Dialogic® 2000 Media Gateway Series Installation and Configuration Note

for Microsoft® Lync 2010

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www.dialogic.com

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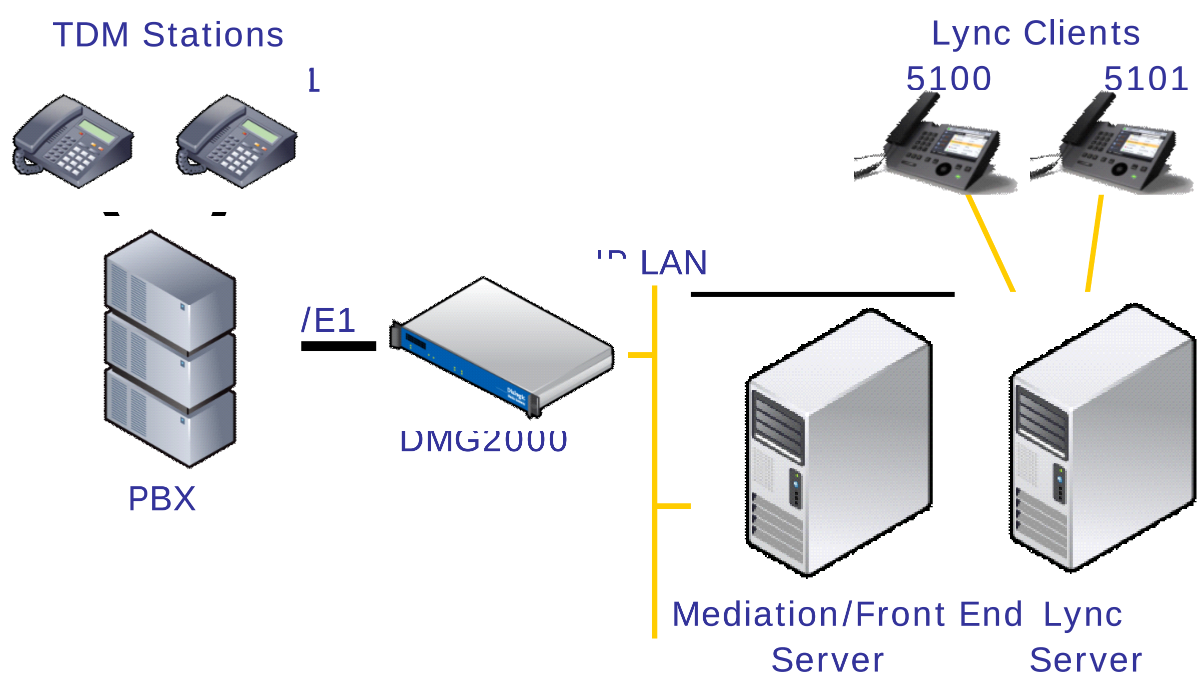
1. Scope

This document is intended to detail a typical installation and configuration of Dialogic® 2000 Media Gateway Series (DMG2000) when used to interface between a PBX or Central Office and Microsoft® Lync 2010.

2. Gateway Configuration Details

Gateway Model(s)	Dialogic® 2000 Media Gateway Series (DMG2030DTIQ, DMG2060DTIQ, DMG2120DTIQ, DMG2060DTISQ, DMG2120DTISQ)
Software Version(s)	Version 6.0 Service 6.0.004_B003
Protocol(s)	T1 CAS, T1/E1 ISDN

2.1 System Diagram



3. Prerequisites

3.1 Trunk Prerequisites

The T1 or E1 trunk must be configured for T1 (NI2, QSIG, 5ESS or DMS protocols) or E1 (Euro ISDN or QSIG protocols).

If connecting to a PBX, refer to the Unified Messaging Integration Notes for guidance at:
http://www.dialogic.com/support/helpweb/mg/iw1904.aspx

For more information on PBX programming, refer to:
http://www.dialogic.com/solutions/unified-communications/microsoft-pbx-interop-and-config-guides.aspx

3.1.1 Cabling Requirements

Cabling for ISDN connections must be CAT5e or better. Standard voice quality cable will not provide optimum signal quality, and will cause the gateway to experience problems establishing a connection on the D-Channel.

If connecting the gateway directly to the PBX, it may be necessary to use a T1 crossover cable (Pin 1 is connected to Pin 4 and Pin 2 is connected to Pin 5). This is dependent on the PBX type to which the gateway is being connected, so if after connecting the gateway to the PBX the Alarm light on the front of the gateway remains “Red”, try using the crossover cable.

3.2 Gateway Prerequisites

The DMG2000 must be installed with Version 6.0.SU6.0.004_B003.

4. Summary of Limitations

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

5. Gateway Setup Notes

5.1 Initial Setup

There are two options for performing the initial configuration of the DMG2000 – serial or IP. It is recommended that serial be used.

During the initial setup of the DMG2000, you will be setting the following parameters:

- Assign the gateway a unique IP address, subnet mask and IP network gateway address (if the latter is required).

- Configure the gateway to use the SIP VoIP protocol.
- Set the Line Mode to T1 or E1.
- Set the Protocol to match your trunk setting.

Connecting to Console Port

Serial:

Connect to the COM 2 port on the DMG2000 using an appropriate program, such as HyperTerminal.

The serial port configuration is:

Baud rate: 115200
Data Buts 8
Stop Bits: 1
Parity: none
Flow Control: none

Serial Port Pin Out

Pin	Signal
1	Data Carrier Detect
2	Transmit Data
3	Receive Data
4	Data Terminal Ready
5	Signal Ground
6	Data Set Ready
7	Clear to Send
8	Request to Send
9	Ring Indicator

Ethernet:

Default DMG2000 IP address: **10.12.13.74**
Change the IP address of your computer to be in the same subnet as the default. Telnet into the DMG2000 and then follow the commands noted below:

Running QuickCFG

Press Enter key until you get to the "PIMG" prompt. Follow the steps below and modify the settings in **red** to match your environment. The values in **bold** are what you will be entering.

```
PIMG> pwd
Enter Password: IpodAdmin
Admin level accepted.
PIMG-admin> quickcfg
LAN 1 IP Address[10.12.13.74] : (Enter new IP Address that matches
gateway IP address entered in Mediation server)
LAN 1 Subnet Mask[255.255.255.0] : (Enter new Subnet Mask)
LAN 1 Default Network Gateway Address[10.2.2.5] : (Enter new Default
Network Gateway Address)
LAN 2 IP Address[10.2.2.2] :
LAN 2 Subnet Mask[255.255.255.0] :
Select Line Mode ...
  Valid entries:
    1. T1
    2. E1
Enter Number for Line Mode Selection [T1] : 1
Select Protocol ...
  Valid entries:
    1. CAS - Loop Start
    2. CAS - Ground Start
    3. CAS - E&M Immediate
    4. CAS - E&M Delay
    5. CAS - E&M Wink
    6. ISDN - QSIG
    7. ISDN - NI-2
    8. ISDN - 5ESS
    9. ISDN - DMS-100
Enter Number for Protocol Selection [ISDN - NI-2] : 6
Saving parameters now...
Parameters successfully configured!
******* Restart Required ******* (Type 'restart')
PIMG-admin> restart
rebooting...
```

5.2 Final Web Configuration

Once the initial configuration is complete and the DMG2000 has been reset, it is necessary to log into the web interface by browsing to the IP address of the DMG2000 using "admin" as the user and using the gateway password ("IpodAdmin" is the default).

Sample Configuration files
Download available at:
http://www.dialogic.com/~/media/microsoftuc/DMG2000_Lync_Config.zip

- There are two sample configuration files for adjusting gateway parameters to enable interoperability with Microsoft® Lync 2010 specific settings. The "**DMG2000 Lync Config u-law.ini**" file, among other functions, will set up the codec to be G.711 uLaw for use in North America and other areas that use uLaw. The "**DMG2000 Lync Config a-law.ini**" file, among other functions, will set up the codec to be G.711 aLaw for use in Europe and other regions that use aLaw. In addition to changing the default settings, these files also contain some sample Dial Plan configurations to provide a starting point for configuration the E.164 phone number conversions.
- To import one of these files into the DMG2000, use the Import/Export page on the DMG2000 web interface. Select **IMPORT** and browse to reach the desired ".ini" file to import.

Setting T1 / E1 Parameters

Line Encoding and Framing

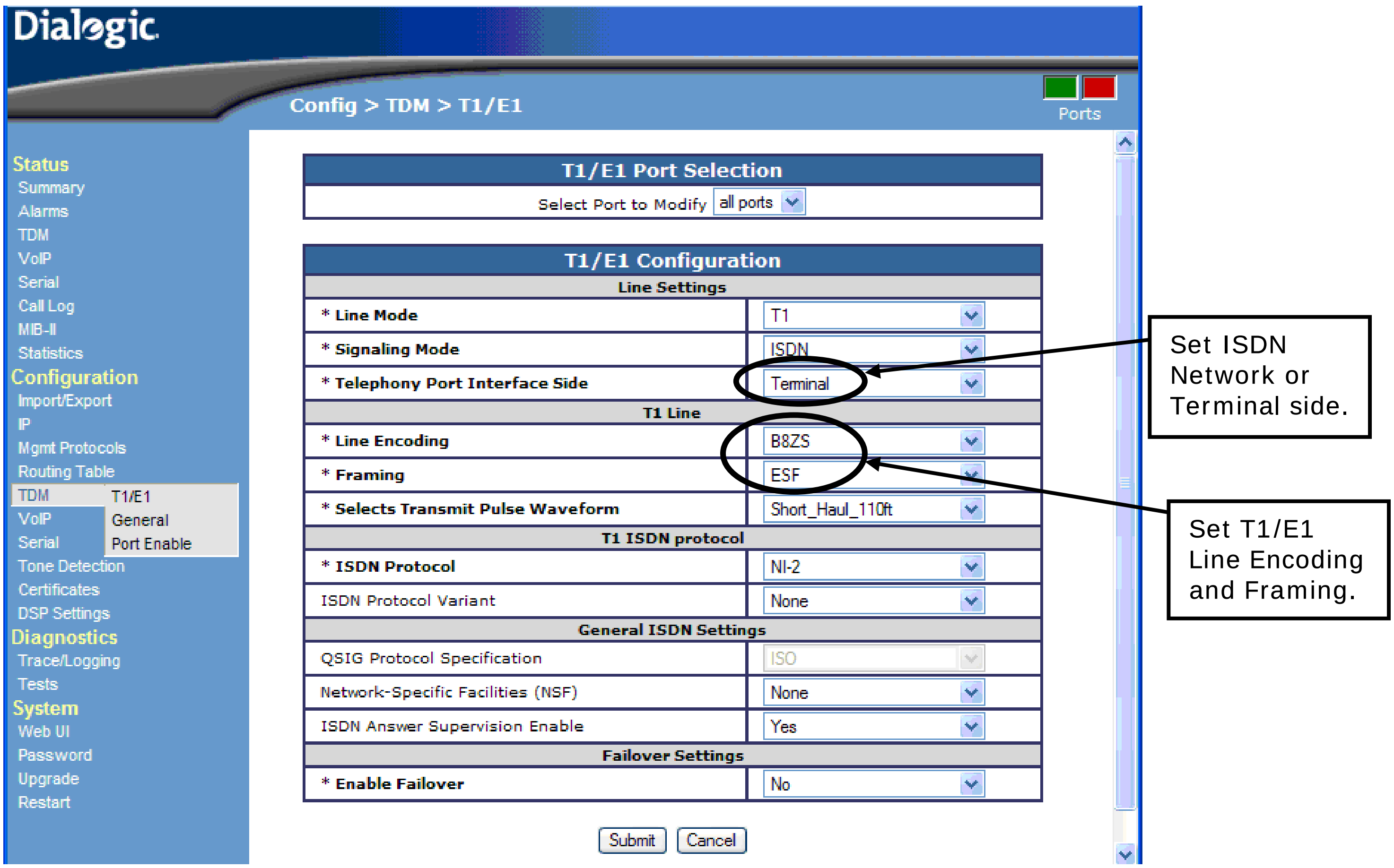
It is necessary to ensure that the Line Encoding and Framing match those of the T1 or E1 line coming from the PBX or Central Office.

ISDN Protocol

Since ISDN protocols are not necessarily symmetric protocol it is necessary to determine which device (PBX or Gateway) is going to function as the Network side of the protocol. It is recommended that if the PBX can support Network side that it be configured as Network in which case the gateway needs to be configured as Terminal. Setting the Protocol side is done by changing the "Telephony Port Interface Side" to the setting you want the gateway to function.

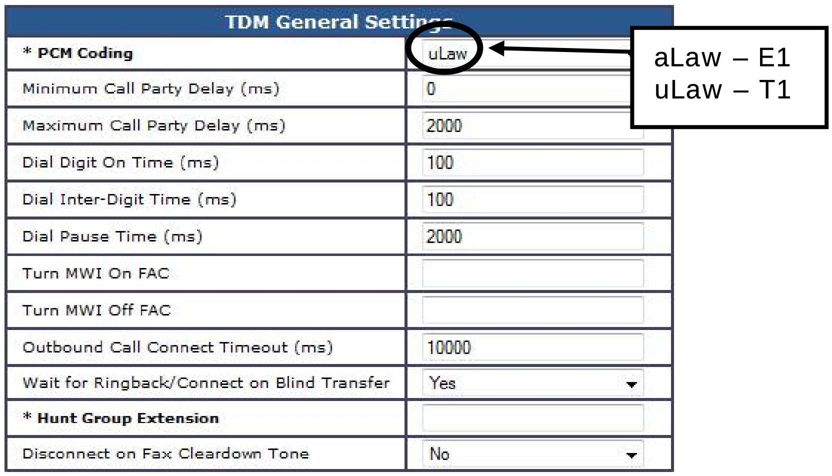
Setting Line Encoding, Framing, and ISDN Protocol

Navigate to the **TDM > T1/E1** page.



Setting PCM Coding for TDM

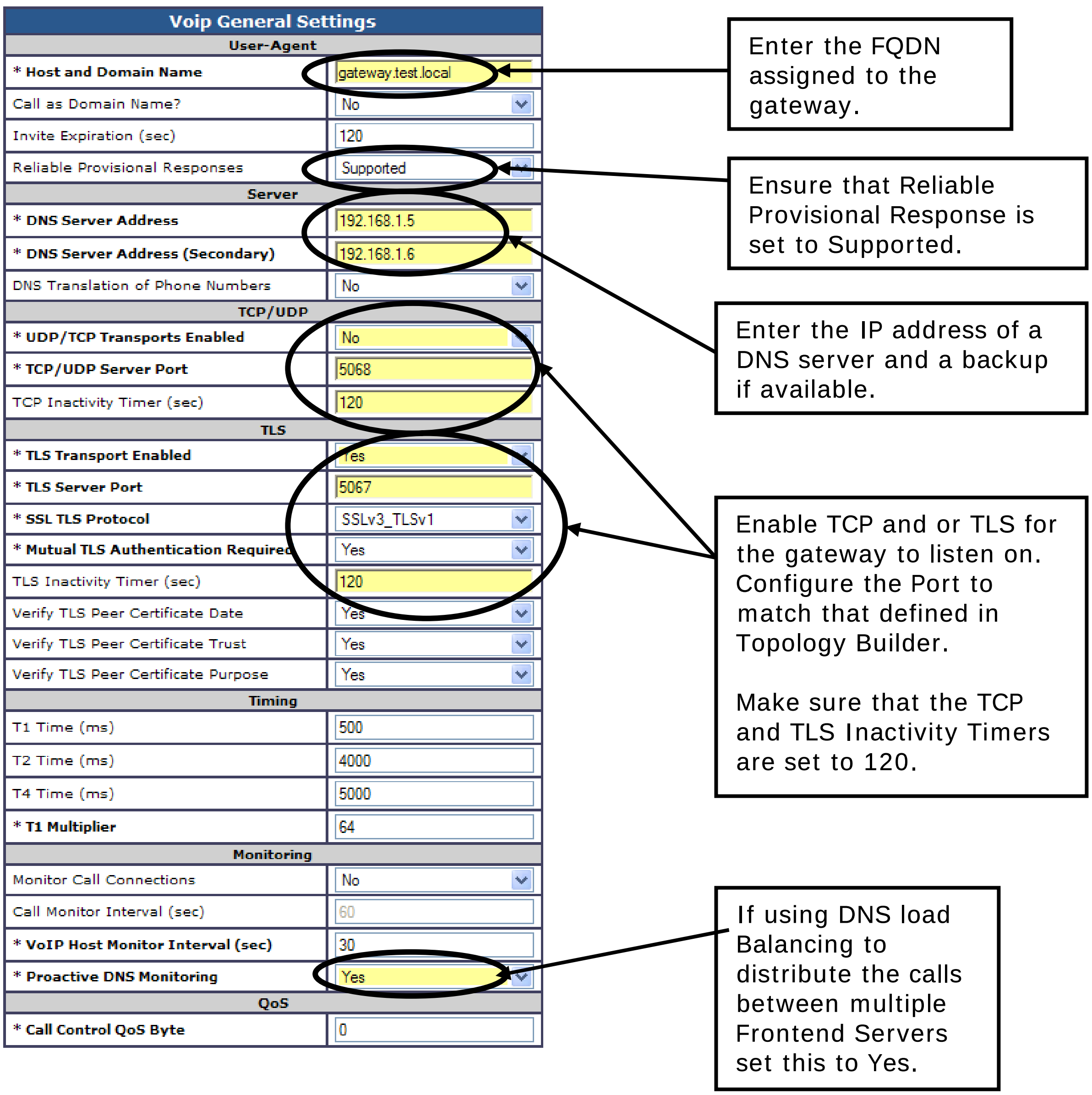
Navigate to the **TDM > General** page.



Setting VoIP Parameters

Navigate to the **VoIP > General** page and the following VoIP parameters will need to be set:

- Gateway's FQDN
- DNS server IP addresses
- TCP or TLS Listen ports
- DNS monitoring if DNS load balancing is being used



Setting Network Groups

Navigate to the **VoIP > Network Groups** page.

On the Network Groups page you will be configuring the outbound transport, voice codec, packet size and whether you want RTP or SRTP. It is possible to set up multiple different network groups with different characteristics for different IP endpoints. The Networks groups will be referenced in the route table setup further down in this document.

VoIP Network Group Selection	
Select Group to Modify	Network Group#1

VoIP Network Group Configuration	
Network Group	
Network Group Label	Network Group #1
Transport	
Transport Protocol	TLS
SIPS URI Scheme	No
URI Parameters	
User Phone Parameter	Yes
Local Phone Context	
Remote Phone Context	
Diversion Header Format	TEL
Proxy	
Primary Proxy Server Address	
Primary Proxy Server Port	5060
Backup Proxy Server Address	
Backup Proxy Server Port	5060
Proxy Query Interval (sec)	30
Registration	
Registration Server Address	
Registration Server Port	5060
Registered User	
Gateway Name	
Registration Expiration (sec)	120
Audio	
Codec #1	G.711u
Codec #2	G.711a
Codec #3	None
Codec #4	None
Packet Time (ms)	20
SRTP	
SRTP Preference	SRTP_Only
Authentication Tag Length	80
MKI on Transmit Stream	No
Key Derivation Enable	No
Key Derivation Rate	16
Window Size Hint	64
UnEncrypted SRTP Enable	No
UnEncrypted SRTCP Enable	No
UnAuthenticated SRTP Enable	No

Select the transport for outbound calls from the gateway.

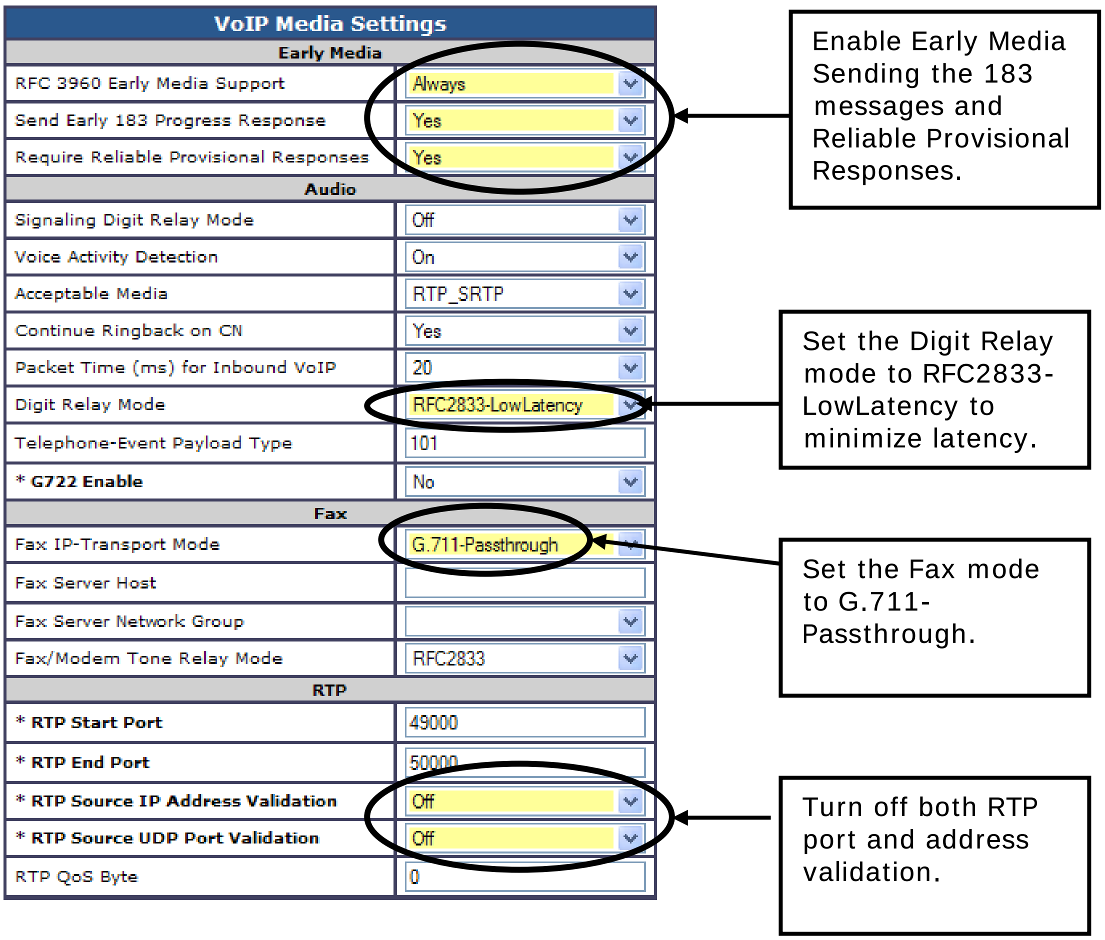
If using SRTP then set SRTP Preference to SRTP_Only.

Set MKI on Transmit Stream to No.

Configuring Media Settings

Navigate to the **VoIP > Media** page.

On this page, you will be setting up Early Media, configuring fax for G.711 pass-through, setting the DTMF digit transmission to RFc2833 with the lowest latency possible. You will also be configuring the RTP port validation.



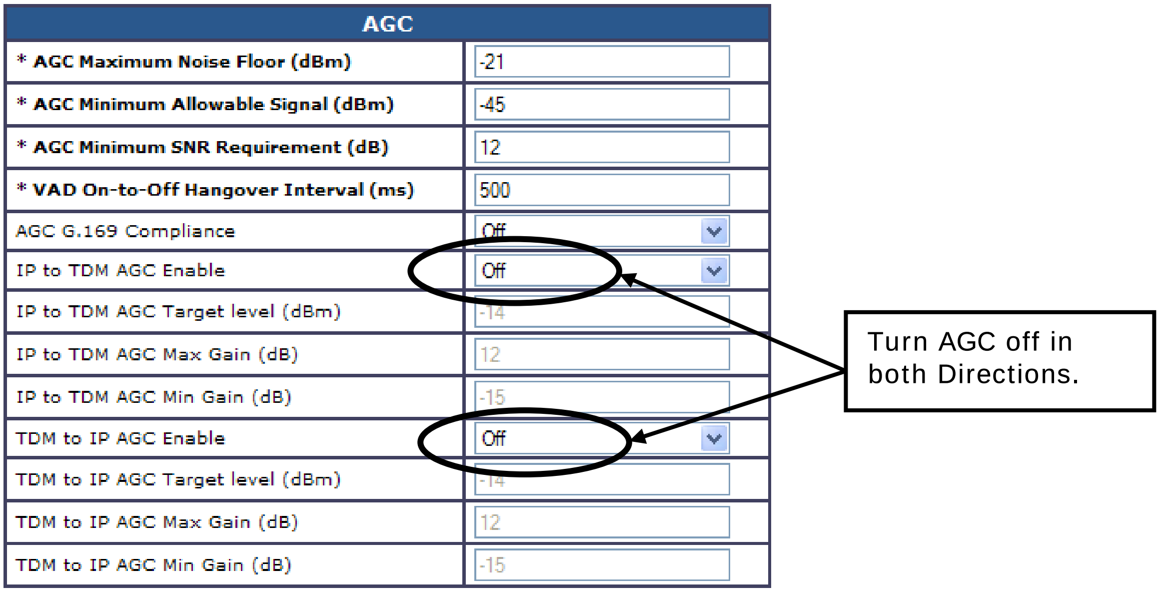
Configuring DSP Settings

Navigate to the **DSP Settings** page.

DSP Advanced Settings	
Line Echo Cancellation	On
Line Echo Cancellation NLP (non-linear processor)	On
Line Echo Cancellation NLP Aggressiveness	Normal
Echo Cancellation Gain (dB)	0
Voice activity noise floor (dBm)	-32
Voice activity Measurement Period (ms)	200
Voice activity Signal to Noise Ratio (dB)	20
Call Progress Filter Threshold (dBm)	-30
Call Progress Filter Debounce (ms)	100
Call Progress Filter SNR (dB)	20
Call Progress Filter Two Tone Max Twist (dB)	3
Jitter-Buffer Minimum Delay (ms)	0
Jitter-Buffer Maximum Delay (ms)	200
Jitter-Buffer Initial Delay (ms)	20
Jitter-Buffer Adaptation Period (ms)	10000
Jitter-Buffer Deletion Threshold (ms)	500
* **Jitter-Buffer Frame Deletion Mode**	Soft
TDM to TDM Media Always Clear Mode	Off
TDM to IP Gain Adjustment (db)	0
IP to TDM Gain Adjustment (db)	0

Enable Echo Cancellation with NLP and normal Aggressiveness.

Configure the Jitter Buffer.


AGC
* AGC Maximum Noise Floor (dBm)
-21
* AGC Minimum Allowable Signal (dBm)
-45
* AGC Minimum SNR Requirement (dB)
12
* VAD On-to-Off Hangover Interval (ms)
500
AGC G.169 Compliance
Off
IP to TDM AGC Enable
Off
IP to TDM AGC Target level (dBm)
-14
IP to TDM AGC Max Gain (dB)
12
IP to TDM AGC Min Gain (dB)
-15
TDM to IP AGC Enable
Off
TDM to IP AGC Target level (dBm)
-14
TDM to IP AGC Max Gain (dB)
12
TDM to IP AGC Min Gain (dB)
-15
Turn AGC off in both Directions.

Configuring Route Table for E.164 support

Configuring Calls to PSTN Network

Microsoft® Lync sends the phone number to the DMG2000 in E.164 format. It is necessary to convert this to a dialable number, which, in turn, can be sent to the central office or to your PBX.

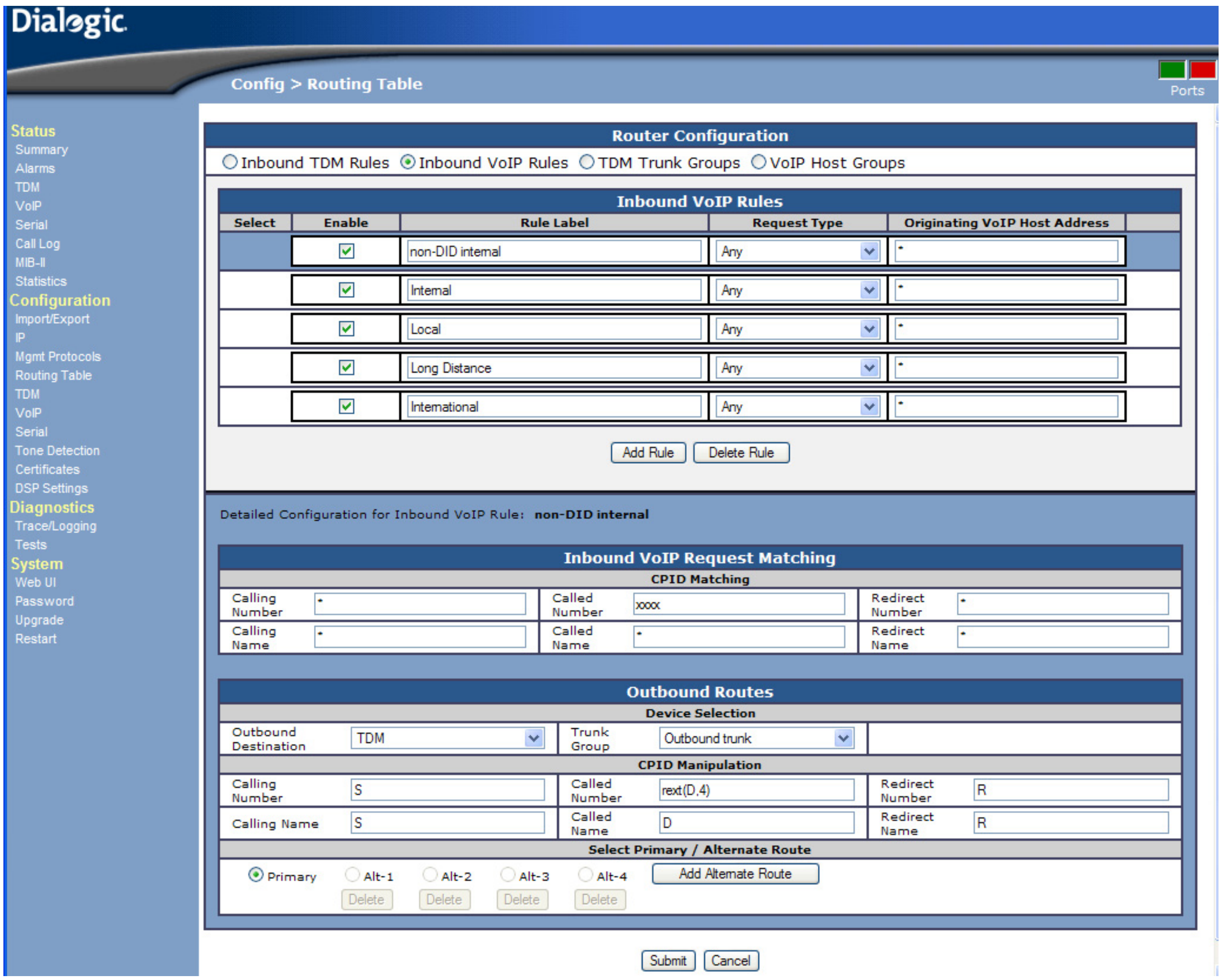
North America (**DMG2000 Lync Config u-law.ini**)

- The rules in the sample configuration file "**DMG2000 Lync Config u-law.ini**" perform the following dial sting manipulations:

Phone number type	Microsoft® Lync sent phone number	Phone number sent to CO or PBX
4-digit extension from non-DID number	+14258811000;ext=1234	1234
4-digit Extension (starting with 881)	+14258812345	2345
Local call	+14251234567	91234567
Long Distance	+14151234567	914251234567
International	+44123456789	901144123456789

- It will be necessary to modify these rules to fit your environment. You will need to match your internal extension pattern.
- If you are connected directly to a trunk line coming from a phone company, it will be necessary to remove the trunk access code "9" from these rules. Depending on your PBX configuration, it might be necessary as well to change the sample trunk access code to one that matches your environment.
- To change the Routing Table settings, log into the web interface, then open the "Routing Table". With the Radio button selected for Inbound VoIP rules select among the five "Inbound VoIP Rules" to see the routing and CPID manipulations for each rule.
    - In the "non-DID internal" rule the gateway will automatically extract the number string following the "ext" field of the Invite and pass to the Routing table. Because of this all that is necessary to do in the CPID manipulation is to pass the extension.
    - The "Internal" rule will extract the last 4 number from the right side to create a 4-digit extension to be dialed on the local PBX.

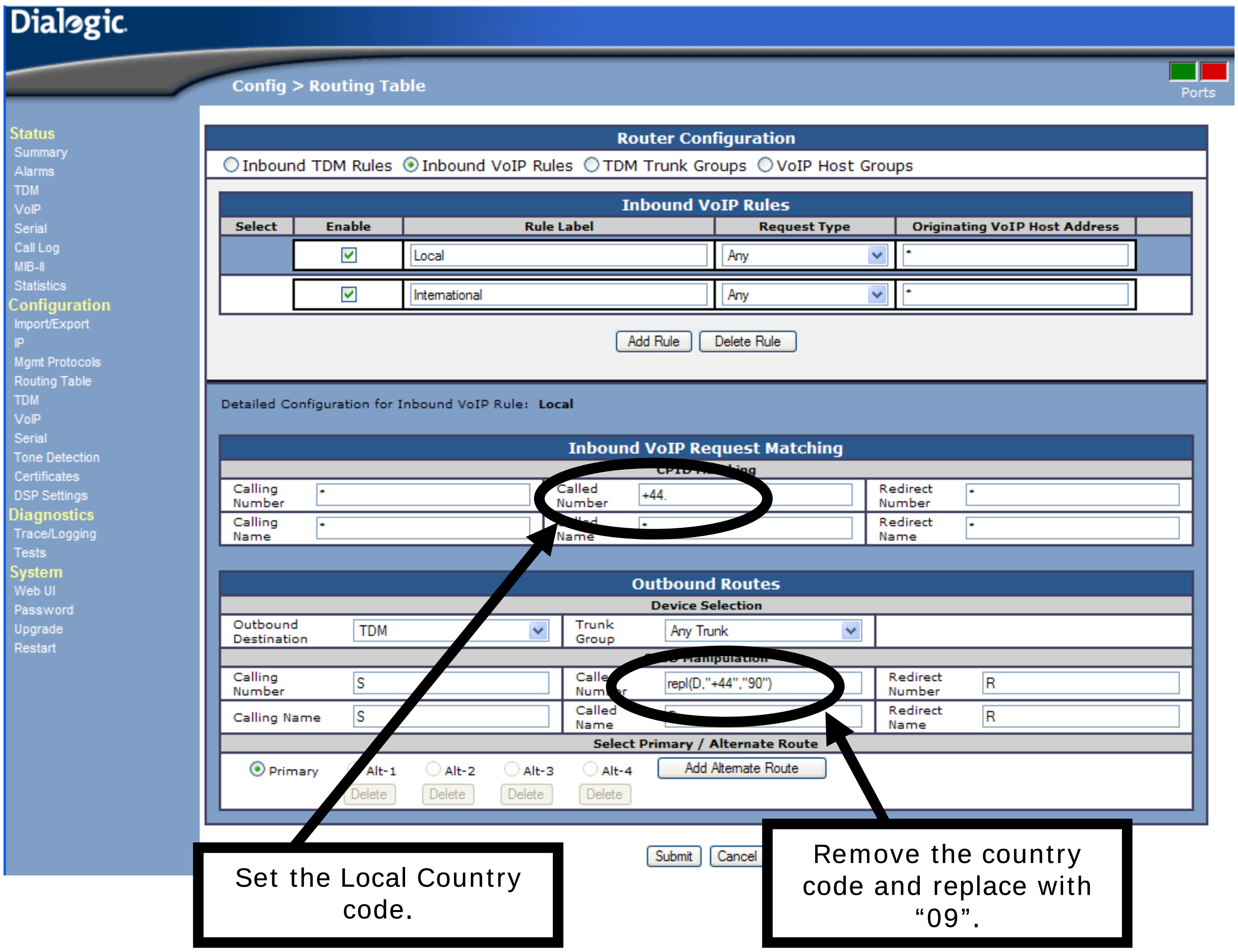
- The “Local” rule is extracting seven (7) digits from the right side (relx(d,7) and pre-pending the trunk access code “9” to the number. If you are connected directly to the phone company, you will want to change this rule just to extract the seven (7) digits. It should look like this: rext(D,7).
- All the “Domestic” rule is doing is adding the trunk access number. To the 11 digits following the “+”. Depending on your configuration, this can be changed or deleted.
- The “International” rule is adding the trunk access number “9” and the international access number “011”. If necessary, you can change or delete the trunk access number.



Europe (**DMG2000 Lync Config a-law.ini**)

Phone number type	Microsoft® Lync sent phone number	Phone number sent to CO or PBX
National	+44123456789	0123456789
International	+49123456789	0049123456789

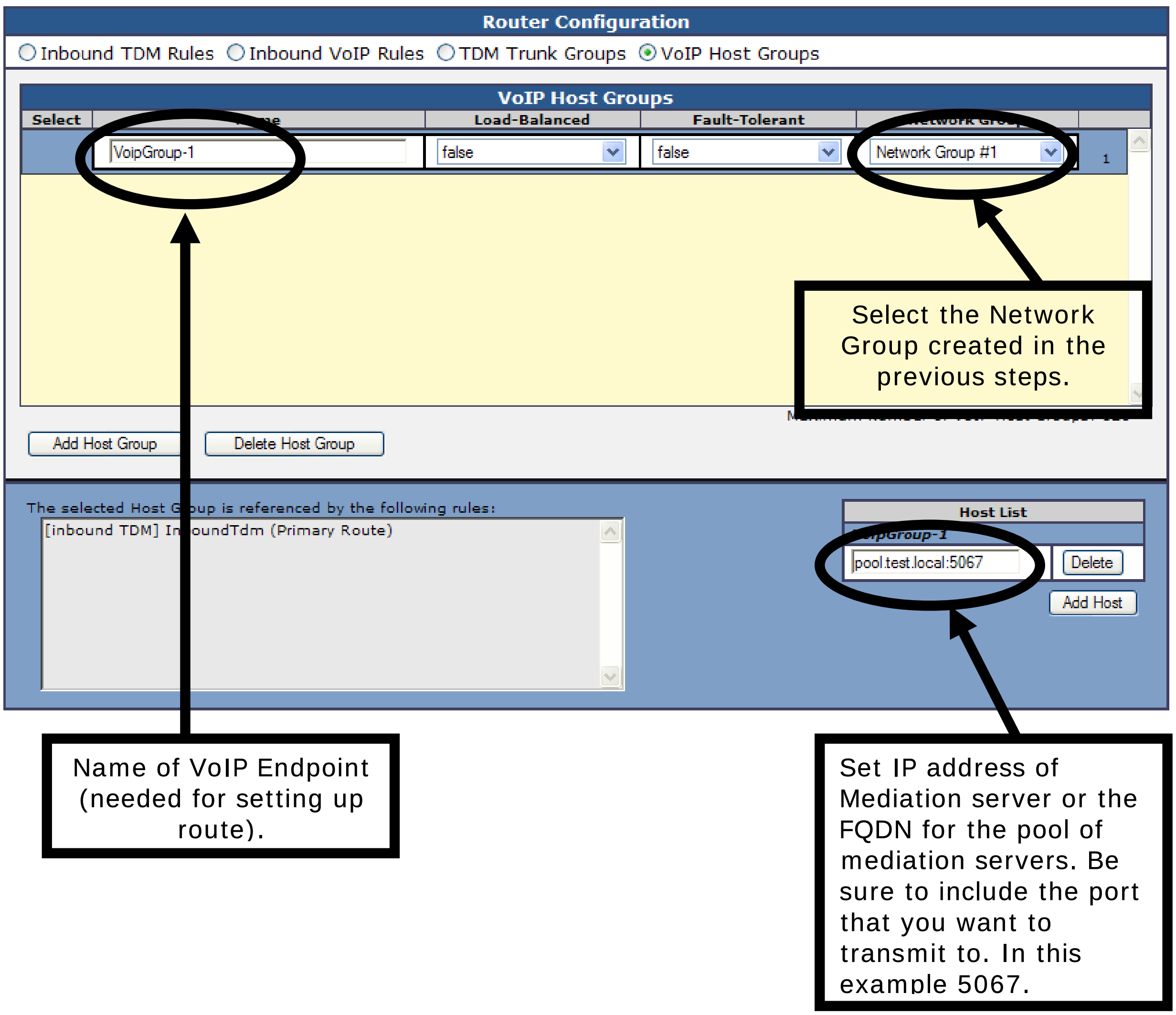
- Changing “National” dial plan to match your country
  - In this example, and in the applicable attached sample “.ini” configuration file, the dial plan is set up to determine a “National” number in the UK. If you are located in another country, you will need to change the National dial plan to match your specific country code. To do so, you will need to edit the “Inbound VoIP Routing” rule and modify the “CPID Manipulation” setting to match your country.
- Inbound VOIP Routing
  - The Inbound routing rules compare the number sent by Microsoft® Lync and look for the country code. If the located code matches the desired code for the country in which the DMG2000 is deployed - in this case the UK - then the manipulation for a national number is run. All other calls are treated as international calls.
- CPID Manipulation
  - For a “National” number, the country code is replaced with a “0” and the number is dialed. For international numbers, a “00” is added to the beginning of the dial string.
  - If the DMG2000 is deployed behind a PBX, it might be necessary to add a trunk access to the dial strings as well. To accomplish this, the “Called Number” field of the CPID Manipulation section will need to add the trunk access code. In the example below, you would need to change the rule to be:
    - National repl(D,“+44”,“90”)
    - International repl(D,“+”,“900”)


Dialogic
Config > Routing Table
Ports
Status
Summary
Alarms
TDM
VoIP
Serial
Call Log
MIB-II
Statistics
Configuration
Import/Export
IP
Mgmt Protocols
Routing Table
TDM
VoIP
Serial
Tone Detection
Certificates
DSP Settings
Diagnostics
Trace/Logging
Tests
System
Web UI
Password
Upgrade
Restart
Router Configuration
Inbound TDM Rules
Inbound VoIP Rules
TDM Trunk Groups
VoIP Host Groups
Inbound VoIP Rules
Select
Enable
Rule Label
Request Type
Originating VoIP Host Address
Local
Any
International
Any
Add Rule
Delete Rule
Detailed Configuration for Inbound VoIP Rule: Local
Inbound VoIP Request Matching
Calling Number
Called Number
+44.
Redirect Number
Calling Name
Redirect Name
Outbound Routes
Device Selection
Outbound Destination
TDM
Trunk Group
Any Trunk
Calling Number
S
repl(D,"+44","90")
Redirect Number
R
Calling Name
S
Called Name
Redirect Name
R
Select Primary / Alternate Route
Primary
Alt-1
Alt-2
Alt-3
Alt-4
Add Alternate Route
Delete
Submit
Cancel
Set the Local Country code.
Remove the country code and replace with “09”.

Configuring Calls from TDM to Microsoft® Lync Server

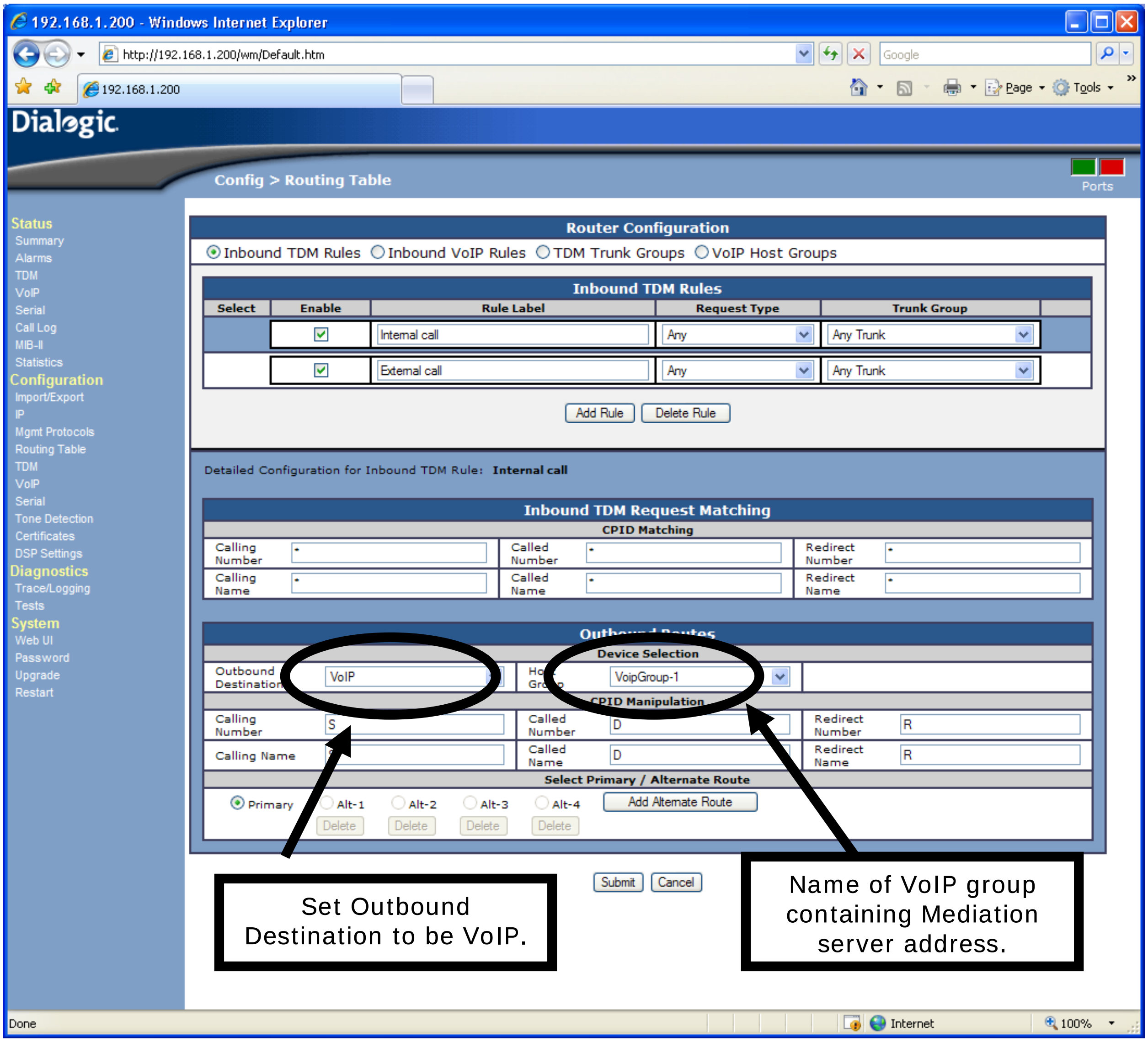
Directing PSTN / PBX Calls to Mediation Server

- It is necessary to direct all incoming calls from the TDM (PSTN) side to the mediation server. This is done in the Routing Table tab of the web interface. Select the Inbound TDM Call Routing tab and enter the IP-address or FQDN of the Mediation server or pool of servers in the URI field.
- Hit "Submit" to save the changes.



Setting Up Route from TDM to IP

- Now you will need to select the "Inbound TDM Rules" to create a route for the incoming TDM calls to the VoIP endpoint:
- Select the "Inbound TDM Rules" radio button and the select the first "Inbound TDM Rule".
- In the "Outbound Routes" for this rule select the "Outbound Destination" and set it to "VoIP".
- For the "Host Group" select the name that was created while setting the IP address in the last step.
- Hit "Submit" to activate the rule.


192.168.1.200 - Windows Internet Explorer
http://192.168.1.200/wm/Default.htm
Dialogic.
Config > Routing Table
Ports
Status
Summary
Alarms
TDM
VoIP
Serial
Call Log
MIB-II
Statistics
Configuration
Import/Export
IP
Mgmt Protocols
Routing Table
TDM
VoIP
Serial
Tone Detection
Certificates
DSP Settings
Diagnostics
Trace/Logging
Tests
System
Web UI
Password
Upgrade
Restart
Router Configuration
Inbound TDM Rules
Inbound VoIP Rules
TDM Trunk Groups
VoIP Host Groups
Inbound TDM Rules
Select
Enable
Rule Label
Request Type
Trunk Group
Internal call
Any
Any Trunk
External call
Add Rule
Delete Rule
Detailed Configuration for Inbound TDM Rule: Internal call
Inbound TDM Request Matching
CPID Matching
Calling Number
Called Number
Redirect Number
Calling Name
Called Name
Redirect Name
Device Selection
Outbound Destination
VoIP
VoipGroup-1
CPID Manipulation
Calling Number
S
Called Number
D
Redirect Number
R
Calling Name
Called Name
D
Redirect Name
R
Select Primary / Alternate Route
Primary
Alt-1
Alt-2
Alt-3
Alt-4
Add Alternate Route
Delete
Submit
Cancel
Set Outbound Destination to be VoIP.
Name of VoIP group containing Mediation server address.
Done
Internet
100%

Converting the Called Party to E.164 format

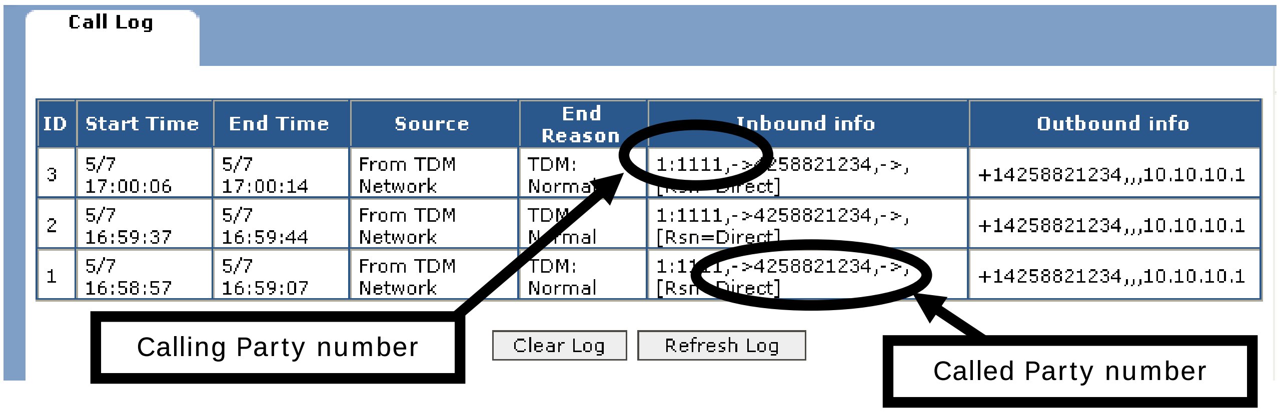
- It is not necessary to convert the Called Party number to E.164 before it is sent to Microsoft® Lync as the existing normalization rules in Microsoft® Lync will take the number the gateway is receiving from the PBX normalize it to the correct format.

Converting Calling Party number to E.164 format

- If you want Microsoft® Lync to be able to do a reverse look up in the GAL or a users contact list it is necessary to have the gateway convert the Calling Party number to E.164 to match the format in the GAL. This manipulation of the calling party information will be dependent on the information that the gateway is receiving from the PSTN or PBX. Here are a few examples of necessary conversions and the rule to achieve the needed conversion.

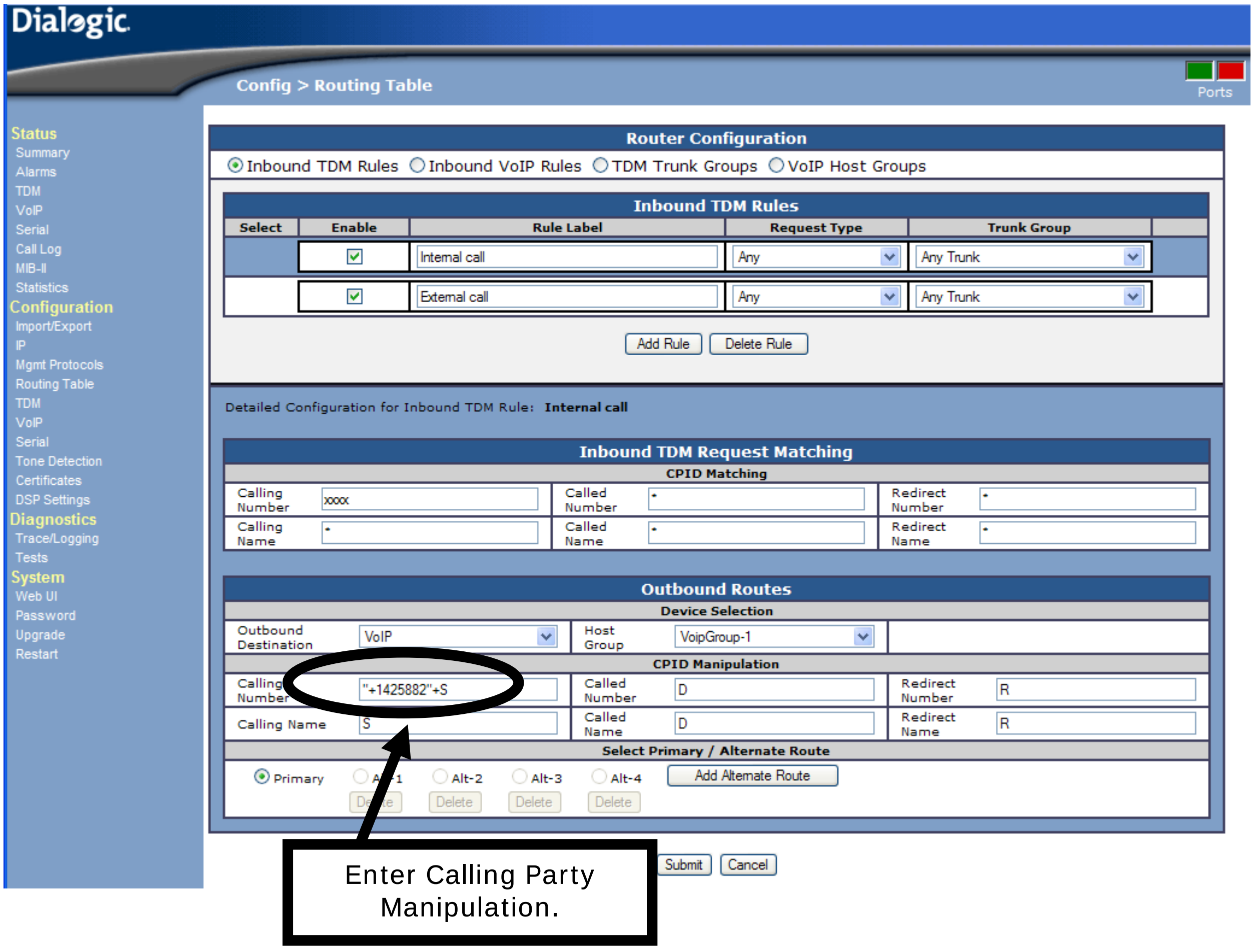
PSTN / PBX Sends	Manipulation Needed	Dial Plan Rule
4-digit extension Ex. 1234	Need to add +1 (area code) and first three number of phone number +1425882	"+1425882"+S
7-digit phone number Ex. 8821234	Need to add +1 and the area code. +1425	"+1425"+S
10-digit number Ex. 428821234	Need to add the +1	"+1"+S
Local Call in UK Ex. 1628123456	Need to add +44	"+44"+S

- If you are unsure what your PBX or the PSTN will be sending to the gateway, you can place a couple of test calls into the gateway and look at the call log to see the information that is being sent. The calling party information can be seen in this screen shot which shows a call from extension 1111 to 425-882-1234. Be sure to place calls from both on the PBX and from outside. It is possible that you will receive a 4-digit number from inside and a 10-digit number from outside. If this is the case you will need to enter two rules one for each number format.



ID	Start Time	End Time	Source	End Reason	Inbound info	Outbound info
3	5/7 17:00:06	5/7 17:00:14	From TDM Network	TDM: Normal	1:1111,->4258821234,->, [Rsn=Direct]	+14258821234,,,10.10.10.1
2	5/7 16:59:37	5/7 16:59:44	From TDM Network	TDM: Normal	1:1111,->4258821234,->, [Rsn=Direct]	+14258821234,,,10.10.10.1
1	5/7 16:58:57	5/7 16:59:07	From TDM Network	TDM: Normal	1:1111,->4258821234,->, [Rsn=Direct]	+14258821234,,,10.10.10.1

- Once you have determined the format of the calling number for your environment and matched it to the rule in the above table, you will need to enter the rule into the DMG2000 gateway. This is done by selecting the Inbound TDM Rules radio button on the Routing Table web page and modifying the “Outbound Routes” rule for “Calling Number” from the samples provided in the configuration files.
  - In the “Calling Number” box enter the rule from the table above that has been changed to match your environment.
  - Hit “Submit” to save the rule.


Dialogic
Config > Routing Table
Ports
Status
Summary
Alarms
TDM
VoIP
Serial
Call Log
MIB-II
Statistics
Configuration
Import/Export
IP
Mgmt Protocols
Routing Table
TDM
VoIP
Serial
Tone Detection
Certificates
DSP Settings
Diagnostics
Trace/Logging
Tests
System
Web UI
Password
Upgrade
Restart
Router Configuration
Inbound TDM Rules Inbound VoIP Rules TDM Trunk Groups VoIP Host Groups
Inbound TDM Rules
Select Enable Rule Label Request Type Trunk Group
Internal call Any Any Trunk
External call Any Any Trunk
Add Rule Delete Rule
Detailed Configuration for Inbound TDM Rule: Internal call
Inbound TDM Request Matching
CPID Matching
Calling Number xxxx
Called Number *
Redirect Number *
Calling Name *
Called Name *
Redirect Name *
Outbound Routes
Device Selection
Outbound Destination VoIP
Host Group VoipGroup-1
CPID Manipulation
Calling Number "+1425882"+S
Called Number D
Redirect Number R
Calling Name S
Called Name D
Redirect Name R
Select Primary / Alternate Route
Primary Alt-1 Alt-2 Alt-3 Alt-4
Add Alternate Route
Delete Delete Delete Delete
Submit Cancel
Enter Calling Party Manipulation.

6. Troubleshooting

6.1 Debugging Tools

- Ethereal/Wireshark – Used to view and analyze the network captures provided by the DMG2000 diagnostic firmware.
- Adobe Audition – Used to review and analyze the audio extracted from the network captures in order to troubleshoot any audio-related issues.

7. Gateway Trace Masks

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

- `voip prot` and `voip code` – These allow the collection of all SIP-related messages as they are sent from and received by the DMG2000. Such data can be important, as in cases where you believe the DMG2000 is unable to communicate properly with the messaging server.
- `tel event` and `tel code` – These allow the collection of all circuit-side activity. Such data can be important, such as when addressing 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 DMG2000 front end interface. This data can be very important, such as when addressing the following scenarios:
    - Call control problems (dropped calls, failing transfers, etc.)
    - Integration problems (incorrect mailbox placement, missed auto-attendant greetings etc.)
- `RouteTable (all keys)` – This will allow the collection of events around the parsing of the dial plan. This will enable the user to see the calling and called numbers being sent to the gateway and see how they being changed by the dial plan configuration.

The following keys are helpful when confronting certain issues and can be enabled for targeted troubleshooting of specific problems. Activating these keys may generate large amounts of data on busy systems and increase the size of the collected log files, but doing so will not harm system performance.

- `dspif` (all keys) – This allows the collection of tone related data. Such data is very helpful in cases where you think you have problems relating to 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 issue, this key may be left disabled.

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

Additional information regarding the Dialogic® 2000 Media Gateway Series (DMG2000) can be found at the following link: http://www.dialogic.com/support/helpweb/mg/default.aspx