Nortel Networks Multiservice Switch

7400/15000/20000

Accounting

NN10600-560

Nortel Networks Multiservice Switch 7400/15000/20000

Accounting

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General availability. Contains information on Nortel Networks Multiservice Switch 7400, 15000, and 20000 for the PCR6.1 release.

Contents

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About this document

This document contains an overview of Nortel Networks Multiservice Switch node accounting, and descriptions of accounting for asynchronous transfer mode (ATM), frame relay, frame relay-to-ATM (FR-ATM), and internet protocol (IP).

The following topics are discussed in this section:

Who should read this document and why

This document is for persons who configure and analyze Nortel Networks Multiservice Switch network accounting and accounting records.

What you need to know

This document assumes that you have a knowledge of ATM, frame relay, FR-ATM, IP, and an understanding of Nortel Networks Multiservice Switch network architecture.

How this document is organized

This document is organized into the following sections:

- “Accounting concepts” (page 29)
- “Accounting for Multiservice Switch services” (page 41)
- “Configuring accounting” (page 21)

What’s new in this document

There were no new features added to this document.

Other changes made to this document include the following:

- The terms Passport and PVG have been rebranded in conjunction with the new Nortel Networks’ brand simplified naming format. Passport is now referred to as the Nortel Networks Multiservice Switch, and PVG is now Media Gateway 7480/15000. For more information on the product rebranding, refer to NN10600-000 *Nortel Networks Multiservice Switch 7400/15000/20000 What’s New in PCRx.x*.

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 should type or that you should 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 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 are to be replaced with specific values.

- UPPERCASE, lowercase

  Nortel Networks Multiservice Switch node commands are not case-sensitive and do not have to match commands and parameters exactly as shown in this document, with the exception of string options values (for example, file and directory names) and string attribute values.

- |

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

- ...

  Three dots in a command indicate that the parameter may be repeated more than once in succession.

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 /).

Procedure conventions

This document uses the following procedure conventions:

- You can enter commands using full component and attribute names, or you can abbreviate them. The commands used in the procedures contain the full component and attribute names in the first instance. In the second instance, the component and attribute names are abbreviated. For more information about abbreviating component and attribute names, see

NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*. All component and attribute names are formatted in italics.

- The introduction of every procedure states whether you must perform the procedure in operational mode or provisioning mode. For more information about these modes, see “Operational mode” (page 16) or “Provisioning mode” (page 16).
- When you complete a procedure, you can verify your changes and activate them as the new node configuration. For more information about completing configuration changes and exiting provisioning mode, see “Activating configuration changes” (page 17).

Operational mode

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

```
#>
```

where:

is the current command number.

In operational mode, you work with operational components and attributes. In operational mode, you can do the following:

- list operational components and display operational attributes to determine the current operating parameters for the node
- control the state of parts of the node by locking and unlocking components
- set certain operational attributes and enter commands to perform diagnostic tests

Provisioning mode

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

```
start Prov
```

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

```
PROV #>
```

where:

is the current command number.

In provisioning mode, you work with the provisionable components and attributes that contain the current and future configurations of the node. You can add and delete components, and display and set provisionable attributes. For information about completing the configuration changes, exiting provisioning mode, and returning to operational mode see, “Activating configuration changes” (page 17).

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

Activating configuration changes

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

CAUTION

Activating a provisioning view can affect service

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

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

```
check Prov
```

Correct any errors, then verify the provisioning changes again.

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

```
save Prov
```

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

```
activate Prov
```

```
confirm Prov
```

```
commit Prov
```

4 End the provisioning session:

```
end Prov
```

Related documents

The following documents provide further information relevant to the Nortel Networks Multiservice Switch accounting system:

- "Multiservice Switch references" (page 18)
- "Preside Multiservice Data Manager workstation references" (page 19)

Multiservice Switch references

See the following documents for accounting details:

- NN10600-030 *Nortel Networks Multiservice Switch 7400/15000/20000 Overview*
- NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*
- NN10600-500 *Nortel Networks Multiservice Switch 7400/15000/20000 Alarms Reference*
- NN10600-550 *Nortel Networks Multiservice Switch 7400/15000/20000 Common Configuration Procedures*
- NN10600-700 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Technology Fundamentals*
- NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*

- NN10600-800 *Nortel Networks Multiservice Switch 7400/15000/20000 IP Technology Fundamentals*
- NN10600-900 *Nortel Networks Multiservice Switch 7400/15000/20000 Frame Relay Technology Fundamentals*
- NN10600-901 *Nortel Networks Multiservice Switch 7400/15000/20000 Frame Relay Configuration Management*
- NN10600-920 *Nortel Networks Multiservice Switch 7400/15000/20000 Operations: Frame Relay to ATM Interworking*

Preside Multiservice Data Manager workstation references

See the following documents for relevant Preside Multiservice Data Manager (MDM) information:

- 241-6001-303 *Preside MDM Administrator Guide*
- 241-6001-309 *Preside MDM Management Data Provider User Guide*
- 241-6001-806 *Preside MDM MDP Data Formats for DPN Reference*

How to get more help

For information about training, problem reporting, and technical support, see the “Nortel Networks support services” section in the product overview document.

Chapter 1
Configuring accounting

Set up Nortel Networks Multiservice Switch nodes to collect accounting information.

Navigation links

- "Prerequisites to configuring accounting" (page 21)
- "Configuring accounting task flow" (page 21)

Prerequisites to configuring accounting

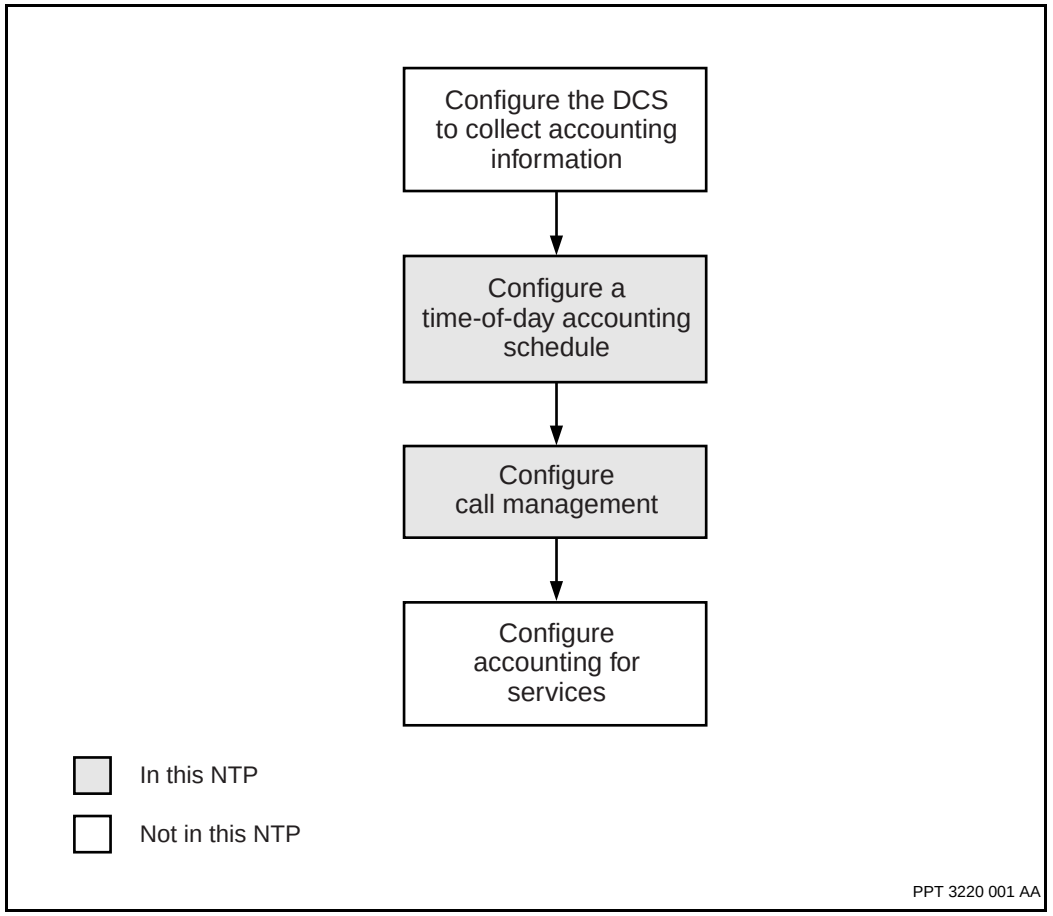
Configure the data collection system (DCS) to collect accounting information:

- In most cases, you can avoid the procedures for setting up data agents, collectors, and spoolers by using the default settings for the DCS. However your particular Nortel Networks Multiservice Switch node configuration may function more efficiently if you modify the defaults.
- After you understand your network requirements, use the procedures in NN10600-561 *Nortel Networks Multiservice Switch 7400/15000/20000 Data Management* to configure or modify the DCS.

Configuring accounting task flow

This task flow shows you the sequence of procedures you perform to configure accounting. To link to any procedure, go to "Navigation links" (page 22).

Figure 1
Configuring accounting task flow



Navigation links

- “Configuring time-of-day accounting (TODA)” (page 23)
- “Configuring call management” (page 26)

Configuring time-of-day accounting (TODA)

Define when the node collects accounting records by setting up a TODA schedule for a 24-hour period. The schedule repeats the following day unless you set up a new schedule.

> ***Note:*** For procedures on how to set up a TODA schedule using the Preside Multiservice Data Manager tool set, see to 241-6001-023 *Preside MDM Configuration Management for Passport User Guide*.

Prerequisites

If there is no active control processor (CP) available, data collection does not occur. A hot standby CP switchover just prior to the following events can cause a CP to become inactive:

- TODA changeover
- statistics collection

Procedure steps

1 Display the current setting for TODA:

```
display Collector/accounting collectionTimes
```

2 Configure schedule times for accounting record collection:

```
set Collector/accounting collectionTimes <time>
```

Note: Setting the *collectionTimes* attribute for any *Collector* component other than accounting has no effect.

3 Verify that you have correctly configured TODA:

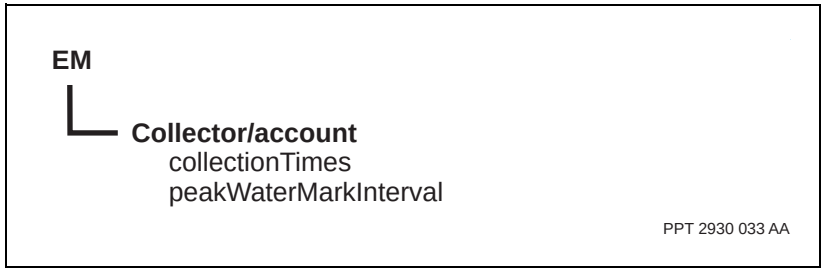
```
display Collector/accounting collectionTimes
```

Variable definitions

Variable	Value
<time>	The time of a scheduled collection. Use 24-hour time in the format hh:mm. You can enter more than one scheduled collection time by separating them with a space. When setting up a TODA schedule, the following rules and restrictions apply: • there is a limit of 24 entries • you can enter the times in any order • duplicates are not permitted • the collection times are triggered in chronological order • entries cannot be less than one hour apart or more than 12 hours apart • if no entries are made, each connection on the switch starts its own 12-hour accounting timer as time-of-day is not provisioned • if any valid collection times are provisioned, the TODA method is used in place of the 12-hour accounting • for accounting management, it is recommended that TODA be set for the same time at each end of the data link connection identifier (DLCI) (frame relay), virtual channel connection (VCC), asynchronous transfer mode (ATM), and even for the whole network.

Procedure job aid

Figure 2
Configuring time-of-day accounting (TODA) component hierarchy



Configuring call management

To prevent the exhaustion of system resources causing the failure of critical system components, engineer call management attributes to limit the number of accounting records processed or the number of calls accepted by a logical processor.

Prerequisites

Use the information in the section "Engineering considerations for call management" (page 33) and the table "Settings for call management parameters" (page 34) to help you engineer the settings of the call management parameters.

Procedure steps

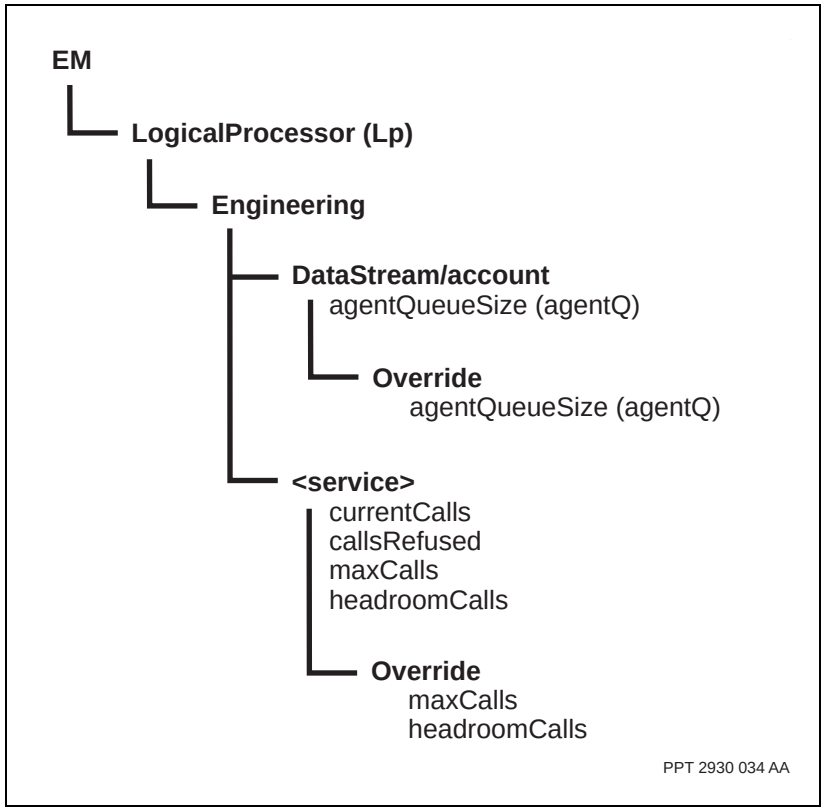
1. Determine the call management policy you want to set for the FP.

   Note: If you choose a policy that allows for memory exhaustion on the FP, note that memory exhaustion can cause the FP to reset. When the FP resets, all queued accounting records are lost and service is interrupted for all connections on the FP.

2. Calculate the settings for agentQueueSize, maxCalls, and headroomCalls using the maximum number of connections supported on the FP (the value X in the table).

Procedure job aid

Figure 3
Configuring call management components hierarchy



Chapter 2
Accounting concepts

This section includes information about Nortel Networks Multiservice Switch accounting concepts that apply to accounting for

- asynchronous transfer mode (ATM)
- frame relay
- frame relay-to-ATM (FR-ATM)
- internet protocol (IP)
- voice networking (VNET)

For concept information, see the following sections:

Disk functions

The disk spools and stores accounting information. For more information, see

Disk spool rate

Contact your Nortel Networks account representative for the maximum number of accounting records that the data collection system (DCS) server can spool in a given time. This rate is for the spooling activity only. The exact number of records that can be spooled depends on

- the central processing unit (CPU) load of the control processor (CP) (what other processing is done at the same time on the CP)
- the CPU load of the function processor (FP)

For example, the activities of setting up and clearing calls need to be considered too. All of these activities are reflected in the sustained call setup/clear rate with accounting enabled.

Disk space

The generated accounting records are stored in the system accounting file on a disk. Nortel Networks Preside Multiservice Data Manager (MDM) Management Data Provider (MDP) must be configured to retrieve the accounting files from the node frequently to prevent the disk from filling up.

Nortel Networks network engineering personnel can calculate how often MDP needs to retrieve the accounting file from the node based on

- the size of an accounting record
- the number of simultaneous connections
- the number of FPs
- for ATM soft virtual channels (SVC), the number of call clears
- the number of time-of-day accounting (TODA) changeovers provisioned per day
- the disk space available for accounting

Accounting records are spooled to accounting files on a disk, which are closed when they exceed a size of 2Mbyte in size. Regardless of size, files are also closed at midnight each night.

Timestamps associated with spool files can be correctly interpreted as follows:

- the timestamp provided by the file system indicates the last time data was received by the file. However, in the case of an empty file it will indicate the time the file was created.
- the timestamp embedded in the name of the file indicates the time a file was created.

A limited number of closed accounting files is allowed to exist on each node. This number is provisioned in attribute *maximumNumberOfFiles* of component *col/acc sp*. The default is 200 files, for which a maximum of 100 Mbyte of disk space will be used by all accounting systems on all the FPs together. Since the *maximumNumberOfFiles* attribute can be set to zero, there is no limit to the number of files that can be generated. However, this implies that accounting files could fill the entire disk. You must configure the MDP system to retrieve the accounting files frequently to prevent the disk from filling up.

CPU utilization

Accounting increases the CPU utilization of the FP. The spooling operation on the CP also increases the CPU utilization of the CP. Therefore, only enable accounting where required for billing purposes, usually at interfaces connecting to outside the network.

CPU performance is determined by the CPU time required to setup and clear a call, format the accounting record and spool it on the disk. At 100% CPU utilization, a certain maximum (sustained) number of calls per given interval cannot be exceeded.

Call management

When a call occurs, system resources are necessary to set up, maintain, and clear the call. Resources are also necessary after the call is completed to generate the appropriate accounting records and spool them to disk. If the node processed all calls and all their accounting records without limit, it could exhaust system resources causing the failure of critical system components.

To prevent this situation, you can configure a number of call management attributes to limit the number of accounting records processed or the number of calls accepted by a logical processor. For more information about call management engineering, see “Configuring call management” (page 26).

See the following sections for more information on call management:

- “Agent queue size” (page 32)
- “Engineering considerations for call management” (page 33)

Agent queue size

The most basic form of call management is to limit the size of the accounting record queue on a logical processor (LP). The queue holds accounting records generated by the accounting agent until the accounting spooler can spool them to the file system. Limiting the queue size prevents accounting records waiting in the queue from exhausting the memory on the LP.

For example, when a TODA event occurs, the accounting agent generates a large number of accounting records (one for each current call). Since the spooler cannot spool the accounting records as quickly as the agent can generate them, the agent queue fills up. The queue continues to grow as the agent generates accounting records for clearing calls. If the call-clearing rate is high enough, the queue becomes very large, exhausting the LP’s memory and causing it to fail. You can prevent this situation by setting an appropriate agent queue size.

When the queue reaches its agent queue size, the agent discards all incoming accounting records. You lose these accounting records, but the LP continues to provide service. If accounting data is very important, set the accounting agent queue size to a high value to prevent the agent from discarding accounting records. However, make sure that when the queue is full, the LP has enough available memory to perform its regular activities.

Engineering considerations for call management

When configuring the call management system, you must consider the following items:

- The disk must have sufficient space to store all the accounting records spooled between Management Data Provider (MDP) collection intervals. For information on MDP, see 241-6001-309 *Preside MDM Management Data Provider User Guide*.
- The CP must have sufficient resources to manage the provisioning system, call setup, and data record spooling.
- Each function processor (FP) must have sufficient resources to manage its applications and the setup, maintenance, and clearing of all its calls.

The following factors influence the disk, CP, and FP requirements:

- frequency of TODA events
- number of calls (average and peak for the node and for each logical processor) that generate accounting records at a TODA event
- call setup and clearing rate for SVCs (switched virtual circuit) (average and peak for the node and for each logical processor)

Table 1
Settings for call management parameters

#	Policy	Description	agentQueue Size	maxCalls	headroom Calls
1	Allow accounting data to be lost	You are willing to risk losing accounting data because accounting data is not important.	<2X	—	—
2	Avoid the loss of accounting data	You want to collect as many accounting records as possible because accounting data is important. However, you are not willing to risk memory exhaustion on the FP from too many records in the accounting agent queue.	2X	—	—
3	Protect accounting data from loss	You are willing to risk memory exhaustion on the FP to collect accounting records because accounting data is critical.	>2X	—	—
4	Disallow SVCs early	You will disallow new SVCs even when less than the number of supported connections are active.	—	<X	—
5	Allow SVCs up to the maximum number of supported connections	You are not willing to risk memory exhaustion on the FP to allow new SVCs in excess of the maximum number of supported connections.	—	X	—
6	Allow more SVCs than the maximum number of supported connections	You are willing to risk memory exhaustion on the FP to allow new SVCs in excess of the maximum number of supported connections.	—	>X	—

Note: x is the maximum number of connections supported on the FP.

(Sheet 1 of 2)

Table 1 (continued)
Settings for call management parameters

#	Policy	Description	agentQueue Size	maxCalls	headroom Calls
7	Make maximum use of resources	You want maximum use of resources on the FP. This policy is a combination of policy 2 and policy 5.	2X	X	—
8	Make maximum use of resources, but accounting records are more important than new SVCs	You want to make maximum use of resources on the FP, but you only want to allow new SVCs as long as there are not too many records in the accounting agent queue.	2X	X	0
9	Make maximum use of resources, but new SVCs are more important than accounting records	You want to make maximum use of resources on the FP but are willing to discard accounting records to allow new SVCs.	2X	X	> 0

Note: x is the maximum number of connections supported on the FP.

(Sheet 2 of 2)

Call types

The *maxCalls* and *headroomCalls* attributes are used in call management. For more information, see:

- “Maximum calls” (page 35)
- “Headroom calls” (page 36)

Maximum calls

The *maxCalls* value is the maximum number of SVC and permanent virtual connection (PVC) calls allowed on the LP. If the current number of PVC and SVC calls (*currentCalls* attribute) exceeds *maxCalls*, call management refuses new SVC calls. In other words, the call management system only accepts a new SVC call when the following condition is true:

currentCalls < *maxCalls*

Set *maxCalls*, at minimum, to the number of provisioned data link connection identifiers (DLCIs) (PVCs) on the LP plus the average number of SVC calls. For example, if you have 400 DLCIs and an average of 100 SVC calls on the LP, set maxCalls to 500 (400 + 100).

> ***Note:*** All PVC calls set up regardless of the *maxCalls* setting. If you have *maxCalls* set to 0 (zero) and have 400 DLCIs, all 400 PVC calls set up, but call management refuses all SVC calls.

The default value for *maxCalls* is very high (1 000 000), which prevents call management from rejecting SVC calls.

Headroom calls

The *headroomCalls* attribute allows you to control how quickly new calls set up when there is a backlog in the accounting queue. This attribute provides additional protection against discarding accounting records.

The accounting queue on an LP can get backlogged when the agent generates accounting records faster than the spooler can spool them to disk. This condition can occur in the following situations:

- A TODA event has just occurred. The agent generates an accounting record for each current call.
- A Nortel Networks Multiservice Switch trunk failure has just occurred. In this situation, all existing PVC and SVC calls clear, generating accounting records.
- There are more accounting records being generated on the node than the spooler can process. The spooler running on the CP collects records from all LPs. If call setup and clearing rates on the whole node exceed estimates, individual accounting queues fill up.

If you set *headroomCalls* to a low value, call management keeps the SVC setup rate low (by rejecting calls) until the spooler eliminates the backlog in the queue. With this setting, accounting records are preserved and the system remains stable. However, users can be frustrated because their calls are being rejected.

If you set *headroomCalls* to a high value, call management allows new calls to set up without limit. This setting can cause the loss of accounting records due to a full accounting queue or memory exhaustion, which prevents the agent from generating accounting records.

The call management only accepts a new SVC call if the following condition is true:

currentCalls + queued accounting records due to call clearing < *maxCalls* + *headroomCalls*

You cannot directly display the number of accounting records due to call clearing. However, the *currentQueueSize* attribute of the *Agent* component indicates the total number of accounting in the queue for the LP.

The default value for *headroomCalls* is very high (1 000 000), which prevents call management from limiting call setup rates.

Record generation and collection

The accounting records generated by Nortel Networks Multiservice Switch nodes are not directly suited for input to a billing program. They must be collected and transferred to a billing host, which can then produce billing data.

For users running Preside Multiservice Data Manager (MDM) software, this is done using File Prober and the MDP. For details on how to use File Prober and the MDP, see 241-6001-309 *Preside MDM Management Data Provider User Guide*. For more information about record generation and collection, see:

- “Accounting record collection” (page 38)
- “Record collecting reasons” (page 40)
- “Time-of-day accounting” (page 40)

Accounting record collection

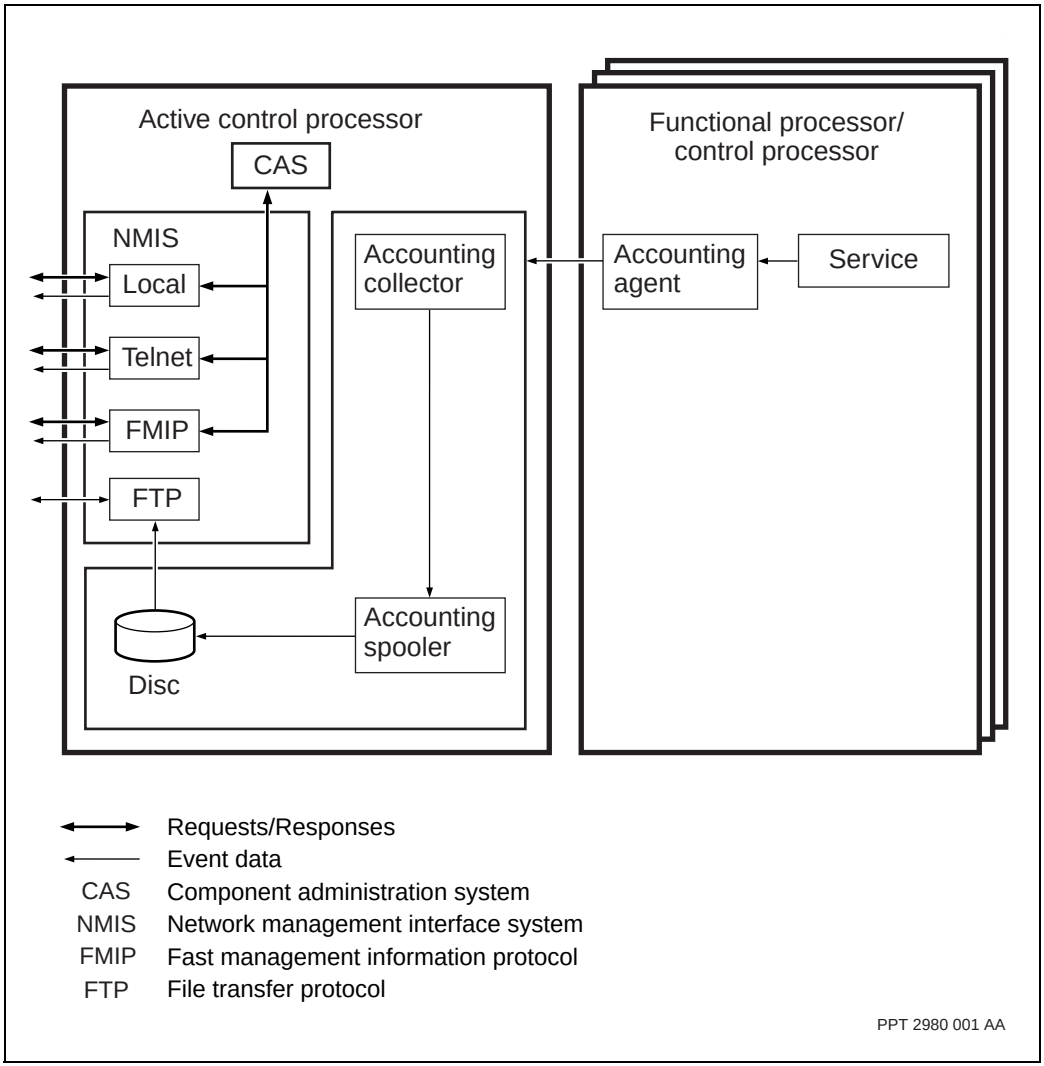
Generated accounting records are spooled by the DCS into accounting files that are stored on the Nortel Networks Multiservice Switch node disk. Accounting files are transferred from the Nortel Networks Multiservice Switch node disk to the MDP.

Accounting files transferred to the MDP are either converted to bulk data format or published format, and are stored on the MDP. After the files are collected and stored on the MDP, they can be transferred to either a billing host or a network engineering host. For more information, see 241-6001-309 *Preside MDM Management Data Provider User Guide*.

The figure “Accounting record collection system” (page 39) illustrates the record collection system.

For a detailed illustration of Voice Networking accounting, refer to “Voice networking accounting in the end-to-end system” (page 56).

Figure 4
Accounting record collection system



Record collecting reasons

Accounting records are generated when at least one of the accounting collection bits (bill, audit, test, study, or force bit) in the *accountCollection* attribute is set. The collection bits set in the attribute indicate the intended purposes of the accounting record. The possible bit settings are described as follows:

- Bill: if the bill option is selected in the *accountCollection* field, accounting records are collected for bill purposes
- Audit: if the audit option is selected in the *accountCollection* field, accounting records are collected for audit purposes
- Test: if the test option is selected in the *accountCollection* field, accounting records are collected for test purposes
- Study: if the study option is selected in the *accountCollection* field, accounting records are collected for study purposes
- Force: if the force option is selected in the *accountCollection* field, accounting records are collected, regardless of whether other reasons are provisioned

Time-of-day accounting

TODA is the scheduled generation of accounting records for all calls. The *Collector/account* component uses the *collectionTimes* attribute to specify the scheduled times to collect accounting data. These scheduled times apply to a 24-hour period. The schedule repeats the following day unless you provision a new schedule.

Chapter 3
Accounting for Multiservice Switch services

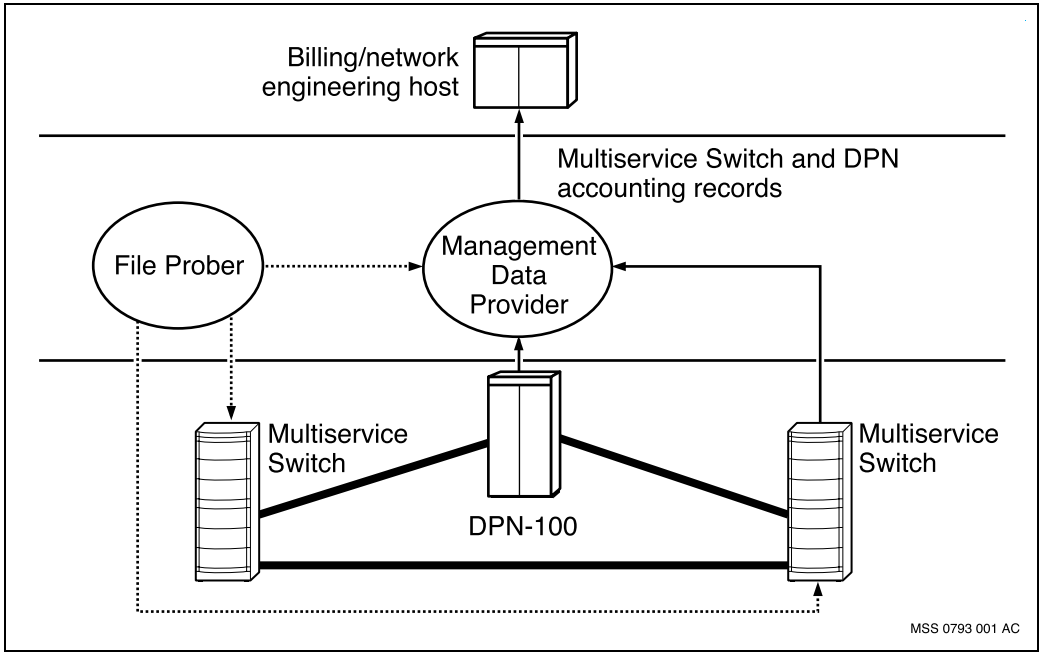
Nortel Networks Multiservice Switch accounting for all services is controlled by a Preside Multiservice Data Manager (MDM) tool called Management Data Provider (MDP). For more information about Preside MDM and Multiservice Switch accounting services, see the following sections:

Accounting management using Preside MDM

Accounting records for all services are transferred from the Nortel Networks Multiservice Switch node disk to the MDP on the Preside Multiservice Data Manager (MDM) workstation. The MDP system converts the accounting records to the standard bulk data format (BDF) or published format, and stores them on the MDP. See the figure "Preside MDM accounting system" (page 42). In these formats the files can be handled by the customer billing server and transferred to either a billing host or a network engineering host. The customer uses their own software packages to post-process the files containing accounting data. For more information on MDP, see 241-6001-309 *Preside MDM Management Data Provider User Guide*.

Note: The Multiservice Switch node-to-MDP file transfer protocol (FTP) connection can timeout when transferring very large amounts of accounting or performance data. If this problem occurs and you cannot complete a successful data transfer, configure the frame relay network-to-network interface (NNI) data link connection identifier (DLCI) to use a transfer priority (TP) of normal (6). You may also want to do this if you anticipate very large data transfers to your MDP.

Figure 5
Preside MDM accounting system



For information on viewing and analyzing accounting records, see 241-6001-806 *Preside MDM MDP Data Formats for DPN Reference*.

For more information about Preside Multiservice Data Manager, see the following sections:

- “Preside MDM capacity” (page 43)
- “Viewing accounting data with Preside MDM” (page 43)

Preside MDM capacity

The number of records generated per day (in the worst case there can be a TODA changeover every hour) has to be correlated with the global capacity of the Preside Multiservice Data Manager (MDM) MDP system to process accounting records, in order to determine how many nodes one MDP workstation can support.

Viewing accounting data with Preside MDM

You can use Preside Multiservice Data Manager (MDM) MDP to view accounting data. Refer to 241-6001-309 *Preside MDM Management Data Provider User Guide* for more information.

ATM accounting

ATM (asynchronous transfer mode) accounting allows a service provider to bill end users based on the amount of network resources they use. Accounting records can also be used for statistics purposes and to inspect quality of service (QoS) parameters.

Usage-based ATM accounting is provided on Nortel Networks Multiservice Switch nodes for permanent, soft permanent, and switched virtual connections (PVC, SPVC, and SVC). The permanent virtual connections can be channels (PVC) or paths (PVP). Configuration procedures are described in NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

There can be one or more ATM FP (function processor) on each node. The accounting data is collected per virtual connection (PVC or PVP). Each virtual connection, either configured or signaled, is under an ATM interface and each interface is associated with a port on a FP. The ATM accounting system collects accounting data on each FP for all the connections at the FP.

During record generation, the collected accounting data is transferred from each FP to the CP (control processor) and spooled to an accounting file by the data collection system (DCS). ATM accounting is responsible for collecting accounting data and accounting record generation. The DCS allows the transfer of accounting records from each FP to the CP, and the spooling of accounting files to the CP disk.

For each connection which traverses more than one interface on one or more nodes, accounting can be turned on at or at

- only one of the ends of the connection (single-ended accounting)
- both ends (double-ended accounting)

Also for any connection, accounting may be turned on at some intermediate nodes, although for performance reasons, this setup is not recommended.

Accounting may be turned on or off per ATM interface. Therefore the interface collects, if turned on, accounting data for all the connections under that interface. In the case of PVCs, accounting may be turned on or off for each connection.

See the figure "Accounting record collection system" (page 39) showing the accounting system on one node.

The ATM accounting feature has the following benefits:

- ATM accounting adds market value for Multiservice Switch ATM nodes, since it enables the service provider to get revenues from per usage billing for the actual traffic.
- ATM accounting enables the network operator to provide proof of QoS requirements and service level agreements (SLAs) to end-users.
- ATM accounting enables a usage-based billing policy which is more flexible and more accurate than flat-rate accounting. Double-ended accounting reflects the amount of data actually transported from end to end. Single-ended accounting eliminates the overhead of correlating the accounting records in downstream systems. However, single-ended accounting does not always accurately reflect the traffic that was actually delivered from end-to-end through the network (since the network may discard some cells).
- The information in the Multiservice Switch ATM node accounting record can be used for network engineering and planning.

For more information, see the following sections:

- "ATM accounting record generation" (page 45)

• “ATM record collection” (page 45)

ATM accounting record generation

Accounting records for ATM nodes are generated per connection point when one of the following events occurs:

- the TODA changeover occurs, if TODA is enabled in DCS
- the accounting timer expires once every 12 hours (per connection) if TODA is disabled
- the call clears

The first two records are called non-final accounting records and the third record is the final accounting record for the call.

If the time between call setup and call clear is shorter than one TODA changeover interval (or 12 hours if TODA is not enabled), then there is only one accounting record. It is generated on call clear and called the initial-and-final accounting record.

Information is provided in the accounting record to distinguish between these types of records.

ATM record collection

The *Vcs* component, under the *Mod* component, does not affect ATM accounting. *Vcs* is part of the frame relay services and has no effect if there are no frame relay services configured. ATM accounting is enabled through the *AtmIf* component.

The following are some factors that effect ATM accounting record collection:

- If none of the accounting collection reasons (which include bill, test, audit, study, and force) in the *accountCollection* attribute are set, no accounting record is generated. The *accountCollection* attribute enables or disables ATM accounting per ATM interface. If any of the collection reasons are set, accounting is turned on.
- If ATM accounting is enabled per ATM interface, all the soft permanent and switched virtual connections under this interface have accounting enabled.

- The *correlationTag* can be enabled or disabled per PVC. Accounting must be enabled per ATM interface by setting one of the collection reason bits. Then each permanent connection can enable or disable accounting by using the *correlationTag* attribute.
- If accounting is turned off and back on again, only the next calls that are set up by the interface are collected.

For more information about ATM accounting configuration, see NN10600-710 *Nortel Networks Multiservice Switch 7400/15000/20000 ATM Configuration Management*.

Frame relay accounting

Frame relay service is a best-effort delivery service (that is, it does not guarantee data delivery through the network). Because of this, traditional billing methods require the network operator to correlate separate statistics gathered from each endpoint to determine the actual data transfer. The frame relay accounting system provides an option for the user to eliminate this manual correlation. In either one or two accounting records it provides an accurate measure of data delivery across the entire end-to-end virtual connection.

Frame relay accounting allows a service provider to bill end users based on the amount of network resources they use. It also allows the generation of end-user reports that can be used to validate QOS parameters. These reports contain relevant usage data such as

- the committed information rate (CIR)
- the excess information rate (EIR)
- byte and frame/segment counts

Billing can be based on end-user data traffic that is collected at the exit (egress) points of a frame relay network. The end-user data traffic is put into one or two accounting records per virtual circuit. The accounting records are then spooled to the node disk.

The benefits of this feature are as follows:

- The set of billing parameters for the frame relay service is concise and supports a variety of billing policies.

- The generation of end-user reports can be generated to validate QOS parameters, peak-to-average traffic ratio, and service contract delivery. Frames from both ends are synchronized, providing an accurate tabulation of frames/bytes that are successfully delivered.
- The service provider can gather detailed information about end-user traffic and can develop billing policies based on this detailed information.
- Single-ended frame relay accounting (when provisioned) reduces the number of accounting records generated and spooled to the downstream processing system.
- This feature relates data from the endpoints of a virtual circuit to each other.
- This feature takes a snapshot of the billing data on both ends of the virtual circuit every 15 minutes and exchanges this information between the endpoints of a virtual circuit. In the event of a path or node failure, the network operator has a record of network activity that is at most, 15 minutes old.
- When there is no data exchanged in the accounting interval, snapshots are not exchanged. This conserves network bandwidth.
- By provisioning a correlation tag identifier with a value (the default is null), the identifier is assigned to a frame relay PVC and becomes part of the accounting record and is listed as the *circuitId* attribute. The value provisioned for the correlation tag is the same value that is reported for the *circuitId* attribute in the accounting report. Only when the correlation tag identifier is provisioned with a value other than the default does the circuitId attribute appear in the accounting record. The use of a circuit identifier facilitates off-switch correlation of data for the interfaces involved in the same permanent connection.

For more information about frame relay accounting, see

- “Frame relay accounting record generation” (page 48)
- “Frame relay record collection” (page 50)

Frame relay accounting record generation

A meter generates accounting records from the collected data. The mode of generation can be provisioned to either singleEnd or bothEnds. In singleEnd generation, only a meter at the master end of the DLCI generates an accounting record, which contains data from both accounting meters at a given virtual circuit (VC). In bothEnds generation, both master and slave meters generate accounting records, which contain only data from the respective local meters. The generation mode is controlled by the *generationMode* attribute in the *mod Vcs* component.

During singleEnd generation, the collection of data by the accounting meters are synchronized using the egress protocol. SingleEnd generation is triggered by the following conditions:

- TODA changeover (all meters react to the same changeover)
- the expiry of the accounting meter timer
- call clear
- change of the configured CIR or EIR values, at either end of the DLCI
- turning rate adaptation or rate enforcement on or off at either end of the DLCI

  Note: The egress protocol is automatically turned off when bothEnds generation is selected.

When bothEnds generation is turned on, record generation is triggered by the charged end for the following conditions:

- TODA change-over (all meters react to the same change-over)
- the expiry of the accounting meter timer (each meter contains its own accounting meter timer)

Accounting intervals at a given VC do not overlap. The end of one accounting interval is also the start of the subsequent accounting interval. Accounting intervals are defined for the whole node by the TODA provisioning schedule. If TODA is not provisioned individually for each VC (DLCI), the accounting interval is set to 12 hours. This interval starts either from the end of a previous accounting interval or from the beginning of a call.

Note: An accounting interval can be shorter than 12 hours if the call is cleared before the end of the 12 hour timer.

Accounting records generated in bothEnds accounting generation mode contain either calling-end counts only (when the node that generated the record is the calling end) or called-end counts only (when the node that generated the record is the called end). Accounting records generated in singleEnd generation mode contain counts from both ends (calling and called counts).

A singleEnd accounting record consists of a synchronized snapshot of the local and remote data taken when the record was generated at a TODA changeover, at the expiry of the 12-hour timer, or at the normal termination of the connection. If a connection clears because of a Nortel Networks Multiservice Switch trunk or remote node failure, the meter generates an accounting record with local and remote snapshots, which are not synchronized. The local snapshot contains the latest counts taken when the connection went down and the remote snapshot will contains data taken by the last egress protocol sequence (at most 15 minutes). The snapshot valid flag in the accounting record is set to zero.

The accounting record is generated by the meter at the non-charged end (even in singleEnd mode) to prevent loss of data during a Multiservice Switch trunk or remote node failure. During a Multiservice Switch trunk failure, an accounting record is generated at each end of the VC. This allows the accounting records to be checked against one another for accuracy. During a node failure, no accounting record exists, so the local and remote snapshots taken by the egress protocol can be used to bill the end user.

If the frame relay backup PVC capability has been provisioned, and a call is redirected to the backup slave, an accounting record is generated on the master end only, if singleEnd accounting is provisioned. If bothEnds accounting is provisioned, an accounting record is generated on the master and primary slave end.

Note: When call redirection occurs, the redirect flag is set to one in the new accounting record, which also contains the called backup data network address (DNA). The optional displays the primary DNA.

See the figure "Accounting record collection system" (page 39) showing the accounting system on one node.

Frame relay record collection

The actual record generation mode on a VC may differ from the one provisioned in the *mod Vcs* component. The mode also depends on the following factors:

- If none of the accounting collection bits (which include bill, test, audit, study, and force) are set on both ends, no accounting record is generated. This result is true even if frame relay accounting has been turned on at the DLCI.
- If singleEnd generation mode is provisioned, but any two of the collection bits are set at the non-charged end, the generation mode is set to bothEnds by the system.

  Note: The charged end is defined as the master end of the PVC. The non-charged end is defined as the slave end of the PVC.

- If bothEnds generation mode is provisioned, but none of the collection bits are set in one of the two ends, the generation mode is set to singleEnd by the system.
- If accidental disconnection occurs, the unique bit in the accounting record is set to false. The generation mode is set to bothEnds by the system.

The accounting timer expiry interval is set at 12 hours. If no traffic is recorded on the VC during the designated time interval, then on clear request, no accounting record is generated for that VC.

Note: An accounting record is generated at TODA change times or at the expiry of the 12 hour timer.

FR-ATM accounting

FR-ATM accounting allows a service provider to bill end users based on the amount of network resources they use. Also, statistics and SLAs can use accounting records. FR-ATM accounting provides usage-based accounting for best-effort delivery services. In these services, network congestion or rate

policing can lose or discard end user frames. Therefore, end-users require account billing according to the amount of data that the network actually transfers.

Each FP has its own, independent, accounting subsystem that can generate records for the FR-ATM connections on that FP. You can turn FR-ATM accounting on at one end interface (single-ended accounting) or at both ends interfaces (double-ended accounting).

The figure, "Accounting record collection system" (page 39) shows the accounting system on one Nortel Networks Multiservice Switch node. The accounting meter collects accounting data. There is one accounting meter for each connection (DLCI) that has accounting turned on. The FR-ATM accounting service sends the accounting data to the accounting system, specifically to the accounting meter.

There is one FR-ATM accounting controller for each FP. Each FR-ATM connection (with accounting enabled) registers with the FR-ATM accounting controller. On each TODA changeover event, the accounting meters collect the accounting data. The DCS then spools the accounting records to the node disk.

The FR-ATM accounting feature has the following benefits:

- FR-ATM accounting enables a usage-based billing policy which is more flexible and more accurate than flat-rate accounting. Double-ended accounting reflects the amount of data actually transported from end-to-end. Single-ended accounting eliminates the overhead of correlating the off-switch accounting records. However, single-ended accounting does not always accurately reflect the traffic that actually transfers from end-to-end through the network.
- FR-ATM accounting adds market value for Multiservice Switch FR-ATM nodes, since it enables the service provider to get revenues from billing for the service they provide.
- FR-ATM accounting enables the network operator to provide proof of meeting QOS requirements and SLAs to end users.
- Network engineering and planning personnel can use the information from the Multiservice Switch FR-ATM accounting record.

- FR-ATM accounting provides accounting records similar to FR accounting. Therefore, the data traffic units are suitable for a frame-based access service such as FR-ATM.

For more information, see the following sections:

- "FR-ATM record collection" (page 52)
- "FR-ATM accounting record generation" (page 52)

FR-ATM accounting record generation

FR-ATM accounting generates an accounting record for each connection point (FRF.5 DLCI, FRF.8 NPVC DLCI, or FRF.8 DLCI), when one of the following events occurs:

- a TODA changeover occurs, if TODA is provisioned in DCS
- the connection's 12-hour accounting timer expires, if TODA is not provisioned
- a call clears

TODA and the expiration of the 12-hour accounting timer trigger non-final accounting records. Call clear triggers final accounting records. For some calls, there can only be one accounting record. FR-ATM accounting generates this single accounting record if a call clears before any TODA changeover or 12-hour accounting timer expiration occurs.

FR-ATM record collection

FR-ATM double-ended accounting is independent from frame relay and ATM accounting. FR-ATM accounting is enabled through the *FrAtm Ca* and *FrAtm Dlci Sp* components.

The following are some other FR-ATM specific collection factors:

- If none of the accounting collection reasons (which consist of bill, test, audit, study, and force) in the *FrAtm Ca accountCollection* attribute are set, FR-ATM accounting is disabled for all subsequent calls and does not generate an accounting record.

- If any of the reasons are set, FR-ATM accounting is on for each FR-ATM interface. Also, a connection must have the *accounting* attribute on under the *FrAtm Dlci Sp* component. Otherwise, FR-ATM accounting is off for that connection.
- If you turn FR-ATM accounting on at the interface level (*FrAtm Ca* component), FR-ATM accounting counts only the next calls that are set up by the interface. Active calls are not affected.
- If you set the *accounting* attribute under the *FrAtm Dlci Sp* component to on, the DLCI re-establishes the call. Active calls are affected.

IP accounting

The internet protocol accounting service allows you to collect, record, and report usage measurements for each customer virtual router (VR) that is part of an IP virtual private network (VPN). The IP accounting statistics provide a breakdown of the volume of IP packets sent and received by VPN customers. IP accounting statistics are collected for three VPN configurations:

- point-to-point (PTP) tunnels
- point-to-multipoint (PTMP) tunnels
- layer 2 data connections (virtual circuits)

Accounting records are generated for each VR within these VPN configurations. VPN site-to-site information is generated for VRs within a VPN connected through IP tunnels. Local site information is available for VRs connected to the network through direct data link connections. The breakdown of the IP traffic based on tunnel usage and aggregate packet counts gives the carrier the ability to analyze the IP packets sent and received by VPN customers.

Layer 3 usage statistics are generated for VRs connected by IP tunnels. IP tunnel encapsulation and decapsulation counts are collected for PTP and PMPT tunnel configurations on ATM IP functional processors. If IP class of service (CoS) is applied to the customer traffic, the statistics are categorized into four possible IP traffic classifications.

The CoS breakdown is generated at tunnel ingress and tunnel egress. For tunnel statistics there is information on tunnel source address, tunnel destination address and packet counts per CoS.

> ***Note:*** Tunnel ingress statistics are recorded as outbound statistics for the protocol port at which the tunnel originates. Similarly, tunnel egress statistics are recorded as inbound statistics for the protocol port at which the tunnel terminates.

Network statistics are provided for layer 2 connections. These statistics are collected for AtmMpe, IP-optimized DLCI, FrDte, and PPP media. Since the VPN site address is unknown, the accounting records gathered at the outgoing traffic ports are aggregate statistics of the number of packets received and sent by the VR to the network. These statistics are broken down by CoS.

The figure "Accounting record collection system" (page 39) illustrates the interactions of the subsystems on a Nortel Networks Multiservice Switch node. It also shows the path that is followed to collect the accounting data from the protocol port to the output of the accounting record at the MDP.

For more information, see the following sections:

- "IP accounting record generation" (page 54)
- "IP record collection" (page 54)

IP accounting record generation

Accounting records for IP are generated for each protocol port with accounting enabled when one of the following events occurs:

- the TODA changeover occurs, if TODA is enabled in DCS
- the accounting timer expires once every 12 hours (per VR and protocol port) if TODA is disabled

For more information about TODA, see "Time-of-day accounting" (page 40).

IP record collection

The accounting record presents the usage statistics collected over a specified time. A record is generated for each protocol port, for each source address, and for each destination address for PTP and PTMP tunnels.

An IP accounting record contains the following information:

- accounting collection reasons
- static data such as VR name, source and destination address, virtual private network identifier (VPN ID), and protocol port identity
- usage data such as collection time, collection duration, packet count, and byte count

For further information on accounting collection reasons, see attribute *Vr Ip accountCollection* in NN10600-060 *Nortel Networks Multiservice Switch 7400/15000/20000 Component Reference*.

Voice networking accounting

Voice networking accounting allows a service provider to bill end-users based on the amount of network resources they use. Accounting records can also be used for network engineering and planning.

Accounting is enabled and disabled by provisioning *VoiceAccounting*, a subcomponent of *voiceRoute*. The DNA must be provisioned on the *voiceRoute*. The check prov command will fail if the DNA is not defined. Accounting records are generated if the DNA is not provisioned on the destination node, or voice networking accounting is not provisioned. The destination node is not identified in the accounting record if the destination DNA is not provisioned.

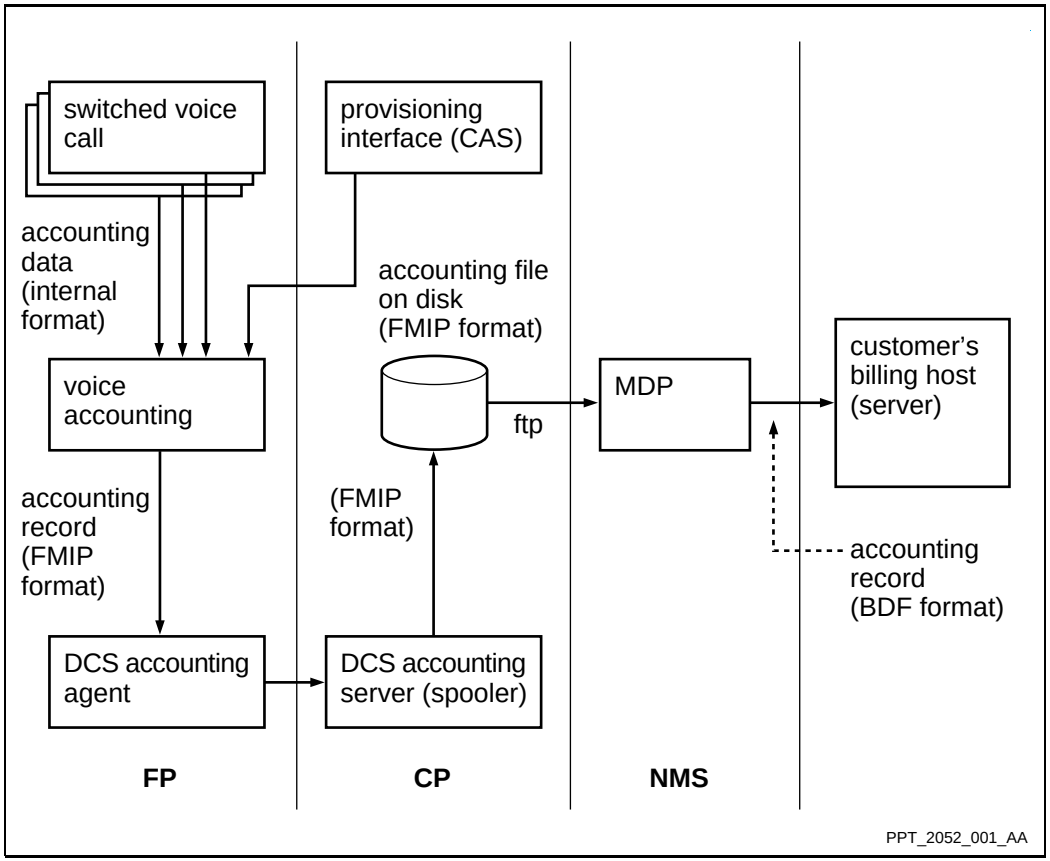
For detailed procedures describing how to provision voice networking accounting, see NN10600-755 *Nortel Networks Multiservice Switch 7400 Operations: Voice Networking*.

The figure "Voice networking accounting in the end-to-end system" (page 56) illustrates voice networking accounting.

For more information, refer to the following sections:

- "Voice networking calls" (page 57)
- "Voice networking record generation" (page 57)
- "Voice networking billing" (page 60)

Figure 6
Voice networking accounting in the end-to-end system



Voice networking accounting takes data generated by a switched voice call on a voice or MVP-E function processor. The voice networking functionality manages the calls, generates the accounting records and provides the link to the Data Collection System (DCS) that spools the records. The Management Data Provider (MDP) collects the files and transfers them to the MDP on the Preside Multiservice Data Manager workstation.

The MDP system converts the accounting records to the standard bulk data format (BDF) and stores them on the MDP host. In this format the files can be handled by the customer's billing server and transferred to either a Billing host or a Network Engineering host. Customers use their own software packages to post-process the (standard) BDF files containing accounting data.

For more information about MDP, refer to 241-6001-309 *Preside MDM Management Data Provider User Guide*.

Voice networking accounting capabilities include

- 30 simultaneous calls per voice or MVP-E function processor
- a Multiservice Switch node with 13 voice or MVP-E function processors

Voice networking accounting provides the following benefits:

- The service provider can gather detailed information about end-user traffic and can develop billing policies based on the information.
- The number of accounting records generated and spooled to the downstream processing system is reduced when single-ended voice networking accounting is provisioned.

Voice networking calls

A single PORS switched connection is considered one call. If a tandem PBX redirects a call to exit and enter the Nortel Networks Multiservice Switch subnet again, new accounting data is collected for the second connection through the subnet.

Each PORS switched voice connection through the subnet has a unique accounting call reference number in the accounting record. The unique number allows downstream, off-switch processing of accounting records to correlate pairs of records that are created by double-ended accounting.

Voice networking record generation

An accounting record is a data record containing information on end-user traffic for a given connection over a certain period of time called an accounting interval. The accounting record specifies the total number of frames (including silence frames) that are transmitted and received during a

call, the number of frames transmitted and received at different compression rates, and the elapsed time of the last interval. The calling address may be specified if it is provided by the interface protocol.

For each compression rate (up to a maximum of three), the accounting record specifies:

- the number of frames transmitted and received
- the compression algorithm
- the frame size
- the bit rate

The generation of an accounting record is controlled by an interval timer that expires after 12 hours, or by the provisioned time-of-day accounting (TODA) schedule. TODAs are provisioned using the Data Collection System (DCS). The accounting record is created at the end of each accounting interval and each time a connection is cleared.

Accounting records can be suppressed for the terminating end of the call by setting the *accountingOptions* attribute while accounting is enabled. The attribute can be provisioned for each *VoiceRoute*.

Double-ended accounting enables accounting and generates records at both the ingress and egress ends of a call. Data collection can be enabled at the ingress and egress points of a connection. Accounting must be enabled at the calling and called end. The called end can not suppress terminating end accounting. Double-ended accounting accurately calculates the number of frames transmitted from end to end.

Single-ended accounting exists when accounting is enabled at one end of a connection and record generation is disabled at the other end of the call. Single-ended accounting will result when

- accounting for the *voiceRoute* is disabled at the called end
- accounting record generation at the called end is disabled by provisioning *voiceRoute voiceAccounting accountingOptions* to *suppressTerminatingEndRecords*

- the called end does not support Nortel Networks Multiservice Switch voice networking accounting

Single-ended accounting eliminates the billing system overhead of correlating calling end voice networking accounting records with the accounting records of called systems. However, in single-ended accounting, there is a risk of losing accounting data for all calls if the single accounting node fails.

For more information on voice networking record generation, see the following:

- "Voice networking accounting components" (page 59)
- "When voice networking records are generated" (page 60)

Voice networking accounting components

Voice networking accounting does not rely on the virtual circuit system. Voice networking accounting is supported on switched voice calls only. By default, voice networking accounting is turned off on all voice routes.

Voice networking accounting is controlled by the *VoiceAccounting* component, which is a subcomponent of *VoiceRoute* component. The component contains the following attributes:

- *accountCollection*: Enables or disables accounting on the voice networking interface and specifies the reason (bill, audit, test, study, or force) for accounting. Any reason will turn accounting on. Calls that are already active before accounting is enabled do not generate accounting records. When accounting is disabled, accounting generation stops without generating a final record will be generated for an in-progress call.
- *accountClass* and *serviceExchange*: Specifies the accounting class and data service exchange associated with the interface. This information is included in the accounting records.
- *calledAddrDigitsTruncatedInRec*: Satisfies the privacy requirements set by many countries by specifying the number of trailing digits of the called number that are removed in the accounting record.

- *accountingOptions:* Specifies voice networking accounting options. For example, you can suppress generation of accounting records at this node when it is a call destination.

For details on configuring voice networking accounting, see NN10600-755 *Nortel Networks Multiservice Switch 7400 Operations: Voice Networking*.

When voice networking records are generated

Accounting records for voice networking are generated when one of the following events occurs:

- the TODA changeover occurs, if TODA is enabled in DCS
- the accounting timer expires (once every 12 hours if TODA is disabled)
- the call clears
- a call attempt fails, including a failed SVC setup

Accounting records are not generated if a time slot is unavailable or if the called number is invalid and the voice networking call server can not resolve the address.

Accounting records are generated for unsuccessful call attempts such as the following:

- the call is unanswered
- bandwidth is unavailable
- the call server resolves the address, but the destination does not exist

TODA or timer expiry generates a non-final accounting record. A final accounting record is generated for a cleared or failed call. Most voice calls generate only one record, called an initial-and-final accounting record. Information is provided in the accounting record to distinguish between these types.

Voice networking billing

The information in the accounting record allows several billing policies to be implemented.

Usage-based billing can include time, frame counts, or both. The total duration of the call is available. The time spent in each interval of the TODA schedule that has different tariffs is also available.

Frames transmitted and received for up to three different compression rates used by the call in the previous accounting interval are included in the accounting record for use in billing. For example, frames transported at different compression rates may be billed at different rates.

For double-ended accounting, at least two accounting records are issued, one at each end. The node automatically generates an accounting call correlation identifier. This allows third party billing systems to correlate records issued for the call. If accounting records are retained from both ends, billing is performed based only on the received counts. This reflects the traffic that was actually delivered to the customer. If the “unique” flag of the voice networking accounting record is not set, the downstream process will search for accounting records to correlate.

For single-ended accounting, billing has to consider both the transmit and receive counts at one end. In one of the directions the count may not accurately reflect the traffic that was actually delivered. However, single-ended accounting reduces the overhead third party billing systems need to correlate the accounting records. If the Voice Networking Accounting record “unique” flag is set, the downstream process will not attempt to correlate records.

MPA voice accounting for Passport 4400

MPA voice accounting allows Nortel Networks Multiservice Switch 7400 nodes to collect time-based accounting information for voice calls over MPANL to Passport 4400 devices. This information can then be processed and managed through existing facilities on the Multiservice Switch 7400 node and in Preside Multiservice Data Manager (MDM). Accounting information is based in connect time instead of traffic volume. As a result, the service provider can bill the end-user for the connection, regardless of the amount of data transmitted or received.

MPA voice accounting is integrated to the existing accounting support for Multiservice Switch 7400 services (the DCS accounting server and agent). The figure “MPA voice accounting in the end-to-end system” (page 65)

illustrates the implementation. Accounting can be enabled at one end of the switched connection (single-ended accounting) or at both ends of the switched connection (double-ended accounting).

The generic requirements for voice accounting includes three functions:

- data generation (also known as collection), through which the node assembles data elements into an unformated record
- data formatting, through which the node assembles or converts data into a standard record format that the downstream billing systems can process
- data transmission, through which the node sends the formatted records to the customer billing server

MPA voice accounting performs data generation only. That is, the accounting record that MPA voice accounting produces is the unformated record. For data formatting and transmission, accounting uses existing facilities on the Multiservice Switch 7400 node and in Preside MDM. The Management Data Provider (MDP) on Preside MDM converts the unformated records to the standard bulk data format (BDF) that the customer billing server is able to processes.

MDP and the BDF are described in 241-6001-309 *Preside MDM Management Data Provider User Guide*.

Benefits of MPA voice accounting

MPA voice accounting provides the following benefits:

- adds market value for Nortel Networks Multiservice Switch 7400 nodes networked to Passport 4400 devices since MPA voice accounting lets the service provider bill for switched voice traffic
- for MPA voice accounting source-end accounting and terminating end accounting MPA voice accounting, Multiservice Switch 7400 nodes can maintain time-based registers and generate an accounting record for voice calls originating from and terminating on Passport 4400 devices
- information in the MPA accounting record can be used for network engineering and planning

MPA voice accounting concepts

The following sections describe concepts that are specific to Voice Networking accounting:

- "Voice networking calls" (page 57)
- "The accounting record and its generation" (page 63)

The MPANL voice call

For accounting purposes, a single MPANL switched connection (SVC over PORS) is one call. Each individual switched voice connection through the subnet has a unique call correlation tag in its accounting record. This tag is also known as the accounting call reference number. The accounting call reference number allows downstream, off-switch processing of accounting records to correlate pairs of accounting records produced by double-ended accounting.

> ***Note:*** The accounting call reference number is not to be confused with the call reference number already used in the MPANL Voice software. The accounting call reference number is a value common to both the source and destination ends of the connection; the call reference number only has significance within a single node.

The accounting record and its generation

Accounting record generation for MPA voice accounting is similar to record generation for Voice Networking calls. The following characteristics are specific to MPA voice accounting only:

- MPA voice accounting supports single-ended accounting by disabling accounting on one of the end-switches involved in a call.
- MPA voice accounting does not support egress accounting.

For more information on record generation, see the section "Voice networking record generation" (page 57).

How does MPA voice accounting work?

This section describes how MPA voice accounting works in the context of a Nortel Networks Multiservice Switch 7400 network. Information is provided in the following sections.

- "Summary of features" (page 64)

- "Types of records for MPA voice accounting" (page 66)
- "Specialized content of accounting records" (page 67)
- "Double- and single-ended accounting" (page 67)

Summary of features

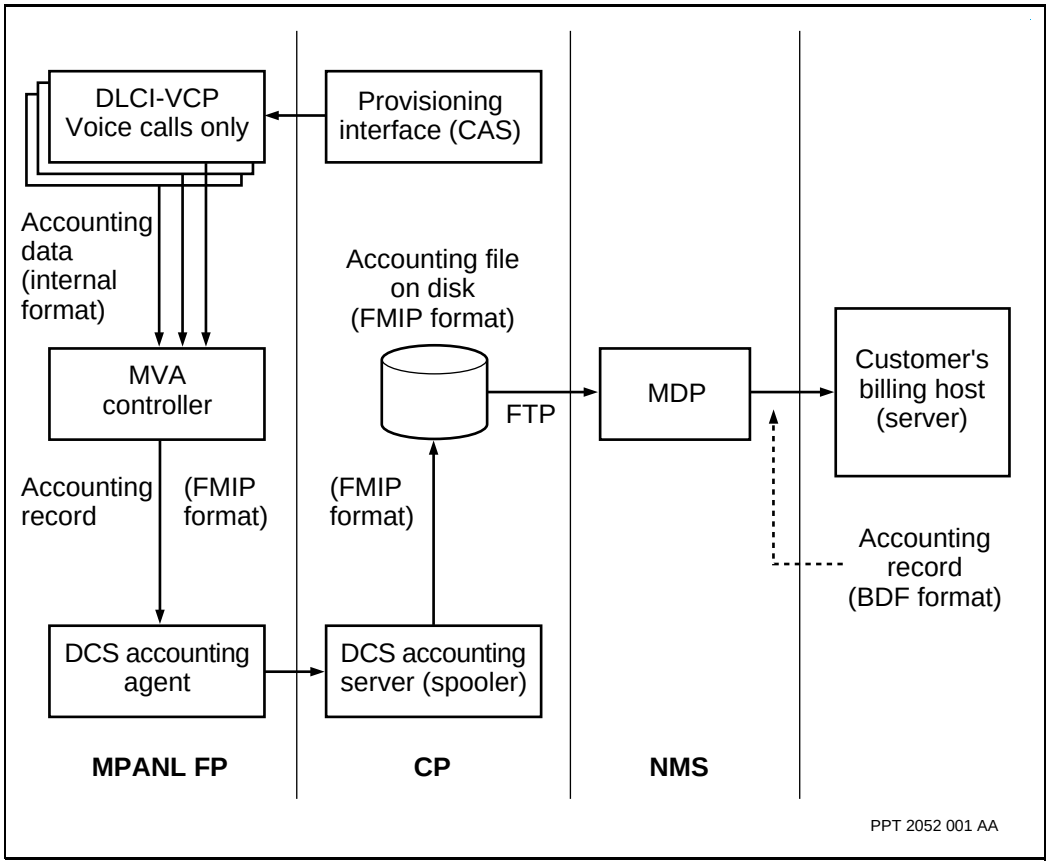
MPA voice accounting includes the following functionality for Nortel Networks Multiservice Switch 7400 and Voice over MPANL:

- collects voice-specific accounting information
- collects accounting information for each voice connection (SVC)
- enables or disables accounting for each MPANL interface
- provides per-connection accounting records, which are suitable for billing purposes but can also be used for network engineering and planning
- permits configurable time periods for the record generation, using the data collection system (DCS)
- converts accounting data from MPA voice accounting internal format to fast management information protocol (FMIP) format and delivery to the DCS for off-switch processing
- supports configuration
- provides accounting records which are similar to FR over DPRS accounting records

The customer using the end-to-end system must configure accounting through the Multiservice Switch node provisioning interface. The customer must also configure the MDP to collect accounting records from the Multiservice Switch 7400 nodes and convert them to BDF. When accounting is enabled, the customer gets the accounting record in BDF format on MDP. For information in off-switch processing, see 241-6001-309 *Preside MDM Management Data Provider User Guide*.

The figure "MPA voice accounting in the end-to-end system" (page 65) illustrates the MPA voice accounting system at work.

Figure 7
MPA voice accounting in the end-to-end system



When accounting is turned on and off

MPA voice accounting begins as soon as it is enabled through configuration and stops when it is disabled through configuration. Specific characteristics of enabling and disabling MPA voice accounting are described in the provisioning section of NN10600-745 *Nortel Networks Multiservice Switch 7400 Operations: Multiservice Passport Access Network Link* .

Types of records for MPA voice accounting

For MPANL voice calls, MPA voice accounting is implemented only for SVCs. Accounting produces records for each call for the following events:

- on Time of Day Accounting (TODA) changes (if TODA is enabled in DCS)
- once every 12 hours for each call if TODA is disabled
- at the end of each call
- once for each unsuccessful call attempt

The first two events are called non-final accounting records.

The third event is the final accounting record for the call. For short SVC calls, the system generates only the final accounting record when the call terminates, in which case the record is called an initial-and-final accounting record. For long SVC calls, the system generates non-final records plus the final record. Information is provided in the accounting record to distinguish between record types.

The system also accounts for SVCs that fail during setup. An unsuccessful call attempt for which an accounting record is generated is one for which there was no initial protocol violation. However, calls that do not generate network traffic, including setup message traffic, do not generate accounting records. Unsuccessful calls for which the system generates an accounting record include (but may not be limited to) the following:

- call not answered
- destination set busy
- no bandwidth available (that is, no path available)
- voice networking call server (VNCS) provisioning inconsistency (for example, VNCS resolves the address but the destination component does not exist)

Examples of unsuccessful call attempts which do not generate accounting records include invalid dialed number.

Specialized content of accounting records

Accounting data collection can be enabled at both the ingress and egress points of a connection (double-ended accounting). Engineering guidelines specify where and how to enable accounting and when to override the default accounting status of the interface. However, the records are generated independently at the two ends. The MPA voice accounting system provides an accounting call reference number in the record to facilitate off-switch correlation. This reference is unique for the call.

Accounting records always specify the called address and calling address (DNA). The connected number is specified if provided by the Passport 4400. The called number and the connected number may differ. The called number may have trailing digits truncated as defined through provisioning. Truncating trailing digits is a privacy requirement in some countries. The connected number is not truncated. The system includes the calling number in the record only if the number is provided by the originator (PP4400 or Voice Networking). Otherwise the calling number is set to 0.

Double- and single-ended accounting

Double-ended accounting is achieved when accounting is enabled on Nortel Networks Multiservice Switch 7400 nodes at both ends. The calling end must have accounting enabled; the called end must have accounting enabled and must not be suppressing terminating end accounting.

Single-ended accounting is achieved when only one end node generates accounting records with no feed-back from the other end. Single-ended accounting is realized when accounting is enabled at one end of the connection, but disabled at the other end through one of the following methods:

- accounting is disabled through provisioning for that voice route at the other end
- accounting is enabled at both ends, but generation of terminating end accounting records has been suppressed through provisioning at the terminating (called) end
- the other end node does not support accounting (either the called or the calling end)

Comparison with other Multiservice Switch networking systems

MPA voice accounting follows implementation criteria that is similar to those for ATM, frame relay double-ended accounting, and Voice Networking accounting.

Record generation

For MPA voice accounting, the way in which accounting records are generated (on TODA changes or every 12 hours) is consistent with frame relay and Voice Networking accounting. The FMIP format of the accounting record is reused. The interface with DCS (to submit the formatted accounting records) is also the same for ATM, frame relay, Voice Networking. Some fields of Voice Networking accounting do not apply to MPA voice accounting.

Reliability

The reliability of MPA voice accounting is similar to the reliability of ATM, frame relay double-ended accounting, and Voice Networking accounting in the following ways:

- accounting records are spooled to disk at the termination of a call
- if a node is out of service, accounting information is lost for all calls that have been active for less than 12 hours
- for calls of very long duration, the system generates records every twelve hours; if a node fails, long-duration calls can lose up to 12 hours of billing information

Peak water marks

Both frame relay accounting and MDP support peak water mark measurements on traffic. Nortel Networks Multiservice Switch 7400 node ATM and Voice Networking accounting do not support peak water mark. MPA Voice Accounting also do not support peak water mark since it does not count cells and bytes.

Provisioning MPA voice accounting

Under the *Mpanl Voice* component, the new *MpaVoiceAccounting* component controls accounting for calls processed for the parent MPANL. Application of attributes are described in the following points:

- The *accountClass* and *serviceExchange* attributes provide additional record tagging options. These tagging options allow the inclusion (in the accounting record) of information that is provisioned at the interface level.
- The *accountCollection* attribute indicates the reasons the accounting records are to be collected by the network. These reasons are billing, test, study, and audit. If no reason is specified, accounting is disabled.
- The *digitsSuppressed* attribute specifies the number of trailing digits which the accounting system removes from the called number in the accounting record. This option satisfies privacy requirements as required in some jurisdictions.
- The *accountingOptions* attribute specifies accounting options. The only setting available at this time is the suppressTerminatingEndRecords flag, which has local significance only. This flag specifies if accounting records are generated for calls that terminate at this Nortel Networks Multiservice Switch 7400 node. Interactions with other attributes are as follows:
  - If no reasons are defined for the *accountingCollection* attribute, the suppressTerminatingEndRecords flag has no effect since accounting is disabled.
  - When at least one reason is defined for the *accountingCollection* attribute, the suppressTerminatingEndRecords flag indicates that accounting records are generated only for calls originating from the provisioned MPANL. Accounting records are not generated for calls received at this MPANL.
  - If the suppressTerminatingEndRecords flag is not set when at least one reason is defined for the *accountingCollection* attribute, then accounting records are always generated for calls sent from or received by this MPANL.

For detailed procedures describing how to provision MPA voice accounting, see NN10600-745 *Nortel Networks Multiservice Switch 7400 Operations: Multiservice Passport Access Network Link* .

MPA voice accounting in special situations

Several situations exist that affect the generation of accounting records:

- "What happens when the node time changes" (page 70)
- "What happens on CP switchover" (page 71)
- "What happens when accounting is enabled or disabled" (page 71)

What happens when the node time changes

If the node time in TODA mode is advanced ahead of the existing TODA time, an accounting record for that call will be generated at the adjusted time. For example, a TODA changeover time is changed from 10:00 to 10:05. An accounting record for the changeover time of 10:00 will be generated at the new time of 10:05.

Multiple records are not generated if the TODA time is changed and the new time skips more than one TODA changeover. Only one record corresponding to the last changeover is generated.

If the node time in TODA mode is moved back at least ten seconds before the TODA call, the accounting record for that call will be generated again at the next TODA changeover. For example, if there is a TODA changeover at 10:00 (for which a record has been generated) and at 10:05 the time is adjusted back to 9:55, then the accounting record is generated once more at 10:00. If time is moved back by less than 10 seconds, the accounting record is not regenerated.

Intermediate accounting records are generated every 12 hours for calls that are connected for long periods of time and are in Timer mode (when TODA is disabled). The interval between two intermediate accounting records which is 12 hours stays the same even if the node time is adjusted. For example, if an accounting record is generated at 9:00 a.m. the next one is due at 9:00 p.m. If the node time is moved forward by 2 hours, the next record is due and is generated at the new time of 11:00 p.m.

As a general rule, the start time and end time fields in the accounting record always represent the node time. They are affected by time changes including manual or automatic time adjustments.

The elapsed time always corresponds to the exact length of the accounting interval. It is calculated from a clock that is not affected by adjustments made to the node.

What happens on CP switchover

The CP switchover is handled by the DCS which is also responsible for maintaining the TODA changeover notification. As for accounting itself, even when a TODA changeover notification is lost because of a CP switchover, there is no fatal impact. The cell counts for each connection continue to record the traffic. The counts are reported in the next or in the final accounting record, which is issued anyway. In this case, the record contains the cell counts that have accumulated over the two accounting intervals.

What happens when accounting is enabled or disabled

If accounting is enabled or disabled, MPA voice accounting has the following effects:

- active calls are dropped
- MPANL is reset
- final accounting records are generated for dropped calls after accounting is disabled and the configured view is activated

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