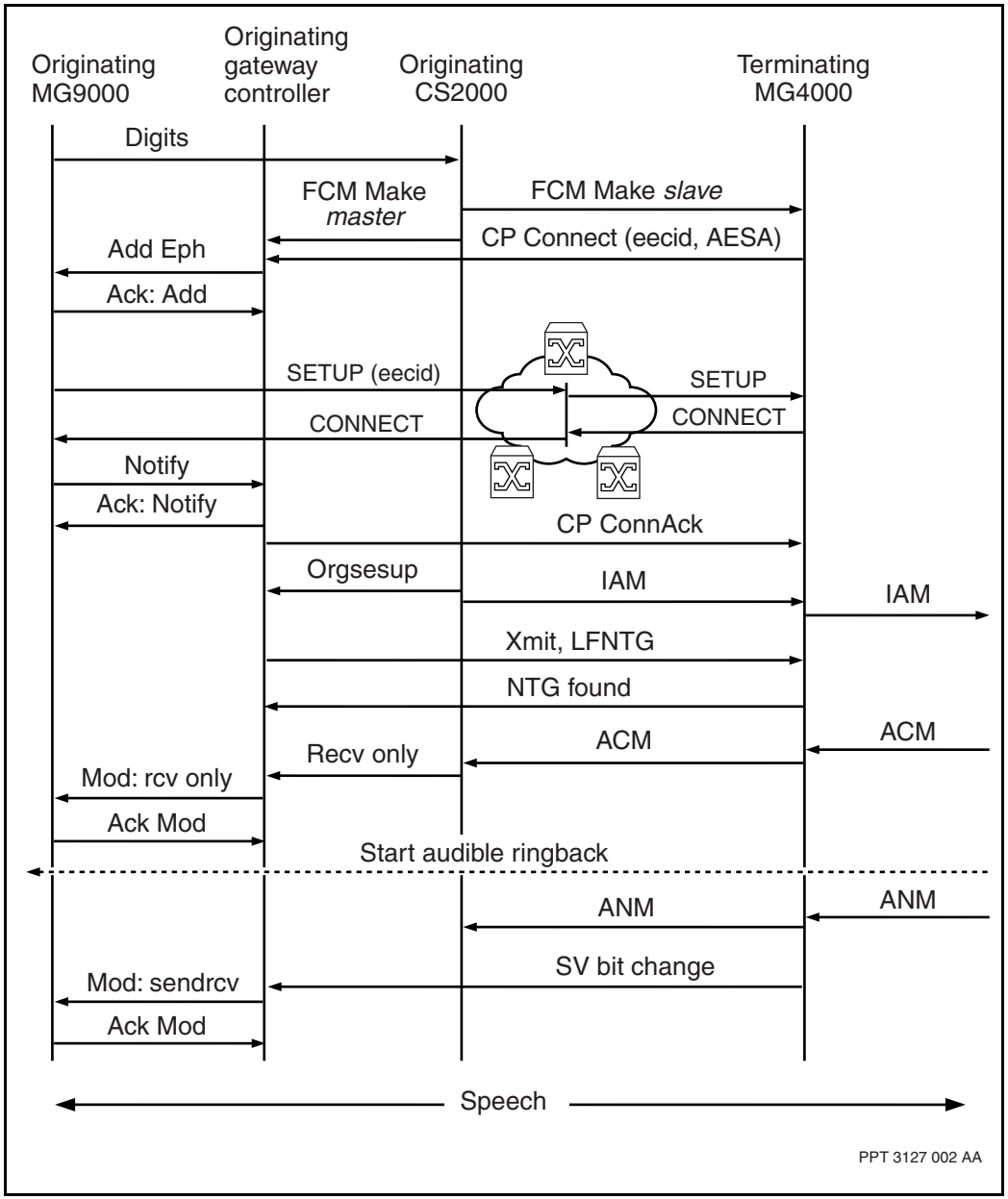
5 With the two GWCs synchronized, ringing is initiated on the terminating line and audible ringback is played on the originating line.

6 When the called party goes off-hook, the terminating MG9000 notifies its GWC, who notifies the originating GWC. The originating GWC then notifies the originating MG9000. Once two-way speech is enabled, the CS2000 is notified.

Carrier Voice over IP end office trunk calls

The following figure shows an example of a basic POTS trunk call to an MG4000 trunk gateway in the same end office.

Figure 22
ATM call walk-through: CVoIP end office trunk call



Call progression and signaling includes the following events and characteristics:

1 The originating MG9000 provides the dial tone and collects digits. Digits are sent to the gateway controller (GWC), who forwards them to the CS2000 for translation and routing.

2 The CS2000 sends a Fabric Control Message (FCM) to the GWC controlling the originating MG9000 and the connection broker in the MG4000. The MG4000 acts as a slave and forwards its AESA to the GWC in the CP connect message. The GWC translates this into H.248 “add ephemeral” message and sends it to the MG9000.

3 An ATM Setup message is sent from the master MG9000 across the ATM core network to the MG4000. The two nodes complete the necessary ATM signalling and establish an AAL1 bearer path between them.

4 The terminating MG9000 notifies its GWC of the successful completion of the ATM SVC establishment. The GWC then acknowledges the CP Connect message. In parallel, the CS2000 initiates supervision, sending out the IAM message to the terminating the end office or to the tandem node. The CS2000 also checks integrity on the speech path.

5 When the ACM message is received from the terminating end office or from the tandem node, a “mod ephemeral” message is sent to cut through the ringing from the terminating node.

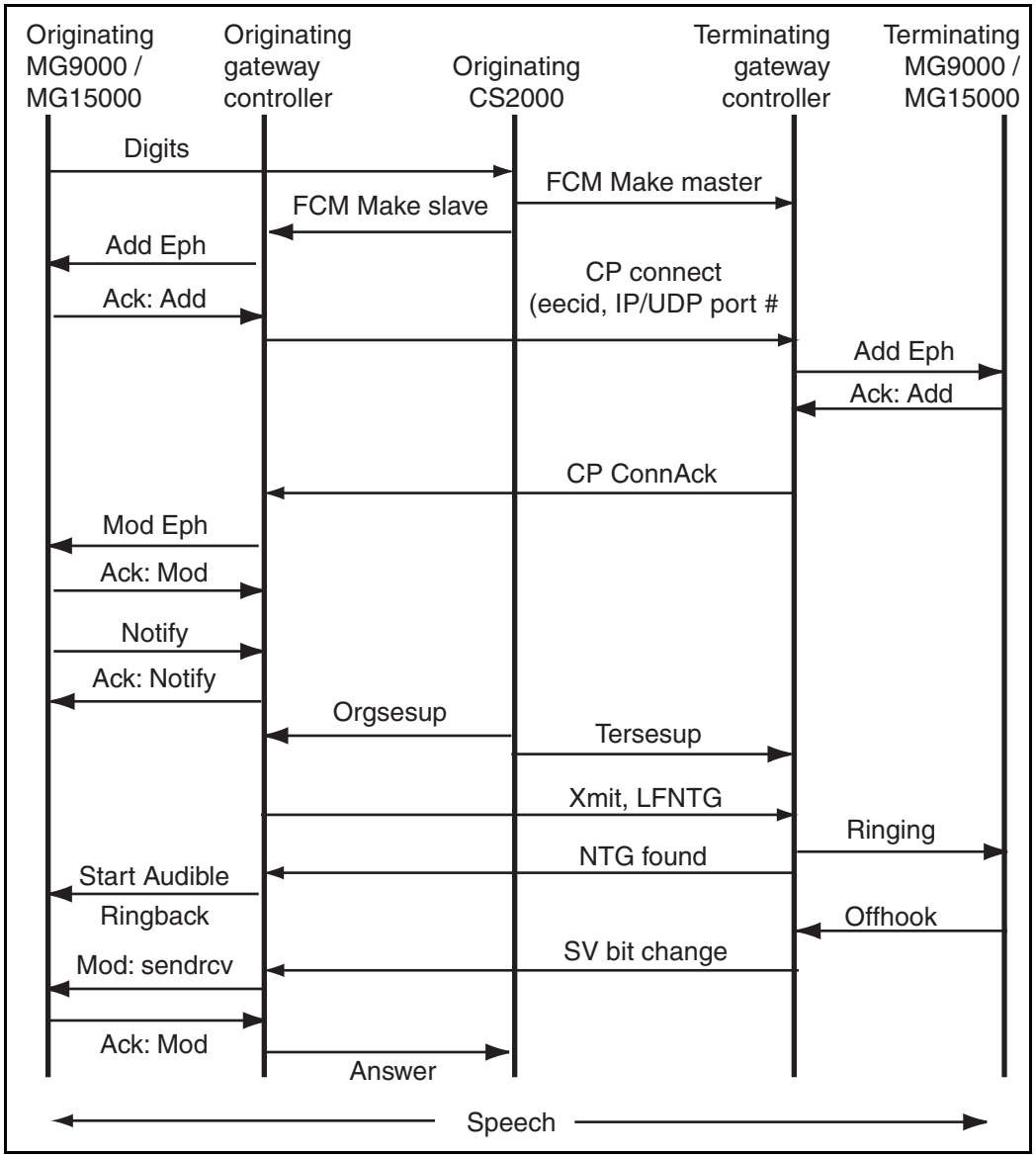
6 When the called party goes off-hook, an ANM message is received from the terminating office and the MG4000 sends the supervision message to the GWC telling it to initiate two-way speech path.

Call progression in the UA-IP solution

Intra-office signaling traffic from gateway to gateway controller

The following figure illustrates the basic call setup for a trunked call between two MG9000 nodes.

Figure 23
IP call walk-through: UA-IP intra-CVoIP end office call



Call progression and signaling includes the following events and characteristics:

1 The originating MG9000/MSS15000 gateway provides the dial tone and collects digits. Digits are sent to the gateway controller (GWC) of the originating MG9000. This GWC then forwards the digits to the CS2000 for translation and routing.

2 The CS2000 sends a Fabric Control Message (FCM) to the GWC controlling the originating MG9000 and the GWC controlling the terminating MG9000. The originating GWC translates this into an H.248 “add ephemeral” message and sends it to the MG9000/MSS15000. The originating GWC also forwards the originating MG9000’s IDP/UDP port number and call correlation information to the terminating GWC.

3 The terminating MG9000 notifies its GWC of the successful completion of the “add ephemeral” message. The terminating GWC then notifies the originating GWC through a “mod ephemeral” message.

4 With the two GWCs synchronized, ringing is initiated on the terminating line and audible ringback is played on the originating line.

5 When the called party goes off-hook, the terminating MG9000 notifies its GWC, who notifies the originating GWC. The originating GWC then notifies the originating MG9000. Once two-way speech is enabled, the CS2000 is notified.

Nortel Multiservice Switch 15000, Media Gateway 15000 and Multiservice Data Manager in Carrier Voice over IP Networks

Product and Technology Basics

PT-AAL1/UA-AAL1/UA-IP/PT-IP

(I)SN09FF and up P1

Customers with queries, can access www.nortel.com/documentfeedback where they will be taken directly to a ‘Document Inquiry’ and ‘Feedback’ form.

Publication: NN10028-111
Document status: Preliminary
Document version: (I)SN09FF and up P1
Document date: April 2006
Printed in Canada

NORTEL