Nortel Networks Multiservice Switch 15000, Media Gateway 15000 and Preside MDM in Succession Networks

Performance

PT-AAL1/UA-AAL1/UA-IP

NN10158-711

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About this document

This document describes performance management for Nortel Networks Multiservice Switch 15000, Nortel Networks Media Gateway 15000, and Nortel Networks Multiservice Data Manager (MDM) within a Succession Network. Performance management involves monitoring, optimizing, and reporting on the behavior and effectiveness of the network. Performance data provides the information required for network planning and engineering.

This document describes performance measurement in the context of a Succession solution, particularly UA-AAL1, PT-AAL1, and UA - IP. However, these performance management tools can also be used in other contexts, for example a Packet Gateway Mobile Switching Center (PGMSC). In those cases, some of the information in this manual may not apply directly. For example, the threshold calculations in Appendix A "Use cases, thresholds, and utilization formulas for NTM statistics" (page 107) apply to specific Succession solutions only. We recommend that you apply knowledge of your own installation to adapt this information to your Succession network.

This chapter includes the following topics:

Who should read this document and why

This document is intended for people who need to understand performance management of Nortel Networks Multiservice Switch 15000 equipment, Media Gateway 15000 equipment, and MDM within all solutions of the Succession portfolio. This document provides information needed by:

- the higher-level management system applications that process the generated CSV files
- customers and network planners who need to know how performance management fits into their operational environment
- operations personnel who need to understand some details of performance management for troubleshooting purposes

What you need to know

Before you read this document, it is helpful to have a general understanding of the concept of the Succession Network, the solutions within that portfolio, and the role Nortel Networks Multiservice Switch 15000 and Media Gateway 15000 nodes can play in these solutions.

For more information about Succession Network PT-AAL1 and UA-AAL1 solutions, see:

- NN10320-100 *ATM Solutions Basics*

For more information about a Succession Network UA - IP solution, see:

- NN10300-100 *IP Solutions Basics*

How this document is organized

This document begins with a high-level description of the performance management function. It then outlines Nortel Networks Multiservice Switch solutions within the Succession Network: PT-AAL1, UA-AAL1, and UA - IP. Next, it describes Network Traffic Management (NTM) statistics collection and data flow within the Succession Network. Next, each of the NTM statistics is described in detail with the exact syntax and range of values given. Lastly, an appendix provides additional reference information on NTM statistics.

This document contains the following sections:

- Chapter 1 “Performance management overview” (page 21)
- Chapter 2 “Performance management overview” (page 21)
- Chapter 3 “NTM statistics description” (page 39)
- Appendix A “Use cases, thresholds, and utilization formulas for NTM statistics” (page 107)

What’s new in this document

The following features were added to this document:

- “New PMs for Succession UA - IP” (page 15)
- “Updated PMs for Multiservice Switch 15000 and Nortel Networks Media Gateway 15000 nodes in Succession” (page 16)
- “New utilization formulas that use PMs” (page 16)
- “New suggested thresholds for monitoring metrics” (page 17)

New PMs for Succession UA - IP

The 5- and 30-minute performance measurements (PMs) now provide Internet protocol (IP) statistics. The IP statistics are available at a physical interface level. You can use IP statistics for operational monitoring and for network planning and engineering. Also, you can obtain performance information from IP statistics, such as link bandwidth utilization, voice call volumes, and error conditions. These are key for monitoring the network using PMs.

IP interface statistics apply to all physical interfaces on Nortel Networks Multiservice Switch 15000 nodes that process layer 3 IP. This includes ports on the Ethernet-based Gigabit Ethernet (GE) function processors (FPs), the control processor (CP) operations, administration, and maintenance (OAM) Ethernet port, and the asynchronous transfer mode (ATM)-based OC-3, OC-12 and DS3 ports.

The following sections were updated:

- Chapter 1, “Performance management overview,” (page 21)
- Chapter 2, “NTM statistics file management,” (page 33)

- Chapter 3, "NTM statistics description," (page 39)
- Appendix A "Use cases, thresholds, and utilization formulas for NTM statistics" (page 107)

Updated PMs for Multiservice Switch 15000 and Nortel Networks Media Gateway 15000 nodes in Succession

Performance measurements (PMs) for the Nortel Networks Multiservice Switch 15000 and Media Gateway 15000 nodes for all Succession solutions now include an expanded range of values. In addition, some PMs available before this release, for example LINKID, also include an expanded range of values.

The new PMs do not re-use or re-define names of older PMs available before this release.

The following sections were updated:

- Chapter 3, "NTM statistics description," (page 39)

New utilization formulas that use PMs

New utilization formulas are now available that use performance measurements (PMs). PMs are not intended to be used by themselves. Rather, you can use several PMs together, to describe a particular state of the system and the network. To this end, new utilization formulas are available that use the new PMs for IP physical interfaces.

Information is provided for ways to use the PMs, and expected values in a steady-state operation of a Succession UA - IP solution.

The utilization formulas available before this release are still valid, and still use the same PM names.

The following sections were updated:

- Appendix A "Use cases, thresholds, and utilization formulas for NTM statistics" (page 107)

New suggested thresholds for monitoring metrics

Appendix A “Use cases, thresholds, and utilization formulas for NTM statistics” (page 107) suggests new thresholds for monitoring metrics. Use both PMs and utilization values to help indicate potential network problems. Note that the threshold values given are suggestions only. You, along with your higher-level management system, must fine-tune these values. Depending on the network, both PMs and utilization can have a wide range of values.

The following sections were updated:

- Appendix A “Use cases, thresholds, and utilization formulas for NTM statistics” (page 107)

Other changes made to this document include the following:

- The terms Passport 15000 and Packet Voice Gateway (PVG) have been rebranded in conjunction with the new Nortel Networks’ brand simplified naming format.

  The Passport 15000 is now referred to as the Nortel Networks Multiservice Switch 15000. The Packet Voice Gateway (PVG) is now referred to as Nortel Networks Media Gateway 15000.

  The Multiservice Switch 15000 and Media Gateway 15000 network elements continue to share common hardware and software aspects. Hybrid systems can combine these network elements’ capabilities, despite the fact that no specific brand exists for such hybrids.

  For more information on the product rebranding, refer to NN10600-000 *Nortel Networks Multiservice Switch 7400/15000/20000 What’s New in PCR6.1*.

Text conventions

This document uses the following text conventions:

- `nonproportional spaced plain type`

  Nonproportional spaced plain type represents system generated text or text that appears on your screen.

- **`nonproportional spaced bold type`**

  Nonproportional spaced bold type represents words that you must type or that you select on the screen.

- *italics*

  Statements that appear in italics in a procedure explain the results of a particular step and appear immediately following the step.

  Words that appear in italics in text are used for naming.

- `[optional_parameter]`

  Words in square brackets represent optional parameters. The command can be entered with or without the words in the square brackets.

- `<general_term>`

  Words in angle brackets represent variables which must be replaced with specific values.

- UPPERCASE, lowercase

  In Nortel Networks Preside Multiservice Data Manager, uppercase and lowercase letters that appear in UNIX commands and parameters must be matched exactly. The system matches upper and lowercase characters differently.

- UPPERCASE, lowercase

  Nortel Networks Multiservice Switch and Media Gateway system commands are not case-sensitive. They do not have to match commands and parameters exactly as shown in this document. The exceptions are string options values (for example, file and directory names) and string attribute values.

- |

  This symbol separates items from which you can select one. For example, ON|OFF indicates that you can specify ON or OFF. If you do not make a choice, a default of ON is assumed.

- ...

  Three dots in a command indicate that the parameter can be repeated.

The term absolute pathname refers to the full specification of a path starting from the root directory. Absolute pathnames always begin with the slash (/) symbol. A relative pathname takes the current directory as its starting point, and starts with any alphanumeric character (other than /).

Related documents

Refer to the following documents while monitoring and managing the performance of tNortel Networks Multiservice Switch 15000 equipment and Preside Multiservice Data Manager servers:

- NN10092-911 *Nortel Networks Multiservice Switch 15000, Media Gateway 15000 and Preside MDM in Succession Networks Fault Management Overview PT-AAL1/UA-AAL1/UA-IP*
- NN10198-912 *Nortel Networks Multiservice Switch 15000, Media Gateway 15000 and Preside MDM in Succession Networks Fault Management Troubleshooting PT-AAL1/UA-AAL1/UA-IP*
- NN10600-520 *Nortel Networks Multiservice Switch 7400/15000/20000 Fault and Performance Management: Troubleshooting*
- NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*
- NN10600-715 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Fault and Performance Management*
- 241-6001-011 *Preside MDM Fault Management User Guide*
- 241-6001-023 *Preside MDM Configuration Management for Passport User Guide*
- 241-6001-310 *Preside MDM Server Reference Guide*

- 297-2667-321 *SuperNode Data Manager Carrier OM Data Delivery Application User Guide*
- 297-5051-913 *SuperNode Data Manager Secure File Transfer User Guide*
- 297-5061-906 *SuperNode Data Manager Fault Tolerant User Guide*

How to get more help

For information on training, problem reporting, and technical support, see the “Nortel Networks support services” section in NN10600-030 *Nortel Networks Multiservice Switch 7400/15000/20000 Overview*.

For information on training, problem reporting, and technical support for the Preside MDM, please contact Global Network Technical Support (GNTS).

Chapter 1
Performance management overview

This section provides an overview of the flow of performance management data for Nortel Networks Multiservice Switch 15000 and Media Gateway 15000 equipment within all Succession Network solutions.

Within the Multiservice Switch in Succession context, performance measurements (PMs) are referred to as network traffic management (NTM) statistics. NTM statistics is the term most commonly used in this document when referring to the collection of performance data from Multiservice Switch 15000 and Media Gateway 15000 nodes.

Multiservice Switch documentation refers to NTM statistics as performance measurements (PMs), and as real-time statistics (rtstats).

The PMs apply to all Multiservice Switch 15000 nodes and Media Gateway 15000 nodes in Succession Network solutions. The Media Gateway 15000 is used only in a UA - IP Succession solution.

In the context of customer Operations Support Systems (OSS) or higher level management systems such the CS2000 Core Manager running on the SDM, NTM statistics and PMs are known as Operational Measurements (OMs).

This chapter includes the sections as follows:

- “Use of performance measurements (PMs)” (page 27)
- “Performance management for IP physical interfaces” (page 30)

Purpose of NTM statistics

Statistics for network traffic management (NTM) are used to measure performance, from a network-level view. The NTM statistics received from the various network elements are typically processed by Operations Support Systems (OSS) applications for use by various groups such as network operations and network planning.

NTM statistics collection and data flow

Network traffic management (NTM) statistics are a type of performance data. The data collection system (DCS) on the node collects NTM statistics from the control and function processors, and ATM and IP interfaces, at 5-minute intervals. To collect the statistics, the DCS uses a real-time statistics stream (rtstats). Each node forwards these records to Nortel Networks Preside Multiservice Data Manager (MDM) servers.

On Nortel Networks Preside Multiservice Data Manager (MDM) servers, the Performance Measurements Stream Processor (PMSP) server application manages performance. NTM statistics originating from node processors flow to the PMSP server application. The PMSP server application converts the statistics into ASCII comma separated value (CSV) formatted 5-minute records. It also creates 30-minute data records by aggregating six 5-minute data records. These are referred to as 5-minute and 30-minute performance measurements (PMs).

The Preside MDM servers transfer the NTM data directly to the OSS applications, or to the CS2000 Core Manager running on the SDM, depending on the Succession Network configuration.

It is possible to view PM records off-switch. To do this, use any application able to read CSV-formatted text, for example Microsoft Excel. To view CSV files located on the Preside MDM server, use the Preside MDM Data Viewer tool in replay mode. For PMs collected on a Preside MDM server in a different system, use one of the methods as follows:

- have the remote file system mounted on your local machine to access the data
- use file transfer protocol (FTP) to transfer the data from the remote machine to the local machine
- telnet to the remote machine and run Data Viewer

Configurations for performance management

It is possible to deploy a dedicated PMSP server, responsible only for processing performance information. This allows you to use a simplex platform and reduce hardware costs. The PMSP server would then communicate with SDM or the OSS to transfer the NTM data.

If you are running Preside MDM performance data collection in a centralized location, you can send the NTM data to different SDM destinations. In this case, use multiple PMSP servers, one for each SDM destination. Each PMSP server collects NTM data only from the Multiservice Switch / Media Gateway nodes that the destination SDM is interested in.

For examples of performance management configurations, see the following figures:

- Figure 1, “Performance data flow to the OSS applications by way of SDM (PT-AAL1/UA-AAL1/UA - IP),” (page 25)
- Figure 2, “Performance data flow to the OSS applications by way of Preside MDM,” (page 26)

Note: Figure 1, “Performance data flow to the OSS applications by way of SDM (PT-AAL1/UA-AAL1/UA - IP),” (page 25) and Figure 2, “Performance data flow to the OSS applications by way of Preside MDM,” (page 26) do not represent the redundant links between the components. For more information about actual connection links and redundancy between links, see NN10114-511 *Nortel Networks*

Multiservice Switch 15000, Media Gateway 15000 and Preside MDM in Succession Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP.

Figure 1
Performance data flow to the OSS applications by way of SDM (PT-AAL1/UA-AAL1/UA - IP)

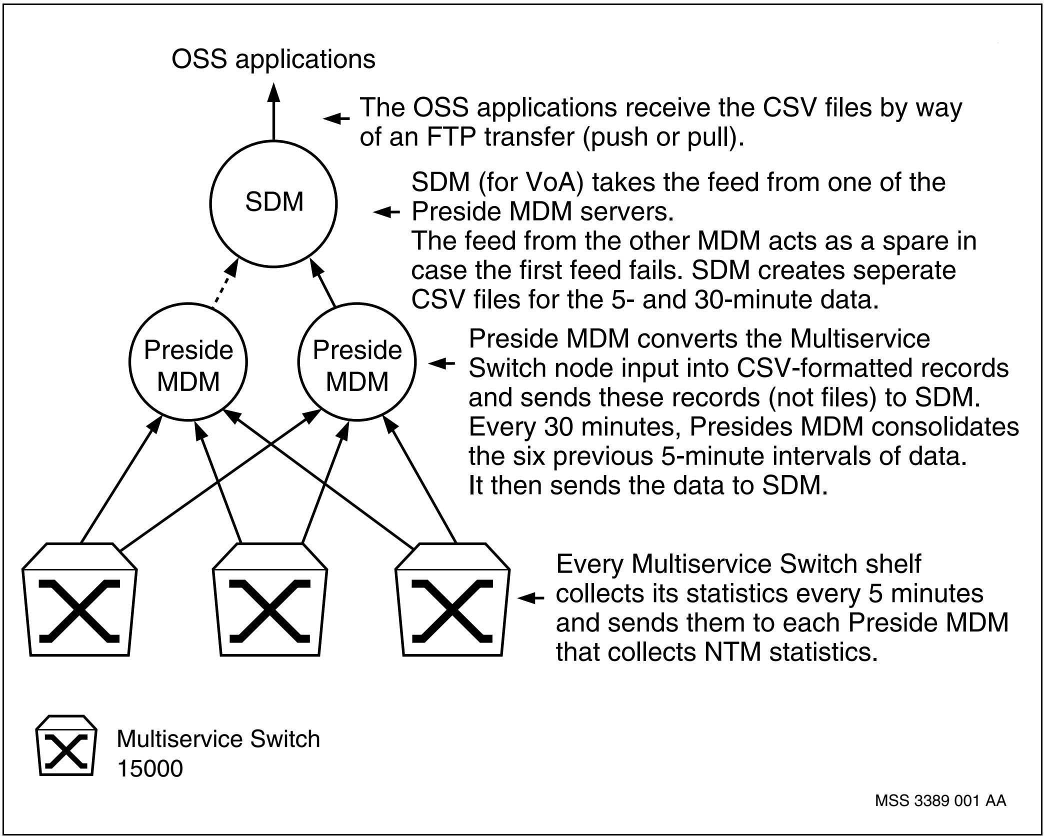
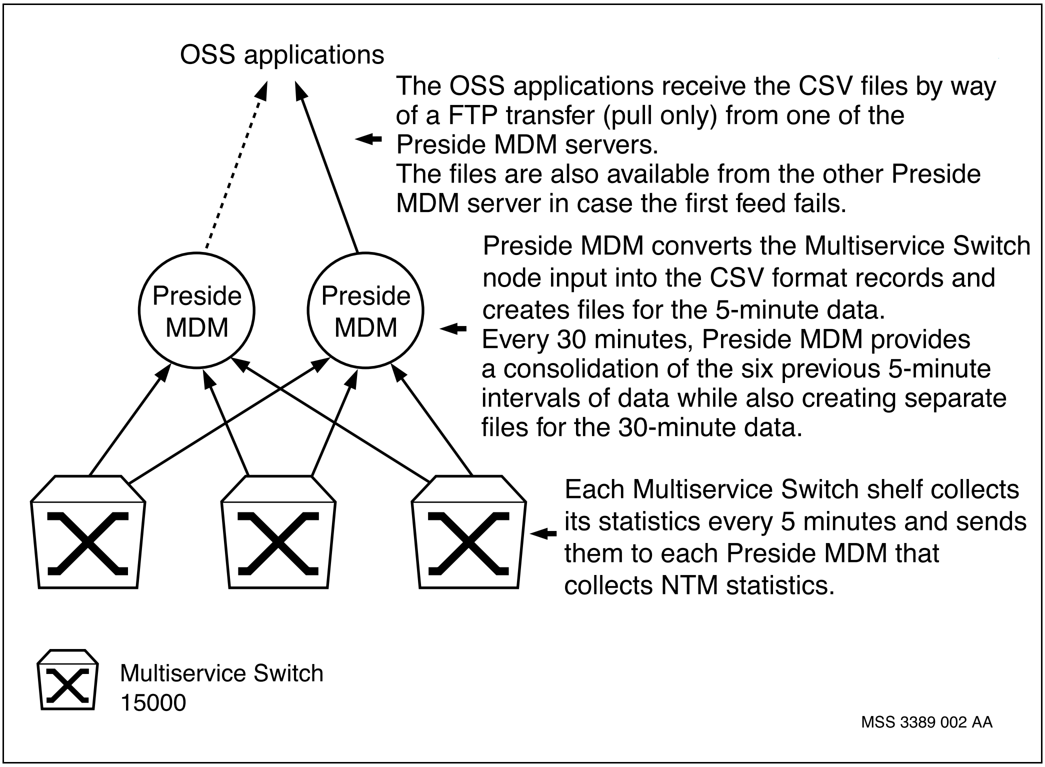


Figure 2
Performance data flow to the OSS applications by way of Preside MDM



Use of performance measurements (PMs)

Performance measurements (PMs) provide performance information to a customer’s network engineering and planning groups, as well as their operations group.

A network operations group generally uses 5-minute PMs to diagnose hardware and software problems in the network, in near real-time. During a network outage, the number of alarms generated network-wide can potentially overwhelm the network operations centre. The volume of PMs, however, remains constant. They provide a view of the network, in an easily accessible format.

A network planning group generally uses 30-minute PMs for longer term analysis and planning, such as flagging potential growth and congestion issues in the network.

Use of PMs for network operations

A network operations group generally uses 5-minute PMs to diagnose problems in the network.

When a fault occurs in the network, a customer operations group requires information to do three things:

1. Fault detection
2. Fault isolation and resolution
3. Determination of the impact to service

A hardware or software problem can be the cause of a fault. An example of a hardware problem is a cut line, or a faulty network card. An example of a software problem is a software defect, an overload condition in the network (the result of mass calling events, disasters, or security attacks), or bad node configuration.

Fault detection alerts the network operator to a potential service-affecting problem in the network. The network operator needs to detect the problem as soon as possible, so as to take recovery action promptly.

Fault isolation helps the network operator identify not only where the problem originated, but what is affected and where to fix it. The network operator needs to determine this quickly, and take action to mitigate the problem. An initial action is to route network traffic around the problem area, in order to restore service. After that, the network operator can determine the cause of the problem and get it repaired.

For both fault detection and fault isolation, the 5-minute PMs, the Succession Operational Measurements (OMs), and the alarms/logs are key.

To help detect hardware problems, start by monitoring the alarms and logs. They give the first indication of a problem. They also give detailed information that is key in determining where and why the problem occurred. Next, use 5-minute PMs to help detect and isolate hardware problems. However, these PMs are slower to report problems than the alarm stream, because they report issues at a 5-minute interval. The alarm stream reports issues within seconds.

To help detect software problems, start by monitoring the 5-minute PMs. Often, issues such as incorrect configurations or software problems do not generate alarms, but do degrade service. Use PMs as the next (and perhaps only) way to detect and isolate a problem. It can be difficult to detect a software problem. There is sometimes no clear indicator of a problem. Monitoring the PMs for abnormal values is sometimes the only way to identify a service degradation. Therefore, it is important to measure typical values of the PMs, and statistical deviation from those values, during normal operation of your network. This helps you to establish a baseline.

Operational measurements (OMs), Succession information available through the DMS OAM Maintenance and Administration Position (MAP), and to a lesser degree node PMs, are useful for determining the impact to service.

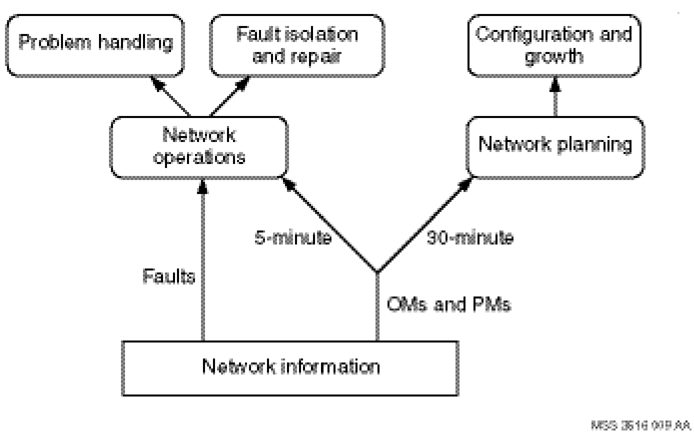
Use of PMs for network planning

On the network planning side, a customer requires information to determine when to schedule growth or redeploy resources. The 30-minute PMs provide useful information for flagging potential growth and congestion issues within the IP or ATM packet cores.

Formulas for calculating link utilization on the IP and ATM links are of great value for estimating growth requirements. Also helpful are formulas for estimating call processing, such as call peak periods, call volume, and average holding times.

Figure 3, “Customer use of PMs,” (page 29) illustrates the potential uses of PMs.

Figure 3
Customer use of PMs



Performance management for IP physical interfaces

The SN07 release introduces Internet protocol (IP) statistics into the 5- and 30-minute performance measurements (PMs). The IP PMs are available at the physical interface level.

You can use IP PMs for operational monitoring, and for network planning and engineering. For metrics derived from IP PMs, see Appendix A “Use cases, thresholds, and utilization formulas for NTM statistics” (page 107). It provides formulas for calculating link bandwidth utilization, voice call volumes, and error conditions. This is helpful information for monitoring the network.

IP interface PMs apply to all physical interfaces on the node that processes layer 3 internet protocol (IP). This includes:

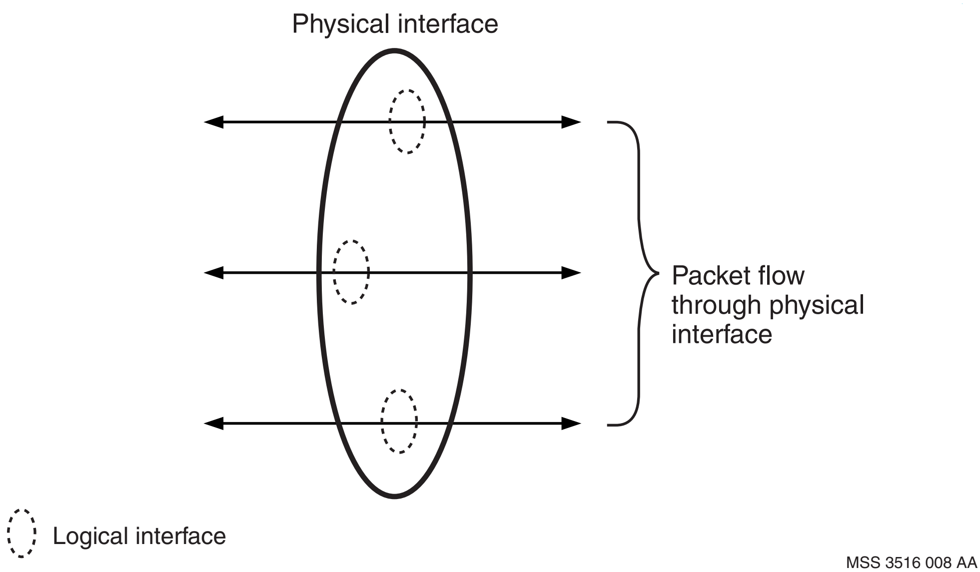
- the ports on the Gigabit Ethernet (GE) functional processor (FP) cards
- the operations, administration, and maintenance (OAM) Ethernet port on the control processor (CP) card
- the asynchronous transfer mode (ATM)-based OC-3, OC-12, and DS3 ports.

In the row of PMs, the LINKID field identifies the name of the physical interface.

An IP physical interface can contain several logical interfaces. These logical interfaces correspond to different virtual routers. The IP PMs cannot help you to resolve problems at the ATM connection level. For this task, use operational attributes instead.

Figure 4, “Physical and logical interfaces (UA-IP),” (page 31) shows an example of a physical interface. This physical interface has several logical interfaces configured on it. The figure also shows packet flow through the logical interfaces. PMs are available for each of the logical interfaces.

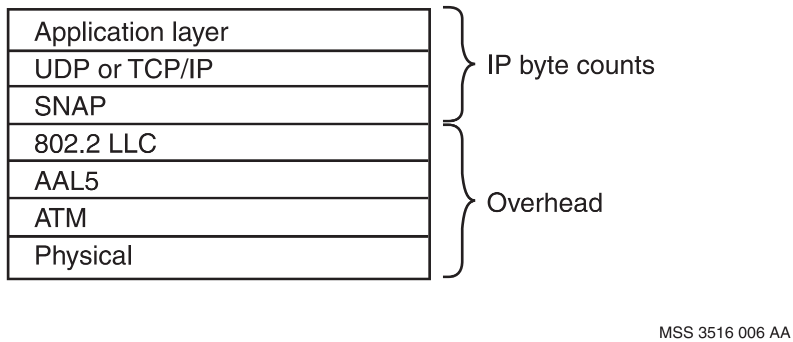
Figure 4
Physical and logical interfaces (UA-IP)



Note: Line automatic protection switching (LAPS) on ATM links results in cell flow over both of the 1+1 protected links. When LAPS is defined, IP statistics are reported for the LAPS component, rather than the individual SONET components. Regardless of which of the protected lines is active, the PMs are always reported for the same component. This component is EM/<shelf> LAPS/<id> STS/0.

Figure 5, “ATM protocol stack,” (page 32) illustrates the protocols used for an ATM interface.

Figure 5
ATM protocol stack



Chapter 2
NTM statistics file management

Network traffic management (NTM) statistics are available from Nortel Networks Multiservice Switch 15000 and Media Gateway 15000 nodes. The same process that collects them also aggregates six 5-minute interval data records into one 30-minute interval data record, and produces CSV-formatted files. CSV-formatted files are comma-separated ASCII-formatted files.

This chapter provides more information on the file names of the 5- and 30-minute data records, and on their location. It includes the sections as follows:

Names and locations of SDM files

NTM statistics data can be configured to be obtained from the SuperNode Data Manager (SDM).The PM file follows the file naming conventions of the Operational Measurement Delivery (OMD) application. The format of the file name is:

```
<name>.<date>.<time>.PP.<type>.CSV
```

Here is an explanation of each element in the file name:

- a name matching the report registration configured by the Operational Measurements User Interface (OMUI). The default files for both 5-minute and 30-minute NTM statistics are created by the OMD application during initial installation. The default file names for the NTM statistics files are PP_5MIN_PM and PP_30MIN_PM, respectively. The default report registration can be deleted and a new report registration can be added. However, no more than one report registration is allowed for the 5-minute and 30-minute NTM statistics at any one time.

- a date stamp indicating the date on which the data was collected, using the format of MM_DD_YYYY
- a time stamp indicating the time at which the data was collected, using the format of HHMM
- the letters “PP” indicating that the collected NTM statistics came from a Multiservice Switch 15000 or Media Gateway 15000 node
- the type of NTM statistics included in the file, either “FIVE” or “THIRTY” minute data
- the format type, always “CSV” for SDM files

Note: The time stamp is relative to the node and represents the end of the time period over which the data was collected.

For example, if the Report Registration name is "PP_5MIN_PM", then the 5-minute NTM statistics file generated for June 23, 2002 at 1325 is named PP_5MIN_PM.06_23_2002.1325.PP.FIVE.CSV.

The collected NTM statistics files are stored in the /omdata/closedNotSent directory. They are now available to the OSS application. The OSS application retrieves the files and moves them to the /omdata/closedSent directory. Upon the transfer of the files, the OMD automatically sets the retention period for the files. The retention period for a file can be configured using the OMUI. It can range from one to fourteen days.

Retrieval of the NTM statistic files from SDM

In order for a user application to retrieve the NTM statistics files for a particular node, or set of nodes, the following information must be available:

- the IP address of the SDM platform running the OMD application which interacts with those Nortel Networks Preside Multiservice Data Manager servers running the PMSP instance that collects PM data from the node

For more information about the OMD application interface, see the SDM documentation.

Names and locations of Preside MDM files

When NTM statistics data is configured to be obtained from Nortel Networks Preside Multiservice Data Manager (MDM) servers, the name of the file is similar to that used by SDM. However, the Host Group Directory Server (HGDS) group name or shelf name indicating the source of the NTM statistics data replaces the "PP" string found after the time stamp in the SDM file name. The format for the file name appears below.

```
<name>.<date>.<time>.<HGDS group or shelf
name>.<type>.CSV
```

where the elements of the file name are as follows:

- a name matching the report registration, either PP_5MIN_PM or PP_30MIN_PM
- a date stamp indicating the date on which the data was collected, using the format MM_DD_YYYY
- a time stamp indicating the time at which the data was collected, using the format HHMM
- text indicating either the node's HGDS group name or the node shelf name found in the NTM statistics data record
- the type of NTM statistics included in the file, either "FIVE" or "THIRTY" minute data
- the format type, either "CSV" or "CO"

Note 1: While a file is open, the format type extension is set to "CO". Files with this extension are currently being written to. Therefore, they must not be transferred or manipulated in any way. After the file is successfully closed, it is renamed with a "CSV" extension. This indicates that the file can now be manipulated.

Note 2: The time stamp is relative to the node. It represents the end of the time period over which the data was collected.

For example, the name of a Preside MDM 5-minute NTM statistics file generated on June 23, 2002 at 1325 is `PP_5MIN_PM.06_23_2002.1325.PM_REGION1.FIVE.CSV`.

The actual storage directory for the NTM statistics files is specified when the Preside MDM PMSP application is being installed. Each PMSP instance controls a set of nodes defined by an HGDS group. In the example below, this is groupX. These PMSP instances write files into a unique directory defined through a command line option. The convention to use for installing a PMSP application is as follows:

1 Create a directory called `/opt/MagellanNMS/data/pmsp/<groupX>`, where <groupX> is a string that is unique for each PMSP instance.

2 Create two sub-directories of the `<groupX>` directory, one called `closedNotSent` and another called `closedSent` (this aligns with the directory names used on the SDM).

If the `closedNotSent` directory is missing or is not writable, the PMSP application does not install.

3 Use the following optional parameters with the PMSP command (see step 1) to specify that the 5- and 30-minute streamed NTM statistics are written to the `closedNotSent` directory and the latency time-out in seconds: `[-savefile -hgds | -shelf]`, `[-ppexpire <seconds>]`.

Note 1: See 241-6001-310 *Preside MDM Server Reference Guide* for all the options.

Note 2: You must include the savefile parameter in the PMSP command to create the CSV-formatted files on the Preside MDM server.

Note 3: Nortel Networks recommends you have a consistent time-out value across the all the Preside MDM servers. This allows the applications retrieving the files to be set up to log in only after the files are closed. The default latency time-out value is 15 seconds. To change it, include the -ppexpire parameter in the PMSP command, and set <seconds> to the value of your choice. For information on choosing a latency time-out value, refer to the 241-6001-101 *Preside MDM Engineering Guide*.

Note 4: Add the optional -nosync argument to the command above if you want the PMSP to process records with time stamps that fall outside of the pre-set 5-minute collection interval or 30-minute aggregate interval.

During installation, Nortel Networks recommends specifying a cron job, to clean up PM files. The default setting cleans up files that are older than 30 days from both the `closedNotSent` and `closedSent` directories. For more information on using the `crontab` command, see NN10180-611 *Nortel Networks Multiservice Switch 15000, Media Gateway 15000 and Preside MDM in Succession Networks Security and Administration PT-AAL1/UA-AAL1/UA-IP*.

After successfully transferring closed files with a `CSV` extension (not those with a `CO` extension) from the `closedNotSent` directory using FTP, the user application (usually, the OSS application) proceeds as follows:

- moves the files to the corresponding `closedSent` directory (the recommended option)
- deletes the files

Note: Multiple, independent OSS applications can require the use of the same NTM statistics files. The customer is responsible for ensuring that all applications maintain access to the files even if they are moved or deleted.

Retrieval of the NTM statistic files from storage

In order for a user application to retrieve the NTM statistics files for a particular node, or set of nodes, the following information must be available:

- the IP address of the Nortel Networks Preside Multiservice Data Manager (MDM) platform running the PMSP instance which is collecting PM data from the node
- the IP address of the redundant Preside MDM platform, if applicable
- the latency expiry time (required so that the application logs in only after the files are closed)
- the HGDS group name, for example, `<groupX>` (required in order to locate the proper subdirectory of `/opt/MagellanNMS/data/pmsp`
- knowledge of whether the CSV files are on a per-HGDS group or per-shelf basis. This must be consistent across the PMSP servers on different Preside MDM servers. The OSS applications can retrieve CSV files by searching for file names containing either an HGDS group name or a shelf name, but not a mixture of both.

Chapter 3
NTM statistics description

This chapter gives detailed information about performance management using NTM statistics. It includes the sections as follows:

Description of the header line of a CSV file

The first line in a comma-separated CSV-formatted file is the header line. The header line contains a keyword for each NTM field with each keyword separated from the others by commas. The position of the keyword in the header line determines the corresponding position in the subsequent records (doled out one line per record) of the values for a particular interface.

For the content of the header for this release, see "Sample header line of a CSV-formatted file" (page 40). For a sample CSV-formatted file with header line and body text, see "Partial example of a 5-minute CSV-formatted file" (page 42).

Figure 6
Sample header line of a CSV-formatted file

```
DATE,TIME,SHELFID,OFFICEID,SYSUTIL,LINKID,CRITICALSETALARMS,MAJORSETALARMS,MIN
ORSETALARMS,CRITICALCLEARALARMS,MAJORCLEARALARMS,MINORCLEARALARMS,MAXT
EMP,CARDUTILAVG,LMBUTIL,LINKCAP,SIGNALLINGCHANNELSTATUS,INCLP0+1,INCBRCLP0+1
,INRTVBRCLP0+1,INNRTVBRCLP0+1,INUBRCLP0+1,OUTCLP0+1,OUTCBRCLP0+1,OUTRTVBRC
LP0+1,OUTNRTVBRCLP0+1,OUTUBRCLP0+1,OUTCLP0+1DIS,INCLP0+1DIS,OUTCBRCLP0+1DI
S,OUTRTVBRCLP0+1DIS,OUTNRTVBRCLP0+1DIS,OUTUBRCLP0+1DIS,REMOTEATMIFLABEL,IN
SETUP,INCBRSETUP,INRTVBRSETUP,INNRTVBRSETUP,INUBRSETUP,INCBRFAIL,INRTVBRFAIL,
INNRTVBRFAIL,INUBRFAIL,INFAIL3,INFAIL17,INFAIL18,INFAIL21,INFAIL27,INFAIL28,INFAIL35,INF
AIL36,INFAIL37,INFAIL41,INFAIL45,INFAIL47,INFAIL49,INFAIL57,INFAIL58,INFAIL63,INFAIL65,INFA
IL73,INFAIL78,INFAIL88,INFAIL96,INFAIL99,INFAIL100,INFAIL104,INFAIL111,OUTSETUP,OUTCBR
SETUP,OUTRTVBRSETUP,OUTNRTVBRSETUP,OUTUBRSETUP,OUTCBRFAIL,OUTRTVBRFAIL,O
UTNRTVBRFAIL,OUTUBRFAIL,OUTFAIL3,OUTFAIL17,OUTFAIL18,OUTFAIL21,OUTFAIL27,OUTFAI
L28,OUTFAIL35,OUTFAIL36,OUTFAIL37,OUTFAIL41,OUTFAIL45,OUTFAIL47,OUTFAIL49,OUTFAIL
57,OUTFAIL58,OUTFAIL63,OUTFAIL65,OUTFAIL73,OUTFAIL78,OUTFAIL88,OUTFAIL96,OUTFAIL9
9,OUTFAIL100,OUTFAIL104,OUTFAIL111,IPLINKCAP,INBYTES,OUTBYTES,INPACKETS,OUTPAC
KETS,INTCPPACKETSLOCAL,INUDPPACKETSLOCAL,INICMPPACKETSLOCAL,INOSPFPACKETS
LOCAL,INARPPACKETSLOCAL,INOTHERPACKETSLOCAL,OUTTCPPACKETSLOCAL,OUTUDPPA
CKETSLOCAL,OUTICMPPACKETSLOCAL,OUTOSPFPACKETSLOCAL,OUTARPPACKETSLOCAL,
OUTOTHERPACKETSLOCAL,INDIFFSERVBEARER,INDIFFSERVCONTROL,INDIFFSERVNETWO
RK,INDIFFSERVOAMP,INDIFFSERVDEFAULT,INDIFFSERVOTHER,OUTDIFFSERVBEARER,OUTDI
FFSERVCONTROL,OUTDIFFSERVNETWORK,OUTDIFFSERVOAMP,OUTDIFFSERVDEFAULT,OUT
DIFFSERVOTHER,INPACKETSDIS,OUTPACKETSDIS,INLOCALEXCEPTIONS,INFWDEXCEPTION
S,VSPUTILAVG,CONGSECS,OVLDCMDSREJECTED,OUTH248RETRAN,INH248RETRAN,FAILOV
ERS,CALLFAILSNET,CALLFAILTDM,DIGITREJECT,CALLSETUPS,ACTIVECALLAVG,ACTIVECALL
MIN,ACTIVECALLMAX
```

> ***Note:*** Some of the NTM statistics described in this document are based on GR-477-CORE R4-7, O4-10, R4-11, R4-12, and R4-13 standards, with the intention of applying various network level controls.

Each file has one header line. In SN04 and SN05, the header line is approximately 500-600 characters in length. In SN06, the header line is approximately 700 characters. In SN07, the header line is approximately 1848 characters.

The header format of the PM data files is the same on either Nortel Networks Preside Multiservice Data Manager (MDM) or the SuperNode Data Manager (SDM). Any downstream process, such as the network operational support system (OSS), must parse the header file to determine the position of the fields in the PM data file.

The header of the CSV-formatted file in SN07 includes the PMs previously available in SN06, as well as those available in SN07. See Figure 6, “Sample header line of a CSV-formatted file,” (page 40) for an example of this header.

Sample CSV file

The header line drives downstream processing of the files. The header line is the first line of the file. All of the NTM statistics contained in the record are listed in the header of the file. For an example of a header line, see “Partial example of a 5-minute CSV-formatted file” (page 42). The sample CSV file is a 5-minute file called `PP_5MIN_PM.11_25_2002.0830.OTWAONXCCGO.FIVE.CSV.` This CSV file was generated on November 25, 2002 at 8:30 am. It contains 5-minute NTM statistics data from a shelf with the node name `OTWAONXCCGO.` See the sections “Description of system level PMs” (page 47) and “Description of PDU setup failure PMs” (page 87) for descriptions of the NTM statistics contained in this sample file.

Each record that follows the header in the file consists of one line. Each line is the record of information for one component of a Nortel Networks Multiservice Switch 15000 node. This component can be an ATM interface, a physical IP port, a card, or a shelf. The information for each NTM statistic appears in the line, in an attribute field. The attribute fields appears in the same order as in the header line. The attribute fields are separated by commas. If the information for a NTM statistic is unavailable for a specific interval, the attribute field is blank. A comma appears before and after it. For an example of the records in a CSV file, see “Partial example of a 5-minute CSV-formatted file” (page 42).

A single file, containing a single header row, describes all the PMs. Each row in the PM file contains entries for all statistic types collected from the node. However, not all statistics types apply to every type of component (indicated by LINKID). Therefore, most rows contain many empty values, and the overall PM file is sparsely filled. For example, a row containing a LINKID corresponding to a card does not contain values for the ATM interface statistics. The row only contains values for the card statistics. It is important, therefore, to check the LINKID to understand the context of every row.

Note: If you open the CSV file using the Microsoft Excel application, the dates in the file display slashes ("/") as delimiters rather than with the hyphens ("-") actually contained in the file. See Figure 7, "Partial example of a 5-minute CSV-formatted file," (page 42). This is an example of part of a CSV-formatted file. It uses hyphens to separate the elements in the date. This example contains the PMs for a single shelf only, for the sake of brevity.

Figure 7
Partial example of a 5-minute CSV-formatted file

```
DATE,TIME,SHELFID,OFFICEID,SYSUTIL,LINKID,CRITICALSETALARMS,MAJORSETALAR
MS,MINORSETALARMS,CRITICALCLEARALARMS,MAJORCLEARALARMS,MINORCLEARALARMS,
MAXTEMP,CARDUTILAVG,LMBUTIL,LINKCAP,SIGNALLINGCHANNELSTATUS,INCLP0+1,INC
BRCLP0+1,INRTVBRCLP0+1,INNRTVBRCLP0+1,INUBRCLP0+1,OUTCLP0+1,OUTCBRCLP0+1
,OUTRTVBRCLP0+1,OUTNRTVBRCLP0+1,OUTUBRCLP0+1,OUTCLP0+1DIS,INCLP0+1DIS,OU
TCBRCLP0+1DIS,OUTRTVBRCLP0+1DIS,OUTNRTVBRCLP0+1DIS,OUTUBRCLP0+1DIS,REMOT
EATMIFLABEL,INSETUP,INCBRSETUP,INRTVBRSETUP,INNRTVBRSETUP,INUBRSETUP,INC
BRFAIL,INRTVBRFAIL,INNRTVBRFAIL,INUBRFAIL,INFAIL3,INFAIL17,INFAIL18,INFA
IL21,INFAIL27,INFAIL28,INFAIL35,INFAIL36,INFAIL37,INFAIL41,INFAIL45,INFA
IL47,INFAIL49,INFAIL57,INFAIL58,INFAIL63,INFAIL65,INFAIL73,INFAIL78,INFA
IL88,INFAIL96,INFAIL99,INFAIL100,INFAIL104,INFAIL111,OUTSETUP,OUTCBRSETU
P,OUTRTVBRSETUP,OUTNRTVBRSETUP,OUTUBRSETUP,OUTCBRFAIL,OUTRTVBRFAIL,OUTNR
TVBRFAIL,OUTUBRFAIL,OUTFAIL3,OUTFAIL17,OUTFAIL18,OUTFAIL21,OUTFAIL27,OUT
FAIL28,OUTFAIL35,OUTFAIL36,OUTFAIL37,OUTFAIL41,OUTFAIL45,OUTFAIL47,OUTFA
IL49,OUTFAIL57,OUTFAIL58,OUTFAIL63,OUTFAIL65,OUTFAIL73,OUTFAIL78,OUTFAIL
88,OUTFAIL96,OUTFAIL99,OUTFAIL100,OUTFAIL104,OUTFAIL111,IPLINKCAP,INBYTE
S,OUTBYTES,INPACKETS,OUTPACKETS,INTCPPACKETSLOCAL,INUDPPACKETSLOCAL,INIC
MPPACKETSLOCAL,INOSPFPACKETSLOCAL,INARPPACKETSLOCAL,INOTHERPACKETSLOCAL,
OUTTCPPACKETSLOCAL,OUTUDPPACKETSLOCAL,OUTICMPPACKETSLOCAL,OUTOSPFPACKETS
LOCAL,OUTARPPACKETSLOCAL,OUTOTHERPACKETSLOCAL,INDIFFSERVBEARER,INDIFFSER
VCONTROL,INDIFFSERVNETWORK,INDIFFSERVOAMP,INDIFFSERVDEFAULT,INDIFFSERVOT
HER,OUTDIFFSERVBEARER,OUTDIFFSERVCONTROL,OUTDIFFSERVNETWORK,OUTDIFFSERVO
AMP,OUTDIFFSERVDEFAULT,OUTDIFFSERVOTHER,INPACKETSDIS,OUTPACKETSDIS,INLOC
ALEXCEPTIONS,INFWDEXCEPTIONS,VSPUTILAVG,CONGSECS,OVLDCMDSREJECTED,OUTH24
8RETRAN,INH248RETRAN,FAILOVERS,CALLFAILSNET,CALLFAILTDM,DIGITREJECT,CALL
SETUPS,ACTIVECALLAVG,ACTIVECALLMIN,ACTIVECALLMAX

6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 SHELF CARD/
14,,,,,,,,3,0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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```
6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 SHELF CARD/
15,,,,,,,,3,0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 SHELF CARD/
12,,,,,,,,4,0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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FABRICCARD/
X,,,,,,,31,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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FABRICCARD/
Y,,,,,,,32,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 LP/10 SONET/
0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,74879990,1440,30936,20,171,0,0,20,0,0,0,141,0,
20,0,0,10,,,,,,,,,,,,,0,0,20,0,,,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 LP/14 SONET/
1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,18719971,3870336,560,30237,20,0,0,0,0,0,0,10,0
,0,0,0,10,,,,,,,,,,,,,0,0,0,0,,,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 LP/12 VSP
PMODULE/1 PBLOCK/
1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 LP/12 VSP
PMODULE/2 PBLOCK/
1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 LP/12 VSP
PMODULE/3 PBLOCK/
1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 ATMIF/
```

```
1000,,,,,,,,,,1412830,1,199,0,141,58,0,1105,0,160,948,0,0,0,0,0,0,0,EM/
DESIGN_3 ATMIF/
600,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
2,0,0,0,2,0,0,0,2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 ATMIF/
1401,,,,,,,,,,353207,0,105997087,0,105997087,0,0,20,0,10,10,0,0,0,0,0,0,
0,GEN/
MG9K_6,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,
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6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 LP/11 SONET/3
STS/
0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,74879990,652,18088790244,13,141318123,0,0,0,0,
0,0,1,0,0,0,0,4,,,,,,,,,,,,,0,0,0,0,,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 LP/10 SONET/3
STS/
0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,74879990,18084439808,280,141284686,10,0,0,0,0,
0,0,0,0,0,0,0,10,,,,,,,,,,,,,0,0,0,0,,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 NSTA/12
VGS,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,0,0,334,0,
0,0,0,0,0,0,0,0

6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6
SHELF,0,0,0,0,0,0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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6/28/2004,16:00:00,EM/DESIGN_6,OTWAONABCDE,6,EM/DESIGN_6 LP/0 OAMENET/
0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,12500000,116636,256,1439,4,251,0,0,0,825,300,0
,0,0,0,0,0,,,,,,,,,,,,,0,0,1376,0,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_3,OTWAONABCDE,4,EM/DESIGN_3 DLEP/6 VSP
PMODULE/1 PBLOCK/
1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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6/28/2004,16:00:00,EM/DESIGN_3,OTWAONABCDE,4,EM/DESIGN_3 DLEP/6 VSP
PMODULE/1 PBLOCK/
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2,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
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6/28/2004,16:00:00,EM/DESIGN_3,OTWAONABCDE,4,EM/DESIGN_3 LP/15 ETH/
3,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,125000000,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,,,,
,,,,,,,,0,0,0,0,,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_3,OTWAONABCDE,4,EM/DESIGN_3 LP/14 ETH/
1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,125000000,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,,,,
,,,,,,,,0,0,0,0,,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_3,OTWAONABCDE,4,EM/DESIGN_3 LP/15 ETH/
1,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,125000000,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,,,,,
,,,,,,,,0,0,0,0,,,,,,,,,,,,,

6/28/2004,16:00:00,EM/DESIGN_3,OTWAONABCDE,4,EM/DESIGN_3 NSTA/12
VGS,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,0,0,333,0,
0,0,0,0,0,0,0,0
```

> ***Note:*** Sometimes the PM records are described as matching one line per link. This seems to imply that a record corresponds to a physical port. This is not the case. In the past, there was a one-to-one correspondence between a link or port, and an ATM interface. Currently, an ATM interface does not correspond to a physical port. It can use a sub-portion of a link or port. As well, today records are provided for not only ATM interfaces, but also for physical IP ports, card, and shelves. Thus, it is more accurate to say that each record corresponds to an individual component of a node.

When a PM value is not available for a particular attribute in a CSV record, it appears as a null value delimited by commas. This is extremely common. Most rows contain many empty values, and the overall PM file is sparsely filled. This is because not all the PM attributes apply to the particular LINKID component name in that row.

It can happen that a PM attribute applies to the LINK component name in a row, but the value is missing. The cause can be inadequate engineering latency. In this case, the number of interfaces for which PMs are reported exceeds the engineering latency. Latency refers to the time required for a signal to travel from one point on a network to another. Latency is initially configured on the Performance Measurements Stream Processor (PMSP) on the Preside MDM server. Let's say you add ATM interfaces in order to handle increased processing requirements. The latency can then become too small. Some raw performance information does not get processed in time. If this condition persists, adjust the latency configuration accordingly. For information on how to do this, see "Network-level TOD synchronization" (page 99).

If no records are received during the data collection period for a particular interface, a 5-minute interval record is not generated for that interface for that interval.

When values are missing from the attribute fields, there are consecutive commas in the CSV-format record, with no value in between.

SN06 to SN07 migration considerations

Downstream OSS changes are required to support the new PMs. Depending on the method used to parse the PM files, the OSS may not be compatible with the SN07 PM stream. SN02 to SN06 releases supported only ATMIF LINKIDs and each row in the PM file was fully populated.

In SN07 there are a number of LINKID types. Rows in the PM file will only be populated with statistics that apply to the LINKID being reported. If a Voice over ATM customer wants to continue to process only SN06 statistics, their OSS needs to do the following:

1. Parse the header line to check only the columns in the PM file relevant to their application. There are no changes to the SN02 to SN06 header names in the SN07 format. For example, INSETUP is still entitled INSETUP, regardless of Succession release.
2. Parse the LINKID field in each row of the PM file. Only use rows which contain a LINKID of the format EM/ ATMIF/.

Properly parsing and using the PM file header line ensures that the OSS is forwards compatible with newer releases of the PMs. The OSS should always read the header line.

Description of NTM statistics

This section describes all the NTM statistics collected from Nortel Networks Multiservice Switch 15000 nodes in a Succession PT-AAL1, UA-AAL1 or UA - IP solution.

This section groups the NTM statistics descriptions by type. Therefore, it does not necessarily discuss the NTM statistics in the same order as they appear in the header line of the CSV file. See Figure 6, "Sample header line of a CSV-formatted file," (page 40) for an example of a header line.

This section includes the following topics:

Description of system level PMs

This section describes the system level performance measurements (PMs), collected from Nortel Networks Multiservice Switch 15000 nodes in the Succession Network.

DATE

This NTM field identifies the date of the collection period. The date is represented in the format `MM-DD-YYYY`, where `MM` is the month (01-12), `DD` is the day (01-31), and `YYYY` is the year in a four-digit format (for example, 2001).

This field contains the node-created date, which is generated when the node sends the record to the Nortel Networks Preside Multiservice Data Manager server.

TIME

This NTM field identifies the ending time of the collection period. The time is represented in the format `HH:MM:SS`, where `HH` is the hour (00-23), `MM` is the minutes (00-59), and `SS` is the seconds (00-59).

The PM record is time-stamped with the node-created time, which is generated when the node sends the record to the Nortel Networks Preside Multiservice Data Manager server.

SHELFID

This NTM field identifies the Multiservice Switch shelf. The shelf ID is included in each NTM record, even though it is the same for every ATM interface on that shelf.

Format: `EM/<Shelf ID>` SHELF

Range: `<Shelf ID>` This attribute is the node name of the shelf. The shelf id consists of 1 to 12 characters. The valid character set includes alphabetic characters (all upper case), the digits 0 through 9, as well as the underscore and period punctuation marks. A Multiservice Switch shelf ID in Succession networks usually contains the value of the Common Language Location Identifier (CLLI). The CLLI is an industry-standard alphanumeric string to identify equipment location. It is, at most, 11 characters long. When the CLLI does not uniquely identify a single shelf instance, a twelfth character must be added to the CLLI from the valid character set to make the string unique.

OFFICEID

This NTM field contains the Common Language Location Identifier (CLLI) or equivalent, of the overall Succession office. The CLLI is typically defined by the location of the CS2000. The -officeid <name> parameter of the PMSP command sets the value of CLLI. Each PMSP instance can be configured with a single identifier which is reported in each NTM record. That is, all the nodes being collected from are considered part of that Succession office in that they have subtending gateways (for example, MG4000) that are part of that Succession office.

Format: `<office identifier string>`

Range: `<office identifier string>` This attribute is typically the 11 character alphanumeric CLLI, or equivalent, that identifies the office (for example, defined by the location of the CS2000). It must not include the comma character.

Description of shelf PMs

This section describes the shelf level performance measurements (PMs), collected from Nortel Networks Multiservice Switch 15000 nodes in the Succession Network.

Shelf level PMs indicate the over-all health and performance of the node. This information is helpful for monitoring network operations, rather than for planning future engineering.

The key PMs for the network operator are those that report the number of alarms (critical, major, and minor) which occurred during the past 5-minute interval. Any sudden rise in these indicators from one 5-minute interval to the next indicates a problem in the network, involving the shelf. Normally, these indicators are zero, unless maintenance is being performed.

The number of clears that the clear alarm PMs (MINORCLEARALARMS and MAJORCLEARALARMS) indicate does not necessarily match the number of clear alarms that appear in the alarm log display. The PMs count one alarm clear for any alarm that is set for a component, regardless of the alarm severity. This is done in order that the alarm clear PMs (MINORCLEARALARMS and MAJORCLEARALARMS) correspond one-to-one to the alarm set PMs (MINORSETALARMS and MAJORSETALARMS). For example:

1. A minor alarm is raised against a LAPS component. The minor alarm set text spools to the alarm history display. The component now has an active minor alarm. The MINORSETALARMS PM increments by 1.
2. A major alarm is raised against the same LAPS component, upgrading the alarm severity. The major alarm set text spools to the alarm history display. The component now has an active major alarm. MINORCLEARALARMS and MAJORCLEARALARMS both increment by 1. Note that a clear alarm does NOT spool to the alarm history display.
3. A clear alarm is issued against the same LAPS component. Someone corrects the problem which is causing the alarm. The clear alarm text

spools to the alarm history display. The component no longer has an active alarm. MAJORCLEARALARMS increments by 1.

4 The MINORSETALARMS, MAJORSETALARMS, MINORCLEARALARMS, and MAJORCLEARALARMS PMS are now all set to 1.

The shelf-level PMs appear as a single row (per-shelf) in the 5-minute and 30-minute PM files. The DATE, TIME, SHELFID, OFFICEID, SYSUTIL, and LINKID fields also appear in the row. Any other PMs appear in the row as nulls, delimited by commas. LINKID is set to the same value as "SHELFID" (page 48).

SYSUTIL

This NTM field indicates approximately how busy the network element is. It reports the maximum value of all the control processor (CP) and function processor (FP) card utilizations.

SYSUTIL is now made redundant by the card PM called CARDUTILAVG. CARDUTILAVG reports the average CPU utilization of a specific card. You can determine the SYSUTIL value from the values of all CARDUTILAVG PMs for a shelf. See "CARDUTILAVG" (page 59) for more details.

SYSUTIL is still reported for backwards compatibility. It appears in every rows in the PM file. This is unlike other PMs, which appear in a row only when they apply to the particular component identified by the LINKID.

Range: 0 through 100 (percent)

LINKID

This NTM field appears in the header line of the 5-minute or 30-minute PM file. It is the key for identifying which PMs are referenced in a row. Use it to determine to which component the contents of a row apply.

Five component types support the use of PMs as follows:

- shelf
- card
- ATM interface

- physical interface which carries IP packets. This can be Gigabit Ethernet (GE), IP over ATM, or CP LAN Ethernet
- media gateway (MG) voice services processor (VSP) card

Use the LINKID formats as shown in Table 1, “LINKID formats for component types,” (page 51)

Table 1
LINKID formats for component types

Component type	LINKID format	Range
Multiservice Switch shelf	“EM/<Shelf ID> SHELF”	<Shelf ID> is the node name of the shelf. See “SHELFID” (page 48) for a full description
Multiservice Switch card	“EM/<Shelf ID> SHELF CARD/<n>”	<Shelf ID> is the node name of the shelf. See “SHELFID” (page 48) for a full description <n> is the card number, a value from 0 through 15.
Multiservice Switch 15000 fabric card	“EM/<Shelf ID> SHELF FABRICCARD/ <Fabric ID>	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48) for a full description. <Fabric ID> is the name of the fabric card. There are two fabric cards, labeled X andY.
ATM interface	“EM/<Shelf ID> ATMIF/<ATM ID>	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48) for a full description. <ATM ID> is the ATM interface number. See the conventions given for “Range” directly after this table.
Physical IP interface (GE)	“EM/<Shelf ID> LP/<n> ETH/<y>”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48) for a full description. `<n>` This attribute is the logical processor number, a value from 0 through 15. <y> This attribute is the Ethernet port number on the card, from 0 through 3.
(Sheet 1 of 5)		

Table 1 (Continued)
LINKID formats for component types

Component type	LINKID format	Range
Physical IP interface (IP over ATM)	“EM/<Shelf ID> LP/ <n> SONET/<y>”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48). `<n>` is the logical processor number, a value from 0 through 15. <y> is the synchronous optical network (SONET) port number on the card, a value from 0 through 15.
Physical IP interface (IP over ATM) (North American)	“EM/<Shelf ID> LP/n SONET/<y> STS/0”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48). `<n>` is the logical processor number, a value from 0 through 15. <y> is the synchronous optical network (SONET) port number on the card, a value from 0 through 15. SONET is a North American standard. STS stands for Synchronous Transport Signal.
Physical IP interface (IP over ATM)	“EM/<Shelf ID> LAPS/<n> STS/0”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48). LAPS stands for line automatic protection switching. `<n>` is the same value as for ATMIF. It is the logical processor number, a value from 0 through 15. STS stands for Synchronous Transport Signal.
(Sheet 2 of 5)		

Table 1 (Continued)
LINKID formats for component types

Component type	LINKID format	Range
Physical IP interface (IP over ATM)	“EM/<Shelf ID> LAPS/<n> STS/<z>”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48). LAPS stands for line automatic protection switching. `<n>` is the same value as for ATMIF. It is the logical processor number, a value from 0 through 15. STS stands for Synchronous Transport Signal.
Physical IP interface (IP over ATM)	“EM/<Shelf ID> LAPS/<n>	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48). LAPS stands for line automatic protection switching. `<n>` is the same value as for ATMIF. It is the logical processor number, a value from 0 through 15.
Physical IP interface (IP over ATM) (European)	“EM/<Shelf ID> LP/ <n> SDH/<y> VC4/0”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48). `<n>` is the logical processor number, a value from 0 through 15. <y> is the synchronous digital hierarchy (SDH) port number on the card, a value from 0 through 15. SDH and VC4/0 are European standards.
Physical IP interface (IP over ATM)	“EM/<Shelf ID> LAPS/<n> VC4/0”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48). LAPS<n> is the line automatic protection switching number, that corresponds to the logical processor number, a value from 0 through 15. VC4/0 is a European standard.
(Sheet 3 of 5)		

Table 1 (Continued)
LINKID formats for component types

Component type	LINKID format	Range
Electrical ATM card (for example a 12-port DS3 card)	“EM/<Shelf ID> LP/ <n> DS3/<y>”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48) for a full description. `<n>` is the logical processor number, a value from 0 through 15. <y> is the DS3 port number on the card, a value from 0 through 11.
Electrical channelized ATM card, (for example a 4-port channelized DS3 card)	EM/<Shelf ID> LP/<n> DS3/<y> InverseMultiplexerAtm /<z>”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48) for a full description. `<n>` is the logical processor number, a value from 0 through 15. <y> is the DS3 port number on the card, a value from 0 to 3. <z> is the instance of the DS1 IMA group.
OAM Ethernet port on an active CP card	“EM/<Shelf ID> LP/ <n> OAMENET/0”	`<Shelf ID>` This attribute is the node name of the shelf. See “SHELFID” (page 48) for a full description.
MG VSP card	“EM/<Shelf ID> NSTA/ <n> VGS”	`<Shelf ID>` is the node name of the shelf. See “SHELFID” (page 48) for a full description. `<n>` is the application managing voice services on the VSP card (the LP number).
(Sheet 4 of 5)		

Table 1 (Continued)
LINKID formats for component types

Component type	LINKID format	Range
	"EM/<Shelf ID> LP/ <n> PMODULE/<x> PBLOCK/<y>"	`<Shelf ID>` is the node name of the shelf. See "SHELFID" (page 48) for a full description. `<n>` is the logical processor (LP) number, a value from 0 through 15. <x> is the number of the processing module. <y> is the VSP processing block
	"EM/<Shelf ID> DLEP/ <n> PMODULE/<x> PBLOCK/<y>"	`<Shelf ID>` is the node name of the shelf. See "SHELFID" (page 48) for a full description. `DLEP/<n>` is the Dual-LP Equipment Protection number, a value from 0 through 7. <x> is the number of the processing module. <y> is the VSP processing block
(Sheet 5 of 5)		

For example, a row of PMs in a 5-minute PM file contains information about card 5 of node OTWAONPP01. The LINKID field contains the following:

EM/OTWAONPP01 SHELF CARD/5

A single file, with a single header row, describes all the PMs. Therefore, each row in the PM file contains entries for all statistic types that are collected from the node. However, not all statistics types apply to every type of component (indicated by LINKID). Thus, most rows contain many empty values, and the overall PM file is sparsely filled. For example, a row containing a LINKID corresponding to a card does not contain values for the ATM interface statistics. The row only contains information pertinent to card statistics.It is important, therefore, to use the LINKID to understand the context of every row.

For an ATM interface, the LINKID used is the same ID used in alarms (for example, SCC2 logs) for the ATM interface.

Note: Alarms can specify a subcomponent of the ATMIF.

Range: `<Shelf ID>` This attribute is the node name of the shelf. See “SHELFID” (page 48) for a full description.
`<n>` This attribute indicates a value from 1 to 4095.

A suggested convention for `<n>` on unchannelized cards is to indicate the physical port using the two least significant digits (for example, 00 through to 15). The slot number is indicated using the one or two most significant digits (for example, 2, with no leading 0, through to 15). By convention, the even slot number must be used in the case where the ATMIF is associated with a pair of ports on protected FP cards.

For example, `EM/OTWAONXCCGO ATMIF/200` can be used for port 0 on an FP in slot 2 (or its mate in slot 3) of a shelf with a CLLI of `OTWAONXCCGO`.

A suggested convention for `<n>` on channelized (DS1-IMA) cards is

```
n = xx * 100 + y * 20 + z
where:
xx = Lp number: 2, 4, 6, 8, 10, 12, 14
y = DS-3 port number: 0, 1, 2, 3
z = IMA group number: [0-13]
```

By convention, the even slot number must be used in the case where the ATMIF is associated with a pair of ports on protected FPs.

Note: While the node configuration does not require 1:1 protected electrical FPs to be adjacent, Nortel Networks recommends you follow the same sparing relationship as for the optical cards, so that the card pairings are consistent.

For example, `EM/OTWAONXCCGO ATMIF/1028` denotes IMA group 8, on port 1 on an FP in slot 10 (or its mate in slot 11) of a shelf with a CLLI of `OTWAONXCCGO`.

Note: In a Succession UA-AAL1 solution, the term LINK is typically associated with a physical port. However, for historical reasons, in UA-AAL1, the LINKID field name uses the term even though, for example, the ATM interface can be associated with only a sub-portion of the physical link or port.

CRITICALSETALARMS
This NTM field indicates the number of critical alarms raised on the shelf during the last interval. Note that this is the nodeview, not the Nortel Networks Preside Multiservice Data Manager (MDM) view. The Preside MDM view contains proxy alarms and its own platform alarms.

Range: `0 through 4294967295`

MAJORSETALARMS
This NTM field indicates the number of major alarms set on the shelf during the last interval. Note that this is the node view, not the Preside MDM view. The MDM view contains proxy alarms and its own platform alarms.

Range: `0 through 4294967295`

MINORSETALARMS
This NTM field indicates the number of minor, indeterminate, or warning alarms/logs set on the shelf, during the last interval. Note that this is the node view, not the Preside MDM view. The Preside MDM view contains proxy alarms and its own platform alarms.

Range: `0 through 4294967295`

CRITICALCLEARALARMS
This NTM field indicates the number of critical alarms/logs cleared on the shelf during the last interval.

Range: `0 through 4294967295`

Description of fabric card PMs
This section describes the fabric card performance measurements (PMs), collected from the Nortel Networks Multiservice Switch nodes in the Succession Network. There are two fabric cards per shelf, labeled X and Y.There is one fabric card PM, called MAXTEMP.

MAXTEMP
This NTM field indicates the maximum temperature, in degrees Celsius, of the fabric card, during the last interval.

MAXTEMP appears as a single row (per-shelf) in the 5-minute and 30-minute PM files. The DATE, TIME, SHELFID, OFFICEID, LINKID, and SYSUTIL fields also appear in the row. Any other PMs appear in the row as nulls delimited by commas.

The LINKID value is set to

```
EM/<Shelf ID> SHELF FABRICCARD/X
```

or

```
EM/<Shelf ID> SHELF FABRICCARD/Y
```

where `<Shelf ID>` is the name of the node. See “SHELFID” (page 48) for a full description.

For information about using MAXTEMP to trigger an alarm when shelf fans fails, see “Fan failure troubleshooting” (page 122).

Range: 0 through 100

Description of card PMs

This section describes the card level performance measurements (PMs), collected from the Nortel Networks Multiservice Switch nodes in the Succession Network.

Card-level PMs indicate the performance of all the cards in the shelf. These attributes are key for determining potential software problems in the node.

These PMs are most useful to customers monitoring the network operations. They can also be used by the network engineering groups. Abnormal values in these attributes can indicate problems. However, normal operations such as maintenance activities can also cause sudden changes.

Unprovisioned cards do not appear in the PMs. Thus, the set of LINKIDs does not necessarily contain the full range of card numbers.

The following sections describe the card PMs. All the card level PMs appear as a single row (per-shelf) in the 5-minute and 30-minute PM files. The DATE, TIME, SHELFID, OFFICEID, SYSUTIL, and LINKID fields also appear in the row. Any other PMs appear in the row as nulls, delimited by commas. The LINKID value is set to

```
EM/<Shelf ID> SHELF CARD/<n>
```

where `<Shelf ID>` is the name of the node. See “SHELFID” (page 48) for a full description. `<n>` is the card number [0-15].

CARDUTILAVG

This NTM field indicates the business of the processing component of the Control Processor (CP) card. This is reported as average CPU utilization of the processing during the last 5-minute interval. Each shelf has 2 CPs. One is active, the other is a backup. Each shelf also has up to 14 function processors (FPs).

CARDUTILAVG now makes the SYSUTIL PM redundant. It is possible to determine the SYSUTIL value from the values of all CARDUTILAVG PMs from a shelf.

Range: `0 through 100`

LMBUTIL

This NTM field indicates the average percentage of local message blocks in use, over the PM time interval.

Range: `0 through 100`

LINKCAP

This NTM field indicates the configured capacity, in terms of bandwidth, for the ATM interface. It is specified in units of cells per second. For unchannelized FPs, this value is static; that is, it reports the line rate of the link. For channelized FPs, this value indicates the most recently configured value, although in practice, the value is rarely, if ever, changed.

For more information on link capacity, see Table 2, “Link capacity of Multiservice Switch 15000 FP cards (UA-AAL1),” (page 60).

Table 2
Link capacity of Multiservice Switch 15000 FP cards (UA-AAL1)

Card type	Configuration	Value	Notes
4-port OC3 SmIrAtm	OC3c	353207	Line rate
16-port OC3SmIrAtm	OC3c	353207	Line rate
4-port OC12SmIrAtm	OC12c	1412830	Line rate
4-port DS3ChAtm	1xDS1	3592	
	2xDS1	7185	Minimum value for an IMA MG9K interface
	8xDS1	28740	Maximum value for an IMA MG9K interface
	28xDS1	100592	Overall maximum value
12-port DS3Atm	direct mapping	104268	
	PLCP mapping	96000	

Note: The term LINK is typically associated with a physical port. However, for historical reasons, this field name uses the term even though the ATM interface can be associated with only a sub-portion of the physical link or port.

You can use the value of LINKCAP to calculate the utilization of an interface, or link. For more information, see “Average link utilization (UA-AAL1 and UA - IP)” (page 126).

Description of ATM interface PMs

This section describes the ATM interface performance measurements (PMs), collected from the Nortel Networks Multiservice Switch nodes in a Succession network. The ATM 5-minute PMs have now been available for several Succession releases. They provide statistics for monitoring a PT-AAL1 or a UA-AAL1 Succession core. The SN07 release expands the ATM PMs, to allow the monitoring of a UA-IP Succession core.

Additions to the ATM PMs in this release provide more information at a service category level. In an IP Succession office, these statistics can be used to monitor the performance of the node at layer 2, that is, ATM or Ethernet.

The following sections describe the ATM interface PMs. All the ATM interface PMs appear as a single row (per-shelf) in the 5-minute and 30-minute PM files. The DATE, TIME, SHELFID, OFFICEID, SYSUTIL, and LINKID fields appear in the row. ATM PMs that were available before release SN07, also appear in the row. Any other PMs appear in the row only as nulls, delimited by commas.

The LINKID value is set to:

```
EM/<Shelf ID> ATMIF/<ATM ID>
```

Range: `<Shelf ID>` This attribute is the name of the node. See “SHELFID” (page 48) for a full description.
`<ATM ID>` is the ATM interface identifier. ATM interfaces do not map directly to a physical port. However, the naming convention used for interfaces must identify the pair of equipment-spared functional processors (FPs) and the 1+1 protected link that supports the interface.

ATM interfaces do not always directly map to a physical port. However, the naming convention for interfaces must identify the pair of equipment-spared functional processors (FPs), and the 1+1 protected link that supports the interface.

SIGNALLINGCHANNELSTATUS

This NTM field indicates the status of an ATM signaling channel, during a 5-minute reporting interval. In Succession, this information is more useful for a UA-AAL1 solution than for a UA-IP solution. The possible values are as follows:

- A null or empty value indicates that no signalling is provisioned for this interface.
- 0 indicates that the signaling channel was down at some point during the interval.
- 1 indicates that the signaling channel was up during the entire interval.

For the 30-minute interval data, ignore the value of this field.

Range: null or empty value, 0, 1

For more information, see “Signaling channel status (PT-AAL1 and UA-AAL1)” (page 124) in Appendix A.

INCLP0+1

This NTM field indicates the total number of ATM cells with a cell loss priority (CLP) equal to 0+1, received by the ATM interface during the last interval. This total includes both conformant cells and cells that violated their traffic contract at all points in the network.

Range: 0 through 4294967295

INCBRCLP0+1

This NTM field indicates the total number of certain ATM cells received by the ATM interface, during the last interval. The ATM cells must be of the constant bit rate (CBR) traffic class, and have a cell loss priority (CLP) equal to 0 or 1.

Range: 0 through 4294967295

INRTVBRCLP0+1

This NTM field indicates the total number of certain ATM cells received by the ATM interface, during the last interval. The ATM cells must be of the real time variable bit rate (rtVBR) traffic class, and have a cell loss priority (CLP) equal to 0 or 1.

Range: 0 through 4294967295

INNRTVBRCLP0+1

This NTM field indicates the total number of certain ATM cells received by the ATM interface, during the last interval. The ATM cells must of the non-real time variable bit rate (nrtVBR) traffic class, and have a cell loss priority (CLP) equal to 0 or 1.

Range: 0 through 4294967295

INUBRCLP0+1

This NTM field indicates the total number of certain ATM cells received by the ATM interface, during the last interval. The ATM cells must be of the unspecified bit rate (UBR) traffic class, and have a cell loss priority (CLP) equal to 0 or 1.

Range: 0 through 4294967295

OUTCBRCLP0+1

This NTM field indicates the total number of certain ATM cells transmitted by the ATM interface, during the last interval. The ATM cells must be of the constant bit rate (CBR) traffic class, and have a cell loss priority (CLP) equal to 0 or 1. The total number includes conforming cells and cells that violated their traffic contract at all points in the network.

Range: 0 through 4294967295

OUTRTVBRCLP0+1

This NTM field indicates the total number of certain ATM cells transmitted by the ATM interface, during the last interval. The ATM cells must be of the real time variable bit rate (rtVBR) traffic class, and have a cell loss priority (CLP) equal to 0 or 1. The total number includes conforming cells and cells that violated their traffic contract at all points in the network.

Range: 0 through 4294967295

OUTNRTVBRCLP0+1

This NTM field indicates the total number of certain ATM cells transmitted by the ATM interface, during the last interval. The ATM cells must be of the non-real time variable bit rate (nrtVBR) traffic class, and have a cell loss priority (CLP) equal to 0 or 1. The total number includes both conforming cells and cells that violated their traffic contract at all points in the network.

Range: 0 through 4294967295

OUTUBRCLP0+1

This NTM field indicates the total number of certain ATM cells transmitted by the ATM interface, during the last interval. The ATM cells must be of the unspecified bit rate (UBR) traffic class, and have a cell loss priority (CLP) equal to 0 or 1. The total number includes both conforming cells and cells that violated their traffic contract at all points in the network.

Range: 0 through 4294967295

OUTCLP0+1

This NTM field indicates the total number of ATM cells with any cell loss priority (CLP) value, transmitted by the ATM interface during the last interval. This total includes conforming cells and cells that violated their traffic contract at all points in the network.

Range: 0 through 4294967295

OUTCLP0+1DIS

This NTM field indicates the total number of ATM cells with any cell loss priority (CLP) value, and from any service category, that were discarded during the last interval prior to being transmitted.

Range: 0 through 4294967295

INCLP0+1DIS

This NTM field indicates the total number of ATM cells with any cell loss priority (CLP) value, and from all service categories, that were discarded during the last interval after being received.

> ***Note:*** Access protocol control (APC)-based FPs, including 16-port OC-3 and 4-port OC-12 FPs, do not provide a count of this NTM statistic.

Range: 0 through 4294967295

OUTCBRCLP0+1DIS

This NTM field indicates the total number of ATM cells with any cell loss priority (CLP) value, and from the constant bit rate (CBR) service category, that were discarded during the last interval prior to being transmitted.

Range: 0 through 4294967295

OUTRTVBRCLP0+1DIS

This NTM field indicates the total number of ATM cells with any cell loss priority (CLP) value, from the real-time variable bit rate (rtVBR) service category, that were discarded before being transmitted during the last interval.

Range: 0 through 4294967295

OUTNRTVBRCLP0+1DIS

This NTM field indicates the total number of ATM cells with any cell loss priority (CLP) value, and from the non-real time variable bit rate (nrtVBR) service category, that were discarded during the last interval prior to being transmitted.

Range: 0 through 4294967295

OUTUBRCLP0+1DIS

This NTM field indicates the total number of ATM cells with any cell loss priority (CLP) value, and from the unspecified bit rate (UBR) service category, that were discarded during the last interval prior to being transmitted.

Range: 0 through 4294967295

REMOTEATMIFLABEL

This NTM field indicates the name of the remote side of an ATM interface. The local side is identified by LINKID. The name is set by the configurable attribute, *AtmIf/<n> remoteATMInterfaceLabel,* for the ATM interface named by LINKID. If the remote side of the interface is another Nortel Networks Multiservice Switch 15000 ATM interface, the format of this field must be exactly the same as the LINKID field value. Otherwise, the format of the field can vary depending on the chosen conventions.

Range: 0 through 60 ASCII characters

> ***Note:*** Nortel Networks recommends that you follow a chosen naming convention for consistency. However, the name you choose for REMOTEATMIFLABEL must not include the comma character.

INSETUP

This NTM field indicates the total number of Q.2931 SETUP protocol data units (PDUs) received by the ATM interface, either user-to-network interface (UNI) or private network-to-network (PNNI), during the last interval.

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs that are rejected due to a failure cause. Rejected SETUPs are counted by the INFAILxx statistics. For more information about INFAILxx, see Table 4, “Description of PDU setup failure PMs,” (page 87).

To calculate the incoming call completion rate over the interval, add INSETUP to the sum of the INFAILxx counts.

Range: 0 through 65535

> ***Note:*** For descriptions of the INFAILxx statistics, see Table 4, “Description of PDU setup failure PMs,” (page 87).

INCBRSETUP

This NTM field indicates the total number of Q.931 SETUP protocol data units (PDUs) to establish a constant bit rate (CBR) connection, received by the ATM interface, during the last interval. The ATM interface type must be either user-to-network interface (UNI) or private network-to-network (PNNI).

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs rejected due to a failure cause. Thus, to determine the number of successful SETUPs, substract the INCBRFAIL from INCBRSETUP. Note that if a SETUP is malformed, and its service category cannot be determined, INCBRSETUP and the other per-service-category SETUP statistics do not include it. To determine the number of malformed SETUP messages, subtract the per-service-category SETUP counts from INSETUP. For information about rejected SETUPs, see "Description of PDU setup failure PMs" (page 87). For the number of successful SETUPs, subtract INCBRFAIL from INCBRSETUP.

Range: 0 through 65535

INRTVBRSETUP

This NTM field indicates the total number of Q.931 SETUP protocol data units (PDUs) to establish a real time variable bit rate (rtVBR) connection, received by the ATM interface, during the last interval. The ATM interface must be either user-to-network interface (UNI) or private network-to-network (PNNI).

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs rejected due to a failure cause. For information about rejected SETUPs, see "Description of PDU setup failure PMs" (page 87). For the number of successful SETUPs, subtract INRTVBRFAIL from INRTVBRSETUP.

Range: 0 through 65535

INNRTVBRSETUP

This NTM field indicates the total number of Q.931 SETUP protocol data units (PDUs) to establish a non-real time variable bit rate (nrtVBR) connection, received by the ATM interface, during the last interval. The ATM interface type must be either user-to-network interface (UNI) or private network-to-network (PNNI).

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs rejected due to a failure cause. For information about rejected SETUPs, see "Description of PDU setup failure PMs" (page 87). For the number of successful SETUPs, subtract INNRTVBRFAIL from INNRTVBRSETUP.

Range: 0 through 65535

INUBRSETUP

This NTM field indicates the total number of Q.931 SETUP PDUs to establish an unspecified bit rate (UBR) connection, received by the ATM interface, during the last interval. The ATM interface type must be either user-to-network (UNI) or private network-to-network (PNNI).

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs rejected due to a failure cause. For information about rejected SETUPs, see "Description of PDU setup failure PMs" (page 87). For the number of successful SETUPs, subtract INUBRFAIL from INUBRSETUP.

Range: 0 through 65535

INCBRFAIL

This NTM field is the sum of all INFAILxx counts for certain SETUP messages received by this interface. These SETUP messages attempt to set up a constant bit rate (CBR) call. xx is the failure cause code. Note that INCBRFAIL, and the other per-service-category SETUP failure statistics, do not count malformed SETUP messages for which the service category cannot be determined.

Range: 0 through 65535

INRTVBRFAIL

This NTM field is the sum of all INFAILxx counts for certain SETUP messages received by this interface. The SETUP messages must attempt to set up a real time variable bit rate (rtVBR) call. xx is the failure cause code.

Range: 0 through 65535

INNRTVBRFAIL

This NTM field is the sum of all INFAILxx counts for certain SETUP messages received by this interface. The SETUP messages must attempt to set up a non-real time variable bit rate (nrtVBR) call. xx is the failure cause code.

Range: 0 through 65535

INUBRFAIL

This NTM field is the sum of all INFAILxx counts for certain SETUP messages received by this interface. The SETUP messages must attempt to set up an unspecified bit rate (UBR) call. xx is the failure cause code.

Range: 0 through 65535

OUTSETUP

This NTM field indicates the total number of Q.2931 SETUP PDUs transmitted by the ATM interface, either UNI or PNNI, during the last interval.

This NTM field includes SETUPs that result in a fully connected call as well as SETUPs that are rejected due to a failure cause. Rejected SETUPs are discussed in "Description of PDU setup failure PMs" (page 87). Thus, the outgoing call completion rate over the interval can be calculated by adding OUTSETUP to the sum of the OUTFAILxx statistics.

Range: 0 through 65535

OUTCBRSETUP

This NTM field indicates the total number of Q.931 SETUP protocol data units (PDUs) to establish a CBR connection, transmitted by the ATM interface, during the last interval. The ATM interface type must be either UNI or PNNI.

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs rejected due to a failure. For the number of successful SETUPs, subtract OUTCBRFAIL from OUTCBRSETUP.

Range: 0 through 65535

OUTRTVBRSETUP

This NTM field indicates the total number of Q.931 SETUP protocol data units (PDUs) to establish a real time variable bit rate (rtVBR) connection, transmitted by the ATM interface, during the last interval. The ATM interface type must be either UNI or PNNI.

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs rejected due to a failure. For the number of successful SETUPs, subtract OUTRTVBRFAIL from OUTRTVBRSETUP.

Range: 0 through 65535

OUTNRTVBRSETUP

This NTM field indicates the total number of Q.931 SETUP protocol data units (PDUs) to establish a non-real time variable bit rate (nrtVBR) connection, transmitted by the ATM interface, during the last interval. The ATM interface type must be either UNI or PNNI.

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs rejected due to a failure. For the number of successful SETUPs, subtract OUTNRTVBRFAIL from OUTNRTVBRSETUP.

Range: 0 through 65535

OUTUBRSETUP

This NTM field indicates the total number of Q.931 SETUP protocol data units (PDUs) to establish a UBR connection, transmitted by the ATM interface, during the last interval. The ATM interface type must be either UNI or PNNI.

This NTM field includes SETUPs that result in a fully connected call, as well as SETUPs rejected due to a failure. For the number of successful SETUPs, subtract OUTUBRFAIL from OUTUBRSETUP.

Range: 0 through 65535

OUTCBRFAIL

This NTM field is the sum of all OUTFAILxx counts for SETUP messages sent by this interface, that attempt to set up a constant bit rate (CBR) call, where xx is a failure cause code.

Range: 0 through 65535

OUTRTVBRFAIL

This NTM field is the sum of all OUTFAILxx counts for SETUP messages sent by this interface, that attempt to set up a real time variable bit rate (rtVBR) call. xx is a failure cause code.

Range: 0 through 65535

OUTNRTVBRFAIL

This NTM field is the sum of all OUTFAILxx counts for SETUP messages sent by this interface, that attempt to set up a non-real time variable bit rate (nrtVBR) call. xx is a failure cause code.

Range: 0 through 65535

OUTUBRFAIL

This NTM field is the sum of all OUTFAILxx counts for SETUP messages sent by this interface, that attempt to set up an unspecified bit rate (UBR) call. xx is a failure cause code.

Range: 0 through 65535

Description of IP physical interface PMs

This section describes the performance measurements (PMs) for physical interfaces that support internet protocol (IP). These PMs are collected from Nortel Networks Multiservice Switch nodes in the Succession Network.

These PMs appear as a single row (per-shelf) in the 5-minute and 30-minute PM files. The DATE, TIME, SHELFID, OFFICEID, SYSUTIL, and LINKID fields also appear in the row. Any other PMs appear in the row as nulls delimited by commas. The LINKID value is set to one of several possible values:

```
EM/<Shelf ID> LP/<n> ETH/<y>
```

where <Shelf ID> is the name of the node. See "SHELFID" (page 48) for a full description. <n> is the logical processor number (0 through 15). <y> is the Ethernet port number on the card (0 through 3). This is the LINKID type for reporting on interfaces on the Gigabit Ethernet card.

or one of:

```
EM/<Shelf ID> LP/<n> SONET/<y>

EM/<Shelf ID> LP/<n> SONET/<y> STS/0

EM/<Shelf ID> LP/<n> SDH/<y> VC4/0

EM/<Shelf ID> LAPS/<n> STS/0

EM/<Shelf ID> LAPS/<n> VC4/0
```

where <Shelf ID> is the name of the node. See "SHELFID" (page 48) for a full description. <n> is the logical processor number (0 through 15), and <y> is the SONET port number on the card (0 through 15). This is the LINKID type for reporting on interfaces on optical ATM cards. The SONET components are commonly used for North American deployments.

or

```
EM/<Shelf ID> LP/0 OAMENET/0
```

where `<Shelf ID>` is the name of the node. See “SHELFID” (page 48) for a full description. This is the OAM Ethernet port of the active CP.

or

`EM/<Shelf ID> LP/<n> DS3/<y>`

where `<Shelf ID>` is the name of the node’s self. See “SHELFID” (page 48) for a full description. `<n>` is the logical processor number (0 through 15), and `<y>` is the DS3 port number on the card (0 through 11). This is the LINKID for reporting on electrical ATM card interfaces (12-port DS3).

or

`EM/<Shelf ID> LP/<n> DS3/<y> InverseMultiplexerAtm/<z>`

where `<Shelf ID>` is the name of the node’s shelf. See “SHELFID” (page 48) for a full description. `<n>` is the logical processor number (0 through 15). `<y>` is the DS3 port number on the card (0 through 11). `<z>` is the instance of the DS1 IMA group. This is the LINKID for reporting on electrical channelized ATM card interfaces (4-port DS3 channelized).

IPLINKCAP

This NTM field is the maximum bandwidth of an ATM interface. It reports the maximum cell rate per second, of an ATM interface. LINKCAP reports capacity at the ATM layer. For IP services, regardless of the layer 2 protocol used, whether Ethernet or ATM, IPLINKCAP reports the maximum byte rate per second possible over the link. This rate applies to both incoming and outgoing bandwidth limits.

> ***Note:*** For ATM links, IPLINKCAP reports a maximum layer 3 bandwidth that is not available in reality, because some of this bandwidth is required for cell header overhead.

A related PM, LINKCAP, reports the maximum cell rate (per second) of an ATM interface. This maximum cell rate includes the bandwidth required for the layer 2 overhead of the link. For more information about LINKCAP, see “LINKCAP” (page 60).

Range: Unsigned 64-bit integer

The Nortel Networks Multiservice Switch node in a Succession UA-IP solution forwards voice packets at line rate on an interface, both ingress and egress. Table 3, “Voice capacity of Multiservice Switch 15000 FP cards (UA-IP),” (page 74) shows the bidirectional capacity of IP-capable FP cards in Multiservice Switch 15000 nodes. This includes the aggregate link capacity, and the forwarding capacity of the card’s voice packet IP, for both ITU-T standard G.711 10msec and 20msec packets.

> ***Note:*** In Table 3, “Voice capacity of Multiservice Switch 15000 FP cards (UA-IP),” (page 74), the shaded columns show FP cards that cannot forward voice packets at line rate on all ports simultaneously. Of these cards, the Succession UA-IP solution only supports the 4pOC12SmIrATM (NTHW86) FP card. At G.711 10 msec, an OC-12 link can support 4,700 voice calls. Therefore, use one OC-12 port at most on a 4pOC12SmIrATM FP card for packet forwarding.

Table 3
Voice capacity of Multiservice Switch 15000 FP cards (UA-IP)

Card type	G.711 10 msec		G.711 20 msec	
	Link capacity [a]	Forward capacity	Link capacity [a]	Forward capacity
4pDS3ChAtm PQC12	1,330	N/A[b]	5,600	N/A[b]
12pDS3Atm[c] PQC2	1,380	N/A[b]	1,650	N/A[b]
4pOC3SmIrAtm PQC12	4,670	5,400	5,600	8,064
16pOC3SmIrAtm PQC2	18,700	2,300	24,400	2,800
4pOC12SmIrAtm PQC12	18,700	5,400	24,400	8,064

Table 3 (Continued)
Voice capacity of Multiservice Switch 15000 FP cards (UA-IP)

Card type	G.711 10 msec		G.711 20 msec	
	Link capacity [a]	Forward capacity	Link capacity [a]	Forward capacity
1pOC48ChSmIrAtm PQC2	18,700	2,300	24,400	2,800
4pGE	31,300	19,000	41,600	20,000

[a]Sum of all usable links on an FP card; assumes 100% bearer traffic fill

[b] These two cards do not support Carrier Grade IP. Therefore, use an optical hairpin.

[c] Use only ports 0 through 3 to configure a Succession UA-IP solution.

INBYTES

This NTM field is the total number of bytes incoming to the physical interface during the last interval. It includes overhead from the layer 2 frame header (Ethernet or AAL5). It does not include overhead from ATM cell headers, if the interface supports IP over ATM AAL5.

Range: Unsigned 64-bit integer

OUTBYTES

This NTM field is the total number of bytes outgoing from the interface during the last interval. It includes overhead from the layer 2 frame header (Ethernet or AAL5). It does not include overhead from ATM cell headers, if the interface supports IP over ATM AAL5.

Range: Unsigned 64-bit integer

INPACKETS

This NTM field is the total number of packets incoming to the interface during the last interval. It includes IP and address resolution protocol (ARP) packets. If the interface supports ATM, the total does not include cell flows that do not use the IP layer.

Range: Unsigned 64-bit integer

OUTPACKETS

This NTM field is the total number of packets outgoing from the interface during the last interval. It includes IP and address resolution protocol (ARP) packets. If the interface supports ATM, the total does not include cell flows that do not use the IP layer.

Range: Unsigned 64-bit integer

Layer 4 IP PMs

Layer 4 IP PMs belong to the category of IP physical interface PMs. The Layer 4 IP PMs are as follows:

- INTCPPACKETSLOCAL
- INUDPPACKETSLOCAL
- INICMPPACKETSLOCAL
- INOSPFPACKETSLOCAL
- INARPPACKETSLOCAL
- INOTHERPACKETSLOCAL
- OUTTCPPACKETSLOCAL
- OUTUDPPACKETSLOCAL
- OUTICMPPACKETSLOCAL
- OUTOSPFPACKETSLOCAL
- OUTARPPACKETSLOCAL
- OUTOTHERPACKETSLOCAL

Layer 4 IP PMs only count correctly if VR protocol ports correspond 1:1 to the AtmMpe and AtmIf components. If multiple AC components are bound to the same protocol port, then layer 4 IP stats are counted multiple times, once for every SONET port that applies to the VR protocol port.

For example,

```
atmmpe/<n> ac/1 atmConnection -> atmif/<m> vcc/0.100
nep
```

is a configuration that does not count the layer 4 statistics multiple times. If, however, another AC is defined and bound to the same interface, layer 4 statistics are counted multiple times in the SONET interface.

Multiple counting of statistics is not usually an issue, because normally, protocol ports are not bound to multiple AtmMpe components.

The descriptions of the individual layer 4 IP PMs are in the sections that follow.

INTCPPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of transmission control protocol (TCP) packets destined for this shelf, during the last interval. This does not include packets destined for a VSP card. Locally-destined packets are processed by the CP software, and consume CPU resources.

Range: Unsigned 64-bit integer

INUDPPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of user datagram protocol (UDP) packets destined for this shelf, during the last interval. This does not include packets destined for a voice services processor (VSP) card.

Range: Unsigned 64-bit integer

INICMPPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of Internet control message protocol (ICMP) packets destined for this shelf, during the last interval. This does not include packets destined for a voice services processor (VSP) card.

Range: Unsigned 64-bit integer

INOSPFPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of open shortest path first (OSPF) packets destined for this shelf during the last interval. This does not include packets destined for a voice services processor (VSP) card.

Range: Unsigned 64-bit integer

INARPPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of address resolution protocol (ARP) packets destined for this shelf during the last interval. This does not include packets destined for a voice services processor (VSP) card.

Range: Unsigned 64-bit integer

INOTHERPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of other packets destined for this shelf, during the last interval. This includes packets that use IP in IP (VPN), exterior gateway protocol (EGP), IGP, and IGRP. This does not include packets that use transmission control protocol (TCP), user datagram protocol (UDP), Internet message control protocol (ICMP), address resolution protocol (ARP), or open shortest path first (OSPF). In a pure Succession application, this count is zero.

Range: Unsigned 64-bit integer

OUTTCPPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of TCP packets leaving this interface, that originated on this shelf, during the last interval. This does not include packets from the VSP cards. Locally-sourced packets are processed by the CP or FP, and consume CPU resources.

Range: Unsigned 64-bit integer

OUTUDPPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of UDP packets leaving this interface, that originated on this shelf, during the last interval. This does not include packets from the VSP cards. Locally-sourced packets are processed by the CP or FP, and consume CPU resources.

Range: Unsigned 64-bit integer

OUTICMPPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of ICMP packets leaving this interface, that originated on this shelf, during the last interval. This does not include packets from VSP cards.

Range: Unsigned 64-bit integer

OUTOSPFPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of OSPF packets leaving this interface, that originated on this shelf, during the last interval. This does not include packets from VSP cards.

Range: Unsigned 64-bit integer

OUTARPPACKETSLOCAL

This NTM field is a layer 4 IP PM. It is the number of ARP packets leaving this interface, that originated on this shelf, during the last interval. This does not include packets from VSP cards.

Range: Unsigned 64-bit integer

OUTOTHERPACKETSLOCAL

This NTM field is a layer 4 IP PM. It indicates the number of other packets leaving this interface, that originated on this shelf, during the last interval. This includes IP in IP (VPN), EGP, IGP, and IGRP packets. This does not include TCP, UDP, ICMP, ARP, or OSPF packets. In a pure Succession application, this count is zero.

Range: Unsigned 64-bit integer

INDIFFSERVBEARER
INDIFFSERVCONTROL
INDIFFSERVNETWORK
INDIFFSERVOAMP
INDIFFSERVDEFAULT
INDIFFSERVOTHER
OUTDIFFSERVOTHER
OUTDIFFSERVCONTROL
OUTDIFFSERVNETWORK
OUTDIFFSERVOAMP
OUTDIFFSERVDEFAULT
OUTDIFFSERVOTHER
These NTM fields are not currently implemented.

INPACKETSDIS
This NTM field indicates the number of malformed IP packets incoming to the interface, during the last interval. These packets are corrupted.

> ***Note:*** When the underlying layer 2 medium is ATM, the INPACKETSDIS PM does not reflect discards. Discards occur at the ATM layer, therefore ATM PMs reflect cell discards of the IP over AAL5 flow.

Range: Unsigned 64-bit integer

OUTPACKETSDIS
This NTM field indicates the number of packets attempting to exit the interface but which are rejected instead, during the last interval.These packets are corrupted or lost due to congestion.

> ***Note:*** When the underlying layer 2 medium is ATM, the OUTPACKETSDIS PM does not reflect discards. Discards occur at the ATM layer, therefore ATM PMs reflect cell discards of the IP over AAL5 flow.

Range: Unsigned 64-bit integer

INLOCALEXCEPTIONS
This NTM field indicates the number of packets received by the interface during the last interval, and destined for this shelf, not including the VSP cards, that require exception handling. These packets must be processed by

software. They include most ICMP packets, such as echo packets (ping), or host redirects. Abnormally high counts for this PM can indicate a denial of service attack, or a broken route in the network.

Range: Unsigned 64-bit integer

INFWDEXCEPTIONS

This NTM field indicates the number of packets received by the interface during the last interval, that have a forwarding exception. This statistic is only available when software forwarding is used. Only CP Ethernet ports use software forwarding.

Range: Unsigned 64-bit integer

Description of Media Gateway VSP card processor PMs

This section describes performance measurements (PMs) for Media Gateway voice services processor (VSP) card processors. These are available from the Nortel Networks Multiservice Switch 15000 nodes in a Succession Network. These PMs give performance information about the voice processing of the VSP3 and
VSP3-o cards.

The VSP card processor PMs appear as a single row (per-shelf) in the 5-minute and 30-minute PM files. The DATE, TIME, SHELFID, OFFICEID, SYSUTIL, and LINKID fields also appear in the row. Any other PMs appear in the row as nulls delimited by commas.

For VSP card processor PMs, the LINKID value appears in one of the formats as follows:

- “EM/<Shelf ID> LP/<n> PMODULE/<x> PBLOCK/<y>”
- “EM/<Shelf ID> DLEP/<n> PMODULE/<x> PBLOCK/<y>”

where <Shelf ID> is the node name of the shelf. See “SHELFID” (page 48) for a full description.
<n> For LP, this attribute is the logical processor number, a value from 0 through 15.
<n> For DLEP, this attribute is the Dual-LP Equipment Protection number, a value from 0 through 7.
<x> This attribute is the number of the VSP processing module.
<y> This attribute is the number of the VSP processing block.

VSPUTILAVG

This NTM field indicates the average CPU utilization of the on-board processor on the VSP card. Depending on the VSP type, and the component named in the LINKID field, this PM is reported as shown in Table 4, “VSPUTILAVG PM reporting,” (page 83).

Table 4
VSPUTILAVG PM reporting

Voice services processor (VSP) card	VSP type	LINKID	CPU utilization (%)
VSP3-o	Signaling processing module (SPM)	PMODULE/1 PBLOCK/1	0 through 100
	SSM	PMODULE/1 PBLOCK/2	
VSP3	Signaling processing module (SPM)	PMODULE/1 PBLOCK/1	
	ACM	PMODULE/2 PBLOCK/1	
	SSM	PMODULE/3 PBLOCK/1	

Description of Media Gateway 15000 card PMs

This section describes performance measurements (PMs) for the Media Gateway card PMs. They are available from the Nortel Networks Multiservice Switch 15000 nodes in the Succession Network.

The Media Gateway card PMs appear as a single row (per-shelf) in the 5-minute and 30-minute PM files. The DATE, TIME, SHELFID, OFFICEID, SYSUTIL, and LINKID fields also appear in the row. Any other PMs appear in the row only as nulls delimited by commas.

For Media Gateway card PMs, the LINKID value uses the following format:

- “EM/<Shelf ID> NSTA/<n> VGS”

where `<Shelf ID>` is the name of the node. See “SHELFID” (page 48) for a full description.
`<n>` is the application that manages voice services on the VSP card (the LP number).

CONGSECS

This NTM field indicates the number of seconds during which new media connection requests are rejected because the Media Gateway card is busy, during the last interval.

The LINKID determines for which Media Gateway card this PM is reported.

Range: 0 through 300, or 0 through 1800

OVLDCMDSREJECTED

This NTM field indicates the number of control protocol commands that are rejected due to overload of the input message buffer.

The LINKID determines for which Media Gateway card this PM is reported.

Range: 0 through 4294967295

OUTH248RETRAN

This NTM field indicates the number of media gateway control (MGC) protocol retransmissions by the Media Gateway card. Each retransmission of a given message counts as a single occurrence.

The LINKID determines for which Media Gateway card this PM is reported.

Range: 0 through 4294967295

INH248RETRAN

This NTM field indicates the number of media gateway control (MGC) protocol retransmissions sent by the Media Gateway card. Each retransmission of a given message counts as a single occurrence.

The LINKID determines for which Media Gateway card this PM is reported.

Range: 0 through 4294967295

FAILOVERS

This NTM field indicates the number of times a Media Gateway card performs fail-over procedures and attempts contact with another controller, since an H.248 component is activated.

The LINKID determines for which processor this PM is reported.

Range: 0 through 65535

CALLFAILSNET

This NTM field indicates the number of connections lost to Gateway-detectable network failures in the IP core, during the last interval. This includes:

- Individual integrity time-outs of connection media
- Bulk connection loss caused by ATM virtual channel connection (VCC) failure or release, or removal of the associated component.
- Bulk connection loss caused by failure of local IP media link, or removal of the associated component.

Range: 0 through 4294967295

CALLFAILTDM

This NTM field indicates the number of connections lost due to failure of a time division multiplexing (TDM) port, internal failure, or deletion of a TDM port, since the component was created.

Range: 0 through 4294967295

DIGITREJECT

This NTM field indicates the number of digit collection requests rejected because of lack of resources. A persistent increase in this number indicates that digit collection resources are insufficient.

Range: 0 through 4294967295

CALLSETUPS

This NTM field indicates the number of media connections successfully established by this Media Gateway card, and acknowledged by the media gateway controller (MGC), during the past interval.

Range: 0 through 4294967295

ACTIVECALLAVG

This NTM field indicates the number of active media calls, during the past interval.

Range: 0 through 2016

ACTIVECALLMIN

This NTM field indicates the minimum number of active media calls, during the past interval.

Range: 0 through 2016

ACTIVECALLMAX

This NTM field indicates the maximum number of active media calls, during the past interval.

Range: 0 through 2016

Description of PDU setup failure PMs

This section describes the performance measurements (PMs) for protocol data unit (PDU) setup failure. These are collected from the Nortel Networks Multiservice Switch 15000 nodes in the Succession Network.

There are individual NTM statistics for each supported ATM failure cause. These failure causes are summarized in Table 5, "PMs for PDU setup failure," (page 87)

Table 5
PMs for PDU setup failure

NTM statistic	Range	Failure cause
INFAIL3	0 to 65535	No route to destination
INFAIL17	0 to 65535	User busy
INFAIL18	0 to 65535	No user responding
INFAIL21	0 to 65535	Call rejected
INFAIL27	0 to 65535	Destination out of order
INFAIL28	0 to 65535	Invalid number format (address incomplete)
INFAIL35	0 to 65535	Requested VPI/VCI not available
INFAIL36	0 to 65535	VPI/VCI assignment failure
INFAIL37	0 to 65535	User cell rate not available
INFAIL41	0 to 65535	Temporary failure
INFAIL45	0 to 65535	No VPI/VCI available
INFAIL47	0 to 65535	Resource unavailable, unspecified
INFAIL49	0 to 65535	QOS unavailable
INFAIL57	0 to 65535	Bearer capability not authorized
INFAIL58	0 to 65535	Bearer capability not presently available
INFAIL63	0 to 65535	Service or option not available, unspecified
(Sheet 1 of 3)		

Table 5 (Continued)
PMs for PDU setup failure

NTM statistic	Range	Failure cause
INFAIL65	0 to 65535	Bearer capability not implemented
INFAIL73	0 to 65535	Unsupported combination of traffic parameters
INFAIL78	0 to 65535	AAL parameters cannot be supported
INFAIL88	0 to 65535	Incompatible destination
INFAIL96	0 to 65535	Mandatory information element missing
INFAIL99	0 to 65535	Information element non-existent or not implemented
INFAIL100	0 to 65535	Invalid information element contents
INFAIL104	0 to 65535	Incorrect message length
INFAIL111	0 to 65535	Protocol error, unspecified
OUTFAIL3	0 to 65535	No route to destination
OUTFAIL17	0 to 65535	User busy
OUTFAIL18	0 to 65535	No user responding
OUTFAIL21	0 to 65535	Call rejected
OUTFAIL27	0 to 65535	Destination out of order
OUTFAIL28	0 to 65535	Invalid number format (address incomplete)
OUTFAIL35	0 to 65535	Requested VPCI/VCI not available
OUTFAIL36	0 to 65535	VPCI/VCI assignment failure
OUTFAIL37	0 to 65535	User cell rate not available
OUTFAIL41	0 to 65535	Temporary failure
OUTFAIL45	0 to 65535	No VPCI/VCI available
OUTFAIL47	0 to 65535	Resource unavailable, unspecified
(Sheet 2 of 3)		

Table 5 (Continued)
PMs for PDU setup failure

NTM statistic	Range	Failure cause
OUTFAIL49	0 to 65535	QOS unavailable
OUTFAIL57	0 to 65535	Bearer capability not authorized
OUTFAIL58	0 to 65535	Bearer capability not presently available
OUTFAIL63	0 to 65535	Service or option not available, unspecified
OUTFAIL65	0 to 65535	Bearer capability not implemented
OUTFAIL73	0 to 65535	Unsupported combination of traffic parameters
OUTFAIL78	0 to 65535	AAL parameters cannot be supported
OUTFAIL88	0 to 65535	Incompatible destination
OUTFAIL96	0 to 65535	Mandatory information element missing
OUTFAIL99	0 to 65535	Information element non-existent or not implemented
OUTFAIL100	0 to 65535	Invalid information element contents
OUTFAIL104	0 to 65535	Incorrect message length
OUTFAIL111	0 to 65535	Protocol error, unspecified
(Sheet 3 of 3)		

File engineering

This section provides information to help determine various engineering parameters, both for installation setup of Nortel Networks Preside Multiservice Data Manager (MDM) servers, as well as for a user application platform to determine storage requirements due to NTM statistics data.

On SDM, used in a Succession PT-AAL1 or UA-AAL1 solution only, all the data received from each of the nodes in the network, by way of Preside MDM servers, are stored in a single file per interval. That is, there are separate records for each ATM interface on each shelf. However, all such records for the 5-minute interval are in one file, and all such records for the 30-minute interval are in one file.

Using Preside MDM tools, you can create either one file per interval, as described earlier, or a separate file for each shelf.

Each file has one header line. In SN04 and SN05, the header line is approximately 500-600 characters in length. In SN06, it is approximately 700 characters. In SN07, it is 1848 characters. The PM file is providing more performance information than ever before.

Regardless of whether the record is handled by SDM or Preside MDM, or contains a file per group or a file per shelf, the majority of the content in a file is the information that appears for each ATM interface. Thus, the number of characters in each record is estimated as follows:

- There are 69 fields. Most of them are variable in size, depending on the number of digits in the count. Some of them have a fixed size value (for example, the NTM statistic for Date).
- There are four variable length ASCII text fields: OFFICEID is typically 11 characters (12 including the comma); SHELFID is typically 15 characters (16 including the comma); LINKID is typically 10 to 40 characters; REMOTEATMIFLABEL is typically 25 to 30 characters.

Thus, file size is approximately 5 to 30 KB per shelf.

Calculate the quantity of data that accumulates per day as follows. Assume one shelf per file.

- In 1 hour, the number of 5-minute intervals is 12, the number of 30-minute intervals is 2.
- In a day, the number of files generated is 24 (hours) x 14 (12 + 2) = 336 files
- 336 files x ~30Kbyte/shelf = ~10 Mbytes per day

Thus, file system partitions (for example /opt/MagellanNMS/) and cleanup scheduling must factor in the storage requirements based on actual configurations and potential growth scenarios.

Troubleshooting the interval data records

NTM statistics are collected at 5-minute intervals from the node by the Nortel Networks Multiservice Switch AtmCore, AtmNetworking, and PCS applications, from the control and function processor cards and the ATM interfaces. Each Multiservice Switch node sends NTM statistics to the resident data collection system (DCS), where records of the *rtstats* data type are created for each application. The node then forwards these records to a Nortel Networks Preside Multiservice Data Manager (MDM) server.

The PMSP server running on the Preside MDM server collects and gathers *rtstats* data forwarded to it by the node's DCS application. The PMSP server converts the NTM statistics into the CSV format. On the hour, and every half-hour, the data for all 5-minute intervals within that 30-minute interval are aggregated, for that 30-minute interval only.

A 30-minute interval record includes the same attributes as a 5-minute interval record. The values of the 30-minute file attributes represent a cumulative total of all 5-minute interval records in that 30-minute interval.

> ***Note:*** Even a slight time difference of less than 0.1 of a second can result in large differences in packet information due to high bandwidths.

For more information on 5- and 30-minute interval data, see the following sections

- "5-minute interval data" (page 92)

- “30-minute interval data” (page 94)

  Note: To view NTM statistics collected from a node off-switch, use an application capable of reading CSV-formatted text, such as Microsoft Excel. To view NTM statistics on-switch, use the Preside MDM Data Viewer tool.

5-minute interval data

Nortel Networks Multiservice Switch 15000 nodes collect records with NTM statistics for each 5-minute interval. These 5-minute intervals are synchronized to five minutes after the hour and begin with the nearest 5-minute time increment (time of day between nodes must be synchronized). These records are generated following the completion of each 5-minute interval. The node then forwards the records of the NTM statistics to a Nortel Networks Preside Multiservice Data Manager (MDM) server.

The Preside MDM PMSP server receives the 5-minute interval data and aggregates it for a 30-minute interval. It reports the totals to the SuperNode Data Manager (SDM) for a Succession PT-AAL1 solution, or to a customer operational support system (OSS) for a Succession UA-AAL1 or UA - IP solution.

For information on the potential problems with the 5-minute interval data records, see the following sections:

- “Records with missing or corrupted data” (page 92)
- “Records out-of-time synchronization” (page 93)
- “Time changes” (page 93)
- “CP and FP switchovers” (page 94)

Records with missing or corrupted data

The Preside MDM PMSP server processes the records on a best effort-basis. It sends to the SuperNode Data Manager (SDM), for Succession PT-AAL1 or UA-AAL1, or to IEMS, for Succession UA - IP, or to files on the MDM servers whatever data it receives during a particular interval, for an ATM interface. Attribute fields related to records not received during an interval are left blank in the consolidated CSV data stream sent to either IEMS (for UA-IP), or the SDM (for PT-AAL1 or UA-AAL1).

If a record contains corrupted data, the PMSP server writes the entire raw FMIP record to a file named "`ppc_5min.err`" in the "`/opt/MagellanNMS/data/pmsp`" directory. This file is used to recover partial data, if necessary, or to help determine the reason for corrupt data.

Records out-of-time synchronization

If a record does not belong to the current interval, the current 5-minute interval ATM interface record excludes that record.

If the record belongs to an interval for which 30-minute interval data processing is still in progress, it is still included in the respective 30-minute interval data. The PMSP server issues a warning that indicates that a record from a previous 5-minute interval has been received from a particular node. This warning appears on the System Log Display tool. Only one warning is issued for each node, for each occurrence. For more information, see 241-6001-310 *Preside MDM Server Reference Guide*.

If the record does not belong to the current interval and its 30-minute interval CSV data stream has already been completed, the record is discarded.

Time changes

For network time changes (for example, time changes involving Daylight Savings Time), the PMSP server takes no special action. However, if a network time change occurs on the Preside MDM servers or the nodes, data is not collected until the two systems are synchronized. Until Preside MDM and the nodes are resynchronized, the PMSP server receives data outside of the current interval.

The PMSP server generates interval records and CSV data streams using the timestamp in the raw record. Multiple records can in some cases be generated for a specific time interval (that is, an initial time interval prior to the time changeover and new records after the time fallback). It is not recommended to change network time. However, if the network time must be changed, do it after the 30-minute interval data is successfully transmitted, and before the the data is received from the first 5-minute interval for the next 30-minute interval.

CP and FP switchovers

PMs can be lost during the switchover of either a function processor (FP) or a control processor (CP) card. In that case, the PMs reported for that particular 5-minute interval are not a complete list.

30-minute interval data

Nortel Networks Preside Multiservice Data Manager (MDM) PMSP server creates a single 30-minute interval data stream every half hour. It creates it on the hour and on every half hour. This data stream summarizes the NTM statistics for each interface, from six 5-minute intervals.

A 30-minute interval record includes the same attributes as a 5-minute interval record. For those NTM statistics that use a counter, the counters in the 30-minute files represent a cumulative total of the counters in the 5-minute interval records for that 30-minute interval. If a record for a 5-minute interval is received late, the 5-minute data is not transmitted to the SDM (for PT-AAL1 or UA-AAL1), or IEMS (for UA - IP), or included in the Preside MDM 5-minute files. It is incorporated directly into the 30-minute interval record.

Special considerations

This section describes a number of considerations for users of Nortel Networks Multiservice Switch for Succession performance data and those involved in support and troubleshooting of the performance data system.

Normally, performance data is collected at regular intervals but analyzed only when needed. That is, information originates on the network elements (NEs) and at the designated times, flows through the system to the appropriate element management systems (EMS) and then on to the OSS application where it is processed, as needed, by the customer-managed system.

Occasionally, the data flow and its content are disrupted by events that are external to the performance data system. The effect of disruption of the data flow usually manifests itself in one of several ways. Because the data is stored in files containing records of information collected from different Multiservice Switch subsystems and service domains, the most common indicator of an error is missing information. The following sections discuss the valid scenarios and possible events which can affect performance data in this way:

- "Viewing CSV file considerations" (page 96)
- "Configuration considerations" (page 96)
- "Upgrade considerations" (page 97)
- "Engineering and scalability considerations" (page 98)
- "Time-of-day considerations" (page 99)
- "Outage and switchover condition considerations" (page 101)
- "Traffic management considerations" (page 102)

There are three sets of Succession Network considerations not described here. These additional considerations include error-handling mechanisms that are:

- internal to PMSP, the Preside MDM server process. These mechanisms and the PMSP command line options are described in 241-6001-310 *Preside MDM Server Reference Guide*.
- For PT-AAL1 or UA-AAL1, specific to the SDM OM Data Delivery application. These mechanisms are described in the 297-2667-321 *SuperNode Data Manager Carrier OM Data Delivery Application User Guide* and other related SDM documentation.
- For UA - IP, specific to the Integrated Element Management System (IEMS) application. These mechanisms are described in the IEMS documentation for this Succession release.

Viewing CSV file considerations

Normally, 5- and 30-minute NTM statistics files that contain Nortel Networks Multiservice Switch for Succession performance data are viewed using a customer-supplied OSS application. These applications process the file content and provide the user interface and presentation formats desired by the customer. However, in some troubleshooting scenarios, it is necessary to view a CSV file directly. To view a CSV file directly, use one of the methods as follows:

- The CSV format is read directly by PC applications such as Microsoft Excel. Before using a PC application to open a CSV format file, the file needs to be retrieved into a PC environment. Sometimes the application may present the data according to user-specified rules which typically do not change the meaning of the data but do not reflect the exact syntax of the actual file content. For example, the application can display a date format such as Oct. 25, 2002 instead of the NTM statistics file content which is *10-25-2002*.
- In Nortel Networks Preside Multiservice Data Manager (MDM), the Data Viewer tool is capable of reading a CSV file. For information on the Data Viewer tool, see 241-6001-031 *Preside MDM Performance Management User Guide*.
- On any UNIX-based platform such as SDM or Preside MDM, the most direct way to view the CSV files is to use a UNIX-based editor such as VI or file manipulation commands such as the *more* command. When using these viewing methods, the presentation of information is often difficult to read.

Configuration considerations

In a Succession Network voice over ATM (VoA) solution, performance data flows through several elements in the performance data system before it arrives at its destination, the OSS application. VoA refers to PT-AAL1 or UA-AAL1. Each of these elements in the performance data system has specific configuration requirements. If you discover problems with the flow of performance data through the system, first check that all the configuration parameters are set according to specifications. The various Nortel Networks Preside Multiservice Data Manager (MDM) and Multiservice Switch node configurations are specified in NN10225-512 *Nortel Networks Multiservice Switch 15000 and Media Gateway 15000 in Succession Networks Configuration Attribute Summary PT-AAL1/UA-AAL1/UA-IP*.

Next, if all the configuration parameters appear to be accurate, check the connectivity between the elements involved in the flow of performance data. The procedures for finding a connectivity failure depend on the type of equipment being used. Since this equipment is usually customer-supplied, Nortel Networks cannot recommend specific procedures. If faulty connectivity is the problem, other FCAPS data handling is most likely affected, for example fault flows, or access to the elements for the issuing of commands. If other FCAPS data handling is not affected, then check with the internal SDM and Nortel Networks Preside Multiservice Data Manager error-handling mechanisms as mentioned in “Special considerations” (page 94).

Upgrade considerations

Occasionally, customers upgrade their Succession Network voice over ATM (VoA) solution elements in order to obtain new and enhanced capabilities. VoA refers to PT-AAL1 and UA-AAL1. During the migration from one release to another, elements within the overall solution can be running either the new release or the previous one. New capabilities are not necessarily fully available until all system elements are upgraded to the new release.

Upgrade the OSS performance data application before upgrading the system elements. OSS must be able to distinguish between performance data from the newly upgraded system elements, which typically contain new fields and values, and older system elements. These older systems elements have not yet been upgraded and are sending information in the previous format. This migration scenario can result in a situation where data values appear to be missing from the record. The OSS application needs to be able to receive performance data from both upgraded and non-upgraded elements in the network.

Migrate the Succession system to SN07 in the following order:

1 customer operations support systems (OSS)

2 Succession SDM / Preside Multiservice Data Manager (these two can be upgraded in either order)

3 Multiservice Switch shelf

This ordering ensures that all systems which receive PMs are aware of SN07 format and prior formats. All SN07 systems must be backwards compatible with the releases as follows:

- SN06 (UA-AAL1)
- SN06.2 (UA-AAL1)

Element management systems (EMSs) also must be upgraded prior to network elements (NEs). Similarly, every EMS must be able to handle performance data from both upgraded and non-upgraded network elements.

Refer to the following upgrade documents for each specific release:

- NN10070-461 *Upgrading Nortel Networks Multiservice Switch 15000 in Succession Networks PT-AAL1/UA-AAL1*
- NN10185-461 *Upgrading Preside MDM in Succession Networks*
- NN10419-461 *Upgrading Nortel Networks Multiservice Switch 15000 and Media Gateway 15000/20000 in Succession IP Solutions*

Engineering and scalability considerations

As a network evolves, nodes in a Succession Network voice over ATM (VoA) solution can grow. VoA refers to PT-AAL1 and UA-AAL1. For example, adding more gateways requires the use of more ATM interfaces on the core ATM network elements.

As long as the overall solution configuration remains within the engineering limits, the parameter settings are adjusted accordingly. For example, increasing the latency time-out of the original setting is based only on the initially installed equipment.

As the overall solution configuration approaches the engineering limits, the solution architecture can be affected. For example, the 5-minute PM latency limits are reached by the set of Nortel Networks Multiservice Switch 15000 nodes sending PM data to a specific Nortel Networks Preside Multiservice Data Manager (MDM) server or servers. Therefore, the addition of more nodes into a VoA switch domain can also require the addition of more Preside MDM servers to handle the additional load and still meet the latency requirements.

Refer to the engineering guides and the following configuration guides for more information on the limits of the performance data system:

- NN10114-511 *Nortel Networks Multiservice Switch 15000, Media Gateway 15000 and Preside MDM in Succession Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP*
- NN10225-512 *Nortel Networks Multiservice Switch 15000 and Media Gateway 15000 in Succession Networks Configuration Attribute Summary PT-AAL1/UA-AAL1/UA-IP*
- 241-6001-023 *Preside MDM Configuration Management for Passport User Guide*

Time-of-day considerations

Like other FCAPS data, correlation of performance data across the system is dependent on keeping the elements aligned with the time-of-day (TOD). There are two main aspects of alignment:

- “Network-level TOD synchronization” (page 99)
- “Time alignment within regions” (page 100)

Network-level TOD synchronization

Network-level time-of-day (TOD) synchronization is achieved using the XNTP Network Time Protocol. The XNTP Network Time Protocol is based on the RFC 1305 standard. This protocol is used across all of the system elements involved in the Nortel Networks Multiservice Switch 15000 performance data system. Synchronization is based on a reference time, such as Coordinated Universal Time (UTC), which ensures that the collection times, for example, are aligned across the different elements. Synchronization based on UTC implies that latency time-outs are aligned as well. If the XNTP system lapses into an out-of-sync condition for an extended period of time, the collection of performance data from an element that is dependent on that synchronization can be affected.

At the end of each 5- or 30-minute interval, Nortel Networks Preside Multiservice Data Manager (MDM) sets a timer according to the value of the *-ppexpire* command line option. This value is the latency time-out. By default, if not value is specified, the latency time-out is 15 seconds. Any records received from Multiservice Switch nodes during that time-out window are accepted into the 5-minute interval data. Any records received after the timer expires are discarded from the 5-minute performance data, logged as being discarded by the Preside MDM System Log Display, and included in the 30-minute data for the current 30-minute interval. If the 30-minute interval CSV stream is complete, the record is counted in the next interval or possibly discarded and logged for the 30-minute interval.

Time alignment within regions

Typically, each element in the performance data system is aligned within a region, such as a state or time zone, to the same offset from the reference time. For example, the selected offset reflects the local time zone in which the element resides such as Eastern Standard Time (EST) which is -300 minutes offset from UTC. A Multiservice Switch 15000 node and the Preside MDM server managing it are usually expected to be in the same time zone. Seasonal time changes, such as beginning and ending of Daylight Savings Time, are also handled by the Preside MDM server and Multiservice Switch node, although there are impacts to the performance data collection during the transition time interval. The details concerning seasonal time changes are found in the appendix of NN10114-511 *Nortel Networks Multiservice Switch 15000, Media Gateway 15000 and Preside MDM in Succession Networks Configuration Overview PT-AAL1/UA-AAL1/UA-IP*.

For seasonal time changes, the PMSP server takes no special action. Daylight Savings Time does however, require additional management. When this seasonal time change occurs, for the hour of time that is typically repeated (in North America, this hour usually falls between 1:00 and 2:00 am) CSV files have the same names as similar files produced an hour earlier, prior to the time change. This potential problem requires that the OSS application either move or rename the older files before the new ones with the same name are created. The application can also delete older files if they are left in their original location. This potential problem applies to both SDM and Preside MDM created files.

Outage and switchover condition considerations

Generally, applications in a Succession voice over ATM (VoA) solution require redundancy for all ATM interfaces. VoA refers to PT-AAL1 and UA-AAL1. As long as at least one of the redundant sides of an interface is up when the interval expires, performance data continues to be collected and sent. However, there are rare occasions when an outage or switchover can affect performance data. For more information, see “Traffic management considerations” (page 102).

Table 6
NTM statistic outage and switchover scenarios

Scenario	Condition at end of the interval	Effect on the data
Both sides fail, as in the case of a double FP failure during an interval	Both sides are still down	No data is collected for the ATM interfaces in this card pair
Both sides fail, as in the case of a double FP failure during an interval	One or both sides recover	Data is collected and sent without any indication of there being a failure in the record
FP equipment switchover occurs during an interval	One or both sides are active	Data is collected and sent without any indication in the record that the values reflect only that part of the interval when service was active
CP equipment switchover occurs during an interval	One or both sides are active	Data is collected and sent without any indication in the record that the values reflect only that part of the interval when service was active
CP or FP failure occurs immediately following an interval expiry	CP or FP is down but collected data is still in memory	Data is discarded
Active CP fails near end of an interval	Standby CP is not able to reactivate the performance data expiry timer	No data is collected from the node with the CP failure. The record for the next interval might contain data values from the missed interval and the next interval. This scenario is extremely rare.

Traffic management considerations

Traffic management is effectively a way of achieving reliability while maximizing scalability (capacity).

Traffic management for non-voice ATM

A Nortel Networks Multiservice Switch 15000 node acting as the packet core switch in the Succession network, can carry non-voice data employing several ATM service categories (ASC). The Succession Network uses the constant bit rate (CBR) ASC for carrying voice and real-time variable bit rate (rt-VBR) or non-real-time VBR for carrying media gateway control and management traffic. Multi-service traffic can employ any of the supported ASCs.

Due to the asynchronous nature of ATM traffic, you must pay close attention to the egress queue cells discards when running a large proportion of real-time traffic (for example, CBR and rt-VBR) on ATM network links. Nortel Networks recommends that you run ATM trunk links with approximately 70% real-time traffic. Use the rest of the bandwidth for non-real-time traffic. To assess whether the allowed portion of real-time traffic is too high, monitor the egress cell discards to ensure that cell loss ratio (CLR) is acceptable (OUTCBRCLP+1DIS and OUTRTVBRCLP0+1DIS). Because the cell loss standards and the bandwidth pool configuration differ for each ATM service category, ATM QoS cell discard statistics are needed for each ATM service category. The number of cells discarded provides a means by which network engineers can judge if the QoS objectives of each service category are being met on each ATM network link. As well, it helps determine how well the ATM network links are engineered.

ATM QoS cell discard statistics are available on all the FPs used by Succession customers. For the Succession Network solution, the primary delivery mechanism for these statistics is the 5- and 30-minute NTM statistics stream. This stream is collected by the rtstats DCS queue and PMSP on Nortel Networks Preside Multiservice Data Manager servers. ATM QoS cell discard statistics are available for each ATM interface.

Traffic management for UA-IP

The requirements for traffic management for a Succession UA-IP solution appear in Table 7, "Quality of service objectives in order of priority (UA - IP)," (page 103).

Table 7
Quality of service objectives in order of priority (UA - IP)

Flow	Real-time	Packet loss tolerance	Relative volume
Control (H.248)	Yes	Low	Low
Networking (OSPF, ICMP, ARP)	Yes	Low	Low
OAM	Yes	Medium	Low
voice	Yes	Moderate	High
DSL (ATM only)	Yes	High	Variable

In order to meet the quality of service (QOS) objectives shown in Table 7, "Quality of service objectives in order of priority (UA - IP)," (page 103), Nortel Networks Multiservice Switch systems use congestion control mechanisms.

The system manages congestion and guarantees QOS objectives by marking each cell or frame (regardless of protocol) with an Emission Priority (EP) and a Discard Priority (DP). It then allocates buffer or bandwidth resources to the cell or frame based on these two priorities. Therefore, congestion control has three major phases:

1. Marking: When a cell or frame enters the node, it is assigned an EP and DP appropriate to the flow to which it belongs.
2. Storage: When buffering a frame or cell to enqueue it for processing or transmission on a link, the EP and DP determine whether the frame or cell must be discarded to ensure there is storage for other frames or cells.

3 Transmission/processing: The EP determines the order in which buffered cells and frame are transmitted on a link or processed.

In order to manage congestion on network links, as described in Table 7, “Quality of service objectives in order of priority (UA - IP),” (page 103), the Multiservice Switch node must determine to which flow a packet belongs. It then assigns the appropriate EP and DP to the packet. In Succession, the method used is differentiated service (DiffServ) codepoint, or DSCP.

Table 8
Mapping of DiffServ CP to Multiservice Switch 15000 and ATM TM values

VPN	VR	DiffServ code	Cos	SC	DP	MBG	ATM QoS/EP	Forced Tagging
Multiservice Switch 15000 OAM	0	CS1	0	0	low	-	nrt-Vbr/4	Disabled
Voice, callp and MG9000 OAM	voip	EF voice	3	6	high	-	rt-Vbr/2	Enabled
		CS6 (IP) & CS5 (callp)	2	5	low	5%	rt-Vbr/2	Disabled
		CS1 (OAM)	1	1	low	5%	nrt-Vbr/4	Disabled
DSL (ATM only)	-	-	-	-	-	0%	Ubr/7	Disabled

Upon ingress of a packet, the DP is set, according to DSCP.

The SC is also set according to DSCP, but is mapped to EP based on:

- either the SC to EP mapping (Ethernet) or

- the EP of the ATM Service Category on the selected egress link

The latter is done by first mapping the SC to a Connection Class (CoS), and then assigning each defined CoS to an ATM Vcc with the appropriate ATM Service Category.

For MG9000, bearer and control must be sent and received on the same Vcc. As a result, both bearer and control have the same scheduling and discard priority.

Network link congestion (egress)

DSL traffic is ATM only. It must use ATM traffic management (TM) methods. If it is unspecified bit rate (UBR) and everything else is not, then:

- it uses no packet forwarding capacity
- it is always dequeued for transmission on the link last, which means it gets discarded first, because UBR is always the first service category to get congested

Bearer and Control are both real-time variable bit-rate (rt-VBR). An ATM voice call is constant bit rate (CBR), but the aggregate of several trunks is variable bit rate (VBR) because the bit rate depends on how many are in use. It is natural, therefore, that the ATM ASC used be rt-VBR. In order to honor the discard priority shown in "Quality of service objectives in order of priority (UA - IP)" (page 103), and give priority to Control in cases of congestion, the bearer is given a high discard probability. For example, cell loss priority (CLP) is force tagged to be =1.

Operations, administration, and maintenance (OAM) is non-real time, therefore it is assigned nrt-VBR. Large queues and buffer reduce the chance of packet loss during brief congestion. To guarantee moderate packet loss during sustained congestion, the nrt-VBR service category is given a Minimum Bandwidth Guarantee (MBG). This can be, for example, 5%.

On the Gigabit Ethernet (GE) links to the CS-LAN, the bearer traffic has a lower emission priority (EP). Therefore, the bearer traffic has priority over everything else. To meet the Control and OAM traffic requirements in an overload scenario, those EPs are given a Minimum Bandwidth Guarantee

(MBG) of 5%. This MBG ensures that when there is contention between voice and either control or OAM traffic, the latter wins, because it never exceeds 5% of the link bandwidth.

IP control plane congestion

When a Nortel Networks Multiservice Switch node's queue controller receives a packet for which no forwarding entry is found, an Internet control message protocol (ICMP) host-unreachable or network-unreachable is sent to the source.

The number of packets entering an OC-12 interface can quickly consume all available CPU resources on an FP card if a significant portion of them cannot be forwarded. For example, a local MG9000 fails. That results in potentially 100,000 packets per second that require ICMP host-unreachables. This CPU consumption can impact service on other ports of the same FP card, or to other forwardable packets entering the same interface.

The Media Gateway 9000 (MG9000) and the Media Gateway ignore ICMP packets. Discard these packets by adding a default DiscardRouteEntry to the Virtual Router. Then, all packets that cannot be forwarded are discarded.

Shelf level congestion (CP)

Congestion at the shelf level is limited to the control plane on the CP cards, because the shelf fabric capacity always exceeds the total of the link capacities.

With the exception of open shortest path first (OSPF) running on the CS2000 site shelf, the CP cards do not have many processor intensive tasks on them. Nevertheless, the Class BasedScheduler ensures that management, shelf and processor control systems are given the CPU resources they require.

Appendix A
Use cases, thresholds, and utilization formulas for NTM statistics

This appendix contains detailed information about network traffic management (NTM) statistics. It includes threshold values recommended by Nortel Networks. It gives formulas for calculating utilization rates. Also, it presents several use cases that illustrate scenarios that can occur with ATM signaling.

This appendix includes the sections as follows:

Categories of NTM statistics

Table 9, “Categories of NTM statistics,” (page 108) provides an example of how the NTM statistics fields can be classified into groups. It also explains the function of each of group of related fields.

> ***Note:*** An asterisk next to a name in the NTM statistic fields column of the table “Categories of NTM statistics” (page 108) indicates that many NTM statistics are related to this specific statistic. For the sake of brevity, this table lists only some of them.

Table 9
Categories of NTM statistics

Category	NTM statistic fields	Comment
Basic timing	DATE TIME	These fields provide basic timing information about the specific interval for which NTM statistics are collected.
Identification	SHELFID OFFICEID LINKID REMOTEATMIFLABEL	These fields identify the configuration context of the NTM statistics.
System info	SYSUTIL	This field is reported as part of each interface record but is independent of the interface. See “System utilization” (page 133) for more details.
(Sheet 1 of 7)		

Table 9 (Continued)
Categories of NTM statistics

Category	NTM statistic fields	Comment
Shelf	CRITICALSETALARMS MAJORSETALARMS MINORSETALARMS CRITICALCLEARALARMS MAJORCLEARALARMS MINORCLEARALARMS	These fields indicate the health and performance of the overall Multiservice Switch 15000 / Media Gateway 15000 node. They give a snapshot of the current health of the network operations. The fields for critical, major, and minor alarms report the number of alarms set during the past 5-minute interval. Any sudden increase in these numbers indicates a problem in the network, with the shelf. Normally, these numbers are zero, unless maintenance is taking place.
Shelf - fabric card	MAXTEMP	This shelf-level field describes the fabric card.
Card	CARDUTILAVG LMBUTIL	These card-level fields indicate the performance of the cards in the shelf. They help detect potential software problems in the node. These fields are useful for monitoring network operations. They can also help engineer the network. Abnormal field values can indicate problems. However, maintenance activities can also cause sudden changes. Non-provisioned cards do not appear in the PMs. Therefore, the set of LINKIDs does not necessarily contain the full range of card numbers.
Status info	SIGNALLINGCHANNELSTATUS	This field reports the status of the UNI or PNNI signaling channel. See “Signaling channel status (PT-AAL1 and UA-AAL1)” (page 124) for details.
(Sheet 2 of 7)		

Table 9 (Continued)
Categories of NTM statistics

Category	NTM statistic fields	Comment
Static info	LINKCAP	This field reports a static piece of interface data for each interval in order for the variable data to be interpreted in the correct context.
Variable ATM layer statistics	INCLP0+1 OUTCLP0+1 *DIS	These fields contain call counts, both normal and discard, measured at the Core ATM layer of the interface. See “Discard count usage” (page 129) for more information.
Variable ATM signaling layer statistics	INSETUP INFAIL* OUTSETUP OUTFAIL*	These fields contain call setup counts measured at the ATM signaling layer of the interface. See “Use cases for ATM signaling statistics (PT-AAL1 and UA-AAL1)” (page 115) and “Call failure troubleshooting (PT-AAL1 and UA-AAL1)” (page 121) for more information.
(Sheet 3 of 7)		

Table 9 (Continued)
Categories of NTM statistics

Category	NTM statistic fields	Comment
IP Interface	IPLINKCAP INBYTES OUTBYTES INPACKETS OUTPACKETS INTCPPACKETSLOCAL INUDPPACKETSLOCAL INICMPPACKETSLOCAL INIOSPFPACKETSLOCAL INARPPACKETSLOCAL INOTHERPACKETSLOCAL OUTTCPPACKETSLOCAL OUTUDPPACKETSLOCAL OUTICMPPACKETSLOCAL OUTOSPFPACKETSLOCAL OUTARPPACKETSLOCAL OUTOTHERPACKETSLOCAL INPACKETSDIS OUTPACKETSDIS INLOCALEXCEPTIONS INFWDEXCEPTIONS	The IP PMs provide statistics for monitoring a UA - IP Succession core.They are available for 5- and 30-minute intervals, at the physical interface level. Use them for operational monitoring and to help with network planning and engineering. You can use the IP PMs to calculate measurements such as link bandwidth utilization, voice call volumes, and error conditions.
(Sheet 4 of 7)		

Table 9 (Continued)
Categories of NTM statistics

Category	NTM statistic fields	Comment
ATM Interface	INCBRCLP0+1 INRTVBRCLP0+1 INNRTVBRCLP0+1 INUBRCLP0+1 OUTCBRCLP0+1 OUTRTVBRCLP0+1 OUTNRTVBRCLP0+1 OUTUBRCLP0+1 INCBRSETUP INRTVBRSETUP INNRTVBRSETUP INUBRCLP0+1 OUTCBRCLP0+1 OUTRTVBRCLP0+1 OUTNRTVBRCLP0+1 OUTUBRCLP0+1 INCBRSETUP INRTVBRSETUP INNRTVBRSETUP INUBRSETUP OUTCBRSETUP OUTRTVBRSETUP OUTUBRSETUP	The ATM 5-minute PMs provide statistics for monitoring a PT-AAL1 or UA-AAL1 Succession core.
(Sheet 5 of 7)		

Table 9 (Continued)
Categories of NTM statistics

Category	NTM statistic fields	Comment
ATM Interface (continued)	INCBRFAIL	
	INRTVBRFAIL	
	INNRTVBRFAIL	
	INCBRCLP0+1	
	INRTVBRCLP0+1	
	INNRTVBRCLP0+1	
	INUBRCLP0+1	
	OUTCBRCLP0+1	
	OUTRTVBRCLP0+1	
	OUTNRTVBRCLP0+1	
	OUTUBRCLP0+1	
	INCBRSETUP	
	INRTVBRSETUP	
	INUBRSETUP	
	OUTCBRSETUP	
	OUTRTVBRSETUP	
	OUTNRTVBRSETUP	
	OUTUBRSETUP	
	INCBRFAIL	
	INRTVBRFAIL	
	INNRTVBRFAIL	
	INUBRFAIL	
(Sheet 6 of 7)		

Table 9 (Continued)
Categories of NTM statistics

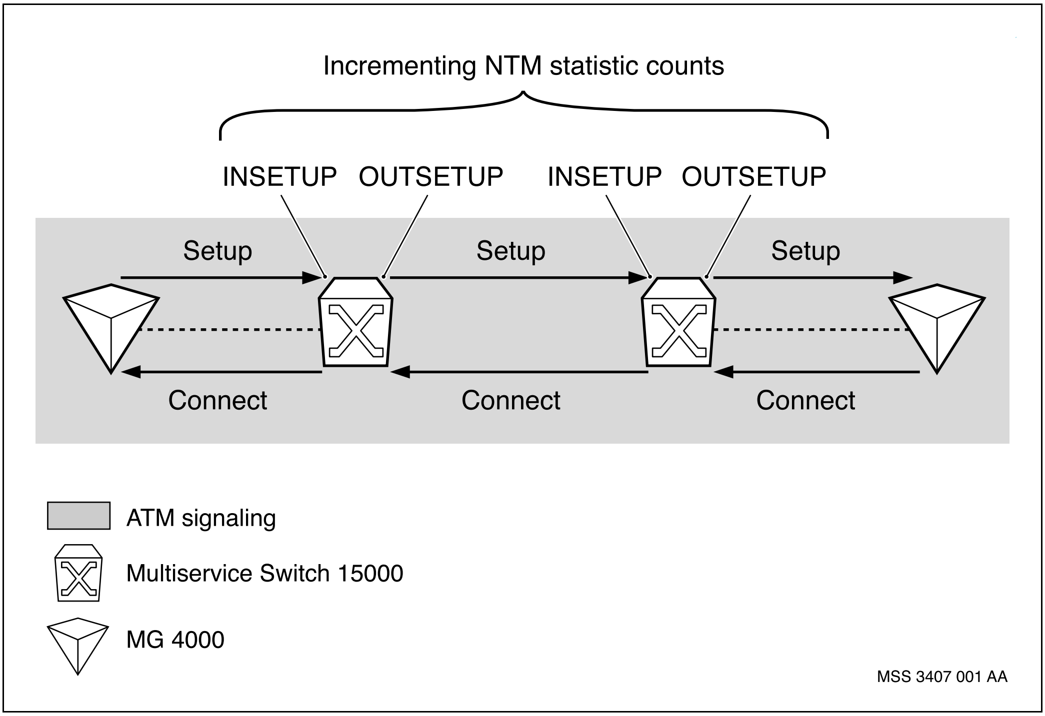
Category	NTM statistic fields	Comment
ATM Interface (continued)	OUTCBRFAIL OUTRTVBRFAIL OUTNRTVBRFAIL OUTUBRFAIL	
Media Gateway Card Processor	VSPUTILAVG	The Media Gateway card processor PM gives card performance information about the voice processing of the VSP3 and VSP3-o cards.
Media Gateway Call Processor	CONGSECS OVLDCMDSREJECTED OUTH248RETRAN INH248RETRAN FAILOVERS CALLFAILSNET CALLFAILTDM DIGITREJECT CALLSETUPS ACTIVECALLAVG ACTIVECALLMIN ACTIVECALLMAX	The Media Gateway call processor PMs give call performance information about the voice processing of the VSP3 and VSP3-o cards.
(Sheet 7 of 7)		

Use cases for ATM signaling statistics (PT-AAL1 and UA-AAL1)

This section provides a set of use cases for the key NTM statistics for ATM signaling. This applies to a Succession PT-AAL1 or UA-AAL1 solution only.

INSETUP and OUTSETUP count the number of switched virtual circuit (SVC) Setup signaling attempts at each interface. These signaling counts increase by one, whether or not the Setup succeeds. The figure "Successful call setup scenario (PT-AAL1 and UA-AAL1)" (page 115) illustrates a use case where the Setup counts are pegged during a successful call establishment. In this case, the successful call traverses an internal PNNI link to establish a connection between MG4000s.

Figure 8
Successful call setup scenario (PT-AAL1 and UA-AAL1)



In the figure “Successful call setup scenario (PT-AAL1 and UA-AAL1)” (page 115), the following actions take place:

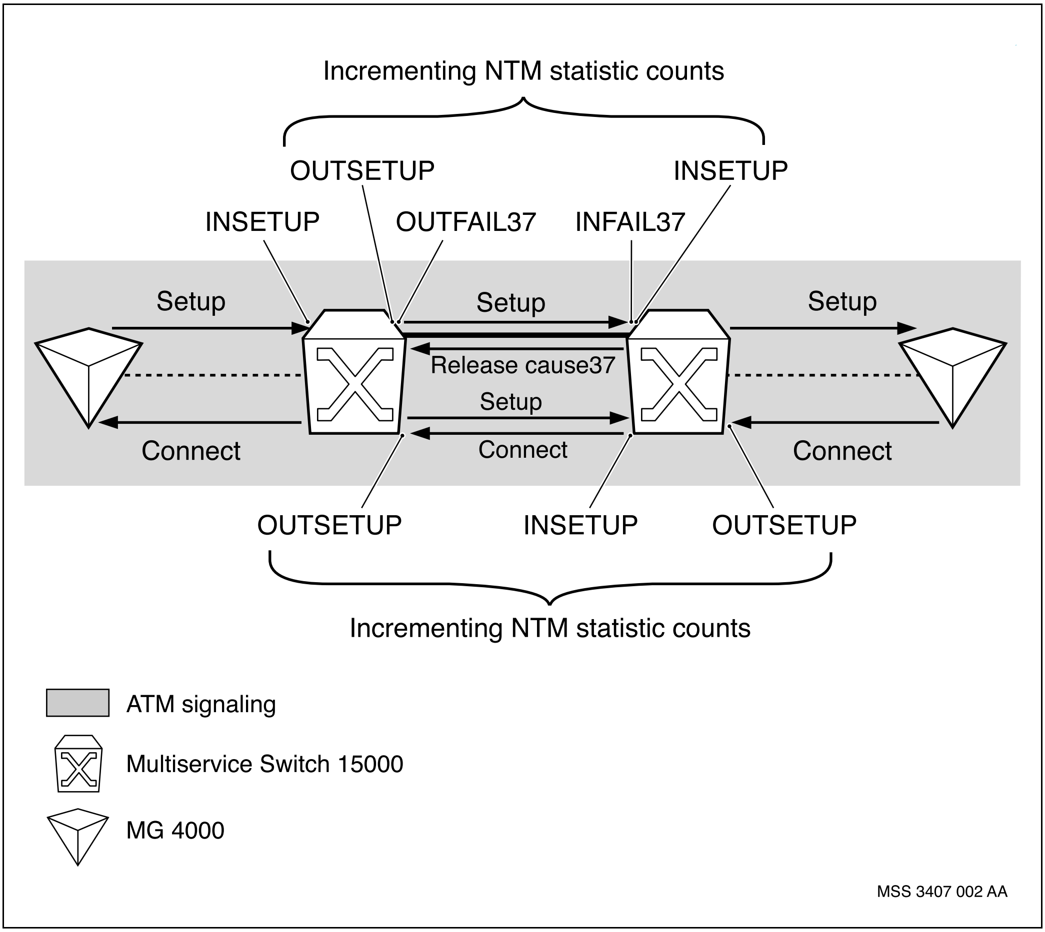
1 The MG4000 on the left-hand side of the figure sends a Setup message to the first Multiservice Switch 15000 node to its right, through an ATM interface. This interface increments its INSETUP count by one.

2 The first Multiservice Switch 15000 node determines that the destination address resides on the Multiservice Switch 15000 node to its right. The first Multiservice Switch 15000 node sends a Setup message across a PNNI link. The outgoing interface increments its OUTSETUP count by one and the incoming interface increments its INSETUP count by one.

3 The Setup message is sent from the second Multiservice Switch 15000 node to the MG4000 on the right-hand side of the figure. The outgoing interface to this MG4000 increments its OUTSETUP count by one. The call set up is complete when the Connect message is received by the MG4000 that initiated the call.

A failure message does not necessarily indicate that a call set up was unsuccessful. For example, if a Setup message is rejected on one PNNI link, an attempt is made to send the message by another PNNI route. The maximum number of retry attempts for alternate PNNI routes is one. This retry is called a crankback. The figure “Successful call setup scenario with crankback” (page 117) illustrates a use case in which the Setup counts are pegged during a successful call establishment. In this case, the successful call is established between MG4000s and a crankback traverses an internal PNNI link.

Figure 9
Successful call setup scenario with crankback



In the figure “Successful call setup scenario with crankback” (page 117), the following actions take place:

1 The MG4000 on the left-hand side of the figure sends a Setup message to the first Multiservice Switch 15000 node to its right, through an ATM interface. The interface between these components increments its INSETUP count by one.

2 The first Multiservice Switch 15000 node determines that the destination address resides on the Multiservice Switch 15000 node to its right. The first Multiservice Switch 15000 node sends a Setup message across a PNNI link. The outgoing interface increments its OUTSETUP count by one. The incoming interface increments its INSETUP count by one.

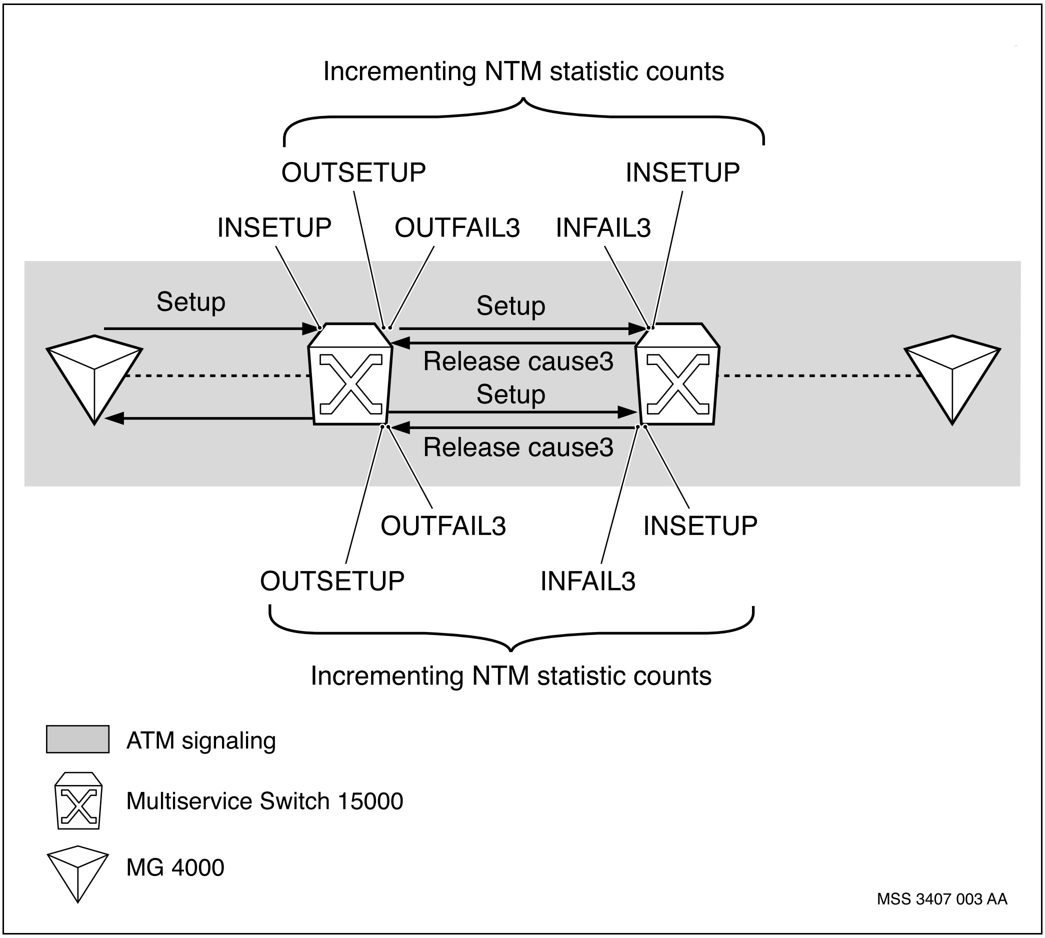
3 The first PNNI link between the Multiservice Switch 15000 nodes is congested. Therefore, connection admission control (CAC) rejects the connection attempt. The interface that originated on the Multiservice Switch 15000 node furthest to the right increments its INFAIL37 count (no user cell rate available) by one. The interface on the left increments its OUTFAIL37 count by one.

4 Crankback occurs. The first Multiservice Switch 15000 node retries the Setup using a different PNNI link. The outgoing interface of the new PNNI link increments its OUTSETUP count by one. The incoming interface to the right of the first Multiservice Switch 15000 node increments its INSETUP count by one.

5 The Setup message is sent to the MG4000 on the right-hand side of the figure. The outgoing interface connected to this MG4000 increments its OUTSETUP count by one. When the Connect message is received by the initiating MG4000, the call set up is complete.

The figure “Unsuccessful call setup scenario” (page 119) is an example of a failed call setup attempt with crankback on the PNNI links. The cause of the failure is an incorrectly configured address on the destination MG4000. The failure is reported with cause code 3 (no route to destination).

Figure 10
Unsuccessful call setup scenario



In the figure “Unsuccessful call setup scenario” (page 119), the following actions take place:

1. The MG4000 on the left-hand side of the figure sends a Setup message to the Multiservice Switch 15000 node to its right through an ATM interface. The interface between these components increments its INSETUP count by one.
2. The first Multiservice Switch 15000 node determines that the destination address resides on the Multiservice Switch 15000 node to its right. The first Multiservice Switch 15000 node sends a Setup message across a PNNI link. The outgoing interface increments its OUTSETUP count by one and the incoming interface increments its INSETUP count by one.
3. The destination or second Multiservice Switch 15000 node can not verify the specific address so it rejects the Setup attempt. The interface originating on the second Multiservice Switch 15000 node increments its INFAIL3 count (no route to destination) by one and the interface originating on the first Multiservice Switch 15000 node increments its OUTFAIL3 count by one.
4. Crankback occurs when the first Multiservice Switch 15000 node retries sending the Setup message using a different PNNI link. The outgoing interface of the new PNNI link increments its OUTSETUP count by one and the incoming interface to the right of the Multiservice Switch 15000 node increments its INSETUP count by one.
5. The destination Multiservice Switch 15000 node still cannot verify the specific address so it rejects the Setup attempt. The new interface on the right-hand side of the figure increments its INFAIL3 count (no route to destination) by one and the new interface to the left increments its OUTFAIL3 count by one. The call setup attempt fails to connect.

Call failure troubleshooting (PT-AAL1 and UA-AAL1)

This section applies to a Succession PT-AAL1 or UA-AAL1 solution only. The following NTM statistics can help you to troubleshoot call failures:

- INFAIL* counts for an interface increment when a RELEASE or RELEASE COMPLETE message is sent in response to a received SETUP message. For example, if an MG4000 requests a SVC setup to a called party address that is unknown to the PNNI database, then an INFAIL3 is pegged. Only call attempt failures are pegged. If a SETUP message is not received, it is not pegged as a failure.
- OUTFAIL* counts for an interface increment when a RELEASE or RELEASE COMPLETE message is received in response to a transmitted SETUP message. For example, an originating Nortel Networks Multiservice Switch 15000 node sends a SETUP message to another node whose VCI range is incorrectly configured. The receiving Multiservice Switch 15000 node replies with an VCI unavailable failure message before the OUTFAIL35 message is pegged.
- Any INFAIL* or OUTFAIL* count greater than zero must be treated as a fault. It must cause an alarm from the OSS application. Further system-level analysis is needed to find the origin of the fault. An exception to the rule is a failure count on a PNNI link. This does not necessarily indicate a call failure.
- A large INFAIL and OUTFAIL count indicates a serious problem. It is recommended that the OSS application raise a major alarm if more than 1% of SETUP messages result in failure. For example, either one of the following conditions on an ATM interface must result in a major alarm being raised by the OSS application:

$$\sum INFAILi \geq INSETUP \times 0.01 \qquad \text{(where i is the cause-code)}$$

$$\sum OUTFAILi \geq OUTSETUP \times 0.01 \qquad \textit{(where i is the cause-code)}$$

Fan failure troubleshooting

Use the NTM statistic called MAXTEMP to help you troubleshoot fan failure in Nortel Networks Multiservice Switch 15000 equipment. This shelf-level PM can help you to raise a critical alarm when fan failure is about to shut down a shelf.

MAXTEMP is a PM that reports fabric card temperature. As Table 13, “PM thresholds,” (page 143) shows, the threshold value of MAXTEMP is 55^{o} C.

Each Multiservice Switch 15000 shelf has three fans. An alarm occurs only when a first fan fails. A shelf can operate with two fans out of service. However, if a third fan fails, the shelf is likely to shut down. Therefore, raise a critical alarm when a second fan fails, and only one fan remains in operation. Do this because another fan failure can quickly take the shelf out of service.

Use MAXTEMP to monitor the fabric card temperature and alert you when a second fan fails. Fan failure causes a sudden rise in the fabric card temperature for about a minute or two. Have your operational support system (OSS) raise a critical alarm upon failure of a second fan.

Raise a critical alarm if either of these situations occurs:

- $MAXTEMP^t > 55° \, C$

  OR

- a fan failure alarm occurs and

$$\boldsymbol{MAXTEMP_t + 2 - MAXTEMP_t > 50^o C}$$

where MAXTEMP^t is the maximum fabric card temperature during PM time interval ‘t’, and MAXTEMP^{t+2} is the maximum fabric card temperature during the PM time interval ‘t+2’ (10 minutes later than t).

Signaling channel status (PT-AAL1 and UA-AAL1)

This section applies to a Succession PT-AAL1 or UA-AAL1 solution only. The SIGNALLINGCHANNELSTATUS field indicates whether an ATM interface was down, or unable to process calls, at any time during a 5-minute interval.

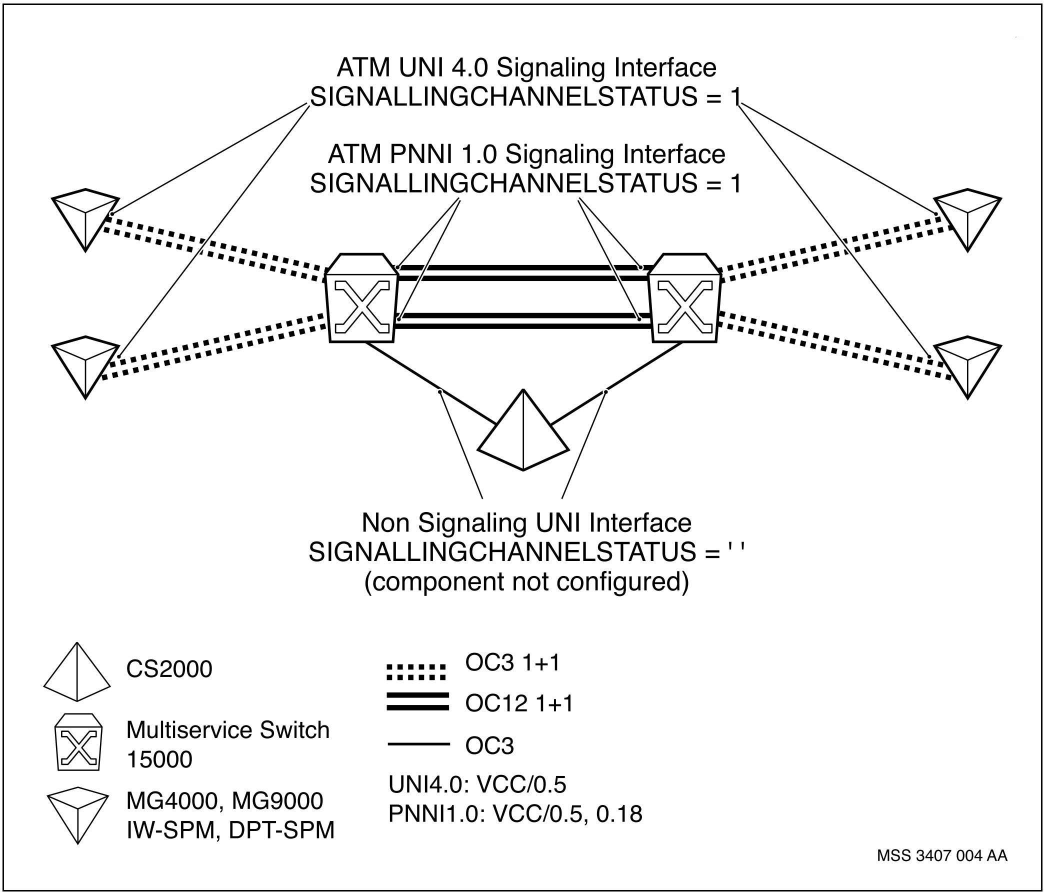
If signaling fails at any time during the 5-minute interval, it reports a value of 0 in the SIGNALLINGCHANNELSTATUS field. If signaling fails and then recovers during the interval, it also reports a value of 0. If signaling does not fail at any time during the interval, it reports a value of 1.

Interfaces connected to MG4000s, MG9000s, IW-SPMs, or UAS components as well as PNNI links require signaling. Therefore, in a Succession UA-AAL1 solution, the SIGNALLINGCHANNELSTATUS field must always report a value of one for active interfaces. If a value of zero is reported in this field for these interfaces, a failure has occurred during the interval. All stable and transient calls are lost.

AMDI interfaces do not use signaling. If signaling is not provisioned on the interface, a null value (“”) is reported. For interfaces with provisioned signaling, a value of zero is reported. This value does not indicate failure.

The figure “Signaling channel status” (page 125) shows the interfaces that use signaling.

Figure 11
Signaling channel status



Utilization formulas

This section provides utilization formulas for the Succession PT-AAL1, UA-AAL1, and UA-IP solutions.

- "Average link utilization (UA-AAL1 and UA - IP)" (page 126)
- "Discard count usage" (page 129)
- "Average call holding time (UA - IP)" (page 131)
- "System utilization" (page 133)
- "Function processor utilization (PT-AAL1 and UA-AAL1)" (page 134)
- "Average packet size (UA-IP)" (page 135)
- "Packet rates" (page 136)
- "Forwarded packets" (page 139)
- "Number of calls supported per port" (page 140)

Average link utilization (UA-AAL1 and UA - IP)

This section gives formulas for calculating average link utilization, for both the Succession UA-AAL1 and UA - IP solutions.

The formulas allow you to determine link utilization at the protocol levels for either layer 3 IP, or the layer 2 ATM.

> ***Note:*** The formulas for average link utilization use the 5-minute PMs. To use the 30-minute PMs instead, substitute 1800 for 300 in each formula. This number is the elapsed time in seconds to which the statistics apply. In other words, specify 18000 seconds for a 30-minute interval. Specify 300 seconds for a 5-minute interval.

ATM link utilization

To calculate average ATM link/interface utilization, use the total ingress (INCLP0+1) and total egress (OUTCLP0+1) cells counts together with the LINKCAP value. LINKCAP is needed because the utilization is relative to the capacity. Table 2, "Link capacity of Multiservice Switch 15000 FP cards (UA-AAL1)," (page 60) lists LINKCAP values for various ATM interface types.

For example, over a 5-minute (300 second) interval, calculate the average incoming link utilization (*averageInAtmLinkUtil*), expressed as a percentage, as follows:

$$averageInAtmLinkUtil = \left(\frac{INCLP0 + 1}{LINKCAP \times 300}\right) \times 100\ percent$$

You can also calculate the corresponding *averageOutLinkUtil* It is approximately the same as *averageInLinkUtil*, because the link is bi-directional. However, for AMDI links which do not contain voice traffic, incoming and outgoing bandwidth are very different. Also, if the application involves MG9000 DSL (or other multiservice) traffic, bandwidth is also different in each direction. Finally, during periods of reduced voice traffic through the network, a larger proportion of control traffic results in unbalanced traffic.

$$outAtmLinkUtilization = \frac{(OUTCLP0 + 1)}{LINKCAP \times 300} \times 100\ percent$$

The recommended thresholds vary depending on the purpose of the interface. Set OSS alarm thresholds to trigger when bandwidth levels rise above a percentage of the maximum values. For example, trigger an alarm when bandwidth level exceed a maximum threshold of 80% or 90%.

Table 10
Average link utilization thresholds

Interface usage	Threshold upper bound	Comment
MG4000, IW-SPM, DPT-SPM	97%	The interface is typically engineered to this capacity.
MG9000	97%	The interface is typically engineered to this capacity.
CS2000 (AMDI)	~10%	This threshold only applies to signaling and OAM traffic.
SAM21 Shelf Controller	~10%	This threshold only applies to signaling and OAM traffic.
UAS	~25%	This threshold only applies to CALEA (voice intercept) in VoA.
PNNI (from Multiservice Switch 15000 node to Multiservice Switch 15000 node)	70%	This threshold is based on typical engineered (for example, CBR or RT-VBR) capacity. The threshold can be set higher if the rest of the bandwidth is being used by other types of traffic.
Note: The threshold upper bounds listed in this table are approximately the maximum bandwidth the links can attain (ignoring control traffic or non-Succession voice traffic).		

IP link utilization

IP link utilization calculates the percentage of the link capacity that is used. Note that if the link is used for layer 2 relay service, such as ATM cell relay, the result of the calculation is only approximate.

$$inIpLinkUtilization = \frac{INBYTES}{IPLINKCAP \times 300} \times 100\ percent$$

$$outIpLinkUtilization = \frac{OUTBYTES}{IPLINKCAP \times 300} \times 100\ percent$$

- A value between 60% and 80% is significant only when it is sustained for at least 30 minutes (six consecutive 5-minute PM reports).
- A value above 80% is significant only when it is sustained for at least 10 minutes.

Discard count usage

Table 11, “Discard count thresholds,” (page 130) provides information about the NTM statistics that count ATM data discards. It provides this for six types of ATM cell discards.

Note: For a 16-port OC-3 FP card with a large number of connections, the reporting of a subset of the total discards can potentially be delayed until the next interval. This is due to the time it takes for the software application to aggregate the interface counts and divide them by the set of per-connection discards.

Table 11
Discard count thresholds

NTM statistic	Threshold information	Comment
OUTCLP0+1DIS	Look for a non-zero value	This count is the aggregation of the per-service-category discard counts. A value of zero means there is no problem. For a value other than zero, examine the per-service-category counts (OUTCBRCLP0+1DIS, OUTRTVBRCLP0+1DIS, and so on).
INCLP0+1DIS	Look for a non-zero value	This count is provided on a subset of the function processors (FPs) only. It cannot be broken down by service category. Non-zero counts indicate traffic policing.
OUTCBRCLP0+1DIS	Depends on engineered capacity	If the link/interface is engineered to the recommended capacity (for example, PNNI links configured for 70% utilization), then the value must be zero. If the link/interface is over-engineered and yet still working properly, a value in the “10’s” of discards can still be acceptable. For any other result, the situation must be flagged.
OUTRTVBRCLP0+1DIS	zero	A value other than zero implies that calls can have been dropped. Dropped calls can impact service. This requires further investigation.
(Sheet 1 of 2)		

Table 11 (Continued)
Discard count thresholds

NTM statistic	Threshold information	Comment
OUTNRTVBRCLP0+1DIS	“N/A” or “as per SLA”	For voice call signaling (for example, H.248), the higher-layer protocols ensure that cells are re-transmitted. However, investigate non-zero counts further to ensure that service is not impacted. In a multi-service context, if data traffic uses this service category, the severity of discards is determined by the customer-defined Service Level Agreements (SLA).
OUTUBRCLP0+1DIS	“N/A” or “as per SLA”	For voice call signaling (for example, H.248), this count is not applicable. In a multi-service context, if data traffic uses this service category, the severity of discards is determined by the customer-defined Service Level Agreement (SLA).
(Sheet 2 of 2)		

Average call holding time (UA - IP)

This section gives formulas for calculating the average holding time of a call, in a Succession UA - IP solution. For a particular interface, use the following formula with trunk group occupancy to calculate average hold time. Use the 30-minute NTM statistics.

The following formula applies to a Succession UA - IP solution only. It calculates the average holding time for calls processed by a particular voice services processing (VSP) card. Specify the attributes of the VSP card in the equation. The equation assumes that the network is stable. Drastic changes in call volumes from one 5-minute interval to the next result in an inaccurate calculation.

$$averageIpVspHoldingTime = \frac{ACTIVECALLAVG}{CALLSETUPS} \times 300 seconds$$

Average call holding time (PT-AAL1 and UA-AAL1)

This section provides a formula for calculating the average holding time for voice over ATM calls, in a Succession UA-AAL1 or PT-AAL1 solution. For a particular interface, use the following formula with trunk group occupancy to calculate average hold time. Use the 30-minute NTM statistics.

This formula calculates average call hold time, assuming that all calls are complete. The number of complete calls includes the sum of all failed call attempts, in other words the sum of both INFAIL* and OUTFAIL*, subtracted from the total of *INSETUP* calls added to *OUTSETUP* calls. This formula also assumes that all SETUP messages are the result of voice call attempts. However, the number of SETUP messages due to control connections must be very low or zero.

$$averageAtmIfHoldingTime = \frac{INCBRCLP0 + 1}{171x(INCBRSETUP + OUTCBRSETUP)} seconds$$

Nortel Networks engineers the Succession ATM core based on call models which assume average holding times of 180 seconds or longer. This assumption allows all links on a function processor (FP) card to run at a 97% constant bit rate (CBR) capacity without the risk of overloading the FP with ATM signaling. If *averageHoldTime* is less than 180 seconds, the corresponding link utilization (*averageInLinkUtil*) used for voice traffic must be less than the following value:

$$averageInLinkUtil < (0.97 \times averageHoldTime / 180)$$

Apply this formula across all the links connected to an FP. If the formula is true for all links, the short holding time is not a problem. If the formula is not true for all links, the average of most ports on the FP must conform to the above formula. Assume that links not involved in signaling, or unused ports on the FP, have zero link utilization.

> ***Note:*** If multiservice traffic is being sent on the same link, the link utilization incorporates both voice and data traffic. Include include the constant bit rate (CBR) traffic in the link utilization when determining average holding times for voice calls.

System utilization

This section gives information for determining system utilization. The CARDUTILAVG PM indicates how busy the processing component of a Nortel Networks Multiservice Switch 15000 card is getting. To determine the business of a shelf, add the values of all the CARDUTILAVG PMs for that shelf, then divide by the number of cards. For more information, see “CARDUTILAVG” (page 59).

The SYSUTIL field also indicates how busy the system is getting. By definition, this NTM statistic is the average processor utilization of the busiest card (either CP or FP) on the shelf.

Because there are up to 16 cards in a shelf, a high value does not necessarily indicate a problem. For example, during maintenance activity, the CP can report a high CPU utilization. This results in a high SYSUTIL value. In this case, the high degree of utilization is normal.

The recommended OSS threshold of 60% for SYSUTIL can be surpassed without a problem as follows:

- A value between 60% and 80% is significant only if it is sustained for at least 30 minutes (six consecutive 5-minute PM reports).
- A value above 80% is significant only if it is sustained for at least 10 minutes.

Function processor utilization (PT-AAL1 and UA-AAL1)

This section gives formulas for calculating function processor (FP) card utilization, in a Succession PT-AAL1 or UA-AAL1 solution.

To determine the signaling utilization of an FP, add all *INSETUP* and *OUTSETUP* messages for all the interfaces belonging to each card pair of the Nortel Networks Multiservice Switch 15000 node. To determine which interfaces belonging to a particular FP, see the LINKID field. This is helpful only if you have followed standard naming conventions.

$$AverageFPutilization = \sum_{j=1}^{n} \frac{INSETUP_j + OUTSETUP_j}{t}$$

Set the average FP signaling utilization low enough to ensure that peaks in traffic remain below the overload value. Most FPs can sustain 260 (half) calls per second without being overloaded. Therefore, an average FP signaling amount of 180 (half) calls per second keeps traffic peaks below the 260 value. For example, 260 calls per second is the sustained performance level of the 16-port OC-3 FP, when it reaches 100% CPU utilization. An average FP signaling amount of 180 calls per second results in peaks of 260 calls per second every 8 to 10 seconds. CP utilization must not average more than 180/260 = 69%.

$$AverageFPutilization \leq x\ calls/s$$

Note: In the above formula, *x* is the average sustained offered load at a customer-defined blocking rate per FP. Nortel Networks recommends a blocking rate of 10^{-8}.

Average packet size (UA-IP)

This section gives formulas for calculating the average packet size being transmitted over a physical link in a Succession UA-IP solution.

To calculate the average layer 3 (IP) packet size, determine what layer 2 is running. The INBTYES and OUTBYTES statistics include the entire layer 2 frame size. Therefore, subtract the layer 2 frame header size from the total frame size to obtain the layer 3 packet size.

The layer 2 Gigabit Ethernet (GE) frame overhead is 18 bytes. The calculations that follow use this value.

The layer 2 frame overhead for IP over ATM is 8 bytes. Substitute that value for calculations for ATM interfaces.

Incoming average packet size (UA-IP)

The following formula calculates the average packet size received on a physical link in a Succession UA-IP solution. Typical packet sizes for G.711 voice are as follows:

- 120 bytes, for G.711- 10ms. This includes 80 bytes for the payload, and 40 bytes for the IP, user datagram protocol (UDP), and real time protocol (RTP) overhead. 100 of these packets are sent every second, in both directions, to support a single voice call.
- 200 bytes, for G.711- 20ms. This includes 160 bytes for the payload, and 40 bytes for the IP, user datagram protocol (UDP), and real time protocol (RTP) overhead. 50 of these packets are sent every second, in both directions, to support a single voice call.

$$averageIncomingPacketSize = \frac{INBTYES}{INPACKETS} - 18\ bytes$$

Outgoing average packet size (UA-IP)

The following formula calculates the average packet size transmitted over a physical link that supports a Succession UA-IP solution. Typical packet sizes for G.711 voice are as follows:

- 120 bytes, for G.711- 10ms. This includes 80 bytes for the payload, and 40 bytes for the IP, user datagram protocol (UDP), and real time protocol (RTP) overhead. 100 of these packets are sent every second, in both directions, to support a single voice call.
- 200 bytes, for G.711- 20ms. This includes 160 bytes for the payload, and 40 bytes for the IP, user datagram protocol (UDP), and real time protocol (RTP) overhead. 50 of these packets are sent every second, in both directions, to support a single voice call.

$$averageOutgoingPacketSize = \frac{OUTBTYES}{OUTPACKETS} - 18\ bytes$$

Packet rates

This section gives formulas for calculating packet rates. You can calculate packet rate per link, packet rate per card, and byte rate per card.

Packet rate per link

The following formulas calculate the average packet rate (per second) over a physical interface. Voice calls account for most packet forwarding. This is especially true on links connecting to gateways, or used for the internal IP core connecting Nortel Networks Multiservice Switch 15000 nodes.

Typical packet rates are 100 per second per voice call (G.711-10ms) or 50 per second per voice call (G.711-20ms).

$$packetIfIncomingRate = \frac{INPACKETS}{300} perSecond$$

$$packetIfOutgoingRate = \frac{OUTPACKETS}{300} perSecond$$

Packet rate per card

The following formulas calculate the average rate of packet processing for a functional processor (FP). These formulas are useful for Passport queue controller (PQC)-12 based cards, such as ATM cards in an SN07 Succession solution. If packet forwarding rates (incoming or outgoing) approach the maximum for a card, packets are lost because of PQC-12 congestion.

PQC12-based cards, for example 4-port OC-12 and 4-port OC-3 cards, have the following maximum rates for packet forwarding. The rate depends on the average packet size, as follows:

- 540000 packets per second for 120 byte packets (G.711-10ms)
- 420000 packets per second for 200 byte packets (G.711-20ms)

$$packetCardIncomingRate = \left(\sum_{p=0}^{n-1} packetIfIncomingRate_p\right) perSecond$$

$$packetCardOutgoingRate = \left(\sum_{p=0}^{n-1} packetIfOutgoingRate_p\right) perSecond$$

where p is a port on the card, and n is the number of ports on the card.

Byte rate per card

The following formulas provide the average incoming and outgoing byte rate per card. This is the total number of bytes flowing through the card. It is the total rate of all interfaces on the card. This is only useful for the 4-port Gigabit Ethernet (GE) card. It is the only card with a total interface bandwidth greater than the fabric bandwidth from the card to the rest of the shelf.

The fabric bandwidth is 2.5 Gigabits per second per card. The 4 ports of the GE card can handle up to 4 Gigabits per second. If much of the traffic is intra-card, or within the card, the 2.5 Gbit/s restriction is most likely not exceeded. However, if most of the traffic is inter-card, or between cards, the 3 or more highly utilized links on a card can become congested.

$$inBytesPerCard = \sum_{p=0}^{n-1} INBYTES_p$$

$$outBytesPerCard = \sum_{p=0}^{n-1} OUTBYTES_p$$

Forwarded packets

This section gives formulas for calculating the total number of forwarded packets on a physical interface. Forwarded packets do not require processing by software.

$$inComingForwardedPackets = INPACKETS - INTCPPACKETSLOCAL - INUDPPACKETSLOCAL - INICMPPACKETSLOCAL - INOSPFPACKETSLOCAL - INARPPACKETSLOCAL - INOTHERPACKETSLOCAL - INLOCALEXCEPTIONS$$

$$outGoingForwardedPackets = OUTPACKETS - OUTCPPACKETSLOCAL - OUTUDPPACKETSLOCAL - OUTICMPPACKETSLOCAL - OUTOSPFPACKETSLOCAL - OUTARPPACKETSLOCAL - OUTOTHERPACKETSLOCAL$$

Use the formulas above to determine the percentage of packets simply being forwarded elsewhere. Ideally, this number is high, because these packets require no software intervention. The exception is when packets are being forwarded to a voice services processor (VSP) card.

$$inPacketForwarding = \frac{inComingForwardedPackets}{INPACKETS} \times 100percent$$

$$outPacketForwarding = \frac{outGoingForwardedPackets}{OUTPACKETS} \times 100percent$$

Number of calls supported per port

This section gives a formula for determining the number of calls that a port can support. Divide the available bandwidth by the bandwidth required per call, times the number of packets (64 byte packets) per second per call.

$$NumberofCallsSupported = \frac{LinkCap}{callBW} \times callPPS$$

where:

- LinkCap is the link capacity
- callBW is the call bandwidth
- callPPS is the number of packets per second per call

For example, an OC-12 ATM link (1412830 cells per second) carrying IP traffic using G.711 10ms coding with RTCP (302 cells per second) at 100 packets per second is required to support 467,824 packets per second.

$$NumberofCallsSupported = \frac{1412830}{320} \times 100 = 467,824PPS$$

Utilization thresholds

This section suggests threshold values for utilization. Utilization values can indicate potential network problems. To calculate utilization values, see “Utilization formulas” (page 126). The question is when does utilization indicate a problem? Examine the results of the utilization formulas to help answer that question. Depending on the network, however, utilization can have a wide range of possible values.

See Table 12, “Utilization thresholds,” (page 141) for information about the range of acceptable values. Note that these are suggested values only. The customer or the OSS application must adjust these values as required.

Table 12
Utilization thresholds

Utilization	Name of value in utilization formula	Suggested threshold	Comment
Average ATM link utilization (incoming)	inAtmLinkUtilization	< 97	See:“ATM link utilization” (page 126)
Average ATM link utilization (outgoing)	outAtmLinkUtilization	< 97	See:“ATM link utilization” (page 126)
Average IP link utilization (incoming)	inIpLinkUtilization	< 80	Customer-specified. See:“IP link utilization” (page 128)
Average IP link utilization (outgoing)	outIpLinkUtilization	< 80	Customer-specified. See:“IP link utilization” (page 128)
Average call holding time for a VSP card (UA-IP)	averageIpVspHoldingTime	> 180	See:“Average call holding time (UA - IP)” (page 131)
Average call holding time (PT-AAL1 and UA-AAL1)	averageAtmIfHoldingTime	> 180	See:“Average call holding time (PT-AAL1 and UA-AAL1)” (page 132)
(Sheet 1 of 2)			

Table 12 (Continued)
Utilization thresholds

Utilization	Name of value in utilization formula	Suggested threshold	Comment
Average packet size received on a physical link (UA-IP)	averageIncomingPacketSize	> 110	See:“Incoming average packet size (UA-IP)” (page 135)
Average packet size transmitted over a physical link (UA-IP)	averageOutgoingPacketSize	> 110	See:“Outgoing average packet size (UA-IP)” (page 136)
Average rate of packet processing for an FP card (incoming)	packetCardIncomingRate	< 400000 (PQC12)	See:“Packet rate per card” (page 137)
Average rate of packet processing for an FP card (outgoing)	packetCardOutgoingRate	< 400000 (PQC12)	See:“Packet rate per card” (page 137)
Total number of forwarded packets on a physical interface (incoming)	inPacketFowarding	> 99	See:“Packet rate per link” (page 137)
Total number of forwarded packets on a physical interface (outgoing)	outPacketForwarding	> 99	See:“Packet rate per link” (page 137)
Average byte rate per card (incoming)	inBytesPerCard	312500000	See:“Byte rate per card” (page 138)
Average byte rate per card (outgoing)	outBytesPerCard	312500000	See:“Byte rate per card” (page 138)
(Sheet 2 of 2)			

PM thresholds

This section suggests threshold values for performance measurements (PMs). PMs can indicate potential network problems. The question is when do PMs indicate a problem? Examine the values of the PMs, to help you answer that question. Depending on the network, however, PMs can have a wide range of possible values.

See Table 13, "PM thresholds," (page 143) for more information about the range of acceptable PM values. Note that these are suggested values only. The value must be fine-tuned by the customer or the OSS application.

Table 13
PM thresholds

Performance measurement (PM)	Threshold	Comment
SYSUTIL	< 60	Varies.
CRITICALSETALARMS	0	
MAJORSETALARMS	0	
MINORSETALARMS	0	
CRITICALCLEARALARMS	0	
MAJORCLEARALARMS	0	
MINORCLEARALARMS	0	
MAXTEMP	< 55^{o} C	See "Fan failure troubleshooting" (page 122).
CARDUTILAVG	< 60	Varies.
LMBUTIL	< 75	
INDIFFSERVBEARER		Varies.
INDIFFSERVCONTROL		Varies.
INDIFFSERVNETWORK		Varies.
INDIFFSERVOAMP		Varies.
INDIFFSERVDEFAULT	0	
(Sheet 1 of 4)		

Table 13 (Continued)
PM thresholds

Performance measurement (PM)	Threshold	Comment
INDIFFSERVOTHER	0	
OUTDIFFSERVBEARER		Varies.
OUTDIFFSERVCONTROL		Varies.
OUTDIFFSERVNETWORK		Varies.
OUTDIFFSERVOAMP		Varies.
OUTDIFFSERVDEFAULT	0	
OUTDIFFSERVOTHER	0	
INPACKETSDIS	< 1% of total	
OUTPACKETSDIS	< 1% of total	
INLOCALEXCEPTIONS	< 3000 (10 per second)	
INFWDEXCEPTIONS	< 3000 (10 per second)	
SIGNALLINGCHANNELSTATUS	1	If interface uses signalling.
INSETUP	0	In a Succession UA-IP solution, steady-state.
OUTSETUP	0	
OUTCBRCLP0+1DIS	$< 10^{-10}$ of total	
OUTRTVBRCLP0+1DIS	$< 10^{-10}$ of total	
OUTNRTVBRCLP0+1DIS	$< 10^{-5}$ of total (H.248)	
OUTUBRCLP0+1DIS	N/A	Not used for voice.
INFAILxx	0	
OUTFAILxx	0	
INCBRSETUP	0	In a Succession UA-IP solution.
INRTVBRSETUP	0	
INNRTVBRSETUP	0	

(Sheet 2 of 4)

Table 13 (Continued)
PM thresholds

Performance measurement (PM)	Threshold	Comment
INUBRSETUP	0	
OUTCBRSETUP	0	In a Succession UA-IP solution.
OUTRTVBRSETUP	0	
OUTNRTVBRSETUP	0	
OUTUBRSETUP	0	
INCBRFAIL	0	
INRTVBRFAIL	0	
INNRTVBRFAIL	0	
INUBRFAIL	0	
OUTCBRFAIL	0	
OUTRTVBRFAIL	0	
OUTNRTVBRFAIL	0	
OUTUBRFAIL	0	
VSPUTILAVG	< 70	
CONGSECS	0	
OVLDCMDSREJECTED	0	
OUTH248RETRAN INH248RETRAN	< 1% loss of the total	1% loss of total, in other words, < 1% x CALLSETUPS x 6 (messages per call) To set up a voice call, 6 messages are required. Therefore, for the total number of messages, you must multiply CALLSETUPS by 6.
FAILOVERS	0	
CALLFAILSNET	0	
(Sheet 3 of 4)		

Table 13 (Continued)
PM thresholds

Performance measurement (PM)	Threshold	Comment
CALLFAILTDM	0	
DIGITREJECT	0	
CALLSETUPS		Over a 5-minute interval.
	< 3600	For VSP3.
	< 7500	For VSP3-o.
ACTIVECALLAVG	< 2016	Or a customer-engineered acceptable load.
ACTIVECALLMIN	< 2016	
ACTIVECALLMAX	< 2016	
(Sheet 4 of 4)		

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