297-1771-132

Digital Switching Systems

DMS-Spectrum Peripheral Module

PRI General Description

DMSSPM15 Standard 04.02 April 2001

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Standard 04.02 for SP15. Modified Chapter 5, “PRI-SPM software” based on SR NV00544.

February 2001

Standard 04.01 for SP15. Added the following for the release:

- Added section entitled “Provisioning of 100/250 PRI trunks on the same SPM” to Chapter 3, “PRI-SPM overview.” This was based on feature 59025428.
- Made the following changes to Chapter 5, “PRI-SPM software”:
  - — Added section entitled “AT&T PRI variant for DMS-500” based on feature 59018675.
  - — Added section entitled “Database interaction” based on feature 59017193.

October 2000

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July 2000

Standard 03.01 for SP14 (CSP13/14). This release includes the following changes:

- Added “PRI provisioning guidelines” section to Chapter 4. Portions of the material now in this section previously was held in the hardware section of the first appendix.
- Made various editorial corrections for grammar and style.

February 2000

Standard 01.03 for SP12 (CSP13). Upissued to include additional technical review feedback.

- Re-wrote “PRI Trunk Provisioning” section to clarify the two differences between provisioning trunks on a DTCI and on an SPM.

- Re-wrote the text in the final bullet on page 4-2 to clarify the differing number of HDLC channels supported by the two versions of the DLC RM card (NTLX72AA and NTLX72BA).

January 2000

Standard 1.02 for SP12 (CSP12). This is the standard release of this document. This release includes comments and feedback from internal reviews.

December 1999

Standard 01.01 for SP12 (CSP12). This is the initial release of this document, and includes comments and feedback from internal review.

Contents

About this document

When to use this document

Use this document when you need general information about Primary Rate Interface (PRI) on the DMS-Spectrum Peripheral Module (SPM).

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the next software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but rereleased in the same software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, check the release information in *Product Documentation Directory, 297-8991-001*.

References in this document

The following documents are referred to in this document:

- *DMS-Spectrum Peripheral Module Service Implementation Guide*, 297-1771-301
- *SPM-Spectrum Peripheral Module Feature Description Reference Manual*, 297-1771-330
- *DMS-Spectrum Peripheral Module Hardware Maintenance Reference Manual*, 297-1771-550
- *DMS-Spectrum Peripheral Module Commands Reference Manual*, 297-1771-819

SPM information is also is included in the following product-specific NTPs. The exact name and NTP number depend on your product.

- *Trouble Locating and Clearing Procedures*
- *Alarm Clearing Procedures*
- *Recovery Procedures*
- *Routine Maintenance Procedures*
- *Card Replacement Procedures*
- *Operational Measurements*
- *Data Schema*
- *Logs*

What precautionary messages mean

The types of precautionary messages used in NT documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION - Information needed to perform a task

ATTENTION

If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

DANGER - Possibility of personal injury

DANGER

Risk of electrocution

Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high-voltage lines. Until the fuses are removed, the high-voltage lines are active, and you risk being electrocuted.

WARNING - Possibility of equipment damage

WARNING

Damage to the backplane connector pins

Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors.

CAUTION - Possibility of service interruption or degradation

CAUTION

Possible loss of service

Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module. Subscriber service will be lost if you remove a card from the active unit.

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Please note that the asterisk also may be used for other purposes, such as a wildcard metacharacter or as a symbol representing scalar multiplication; the context of the appearance of the asterisk serves to clarify its use.

1 Introduction

Spectrum is a multi-application, high-speed platform developed for the DMS family of switches. The Spectrum Peripheral Module (SPM) has a flexible, modular, and highly reliable architecture. This document specifies the addition of ISDN PRI capabilities to the core Spectrum platform.

Spectrum provides many additional or enhanced capabilities not provided by other DMS peripherals. Noteworthy attributes provided by the SPM platform are:

- optical interface
- high density: equivalent of 4.2 digital trunk controller (DTC) frames (4032/960).
- lower operating costs: heating, ventilation, air conditioning (HVAC) and commercial AC power requirements decrease at a linear rate relative to the number of frames.
- more reliable synchronization

Nortel Networks believes that the SPM is and will be the platform of choice to meet the challenge of evolving networks of today and tomorrow. The SPM is designed to enhance the operating company's market position by increasing revenue opportunities and containing costs in current and future applications. Initial SPM applications meet increased demand for cost-effective trunking with a high-speed SONET interface and ISDN PRI, ISUP, and PTS interfaces. In the future, new functions and applications on the SPM platform will allow service providers to meet increased demands for new connectivities as technologies develop.

2 DMS-SPM overview

The DMS-Spectrum Peripheral Module (SPM) is a multi-application, high-speed peripheral for the DMS-family of products. The SPM supports many interfaces and services on a common platform.

The architecture of the SPM consists of

- redundant, duplexed common equipment modules (CEMs) that perform centralized SPM control functions
- resource modules (RMs) of several types that provide processing for other services and for trunk interfaces, including the
  - — OC-3 resource module, which is a redundant, 1+1 non-revertive, point-to-point OC-3 optical interface
  - — voice service processor (VSP) module, which provides integrated echo cancellation
  - — digital signal processor (DSP) module, which provides services such as tone synthesis, integrated testing, continuity testing, and tone reception
  - — asynchronous transfer mode (ATM) resource module, which provides a redundant, 1+1 non-revertive, point-to-point OC-3c optical interface.
  - — data link controller (DLC) resource module, which provides primary rate interface (PRI) capabilities generally equivalent to digital trunk controller - ISDN (DTCI) peripheral

To learn more about the overall capabilities of the SPM as a whole, please consult the *DMS-SPM Service Implementation Guide*, 297-1771-301.

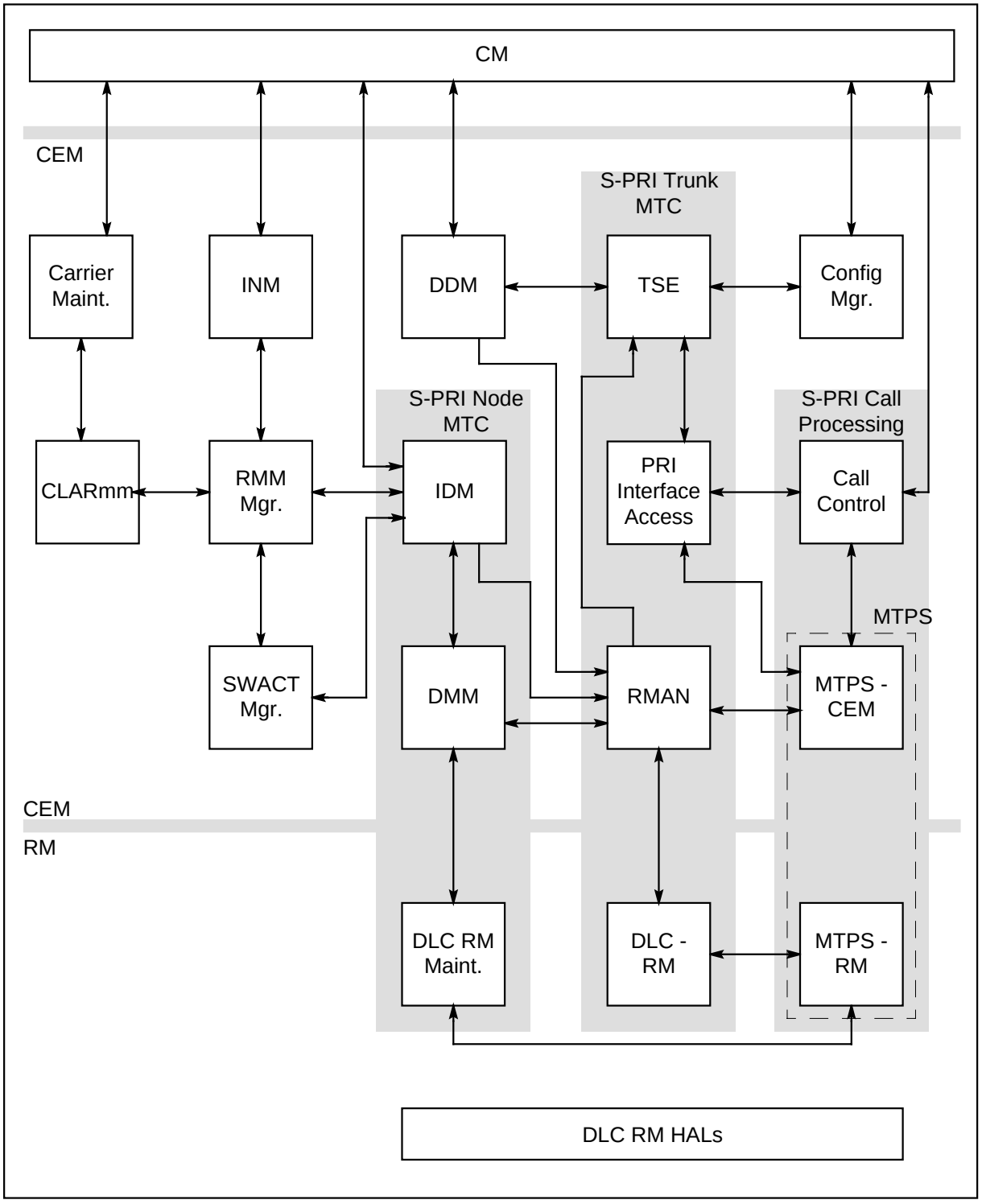
3 PRI-SPM overview

The primary rate interface (PRI) application takes advantage of the existing, re-usable Spectrum base components. At the same time, PRI on the SPM (S-PRI) provides a flexible architectural framework so development of features and capabilities requires minimal effort.

System Diagram

The S-PRI architecture has three main components: trunk maintenance, node maintenance, and call processing. Figure 1 illustrates the composition of these components using a shaded background.

Figure 3-1 SPRI functional component block diagram



System survivability and recovery

The CEMs and RMs have recovery features which preserve system integrity. The physical location that is at fault determines what type of recovery action to perform: a fault in the CEM results in a switch of activity (SWACT), and a fault in the RM results in a sparing action. The following sections describe SWACTs and sparing.

Switch of Activity (SWACT)

A hardware fault in the active CEM initiates a SWACT from the active to the stand-by device. A SWACT also keeps services available during a software upgrade and supports manual (through HMI), temporary change of activity for maintenance purposes.

Sparing

Sparing is the process by which a back-up RM replaces a failed RM or an RM that is to undergo maintenance activity. Sparing, in this context, refers to resource modules, and (in this publication) specifically to DLC resource modules.

Sparing of RMs maintains high availability of devices used to provide services to subscribers. The SPM allows sparing of RMs to be independent of the activity state of the two CEMs.

The sparing action itself can be categorized as controlled or uncontrolled.

- A controlled sparing action occurs when it is manually requested through the human-machine interface and the request does not include the force option. Active calls remain active.
- An uncontrolled sparing action occurs when a fault is detected or when it is manually requested throught the HMI and the request includes the force option.

  Note: If an autonomous sparing action occurs due to a hardware fault, the SPM attempts “warm sparing.". However, if the warm sparing attempt fails, the sparing attempt will proceed as a “cold spare" and all active calls will be cleared.

DLCs are spared in a 1:1 manner; protection groups contain one working RM and one spare. Sparing groups are provisioned using data schema tables MNPRTGRP and MNCKTPAK. (For more information, see the *Data Schema Reference Manual* for your product.)

Human-machine interface

User interface

Node/device interface

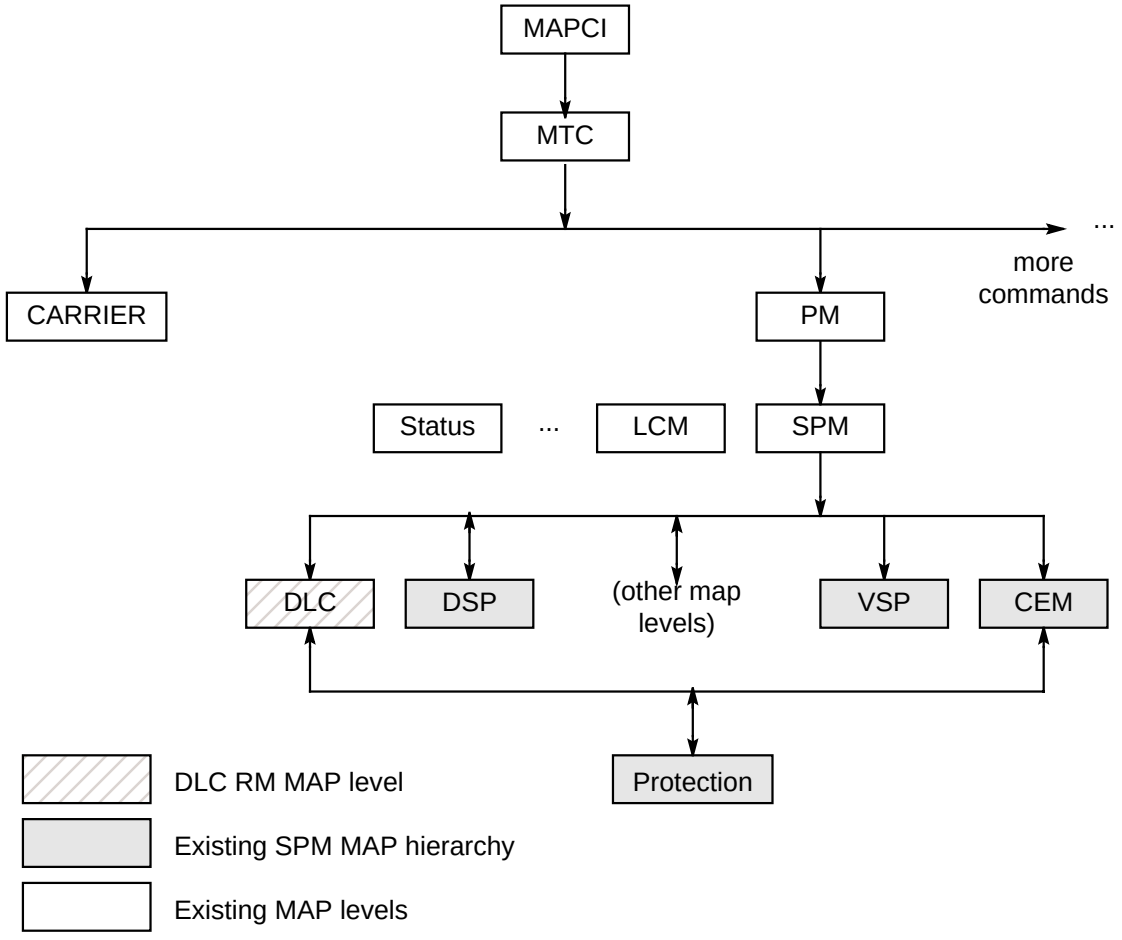
The goal of the user interface is to provide you with a consistent view of the system. The overall design attempts to maintain a uniform look-and-feel. The following are some of the highlights of the user interface:

- The MAPCI-based user interface is presented to you in a hierarchical manner. You can traverse this hierarchy to access various parts of the system. Various MAP levels within this hierarchy are presented so that the context of the level is maintained. For instance, the query command applies to the screen you currently see.
- The user interface provides you with a telescoping feature to help you interact with a specific portion of the system (for example, an HDLC logical link within a particular SPM or RM) without having to worry about the overall system.
- The layout of MAP hierarchy minimizes the need to jump across branches of the command tree.
- There is a set of commands to improve the effectiveness of the interface. Some of the commands include “ListAlm" to list all the alarms associated with the currently-displayed entity, and “AlmRpt" to obtain a detailed report of a specific alarm.
- When possible, menu choice remain consistent throughout the hierarchy.
  - — Navigation commands (such as “post" or “translate") use menu numbers in the range 0 through 5.
  - — Operational commands (such as test, load, and SWACT) use the range 6 through 13
  - — Information-oriented commands (such as “query," or “list alarm") use the range 14 through 18.

  If a command applies to more than one screen, it appears at the same number on all screens.

The user interface MAP hierarchy is shown in the following figure.

Figure 3-2 DLC user interface in the MAP hierarchy



Note: This figure is not an exhaustive set of MAP levels. Its intent is merely to show the placement of the DLC MAP level.

Trunk access interface

PRI trunks on SPM use the same MAP levels used by PRI trunks on XPM at the TTP level for B-channels or at the PRADCH level for D-channels. The difference is transparent to you when working with trunks at the MAP display.

Log message system

PRI on the SPM supports both new and existing logs. Existing logs follow the DMS-100 family log format for the first part of the log. Subsequent information may be SPM specific. Existing logs that are part of the SPM PRI design include ISDN and TRK logs.

Operational measurements (OMs)

The PRI on the SPM supports the following existing OMs:

- PM - PM system busy, manual busy, and on-line fields
- PRADCHL2 - link resets and CRC errors
- PRAFAC - network ring-again service
- TRK - trunk group attempts, completions, and usage
- WIDEBAND - dialable wideband counts
- XPMOCC - time in various processor percent-occupancy ranges

Some OMs are implemented in an SPM-specific manner, including an equivalent for XPMOVLD. Because event counts in these OMs are architecturally specific, a new OM group for SPM overload exists.

Alarm system and diagnostics

The DLC RM uses the existing SPM alarm subsystem. You can assign the severity (critical, major, or minor) to each of four alarm types (SYSB, ISTB, MANB, and PROTFAIL) when provisioning the RM in table MNCKTPAK, or you can use the following default values.

- SYSB - critical
- PROTFAIL - critical
- MANB - major
- ISTB - minor

A test request from the MAP command interface initiates diagnostics on the DLC circuit pack by using the diagnostic subsystem. The subsystem is responsible for executing and interpreting the results of the tests, writing error logs, and reporting faults to the application that requested the diagnostics.

The platform maintenance application is capable of running diagnostics on a particular hardware component of the resource module. The granularity is restricted by the number of diagnostic levels, each representing a unique hardware component registered with it. However, the test request from the MAPCI is interpreted to run all diagnostics (level 0 to a maximum value) on the RM by the maintenance application.

The test runs until one of the following conditions is true:

- all the tests are complete
- a device reports a critical failure. (Tests continue to run if non-critical failures occur.)

Provisioning

Table control (device/TRK)

MAP provisioning operations

MAP provisioning provides for a logical step-by-step navigation method to fully define an SPM, including both equipment and carriers. The telescoping capability of MAP hierarchies simplifies the task of zooming to a particular sub-element.

The data model is structured similarly to the network management model and presents a logical flow from container (the node and shelf) to contained objects (modules, links, or carriers provided by module and sub-carrier contained within the carrier).

PRI provisioning

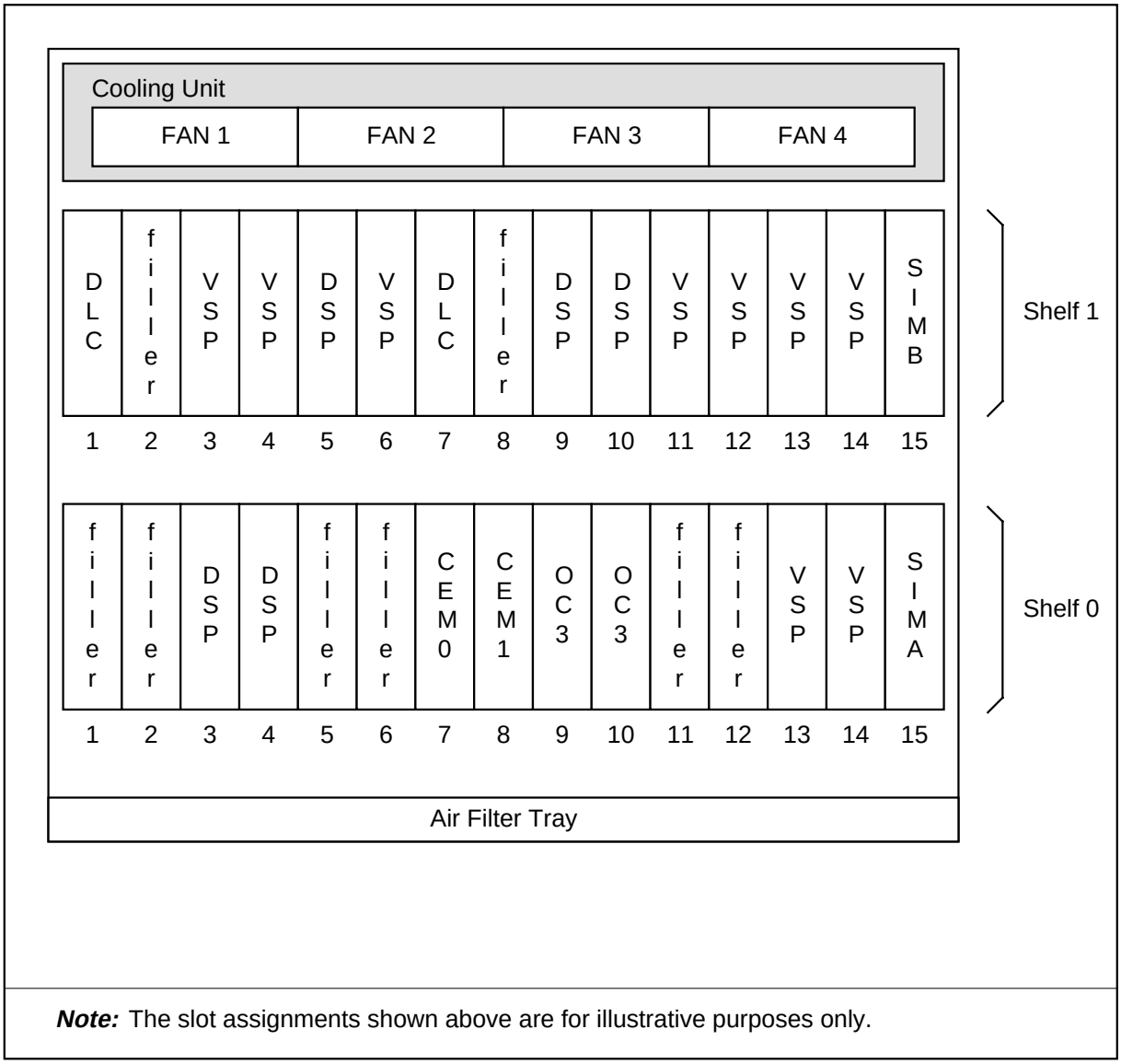
The S-PRI application segregates PRI service from access. S-PRI uses the same MAPCI levels as DTCI peripheral modules to manage the SPM-based trunks.

The S-PRI access layer requires the base platform layers. The intent is to create an HDLC message interface subsystem which does not preclude future services. PRI has only one logical link (56k or 64k channel) but many other application require multiple logical links or physical links with varying amounts of bandwidth. With enhanced functionality, the DLC RM can mix different DLC protocols easily and provide a more cost effective solution.

Hardware provisioning

The following figure shows an example of an SPM configuration for 100% echo cancellation and installed PRI interfaces.

Figure 3-3 Shelf layout 100% echo cancellation and PRI interfaces



Note: The slot assignments shown above are for illustrative purposes only.

The provisioning is as follows:

- always required:
  - — 4 fan units
  - — 2 SIMs
  - — 2 CEMs
- OC3 interface, 1+1 sparing
  - — 2 OC-3 interface RMs
- DSP services
  - — 5 DSPs (4+1 sparing), providing tone synthesizers (TONESYN), continuity tone receivers (COT), and DTMF tone receivers with dialtone generation (DTMF+DT)
- 2 DLC RMs.

To provide 100% echo cancellation, two configurations are recommended:

- Provision NTLX66AA or NTLX66BA VSP RMs in slots 13 and 14 of shelf 0 and slots 3, 4, 6, and slots 11-14 of shelf 1.
- Provision NTLX85AA or NTLX86AA VSP RMs in slots 3, 4, and 13 of shelf 0 and slots 5, 6, and 14 of shelf 1

All unused slots must be equipped with filler modules to maintain the integrity of thermal airflow and eletromagnetic interference protection.

DLC RM Provisioning

The PRI application requires two DLC RMs. One is the active RM, while the other is a hot stand-by. The SPM requires no DLC RMs if the SPM does not provide PRI services.

The DLC RM can be provisioned in any available RM slot (shelf 0, slots 1-6 and 11-14, and shelf 1 slots 1-14). In an SPM using the high-speed backplane (PEC code NTLX51BA), Nortel Networks suggests you use slots 1 and 7 of shelf 1. Because the DLC places only modest bandwidth demands on the backplane, using these slots assures the high-speed slots remain available for circuit packs that require greater capacity. Each DLC RM has the capability to terminate 84 D-channels from a fully PRI-configured OC-3 (one from each of the 84 possible 23B+D PRI carriers).

PRI Trunk provisioning

The process for provisioning D- and B-channel trunks is very similar between a DTCI and an SPM. There are only two provisioning-related differences. The first is that for SPM an additional table, MNPRIIID, exists to associate each DS1 carrier and its interface identifier. (On a DTCI, the interface IDs are in

table LTCPSINV.) The second provisioning difference involves the addition of table MNHSCARR for trunks on an SPM.

To provision a PRI B-channel and D-channel on an SPM, you must enter datafill in the following DMS tables:

- CLLI
- TRKGRP
- MNHSCARR (SPM specific)
- MNPRIIID (SPM specific)
- TRKSGRP
- TRKMEM
- LTDEF
- LTMAP

Except for MNPRIIID, you enter datafill for all the preceding tables on an SPM platform the same way as on the DTCI platform. The only difference is whether you enter type-of-node datafill values of SPM or DTCI in tables TRKSGRP and TRKMEM.

Provisioning differences exist between the SPM and DTCI platforms due to differences in the transmission facilities. The SPM is OC-3 based, while the DTCI is DS-1 based. On the DTCI, DS-1 tables LTCPSINV and CARRMTC provision DS-1 carriers. On the SPM, table MNHSCARR provisions DS-1 carriers. The SPM platform does not use the LTCPSINV table.

As mentioned, the only PRI-specific provisioning difference between the DTCI and SPM platforms is how you assign interface identifiers to DS-1 carriers. On the DTCI platform, table LTCPSINV associates DS-1 carriers with their interface identifiers. On the SPM, table MNPRIIID performs this association.

Provisioning 100/250 PRI trunks on the same SPM Because the DMS-500 office has both 100 and 250 PRI trunks types, there are additional PRI trunk provisioning differences in the DMS-500 offices. To avoid using two SPMs to provision 100 and 250 trunks, two different term types are provided. Term type PRAB500 is used to reference PRI250 trunks, and PRAB term type is used to reference PRI100 trunks.

Provisioning of both 100/250 PRI trunks on the same SPM is controlled by office parameter “LOCAL_LD_SPRI_ON_SAME_SPM” found in table OFCENG. In order to activate support for both PRI 100 and 250 tunks on the same SPM, LOCAL_LD_SPRI_ON_SAME_SPM must be set to ‘Y’ and the

following termtype and exec lineup combination be datafilled in table MNNODE:

- (PRAB SPMEX) for PRI 100 trunks
- (PRAB500 SPM250) for PRI 250 trunks

Power budgets

The DLC RM does not exceed the maximum allowable power rating for an RM slot. Therefore there are no special power considerations for the DLC RM.

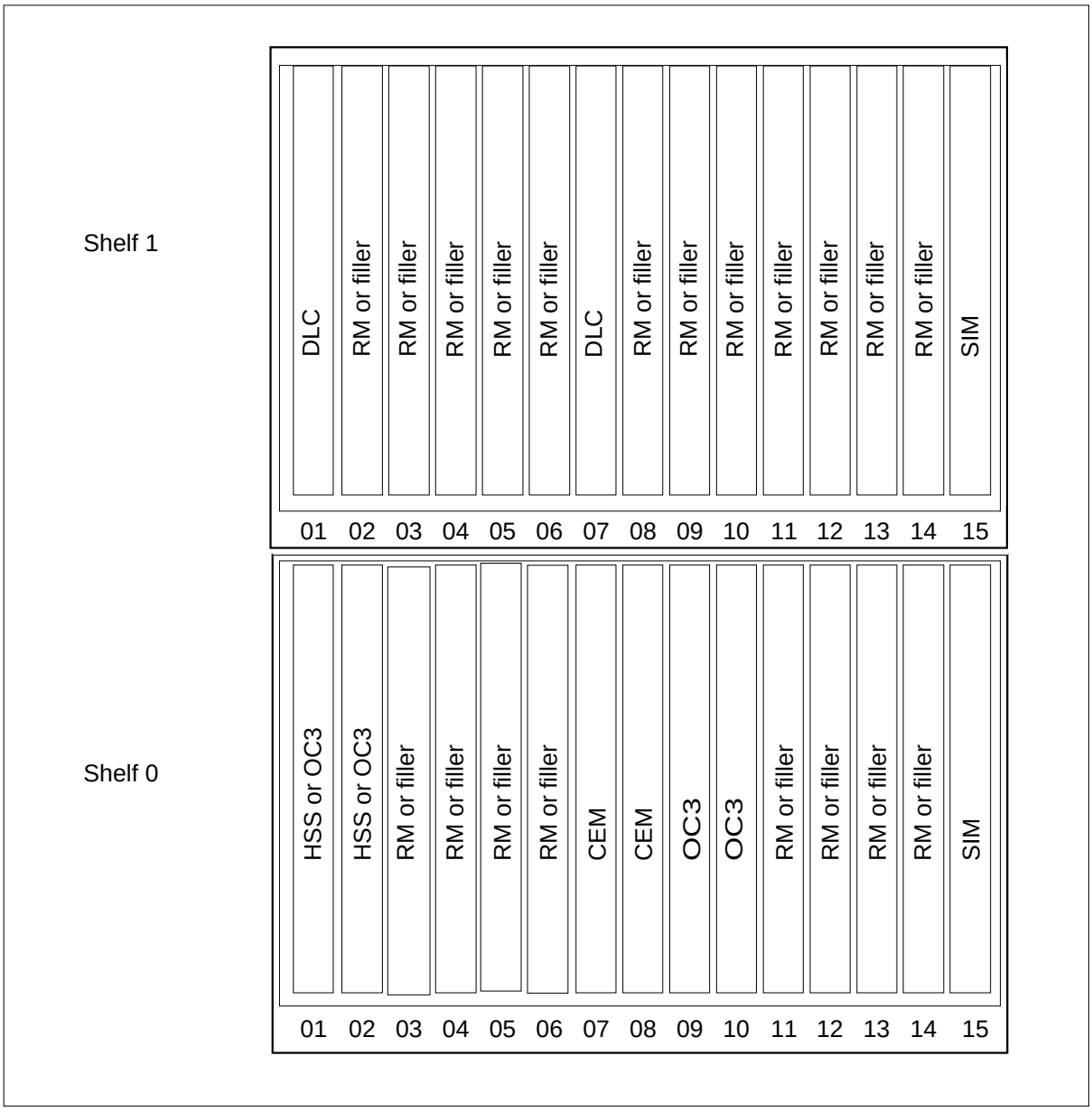
DS-512S host links

The PRI application requires that you provision all four DS-512 ports.

4 PRI-SPM hardware

The hardware required for the primary rate interface (PRI) trunking application is built on the Spectrum Peripheral Module (SPM) base platform. No updates or changes are required to the platform or base hardware for the PRI function. PRI does require an additional module, a Data Link Controller (DLC) (NTLX72AA) resource module (RM). The next figure is an illustration of slot positions for a DLC in a four high-speed slot (4HSS) backplane.

Figure 4-1 RM locations 4HSS



Data link controller

The DLC RM provides data-link protocol termination for multiple port data communications using high-level data link control (HDLC) based frame structures. The DLC RM serves as a bridge between external link layer protocols based on HDLC and a proprietary Digital Multiplex System (DMS) internal messaging protocol, DMSW. Nortel Networks recommends provisioning the DLC RMs in slot positions 1 and 7 of shelf 1 for each SPM node. DLC RMs are always provisioned in pairs.

The hardware architecture of the DLC RM is flexible and expandable. It can accommodate future HDLC based applications with minimal changes or additions.

The principal functions of the DLC RM are:

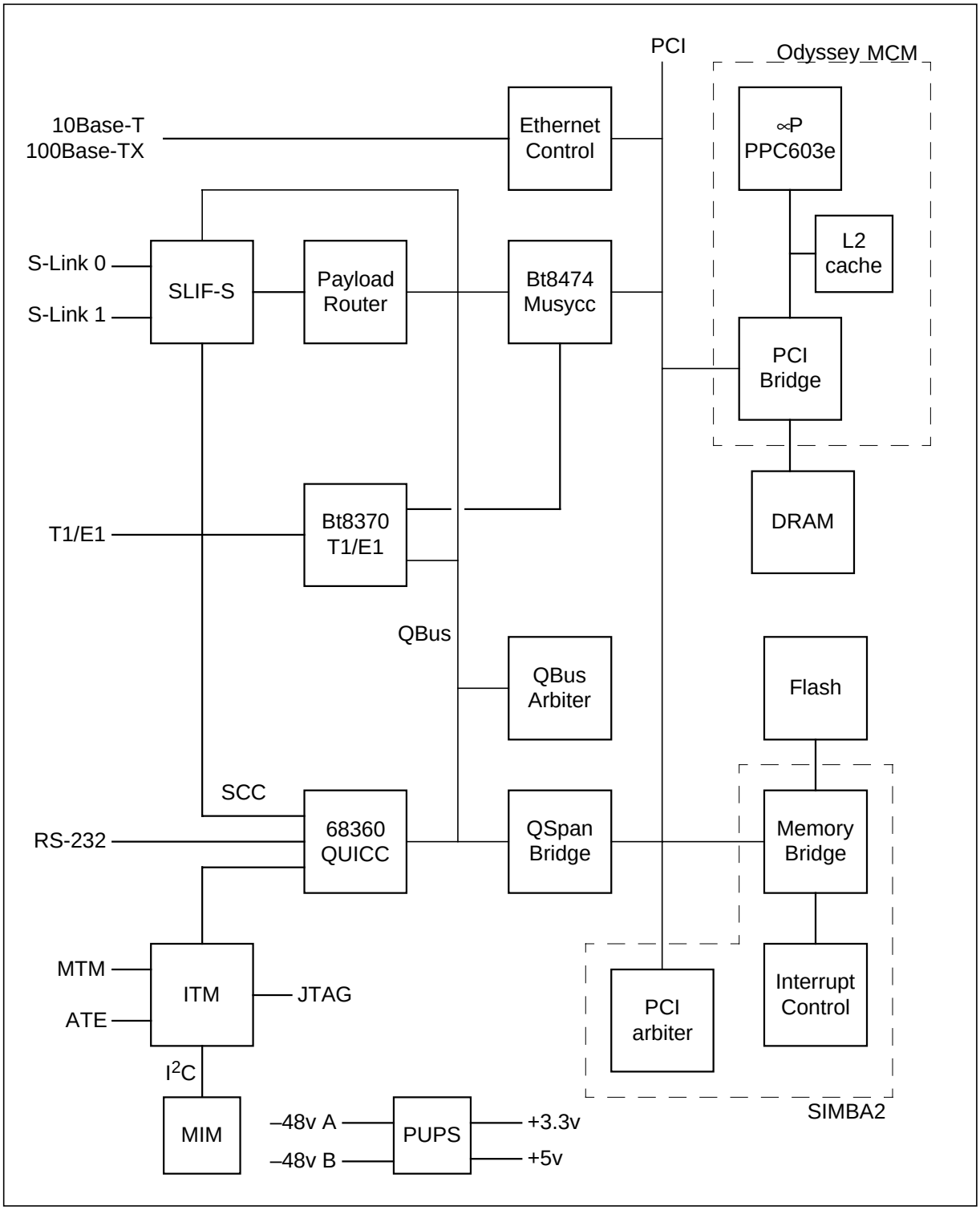
- termination of layer 2 HDLC protocol messages
- termination of proprietary data link protocol messages to and from the active and inactive common equipment module (CEM)
- protocol conversion between HDLC frames and DMSW messages for layer 3 data to be processed within the SPM or DMS core.
- Statistical multiplexing, demultiplexing and retransmission of HDLC frames for layer 3 data to be processed externally.
- transmission and reception of layer 1 data to and from the CEMs using the SPM serial bus

The DLC RM provides:

- support for Q.921 link access procedure on the D-channel (LAPD)
- digital signal level 0 (DS-0) sub-DS-0 (16 kb/s) and wideband (n*64 kb/s) data rates
- 100 MHz PowerPC 603e-based processing engine
- integrated test and maintenance support employing an Institute of Electrical and Electronic Engineers (IEEE) 1149.1 compliant JTAG boundary scan master
- on-board point-of-use power supply. Typical power usage is 21 W, not to exceed 25 W
- an expandable architecture that supports a range of HDLC terminations up to 256 independent channels. The initial hardware release, NTLX72AA supports 128 channels.

The next figure illustrates the functional block diagram of the DLC RM. The sections that follow explain various components and capabilities of the DLC RM.

Figure 4-2 Block diagram DLC RM



Serial link

A serial link (S-link) interface common to all RM types is responsible for the physical interface. The S-link

- recovers data over the S-links from both CEM modules
- monitors link health using cyclic redundancy checks (CRC) checks
- extracts the DMSW messaging channels from both CEM modules
- selects pulse code modulation (PCM) data from the CEMs, based on CEM activity.
- formats the selected data stream, places it onto an internal parallel bus for access by other resources within the RM
- broadcasts outgoing PCM data to both CEMs
- inserts outgoing DMSW messaging timeslots to each CEM
- provides facilities for low-level link, RM control and RM status facilities, including test and identification storage

Note: An S-link connects the DLC RM to each of the two CEMs.

Payload router

The payload router converts the multiplexed parallel PCM bus of the slave S-link and the individual serial data streams of the HDLC controllers. Channel mapping is fixed in the payload router since DS-0 switching is performed in the CEMs and channel to port assignments are configured within the HDLC controllers.

Multi-channel HDLC controllers

The generic HDLC layer 2 termination function is accomplished using a set of HDLC controller devices. The HDLC controllers provide the following communication functions:

- flag insertion and detection
- payload insertion and extraction
- zero-bit insertion and deletion for flag transparency
- CRC generation and checking
- error detection
- inter-frame idle insertion
- aborted message indication and detection

Serial time division multiplexed (TDM) buses send HDLC messages to and from the payload router. On the processor side, each HDLC controller has direct memory access to a common host bus for retrieving and deposit of the

message payload into the main memory. Internal buffering in both the transmit and receive directions reduces the overhead in host bus usage. Message data structure is controlled through a set of descriptors that are stored in the main memory. Each HDLC controller manages up to 128 channels. The hardware architecture supports up to four controllers per module.

Processor complex

The processor complex in conjunction with the HDLC controllers perform all specific link layer protocol. The processor complex is responsible for the local initialization, configuration and maintenance of the RM. The processor complex is also responsible for communication with the CEMs using the S-link messaging facility.

A 100 MHz PowerPC 603e is integrated with a level 2 cache memory, along with a bus bridge and main memory controller.

A bank of dynamic random-access memory (DRAM) provides storage for the processor, message data buffer and descriptor memory. Flash memory provides non-volatile storage of boot code, internal fault information and an image of the application code.

Quad integrated communication controller

Several of the communication ports on the DLC are implemented using a Motorola 68360 Quad Integrated Communications Controller (QUICC) processor operating in the central processing unit (CPU) mode. A bus bridge adapts the QUICC's bus to the peripheral component interconnect (PCI) bus for communication with the host processor. The QUICC provides the following:

- two serial communication controller buses that transport data to and from the slave S-link DMSW messaging block
- a serial peripheral interface bus for intelligent test bust master (ITM) access
- a universal asynchronous receiver-transmitter (UART) interface used for initial hardware and software debug
- chip select and write enable signals for Q-Bus peripherals
- watchdog and general purpose timers

QSpan bridge

The QSpan bridge adapts the PCI bus to the QUICC bus which provides host processor access to the QUICC and QBus peripherals. The QSpan bridge also permits the QUICC to access the main memory using the PCI bus.

PCI bus arbiter

The bus arbiter receives requests for host bus access from the processor, HDLC controllers, QSpan bridge and Ethernet controller. The PCI bus arbiter grants access to one agent at a time ensuring each agent has fair access to the bus.

Interrupt controller

The interrupt controller provides a consolidation point for all interrupt sources on the module. The interrupt controller presents one maskable and one non-maskable interrupt to the host processor.

Integrated test bus master

The ITM interfaces the system module test and maintenance bus to the RM. Access is provided to the

- internal JTAG bus
- processor communication
- circuit card reset control
- module information memory access
- circuit card light emitting diode (LED) control

Power supply

A DC-to-DC point of use power supply converts the -48V A and B feeds to the +3.3V and +5V supply rails required for the module circuitry.

Electromagnetic compatibility

The DLC RM when inserted into an SPM rack and operating to provide PRI service, does not cause the SPM to fail to meet applicable electromagnetic compatibility (EMC), radio frequency immunity (RFI) or electrostatic discharge (ESD) requirements.

The physical packaging of the DLC RM provides electromagnetic shielding for the circuit card and integrated circuits it contains. This shielding is part of the EMC strategy to meet emissions and immunity requirements. Apertures in the modules prevent leakage of high frequency noise beyond the level provided in the EMC budget. Although the module reduces emissions from the circuit cards and integrated circuits, it does not prevent noise conducted on attached cables. The modules are referenced to frame ground through a gasket to the multi-layer backplane and through the guide pins in the backplane connector.

PRI synchronization requirements

The PRI places no special synchronization requirements on the SPM equipment and continues to work regardless of the synchronization mode selected for the SPM.

5 PRI-SPM software

This chapter describes SPM PRI software components.

Call processing description

Call processing (also known as call control or Callp) functionality provides generic call control requirements. This means that design and implementation of call control procedures is not S-PRI specific. In a generic call control architecture, call control supervises a call from its origination to its termination independently of user-side and network-side signalling protocols.

The following are essential functions of call control:

- provides resources for call completion, UTR, and tone generation
- provides routing information for call completion
- provides or negotiates for resources required for the call

PRI on the SPM (S-PRI) call control is implemented based on both ISUP call control framework and PTS call control. S-PRI does not change prior functionality in the CM. Protocol variants are implemented through subclassing, making call control at the base level.

Primary functions of call control are summarized as follows:

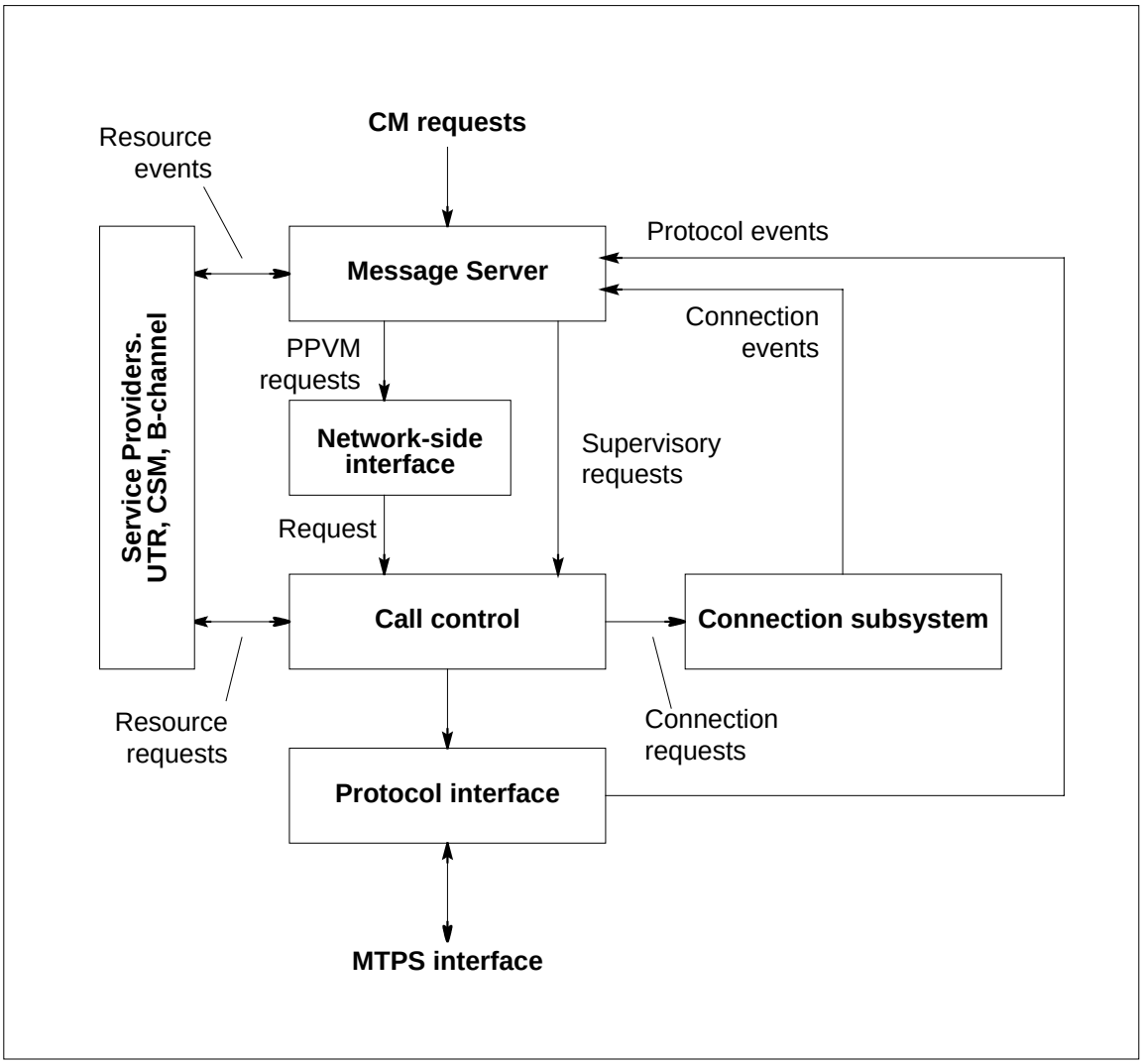
- process PPVM supervision request
- post execs based on events with the call control subsystem
- run a state machine for communicating with the far end
- run the CSM protocol for communicating integrity and CDB events
- provide an abstraction between SCP messaging and Q.931 messaging.

The call control component is derived based on classes defined by the SPM call processing framework. The call control framework processes externally generated PPVM messages and Q.931 events with their related data in SCP format.

The CM sends its supervision in the form of PPVM primitives. The primitives are either physical or logical actions to perform. Physical actions are directed toward connection-oriented activities such as integrity monitoring and PCM connections. Logical actions are directed toward Q.931 protocol activities such as B-channel management and Q.931 signalling.

The call control architecture in the following figure shows the message flow of the call control functional blocks. Network side messaging and user side messaging are encapsulated and can be replaced based on the type of messaging. Network and user side messaging is normalized into generic events processed within call control.

Figure 5-1 Call control, high level overview



Trunk maintenance description

The CM, CEM, and RM each have software components for Spectrum PRI trunk maintenance. The following sections explain these components.

CM trunk maintenance software

Trunk maintenance software in the CM is composed of the following major components:

- B-channel (BCH) and D-channel (DCH) state machines: maintain the states of the B and D channels. These state machines must respond to external events from carrier, speech, and MAP maintenance. They also must respond to protocol events sent from the CEM.
- Carrier Maintenance: maintains the DS-1s contained within the OC-3 carrier. When carriers come in and out of service, the affected applications must be informed. In the case of PRI, the BCH and DCH state machines are notified and the appropriate actions are taken.
- Speech Link Maintenance: maintains the DS-512 links into the DMS-Core network. As in the case of carriers, when speech links come in and out of service, the affected applications must be informed. In the case of PRI the BCH and DCH state machines are notified and the appropriate actions are taken.
- MAP Maintenance: provides the interface to the user. Through the MAP, a craftsperson can perform maintenance actions on PRI resources. These maintenance actions include BSYing and RTSing BCHs and DCHs. For example, the craftsperson can request SWACTs of DCHs. The PRADCH level of the MAP contains the most-frequently used DCH maintenance actions. The TTP level contains the most-frequently used BCH maintenance actions.
- Application Handler: provides applications such as trunk maintenance message routing and delivery functions unique to the requirements of individual applications.
- Table Control: provides a means to datafill PRI BCHs and DCHs. A new table allowing users to associate application data with carriers in the OC-3 hierarchy is being added.

CEM trunk maintenance software

The CEM trunk maintenance software is composed of the following major components:

- TSE (Trunk "Stuff" Encapsulator): maintains a view of the DS-1 carriers and their associated resources. In the case of PRI, carriers are associated with BCHs and DCHs. All trunk maintenance actions in the CEM are driven from TSE. For example, if a DCH is brought into service, TSE receives an RTS request from the CM and then instructs MTPS to bring the DCH and its associated data links into service. When MTPS has

successfully RTSd the DCH, MTPS informs TSE. TSE in turn sends a message to the CM trunk maintenance code indicating that the DCH is in service.

- MTPS (Message Transfer and Protocol Stack): insulates details of the protocol being used from its client processes. In the case of PRI, the Q.931 and Q.921 protocols are used. This insulation removes the burden from the TSE to have to understand the exact details of how a DCH or BCH is brought into service from the perspective of the protocol.
- Call Processing: processes ISDN PRI calls and plays a role in BCH maintenance. When TSE receives a request to bring a BCH into service, call processing primitives are sent to configure the call processing component.

RM trunk maintenance software

The RM trunk maintenance software is composed of the following major components:

- MTPS (Message Transfer and Protocol Stack): Layer 2 and Layer 1 portions of MTPS reside in the RM.
- Config Manager: Receives DCH channel configuration from the CEM and requests MTPS to configure the hardware.

Platform node and device maintenance description

The CM, the CEM, and the RM processors contain the software for Spectrum PRI platform maintenance. Besides the obvious goal of delivering the required functionality, the follwoing design goals characterize platform maintenance software:

- Achieve a high degree of reuse of the existing Spectrum node/device maintenance framework.
- As one of the first few RMs added to the Spectrum base platform, identify opportunities to make the node/device maintenance framework more generic, more maintainable, and more extensible for future applications.

The following sections give a brief overview of the software components in the CM, the CEM, and the RMs.

CM platform maintenance software

The CM platform maintenance software consists of these components:

- Integrated Node Maintenance (INM) / Integrated Device Maintenance (IDM): These generic maintenance frameworks, which reside in portions

on both the CM and CEM, handle all routine maintenance requests (BSY, TST, RTS, etc.).

- MAPCI and Table Control: These systems function as the user interface to allow the craftsperson to provision and maintain the SPM and its RMs. Maintenance commands issued from the MAP are sent through the SIS interface to INM/IDM for processing.
- Logs and Alarms: Provide a feedback mechanism which notifies craftspersons of problems.
- OAM Database: Contains information related to the various entities (such as SPM nodes, shelves, RMs, or protection groups) that comprise an SPM. The database is tied into the other systems mentioned above.
- DDM (Distributed Data Manager): Transports the maintenance specific tables in the CM to the CEM for use by CEM maintenance components.

CEM platform maintenance software

CEM platform maintenance software components include:

- SPM Maintenance Database: Represents the SPM maintenance-specific DMS information on the CEM side. SPM maintenance uses the DDM (distributed data manager) to transport all physical circuit pack datafill for the SPM from the CM to SPM.
- IDM Local Database: Contains configuration information for both provisioned protection groups and the devices contained in the protection or device groupings, and the dynamic status information for each of the device maintained by IDM.
- IDM Configuration Manager: Triggers the creation of the appropriate ObjecTime objects based on the configuration information contained within the IDM local DB.
- DLC Protection Group: gathers the same type of devices for sparing.
- DLC Device Grouping Actor (DGA): Encapsulates the device maintenance behavior that pertains to all devices, or a subset thereof, provisioned within the same protection group.
- ScreenerRouter: Screens incoming maintenance requests and routes them to the appropriate entity. If a unit maintenance request comes in while device maintenance is in progress, this component aborts all device maintenance.
- LoaderController: Provides the infrastructure for performing software upgrades on the devices (RMs). Thus, the LoaderController is responsible for any RM software upgrades, which include the initial preparation and the necessary cleanup after the transmission of the loadfile records to the RM.

- Sparing Manager: Performs protection switches between the devices provisioned in the device grouping. The Sparing Manager responds to externally generated requests; the Sparing Manager does not determine when and when not to spare). Sparing triggers can be received indirectly from both the device's user interface or from the DMM.
- Base Device Maintenance Manager (DMM) Container: Represents the entire protection/device grouping to the system. The individual devices within the device grouping are represented by a device maintenance manager (DMM). A DMM is the maintenance representative of a device being maintained by IDM. In SPM, devices maintained by IDM are resource modules. As such, the maintenance behavior of each RM is described by exactly one DMM on each CEM. Control of maintenance requests such as BSY, TST and RTS reside here.

RM maintenance software

RM platform maintenance software components include:

- Maintenance Supervisor: Processes maintenance requests from either the CEM's device maintenance routines or internal maintenance requests within the RM. The Maintenance Supervisor forwards diagnostic requests to the diagnostic driver, maintains RM states to reflect the actual status of the module, and informs interested parties of any RM state changes. The Maintenance Supervisor also forwards RM fault reports to the CEM's device maintenance routines so that corrective action can be taken to recover from any degradation of services.
- Fault Manager: Receives notifications of RM state changes and either enables or disables fault reporting for the Fault Actors based on the current state. This component is part of the RM maintenance framework
- Diagnostic Driver: Provides the mechanism to initiate the diagnostics according to the test dependency level bound with the diagnostic driver. It allows either a single test or multiple tests to be executed. This component is part of the RM maintenance framework.
- DLC Device Diagnostic Container: The components held within this container interface with the hardware abstraction layers (HALs) and invoke InService or OutOfService tests on the processor, S-Links, ITM, or DLC hardware.

DLC software relationships

Figure 2, “DLC RM software relationships” on page 2-10 illustrates the relationships among the following components:

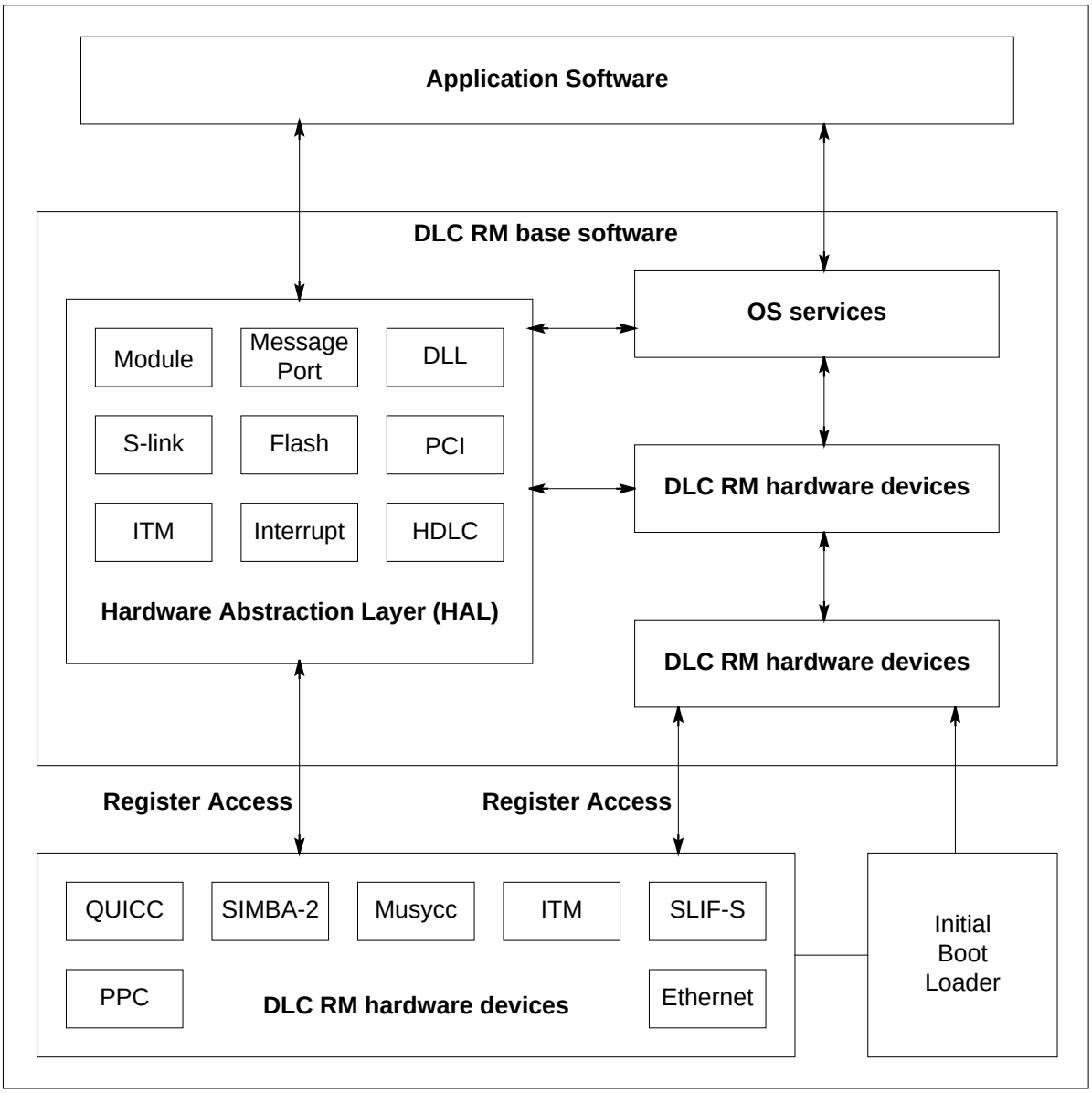
- Operating System (OS): The DLC RM uses VRTX Operating System.
- OS Services: This consists of base utilities and common services, and helps to isolate the application software from OS-dependent functions.

- Board Support Package (BSP): The BSP creates an insulating layer between the OS Services and the specific hardware implementations. This eases the transition for new hardware introduction. Additionally, the BSP supports the run-time kernel of external vendors, and provides a uniform application interface for its services.
- Initial Boot Loader (IBL): The IBL is the smallest possible set of non-downloadable firmware necessary to allow download of software in the field.
- Hardware Abstraction Layer (HAL): The HAL serves to isolate hardware specific knowledge from the application layers above. Typically, a HAL component consists of both a physical device driver for a particular hardware chip, and a logical device driver which interfaces to the application software.

Examples of existing HAL components include the S-Link HAL (interfacing the SLIF-S devices), the ITM HAL (for the Integrated Test Bus Master), and the Interrupt HAL which interfaces application code with device-specific interrupts.

For the DLC RM, there is a HDLC HAL that includes a logical device driver interface and physical device drivers for the Musycc chips.

Figure 5-2 DLC RM software relationships



Software variant control

The SPM software architecture allows implementation of future customer variances through refinement of the base SPM software. Use of an object-oriented methodology permits maximum reuse of existing software in

extending the functionality to support market specific features. Table 5-1 lists the supported PRI variants for the SPM.

Table 5-1 Supported PRI variants

LTDEF variant	TRKSGRP IFCLASS
N449PRI	NETWORK
NIPRI	NETWORK
NTNAPRI	NETWORK USER
U449PRI	USER
U459PRI	USER

Database interaction

Calling Name Delivery (also know as CNAM) provides the called party with the calling party's name when the call originates over a PRI trunk. The calling party's name is retrieved in one of two ways:

- A centralized data base using Transaction Capabilities Application Part (TCAP) messaging
- A local table lookup.

Which option is used is determined by datafilling the TCAPNM sub-option in table CUSTNTWK. You have two choices (LOCAL or NONLOCAL). When you set the TCAPNM sub-option to LOCAL, the TCAPNM Local Lookup feature searches the local DMS database for the calling name, or captures the calling name from the PIP (Party Info Parm) parameter.

When you set the TCAPNM sub-option to NONLOCAL, the TCAP layer of the SS7 protocol is used to retrieve the calling party's name from the centralized name database. The following conditions determine if a TCAP name query should be sent:

- The PRI Calling Name Delivery option is datafilled in table LTDATA.
- When the local name lookup feature is active it intercepts any attempt to launch a TCAP name query and searches for a local name. If the local name is not found, a TCAP name query is sent to obtain the calling name.

- A user provided North American Numbering Plan (NANP) calling number or a network provided NANP calling number must be present to launch a TCAP query.
- The calling number Privacy Indicator is checked. If either of the PI variables “private” or “blocking toggle” are found the TCAP query is not launched.

Once it has been determined that a TCAP Name query should be sent, a TCAP query is launched to the centralized database using the calling party’s DN as an index resulting in one of the following response:

- If the TCAP query is unsuccessful a ‘not available’ indication is delivered to the called party.
- If the TCAP query is successfully launched, the initial Q.931 SETUP message is sent to the called party.
- If the calling name is unavailable or restricted, no TCAP query is sent, and the called party receives a ‘private’ or not available’ name indication in the Q.931 SETUP message.

Appendix A Related Information

This appendix contains a summary of basic documentation available elsewhere in the documentation suite for your product. The sections that follow refer you to sources that contain the most detailed, product-specific information for these PRI-related documentation components.

Alarms

The following alarms relate to Primary Rate Interface (PRI) functionality on the Spectrum Peripheral Module.

- PM 1SPM ISTB SPM
- PM 1SPM MANB SPM
- PM 1SPM PROTFAIL SPM
- PM 1SPM SYSB SPM

For complete information on any of these alarms, consult the *Alarms Reference Manual* for your product.

Card replacement procedures

PRI interfaces terminate onto the NTLX72AA data link controller (DLC) resource module (RM) circuit pack. The NTLX72AA DLC RM provides resources for call processing for the DMS-Spectrum Peripheral Module (SPM).

Consult the *Card Replacement Procedures Manual* for your product for detailed instructions on performing maintenance operations on the DLC RM.

Command inferface

Commands related to the SPM data link controller (DLC) resource module (RM) are in the SPMDLCDIR (SPM data link controller directory) MAP level. The SPMDLCDIR commands are as follows:

- Tst
- Bsy
- RTS
- Offl
- LoadMod
- Next
- Select
- QueryMod

- ListAlm
- Prot

The *DMS-SPM Commands Reference Manual*, 297-1771-819, fully describes the SPMDLCDIR MAP level, including the syntax, purpose, semantics, and examples of each command. Included with each command description are typical messages that may result when you use the command. Please consult this publication for additional information.

Data schema

For complete information on any of the following data schema tables related to PRI on the SPM, consult the *Data Schema Reference Manual* for your product.

- MNCKTPAK
- MNHSCARR
- MNLINK
- MNNODE
- MNPRIIID
- MNPRTGRP
- MNSHELF
- TRKSGRP

Feature description manual

The following descriptions are summaries of information from the *DMS-SPM Feature Description Reference Manual*, 297-1771-330. Please consult that publication for the complete feature description.

- AF7583 - Spectrum Peripheral Module Platform Maintenance Software

  This feature provides the operations, administration, maintenance, and provisioning (OAM&P) capabilities in the Computing Module (CM) to support a Data Link Controller (DLC) Resource Module (RM).

- AF7786 - SPM PRI Trunk Maintenance and Provisioning

  The Spectrum peripheral module (SPM) is a multi-application platform that provides an OC-3 interface to the DMS SuperNode. This feature offers the ability to perform trunk maintenance and provisioning of primary rate interfaces (PRIs) on an SPM node.

- AF7810 - Spectrum Peripheral Module Primary Rate Interface Data Link Controller Device Maintenance. This feature includes the following components:
  - — DLC RM device registration
  - — DLC RM device provisioning
  - — Data download
  - — DLC RM device MAPs/CI design
  - — DLC device alarms
  - — DLC device logs
- AX1336 - Echo Cancellation for Primary Rate Interface

  Data schema table SPMECAN stores control parameters that define the echo response behavior of an SPM echo canceller. This feature allows customer-controlled provisioning, through CM datafill, of SPM-resident echo cancellers for PRI trunks.
- 59007933 - SPRI NI-2 Development

  SPRI NI-2 Development provides integrated services digital network primary rate interface (ISDN PRI) functionality on the SPM for the local exchange carrier (LEC) DMS-100 market. This feature provides support for ISDN PRI on an SPM for the DMS-100 switch based on the National ISDN-2 (NI-2) protocols.
- 59017193 - PRI Originating Calling Name Delivery

  PRI Originating Calling Name Delivery is an originating feature which provides the called party (terminating agent) with the calling party's name when the call originates over a PRI (Primary Rate Interface) trunk.
- 59018675 - Support of AT&T PRI Variant for DMS-500

  This feature provides support of the 4ESS and 5ESS PRI variant on the SPM for the DMS-500 market.
- 59025428 - Support of 100/250 PRI Trunks on Same SPM for DMS-500

  This feature allows PRI 100 and PRI 250 trunks to coexist on the same SPM in a DMS500 switch by creating a new termtype for PRA250 trunks in the DMS500 office.

Hardware reference

PRI interfaces terminate on the NTLX72AA data link controller (DLC) resource module (RM) circuit pack. The NTLX72AA DLC RM provides

resources for call processing for the DMS-Spectrum Peripheral Module (SPM).

ATTENTION

The data link controller (DLC) may not apply to all markets.

The *DMS-SPM Hardware Maintenance Reference Manual*, 297-1771-550, contains additional information on the data link controller RM.

Logs

The following list summarizes the logs related to Primary Rate Interface (PRI) functionality on the Spectrum Peripheral Module. For complete information on any of the following log reports, consult the *Logs Reference Manual* for your product.

- SPM707 - The SPM generates the SPM 707 log when the dynamic update fails for the ISDNPARM table.
- SPM708 - The SPM generates the SPM 708 log when the DDM audit updates the ISDNPARM table.
- SPM709 - The SPM generates the SPM709 log when the dynamic update fails for the ISDNPROT table.
- SPM710 - The SPM generates the SPM710 log when the audit updates the ISDNPROT table.

Operational measurements

The following is a list of the operational measurements related to Primary Rate Interface (PRI) functionality on the Spectrum Peripheral Module. For complete information on any of the following operational measurements, consult the *Operational Measurements Reference Manual* for your product.

- PM
- PRADCHL2
- PRAFAC
- WIDEBAND

List of terms

ABSBH
average busy season busy hour

ACD
automatic call distribution

AHT
average holding time

AIN
Advanced Intelligent Network

ANSI
American National Standards Institute

ANSI ISUP
American National Standards Institute defined ISUP

AP
application processor

ARP
address resolution protocol

ARU
audio response unit

ASIC
application specific integrated circuit

ATE
Automated Test Equipment

ATM
asynchronous transfer mode

ATOC
automated TUSA operator console

BATMOS
bipolar analog telephony metal oxide semiconductor (ASIC process)

BFM
basic file management

BFP
basic format packetization

BHCA
busy hour call attempts

BITE
BNR Integrated Test Environment

BRI
basic rate interface

BRISC
B type reduced instruction set computer

BW
bandwidth

CA
central agent

CALLP
call processing

CATV
cable access television

CC
central control

CCITT
Comite Consultatif International Telegraphique et Telephonique

CCP
central control processor

CCS7
common channel signaling #7 (similar to SS7)

CEM
common equipment module

CFB
call forward busy

CFNA
call forward no answer

CLI
calling line identity

CLID
calling line identity delivery

CM
computing module

CMIC
core messaging integrated circuit

CMOS
complimentary metal oxide semiconductor

CMR
CLASS modem resource

CMU
card maintenance unit

CO
captive office

COO
cost of ownership

COT
continuity test

CP
call processing

CPE
customer premises equipment

CPM
communications processor module (microcoded RISC engine)

CPS
call processing server

CPU
central processor unit

CTUP
China telephony user part

DAL
dedicated access line

DCH
d-channel handler

DDI
direct dialling in

DDM
data distribution manager

DDU
digital data unit

DID
direct inward dialling

DLC
digital loop carrier or data link controller

DMS
digital multiplex switch

DMS-100
local access exchange

DMS-250
inter-exchange carrier switching system

DMSW
DMS proprietary internal data link protocol

DMSX
DMS proprietary internal data link protocol

DMSY
DMS proprietary internal data link protocol

DOD
direct outward dialling

DRAM
digital recorded announcement machine, or dynamic random access memory

DS-0
digital signal zero (64 kbps)

DS-1
digital signal one (1.544 Mbps)

DS-512S
digital signal 512S (40.96 Mbps) unique to Spectrum DSP digital signal processor or processing

DT
dial tone

DTC
DTC digital trunk controller

DTC7
CCS7 (ISUP) digital trunk controller

DTCI
digital trunk controller for ISDN

DTCOi
ISDN digital trunk controller for offshore applications

DWS
dialable wideband service

E1
European notation for carrier system commonly called PCM30

EC
echo canceller (also: ECAN)

EDCH
enhanced d-channel handler

EIU
Ethernet interface unit

ELM
extended link maintenance

EMC
electro-magnetic compatability

EMI
electro-magnetic interference

ENET
enhanced network (component of DMS)

EOC
embedded operations channel

ETSI
European Telecommunications Standards Institute

EVS
enhanced voice services f/w firmware

FA
field analysis

FID
file identifier

FIFO
first-in first-out

FP
file processor

FRU
field replacable unit

FTFS
frame transport system

FTS
file transfer protocol

GL100
Global DMS-100 using GSF base

GOS
grade of service

GPP
global peripheral platform

GSF
Generic Services Framework

GSM
group system mobile

H/W
hardware

HAL
hardware abstraction layer

HDBH
high day busy hour

HDLC
high-level data link control (standard messaging protocol)

HILAPI
high level application interface

HLDV
high level design verification

HLIU
high speed link interface unit

HMI
human machine interface

I/O
input/output

IBN7
intelligent business network CCS7

ICM
integrated connection memory (ASIC)

ICRC
ILM central resource controller

IEC
inter LATA exchange carrier

IEEE
Institute for Electrical & Electronic Engineers

ILLP
inter link-to-link protocol

ILM
integrated link maintenance

IMC
inter-machine communications

IMT
inter-machine trunk

IN
intelligent network

INM
integrated node maintenance

IOC
input output controller

IOP
input/output processor

IOUI
input/output utility interface

IP
inter-processor or internet protocol

IPC
inter-processor communications

ISA
integrated service access

ISDN
integrated services digital network

ISM
integrated services module

ISN
intelligent services network

ISNAP
intelligent services network applications processor

ISO
International Standards Organization

ISUP
ISDN signaling user part

ITM
Intelligent test bust master ASIC

ITU
International Tecommunications Union (part of the United Nations)

IV
integration verification

JTAG
Joint Test Action Group

kbps
kilo (thousand) bits per second

LA
local agent LAN local area network

LAPD
link access protocol for the d-channel

LATA
local access and transport area

LEC
local exchange carrier

LFS
link fault sectionalization

LGC
line group controller

LIFO
last-in first-out

LIU
link interface unit

LPMIC
link protocol and message interface (ASIC)

LPP
link peripheral processor

LSM
linkset management

LSSGR
LATA switching systems generic requirements

MAP
maintenance and administration position

Mbps
Mega (million) bits per second

MCM
message channel maintenance

MCS
micro-controller system

MEM
memory

MITE
MCI Integrated Test Environment

MLIU
multi-link interface unit

MS
message switch

MTBF
mean time between failures

MTC
maintenance

MTM
module test and maintenance

MTP
message transfer part

MTS
message transport service

MTX
mobile telephone exchange

NI-1
National ISDN-1

NI-2
National ISDN-2

NFAS
Non-facility associted signalling

NRAG
network ring-again

NT
Northern Telecom

NTNAPRI
Northern Telecom North American primary rate interface

NTP
Northern Telecom Technical Publication

OAM
operations, administration and maintenance

OAM&P
operations, administration, maintenance & provisioning

OC-3
Optical Carrier Rate 3 (Sonet OC-3 = STS-3 = 155.52 Mbps)

OM
operational measurements

ONC
Operator Network Console

ONP
one night process

PABX
private automatic branch exchange

PBX
private branch exchange

PC
personal computer

PCI
peripheral component interconnect (cpu bus)

PCM
pulse code modulation

PCP
printed circuit pack

PD
product deployment

PEC
product equipment code

PLD
PCM30 line drawer

PLGC
PCM30 line group controller

PM
peripheral modules

PQFP
plastic quad flat pack

PRI
primary rate interface

PSTN
public switched telephone network

PTS
per-trunk signaling

PUPS
point of use power supply

PVP
product verification plan

PVS
product verification strategy

QLC
DS512 quad link controller (ASIC)

QPM
quad port memory (ASIC)

QUICC
quad integrated communications controller

RA
reliability analysis

RAM
random access memory

RBOC
regional bell operating company

REX
routine exercise

RFTFS
remote fault tolerant file system

RLT
release link trunk

RM
resource module, or resource maintenance

RMM
resource maintenance manager

ROM
read-only memory

RSM
routeset management

RTP
Research Triangle Park, Raleigh NC

RV
requirements validation s/w software

SAPI
service access point identifier

SAPI-0
ISDN Q.931 call control signalling information

SAPI-16
ISDN Q.931 user packet data

SCAI
switch to computer access interface

SCCP
signaling connection control part

SCP
signaling control point

SDH
synchronous digital hierarchy

SDRAM
synchronous dynamic random access memory

SLIF-S
S-link interface slave ASIC

SLM
system load module

SMT
ST-bus mapper/tracer (ASIC)

SN
SuperNode

SNAP
SuperNode access protocol

SNSE
SuperNode system enhanced

SOC
system overload control

SONET
synchronous optical network

SOS
software operating system

SPM
Spectrum peripheral module

SRAM
static random access memory

SS7
switching system #7

STM
synchronous transfer mode

STP
signalling transfer point

STR
special tone receiver

STS
synchronous transport signal

SWACT
switch activity

T1
North American common carrier rate (DS-1 or 1.544 Mbps)

TBD
to be determined

TCAP
transaction capabilities applications part

TCP
transmission control protocol

TE
test execution

TEI
terminal endpoint identifier

TML
terminating matching loss

TMN
telecommunications management network

TOPS
traffic operator position system

TPT
terminal processing task

UCS
universal carrier service

UP
XPM unified processor

UTR
universal tone receiver

UUI
user-to-user information

VO
verification office

VSP
voice services processor

VT
virtual tributary (Sonet)

XPM
extended peripheral module

XPT
crosspoint

Digital Switching Systems

DMS-Spectrum Peripheral Module

PRI General Description

Publication number: 297-1771-132
Product release: DMSSPM15
Document release: Standard 04.02
Date: April 2001
Published in the United States of America

NORTEL NETWORKS™

How the world shares ideas.