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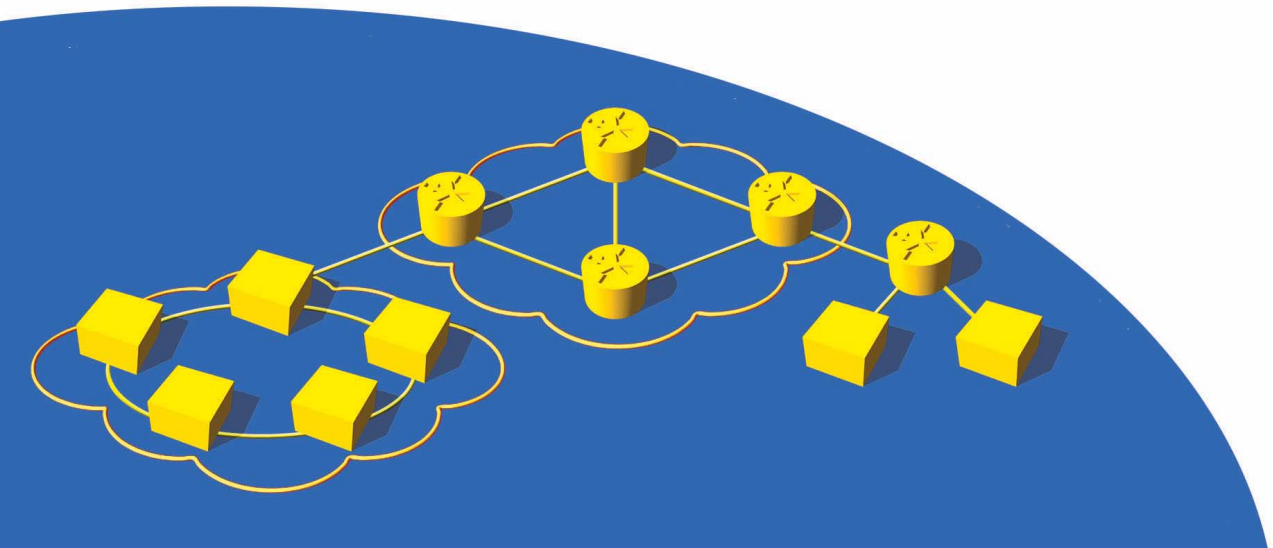
Application Note

Trunking Gateway: Configuring for Testing

June 2004



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Trunking Gateway: Configuring for Testing

This application note provides guidelines for configuring trunking gateways for testing.

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Overview

In a family of Media Gateways, the Trunking Gateway (TG) is differentiated by its main purpose of supporting a media path from/to IP-based voice networks to/from PSTN TDM trunks. As such a unit, a TG does not have any means to process the signaling information and always requires an external call control function provided by a call agent or Media Gateway Controller (MGC). In most applications, the TG provides a bearer path between networks, where the signaling is separated from the bearer path. There can be one or more TGs in VoIP networks, and all of them can be controlled by one or more MGCs.

Quality of voice processing, capacity, and functionality under the heavy load are the most important functions of the TG that need to be tested. Abacus provides a means to load the TG by originating and terminating traffic either from the IP side or from the PSTN side. Abacus's measurements and reporting capabilities provide you with test results sufficient to troubleshoot the TG.

The main objective of this Application Note is to guide you through the steps needed to configure communication links between Abacus and the TG or TGs under test. We will focus on two specific Abacus Features used for configuring TG testing: *Clear Channel signaling* and the *Network Topology Diagram*.

It is assumed that you are already familiar with testing using Abacus and know how to assign cards, configure protocols, and specify measurements and results. If while going through this Application Note you need to refresh your knowledge of Abacus, use the Abacus Help file and Manual as reference documents.

Introduction

A TG by definition does not process any signaling protocols. To support configuration of TDM and IP trunks to test a TG, Abacus introduces a specific signaling protocol named Clear Channel. Clear Channel is an internal signaling protocol added to Abacus's supported list of protocols for emulating Common Channel Signaling (CCS) networks.

Also, a new tool was designed to help you to configure multiple parameters and properties of network interfaces between PSTN trunks, IP trunks, and MGC. This tool is the **Network Topology Diagram**.

This Application Note will walk you through the configuration steps by showing examples of the most common testing cases for TG tests. First we will configure the parameters common to all test cases and then move to configuration steps for specific tests.

Configuring Tests

Configuring System Parameters

To test a TG in all test cases, the minimum number of cards needed is one PCG or TCG card and one ICG card. You configure these cards in the **Protocol Selection** and **Partition and Timing** windows. We assume that in the **Hardware** window you have already assigned all PCGs or TCGs and ICGs for these tests to you (*Owner* is listed as *Self* in the **Shelf** panel).

Protocol Selection Window

Using the **Protocol Selection** window, you assign which ICG and PCG cards (by slot numbers) will be used to emulate the IP, MGC, and TDM Trunk, respectively. Depending on your test case and number of channels you need to load, there can be more than one card for each functional interface. The **Protocol Selection** window is where you assign additional ICG and PCG or TCG cards to emulate more IP and TDM channels.

For our examples in this Application Note, we will use the minimum number of cards (one PCG or TCG and one ICG). To configure them, we will use the **Card** and **ICG** panels of the **Protocol Selection** window.

Card Panel

Using the **Card** panel, you specify the physical interfaces you need to your TG, the signaling protocols used, and which functionality – exchange or subscriber – you need to emulate for the interfaces.

For TDM trunk PCG (or TCG) cards and for MGC emulation (ICG) cards, you must always configure the *Clear Channel Signaling* protocol.

Corresponding to a channel type (chosen in the **Physical** column), the Clear Channel protocol provides “ClrChn T1”, “ClrChn E1”, and “ClrChn VoIP” choices.

For a card side to be used with Clear Channel, the only option is *Exchange*.

Figure 1 is an example where an ICG in slot 3 is configured to emulate MGC, and a PCG in slot 2 is configured to emulate a TDM trunk. The **Circuit** column is not configured in this panel and is shown in gray.

ICG Panel

Figure 2 shows the **ICG** panel. In this panel, you need to configure ICG testing and IP parameters. In our example, one ICG card in slot 3 emulates IP trunks and MGC using the *MGCP* signaling protocol. IP Trunks emulation is specified by a number of channels mapped to PSTN over Clear Channel in the **Partition and Timing | Association** panel. The number of channels configured in **Chan Quantity** in **ICG Units Setting** represents the maximum number of available channels.

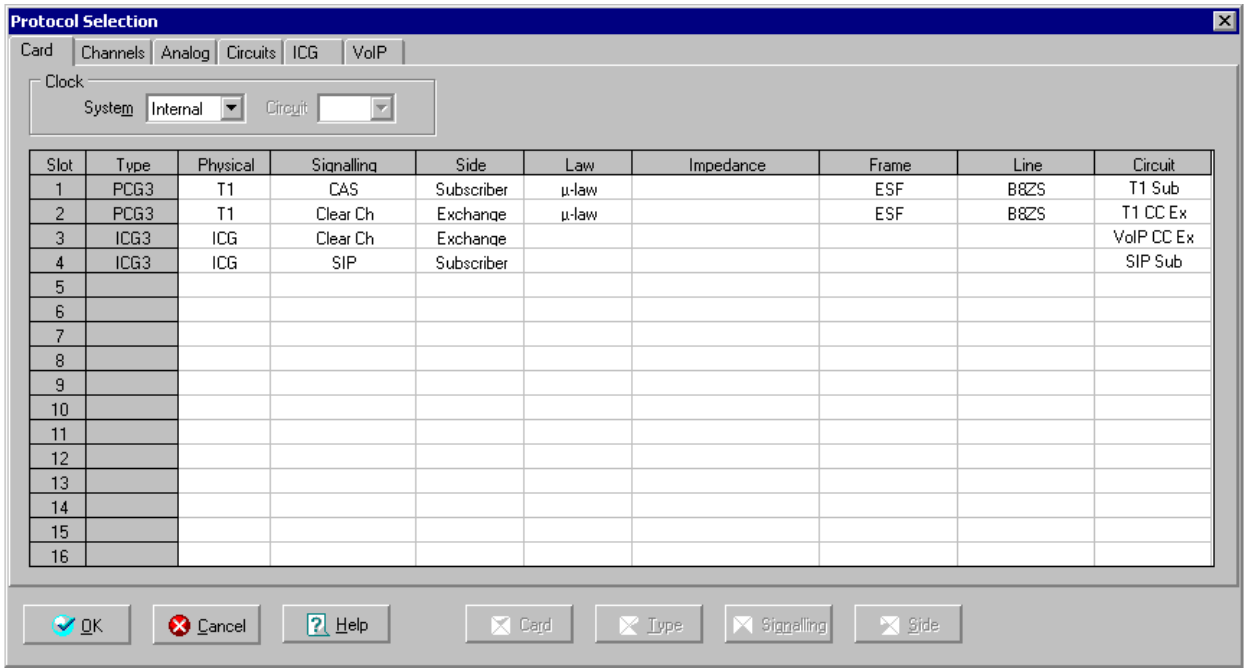

Figure 1. Protocol Selection Window – Card Panel

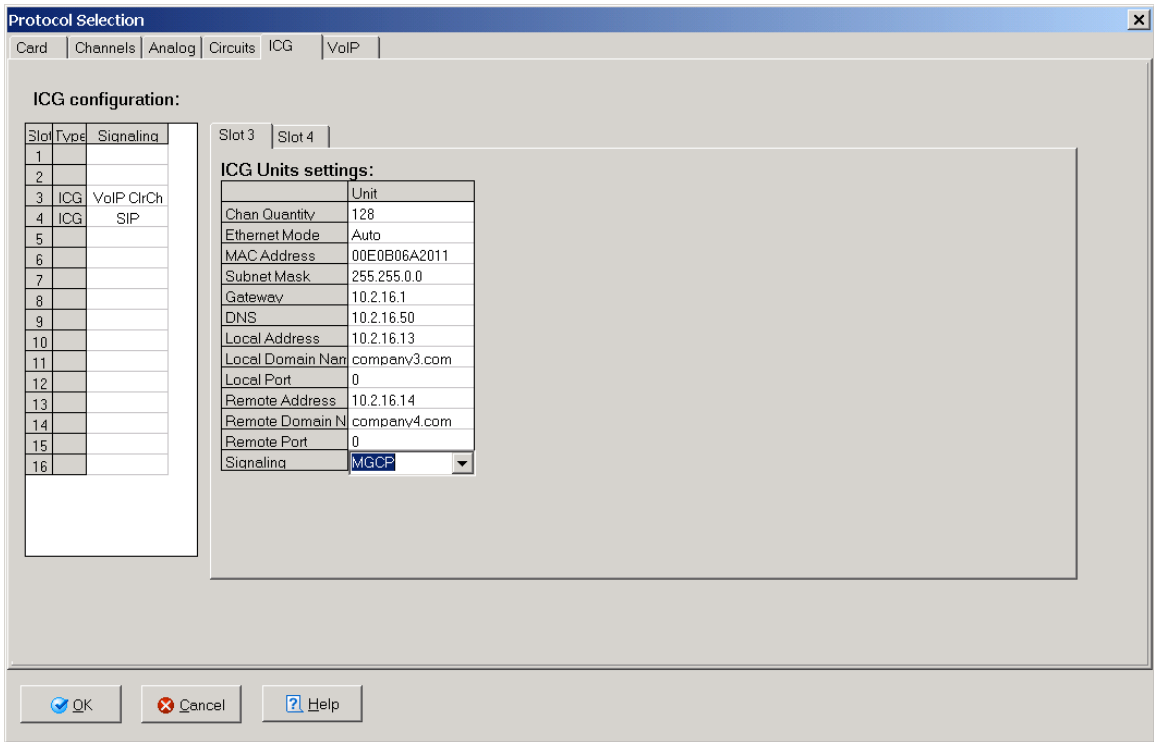

Figure 2. Protocol Selection Window – ICG Panel

The **ICG** panel is where this protocol should be configured. At least one ICG card should support the MGC protocol. We specified this ICG in the **Cards** panel as *Clear Ch* (shown as *VoiP ClrCh* in the **Configuration/Signaling** table on the **IGC** panel). In the **ICG Units Setting** table, we selected *MGCP* from the **Signaling** drop-down list in the **Unit** column.

In the **ICG Units Setting** table, in a case when only one ICG card is used, the **Chan Quantity** field should always have a number of channels specified. The **Signaling** field in this case should always have *MGCP* or *MEGACO* specified.

When two or more ICG cards are used, if any ICG card is dedicated to the emulation of MGC, the **Chan Quantity** field should be set to *0*. If any other card is dedicated to the emulation of IP Trunks only, the **Signaling** field of the **ICG Units Setting** table should be set to *None*.

Partitioning and Timing Window – Association Panel

In this window, we need to specify how many voice channels to configure for the test and how these channels are mapped between PSTN and IP trunks. We need to define how to group the channels (*Set*), which channels and how many (*From, To, Total*), traffic direction (from Terminate toward Originate, or others), and how sets are linked.

Figure 3 shows an example where we configured a total of 8 channels linked in sets between T1 ClrCh Exchange 1 and VoIP ClrCh Exchange 1. For convenience, we used the **Split** button to show both panels in the same window. Clicking in turn in the **T1 ClrCh Exchange** panel and the **VoIP ClrCh Exchange** panel allows you to configure the PSTN and IP trunks. The links shown in the example are associated to Set number 1 and thus have Exchange 1 defined in the link name.

Using the Network Topology Diagram

General

The testing configuration for a Trunking Gateway is always a network of interconnected TGs, MGCs, PSTN Trunks, and IP Trunks. Abacus provides you with a graphical tool, where with a small number of network elements, you can depict the testing network. The **Network Topology Diagram** provides a means to interconnect pre-defined elements and specify their interfaces. You initiate the diagram by selecting the main menu **Configure | Network Topology Diagram** command.

In the steps below you will learn how to use the **Network Topology Diagram**. The examples shown are based on the most practical Test Cases.

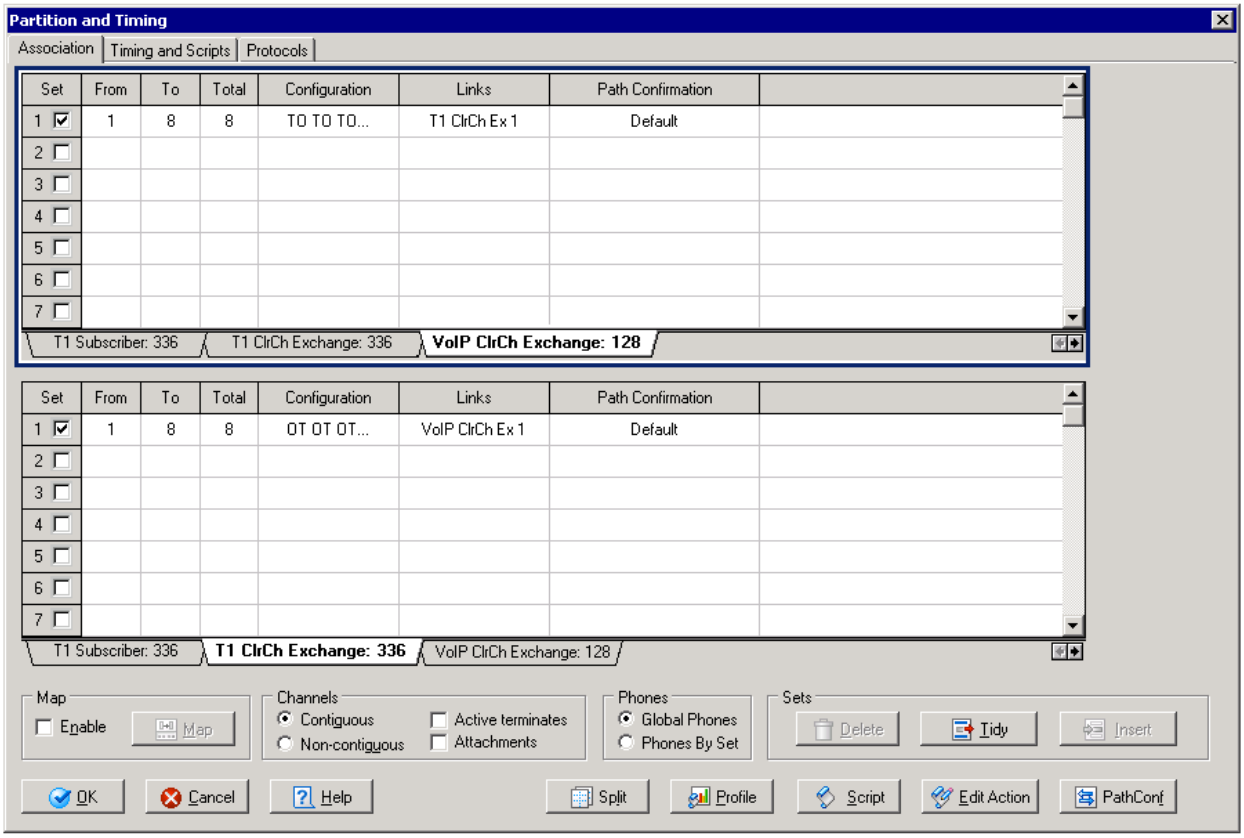

Figure 3. Partition and Timing Window – Association Panel

Network Elements

The existing collection of elements is shown on the Icon Bar (*Figure 4*) on the top of the **Network Topology Diagram** window. The elements are separated into two groups: representation of different Devices Under Tests (DUTs) on the left side, and Abacus Emulation elements on the right side. Each network element has interfaces specific to its functions. The thick black lines attached to an element icon are the interface lines (vertexes).

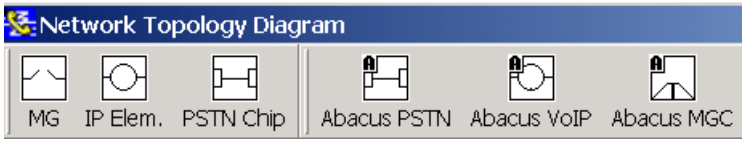

Figure 4. Network Topology Diagram – Icon Bar

Only Media Gateway (**MG**) as a representation of a DUT Trunking Gateway is presented in this application note. Two other MG elements, **IP Elem** and **PSTN Chip**, are used in test cases where the MG is not a TG. These two DUTs do not use MGC call control and have only IP or only PSTN trunks on both sides.

The element icons and their purposes and properties are specified in the following paragraphs. We will learn how to configure these properties in *"Test Case 1" on page 8* and *"Test Case 2" on page 13*.

DUT Media Gateway

The DUT **MG** element (*Figure 5*) supports three interfaces:

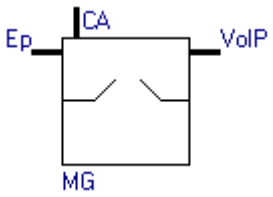

Figure 5. DUT Element – Media Gateway

- *CA* (Call Agent) – toward Media Gateway Controller. A signaling protocol, IP address, and Ports should be specified for the MG.
- *VoIP* – toward IP Trunk or another MG. *VoIP* connection specifies the number and properties of RTP streams toward IP phones emulated by an Abacus ICG card.
- *Ep* (endpoints) – toward either PSTN trunk or another Media Gateway. Endpoints are the general name used in Abacus for endpoints and terminations as they are specified for MGCP and MEGACO protocols. In our testing cases, the endpoints are DS0 channels. In Abacus, an endpoint always has a channel associated with it.

Abacus Media Gateway Controller

The Abacus **MGC** (*Figure 6*) emulates call control messages between a TG and a Signaling Network. MGCP and MEGACO are supported. The signaling protocol, IP address, and Port should be specified.

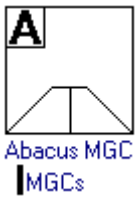

Figure 6. Abacus Element – Media Gateway Controller

Abacus PSTN Trunk

The Abacus **PSTN** trunk element (*Figure 7*) emulates TDM traffic over T1 or E1 physical interfaces. Each interface can be connected to more than one Media Gateway Endpoint. The number of channels and signaling interface should be specified.

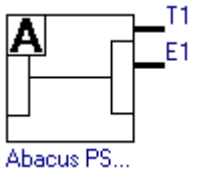

Figure 7. Abacus Element – PSTN Trunk

Abacus VoIP Trunk

The Abacus **VoIP** trunk element (*Figure 8*) emulates IP traffic over the Ethernet. RTP stream parameters should be specified and mapped to PSTN channels.

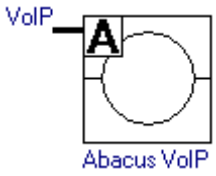

Figure 8. Abacus Element – VoIP Trunk

Example Test Cases

Test Case 1

In this case, we will discuss the most used configuration, where one Trunking Gateway has a PSTN trunk on one side and an IP trunk on another. The MGC provides a call control. Abacus also supports test cases where two or more PSTN trunks or two or more IP trunks are connected on both sides of a TG.

Refer to the test setup shown in *Figure 9*. You need an Abacus system with at least one PCG or TCG card and one ICG card connected into the network. The PCG or TCG card emulates the PSTN trunk, and the ICG card emulates the IP trunk and the MGCP (our case) or MEGACO interfaces of the MGC. Two or more ICG cards can also be used, one or more for the IP trunk and one or more for MGC emulation.

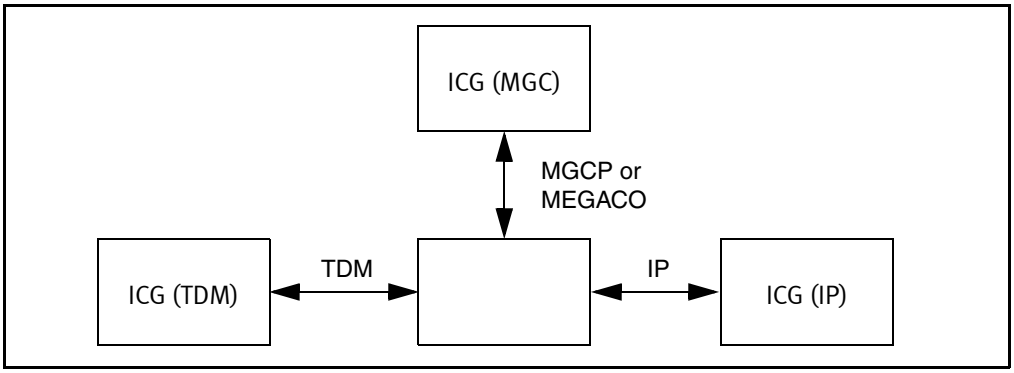

Figure 9. Test Diagram: Test Case 1

Configuring System Parameters

As noted before, the steps performed in *"Configuring System Parameters" on page 3* are applicable to any test case. We have already configured system parameters in the **Protocol Selection** and **Partition and Timing** windows for this test case.

The next step is to configure network parameters using the **Network Topology Diagram**.

Configuring the Network Topology Diagram

Refer to the Abacus representation of Test Case 1 in *Figure 10*. To create this configuration, we will perform the following steps:

Placing Network Elements

1. In the icon bar, click **Abacus MGC**, **Abacus PSTN**, **Abacus VoIP**, and **(SUT) MG**. Abacus automatically places the elements as shown in *Figure 10*.
2. Make the connection (edge) between elements **PSTN** and **MG**:
   - **a** Click on **Abacus PSTN** vertex *T1*.
   - **b** Hold down the **Ctrl** key and click on **MG** vertex *Ep*.
   - **c** Click **Connect** to create the edge.
3. Make the connection (edge) between elements **MGC** and **MG**:
   - **a** Click on **Abacus MGC** vertex *MGCs*.
   - **b** Hold down the **Ctrl** key and click on **MG** vertex *CA*.
   - **c** Click **Connect** to create the edge.
4. Make the connection (edge) between elements **IP** and **MG**. To have the signaling supported, the connection should be done between the MGC and the IP trunk.
   - **a** Click on **Abacus MGC** vertex *MGC*.
   - **b** Hold down the **Ctrl** key and click on **Abacus VoIP** vertex *VoIP*.
   - **c** Click **Connect** to create the edge.

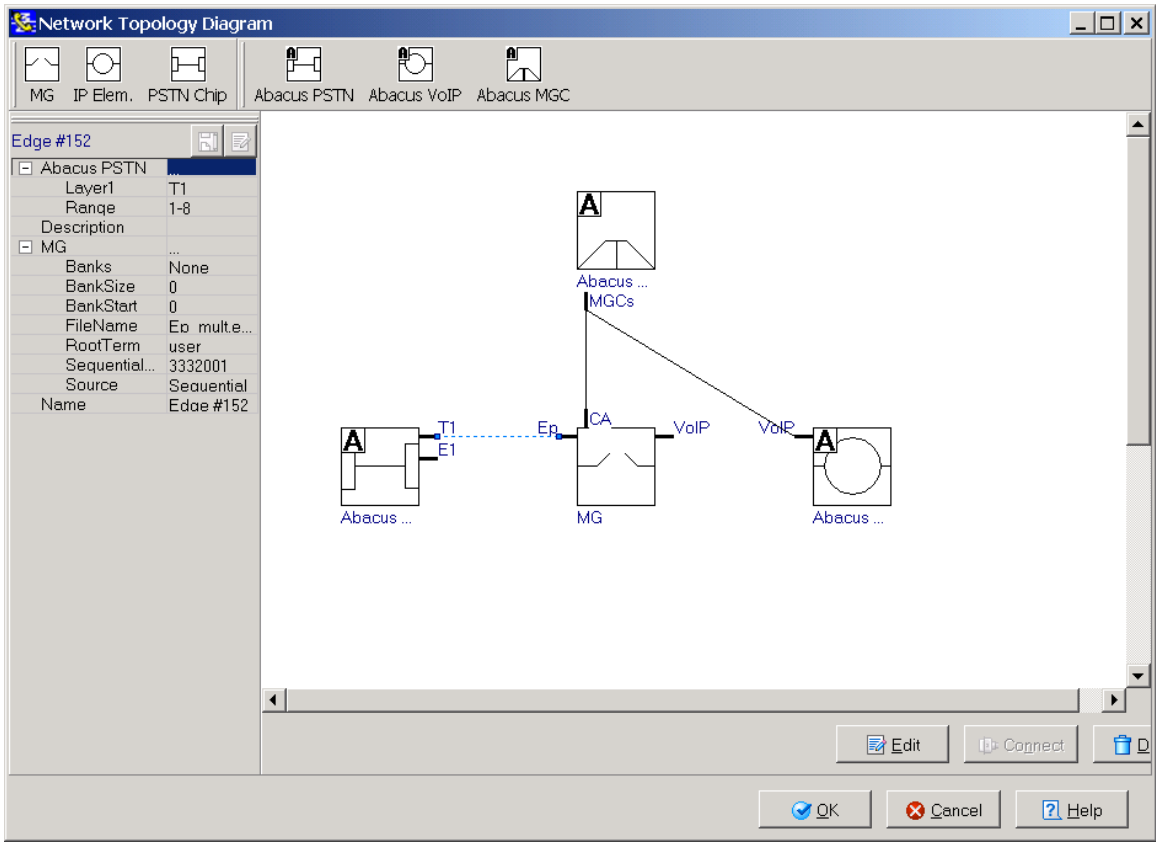

Figure 10. Network Topology Diagram Setup: Test Case 1

Configuring Connections (Edges)

To configure a connection properties, click on the corresponding edge. The line will change its color to blue, and the edge properties will appear on the **Properties Viewer** on the left side of the **Network Topology Diagram**.

In *Figure 10*, the **Properties Viewer** shows properties of the connection between PSTN and MG.

You can edit the parameters shown in the **Properties Viewer** by using the **Edge Editor**. The **Edge Editor** can be opened by either clicking on the edge and then on the **Edit** button or by double-clicking on the edge. The **Edge Editor** provides additional GUI panels where channel assignments can be viewed in the circuit diagram.

The use of the editor is presented in the following paragraphs. The results of all our configuring connection activities will be displayed in the **Properties Viewer** every time you click on an edge. We will go through each step for a PSTN to MG connection and show the specifics for IP to MG and MGC to MG properties.

Configuring properties and reviewing the results will be the same for each edge you choose to edit. You can follow the steps described above for PSTN to MG and edit the properties of the communication interfaces from MGC and TG and from IP and TG.

PSTN to MG

Double-clicking on the edge opens a window with both PSTN and MG endpoints for the edge. The **PSTN** side has two panels, **Properties** and **Timeslots**, and the **MG** side has one panel, Endpoint **Properties**. *Figure 11* shows the PSTN **Properties** and Endpoint **Properties** panels, and *Figure 12* shows the PSTN **Timeslots** and Endpoints **Properties** panels.

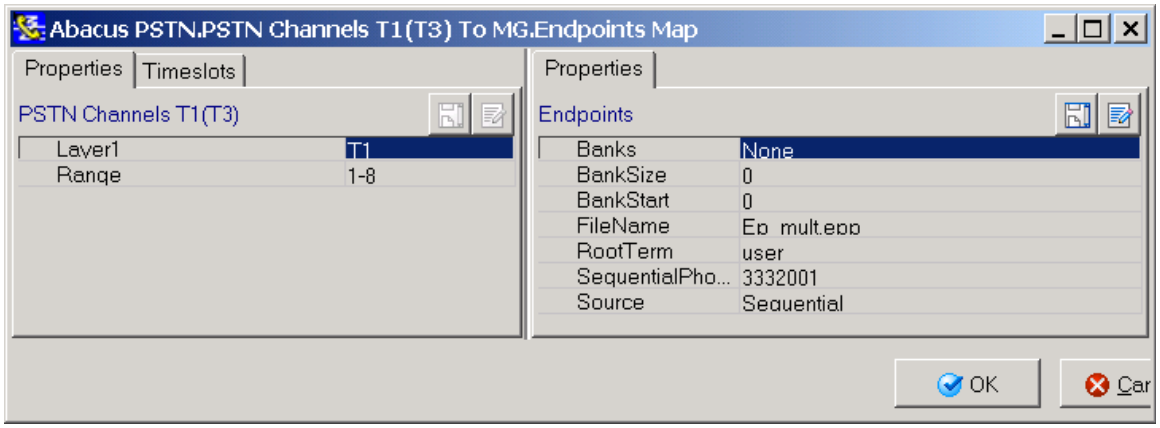

Figure 11. PSTN Properties and Endpoints Properties Panels

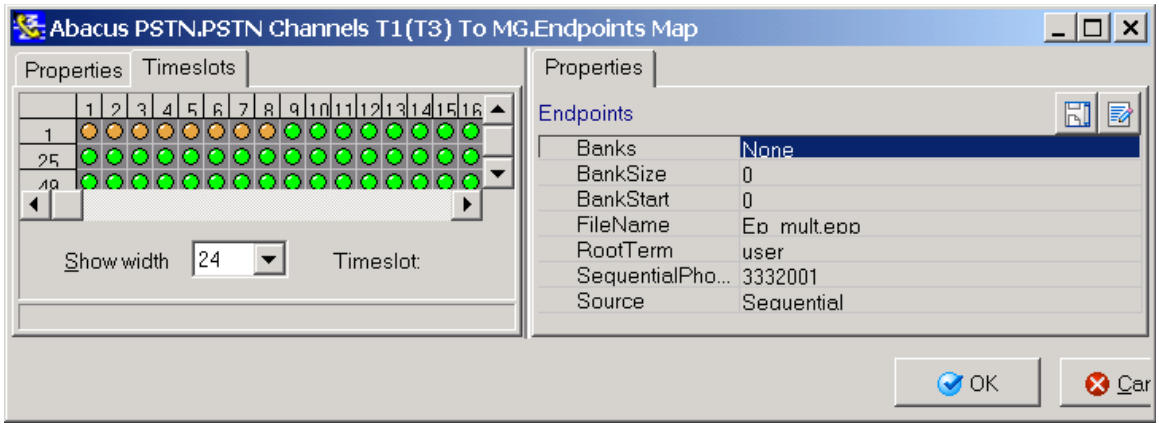

Figure 12. PSTN Timeslots and Endpoints Properties Panels

- **PSTN Properties Panel** (left side of *Figure 11*)

  The PSTN **Properties** panel provides you with the following options:

  - Input the parameters of channels you did not input during the System Configuration steps

- Change properties you input during the System Configuration steps

In the example in *Figure 11*, you can change the physical interface from T1 to E1.The total number of channels in a range can be changed from 1-8 to any other range from available TDM slots

- **PSTN Timeslots Panel** (left side of *Figure 12*)

  This panel is available for edges where physical channels are configured. You can view the current status of a channel, where a channel represents the physical channel or timeslot. The color of the LED specifies if the channel in use by other connection (blue), assigned to this edge (amber), or available (green).

  Channels coded blue cannot be changed on this panel. Status of channels coded amber or green can be toggled in the following ways:

  - Toggle the status of an individual channel by clicking on its LED.
  - Toggle the status of multiple consecutive channels as follows:
    1. Hold the left mouse button down while dragging the cursor over a group of channels. Selected channels are indicated by a blue background.
    2. Right-click to display a popup menu.
    3. To toggle unselected (green) channels to selected (amber), click **Select Channels** in the popup menu. To toggle selected (amber) channels to selected (green), click **Unselect Channels**.

  Changing and saving the channel or channels status in this window will have the same effect as if you done it in the **Partition and Timing** and **Protocol Selection** windows.

  When you restart the test, these changes will take effect.

- **Endpoint Properties Panel** (right side of *Figure 11* and *Figure 12*)

  An Endpoint is a Trunking Gateway in a set of logical channels connection points to the link to the PSTN side of a testing network. The properties of this point are the properties of TG under test.

  Endpoints are characterized by the phone number configuration options. The properties displayed and configured on this panel should be mapped in the way described in the Abacus “Phone Numbers: MGCP and MEGACO” help file.

MGC to MG

Figure 13 shows details of the **Properties Viewer** panels. You can see that instead of the **Timeslot** panel, an **Abacus MGC** panel is displayed. This panel shows and provides the ability to edit the slot numbers and unit numbers of ICG card(s) assigned for MGC emulation.

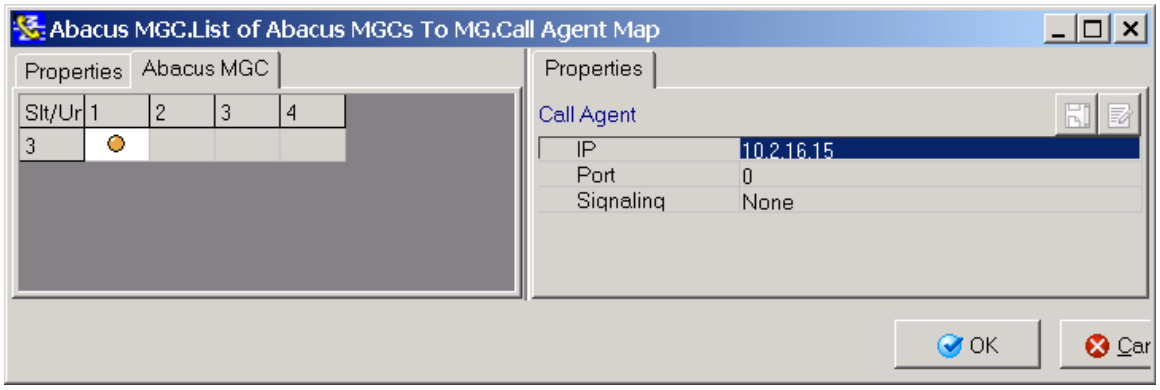

Figure 13. Abacus MGC and Call Agent Properties Panels

IP to MG

As you can see from *Figure 14*, this editor window also consists of two sides, but unlike in the previous screen, there are two panels in both parts.

It should also be mentioned that we configure IP channels on the left side, but instead of configuring endpoints of the MG, we configure MGC properties. On the **Network Topology Diagram**, a connection between IP Trunk and MG is also shown as a logical connection between IP Trunk and MGC. The reason for that is that the endpoints or terminations of the MG should be configured one time for both sides, PSTN and IP. We made the mapping between PSTN and IP channels in **Partition and Timing/Association** Panel, when linked Set number 1 for both IP and TDM sides.

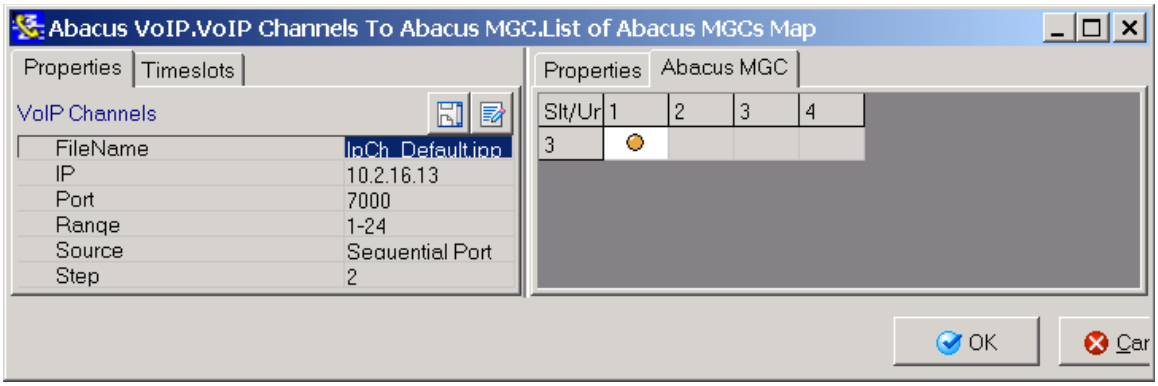

Figure 14. VoIP Channels Properties and Abacus MGC Panels

Test Case 2

It is useful to review a test case where two or more Trunking Gateways are connected in a network. As an example, the network configuration shown in *Figure 15* is used. In this test, Abacus emulates two PSTN trunks connected to TGs, while these two TGs exchange

media traffic over an ATM. This test case can be extended to any configuration where two or more TGs are connected back-to-back and use any standard or proprietary media transmission protocols between them. Abacus supports this test case for all combinations of PSTN and IP trunks on both sides. Both sides can be IP trunks, or PSTN (shown), or IP on any side and PSTN on another.

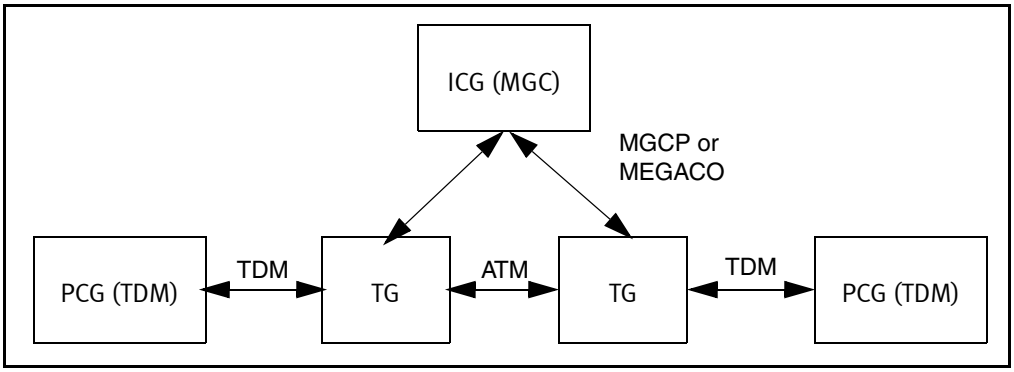

Figure 15. Test Diagram: Test Case 2

The **Network Topology Diagram** representing this test case is shown in *Figure 16*. An Abacus MGC is connected to the CA point of each TG, and an Abacus PSTN T1 is connected to endpoints of each TG.

VoIP connection points of the TG are not connected together. Abacus does not emulate these points and is not aware of the protocols used by TGs.

We will not go through Configuring System Parameters and Configuring Network Topology diagram for this test case. The steps are the same as they described for *"Test Case 1" on page 8*.

Summary

This application note has shown how to configure Abacus to emulate all network elements required for Trunking Gateway testing. A specific Clear Channel signaling protocol is implemented in Abacus to emulate the features of Common Channels Signaling used in PSTN.

You learned how to use different GUI options for a more convenient and expeditious way of mapping your testing needs into connections and properties emulation. N**etwork Topology Diagram** knowledge will help you to easily visualize and set up a variety of parameters and connections.

Along with knowledge of functionality and capacity testing and verification means provided by Abacus, the steps outlined in this Application Note will guide you in you activities.

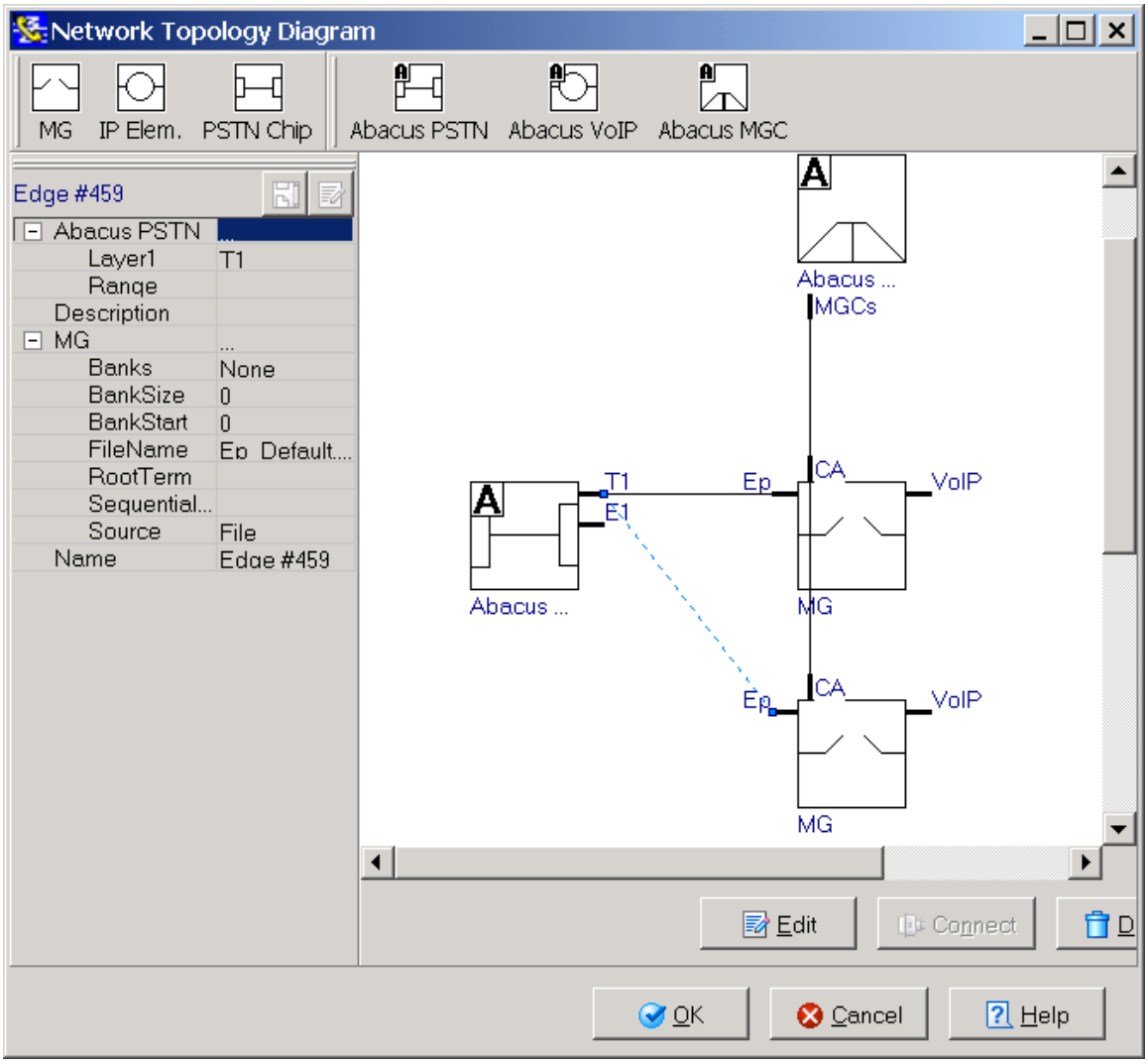

Figure 16. Network Topology Diagram Setup: Test Case 2

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