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Application Note

Introduction to the DiaStar™ Server Release 1.0

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Application Note

Executive Summary

Project DiaStar™ is an open source project sponsored by the Dialogic Corporation whose purpose is to create software that allows open source developers to access portions of the Dialogic® product portfolio and bring advanced communications technology to demanding open source markets.

The DiaStar™ Server (DSS) was developed by Project DiaStar, and acts as a multi-function peripheral that can be implemented as a media gateway, signaling gateway, or media server. Because it operates in a distributed client-server environment, DSS can provide many beneficial features for open source developers working on Asterisk® or other open source implementations.

The first DiaStar™ Technology release is a TDM gateway that uses DSS, can work with Asterisk, and leverages Dialogic® Perfect Call, which provides Call Progress Analysis (CPA) for outbound calling. A chan_woomera client for Asterisk is also included.

This application note introduces the DSS and provides pointers to a wealth of resources for using it. Topics include configurations with Asterisk and call flow.

Note: Many of the resources mentioned in this application note are found on the Project DiaStar website and elsewhere. For your convenience, the links to these resources are live in the PDF version of this application note, which can be downloaded at www.dialogic.com/products/docs/appnotes/11541-diastar-intro-an.pdf. No registration is required to access or download this application note.

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Table of Contents

Introduction 2
- Highlights 2
- Components in the DiaStar™ Server 2
- Using the DiaStar™ Server to Interface with the PSTN 3

DiaStar™ Technology Configurations 3
- Co-Resident DiaStar™ Server and Asterisk® PBX 4
- One DiaStar™ Server, One Asterisk® PBX 4
- One DiaStar™ Server, Multiple Asterisk® PBXs 5
- Multiple DiaStar™ Servers, One Asterisk® PBX 6
- Multiple DiaStar™ Servers, Multiple Asterisk® PBXs 7

chan_woomera Client for Asterisk® 7
DiaStar™ Server and Asterisk® Call Flow 8
The Project DiaStar™ Open Source Project 10
Getting Started with the DiaStar™ Server 10
- Documentation 10
- Support 10

Acronyms 11
For More Information 11

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Introduction

Project DiaStar™ is an open source project sponsored by the Dialogic Corporation whose purpose is to create software that allows open source developers to access portions of the Dialogic® product portfolio and bring advanced communications technology to demanding open source markets. The website for the project is located at www.projectdiastar.org.

The DiaStar™ Server (DSS) is the first available software developed from Project DiaStar. DSS acts as a multi-function peripheral that can be implemented as a media gateway, signaling gateway, or media server. The DSS operates in support of an Asterisk® (or other open source) implementation via the open source Woomera protocol. Additionally, the DSS is a Woomera-compliant server and can operate with projects or products that implement a corresponding Woomera client (such as chan_woomera for Asterisk).

Highlights

DSS can provide many beneficial features, including enhanced scalability, reliability, redundancy, and control. Here are some of the highlights of the first release of DSS:

- **Creates a client/server architecture for Asterisk** — Enhances reliability, scalability, and redundancy for Asterisk implementations (FreeSWITCH® support is planned)
- **Distributed architecture allows media and signaling functions to be abstracted and moved from a telephony server to the DSS** — Reduces the processing load on a telephony server
- **Abstracts and encapsulates media, signaling, and gateway functions** — Allows developers to access Dialogic® functionality while working within their native programming environment
- **Multiple configurations, including one telephony server to one DSS, multiple telephony servers to one DSS, or one telephony server to multiple DSSs** — Provides flexibility in distributing and balancing processing loads; multiple telephony clients can share the resources of a single DSS
- **Compatible with Dialogic® HMP Interface Boards (DNI Boards)** — Allows converged TDM-IP and TDM-only solutions in PCI and PCIe form factors
- **Supports video, SS7 signaling, fax, and FoIP (planned)** — Enables high-value media and signaling capabilities to be brought to the market in a reliable and scalable way
- **Up to 24 spans (720 simultaneous calls) of TDM connectivity (T1/E1) per DSS** — Enables high-density solutions

Components in the DiaStar™ Server

DSS includes an open-source Woomera-compliant server that communicates with Asterisk and a closed-source component that communicates with the Dialogic® products inside DSS. These Dialogic products include DNI Boards, which provide T1 or E1 connections with a variety of protocols (ISDN variants, T1/E1 CAS, etc.), as well as certain derivatives of Dialogic's industry-leading media processing software that can add functionality, such as call progress analysis, fax, FoIP, SS7 signaling, and video. Not all of these features and functions will be available in the initial release of DSS. For information about feature and function availability, visit the Project DiaStar website or contact your local Dialogic sales representative.

Using the DiaStar™ Server to Interface with the PSTN

When used with open source telephony clients, DSS can act as a network interface to the Public Switched Telephone Network (PSTN). Although it is possible to connect an application server, such as Asterisk, directly to one or more PSTN interface boards, placing this functionality in a separate server can provide the following benefits:

- **Scalability** — Media functions can be either performed by the telephony application or offloaded to the DSS to enable higher channel counts than are possible in a single-server system
- **Redundancy** — A system can be configured without a single point of failure. If interrupted, the system switches to a backup component.
- **Reliability** — Dialogic products are engineered to provide high reliability and availability. Adding a DSS might require some initial downtime to configure Asterisk, but adding chan_woomera clients for Asterisk should not require downtime.
- **Control** – Placing functionality into separate, smaller components provides greater control over the functioning of each individual component

The DSS leverages Dialogic's proven media processing software and PSTN network interface technology. The full suite of PSTN protocols (ISDN, CAS, and SS7 over T1/E1) found in the Dialogic® Global Call API can be used with DSS. In addition, Dialogic's many years of experience in efficiently converting media streams from Time Division Multiplexed (TDM) to Internet Protocol (IP) helps to provide very low latency.

For telephony client connectivity, the DSS uses a communications protocol based on Woomera, an open source, IP-based signaling protocol for Local Area Network (LAN) environments. The protocol used by the DSS is a readable text-based protocol that is easy to understand and debug, and that uses Real Time Protocol (RTP) to deliver media streams efficiently.

The first DiaStar™ Technology release is a TDM gateway that uses DSS, can work with an Asterisk PBX, and leverages Dialogic® Perfect Call, which provides Call Progress Analysis (CPA) for outbound calling. A chan_woomera client for Asterisk is also included.

DiaStar™ Technology Configurations

Because DiaStar Technology uses a client-server architecture, one or more clients can request services via an IP connection from DSS. The clients act as telephony application servers and request call delivery using a communications protocol based on Woomera. The DSS interacts with the PSTN using ISDN, CAS, or SS7 over T1/E1 signaling and a TDM-based media stream, and then translates the calls into a format that the client can understand.

The DSS, chan_woomera client, and Asterisk PBX components can be configured in various ways to provide different levels of scalability and reliability. The following configurations are supported as of September 2009:

- Co-Resident DSS and Asterisk PBX
- One DSS, one Asterisk PBX
- One DSS, multiple Asterisk PBXs
- Multiple DSSs, one Asterisk PBX
- Multiple DSSs, multiple Asterisk PBXs

Co-Resident DiaStar™ Server and Asterisk® PBX

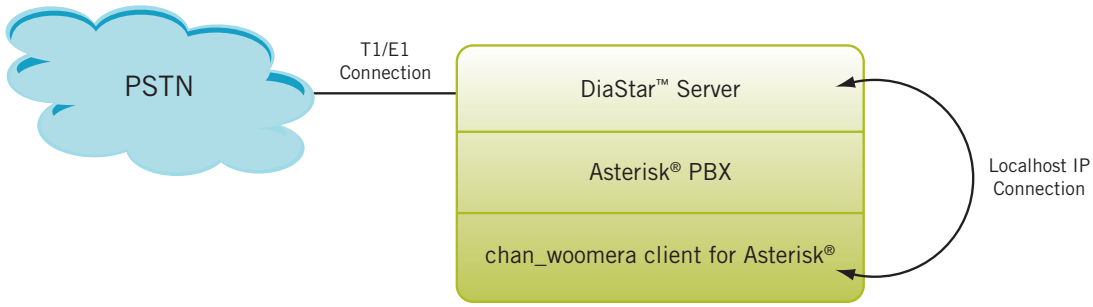

Figure 1. One Co-Resident Server for DSS and Asterisk PBX

Figure 1 shows both DSS and the Asterisk PBX running on the same system. Such co-residency allows Dialogic® PSTN connectivity products to be used with Asterisk on a single system when sufficient CPU and memory resources are available to run the desired number of channels. A co-resident server also enables a convenient test environment.

Unix domain sockets on the localhost IP interface provide the client-server connection that runs the Woomera protocol. Such a setup provides speed and efficiency, as the packets involved do not need to be sent to the Ethernet NIC for delivery to an external system.

One DiaStar™ Server, One Asterisk® PBX

Figure 2 shows a configuration with one DSS and one Asterisk PBX.

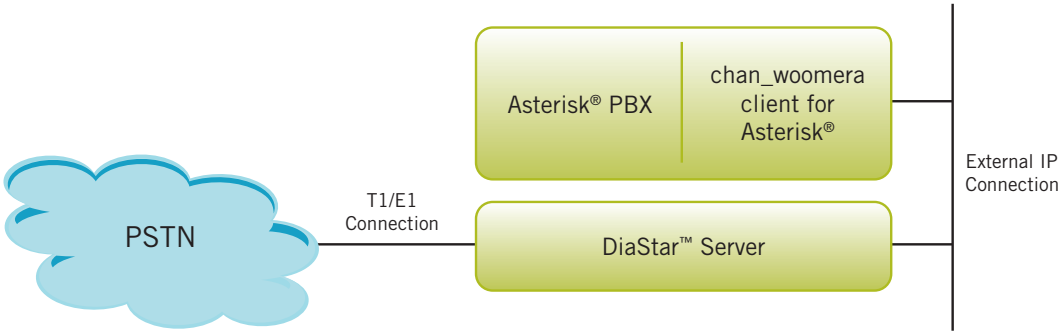

Figure 2. One DSS, One Asterisk PBX

In this configuration, the separation of the PSTN interface on the DSS from the application processing on the Asterisk PBX allows the use of smaller, less expensive systems to reach the same channel density as non-distributed systems. The configuration neatly separates functionality, but does not provide any added reliability, because both parts of the system must be operational in order to handle calls. No redundant components are present.

One DiaStar™ Server, Multiple Asterisk® PBXs

Figure 3 shows a configuration with one DSS and multiple Asterisk PBXs.

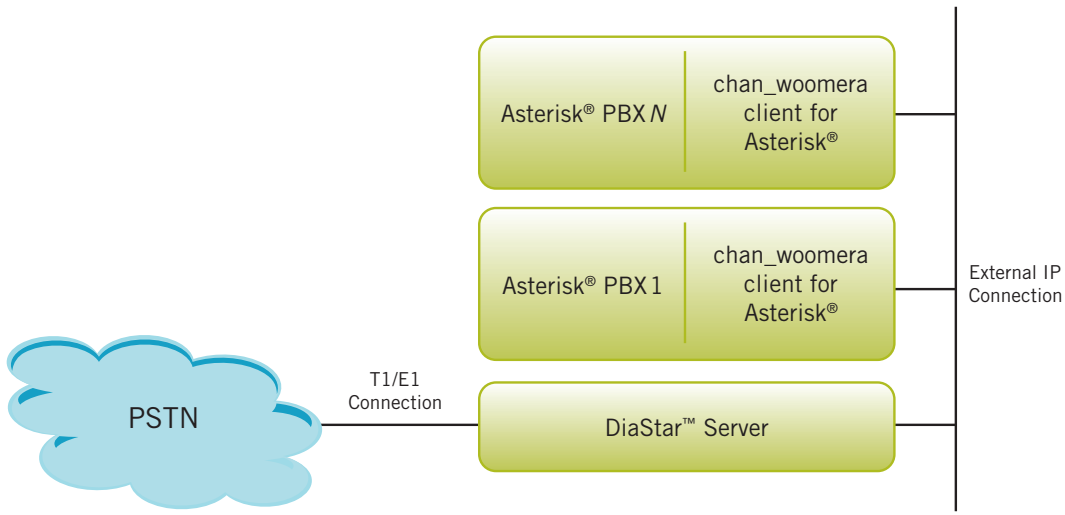

Figure 3. One DSS, Multiple Asterisk PBXs

This configuration spreads application services across multiple clients, providing the following advantages:

- **Higher call volume** — When all Asterisk PBXs are fully operational, each Asterisk installation can handle a maximum number of calls that does not exceed the "safe" limit of simultaneous Asterisk channels. Generally, a DSS with Dialogic® PSTN interface hardware can carry more calls than an Asterisk installation alone
- **Load balancing** — The DSS can accept connections from a number of clients, and then offer an incoming call to these clients almost simultaneously. The first client to respond to the HELLO with an ACCEPT receives the call. Thus, the least busy or fastest client processes the call, directing traffic away from busier or slower clients.
- **Redundancy** — If one of the Asterisk PBX systems goes down, another will be available to take calls. In this case, overall system capacity is reduced, but the system can function until the malfunctioning client is repaired. If extra capacity is built into a number of Asterisk servers (***N***), then ***N*** – 1 servers should be able to handle the full call volume.
- **Resource sharing** — Multiple Asterisk PBXs can share the same TDM hardware and PSTN lines. Physical system configuration is easier if network interface boards and supporting software are confined to a single system.

Multiple DiaStar™ Servers, One Asterisk® PBX

Figure 4 shows a configuration with multiple DSSs and one Asterisk PBX.

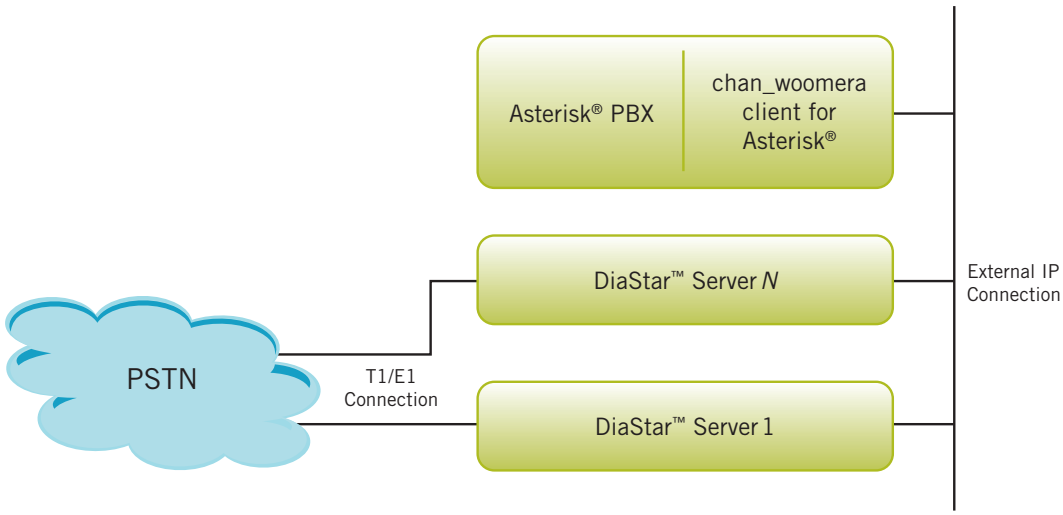

Figure 4. Multiple DSSs, One Asterisk PBX

In this configuration, multiple DSSs handle separate trunks from a central office and direct calls to one Asterisk PBX. If one DSS encounters a problem and refuses to take calls, the central office can redirect calls to another DSS. No change is noticeable to the application or the callers, because calls can reach the same Asterisk PBX through any DSS.

Multiple DiaStar™ Servers, Multiple Asterisk® PBXs

Figure 5 shows a configuration with multiple DSSs and multiple Asterisk PBXs.

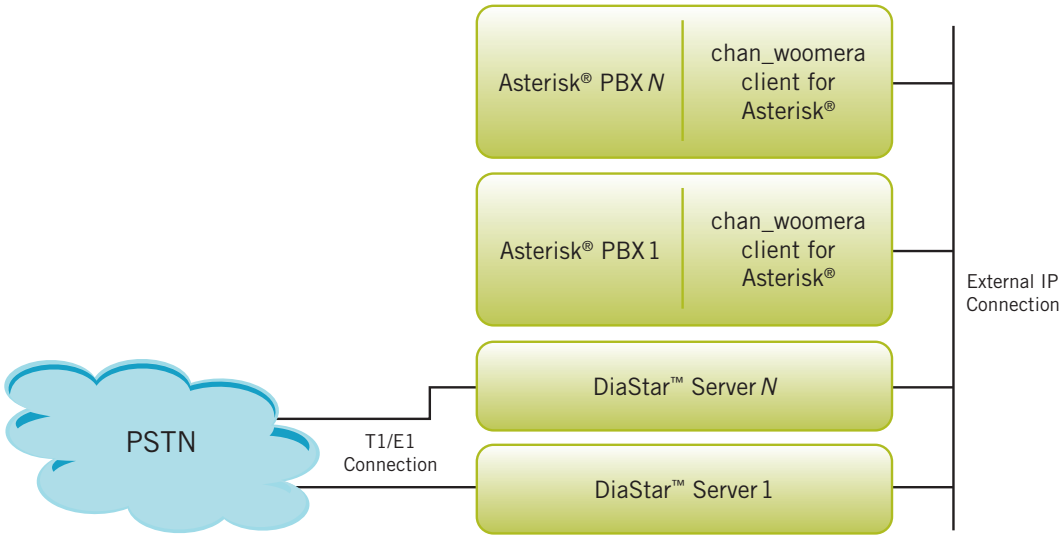

Figure 5. Multiple DSSs, Multiple Asterisk PBXs

In this configuration, multiple DSSs and multiple Asterisk PBXs are possible. The exact configuration depends on the needs of the installation. Factors include:

- Number of trunks from the PSTN
- Level of redundancy desired
- Type and number of applications running on Asterisk

chan_woomera Client for Asterisk®

A wide variety of Asterisk "channel drivers" are available for the many different technologies that Asterisk supports, including SIP, ISDN, and IAX. Although it is possible to write a "chan_dialogic" client to take advantage of the Dialogic Global Call API and Dialogic® R4 API, moving this part of the channel driver into a separate server (DSS) and using an IP-based client for application processing (such as the chan_woomera client for Asterisk), can provide more flexibility than bundling this functionality into a single component.

A chan_woomera client for Asterisk is distributed with the DSS and is easily built and installed. For information, see *Asterisk Client (chan_woomera) – Download, Build and Install*

DiaStar™ Server and Asterisk® Call Flow

The call flow diagram in Figure 6 shows how an inbound call from the PSTN is routed to DSS and then to a chan_woomera client for Asterisk and an Asterisk PBX.

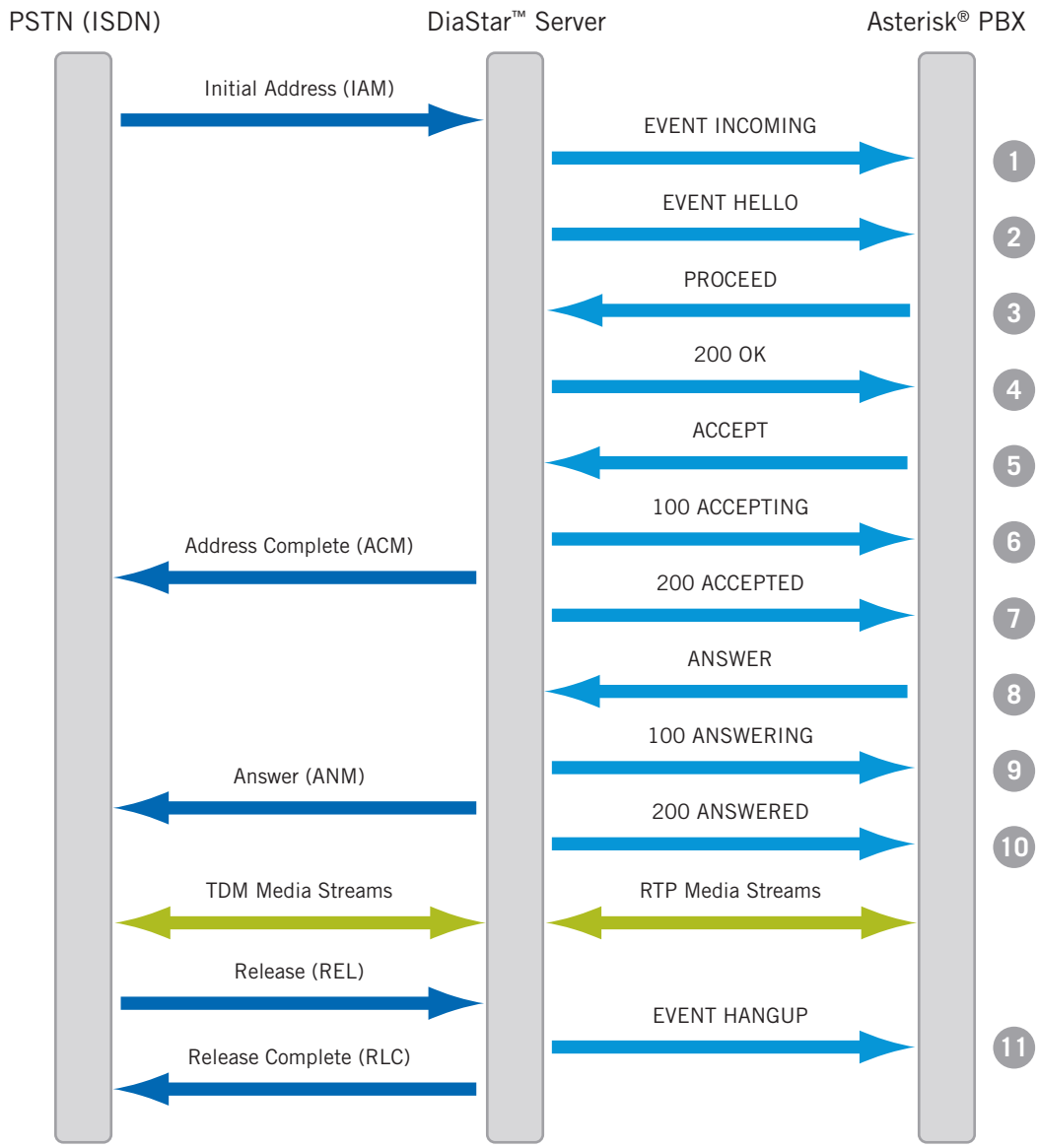

Figure 6. Call Flow for an Inbound PSTN Call

The messages on the call flow diagram are numbered in Figure 6 and explained in Table 1.

	Message	Description	Sample message data
1	EVENT INCOMING	An inbound ISDN call triggers an incoming event message that includes a unique call identifier, ANI, DNIS, IP address and port number of the DSS where responses will be sent, and the ISDN protocol. In configurations with multiple clients, all clients receive this event.	Unique-Call-Id: 40000000 Local-Number: 8005550003 Remote-Number: 7654321 Contact: 192.168.1.119:42420 Protocol: isdn
2	EVENT HELLO	DSS provides additional media information to the client. In configurations with multiple clients, all clients receive this event. The first client to respond with an ACCEPT message is given the call.	Contact:192.168.1.119:42420 RTP-Audio-Format: ULAW Supported-Protocols: isdn Version: 3.1.1
3	PROCEED	Client wants to accept the call.	Unique-Call-Id: 40000000
4	200 OK	DSS will send the call to this client.	
5	ACCEPT	Client provides an IP address and port number for the RTP audio stream.	Unique-Call-Id: 40000000 RTP-Audio: 127.0.0.1:23510
6	100 ACCEPTING	DSS is accepting the call.	Unique-Call-Id: 40000000 Local-Number: 8005550003 Remote-Number: 7654321 Protocol: isdn
7	200 ACCEPTED	Call is accepted. DSS provides an IP address and port number for the RTP audio stream, and suggests how DTMF should be handled.	RTP-Audio: 192.168.1.119:49348 DTMF: OutofBand
8	ANSWER	Client instructs the DSS to answer the call.	Unique-Call-Id: 40000000
9	100 ANSWERING	DSS is answering the call.	Unique-Call-Id: 40000000 Local-Number: 8005550003 Remote-Number: 7654321 Protocol: isdn
10	200 ANSWERED	Call is answered. DSS provides an IP address and port number for the RTP audio stream and the method of DTMF transmission. The media streams are now started on both sides, and the call is underway	RTP-Audio: 192.168.1.119:49348 DTMF: OutofBand
11	EVENT HANGUP	A hangup on the PSTN side generates a hangup event from DSS to client. The DSS tears down media streams and completes the hangup on the PSTN.	Unique-Call-Id: 40000000 Local-Number: 8005550003 Remote-Number: 7654321 Contact: 92.168.1.119:42420 Protocol: isdn Reason: 16 Reason-String: Normal Clearing

Table 1. Messages Exchanged between a DSS and an Asterisk PBX

The Project DiaStar™ Open Source Project

Project DiaStar is an open source General Public License (GPL) project based on Dialogic® hardware and software. It is supported through a website called projectdiastar.org.

The Project DiaStar website provides the following for Project DiaStar:

- **Subversion source code repository** — A publicly accessible source code repository that contains the latest submitted code changes. Anyone can browse the source code tree.
- **Source code documentation** — Doxygen-based documentation for source code
- **Wiki** — A reader-modifiable Wiki with instructions for building, installing, configuring, and running the DSS and its supported clients
- **Bug Tracking** — A Mantis bug tracking system.
- **Downloads of tested/qualified releases** — Configured as bundles of source code or ISO images of the CentOS operating system, together with DSS and client source code and prebuilt executables.

Getting Started with the DiaStar™ Server

The DSS requires DNI Boards for PSTN connectivity. DNI Boards are available for the PCI or PCI Express form factors in single through octal span versions. For information about DNI Boards, visit the Dialogic website. A list of Dialogic channel partners that sell DNI Boards is available online.

Documentation

The following documents describe how to download, build, install, and use the DSS and open source clients.

Note: If you are viewing this application note in a printed version, please download the PDF version where all links are live at www.dialogic.com/products/docs/appnotes/11541-diastar-intro-an.pdf. No registration is required to access or download this application note.

DiaStar™ Server

Project DiaStar™ Server - ISO Install — Describes the simplest method for installing Linux and DSS (recommended whenever feasible)

Project DiaStar™ Server - Download, Build and Install — Discusses custom installation

Project DiaStar™ Server - User's Guide — Provides information about configuring and running DSS

chan_woomera Client for Asterisk®

Asterisk Client (chan_woomera) - Download, Build and Install — Describes setting up the Woomera client with Asterisk

Asterisk Client (chan_woomera) - User's Guide — Provides Asterisk commands used with chan_woomera

Support

A variety of paid support options are available for DiaStar Technology. For information, visit the Dialogic website.

Wikis and other ways of obtaining free open community support can be found on the Project DiaStar website.

Acronyms

ANI Automatic Number Identification

CPA Call Progress Analysis

CPU Central Processing Unit

DNI Digital Network Interface (HMP Interface Boards)

DNIS Dialed Number Identification Service

GPL General Public License

IP Internet Protocol

ISDN Integrated Services Digital Network

LAN Local Area Network

PBX Private Branch Exchange

PSTN Public Switched Telephone Network

RTP Real Time Protocol

SIP Session Initiation Protocol

TDM Time Division Multiplexed

WAN Wide Area Network

For More Information

Asterisk

Woomera Protocol

WoomeraVoipWiki

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www.dialogic.com

Dialogic Corporation
9800 Cavendish Blvd., 5th floor
Montreal, Quebec
CANADA H4M 2V9

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