

1. Scope

This document is intended to detail a typical installation and configuration of a PBX IP-Media Gateway when used to interface between a PBX and a unified messaging type application.

2. Configuration Details

Listed below are the specific details of the PBX and gateways used in the testing to construct the following documentation.

2.1 PBX

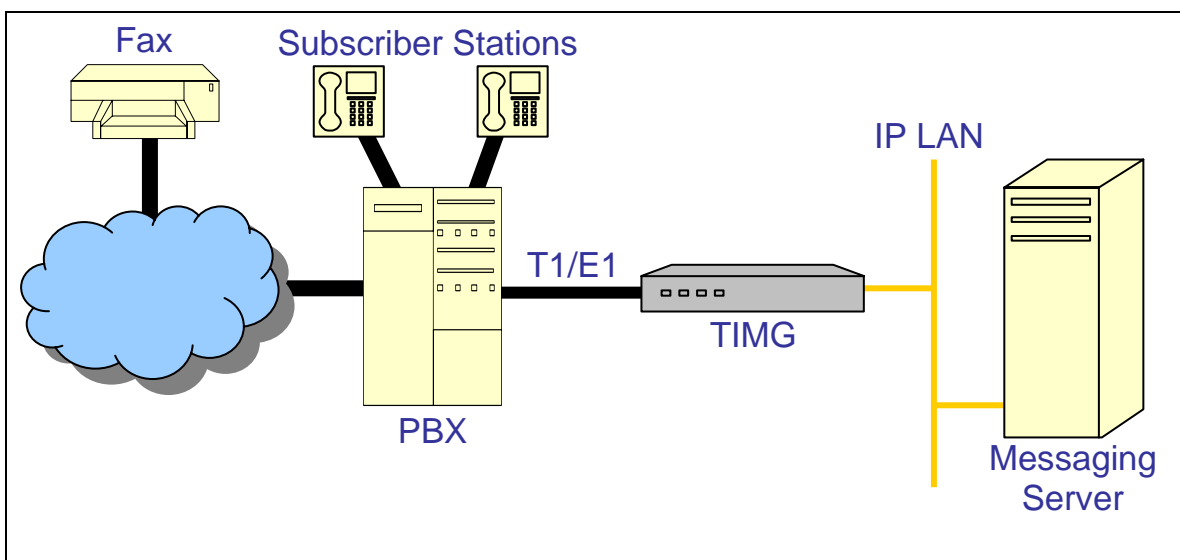
PBX Vendor	Nortel
Model(s)	Option 11c
Software Version(s)	Release 25
Additional Notes	N/A

2.2 Gateway

Gateway Model	TIMG300DTI
Software Version(s)	5.0.42
Protocol	T1 QSIG

2.3 System Diagram

The diagram below details the setup used in the testing and creation of the technical document.



3. Prerequisites

3.1 PBX Prerequisites

PBX must have all supplemental service packages installed for the QSIG protocol to operate properly and provide all advanced supplemental services.

Listed below is a table of required software packages:

Package Name	Package Number
End to End Signaling package (EES)	10
Integrated Message System package (IMS)	35
Message Waiting Center package (MWC)	46
ISDN Signaling package (ISDN)	145
Advanced ISDN Network Services (NTWK)	148
1.5 Mb Primary Rate Access package (PRA)	146 or
2.0 Mb Primary Rate Interface package (PRI2)	154
International Primary Rate Interface package (IPRA)	202
Message Waiting Indication (MWI)	219
Multi Purpose Serial Data Link package (MSDL)	222
QM reference signaling point Interface package (QSIG)	263
QSIG Generic Functional protocol package (QSIGGF)	305
QSIG Supplementary Services package (QSIG-SS)	316
MCDN End to End Transparency package (MEET)	348

3.1.1 PBX Equipment Required

To connect to the PBX using T1 QSIG you must use a DTI/PRI - NTAK09BA line card.

3.1.2 PBX Cabling Requirements

Cabling for QSIG connections must be CAT5e or better. Standard voice quality cable will not provide optimum signal quality and the gateway will have problems establishing connection on the D-Channel.

3.2 Gateway Prerequisites

The gateway needs to support a T1 QSIG interface.

4. Summary of Limitations

No limitations noted as of the last update to this document.

5. Gateway Setup Notes

During the initial setup of the Dialogic gateway using the serial port you must:

- Assign the gateway a Unique IP address, subnet mask and network gateway address (if the latter is required).
- Configure the gateway to use the SIP VoIP protocol.
- Set the Line Mode to T1.
- Set the Protocol to ISDN - QSIG.

During the solution specific setup of the Dialogic gateway using the web interface you must:

- Configure the gateway with at least a single IP endpoint pointing to your voice server.
- Set the Voice coder to be either G7.11 (default) or G.273 if required.
- Set the Line Encoding and Line Framing as required by your T1 Interface. Typical settings are Encoding = B8ZS and Framing = ESF.

6. PBX Setup Notes

The basic steps of setting up the PBX for use with this gateway and a voice processing system are as follows:

- Configuring the D-channel.
- Configuring the route data block.
- Adding the trunk members to the D-channel.
- Enabling the hardware and D-channel.
- Defining a route list and coordinated dialing plan.
- Setting up the subscribers stations.

All PBX programming is done via a serial terminal connected to the PBXs administration port.

The basic commands that you will encounter on the PBX to perform these actions are:

Add Route Data Block	LD16
Add D-Channel	LD17
Add Trunk Members	LD14
Enable MSDL card	LD96
Enable D-Channel	LD96
Define Route List	LD86
Define Coordinated Dialing Plan	LD87

6.1 Configuring the D-Channel

Add the D-channel (ADAN) using overlay LD17. Several of the fields require site specific entries, these are:

- `Adan` requires a d-channel number that is independent of other d-channel numbers on the switch.
- `Cdno` and `Dchl` require an independent trunk access code number.

The fields of this overlay that must be modified in this step are:

`Type`, `Adan`, `Ctyp`, `Cdno`, `Des`, `Usr`, `Ifc`, `Pinx`, `Isdn_Mcnt`, `Clid`,
`Dchl`, `Side`.

The programming example below shows how to configure a D-Channel using LD17. For all other fields not noted in the example press RETURN to use default values.

```

REQ  chg
TYPE cfn
ADAN new dch 7
CTYP msdl
CDNO 7
PORT 1
DES
USR  pri
IFC  isgf
PINX_CUST 0
ISDN_MCNT 300
CLID opt0
DCHL 7
PRI
OTBF
DRAT
SIDE net
CNEG
RLS
RCAP COLP NDI CCBI CCWI PRI DV3I CTI QMWI
OVLN
OVLS
MBGA
TIMR
LAPD

```

- At the prompt `REQ` enter `CHG` to change an entry in the configuration record and press `RETURN`
- At the prompt `ADAN` enter `NEW DCH XX`
 - Where `xx` is an available d-channel number, press `RETURN`
- At the prompt `CTYP` enter `MSDL` press `RETURN`
- At the prompt `CDNO` enter `XX`
 - where `xx` is the card slot location of the T-1 card, press `RETURN`
- At the prompt `DES` enter `XX`
 - where `xx` is any name designation for the T1, press `RETURN`
- At the prompt `USR` enter `PRI` press `RETURN`
- At the prompt `IFC` enter `ISGF` press `RETURN`
- At the prompt `PINX_CUST` enter `0` press `RETURN`
- At the prompt `ISDN_MCNT` enter `300` press `RETURN`
- At the prompt `CLID` enter `OPT0` press `RETURN`
- At the prompt `DCHL` enter `XX`
 - Where `xx` is the card slot location of the T-1 card, press `RETURN`
- At the prompt `SIDE` enter `NET` to set the PBX to the network side of the connection and press `RETURN`

6.2 Configuring the Route Data Block

Add the trunk route data block (RDB) using overlay `LD16`. In this overlay several of the fields require site specific entries, these are:

- `Rout` requires a route number that is independent of other route numbers on the switch.
- `Acod` requires an independent trunk access code number.

The fields of this overlay that must be modified in this step are:

Rout, Des, Tktp. Esn, Cnvt, Sat, Rcls, Dtrk, Brip, Dgtp, Isdn, Mode, Ifc, Pni, Chty, Ctyp, Inac, Cpfxs, Dapc, Intc, Dsel, Ptyp, Auto, Dnis, Dcdr, Icoq, Srch, Trmb, Acod, Clen Tcpp, Biln, Sigo, Drng, Cdr, Mus, Racd, Ohq, Ohqt, Cbq, Auth, Ttbl, Plev, Alrm.

The programming example below shows how to configure the Route Data Block using LD16. For all other fields not noted in the example press RETURN to use default values.

```
REQ new
TYPE rdb
CUST 0
DMOD
ROUT 7
DES 7
TKTP pri
TKTP pra
TKTP tie
ESN no
CNVT no
SAT no
RCLS ext
DTRK yes
BRIP no
DGTP pra
SCH0341
DGTP pri
ISDN YES
MODE pra
IFC isgf
PNI 00000
CHTY bch
CTYP ukwn
INAC no
CPFXS yes
DAPC no
INTC no
DSEL vod
PTYP pri
AUTO no
DNIS no
DCDR no
IANI
ICOG iao
SRCH rrb
TRMB yes
STEP
ACOD 7000
CLEN 1
SCH6710
TCPP no
TARG
BILN no
SGRP
OABS
INST
IDC
ANTK
SIGO std
```

```

CNTL
DRNG no
CDR no
MUS no
RACD no
FRL
OHQ no
OHQT n
SCH0030
OHQT o
SCH0030
OHQT
CBQ no
AUTH no
TTBL 0
ATAN
PLEV 2
ALRM no

```

- At the prompt REQ enter NEW press RETURN
- At the prompt TYPE enter RDB press RETURN
- At the prompt CUST enter XX
 - where xx is the defined customer number press RETURN
- At the prompt DMOD press RETURN
- At the prompt ROUT enter XX
 - where xx is an available route number then press RETURN
- At the prompt DES enter XX
 - where xx is any name designation for the trunk route press RETURN
- At the prompt TKTP enter TIE press RETURN
- At the prompt ESN enter NO press RETURN
- At the prompt CNVT enter NO press RETURN
- At the prompt SAT enter NO press RETURN
- At the prompt RCLS enter EXT press RETURN
- At the prompt DTRK enter YES press RETURN
- At the prompt BRIP enter NO press RETURN
- At the prompt DGTP enter PRI press RETURN
- At the prompt ISDN enter YES press RETURN
- At the prompt MODE enter PRA press RETURN
- At the prompt IFC type ISGF press RETURN
- At the prompt PNI enter 00000 press RETURN
- At the prompt CHTY enter BCH press RETURN
- At the prompt CTYP enter UKWN press RETURN
- At the prompt INAC enter NO press RETURN
- At the prompt CPFXS enter YES press RETURN
- At the prompt DAPC enter NO press RETURN
- At the prompt INTC enter NO press RETURN
- At the prompt DSEL enter VOD press RETURN
- At the prompt PTYP enter PRI press RETURN
- At the prompt AUTO enter NO press RETURN
- At the prompt DNIS enter NO press RETURN
- At the prompt DCDR enter NO press RETURN
- At the prompt ICOG enter IAO press RETURN
- At the prompt SRCH enter RRB press RETURN
- At the prompt TRMB enter YES press RETURN

- At the prompt `ACOD` enter `XXXX`
 - where `XXXX` is an available trunk access code number the same length as the phone extension numbers and press `RETURN`
- At the prompt `CLEN` enter `1` press `RETURN`
- At the prompt `TCPP` enter `NO` press `RETURN`
- At the prompt `BILN` enter `NO` press `RETURN`
- At the prompt `SIGO` enter `STD` press `RETURN`
- At the prompt `DRNG` enter `NO` press `RETURN`
- At the prompt `CDR` enter `NO` press `RETURN`
- At the prompt `MUS` enter `NO` press `RETURN`
- At the prompt `RACD` enter `NO` press `RETURN`
- At the prompt `OHQ` enter `NO` press `RETURN`
- At the prompt `OHQT` enter `00` press `RETURN`
- At the prompt `CBQ` enter `NO` press `RETURN`
- At the prompt `AUTH` enter `NO` press `RETURN`
- At the prompt `TTBL` enter `0` press `RETURN`
- At the prompt `PLEV` enter `2` press `RETURN`
- At the prompt `ALRM` enter `NO` press `RETURN`

6.3 Adding Trunk Members to the D-Channel

Now that the trunk and D-Channel are created you must assign each member of the trunk to this route group using overlay `LD14`.

The fields of this overlay that must be modified in this step are:

`Type, TN, Cust, Cden, Trk, Pcml, Ncos, Rtmb, Tgar, Ast, Iapg, Cls.`

The programming example below shows how to add trunk members to the D-Channel using `LD14`. This needs to be repeated for each B-Channel you are adding to the D-Channel (23 times per span). For all other fields not noted in the example press `RETURN` to use default values.

```
REQ new
TYPE tie
TN 7 1
DES
PDCA
PCML
CUST 0
NCOS 0
RTMB 7 1
B-CHANNEL SIGNALING
MNDN
TGAR 1
AST
CLS unr dtn
TKID
```

- At the prompt `TYPE` enter `TIE` press `RETURN`
- At the prompt `TN` enter `XX XX`
 - where `XX XX` is the slot and port number of each channel of the T1 hardware press `RETURN`
- At the prompt `CUST` enter `XX`
 - where `XX` is the defined customer number press `RETURN`
- At the prompt `CDEN` press `RETURN`

- At the prompt `TRK` enter `PRI` press `RETURN`
- At the prompt `PCML` press `RETURN`
- At the prompt `NCOS` enter `0` press `RETURN`
- At the prompt `RTMB` enter `XX XX`
 - where `xx xx` is the rout number and member defined previously in `LD16` press `RETURN`
- At the prompt `TGAR` enter `1` press `RETURN`
- At the prompt `AST` enter `NO` press `RETURN`
- At the prompt `IAPG` enter `0` press `RETURN`
- At the prompt `CLS` enter `UNR DTN` press `RETURN`

6.4 Enabling the MSDL Board and D-Channel

To use the newly added card and D-Channel you need to enable both of them using overlay `LD96`.

- Enter the command `enl msdl xx`
 - where `xx` is the D-Channel number defined in `LD17` and press `RETURN`
- Enter the command `enl dch xx`
 - Where `xx` is the D-Channel; number assigned in `LD17` and press `RETURN`

6.5 Defining a Route List

Use overlay `LD86` to define a route list.

The fields of this overlay that must be modified in this step are:

`Req, Cust, Feat, Rli, Entr, Lter, Rout, Tod, Cnv, Exp, Frl, Dmi, Fci, Fsni, Ohq, Cbq, Iset, Mfrl, Ovll.`

The programming example below shows how to define a rout list using `LD86`. For all other fields not noted in the example press `RETURN` to use default values.


```

>ld 86
ESN000
REQ new
CUST 0
FEAT
FEAT rlb
RLI 1
ENTR 0
LTER no
ROUT 7
TOD
CNV no
EXP no
FRL 0
DMI 0
FCI 0
FSNI 0
SBOC
OHQ no
CBQ no
ENTR 0
ESN001
ENTR
ISET 0
NALT
MFRL 0
OVLL 0

```

- At the prompt REQ enter NEW press RETURN
- At the prompt CUST enter XX
 - where xx is the defined customer number press RETURN
- At the prompt FEAT enter RLB press RETURN
- At the prompt RLI enter X
 - where x is the next available route list index number press RETURN
- At the prompt ENTR enter X
 - where x is the entry number for the NARS/BARS route list and press RETURN
- At the prompt LTER enter NO press RETURN
- At the prompt ROUT enter X
 - where x is the route number defined in the previous steps and press RETURN
- At the prompt CNV enter NO press RETURN
- At the prompt EXP enter NO press RETURN
- At the prompt FRL enter 0
 - Where Facility restriction level it should be set as low as possible. press RETURN
- At the prompt DMI enter 0 press RETURN
- At the prompt FCI enter 0 press RETURN
- At the prompt FSNI enter 0 press RETURN
- At the prompt OHQ enter NO press RETURN
- At the prompt CBQ enter NO press RETURN
- At the prompt ISET enter 0 press RETURN
- At the prompt MFRL enter 0 press RETURN
- At the prompt OVLL enter 0 press RETURN

6.6 Defining the Coordinated Dialing Plan

Use overlay LD87 to define your CDP (Coordinated Dialing Plan). This is the method used to be able to access the trunk as a forwarding point for station sets using an extension number.

The fields of this overlay that must be modified in this step are:

Req, Cust, Feat, Type, Dsc, Flen, Dsp, Rli.

The programming example below shows how to define a CDP using LD87. For all other fields not noted in the example press RETURN to use default values.

```
>ld 87
ESN000
REQ new
CUST 0
FEAT cdp
TYPE dsc
DSC 5000
FLEN 4
DSP lsc
RLI 1
NPA
NXX
DSC
```

- At the prompt REQ enter NEW press RETURN
- At the prompt CUST enter XX
 - where xx is the defined customer number press RETURN
- At the prompt FEAT enter CDP press RETURN
- At the prompt TYPE enter DSC press RETURN
- At the prompt DSC enter XXXX
 - Where xxxxx is the extension you want to use to access the trunk route list and press RETURN
- At the prompt FLEN enter X
 - Where x is the length of the extensions in this CDP and press RETURN
- At the prompt DSP enter LSC press RETURN
- At the prompt RLI enter X
 - Where x is the rout list index created in LD86 and press RETURN

6.7 Setting Up Subscriber Station Sets

This is an example of how to set up a subscriber that uses a digital station set to forward correctly to the server. Use the LD11 command to change the stations parameters as shown below.

```
>LD 11
REQ   CHG
TYPE  2008
TN    0 1 8 3
ECHG
DES
FDN   5000
TGAR
HUNT  5000
NCOS
RNPG
SSU
CLS   HTA FNA MWA CFTA SFA
EFD   5000
EHT   5000
.
.
.
```

Important notes about the above programming:

1. The `FDN` field is where you specify the destination for this station set to forward to under ring no answer conditions. It should be configured to send the calls to the CDP defined to access the trunk route list.
2. The `CLS` field is required to have `HTA`, `FNA`, `MWA`, `CFTA` and `SFA` configured. If these are not configured properly the remainder of the programming is not going to provide you with the proper prompts to continue.
3. The `EFD` field (only seen if the `CLS` has been set up properly) is where you specify the destination for external calls to the station to forward under ring no answer conditions. It should be configured to send the calls to the CDP defined to access the trunk route list.
4. The `HUNT` field is where you specify the destination for internal calls to the station to forward under busy conditions. It should be configured to send the calls to the CDP defined to access the trunk route list.
5. The `EHT` field (only seen if the `CLS` has been set up properly) is where you specify the destination for external calls to the station to forward under busy conditions. It should be configured to send the calls to the CDP defined to access the trunk route list.
6. The `MWA` setting in the `CLS` field allows this station to make use of its MWI light. If this is not configured the stations MWI lamp will not work.

This is an example of how to set up a subscriber that uses an analog station set to forward correctly to the server. Use the `LD10` command to change the stations parameters as shown below.

```

>LD 10
REQ   CHG
TYPE  500
TN    0 0 7 1
CDEN
DES
FDN   5000
CUST
DIG
DN
HUNT  5000
TGAR
NCOS
RNPG
CLS   HTA FNA MWA LPA CFTA SFA
FTR
EFD   5000
EHT   5000
.
.
.

```

Important notes about the above programming:

1. The `FDN` field is where you specify the destination for this station set to forward to under ring no answer conditions. It should be configured to send the calls to the CDP defined to access the trunk route list.
2. The `CLS` field is required to have `HTA`, `FNA`, `MWA`, `LPA`, `CFTA` and `SFA` configured. If these are not configured properly the remainder of the programming is not going to provide you with the proper prompts to continue.
3. The `EFD` field (only seen if the `CLS` has been set up properly) is where you specify the destination for external calls to the station to forward under ring no answer conditions. It should be configured to send the calls to the CDP defined to access the trunk route list.
4. The `HUNT` field is where you specify the destination for internal calls to the station to forward under busy conditions. It should be configured to send the calls to the CDP defined to access the trunk route list.
5. The `EHT` field (only seen if the `CLS` has been set up properly) is where you specify the destination for external calls to the station to forward under busy conditions. It should be configured to send the calls to the CDP defined to access the trunk route list.
6. The `MWA` setting in the `CLS` field allows this station to make use of the MWI feature.
7. The `LPA` setting in the `CLS` field controls the phones MWI notification method. On analog stations with a neon MWI lamp this setting must be included to use it. Without this setting the analog station will only have stutter dial tone as its notification method.

6.8 Additional Comments

N/A

7. Testing Validation Matrix

The table below shows various test scenarios that are run as typical validation scenarios when the gateway is used in a voice messaging situation. The notes column specifies any notable parts of the test.

The test scenarios below assume that all gateway configuration parameters are at their default values. For a complete sample showing call flows and states please consult the Gateway SIP Compatibility Guide.

Test Number	Call Scenario Description	Notes
Inbound call scenarios		
1	Direct call to hunt group.	The calling party number is expected to be contained in the From header of the Invite.
2	Internal ring-no-answer forward.	The called party will be shown in the Diversion header of the invite. The calling party will be contained in the From header. The reason of the diversion header is shown as no-answer.
3	External ring-no-answer forward.	The called party will be shown in the Diversion header of the invite. The calling party (if available) will be contained in the From header. The reason of the diversion is shown as no-answer.
4	Internal busy forward from a subscribers station set.	The called party will be shown in the Diversion header of the invite. The calling party will be contained in the From header. The reason of the diversion header is shown as busy.
5	External busy forward from a subscribers station set.	The called party will be shown in the Diversion header of the invite. The calling party will be contained in the From header. The reason of the diversion header is shown as busy.
6	Internal all call forward from a subscribers station set.	The called party will be shown in the Diversion header of the invite. The calling party will be contained in the From header. The reason of the diversion header is shown as fwd-all.
7	External all call forward from a subscribers station set.	The called party will be shown in the Diversion header of the invite. The calling party will be contained in the From header. The reason of the diversion header is shown as fwd-all.
Transfer Scenarios		
8	Blind transfer to a station from messaging server where the destination answers the call.	The transfer is completed once the destination is judged as connected. Depending upon the speed that the destination is answered the caller and called parties may be connected together with a slight bit of the called parties voice clipped. The calling party is not available. The transfer was by join, not a path replacement.

9	Blind transfer to a station from messaging server where the destination does not answer the call.	If the station is configured to forward back to the gateway then the call will arrive looking as a forwarded call with the called party being the transfer destination but the calling party may be the gateway port performing the transfer, depending on how quickly the transfer to the destination can be completed. The calling party is not available. The transfer was by join, not a path replacement.
10	Blind transfer to a subscribers station from messaging server where the destination is busy.	The transfer should fail.
11	Blind transfer to an invalid number.	The transfer should fail.
12	Supervised transfer to a subscribers station from messaging server where the user does not answer the call.	The transfer completion speed and timing is up to the application. The application should decide to either complete the transfer and let the stations forwarding carry it back to the gateway or abort it before the forwarding happens. The calling party is not available. The transfer was by join, not a path replacement.
13	Supervised transfer to a subscribers station from messaging server where the user answers the call.	The transfer completion speed and timing is up to the application. The calling party is not available. The transfer was by join, not a path replacement.
13	Supervised transfer to a subscribers station from messaging server where the destination is busy.	The transfer completion speed and timing is up to the application. The application should decide to either complete the transfer and let the stations forwarding carry it back to the gateway or abort it before the forwarding happens. The calling party is not available. The transfer was by join, not a path replacement.
14	Supervised transfer to an Invalid number.	The transfer completion speed and timing is up to the application.
Outbound Call Scenarios		
15	Outbound call to subscriber station that answers.	The call is flagged to the application as completed when the gateway can determine that the call has been connected through. The application should take this into account when making decision when to start the audio stream.
16	Outbound call to subscriber station that	The application needs to take into account if the destination has been set to

	does not answer.	forward back to the gateway for a ring no answer condition and judge accordingly when to either stop waiting for an answer and cancel the call or know that it will end up arriving back to the gateway as a forwarded call.
17	Outbound call to subscriber station that is busy.	The application needs to take into account if the destination has been set to forward back to the gateway for a ring no answer condition and judge accordingly when to either cancel the call or know that it will end up arriving back to the gateway as a forwarded call.
18	Outbound call to an external number.	Depending on the state of the destination the call will either be judged as connected or fail do to busy or error tone conditions.
MWI Scenarios		
19	Turn a subscribers light on that is currently off.	This should return success.
20	Turn a subscribers light on that is currently on.	This should return success.
21	Turn a subscribers light off that is currently on.	This should return success.
22	Turn a subscribers light off that is currently off.	This should return success.

8. Troubleshooting

8.1 Important Debugging Tools

- Ethereal/Wireshark – Used to view and analyze the network captures provided by the Dialogic gateway diagnostic firmware.
- Adobe Audition -- Used to review and analyze the audio extracted from the network captures to troubleshoot any audio related issues.

8.2 Important Gateway Trace Masks

These keys are helpful during all troubleshooting scenarios and should be considered keys to activate by default fro all troubleshooting cases.

- `voip prot` and `voip code` – this allows the collection of all SIP related messages as they are sent from and received by the gateway. This data is important in cases where you feel that the gateway is not able to communicate properly with the messaging server.

- `tel event` and `tel code` – This allows the collection of all circuit side activity of the emulated station set such as display updates, key presses, light transitions and hook state changes. This data is very important in the following scenarios:
 - Call control problems (dropped calls, failing transfers, etc...)
 - Integration problems (incorrect mailbox placement, missed auto-attendant greetings etc...)
- `teldrv prot` – This allows the collection of all ISDN messages both transmitted and received on the gateways front end interface. This data is very important in the following scenarios:
 - Call control problems (dropped calls, failing transfers, etc...)
 - Integration problems (incorrect mailbox placement, missed auto-attendant greetings etc...)

These keys are helpful during specific issues and can be enabled for targeted troubleshooting of very specific cases. Activation of these keys may generate large amounts of data on busy systems and increase the size of the collected log files, but will not harm system performance.

- `dspif` (all keys) – This allows the collection of tone related data. This data is very helpful in cases where you think you have problems detection specific tones that should be, should not be, or are expected to be present at specific times during the call. If you do not suspect a tone related issues this key may be left disabled.

NOTE: Turning on all traces is not recommended. Doing this floods the debug stream with significant amounts of information that can cause delays in determining the root cause of a problem.

9. Appendix

9.1 Abbreviations

LBRC	Low Bit Rate Coder
MWI	Message Waiting Indication
LWC	Leave Word Calling
PBX	Private Branch Exchange

For more details, go to www.dialogic.com.

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05-2578-001 12/06