

Application Note

**Using Dialogic[®]
Diva[®] Media Board
Fax Capabilities
with Asterisk[®]**

Using Dialogic® Diva® Media Board Fax Capabilities with Asterisk®

Application Note

Executive Summary

The fax capabilities found on Dialogic® Diva® Media Boards make a powerful set of enhanced fax features available to Asterisk® PBX integrators and users, including the ability to generate and receive faxes over TDM channels, generate and receive faxes over analog telephony channels, detect incoming fax tones, and handle T.38 and clear channel (FoIP) faxes. The Diva Media Boards can also offload much of the media processing from Asterisk, resulting in increased efficiency and reliability.

Some additional Asterisk configuration is needed to use the fax features enabled by Diva Media Boards. This application note examines these features, and explains how to configure and use them.

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Introduction

This application note examines the fax-related features available with Dialogic® Diva® Media Boards and shows how to set up Asterisk® PBX configuration files for inbound and outbound fax. The same principles apply, whether you are configuring a low density Diva analog board or a higher density Diva T1/E1 board.

When using Diva Media Boards with Asterisk, all media processing is done by Diva hardware using media commands called *capicommands*. These commands access media functions on the media boards that are often not available on Asterisk itself. For example, the *sendfax* and *recvfax* commands control the sending, receiving, and polling of faxes over TDM analog telephony channels or over IP. *capicommands* are called from the Asterisk Dialplan file, *extensions.conf*, in the same manner as any other Asterisk command. For an example, see the *extensions.conf* section, later in this paper.

The Asterisk channel driver used with Diva Media Boards, *chan_capi*, uses the Common ISDN API (CAPI) with Diva-specific extensions as its interface to Diva Media Board functionality. *chan_capi* is part of the [Dialogic® Diva® System Release 9.0.xLIN download](#). More details of the *chan_capi* driver are available from the [Melware.org Wiki](#).

Figure 1 shows the relationship between Asterisk and the Diva Media Boards:

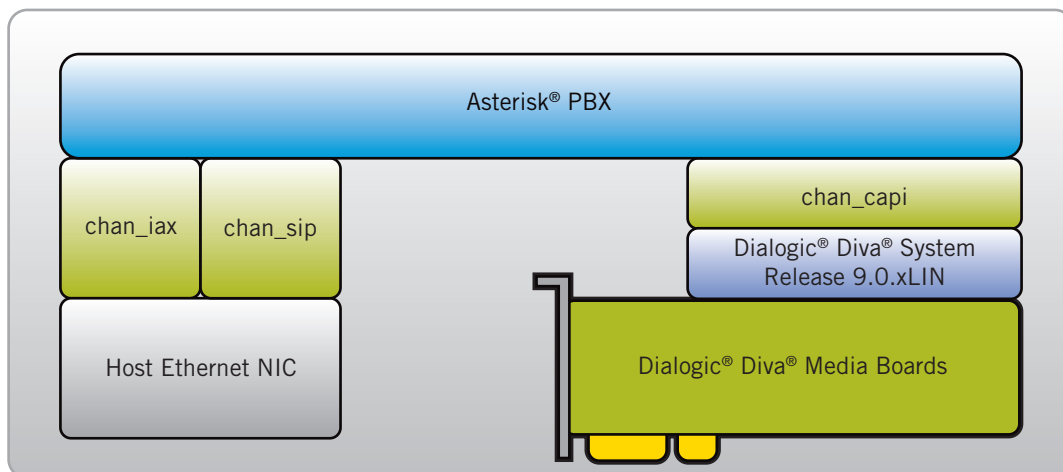


Figure 1. Relationship between Asterisk® and the Dialogic® Diva® Media Boards

Note: *chan_capi* has formerly been called *chan_dialogicdiva*. Whenever you find occurrences of the name “*chan_dialogicdiva*” in certain files, web pages, and documents, you can exchange it with the name “*chan_capi*.”

Fax Features of Dialogic® Diva® Media Boards

Diva Media Boards provide the following fax features:

- Intelligent fax processing
- Reliable data transfer
- Automatic T.30 protocol adjustment
- Error correction mode
- Document compression
- Ability to generate and receive V.34 fax
- Ability to generate and receive T.38 fax

Intelligent Fax Processing

A telephony application that sends and receives faxes under Asterisk without the use of Diva Media Boards might encounter the following issues:

- Interruptions in the data stream between the application and the fax device, which can affect the quality of the fax document.
- Not every device supports the feature set provided by the T.30 fax protocol, which might limit functionality and require modification of the application.
- Fax document compression might force the application to include logic for receiving compressed data, generating a compressed data stream on demand, and providing documents in different compression formats when transmitting.
- A legacy fax application is unable to deal with transmission speeds higher than 14.4 Kbps. To use V.34 fax transmission speeds of up to 33.6 Kbps, the application needs modification.
- A need to deal with low-level T.30 protocol settings such as scan line time, compression, error correction, and so forth.

Diva Media Boards can overcome these drawbacks, because they allow the use of `chan_capi` software to process fax documents with a level of reliability and flexibility comparable to a more sophisticated, lower-level fax API.

Reliable Data Transfer

Diva Media Boards provide a high-performance block-oriented ISDN Direct Interface (IDI) between the board hardware and the host CPU. The data transfer between the host CPU and the Diva Media Board memory is performed via a BUS master direct memory access (DMA), which reduces the CPU load on the host and provides data stream reliability through buffering and block-oriented data transfer. The entire data processing operation is performed on the Diva Media Board.

Automatic T.30 Protocol Parameter Adjustment

The T.30 protocol stack that runs on the CPU of the Diva Media Board can adjust transmission parameters to provide reliable and fast document transmission without requiring application intervention.

You can optionally use the global fax configuration options of Diva Media Boards to overrule the automatic T.30 protocol parameter adjustment.

Error Correction Mode

You can use the global fax configuration options of Diva Media Boards to enable and manage Error Correction Mode (ECM) support. When ECM support is enabled, the Diva Media Board uses ECM mode for document transfer, if requested by the other side.

Diva Media Boards use their internal memory to store document data, and they retrieve data (up to 64 Kbytes for every channel) from this buffer for ECM re-transmissions. This can reduce the host CPU load and increase the reliability of the fax transmission.

Document Compression

Diva Media Boards use MR, MMR, and T.6 fax document compression. To reduce transmission time, the media boards select the most efficient compression algorithm supported by the other side.

A Diva Media Board's CPU handles compression in the following ways:

- For fax transmission, it re-compresses 1D-coded page data from the application to the format requested by the other side. This process is fully transparent to the application, which deals only with 1D (MH) encoded data.
- For fax reception, it converts received data to 1D-coded page data that is sent to the application.

You can use the global fax configuration options of Diva Media Boards to adjust the compression-related protocol settings, if the application does not provide the required parameters. For information, see the [Dialogic® Diva® System Release 9.0LIN Reference Guide](#).

V.34 Fax

You can use the global fax configuration options of Diva Media Boards to enable V.34 (33.6 Kbps) fax support. If a Diva Media Board needs to establish a connection with a transmission speed higher than 14.4 Kbps (V.34), it can do so without application intervention.

T.38 Fax

When a Dialogic® Diva® softIP virtual board is licensed and configured, the application can use the chan_capi software to send T.38 fax (FoIP). Call control is implemented using SIP, with RTP carrying the encoded fax information. The features available for configuring and using T.38 fax are almost identical to those available for T.30 fax.

Setting up Asterisk®

To use Diva Media Boards with Asterisk, you need a working Asterisk installation that includes the Diva drivers provided by the chan_capi software. The following training course on the Dialogic Service Center website describes how to install and configure the Diva drivers with Asterisk: [Understanding and Installing Dialogic® Diva® Drivers with Asterisk](#).

Access to this webinar requires a Web Visuals participant account and login. You can create an account by clicking Create Participant Account on the left side of the web page.

For additional information about setting up Asterisk, see the Asterisk homepage at <http://www.asterisk.org>.

Global Fax Configuration Options of Dialogic® Diva® Media Boards

You can configure Diva Media Boards for fax by using the web interface for the boards. This includes setting global fax options for each media board. The global fax options allow you to override parameters passed to the board by the Asterisk fax application and to control parameters running on the board's T.30 protocols. This provides a high level of flexibility, since capicommands are relatively simple to use.

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To access the global fax configuration options, follow these steps:

- 1 Open your browser and point to: <http://localhost:10005>, or use console mode configuration that can be initiated using `/user/lib/opensdiva/divas/Config`.
- 2 Click on the Board configuration link.
- 3 Click on the board to be configured.
- 4 Set View extended configuration to yes.
- 5 Scroll down to the Fax Options group.

Figure 2 shows the global fax configuration option defaults:

Fax Options	
Max Fax Speed Limit:	No fax speed limit (default) ▼
Min Fax Speed Limit:	No fax speed limit (default) ▼
Non-Productive Fax Session Time Limit:	Off (default) ▼
Disable Fine Resolution:	Off ▼
Disable Error Correction Mode (ECM):	Off ▼
Use ECM Frame Length Of 64 Bytes:	Off ▼
Disable 2D Fax Document Compression:	Off ▼
Disable T.6 Fax Document Compression:	Off ▼
Disable Uncompressed T.6 Fax Document Lines:	Off ▼
Refuse Incoming Polling Requests:	Off ▼
Hide 'Total Pages' Information In Fax Message:	Off ▼
Hide 'Head Line' Information In Fax Message:	Off ▼
Hide 'Page Info' information In Fax Message:	Off ▼
Disable Fallback To Lower Speed On Failure:	Off ▼

Figure 2. Fax Option Defaults on the Web Interface for Dialogic® Diva® Media Boards

For more information about the global fax configuration options, click on an option to display the related Help, or refer to the section on global fax configuration options in the [Dialogic® Diva® System Release 9.0LIN Reference Guide](#).

Basic Fax with Dialogic® Diva® Media Boards and Asterisk®

The Asterisk application can send capicommands directly to a Diva Media Board. This section describes how to use capicommands to send a fax, receive a fax, and obtain fax results.

Sending a Fax

Use capicommand sendfax with the Asterisk Dial function to send a fax in one of these formats:

- .sff - Structured fax file format
- .cff or .jpg - Color fax file format
- .txt - ASCII text file

Note: The type of document is detected based on the file context, and not on the file extension.

If a fax machine answers, the fax is sent, and the call hangs up when done. If no fax machine is detected, the fax attempt times out and the call hangs up.

Syntax

The syntax for capicommand sendfax is:

```
capicommand(sendfax[|<filename>|<stationid>|<pageheader>|<options>])
```

Where:

- <filename> is a mandatory parameter containing the full path and file name for the resulting fax file.
- <stationid> is an optional user-defined identifier.

<pageheader> is an optional small header line at the top of the page containing the date, header information, originating telephone number, and page number.

- <options> is one of the following:

b - Enable T.43 coding.

d - Do not use MR (2D) coding.

e - Do not use ECM.

f - Allow fine resolution.

j - Enable JPEG coding.

k - Keep the fax document if there are errors. (By default, the document is removed if a fax transmission is not successful.)

m - Do not use MMR (T.6) coding.

t - Do not use T.85.

u - Activate support for super/ultra fine resolutions and paper formats.

The following Asterisk Dialplan shows how to send a fax. In this example, the Dialplan makes an outbound call to 19739676000 and assumes that there is a fax machine available on the other side. When the other side answers the call, the Dialplan goes to the sendfax context and issues capicommand sendfax with the following parameters:

<stationid> = 888-111-2345

<pageheader> = Outgoing Fax

<options> = f (Allow fine resolution)

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```
exten => 1,1,Dial(capi/ISDN1/19739676000,20,G(sendfax,100,1))
[sendfax]
exten => 100,1,capicommand(sendfax|/tmp/sendfax001.sff|888-111-2345|Outgoing Fax|f)
exten => 100,2,Hangup
```

For more information about capicommand sendfax, see README.Diva.fax in the /usr/lib/opensdiva/divas/chan_capi_readme directory.

Fax Tone Detection for Sending a Fax

You can set up a conditional situation so that a fax is sent only if a fax tone is detected on answer. To enable fax tone detection, follow these steps:

- 1 Click the CHAN_CAPI configuration link on the main page of the Diva web interface, as shown below:



Figure 3. Main Page of the Web Interface for Dialogic® Diva® Media Boards

- 2 Set the Fax detection field to incoming, outgoing, or both call directions.
- 3 Optionally, reset the timeout for waiting for a fax tone after answer by changing the default setting for the Fax detection time field.

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The CHAN_CAPI configuration screen is shown below:

Dialogic

HOME CHAN_CAPI Configuration

Available CHAN_CAPI Boards

M-Board 1

Board 1
Dialogic Diva Analog-2 PCIe v1 SN: 1003

CHAN_CAPI: Used by CHAN_CAPI as [ISDN1]

Echo Cancellation: Off

RTP: Off

Fax detection: both call directions

Fax detection time: Unlimited (call duration)

Hold type: local

Context: isdn-in

Dialout group: 1

PBX call group: default

PBX pickup group: default

PBX transfer group: default

Create capi.conf Download capi.conf Download modules.conf Download README

Figure 4. CHAN_CAPI Configuration Screen

When fax tone detection is enabled, an extension labeled fax is activated, as shown below:

```
exten => fax,1,capicommand(sendfax/tmp/sendfax001.sffl888-111-2345|Outgoing Fax)
```

You can explicitly use tone detection in the Dialplan to analyze the sound heard on answer, and to direct the call to a particular extension if human speech is detected. In the following example, a call is directed to extension 100 when the Dialplan detects human speech:

```
exten => 1,n,capicommand(starttonedetection|100)

exten => 100,1,capicommand(stoptonedetect)
; Can now look for 0xC9 = human speech detected
exten => 100,n,SetTone(TONERCVD=${CAPIDETECTEDTONE})
```

For more information about tone detection, refer to README.media in the [Dialogic® Diva® System Release 9.0.xLIN download](#).

Receiving a Fax

A call made by Asterisk is usually answered using the Asterisk Answer() command, which places the application in voice mode. If you are certain that the incoming call is a fax and want to answer a channel in fax mode, use capicommand receivefax instead of Answer() in the Dialplan. Alternatively, you can switch to fax mode by calling capicommand receivefax after answering a call with Answer().

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By default, the file is deleted if fax reception is not successful. To keep partially received or questionable files, use the k option (“keep bad fax”), as shown in the following example:

```
capicommand(receivefax|/tmp/recvdfax.${UNIQUEID}|888-111-2345|
Incoming Fax|k)
```

Syntax

The syntax for receivefax is:

```
capicommand(receivefax|<filename>[|<stationid>|<pageheader>|<options>])
```

Where:

- <filename> is a mandatory parameter containing the full path and file name for the resulting fax file.
- <stationid> is an optional user-defined identifier.
- <pageheader> is an optional small header line at the top of the page containing the date, header information, originating telephone number, and page number.
- <options> is one of the following fax options:
 - b - Enable T.43 coding.
 - d - Do not use MR (2D) coding.
 - e - Do not use ECM.
 - f - Allow fine resolution.
 - j - Enable JPEG coding.
 - k - Keep the fax document if there are errors. (By default, the document is removed if fax transmission is not successful.)
 - m - Do not use MMR (T.6) coding.
 - t - Do not use T.85.
 - u - Activate support for super/ultra fine resolutions and paper formats.

The following example shows how to receive an incoming fax from the station identified by 888-111-2345.

```
[recvfax]
exten => fax,1,capicommand(receivefax|/tmp/recvdfax.${UNIQUEID}|
888-111-2345|Incoming Fax|)
```

For more information about capicommand receivefax syntax, see the README.Diva.fax file in the /usr/lib/divas/chan_capi_readme directory.

Fax Tone Detection for Receiving a Fax

If a line is not dedicated to fax, the application can answer in voice mode and then direct the Dialplan to receive the fax when a fax tone is detected. You can use hardware DSP fax tone detection to detect a fax.

To enable fax tone detection:

- 1 Access the CHAN_CAPI configuration screen from the main page of the Diva Media Board's web interface.
- 2 Set the Fax detection field to incoming, outgoing, or both call directions.
- 3 Optionally, reset the timeout for waiting for the fax tone after answer by changing the default setting for the Fax detection time field.

If a fax tone is detected on the other side, the Dialplan jumps to the fax context.

In the following example, an incoming call is directed to the mainmenu context, where a greeting/menu plays while the system listens for a DTMF tone entered as a menu choice. If a fax tone is detected, control jumps to the fax extension, where capicommand receivefax executes.

```
[mainmenu]
exten => s,1,Answer
exten => s,n,Background(maingreeting)
exten => s,n,WaitExten
exten => 1,1,Goto(ringphone1,s,1)
exten => 2,1,Goto(ringphone2,s,1)
exten => fax,1,capicommand(receivefax|/tmp/recvdfax.${UNIQUEID}
|888-111-2345|Incoming Fax|)
```

For more information about extensions.conf, see the extensions.conf section, later in this application note. For a sample CHAN_CAPI screen, see Figure 4, "CHAN_CAPI Configuration Screen" earlier in this application note.

CAPI Fax Format

The output of capicommand receivefax is formatted as a structured fax format (.sff) file, which is the standard format for a fax file under the Common ISDN Application Programming Interface (CAPI). In most cases, you will need to convert this type of file into a standard graphic file format before it can be viewed.

To convert an .sff file to standard graphic file format, do any of the following:

- Use the sff2tiff utility to convert the .sff file to .tif. This utility comes with the Diva System Release, and may need to be built from source, depending on the capi installation options used. It supports all fax resolutions (Standard, Fine, Super Fine, and Ultra Fine), and non-standard paper formats.
- To build sff2tiff from source, access /usr/lib/opensdiva/divas/src/src, and type the following commands:

```
tar -xvfz acopy2.tgz
cd acopy2
./configure
make
```

- Use the sfftobmp utility from SffTools (<http://sfftools.sourceforge.net/sffview.html>) to convert the .sff file to a .bmp, .jpg, or .tif file. This utility does not provide support for SuperFine resolutions, UltraFine resolutions, or non-standard paper formats.
- Use the freeware graphic viewer IrfanView to view a fax in .sff format without converting it. This utility does not provide support for SuperFine resolutions, UltraFine resolutions, or non-standard paper formats.

Obtaining Fax Results

The following Asterisk variables record the results of sending or receiving a fax:

Variable	Description
FAXCFFFORMAT	Applies if FAXFORMAT is set to 8 (Native). Values are: 1 - Continuous tone color and gray-scale mode according to T.4 Annex E, using JPEG coding 2 - Lossless color and gray-scale mode according to T.43, using JBIG coding
FAXEXTEN	Original Asterisk extension number, if fax detection is activated
FAXFORMAT	Format of the received fax document. Values are: 0 - CAPI structured fax format 1 - Plain fax format (modified Huffman coding) 2 - PCX 3 - DCX 4 - TIFF 5 - ASCII 6 - Extended ANSI 7 - Binary File transfer 8 - Native (CFF)
FAXID	ID of the remote fax machine
FAXPAGES	Number of pages received
FAXRATE	Baud rate of the fax connection
FAXREASON	B3 disconnect reason
FAXREASONTEXT	Text representation of the FAXREASON value
FAXRESOLUTION	Applies if FAXFORMAT is set to 8 (Native). Values are: 1 - Continuous tone color and gray-scale mode according to T.4 Annex E, using JPEG coding 2 - Lossless color and gray-scale mode according to T.43, using JBIG coding
FAXSTATUS	Status of the fax transmission. Values are: 0 - Successful 1 - Error

Table 1. Asterisk® Variables that Record Fax Results

The following example shows a section of an Asterisk Dialplan that uses variables to capture fax results for printing:

```
[recvfax]
exten => fax,1,capicommand(receivefax|/tmp/recvdfax.${UNIQUEID}
|888-111-2345|Incoming Fax|)

; Fax results logged. Hangup channel used as call will be over with
exten => h,n,AGI(printfaxresults.sh,${FAXSTATUS},${FAXREASON},${FAXREASONTEXT},
${FAXRATE},${FAXRESOLUTION},${FAXFORMAT},${FAXCFFFORMAT},
${FAXPAGES},${FAXID},${FAXEXTEN},${ElapsedFaxTime},Faxesreceived.log)
```

Note: This example is taken from the printfaxresults.sh script. To see the complete script, refer to printfaxresults.sh later in this application note.

Enhanced Fax with Dialogic® Diva® Media Boards and Asterisk®

The fax scenarios described in this section are based on the following criteria:

- Dell PowerEdge SC440 with an Intel Pentium Dual Core CPU @ 2.00 GHz and 2 GB of memory
- Dialogic® Diva® Analog-2 Media Board, PCIe version
- Hewlett Packard OfficeJet G85xi Printer/Fax/Scanner/Copier
- Two live US analog telephone lines
- RedHat Enterprise Linux 4, Update 6
- Dialogic® Diva® drivers 9.0-109-72, which include the chan_capi software
- Asterisk 1.6.0.7

The scenarios were tested in one of the following ways:

- Back-to-back on the board, with one side sending the fax and the other side receiving it.
- Between the board and the Hewlett Packard fax machine.

V.34 “Fast” Fax

V.34 provides one of the widest ranges of supported data transmission rates, allowing it to obtain more favorable speeds and reliability over a wide range of line conditions. With V.34, fax pages are transmitted at 33600 bps. This is more than twice the speed of V.17, which transmits faxes at 14400 bps, and more than three times the speed of 9600 bps fax. After each page is transmitted in a V.34 system, a retraining or re-synchronizing process is done between each additional page until the fax call is completed.

Transmission rates are automatically negotiated and set when the two sides first connect.

V.34 speeds can be implemented with a back-to-back connection on an analog or digital Diva Media Board. Since both sides support V.34, the highest possible rate between the two stations is chosen. In the case of the analog lines used for this test, this resulted in a 31200 bps connection.

The following example compares the results of sending a gray scale picture at V.17 speed (14400 bps) versus sending the same picture at V.34 speed (33600 bps). Figure 5 shows the picture used in this example:



Figure 5. Sample Gray Scale Picture Used in Fax Example

The results of the V.17 speed fax are:

```
FAXSTATUS = 0
FAXREASON = 0
FAXREASONTEXT = OK
FAXRATE = 14400
FAXRESOLUTION= 1
FAXFORMAT = 0
FAXPAGES = 1
FAXID = 888 123 4567
FAXEXTEN = s
Elapsed time for fax send/receive = 545 seconds
```

The results of the V.34 speed fax are:

```
FAXSTATUS = 0
FAXREASON = 0
FAXREASONTEXT = OK
FAXRATE = 31200
FAXRESOLUTION= 1
FAXFORMAT = 0
FAXPAGES = 1
FAXID = 888 123 4567
FAXEXTEN = s
Elapsed time for fax send/receive = 242 seconds
```

V.34 speed (even cut back to 31200 bps due to analog line factors) allowed the picture to be sent in less than half (44%) of the time needed to send the fax at V.17 speed, with no loss of picture quality.

Color Fax

Color fax is implemented using the following fax formats:

- Lossless color and gray-scale mode (T.43 using JBIG encoding).
- Continuous color tone and gray-scale mode (T.4 Annex E using JPEG encoding, which can be viewed as a JPEG file).

These formats are not included in the standard CAPI structured fax format.

To send a color fax, provide the fax file in .cff format, and use the exten context in the Asterisk Dialplan:

```
exten => 100,n, capicommand (sendfax|tmp/outboundfax.cff|
888-123-4567|Dialogic Diva Test Sendfax)
```

To enable the two types of color fax reception, add the b and j options to capicommand receivefax. For example:

```
; Options "bj" enable JBIG or JPEG color fax reception
exten => 200,n,capicommand(receivefax|
/tmp/inboundfax.sff|888-765-4321|
Dialogic Diva Test Recvfax|bj)
```

T.38 Fax (FoIP)

Configure T.38 fax parameters in the same way as T.30 fax parameters on the extended configuration screen for the media board. (See the “Global Fax Configuration Options of Dialogic® Diva® Media Boards” section, above.)

T.38 can be tested with the two-port [Dialogic® Diva® softIP for SIP demo license](#). Once the license is installed and activated, a Diva softIP M-board is available for configuration. To configure the M-board, follow these steps:

- 1 Configure the IP-related parameters for the board on the Board Configuration page of the web interface.
- 2 Update capi.conf so that the Asterisk Dialplan can interact with the FoIP/SIP channels. Either edit the file directly or use the CHAN-CAPI configuration screen on the web interface, as described in the following section.

Clear Channel FoIP

In addition to T.38 fax using Diva SoftIP for SIP, Diva Media Boards can be used to establish a clear channel FoIP connection. Configure clear channel FoIP parameters in the same way as T.38 and T.30 fax parameters on the extended configuration screen for the media board. (See the “Global Fax Configuration Options of Dialogic® Diva® Media Boards” section, above.) When you configure clear channel FoIP parameters, you must also allocate the DSP-based fax resources used by the IP connection. These are obtained from the Diva hardware using the chan_capi resource command in the Asterisk Dialplan prior to sending or receiving the fax.

For more information, see the Diva and Asterisk related groups on the [Dialogic Exchange Network](#).

Configuration Files and Utilities

Use the following configuration files and utilities to use Diva Media Boards with Asterisk:

- capi.conf
- extensions.conf
- printfaxresults.sh
- fax.call
- t38fax.call

capi.conf

The capi.conf file enumerates the parameters used to configure the Dialogic® Diva® channel drivers. To create capi.conf, follow these steps:

- 1 From the main page on the Diva media board web interface, click the CHAN_CAPI link.

A screen like the following displays for each Diva Media board:

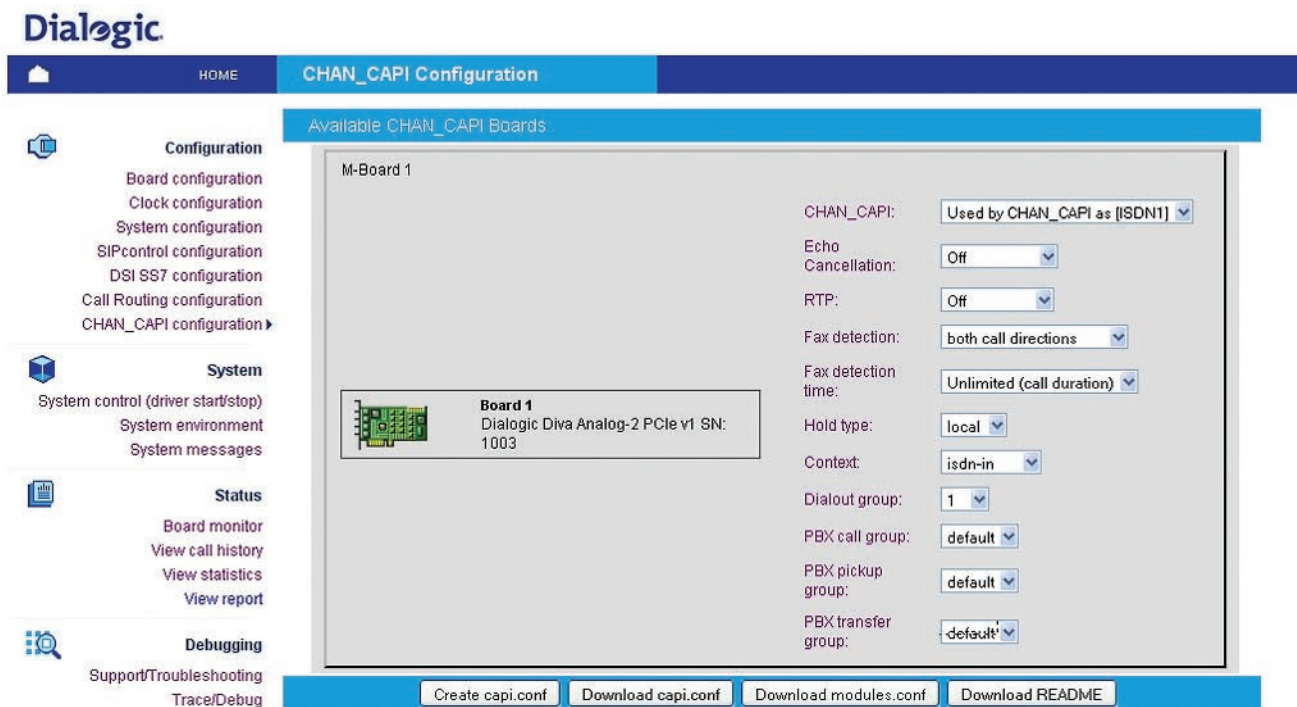


Figure 6. CHAN_CAPI Configuration Screen

- 2 Select appropriate values for the Fax detection and Fax detection time fields. For the other fields, default values should be fine for most configurations. Click on a field title to view the related Help.
- 3 Click the Create capi.conf button to create the capi.conf file according to the values defined on this screen. The system also creates or modifies the Asterisk module.conf file, so that the capi.conf file automatically loads when Asterisk starts.
- 4 Optionally, click the Download modules.conf button on the bottom of the screen to see the contents of the module.conf file.

Note: Once the capi.conf file is created, you may need to edit it manually.

extensions.conf

The extensions.conf file contains the Asterisk Dialplan, which controls how incoming and outgoing calls are handled and routed. If you have your own extensions.conf file, you can copy it to the /etc/asterisk directory, which is created when you install Asterisk. Alternatively, you can create an extensions.conf file by entering **make samples** at the command line. This command creates a set of sample configuration files in the /etc/asterisk directory, including a base extensions.conf file that can be modified at any time.

Once the basic extensions.conf file is taking/receiving voice calls, you can modify it to send faxes, receive faxes, and detect fax tones. The following extensions.conf file excerpt contains the contexts used to perform the fax scenarios discussed in this application note:

```
; Contexts for Dialogic Diva Fax Feature Tests
[isdn-in]
; Diva CAPI context for inbound calls
exten => s,1,Goto(mainmenu,s,1)
[sendfax]
; Expect to get here from dotcall script making outbound call or from mainmenu below
;
; Send fax, log results, then hang up. Don't forget to set the location of the
outbound fax file
exten => 100,1,Verbose(:> Sending Dialogic Diva Fax...)
exten => 100,n,set(BeforeFaxTime=${EPOCH})
exten => 100,n,capicommand(sendfax|/root/opensource/diva/fax/outboundfax.sff|888-123-
4567|Dialogic Diva Test Sendfax)
exten => 100,n,Hangup
exten => h,1,set(ElapsedFaxTime=${EPOCH}-${BeforeFaxTime})
; Log fax results. Hang-up channel used since call will be over with
exten => h,n,AGI(printfaxresults.sh,${FAXSTATUS},${FAXREASON},${FAXREASONTEXT},${FAXRATE
},${FAXRESOLUTION},${FAXFORMAT},${FAXCFFFORMAT},${FAXPAGES},${FAXID},${FAXEXTEN},${Elapse
dFaxTime},FaxesSent.log)
[recvfax]
; Expect to get here when a fax tone is detected. Don't forget to set the location of
the bound fax file
exten => 200,1,Verbose(:> Receiving Dialogic Diva Fax...)
exten => 200,n,set(BeforeFaxTime=${EPOCH})
; Options "bj" enable JBIG or JPEG color fax reception
exten => 200,n,capicommand(receivefax|/root/opensource/diva/fax/inboundfax.sff|888-765-
4321|Dialogic Diva Test Recvfax|bj)
exten => 200,n,Hangup()
exten => h,1,set(ElapsedFaxTime=${EPOCH}-${BeforeFaxTime})
; Log fax results. Hang-up channel used since call will be over with
exten => h,n,AGI(printfaxresults.sh,${FAXSTATUS},${FAXREASON},${FAXREASONTEXT},${FAXRATE
},${FAXRESOLUTION},${FAXFORMAT},${FAXCFFFORMAT},${FAXPAGES},${FAXID},${FAXEXTEN},${Elapse
dFaxTime},Faxesreceived.log)
exten => 200,n,Hangup()
[mainmenu]
exten => s,1,Answer
exten => s,n,Background(demo-congrats) ; Use "Welcome to demo" Asterisk sample file
; Very simple menu
exten => s,n,WaitExten
exten => 1,1,Dial(capi/ANALOG/19787449098,20,G(sendfax,100,1))
exten => 2,1,Hangup()
; Example of detecting fax tone by diva card.
; When that is the case, "fax" extension is returned, and we go to
; recvfax context
exten => fax,1,Goto(recvfax,200,1)
```

printfaxresults.sh

The printfaxresults.sh utility is an Asterisk AGI script that logs the results of the fax transmission or reception. To use this utility:

- Copy the code shown below into the /var/lib/asterisk/agi-bin directory.
- Invoke the script in the Asterisk Dialplan (extensions.conf) using fax result variables.

The script expects eleven arguments, so make sure to coordinate any changes to the script with changes to extensions.conf.

```
#!/bin/sh
OUTFILE=/tmp/${12}
rm -f $OUTFILE
echo "Results of Dialogic Diva Fax send/receive" >> $OUTFILE
echo "-----" >> $OUTFILE
echo >> $OUTFILE
echo "FAXSTATUS = "$1 >> $OUTFILE
echo "FAXREASON = "$2 >> $OUTFILE
echo "FAXREASONTEXT = "$3 >> $OUTFILE
echo "FAXRATE = "$4 >> $OUTFILE
echo "FAXRESOLUTION= "$5 >> $OUTFILE
echo "FAXFORMAT = "$6 >> $OUTFILE
echo "FAXCFFFORMAT = "$7 >> $OUTFILE
echo "FAXPAGES = "$8 >> $OUTFILE
echo "FAXID = "$9 >> $OUTFILE
echo "FAXEXTEN = "$10 >> $OUTFILE
echo "Elapsed time for fax send/receive = ${11} seconds" >> $OUTFILE
echo >> $OUTFILE
echo >> $OUTFILE
```

fax.call

The fax.call utility is an Asterisk AGI script that sends an outbound fax from a system configured with Diva Media Boards. To use this utility:

- 1 Copy the code shown below into the /var/spool/asterisk/outgoing directory.
- 2 Replace 8005551212 with the fax number to dial.
- 3 Make sure the Asterisk Dialplan has a sendfax context to trigger the outbound fax call.

```
Channel: capi/ISDN1/8005551212
MaxRetries: 0
Context: sendfax
Extension: 100
Priority: 1
```

For more information about sending a fax, refer to "Sending a Fax," above.

t38fax.call

The t38fax.call utility is an Asterisk AGI script that sends an outbound T.38 fax from a system configured with Dialogic® Diva® SoftIP. To use this utility:

- 1 Copy the code shown below into the /var/spool/asterisk/outgoing directory.
- 2 Replace sip:1000@192.168.1.120 with the SIP address of the other T.38 endpoint.
- 3 Make sure the Asterisk Dialplan has a sendfax context to trigger the outbound fax call.

```
Channel: capi/ISDN1/sip:1000@192.168.1.120
MaxRetries: 0
Context: sendfax
Extension: 100
Priority: 1
```

For more information about sending a fax, refer to “Sending a Fax,” above.

Dialogic® Diva® Media Board Commands

This section lists the chan_capi commands, which are the Diva Media Board commands that can be sent from an Asterisk extensions.conf file as part of a Dialplan. There are other call-control related commands that are not described here. For information on the call-control related commands and more details on the media commands, see the series of README files that accompany the [Diva System Release for Linux \(SR 9.0.xLIN\)](#).

Command	Summary
chat	Places the caller into a chat room/conference.
clamping	Activates or deactivates the suppression (removal from voice stream) of DTMF tones.
incpitchcontrol	Incrementally changes the recording (receive direction) and playback (transmit direction) rate. Valid range is 1250 to 51200 Hz.
increceivedgain	Incrementally changes digital gain control (DGC) for the receive direction. Valid range is -127 dBm to +6 dBm.
incsenddgain	Incrementally changes the DGC for the receive direction. Valid range is -127 dBm to +6 dBm.
mftonedetection	Activates or deactivates MF listen on B channel data. If activated, maps MF tones to the appropriate DTMF digits. MF digits K1, K2, KP, S1, and ST map to DTMF digits A, B, C, D, and * respectively.
noisesuppressor	Activates or deactivates the suppression of ambient noise. This command removes non-speech noise (such as that caused by fans, air cooling systems, cars, and trains) and non speech sounds from speech in an audio stream.
pitchcontrol	Sets the recording (receive direction) and playback (transmit direction) rate. Valid range is 1250 to 51200 Hz.
pulsedetection	Activates or deactivates dial pulse detection. If activated, detected dialog pulses are mapped to appropriate DTMF digits.
receiveagc	Activates or deactivates Automatic Gain Control (AGC) for the receive direction. The AGC level is -6dBm.
receivedgain	Controls DGC for the receive direction. Valid range is -127 dBm to +6 dBm.
sendtone	If activated, sending one tone while another tone is already active automatically replaces the tone being transmitted with the new one. Sending DTMF digits automatically stops tone transmission.
starttonedetection	Starts the ability to detect a wide range of complex tones such as dial, ring, busy, SIT, fax, answering machine, and human speech.
stoptone	Stops the transmission of the currently active tone (sent by sendtone).
stoptonedetection	Stops the detection of complex tones.
sendagc	Activates or deactivates AGC for the send direction. The AGC level is -6 dBm.
senddgain	Controls DGC for the send direction. The gain level is in the range of -127 dBm to +6 dBm.
vc	<p>Applies media control commands during voice message playback to the voice stream, without interrupting the playback of the stream. This also applies to conferences and connections between two parties.</p> <p>vc binds arbitrary chan_capi commands to sequences of events such as DTMF digits. Once events are detected, the appropriate command is executed without interruption to the voice stream.</p> <p>chan_capi commands used with vc include AGC, noise suppression, and controlling the level of the signal or playback speed.</p> <p>vc commands can be used with any supported channel driver command, but they are not executed in the context of the Dialplan. Instead, they are executed using the context of detected events parallel to and independent from the Dialplan.</p>

Table 2. Dialogic® Diva® Media Board Commands for the Asterisk® Dialplan

Acronyms

AGC	Automatic Gain Control
API	Application Programming Interface
CAPI	Common ISDN Application Programming Interface
CPU	Central Processing Unit
DGC	Digital Gain Control
DMA	Direct Memory Access
DTMF	Dual-Tone Multi-Frequency
ECM	Error Correction Mode
ISDN	Integrated Services Digital Network
MH	Modified Huffman
MF	Multi-frequency
MMR	Modified Modified Read
MR	Modified Read
PBX	Private Branch Exchange
RISC	Reduced Instruction Set Computer
TDM	Time Division Multiplex

For More Information

Downloads

You can download the following software related to the fax capability of Diva Media Boards and Asterisk:

- Dialogic® Diva® System Release 9.0.xLIN
- Asterisk Releases from Digium, Inc. at <http://www.asterisk.org/downloads>
- chan-capi module, from the Melware.org Wiki at <http://www.melware.org/ChanCapi>

Articles

The following articles contain information relating to the fax capabilities of Diva Media Boards, CAPI, or Asterisk:

- Articles accessible by clicking the following links on the [Dialogic Service Center](#) web page:
 - How to detect a fax call
 - Detecting Fax CED and CNG tones
 - Supported TIFF formats for Fax
 - Troubleshooting Diva SDK fax issues
- Articles and developer support at <http://www.asterisk.org/support>
- CAPI Association, “CAPI: Common ISDN Interface,” at <http://www.capi.org>
- [V.34 Fax - Making Improved Performance and Cost Savings Possible](#)

README Files

README files that reference fax-related information for Diva Media Boards are located in the main directory of the Dialogic® Diva® System Release, or under `/usr/lib/opensdiva/divas/chan_capi_readme` after the Diva drivers are installed. The names of the readme files are README, README.Diva.fax, README.Diva.qsig, README.media, and README.qsig.

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