Dialogic

Application Note

Dialogic® DM/N160TEC Digital Telephony Interface Board: High-Density Time Slot Routing Test

Executive Summary

This application note describes the performance of the Dialogic® DM/N160TEC Digital Telephony Interface Board and the tests that were conducted to verify the audio path integrity of time slots when there is a large amount of simultaneous routing done on the CT Bus. It also provides information on how to install and configure a system to run this test.

Table of Contents

Introduction

This application note characterizes the performance of the Dialogic® DM/N160TEC Digital Telephony Interface Board and describes testing that was performed to verify the audio path integrity of time slots when there is a large amount of simultaneous routing done on the CT Bus. This application note also explains how to install and configure a system to run this test.

This information can be used by developers as a reference to verify the network switching capabilities of a DM/N160TEC, and to become familiar with methods for achieving high-density performance, as identified during the development and testing described in this document. The test programs can be used as sample code for developing network switching applications with the DM/N160TEC. A .zip file containing the test programs and other components can be downloaded (see the *Sample Code* section).

Test Description

This section provides an overview of the test application and lists the hardware and software needed for running the test.

Overview

A test application was developed to verify the integrity of time slot routing for high-density configurations using a DM/N160TEC, which is a high-density, digital telephony interface Dialogic® board that supports 16 spans (up to 480 channels) and is configurable as T1, E1, or a mix of both (in units of four).

In this test, eight DM/N160TEC boards were used, enabling up to 3840 time slot routes. The test divided the system into two sections with four DM/N160TEC boards each. The first set of four boards was used to receive inbound NET5 ISDN calls from an external stimulus system. The external stimulus system was made up of 16 Dialogic® DM/V1200A-4E1 Media Boards. Crossover cables physically connected the 64 E1 spans on the stimulus side and the first set of DM/N160TEC boards. The 64 E1 spans on the second set of DM/N160TEC boards were connected with RJ-45 loopback connectors.

The stimulus system initiated ISDN calls for all channels on all 64 E1 spans. When the first set of DM/N160TEC boards answered the calls, each channel then performed a full duplex route to the corresponding channel in the second set of DM/N160TEC boards (for example, channel 3 on physical board 1 would route to channel 3 on physical board 5).

Once a call was connected and the time slots were routed, the stimulus side transmitted DTMFs, and then it looked to detect the same DTMFs that were sent out. Since the second set of DM/N160TEC boards had loopback connectors plugged into their E1 spans, once the time slots were routed, the audio path reflected back to the originating stimulus side, which allowed the DM/V1200A-4E1 to receive the same DTMFs that were transmitted. If the DTMF that was detected was the same as the one that was transmitted, this ensured that the time slot route was good.

See Figure 1 for a system overview, and Figure 2 for a detailed representation of DTMF transmit and receive paths.

Hardware Components

The following hardware components were used in the high-density time slot routing test.

For the target (inbound) system:

- Performance Technologies Ziatech ZT 5084 chassis
- Intel Pentium III processor (500 MHz)
- 256 MB RAM
- 8 Dialogic® DM/N160TEC boards
- 64 RJ-45 loopback connectors (pin1 connected to pin4, pin2 connected to pin5)

For the stimulus (outbound) system:

- 2 ZT 5084 chassis
- Pentium III processor (500 MHz)
- 256 MB RAM
- 16 Dialogic® DM/V1200A-4E1 boards

Cabling:

- 64 crossover cables

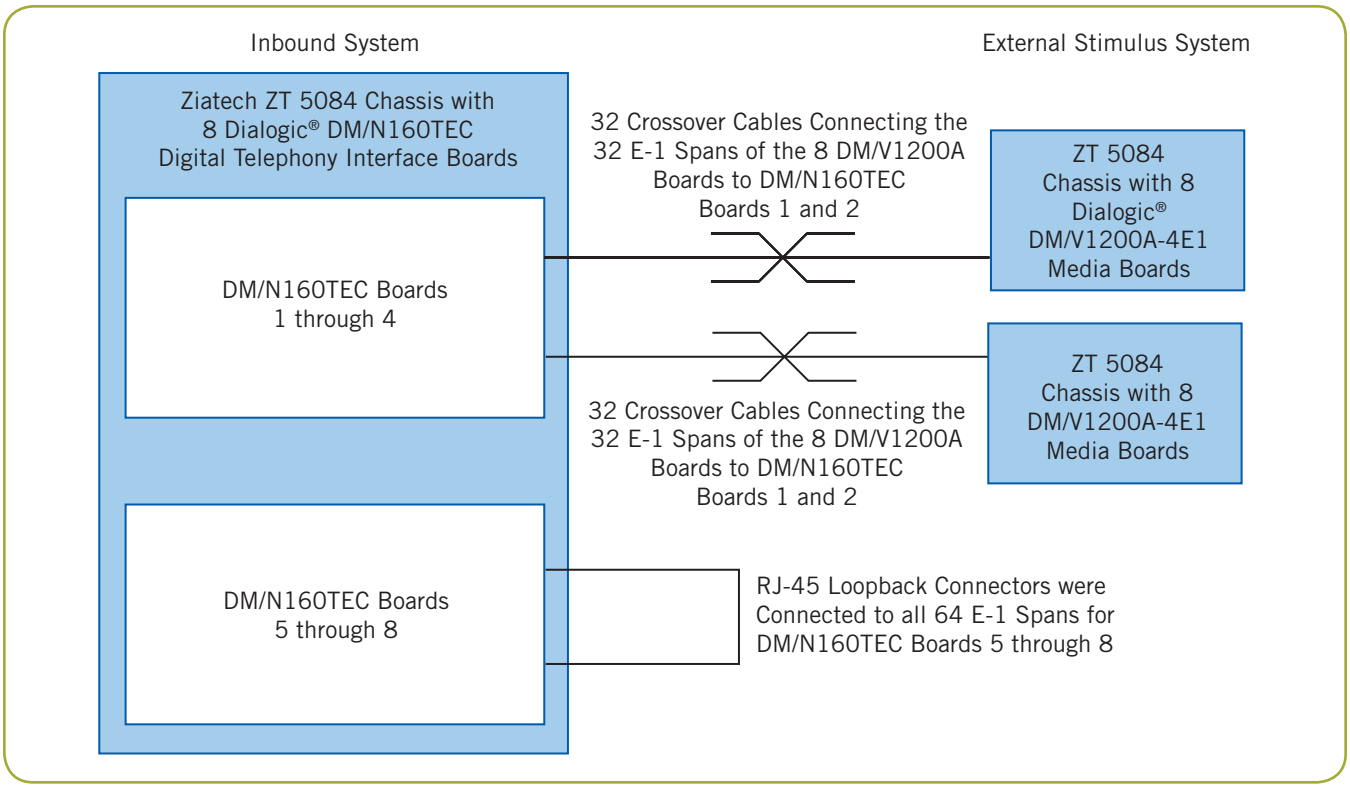

Figure 1. System Overview

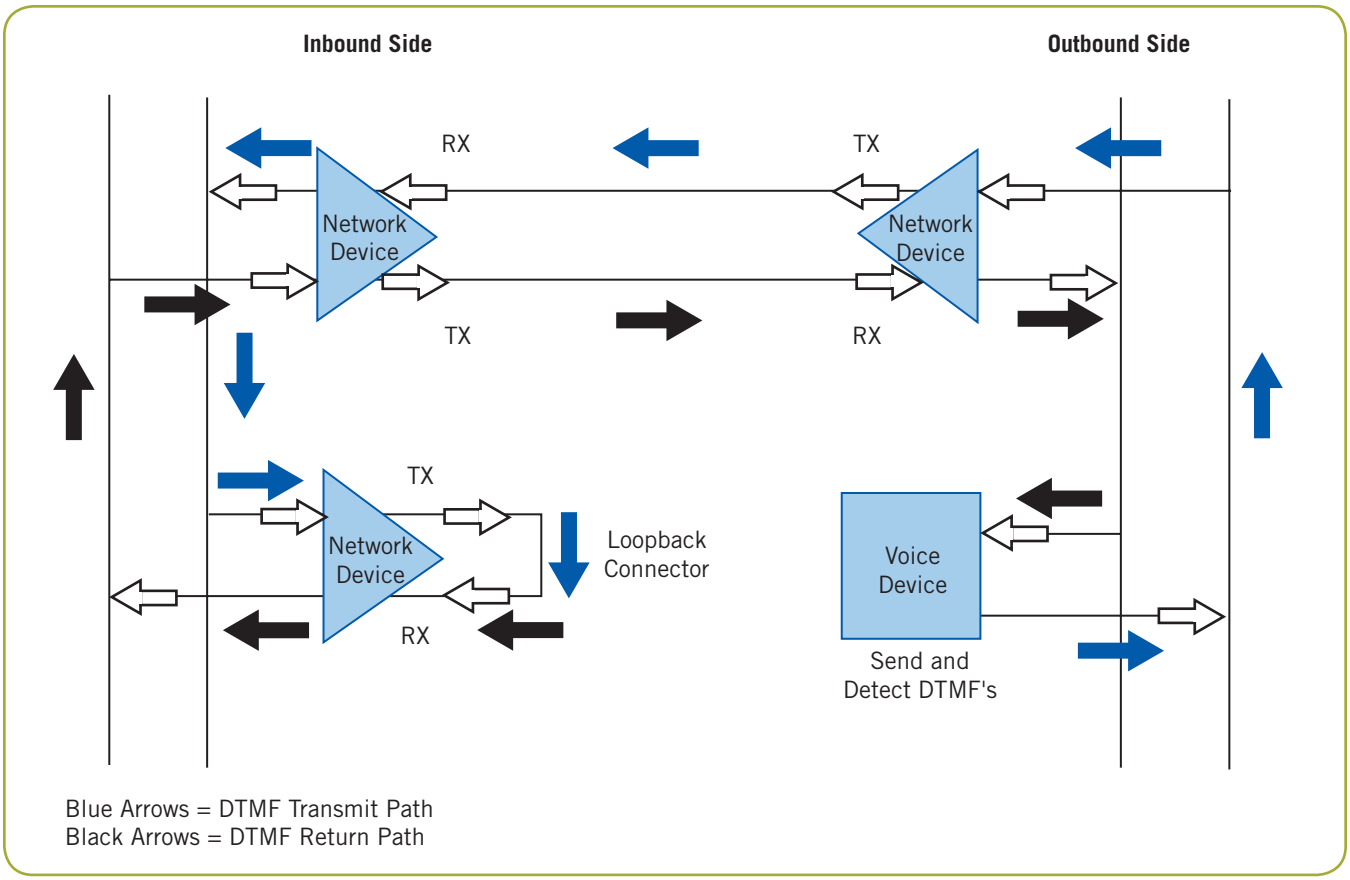

Figure 2. DTMF Transmit and Receive Paths

Software Components

The following software components were used in the high-density time slot routing test:

- Windows® 2000 operating system (Professional)
- Dialogic® System Release 6.0 for CompactPCI for Windows®
- Application test software:
  — mtansr.c
  — mtmake.c
  — test.pcm

You can access the application test software (see the *Sample Code* section).

Application Features

The mtansr and mtmake programs are sample code for using the Dialogic® Global Call API functions. They are also samples for using the single-threaded asynchronous polled model.

For pure switching applications where voice resources are not used with the DM/N160TEC board, the mtansr program is an example of how to route time slots.

For applications that require voice resources, where the DM/N160TEC board is used with a separate voice resource board, the mtmake program is an example of how to incorporate voice devices separately by using the dx_open function. The mtmake program also shows how to handle and differentiate between Global Call API events and non-Global Call API events (for example, voice device events).

Testing and Performance

This section describes the test methodology and performance data for the high-density time slot routing test performed by Dialogic.

Testing

The premise of this test configuration is that if the time slots are routed correctly and there is no degradation in the routing path, the stimulus system that initiates the call and sends the DTMFs should be able to detect the same DTMFs that were transmitted.

For this test, over 4000 calls were initiated for all channels, enabling 3840 time slots to be routed in full duplex mode for all 4000 calls. All channels were able to detect the digits for every call.

Test Methodology

The program flow is described below.

Stimulus System	Inbound System
	Wait for Unblocked event Initiate gc_WaitCall( )
Wait for Unblocked event Initiate gc_MakeCall( )	
	Wait for GCEV_OFFERED event Initiate full duplex route
Wait for GCEV_CONNECTED event Send DTMFs via dx_play( ) Detect DTMFs Compare with the sent DTMFs Call gc_DropCall( ) Wait for GCEV_DROPCALL event Call gc_ReleaseCall( )	
	Wait for GCEV_DISCONNECT event Initiate gc_DropCall( ), unroute time slots Wait for GCEV_DROPCALL event Initiate gc_ReleaseCall( ) Wait for another call
Initiate another call After completion of all calls, print summary report	

Performance Data

The performance data is straightforward; all this test was looking for is success or failure in detecting the digits. All digits were detected successfully. You can access a sample output file (testoutput.txt) (see the *Sample Code* section).

Also note that using the sr_waitevt function in single threaded mode performs efficiently with up to 68 spans; beyond 68 spans, the multithreaded model should be used.

Setting Up the Test Configuration

This section describes the basic procedures used by Dialogic for installing the hardware and software required for the high-density time slot routing test. More detailed procedures can be found in the documentation that comes with the hardware and system software. You can also follow these instructions to set up a test of your own.

Installing Hardware Components

Refer to Figure 1, System Overview, for the hardware setup. The hardware must be installed before Dialogic® System Release 6.0 CompactPCI for Windows.

1. Install the Dialogic® DM/N160TEC and DM/V1200A-4E1 boards as explained in the Dialogic® Quick Install Card that is included with the Dialogic® boards.
2. Connect the DM/N160TEC boards 1-4 to the stimulus system using 64 crossover cables.
3. For the remaining 64 spans on DM/N160TEC boards 5-8, insert RJ-45 loopback connectors to connect pin1 to pin4 and pin2 to pin5.

Installing Software Components

Install the Dialogic® 6.0 CompactPCI System Release software on each computer as explained in the *Dialogic® System Release 6.0 CompactPCI Feature Pack 1 for Windows Software Installation Guide*. The following options are selected on the Select Technologies screen:

- Software for Dialogic® DMV/DMN/DMT boards – For the system with the DM/V1200A-4E1 boards.
- Software for the Dialogic® High Density DMN (DM/N160TEC) – For the system with the DM/N160TEC boards.
- Software Development Kit (SDK) – For a development environment, includes libraries and header files.

Refer to the software installation guide for information about other options.

In addition, copy the application test software provided with this application note:

- mtansr.c for the inbound system
- mtmake.c and test.pcm for the outbound system

Uninstalling Software Components

If you want to uninstall the Dialogic® System Release 6.0 CompactPCI software, follow the procedure in the *Dialogic® System Release 6.0 cPCI Feature Pack 1 for Windows Software Installation Guide*.

Configuring the Test

This section provides information about configuring the Dialogic® boards for the high-density time slot routing test. More detailed information about configuration can be found in the Configuration Guide for the Dialogic® board (see For More Information). You can use these instructions to set up your own test.

Configuration Overview

The steps to configure the boards are:

1. Start the Dialogic® Configuration Manager (DCM).
2. Select the configuration files – the Product Configuration Description (PCD) and Feature Configuration Description (FCD) file – for each board.
3. Modify the FCD file parameters for the DM/V1200A-4E1 to set up the stimulus side as an ISDN network.

These steps are described in the sections that follow.

Configuration Procedures

Starting the Dialogic® Configuration Manager (DCM)

Once the Dialogic® system release is installed, you start the configuration process by invoking the Dialogic Configuration Manager (DCM) as follows: from the Start menu, select Programs➔Dialogic® Release 6.0 cPCI➔Dialogic Configuration Manager-DCM.

The DCM main window contains a tree structure of the boards installed in your system. Double-clicking on a model name of a Dialogic® board in the DCM main window displays the board's property sheets. The property sheets display the board's configuration

parameters, grouped together on tabs according to the type of board functionality they affect. DCM provides online help for all parameters.

Selecting the Configuration Files

Two configuration files, a Product Configuration Description (PCD) file and a Feature Configuration Description (FCD) file, must be downloaded to each Dialogic® DM3 Architecture board in your system. The PCD and FCD files for a configuration have the same name; only the extensions (.pcd and .fcd, respectively) differ.

For the high-density time slot routing test, the following configuration files are used:

- Dialogic® DM/N160TEC boards: dti16_isdn_net5
- Dialogic® DM/V1200A-4E1 boards: ml1b_qs2_net5

In the DCM, select the configuration files for each board on the Misc property sheet. The parameters are FCDFileName and PCDFileName.

Modifying the FCD File Parameters for the Stimulus System

The default settings in the ml1b_qs2_net5.fcd file have to be modified before running the high-density time slot routing test. FCD files cannot be directly edited, but each FCD file has an associated CONFIG file that contains the modifiable parameter settings used to configure components. Parameters can be modified in the CONFIG file, and the CONFIG file is then used to generate a modified FCD file. Modifying the FCD file parameters is as follows:

- Edit the associated CONFIG file.
- Save and close the CONFIG file.
- For Windows® operating systems, the FCD file is automatically created when the PCD file and modified CONFIG file are downloaded to the board.

Note: If you want to preserve the default parameter values contained in the CONFIG file, make a backup copy of the file prior to editing it.

To edit the CONFIG file:

1. Use Microsoft® WordPad to edit the file ml1b_qs2_net5.config. The default location for the file is C:\Program Files\Dialogic\data.
2. Look for the [CCS] section of the file, which contains Common Channel Signaling parameters. In the [CCS] section, you will see a group of parameters for each of the four trunks on the DM/V1200A-4E1, [CCS.1] through [CCS.4].
3. Set parameter 0x17 (ISDN Protocol Mode) to 1 (Network Mode) in each of the sections [CCS.1] through [CCS.4].
4. Save and close the file.

Following is an excerpt from the ml1b_qs_net5.config file that has to be modified. The line to edit is shown in bold. To switch to Network Mode, change Setparm=0x17,0 to Setparm=0x17,1. Make this change in sections [CCS.1] through [CCS.4] of the ml1b_qs2_net5.config file.

```
[CCS.1]
! Q.931 Timer Values in milliseconds
Setparm=0x14,15000! Q.931 timer 302. Default=15000 msec.
Setparm=0x0b,4000! Q.931 timer 303. Default=4000 msec.
Setparm=0x0c,30000! Q.931 timer 304. Default=30000 msec.
Setparm=0x0d,30000! Q.931 timer 305. Default=30000 msec.
Setparm=0x0e,4000! Q.931 timer 308. Default=4000 msec.
Setparm=0x0f,10000! Q.931 timer 310. Default=10000 msec.
Setparm=0x10,4000! Q.931 timer 313. Default=4000 msec.
Setparm=0x15,400! TEI retry timer Default=400 msec.
Setparm=0x16,200! TEI state 4 min stability time. Default=200 msec.
Setparm=0x13,0! Symmetrical C.E. protocol. 0=disable 1=enable
Setparm=0x17,0! ISDN Protocol Mode.  0 = USER_MODE; 1 = NETWORK_MODE
Setparm=0x9,0! 0=disabled, 1=enable Layer 2 access.
              ! When Layer 2 access is enabled call control is no
              ! longer supported for the channels on this line.
```

The resulting FCD file is automatically created when the PCD file and modified CONFIG file are downloaded to the board. The FCD file is located in the C:\Program Files\Dialogic\Data directory.

The FCD parameters are downloaded when the system is initialized as described below.

Configuration Parameters

For more information about the parameters in .config files, see the Configuration Guide for the Dialogic® board (see For More Information).

Starting the System

The new configuration settings do not take effect until the system is initialized. Before system initialization, make sure you perform all of the necessary configuration procedures. To initialize the system for the first time, proceed as follows:

- From the DCM main window, select the root of the tree structure (Configured Devices on…) by clicking on it.
- Select Enable Device(s) from the Device pull-down menu (or by clicking on the Enable Device(s) icon on the DCM toolbar).
- Select Start System from the System pull-down menu (or by clicking on the Start All Enabled Devices icon on the DCM toolbar).
- Verify that the system has started (indicated by a status of Started in the System Service Status line at the bottom of the DCM main window).

If you have problems, see the Troubleshooting section of the *Dialogic® System Release 6.0 CompactPCI for Windows Administration Guide*.

Running the Test Application

This section describes the basic test procedure and the command line arguments that can be used to enable different features when running the high-density time slot routing test.

The high-density time slot routing test code consists of two programs:

- **mtmake** — The outbound program that makes the calls, sends and detects DTMFs
- **mtansr** — The inbound program that answers calls and routes the time slots

The DTMFs are transmitted by using the dx_play function; the mtmake program plays the file test.pcm, which is a recording of DTMFs “51*#”. The mtmake program prints a summary report of how many calls were successfully connected and how many times the DTMFs were not detected correctly.

Both programs use command line arguments to enable different features. The arguments and their descriptions are listed as follows:

Outbound Program mtmake

Usage: mtmake -Bn -Cn -D -Fn -G -Ln -Mn -Nn -Ps -S -Ts -X
where:

-Bn	First voice board, default: 1
-Cn	First voice channel, default: 1
-D	Drops call at end of connected state, default: FALSE (does not drop call)
-Fn	First network trunk, default: 1
-G	Enables digit generation and detection after answer, default: disabled
-Ln	Number of calls to make per port (0=infinite), default: 1
-Mn	Number of threads to use, default: 1
-Nn	Number of ports to use, default: 1
-Ps	Global Call API protocol, default: ISDN
-S	Check if GCEV_DISCONNECTED received in connected state, default: FALSE
-Ts	Trunk type, where: -TE = E1 ISDN -TI = T1 ISDN (default) -TR = E1 R2MF/CAS -TT = T1 robbed bit
-X	Terminate upon missed digits if using -G option, default: disabled

Inbound Program mtansr

Usage: mtansr -Fn -Mn -Nn -Ps -Rn -Ts

where:

-Fn	First network trunk, default: 1
-Mn	Number of threads to use, default: 1
-Nn	Number of ports to use, default: 1
-Ps	Global Call API protocol, default: ISDN
-Rn	Starting trunk for routed devices, default: 65 (65 is the first trunk of the fifth board)
-Ts	Trunk type, where: -TE = E1 ISDN -TI = T1 ISDN (default) -TR = E1 R2MF/CAS -TT = T1 robbed bit

Sample Code

Sample code may be downloaded at http://www.dialogic.com/goto/?10565

For More Information

The documents listed in this section, except for the Dialogic® Quick Install Cards, are available on the electronic bookshelf that is provided with Dialogic® System Release Software. The bookshelf is available at http://www.dialogic.com/manuals/default.htm. The Dialogic® Quick Install Cards are shipped with the Dialogic® boards.

Information about installation and configuration in this application note came from the software installation and configuration guides listed as follows:

Dialogic® System Release 6.0 CompactPCI Feature Pack 1 for Windows Service Update Software Installation Guide

DM3 Architecture for CompactPCI on Windows Configuration Guide

The Dialogic® Quick Install Card shipped with each Dialogic board describes how to install the board.

The following documents provide information about administration and diagnostics:
Dialogic® System Release 6.0 CompactPCI for Windows Administration Guide

SNMP Agent Software for Windows Operating Systems Administration Guide

Dialogic® System Software for DM3 Architecture Products on Windows Diagnostics Guide

The following documents provide information about application development:
Global Call API for Linux and Windows Operating Systems Library Reference

Global Call API for Windows Operating Systems Programming Guide

Standard Runtime Library API for Linux and Windows Operating Systems Library Reference

Standard Runtime Library API for Windows Operating Systems Programming Guide

Voice API for Windows Operating Systems Library Reference

Voice API for Windows Operating Systems Programming Guide

Additional information about the products used in this high-density time slot routing test is available online at this URL: http://www.dialogic.com/products/default.htm.

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To learn more about Dialogic® products, go to **www.dialogic.com.**

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