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Nortel Multiservice Switch 7400/15000/20000
Overview

Contents

Nortel Multiservice Switch 7400/15000/20000
Overview
NN10600-030   7.2S1   Standard
PCR7.2 and up   March 2006

What's new

The following feature was added to this document:

- Secure shell (ssh) on Nortel Multiservice Switch 15000 and 20000 (page 7)

Attention: To ensure that you are using the most current version of an NTP, check the current NTP list in NN10600-000 *Nortel Multiservice Switch 7400/ 15000/20000 What's New*.

Secure shell (ssh) on Nortel Multiservice Switch 15000 and 20000

The following sections were updated for this feature:

- Network management functions (page 42)
- Network management devices (page 45)
- Network management connections (page 46)

The following sections were added for this feature:

- Secure shell (Ssh) access to a node (page 53)
- Connecting to a device using secure shell (Ssh) (page 54)

Nortel Confidential

Multiservice Switch hardware

The basic hardware structure of Nortel Multiservice Switch shelves consists of a mounting apparatus, the shelf assembly, power components and the cards that plug into the shelf to provide functionality.

Nortel Multiservice Switch 7400 series is physically different and do not share hardware with and Multiservice Switch 15000 and Multiservice Switch 20000 devices.

Control processors and function processors have the same role on all Multiservice Switch nodes. However, the cards and modules that are intended to be used on Multiservice Switch 15000 and Multiservice Switch 20000 nodes are physically different from the cards available for Multiservice Switch 7400 nodes.

Navigation

Multiservice Switch 7400 hardware

Multiservice Switch 7400 shelves are available in these four models:

Each model supports Multiservice Switch 7400 software applications and function processors (FPs).

Multiservice Switch 7420 hardware

A Nortel Multiservice Switch 7420 device supports a maximum of three processor cards: two FPs and one CP. For a detailed view, see the figure 3-slot Multiservice Switch 7420 (page 9). Multiservice Switch 7420 nodes can be mounted as a stand alone unit either on a desk-top (horizontally) or on the floor (vertically). You can also install Multiservice Switch 7420 nodes in cabinets or standard 19" racks.

3-slot Multiservice Switch 7420

Front view

Slot 2
Slot 1
Slot 0

NORTEL

Control and function processor cards

Power switch

Rear view

Local operator port

DC terminal block

PPT 3221 001 AA
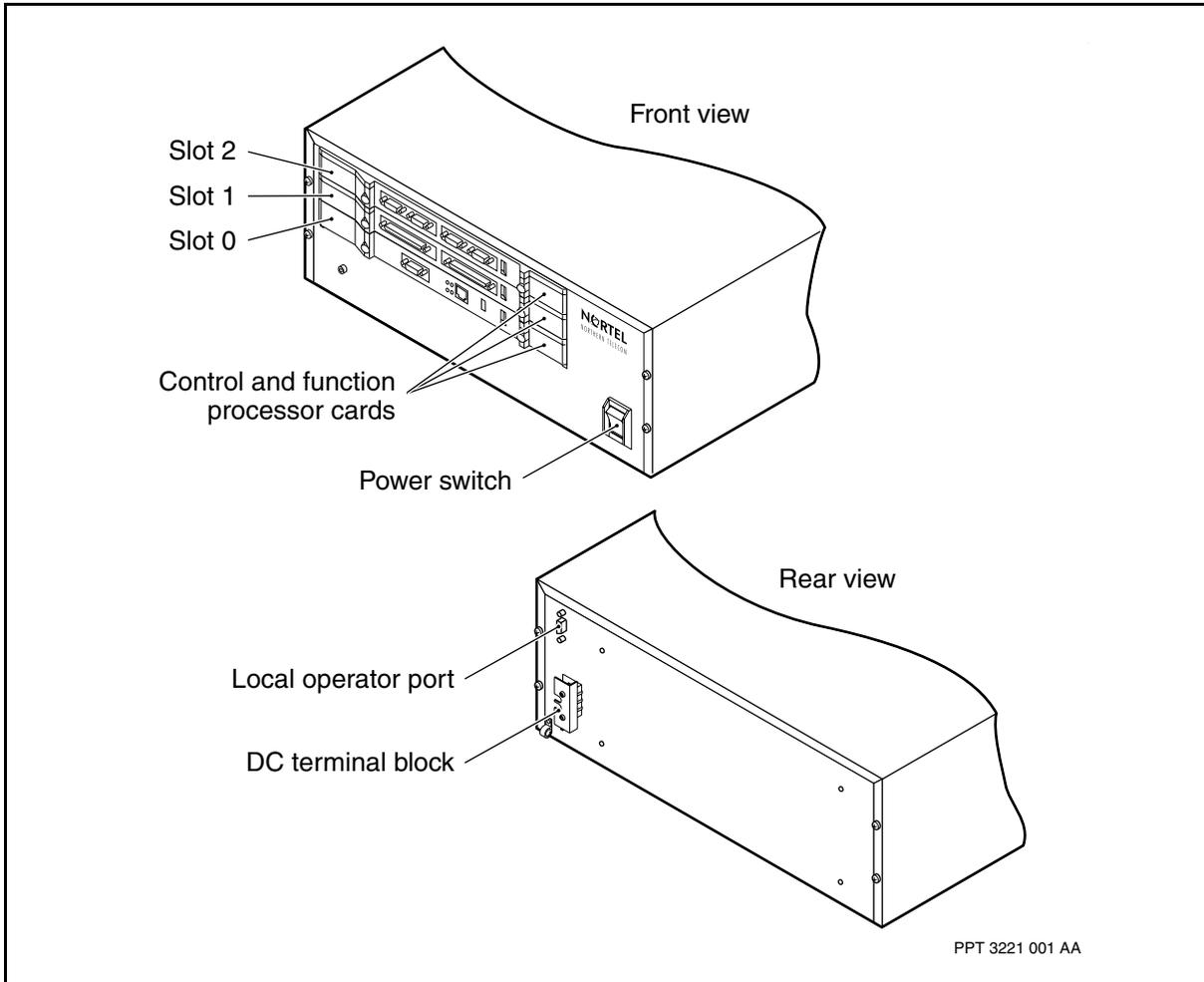
Multiservice Switch 7440 hardware

A Nortel Multiservice Switch 7440 device supports a maximum of five processor cards: four FPs and one CP. For a detailed view, see the figure 5-slot Multiservice Switch 7440 (page 10). You can install a Multiservice Switch 7440 on the floor as a stand-alone unit. You can also install it in a cabinet or a 19-inch standard rack. A 19-inch rack holds a maximum of six Multiservice Switch 7440 nodes.

5-slot Multiservice Switch 7440

Cable management area

Power supplies

Function and control processor cards

Slot 0

Slot 4

Cooling unit chassis (minimum air intake area is 40 sq. inches)

Node shelf assembly

PPT 0908 001 AB
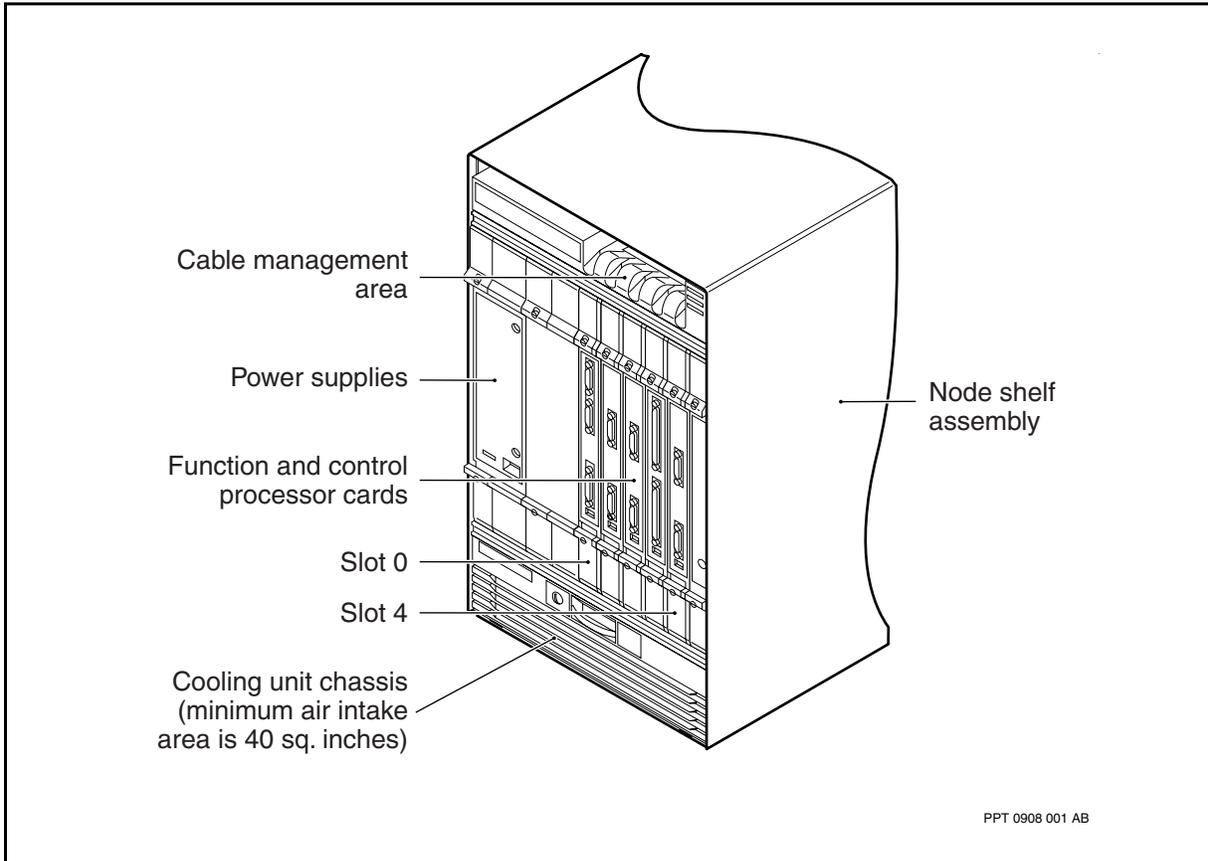
Multiservice Switch 7460 hardware

The Nortel Multiservice Switch 7460 shelf supports a maximum of eight processor cards: one or two CPs and seven or six FPs. For a detailed view, see the figure Four Multiservice Switch 7460 shelves in a rack (page 11). You can install the Multiservice Switch 7460 in a cabinet, a Multiservice Switch seismic cabinet, or a 19-inch standard rack. A 19-inch rack holds a maximum of four Multiservice Switch 7460 nodes.

Four Multiservice Switch 7460 shelves in a rack

Shelf assembly

Cable management bracket

Cooling unit

Mounting ear

Power supplies

19-inch rack

PPT 3498 004 AA
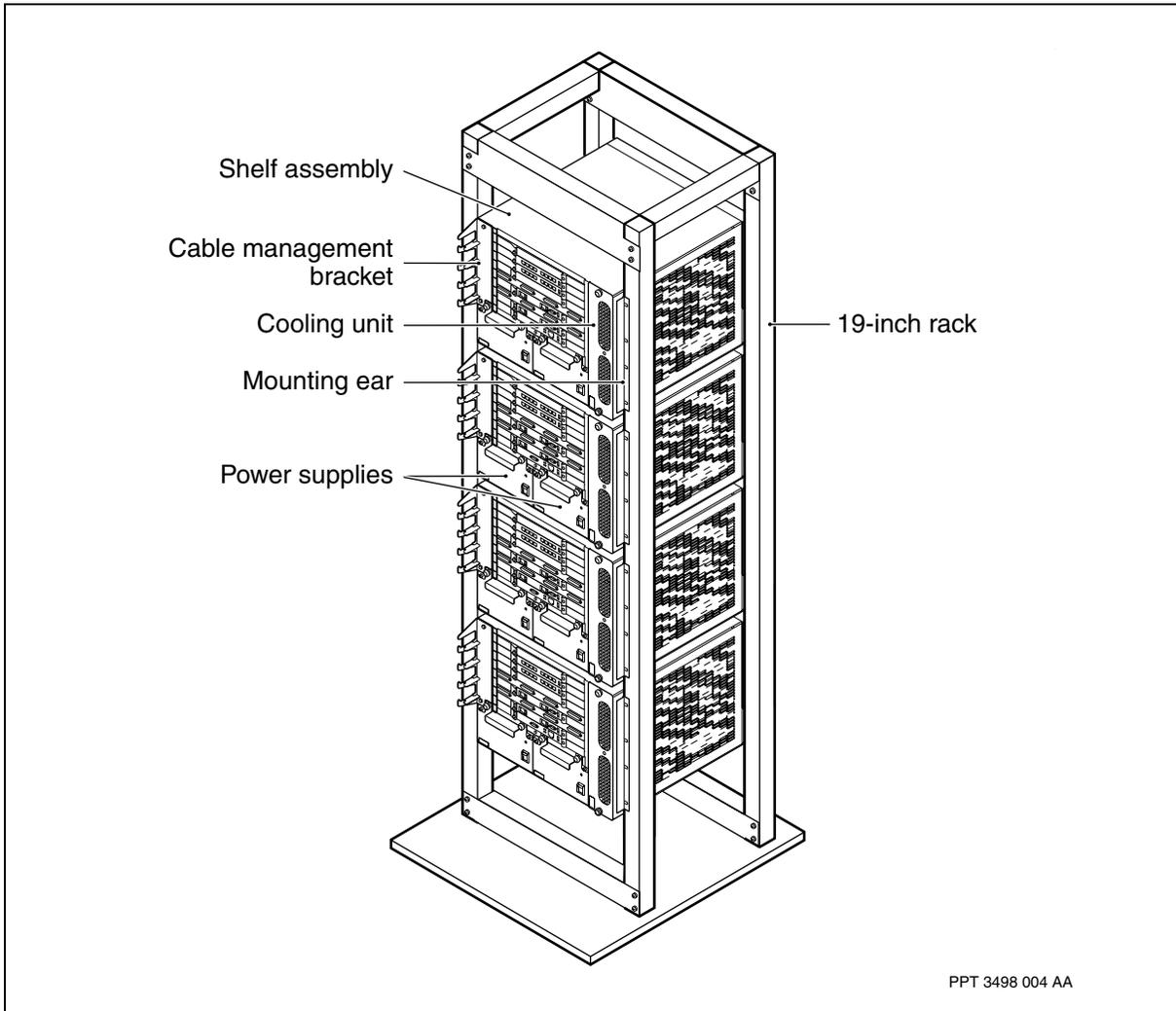
Multiservice Switch 7480 hardware

The Nortel Multiservice Switch 7480 shelf supports a maximum of 16 processor cards: a CP with 14 function processors and a spare CP (or 15 FPs without a spare CP). For a detailed view, see the figure 16-slot Multiservice Switch 7480 (page 12). You can install the Multiservice Switch 7480 in a cabinet, Multiservice Switch seismic cabinet, or in a standard 19-inch rack. A standard 19-inch rack can hold two Multiservice Switch 7480 nodes, or one node and its related termination panels.

16-slot Multiservice Switch 7480

MSS 3593 001 AA
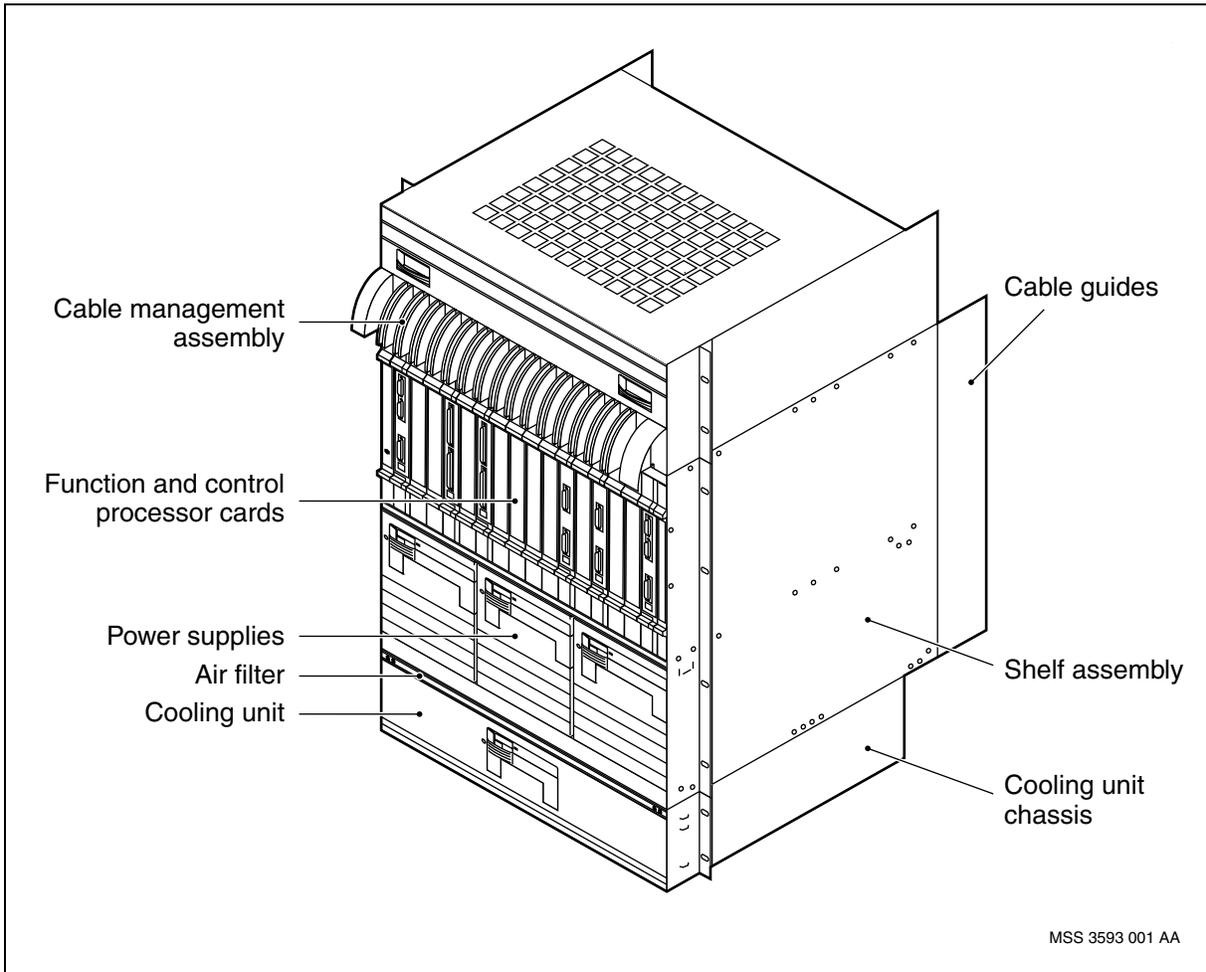
For more information about series hardware, see the following documents:

- NN10600-170 *Nortel Multiservice Switch 7400 Hardware Description*

- NN10600-175 *Nortel Multiservice Switch 7400 Hardware Installation, Maintenance, and Upgrade*

- NN10600-172 *Nortel Multiservice Switch 7400 FP Cabling Reference*

Multiservice Switch 15000 hardware

The Nortel Multiservice Switch 15000 device is installed in a frame that can hold two independent devices. Each 18-slot Multiservice Switch 15000 shelf supports a maximum of 16 processor cards.

- slot 0 is dedicated for the primary control processor (CP) card

- fourteen slots are dedicated for function processor (FP) cards that are connected to fabric cards

- slot 1 is used for a redundant CP card or an FP when running non-redundantly

- two slots are reserved for future use

The two fabric cards interconnect the processor cards. Each processor card has redundant serial links to the two fabric cards.

Two Multiservice Switch 15000 shelves in a NEBS 2000 frame

Multiservice Switch 15000 or 20000

NEBS2000 frame

Multiservice Switch 15000 or 20000

MSS 3159 001 AA
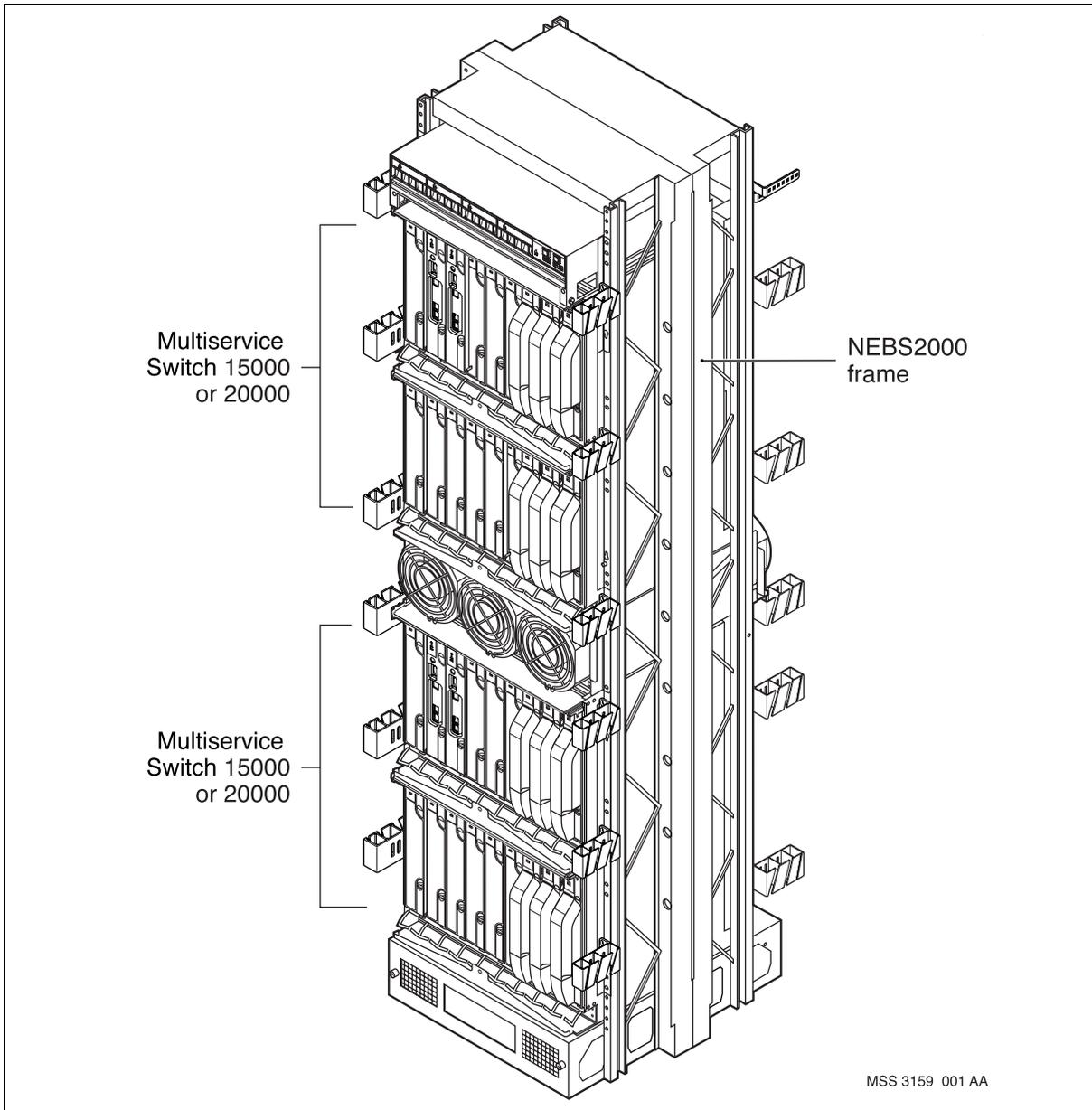
For more information about Multiservice Switch 15000 hardware and the services they support, see the following documents:

- NN10600-120 *Nortel Multiservice Switch 15000/20000 Hardware Description*

- NN10600-130 *Nortel Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade*

Multiservice Switch 15000 VSS hardware

Nortel Multiservice Switch 15000 Variable Speed Switch (VSS) device is installed in a network equipment building system (NEBS) frame that holds two independent devices: Multiservice Switch 7480 shelf in the upper part and Multiservice Switch 15000 shelf in the lower part of the frame. For a detailed view of Multiservice Switch 15000 VSS device, see .

Multiservice Switch 15000 VSS

PPT 2912 001 AA

For more information about Multiservice Switch 15000 VSS hardware see

- Multiservice Switch 7480 hardware (page 11)
- Multiservice Switch 15000 hardware (page 12)

You can connect Multiservice Switch 7480 and Multiservice Switch 15000 nodes using a single-mode or multi-mode fibre cable, through an OC-3 FP on each node. For more information about Multiservice Switch 15000 VSS FP cards see, Multiservice Switch function processors (page 18). For information

on connecting Multiservice Switch 7480 and Multiservice Switch 15000 nodes in Multiservice Switch 15000 VSS, see NN10600-130 *Nortel Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade*.

A separate cabinet is required to house the Multiservice Switch 15000 VSS sparing panels. See NN10600-125 *Nortel Multiservice Switch 15000/20000 Planning Site Requirements* for more information about the sparing panel requirements.

For information about

- preparing the site for Multiservice Switch 15000 VSS installation, see NN10600-125 *Nortel Multiservice Switch 15000/20000 Planning Site Requirements*.

- installing and maintaining Multiservice Switch 15000 VSS, see NN10600-130 *Nortel Multiservice Switch 15000/20000 Hardware Installation, Maintenance, and Upgrade*.

Multiservice Switch 20000 hardware

The Nortel Multiservice Switch 20000 device shares much of the hardware of a Multiservice Switch 15000, including the methods of installing one in a rack or two in a NEBS 2000 frame. The breaker interface panel (BIP) uses the same type of power distribution unit, with this exception, the Multiservice Switch 20000 version uses 25 A breakers and not 20 A. The power input feeds remain the same, however, you cannot power a Multiservice Switch 20000 and a Multiservice Switch 15000 shelf from the same BIP in the same frame.

The plug-in modules and fabrics at the rear of the Multiservice Switch 20000 shelf are redesigned for improved capacity, performance, or usability. The backplane is designed to accommodate fabrics of different capacities and is scalable to 160 Gbits/s. The initial 112 Gbits/s fabrics continue to load-balance and load-share with 70 Gbits/s of shelf (user) capacity so that either fabric can take over the load of its mate and FP traffic is maintained.

The shelf assembly of the Multiservice Switch 20000 is designed to ship with cards in place. This means that the control processor (CP3), function processor (FP), and fabric cards can be pre-loaded with software, placed in pre-determined slots (including filler cards), and shipped safely in a partially seated transportation position. Shipping in-place means the cards can be powered up as soon as they are seated.

Information about the Multiservice Switch 20000 hardware (and software) is the same as a Multiservice Switch 15000 unless otherwise specified. From the rear, the look of the plug-in modules and fabrics has changed. From the front, a Multiservice Switch 20000 shelf looks very much like a Multiservice Switch 15000 shelf.

Two Multiservice Switch 20000 shelves in a NEBS 2000 frame

Multiservice
Switch 15000
or 20000

NEBS2000
frame

Multiservice
Switch 15000
or 20000

MSS 3159 001 AA
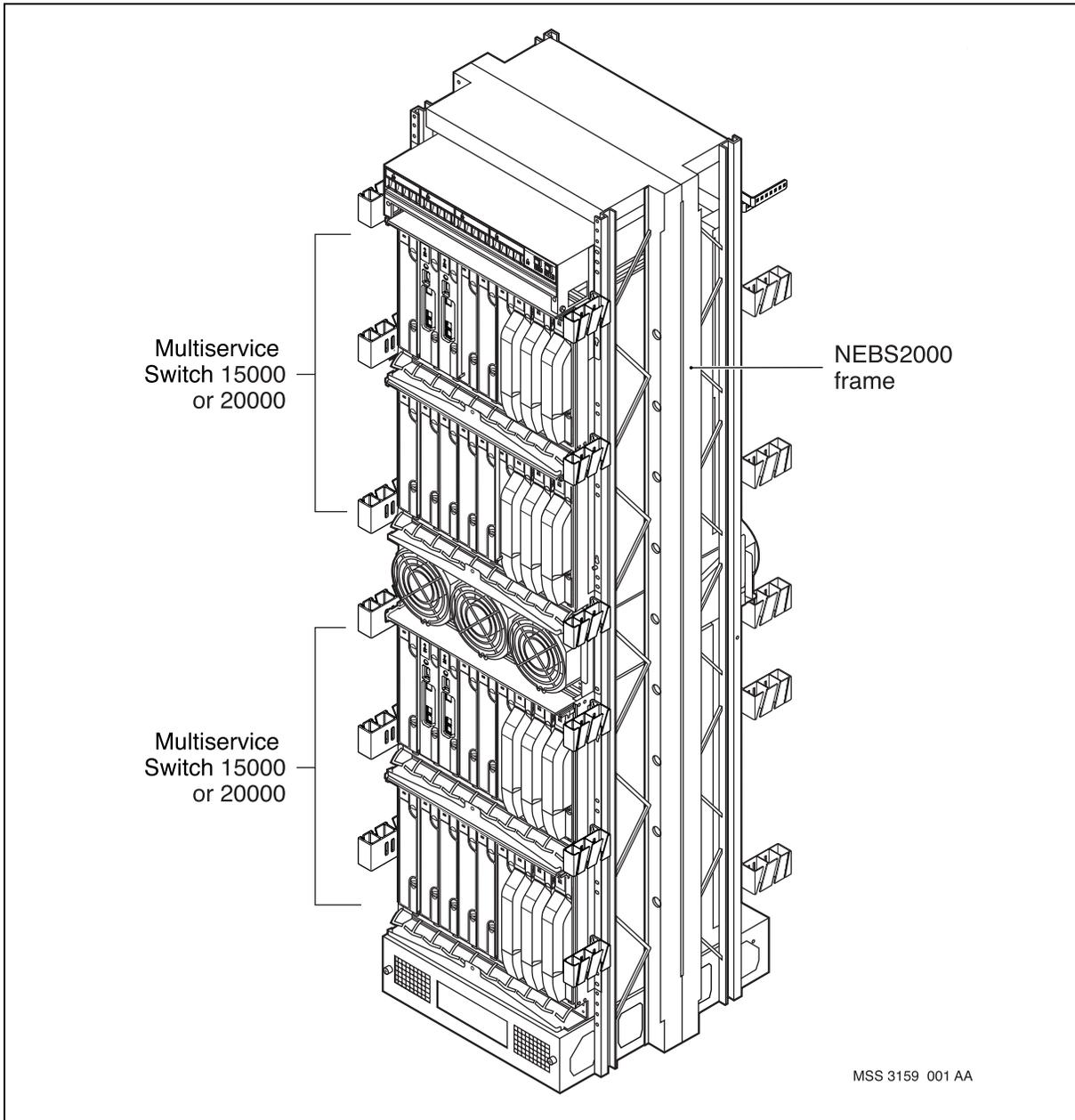
For more information about the hardware see NN10600-120 *Nortel Multiservice Switch 15000/20000 Hardware Description*.

Multiservice Switch control processors

The Nortel Multiservice Switch 7400/15000/20000 control processor (CP) card controls overall processing in the node. Some of the basic functions it performs are booting the switch, collecting and maintaining shelf inventory and statistical data, as well as maintaining routing tables.

The card contains a standard core computing engine with a disk drive, as well as circuits to provide a Stratum-3 timing reference, the external clock synchronization interfaces (DS1/E1), and operation access ports (Ethernet, RS-232 interfaces).

The CP can operate in redundant mode. In redundant mode, two CPs must be installed. These two CPs contain duplicated information and are connected with redundant links. While one CP operates as the active card, the second card operates in warm standby mode to provide high availability. If the active CP should fail, the standby CP automatically takes over.

For more information about control processors see NN10600-170 *Nortel Multiservice Switch 7400 Hardware Description* or NN10600-120 *Nortel Multiservice Switch 15000/20000 Hardware Description*.

Multiservice Switch function processors

Function processors (FP) provide interface ports that connect network communications facilities to Nortel Multiservice Switch nodes. FPs support and execute real-time processes that enable service delivery.

The function of the FP is determined by the type of electrical or optical interface on the card, as well as the software running on the processor. Each type of interface provides circuitry and faceplate connectors specific to its function.

Some electrical FPs must be provided with special interface cables and a separate fanout panel in cases where there is insufficient faceplate area for standard connectors, or where FP sparing is required. Different FP types are available for Multiservice Switch nodes to support specific link interfaces.

Many FPs use termination panels and support 1:1 sparing. Electrical FPs that support sparing require a sparing panel. Some optical FPs can support sparing without the use of a termination panel. Some termination panels also break out the ports of the FP so that each port has an access and termination point for customer equipment connections.

Each FP supports one or more services. For more information about Multiservice Switch FPs and the services they support see NN10600-120 *Nortel Multiservice Switch 15000/20000 Hardware Description*, NN10600-170 *Nortel Multiservice Switch 7400 Hardware Description*, or NN10600-551 *Nortel Multiservice Switch 7400/15000/20000 FP Configuration Reference*.

Multiservice Switch introduction

Nortel Multiservice Switch is a family of carrier-grade, integrated, toll-quality voice, data gateway and network products.

Multiservice Switch networks deliver a powerful range of standards-based interfaces and services, including frame relay, ATM, and IP. Multiservice Switch provides multiprotocol routing services, intelligent traffic management, and simultaneously supports voice, data, and video traffic.

Multiservice Switch networks are scalable: networks scale easily from a few nodes to thousands of nodes. Redundancy and sparing capabilities mean that Multiservice Switch systems provide the high reliability and redundancy required by today's networks.

Multiservice Switch can simultaneously support multiple services using both frame and cell switching, and provides multimedia solutions from the backbone to the access layer.

Multiservice Switch provides the high reliability and redundancy required by today's networks by supporting:

- a variety of equipment sparing schemes for electrical and optical interfaces

- SONET or SDH line automatic protection switching (APS)

- a means for upgrading software without interrupting some services being provided by the node

- service software that can run uninterrupted, even when the hardware providing the service changes

Navigation

Multiservice Switch models

Nortel Multiservice Switch systems offer a selection of products with different cost structures, scalability and functionality. You can choose the platform with the services you require while managing your cost effectiveness and growth potential.

Multiservice Switch hardware and software are modular. You can tailor the hardware and software components to meet the requirements of each site and to evolve to future technologies.

See the following sections for more information:

- Multiservice Switch 7400 introduction (page 20)
- Multiservice Switch 15000 introduction (page 21)
- Multiservice Switch 15000 VSS introduction (page 21)
- Multiservice Switch 20000 introduction (page 21)

Multiservice Switch 7400 introduction

Nortel Multiservice Switch 7400 series includes Multiservice Switch 7420, Multiservice Switch 7440, Multiservice Switch 7460, and Multiservice Switch 7480.

The Multiservice Switch 7420 is a 3-slot device, ideal for branch or regional sites as a network consolidator node or tandem switch that feeds other sites. The Multiservice Switch 7420 is also used for aggregation and switching traffic in radio access networks.

The Multiservice Switch 7440 is a 5-slot device, ideal for branch or regional sites as a network consolidator node or tandem switch. Its increased size offers greater traffic capacity or hardware redundancy. This node can also handle backbone applications in sites that do not require the high fanout of the 16-slot switch making it a cost-effective choice for service providers at smaller sites.

The Multiservice Switch 7480 is a 16-slot device that provides superior reliability and redundancy required by service providers. The 16-slot node offers two load-sharing buses and support for redundant power supplies. Multiservice Switch processor cards also support sparing. Therefore, even in the unlikely event of a failure, the node continues to deliver service.

The 8-slot Multiservice Switch 7460 device offers the same capabilities as the 16-slot Multiservice Switch 7480 device, but with a smaller form factor. The Multiservice Switch 7460 supports up to 7 single-slot FPs and 1 CP, has one redundant cooling unit, dual power feeds, and supports the same processor cards as the rest of the Multiservice Switch 7400 series.

The Multiservice Switch 7400 device offers a full range of data services and enables customers to use a single ATM access link to transport voice, video, and data. Statistical multiplexing, voice compression, and silence and fax idle suppression techniques maximize bandwidth savings. Echo cancellation, comfort noise generation, and congestion handling techniques ensure that the Multiservice Switch 7400 voice services deliver toll quality services.

Multiservice Switch 15000 introduction

Nortel Multiservice Switch 15000 is a multiservice ATM-based data device that can be deployed as a backbone for existing Multiservice Switch edge node networks or as a service provider ATM backbone node. In addition to ATM, it delivers a powerful range of standards-based interfaces and services, including frame relay and IP. Multiservice Switch 15000 nodes provide multiprotocol routing services, intelligent traffic management, and simultaneously supports voice, data, video and image traffic. It offers full redundancy, scalable high capacity, high-speed access and trunking, and optional SONET or SDH integration.

Multiservice Switch 15000 VSS introduction

Nortel Multiservice Switch 15000-Variable Speed Switch (Multiservice Switch 15000 VSS) is a combined edge (Multiservice Switch 7480) and core (Multiservice Switch 15000) multi-service device. Multiservice Switch 15000 VSS offers low-speed accessibility at the edge of a network and high speed switching at the core of a network.

In addition to ATM, Multiservice Switch 15000 VSS delivers a wide range of standard-based high-speed interfaces and services, including frame relay, circuit emulation, voice, and Internet protocol (IP). These interfaces provide a wide variety of access and trunking speeds from channelized DS0 to OC-48.

Multiservice Switch 15000 VSS provides high density scalability that includes

- more than 43,000 DS0's in a network equipment building system (NEBS) frame compliant footprint

- high throughput, beyond 43 Gbit/s

Multiservice Switch 15000 VSS nodes are DC powered. An external AC power rectifier provides power for AC requirements.

Multiservice Switch 20000 introduction

Nortel Multiservice Switch 20000 provides the same functionality and services as a Multiservice Switch 15000, and offers significant hardware improvements and increased shelf (user) capacity.

Multiservice Switch 20000 can re-deploy FPs that were previously loaded with Passport Carrier Release (PCR) software 2.3 or later, and re-deploy CP3s with PCR 3.1 or later software provided the cards are migrated to the current PCR of the switch.

Multiservice Switch century compliance

Nortel Multiservice Switch devices are Century Compliant. "Century Compliant" or "Century Compliance" means that the product functions without any material, service-affecting non-conformance to the applicable Nortel product specifications with respect to the operations performed by such product which are date dependent, provided that the identified baseline software and requisite hardware are installed, and the use conforms to the associated documentation. The statement that a product is Century Compliant should not be interpreted as a commitment to support such a product beyond its committed support window.

Multiservice Switch software infrastructure

Nortel Multiservice Switch software has five main classes: base, networking, trunking, access services, and packet voice gateway.

The base software provides basic system functions that support the remaining software. Base software functions include software management, command processing, file storage, data collection, port management, and network management interfaces.

Networking software provides capabilities for forwarding a packet of information from its source to its destination. Networking software includes routing and congestion management functions.

Trunking software provides the capabilities for interconnecting Multiservice Switch nodes.

Access service software provides the communication functions of Multiservice Switch nodes, such as frame relay, ATM, and internet protocol (IP).

Navigation

Multiservice Switch base software

Nortel Multiservice Switch base software system functions include command processing, shelf management, file storage, data collection, and network management interfaces. See the following sections for more information:

- Command processing (page 24)
- Data collection (page 24)
- File system (page 25)
- Network management interfaces (page 25)
- Processor control system (page 26)
- Software control system (page 26)
- Multiservice Switch 7400 bus control (page 26)
- Multiservice Switch 15000 and Multiservice Switch 20000 backplane control system (page 27)
- Port management (page 27)

Command processing

The base software controls and processes commands and allow you to configure the node. Components provide the infrastructure through which network operators and administrators interact with Nortel Multiservice Switch networks. Components represent the hardware, software, and services on a Multiservice Switch node. To modify the node configuration, you change the value of component attributes. You can do this directly by entering commands in the text interface, or indirectly by using a network management device.

For more information about components, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Data collection

Nortel Multiservice Switch data collection system (DCS) is part of the base software and is responsible for collecting the data needed for troubleshooting, performance tuning, and billing. To analyze this data, it is transferred to the management data provider (MDP) on Multiservice Data Manager. The data collection system collects the following types of network management data:

- alarms and state change notifications
- accounting records
- performance measurements
- operator logs and debug information
- SNMP traps that are alerts to fault conditions

File system

Nortel Multiservice Switch file system stores the software and configuration files that run the node, as well as data generated by the node. The file system contains up to two physical disks, one located on each of the control processors. When you install and configure a main and spare control processor, the disks on the control processors provide file system redundancy when the disks are synchronized.

For information about file system synchronization and redundancy, see NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

Network management interfaces

The network management interface system (NMIS) is the part of the base software that enables you to access Nortel Multiservice Switch nodes through a network management device. The NMIS also provides network management access security.

Multiservice Switch systems support five types of network management interfaces: local operator, Telnet, fast management information protocol (FMIP), file transfer protocol (FTP), and secure shell (ssh).

The local operator interface allows a co-located ASCII terminal to act as a local operator. The Telnet or ssh interface allows remote operator sessions.

A Multiservice Data Manager workstation can connect with a Multiservice Switch node through the Ethernet port on the node control processor card.

The FMIP interface is a Nortel proprietary management information protocol. An FMIP interface operates between a Multiservice Switch node and a workstation running Nortel Multiservice Data Manager.

> **CAUTION**
> **Risk of system failure**
> Do not use the file transfer protocol (FTP) access to delete files or directories from the Nortel Multiservice Switch provisioning file system because the Multiservice Switch can fail. To delete files or directories from the Multiservice Switch provisioning file system, use the *tidy prov* command. For more information about the *tidy prov* command, see NN10600-050 *Nortel Multiservice Switch 7400/ 15000/20000 Command Reference*.

The FTP interface allows file transfers to and from local disks.

For more information about Multiservice Switch network management, see Multiservice Switch network management (page 42).

Processor control system

The processor control system manages the processor cards. Specifically, it

- sequences system start-up

- determines when processor cards are available for service and loads them with the appropriate software

- monitors processor cards and invokes appropriate recovery procedures when problems are detected

- supports processor card sparing

- provides a control interface for the command processing system so that you can monitor the system and perform corrective actions, if necessary

Software control system

Nortel Multiservice Switch system software is stored at a distribution site that is remotely accessible by network nodes. Multiservice Switch software control systems allow you to download software from the software distribution site to a Multiservice Switch node.

This system manages the software installed in the node. Multiservice Switch software has separate applications that contain the software for a distinct type of service. Each application has an associated version number. An application version can also have one or more patches, which enhance or correct its functionality. Multiservice Switch software control system manages the software versions and patches residing on the node.

After the software is downloaded to the node, the software control system allows you to configure software services and applications on processor cards.

For more information about the software control system, see NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures.*

Multiservice Switch 7400 bus control

Nortel Multiservice Switch 7400 base software controls its two 800 Mbit/s buses. The bus enables the processor cards on the shelf to communicate. When both buses are in operation, the node runs in dual bus mode, where both buses share the traffic on the bus, and provide a bandwidth of 1.6 Gbit/s. If one bus becomes disabled, the node is in single bus mode and traffic runs on the enabled bus. If necessary, Multiservice Switch node's automatically change between single bus mode and dual bus mode.

Multiservice Switch 15000 and Multiservice Switch 20000 backplane control system

The backplane control systems on Nortel Multiservice Switch 15000 and Multiservice Switch 20000 nodes control the two fabrics. The fabrics enable the processor cards on the shelf to communicate with other cards in the shelf. When both fabrics are operational, the node runs in dual-fabric mode and both fabrics share the transport of processor card cells. With a disabled fabric, the node is in single-fabric mode and all processor card cells run on the enabled fabric. Both nodes can automatically change between single- and dual-fabric mode depending on the state of the individual fabrics.

The backplane control system provides a fabric component interface in order to allow the user to monitor or to perform corrective actions on the fabric. Any operator commands such as locking, unlocking, or testing the fabric are controlled by the backplane control system.

The two 56.3 Gbit/s fabrics of the Multiservice Switch 15000 provide 40 Gbit/s shelf (user) capacity.

The two 112.6 Gbit/s fabrics of the Multiservice Switch 20000 provide 70 Gbit/s shelf (user) capacity.

Port management

The port management function of the base software controls and manages the ports and channels on each processor card.

A logical processor is a logical entity that you map to one or more processor cards and to a group of software features. For each logical processor, you must configure the ports and channels that exist on the processor card. After you define the ports and channels of a logical processor, you can link them to the service that you require for that port or channel.

For information about logical processors, see NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

Multiservice Switch networking software

Nortel Multiservice Switch networking software provides routing capabilities. Multiservice Switch routing systems enable Multiservice Switch nodes to forward packets of information from a source to a destination. Multiservice Switch software supports both connectionless and connection-oriented routing.

The base routing system provides transport resource and topology management. For more information, see Base routing system (page 28), Transport resource manager (page 28), and Topology manager (page 32).

Multiservice Switch software support the following connectionless routing systems:

- Dynamic packet routing system (DPRS) (page 35)
- IP routing system (page 35)

Multiservice Switch software support the following connection-oriented routing systems:

- Path-oriented routing system (PORS) (page 35)
- ATM routing system (page 36)

Base routing system

The base routing system captures and maintains a view of the Nortel Multiservice Switch network topology. The system calculates the best path based on characteristics that exist in all Multiservice Switch nodes in the network.

The base routing system provides transport resource and topology management through the transport resource manager (TRM) and the topology manager.

Transport resource manager

The transport resource manager (TRM) is a subsystem of the base routing system. It is responsible for management and monitoring of link resources (Nortel Multiservice Switch trunks and DPN gateways) on the node. TRM assists in handling link up and link down requests and is the intermediary between the Multiservice Switch trunking and routing systems. It also manages the grouping of links into link groups. TRM resides in the network layer.

IP, DPN gateway, and frame/cell trunk are available only on Multiservice Switch 7400 series devices. Multiservice Switch 15000 and Multiservice Switch 20000 devices do not use these services.

TRM has the following features:

- Common point of access to node's view of connectivity: TRM provides a single location that gives a view of all the neighbor nodes, links, and link groups. TRM also makes link characteristics visible, collects statistics for links, and learns which LNNs are supported on a link.
- TRM provides the base support for topology regions. Topology regions are used to support very large networks by restricting the topology information that is shared within the network. TRM detects when neighbors are in different regions (region boundaries).

- TRM supports the link group concept. TRM builds and maintains the link group tables. Link groups allow cost effective and flexible Multiservice Switch trunking options. Link groups enable multiple links, and therefore increased available bandwidth, between nodes. This function is similar to inverse muxing without extra hardware.

TRM and the network layer

TRM interacts with other components in the network layer and in the switching layer. TRM resides on the control processor of each node and handles information as follows:

- receives information from the link elements of the Nortel Multiservice Switch trunking system located on the function processors

- sends information to the topology manager and DPRS component on the control processor

The figure Multiservice Switch base routing system–transport resource and topology manager (page 30) highlights the interaction of base routing components.

Multiservice Switch base routing system–transport resource and topology manager

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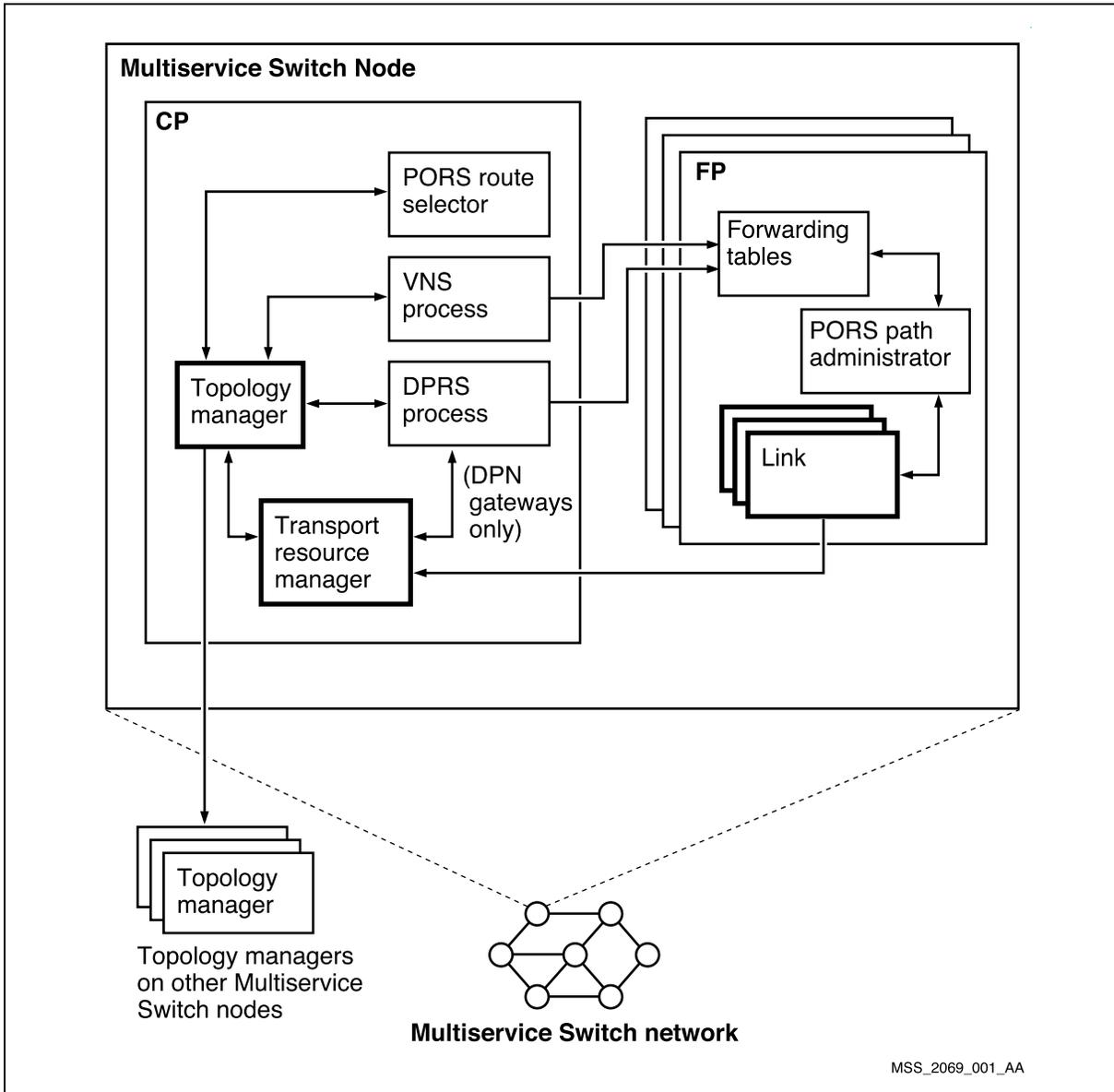
Link information exchange

The node transport resource management (TRM) subsystem communicates with the local Nortel Multiservice Switch trunking system to learn the status (up or down) of all usable links (Multiservice Switch trunk nodes and DPN gateways), their attributes to support various classes of routing (such as speed and delay), and the logical network that they support.

This information is required by two sources:

- the topology manager to learn the link state information, and DPRS to learn of gateways

- routing protocols to compute the metrics advertised for each of the available Multiservice Switch network links

TRM maintains the logical network connectivity between neighbor nodes.

Link group information exchange

The TRM subsystem organizes multiple links to neighbor nodes into link groups. TRM builds and maintains link group tables and link MPID tables. TRM broadcasts these tables to all processors on the shelf for use by the packet forwarding systems.

Link groups are used to carry DPRS traffic. PORS can make use of all the links in a link group to carry traffic. However, it treats each Multiservice Switch trunk individually and does not make use of the link group concept.

There can be up to four links in a link group, and each node can support up to 255 link groups. Link groups, made up of Multiservice Switch trunk nodes or DPN gateways, are included in this total. Links in a link group may have differing characteristics, such as speed and delay, but support the same set of logical networks and maximum transmission unit (maximum packet size).

Preferred links include some or all links in a link group that carry traffic for DPRS. For example, a high delay satellite link in a link group would not be chosen as a delay preferred link if a terrestrial link also exists in that link group. TRM determines throughput and delay preferred links. DPRS packet forwarding uses both throughput preferred links and delay preferred links.

Bandwidth reservation and TRM

TRM also learns of the reserved PORS bandwidth of each link. The PORS bandwidth reserved on each link limits the number of PORS connections that can be established over that link. The total amount of peak or average reserved bandwidth for the connections cannot exceed the link's PORS reserved bandwidth.

DPRS calculates metrics based on the bandwidth available once the PORS reserved bandwidth has been subtracted from total available bandwidth. For more information see NN10600-435 *Nortel Multiservice Switch 7400/15000/ 20000 Operations: Path-Oriented Routing System*.

The link override information is also learned by TRM for DPRS. If a link speed (bandwidth) or delay override is provisioned, the override is selected as the prevailing link bandwidth and or delay.

Topology regions

A topology region is an autonomous group of Multiservice Switch nodes, where the complete topology of all nodes in that portion of the network is known to the topology system. The topology of the rest of the network remains unknown to the node IDs within the topology region.

Provisioning topology regions within a network improves network scaling because nodes only need to know the topology of their own region. Topology regions create greater network autonomy and make it possible to increase the size of networks by allowing nodes to be reused in different topology regions.

TRM provides the infrastructure to support topology regions by detecting neighbors that are part of a different region. The topology manager is not informed of such links.

TRM components

The *TransportResource (Trm)* component resides on all Nortel Multiservice Switch modules and is responsible for managing link resources. This component acts as an intermediary between a link, and all the routing systems that use the links.

For *Trm* component state combination information see the table Transport Resource Manager component state combination (page 32).

Transport Resource Manager component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Enabled, Active	The *TransportResource* component is operational and is communicating with each of the Multiservice Switch trunks and gateways configured in the module. It is able to receive and process requests.

For more information on components, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Topology manager

The topology manager system is an element of the base routing system, along with the transport resource manager system. The topology manager subsystem manages the topological view of Nortel Multiservice Switch nodes in a network.

A Multiservice Switch node needs full knowledge of the network in which it is working. This knowledge encompasses two dimensions: the connectivity of other nodes, and the characteristics of interconnecting links and link groups between all nodes.

The Multiservice Switch topology system has the following characteristics:

- Topology computes efficient paths for connectionless traffic and enables almost instantaneous rerouting when topology changes occur. Topology supports both the delay and throughput RCOS (DPRS delay and throughput).

- Topology distributes link attributes such as cost, delay, and bandwidth utilization to PORS. PORS uses this information to compute paths.

- Topology provides the base support for logical networks. Logical networks provide the capability to logically partition physical networks.

Topology manager and the network layer

Topology manager is located in the network layer. It retrieves information from and distributes information to other elements of the network layer.

The topology manager resides on the control processor of each node and handles information as follows:

- receives information from TRM located on the control processor

- sends information to the routing system components on the control processor and to the other topology managers on other nodes

The figure Multiservice Switch base routing system–transport resource and topology manager (page 30) illustrates the interaction of base routing components.

Local node discovery

The topology manager interworks with TRM to learn local link characteristics and status such as all the link groups connecting to neighbors. TRM also notifies topology of any link state changes such as connectivity, bandwidth and delay. The topology manager updates its database with this local node information.

Neighbor discovery

Nortel Multiservice Switch nodes automatically learn the network topology upon establishing connectivity to the network. When the topology system detects a link to a new neighbor node, it initiates the neighbor staging protocol. This protocol effectively synchronizes the topology databases on both nodes. This process ultimately ensures that up to date topology information is learned immediately and dynamically by new nodes as they join the network.

Network internal topology discovery

On each Nortel Multiservice Switch node, the topology manager is responsible for learning the network topology. It propagates link state information about its own node to topology managers on all other switches within its topology region and maintains its own topological database. Each topology manager learns the complete network topology through this process such that the topology systems on all nodes maintain an identical view of the network. This view includes all Multiservice Switch nodes in the network (or the topology region if they are deployed in the network), and the links (or link groups) between them.

Path computation

The topology manager computes optimal paths through the network for each connectionless routing system using the shortest path first algorithm. The paths are generated by using a distributed link-state routing protocol based on the IP standard OSPF (open shortest path first). The trees contain network path information. The topology manager provides the summary information to the routing manager for DPRS, and acts as a database for PORS.

Topology also provides quick, transparent recovery for all virtual circuits (VCs) or connectionless flows. Topology reacts quickly to network events and computes new paths to make use of new facilities and to avoid failures and congestion.

Supporting logical networks

Topology knows the logical network numbers (LNNs) for the link groups and carries this information to every node in the network.

Topology components

The *Topology (Top)* component is a subcomponent of *Routing (Rtg)* residing on all Nortel Multiservice Switch modules. The *Topology* component maintains a topological database describing the Multiservice Switch network topology in terms of nodes and connectivity between them. It computes the reachability costs to each Multiservice Switch node for the different routing systems taking into account the underlying transport attributes (for example delay, throughput) of interest to them.

For *Topology* component state combination information see the table .

Topology component state combination

Combination (Administrative, Operational, Usage)	Details
Unlocked, Enabled, Active	Topology is exchanging routing protocol data units with Multiservice Switch neighbors. It is capable of mapping additional Multiservice Switch nodes in its topological database.
Unlocked, Enabled, Busy	Topology is operational, but its topological database cannot accept more Multiservice Switch nodes. The number of Multiservice Switch nodes stored in the topology database has reached the maximum network node number (256).

For more information on components, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Dynamic packet routing system (DPRS)

Dynamic packet routing system (DPRS) uses a hierarchical addressing routing protocol and uses topology information to find the best routes to every destination address. Forwarding tables record these routes for use by the packet forwarding function.

For more information about DPRS, see NN10600-425 *Nortel Multiservice Switch 7400/15000/20000 Operations: Dynamic Packet Routing System*.

DPRS supports frame relay services, and the transport of DPN-100 traffic across a Nortel Multiservice Switch backbone network.

IP routing system

Nortel Multiservice Switch networks support the native routing of standard IP traffic with connectionless routing. It supports the following IP routing protocols:

- open shortest path first (OSPF)

- routing information protocol (RIP)

- border gateway protocol version 4(BGP-4) for IP

Multiservice Switch network IP services support the following WAN services: ATM multiprotocol encapsulation service, frame relay DTE, point-to-point protocol, 10BaseT Ethernet, 100BaseT Ethernet, and gigabit Ethernet.

Path-oriented routing system (PORS)

The path-oriented routing system (PORS) provides a connection-oriented routing system that automatically establishes and maintains a connection. PORS supports switched and permanent connections. PORS transports traffic that responds to delay variance such as video, voice, and transparent

traffic across Nortel Multiservice Switch networks. At call setup time, PORS establishes a path and reserves bandwidth, allowing all packets to flow along the same path to the destination. PORS removes the path when it no longer needs the connection.

In conjunction with voice and transparent data services, PORS also utilizes the network clock synchronization, which synchronizes the clocks on both ends of a data path to a single master clock signal.

For more information, see NN10600-435 *Nortel Multiservice Switch 7400/15000/20000 Operations: Path-Oriented Routing System*.

ATM routing system

The ATM routing system is a connection-oriented system. ATM routing provides dynamic runtime connection setup between Nortel Multiservice Switch nodes, allowing them to interwork with other ATM switches. ATM routing provides the addressing, signaling, and routing facilities to support switched virtual connections (SVCs), soft permanent virtual connections (SPVCs), soft permanent virtual paths (SPVPs), and permanent virtual connections (PVCs). These networking capabilities allow you to set up ATM connections in real time.

Multiservice Switch supports both IISP-based static routing and PNNI-based dynamic routing. However, a mix of routing types is not supported.

For more information, see 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*

Trunking software

Nortel Multiservice Switch trunking systems enable Multiservice Switch nodes to connect to other Multiservice Switch nodes and to DPN-100 modules. Multiservice Switch trunking systems include:

Multiservice Switch trunks

Nortel Multiservice Switch node-to-Multiservice Switch node links are called trunks. A Multiservice Switch trunk is a point-to-point or logical connection (ATM virtual channel connection) between two Multiservice Switch nodes over which proprietary routing protocols can run. Multiservice Switch trunks use an ATM transport mechanism.

Multiservice Switch trunks over ATM (previously called ATM logical trunks) encapsulate frame traffic into ATM traffic. The Multiservice Switch trunk over ATM uses one or more ATM VCCs and standard ATM adaptation layer protocols based on ATM adaptation layer type one (AAL1) and ATM adaptation layer type five (AAL5).

For more information, see NN10600-420 *Nortel Multiservice Switch 7400/15000/20000 Operations: Trunking*.

Multiservice Switch 7400 trunks for multi-service access

Some function processors (FPs) for multi-service access (MSA) can be configured to provide SONET or SDH optical trunking through the one or two OC3/STM1 ports on the same FP. For the MSA FPs with two OC3/STM1 ports, only one carries traffic while the other backs it up with automatic protection switching (APS). Whether APS is enabled or not, port protection can also be set up through the dynamic packet routing system (DPRS).

Configuring the ports as trunks is described in NN10600-420 *Nortel Multiservice Switch 7400/15000/20000 Operations: Trunking*. For information on which FPs can be configured for SONET or SDH optical trunking, refer to NN10600-551 *Nortel Multiservice Switch 7400/15000/20000 FP Configuration Reference*.

DPN gateways for Multiservice Switch 7400

Links to other networks are called gateways. Nortel Multiservice Switch-to-DPN trunking (DPN gateway) uses two DPN trunking protocols: universal trunk protocol (UTP), and light-weight trunk protocol (LTP) over frame relay. A DPN gateway can link to an access module (AM), resource module (RM), or an RM configured as a call-server resource module (CSRM). A gateway connection at the AM side is called a network link. A gateway connection at the RM or CSRM side is called a DPN trunk.

Multiservice Switch addressing

This section provides background on addressing. The topics covered are as follows:

Role of addressing

An address uniquely identifies a network element. This identifier may be unique within or outside a network, depending on the addressing plan. The network element may be a Nortel Multiservice Switch node, DPN-100 module, work station, telephone, service port, or other network device.

An important aspect of the addressing function is to identify and resolve any differences between address formats. Routers and servers translate external network addresses to Multiservice Switch system internal addresses. This address resolution allows connections to be established and packets routed.

Addressing features

Nortel Multiservice Switch system has several addressing features.

Compliance to external addressing plans

Multiservice Switch systems support addresses complying to the following standard addressing plans and formats:

- E.164

- X.121

- Internet Protocol (IP)

- Media Access Control (MAC)

- Network Service Access Point (NSAP)

Attention: Data network address (DNA) is a Multiservice Switch system-defined term for an address that identifies a device in a Multiservice Switch network. DNAs conform to X.121 and E.164 numbering systems.

Support of Multiservice Switch internal identifiers

Nortel Multiservice Switch systems use the following internal identifiers, which are used to optimize call establishment and packet routing:

- RID

- MID

- node identifier (nodeId)

- node name

See the figure External addressing plans and Multiservice Switch internal identifiers (page 39) for the addressing plan usage for several network entities.

External addressing plans and Multiservice Switch internal identifiers

DNA
X.121
E.164

FR

Nodeld
and path list
(PORS call
setup only)

DNA
X.121
E.164

IP

IP

PABX

FRUNI

MAC

VR   IPIFR

IP

RID/MID/
MPID
(DPRS)

IP (VR)
Nodeld (VNS)

NSAP (ATM
call setup
only)

External
X.121
E.164
IP
MAC
NSAP

RID/MID
Nodeld
Node name
Network prefix
part of NSAP

**Multiservice Switch
internal**
RID/MID
Nodeld
Node name

ATM

ESI part
of NSAP

AM   MID

DNA
X.121
E.164

ATM end station

MSS 2181 001 AA
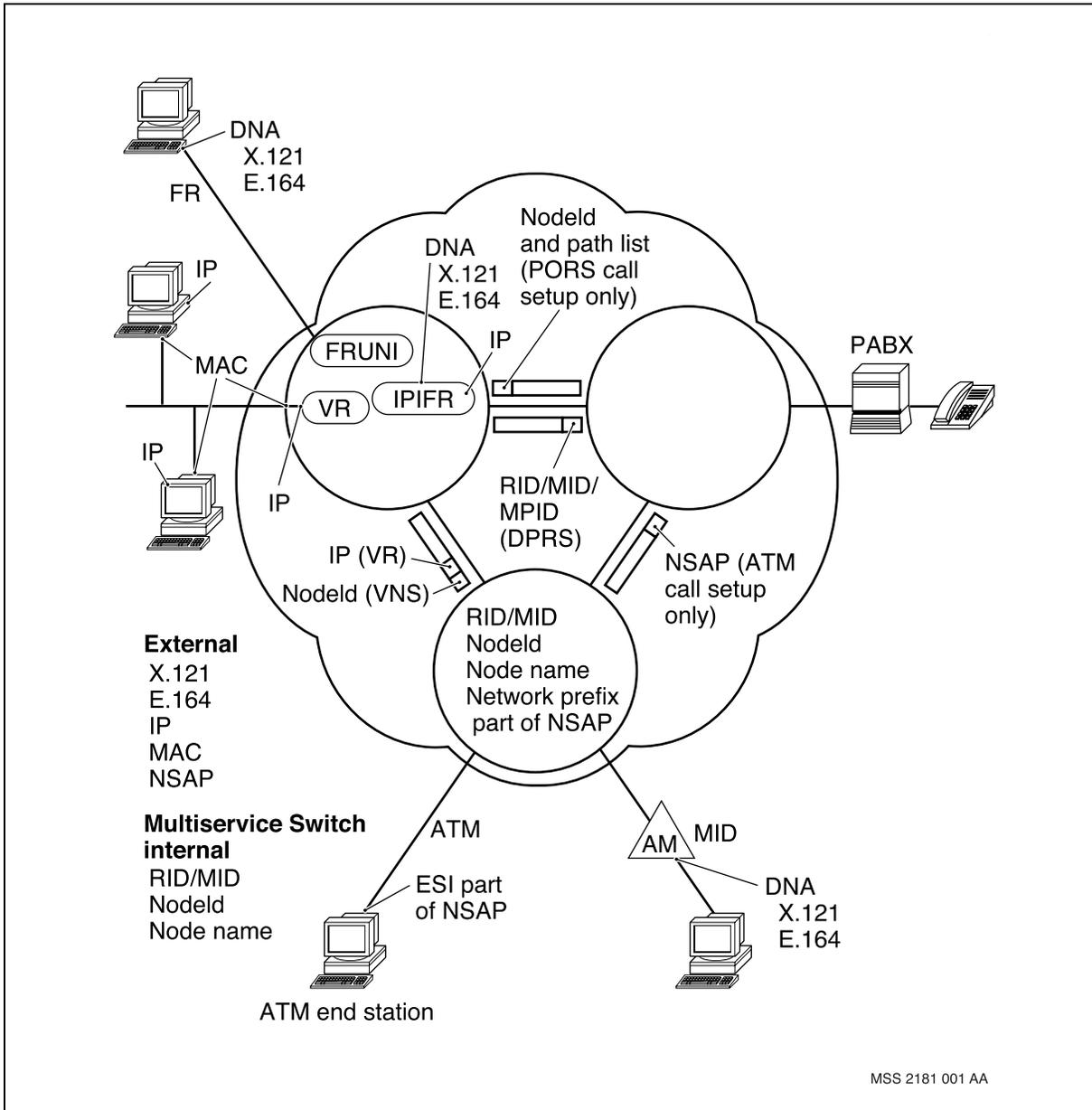
Addressing mechanisms

This section describes the following addressing mechanisms:

-
-

External addressing plan formats

An addressing plan, also known as an addressing scheme or numbering plan, defines a format for identifying an endpoint. Nortel Multiservice Switch systems support the most common external addressing plans recognized by ITU-T and IETF.

Multiservice Switch system services using the Dynamic Packet Routing System (DPRS) can accept the X.121 and E.164 addressing format for both international and national addresses. IP services use IP and MAC addressing formats. PORS services use X.121, E.164, and NSAP addresses. ATM services accept E.164 and NSAP addresses.

Multiservice Switch internal identifiers

Nortel Multiservice Switch systems support external addressing plans by translating them when necessary to proprietary or internal identifiers for Multiservice Switch network use.

Multiservice Switch networks and nodes have several identifiers (see the table Multiservice Switch internal address information (page 40)). The identifiers are provisioned by the network operator. Each identifier is used by the routing system, and in some cases for network management too.

Multiservice Switch internal address information

Level	Name	Length	Example	Use
Network	RID	7 bits	15	DPRS for routing
Node	MID	11 bits	275	DPRS for routing
	nodeId	32 bits	1244	PORS for call setup; and network management
	node name	12 character ASCII string	EM/Toronto	mnemonic for a node. Synonymous with nodeId within a region.
				PORS for call setup; network management.

Attention: Network management is outside the scope of this NTP.

RID/MID

DPRS uses the hierarchical routing identifier/module identifier (RID/MID) addressing system.

NodeId

The node identifier (nodeId) is an internal concept within base routing. NodeIds are stored in the topology database and used by the topology process to select the best routes to each nodeId for the DPRS and PORS routing systems. These routes are placed in the routing system's forwarding tables.

Node name

PORS BTDS, HTDS, and voice service use the node name addressing system for call set up. Node name is synonymous with nodeId and is used to determine nodeId.

Multiservice Switch network management

Use the following sections to learn more about Nortel Multiservice Switch network management.

Navigation

Network management functions

There are five functions of network management. Some network management devices enable you to perform all five functions of network management. Other devices perform a part of these functions.

For information about network management functions, see the following sections:

Fault management

Nortel Multiservice Switch network fault management includes monitoring Multiservice Switch nodes or networks, with a network management device. Multiservice Switch nodes generate alarms to indicate node or network faults. Multiservice Switch systems also provide OSI state information that can help you determine the cause of a fault.

For general information on Multiservice Switch alarms, see Multiservice Switch alarms (page 56). For information on specific alarms, see NN10600-500 *Nortel Multiservice Switch 6400/7400/15000/20000 Alarms Reference*. For information on OSI state information, see NN10600-520 *Nortel Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*.

Multiservice Switch networks also support Trace System (TS). TS is a tool that monitors incoming and outgoing data for a specific frame relay connection. TS copies the data in real time and sends it to a remote receiver. You can configure a trace session to copy distinct types of frames.

For more information about Trace System, see 241-5701-510 *Passport 7400, 15000, 20000 Trace Guide*.

Configuration management

Configuration management services include hardware provisioning and software management. Provisioning modifies Nortel Multiservice Switch components and attributes to add or delete services, or to change the behavior of the node or services. Software management configures and downloads software to nodes to add or upgrade services or features.

Multiservice Switch system configuration management is dynamic, online, and does not require down time for processor cards. Multiservice Switch systems store provisioning data on each node. Each node stores its working configuration, and can also store different configurations. Network management devices can retrieve copies of these configuration files to create backups.

For information on configuring the base system, or managing the software running on your Multiservice Switch nodes, see NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

Accounting management

Nortel Multiservice Switch data collection system collects information about the use of some services. You can use this data for billing customers.

In a redundant CP configuration, two fault-tolerant disks, each containing the same data, store accounting data for frame relay and ATM services. You can schedule time-of-day accounting to allow for modifications (for example, changes in tariff rates).

Multiservice Switch systems also include a call management capability that helps to prevent the loss of accounting records. This capability only applies to frame relay SVCs. The call management system only accepts a new call if there are enough system resources to process the call and its associated accounting records at the moment the call is made.

For more information about accounting, see NN10600-560 *Nortel Multiservice Switch 7400/15000/20000 Accounting*.

Performance management

Nortel Multiservice Switch data collection system collects statistics and real-time statistical data on a node-by-node basis to evaluate system performance. In a redundant CP configuration, two fault-tolerant disks, each containing the same data, store network planning statistics. The real-time statistics are not spooled to disk. They may be viewed in ASCII format through a network management interface system (NMIS) local, Telnet or Ssh session, or retrieved by the Multiservice Data Manager workstation through an NMIS FMIP session.

A network management device can retrieve and analyze these statistics and real-time statistics to determine node or network performance. For more information on performance management, see NN10600-561 *Nortel Multiservice Switch 7400/15000/20000 Data Management*.

Security management

Nortel Multiservice Switch systems provide varying levels of security that include user ID and password protection, command logging, an allowed-IP address list, and session control. For more information on security management, see NN10400-605 *Nortel Multiservice Data Manager Network Security Fundamentals*.

You can configure each Multiservice Switch user ID with allowed interface types: local operator, FMIP, remote, and FTP. The remote allowed interface type applies to both Telnet and secure shell (Ssh). You can provision a list of IP addresses to indicate network management devices from which a Multiservice Switch node accepts a connection.

Note that both secure and non-secure FTP is supported between Multiservice Switch nodes and Multiservice Data Manager workstations. See NN10400-607 *Nortel Multiservice Data Manager Network Security: Secure Communications Configuration* for details.

IPSec for switched Media Gateway call control connections is supported between a Media Gateway switch (MG) with VSP3-o FPs running VoIP and the Media Gateway Controller (MGC) employing the H.248 call control protocol. See NN10600-780 *Nortel Media Gateway 7480/15000 Technology Fundamentals* for details.

Network management devices

You can configure and manage Nortel Multiservice Switch nodes or networks with a variety of network management devices. For more information, see the following sections:

Multiservice Switch systems allow you to connect to a network management device over different types of connections. See .

Local or remote devices

The most direct method for managing Nortel Multiservice Switch nodes is to use a VT100 terminal or a VT100 terminal emulator with a direct connection to the V.24 port on any of the node's control processor cards. This local access provides you with a text interface where you can enter commands and view alarms.

With a local VT100 terminal, you must be in the same location with the node to manage it. Often this is not possible or practical. You can manage your node from a remote site using a Telnet or Ssh application. With Telnet or Ssh, you can log into a node's text interface from a remote workstation. You can enter commands and view alarms as if you were using the local VT100 terminal.

Local, Telnet or Ssh devices enable you to configure a node and to perform fault and security management with operations and maintenance commands.

For more information about commands, see NN10600-450 *Nortel Multiservice Switch 7400: Operations: DPN-100 Interworking*.

Multiservice Data Manager

Nortel Multiservice Data Manager (MDM) provides a general description of a network. Common network management tools and procedures enable you to manage Nortel Multiservice Switch, DPN-100, and SNMP devices. The graphical user interface can be customized so that you can adjust the look and behavior of the system. MDM is scalable and can manage networks that contain a number of network elements and subcomponents in many different locations. MDM delivers the following capabilities:

- allows you to view and manage each Multiservice Switch node or DPN-100 module as one of many integrated elements within the network
- provides standard network views and equivalent alarm and display systems for Multiservice Switch and DPN-100

- provides fault, configuration, accounting, performance, and security management for integrated networks

Telnet, Ssh, FTP, and Multiservice Switch system's proprietary protocol, fast management information protocol (FMIP), transport information to MDM workstations.

For more information about Multiservice Data Manager, see 241-6001-801 *Nortel Multiservice Data Manager Overview*.

SNMP-based network management devices

You can use an SNMP-based management application to manage Nortel Multiservice Switch networks. Multiservice Switch networks support SNMP-based management devices for surveillance and fault management. It also supports both standard and enterprise MIBs.

For more information, see NN10600-300 *Nortel Multiservice Switch 7400/ 15000/20000 Operations: SNMP*.

Network management connections

To manipulate and view nodes you must into the network from a network management workstation. When you log into a Nortel Multiservice Switch node, you are in Multiservice Switch system's text interface where you can view alarms and enter commands.

There are four ways to log into a Multiservice Switch node:

- from the local VT100 terminal or VT100 terminal emulator
- from a Telnet client (on a management workstation or another Multiservice Switch node)
- from a Ssh client (on a management workstation or another Multiservice Switch node)
- from the Command Console in Multiservice Data Manager

When setting up your local VT100 or terminal emulator, make sure it is set to 9600 bit/s, 1 stop bit, no parity. The keyboard shortcut Control-Q may need to be pressed to resume output after connecting the local VT100 terminal or VT100 terminal emulator.

Regardless of how you log in, you must provide valid user information for that node. In some cases, the IP address of the workstation you are using must be on the valid IP address list for the node. For more information, see NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.

For more information on Multiservice Switch node log in, see the following:

Understanding the network management interface system

The network management interface system (NMIS) manages a number of network manager interfaces. Whenever you log into a Nortel Multiservice Switch node, you use a session of a network management interface.

The figure Network management interface components and attributes (page 48) illustrates the components and attributes that represent the network management interface system.

See the following for more information on the NMIS:

Network management interface components and attributes

```
EM
  └── NetworkManagementInterfaceSystem (Nmis)
        ├── Local
        │     maxAllowedSessions
        │     activeSessions
        │     timeoutPeriod
        │     └── Session
        │           userid
        │           dataStreams
        │           screenWidth (width)
        │           idleTime
        ├── Telnet
        │     maxAllowedSessions
        │     activeSessions
        │     └── Session
        │           userid
        │           dataStreams
        │           remoteIpAddr (address)
        │           remoteTcpPort (port)
        │           screenWidth (width)
        │           └── Client
        │                 virtualRouter (vr)
        │                 remoteIpAddr (address)
        │                 remoteTcpPort (port)
        ├── SecureShell (Ssh)
        │     maxAllowedSessions
        │     activeSessions
        │     └── Session
        │           userid
        │           dataStreams
        │           remoteIpAddr (address)
        │           remoteTcpPort (port)
        │           screenWidth (width)
        │           idleTime
        │           role
        │           loginTime
        ├── Fmip
        │     maxAllowedSessions
        │     activeSessions
        │     └── Session
        │           userid
        │           dataStreams
        │           remoteIpAddr (address)
        │           remoteTcpPort (port)
        │           screenWidth (width)
        └── Ftp
              maxAllowedSessions
              activeSessions
              └── Session
                    userid
                    remoteIpAddr (address)
                    remoteTcpPort (port)
```

Note: All attributes are optional

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Network management interfaces
There are five network management interfaces you can use to log into a Nortel Multiservice Switch node:

- local (local operator)

- telnet

- Ssh

- FMIP

- FTP

Each of the interfaces has a corresponding subcomponent which represents the interface. All of the subcomponents have two attributes: *maxAllowedSessions* and *activeSessions*. The *maxAllowedSessions* attribute specifies the maximum number of simultaneous sessions the interface can have. The *activeSessions* attribute specifies the number of simultaneous sessions currently active on the interface.

The *local*, *Telnet* or *Ssh* subcomponents have the attribute *timeoutPeriod*. For more information, see either Idle local operator sessions (page 50) or Idle Telnet sessions (page 52).

Network management interface sessions
When you log into a Nortel Multiservice Switch node through a management interface, the system dynamically creates a *Session* subcomponent to represent your connection. It automatically removes the *Session* subcomponent when you log out of the node.

Each network manager interface has the following basic session attributes:

- *userid*

- *dataStreams*

- *width*

The *userid* attribute identifies the user account that initiated the session. The *dataStreams* attribute identifies which data streams (alarms, SCNs, operator logs, debug information, or rtstats) Multiservice Switch system displays during the operator session. The *width* attribute identifies the maximum width of the operator command responses.

Remote access sessions (Telnet, Ssh, FMIP, and FTP) also include information about the remote connection. The *remoteIpAddress* attribute reports the IP address of the remote device, and the *remoteTcpPort* attribute reports the TCP port number on the remote device used for the session.

Log in from a local operator terminal

For information on how to log into a Nortel Multiservice Switch node from a local operator terminal, see NN10600-270 *Nortel Multiservice Switch 7400/15000/20000 Software Installation*.

Idle local operator sessions

The local *timeoutPeriod* attribute is disabled by default, meaning local sessions can remain idle indefinitely. This state of inactivity uses up system resources needlessly as well as offers a security risk since unauthorized access is a possibility. All terminations due to inactivity are logged and an override capability is available. For more information about timeoutProtocol, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Telnet access to a node

When you log into a Nortel Multiservice Switch node from a management workstation using Telnet, the Multiservice Switch system acts as a Telnet server. The Telnet server accepts up to 12 incoming Telnet connections for CP2 and up to 16 incoming sessions for CP3.

Attention: CP1 is not supported.

Multiservice Switch nodes can also act as Telnet clients, making outgoing Telnet connections to Telnet servers. Since Multiservice Switch systems can behave as both Telnet clients and servers, you can use the Telnet Vr or Telnet Rtr command on one node to connect to another node. You can also use the Telnet Vr or Telnet Rtr command to connect to any device supporting standard Telnet access. Multiservice Switch nodes or devices must be accessible through a management or customer virtual router or router.

The figure illustrates how you can use the Telnet command to connect Multiservice Switch nodes. First you Telnet to Multiservice Switch 1 from a management workstation using a Telnet client application. After you log into the Telnet server on Multiservice Switch 1, use the Telnet Vr or Telnet Rtr command to establish a Telnet connection to Multiservice Switch 2. You are now using the Telnet client on Multiservice Switch 1 to connect to the Telnet server on Multiservice Switch 2.

Using Telnet to connect Multiservice Switch nodes

Telnet
client

Management
workstation

Telnet
server

Multiservice Switch 2

Telnet
server

Telnet
client

Multiservice Switch 1

━━━ Telnet connection
─── IP connection

MSS 3097 001 AA
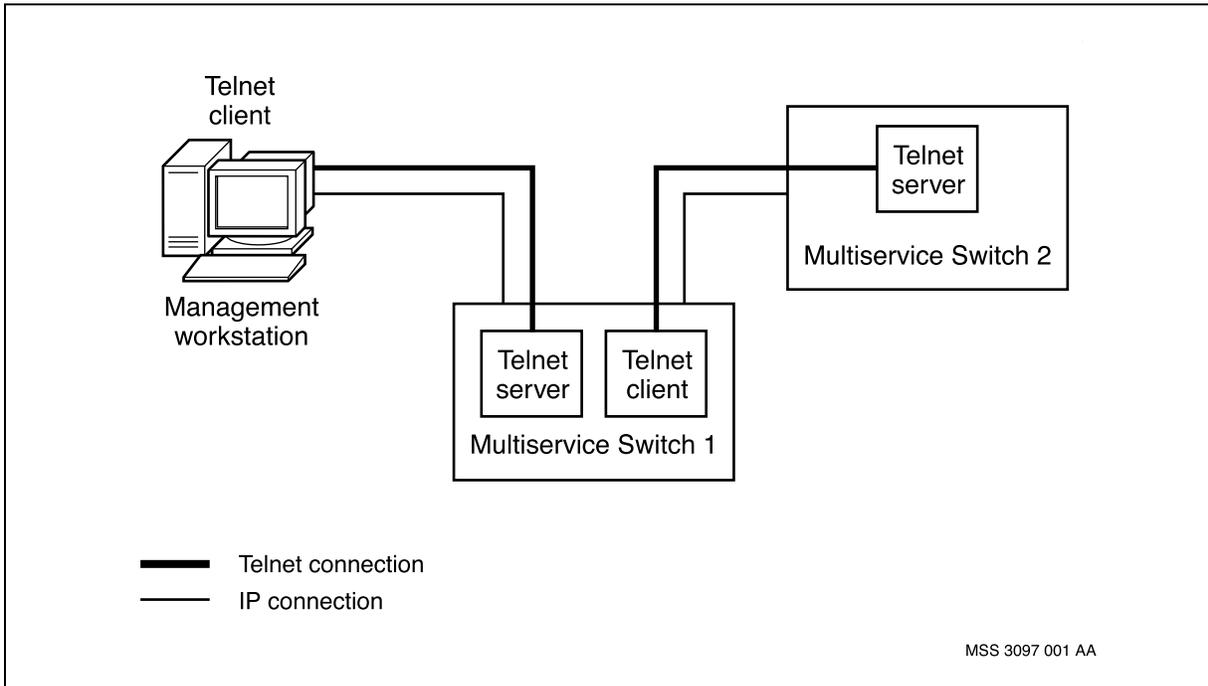
Telnet client and server sessions
Nortel Multiservice Switch systems can act as both Telnet clients and servers. It acts as a server when you use a Telnet application to log into a node. Up to 12 different users can simultaneously log into a Multiservice Switch node that is equipped with CP2. Up to 16 different users can simultaneously log into a Multiservice Switch node that is equipped with CP3.

Attention: CP1 is not supported.

Multiservice Switch nodes act as Telnet clients when you use the Telnet Vr or Telnet Rtr command to establish a connection from one node to another node, or from a Multiservice Switch node to any other device supporting standard Telnet access.

An instance of a *Session* component represents a single Telnet server connection. After you have a Telnet server connection, you can use the Telnet Vr or Telnet Rtr command to establish a client connection. A *Client* component represents this outgoing connection. The attributes of the *Client* component report the IP address and TCP of the remote device, as well as the virtual router or router used to access the remote device.

For more information on Telnet commands, see NN10600-050 *Nortel Multiservice Switch 7400/15000/20000 Command Reference*.

Idle Telnet sessions

Nortel Multiservice Switch nodes allow up to 12 Telnet sessions to be simultaneously active when equipped with CP2, and up to 16 sessions when equipped with CP3. Sessions that are idle continue to use system resources. As a result, the timeoutPeriod attribute is introduced to allow users with *systemAdministration* access to determine how long telnet sessions can remain idle before they are terminated. This attribute is disabled by default, however, it can be provisioned to be anywhere between 5 and 120 minutes. By provisioning a value for this attribute, idle sessions will be terminated after a certain length of time so that new sessions can be initiated. Additionally, when sessions are idle there is a possibility for unauthorized access. This risk is reduced with the introduction of the *timeoutPeriod* attribute.

The *timeoutPeriod* is applicable to all sessions that are created after this attribute is set. The setting of the *timeoutPeriod* is limited to users with a command impact of *systemAdministration*. If the value of the *timeoutPeriod* is changed, only new sessions created after the activation will be affected.

Each session has a unique *idleTime* value indicating the amount of time the session has been idle, even if the *timeoutPeriod* is disabled. If the *timeoutPeriod* is provisioned, a warning will automatically be issued when an idle session is within one minute of its *timeoutPeriod*.

Attention: The *idleTime* attribute begins counting idle time after the user has received a final response and has not entered any new commands. It only applies to Telnet sessions in server mode. Sessions that make use of Telnet client, as well as sessions that run in startup mode, are exempt from inactivity tracking.

All terminations due to inactivity are logged and an override capability is available. The override capability allows users with a command impact of *systemAdministration* to disable the *timeoutProtocol* for specific user IDs. Those user IDs for which the *timeoutProtocol* has been disabled are exempt from inactivity tracking. The *timeoutProtocol* is enabled by default; therefore, when a *timeoutPeriod* has been configured, it applies to all Telnet sessions.

Connecting to a device using Telnet

To connect to Nortel Multiservice Switch node via Telnet when working from a remote location, ensure:

- the node has a properly configured virtual router or router.

- your user ID is allowed outgoing Telnet access. For information on allowing outgoing telnet access, see NN10400-605 *Nortel Multiservice Data Manager Network Security Fundamentals*.

- the IP address of the device you are connecting to is accessible through a management or customer virtual router or router on the node. The IP address is within the address space of the specified virtual router or router.

- you have a user ID and password for the remote device.

- if you are connecting to another Multiservice Switch node and that node has IP address checking enabled, the IP address of your node is on the valid IP address list.

Use the following commands:

```
telnet -ipAddress(<remoteAddress>) Vr/
<virtualRouter_instance>

telnet -ipAddress(<remoteAddress>) Rtr/
<Router_instance>

telnet -ipAddress(<remoteAddress>) Rtr/
<Router_instance> Vrf/<VpnRouteForwarder_instance>
```

If you are connected to another Multiservice Switch node, the connection is transparent. Command responses and alarms appear on screen as if you had directly connected to the node from a management workstation. If you are uncertain which Multiservice Switch node you are connected to, use the me command.

Secure shell (Ssh) access to a node

Secure shell (Ssh) is an alternative to telnet which sets up a secure CLI (Command Line Interface) connection to Multiservice Switches so that confidential information and security keys can be exchanged without compromise to the system.

The figure Using Ssh to connect Multiservice Switch nodes (page 54) illustrates how you can use Ssh to connect Multiservice Switch nodes. Ssh operates over TCP and provides a secure connection. In its simplest mode of operation, an Ssh client connects to a Ssh server, then negotiates a symmetric shared secret session key using Diffie Hellman. This session key is used to encrypt the users session. At this point, standard user authentication is used, and a user name and password are passed over the encrypted session. If authenticated, the server starts a command shell over the encrypted session.

Using Ssh to connect Multiservice Switch nodes

Client

Ssh   #$^%^&$**$$%^**(#%&#%&$&$

Internet

Server
MSS 15000

MSS 4002 100 AA
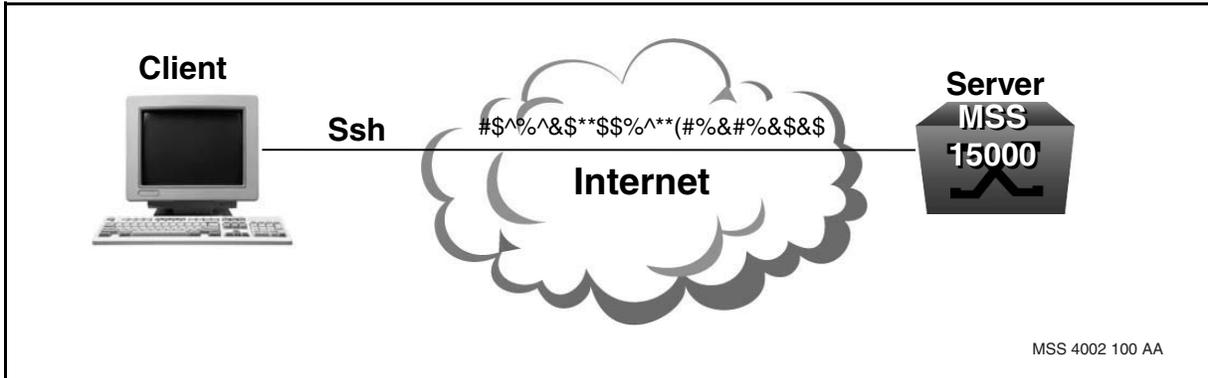
> **Attention:** Ssh is only supported on Nortel Multiservice Switch 15000 and 20000.

Connecting to a device using secure shell (Ssh)

To connect to Nortel Multiservice Switch node via secure shell when working from a remote location, ensure:

- the node has a properly configured virtual router or router.

- your user ID is allowed remote access.

- the IP address of the device you are connecting to is accessible through a management or customer virtual router or router on the node. The IP address is within the address space of the specified virtual router or router.

- if you are connecting to another Multiservice Switch node and that node has IP address checking enabled, the IP address of your node is on the valid IP address list.

For configuration information regarding the secure shell (Ssh) client, see the section Configuring secure shell (Ssh) at NN10600-601 *Nortel Multiservice Switch 7400/15000/20000 Security Management*.

The command to establish a connection with a Multiservice Switch secure shell daemon server (Sshd) from a secure shell (Ssh) client differs depending on the Ssh client. The following is an example from a Solaris 9 SSSH client.

Use the following commands:

```
ssh 47.138.179.41
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@    WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED! @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
It is also possible that the DSA host key has just been
changed.
```

```
The fingerprint for the DSA key sent by the remote host
is f7:f9:07:9f:e1:0b:94:92:82:14:50:ef:ff:35:0d:e0.
Please contact your system administrator.
Add correct host key in /home/<userid>/.ssh/known_hosts
to get rid of this message.
Offending key in /home/<userid>/.ssh/known_hosts:1
Password authentication is disabled to avoid man-in-the-
middle attacks.
X11 forwarding is disabled to avoid man-in-the-middle
attacks.
WARNING! This computer system and network is PRIVATE and
PROPRIETARY and may only be accessed by authorized users.
Unauthorized use of this computer system or network is
strictly prohibited and may be subject to criminal
prosecution, employee discipline up to and including
discharge, or the termination of vendor/service
contracts. The owner, or its agents, may monitor any
activity or communication on the computer system or
network, you are consenting to such monitoring and
information retrieval for law enforcement and other
purposes. Users should have no expectation of privacy as
to any communication or information stored within the
computer system or network, including information
stored locally or remotely on a hard drive or other media
in use with this computer system or network.
Enter login:
```

The host identification warning above is shown the first time you connect to the Multiservice Switch or if the Multiservice Switch changed its host keys since you last connected.

Multiservice Data Manager connections

You can connect a Nortel Multiservice Switch node to Multiservice Data Manager workstation in one of the following ways:

- connect the node to the workstation through a Multiservice Switch node-only network

- connect the node directly to the workstation

- connect the node to the workstation through IP networking services

- for Multiservice Switch 7400 nodes only, connect the node to the workstation through a DPN network

Multiservice Switch StartUp utility enables you to initially connect a Multiservice Switch node to a network management device through any of these connections.

For more information about StartUp, see NN10600-271 *Nortel Multiservice Switch 7400/15000/20000 Network Management Connectivity*.

Multiservice Switch alarms

Nortel Multiservice Switch provides a method for components in the system to asynchronously signal events or alarms to an external management device (for example, a VT100 terminal or a network management workstation).

Multiservice Switch alarms are based on an event-driven system (that is, alarms are generated when certain events occur).

Common alarm situations include the following:

- a failure or fault occurs (this is a set alarm)

- a fault or failure condition has been fixed (this is a clear alarm)

- cases where conditions are transient or cannot be repaired (a message alarm may appear to inform you of the condition).

Alarm strategy

Nortel Multiservice Switch alarms are designed to minimize the occurrence of multiple alarm generation in the event of a failure or error condition. In general, only the component that fails or detects the failure generates the alarm, thus preventing the generation of an entire chain of alarms from components associated with the failed component.

Attention: There are some cases when a fault or failure results in the generation of more than one alarm.

Using state change notifications, the component that fails notifies other components above and below it on the component hierarchy to indicate that it is no longer in service. The related components do not generate an alarm because they have been notified of the change of state.

When the component is back in service, it clears its previous alarm and notifies its subcomponents (as well as other components that may be dependent on it) of its new state.

Alarms and customer identifiers

All Nortel Multiservice Switch alarms contain a customer identifier (CID). The CID does not appear on the interface, but is essential in determining which alarms are displayed to which users. Alarms are displayed based on the CID of the user Id.

What causes alarms

Generally speaking, alarms occur in the following situations:

- degradation/quality of service conditions (for example, the onset of severe congestion)

- processing errors (for example, protocol errors)

- engineering alarms (for example, insufficient memory for a required component)

- out-of-service conditions (for example, hardware failures such as a functional processor or power supply failure)

- software errors (that is, an unexpected condition has been detected in software)

- administrative conditions (such as using the lock command to temporarily lock a component)

- security violations (for example, successive invalid logon attempts)

How are alarms cleared?

Clearing an alarm may involve taking one of several actions, or in some cases, no action at all. It may require that you act immediately to a condition in the network, call for help, change a piece of hardware or simply wait until the condition has cleared itself.

Attention: You can report an alarm to Nortel by opening a customer service request (CSR).

The following list describes some general methods for clearing alarms:

- replacing hardware (for example, a control processor)

- taking no action—in some cases such as threshold alarms, no action may be required on the part of the user—the alarm clears itself if conditions return to normal

Attention: Alarms can also be cleared using the Integrated Alarm Display. However, it clears only the alarm logs in Multiservice Data Manager and not those at the node.

Attention: These are only general remedial actions. For specifics on clearing individual alarms, refer to NN10600-500 *Nortel Multiservice Switch 6400/7400/15000/20000 Alarms Reference*.

What are state change notifications?

State change notifications (SCN) are intended primarily for use by network management systems for determining the impact of a certain failure.

When the OSI operational state or the OSI procedural status of a particular component changes, the system automatically generates an SCN. This information is used to update the network model.

For more information on OSI operational state and OSI procedural status, refer to Operational state (page 64) and Procedural status (page 67),.

How to interpret alarm information

Depending on your requirements, you may want to interpret an alarm as it appears on the text interface, in Nortel Multiservice Data Manager, or as it is documented in NN10600-500 *Nortel Multiservice Switch 6400/7400/15000/ 20000 Alarms Reference*.

For information on interpreting alarms as they appear on your text interface device, refer to Chapter Interpreting alarms (page 58).

SONET/SDH alarm handling on Nortel Multiservice Switch 7400 nodes has been improved to follow the hierarchical near end failure model such that it is now consistent with Multiservice Switch 15000 nodes and other transport equipment. In the case of an LOS for example, all the lower precedent alarms (LOF, AIS, RFI, UnusableTxClkRef) will not be raised.

Interpreting alarms

This section will help you interpret Nortel Multiservice Switch alarms as they appear on a text interface device (that is, an ASCII-based terminal such as a VT100 or a Telnet or Ssh session). Included is an example to help you understand the fields and terms discussed in the chapter.

Attention: The format and contents of the user interface are subject to change over time.

Alarm screens

The sample screens and paragraphs in this section will familiarize you with the appearance of Multiservice Switch alarms as they appear on a text interface device and the Alarm Display (AD) tool.

The section Alarm fields (page 60) provides a description of the fields that appear in the alarm formats shown below.

Alarm format on a text interface device

The figure Alarm format on a text interface device (page 59) shows the alarm format used on a text interface device.

Alarm format on a text interface device

```
      <Component name>; <date> <time>
<status> <severity>  <type>  <cause>                <alarm index>
      ADMIN: <admin>   OPER: <oper>   USAGE: <usage>
      AVAIL: <avail>   PROC: <proc>   CNTRL: <control>
      ALARM: <alarms>  STBY <stdby>   UNKNW: <unknown>
      Id: <notifId>  Rel: [<relatedComp1>; <relatedComp2>; ...]
      [Com: <commentData>]
      [Op:  <operatorData>]
      Int: <process id>; <filename>; <linenumber>; <version>
           [<internalData>]
```

PPT 0001 001 AA

Alarm format on the Alarm Display

The figure shows the Multiservice Switch alarm format used on the Nortel Multiservice Data Manager Alarm Display (AD) tool.

Alarm format using the Alarm Display tool

```
    <severity> <status> <NTP index> <date> <time> <component name>
    ID: <notifId> TYPE: <type> CAUSE: <cause>
    [CO: <commentData>]
    [OP: <operatorData>]
    [EX: <internalData>]
    RAW: <raw> ADMIN: <admin> OPER: <oper> USAGE: <usage>
                     AVAIL: <avail> PROC:<proc>  CNTRL: <control>
                     ALARM: <alarm> STBY:<stdby> UNKNW: <unknown>
    [REL COMP: <Related Component name>] <--one line per
            related component
    INT: <process id>; <filename>; <line number>; <version>
```

PPT 0002 001 AA

The possible values for the RAW state are:

- insv (in service)

- oos (out of service)

- trb (troubled)

- unk (unknown)

- nex (non-existent)

Example of an alarm on a text interface device

The figure Alarm on a text interface device (page 60) shows an example of an alarm as it would appear on a text interface device.

Alarm on a text interface device

```
        Shelf Card/1; 1993-05-11 18:30:08.99
   CLR   warning   equipment   processorProblem          11010001
        ADMIN: unlocked     OPER: disabled     USAGE: idle
        AVAIL: dependency   PROC: initializing CNTRL: SubjectToTest
        ALARM: alrmOutstdng STBY: coldst       UNKNW: false
        Id:    03        Rel: Shelf Card/13
        Com:   This is a hypothetical alarm.
        Op:    596F7572206E616D65206973206D7564
        Int:   1/9/215; dcsTESTApRecord.cc;255; user1.23.7



                                                        PPT 0003 001 AA
```

Example of an alarm on the Alarm Display

The figure Alarm on the Alarm Display tool (page 60) shows an example of an alarm as it would appear on the Alarm Display (AD) for Multiservice Switch.

Alarm on the Alarm Display tool

```
   WARNING   SET 70116501 1995-11-23 20:39:52 EM/NODEY2C5 LP/2 X21/1
   ID: 02000001   TYPE: processing        CAUSE: configurationError
   CO: Termination switch setting does not match provisioned.
       Check switch setting or provisioned data
       (lineTerminationRequired).
   RAW: oos    ADMIN:unlocked      OPER:disabled         USAGE:idle
              AVAIL:            PROC:             CNTRL:
              ALARM:            STBY: notSet      UNKNW:
   INT: 2/0/3/32550;PmsHwProcessHandler_Actor.cc;598;;



                                                        PPT 0004 001 AA
```

Alarm fields

Alarm fields are described below in table format to assist you in interpreting alarms. The fields are listed in the order they appear on the text interface. The third column of the table Alarm fields of the text interface (page 61) gives an example of each field taken from the figure Alarm on a text interface device (page 60). Column 4 states whether the field is mandatory or optional.

A mandatory field must be present in the display, while optional fields may not be present.

Some fields are for internal use only and are noted as such in the description column of the table Alarm fields of the text interface (page 61).

Where necessary, subsections following the table describe fields in further detail (for example, the Alarm index field).

Alarm fields of the text interface

Field	Description	Example from **Alarm on a text interface device (page 60)**	M/O
component name	The full name of the component needing repair, or detecting the fault. The component name can be used for hierarchically clearing alarms for its subcomponents (since the subcomponent name is derived from the component name).	Shelf Card/1	M
date and time	The date and time the alarm was issued.	1993-05-11 18:30:08.99	M
status	Indicates the status of an alarm. The possible values for this field include message (MSG), set (SET) or clear (CLR).	CLR	M
severity	Indicates the severity of the alarm. The value will be one of, critical, major, minor, warning, indeterminate, cleared. For further details, refer to ITU-T Recommendation X.733.	warning	M
type	This is a general explanation of why the alarm was generated. Possible values for this field include communications, quality of service, processing, equipment, environmental, security, operator, debug, or unknown. For further details, refer to Type (page 63).	equipment	M
cause	This provides another level of detail of why the alarm was generated. It is information given in addition to the general explanation given in the Type field. For further details, refer to NN10600-500 *Nortel Multiservice Switch 6400/7400/15000/ 20000 Alarms Reference*.	processorProblem	M
(1 of 3)			

Alarm fields of the text interface (continued)

Field	Description	Example from Alarm on a text interface device (page 60)	M/O
Alarm index	An eight-digit number which is the principal alarm identifier. It consists of an IndexGroup and SubIndex. For further details see Alarm index (page 64).	11010001	M
ADMIN, OPER, USAGE	These fields describe the possible OSI states, that is, the administrative state, operational state, and usage state of the component. For information on OSI states, refer to OSI states (page 64). For component-specific OSI state combinations, refer to the appropriate Appendix in NN10600-520 *Nortel Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*. Some of this information is also included in the user guides for the various services.	unlocked/disabled/idle	M
AVAIL, PROC, CNTRL, ALARM, STBY, UNKNW	These fields describe OSI status. Included in this group are availability status, procedural status, control status, alarm status, standby status, and unknown status. For information on OSI status, refer to OSI status (page 66).	dependency/initializing/ subjectToTest/ alrmOutstdng/coldSt/ false	M
Id	The system automatically inserts the notification Identifier. Notification identifiers are unique within each Multiservice Switch system.	03	M
Rel	A list of known related components. Usually it is only the supporting hardware name that the affected component resides on. For example the LP and possibly the card number. This field may appear as blank if there are no related components.	Shelf Card/13	O
Com	Comment data is additional data in ASCII format. It provides the operator with extra information in the form of a comment.The text appearing in this field is self-explanatory.	This is a hypothetical alarm.	O
(2 of 3)			

Alarm fields of the text interface (continued)

Field	Description	Example from **Alarm on a text interface device (page 60)**	M/O
Op	Operator data is hex-format data that an operator can use for additional information. If operator data exists, it is explained in the "details" section of the individual alarms in NN10600-550 *Nortel Multiservice Switch 7400/15000/20000 Common Configuration Procedures*.	596F7572206E616...	O
Int	Internal data is additional information in Hex-format that can be used by internal support personnel. Contained within this field are the processId (Pid), filename, linenumber and version.	1/9/215; dcsTESTApRecord.cc; 255; user1.23.7	O
processId	Used internally	1/9/215	O
filename	Used internally	dcsTESTApRecord.cc	O
linenumber	Used internally	255	O
version	Used internally	user1.23.7	O
(3 of 3)			

Type
The following explains the values that can appear in the Type field:

- communications alarm indicates a problem related to communication (for example, protocol errors)

- qualityOfService alarm indicates a problem related to quality of service (for example, crossing thresholds)

- processing alarm indicates a problem related to processing data (for example, a memory problem)

- equipment alarm indicates a problem with the physical equipment (for example, a processor failure)

- environmental alarm indicates a problem related to the enclosure in which the equipment resides (for example, flood detected)

- security alarm indicates a problem related to security (for example, an unauthorized access)

- operator alarm indicates that some event was caused by operator action (for example, locking a component)

- debug alarm indicates that the event was for debugging purposes

- unknown alarm indicates that reason for the event is not known

Alarm index

The Alarm index consists of eight BCD digits. The first four digits are collectively known as the IndexGroup and the remaining four digits are known as the SubIndex.

The IndexGroup is a four-digit number representing logical groupings of alarms. For example, it may represent:

- an application service

- an internal subsystem

- a component type

- a component class

- a software module

- a similarity of event

The SubIndex is a four-digit number that has significance only within the IndexGroup.

OSI states

Nortel Multiservice Switch systems component state definitions follow the OSI standards. OSI states mays be exhibited by any application. Components that do not provide any behavior do not require any component state variables defined.

Further details are found in ITU-T Recommendation X.731, Information technology - Open Systems Interconnection - Systems Management - Part 2: State management function.

A component has three high-level state variables: an operational state, a usage state, and an administrative state. These states are the primary factors affecting the management state of a component.

Operational state

The operational state of a component indicates whether the resource is physically installed and operational.

Not all types of components exhibit all possible states. For example, a component that has no visible dependencies on other components may not show the disabled operational state.

You cannot cause a component to change from one state to another. You can, however, gather information about the operational state of a component by using the appropriate operator command. Specific events associated with a component can cause specific transitions from one operational state value to another.

The two possible values for this attribute are:

- enabled—the component is partially or fully operable and available for use

- disabled—the resource is totally inoperable and unable to provide service

Usage state

The usage state of a component indicates whether the resource is actively in use at a specific time, and if so, whether it has spare capacity for additional users.

The usage state can have one of the following values:

- idle—the component is not currently in use

- active—the component is in use, and has sufficient spare capacity to provide for additional users simultaneously

- busy—the component is in use, but it has no spare operating capacity to provide for additional users at this instant. This is also used for components that have only one user. A component that has only one user typically exhibits an idle or busy state value.

Attention: Not all usage state values are applicable to every component.

Administrative state

Administration specifies the permission to use or prohibition against using the resource. These permissions are imposed typically through the System Administrator.

The administration state can have one of the following values:

- locked—indicates that the component is administratively prohibited from performing services for its users

- shutting down—use of the resource (or component is administratively permitted to existing instances only. While the system remains in the shutting down state, the manager may at any time cause the object to revert to the unlocked state. This simply provides a state when shutting down a component (or service)—existing users of the component may still be serviced, but any new users are denied the resource that the component provides.

- unlocked—the component is permitted to perform services for its users

---

Attention: The administration of a component operates independently of its operability.

Attention: Some classes of components may exhibit only a subset of the possible administrative state values.

OSI status

In addition to the three state attributes, six status attributes also exist within OSI. The primary function of these attributes is to provide additional information about a component's operability and usage. These attributes are:

- alarm status
- procedural status
- availability status
- control status
- standby status
- unknown status

Alarm status

Nortel Multiservice Switch systems implement this attribute as a read-only set-valued attribute. Possible values for the alarms status attribute are:

- empty set—the attribute value appears as empty.
- under repair—the resource is being repaired. The operational state can be either enabled or disabled.
- critical—one or more critical alarms indicating a fault or failure have been detected and have not been cleared. The operational state can be either enabled or disabled.
- major—one or more major alarms indicating a fault have been detected and have not been cleared. These faults can be disabling.
- minor—one or more minor alarms indicating a fault, have been detected and have not been cleared. These faults can be disabling.
- alarm outstanding—one or more alarms have been detected and have not been cleared. The condition may or may not be disabling. If the operational state is enabled, additional component-specific attributes may indicate the nature and cause of the condition.

Procedural status

Nortel Multiservice Switch systems implement this attribute as a read-only set-valued attribute. Possible values for the alarms status attribute are:

- empty set—the attribute value appears as empty.

- initialization required—the resource requires initialization before it can perform normal function and this has not been initiated. The operator will initiate it. The operational state is disabled.

- not initialized—the resource requires initialization before it can perform normal functions and this has not been initiated. The resource will initialize itself autonomously. The operational state is either disabled or enabled.

- reporting—the resource has completed some operation and is notifying the results (for example, a test process) The operational state is enabled.

- terminating—the resource is in termination phase. If the resource does not initialize itself autonomously, the operational state is disabled; otherwise, it can be either disabled or enabled.

Availability status

Nortel Multiservice Switch systems implement this attribute as a read-only set-valued attribute. The two most common values are failed and dependency, both of which only apply when the operational state is Disabled. Possible values for availability status are:

- empty set—the attribute value appears as empty.

- in test—the resource is undergoing a test procedure. If the administrative state is locked or shutting down, normal users are precluded from using it and the control status is set to reserved for test.

- failed—the resource has an internal fault that prevents it from operating. The operational state is disabled.

- power off—the resource requires power.

- off line—the resource requires a routine operation to be performed to place it on-line and make it available. The operational state is disabled.

- off duty—the resource has been made inactive by an internal control process in accordance with a time schedule. Under normal conditions, It should come back into operation through the same mechanism. The operational state can be either enabled or disabled.

- dependency—the resource cannot operate because some other resource on which it depends is unavailable. The operational state is disabled.

- degraded—the service available from the resource is degraded in some respect such as speed or operating capacity. However, the service remains available for service. The operational state is enabled.

- not installed—the resource is not present or is incomplete.

- log full—indicates a log full condition as specified by ITU-T Recommendation X.735. Multiservice Switch components do not use this attribute.

Control status

Nortel Multiservice Switch systems implement this attribute as a read-only, set-valued attribute. The control status may have the following values:

- empty set—the attribute value appears as empty.

- subject to test—the resource is available to normal users but tests may be conducted simultaneously, causing it to possibly exhibit unusual behavior to users.

- part of services locked—a manager has restricted a particular part of the service from users. The administrative state is unlocked (for example, incoming service barred).

- reserved for test—the resource is administratively unavailable because it is undergoing a test procedure. The administrative state is locked.

- suspended—service is administratively suspended to users.

Standby status

Nortel Multiservice Switch systems implement this attribute as a read-only, single-valued attribute. The standby status may have one of the following values:

- empty—this is a non-standard value which is used to indicate that the component does not use the attribute or none of the other values apply.

- hot standby—not providing service but operating in sync mode to take over immediately status.

- cold standby—not providing service and not synchronized. It requires some initialization activity.

- providing service—the backup resource is providing service.

Unknown status

This attribute is used to indicate that the state of the resource represented by the managed object is unknown. When the unknown status attribute value is true, the value of the state attributes may not reflect the actual state of the resource.

Summary of Multiservice Switch OSI state and status attributes
The following table provides a summary of Nortel Multiservice Switch system state and status attributes.

OSI states and status attributes

Attribute	Values
Operational state	enabled, disabled
Usage state	idle, active, busy
Administrative state	unlocked, locked, shutting down
Alarm status	empty, under repair, critical, major, minor, alarm, outstanding
Procedural status	empty, initialization required, not initialized, initializing, reporting, terminating
Availability status	empty, in text, failed, power off, off line, off duty, dependency, degraded, not installed, log full
Control status	empty, subject to test, part of services locked, reserved for test, suspended.
Standby status	not set, hot standby, cold standby, providing service
Unknown status	true or false

Multiservice Switch provisioning system

Use the following sections to learn more about Nortel Multiservice Switch provisioning system.

Navigation

Multiservice Switch text interface

Nortel Multiservice Switch text interface allows you to enter commands to configure the node, control the state of system, and perform diagnostic tests. The text interface has two modes: provisioning and operational. In provisioning mode, you enter commands to configure the node. In operational mode, you enter commands to control the state of the system and to perform diagnostic tests. In both modes, you can view alarms, which indicate faults.

The following sections describe the characteristics of the text interface:

Operational mode

When you initially log into a Nortel Multiservice Switch node, you are in operational mode. Multiservice Switch systems use the following command prompt when you are in operational mode:

```
#>
```

where:
is a sequential number assigned to commands

In operational mode, you work with operational components and attributes. In operational mode, you can

- list operational components and display operational attributes to determine the current operating parameters for the node

- control the state of parts of the node by locking and unlocking components

- set certain operational attributes and enter commands to perform diagnostic tests

For information on provisionable attributes, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Provisioning mode

To change from operational mode to provisioning mode, use the start Prov command. Only one user can be in provisioning mode at a time. Nortel Multiservice Switch systems use the following command prompt whenever you are in provisioning mode:

```
PROV #>
```

where:
is the current command number

In provisioning mode, you work with the provisionable components and attributes which contain the current and future configuration of the node. You can add and delete components, as well as display and set provisionable attributes. You can also verify your changes and then activate them as the new node configuration. You end provisioning mode and return to operational mode using the end Prov command.

For information on provisionable attributes, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Provisioning views

Nortel Multiservice Switch provisioning system lets you safely modify the configuration of your node. All the data that makes up a Multiservice Switch node's configuration is called a view. Using the provisioning system, you can load views, save views, modify views, and activate a view as the current node configuration. The figure Provisioning system components and attributes (page 73) illustrates the components and attributes that represent the provisioning system.

Multiservice Switch system has four types of views:

- current view

- edit view

- committed view

- saved view

The current view is the configuration that is currently running on your node. The edit view is the view that you are currently modifying using the provisioning system and that can potentially become the next current view. A saved view is the view that was saved on the file system. The committed view is the view Multiservice Switch systems use when the node restarts.

The current and edit views are stored in memory. The saved and committed views are stored on the file system. The figure Location of Multiservice Switch views (page 74) illustrates this relationship.

For more information on the provisioning system, see the following sections:

- Current view (page 74)
- Edit view (page 75)
- Committed view (page 76)
- Saved view (page 77)

Provisioning system components and attributes

```
EM
  └── ProvisioningSystem (Prov)
       │    provisioningActivity
       │    activityProgress
       │    committedFileName
       │    currentViewFileName
       │    lastUsedFileName
       │    provisioningSession (session)
       │    provisioningUser (user)
       │    checkRequired
       │    confirmRequired
       │    editViewName (evName)
       │    editViewAddedComponents (evAdded)
       │    editViewDeletedComponents (evDeleted)
       │    editViewChangedComponents (evChanged)
       │    journalUsage
       │    restorePossible
       │    journalDisabledReason
       │    journaling (provisionable)
       │
       └── View
                user
                checkState
                components (comps)
                formats
                baseView (base)
                version
                creationDate
```

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Location of Multiservice Switch views

```
Multiservice Switch node

                    ┌──────────────────┬──────────────────┐
                    │ Memory           │ Current view     │
                    │                  ├──────────────────┤
                    │                  │ Edit view        │
                    └──────────────────┴──────────────────┘

                              Disk
                                           • • •
                         ┌──────────────────┐
                         │ AB.full.110      │
                      ┌──┴───────────────┐  │
                      │ AB.full.111      │  │
     Committed view ──┬──────────────────┤  │
                      │ AB.full.112      │  │
                      └──────────────────┘  │

                                        MSS 2708 001 AA
```
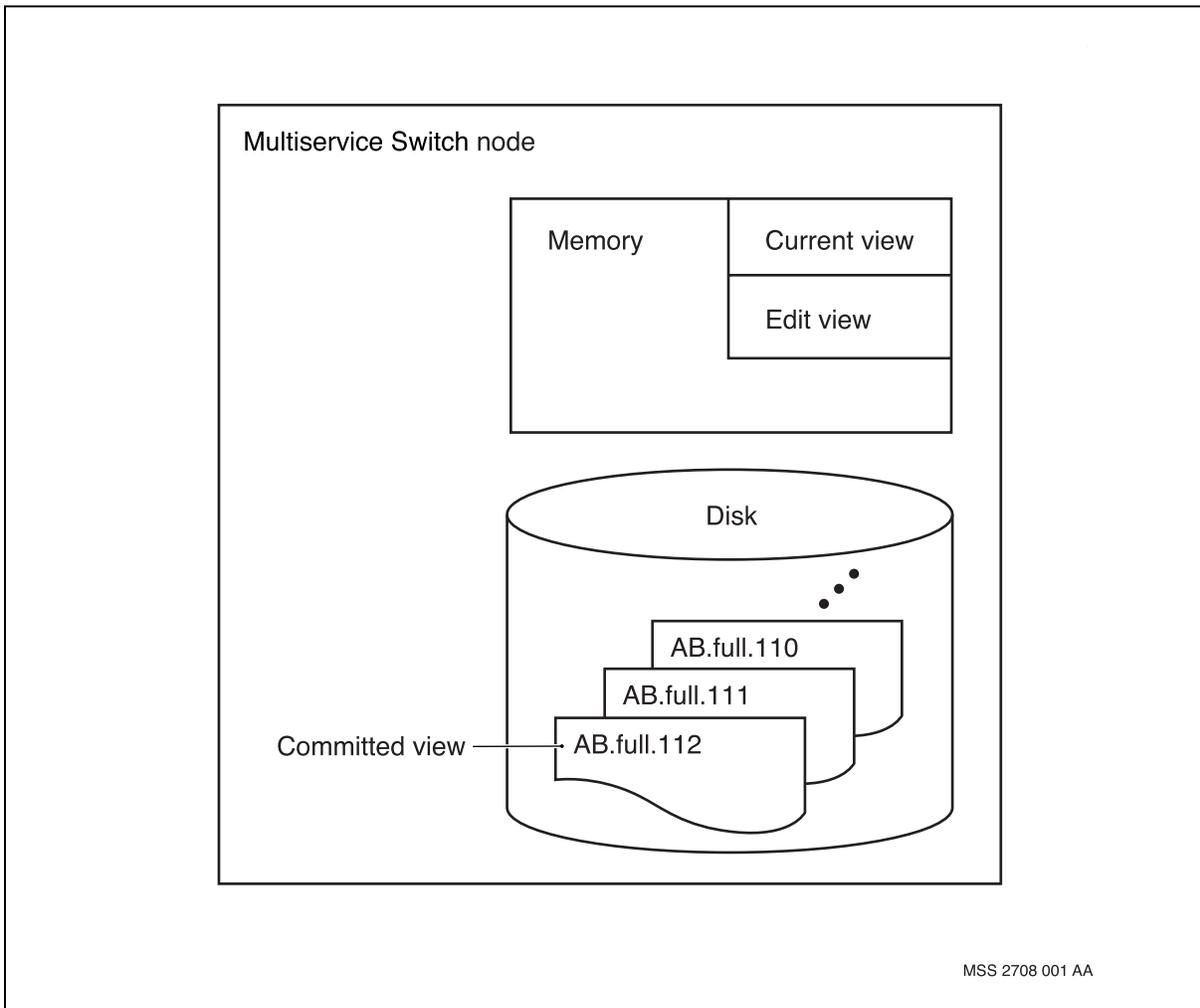
Current view

The current view contains the set of provisioned and operational data that defines the current configuration and operating parameters of the Nortel Multiservice Switch node.

The provisioning system controls the provisioned data (provisioned components and attributes) which stores the current configuration. You can view and modify the operational data of the current view (operational components and attributes), but you cannot save it directly to the file system. All operational data, including any modification you have made, is lost when the node restarts or resets. This data can be restored if node recovery was enabled earlier through the Restore Prov command. For more information about node recovery, see .

If node recovery (journaling files are saved) was disabled earlier, a control processor switchover will result in loss of operational data. If node recovery is enabled, there will be no loss of operational data due to the switchover.

When you make configuration changes, you do not make them directly to the current view. You modify the edit view using the provisioning system. When you are satisfied with the edit view, you activate it as the new current view. If node recovery is enabled, then the changes you made are automatically journaled to the file system.

You can perform the following actions on the current view using the provisioning system:

- store the current view as a saved view

- commit the current view as the view to use if the node restarts

- copy the current view into the edit view

You perform these actions using provisioning commands.

The only way to change the provisionable components and attributes of the current view is to activate either the edit view or saved view. If you activate the edit or saved view, but do not commit it, the committed view becomes the current view on a node reset or restart. If node recovery was enabled earlier, then the previous current view can be restored via the Restore Prov command. On a control processor switchover, the committed view becomes the current view if node recovery was disabled earlier; otherwise, the previous view is retained. For more information on node recovery, see Node recovery (page 92).

The *currentViewFileName* attribute of the *ProvisioningSystem* component indicates the name of the current view if it has been saved to the file system.

Edit view

The edit view is the set of provisioned data representing a node configuration which you can modify. You can make changes to the edit view using the provisioning system without affecting the current node configuration (current view). When you are satisfied with the edit view you can activate it, making it the current view.

Before you can activate an edit view, you must perform a semantic check on it. The semantic check verifies that all the settings in the edit view are self-consistent. If there are problems, the semantic check identifies them and indicates how to fix them. The semantic check also indicates any consequences of activating the edit view. For example, activating an edit view can cause a node restart.

To work with the edit view, you must start a provisioning session by entering into provisioning mode. The *provisioningUser* attribute of the *ProvisioningSystem* component indicates the user ID of the user currently in provisioning mode. Once in provisioning mode, you can perform the following actions to the edit view:

- apply changes stored in a saved view to the edit view

- delete non-permanent components

- add components

- set provisioned attribute values

- copy the current view into the edit view

- perform a semantic check of the edit view

- save the edit view to a saved view

- activate the edit view as the current view, making it the current node configuration

You perform most of these actions using provisioning commands.

The *editViewName* attribute of the *ProvisioningSystem* component indicates the name of the edit view if it has been saved. The *editViewAddedComponents*, *editViewDeletedComponents*, and the *editViewChangedComponents* attributes count the components in the edit view that were added, deleted, or changed from the current view.

When the node restarts, the edit view becomes identical with the current view and the commit view. Unless you save the edit view, any changes you made but did not activate are lost.

Committed view

The committed view is a saved version of a current view that the node uses when it resets, restarts, or changes over from the active to the standby control processor.

The committed view provides a configuration that is known to work and will allow the node to initialize, as well as connect to the network. This configuration is important when you are trying to activate new configurations. If the new configuration is faulty, the committed view provides a configuration to which the node can return (roll back). After activating a new configuration, you have 20 minutes to confirm that the new configuration has successfully initialized and that the node is operating properly. If you do not confirm the activation within 20 minutes, Nortel Multiservice Switch system automatically restarts the node using the committed view.

Setting the *autoConfirm* attribute to on will automatically confirm configuration changes when the changes are activated. If the configuration changes impact the connectivity between the network manager and the node, the Multiservice Switch system will not restart the node using the previously committed view. This may isolate the switch from the network manager.

In some instances, a committed view is not identical to the current view. When you activate an edit view as the current view, the current view and the committed view are different. The current view contains newly updated configuration data, while the committed view contains configuration data based on a previous current view.

Only when you commit the current view are the two views identical. Before you can commit the current view, you must save it to the file system. If you have a dual-CP node, the disks must also be synchronized.

The *committedFileName* attribute of the *ProvisioningSystem* component indicates the file name of the committed view.

Saved view

A saved view is a copy of the current view, edit view, or committed view stored on the file system.

You can save an edit view so you can reopen and change it later. Saving the edit view also means that your configuration changes are not lost in the event of a node restart.

An instance of the *View* component (a subcomponent of *ProvisioningSystem*) represents each saved view stored on the file system. The attributes of the *View* component detail the saved view, including its type, formats, and semantic check state.

There are two types of saved views:

- full saved views

- partial saved views

A full saved view includes all configuration data from either the edit or current view. You can load it into the edit view and activate it as the current view. You can also directly activate a full saved view as long as you semantically checked it before saving it.

A partial saved view includes all the configuration data for a component and all its subcomponents from either the edit or current view. You can load the component from a partial saved view into the edit view to add the component or change an existing component's configuration. You cannot activate a partial saved view.

A single saved view can have several formats. The format of the saved view depends on the options you used when saving the view and whether or not the view is the committed view. The table Format of saved views (page 78) describes the possible formats for a saved view.

Saved views are stored in subdirectories and files in the /provisioning directory. When you save a view, Nortel Multiservice Switch system assigns it a name, which becomes a subdirectory of the provisioning directory. The subdirectory contains the view in its various formats. For information on naming saved views, see NN10600-050 *Nortel Multiservice Switch 7400/ 15000/20000 Command Reference.*

Format of saved views

Saved view format	Associated view	Contents and characteristics	Storage format
portable	Current or edit views	Includes all configuration data. A portable saved view can be moved from one Multiservice Switch node to another, where you can load and further modify it.	Multiservice Switch internal
ASCII	Current or edit views	Includes all configuration data. You can use views in ASCII format with non-Multiservice Switch tools to generate configuration printouts.	ASCII
commit	Committed view	Includes all configuration data in the committed view. This format is in a Multiservice Switch node-internal format that enables fast activation.	Multiservice Switch internal
delta	Edit view	Includes the changes made between the current view and the edit view. This format loads and saves faster than the other formats. You can also apply the changes stored in a delta view to the edit view. You can activate a view stored in this format only if activating it does not require a system restart.	Multiservice Switch internal
part (partial)	Current or edit views	Includes all information about a component, including all its subcomponents and associated attributes. You can use views in partial format with non-Multiservice Switch tools to generate configuration printouts.	ASCII
(1 of 2)			

Format of saved views (continued)

Saved view format	Associated view	Contents and characteristics	Storage format
pre-4.X provisioning files	Current and edit view	Includes all information about the Multiservice Switch configuration. You can convert Pre-4.X provisioning files to portable or ASCII format (depending on the view type) by loading them into the edit view on the current release.	Multiservice Switch internal
Attention: Pre-4.X files are used with the Multiservice Switch 7400 series only.			
(2 of 2)			

The figure Relationship between views and provisioning commands (page 80) illustrates the relationship between provisioning commands and Multiservice Switch system views.

Relationship between views and provisioning commands

PPT 2930 001 AA
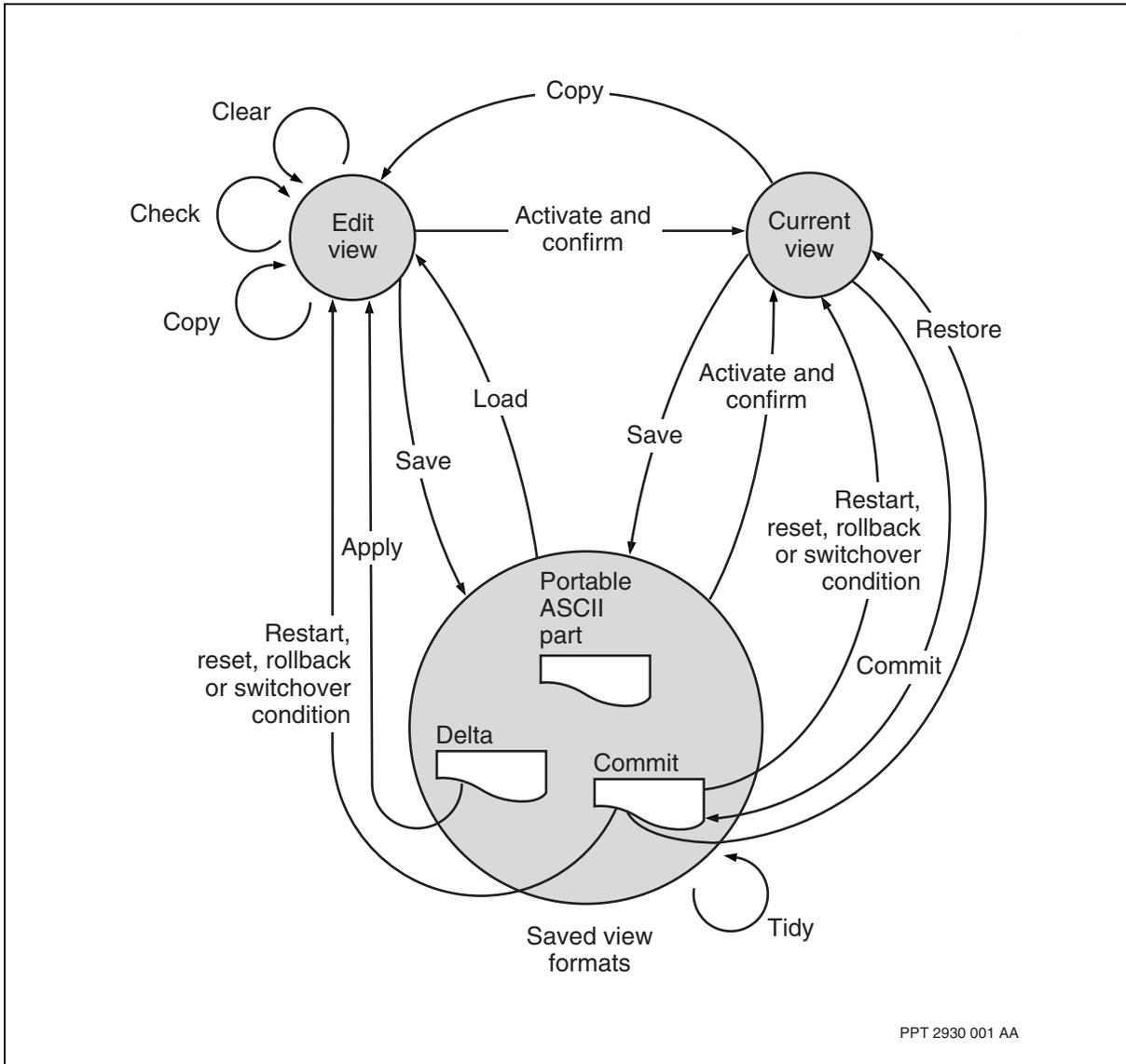
Activating and committing configuration changes

The figure Flowchart for activating configuration changes (page 81) illustrates the steps you follow when activating configuration changes.

Flowchart for activating configuration changes

```
        ┌─────────────────────┐
        │  Start provisioning  │
        │     start Prov       │
        └─────────────────────┘
                   │
                   ▼
        ┌─────────────────────┐
        │  Verify the changes  │
        │     check Prov       │
        └─────────────────────┘
                   │
                   ▼
        ┌─────────────────────┐
        │ Activate the edit view│
        │     activate Prov    │
        └─────────────────────┘
                   │
                   ▼
        ┌─────────────────────┐
        │ Confirm the activation│
        │     confirm Prov     │
        └─────────────────────┘
                   │
                   ▼
        ┌─────────────────────┐
        │Commit the configuration│
        │     commit Prov      │
        └─────────────────────┘
                   │
                   ▼
        ┌─────────────────────┐
        │   End provisioning   │
        │      end Prov        │
        └─────────────────────┘
```
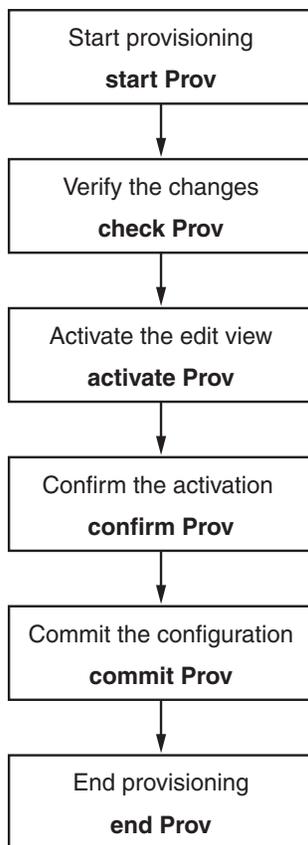
PPT 2703 001 AA

Configuring for immediate activation

After you have completed your immediate activation, you apply the saved changes back into the edit view. The figure Flowchart for immediate configuration (page 82) illustrates the process.

Flowchart for immediate configuration

```
┌─────────────────────┐
│  Start provisioning │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│  Save the edit view │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│   Copy current      │
│ view into edit view │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐          ┌─────────────────────┐
│   Make changes      │◄─────     │   Commit the new    │
│   and additions     │           │    current view     │
└─────────────────────┘          └─────────────────────┘
           │                                 │
           ▼                                 ▼
┌─────────────────────┐          ┌─────────────────────┐
│  Do a check prov    │          │ Merge regular order │
│ and correct if needed│         │    processing to    │
└─────────────────────┘          │    the edit view    │
           │                     └─────────────────────┘
           ▼                                 │
┌─────────────────────┐                      ▼
│ Activate the edit view│        ┌─────────────────────┐
└─────────────────────┘          │  Save the merged    │
           │                     │      changes        │
           ▼              Yes    └─────────────────────┘
┌─────────────────────┐   ◇                  │
│ Confirm the activation│─►Additional         ▼
└─────────────────────┘   changes    ┌─────────────────────┐
                          needed? No  │  End provisioning   │
                                      └─────────────────────┘
```
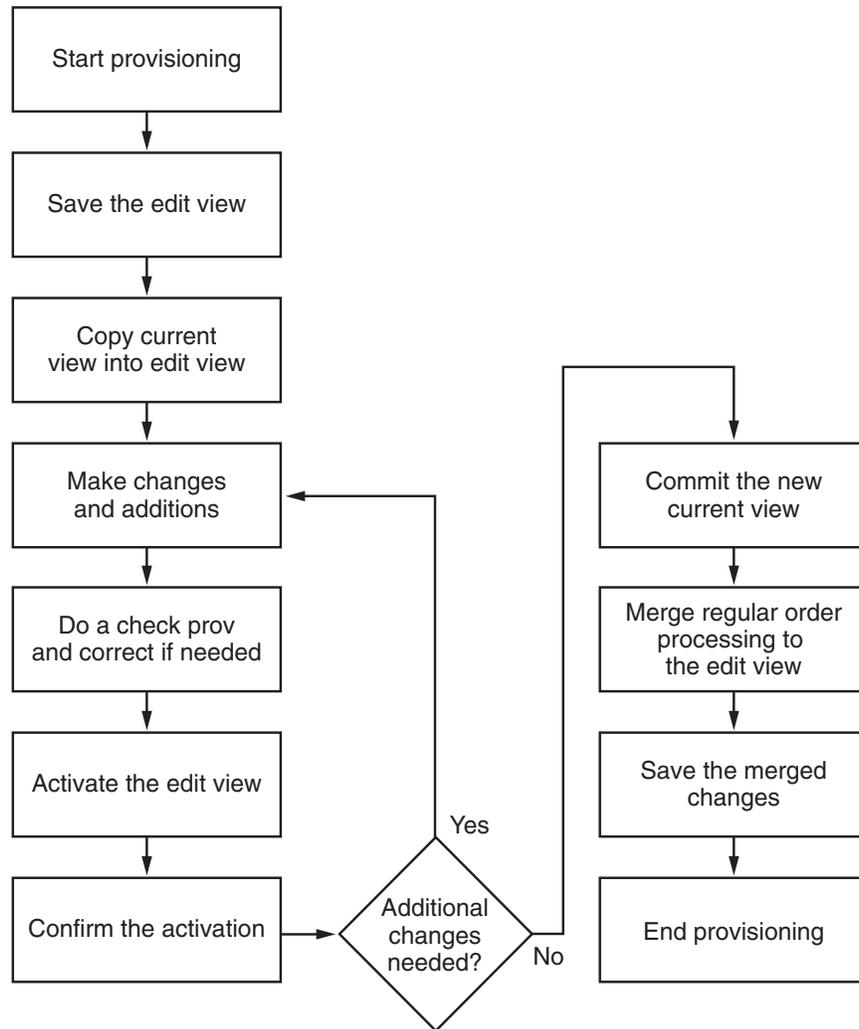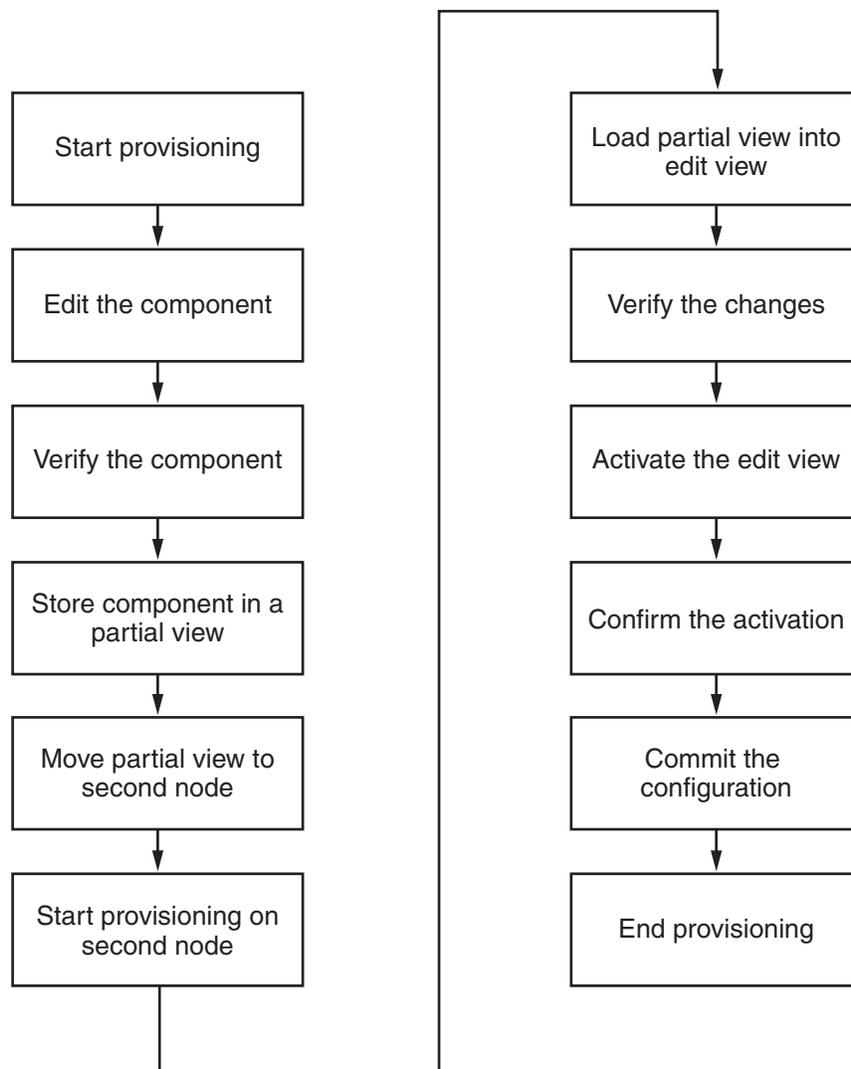
PPT 2704 001 AA

Copying a component configuration to another node

The figure Flowchart for using partial views (page 83) illustrates the steps for developing a configuration for a component on one node and then using that configuration on other nodes in the network.

Flowchart for using partial views

Start provisioning	Load partial view into edit view
Edit the component	Verify the changes
Verify the component	Activate the edit view
Store component in a partial view	Confirm the activation
Move partial view to second node	Commit the configuration
Start provisioning on second node	End provisioning

PPT 2705 001 AA

Command basics

Commands are your main interface to Nortel Multiservice Switch nodes when you are working through a VT100 terminal (local interface) or a terminal emulator (telnet interface). Commands allow you to manage a node, whether you are creating the initial configuration, monitoring alarms, performing maintenance, or adding new capabilities.

The following sections describe important concepts for successfully using Multiservice Switch system commands:

-

-

-

-

-

Components and commands

Components represent the hardware, software, and services associated with a Nortel Multiservice Switch node. Multiservice Switch commands are always directed at components. Almost every command requires you to specify a component. The commands that do not require a component are implicitly directed at the root component.

The following sections briefly describe components:

-

-

-

-

-

-

-

-

For more detailed information on components, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Component hierarchy

Components are organized into a hierarchy. Most components have a parent component and one or more subcomponents. For example, the *Shelf* component is the parent of two *Bus* subcomponents. Each *Bus* component also functions as a parent component to a *Test* subcomponent.

The *EM* component is the top component in the hierarchy, and has no parent component. However, in most cases you do not have to specify the *EM* component, so its subcomponents—such as *Shelf* and *ProvisioningSystem*— become the highest in the hierarchy.

Types and instances
When working with components, it is important to understand the difference between component types and instances. A component type is a kind (or a class) of components. A component instance is a particular component of a component type. A type always has one or more instances.

You specify a component using both its type and instance value, separated by a slash (/). An instance value can be made of letters or numbers. For example, the *Card* component type uses numbers, starting at 0, for its instance values. The following text represents instance 0 of the *Card* component type:

```
Card/0
```

Certain component types, such as *Shelf*, can only have one instance. When you use these components, only specify the component type and not an instance value (and without the slash). To specify the *Shelf* component, enter the following:

```
Shelf
```

Multi-indexed components
Some components need more than one instance value to identify them. These multi-indexed components have their multiple instance values separated by commas (,). For example, the *View* subcomponent of the *VirtualRouter Snmp* component requires two instance values, as follows:

```
View/12, 1112
```

Component name
Since components are organized in a hierarchy, a complete component name includes type, instance, and hierarchy information. A component name consists of a number of type-instances pairs, starting from the root component (ignoring the *EM* component) and specifying all the components in the hierarchy. For example, the complete name of instance 0 of the *Card* component type is the following:

```
Shelf Card/0
```

The name of the *Test* subcomponent (which has only one instance) of *Card/0*, is the following:

```
Shelf Card/0 Test
```

Component class
In some cases, you do not need to know the particular instances of a component. A component class defines only the type and hierarchy information about a component, without the instance values. The component class for the *Test* subcomponent of *Card/0*, is the following:

```
Shelf Card Test
```

Attributes

Attributes hold the data associated with a component. For example, the type of card associated with a particular *Card* component is stored in the *cardType* attribute. If *Card/1* is a V.35 card, its *cardType* attribute is V35.

There are two kinds of attributes: operational and provisionable. Operational attributes hold data for monitoring the operation of the node. Usually, the system automatically sets this data, which includes OSI state and statistical information. You can set the values of some operational attributes, but your settings will be lost when the node restarts.

Provisionable attributes hold the configuration data. These attributes define the general parameters and the specific services running on the node. The data in provisionable attributes is preserved during a node restart.

Groups

Related attributes are collected together in groups. For example, all the provisionable attributes of the *Card* component are part of the Provisioned group. Every attribute must be part of a group. Most components have a Provisioned group for its provisionable attributes and an Operational group for its operational attributes.

Verbs

Verbs combine with a component name to specify a command. The verb defines the action of the command. For example, you can combine the list verb with any component to list its subcomponents. To list the subcomponents of the *Shelf* component, use the list verb with the *Shelf* component:

```
list Shelf
```

Command syntax

With only a few exceptions, all commands have two parts: a verb followed by a component name. Some commands also allow you to specify options that modify the function of the command.

The following, then, is the general syntax for a command:

```
<verb> [-<option_name>]... <component_name>
```

Some commands—such as set, display, list, and find—also allow you to specify attributes and groups following the component name.

The following sections describe the syntax for parts of a command:

- Component syntax (page 87)
- Option syntax (page 87)
- Attribute and group syntax (page 87)
- Saved view filename syntax (page 88)

- File and directory syntax (page 88)

Component syntax

Most commands require a full component name, including type, instance and hierarchy information. The following is the syntax for a component name:

```
<type>/<instance> ...
```

For more information on component names, see Component name (page 85).

It is possible to replace instance values or a type-instance pair with a wildcard character in the Display and List commands. For more information, see NN10600-050 *Nortel Multiservice Switch 7400/15000/20000 Command Reference*.

Some commands, like Help, only require the component class, which has the following syntax:

```
<type>...
```

For more information on component classes, see Component class (page 85).

Option syntax

Options always appear between the verb and component parts of a command and begin with a hyphen (-). Some options allow you to specify values, which you must enclose in parenthesis. The syntax for an option with a value is as follows:

```
-<option_name>(<option_value>)
```

For example, when you use the help command, you specify a verb as an option value. To get help on the start verb for the Prov command, you would enter the following command:

```
help -verb(start) Prov
```

If a command can take more than one option, specify each option separated by a space. For example:

```
display -current -noTabular Lp/0
```

Attribute and group syntax

Attributes and groups always appear after the component. You can specify more than one group or attribute by separating them with a comma. The syntax is as follows:

```
<attribute>|<group> [, <attribute>|<group>]...
```

You can mix both groups and attributes in the same command. The following example specifies an attribute (activeCard) and a group (Provisioned):

```
display Lp/0 activeCard, Provisioned
```

Saved view filename syntax

Many of the provisioning commands allow you to work with a previously saved provisioning view. When you save a provisioning view on the file system using the save Prov command, its filename has a specific form. If you want to load the provisioning view, use the following syntax to specify its filename.

        `<name>.<type>.<sequence>`

where:

<name> is the name of the view

<type> is either full for a full view, or part for a partial view

<sequence> is a three-digit number that differentiates views with this name and type

You would specify the 3rd iteration of the full provisioning view named Basic as follows:

        `Basic.full.003`

When specifying the filename of a saved view, you must always include the name. If you only specify the name and type, Nortel Multiservice Switch systems use the most recent version of the view with that name and type. If you only specify the name, Multiservice Switch systems use the most recent full saved view, unless only partial saved views exist with that name. In that case, the system uses the most recent partial saved view.

Saved view filenames are case sensitive.

File and directory syntax

Most file system commands require that you specify a file or directory as part of an option. If the file or directory is in the current working directory, you only need to specify its name.

If the file or directory is not in the current working directory, you will have to indicate where the file is located by using its path. You specify a path using a slash character (/) to separate directory names. The highest level, or root directory, is a single slash character (/). For example, to specify the spooled directory, which is a subdirectory of root, use the following syntax:

        `/spooled`

You can specify a path absolutely, including the full path from the root directory, or relatively. When building a relative path use two dots (..) to refer to the directory above the current working directory. For example, to specify the info.txt file in the directory above the current working directory, use the following syntax:

        `../info.txt`

You can use more than one set of dots, separated by slashes, to refer to directories more than one level above the current working directory. For example, to specify the info.txt file in the directory two levels above the current working directory, use the following syntax:

    ../../info.txt

In some cases, your relative path might simply be the current working directory. You can specify the current working directory using a single dot (.).

When you specify a path, enclose it in quotation marks (" "). If you do not enclose the path in quotation marks, the system will misinterpret the slash (/) characters within the name.

Filenames and directory names are case sensitive. A filename can only contain letters, numbers, the . (dot) character, or the _ (underscore) character.

Command and response lines

There are four pieces of information for every command:

- command line

- component

- command response

- status line

The figure Sample command and response (page 90) provides an example of a sample command and all its associated information. The command line is where you enter a Nortel Multiservice Switch system command. The prompt for the command line changes depending on whether you are in operational mode (#>) or provisioning mode (PROV #>). In this example, the prompt indicates provisioning mode. For information on commands and their syntax, see NN10600-050 *Nortel Multiservice Switch 7400/15000/20000 Command Reference*.

After you enter a command, the system first responds with the full name of the component affected by the command. In the example, the command affects the *Shelf Card/0* component.

Following the component name is the particular response of the command. Depending on the command, the response can be one line or pages of information. In the example, the command responds with the provisionable attributes of the *Shelf Card/0* component.

The response is followed by a status line. The status line reports the status of the command (ok or command failed) and the date and time (in the YYYY-MM-DD HH:MM:SS.SS format).

If the command is unsuccessful, the status line indicates that the command failed and the response provides details on why it failed. When a command fails because you enter it incorrectly, The system replaces the command response with the syntax error information. Syntax error information contains the following two pieces of information:

- invalid syntax

- input

The figure Sample syntax error (page 90) provides a sample of an incorrectly entered command. The invalid syntax line describes the syntax error. The description has the incorrect part (for example, verb, component, or attribute) of the command in curly brackets ({}) followed by an explanation. In the example, the command contains the incorrect component name *Cord* (instead of *Card*). The invalid syntax line reports that Multiservice Switch system does not recognize the component name.

The input line repeats the command you entered with curly brackets ({}) around the part of the command that the system cannot interpret. In the example, the unrecognized word Cord has curly brackets around it.

Sample command and response

command line
component name
	`PROV 2> display Shelf Card/0`
	`Shelf Card/0`
	`    cardType = CPeE`

response	`    configuredLPs = Lp/0`
	`    sparingConnection = notApplicable`
	`    commentText     = ""`

status line	`ok XXXX-09-24 15:39:54.95`

Sample syntax error

```
4> lock Shelf Cord/0
Shelf
Invalid syntax: {component name} unexpected, value
unrecognized.
        Input: lock Shelf {Cord}/0
command failed XXXX-09-24 15:42:24.12
```

Command permissions

To execute a command, you must have the proper permission. Your permission depends on the user ID or role you used to log into the Nortel Multiservice Switch node. You can determine your current permissions using the me command.

The required permission to execute a command depends on the verb and component that combine to form the command.

A system command has three types of permission:

- Impact (page 91)
- Scope (page 91)
- Customer Identifier (page 92)

You can determine the impact, scope, and customer identifier requirements of a command by looking up its verb and component in NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*. You can also use by using the help command. For more information on security, see NN10400-605 *Nortel Multiservice Data Manager Network Security Fundamentals*.

Impact

The impact of a command is defined by its verb. To execute a command, you need to have an impact assigned to your user ID equal to or greater than the required impact of the verb. The following table shows the five possible verb impacts, from highest to lowest.

Verb impacts

Impact	Verbs that
Debug	Are executed by Nortel personnel
System Administration	Change the security of the node
Configuration	Change the configuration of the node
Service	Maintain services
Passive	Display information about the node and services

Scope

The component defines the scope of a command. To execute a command, you need to have a scope equal to or greater than the scope of the component. The following table shows the three possible component scopes, from highest to lowest.

Component scopes

Impact	Components that
Network	Affect the operation of the entire network
Device	Affect the operation of a node
Application	Affect the operation of a single service application or access port

Customer Identifier

Most components have a provisionable customer identifier, that indicates the customer who is allowed to manage the component. The components that do not have a provisionable customer identifier have a default value of zero or use their parent's identification. To execute a command you need to have the same customer identifier as the component specified in the command.

Customer identifiers are numbers from 0 to 8191. Identifier 0 is reserved for the network owner.

Commands and operator modes

Nortel Multiservice Switch systems have two operator modes: operational and provisioning. You use operational mode to monitor and maintain the node. You use provisioning mode to change the configuration of the node.

Commands can be associated with a particular operator mode. You can only use some commands, such as add and delete, while in provisioning mode. Other commands, such as display and list, work in both modes, but give different results in each.

Node recovery

The node recovery feature introduces automatic journaling of the current view. That is, a journal log file is created during each manual activation and contains a delta of the configuration changes between the current and edit views. This enables the current view to be manually recovered in the case of a node reset through the restore Prov command, even if the current view has not been explicitly saved by the user. This feature, in conjunction with the Nortel Multiservice Data Manager Node Recovery tool, also enables the current view to be efficiently backed-up and restored in the case of a complete node failure.

Only configuration changes that have been confirmed can be restored. Note that journal log files are not saved for null activations (where no configuration changes have been made) or for activations that will result in a node reload, such as a software migration.

The saving of journal log files can become disabled in the following cases:

- when journal log file saving is disabled via provisioning

- when node recovery is enabled after being disabled, an initial commit must be done before the provisioning system can save journal log files (since journals are based on the committed view)

- too many log files were created since last the commit Prov was performed

- a file system error occurs (for example, disk is corrupted or disk is full)

- the file system is locked

- when it is the first manual activation after a node reload and the current view is different than the committed view (for example, after a software migration, but before the commit)

- when the activation results in a node reload activation (for example, a software migration activation)

When a new provisioning view is committed, all pre-existing journal log files are automatically removed by the system since the current view is now equal to the committed view and is thus saved.

The journal log files are saved in the following directory: /provisioning/journal/ current. Note that this directory only exists if there are journal log files are created.

For information about node recovery see, 241-6001-807 *Nortel Multiservice Data Manager Network Backup and Restore*

The *maxNumberJournalFiles* attribute of the *ProvisioningSystem* component specifies the maximum number of journal files that can be saved.

The *currentJournal* attribute of the *ProvisioningSystem* component indicates the number of journal log files that have been saved since the last Commit Prov command was issued.

The restorePossible attribute of the *ProvisioningSystem* component indicates if it is possible to perform the restore Prov is possible. For more information about this command, see NN10600-050 *Nortel Multiservice Switch 7400/ 15000/20000 Command Reference*.

The *journalDisabledReason* attribute of the *ProvisioningSystem* component indicates whether or not journaling is disabled.

Multiservice Switch services

Nortel Multiservice Switch systems deliver a powerful range of standard-based interfaces and services. Multiservice Switch services provide the support needed to simultaneously manipulate and manage any mix of voice, data, video and image traffic. Multiservice Switch systems provide multiprotocol routing services and intelligent traffic management.

Navigation

Multiservice Switch frame relay services

Frame relay is a fast access service that provides high-performance connectivity. Frame relay speeds the transmission of frames through the network by transferring processes such as flow control, validation, and error checking to end devices. Frame relay supports only core communication functions such as transparency, multiplexing, congestion detection, and notification.

Nortel Multiservice Switch frame relay services support both permanent and switched virtual circuits (PVCs and SVCs). PVCs are suitable for high use sites where you determine the connections ahead of time. SVCs establish and remove frame relay connections when required.

See the following sections for more information:

Multiservice Switch frame relay UNI service

The frame relay user-to-network interface (UNI) service provides a communications interface between a user device and the network. Nortel Multiservice Switch FR UNI service supports permanent virtual circuit (PVC), switched permanent virtual circuit (SPVC), and switched virtual circuit (SVC) connections.

A PVC is a predetermined logical connection. It remains in place even when not transmitting traffic.

An SPVC is a logical connection whose endpoints are configured by the user, but whose datapath is set up dynamically across networks.

An SVC is a logical connection that is established dynamically, on an as-required basis. User equipment signals the call to the desired destination, relieving the network provider of having to configure the connection. When the connection is no longer required, the subscriber application tears down the SVC.

For more information, see NN10600-900 *Nortel Multiservice Switch 7400/ 15000/20000 Frame Relay Technology Fundamentals*.

Multiservice Switch frame relay NNI service

Nortel Multiservice Switch frame relay network-to-network interface (NNI) service provides a communication interface between two frame relay networks. This service transmits network status signaling information through the network, and provides end-to-end information about connections that span different frame relay networks. Multiservice Switch FR NNI service also ensures multi-vendor network compatibility with networks that conform to the FRF.2 Implementation Agreement.

Multiservice Switch FR NNI service supports permanent virtual circuit (PVC), switched permanent virtual circuit (SPVC), and switched virtual circuit (SVC) connections.

A PVC is a predetermined logical connection. It remains in place even when not transmitting traffic.

An SPVC is a logical connection whose endpoints are configured by the user, but whose datapath is set up dynamically across networks.

An SVC is a logical connection that is established dynamically, on an as-required basis. User equipment signals the call to the desired destination, relieving the network provider of having to configure the connection. When the connection is no longer required, the subscriber application tears down the SVC.

For more information, see NN10600-900 *Nortel Multiservice Switch 7400/ 15000/20000 Frame Relay Technology Fundamentals*.

Multiservice Switch frame relay to ATM service

Nortel Multiservice Switch frame relay to asynchronous transfer mode interworking service (FR-ATM interworking service) transports frame relay traffic over ATM. FR-ATM interworking service improves connectivity between customer frame relay networks and end points, and ATM backbones and end points.

Multiservice Switch FR-ATM interworking service connects frame relay permanent virtual connections (PVCs) to ATM PVCs. Multiservice Switch FR-ATM interworking service supports the standard service interworking function (SIWF) FRF.8 and the standard network interworking function (NIWF) FRF.5.

Multiservice Switch FR-ATM service provides

- standard-based frame relay to ATM interoperability

- full local management interface capabilities at the user-to-network interface and network-to-network interface

- full traffic management capabilities

- support of many ATM physical interfaces

For more information, see NN10600-920 *Nortel Multiservice Switch 7400/ 15000/20000 Operations: Frame Relay to ATM Interworking*.

Frame relay ISDN switched access service for Multiservice Switch 7400

The integrated services digital network (ISDN) technology provides a digital switched access path through an ISDN network. The frame relay ISDN switched access service can support B-channel circuit connections over primary rate interface links as required. The B channel supports the frame relay user-to-network interface (UNI).

Frame relay ISDN switched access service provides

- end-to-end digital transmission

- outbound signaling capabilities

- simple architecture multimedia service

- bandwidth sharing and bandwidth on demand

For more information, see NN10600-900 *Nortel Multiservice Switch 7400/ 15000/20000 Frame Relay Technology Fundamentals*.

Multiservice Switch ATM services

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 ATM networks are interoperable with the bearer services of other public ATM networks.

Multiservice Switch ATM service supports 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 soft permanent virtual circuits (SPVC), soft permanent virtual paths (SPVP), and switched virtual circuits (SVC). SPVCs and SPVPs require provisioning at the source end-point only. SVCs are fully dynamic and require no end-point provisioning.

Multiservice Switch systems support three ATM interfaces in addition to the basic types. User-to-network interface (UNI 3.0, 3.1, and 4.0) is the interface between a customer premises equipment (CPE) and the network between nodes on the network edge. UNI uses an interim local management interface for dynamic address registration, and for link and physical layer status, configuration, and control. Interim interswitch signaling protocol (IISP 1.0) is the interface between Multiservice Switch nodes and other vendor ATM nodes. IISP builds on UNI and makes static routing possible in a dynamic network. Private network-to-network interface (PNNI 1.0) is the interface between Multiservice Switch nodes and other vendor ATM nodes. PNNI makes routing in a dynamic network possible. PNNI increases network scalability and efficient address summarization.

Multiservice Switch ATM service provides quality of service traffic management. This service also provides automatic and initiated operations, maintenance, and testing capabilities to monitor and control the ATM infrastructure.

For more information about, see 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*, and NN10600-715 *Nortel Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*.

Multiservice Switch ATM services include

- Multiservice Switch ATM bearer service (page 98)
- Multiservice Switch trunking over ATM service (page 98)

Multiservice Switch ATM bearer service

Nortel Multiservice Switch ATM bearer service allows ATM users and external equipment access to Multiservice Switch networks.

The service provides sequence-preserving connection-oriented cell transfer between a source and destination with an agreed quality of service and throughput. An ATM bearer service connection can be part of a connection that extends into an external ATM network.

An ATM virtual channel connection (VCC) or a virtual path connection (VPC) provides the Multiservice Switch ATM bearer service between two external ATM users. The external connection can be made to a Multiservice Switch node or an external network. Each ATM hop in a network assigns VP and VC values to the connection.

For more information, see NN10600-700 *Nortel Multiservice Switch 7400/ 15000/20000 ATM Technology Fundamentals*.

Multiservice Switch trunking over ATM service

A logical Nortel Multiservice Switch trunk over ATM is a cell trunk that encapsulates frame trunk traffic through ATM adaptation layer 5 (AAL5) into ATM cells. These logical trunks reroute traffic around failures.

Logical Multiservice Switch trunking over ATM provides a logical interconnection for Multiservice Switch nodes over ATM facilities. This trunking service provides the ability to map many trunks to one ATM pipe in a point-to-point method. This service replaces the physical medium of ATM VCC trunks with multiple VCCs supported on a single interface (or port).

You can use Multiservice Switch trunking over ATM service instead of leased lines to interconnect Multiservice Switch nodes. This feature provides the following advantages:

- economy

- high-speed (in excess of 155 Mbit/s) throughput

- increased trunking capacity

For more information, see NN10600-700 *Nortel Multiservice Switch 7400/ 15000/20000 ATM Technology Fundamentals*.

Multiservice Switch inverse multiplexing for ATM service

In Nortel Multiservice Switch networks, the IMA functionality provides the capability to provision a logical UNI (UNI 3.0, 3.1, and 4.0) to group up to 28 DS1 channels belonging to a DS3 physical link. This allows Multiservice Switch networks to support a bandwidth greater than what can be provided by a single DS1 link.

Inverse multiplexing for ATM (IMA) supports the transparent transmission of ATM cell data over IMA link groups. IMA transmits a single data stream of ATM layer cell traffic to multiple DS1 logical links for transmission across the network. At the remote end, IMA orders the cells into their original sequence.

Multiservice Switch IMA service supports the ATM Forum Inverse Multiplexing for ATM specification.

For more information, see NN10600-730 *Nortel Multiservice Switch 7400/ 15000/20000 Operations: Inverse Multiplexing for ATM.*

Multiservice Switch AAL1 circuit emulation service

The ATM adaptation layer 1 (AAL1) circuit emulation service (CES) transports DS1 and E1 time division multiplexed (TDM) constant bit rate (CBR) data over an ATM network. The service transmits this data at the high-performance level of a dedicated (leased) circuit. Voice and video are examples of CBR data.

Nortel Multiservice Switch AAL1 CES service converts structured or unstructured DS1 or E1 circuit data to standard AAL1 cells. AAL1 CES transmits these cells across an ATM network. At the remote end, AAL1 CES converts the data to its original DS1 or E1 circuit form.

AAL1 CES provides

- multivendor interoperability for DS1 or E1 TDM circuits over ATM networks
- the maintenance of leased circuits while gradually evolving the network to full ATM capability
- full DS1 services over ATM networks without changing existing DS1 or E1 terminal equipment

For more information, see NN10600-720 *Nortel Multiservice Switch 7400/ 15000/20000 Operations: AAL1 Circuit Emulation.*

Multiservice Switch IP services

Nortel Multiservice Switch networks support IP traffic routing and forwarding over a wide area network (WAN). Multiservice Switch networks use virtual routers (VR) to forward IP packets over a carrier network, and to provide traffic isolation for individual customers sharing switching and transmission

resources. Each Multiservice Switch node can support multiple VRs. In addition, carriers can provide differentiated classes of service for IP traffic and IP virtual private network (VPN) capabilities.

For more information, see the following sections:

- IP over ATM (page 100)

- IP over frame relay using frame relay DTE (page 100)

- IP over frame relay using IP-optimized DLCIs (page 101)

- IP over gigabit Ethernet (page 101)

- IP over point-to-point protocol (PPP) (page 101)

- IP routing protocols (page 101)

- IP class of service (CoS) (page 102)

- IP DiffServ (page 102)

- IP virtual private networks (page 102)

For more information, see NN10600-800 *Nortel Multiservice Switch 7400/ 15000/20000 IP Technology Fundamentals* and NN10600-801 *Nortel Multiservice Switch 7400/15000/20000 IP Configuration Management*.

IP over ATM

Nortel Multiservice Switch networks support IP forwarding over ATM in accordance with RFC 1483. You can use Multiservice Switch ATM multiprotocol encapsulation (MPE) service to transmit IP frames to external routers, or to VRs on multiple Multiservice Switch nodes through an ATM network. By default, the frame forwarding decisions for IP traffic over ATM occur on the ATM IP FPs.

Multiservice Switch ATM MPE service supports two methods for carrying IP traffic over ATM adaptation layer 5 (AAL5). Logical link control (LLC) encapsulation allows each ATM connection under an ATM MPE interface to carry multiple protocols. Virtual circuit (VC) encapsulation allows each ATM connection under an ATM MPE interface to carry a single protocol type (that is, IP).

IP over frame relay using frame relay DTE

Nortel Multiservice Switch networks support IP forwarding over frame relay in accordance with RFC 1490. Frame relay data terminating equipment (FR DTE) access service provides the interface for the customer equipment to the Multiservice Switch network by using a frame relay connection. You can use this service to connect multiple IP VPNs over a frame relay network.

IP over frame relay using IP-optimized DLCIs

Nortel Multiservice Switch networks support IP forwarding over frame relay in accordance with RFC 1490. An IP-optimized data link connection identifier (DLCI) can directly bind to a virtual router protocol port. This type of DLCI is linked to the Multiservice Switch node's frame relay user-to-network interface (FRUNI), which eliminates the need for a frame relay DTE and simplifies provisioning.

Due to its flexibility and performance, using IP-optimized DLCIs is the preferred method for frame relay access to an IP VPN.

IP over gigabit Ethernet

Nortel Multiservice Switch networks support IP forwarding over gigabit Ethernet in accordance with RFC 894. Gigabit Ethernet is a high-speed facility that supports data transfer rates of up to one gigabit per second. It is used as a direct WAN access vehicle for large enterprises as well as an uplink for aggregating many lower-speed Ethernet end-customers. It is also used as an interface for trunking between edge service nodes and IP core networks.

IP over point-to-point protocol (PPP)

Nortel Multiservice Switch networks support IP forwarding over point-to-point protocol (PPP) in accordance with RFC 1661. PPP is a link layer protocol (LLP). It provides a simple, reliable method of transporting IP datagrams by encapsulating them into a high-level data link control (HDLC) frame.

PPP is designed for simple links that transport packets between two peers. These links provide full-duplex (simultaneous and bi-directional) operation and are assumed to deliver packets in order. PPP can provide a common solution for easy connection of a wide variety of hosts, bridges, and routers.

Multi-link PPP (MLPPP) is an extension of the PPP. MLPPP, in accordance with RFC 1990, allows multiple physical links to be bundled into a single logical data link offering a greater transmission rate for the PPP service. MLPPP also provides load sharing across multiple links and reduces the impact of a single link failure.

IP routing protocols

Each VR on a Nortel Multiservice Switch node has a separate IP forwarding table and routing database to ensure the isolation of individual customer traffic. In addition to static routes, Multiservice Switch networks support the following dynamic routing protocols:

- routing information protocol (RIP)
- open shortest path first (OSPF)
- border gateway protocol version 4 (BGP-4)

IP class of service (CoS)

Nortel Multiservice Switch networks support differentiation of IP traffic for different levels of service. Multiservice Switch nodes examine layer 2, 3, and 4 parameters to classify each IP packet as it enters the node, and can forward these packets with different qualities of service over media that support multiple QoS.

IP DiffServ

IP DiffServ on Nortel Multiservice Switch nodes provides an IP differentiated services framework that delivers traffic management at each node in a network. Each virtual router can be configured to support a set of per-hop-behaviors for handling the flow of IP packets.

IP virtual private networks

An IP VPN consists of multiple customer VRs, each representing a private customer VPN site. Nortel Multiservice Switch networks support site-to-site intranet connectivity between customer VRs over the carrier network. Using IP VPN accounting you can measure the volume of IP data sent and received by VPN customers.

For more information, see NN10600-802 *Nortel Multiservice Switch 7400/ 15000/20000 IP VPN Technology Fundamentals* and NN10600-803 *Nortel Multiservice Switch 7400/15000/20000 IP VPN Configuration Management*.
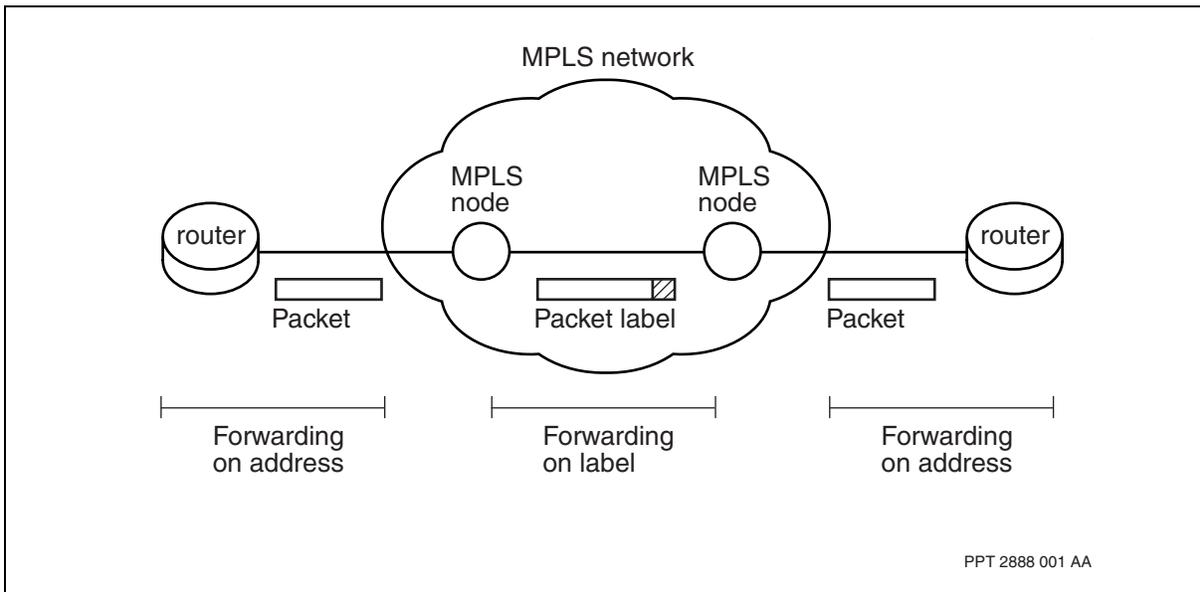
Multiprotocol label switching

Multiprotocol label switching (MPLS) is a label-swapping, networking technology that forwards packet traffic over multiple, underlying layer-2 media. This technology integrates layer-2 switching and layer-3 routing by linking the layer-2 infrastructure with layer-3 routing characteristics. Layer-3 routing occurs at the edge of the network, and layer-2 switching takes over in the MPLS network core. See the figure MPLS technology (page 103).

Essentially, MPLS forwards a packet by swapping labels at each node in its path. MPLS makes it possible to create new label formats without having to change routing protocols. For example, MPLS traffic can include internet protocol (IP), frame relay, ATM, and even optical waveforms.

MPLS technology

MPLS network

MPLS node   MPLS node

router   router

Packet   Packet label   Packet

Forwarding on address   Forwarding on label   Forwarding on address

PPT 2888 001 AA

In its generic concept, MPLS can switch a frame from any kind of layer-2 link to any other kind of layer-2 link. At this stage in the development of its standards, MPLS supports ATM, frame relay, Ethernet, and point-to-point protocol (PPP). Because traffic flow is independent of the MPLS control protocols, MPLS will be able to support routing protocols that have not yet been defined without any need for the underlying forwarding hardware to change.

With MPLS, layer-3 traffic flows take advantage of the layer-2 traffic engineering abilities and quality of service (QoS) performance, without losing the benefit of existing best-effort, hop-by-hop routing.

MPLS is an emerging standard for network-layer packet forwarding, based on a number of signaling protocols proposed by the Internet Engineering Task Force (IETF). Among these protocols are the label distribution protocol (LDP), border gateway protocol (BGP), and resource reservation protocol for traffic engineered tunnels (RSVP-TE). These signaling protocols distribute labels and forward MPLS traffic. The choice of protocol depends on factors such as the location and role of the switching node. In some cases, a node uses more than one distribution protocol.

Media Gateway

Nortel Multiservice Switch Media Gateway application is a carrier-grade integrated voice and data interworking service. Multiservice Switch Media Gateway creates a gateway between a time division multiplexed (TDM) network and a Multiservice Switch ATM or IP network.

With Multiservice Switch Media Gateway, the central office switch manages the call. However, instead of using TDM bearer channels to transport the traffic, traffic is routed to ATM bearer channels or IP circuits in a Multiservice Switch network.

Statistical multiplexing, voice compression, adaptive differential pulse code modulation (ADPCM), silence and fax idle suppression techniques maximize bandwidth savings. Echo cancellation, comfort noise generation, and congestion handling techniques ensure that Media Gateway also delivers toll-quality voice service. (Note that these service are not supported on all variants of Multiservice Switch Media Gateway.)
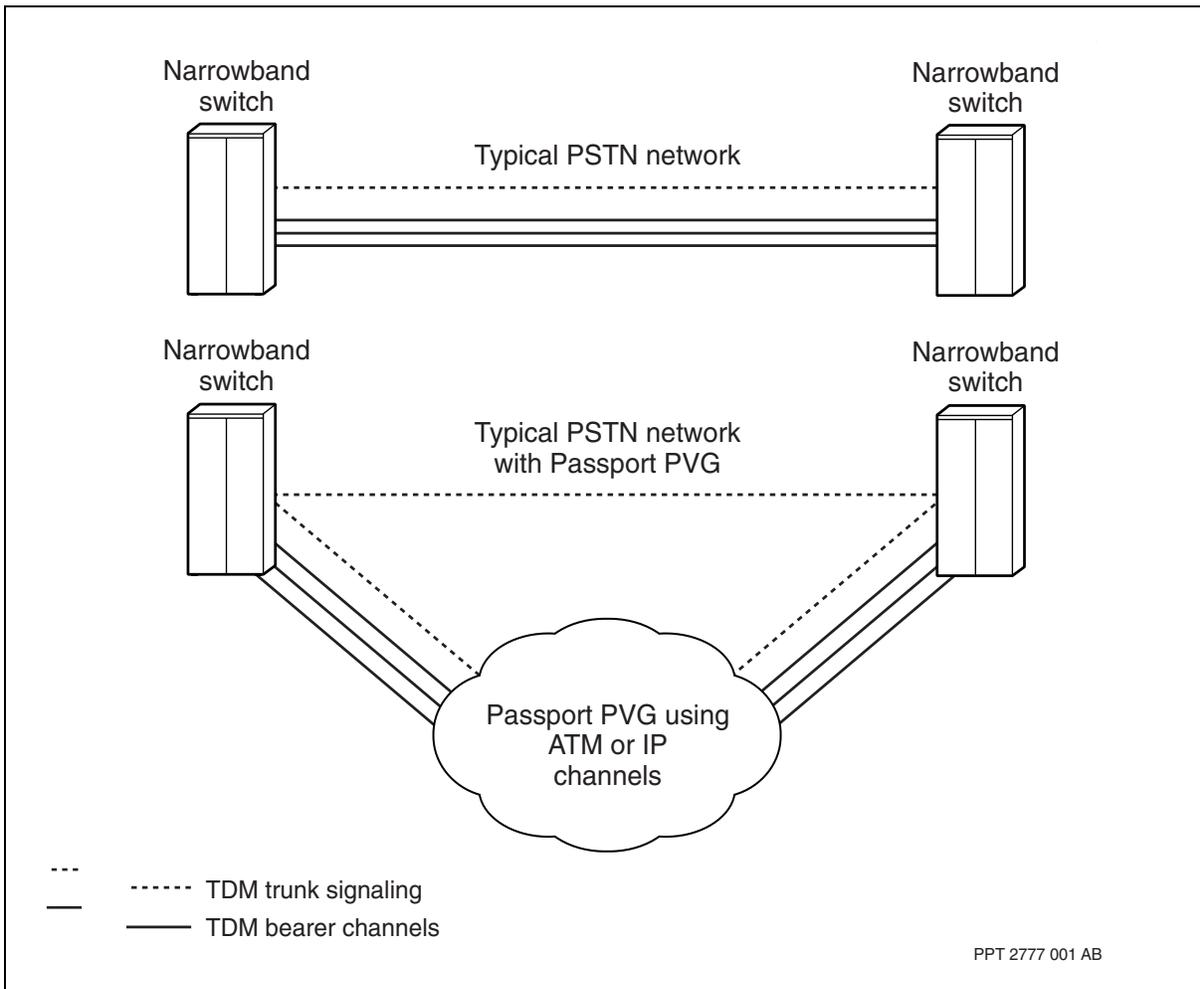
The figure Multiservice Switch Media Gateway configuration (page 105) shows two scenarios. The top part of the figure shows a typical PSTN network, consisting of narrowband switches that transport TDM signaling trunks and TDM bearer channels.

The bottom part of the figure shows a PSTN network with Media Gateway at work. TDM signaling trunks manage calls and ATM or IP channels transport voice and voice band data traffic over virtual connections. The virtual connections can consist of the following:

- permanent virtual connections (PVC)

- provisioned switched virtual connections (provisioned SVC)

- switched virtual connections (SVC)

- switched permanent virtual connections (SPVC)

- virtual router access point (VRAP)

Multiservice Switch Media Gateway configuration

Narrowband switch

Narrowband switch

Typical PSTN network

Narrowband switch

Narrowband switch

Typical PSTN network
with Passport PVG

Passport PVG using
ATM or IP
channels

- - - - - - - TDM trunk signaling

———— TDM bearer channels

PPT 2777 001 AB

The following Multiservice Switch Media Gateway applications are available:

- Non-switched Media Gateway using ATM (page 105)

- Switched Media Gateway using ATM (page 106)

- Switched Media Gateway using IP (page 106)

Non-switched Media Gateway using ATM

In non-switched Media Gateway, narrowband signaling arriving at the Nortel Multiservice Switch node is statically mapped to an ATM adaptation layer 2 (AAL2) channel. Similarly, each TDM time slot is statically mapped to a particular AAL2 channel identifier (CID) within an ATM virtual channel connection (VCC). Both are transported through the ATM network to another Multiservice Switch node. At the remote end, both are mapped back to TDM time slots and passed to another narrowband switch in the service provider

network. In this application, narrowband signals do not terminate at the Multiservice Switch node, but rather travel transparently over the ATM network.

Switched Media Gateway using ATM

In switched Media Gateway using ATM, an interworking function (IWF) terminates narrowband signaling. This method allows Nortel Multiservice Switch Media Gateway to dynamically create voice and voice band data connections between the service provider's TDM network and the ATM network. Incoming TDM time slots are dynamically mapped to outgoing AAL2 CIDs within an ATM VCC for each call. This mapping can also occur in the reverse direction with incoming CIDs within ATM VCCs being mapped to outgoing TDM time slots.

Switched Media Gateway using IP

In switched Media Gateway using IP, an IWF terminates narrowband signaling similar to switched Media Gateway using ATM. This method allows Multiservice Switch Media Gateway to dynamically create voice and voice band data connections between the service provider TDM network and the IP network. Incoming TDM time slots are dynamically mapped or switched to outgoing user datagram protocol (UDP) ports for each call. This mapping can also occur in the reverse direction, with incoming UDPs being switched to outgoing TDM time slots.

Voice platform for Multiservice Switch 7400

Nortel Multiservice Switch 7400 nodes provide three types of multipurpose voice services:

- Multiservice Switch 7400 voice transport service (page 106)
- Multiservice Switch 7400 DCME voice service (page 107)
- Multiservice Switch 7400 Voice networking service (page 107)

Multiservice Switch 7400 voice transport service

Nortel Multiservice Switch voice transport service can multiplex voice traffic onto an integrated backbone network with other traffic types. The voice transport service is based on cell switching techniques. The switching system transmits cells when they contain important digitized voice information. When a voice circuit is inactive, the bandwidth allocated for the circuit is available for other traffic.

Multiservice Switch voice transport service handles voice, video, data, image switching, and transport. The service uses a concurrent frame and cell transport technology. To reduce overhead, the service transports data traffic that allows delay changes as variable length frames. Multiservice Switch voice

transport service transports time-sensitive, constant bit rate (CBR) traffic, such as voice and video, across a Multiservice Switch network in fixed length cells.

Multiservice Switch voice transport service uses a frame-cell trunk interrupting mode method to make sure that voice cells receive priority in an environment that contains a combination of voice and data traffic. The service also ensures that any delay variance introduced between voice cells does not have an effect on voice quality. Multiservice Switch voice transport service uses the path-oriented routing system (PORS) to provide end-to-end paths that allow calculated delay differences and maintain cell order in a selected path. Multiservice Switch voice transport service also uses network clock synchronization to allow the access lines at both ends of a transparent data connection to transmit cells at the same rate.

For more information, see NN10600-750 *Nortel Multiservice Switch 7400 Operations: Voice Transport*.

Multiservice Switch 7400 DCME voice service

Nortel Multiservice Switch DCME voice service communicates both the availability of transmission channels and bandwidth, for a range of call types, to international switching centers (ISCs). Supported call types include voice band (speech, modem, and facsimile), 3.1 kHz audio, and 64 kbit/s unrestricted.

Multiservice Switch DCME voice service allows two interconnected Multiservice Switch nodes to emulate digital circuit multiplication equipment (DCME). International switching centers (ISCs) use DCME to process calls.

Multiservice Switch networks provide DCME functionality through support of ITU-T Recommendation Q.50. For more information about the DCME voice service, see NN10600-760 *Nortel Multiservice Switch 7400 Operations: DCME Voice Service* .

Multiservice Switch DCME voice service maintains a pool of pre-established path-oriented routing system (PORS) logical connections (LC) across a Multiservice Switch network to manage bursts of calls from ISCs. In addition, Multiservice Switch DCME voice service can configure new LCs on request. To reduce the bandwidth necessary to transmit pulse code modulation (PCM) encoded audio traffic, Multiservice Switch DCME voice service uses compression encoding algorithms.

Multiservice Switch 7400 Voice networking service

Nortel Multiservice Switch voice networking service provides routing of voice, modem, facsimile, and data calls through a Multiservice Switch network to addresses (dialed numbers) provided by the calling PBX. Multiservice Switch voice networking service selects the best path through the network using a

switched virtual circuit (SVC). Voice networking sets up and tears down an SVC for each new call, releasing bandwidth in the network for subsequent calls. Multiservice Switch voice networking service uses the path-oriented routing system and the dynamic packet routing system to route calls between Multiservice Switch nodes.

Multiservice Switch voice networking service allows you to define quality of service parameters based on the dialed number by using compression algorithms and both silence and idle period suppression techniques to increase bandwidth savings. Echo cancellation, comfort noise generation, network loss planning features, and congestion handling techniques provide toll-quality voice.

Multiservice Switch voice networking service supports a number of signaling protocols that allow it to communicate with a wide range of PBXs. Multiservice Switch voice networking service supports signaling based on both channel associated signaling (CAS) and common channel signaling (CCS) formats.

For more information, see NN10600-755 *Nortel Multiservice Switch 7400 Operations: Voice Networking*.

Transparent data services for Multiservice Switch 7400

Nortel Multiservice Switch transparent data services enable you to consolidate different traffic types over a Multiservice Switch backbone to reduce bandwidth use and minimize costs. Multiservice Switch transparent data services use path-oriented routing systems (PORS) and common Multiservice Switch trunks that normally do not require additional equipment.

Multiservice Switch nodes provide two transparent data services: bit transparent data service (BTDS) and high-level data link control (HDLC) transparent data service (HTDS). For more information, see the following sections:

Multiservice Switch 7400 HDLC transparent data service

The high-level data link control (HDLC) transparent data service (HTDS) transmits data using any protocols, including proprietary protocols, that use HDLC at the link layer. The frames travel through an end-to-end connection without a change.

HTDS provides good transfer speeds, low bandwidth requirements, and low costs. Common Nortel Multiservice Switch trunks provide this service without the need for additional customer equipment.

Path oriented routing service (PORS) provides the connection through determined fixed paths. These paths allow a minimum of delay differences in a connection. PORS maintains ordering but does not guarantee delivery. Higher layer protocols are responsible for frame recovery.

For more information, see NN10600-770 *Nortel Multiservice Switch 7400 Operations: HDLC Transparent Data Service*.

Multiservice Switch 7400 bit transparent data service

The bit transparent data service (BTDS) enables you to transmit constant bit rate data, such as video, across a network.

BTDS transfers data between user devices over permanent logical connections. At the source nodes, Nortel Multiservice Switch systems format the data into fixed length cells and transmits them across the network transparently. At the destination node, the cells are reformatted into the original data stream.

BTDS uses the path oriented routing system (PORS) service and network clock synchronization (NCS) service.

For more information, see NN10600-755 *Nortel Multiservice Switch 7400 Operations: Voice Networking*.

Multiservice Switch customer services

Use the following sections to learn more about Nortel Multiservice Switch customer services.

Navigation

Ordering procedures

The following information can help you to produce an order for Nortel Multiservice Switch hardware and software:

Ordering and delivering process

You can request only those Nortel Multiservice Switch hardware assemblies required for your network. You can upgrade your network by ordering other Multiservice Switch assemblies to install in your node.

Typically, you receive your Multiservice Switch node in its bay, with most assemblies installed at your selected site. You must install the control processors and function processors.

Nortel delivers software on CD-ROM to your selected site. The CD-ROM contains the software files described in the supplement report. The supplement report comes with the delivery.

As software changes, you automatically receive a software update on CD-ROM. The software update includes both current and new versions of supported base and application software. The software update replaces the previous release.

> **Attention:** When you issue a service request (SR) for a software problem, you may receive an emergency fix. Nortel updates fixes to the next version of an application that receives current support. See Service requests (page 114) for more information.

You can order documentation with each Multiservice Switch node. The documentation is available in several formats, including paper and CD-ROM.

Order preparation guidelines and considerations

The following items are guidelines to help you prepare for an order. If necessary, see your account manager during the process.

- Complete all planning and engineering activities to determine your requirements. For more information about planning and engineering, see NN10600-125 *Nortel Multiservice Switch 15000/20000 Planning Site Requirements* or NN10600-170 *Nortel Multiservice Switch 7400 Hardware Description*.

- Make sure that you identify each item and its dependencies.

- Determine your delivery requirements:

  — delivery date according to availability of the equipment

  — destination address of hardware, software, and documentation

  — destination address for billing and accounting information

- Determine your training and support needs.

- Determine licensing requirements for software use.

- Determine and procure additional products for supporting the Multiservice Switch network (for example, workstations, text interface device, and printers).

- Consult with your Nortel account manager to prepare a purchase order and other documents required to procure Multiservice Switch products.

Finding out more about the Multiservice Switch products

Your account manager is your primary information resource for determining your needs and possible solutions.

The following resources can answer questions about Nortel Multiservice Switch and other Nortel products:

- Nortel customer service representatives

- http://www.nortelnetworks.com

Nortel support services

Nortel support services can help you with training, problem reporting, and general requests. The following sections provide detailed information:

- Multiservice Switch courses (page 112)

- Nortel training centers (page 113)

- Service requests (page 114)

- Nortel technical support groups (page 114)

Multiservice Switch courses

Nortel provides training courses in all aspects of Nortel Multiservice Switch operations. These courses are currently evolving to meet customer needs and the expanding product requirements.

Currently Nortel offers the following courses, although these offerings may be replaced as necessary:

- Multiservice Switch Overview (page 112)

- Operating and Monitoring a Multiservice Switch Node (page 112)

- Provisioning and Maintaining a Multiservice Switch Node (page 113)

- Multiservice Switch Services, Nodal and Backbone Engineering (page 113)

- Multiservice Switch services courses (page 113)

For a complete list of courses available, or specific training material information, including schedules and registration details, contact your account prime, or one of the Nortel training centers (page 113).

Multiservice Switch Overview

This course is designed for anyone who needs an introduction to Nortel Multiservice Switch systems and functionality. The course covers the following topics: Multiservice Switch network architecture, Multiservice Switch network access services, routing systems overview and network management. It is presented in a downloadable self-study format.

Operating and Monitoring a Multiservice Switch Node

This course is designed for anyone who needs to monitor and ensure continual operation of Nortel Multiservice Switch 7400, Multiservice Switch 15000, or Multiservice Switch 20000 nodes.

The course provides an in-depth knowledge of Multiservice Switch component architecture. Students develop the skills and knowledge to monitor the node through the use of surveillance tools, and respond to and interpret alarms. A brief overview of the available NMS surveillance tools is provided.

Provisioning and Maintaining a Multiservice Switch Node

This course is designed for anyone who needs to provision, commission or maintain Nortel Multiservice Switch nodes.

The course provides an in-depth knowledge of Multiservice Switch node provisioning, maintenance and troubleshooting. Students will use the command line interface to provision and commission a factory-default Multiservice Switch node. Students will also learn and practice troubleshooting and maintenance procedures.

Multiservice Switch Services, Nodal and Backbone Engineering

This course is designed for anyone involved in the engineering of Nortel Multiservice Switch networks. After introducing Multiservice Switch network engineering and a description of Multiservice Switch hardware and routing systems, the course covers network engineering for both the node, and the backbone. The course also covers network engineering for the following services:

- ATM
- frame relay
- voice
- transparent data services

Multiservice Switch services courses

There are several services-related courses which will be available for Nortel Multiservice Switch. Please contact your regional training center for more information.

Nortel training centers

Nortel Multiservice Switch system training is available on an on-going basis. To register, or for more information, contact one of the Nortel training centers listed in the following table.

Nortel training center phone numbers

Area	Country	City	Number
North America (toll-free) *When you call this number, select a product, then choose whether you want information about training or documentation services*	1	877	662-5669
Asia Pacific	61	2	9325-5223
Europe, Middle East, Africa	44(0)	870	550-2501
Caribbean and Latin America			
Brazil	55	19	705-7979
Colombia	57	1	521-4222
Mexico	5	2	5480-8209
Sunrise, FL	1	954	851-8464

Service requests

A change request (CR) allows you to accurately define and report a problem to Nortel. Nortel produces the solution for you. On acceptance, Nortel includes the solution in a future software release.

To open a CR, gather all information necessary to reproduce the problem and then request that your local Nortel technical support group open a CR.

Nortel technical support groups

Nortel Multiservice Switch technical support is available from Nortel worldwide technical support groups that appear in the table below.

Nortel worldwide technical support groups

Area	Center	Address	Telephone
Canada	Training and Documentation Services	3500 Carling Avenue Ottawa, ON K1Y 4H7	Tel.: (877) 662-5669 Web: http://www.nortelnetworks.com/td
United States	Training and Documentation Services	901 Corporate Centre Drive Raleigh, North Carolina United States 27607	Tel.: (877) 662-5669 Web: http://www.nortelnetworks.com/td
		(1 of 2)	

Nortel worldwide technical support groups (continued)

Area	Center	Address	Telephone
United Kingdom	Nortel Training Services	Maidenhead Office Park Westacott Way Maidenhead, Berkshire SL6 3QH	Tel.: +44 (0) 1628 438857 Fax: +44 (0) 1628 438894 Web: http://www.nortelnetworks.com/ servsup/ets/
Asia/Pacific	Nortel Technical Training Centre	Level 5, 380 St. Kilda Road Melbourne, Victoria 3004 Australia	Tel.: +61 3 9206 4646 Fax: +61 3 9206 4844
(2 of 2)			

Procedure conventions

This document uses the following procedure conventions:

- You can enter commands using full component and attribute names, or you can abbreviate them. The commands used in the procedures contain the full component and attribute names in the first instance. In the second instance, the component and attribute names are abbreviated. For more information on abbreviating component and attribute names, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*. All component and attribute names are formatted in italics.

- The introduction of every procedure states whether you must perform the procedure in operational mode or provisioning mode. For more information on these modes, see Operational mode (page 116) or Provisioning mode (page 117).

- When you complete a procedure, you can verify your changes and then activate them as the new node configuration. For more information on completing configuration changes and exiting provisioning mode, see Activating configuration changes (page 117).

Operational mode

Procedures contained within this document can either be performed in operational mode or provisioning mode. When you initially log into a node, you are in operational mode. Nortel Multiservice Switch systems use the following command prompt when you are in operational mode:

```
#>
```

where:
is the current command number

In operational mode, you work with operational components and attributes. In operational mode, you can

- list operational components and display operational attributes to determine the current operating parameters for the node

- control the state of parts of the node by locking and unlocking components

- set certain operational attributes and enter commands to perform diagnostic tests

Provisioning mode

To change from operational mode to provisioning mode, type the following command at the operator prompt:

start Prov

Only one user can be in provisioning mode at a time. Nortel Multiservice Switch systems use the following command prompt whenever you are in provisioning mode:

PROV #>

where:

is the current command number

In provisioning mode, you work with the provisionable components and attributes that contain the current and future configurations of the node. You can add and delete components, and display and set provisionable attributes. For information on completing the configuration changes, exiting provisioning mode, and returning to operational mode see Activating configuration changes (page 117).

For information on operational and provisionable attributes, see NN10600-060 *Nortel Multiservice Switch 7400/15000/20000 Component Reference*.

Activating configuration changes

Several procedures in this document ask that you complete the configuration changes. When you complete the configuration changes, you are activating the configuration changes, confirming that you want to activate them, and saving the changes. You are instructed to complete the configuration changes only at the end of procedures that you perform in provisioning mode.

⚠	**CAUTION** **Activating a provisioning view can affect service** Activating a provisioning view can result in a CP reload or restart, causing all services on the node to fail. See NN10600-050 *Nortel Multiservice Switch 7400/15000/20000 Command Reference*, for more information.

> **CAUTION**
>
> **Risk of service failure**
>
> When you activate the provisioning changes (see step 3), you have 20 minutes to confirm these changes. If you do not confirm these changes within 20 minutes, the shelf resets and all services on the node fail.

1 Verify that the provisioning changes you have made are acceptable.

   check Prov

   Correct any errors and then verify the provisioning changes again.

2 If you want to store the provisioning changes in a file, save the provisioning view.

   save -f(<filename>) Prov

3 If you want these changes as well as other changes made in the edit view to take effect immediately, activate, confirm, and commit the provisioning changes.

   activate Prov
   confirm Prov
   commit Prov

4 End the provisioning session.

   end Prov

Nortel Multiservice Switch 7400/15000/20000

Overview