User's Manual

AudioCodes One Voice™ Operations Center

AudioCodes Routing Manager (ARM)

Version 8.0

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Notice

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Abbreviations and Terminology

Each abbreviation, unless widely used, is spelled out in full when first used.

Related Documentation

Manual Name
ARM Installation Manual
ARM User's Manual
Mediant 9000 SBC User's Manual
Mediant 4000 SBC User's Manual
Mediant 3000 Gateway User's Manual
Mediant SE SBC User's Manual
Mediant SE-H SBC User's Manual
Mediant VE SBC User's Manual
Mediant VE-H SBC User's Manual
Mediant 1000B Gateway and E-SBC User's Manual
Mediant 800B Gateway and E-SBC User's Manual
Mediant 500 Gateway and E-SBC User's Manual
Mediant 500 MSBR User's Manual
Mediant 500L Gateway and E-SBC User's Manual
Mediant 500L MSBR User's Manual
MP-1288 High-Density Analog Media Gateway User's Manual
One Voice Operations Center Server Installation, Operation and Maintenance Manual
One Voice Operations Center Integration with Northbound Interfaces
One Voice Operations Center User's Manual
One Voice Operations Center Product Description
One Voice Operations Center Alarms Guide
One Voice Operations Center Security Guidelines

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Document Revision Record

LTRT	Description
41880	Initial release
41881	New features: Adding ADs, Users and Users Groups, Adding an LDAP Property, Adding a User, Adding a User Property, Adding a User Group, Configuring Settings, Adding Operators, Adding Routing Servers, Configuring a Syslog Server, Adding a Number Manipulation Group, Adding a Prefix Group, Adding an NTP Server, Adding a Software License, Routing
41882	New: Section 8, Migrating Media Gateway Routing
41883	Modified performance capability, added new GUI screens, deleted Network Table view, added Time-Base Routing, added Policy Studio, other minor additions.
41884	Version Release 7.4. Quality-based routing (MOS / ASR). Call Discard. SIP Reason. Test Route Details. Top 5 Routes. Layers. Center Map. Save Items Location. Configure directly in Web interface. Web interface 7.2. Other SIP Request Types.
41885	Time-based routing condition; Pcon Weight; Detach (Pcons); Routing Rules Hits Counting; Load Balancing; Single Sign On; New ARM login; Router Lock/Unlock; Test Routing Rule.
41886	Offline Provisioning | Alarms Journal | Call Detail Records | Add Connection | Advanced Condition: Call Preemption for Emergency Calls
41887	Support for 3rd party nodes. Manually added AudioCodes nodes. Statistics page and reports. Collapse/Expand nodes' associated VoIP peers. Class of Service. More robust node's state machine. Multiple Routing Attempts in Load Balancing Routing Rule Action. Routing Based on Call Trigger. New ARM License Model. SIP P-Asserted-Identity Manipulation in ARM Policy Studio. Upgrade of ARM Machines OS to CentOS 6.9. Enforcement of Memory Requirements for ARM VMs. CDR enhancements. LDAP operator authentication. Saving ARM configuration from GUI.

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1 Overview

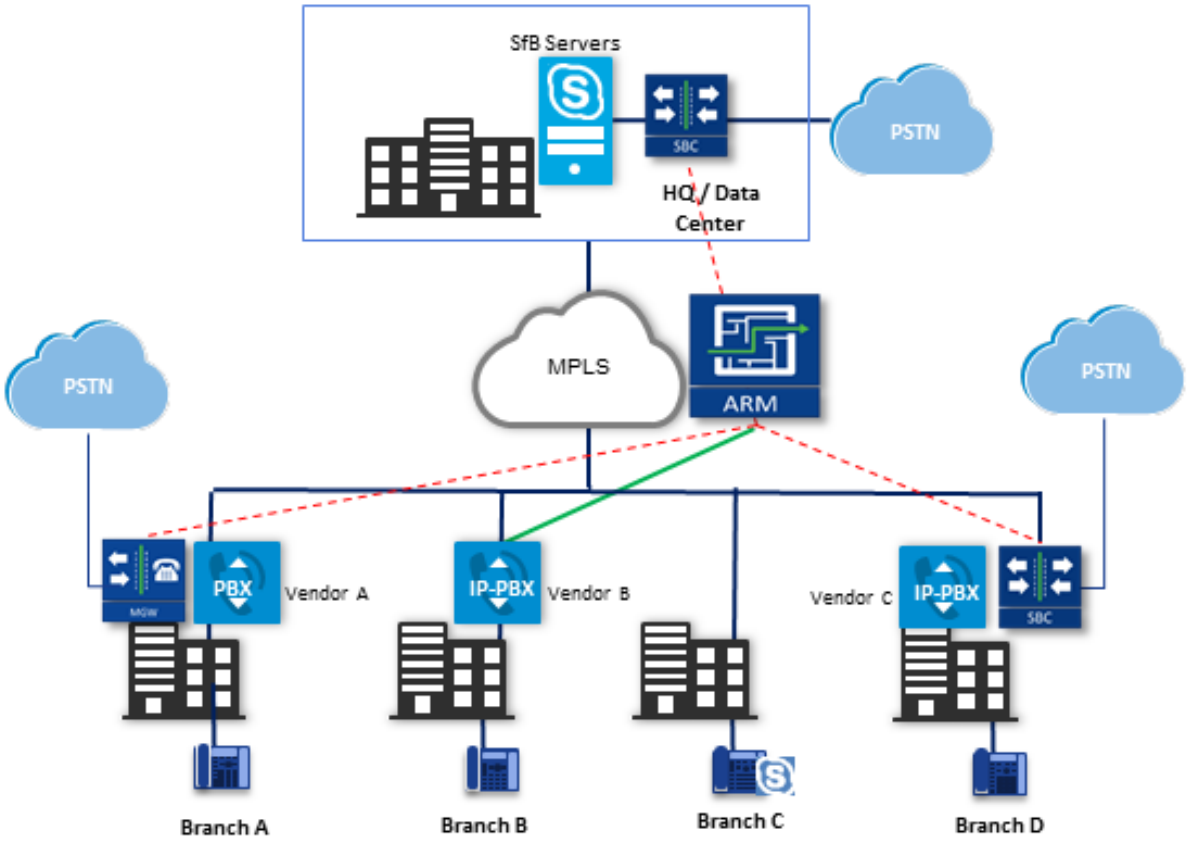
This document shows how to use the AudioCodes Routing Manager (ARM). The ARM is a LINUX-based, software-only, telephony management product which expedites and streamlines IP telephony routing for enterprises with multiple globally distributed branches. The ARM determines the quickest, least expensive, and best call quality routes in packet networks.

Routing data, previously located on the SBC, Unified Communications (UC) application (e.g., Microsoft's Skype for Business), or Media Gateway, is now located on the ARM server. If an enterprise has an SBC in every branch, a single ARM, deployed in HQ, can route all calls in the globally distributed corporate network to PSTN, the local provider, enterprise headquarters, or to the IP network.

Routing rules, configured by the IT manager in the ARM's Routing Table, perform the routing.

If an enterprise has only one or two branches, its IT manager can easily independently implement maintenance changes. In globally distributed enterprises, IT managers until now had to laboriously implement changes, multiple times, per branch. With the ARM, IT managers implement changes only once, saving significant labor and time resources and costs.

The figure below shows a typical, globally-distributed, multi-branch enterprise VoIP network.



VoIP networks like this typically require:

- Distributed routing & policy enforcement
- Distributed PSTN
- Multiple VoIP network entities' configurations (i.e., SBC, Media Gateway)
- Multiple Dial Plans
- SIP Interworking between IP PBXs
- Large number of end users policies
- Efficient ARM routing management

1.1 Features

ARM features are as follows:

- Centralized, enterprise-wide session routing management
- Centralized & optimized PSTN routing
- Automatic discovery of VoIP network entities
- Supports third-party devices as well as AudioCodes SBCs and gateways
- Smart Dial Plan management
  - Centralized Dial Plan logic; simple, clear, intuitive and easy to maintain
  - Dialing plan dry test by 'Test Route' simulation
  - Incoming number manipulation
  - Outgoing number manipulation
  - User properties manipulation
- Reduces SIP trunk costs
  - Implements Tail-End-Hop-Off Routing
  - Assigns actions to routing rules with different sequence
  - Source and destination number manipulation
- Advanced routing based on user properties
- Quality-based routing
- Time-based routing
- Flexible load balancing
- Automatic topology network generation
- Manual network generation (simply drawing lines between dots)
- On-the-fly routing calculation:
  - Centralized management of Network Routing Rules
  - Routing decision is based on source / destination call parameters, and user properties
  - Predefined weights on connections
  - User information from external Data Bases (e.g., LDAP)
  - Flexible API
- Intuitive graphical representation of the enterprise VoIP network
- Personalized Call Routing Applications
  - Communication-Enabled Business Process
  - Full on-line management and routing via REST API
  - Fallback to SBC routing table if call does not match ARM configuration

1.2 Benefits

The ARM benefits users as follows:

- Reduces operational time spent on designing and provisioning network topology
- Reduces OPEX, avoiding routing configuration of VoIP network entities
- Reduces time spent implementing network evolutions such as:
  - Adding new connections to PSTN (e.g., SIP trunks)
  - Adding new branches to the enterprise VoIP network
  - Modifying user voice services privileges

1.3 Simplicity

- VoIP network entities registering in the ARM
- Auto-discovery of VoIP peers
- One-click topology network creation, star formation
- Customized topology network.
  - Configuring a connection is as simple as drawing a line.
  - Modify by adding, deleting and changing connections
- ARM connects to user data base

1.4 ARM-Routed Devices

The following devices can be routed by the ARM:

- Mediant 9000 SBC
- Mediant 4000 SBC
- Mediant 3000 Gateway
- Mediant 2600 E-SBC
- Mediant SE/VE SBC
- Mediant 1000B Gateway and E-SBC and Mediant 1000B MSBR
- Mediant 800B Gateway and E-SBC and Mediant 800B MSBR
- Mediant 500 E-SBC
- Mediant 500L MSBR and Mediant 500 MSBR

1.5 Third-Party Open-Source Software

The following third-party open-source software is supported by the ARM:

- CentOS Linux 6.6
- Spring Framework (released under version 2.0)
- MariaDB relational database management system
- ActiveMQ (using the Apache 2.0 license)
- HiberNate (projects licensed under Lesser General Public License (LGPL) v2.1)
- Log4J (Apache License 2.0)
- Guava (Google core libraries - Apache License 2.0)
- jackson-core
- Apache Commons Logging™
- HttpClient - Apache
- XStream (Group: com.thoughtworks.xstream)
- Jersey client
- Joda-Time
- SLF4J (Simple Logging Facade for Java)
- HikariCP Java 6
- Aspectj™ extension to Java
- SNMP4J (Open Source SNMP API for Java)
- Mockito

2 Getting Started with the ARM

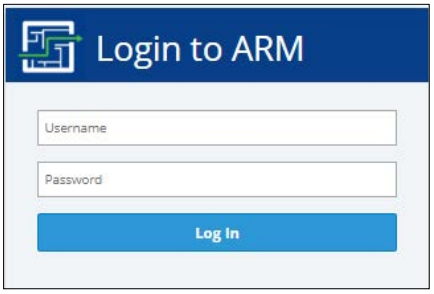
After installing the ARM and performing initial configuration (see the *ARM Installation Manual*), you can get started with the ARM.

2.1 Logging in

This section shows how to log in.

➢ **To log in:**

1. Point your web browser to the ARM's IP address and press Enter.



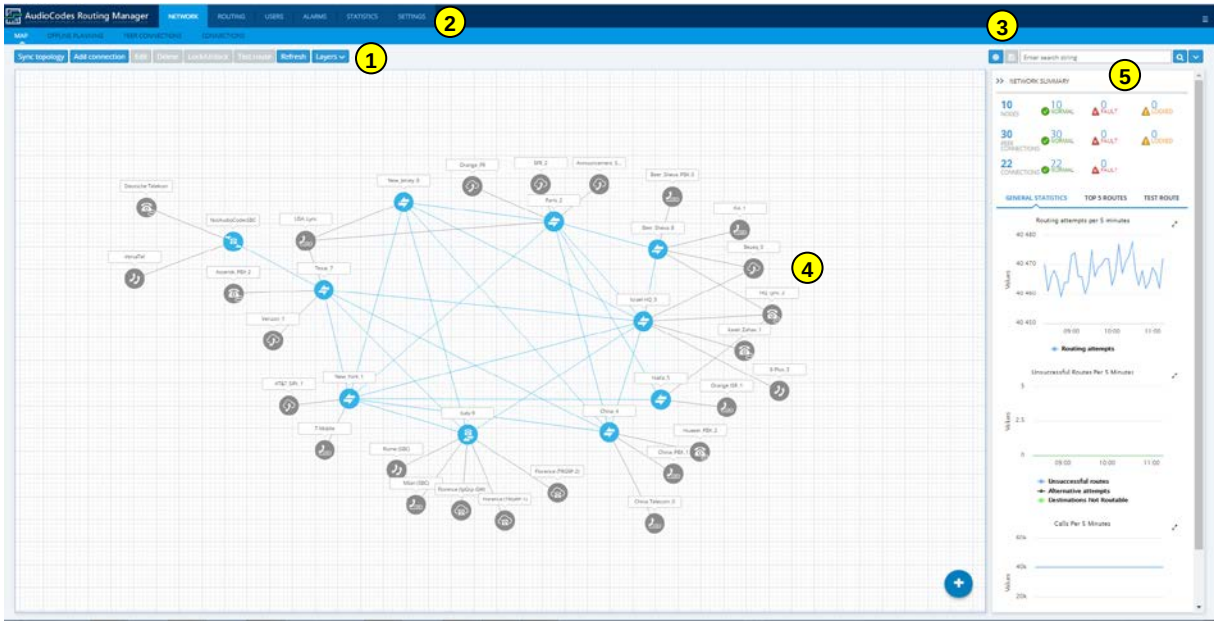
2. In the Login to ARM screen, log in using the default **Operator** and **Operator** username and password. It's advisable to change these as soon as possible (see Section 7.4.4 for instructions on how to change them).

   The ARM opens in the Network page, Map view (default) in your browser.
   By default, all VoIP entities managed in the network are displayed.

2.2 Getting Acquainted with the ARM GUI

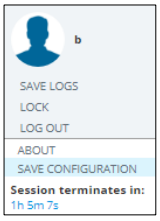
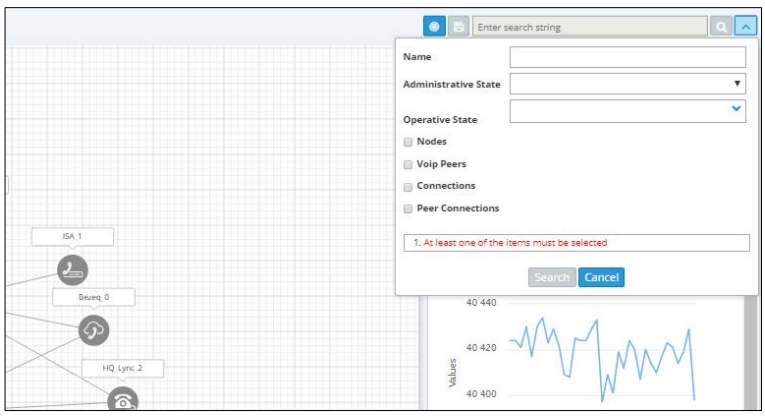
This section familiarizes you with the ARM GUI. The internet browser based graphic user interface visualizes VoIP network topology and its components, providing centralized, dynamic network management and router rules and logic management. After logging in, the Network page, Map view opens by default, as shown in the figure below.

Figure 2-1: ARM GUI - Network Page - Map View



Use Table 2-1 below as a reference to Figure 2-1 shown above.

Table 2-1: ARM GUI – Map View

#	GUI Area	Description
1	Actions Bar	▪ Sync Topology ▪ Add Connection ▪ Edit ▪ Delete ▪ Lock/Unlock ▪ Test Route ▪ Refresh ▪ Layers ✓ topology ✓ quality
2	Toolbar	Toolbar icons let you navigate to the following ARM pages: NETWORK, ROUTING, USERS, ALARMS, STATISTICS and SETTINGS.
		Located on the right side of the toolbar. Click to:  • Save logs (GUI logs) • Lock (Terminates user's ARM GUI session) • Log out • Display the ARM version (About) • Save Configuration: The *ARM_Configuration.zip* file (ARM database) is saved locally in the client's 'Downloads' directory. You can send it to AudioCodes for troubleshooting. In parallel, basic ARM backup is performed and the backup file is stored in the configurator's */home/backup* directory. You can use it to restore the configuration on the same machine using standard ARM restore procedure. • Display how much time remains before the session terminates
3		Center Map
		Save Items Location (saves network entities positions in the map)
	Search	Enables you to locate specific information in the Network Map view, Routing page, Users page, Alarms page and Settings page. 1 Click ^ adjacent to 'Enter search string'.  2 Define search parameters: Name and/or Administrative State and/or Operative State. At least one item must be selected.

#	GUI Area	Description
4	Main Screen	The Network page displays a Map view of network entities.
5	Summary Panes	The Network page, Map view, displays these summary panes: • **Network Summary** ✓ Nodes (Available, Unavailable, Locked) ✓ Peer Connections (Available, Unavailable, Locked) ✓ Connections (Available, Unavailable) • **General Statistics** ✓ Routing Attempts per 5 Minutes ✓ Unsuccessful Routes per 5 Minutes ✓ Unsuccessful Routes (Alternative Attempts / Destinations Not Routable) ✓ Calls per 5 Minutes (Destination Calls / Transient Calls) • **Top 5 Routes** • **Test Route**

2.2.1 Getting Acquainted with the Network Map Topology Layer

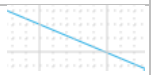
In the Network page, Map view, you can view node information and perform network map actions. Network Map view shows the four main entities that comprise the network topology:

- Nodes
- VoIP Peers
- Peer Connections
- Connections

The table below explains each.

Table 2-2: Network Map view – Network Entities

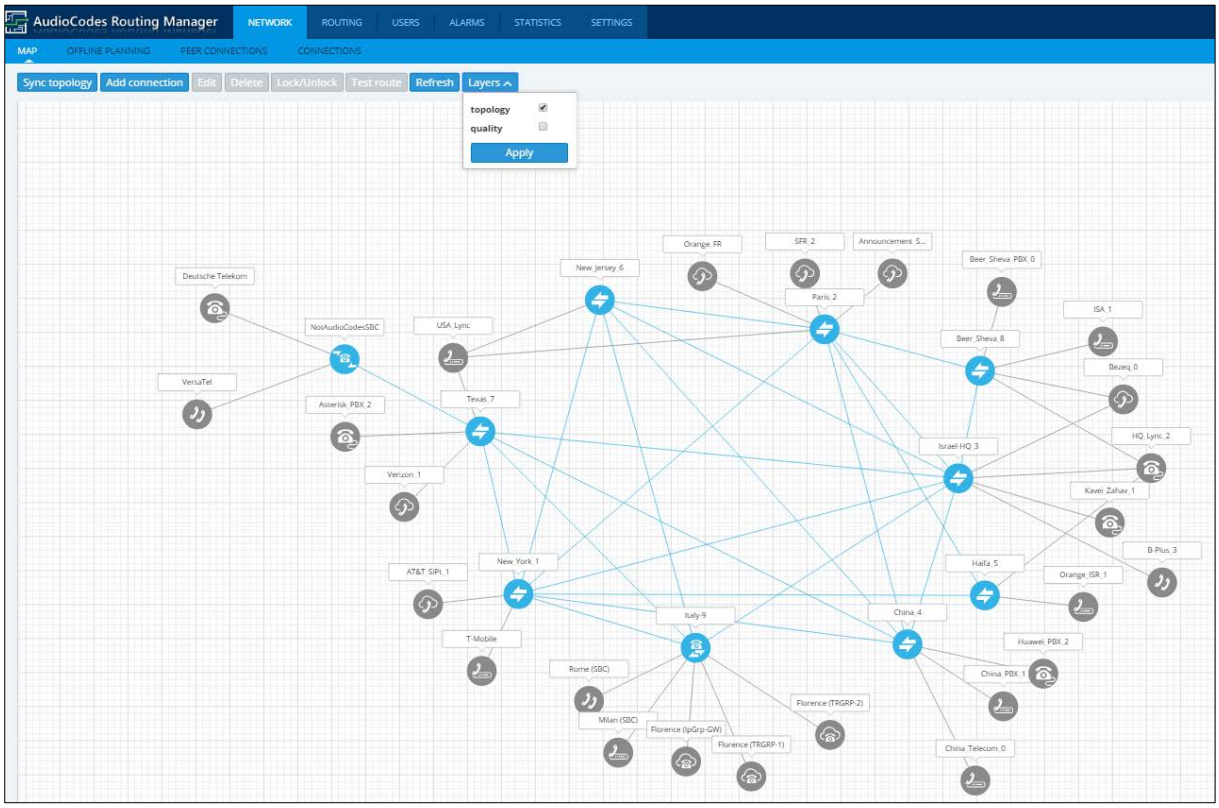
Network Entity	Icon	Explanation
Node		Indicates an AudioCodes SBC communicating with the ARM. It's part of the ARM network topology. Blue = operative state available/logging in Red = operative state unavailable/unrouteable Orange = operative state logged out Strikethrough = locked No strikethrough = unlocked
		Indicates an AudioCodes gateway communicating with the ARM. It's part of the ARM network topology. Blue = operative state available Red = operative state unavailable INVALID CONFIGURATION Orange = operative state logged out Strikethrough = locked No strikethrough = unlocked
		Indicates a hybrid AudioCodes device (AudioCodes' Gateway and SBC in one). Blue = operative state available Red = operative state unavailable INVALID CONFIGURATION

Network Entity	Icon	Explanation
		Orange = operative state logged out Strikethrough = locked No strikethrough = unlocked
		Indicates a third-party, non-AudioCodes device (SBC or gateway) communicating with the ARM. It's part of the ARM network topology.
VoIP Peer		Indicates a non-AudioCodes device or entity that is also part of the ARM network topology: PBXs, SIP trunks, other vendors' SBCs / gateways. These devices participate in processing ARM network calls and are connected to Nodes by 'Peer Connections'. The ARM operator can configure one of six VoIP Peer types.
		SIP trunk
		PSTN
		IP phones
		Legacy PBX | IP PBX
		N/A Not applicable
Connection		Indicated by a blue line (available) or a red line (unavailable). Joins two Nodes. Calls can be routed between two Nodes only if there is a Connection between them. Defined by adding an IP Group (at Node level). From AudioCodes' gateway/SBC perspective, a 'Connection' is an 'IP Group'. Connections between Nodes are added by the ARM operator.
Peer Connection		Indicated by a black line between a Node and a VoIP Peer. Represents a group of routing destinations/sources (connections to a VoIP Peer), 'last mile' connectivity. From AudioCodes' gateway/SBC perspective, a Peer Connection is a 'PSTN Trunk Group' or 'IP Group'. Red line = administrative state is unlocked / operative state is unavailable (no connection between the AudioCodes device and the remote device) / predeleted (IP Group was deleted from the device) Black line through a red sphere = unavailable and locked Black line through a black sphere = available but locked

2.2.2 Getting Acquainted with the Network Map Quality Layer

The Network Map view displays a **Layers** tab that allows the operator to choose **topology** and / or **quality**.

Figure 2-2: Network Map – Topology Layer

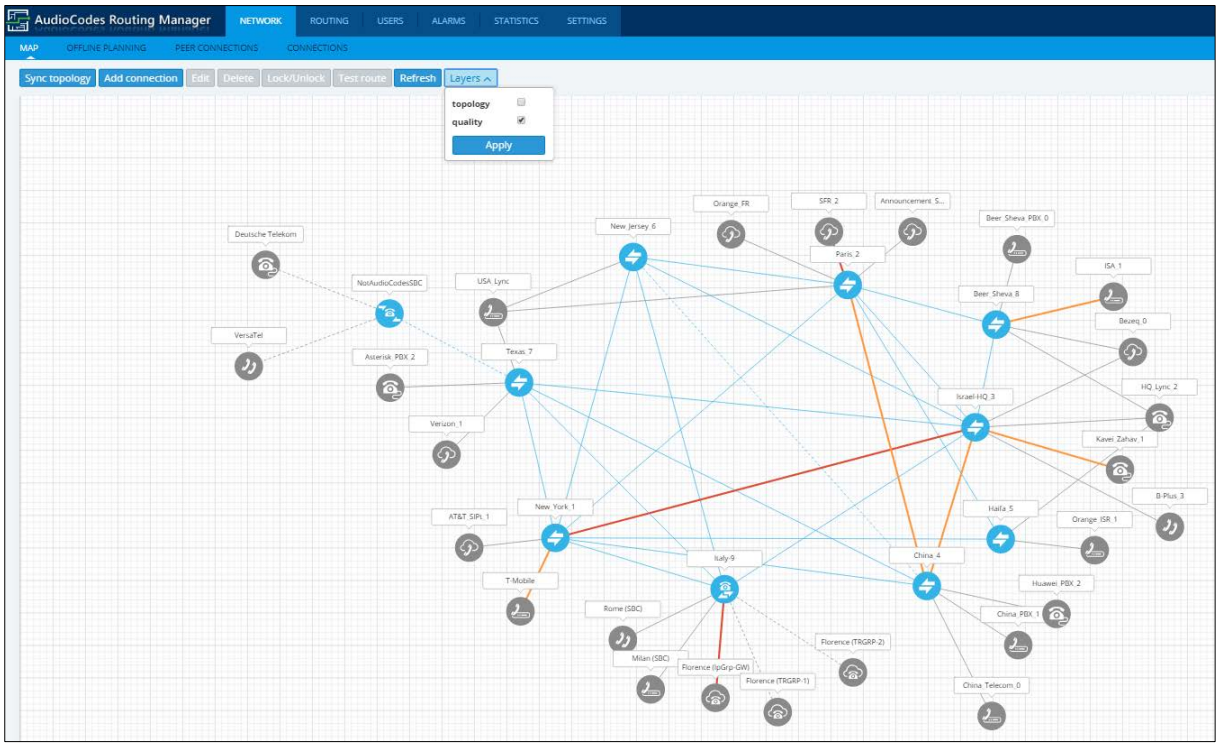


The **topology** layer displays the *availability status* of network entities.

The **quality** layer displays the *quality status* of network Connections and Peer Connections.

When both the **topology** layer and the **quality** layer are selected, the Network Map displays the *aggregated availability status and quality status*.

Figure 2-3: Network Map –Quality Layer



The figure above shows the Network Map when the **Quality Layer** is applied.

Table 2-3 describes the different quality color codes.

Table 2-3: Quality Color Codes

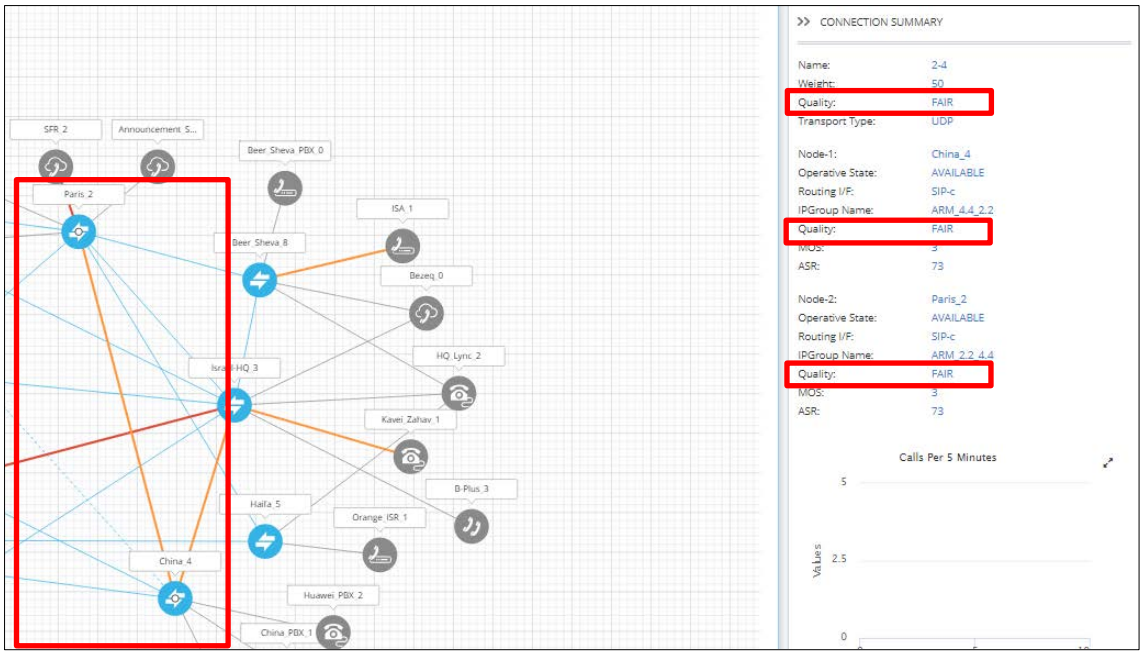
Color	Description
Blue	GOOD quality Connection
Grey	GOOD quality Peer Connection
Orange	FAIR quality Connection / Peer Connection
Red	BAD quality Connection / Peer Connection
Dotted grey	UNKNOWN quality, i.e., there is insufficient data to determine quality statistics. After enough calls are routed by the Connection / Peer Connection, the color changes from grey to the color of the determined quality static.

A glance at the page reveals the quality of each Connection and Peer Connection, indicated by color code.

➢ **To view a summary of a Connection, including quality:**

1. In the Network Map page, select **topology** layer and/or **quality** layer and then click (select) the Connection whose summary you want to view.

Figure 2-4: Connection Summary Including Quality

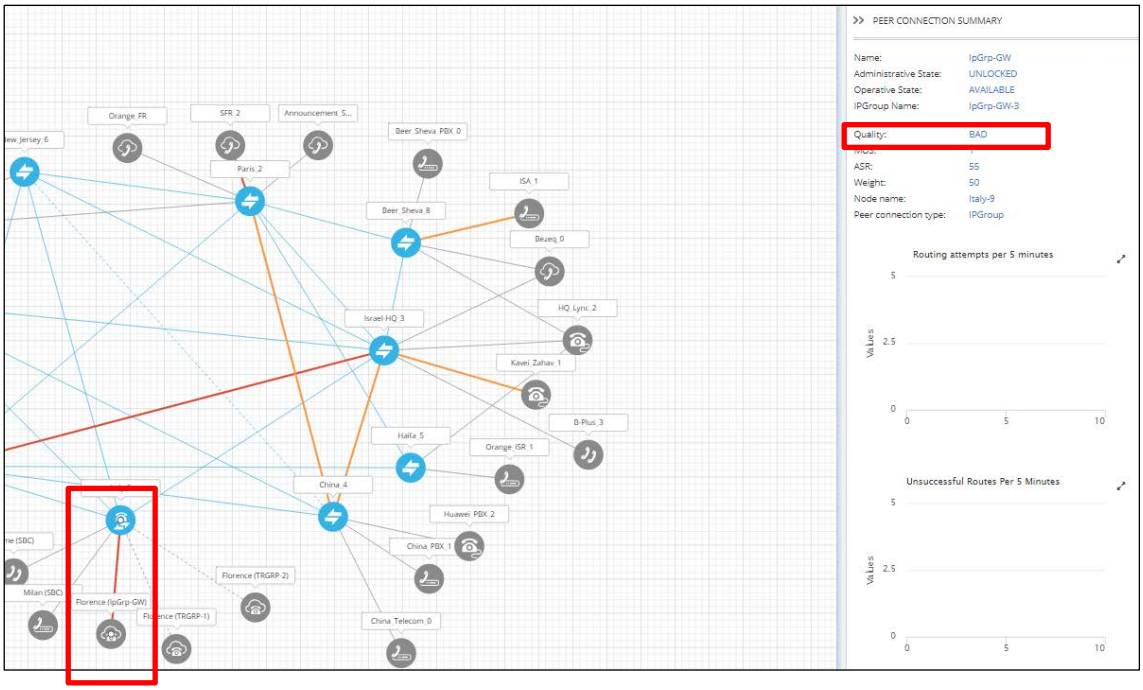


2. In the Connection Summary pane on the right side of the Network Map page, view the Connection Summary. The figure above shows the Connection Summary pane for the Connection between node-1 China_4 and node-2 Paris_2. The 'Quality' parameter for both nodes is 'FAIR'.
3. Use each direction's MOS and ASR values to tune the threshold for quality-based routing [Settings > Routing > Quality Based Routing] and optimize network quality.

➢ **To view a summary of a Peer Connection, including quality:**

1. In the Network Map page, select **topology** layer and/or **quality** layer and then click (select) the Peer Connection whose summary you want to view.

Figure 2-5: Quality Layer - Peer Connection



2. In the Peer Connection Summary pane on the right side of the Network Map page, view the Peer Connection Summary for the Peer Connection you clicked (selected). The figure above shows the Peer Connection whose name is 'IpGrp-GW'. The 'Quality' parameter is 'BAD'.
3. Use each direction's MOS and ASR values to tune the threshold for quality-based routing [Settings > Routing > Quality Based Routing] and optimize network quality.

2.2.3 Getting Acquainted with Network Map Page Actions

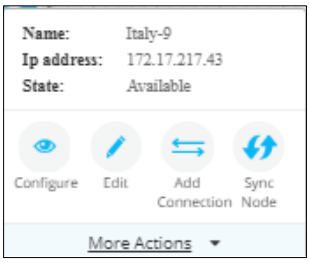
2.2.3.1 Node Information and Actions

In the Network page, Map view, you can view node information and perform node actions.

➢ **To view node information:**

1. Point your cursor over the node whose information you want to view.

Figure 2-6: Node Information

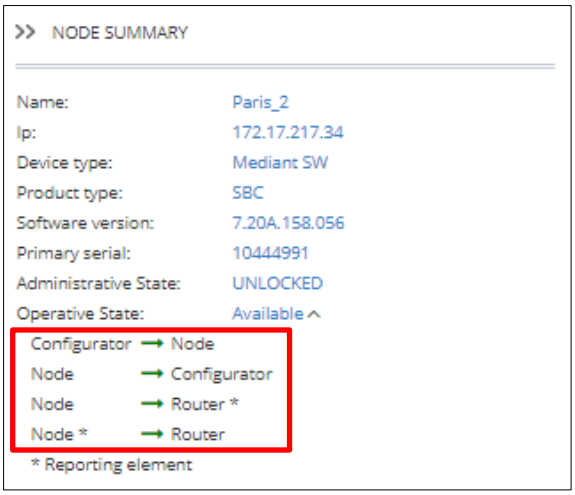


2. Use the table below as reference.

Table 2-4: Node Information

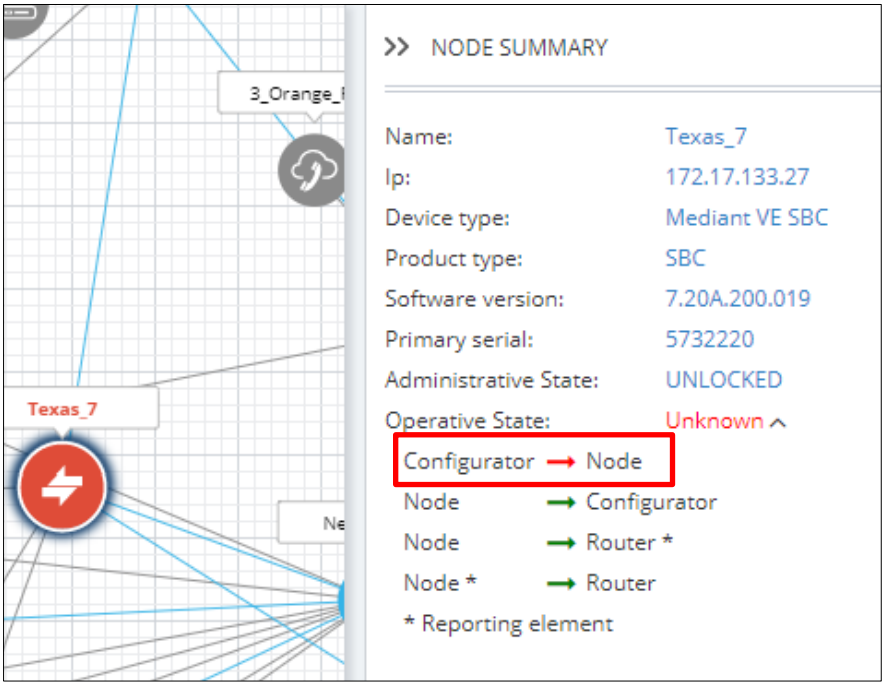
Item	Description
Name	The name of the Node
IP Address	The IP address of the Node
Operative State	Available / Unavailable / Unrouteable / Logged out / Logging in. The ARM provides a robust node State Machine based on the node's connectivity to the ARM component. When determining a node's connectivity and ability to process a call in the State Machine, the ARM factors in the node's connectivity to the ARM Configurator (both ways), the node's connectivity to ARM Routers (from the node's perspective) and the node's connectivity to ARM Routers (from the ARM Routers perspective). The ARM Routers attempt to serve the node's routing requests even if the node is reported as disconnected from the ARM Configurator. In this case, the ARM Router routes calls based on last available information about the nodes' interfaces, their availability and quality. This node's 'Unknown' state is reported via ARM alarms. A node becomes Unrouteable only if all ARM Routers report that the node does not communicate with them (neither 'keep-alive' nor 'Get Route' requests). To help you localize a network issue, the Node Summary screen displays a detailed view of the node's connectivity status, as shown in Figure 2-7.

Figure 2-7: Node Summary – Operative State



The example below shows a node's 'Unknown' state when the ARM Configurator is unable to access the SBC 'Texas'. Note that in this state, call routing requests coming from this node to the ARM Routers will be served.

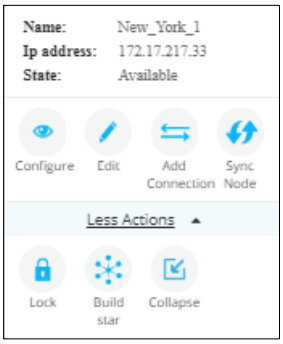
Figure 2-8: Node's 'Unknown' State



➢ **To perform an action on a node:**

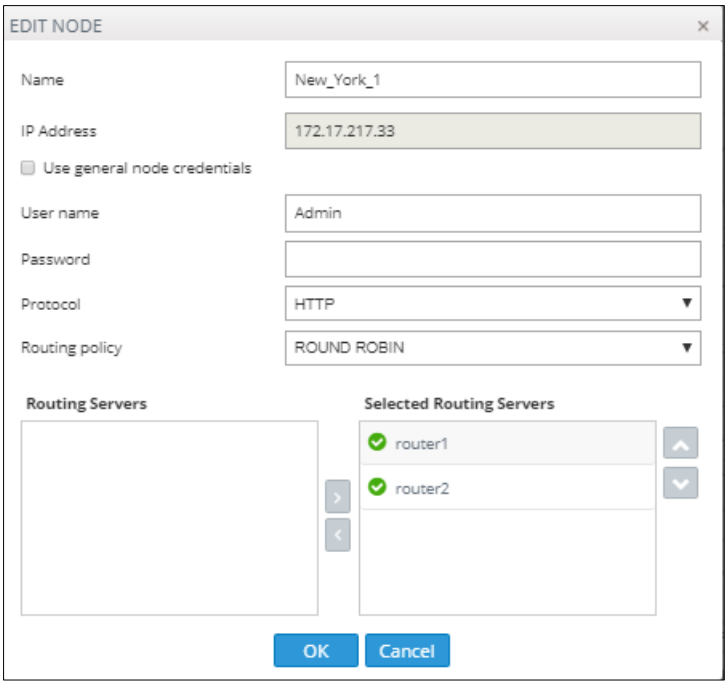
1. Point the cursor over the node on which to perform an action.

Figure 2-9: Node Actions



2. In the popup, click:
   a. **Configure**. Lets you directly configure a node (or SIP module) in the node's Web interface without needing to provide the node's credentials (Single Sign-on). See the AudioCodes device's *User's Manual* for detailed information. Nodes version 7.2.150 and later are supported. Earlier node versions do not support single sign-on; you must provide credentials before you can access their Web interface. Click the option; the node's Web interface opens without prompting the operator for credentials.
   b. **Edit** [also available by selecting the node and then clicking the **Edit** button]
      - In the Edit Node dialog that opens - see the figure below - update the credentials of the device if necessary (Name, User name and Password).

Figure 2-10: Edit Node



      - From the 'Protocol' dropdown, select the protocol that the ARM Configurator (server) uses when communicating with this node. Default: **HTTPS**. If you don't want to encrypt the traffic – e.g., when debugging – use **HTTP**.
      - From the 'Routing policy' dropdown, select either:
        - **Round Robin** (default). For each request, the node selects a different router.

- **Sticky Last Available**. The node picks the first available router from the routers that are listed in order of priority under 'Selected Routing Server', and stays with it until it fails. If it fails, the node continues down the list. The node therefore only functions with one router at a time.
- **Sticky Primary**. The node picks the first available router from the routers that are listed in order of priority under 'Selected Routing Server', and stays with it until it fails. If it fails, the node goes to the highest available router in the list. The node therefore functions at any time with the highest available router in the list.

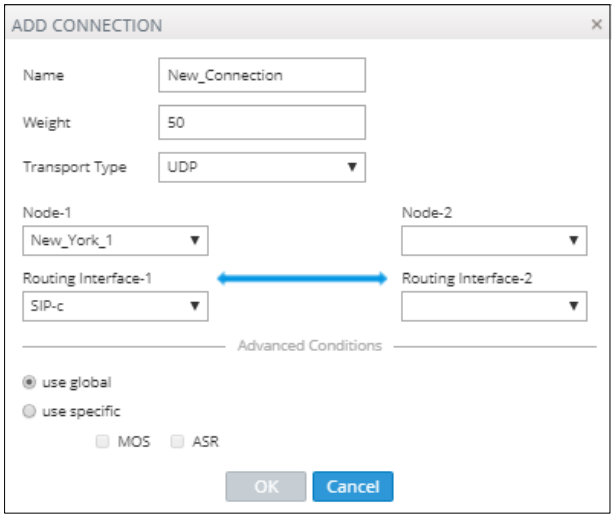
♦ **Routing Server**

- Allows you to select routers to operate with the selected node. Useful if an enterprise has servers located in different regions and you want a node in one region to be served by routers located only in that region (for example).

  The pane lets you define *the order* of the routers in the node, which is relevant for the Sticky routing policies.

c. **Add Connection** [also available by selecting the node and then clicking the **Add Connection** button]

Figure 2-11: Add Connection



♦ Make sure the relevant SIP interface in the SBC is provisioned and configured as 'Used by routing server'

♦ Click **Add Connection** and then click the Node *to which* to make the Connection; a line is defined to indicate that the connection was made.

♦ In the Connection Definition dialog that opens, select the routing interface for Node-1 and then for Node-2, and then click **Apply**. See Section 3.1 for more information.

d. **Sync Node**

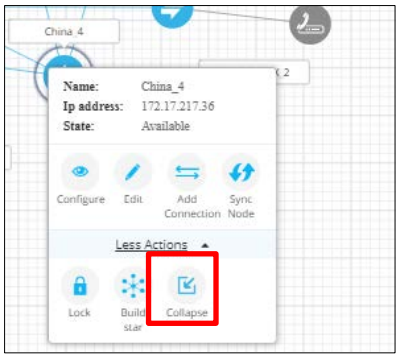
e. **Lock/Unlock**

f. **Build Star** (Topology)

g. **Collapse**. In Network Map view, you can collapse VoIP Peers associated with a node. In large networks containing multiple VoIP Peers with each VoIP Peer connected to a node, this can significantly simplify Network Map view, factilitating more effective management. To apply a collapse:

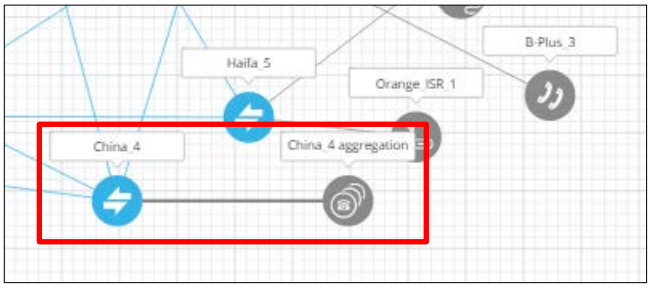
♦ Select the action from the node hoover menu.

Figure 2-12: Node Hoover Menu - Collapse



- All VoIP Peers associated with the node collapse.

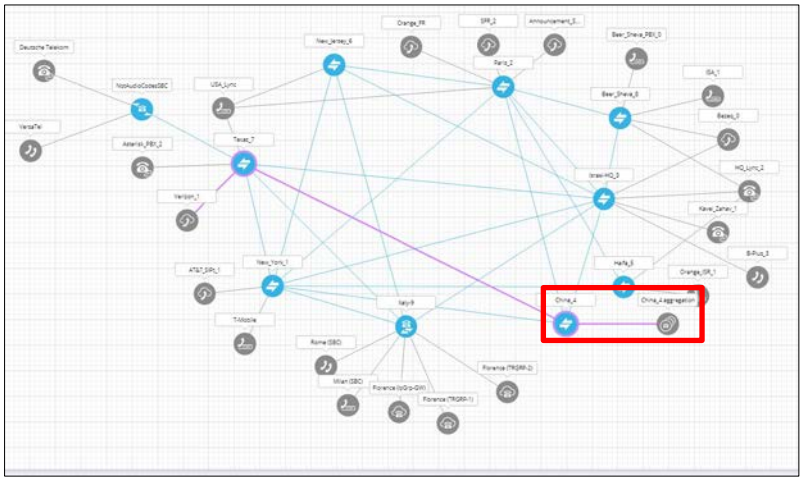
Figure 2-13: Collapsed VoIP Peers



Note:

- A VoIP Peer associated with more than one node is excluded from the collapsed group.
- If a test route is performed that terminates on a collapsed VoIP Peer, the VoIP Peer will not be expanded automatically and the path displayed in the GUI will terminate on the collapsed icon.

Figure 2-14: Test Route Path Terminates on Collapsed VoIP Peer



h. **Expand**. Click the 'Expand' action to expand previously collapsed VoIP Peers associated with a node.

Figure 2-15: Expand Node VoIP Peers

i. **Delete**. Only available if the Node has been **Locked** and no routing rules and Policy Studio rules are associated with it. If routing rules *are* associated with the Node or its Peer Connections and you want to delete it, update or delete the rule so it does not refer to the topology entity which is going to be deleted.

2.2.3.2 VoIP Peer Information and Actions

In the Network page, Map view, you can view VoIP Peer information and perform VoIP Peer actions. There are six types of VoIP Peers:

- SIP Trunk
- PBX
- IP PBX
- PSTN
- IP Phone
- N/A (default)

➢ **To view VoIP Peer information:**

1. Point your cursor over the VoIP Peer whose information you want to view.

Figure 2-16: SIP Trunk

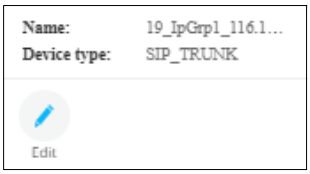
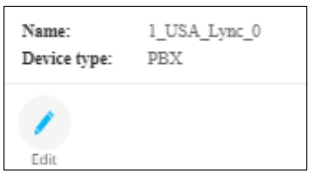


Figure 2-17: PBX | IP PBX



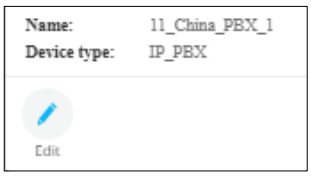


Figure 2-18: PSTN

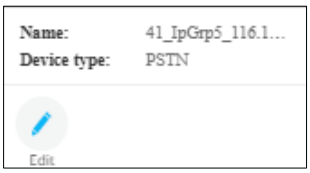
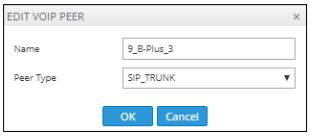


Figure 2-19: IP Phone

➢ **To edit a VoIP Peer:**

- Point your cursor over the VoIP Peer and then click **Edit** in the popup.

Figure 2-20: Edit VoIP Peer



  - You can edit the 'Name' of the VoIP Peer and/or select the 'Peer Type' from the dropdown.

➢ **To delete a VoIP Peer:**

- Point your cursor over the VoIP Peer and then click **Delete** in the popup.

Note: The **Delete** option is only available if no Peer Connection or routing rules are associated with the VoIP Peer. If there are, you must first update / delete routing rules before you can delete the VoIP Peer. You must then associate the Peer Connection with another VoIP Peer.

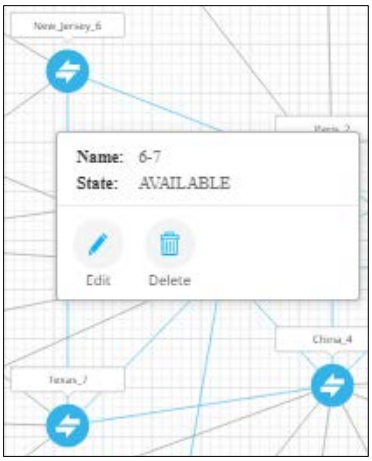
2.2.3.3 Connection Information and Actions

In the Network page, Map view, you can view connection information and perform connection actions.

➢ **To view connection information:**

1. Point your cursor over the connection whose information you want to view.

Figure 2-21: Connection Information

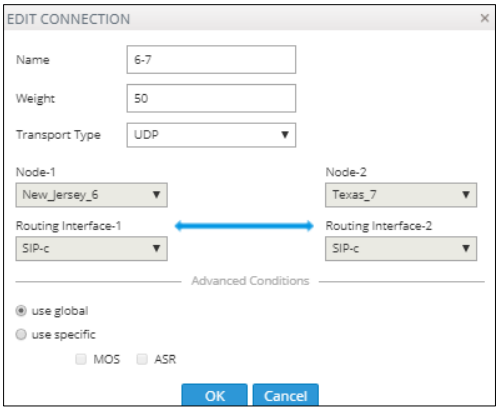


2. You can view the Name and the State of the connection.

➢ **To perform an action on a connection:**

1. In the popup menu, click **Edit** -or- **Delete**. [Note that **Add connection**, **Edit** and **Delete** are also available as action buttons in the Network Map page].

Figure 2-22: Edit Connection



2. You can edit the:
   - name of the connection

- Weight (Range: 0-100. Default: 50)
- Transport Type (Default: UDP)

3. Leave the option **use global** at its default for quality-based routing to be applied using global (ARM level) settings. Select **use specific** to overwrite the global settings of quality-based routing condition for a specific connection, and then select the enabled 'MOS' and/or 'ASR' option (see Section 7.3 for related information).

2.2.3.4 Peer Connection Information and Actions

In the Network page, Map view, you can view Peer Connection information and perform peer connection actions.

➢ **To view peer connection information:**

1. Point your cursor over the peer connection whose information you want to view.

Figure 2-23: Peer Connection Information

2. View the Peer Connection's Name and State.

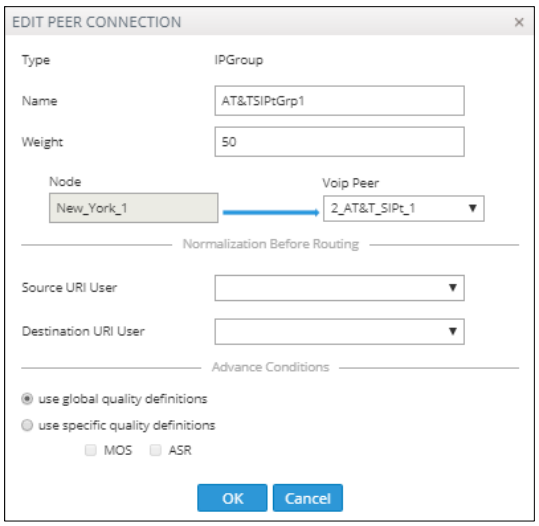
➢ **To perform an action on a peer connection:**

Note:

- The **Delete** option will only be available for Peer Connections in locked and pre-deleted state, unassociated with routing rules or with a Policy Studio rule.
- The **Detach** option will only be available if the Peer Connection is connected to a VoIP Peer that is connected to more than one Peer Connection.
- Action buttons **Add connection**, **Edit**, **Delete** and **Lock/Unlock** are also available in the Network Map page.

1. In the popup menu, click **Edit**.

Figure 2-24: Edit Peer Connection



a. Modify the weight (Range: 0-100; Default: 50) for the ARM to calculate the optimal call path. Use if you have a VoIP Peer as a Routing Rule action and you want to prioritize a specific Peer Connection (e.g., SIP trunk) to be chosen for calls routing. Also use to reflect Peer Connection cost or bandwidth.

b. From dropdown list, select the VoIP Peer that this Peer Connection is connected to.

c. From the dropdowns, select the Normalization Rule for Source and Destination URI User if pre-routing manipulation is required for a specific Peer Connection (defined as shown in Section 7.2.1).

d. Leave **use global quality definitions** selected (default) for this Peer Connection to use the global quality profile configured as shown in Section 7.3.1.
Select **use specific quality definitions** for this Peer Connection to use only the 'MOS' or the 'ASR' criteria of the quality profile configured as shown in Section 7.3.1.

2. **Test** the Route (see Section 3.6)

3. **Delete** the Peer Connection. Only Peer Connections in locked and pre-deleted state, unassociated with routing rules or with a Policy Studio rule, can be deleted.

4. If the Peer Connection is connected to a VoIP Peer that is connected to more than one Peer Connection, you can click **Detach**. You'll be prompted to define a name for a new VoIP Peer.

2.2.4 Peer Connections Page Actions

In the Peer Connections page (**Network** page > **Peer Connections**) you can view the Peer Connections.

Figure 2-25: Peer Connections

You can view the following information on each Peer Connection:

- Status
- Node
- Name
- VoIP Peer
- IP Group
- Operative State
- Administrative State
- Quality

The information displayed in the Network page's Peer Connection view is identical to that displayed in the Network Map view described under Section 2.2.3.4. You can search for the name of a Node associated with the Peer Connection, *its* name, or a VoIP Peer name. It's useful to find, for example, all Peer Connections of a specific Node.

You can perform the following actions:

- Sync Topology
- Edit (after selecting the row of the Peer Connection to edit)

- Delete (after selecting the row of the Peer Connection to delete)
- Lock/Unlock (after selecting the row of the Peer Connection to lock/unlock)

Multiple rows can be selected; multiple actions (delete, lock/unlock, etc.) are supported. For more information about Sync Topology, see Section 3.4. For more information about the Edit, Delete and Lock/Unlock actions, see under Section 2.2.3.4.

2.2.5 Connections Page Actions

In the Connections page (**Network** > **Connections**) you can view the connections you defined.

Figure 2-26: Connections

You can view the following information on each connection:

- Status
- Node 1
- Routing Interface 1
- Name
- Node 2
- Routing Interface 2
- Weight
- Quality

The Search functionality is allowed for all the relevant information fields: Node Name, Connection Name, Weight or Routing Interface.

The information displayed in the Network page's Connections view is identical to that displayed in the Network Map view described under Section 2.2.3.3.

You can perform the following actions:

- Sync Topology
- Add Connection (after selecting the row of the connection to edit)
- Edit Connection (after selecting the row of the connection to edit)
- Delete Connection (after selecting the row of the connection to edit)

Multiple rows can be selected and multiple delete is supported. For more information about Sync Topology, see Section 3.4. For more information about the Add, Edit and Delete Connection, see under Section 2.2.3.3.

Note: Do not modify the SBC-level / gateway-level configuration of the connections created by the ARM. It will disrupt routing decisions/performance.

2.2.6 Viewing Network Summary Panes

This section shows how to view Network Summary panes in the right margin of the Network Map page, which can inform you how to optimize call routing in the network. You can choose to display:

- Overall Network Statistics - statistics related to the *entire network* are displayed by default; no entity in the Network Map is selected. See Section 2.2.6.1.
- Statistics on a network entity – select the network entity in the Network Map for which to display statistics. See Section 2.2.6.2.

2.2.6.1 Overall Network Statistics

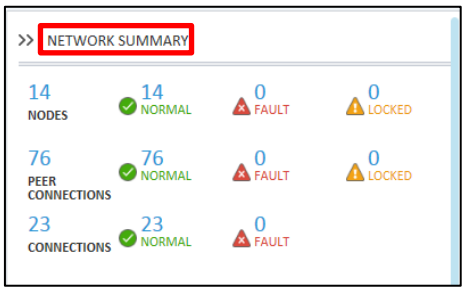
Statistics related to the *entire network* are by default displayed. No entity in the Network Map is selected. This pane displays four sections:

- Network Summary (see below)
- General Statistics (see Section 2.2.6.1.2)
- Top 5 Routes (see Section 2.2.6.1.3)
- Test Route (see Section 2.2.6.1.4)

2.2.6.1.1 Network Summary

The Network Summary pane displays routing statistics and availability network statuses which help operators optimize routing in their telephony networks, reducing unnecessary consumption of resources and decreasing expenses.

Figure 2-27: Network Summary



The pane displays:

- Network Entities Statuses (left to right):
  - The total number of nodes/Peer Connections/Connections in the network
  - The number of nodes/Peer Connections/Connections in the network that are unlocked and available, i.e., 'normal'
  - The number of nodes//Peer Connections/Connections in the network that are 'fault', i.e., unavailable
  - The number of nodes/Peer Connections in the network that are 'locked' (Connections cannot be locked/unlocked)

When **Quality Layer** is selected, the 'Faulty' counters for Peer Connections and Connections can change. All **red** (bad), **orange** (fair) or **unknown** Connections / Peer Connections are considered 'Faulty' because they less than perfect.

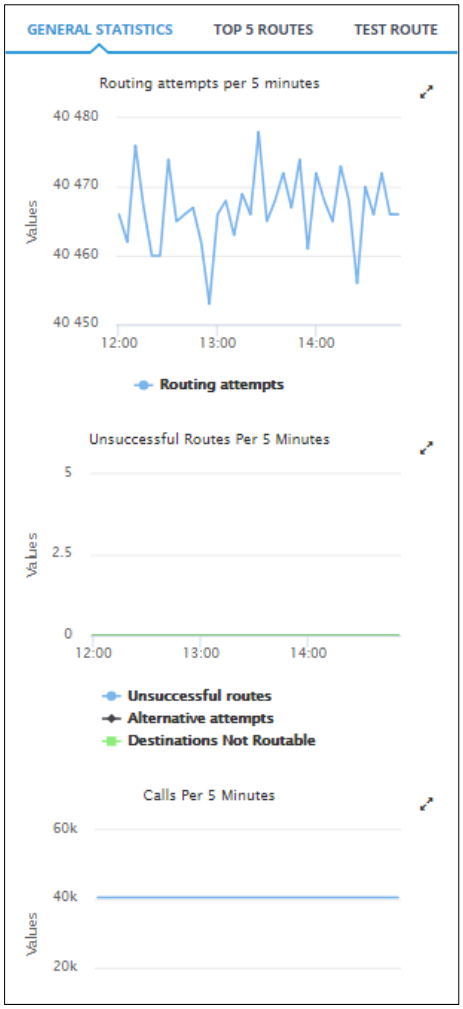
2.2.6.1.2 General Statistics

You can display statistics related to the *entire network*.

➢ **To display statistics related to the entire network:**

- Open the ARM's network map and in the General Summary window, click the **General Statistics** tab.

Figure 2-28: General Statistics Pane



Three graphs are displayed (top to bottom):

- The number of routing attempts made in the entire network every five minutes
- The number of unsuccessful routes made every five minutes, including the number of alternative attempts and the number of unrouteable destinations
- The number of calls made every five minutes, including the number of destination calls and the number of transient calls.

➢ **To facilitate your analysis:**

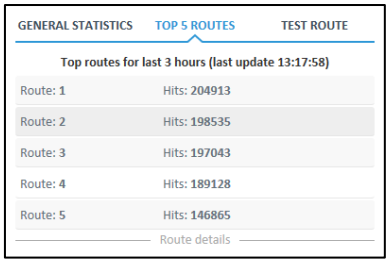
- Click the expand icon next to any of the three graphs to project a zoomed-in graph to the front.

Figure 2-29: Projecting a Zoomed-in Graph to the Front

2.2.6.1.3 Top 5 Routes Pane

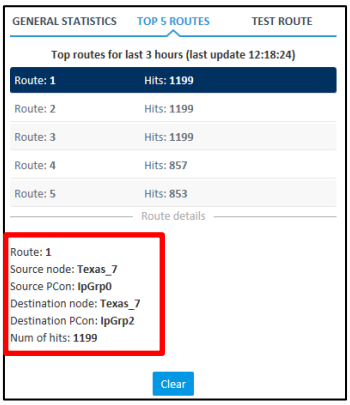
The Top 5 Routes pane under the **Top 5 Routes** tab gives operators visibility into the routes most frequently used over the last three hours.

Figure 2-30: Top 5 Routes



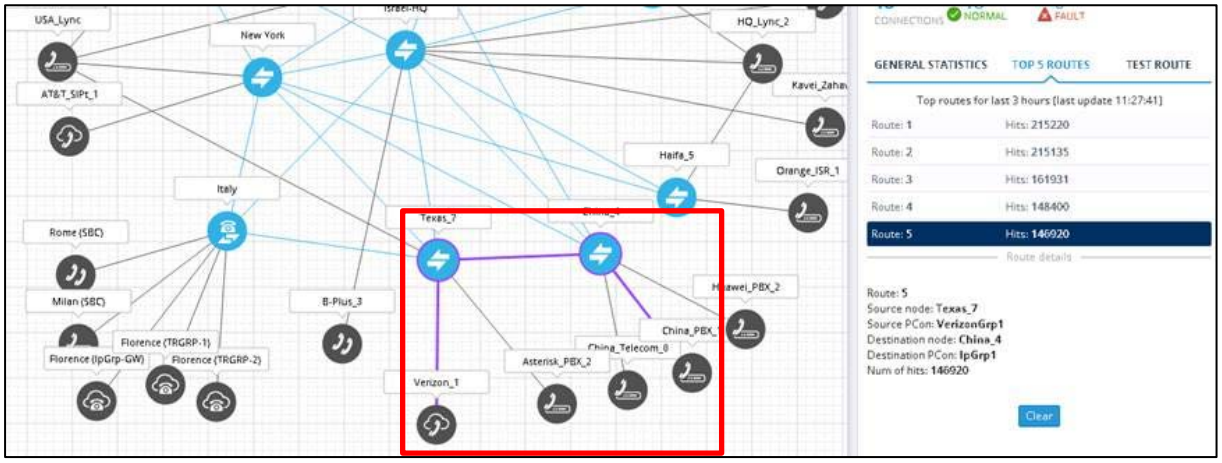
Select a route to display its details: Source Node/Peer Connection and destination Node/Peer Connection.

Figure 2-31: Top 5 Routes – Route Details



Selecting a specific route also displays the popular path visually in the Network map, as you can see in the figure below.

Figure 2-32: Popular Path Visualized in the Network Map



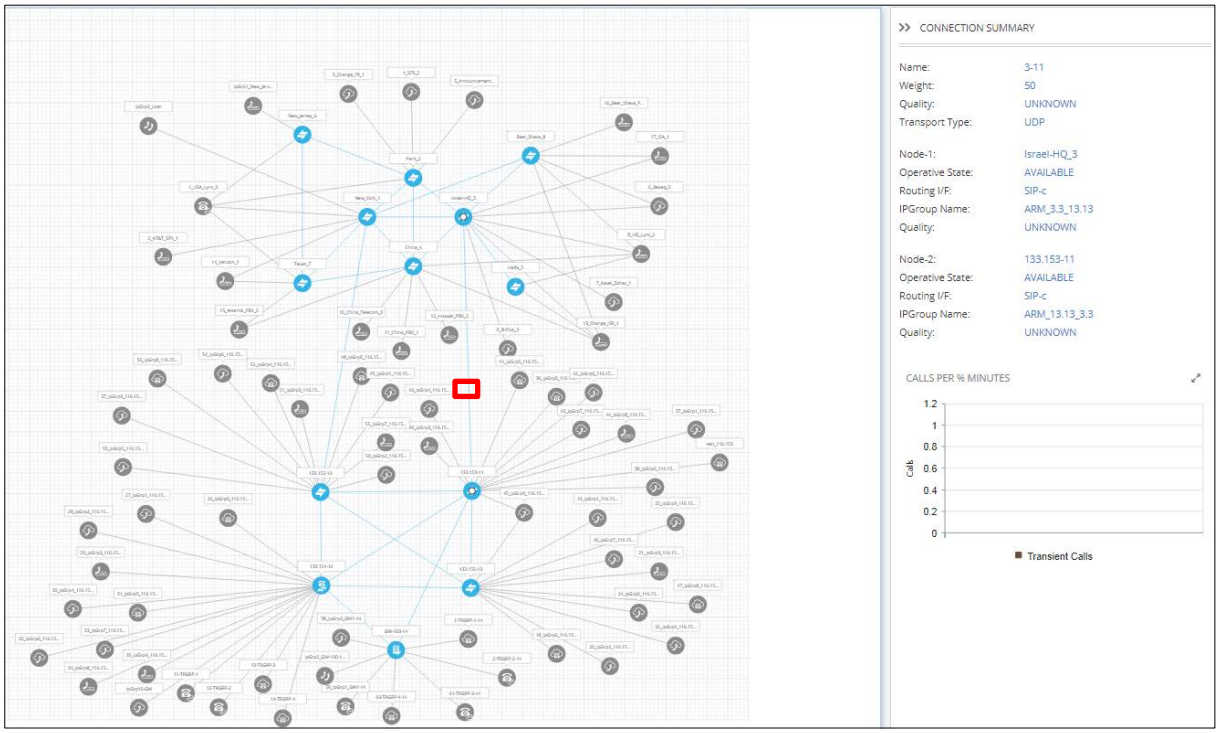
2.2.6.1.4 Test Route

See Section 3.6 for detailed information.

2.2.6.2 Statistics on a Selected Entity

When you select one of the entities in the map, the Network Summary window displays statistics related to that selected entity.

Figure 2-33: Summary Pane Displaying Information Related to a Selected Entity - Connection



3 Defining a Network Topology

Part of the ARM's network topology is automatically discovered and added to the ARM's Network Map.

Other entities must be provisioned by you.

3.1 Adding an AudioCodes Node to the ARM

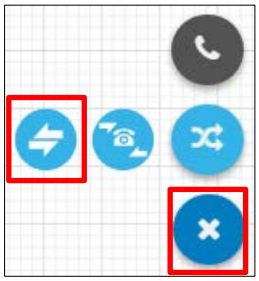
AudioCodes nodes (SBCs and gateways) are automatically detected and displayed in the ARM's Network Map, allowing you to begin configuring actions immediately after auto-detection.

When a new node is added either by auto-detection or manually to the ARM, the ARM automatically detects Peer Connections and Routing interfaces associated with the node.

➢ **To manually add a node to the ARM:**

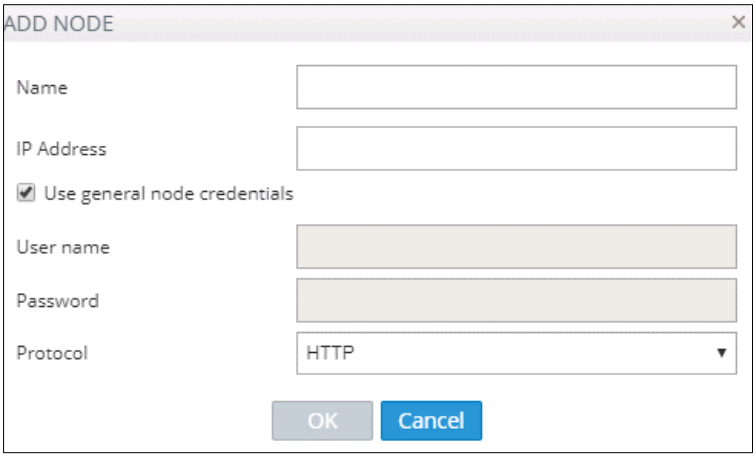
1. Click the + icon and then drag and drop the AudioCodes node into the Network Map, as illustrated in the figure below. The + icon changes to **x**.

Figure 3-1: Drag and Drop an AudioCodes Node into the Network Map



2. Provide a name, IP address and node credentials.

Figure 3-2: Node Name | IP Address | Credentials

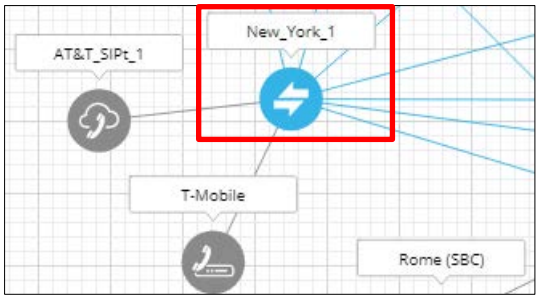


3. View the added AudioCodes node in the Topology Map; all elements associated with the node are automatically provisioned and displayed in the Network Map.

Note:

- Peer Connections are displayed in Locked state; you need to perform an unlock for them to provide a service.
- Node provisioning by auto-detection is described in Section 10.

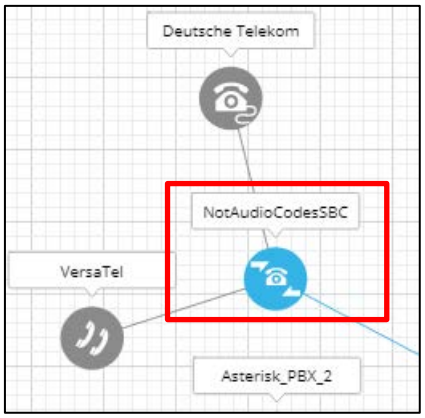
Figure 3-3: Added AudioCodes Node



3.2 Adding a Third-Party Node to the ARM

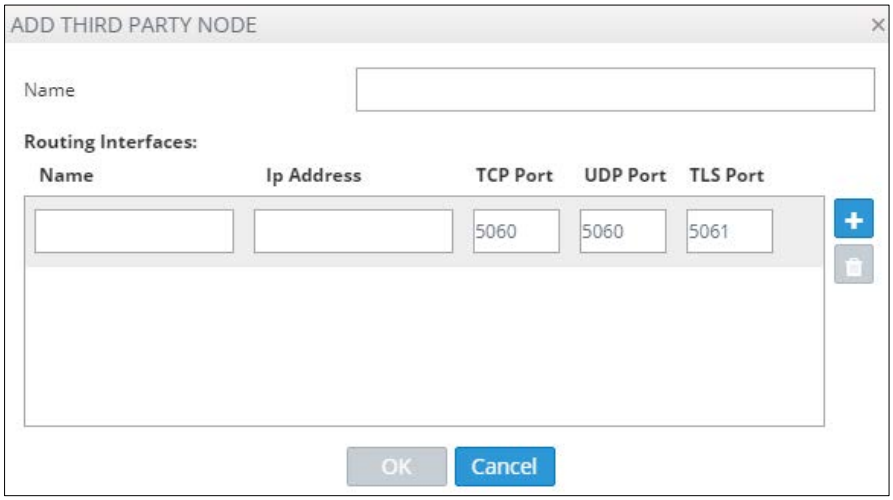
The ARM allows you to add third-party, non-AudioCodes nodes (SBCs and Media Gateways) to the Network Map so that the ARM can be used for call routing in heterogeneous environments with a mix of AudioCodes and non-AudioCodes nodes as part of your network.

Figure 3-4: Third-Party Device Added to the Network Map



➢ **To add a third-party device:**

1. Click the + icon and then drag and drop the third-party node icon into the Network Map.

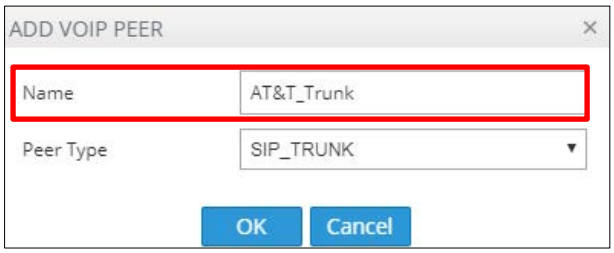


2. Provide the third-party device's properties. The third-party device's remote IP address is used as the destination address of the connection from the AudioCodes device.
3. Add a VoIP Peer according to type, e.g., SIP trunk or PBX, and attach it to the third-party node by dragging and dropping it from the 'add voippeer' menu.

Figure 3-5: Adding a VoIP Peer

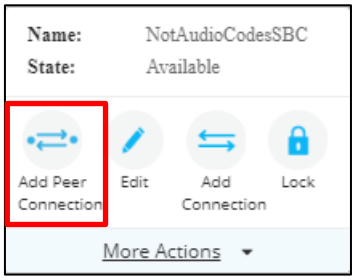
4. In the 'Add VoIP Peer' screen, give the VoIP Peer a name.

Figure 3-6: Adding a VoIP Peer – Giving the VoIP Peer a Name



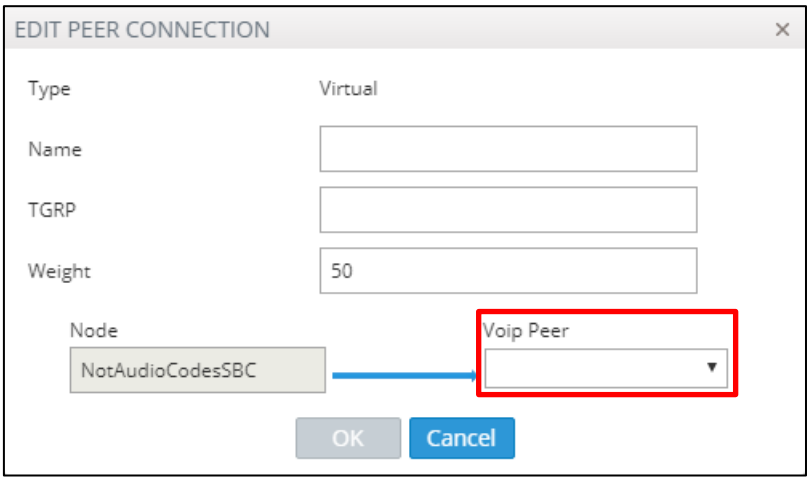
5. Associate the VoIP Peer with the third-party node using a Peer Connection, by drawing a line between the VoIP Peer and the third-party node, or using action 'Add Peer Connection'.

Figure 3-7: Add Peer Connection



Note: The action 'Add Peer Connection' is available only to third-party, non-AudioCodes SBCs or Media Gateways. It's not applicable to AudioCodes SBCs or Media Gateways.

Figure 3-8: Edit Peer Connection



6. You need to connect the third-party device to the ARM topology, to an AudioCodes node or to a SIP module, for end-to-end routing capabilities.

Note: The ARM uses standard SIP TGRP capabilities to communicate with a third-party device interface that does not support AudioCodes nodes' REST API, so when adding a Peer Connection to a third-party device, you're prompted to provide TGRP. The TGRP must match the configuration in the third-party device. When the ARM chooses to route a call towards a specific Peer Connection of the third-party device, it installs into the SIP Invite the TGRP name configured in the ARM.

The ARM performs routing to Peer Connections attached to third-party devices. In the Routing Rules definition, choose the Peer Connection or VoIP Peer associated with the third-party device and in this way, achieve end-to-end routing in a heterogenous network.

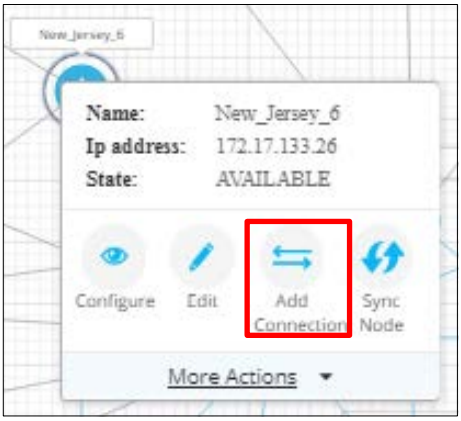
3.3 Adding Connections

You can define a connection between two nodes.

➢ **To add a connection:**

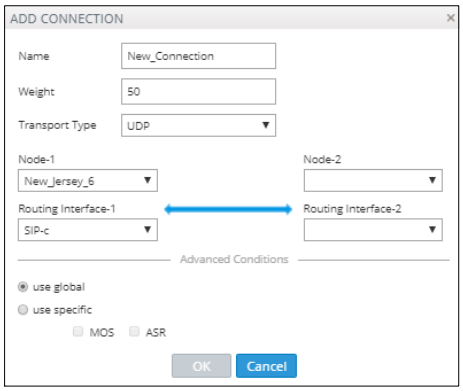
1. In the Network Map view, point your cursor to the node from which to define the connection and in the popup menu click **Add Connection**.

Figure 3-9: Add Connection



Alternatively, in the Network Map view select the node to which to add a connection and then click the action button **Add connection**.

Figure 3-10: Add Connection



2. Provide an intuitive name for the connection, to later facilitate user-friendly management in the ARM GUI.
3. Select the weight. Default: 50. Range: 1-100.

4. From the 'Transport Type' dropdown, select **UDP** (default), **TCP** or **TLS**.
5. From the 'Node-1' dropdown, select the name of the node and from the 'Routing Interface-1' dropdown, select its routing interface
6. From the 'Node-2' dropdown, select the name of the node and from the 'Routing Interface-2' dropdown, select its routing interface
7. To define Advanced Conditions (quality-based routing), see Section 7.3.
8. Click **OK**; the connection is made.

3.4 Synchronizing Topology

The Sync Topology feature allows you to perform *manual* synchronization *per Node* or *per global topology synchronization*, depending on where the synchronization action was run.

It's important that node status is fully synchronized with the ARM server *at all times* for the ARM GUI to display the node successfully and for routing to be performed correctly.

For an SBC / Media Gateway to be displayed in the ARM GUI, you need to point it to the ARM server IP address using the Web interface.

The ARM auto-discovers all network entities such as Nodes, Peer Connection and VoIP Peers, associates a VoIP peer with each Peer Connection, and displays them in the Network Map view.

The ARM detects activity originating from a node and puts the node on the map (peer collection). The ARM recognizes a newly added node and extracts all IP groups (i.e., Peer Connections). Users must add connections between nodes and change the VoIP peer types (see the previous section).

If a node's status is changed, the ARM detects this when synchronization is performed and automatically maps it. When synchronizing, the ARM obtains the names and statuses of connections and Peer Connections from each node and compares them to what it already knows. The Sync Topology feature therefore makes sure that the ARM is fully identified with the node's identifiers: IP address, credentials, node type, software version.

➢ **To sync:**

- In the Network Map view or Peer Connections view or Connections view, click **Sync Topology** on the action buttons bar.

Figure 3-11: Sync Topology

Global synchronization of the entire network is performed.

3.5 Building a Star Topology

You can build a star topology to enhance effective management. In a star topology, every node selected is connected to a central node:

All VoIP traffic from/to connected star nodes passes through the central node.

➢ **To build a star topology:**

1. In the Network Map view, point your cursor to a node and in the popup menu click **More Actions** and then **Build star**.

Figure 3-12: Build Star

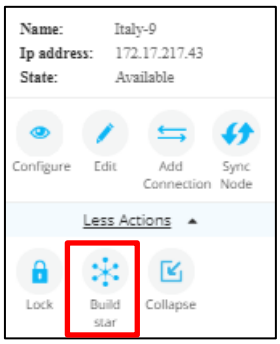
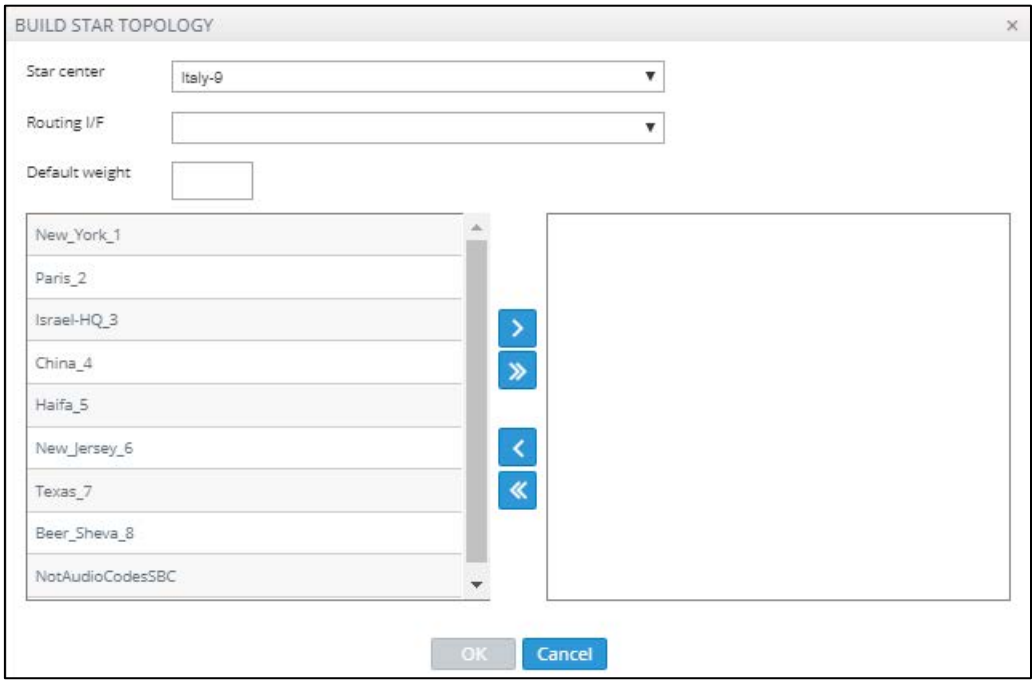


Figure 3-13: Build Star Topology



2. In the left pane of the Build Star Topology screen select the nodes that you want to connect to the star and then click ›
3. Configure the screen using Table 3-1 on the next page as reference.

Table 3-1: Build Star Topology

Parameter	Description
Star center	The node you pointed your cursor to before selecting the 'Build Star' menu option is displayed in the field; it'll be at the center of the star. To select another node to be at the center of the star instead of this node, from the dropdown list of nodes select the node.
Routing I/F	Select one of the SIP interfaces from which connections will be made from this node in the star center, to the other nodes in the star. E.g.: ▪ SIP-c ▪ SIP-0 ▪ SIP-1 ▪ SIP-2
Default weight	Enter the weight 1-100 to be applied to *all connections* in the star topology build. Later, you can prioritize *per connection* (see under Section 2.2.3.3 for more information). The ARM uses this setting to select the most optimal routing path for each call. The parameter therefore facilitates more effective network management.
The builder panes	Use the builder panes to build your topology star. From the left pane, select the nodes to include in the star, and then click >> to move them to the right pane. If you select a single node at a time, select it and then click >. To remove a node from the build, in the right pane click <, or << to remove multiple modes after selecting them.

4. Click **OK**; the topology is built. You can view it in Topology Map view.

3.6 Testing a Route

You can configure and test a route to make sure the call routing rule, the manipulation rule, the topology status, etc., all perform according to expectations, without impacting live calls traffic.

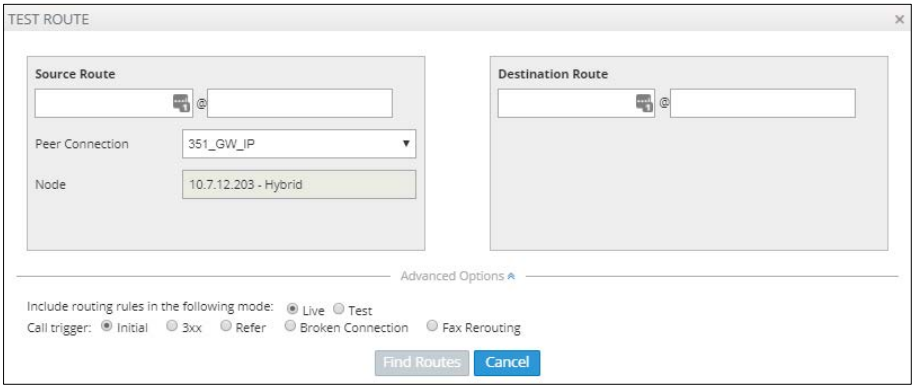
➢ **To test a route:**

1. In the Network Map view, point the mouse over the connection between a node and a VoIP Peer (Peer Connection) [or select the link and click the **Test Route** button].

Figure 3-14: Test Route

2. Select **Test route**.

Figure 3-15: Test Route

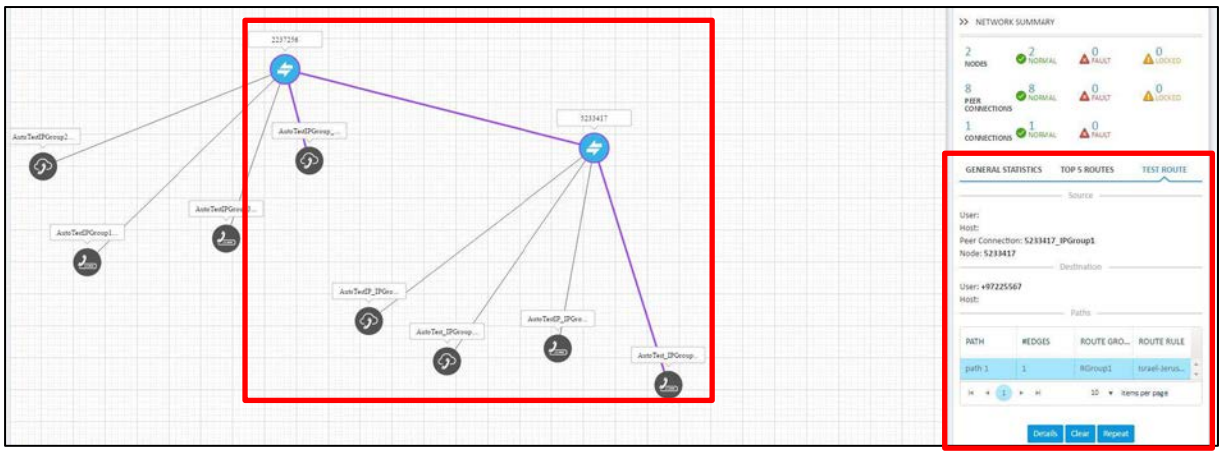


3. [Optional] Enter the Source and Destination Route. From the dropdown, select the **Peer Connection**.
4. Under 'Advanced Options', select the routing rules mode:
   - **Live**. When a new call destination is calculated, the Routing Rule is taken into consideration and live traffic may be impacted.
   - **Test**. Tests the Routing Rule or Dial Plan *offline* without impacting or disrupting live calls traffic.
   - **Live** *and* **Test** selected together. The Routing Rule is considered when:
     - calculating the live routing path -and-
     - testing a route in the live topology map *and* in the offline planning page

   Each routing rule can be enabled or disabled separately for **Live** mode and/or **Test** mode (see also under Section 8.2).
5. Under 'Advanced Options', select the call trigger. By default, the **Initial** option is enabled. See step 11 on page 110 for more information about call triggers.
6. Click **Find Routes**. Test routing is performed *as if* a real call is occurring, taking Operative State and Admin State of topology entities (Connections, nodes, Peer Connections), and the Admin State of routing rules, into account. In addition, the

entity's Quality or Time/Date criteria are taken into consideration if required by the Routing Rule (Advanced Condition). The Route Path is highlighted violet (shown in Figure 3-16); the TEST ROUTE pane on the right displays detailed information.

Figure 3-16: Route Path



7. In the Test Route pane shown in Figure 3-16, click **Details**.

Figure 3-17: Test Route Details

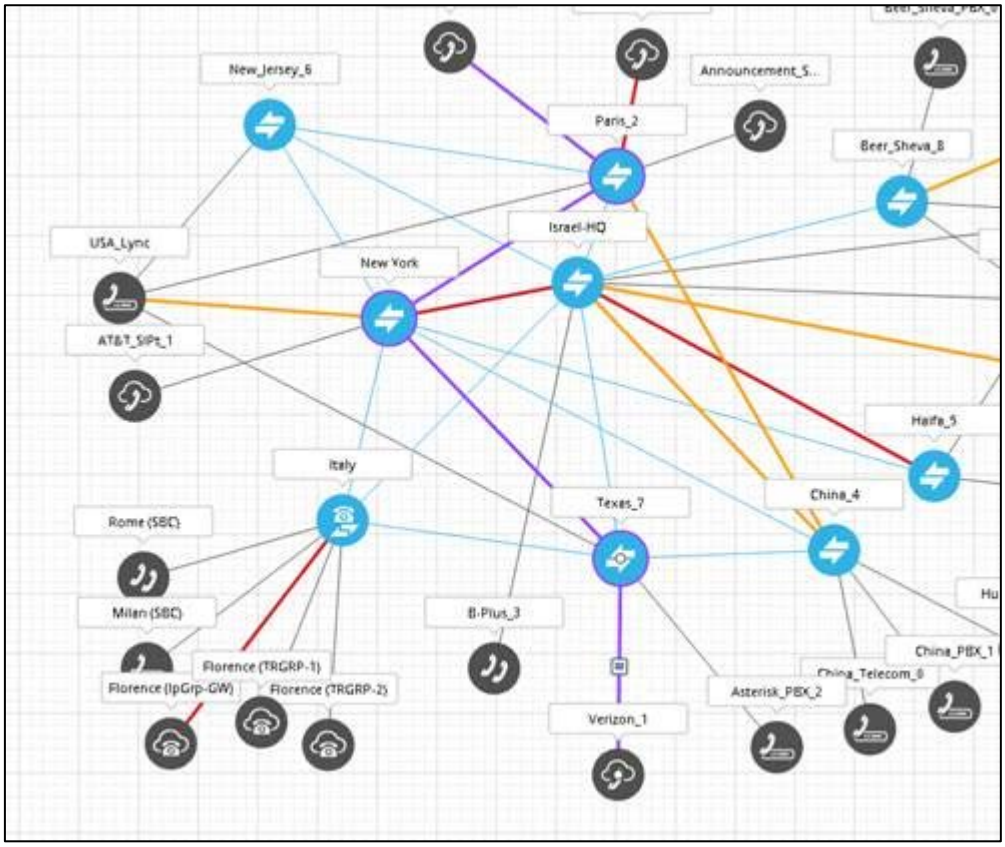
8. In the example above:
   - Compare the column ORIGINAL to the column NEW; the number changed because of a normalization rule that was applied. The normalization rule was configured in the Normalization Group rules attached to the Peer Connection. For related information, see also under Section 2.2.4 and Appendix C.

Figure 3-18: Strip + from the Number

   - Column WHEN indicates when manipulation was performed, i.e., *before* or *after* routing. In the example above, manipulation was performed *before routing*.
   - Column ENTITY indicates which part of the SIP Request was manipulated.
     - Possible values: Source URI User, Source URI Host, Destination URI User, Destination URI Host, Destination IP Address, Destination Port, Destination Protocol, User Credential User Name, User Credential Password
   - Column CHANGED BY – the first row indicates by global Normalization Group – see under Section 7.2.1 and Section 7.2.3 for detailed information; the second row indicates that the normalization was attached to a Peer Connection - see under Section 2.2.3.4 for detailed information.
   - Column NORMALIZATION/MANIPULATION GROUP indicates which 'Manipulation Group' the entity passed through, according to which regular expression the entity was changed.

The figure below shows an example of a test call with a quality advanced condition. The condition avoids passing through 'bad' or 'fair' Connections/Peer Connections.

Figure 3-19: Example of a Test Call with a 'Quality' Advanced Routing Condition



4 Designing a Network Topology in the Offline Planning Page

The ARM gives operators an add-on *to design* an IP network in the Offline Planning page starting from the beginning.

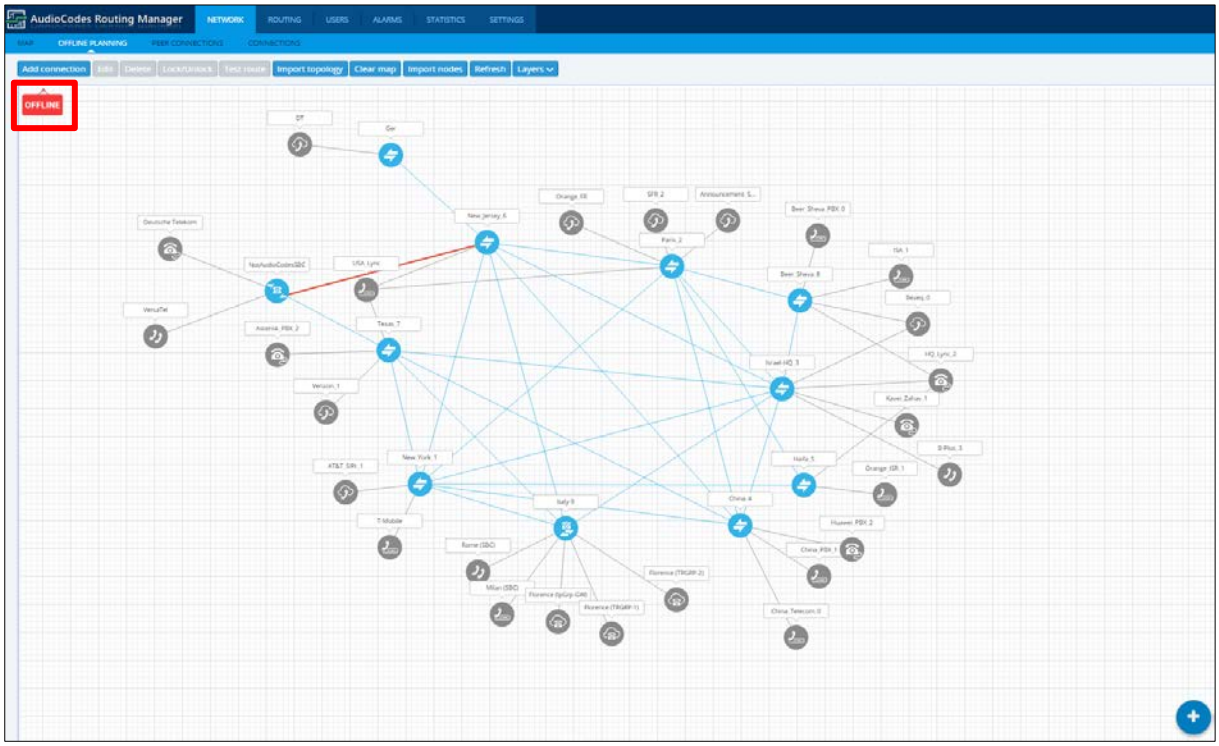
Operators can alternatively import an existing live topology into the page, make changes to entities' configuration and statuses, and test how the changes impact network functionality.

Feature benefits:

- Saves expenses in the network design phase | maintenance phase
- Prevents routing errors from occurring
- Decreases maintenance windows

The Offline Planning page is essentially a Map view that can be used as a *sandbox for network design and testing purposes*.

Figure 4-1: Offline Planning



In the view, the operator can create virtual nodes, Peer Connections, VoIP Peers, and Connections. The operator can import a full, currently-used topology, or *part* of one, e.g., a specific node, for making changes and testing offline.

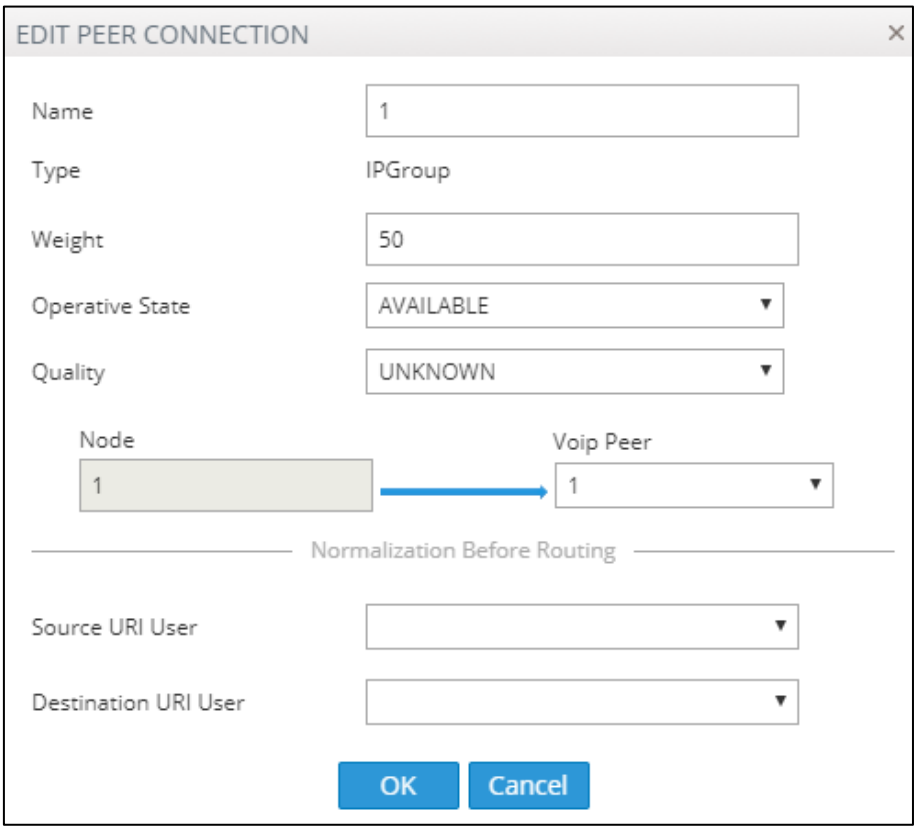
The operator can 'play' with the Administrative State, Operative State, Quality and Weight - if available - of each virtual entity and test how the changes impact call traffic.

After entities are added to the Offline Planning page they can be used in Routing Rules in testing mode; live network traffic will not be impacted.

The feature allows operators to test almost any scenario *before transposing the configuration to the live topology*.

The figure below shows the Operative State and Quality settings per peer connection.

Figure 4-2: Edit Peer Connection



After designing virtual VoIP network entities, you can export them to the live topology. When you export a newly defined node to the live topology, the node configuration downloads to AudioCodes' device which automatically connects to the live topology.[1]

4.1 Performing Actions in the Offline Planning Page

In the Offline Planning page, you can perform the following actions:

- Add a virtual entity to the Offline Planning page
- Import an existing node and all entities associated with it from the live topology
- Import a full topology from the live topology
- Combine a virtual configuration with an imported one

4.1.1 Adding a Virtual Entity

Two types of virtual entities can be added to the Offline Planning page:

- Nodes
- VoIP Peers

➢ **To add a virtual node:**

1. In the Offline Planning page, click and then click ; then select the virtual node type or third-party node type using Table 4-1 as reference.

[1] When exporting an offline node to the live ARM topology, only the *connections* in the live node are provisioned; you need to *manually provision Peer Connections* in the node.

Table 4-1: Add a Virtual Node

Icon	Used to
	Drag and drop a virtual *hybrid* device onto the Offline Planning page.
	Drag and drop a virtual *gateway* onto the Offline Planning page.
	Drag and drop a virtual *SBC* onto the Offline Planning page.

2. Drag the selected type of device to the map and configure its name.

➢ **To add a virtual VoIP Peer:**

1. Click and then ; then select the VoIP Peer type using the following table as reference.

Table 4-2: Add a Virtual VoIP Peer

Icon	Used to
	Drag and drop a *PSTN entity* onto the Offline Planning page.
	Drag and drop a *PBX* onto the Offline Planning page.
	Drag and drop an *IP PBX* onto the Offline Planning page.
	Drag and drop a *SIP Trunk* onto the Offline Planning page.
	Drag and drop an *IP phone* onto the Offline Planning page.

2. Drag the icon to the map and configure the name of the VoIP Peer.

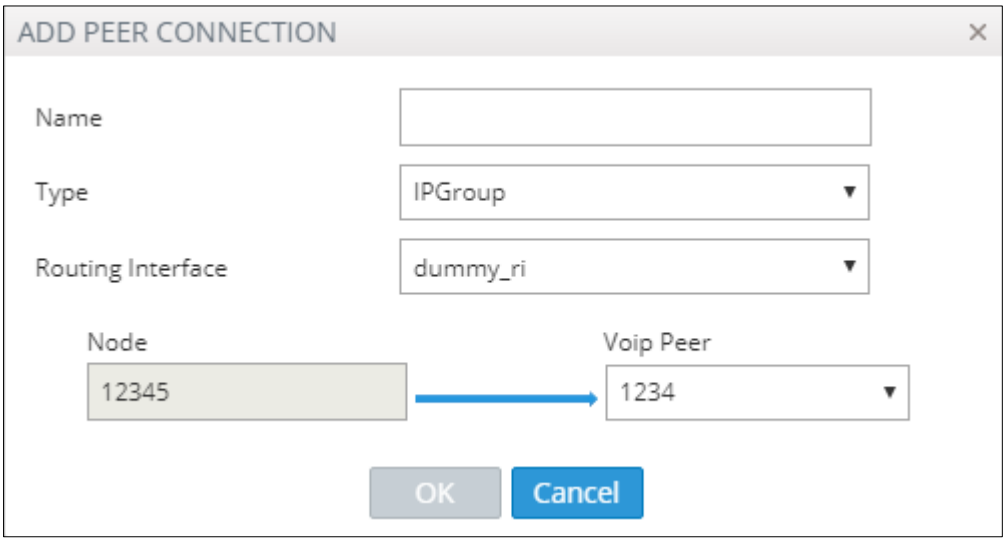
4.1.2 Adding a Virtual Peer Connection to the Offline Planning Page

You can add a virtual Peer Connection to the Offline Planning page.

➢ **To add a virtual Peer Connection:**

- Drag a line from the center of a node to a VoIP Peer and then configure it in the Add Peer Connection screen that opens:

Figure 4-3: Add Peer Connection



4.1.3 Adding a Virtual Connection

You can add a virtual Connection to the Offline Planning page.

➢ **To add a virtual connection to the Offline Planning page:**

- Click the **Add Connection** button to add a connection between two offline nodes; the same screen shown in Figure 3-10 is displayed; the procedure is identical to that performed in the live topology.

4.1.4 Importing a Full Topology

You can import a full topology from the live topology map to the Offline Planning page.

➢ **To import a full topology:**

- Click the **Import topology** button; all network entities in the live topology including nodes, VoIP Peers, Peer Connections and Connections will be imported.

4.1.5 Importing a Node from the Live Topology

You can import a node from the live topology to the Offline Planning page.

➢ **To import a node from the live topology:**

- Click the **Import nodes** button and select a relevant node from the list that pops up; the node will be added to the Offline Planning map together with Peer Connections and VoIP Peers associated with that node.

4.1.6 Deleting a Virtual Entity

You can delete a virtual entity from the Offline Planning page.

➢ **To delete a virtual entity from the Offline Planning page:**

- Select an entity and then click **Delete**.
- Click **Clear Map** to delete all entities from the page.

4.1.7 Testing a Route

You can test a route in the Offline Planning page.

➢ **To test a route:**

- To test a route in a virtual network, select the Peer Connection and then select **Test Route** (see Section 3.6). Testing a route in the Offline Planning page factors in all entities configured in the Offline Planning page and their status and voice quality.

4.1.8 Exporting a Node from the Offline Page to the Live Topology

You can export a node from the offline page to the live topology.

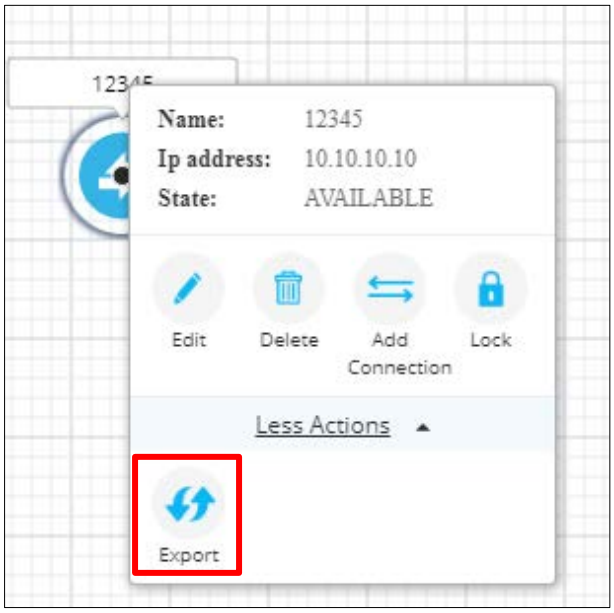
➢ **To export a node from the Offline Page to the live topology:**

Note:

- Before exporting a node to the live topology, make sure it's correctly configured in the Offline Planning page.
- If a node with the same IP address already exists in the live topology, the entire configuration of the node will be transferred to that node in the live topology.
- Before exporting a node to the live topology, make sure all Peer Connections (IPGroups) are configured on that node.

- In the offline map, point your mouse over a node and from the popup click **More Actions** > **Export**.

Figure 4-4: Export



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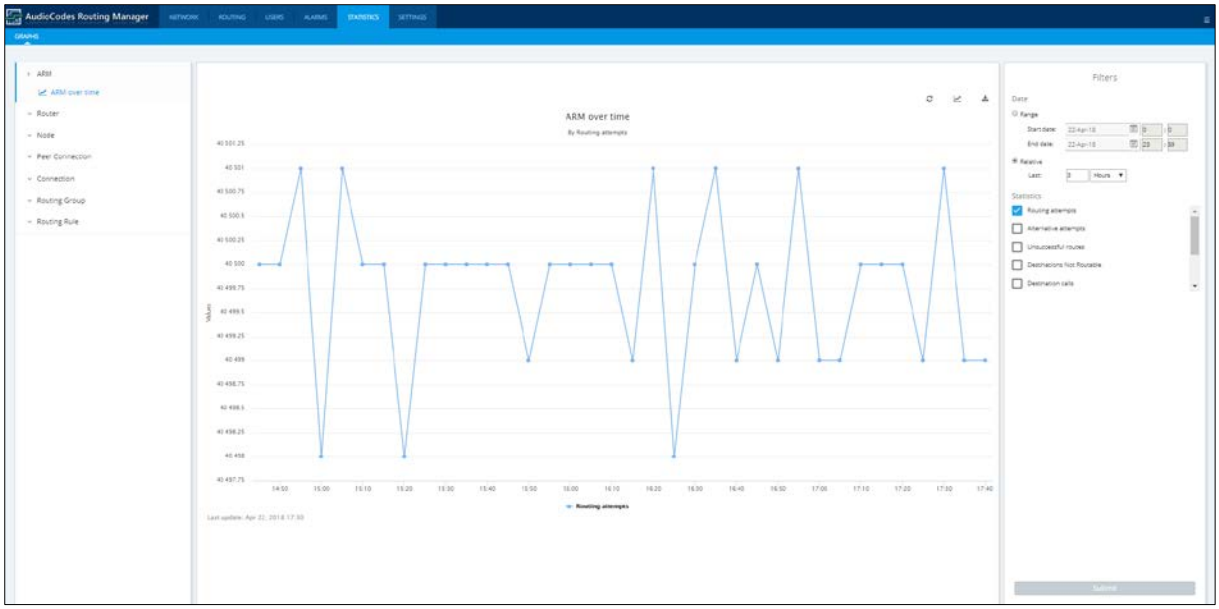
5 Viewing Statistics and Reports

The ARM provides a Statistics Graphs page and ARM-embedded statistics reports, allowing you to debug, monitor and optimize your network and routing. Statistics charts provide you with a clear view of your network and routing performance, helping you better understand, analyze, debug and optimize network routing and resources usage.

➢ **To use statistics graphs:**

- Open the Statistics Graphs page (**Statistics** > **Graphs**).

Figure 5-1: Statistics Graphs Page – ARM over time



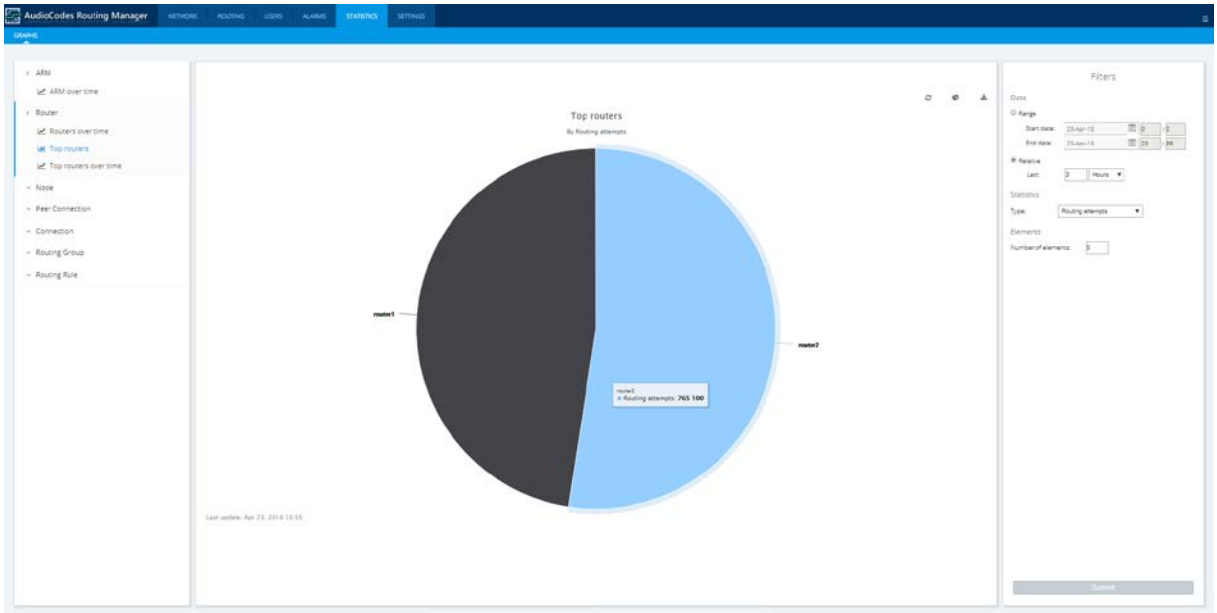
The page is divided into three sections.

Table 5-1: Statistics Graphs Page (From Left to Right)

Element	Filters	Graphical Representation
Statistics are displayed *per element*. Select either: • ARM • Router (Routers over time, Top routers, Top routers over time) • Node (Nodes over time, Top nodes, Top nodes over time, Nodes by peer connections, Top nodes by peer connections) • Peer Connection (Peer connections over time, Top peer connections, Top peer connections over time) • Connection (Connections over time, Top connections, Top connections over time) • Routing Group (Routing groups over time, Top routing groups, Top routing	Filters differ depending on the element selected. *For all elements except Routing Group and Routing Rule, select from*: • 'Date' ('Range' or 'Relative') • Statistics Type: ✓ Routing attempts ✓ Alternative attempts ✓ Unsuccessful routes ✓ Destinations Not Routable ✓ Destination calls ✓ Transient calls (does not apply to Peer Connection) (for Connection, only this filter applies)	Graphic representation of the statistics of the selected element in a chart, with a range of graph functionalities: • Refresh • Chart type (line, area or stacked area) Export chart

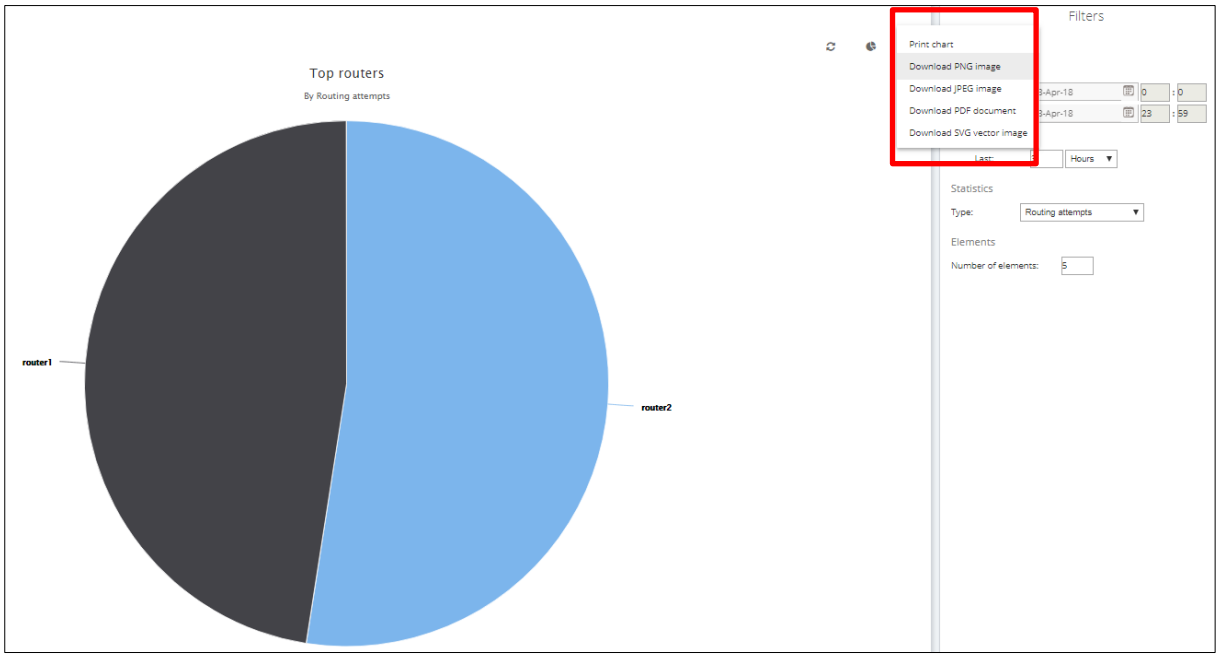
Element	Filters	Graphical Representation
groups over time, Top routing groups by rules, Top routing groups by rules) • Routing Rule (Routing rules over time, Top routing rules, Top routing rules over time, Routing rules by actions, Top routing rules by actions)	✓ Drop routing request ✓ No match rule • Elements ✓ Search ✓ Number • Stacked Elements ✓ Search ✓ Number • Statistics Type (only applies to Routing Group and Routing Rule) ✓ Routing rules attempts ✓ Routing first match ✓ Routing second match ✓ Routing third match ✓ Routing rules failures	

Figure 5-2: Top Routers Filtered by Routing Attempts Displayed as a Pie Chart



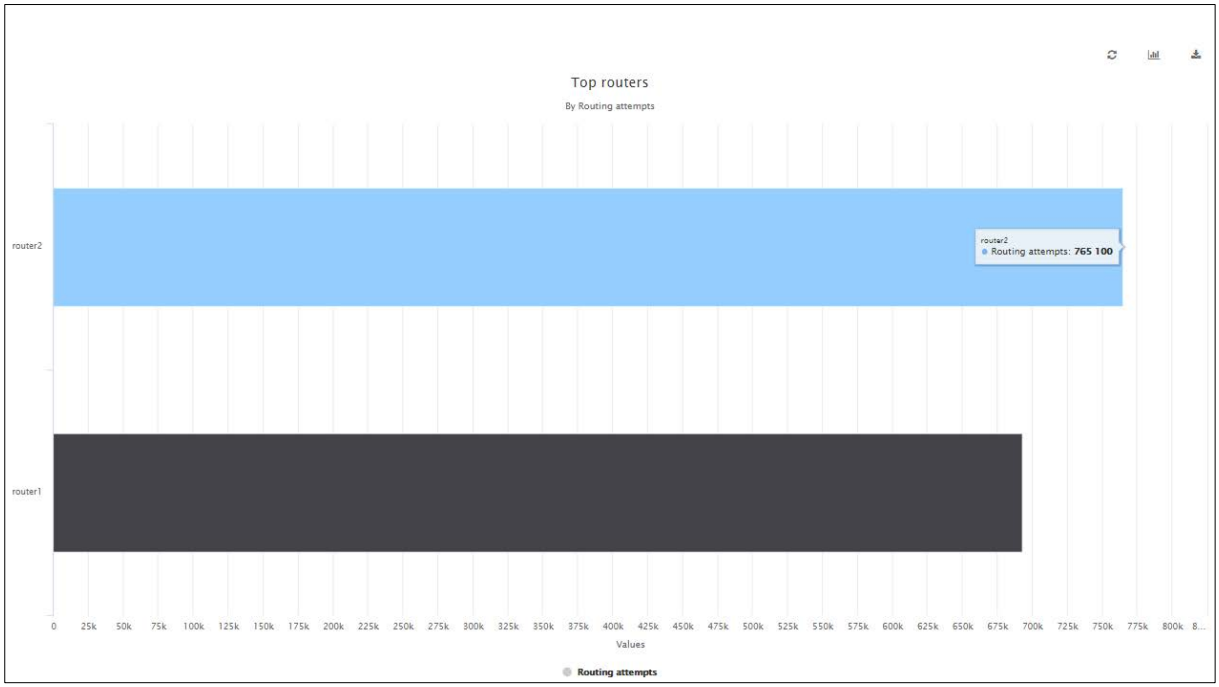
- A glance at the chart immediately reveals the top router. Point your cursor over a segment to display the number of routing attempts attempted by that router.
- You can print the chart or download the statistics in a format of your choice.

Figure 5-3: Downloading Statistics in a Format of Choice



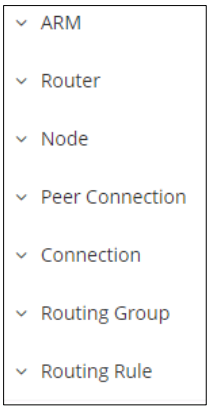
- You can select your preferred graphical representation – bar chart, column chart or pie chart. An icon 'Select chart type' allows you to present statistics according to your preferred graphical representation.

Figure 5-4: Top Routers Filtered by Routing Attempts Displayed as a Bar Chart



- A glance at this chart also immediately reveals the top router. Point the cursor over a bar to display the number of routing attempts attempted by that router. The figure below shows the elements that hold statistics information.

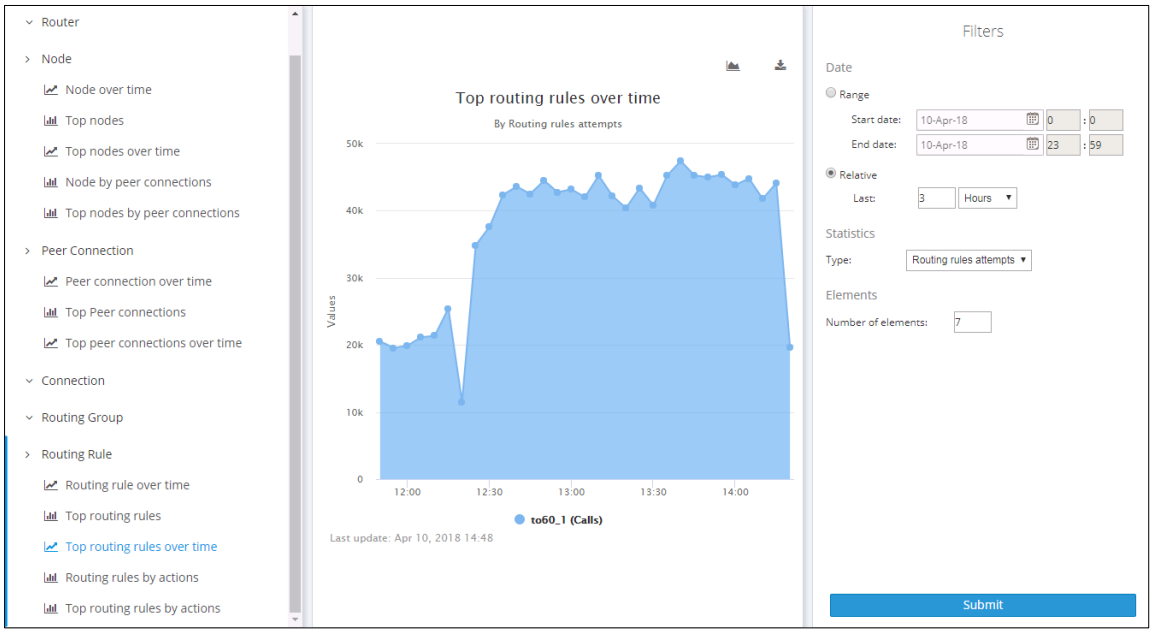
Figure 5-5: Elements that Hold Statistics Information



Each element displays subcategories. Under Routing Rule, for example, you can select 'Top Routing rules over time' or 'Top Routing rules by action'.

In addition, in the Filters section of the page, you can select 'Number of elements'.

Figure 5-6: Top Routing rules over time



6 Performing User-Related Administration

The Users page in the ARM allows the ARM operator to:

- Add users to the ARM (see the next section)
- Add Users Groups to the ARM (see Section 6.2)
- Add an LDAP Server to the ARM (see Section 6.3)
- Add a Property Dictionary to the ARM (see Section 6.4)

6.1 Adding a User Not Listed in an AD to the ARM

Enterprises have databases in which employee information is stored. Enterprises generally store information related to employees on Microsoft's Active Directory (AD) server. The ARM supports multiple ADs. The ARM's user administration feature can connect to an AD and import user calls routing related information into the ARM database. Operators can alternatively add users who are not listed in an AD database, to the ARM database.

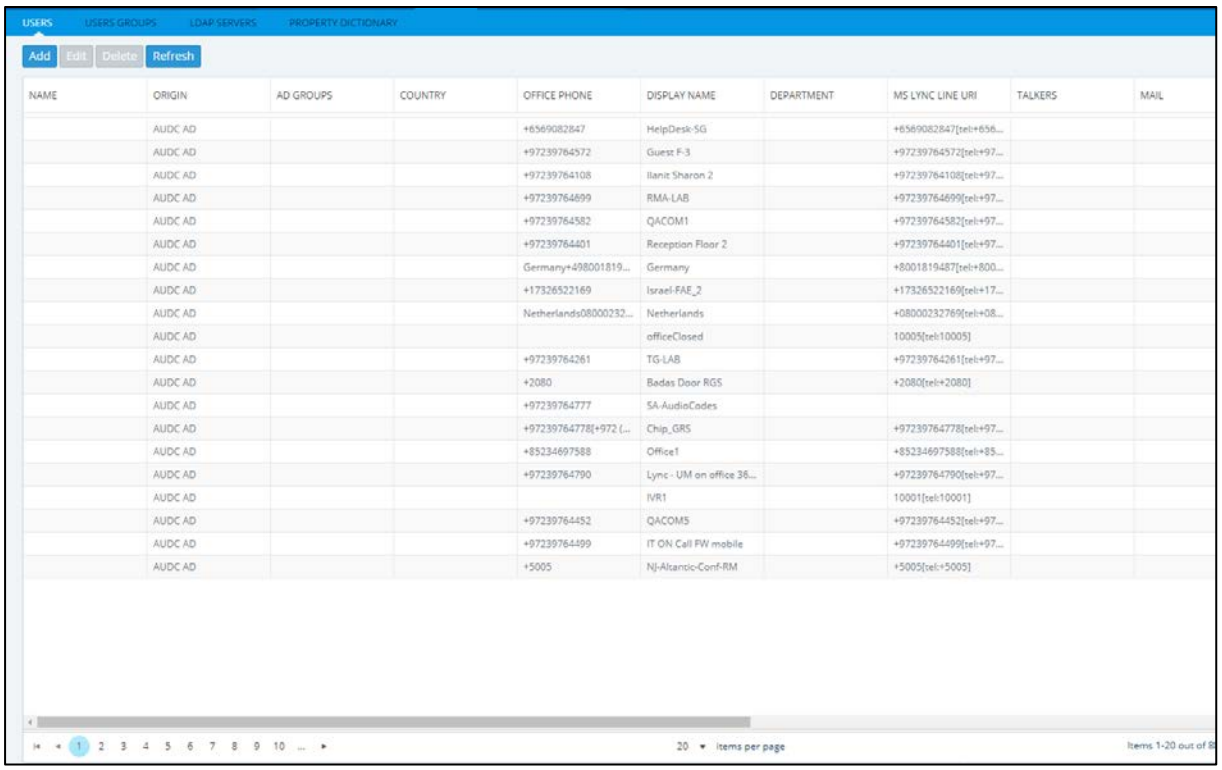
Enterprises that store their users in another format (Excel, for example) can also import these users into the ARM as local ARM users using the ARM northbound REST API. For more information and assistance, contact AudioCodes Professional Services.

To view the users listed in the AD database and their AD attributes, you need to provision the LDAP server as shown under Section 6.3.

➢ **To add a user who is not listed in an AD database, to the ARM database:**

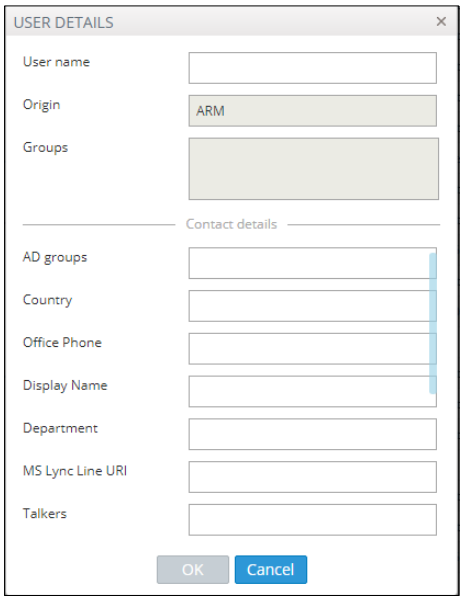
1. In the ARM's Users page, click the **Users** tab.

Figure 6-1: Users Page – Users tab



2. Click **Add**.

Figure 6-2: User Details

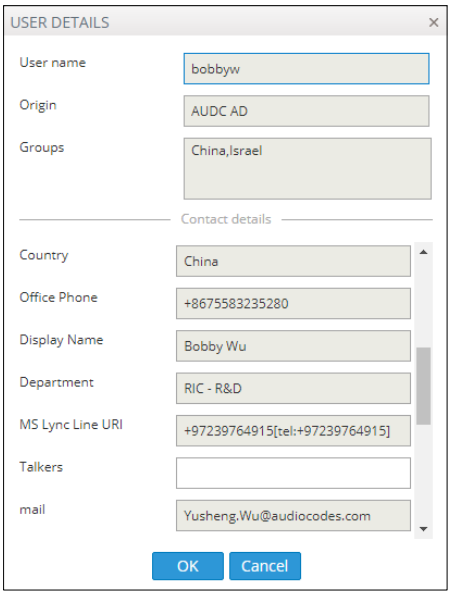


User Details are taken from the Property Dictionary screen. If a property is added in the Property Dictionary screen, it appears here. To add a property, see Section 6.4.

Note that if an LDAP server is provisioned, the ARM automatically brings users from it to the ARM database, and displays them in the GUI under the **User** tab.

3. Click **OK**; the user is added and displayed in the Users page. To view and/or edit, select the user's row and click **Edit**; the screen shown below is displayed.

Figure 6-3: User Details



Note: Grayed fields in the figure above indicate that the origin of this user isn't ARM and cannot be edited. Non-grayed fields indicate that the origin of the user is ARM and *can* be edited.

6.2 Adding Users Groups to the ARM

You can define Users Groups by defining a set of criteria in the user properties. The ARM automatically associates users with the defined Users Group, based on the conditions you define. You can then use the Users Groups in your Routing Rules as match conditions. Each Users Group has one 'Dialable Number' attribute. When a route request is received with a source or destination URI matching the group's 'Dialable Number' property for one of the users in the group, the Routing Rules with this source or destination Users Group are matched.

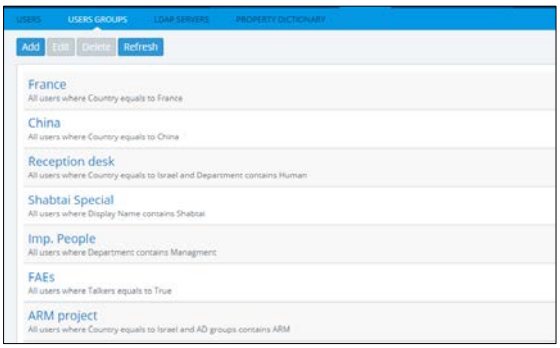
A Users Group can have a single attribute condition or a combination of attributes conditions. For a user to be a part of the Users Group, all the conditions must be matched. A single condition can have a set of values to compare to. If any of the values of the condition are matched, the condition is considered a match.

Example: You can define a Users Group where the 'Dialable Number' attribute is 'Mobile phone number' and the conditions are Country equals Germany and Department equals Marketing or Sales.

➢ To add a Users Group:

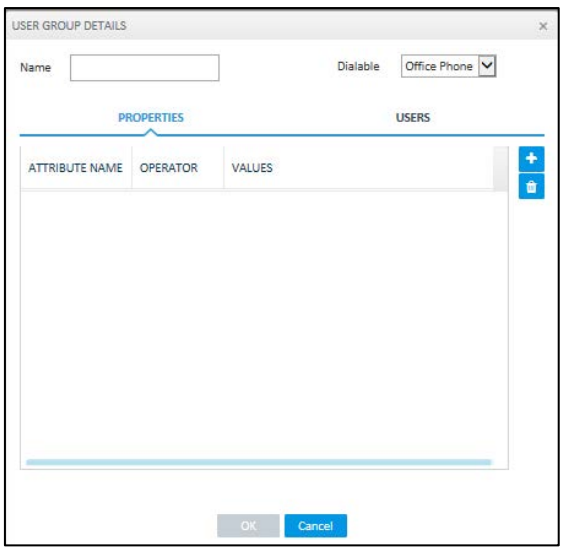
1. In the Users page, click the **Users Groups** tab.

Figure 6-4: Users Groups



2. Click **Add**.

Figure 6-5: Users Group Details



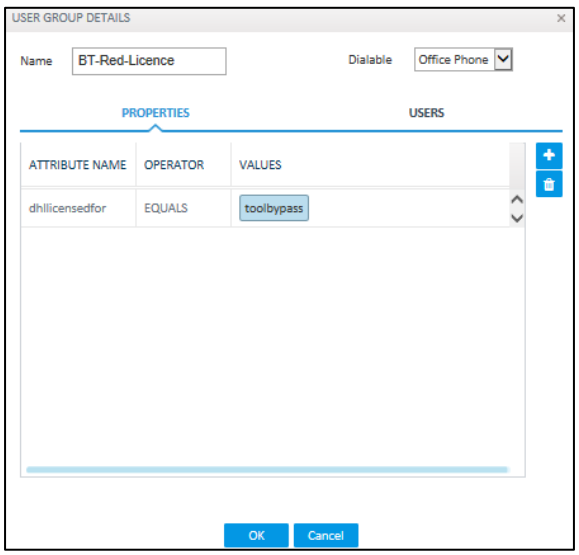
3. Configure the details using Table 6-1 as reference.

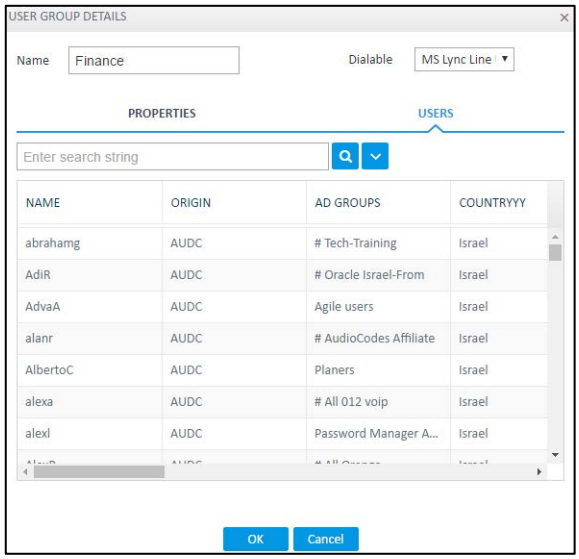
Table 6-1: Users Group Details

Setting	Description
Name	Enter a name for the group for intuitive future reference.
Dialable	From the dropdown, select one of the Dialable Number properties. This is the user's property that is compared to the received source or destination URI to determine if the route request is from/to one of the users in this User Group. Example: 'Office phone number'.
Attribute Name	Click the field and from the dropdown, select a user attribute according to which the user will be associated with the group. Example: Country. Click the plus button **+** to add more attributes. All attributes must match for the user to be a member of the group.
equals / not equals contains / not contains	From the dropdown, select the operation to be used to define the criterion.
Value	Enter a value for the attribute, according to which the user will be associated with the group. Example: Sweden. Press enter to add more values. At least one of the values must match for the attribute to be considered a match.

➢ **To edit a Users Group:**

1. In the Users page, select the user group to edit and then click **Edit**; the User Group Details screen opens – under the **Properties** tab. You can see the users who are associated with the group under the **Users** tab of the User Group Details screen.





2. Edit using the table above as reference, and then click the **Users** tab; the screen shown above right opens allowing you to view the users that were associated to the group in the **Users** tab of the User Group Details dialog.

6.3 Adding an LDAP Server to the ARM

Network administrators can add multiple Active Directories (ADs) to the ARM database using LDAP protocol.

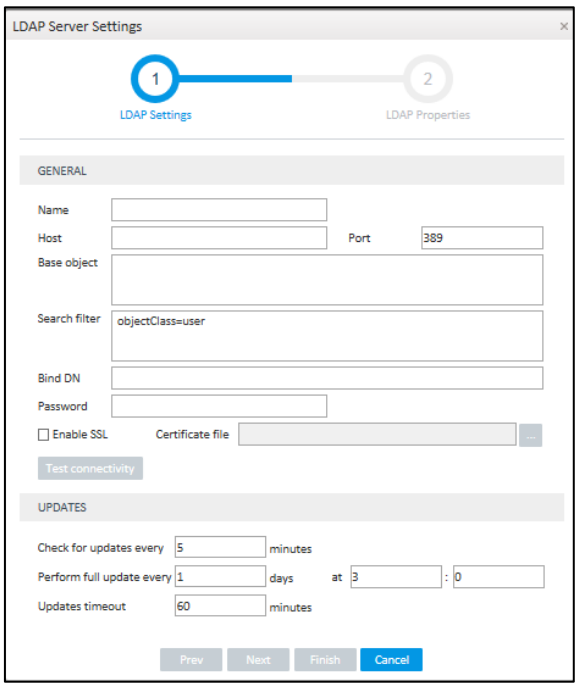
➢ **To add an LDAP server:**

1. In the Users page, click the **LDAP Servers** tab.

Figure 6-6: Users Page – LDAP Servers tab

2. Click **Add**; the LDAP Server Settings open.

Figure 6-7: LDAP Server Settings



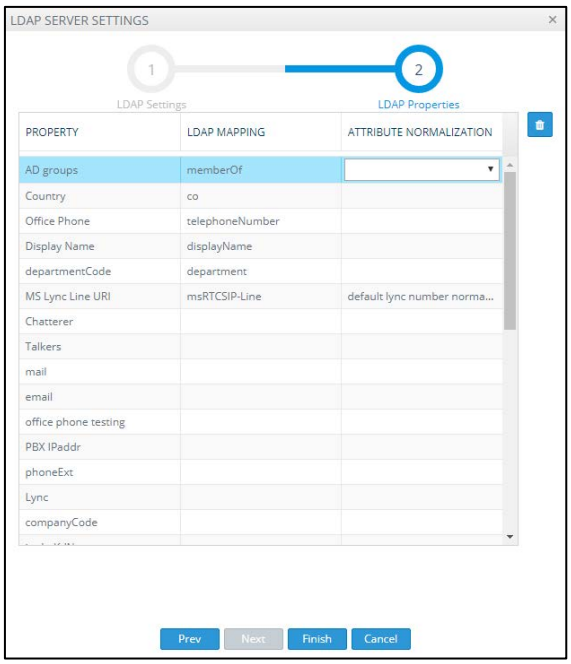
3. Configure the settings using Table 6-2 as reference.

Table 6-2: LDAP Server Settings

Setting	Description
Server name	Enter an intuitive name for the LDAP server.
Host	IP address or DNS name of the LDAP server on which the AD is located.
Port	The LDAP port. Default: 389
Base Object	Consult your IT manager responsible for the Active Directory in your enterprise. The setting defines the full path (DN) to the object in the AD tree where the user's information is located. The valid value is a string of up to 256 characters. Example (read from right to left): ou=Users;ou=APC;ou=Israel;ou=AudioCodes;dc=corp;dc=audiocodes;dc=com The DN path is defined by the LDAP names OU (organizational unit) and DC (domain component).
Search Filter	An LDAP search filter used when fetching the users from the LDAP server under the base DN. The default is 'objectClass=user'.
Security Settings	
Bind DN	The DN (distinguished name) or username of the user used to bind to the LDAP server. For example: ldap_bind@corp.audiocodes.com
Password	Defines the LDAP password used to connect.
Enable SSL	Enables or disables the connection over SSL. Default: Disable. When disabled, communications with the AD server will be open, i.e., unencoded/unencrypted. When left unchanged at the default; the **Browse** button adjacent to 'Certificate File to Upload' will be unavailable; when enabled, the **Browse** button becomes available.
Certificate file	Enables verification that it is the AD server and no other entity that is communicating with the ARM server. Allows you to browse for a root certificate. When the AD server then sends a certificate, the ARM server uses the root certificate to verify that it is the AD server and no other entity on the other side. Following verification, communications are SSL-encoded.
Updates	
Check for updates every *n* minutes	Defines how frequently the ARM server checks the AD server for updates. Note that during the update, the ARM only obtains new AD users or relevant user information updates (only the delta).
Perform full update every *n* days at	Defines how frequently the ARM server performs a full update from the AD server. Note that a full update is mainly required to remove users deleted from the organization's AD (this information cannot be obtained by an AD update).
Updates timeout	If the AD server doesn't answer within the period set, the ARM server determines that the AD server is disconnected and a refresh is sent.
Test Connectivity	Click the button to test the connectivity between the ARM server and the AD server.

4. Click **OK** now or click it after the **Next** button. You can also click **Test connectivity;** the LDAP Properties page opens:

Figure 6-8: LDAP Properties



Properties that have LDAP mappings will be synced from the LDAP server. Properties that do not have LDAP mappings can be configured locally.

➢ To attach a Normalization Group (Rule) to an LDAP property:

1. Select the row of the LDAP property to which to attach a Normalization Group (Rule).
2. From the property's Attribute Normalization dropdown, select a Normalization Group. See Section 7.2.1 for information on how to configure a Normalization Group.
3. Click **Finish**.

➢ To view the AD summary:

- In the Users page, click the **LDAP Servers** tab and select the AD whose summary you want to view.

Figure 6-9: Users Page – LDAP Servers tab – AD Summary

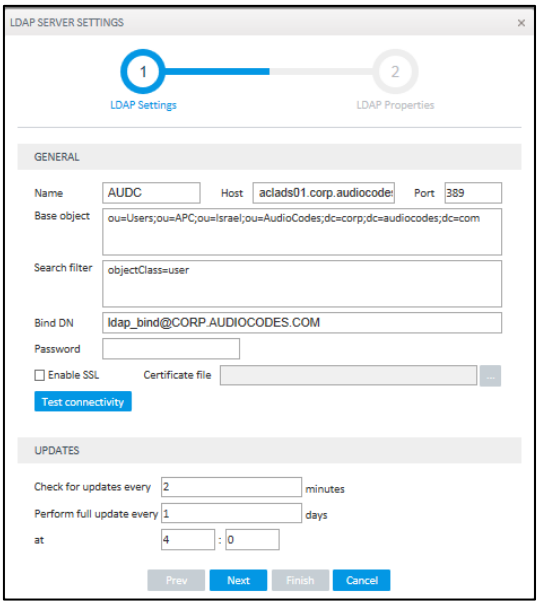
Table 6-3: Active Directories Summary

Sync	ARM and AD databases synchronization schedule. Displays the synchronization frequency: 1-48, i.e., between once every hour (most frequent) to once every two days (most infrequent).
Last Sync	Displays the last time the ARM and the Active Directory databases were synchronized.
Full Sync	Displays the time (hour and minute) at which to start a full synchronization. Also displays the frequency: 1-7, i.e., between once a day (most frequent) to once a week (most infrequent).
Last Full Sync	Displays the last time the ARM and the Active Directory databases were fully synchronized.

➢ **To edit an LDAP server:**

1. In the Users page under the **LDAP Servers** tab, select the server to edit and then click **Edit**; the LDAP Server Settings open.

Figure 6-10: LDAP Server Settings



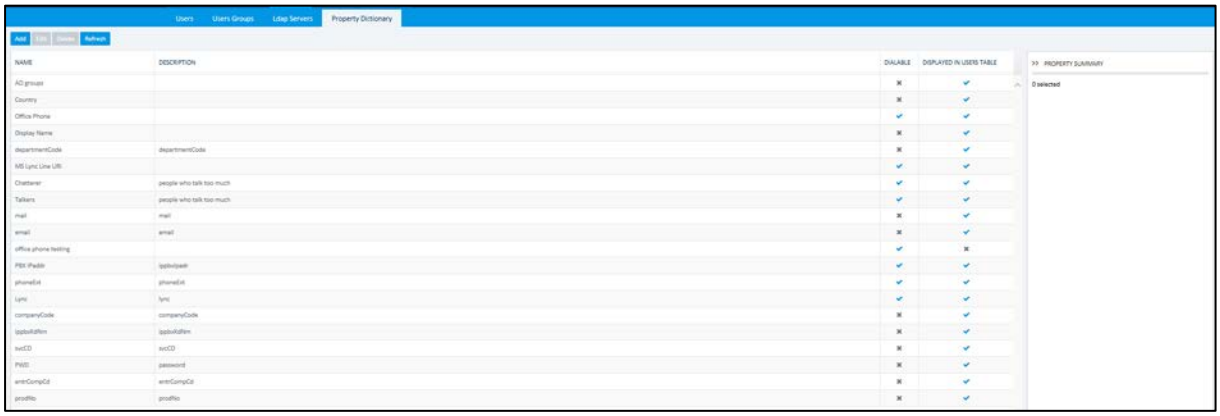
2. Edit the LDAP Server Settings screen, click **Test Connectivity** to test the connection settings and then click **Next**; the LDAP Properties screen shown in Figure 6-8 opens.
3. For each LDAP property's LDAP Mapping dropdown, select a mapping. Properties that have LDAP mappings will be synced from the LDAP server. Properties that do not have LDAP mappings can be configured locally.
4. Select the row of the LDAP property to which to attach a Normalization Group (Rule) and then from the property's Attribute Normalization dropdown, select a Normalization Group. See Section 7.2.1 for information about how to configure a Normalization Group.
5. Click **Finish**.

After updating an LDAP server, a full sync is started. After a short while (depending on the size and responsiveness of the LDAP server), you can view the updated users in the Users page.

6.4 Adding a Property Dictionary to the ARM

The Users page's Property Dictionary tab lets the operator administer the Property Dictionary, a set of all the properties that a user can have.

Figure 6-11: Users Page – Property Dictionary tab

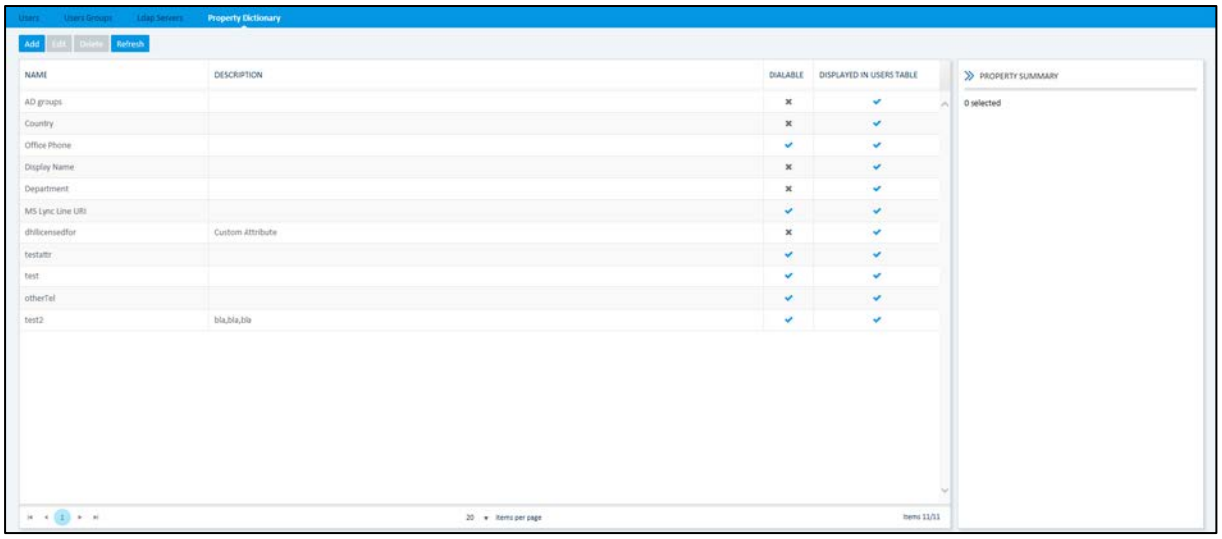


After adding a property to the dictionary, you can add it to some or all your LDAP servers. Properties added to an LDAP server will automatically be read from the LDAP server. Properties not added can be set locally in the ARM for each user. The Properties from the dictionary can then be used as User Group conditions as well as in in 'Policy Studio'.

➢ **To add / edit a property:**

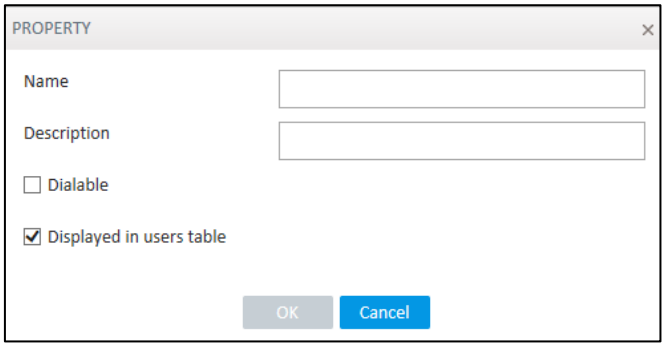
1. Open the Property Dictionary page (**Users** menu > **Property Dictionary** tab).

Figure 6-12: Property Dictionary



2. Click **Add** or **Edit**.

Figure 6-13: Property



3. Use the table below as reference.

Table 6-4: Add Property

Setting	Description
Name	Define an intuitive name for the property, for intuitive future reference.
Description	Enter a brief description of the property, for intuitive future reference.
Dialable	Defines if this property is a dialable number. Only dialable numbers are used for matching with a received source or destination URI in a route request. Examples of dialable number properties: Office phone number, mobile phone number, Skype number, etc.
Display in Users Table	Select the option to display the user property in the Users page. The option can be used to reduce clutter on the Users page.

7 Configuring Settings

The Settings page (under the Settings menu) lets you

- Network Services Settings
  - Syslog server (see Section 7.1.1)
  - NTP server (see Section 7.1.2)
- Call Flow Settings
  - Normalization Groups (see Section 7.2.1)
  - Prefix Groups (see Section 7.2.2)
  - Normalization Before Routing (see Section 7.2.3)
  - Policy Studio (see Section 7.2.4)
- Routing Settings
  - Configuring a Quality Based Routing Condition (see Section 7.3.1)
  - Configuring a Time-Based Routing Condition (see Section 7.3.2)
  - Configuring SIP Alternative Route Reason (see Section 7.3.3)
  - Configuring Global Routing Settings (see Section 7.3.4)
- Administration Settings
  - Software License (see Section 7.4.1)
  - Security (see Section 7.4.3)
  - Operators (see Section 7.4.4)
- Routing Servers Settings
  - Adding a Routing Server (see Section 7.4.4.2)
  - Editing a Routing Server (see Section 7.5.1)
  - Locking/Unlocking a Routing Server (see Section 7.5.2)

7.1 Network Services Settings

This section shows how to edit a syslog server and add/edit an NTP server.

7.1.1 Editing a Syslog Server

This section shows how to edit a Syslog Server.

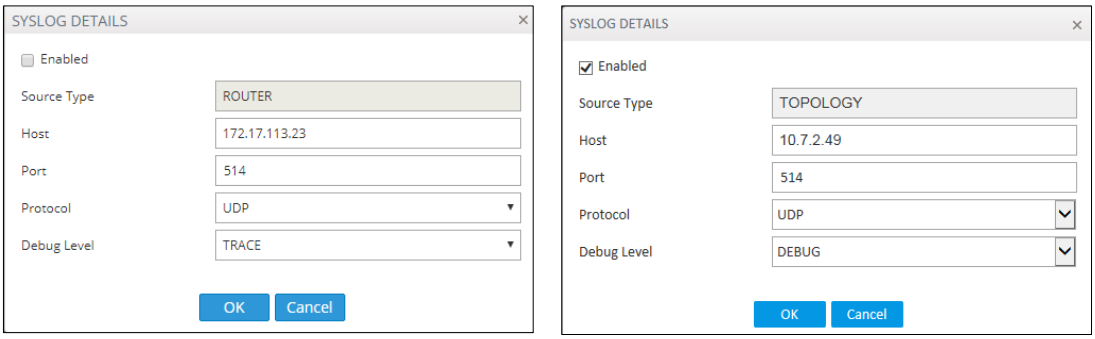
➢ **To edit a Syslog Server:**

1. In the Settings page, click the **Syslog** tab.

Figure 7-1: Network Services

2. Select the Router or Topology row and then click the enabled **Edit** button.

Figure 7-2: Syslog Details



3. Configure the syslog details using Table 7-1 as reference.

Table 7-1: Syslog Details

Setting	Description
Host	IP address or host name of the remote syslog server to which messages are sent.
Port	Port of the remote syslog server to which messages are sent.
Protocol	Leave at default (UDP).
Debug Level	From the 'Debug Level' dropdown select either: • TRACE (default level for the Router; only messages whose debug level is TRACE are sent to the syslog server) • DEBUG (default level for Topology; only messages whose debug level is DEBUG and higher are sent to the syslog server) • WARN • ERROR

Note:

- When enabling syslog for a Router, there's a single syslog server for all Routing servers in the ARM. All ARM Routers send their syslog to this syslog server (at the same 'Debug Level'). This is necessary for proper calls debugging, as a single call can be processed by several different ARM Routers (they are state-less). For the ARM Configurator, however, you can assign a different syslog server.

7.1.2 Adding/Editing an NTP Server

This section shows how to add an NTP server.

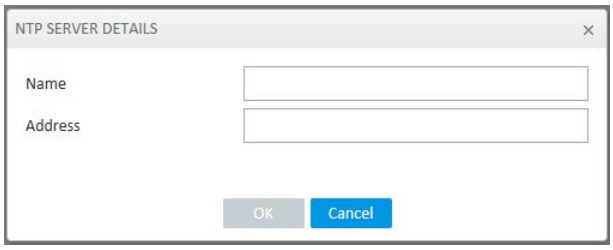
➢ **To add an NTP server:**

1. Open the NTP Servers page (**Settings** menu > **Network Services** tab > **NTP Servers** item).

Figure 7-3: NTP Servers

2. Click **Add**.

Figure 7-4: NTP Server Details



3. Configure the NTP server details using the table below as reference. The same details open when editing the server.

Table 7-2: NTP Server Details

Setting	Description
Name	Enter a name for the NTP server.
Address	Enter the IP address or host name of the NTP server.

4. Click **OK**.

7.1.3 Prioritizing Traffic According to Class of Service

The ARM supports Differentiated Services (DiffServ) protocol for specifying and controlling network traffic *by class*, so that certain types of traffic get priority over others.

DiffServ uses a 6-bit differentiated services code point (DSCP) in the 8-bit differentiated services field (DS field) in the IP header for packet classification purposes.

The ARM lets you configure the DSCP value for outgoing packets coming from the ARM Configurator and from the ARM Routers. Different values for Gold, Silver and Bronze can be configured. The table below shows how protocols are mapped to class of service.

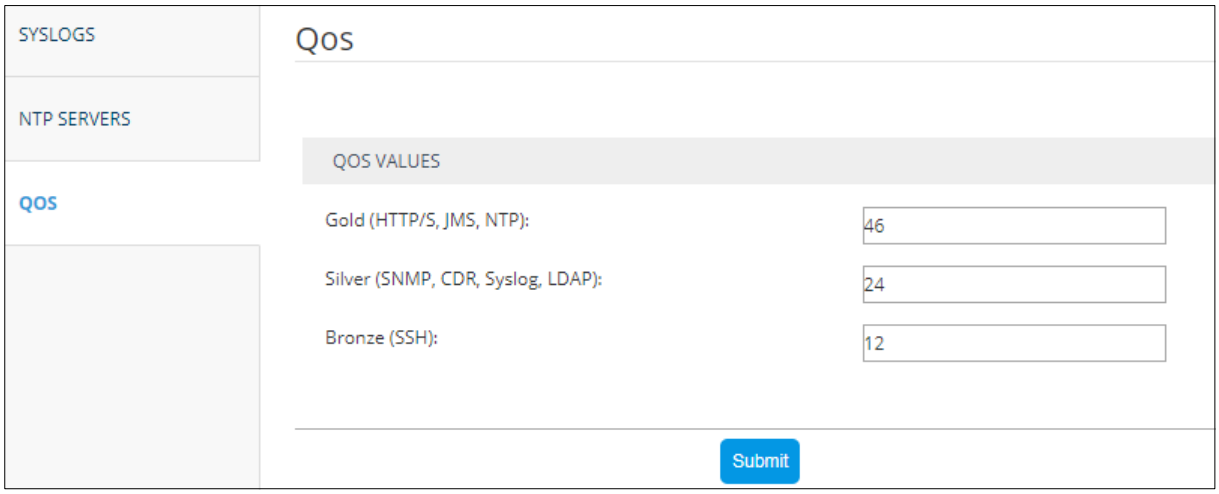
Table 7-3: Protocols Mapped to Class of Service

Application Protocol	Class of Service (Priority)	Traffic Type
HTTP/HTTPs	Gold	• Signaling/Control • Communication between node and ARM Configurator, node and ARM Configurators • Some communication between ARM Routers and ARM Configurator
JMS	Gold	Management affecting signaling. Critical communication between ARM Configurator and ARM Routers.
NTP	Gold	Control and Management
SNMP	Silver	Management (SNMP traps)
CDRs and Syslog	Silver	Management
LDAP	Silver	Management (for ARM users)
SSH	Bronze	Management

➢ **To configure the feature:**

1. Open the QoS page (**Settings** > **Network Services** > **QOS**) shown in the figure below.

Figure 7-5: QoS



2. Configure QoS values using Table 7-4 on the next page as reference

Table 7-4: QoS Settings

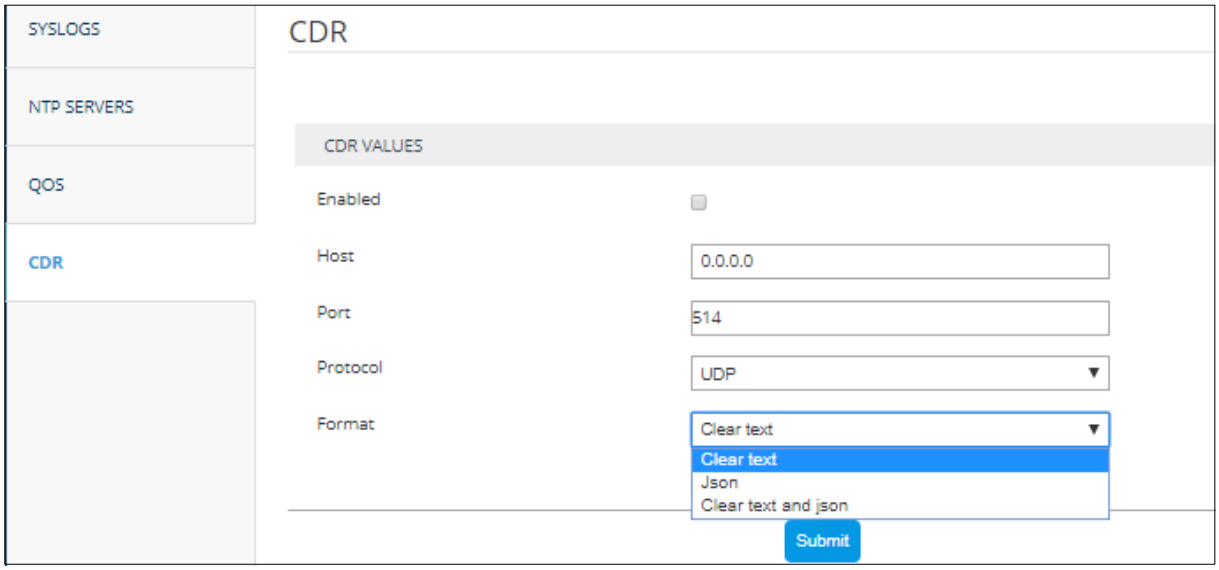
Setting	Description
Gold	[Application protocol: HTTP/S, JMS, NTP] You can change the default value of 46 to suit the requirements of your IP network. As part of IP network planning and optimization, the value can be changed to a value in the range between 0-63. The value determines priority of IP packets related to 'Gold' service.
Silver	[Application protocol: SNMP, CDR, Syslog, LDAP] You can change the default value of 24 to suit the requirements of your IP network. As part of IP network planning and optimization, the value can be changed to a value in the range between 0-63. The value determines priority of IP packets related to 'Silver' service.
Bronze	[Application protocol: SSH] You can change the default value of 12 to suit the requirements of your IP network. As part of IP network planning and optimization, the value can be changed to a value in the range between 0-63. The value determines priority of IP packets related to 'Bronze' service.

7.1.4 Enabling CDRs

The ARM allows you to enable Call Detail Records (CDRs) containing information on all calls routed by the ARM, including source and destination users, call duration and the call path. CDRs are sent as Syslog packets to a server IP address that you need to configure.

➢ **To enable CDRs:**

1. Open the CDR page (**Settings** > **Network Services** > **CDR**).



2. Configure the parameters using the table below as reference.

Table 7-5: CDR Parameters

Setting	Description
Enabled	Select or clear the option to enable or disable CDRs.
Host	Enter the IP address of the server.
Port	Enter the server port.
Protocol	From the dropdown, select UDP (default) or TCP over which the CDRs will be sent.
Format	From the dropdown, select a format. You can select to have CDRs in clear text, JSON format, or in both.

See also Appendix G.

7.2 Call Flow Settings

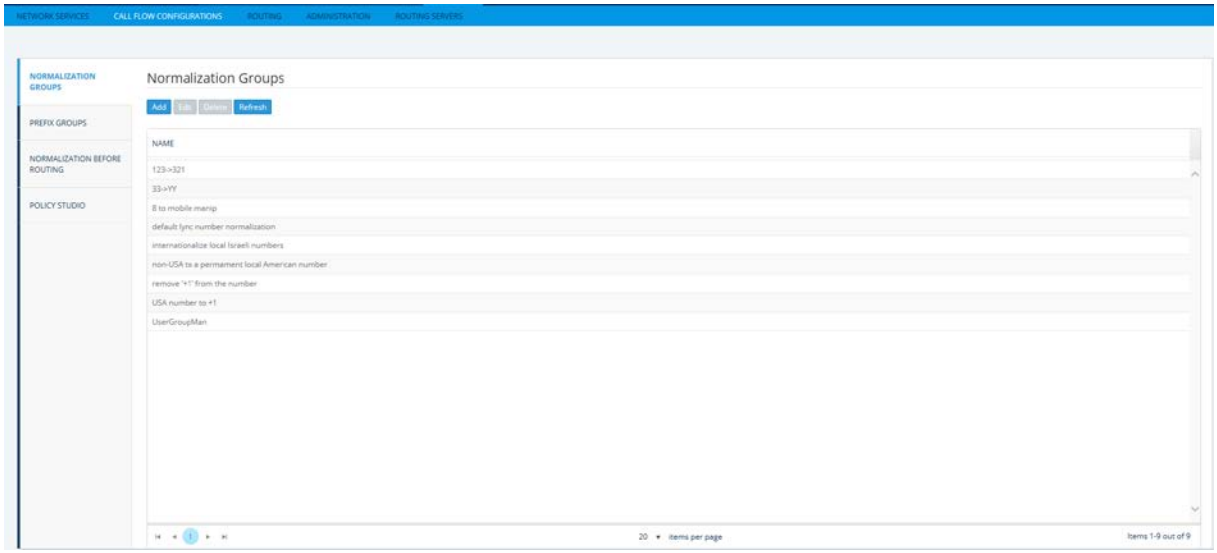
7.2.1 Adding a Normalization Group

You can add a Normalization Group. A Normalization Group can comprise one rule or multiple rules. If there are multiple rules in a group, manipulation is performed in the order the rules are listed. The output of the first rule will be the input of the next.

➢ **To add a Normalization Group:**

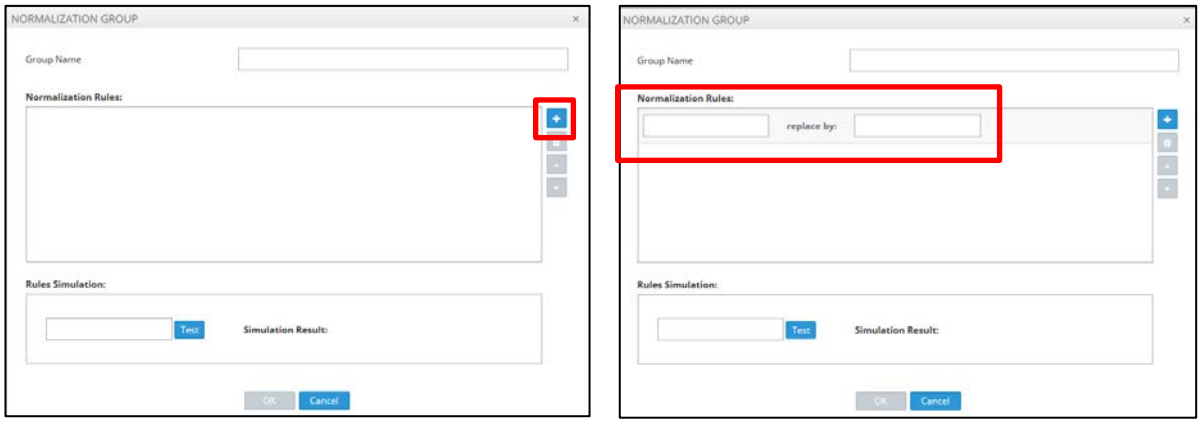
1. Open the Normalization Groups page (**Settings** menu > **Call Flow Configurations** tab > **Normalization Groups**).

Figure 7-6: Normalization Groups



2. Click **Add**.

Figure 7-7: Normalization Groups



3. Use the table below as reference.

Table 7-6: Normalization Groups

Setting	Description
Group Name	Enter a Group Name for intuitive future reference.
Normalization Rules	3 Click the **+** button adjacent to the pane as shown in the figure above. 4 In the left textbox, enter a regular expression. For more information about regular expressions, refer to online tutorials or see Appendix C. 5 In the **replace by** field, enter the text that will replace the found regex. You can use groups collected by brackets (…) in the regex in the replacement string using $1, $2,… See a regex tutorial for more information.
Rules Simulation: Test	Use the rules simulation to test different possible inputs and verify that the regex sequence you entered produces the result you intended. ▪ Enter any value you want to test and click **Test**; the result of each individual rule is displayed to the right; the result of all the rules together is displayed lowermost right.

Note: After a Normalization Group is defined, you can attach it to a:

- Peer connection (see Section 2.2.3.4).
- Globally (see Section 7.2.3)
- Routing Rule action (see Section 8.2)
- LDAP attribute (see Section 6.3)

Note: The same Normalization Group can be reused/attached several times in any of the above cases.

7.2.2 Adding/Editing a Prefix Group

This section shows how to make routing management and Dial Plan management easier, more efficient and more convenient for operators, using Prefix Groups. The Prefix Groups feature also makes it possible to import an existing customer's Dial Plan into the ARM using the northbound REST API.

Every routing rule can have scores of prefixes. Grouping prefixes and then associating groups with routing rules reduces visual complexity and allows for more effective management. Prefix Groups save operators from repeatedly having to add prefixes to rules.

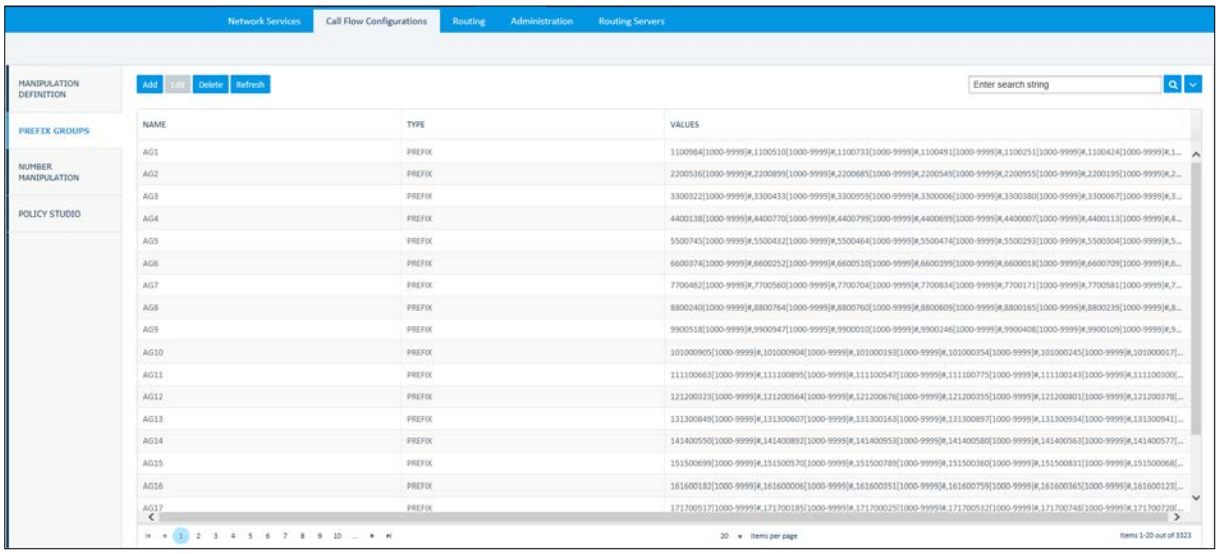
Once defined, the Prefix Group comprising multiple prefixes is associated with a routing rule (see Section 8.2 for information on how define a routing rule). If, for example, an enterprise has distributed offices, the following can be defined: If a caller calls from source prefix x, the call is sent from SBC 1; if a caller calls from source prefix 2, the call is sent from SBC 2.

Note: To develop a customer-specific Dial Plan into an ARM Prefix Group, the REST API is available. This can significantly facilitate ARM provisioning.

➢ **To add a Prefix Group:**

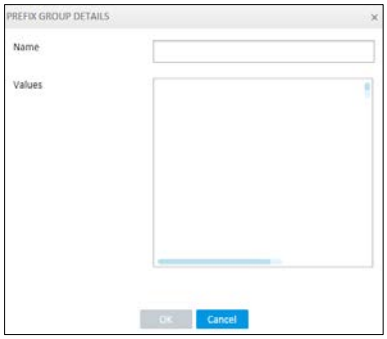
1. Open the Prefix Groups page (**Settings** menu > **Call Flow Configurations** tab > **Prefix Groups** item).

Figure 7-8: Prefix Groups



2. Click the **Add** icon.

Figure 7-9: Prefix Group Details



3. Configure the Prefix Group using Table 7-7 as reference.

Table 7-7: Prefix Group Details

Setting	Description
Name	Enter a name for the prefix group.
Values	Enter a Prefix or many prefixes and then click **Enter**. The syntax for prefixes in 'Prefix group' is the same as for a single prefix in a Routing rule. See also Appendix B.

4. Click **OK**; after creating a group, open the Routing page and associate the group with a rule's condition – it can be associated with Source, Destination or both.

7.2.3 Normalization Before Routing

This section shows how to apply a normalization rules group to a routing request's source user part and to a routing request's destination user part. See Section 7.2.1 for information on how to add a normalization rules group.

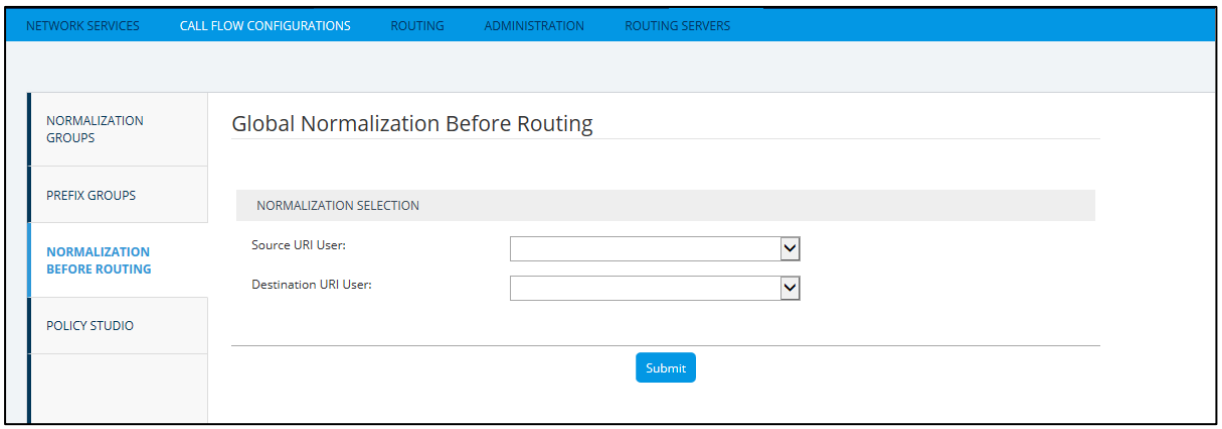
When the ARM receives a routing request, it normalizes the routing request's source user part with the chosen Normalization Group, and the routing request's destination user part with the chosen Normalization Group.

'Global Normalization Before Routing' parameters configured in this page are used globally for the entire network as pre-routing normalization. This global normalization can be overwritten at a Peer Connection level with other Normalization Rules if required (see under Section 2.2.3.4).

➢ **To attach a normalization rules group globally before routing:**

1. Open the Normalization Before Routing page (**Settings** menu > **Call Flow Configurations** tab > **Normalization Before Routing** item).

Figure 7-10: Normalization Before Routing



2. Use the table below as reference.

Table 7-8: Normalization Before Routing

Setting	Description
Source URI User	From the dropdown, select the normalization rules group. This will be the normalization on the Source URI User field.
Destination URI User	From the dropdown, select the normalization rules group. This will be the normalization on the Destination URI User field.

3. Click **Submit**.

7.2.4 Policy Studio

This feature allows adding information to route requests that is not contained in the route requests but is taken from the user table. To accomplish this with legacy products without ARM, the LDAP server must be queried for every call using complex query rules, creating delays and straining the server. In the ARM, the user table is loaded to memory and information gathering is handled internally in real time. Policy Studio Use Examples:

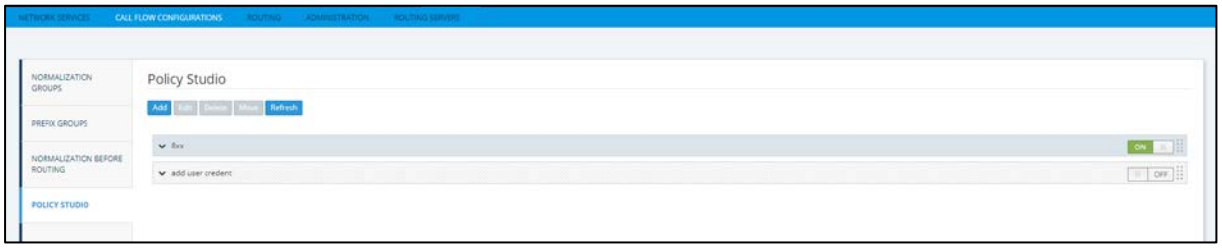
- Each user has an internal 4-digit extension and an unrelated external phone number. When a user makes a call outside the enterprise, the source number, i.e., the user's extension, must be replaced with their external number. When a call comes in from outside, the external number must be replaced with the user's extension.
- Same as the previous example but, in addition, there can be more than one user with the same extension, and what differentiates them is their hostname. The ARM can locate the user based on a combination of the extension and hostname attributes.

Policy Studio is a set of rules. Each rule contains a match condition and an action. The match condition is a set of route request fields to be compared, and a set of user properties to be compared to. The match condition also has a source node or Peer Connection or set of source nodes or Peer Connections. The action is a set of route request or response fields to be replaced, and a set of user fields to replace them with. For every route request received, the ARM processes all the rules from top to bottom. For each, the ARM searches in the users table for a user that matches all the fields. If a user is not found, the ARM proceeds to the next rule. If a user is found, the ARM stops parsing the rules and performs the action in this rule. The action is to replace all the listed fields with the properties of the user, as configured.

➢ **To add a Policy Studio rule:**

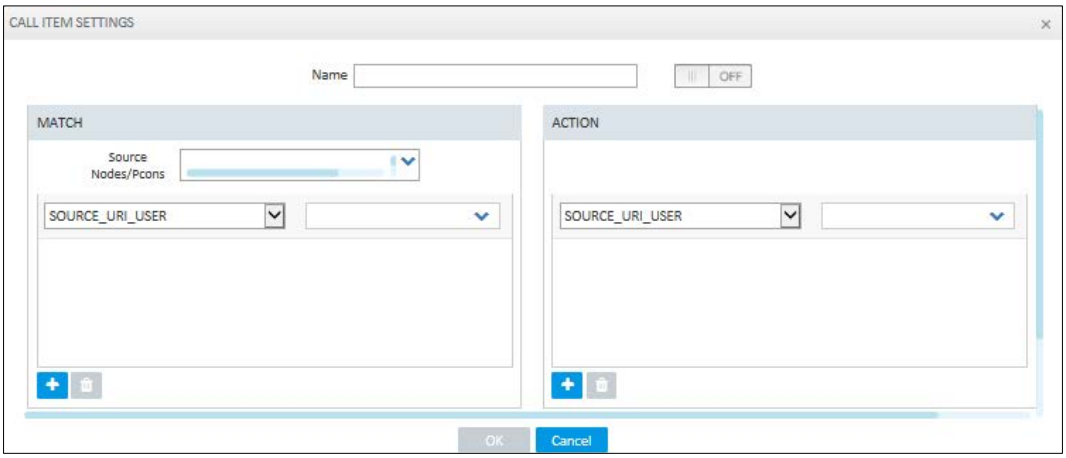
1. Open the Policy Studio page (**Settings** menu > **Call Flow Configurations** tab > **Policy Studio** item).

Figure 7-11: Policy Studio



2. Click **Add**.

Figure 7-12: Policy Studio Settings



3. Configure the settings using the table below as reference.

Table 7-9: Policy Studio Settings

Setting	Description
Name	Defines the name of the Policy Studio rule to add, to facilitate management of the feature.
MATCH	The set of match conditions for finding a user from the Users table. Click **+** to add more conditions.
Source Nodes / Peer Connections	Select a Node or Peer Connection - or set of Nodes or Peer Connections - for which this rule will be used. If left empty, the rule is used regardless of the origin of the call.
Request field	Select a route REQUEST field from the following available fields (this is a field from the route REQUEST that is compared with the user properties): ▪ SOURCE_URI_USER ▪ SOURCE_URI_HOST ▪ DEST_URI_USER ▪ DEST_URI_HOST ▪ CONTACT_URI_USER ▪ CONTACT_URI_HOST ▪ CONTACT_URI_HOST If a call matches the selected criterion, the manipulative action you select below will be performed. For a SIP field manipulation example, see Example 2 under Section 7.2.4.2 below.
Action	The set of replacement actions that will be performed on the route request and route response fields for a found user.
Action field	Select a route request or route response field from the following available fields (when a user is found, this field will be replaced with the value of the configured user properties): ▪ SOURCE_URI_USER ▪ SOURCE_URI_HOST ▪ DEST_URI_USER ▪ DEST_URI_HOST ▪ DEST_IP_ADDR ▪ DEST_PORT ▪ DEST_PROTOCOL [the P-ASSERTED_IDENTITY_USER will be

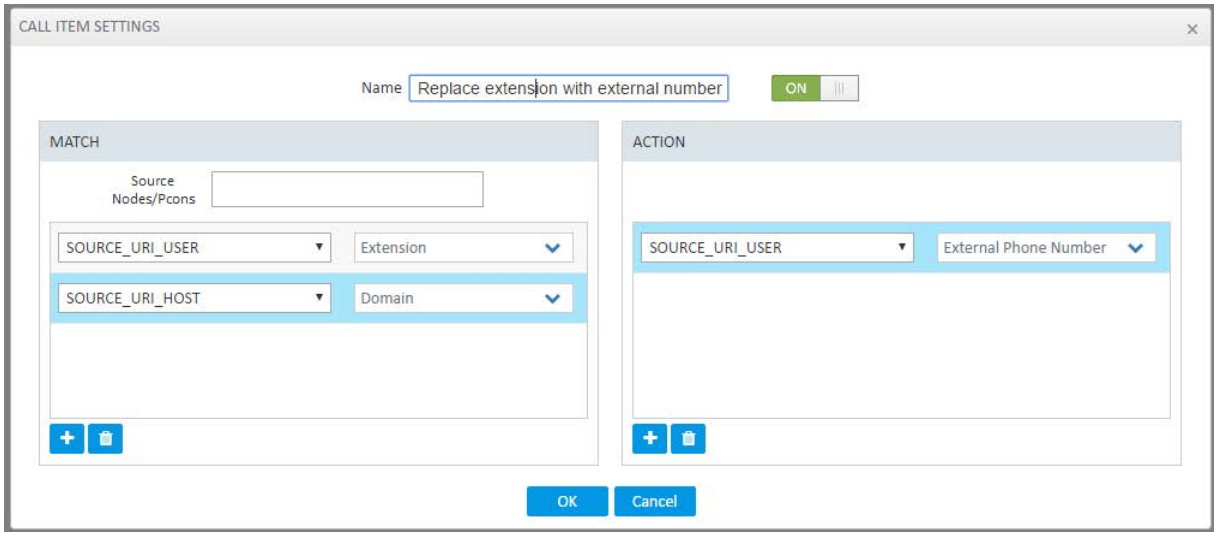
Setting	Description
	replaced by company site main number P-ASSERTED_IDENTITY_DISPLAY_NAME] ▪ USER_CREDENTIALS_USER_NAME ▪ USER_CREDENTIALS_PASSWORD Multiple actions can be defined. Click **+** to define another action. **Note**: If either USER_CREDENTIALS_USER_NAME *or* USER_CREDENTIALS_PASSWORD is used in an action, you must add *both*. For a SIP field manipulation example, see Example 2 under Section 7.2.4.2 below.
Request User Property	Select a set of user properties. The request field is compared to these properties of the users. If any of the properties of a user is equal to the value of the field, then this condition is considered a match.
Replacement User Property	Select a set of user properties. The action is to replace the value in the request or response field with the value of this user property. If the found user has no value for this property, then no action is done on this field. If there more than one property is listed here, then ARM replaces the field with the first property if the user has it. If the user does not have it, ARM proceeds to the next property in the list, in the configured order.

7.2.4.1 Example 1 of a Policy Studio Rule

Refer to the defined Policy Studio rule shown in Figure 7-13 below:

- For every route request, ARM will search for a user whose *extension* property is equal to the value of the SOURCE_URI_USER field and whose *domain* property is equal to the SOURCE_URI_HOST field.
- ARM will then replace the SOURCE_URI_USER field with the value of the found user's *external phone number* property.

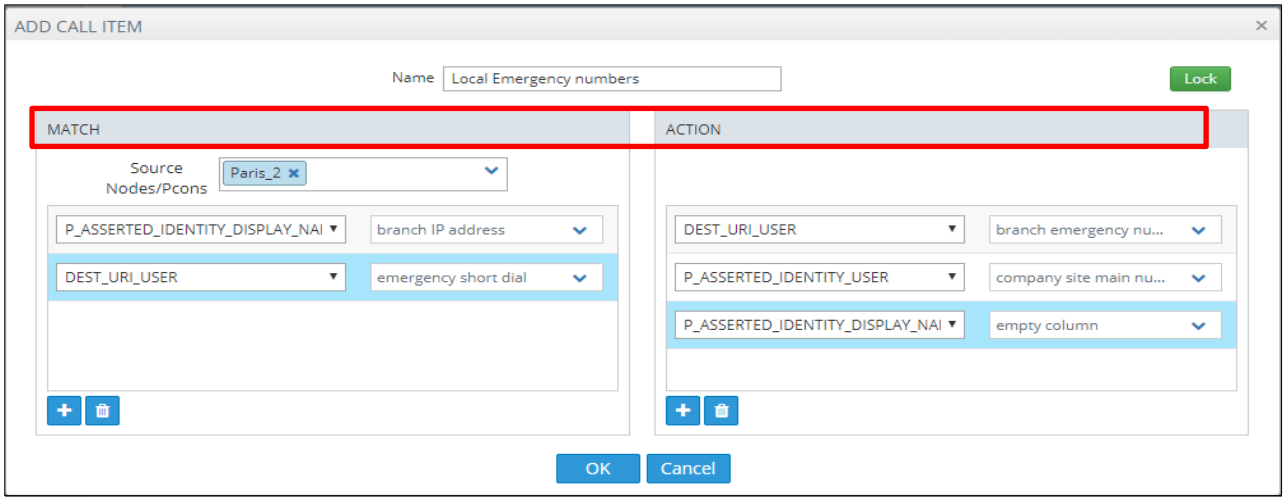
Figure 7-13: Policy Studio Rule Example 1



7.2.4.2 Example 2 of a Policy Studio Rule

The ARM's Policy Studio Rule allows you to manipulate a rule to provide Location Based Emergency calls routing in a CCE environment with ARM capabilities. Refer to the defined Policy Studio Rule shown in Figure 7-14 below:

Figure 7-14: Policy Studio Rule Example 2



In the rule above.

- The node sends a route request to the ARM. The request includes the two fields under MATCH and the values configured for them; if one and/or the other exists and their values are those configured, then the manipulations configured under ACTION will be used in response to the route request:
  - DEST_URI_USER will be replaced by *branch emergency number*
  - P-ASSERTED_IDENTITY_USER will be replaced by *company site main number*
  - P-ASSERTED_IDENTITY_DISPLAY_NAME will be replaced by *empty column*

7.3 Routing Settings

7.3.1 Configuring Criteria for a Quality Profile

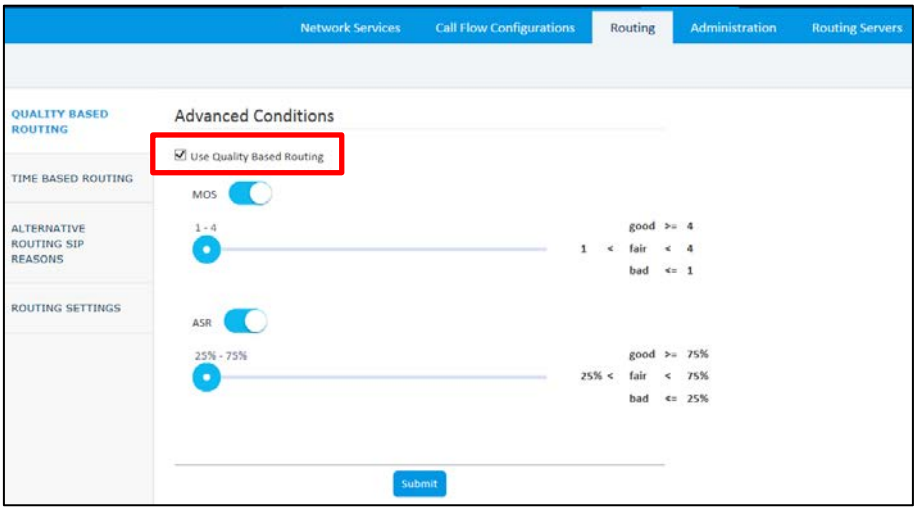
You can configure criteria for a quality profile for bad, fair or good call paths based on the calculation of MOS and ASR. You can configure a specific Peer Connection to exclude either the MOS or the ASR criterion (see Section 2.2.3.4). After enabling 'Use Quality Based Routing' (see the figure below), the quality status of Peer Connections and Connections will be displayed in the network map's Quality Layer. The configured quality profile can be associated with a Routing Rule (see Section 8.2) which will be applied only if all Peer Connections and Connections in the route meet the criteria.

Note: The quality of voice on a line is calculated based on the quality of voice measured in multiple calls over a period. The ARM issues alarm indications for quality change.

➢ **To configure a quality based routing condition:**

1. Open the Advanced Conditions screen (**Settings** > **Routing** > **Quality Based Routing**). By default, **Use Quality Based Routing** is selected. If it isn't, select it.

Figure 7-15: Configuring Criteria for a Quality Profile



2. Activate either MOS, ASR or both and then configure criteria by dragging the range indicators to the lower and upper limit you require. Use the table below as reference.

Table 7-10: Configuring Criteria for a Quality Profile

Quality Condition	Description
MOS (Mean Opinion Score)	Specified by ITU-T Recommendation P.800, MOS is the average grade on a quality scale of Good to Failed, given to voice calls made over a VoIP network, after testing. MOS-LQ = listening quality, i.e., the quality of audio for listening purposes; it doesn't take bi-directional effects, such as delay and echo into account. MOS-CQ = conversational quality; it takes listening quality in both directions into account, as well as the bi-directional effects.
ASR (Answer-Seizure Ratio)	Measurement of network quality and rate of successful calls. % of answered calls relative to the total call volume.

3. Click **Submit**; a quality profile is generated which you can associate with a Routing Rule (see Section 8.2).

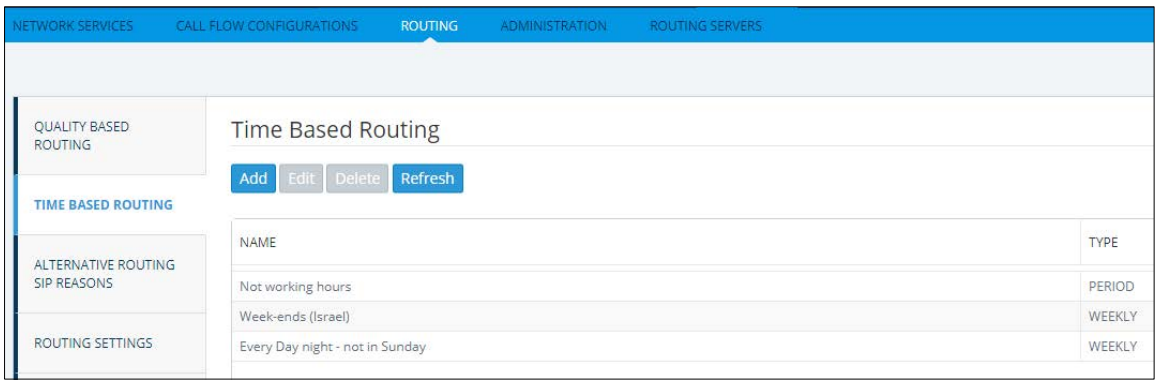
7.3.2 Configuring a Time-Based Routing Condition

The time-based routing feature allows you to configure a routing rule activated only at the time specified in a time condition. You can configure a condition and then associate it with a routing group or a routing rule, or both (see Section 8.2 under 'Advanced Conditions').

➢ **To configure a time-based routing condition:**

1. Open the Time-Based Routing screen (**Settings** > **Routing** > **Time Based Routing**).

Figure 7-16: Time Based Routing



2. Add a time-based routing condition: Click **Add**; the Time Condition screen is displayed.

Figure 7-17: Time Condition

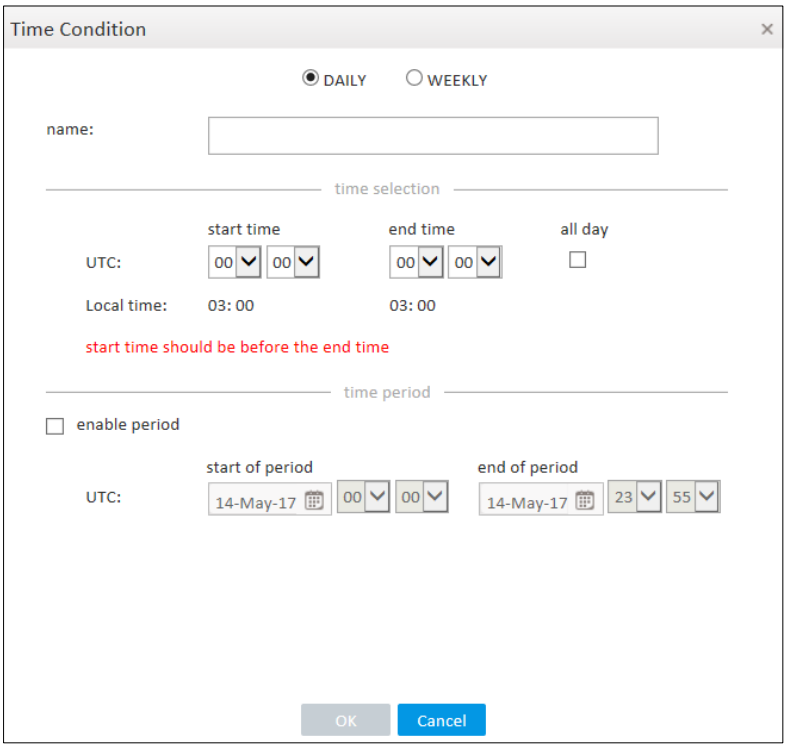
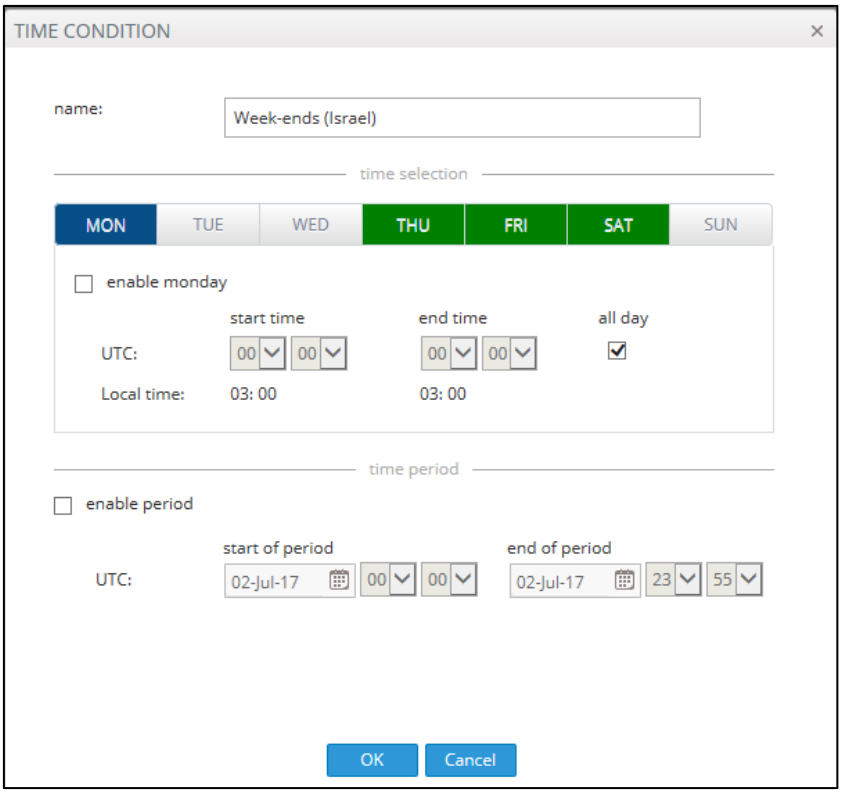


Figure 7-18: Time Condition - Example



3. Configure a time-based routing condition. Use the table below as reference. See the figure above for an example.

Table 7-11: Time Condition

Time Condition	Description
Daily/Weekly	Select either **Daily** or **Weekly**. **Daily** - This is a daily recurring period. **Weekly** - This is a period recurring on given days of the week. The figure above shows a configured weekly condition. Green 'day' button: activated on that day. Blue 'day' button: selected to configure it.
Name	Enter an intuitive name to later easily identify the condition when applying it.
Start time	From the dropdowns, select the hour and the minutes past the hour. The times are configured in UTC (Coordinated Universal Time).
End time	From the dropdowns, select the hour and the minutes past the hour
All day	Select this option to base the routing condition on the entire day.
Enable period	Select this option to base the routing condition on a period.
Start of period	From the calendar icon, select the date on which the period will start. From the dropdowns, select the hour and the minutes past the hour.
End of period	From the calendar icon, select the date on which the period will end. From the dropdowns, select the hour and the minutes past the hour.

4. Click **OK**; a profile is generated which you can associate with a Routing Rule (see Section 8.2 under 'Advanced Conditions'). Also, you can associate the configured time condition with a Routing Group. In this case, it will apply to *all* Routing Rules in the Group. Note that the same time condition profile can be reused multiple times.

7.3.3 Configuring SIP Alternative Route Reason

The ARM operator can configure SIP responses in the SIP Alternative Route Reason page, which will cause the ARM to apply alternative routing paths if available.

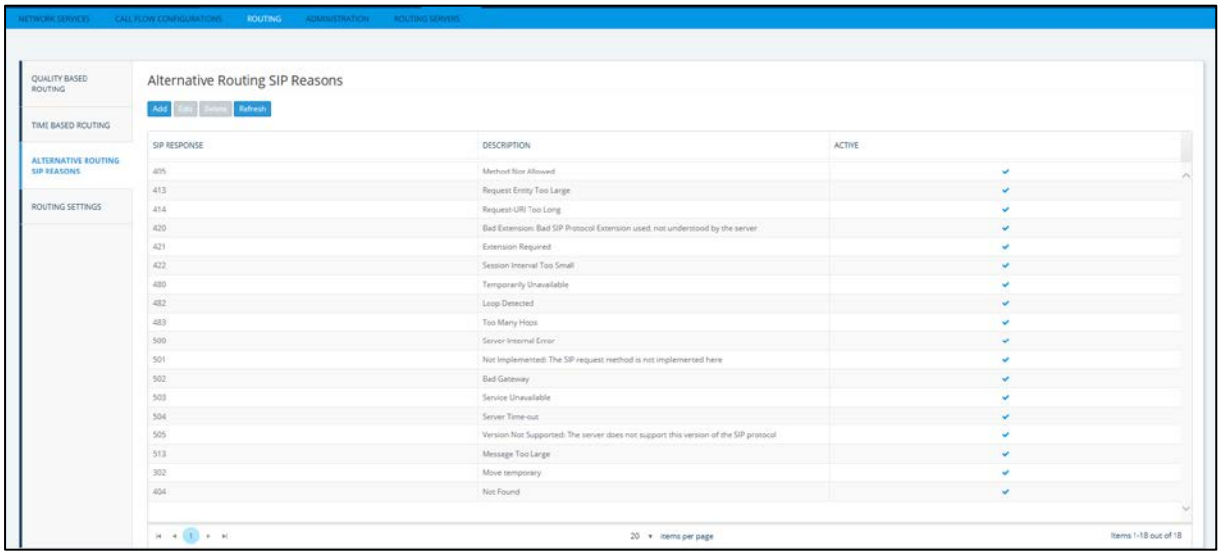
Note: If a call fails and the SIP response received from the remote side is not configured in the SIP Alternative Route Reason page, the ARM will not apply an alternative route for the call.

The page allows operators to change the default ARM behavior for an Alternative Routing decision.

➢ **To configure a SIP Alternative Route Reason:**

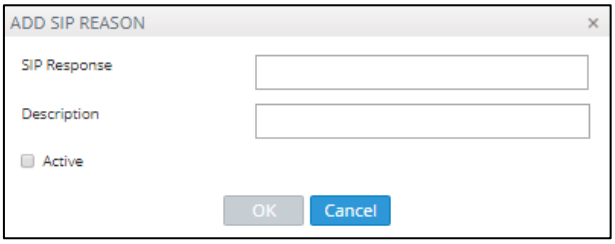
1. Open the Alternative Routing SIP Reasons page (**Settings** > **Routing** > **Alternative Routing SIP Reasons**).

Figure 7-19: Alternative Routing SIP Reasons Page



2. Click the **Add** tab.

Figure 7-20: Adding an Alternative Routing SIP Reason



3. Enter the SIP Response number (200-600).
4. Provide a description of the reason.
5. Select the **Active** option to activate the configuration.
6. Click the now-enabled **OK** button.

➢ **To edit a SIP Alternative Route Reason:**

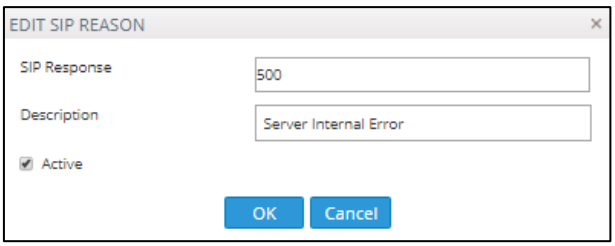
1. In the Alternative Routing SIP Reasons screen, select the SIP response to edit.

Note:

- SIP responses are listed in numerical order.
- You can browse to the next page or to the last page of responses.
- You can browse to the page before the page you are on, if you're not on the first page, or you can browse to the first page.

2. Click **Edit**.

Figure 7-21: Editing an Alternative Routing SIP Reason



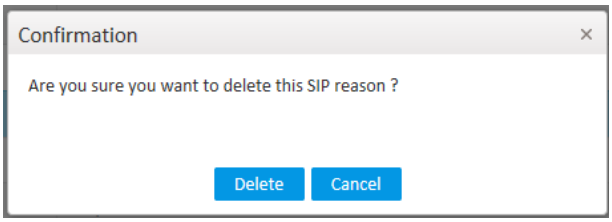
3. Edit according to your requirements and click **OK**.

Note: By clearing the 'Active' option, the operator can 'deactivate' a SIP reason without deleting its row in the table. If a SIP reason is 'deactivated', the ARM will not apply an alternative route. The ARM will function as if there is no row at all. The 'deactivated' row, however, remains in the table, and if the operator redecides, it can be 'reactivated' by selecting the 'Active' option.

➢ **To delete a SIP Alternative Route Reason:**

1. In the Alternative Routing SIP Reasons screen, select the SIP response to delete.

Figure 7-22: Deleting an Alternative Routing SIP Reason



2. Click **Delete**.

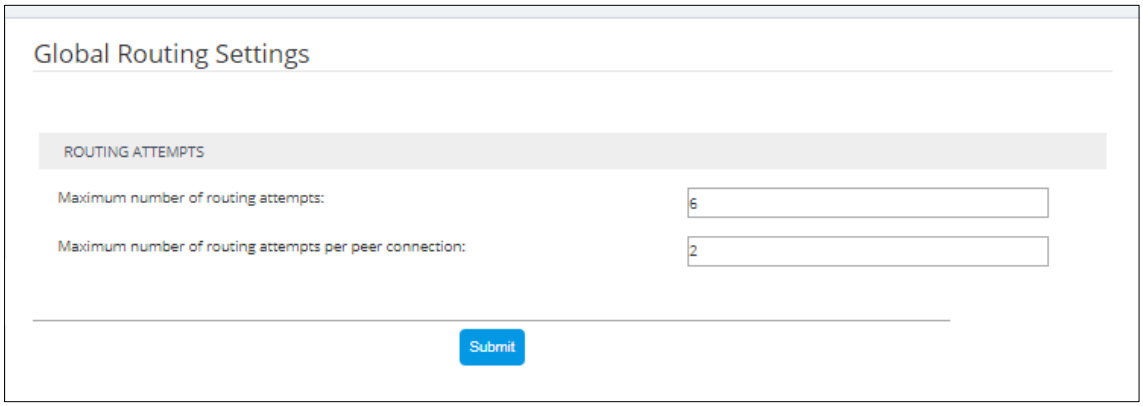
7.3.4 Configuring Global Routing Settings

This section shows how to configure global routing settings.

➢ **To configure global routing settings:**

1. Open the Routing Settings page (**Settings** menu > **Routing** tab > **Routing Settings** item).

Figure 7-23: Global Routing Settings



2. Configure the parameters using the table below as reference.

Table 7-12: Routing Settings

Setting	Description
Maximum number of Routing Attempts	Defines the maximum number of routing attempts per call. If the maximum number of routing attempts has not yet been reached, the ARM searches for an alternative routing possibility for the specific call.
Maximum number of routing attempts per Peer Connection	Defines the maximum number of routing attempts per Peer Connection. If the maximum number of routing attempts has not yet been reached, the ARM tries to re-route the call to a preferable Peer Connection. Default: 2 attempts.

3. Click **Submit**.

7.4 Administration Settings

This section shows how to perform administrative tasks:

- Configure a software license (see the section below)
- Manage security (see Section 7.4.3)
- Add an operator (see Section 7.4.4)

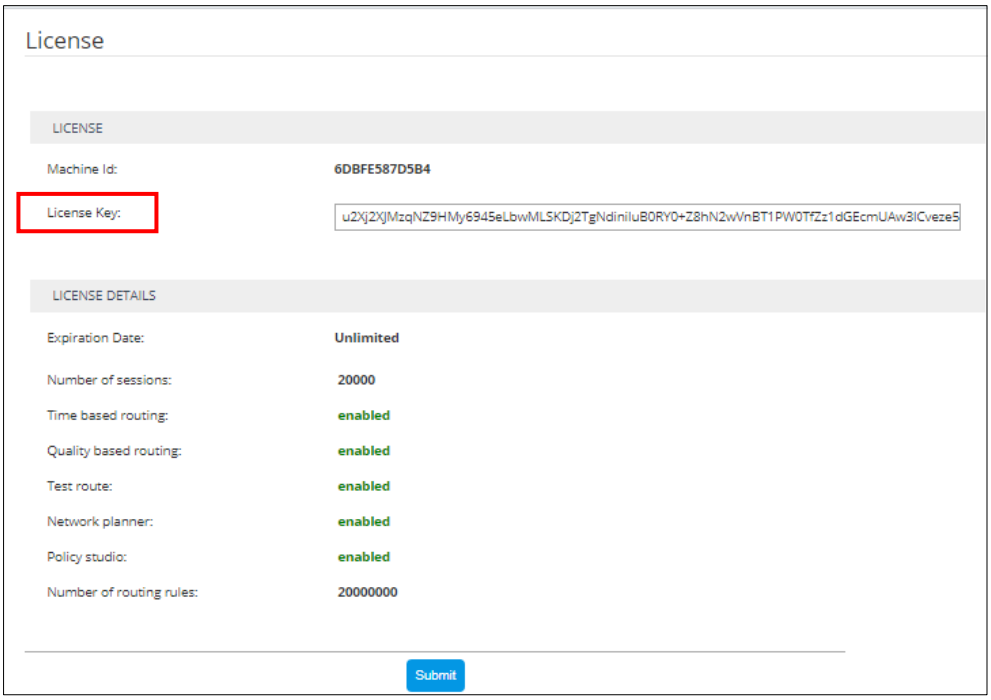
7.4.1 Activating Your License

The ARM must be licensed with a valid license for the product to become fully operational. This section shows how to activate your license.

➢ **To activate your license:**

1. Open the License page (**Settings** menu > **Administration** tab **License** item).

Figure 7-24: License Page



2. Select and copy the 'License Key' shown in red in the figure above.
3. Activate the product through the AudioCodes License Activation tool at www.audiocodes.com/swactivation. You'll need your Product Key and the Configurator's Machine ID for the activation process. An email will subsequently be sent to you with your License Key.
4. Copy and paste the License Key string that AudioCodes sends you into the 'License Key' field, and then click **Submit**; the number of sessions purchased and the license expiry date are displayed.
5. Make sure the license details (the number of sessions purchased and the license's expiry date) match those that you purchased.

7.4.2 Viewing License Details

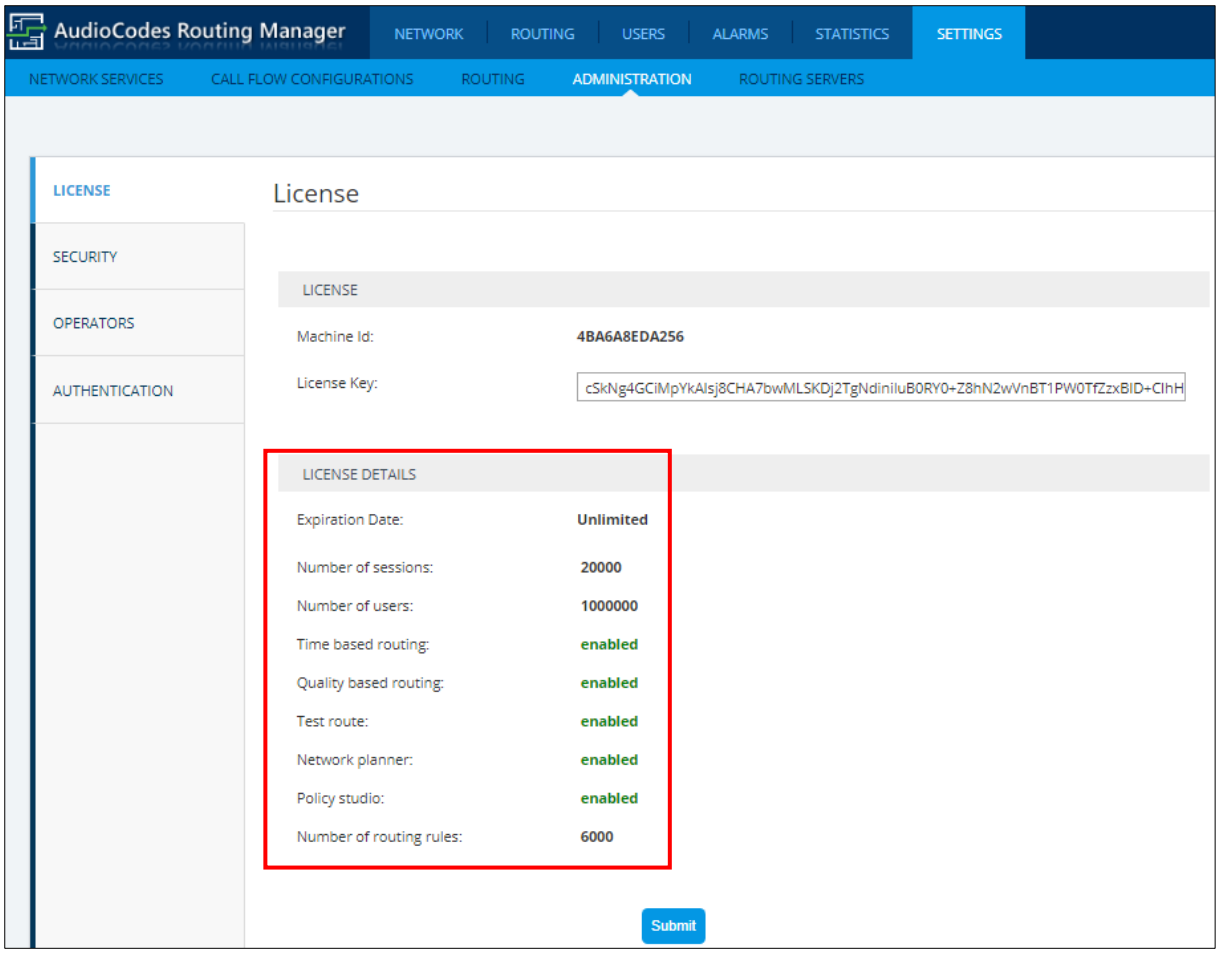
License policy is based on the following aspects of ARM functionality and capacity:

- Expiration Date
- Number of Sessions
- Number of Users
- Number of Routing Rules
- Tune Based Routing (can be either enabled or disabled)
- Quality Based Routing (can be either enabled or disabled)
- Test Route (can be either enabled or disabled)
- Network Planner (can be either enabled or disabled)
- Policy Studio (can be either enabled or disabled)

➢ **To view information about the license applied to your ARM:**

- Open the the License Details page (**Settings** > **Administration** > **License**).

Figure 7-25: License Details



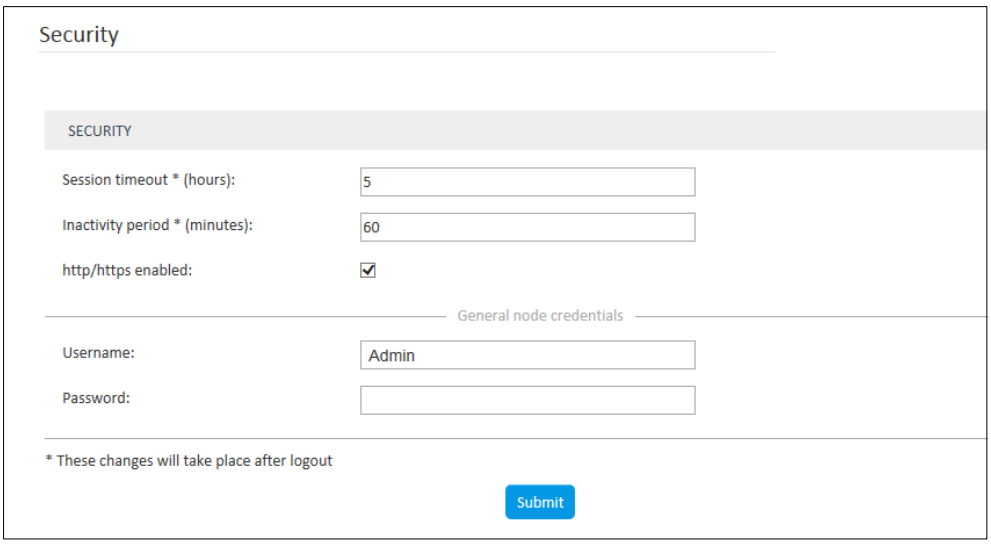
7.4.3 Securing the ARM

This section shows how to secure the ARM.

➢ **To secure the ARM:**

1. Open the Security page (**Settings** menu > **Administration** tab **Security** item).

Figure 7-26: Security Page



2. Use the table below as reference.

Table 7-13: Security Settings

Setting	Description
Session timeout (hours)	Closes the session timeout and forces the user to reenter their password (to reopen the session) if the timeout you define (in hours) expires. Note that this setting only takes effect after logging out and then re-logging in.
Inactivity period (minutes)	Suspends the user's account if the user does not log in to the ARM over the period you define. **0** disables the feature; users accounts will then never be suspended due to inactivity. Note that this setting only takes effect after logging out and then re-logging in.
http/https enabled	Enables an HTTP/HTTPS connection between the ARM server and the SBC / Gateway.
General Node Credentials	
Username	Username and Password are the default credentials that ARM uses when communicating with the node. Default: Admin/Admin. The ARM uses this Username if in the EDIT NODE screen (see above for more information), you select **Use general credentials**. Change the Username only if the credentials of the node aren't Admin/Admin.
Password	Username and Password are the default credentials that ARM uses when communicating with the node. Default: Admin/Admin. The ARM uses this Password if in the EDIT NODE screen (see above for more information), you select **Use general credentials**. Change the Password only if the credentials of the node aren't Admin/Admin.

3. Click **Submit**; the security configuration is saved.

7.4.4 Provisioning Operators

Operators, i.e., network administrators or IT managers, and operator credentials can be provisioned in two ways:

- Using the ARM's Operators page's – see the section below.
- Using the enterprise's LDAP server – see Section 7.4.4.1

If LDAP is used, the order will be:

- LDAP
- Local storage (database)

If an LDAP server is used but it is down or the operator can't be authenticated with it because either the operator isn't found or the password doesn't match, the local operators table is used.

The two ways of provisioning operators therefore coexist with one another.

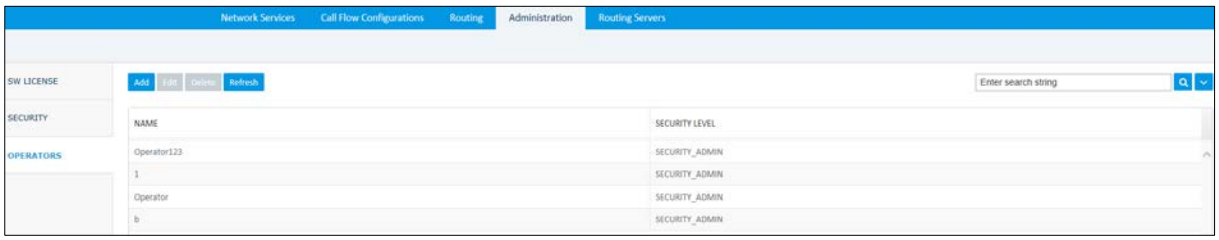
7.4.4.1 Manually Provisioning an Operator in the ARM's Operators Page

This section shows how to manually provision operators using the ARM's Operators Page.

➢ **To manually add an operator:**

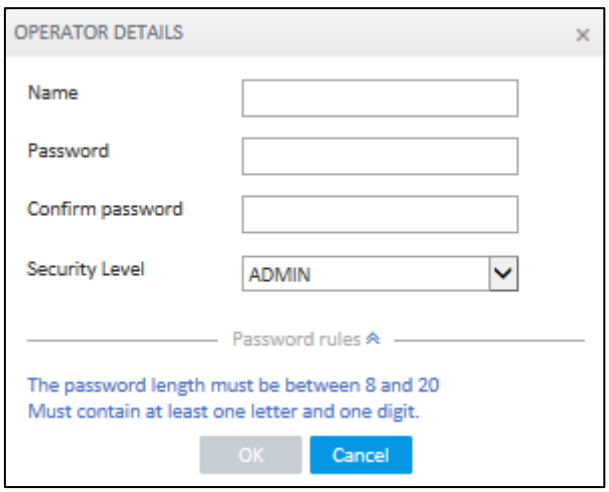
1. Open the Operators page (**Settings** menu > **Administration** tab **Operators** item).

Figure 7-27: Operators



2. Click **Add**.

Figure 7-28: Operator Details



3. Configure the operator details using the table below as reference.

Table 7-14: Operator Details

Setting	Description
Name	Enter a name for the operator to log in with.
Password	Enter a password for the operator to log in with.
Password confirm	Confirm the password.
Security Level	Select a Security Level for the operator: **ADMIN** or **SECURITY_ ADMIN**. **ADMIN** cannot (for example) change passwords, add or change operators, or perform licensing.

4. Click **OK**; the operator is added to the local ARM database.

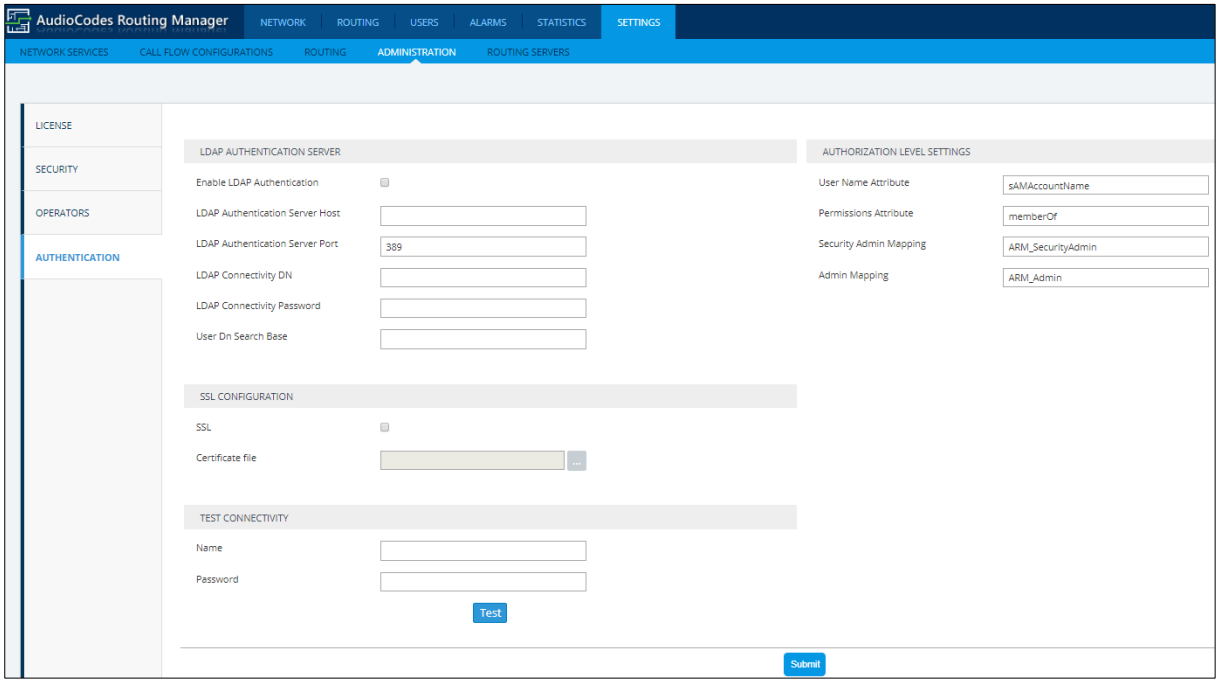
7.4.4.2 Provisioning Operators using an LDAP Server

ARM allows using the enterprise's LDAP server for operator login authentication. This feature is *in addition to* local operator login authentication described in the previous section.

➢ **To add an LDAP operator login authentication server:**

1. Open the Authentication page (**Settings** > **Administration** > **Authentication**).

Figure 7-29: Authentication Page



Note: Only operators with a security level of **Admin** can edit LDAP authentication server parameters.

2. Configure the LDAP Authentication Server parameters using the table below as reference.

Table 7-15: LDAP Authentication Server Parameters

Parameter	Description
Enable LDAP Authentication	Select or clear this option to enable or disable operator login authentication using an LDAP-compliant authentication server.
LDAP Authentication Server Host	Enter the IP address of the LDAP server's host.
LDAP Authentication Server Port	Enter the LDAP server's port number. Default: 389
LDAP Connectivity DN	Configure the 'LDAP Connectivity DN' parameter as required.
LDAP Connectivity Password	Configure the 'LDAP Connectivity Password' as required.
User DN Search Base	Configure the 'User DN Search Base' as required.

3. Configure the SSL parameters to secure the connection to the LDAP server, using the table below as reference.

Table 7-16: SSL Parameters

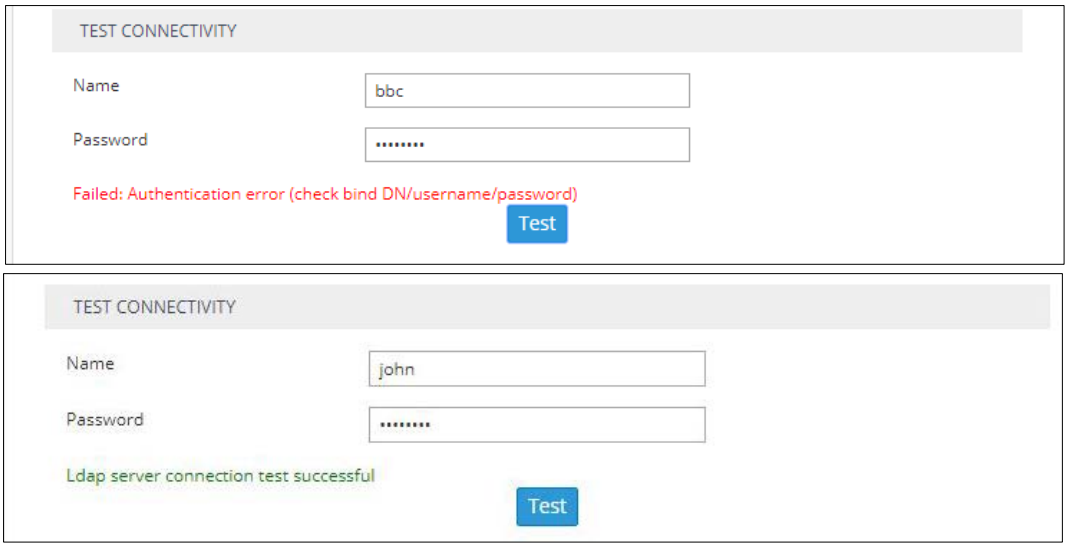
Parameter	Description
SSL	Select the 'SSL' option to secure the connection with the LDAP server over SSL. If left unselected (default), the connection with the LDAP server will be non-secured.
Certificate file	Click the 'Certificate file' browse button to browse to and select the certificate file that you want to use to secure the connection with the LDAP server over SSL. If SSL is selected and a certificate is also selected, an HTTPS connection between the ARM and the LDAP server will be opened. The ARM authenticates the SSL connection using the certificate.

4. Configure the Test Connectivity parameters to test the connection to the LDAP server. Use the table below as reference.

Table 7-17: Test Connectivity

Parameter	Description
Name	If 'Name' is undefined (empty), the connectivity test checks if the LDAP authentication server can be logged into according to the values defined under the 'LDAP Authentication Server' parameters described in Table 7-15 above. If you enter a user name, the connectivity test checks that it's valid for logging into the ARM. Enter the user name assigned to the LDAP server.
Password	If 'Password' is undefined (empty), the connectivity test checks if the LDAP authentication server can be logged into according to the values defined under the 'LDAP Authentication Server' parameters described in Table 7-15 above. If you enter a user password, the connectivity test checks that it's valid for logging into the ARM. Enter the password required for accessing the LDAP server.

Figure 7-30: LDAP Connectivity Test Result



5. View the result of the LDAP server connectivity test; the figure uppermost shows a failed test while the lowermost figure shows a successful connection.
6. Under the page section 'Authorization Level Settings', you can provide mapping of the ARM's access rules (‘Security Admin’ and ‘Admin’) into the LDAP server’s values. Use the table below as reference.

Table 7-18: Test Connectivity

Parameter	Description
User Name Attribute	The name of the LDAP-complaint server's directory | folder in which the enterprise's user names are located. Default: sAMAccountName. When the operator logs in, the authentication feature checks *in this directory* | *folder* that the operator's name exists.
Permissions Attribute	The name of the LDAP-complaint server's directory | folder in which the permissions are located. Default: memberOf. When the operator logs in, the authentication feature checks *in this directory* | *folder* if they have permission to log in.
Security Admin Mapping	The name of the LDAP-complaint server's directory | folder in which the ARM's access rule is mapped. Default: ARM_SecurityAdmin. When the operator logs in, the authentication feature checks *against this directory* | *folder* if login is allowed or not.
Admin Mapping	The name of the LDAP-complaint server's directory | folder in which the ARM's access rule is mapped. Default: Default: ARM_Admin. When the operator logs in, the authentication feature checks *against this directory* | *folder* if login is allowed or not.

If LDAP authentication is enabled, the order used to authenticate operator login is:

- LDAP
- Local storage (Database)

If the LDAP server is down or if the operator can't be authenticated with the LDAP server because either the operator isn't found or the password doesn't match, the local operators table is used.

7. Click **Submit**.

7.5 Adding a Routing Server

This section shows how to add a Routing Server. ARM Version 8.0 supports up to 10 Routing Servers.

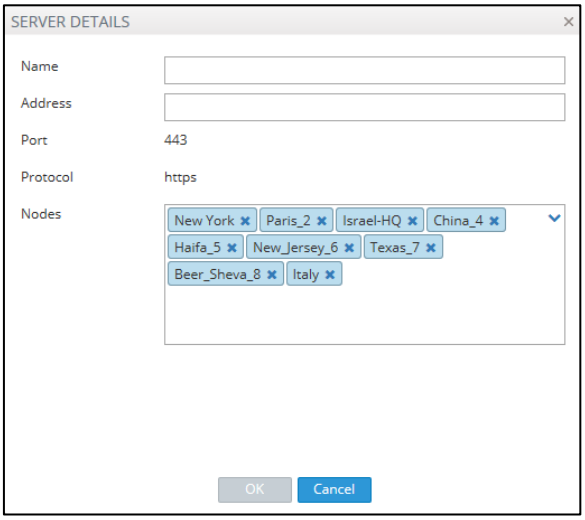
➢ **To add a Routing Server:**

1. Open the Routing Servers page (**Settings** menu > **Routing Servers** tab).

Figure 7-31: Routing Servers

2. Click **Add**.

Figure 7-32: Server Details



The ARM operator can edit the Nodes list when adding the new router. After it's added, the operator can connect or disconnect the Node to/from a specific router via the node's Properties (see Figure 2-10 and the description under Section 2.2.3.1). A node can also be associated with Routers from the node's Edit action (see also Section 2.2.3.1)

3. Configure the routing server using Table 7-19 below as reference.

Table 7-19: Routing Server Details

Setting	Description
Name	Enter a name for the ARM Router (routing server).
Address	Enter the IP address or host name for the ARM Router (routing server).
Port	[Read only] ARM Router (routing server) port number. Default: 443
Protocol	[Read only] HTTPS
Nodes	Allows you to specify to which Nodes (SBCs/Gateways) the routing server will be added. Only possible when *adding* a routing server, not when *editing*.

4. Click **OK**; the routing server is added.

7.5.1 Editing a Routing Server

This section shows how to edit a routing server.

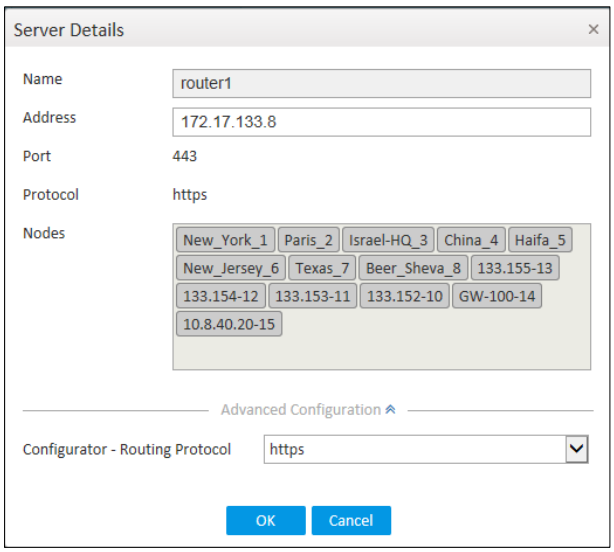
➢ **To edit a Routing Server:**

1. Open the Routing Servers page (**Settings** menu > **Routing Servers** tab).

Figure 7-33: Routing Servers

2. Select the row of the routing server to edit, and then click **Edit**.

Figure 7-34: Server Details



3. Configure the server details using the table below as reference.

Table 7-20: Server Details

Setting	Description
Name	[Read-only] The name of the ARM Router (routing server).
Address	Enter the IP address or host name for the ARM Router (routing server).
Port	[Read only] ARM Router (routing server) port number. Default: 443.
Protocol	[Read only] HTTPS
Nodes	[Read only] The Nodes (SBCs or Gateways) to which the router was added.
Advanced Configuration	
Configurator – Routing	To display this parameter, click ⌄⌄ adjacent to Advanced Configuration. From the dropdown, select the protocol between the Configurator and the Router (HTTP or HTTPS). Default: HTTPS. HTTP can temporarily be used for debugging purposes.

7.5.2 Locking/Unlocking a Routing Server

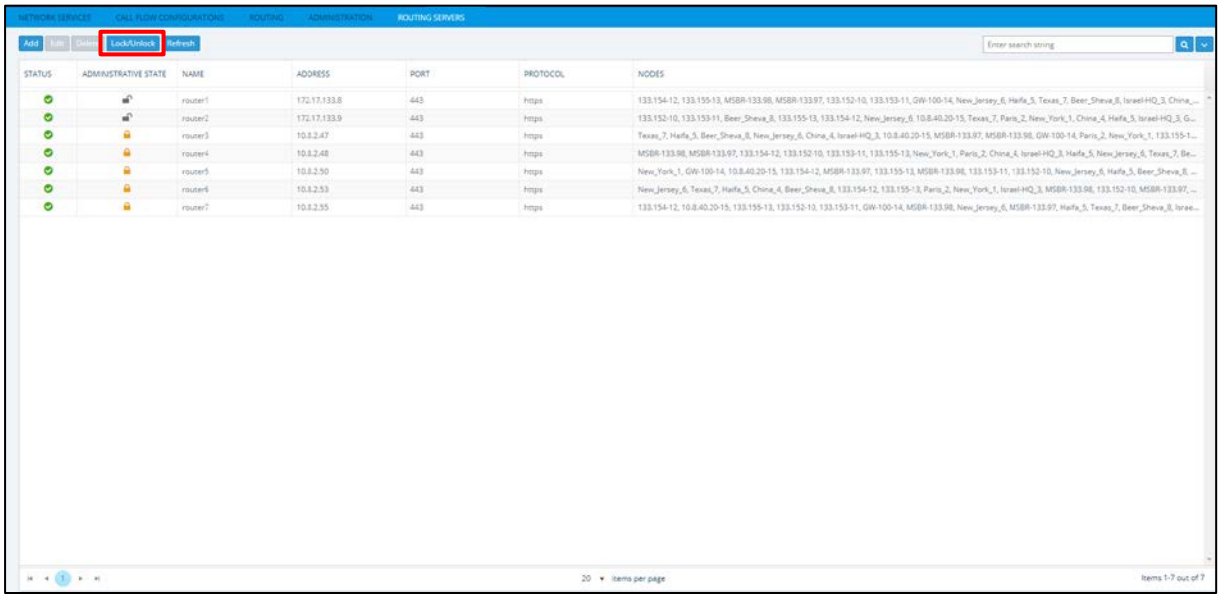
The ARM allows users to lock routing servers, for troubleshooting or maintenance purposes. Locking a routing server causes the devices to disconnect from the locked routing server, causing all traffic to divert to the other unlocked and available servers. Unlocking a routing server causes the devices to reconnect, and makes the routing server fully functional.

A locked routing server can also be associated with ARM Nodes without participation in calls routing. This can be useful during the preparation phase for network setup.

➢ **To lock or unlock a Routing Server:**

1. Open the Routing Servers page (**Settings** > **Routing Servers**).

Figure 7-35: Routing Servers - Administrative State



2. Determine from the icon under the 'Administrative State' column whether a routing server is locked or unlocked, and then click the **Lock / Unlock** button.

   An unlock performs a restart of the Routing Manager software. The action takes a few seconds, during which time the Routing Manager is unavailable due to the restart.

   A lock action is immediate.

   These actions can be applied to any particular ARM router. The functionality lets you gracefully take a router temporarily out of service. A locked router responds to all keep-alive and login requests, from all nodes, with a standard 'Service Unavailable' HTML error. This behavior causes all nodes to be disconnected from the router, effectively taking the router out of service. The router still responds to any other request from the nodes or the configurator, which makes the lock action graceful since calls, statistical calculations and software upgrades are unaffected.

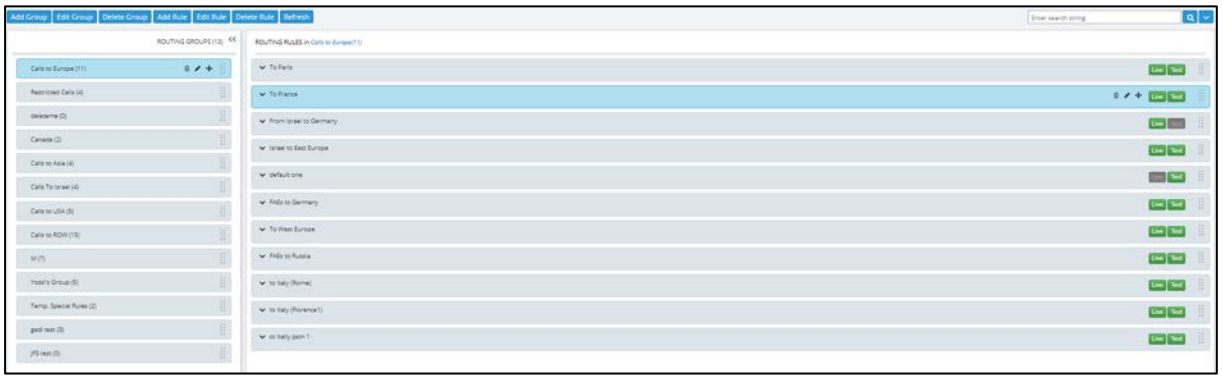
8 Defining Calls Routing

The ARM lets IT managers, responsible for enterprise VoIP, define call routing. ARM routing provides a comprehensive call routing solution for a telephony network.

➢ **To define calls routing:**

- Open the Routing page ('Routing' menu); the page opens under the **Routing Groups** tab by default.

Figure 8-1: Routing – Routing Groups



➢ **Follow this procedure when defining calls routing policy (ARM Dial Plan):**

1. Add a new Routing Group (see Section 8.1)
2. Add a new Routing Rule (see Section 8.2)
3. Test the route (see Section 3.6)

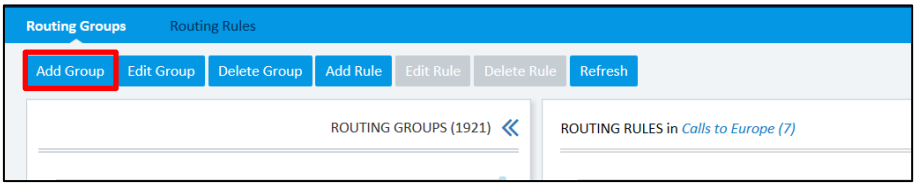
8.1 Adding a Routing Group

Before adding a rule, you must add a Routing Group. Routing Groups help present rules in the GUI in an organized fashion, enhancing user experience. Routing Groups also allow you to move a group of Routing Rules, collectively changing their routing priority.

➢ To add a Routing Group:

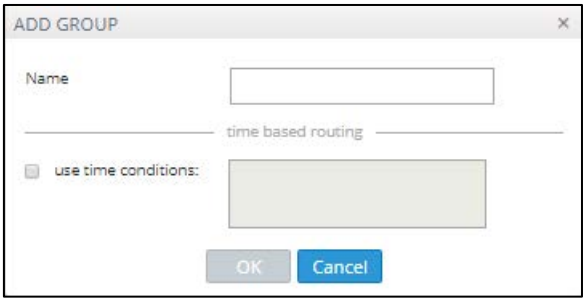
1. In the Routing page under the **Routing Groups** tab, click **Add Group**.

Figure 8-2: Add Group



The Add Group screen opens.

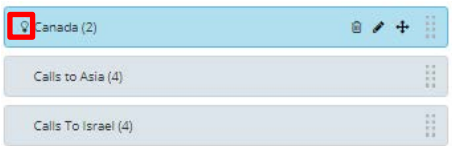
Figure 8-3: Add Group



2. Define a name for the Routing Group to be added. Define a user-friendly name to facilitate intuitive management by administrators. Some example of groups you can add are 'Restricted Calls', 'Calls to Europe', 'Calls to Far East', 'Calls to ROW', etc.

Note: The routing group's name must be distinct from names of other routing group names, and must be between 1-999 characters.

3. Select the **use time conditions** option to attach a time condition to the Routing Group. See Section 7.3.2 for related information on how to attach a time condition to a Routing Rule. You can attach multiple time conditions. These conditions will apply to all rules in the group. Note that if you attach a time condition to a group, it's indicated visually in the Routing Groups page as follows:



4. Click **OK**; the new Routing Group is added to the list.

Note:

- Routing Groups listed higher take precedence over those lower.
- Routing Groups in the list can be reordered (see Section 8.1.2).
- Priority is calculated internally, based on Previous and Next groups.

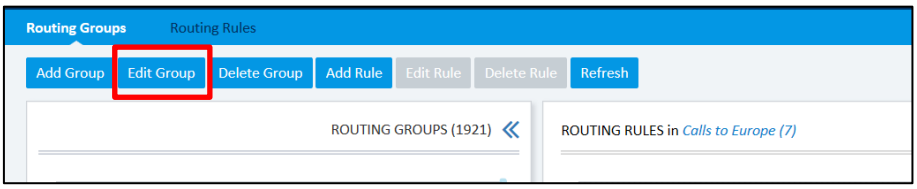
8.1.1 Editing a Routing Group

You can edit a Routing Group if necessary.

➢ **To edit a Routing Group:**

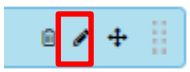
1. In the Routing page under the **Routing Groups** tab, select the Routing Group to edit, and then either:
   a. Click **Edit Group** shown in the figure below -or-

Figure 8-4: Edit Group



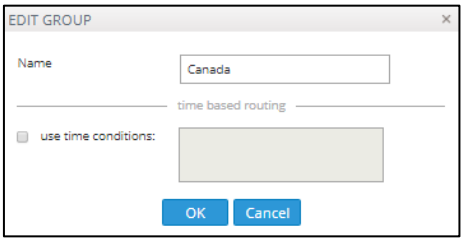
   b. Click the **Edit** icon in its row which is then enabled, shown in the figure below.

Figure 8-5: Edit Group



The Edit Group screen opens.

Figure 8-6: Edit Group



2. Edit the 'Name' field. Enter a user-friendly name to facilitate intuitive management by network administrators.
3. Edit the time condition. You can clear the **use time conditions** option to remove the condition. See Section 7.3.2 for related information. You can alternatively remove a single condition if multiple time conditions are attached.
4. Click **OK**.

8.1.2 Moving a Routing Group

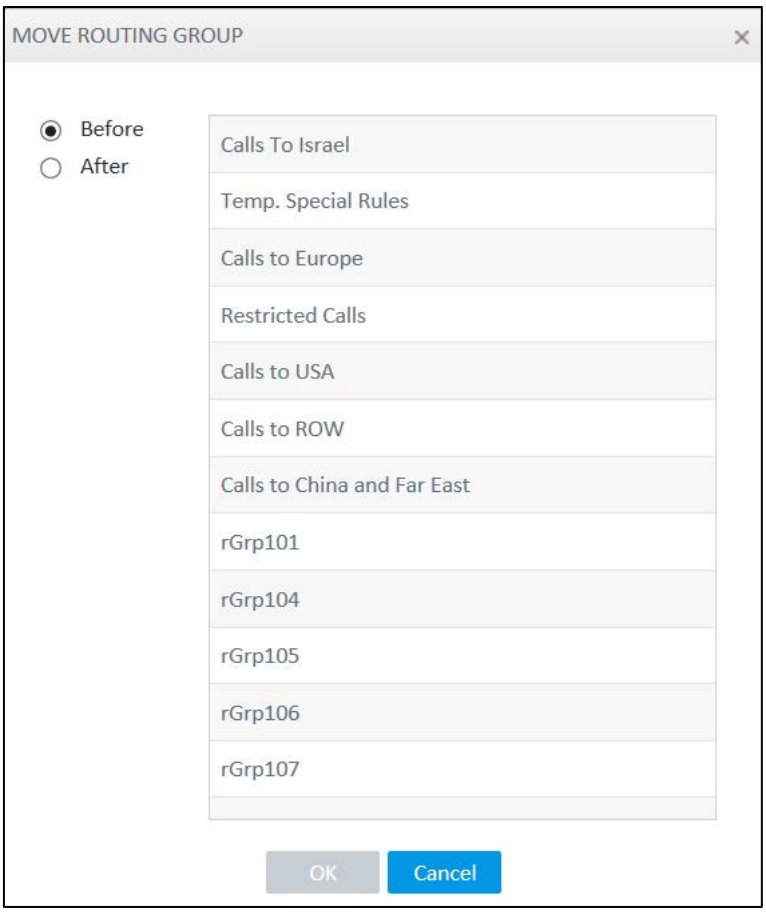
You can promote or demote a Routing Group listed in the Routing Groups page. When moving a Routing Group, all its Routing Rules are moved and the routing priority of all the Routing Rules in the group are collectively changed at once. Routing Groups listed higher in the page take precedence over those listed lower.

➢ **To move a routing group:**

1. In the Routing page, under the **Routing Groups** tab, either drag and drop the Routing Group to where you want to locate it, or select it and then click the then-enabled **Move** icon ✣ next to it.

   The Move Routing Group dialog opens:

Figure 8-7: Move Routing Group



2. Select **Before** or **After,** click the Routing Group before which / after which to move the Routing Group you want to promote/demote, and then click **OK**.

   Alternatively, you can move a Routing Group by clicking the icon shown in the figure below, and then dragging it and dropping it in the Routing Groups page.

Figure 8-8: Moving a Routing Group by Dragging and Dropping

8.1.3 Deleting a Routing Group

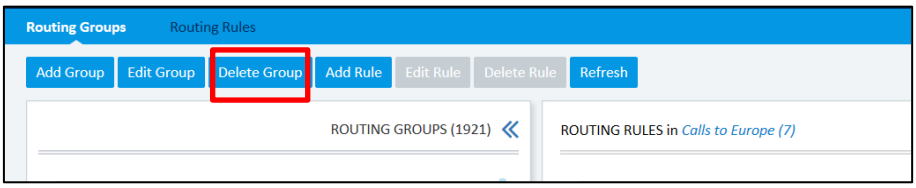
You can delete a Routing Group if necessary, including rules associated with the group.

➢ **To delete a Routing Group:**

- In the Routing page under the **Routing Group** icon, select the Routing Group to delete and then either:

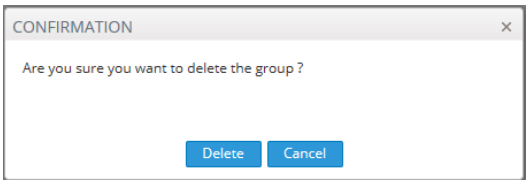
  a. Click **Delete Group**:

Figure 8-9: Delete Routing Group



-or-

  b. Click the **Delete** icon in its row which is then enabled:
  You're prompted to confirm:



  c. Click **Delete**.

8.2 Adding a New Routing Rule

After adding a Routing Group, add a new Routing Rule to associate with the Group. Each Routing Rule is given a unique priority within the Routing Group. A rule listed higher than another, even if in the same Routing Group, takes precedence.

Note:

- Routing rules are defined *within* Routing Groups.
  - √ To view a specific Routing Group's Routing Rules, click that Group.
  - √ To view all Routing Rules, click the **Routing Rules** tab.
- Any modification to the routing configuration (adding, deleting or modifying) takes effect within 60 seconds after the modification request is answered by the configurator and does not affect active calls.
- Any modification to routing logic because of an operational state change to a node or Peer Connection takes effect within 60 seconds after the status change is identified by the configurator.
- Any modification to routing logic because of a node or Peer Connection administrative state change takes effect within 60 seconds after the status change is identified by the configurator.
- Changes in users or user groups take effect within 60 seconds after the modification is identified by the configurator.

Routing Rules include:

- **Conditions:** [Optional] Define the characteristics of the route request, e.g., the User Group and phone prefix of the originator/destination.
- **Actions:** [Mandatory] Define actions performed if the call matches the rule conditions i.e., routes the call to the specified destination, or discards it specifying a SIP reason.

Figure 8-10: Example of a Routing Rule

The ARM parses from the top Routing Group listed, to the bottom Routing Group listed, and within each Routing Group from the top Routing Rule listed to the bottom Routing Rule listed. If it finds a matching rule and if devices and Connections/Peer Connections are available, it sends the call to the destination configured for that rule. If it doesn't find a matching rule, it indicates that a route for the call has not been found.

Alternative Routing

The ARM performs alternative routing as follows:

- The ARM attempts to build an alternative path for the same Routing Rule action (Node, Peer Connection, VoIP Peer), if available.
- ARM attempts to build an alternative action (Node, Peer Connection, VoIP Peer), if available, for this call, in the order that actions are listed in the Routing Rule.
- All routing alternatives are sorted by weighted path, cost and then by number of hops.

Load Balancing

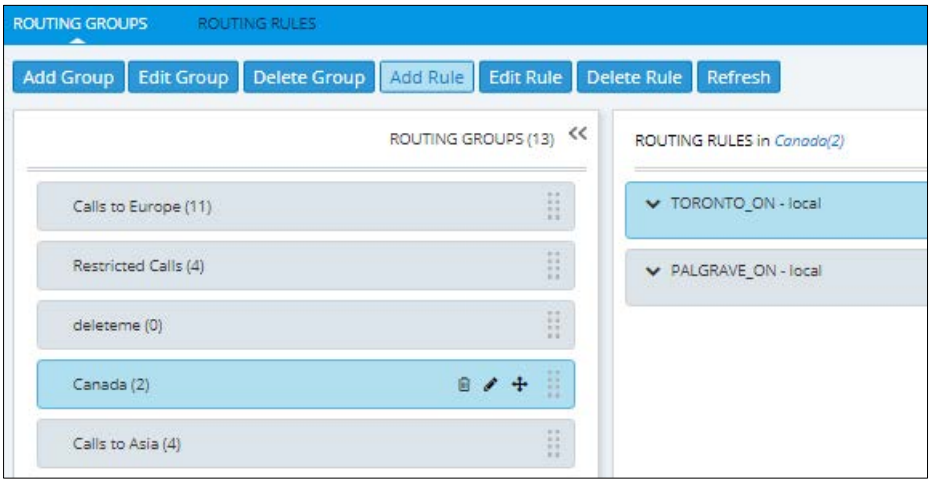
The ARM can balance call traffic between multiple destinations of the same Action. Call traffic can be distributed *equally* between destinations, or the distribution can be *defined by the operator*. Multiple routing attempts can be configured. Default: 1. Max: 3. The max can't exceed the number of destinations in the load balancing action. If a call to a destination configured in a load balancing action fails, the ARM will try to route it to one of the destinations configured in load balancing before searching for a new rule or action for it.

Discard Call - the ARM can be configured to discard calls matching specific conditions as a single action, or as the last action of a rule if previous destinations were unavailable.

➢ To add a new Routing Rule to a Routing Group:

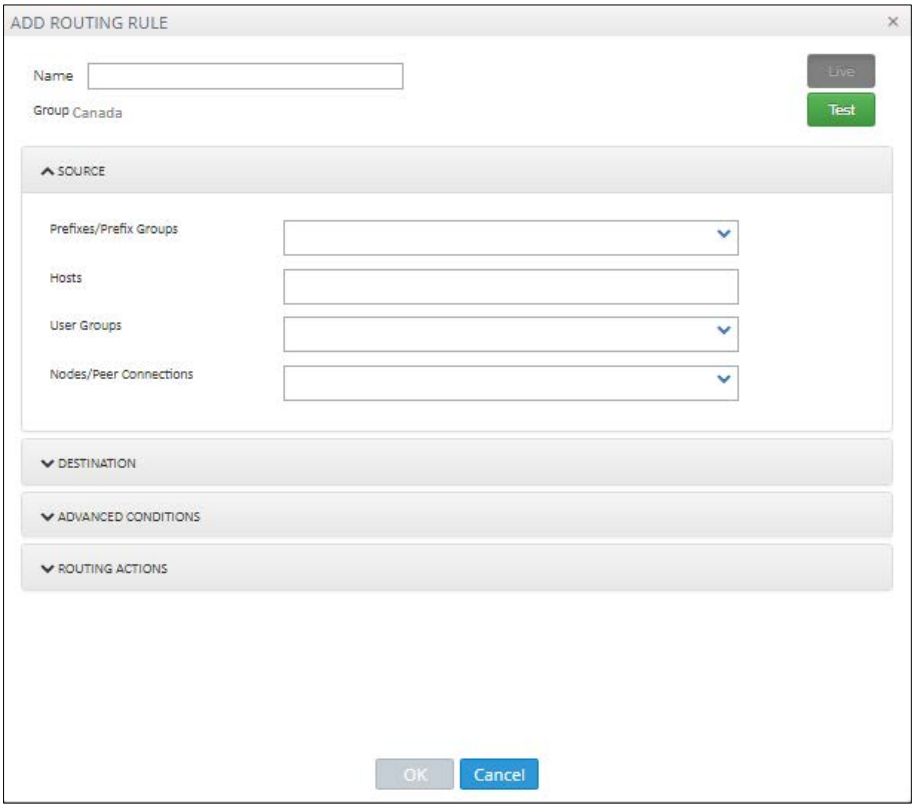
1. In the Routing Groups page under the **Routing Groups** tab, select the Routing Group with which to associate the rule, and then click **Add Rule**.

Figure 8-11: Add Rule



This screen opens:

Figure 8-12: Add Routing Rule



2. Enter a name for the routing rule that is distinct from the names of the other routing rules in the same group. Define a user-friendly name to facilitate intuitive management by network administrators. The name can be between 1-999 characters.
3. Enable **Live** and/or **Test** mode. See Section 3.6.

- **Live**. The rule will be taken into consideration for live calls traffic.
- **Test**. The route will be tested offline without impacting live calls traffic.

By default, new routing rules are added with **Test** mode enabled and **Live** mode disabled. It is highly recommended to test the newly added routing rule before enabling it for live calls.

The table below shows the combinations that are supported for a Routing Rule:

Table 8-1: Live | Test Mode Combinations

Live | Test Combination	Explanation
Live is enabled | Test is enabled	The rule will be considered for *both test and live traffic*.
Live is enabled | Test is disabled	The rule will be considered only for *live traffic*. Test mode won't be impacted. Select this option to simulate rule removal.
Live is disabled | Test is enabled	The rule will only be considered only for *test mode*. Live traffic won't be impacted. Select this option to simulate and test a newly added rule.
Live is disabled | Test is disabled	The rule will not be considered *for test nor live traffic*. Select this option to prepare a Dial Plan.

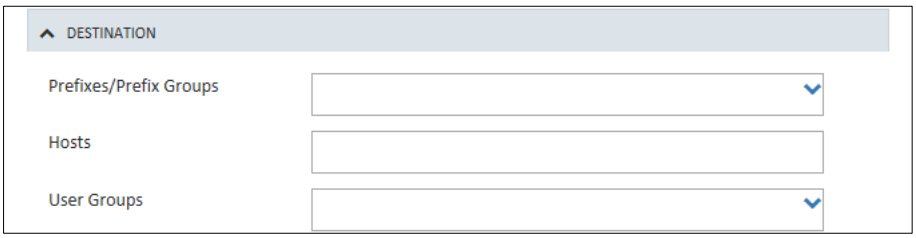
4. Configure the settings under 'Source' - use the table below as reference.

Table 8-2: Source Settings

Setting	Description
Prefixes/Prefix Groups	Enter a source number prefix, or list of prefixes. You can also enter the name of a prefix group, or from the dropdown select a prefix group or list of prefix groups. See Section 7.2.2.
Hosts	Enter a source hostname, or list of hostnames.
User Groups	Enter the name of a source user group or list of source user groups, or select user groups from the dropdown. See Section 6.2.
Nodes/Peer Connections	Enter names of source nodes or peer connections, or a list of nodes or peer connections, or select nodes or peer connections from the dropdown. Must be configured if you want to define a routing rule applicable to specific call sources rather than (globally) to the entire network.

5. In the Routing Rule Settings screen, click **Destination**.

Figure 8-13: Destination



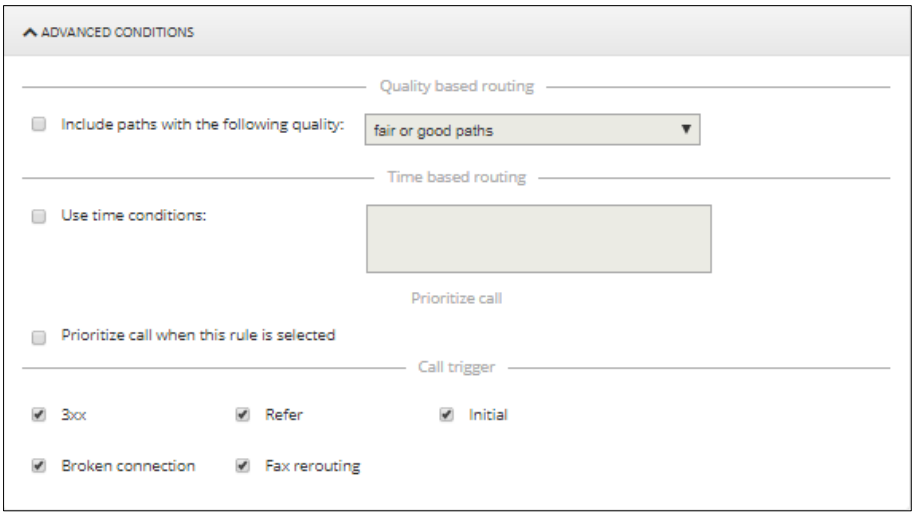
6. Configure the 'Destination' settings using the table below as reference.

Table 8-3: Destination Settings

Setting	Description
Prefix/Prefix Groups	Enter a destination number prefix, or list of prefixes. You can also enter the names of a prefix group or select prefix groups from the dropdown.
Hosts	Enter a destination hostname or list of hostnames.
User Groups	Enter the names of a user group, or list of destination user groups or select user groups from the dropdown.

7. In the Routing Rule Settings screen, click **Advanced Conditions**.

Figure 8-14: Advanced Conditions

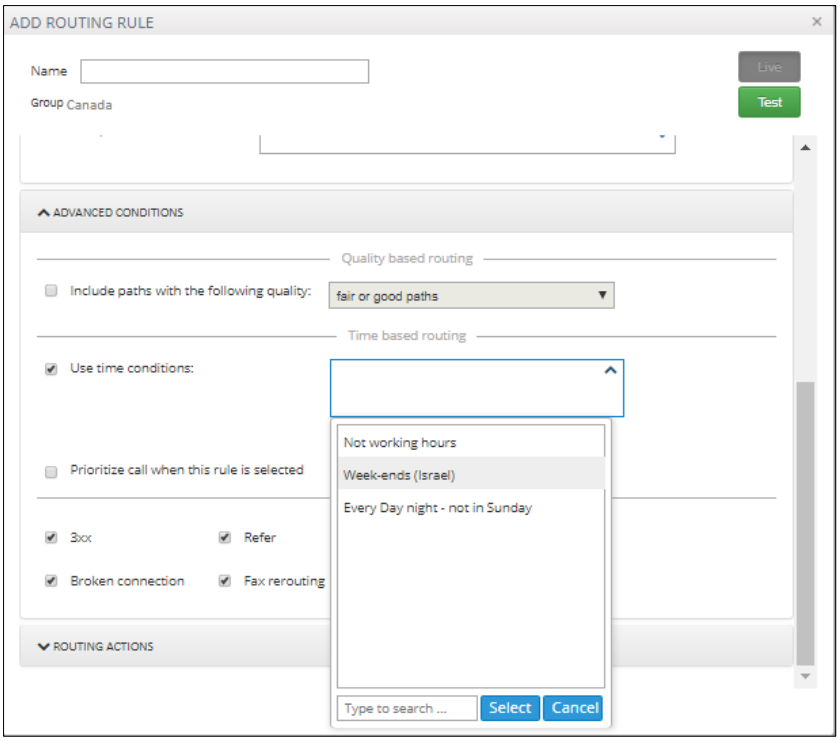


8. Under 'Quality Based Routing', select the option **include paths with the following quality**; the dropdown becomes available. From it, select the quality criteria that you defined as shown in Section 7.3. Criteria for bad, fair and good quality, based on the calculation of MOS and ASR, can be defined. This screen lets you associate the criteria you defined with the Routing Rule.
9. Under 'Time Based Routing', select the option **use time conditions**; the pane becomes available. From the dropdown, select the time on which routing will be based, configured under **Settings** > **Routing** > **Time Based Routing** (see Section 7.3 for information about configuring a time range).

Note:

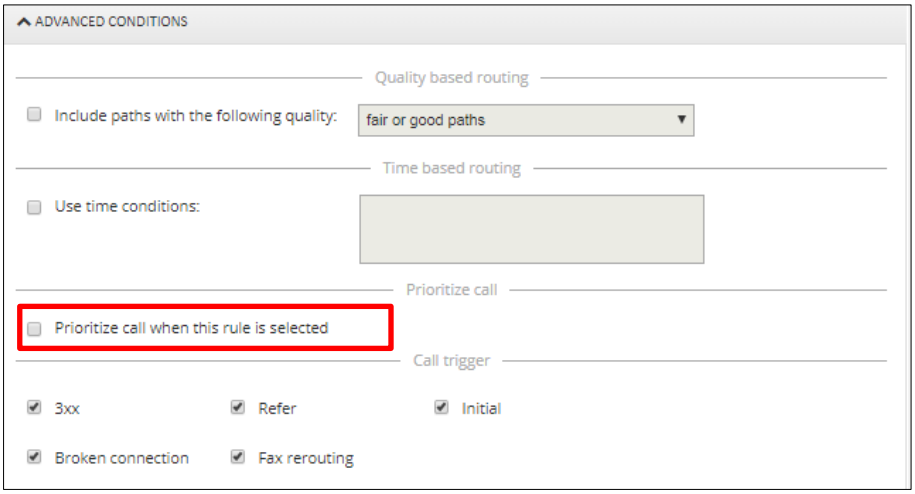
- More than one Time Condition can be associated with the same Routing Rule. Activation of the Routing Rule is then performed in 'or' between Time Conditions.
- A Time Condition can be attached to a Routing Rule which belongs to a Routing Group with an already-associated period; the ARM's calculation of this Routing Rule's activation will then be 'and'; the rule will be activated during the period assigned to the Routing Group *and* the period assigned to the Routing Rule.

Figure 8-15: Advanced Conditions - Use Time Condition



10. Select **Prioritize call when this rule is selected** to prioritize emergency calls over regular calls. The ARM supports emergency call preemption for SBC and gateway calls. If one of the devices is unavailable to process an emergency call because of lack of resources, a regular call will be preempted to free up resources so that the emergency call will be established. The ARM may preempt more than one active call to provide sufficient resources for processing the emergency call. Emergency calls can be identified by the matching rules parameters in the Routing Rule Settings screen.

Figure 8-16: Advanced Conditions – Prioritize call when this rule is selected



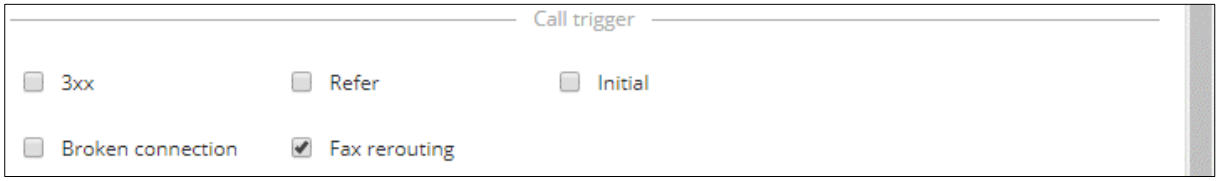
11. Under 'Advanced Conditions', select a **Call Trigger** to activate the rule for a specific Invite reason (i.e., alternative routing). By default, all 'Call Trigger' options are selected, so routing by default is based on all Call Triggers. At least one must be selected. The node applies to the ARM for a routing decision when it is triggered by another condition – such as a fax call or a Broken RTP connection. You can configure a rule to be triggered for example only for a fax call or for a 'Refer call'. Call Trigger options are:

- **3xx** [Re-routes the request if it was triggered because of a SIP 3xx response]
- **REFER** [Re-routes the INVITE if it was triggered because of a REFER request]
- **Initial** [This routing rule is used for regular requests that the device forwards to the destination]
- **Broken Connection** [If the Node detects a broken RTP connection during the call and the Broken RTP Connection feature is enabled in Pcon Ip-Profile (IP Profile > Broken Connection Mode = Reroute), you can use this option as an explicit matching characteristic to route the call to an alternative destination. Note that it's not supported for an incoming call from a third-party Pcon.
- **Fax rerouting** [This trigger will be used if the Node detects a call as a fax and the fax recognition feature is enabled on the Peer Connection. To enable the feature, the device Web interface's 'Routing Mode' parameter must be configured to **Rerouting without delay** (IP Profile > Rerouting Mode). Make sure this IP Profile is associated with the relevant IP Group. You can use this option as an explicit matching characteristic to route the call to an alternative fax destination.

Note: Fax call trigger is unsupported for incoming calls from third-party Peer Connection.

12. Each rule is by default relevant in all circumstances because all Call Triggers are selected by default, but if you want to provide specific routing, for example, for fax calls only, select it as follows:

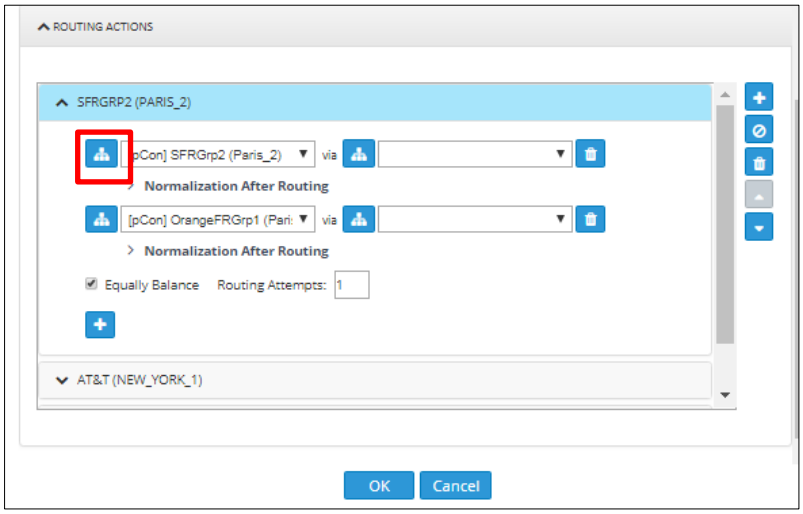
Figure 8-17: Advanced Conditions – Specific Call Trigger/s Selected



In this case, the initial call is routed according to the generic Routing Rules (followed by the SIP Invite message). When the SBC categorizes this call as a fax call, another request for routing is sent to the ARM with the 'Fax Rerouting' trigger. This routing request matches another ARM Routing Rule dedicated for fax rerouting. In this way, you can route fax calls to a 'Fax-to Mail' server (for example).

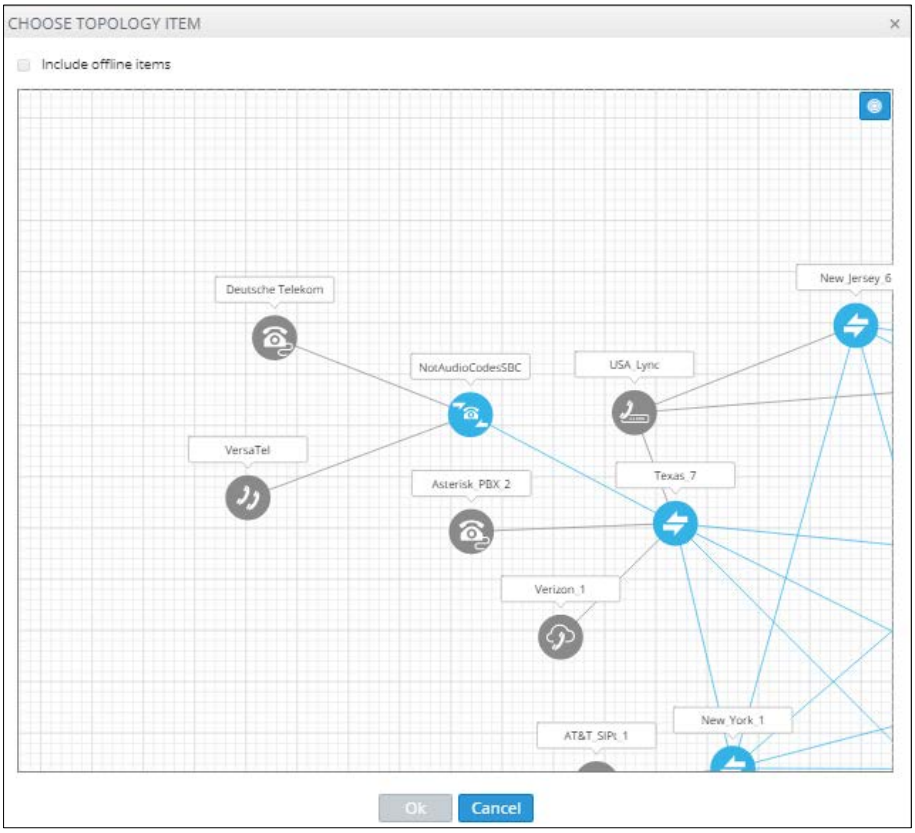
13. In the Routing Rule Settings screen, click **Routing Actions**: The action or set of actions to be taken if this Routing Rule matches. To select the action, click the icon illustrated in the figure below (recommended) or select it from the dropdown.

Figure 8-18: Routing Actions



- The 'Choose Topology Item' screen opens.

Figure 8-19: Choose Topology Item



- In the 'Choose Topology Item' screen, select the VoIP Peer, Peer Connection or Node to serve as the Action in the Routing Rule, and then click **OK**. This is an easy, visual way of selecting the correct topology element, especially in large networks with high numbers of topology elements where human error can easily occur.

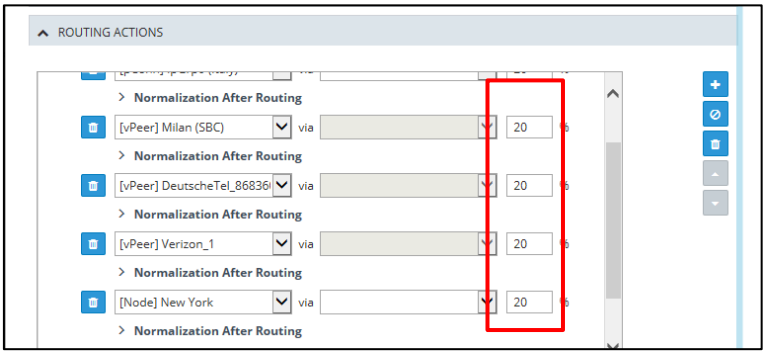
14. Use the table below as reference.

Table 8-4: Routing Actions

Setting	Description
[Action] left dropdown field	Select from the dropdown the Peer Connection, VoIP Peer or Node to which the call will be routed. In the figure above, the Peer Connection **IpGrp1 (Italy)** is selected.
[Via] right dropdown field	[Optional] Select from the dropdown the Node that the call must pass through. In the figure above, the Node **Paris_2** is selected. Only a single Node can be added in Via.
> Normalization groups	Click **>** to open post routing (after routing) normalization.
Source normalization group	Select a normalization group (see Section 7.2.1) to manipulate the source number in the outgoing call to the peer connection. The source normalization group can only be connected to an IP Group or VoIP Peer. It cannot be connected to a Node.
Destination normalization group	Select a normalization group (see Section 7.2.1) to manipulate the destination number in the outgoing call to the peer connection. The destination normalization group can only be connected to an IP Group or VoIP Peer. It cannot be connected to a Node.

15. Click **Add loading balancing**; the screen shown in Figure 8-20 on the next page is displayed.

Figure 8-20: Routing Actions – Load Balancing - Equally Balanced (Default)

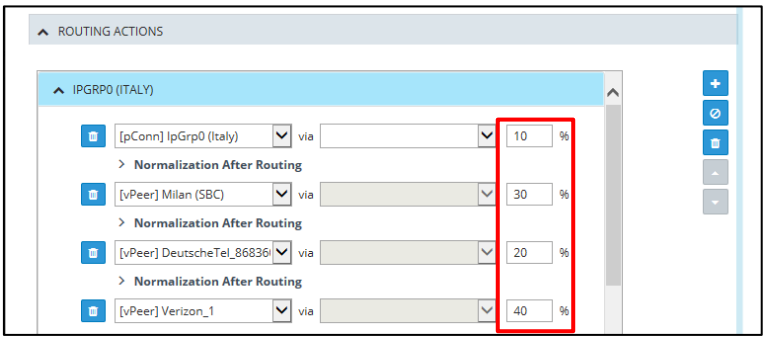


Load balancing is added between more than one Peer Connection, Node or VoIP Peer. By default, these are *equally balanced*, i.e., the same percentage is assigned for each option, as shown in the figure above.

You can optionally *define your own percentage* by clearing the 'Equally Balance' option. Any distribution can be chosen, i.e., any percentage of calls can be handled by a specific routing option. Several routing destinations (more than two) are supported using the **Add load balancing** button, as shown in Figure 8-21 below.

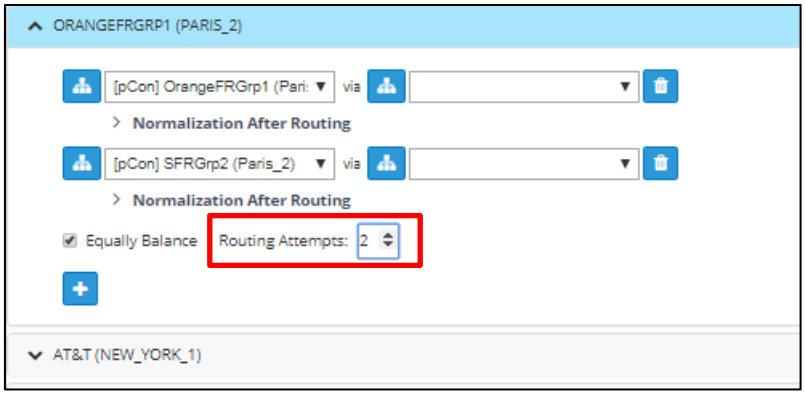
16. Enter the percentage of routes that will take this action when load balancing is configured and **Equally Balance** is cleared. Make sure you have 100% in the Action's calls destinations summary else you won't be allowed to enable the action.

Figure 8-21: Routing Actions – Load Balancing - Defining Your Own Percentages



17. Configure the parameter 'Routing Attempts' as shown in the figure below. The maximum attempts that can be configured is 3. Default: 1. The maximum number of 'Routing Attempts' can't exceed the number of destinations in the action (see for example the action ORANGEFRGRP1 (PARIS_2) in the figure below).

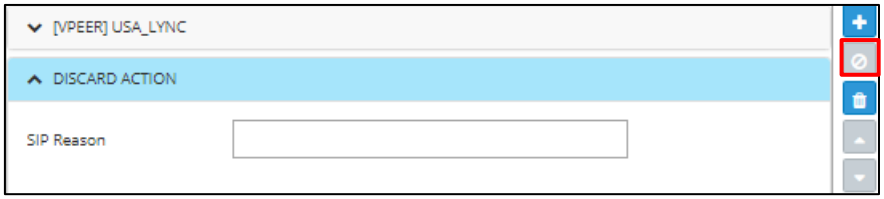
Figure 8-22: Equally Balance: Routing Attempts = 2



The 'Routing Attempts' parameter determines the number of attempts that will be made within the load balancing action. If load balancing is configured within a Routing Rule's Action and a call to a destination configured in this Action fails for some reason, the ARM will try to route the call to one of the destinations configured in load balancing before searching for a new rule or action for the call.

18. Click the Call Discard action icon

Figure 8-23: Routing Actions – Call Discard



19. Configure using the table below as reference

Table 8-5: Routing Actions – Call Discard

Setting	Description
Discard Action	In a routing rule, you can apply a policy to attempt multiple routing options and to discard the call if none succeed. The **Discard call** routing action can be used - in addition to other routing actions of the same rule - as a last routing rule action or as a sole action. You can provide a specific SIP reason for 'Discard Call' as well as use the last SIP reason received from the SBC or the Gateway.
SIP Reason	Enter the SIP reason to be returned to the source peer connection when rejecting the call. Must be a valid SIP reason.

Note: If any field is left empty (Prefix Group/Host/User Group/Nodes/Peer Connections), the rule will not check it.

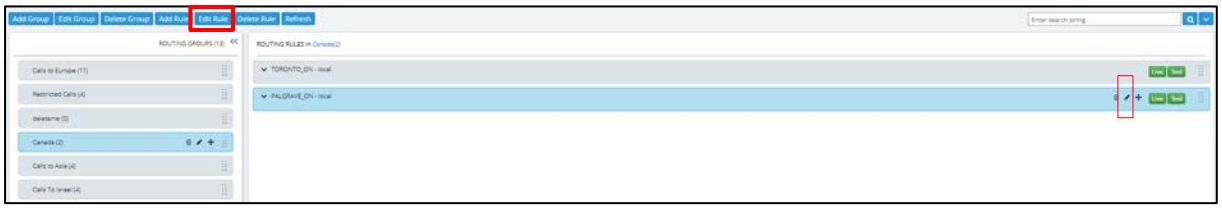
8.2.1 Editing a Routing Rule

You can edit a rule if necessary.

➢ **To edit a Routing Rule:**

- Select the Routing Group under which the rule is defined, select the Routing Rule to edit, and then either:
  - **a.** Click the then-enabled **Edit Rule** button or click the then-enabled **Edit** icon, shown in the figure below; the screen shown in Figure 8-12 is displayed.

Figure 8-24: Edit Rule



  - **b.** Edit the rule using the tables above as reference.
  - **c.** To view a rule's conditions and actions, expand the rule by clicking the **v** icon; the window shown in the figure below opens. In the left pane, you can see the route conditions. In the right pane, you can see the actions.

Figure 8-25: Viewing a Routing Rule's Conditions-Actions

8.2.2 Moving a Routing Rule

You can move a rule within the group under which it is defined, or you can move it to another group, above or below a rule defined within that group.

➢ **To move a rule:**

1. Click the Routing Group under which the rule is defined and then
   - Drag and drop the rule to the Routing Group you want to move it to -OR-
   - Select the rule to move and then click the now-enabled **Move** icon; the Move Routing Rule dialog is displayed.

Figure 8-26: Move icon

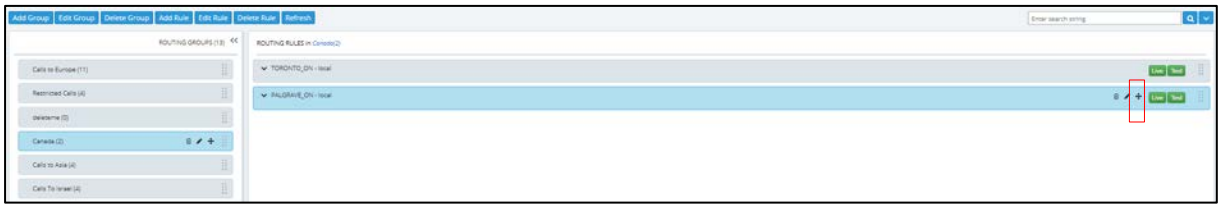
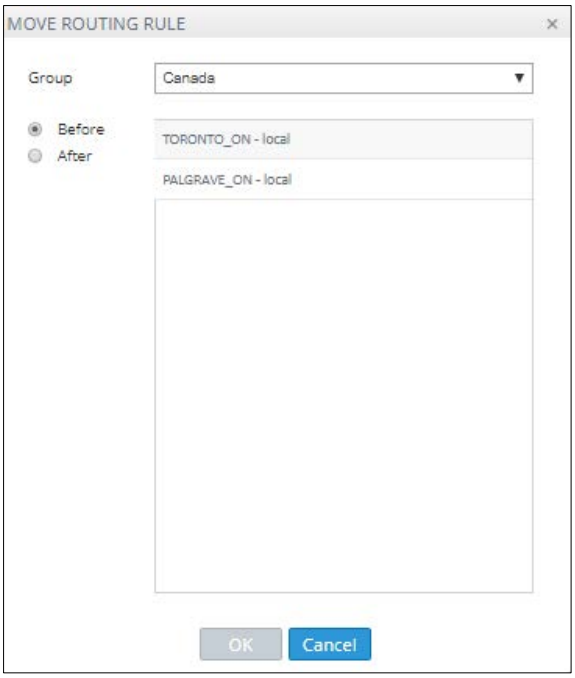


Figure 8-27: Move Routing Rule



2. From the 'Group' dropdown, select the group to which you want to move the rule.
3. Select either **Before** (default) or **After** and then select the rule before which or after which you want to move the rule.
4. Click **OK**; the rule is moved to the location you defined.

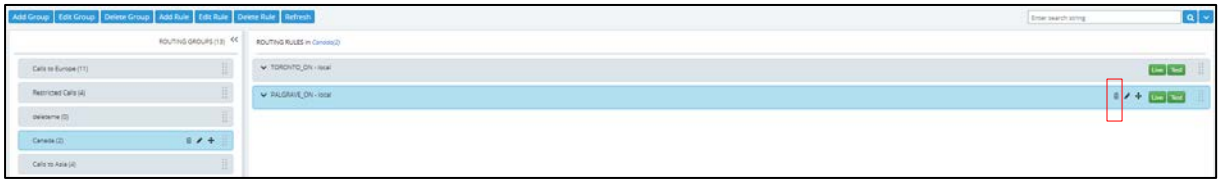
8.2.3 Deleting a Rule

You can delete a rule if necessary.

➢ **To delete a rule:**

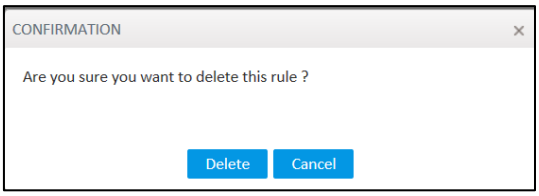
1. Click the group under which the rule is defined and then adjacent to the defined rule that you want to delete, click the now-enabled **Delete** icon shown in the figure below –OR- click the now enabled **Delete Route** button also shown in the figure below.

Figure 8-28: Delete Icon



2. In the Confirmation prompt 'Are you sure you want to delete this rule?' shown in the figure below, click **Delete**.

Figure 8-29: Delete Icon



The rule is deleted.

8.3 Testing a Route

You can test a route to make sure it performs according to expectations. See Section 3.6 for more information.

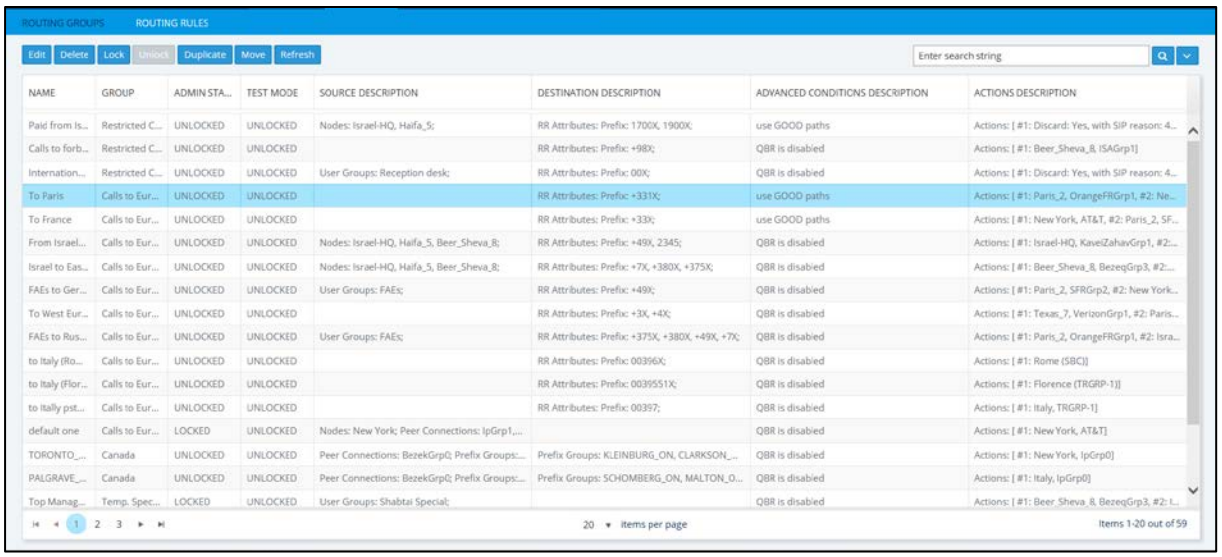
8.4 Using the Routing Rules Table View Page

Some network administrators prefer to manage routing rules in the Routing Rules table view page. The page offers a significant advantage: Administrators can select multiple rules and perform a multi-action on the selection.

➢ **To open the page:**

1. In the Routing page, click the **Routing Rules** menu.

Figure 8-30: Routing Rules Table View Page



2. Select a rule or select multiple rules; the actions buttons are activated. Administrators can:
   - Edit a rule
   - Delete rules
   - Lock / Unlock rules
   - Duplicate a rule (allows administrators to conveniently and easily add a rule based on an already defined rule)
   - Move rules
3. In the Search field, enter a search string. The functionality allows administrators to search in all the defined rules, not just in a Rules Group.

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9 Viewing Alarms

The Alarms page shown in the figures below displays alarms generated in the enterprise's network topology, e.g., SBC disconnected. In the page, you can view alarms information displayed under two tabs:

- **Active Alarms** (default)
- **History Alarms**

9.1 Active Alarms | History Alarms

The Active Alarms and the History Alarms pages under the Alarms menu display these column headers:

- SEVERITY
- DATE AND TIME
- NAME
- ALARM SOURCE
- DESCRIPTION

Figure 9-1: Alarms – Active Alarms + Alarm Summary

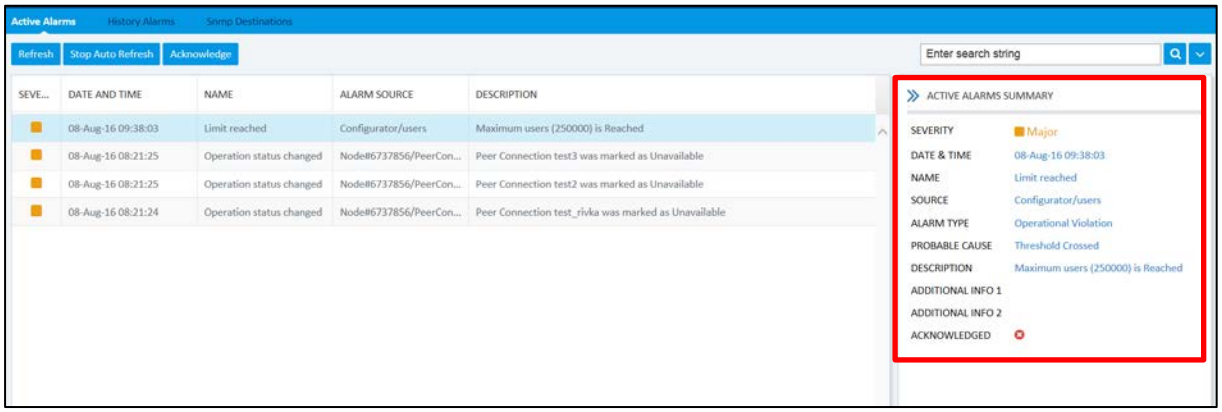
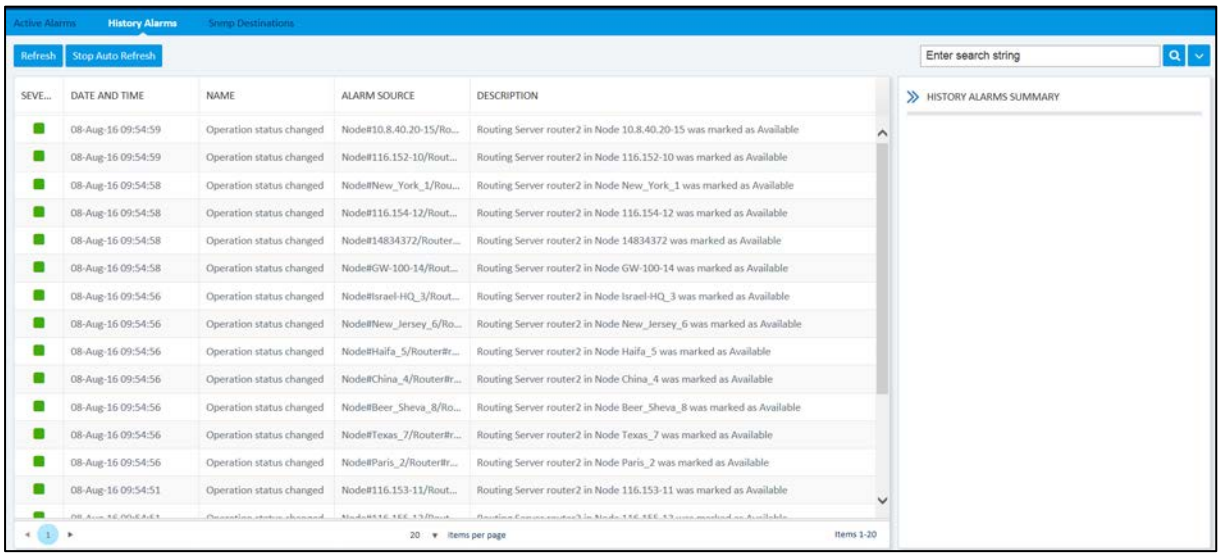


Figure 9-2: Alarms – History Alarms



Click any alarm listed on any page; that alarm's ALARM SUMMARY pane, shown above, displays the column information as well as:

- ALARM TYPE
- PROBABLE CAUSE
- ADDITIONAL INFO1
- ADDITIONAL INFO2
- ACKNOWLEDGED

In the Active Alarms and History Alarms pages you can:

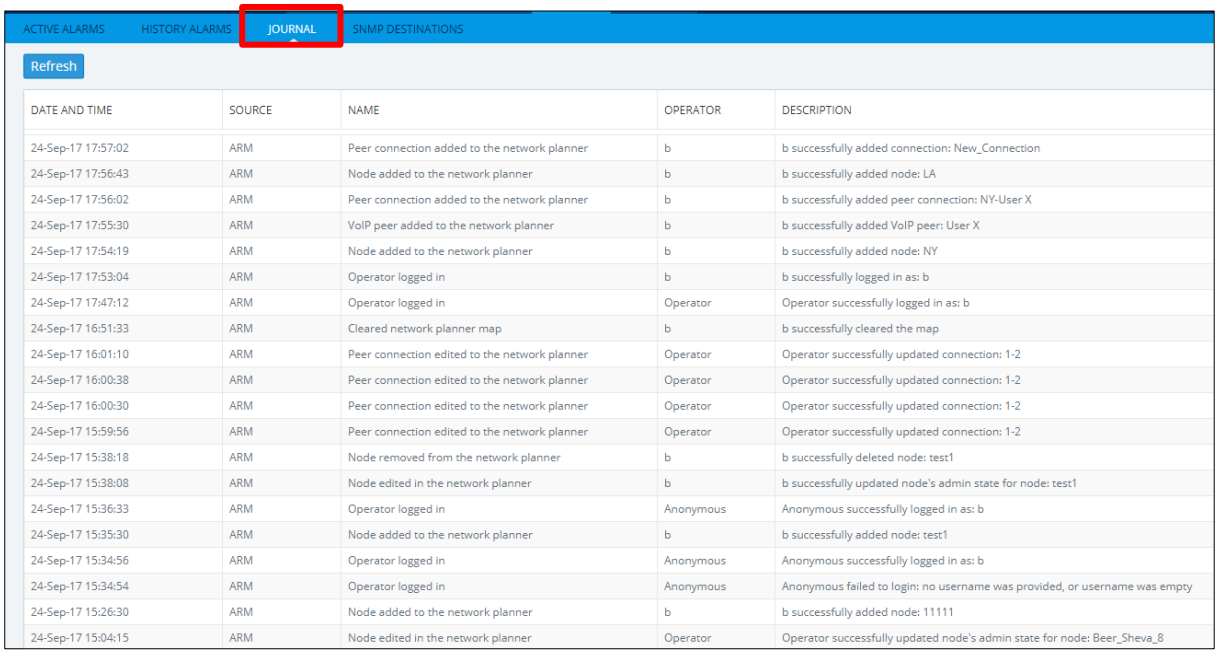
- Sort alarms, according to column header
- Use the 'Search' feature to locate specific alarms (see Section 9.4 below).
- **Refresh** the page / **Stop Auto Refresh**
- **Acknowledge Alarm** [Applies only to the Active Alarms page] Click the button to clear a selected alarm from the page. Note that after acknowledging it, the alarm can be still viewed in the History Alarms page.

9.2 Journal Page

The Journal page allows you to view historical actions and activities performed in the ARM by all operators, up to the present time.

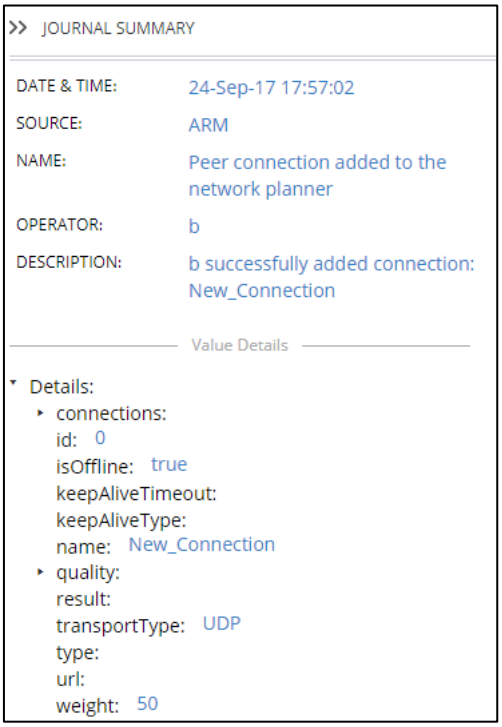
The page can help you determine if another operator's action or activity may have changed network functionality and been responsible for an active alarm.

Figure 9-3: Journal Page



DATE AND TIME	SOURCE	NAME	OPERATOR	DESCRIPTION
24-Sep-17 17:57:02	ARM	Peer connection added to the network planner	b	b successfully added connection: New_Connection
24-Sep-17 17:56:43	ARM	Node added to the network planner	b	b successfully added node: LA
24-Sep-17 17:56:02	ARM	Peer connection added to the network planner	b	b successfully added peer connection: NY-User X
24-Sep-17 17:55:30	ARM	VoIP peer added to the network planner	b	b successfully added VoIP peer: User X
24-Sep-17 17:54:19	ARM	Node added to the network planner	b	b successfully added node: NY
24-Sep-17 17:53:04	ARM	Operator logged in	b	b successfully logged in as: b
24-Sep-17 17:47:12	ARM	Operator logged in	Operator	Operator successfully logged in as: b
24-Sep-17 16:51:33	ARM	Cleared network planner map	b	b successfully cleared the map
24-Sep-17 16:01:10	ARM	Peer connection edited to the network planner	Operator	Operator successfully updated connection: 1-2
24-Sep-17 16:00:38	ARM	Peer connection edited to the network planner	Operator	Operator successfully updated connection: 1-2
24-Sep-17 16:00:30	ARM	Peer connection edited to the network planner	Operator	Operator successfully updated connection: 1-2
24-Sep-17 15:59:56	ARM	Peer connection edited to the network planner	Operator	Operator successfully updated connection: 1-2
24-Sep-17 15:38:18	ARM	Node removed from the network planner	b	b successfully deleted node: test1
24-Sep-17 15:38:08	ARM	Node edited in the network planner	b	b successfully updated node's admin state for node: test1
24-Sep-17 15:36:33	ARM	Operator logged in	Anonymous	Anonymous successfully logged in as: b
24-Sep-17 15:35:30	ARM	Node added to the network planner	b	b successfully added node: test1
24-Sep-17 15:34:56	ARM	Operator logged in	Anonymous	Anonymous successfully logged in as: b
24-Sep-17 15:34:54	ARM	Operator logged in	Anonymous	Anonymous failed to login: no username was provided, or username was empty
24-Sep-17 15:26:30	ARM	Node added to the network planner	b	b successfully added node: 11111
24-Sep-17 15:04:15	ARM	Node edited in the network planner	Operator	Operator successfully updated node's admin state for node: Beer_Sheva_8

The page can help you 'debug' a routing issue that may occur in the network. Each row chronologically indicates an operator action | activity. Selecting a row displays the details of that action | activity in a Journal Summary pane located on the right side of the page:



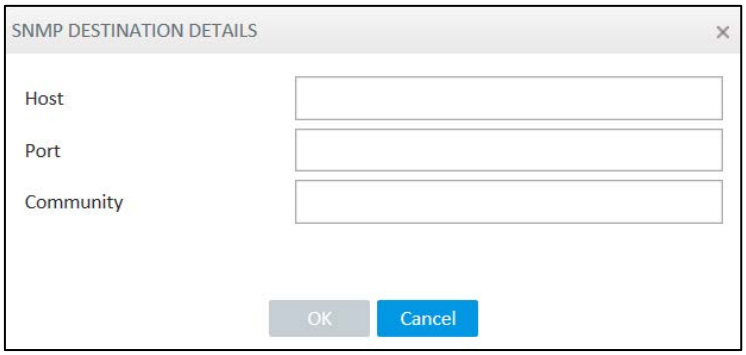
9.3 Collecting Info via SNMP to Enhance IP Network Telephony Performance

This feature provides enterprise network administrators the option to collect information on devices via Operations Support Systems (OSS) traps sent over Simple Network Management Protocol (SNMP). Network administrators can then modify that information to enhance telephony network performance.

➢ **To collect information via SNMP:**

1. In the Alarms page, click the **SNMP Destinations** tab and then click **Add**.

Figure 9-4: SNMP Destination Details



2. Use Table 9-1 on the next page as reference.

Table 9-1: SNMP Destination Details

Setting	Description
Host	Enter the IP address of the OSS host.
Port	Enter the number of the port to which to send OSS traps.
Community	SNMP Community String. Sent with each Get-Request as a type of password to allow or deny access.

9.4 Locating a Specific Alarm

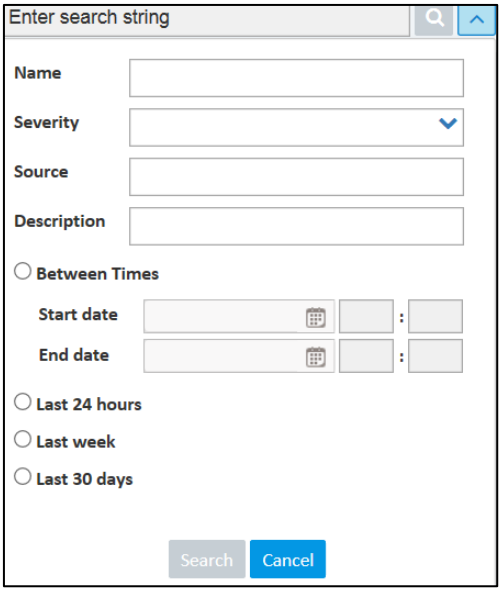
The search feature helps administrators quickly and easily locate specific alarms. This facilitates effective management which in turn leads to improved network performance.

➢ **To search for a specific alarm:**

1. Enter a search string in the search field shown in the figure below, or for an advanced search, click the dropdown arrow; the dialog shown in the figure below it is displayed.

Figure 9-5: Search Field

Figure 9-6: Searching for a Specific Alarm



2. Enter any information about the alarm you know. You must enter information in at least one field.
   - The 'Name' field is identical to the simple search string field.
   - From the 'Severity' dropdown, select Clear, Indeterminate, Warning, Minor, Major or Critical. All alarms whose severity level match your selection will be displayed.
   - For the alarm 'Source', enter the node name or the Peer Connection name, if you know it. All alarms originating from that source will be displayed.
   - In the 'Description' field, enter a key word used to describe the alarm.
   - Select either **Between Times**, **Last 24 hours**, **Last week** or **Last 30 days**. All alarms whose timestamp matches your selection will be displayed.
3. Click **Search**.

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10 Migrating Device Routing to the ARM

This section shows how to migrate device routing to the ARM.

Note:

- This section assumes familiarity with the AudioCodes device whose routing is to be migrated to the ARM. See Related Documentation for references to AudioCodes' device documentation.
- The screenshots shown in this section are of Web interface version 7.2. If you're using Web interface version 7.0 or earlier, refer to earlier versions of this document.

10.1 AudioCodes Device Application Types

Before migrating device routing to the ARM, it's best to first get acquainted with the routing logic of AudioCodes' device application types. This section describes the routing logic of the three AudioCodes device application types:

- SBC device application
- Gateway device application
- Hybrid device running both a Getaway application and an SBC application

10.2 ARM Network Routing Logic

AudioCodes device's routing logic is centralized in its local routing table independently of the ARM. The SBC's routing logic is centralized in the IP-to-IP Routing Table. The Gateway's routing logic is centralized in the Tel-to-IP and IP-to-Tel routing table.

To integrate a device into the ARM network, the routing logic must be migrated to the ARM so that:

- All calls will be routed by the ARM.
- If a device disconnects from the ARM, calls will be managed by the device's internal routing table.
- If the ARM cannot find any route that matches a specific call, the call will be managed by the device's internal routing table.
- If the device fails to establish a call according to the ARM's routing directive (for example, a SIP error is received), the call will be discontinued.

10.2.1 SBC Routing Logic

AudioCodes' SBC routes and handles IP-to-IP calls. The SBC routing logic is centralized in the IP-to-IP Routing Table. For the ARM to route calls, you must configure a related routing rule in the SBC's internal IP-to-IP Routing Table as described in Section 10.6.

10.2.2 Gateway Routing Logic

AudioCodes' Media Gateway routes and handles IP-to-Tel, Tel-to-IP and Tel-to-Tel calls using an *internal loopback IP Group*.

Gateway routing logic is configured in the device's internal IP-to-Tel and Tel-to-IP tables. To migrate the gateway application's routing logic to the ARM network, you must set the routing parameter 'Gateway Routing Server' to **Enable**. When this configuration is applied in the gateway, all its routing goes through the ARM and internal routing configuration is ignored.

10.2.3 Hybrid Device Routing Logic

The ARM routes calls from the hybrid device's PSTN (gateway application) to IP (SBC application) or vice versa.

Calls cannot be routed from an IP Group (PCon in ARM) associated with a gateway application, to an IP Group associated with an SBC application on the same hybrid device.

To support a hybrid device, two internal IP Groups must be configured:

- From the SBC application to the Media Gateway application
- From the Media Gateway application to the SBC application

The ARM GUI does not display these two internal IP Groups. Routing is performed according to the logic described in the SBC and Media Gateway sections above, respectively.

See Section 10.8 for information about how to migrate hybrid device routing to the ARM.

10.3 Connecting the Device to the ARM Topology Server

You need to connect the device to the ARM Topology Server.

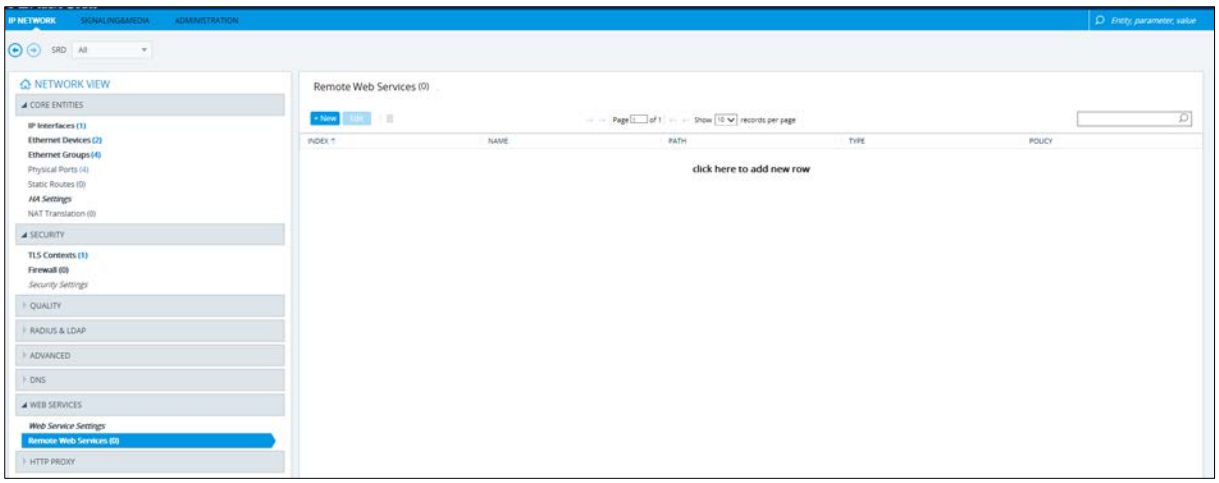
Note: AudioCodes recommends starting a migration by manually adding a device in the ARM Network page as shown in Section 3.1.

For auto-discovery provisioning, take the steps below to connect the device to the ARM network.

➢ **To connect the device:**

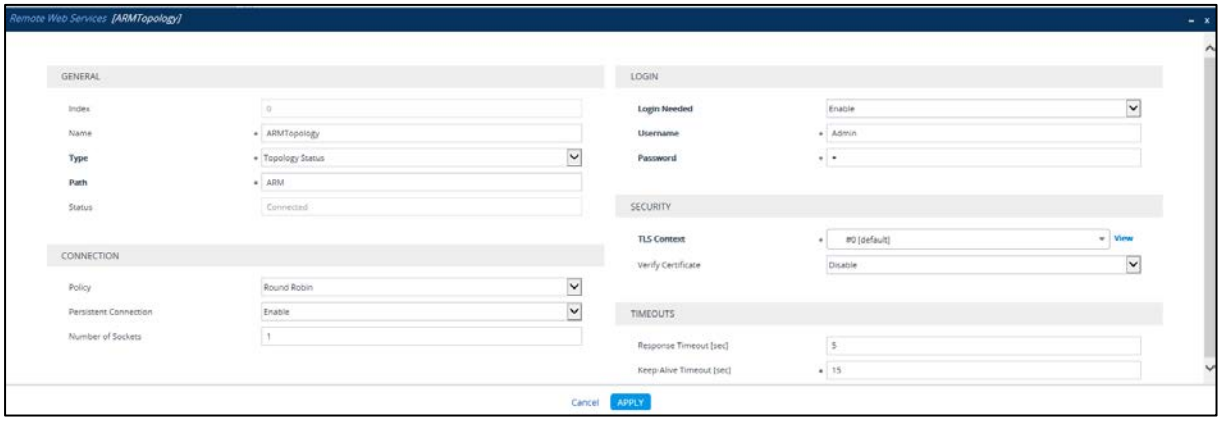
1. In your internet browser, enter the device's IP address in the Address bar, and then in the login page that opens, enter the User Name and Password (**Admin**, **Admin** are the defaults).
2. In the device's Web interface that opens, check the **Setup** menu and then navigate to the HTTP Remote Services page (**IP Network** > **Web Services** > **Remote Web Services**).

Figure 10-1: Web Interface - Remote Web Services



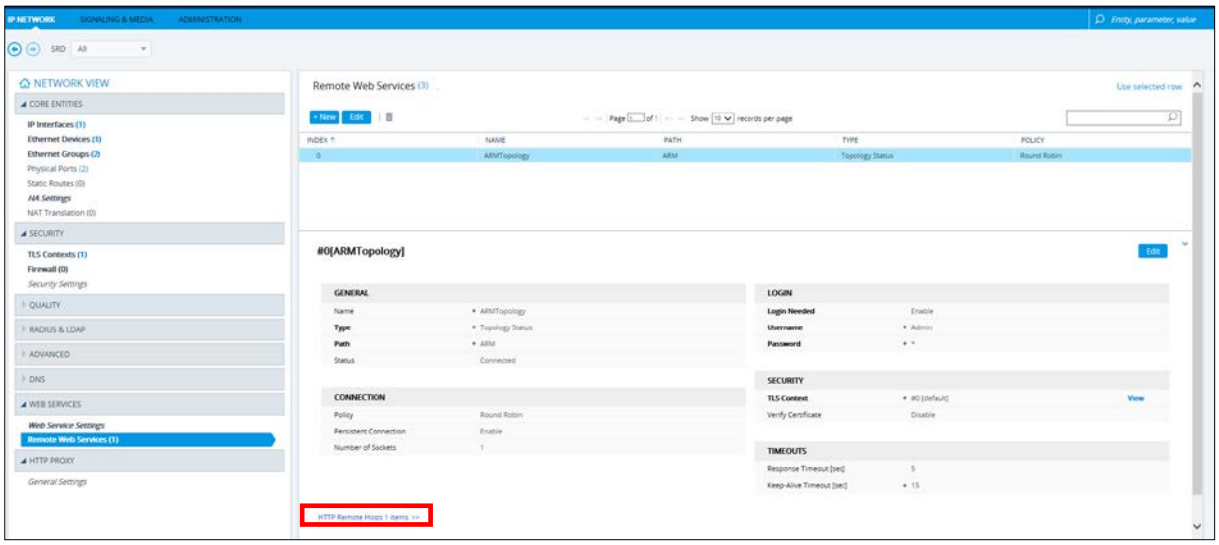
3. Click **+New** or **click here to add new row**.

Figure 10-2: Web Interface - HTTP Remote Services – Add Row



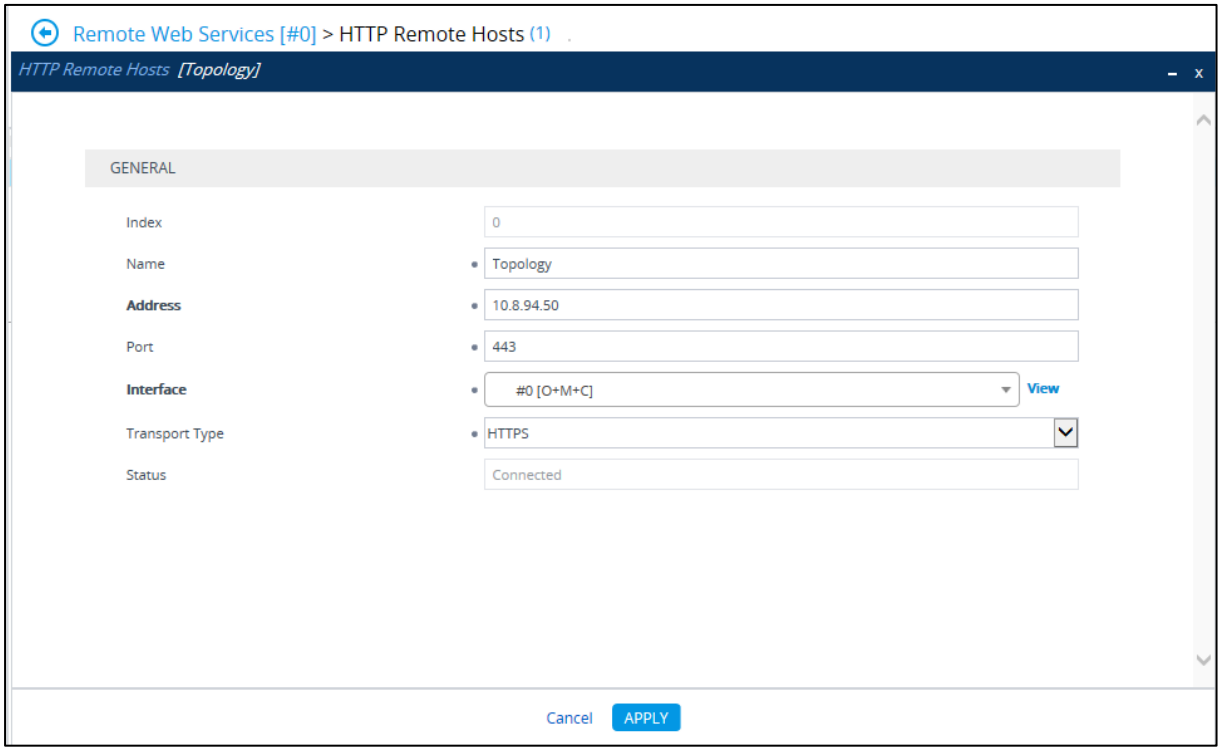
4. Configure the dialog using the figure above as reference, and click **Apply**.

Figure 10-3: Web Interface - Remote Web Services – HTTP Remote Hosts



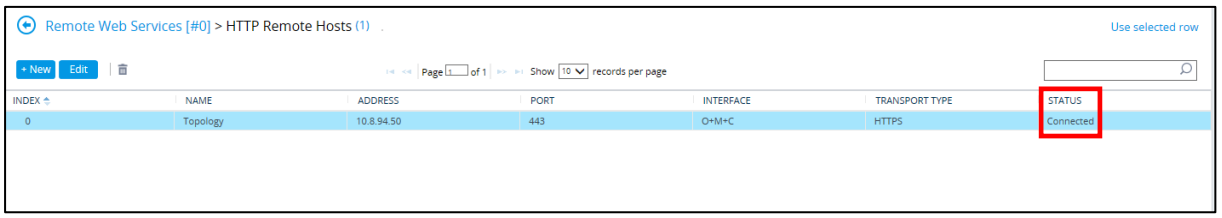
5. Click the **HTTP Remote Hosts** link shown in the figure above.
6. In the HTTP Remote Hosts page that opens, click the **Add** tab.

Figure 10-4: Web Interface - Remote Web Services - HTTP Remote Hosts - Add



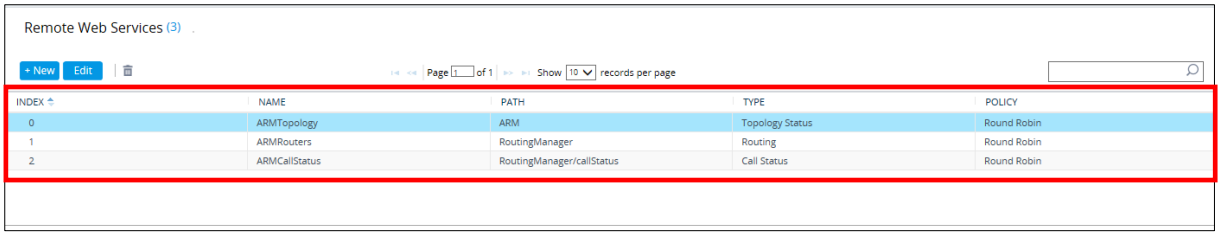
7. Define the IP Address of the ARM Topology Server to which you want to point the device and define the ARM Topology Server settings, and then click **Save**; wait until connected.

Figure 10-5: Web Interface – Device Connected to ARM Topology Server



8. Make sure in the Remote Web Services – HTTP Remote Hosts screen shown in the figure above that the status of the host, i.e., of the ARM Topology Server, is **Connected**.
9. Connect to the router/s.

Figure 10-6: Web Interface – Remote Web Services - Routers



10. Make sure that the device is connected to all HTTP ARM services i.e., ARM Topology Server *and* router/s, as shown in the figure above.

10.4 Defining an IP Interface Dedicated to ARM Traffic

ARM version 7.8 and nodes (SBC or Gateway) version 7.20A.154.044 and later support the capability to define on AudioCodes devices additional IP interfaces for management on any application type (Media and/or Control, not OAMP) and different TLS contexts for each IP interface.

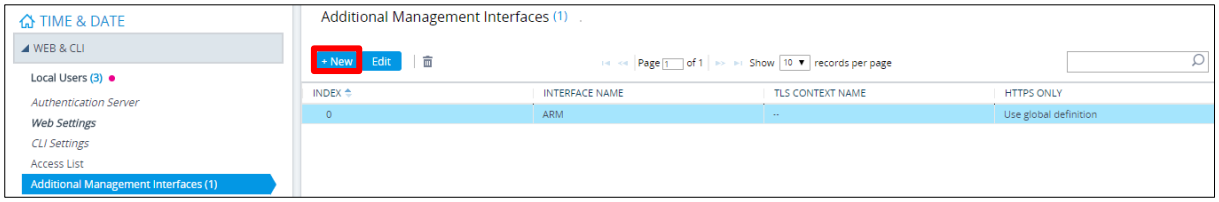
Defining a dedicated IP interface on the device for ARM traffic allows keeping ARM traffic internal, if required, separating ARM traffic from other device management traffic such as Web, SNMP and NTP.

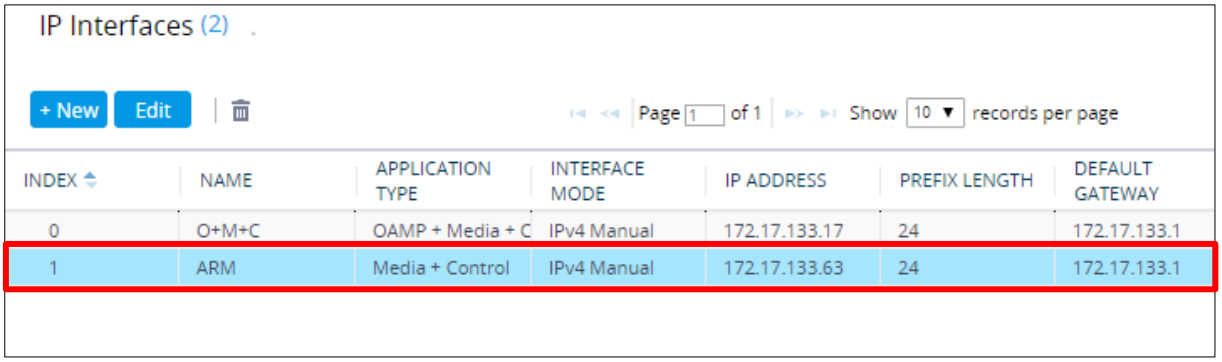
When defining ARM on the node, you must assign an IP interface to the remote host (ARM) and a TLS context for the HTTP Service. The ARM automatically adds its routers to all nodes. When the ARM does this, it uses the same IP interface and TLS context that you defined for the ARM Configurator HTTP Service. If either the IP interface or the TLS context of the ARM Configurator will be changed, the ARM will synchronize the new values to the ARM routers.

➢ **To provide an AudioCodes device with a dedicated ARM interface:**

- Connect to the device's Web interface and in the Web interface, navigate to **Administration** > **Web & CLI** > **Additional Management Interfaces**. Configure an additional IP interface for device routing management as shown in the figure below.

Figure 10-7: Additional Management Interfaces





10.5 Migrating SBC/Gateway/Hybrid Routing to the ARM

This section shows how to migrate an AudioCodes device to the ARM network.

After making sure that the device is connected to all HTTP ARM services i.e., ARM Topology Server *and* router/s, you can begin to migrate the routing logic from that configured in the device, to the ARM. Screenshots in this section are for illustrative purposes. The section shows the general changes that must be made.

➢ **To migrate an AudioCodes device to the ARM network:**

- Configure IP Groups and SIP interfaces used by the ARM:
  1. In the device's Web interface, navigate to the SIP Interface Table Page (**Setup** > **Signaling & Media** > **Core Entities** > **SIP Interfaces**).
  2. Navigate to the SIP Interface Table Page (**Setup** > **Signaling & Media** > **Core Entities** > **SIP Interfaces**).
  3. Locate the SIP Interface to expose the enterprise network to the ARM environment.

Figure 10-8: Web Interface – SIP Interfaces

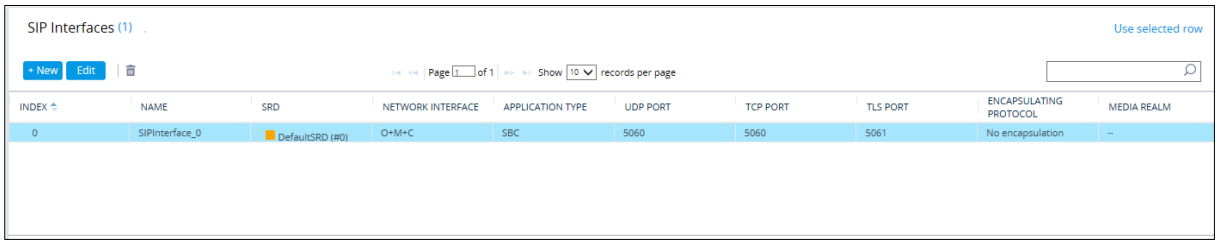
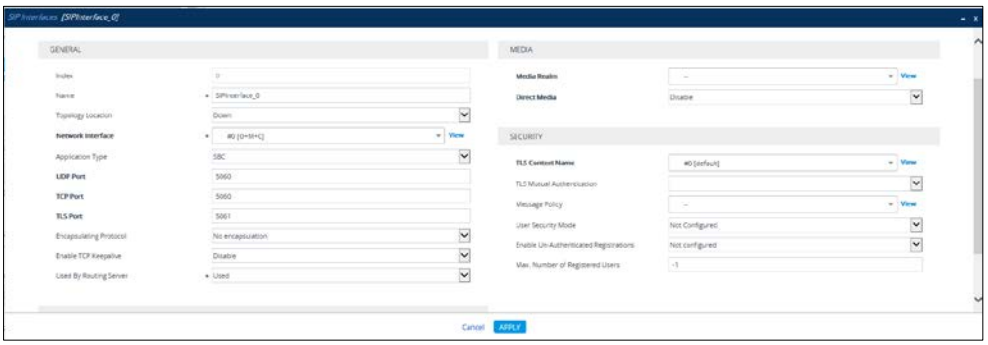


Figure 10-9: Web Interface – SIP Interfaces Table - Configuring a SIP Interface



  4. Set the 'Used by Routing Server' parameter to **Used**.
  5. Click **Save**.

10.6 Migrating SBC Routing to the ARM

This section shows how to migrate SBC routing to the ARM network.

After making sure the SBC is connected to all HTTP ARM services i.e., ARM Topology Server *and* router/s, you can begin to migrate the routing logic from that configured in the SBC, to the ARM. Screenshots in this section are for illustrative purposes only.

Note:

- See also Appendix A.
- 'IP Group' and 'Trunk Group' in the Web are called 'Peer Connection' in the ARM.

➢ **To migrate routing logic to the ARM:**

1. In the Web interface, navigate to the IP Groups page (**Setup** > **Signaling & Media** > **Core Entities** > **IP Groups**).
2. Locate the IP Group to expose the enterprise network to the ARM environment. Make sure the SIP interface associated with this IP Group is configured as 'used by routing server'. See Section 10.5.

Figure 10-10: Web Interface – IP Groups

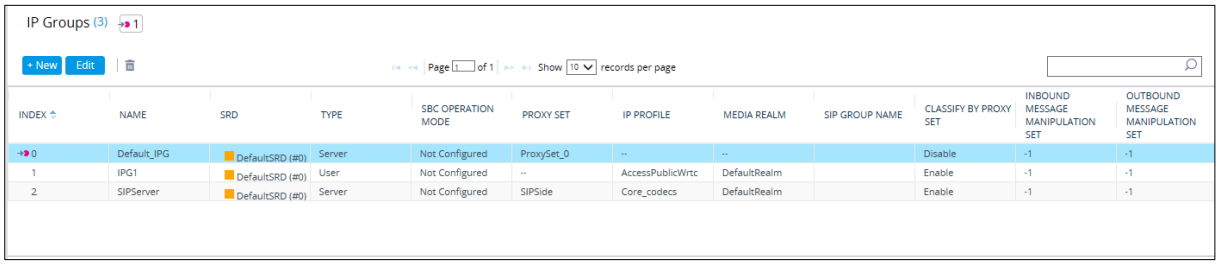
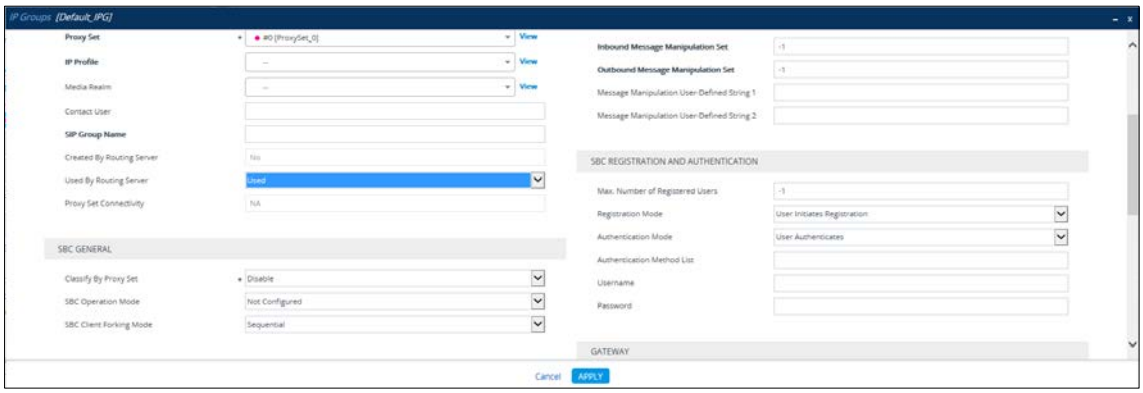


Figure 10-11: Web Interface – IP Groups - Configuring an IP Group



3. [Mandatory] Enter a unique name for the IP Group.
4. [Mandatory] Set the 'Used by Routing Server' parameter to **Used**.
5. Click **Save**.
6. In the ARM GUI, make sure the device is displayed in the Network page, Map view. Verify that the peer connection you configured is displayed. Unlock it (see Section 2.2.3.2); make sure its color is green (see Section 2.2.3.2).

Note: After configuring an IP group and then viewing it in the ARM, it is strongly recommended not to change its unique name. Changing its unique name will prevent routing by the ARM of calls to this Peer Connection (IP group) and receipt by the ARM of calls from this Peer Connection (IP group).

7. In the Web interface, open the IP-to-IP Routing page (**Setup** > **Signaling & Media** > **SBC** > **IP-to-IP Routing**). The screen below shows an example of two routing rules.

Figure 10-12: Web Interface – IP-to-IP Routing

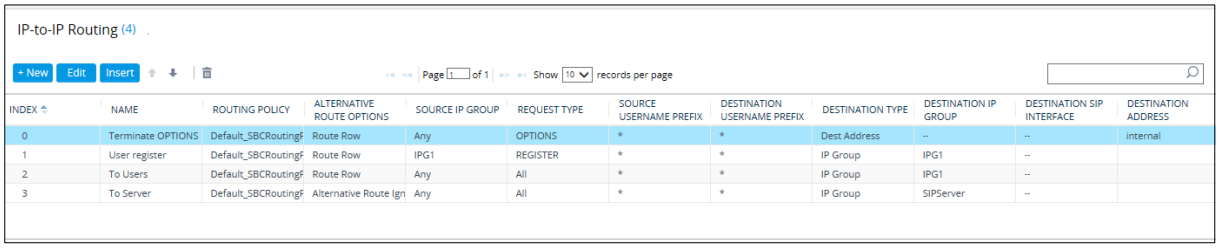
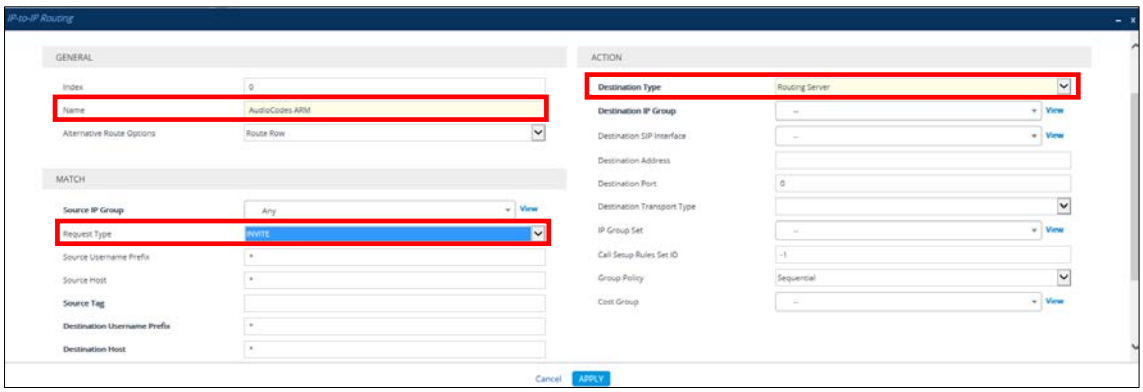


Figure 10-13: Web Interface – IP-to-IP Routing Table – Add Row – Rule tab

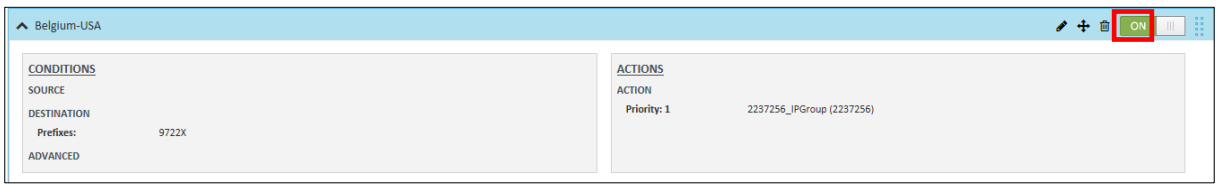


8. Define a 'Name' and for 'Request Type', define **INVITE** (see Appendix E if you need to use the ARM to route other SIP Request Types such as MESSAGE or NOTIFY). Leave all other conditions fields undefined (i.e., No Conditions, or Any).
9. From the 'Destination Type' dropdown, select **Routing Server**. This rule will serve to perform routing via the ARM.
10. Leave all other fields undefined, and then click **Add**.

At this point, your routing service will still be operating according to that defined in the IP-to-IP Routing page in the SBC's Web interface.

11. In the ARM GUI's Routing page, configure a rule parallel to one of the rules configured in the Web interface's IP-to-IP Routing page (see Section 8.1).

Figure 10-14: Configuring a Routing Rule in the ARM



12. In the ARM GUI, switch **ON** the routing rule; rule is now activated in the ARM.
13. In the Web interface, delete the routing rule. The transition is now complete.
14. Perform a Test Route (see Section 8.3 for detailed information).
15. Make a call and make sure it was established by the ARM.

Configure manually using the ini file, or in the Web interface's 'Admin' page, configure 'SendAcSessionIDHeader' = **1** for the SBC/Gateway to preserve the Call ID when a call passes through multiple SBCs/Gateways.

Note: See also Appendix A.

10.7 Migrating Media Gateway Routing to the ARM

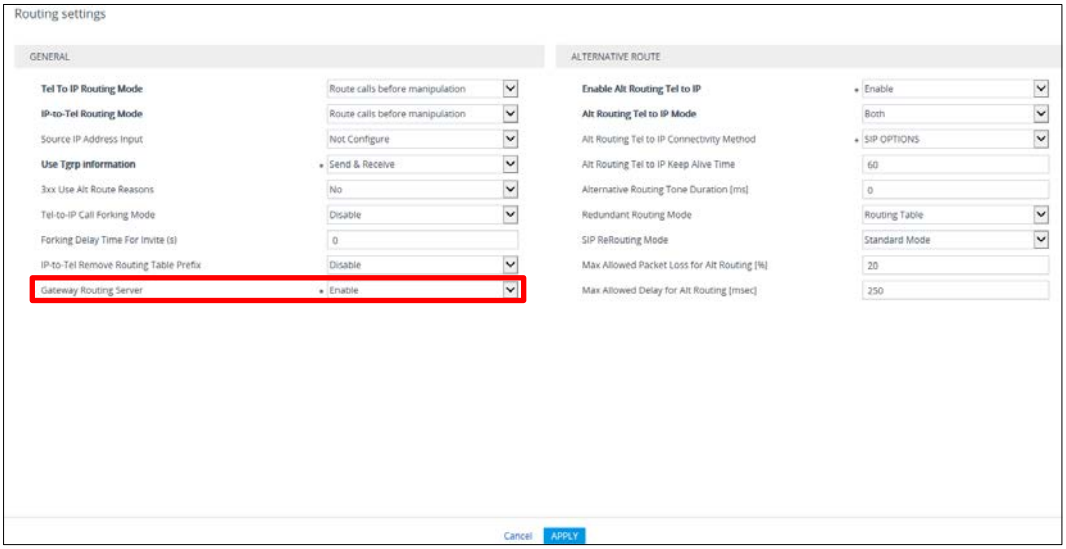
After making sure that the device (the gateway in this case) is connected to all HTTP ARM services i.e., ARM Topology Server and router/s, you can begin to migrate the routing rules from those defined in the Web interface to the ARM. Screenshots are for illustrative purposes.

Note: 'Trunk Group' and 'IP Group' in the Web are called 'Peer Connection' in the ARM.

➢ **To migrate gateway routing rules to the ARM:**

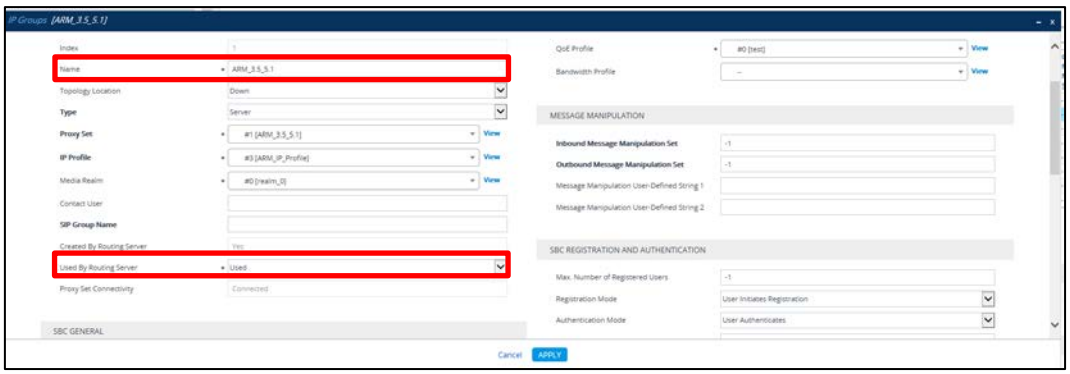
1. In the Web interface, navigate to the Routing Settings page, and set the parameter 'Gateway Routing Server' to **Enable**.

Figure 10-15: Web Interface - Routing Settings Page



2. Navigate in the Web interface to the IP Groups page.
3. Locate the IP Group to expose the enterprise network to the ARM environment.
4. [Mandatory] Enter a unique name for the IP Group as shown in the figure below.
5. Set the 'Used by Routing Server' parameter to **Used** as shown in the figure below, and then click **Apply**.

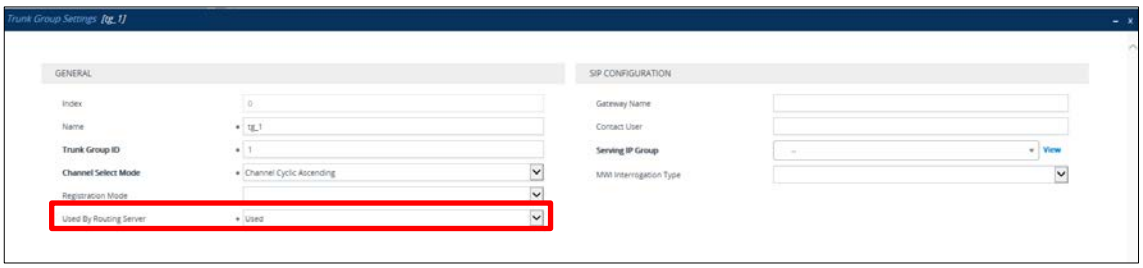
Figure 10-16: Web Interface - IP Groups Page



6. Navigate to the Trunk Group Settings page (**Setup** > **Signaling & Media** > **Gateway** > **Trunk Group Settings**) shown in Figure 10-17.

7. Locate the Trunk Group to expose the enterprise network to the ARM environment.
8. [Mandatory] Enter a unique name for the Trunk Group.
9. Set the 'Used by Routing Server' parameter to **Used**, and then click **Apply**.

Figure 10-17: Web Interface - Trunk Group Settings



10. In the ARM GUI, make sure the device is displayed in the Network page, Map view. Make sure the Peer Connection you configured is displayed. Unlock it and make sure its color is green.

Note: After viewing the trunk group or IP Group in the ARM, it is strongly recommended not to change its unique name. Changing its unique name will prevent routing by the ARM of calls to this Peer Connection (trunk / IP group) and receipt by the ARM of calls from this Peer Connection (trunk / IP group).

At this point, your routing service will still be operating according to that defined in the Tel-to-IP Routing and IP-to-Tel Routing pages in the gateway's Web interface.

11. In the ARM GUI's Routing page, configure a rule parallel to one of the rules configured in the Web interface's Tel-to-IP Routing or IP-to-Tel Routing pages.
12. Unlock the configured gateway Routing Rule in the ARM and check using the Test Route feature that the rules are functioning as required.
13. Delete the parallel rules configured in the Web interface's Tel-to-IP Routing or IP-to-Tel Routing pages.

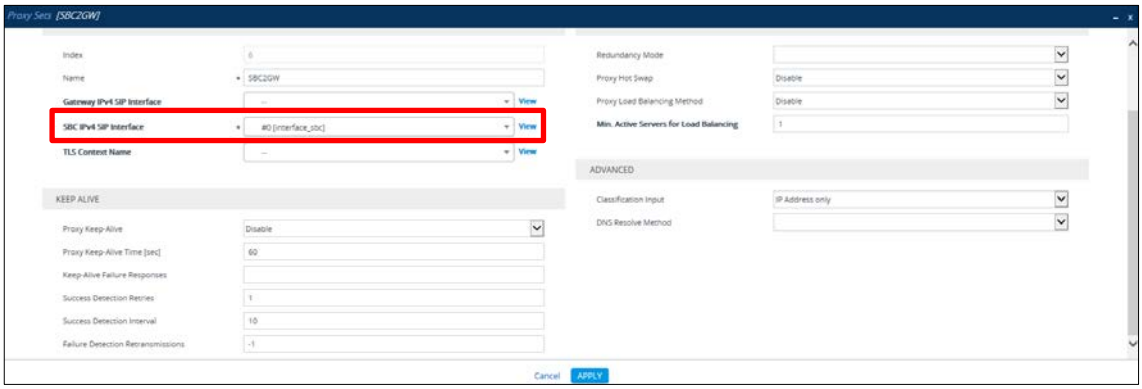
10.8 Migrating Hybrid Routing to the ARM

After making sure that the hybrid device is connected to all HTTP ARM services i.e., ARM Topology Server and router/s, you can begin to migrate the routing rules from those defined in the Web interface to the ARM.

➢ **To migrate hybrid routing rules to the ARM:**

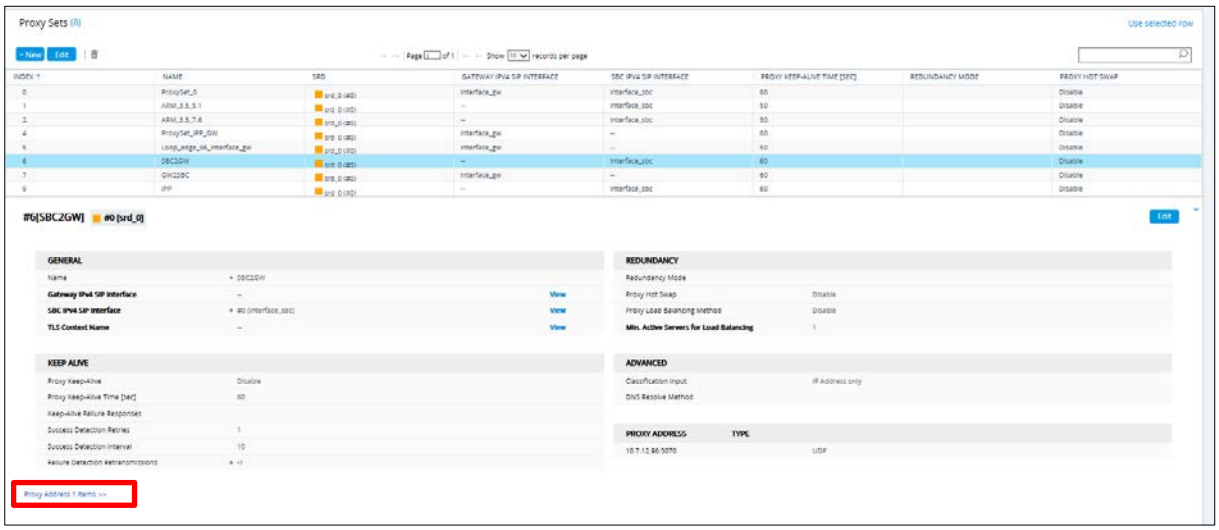
1. Perform migration of the SBC according to the instructions in Section 10.6.
2. Perform migration of the Media Gateway according to the instructions in Section 10.7.
3. Open the hybrid device's Web interface.
4. Create an IP Group (Peer Connection) for the SBC application:
   a. Open the Proxy Sets page (**Setup** > **Signaling & Media** > **Core Entities** > **Proxy Sets**) and then add a Proxy Set for the SBC application:

Figure 10-18: Add Proxy Set – for SBC



   b. From the 'SBC IPv4 SIP Interface' dropdown, select **SBC SIP Interface** and then click **Apply**; the Proxy Sets page opens showing the list of proxy sets, including the proxy set you added.

Figure 10-19: Proxy Sets



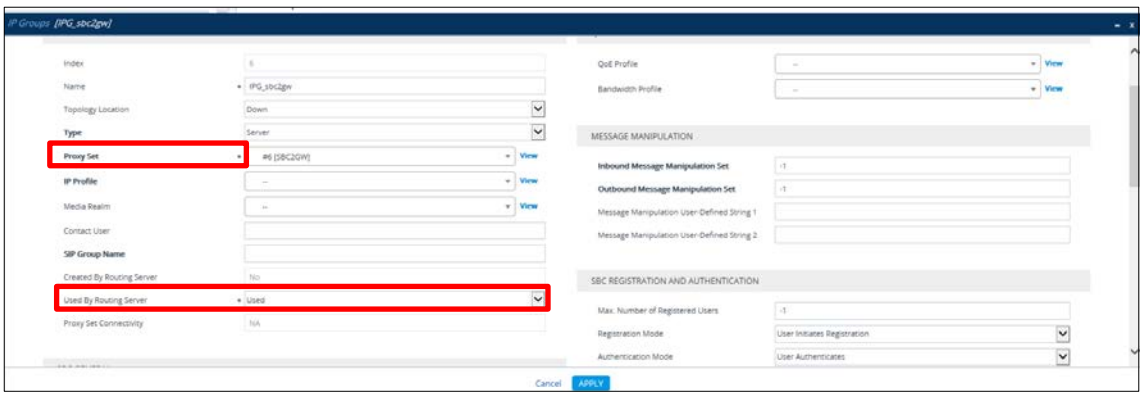
5. From the Proxy Sets list shown in the figure above, select the proxy set you added and then click the Proxy Address link.

Figure 10-20: Add New Proxy Address

a. Enter the Proxy IP Address in the format **<IPAddress>:Port**. This address must point to the Gateway SIP interface address so a loop between the SBC SIP application and the Gateway SIP application is created.

b. Open the IP Groups page (**Setup** > **Signaling & Media** > **IP Groups**), add an IP Group (click **New**) and associate it with the Proxy Set you added in Step 4a:

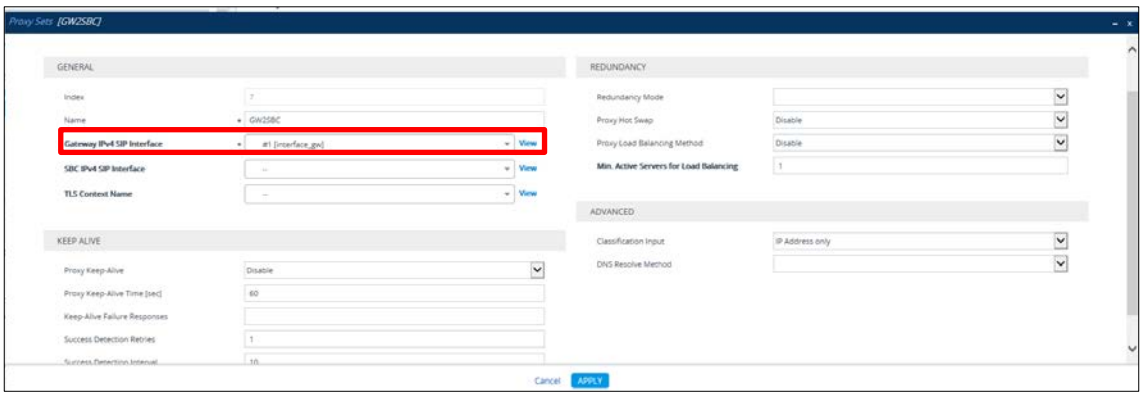
Figure 10-21: IP Group for the SBC Application



6. Create an IP Group (Peer Connection) for the *Media Gateway* application:

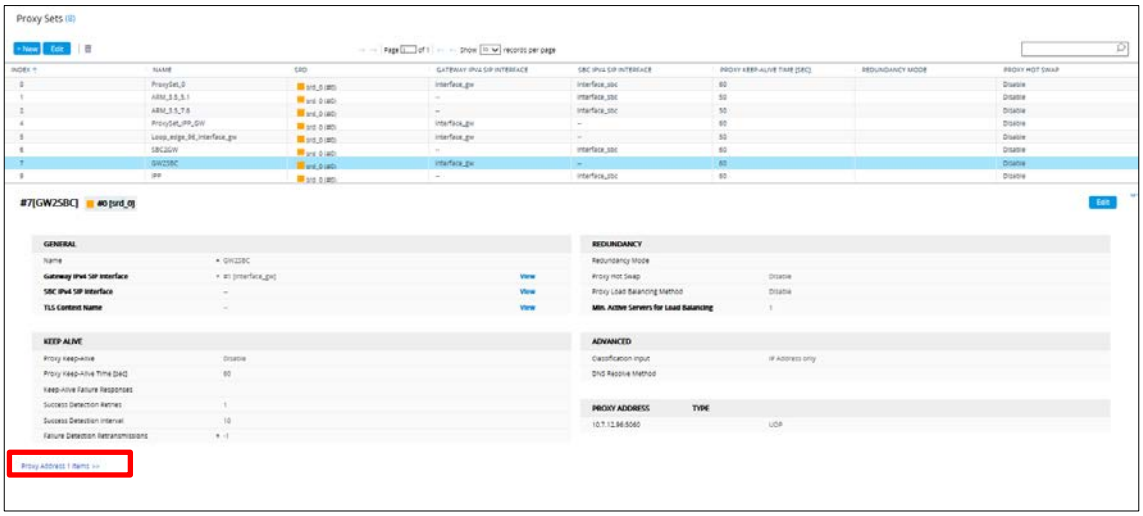
a. Open the Proxy Sets page (**Setup** > **Signaling & Media** > **Core Entities** > **Proxy Sets**) and then add a Proxy Set (click **New**) for the Media Gateway application:

Figure 10-22: New Proxy Set for Media Gateway Application



b. Select **Gateway SIP Interface** from the 'Gateway IPv4 SIP Interface' dropdown and then click **Apply**; the Proxy Sets page opens showing the list of proxy sets, including the proxy set you added.

Figure 10-23: Proxy Sets



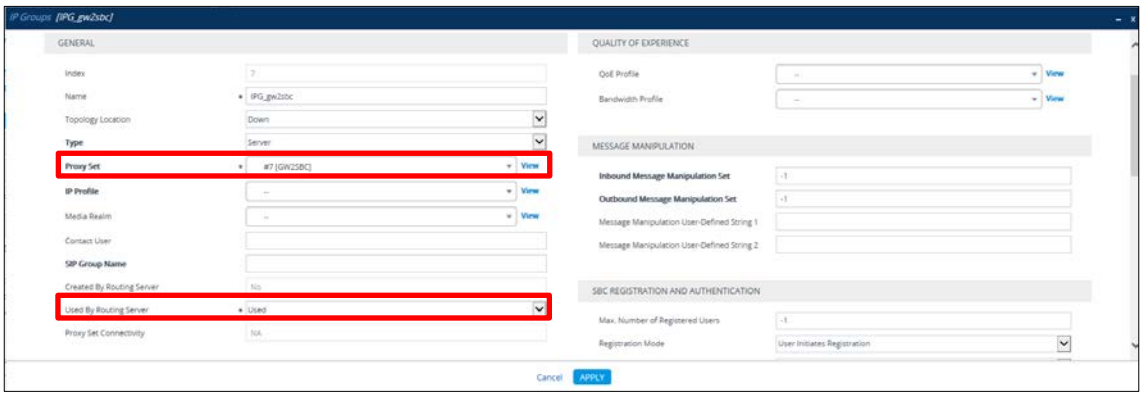
7. From the Proxy Sets list shown in the figure above, select the proxy set you added and then click the Proxy Address link.

Figure 10-24: Add New Proxy Address

a. Enter the Proxy IP Address in the format **<IPAddress>:Port**. This address must point to the SBC SIP interface address so a loop between the Gateway SIP application and the SBC SIP application is created.

b. Open the IP Groups page (**Setup** > **Signaling & Media** > **IP Groups**), add an IP Group (click **New**) and associate it with the Proxy Set you added:

Figure 10-25: IP Group for the SBC Application



8. Click **Apply**. Check in the ARM that calls can be routed to and from the hybrid device.

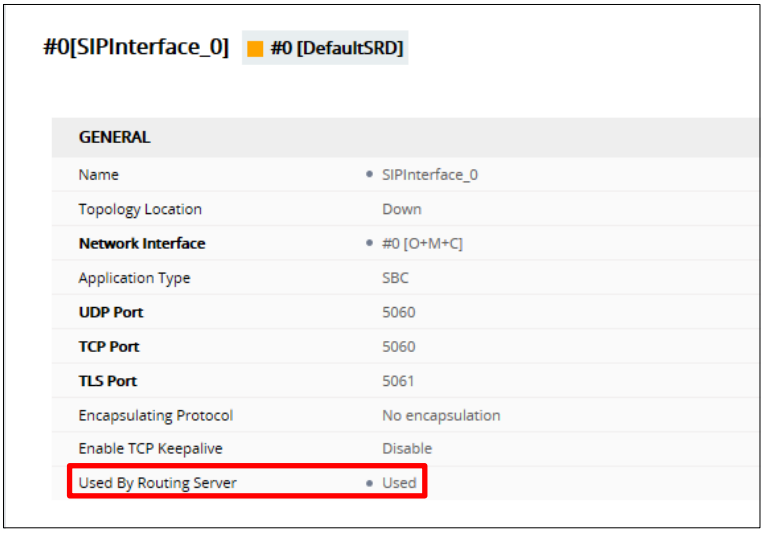
A Checklist for Migrating SBC Routing to the ARM

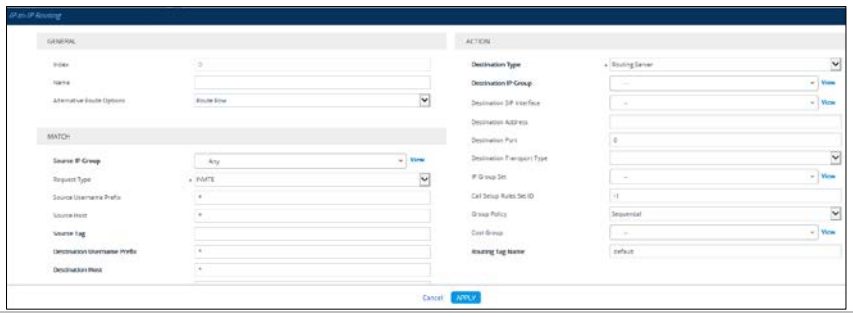
Administrators can use the checklist shown in the table below when migrating SBC routing to the ARM. Tick off the items in the list as you proceed.

Note: The screenshots shown in this section are of Web interface version 7.2. If you're using Web interface version 7.0 or earlier, refer to earlier versions of this document.

Table A-1: SBC Migration Checklist

Item	SBC-Level	What should be viewed in the ARM
1	Configure the SBC in the way you used to, including all the IP Groups for connectivity with external SIP trunks and PBXs.	Unrelated to ARM
2	Configure the IP address of the ARM's 'Configurator' Note: Do not configure Routers independently. Only configure 'Configurator' IP address and credentials: ▪ Configure in the SBC's Web interface (**Setup** > **IP Network** > **Web Services** > **Remote Web Services**): ✓ IP address of the Configurator ✓ User name and Password for connecting to the Configurator. Default: Admin/Admin ▪ Make sure the status of each ARM service is 'Connected'.	View the new Node. Make sure it becomes green-coded, indicating that it's available.

Item	SBC-Level	What should be viewed in the ARM
3	Choose the SIP interfaces you want to use in the ARM (for ARM Peer Connections and ARM Connections) to be 'Used by Routing Server'. ▪ Open the SBC Web interface (**Setup** > **Signaling & Media** > **Core Entities** > **SIP Interfaces**) 	You're able to select the chosen SIP Interfaces as ARM 'Routing Interfaces' for ARM Connections between the Nodes (SBCs)
4	Select each IP Group you want to use in the ARM as a Peer Connection for routing, to be **Used by Routing Server**. These should be, for example, SIP trunks and connections to IP PBXs. ▪ Open the IP Groups page (**Setup** > **Signaling & Media** > **Core Entities** > **IP Groups**). 	View the selected IP Groups as ARM Peer Connections and attached VoIP Peers. View their availability status (green/red). In the ARM, unlock these Peer connections.

Item	SBC-Level	What should be viewed in the ARM
5	At this stage, the ARM does not route calls, though you can apply a 'test route' at the ARM level. The Node (SBC) does not send a routing request to the ARM after a SIP invite.	In the ARM you can now: ▪ View and create ARM topology (connections between the Nodes) ▪ Add ARM routing groups and Routing rules, manipulation groups, etc. ▪ Test yourself using the ARM's 'test route'
6	Command the SBC to route calls using the ARM: ▪ Open the SBC Web interface IP-to-IP Routing (**Setup** > **Signaling & Media** > **SBC** > **IP-to-IP Routing**). ▪ Make sure the rule that routes all INVITE requests to the ARM is configured. The following parameters are mandatory: 'Request Type' = INVITE; 'Destination Type' = Routing Server. 	Calls are now routed by the ARM: ▪ SBC gets an INVITE ▪ Sends routing Request to ARM ▪ Get reply from ARM ▪ Sends INVITE further according to the ARM's instructions
7	Configure manually using the ini file (or in the 'Admin' Web interface page): **SendAcSessionIDHeader = 1**	Causes the SBC to preserve Call ID when a call passes through several SBCs.

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B Prefixes

The table below describes the prefixes rules.

Table B-1: Prefixes

Notation	Description	Examples
[n-m]	Represents a range of numbers. Note: numbers “n” and “m” should be of the same length.	[5551200-5551300]#: represents all numbers from 5551200 to 5551300. 123[100-200]: represents all numbers from 123100 to 123200.
[n,m,...] or n,m,l, …	Represents multiple numbers or strings.	[2,3,4,5,6]#: represents a one-digit number starting with 2, 3, 4, 5, or 6. [11,22,33]XXX#: represents a five-digit number that starts with 11, 22, or 33. [111,222]XXX#: represents a six-digit number that starts with 111 or 222. [2X,3X,4X,50,54]XXXXXX#: represents a 8 digit number starting with 2, 3, 4, 50 or 54 aaa,bbb,ce,field : represents names that start with one of the strings: aaa, bbb, ce or field.
[n1-m1,n2-m2, a,b,c,n3-m3]	Represents a mixed notation of multiple ranges and single numbers.	[123-130,455,766,780-790]: represents numbers 123 to 130, 455, 766, and 780 to 790.
X (capital only)	Represents any single digit or character.	BobX: represents names starting with bob1 or bob2@audiocodes.com AliceX#: represents names of 6 characters length, starting with Alice such as Alice1.
Pound sign (#) at the end of a number	Represents the end of a number.	54324XX#: represents a 7 digit number that starts with 54324.
Empty	Represents any number or string	

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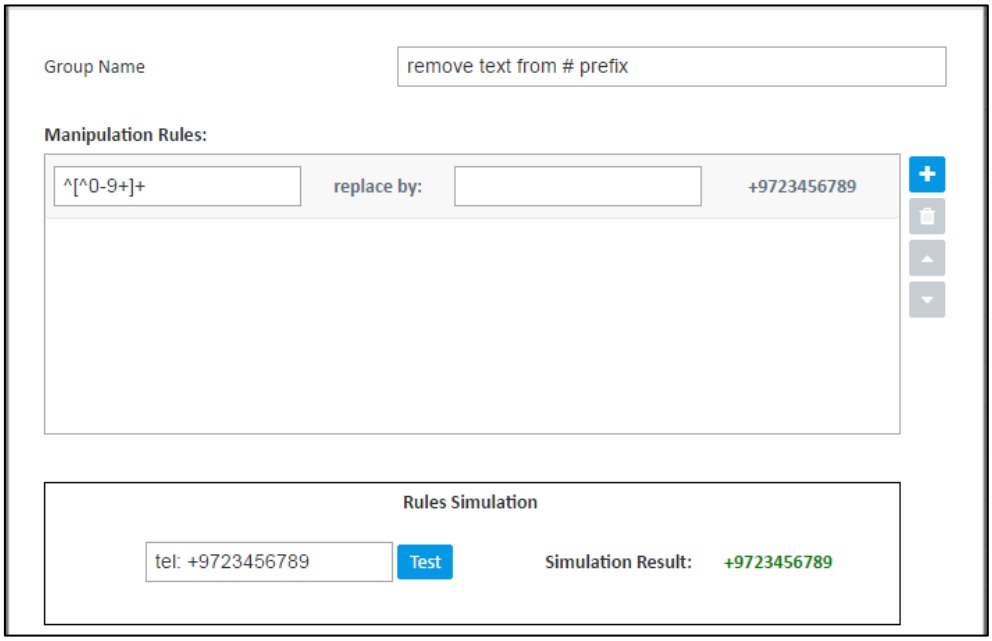
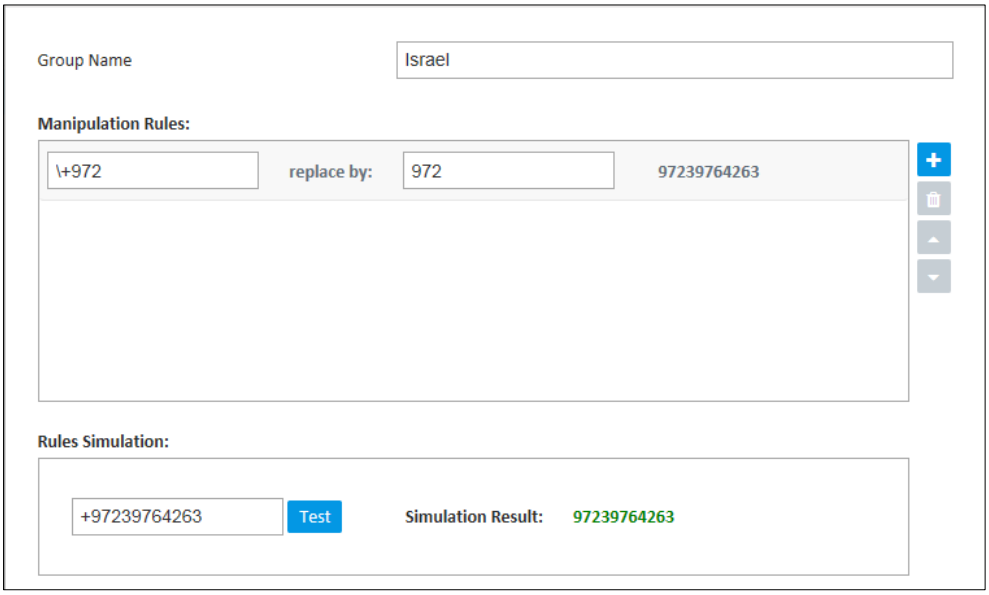
C Examples of Normalization Rules

This appendix shows examples of Normalization Rules and regular expressions.

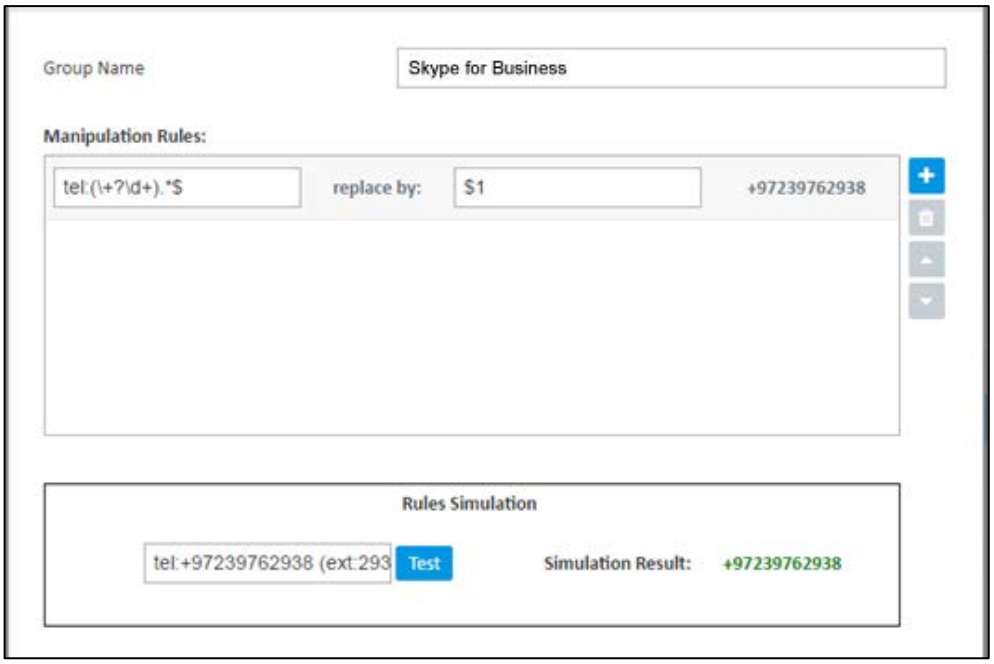
- Remove any non-number text from the prefix of the number:



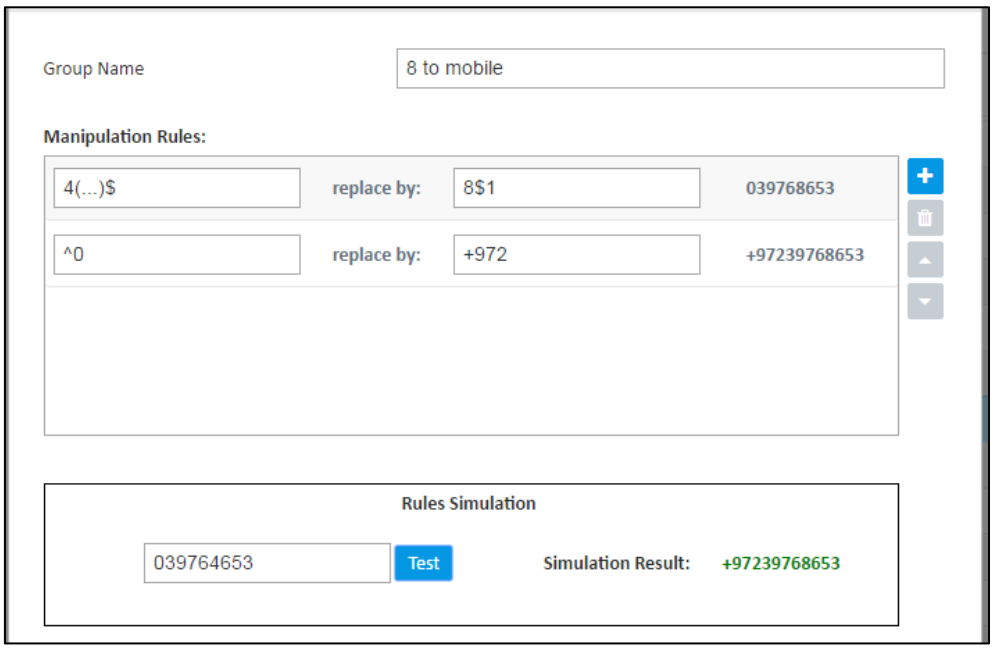
- Strip the **+** from the number.



- Skype for Business: Remove “tel:” from the prefix and any text from the number's suffix. In the **Test** field, the full number is tel:+97239762938 (ext:2938).



- If the fourth digit from the right is **4**, change it to **8**, and if the first digit is **0**, change it to **+972**.



- Click **OK** and then click **Submit**.

D Call Routing

This appendix describes call routing.

- A routing request results in an HTTP error response if no routing is available.
- A routing request from a source node which has an alternate route option returns the next alternate route option. The call route is not recalculated. If the alternate route list is empty, a 404 result is returned.
- A routing request from a node which is not the source node returns the next hop in the routing chain according to the original route selection. The routing logic is not performed again.

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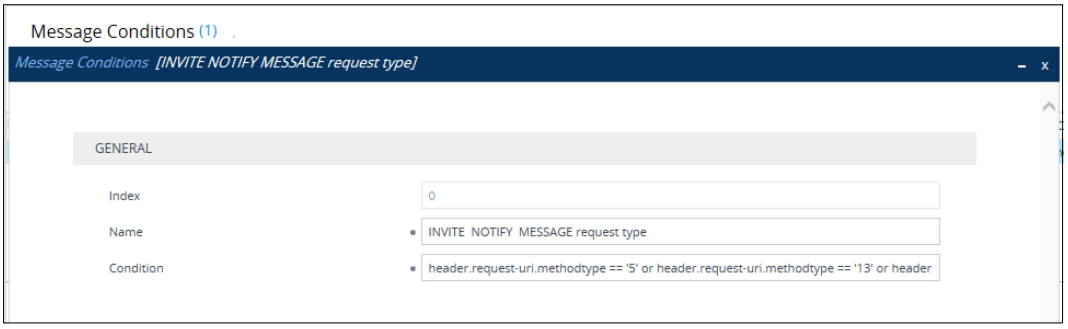
E Configuring an SBC to Send SIP Requests other than INVITE to ARM

This appendix shows how to configure the SBC to send MESSAGE and NOTIFY SIP requests to the ARM. To get not only INVITE but also NOTIFY and MESSAGE, create a new Condition in the Condition table with the value: "header.request-uri.methodtype == '5' or header.request-uri.methodtype == '13' or header.request-uri.methodtype == '14'".

➢ **To configure the SBC to send SIP Requests other than INVITE to the ARM:**

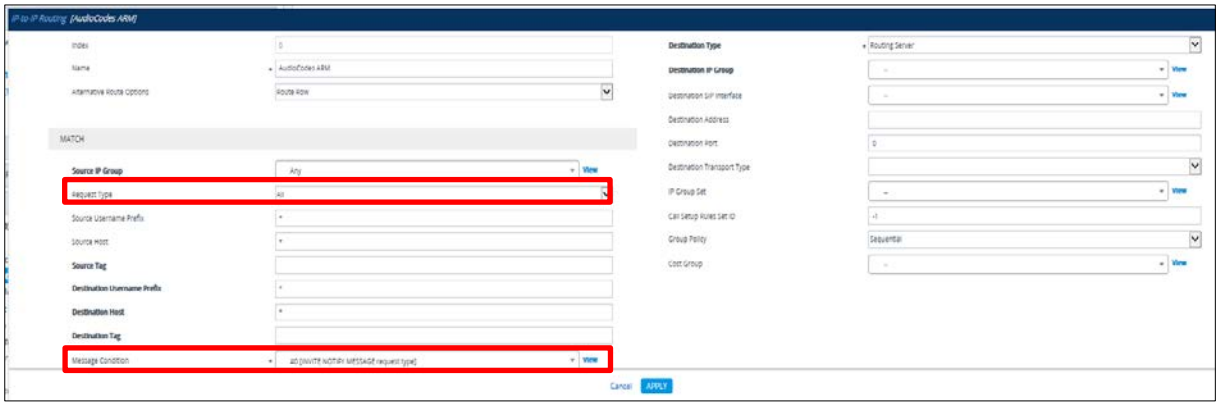
1. Open the Message Conditions page (**Setup** > **Signaling & Media** > **Message Manipulation** > **Message Conditions**) and click **Add**.

Figure E-1: Web Interface – Message Conditions



2. Add the condition as shown in the figure above, and click **Apply**.
3. Open the IP-to-IP Routing page (**Setup** > **Signaling & Media** > **SBC** > **Routing** > **IP-to-IP Routing**), select the row of the Routing Rule that directs calls to the ARM, and click **Edit**.

Figure E-2: Web Interface – IP-to-IP Routing



4. Edit the Routing Rule (see the figure above):
   - Change 'Request Type' from **Invite** to **All**.
   - Select the 'Message Condition' you configured.
5. Click **Apply**.
6. Make a call and make sure the call was established by the ARM.

   Configure manually using the ini file, or in the Web interface's 'Admin' page, configure 'SendAcSessionIDHeader' = **1**. Note that this step is temporary and that a permanent solution is pending. It causes the SBC/Gateway to preserve Call ID when a call passes through several SBC/Gateways.

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F Opening Firewall Ports for the ARM

This appendix shows which ports must be opened for the ARM in the Firewall.

Table F-1: Opening Firewall Ports for the ARM

Connection	Port Type	Secured Connection	Port Number	Purpose	Port side / Flow Direction
ARM and Devices (SBCs/Gateways/Hybrid nodes)					
Device ↔ ARM Configurator (REST communication)	TCP (HTTPS) - default	✓	443	Topology Auto-discovery, Topology Status update, Quality information, long call sessions information (for licensing)	Bi-Directional
	TCP (HTTP) – for debug only	×	80	Topology Auto-discovery, Topology Status update, Quality information, long calls session information (for licensing)	Bi-directional
Device ↔ ARM Router (REST communication)	TCP (HTTPS) - default	✓	443	Routing requests and calls status	Bi-Directional
	TCP (HTTP) – for debug only	×	80	Routing requests and calls status	Bi-directional
ARM and LDAP Active Directory Server					
ARM Configurator ↔ Active Directory LDAP server	TCP (LDAP)	×	389 (Default, can be configured at ARM)	Getting of ARM AD users and updating ARM user database	Bi-directional
	TCP (TLS - LDAPS)	✓	636 3268 for 'Global catalog' Default, can be configured at ARM)	Getting of ARM AD users and updating ARM user database LDAPS (TLS) is configured at ARM	Bi-directional
ARM GUI and North bound Interface					
UI (REST communication) → ARM Configurator	TCP (HTTPS)	✓	443	ARM component status updates, GUI, Provisioning, Alarms indications	Incoming (from ARM Configurator perspective)
Third-party application (via	TCP (HTTPS)	✓	443	ARM component status updates, GUI,	Incoming (from ARM

Connection	Port Type	Secured Connection	Port Number	Purpose	Port side / Flow Direction
official REST API) → ARM Configurator				Provisioning, Alarms indications	Configurator perspective)
ARM Configurator → SNMP Target	UDP (SNMP)	×	161, 162 or configurable	ARM generates SNMP traps/alarms toward predefined SNMP Target.	Outgoing
ARM Management/Maintenance Interfaces					
ARM Configurator ↔ NTP Server	UDP (NTP server)	×	123	ARM Configurator acts as NTP client toward external (pre-configured) NTP server. It also acts as NTP Server toward ARM Routers.	Bi-directional
ARM Router → NTP Server (ARM Configurator)	UDP (NTP)	×	123	ARM Router acts as NTP client	Outgoing
ARM Configurator ↔ Client PC (SSH)	TCP	✓	22	SSH communication between ARM Configurator and external PC initiated by client PC: For ARM maintenance	Bi-directional
ARM Router ↔ Client PC (SSH)	TCP	✓	22	SSH communication between ARM Router and external PC initiated by client PC: For ARM maintenance	Bi-directional
ARM Configurator → Syslog server	TCP	×	514 (by default) or configurable	ARM Configurator logs can be forwarded to external syslog server.	Outgoing
ARM Router → Syslog server	TCP	×	514 (by default) or configurable	ARM Routers logs can be forwarded to external syslog server.	Outgoing
ARM Inter-Components Communication (Configurator ↔ Routers)					
ARM Configurator ↔ ARM Routers	TCP (HTTPS)	✓	443	Getting call statistics from the ARM Configurator; getting call sessions information for ARM licensing	Bi-directional

Connection	Port Type	Secured Connection	Port Number	Purpose	Port side / Flow Direction
	TCP (HTTP) for debugging only	✗	80	Getting call statistics from the ARM Configurator; getting call sessions information for ARM licensing	Bi-directional
ARM Configurator ← JMS Broker	TCP (TLS)	✓	8080	Informing ARM Routers about topology changes (including topology status and quality changes)	Incoming
ARM Router → JMS Broker	TCP (TLS)	✓	8080	Getting Topology updates from ARM	Outgoing

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G About CDRs Sent by ARM to CDR Server

ARM Routers send CDRs (Call Detail Records) to a CDR Server. CDR messages contain information about all calls routed by the ARM, for example, source and destination users, call duration and call path. CDR messages also provide billing details. CDRs are sent as syslog packets to a predefined IP address configured by the operator. CDR syslog messages comply with RFC 3164 and are identified by Facility 17 (local1) and Severity 6 (Informational). CDR messages are built using getRoute and CallStatus_callEnd messages, by the first node in the paths. CDR types are CALL_START and CALL_END.

Calls from an SBC node:

1. Two CALL_START messages are sent per route (path)
2. Two CALL_END messages are sent at the end of the call (not per route)

Calls from a gateway node:

1. One CALL_START message is sent per route (path)
2. One CALL_END message is sent at the end of the call (not per route)

SessionId is identical for all CDR messages related to the same call.

The **routeSeq:**

1. Represents the route (path) the ARM attempts
2. The count starts from 0
3. For example, for an SBC call, when there are three paths to attempt, the ARM sends:
   a. First route (path): Two CALL_START messages and one CALL_END (outgoing leg) message. routeSeq = 0.
   b. Second route (path): Two CALL_START messages and one CALL_END (outgoing leg) message. routeSeq = 1.
   c. Third route (path): Two CALL_START and two CALL_END (incoming and outgoing legs) messages. routeSeq = 2.

The table below describes all CDR fields.

Table G-1: CDR Field Descriptions

CDR Field	Description	CDR Report Type	Format
RouterIp	IP address of the Router that sends the CDR.	All	String (15)
Seq	Each router sends its own sequence CDR staring with 1.	All	String (10)
CdrReportType	Report type: ▪ "CALL_START": CDR is sent upon an getRoute message on the first node. "CALL_END": CDR is sent upon a CALL_STATUS_END_CALL message from the node.	-	String (13)
cdrApplicationType	Endpoint type: ▪ "SBC" ▪ "GW" ▪ "HYBRID" "THIRD_PARTY"	All	String (13)

CDR Field	Description	CDR Report Type	Format
SessionId	Unique Session ID	All	String (20)
callId	CallId of the relevant leg	"CALL_START" – incoming leg. "CALL_END" – both legs.	String (55)
numOfEndCall	Number of CALL_END which should be sent: 1 or 2	"CALL_START"	String (12)
pconOrConnectionName	Pcon or connection name	All	String (35)
direction	Direction of the call: Incoming or Outgoing	"CALL_START"	String (10)
nodeName	Node name as described in the GUI	All	String (25)
nodeId	ARM node database ID address	All	String (11)
nodeIp	Node IP address	All	String (20)
srcUri	Source URI as actually sent (after manipulation).	All	String (50)
srcUriBeforeMap	Source before manipulation.	"CALL_START"	String (50)
dstUri	Destination URI as actually sent (after manipulation).	All	String (50)
dstUriBeforeMap	Destination before manipulation.	"CALL_START"	String (50)
armSetupTime	ARM Router time when sending CALL_START.	"CALL_START"	String (30)
armReleaseTime	ARM Router time when sending CALL_END.	"CALL_END"	String (30)
sbcSetupTime	Gateway / SBC time when start handling Invite message.	"CALL_END"	String (40)
sbcConnectTime	Gateway / SBC time when 200 OK response (i.e., call is established)	"CALL_END"	String (40)
sbcReleaseTime	Gateway / SBC time when a BYE message (i.e., call ends)	"CALL_END"	String (40)
sbcAlertTime	Gateway / SBC time when start ringing	"CALL_END"	String (40)
alertDuration	Time of ringing in milliseconds (should be configured in the SBC /gateway to send in milliseconds)	"CALL_END"	String (13)

CDR Field	Description	CDR Report Type	Format
voiceDuration	Time of voice streamed in milliseconds (should be configured in the SBC /Gateway to send in milliseconds)	"CALL_END"	String (13)
completeDuration	Time of the whole call in milliseconds (from the first incoming Invite until ending the call)	"CALL_END"	String (16)
sipTerminationReason	SIP termination reason	"CALL_END"	String (20)
sipTerminationReasonDesc	SIP termination reason – more detailed	"CALL_END"	String (35)
routeSeq	Each route (path) of a call has a number. Starting from 0.	"CALL_START"	String (8)
sipInterface	sipInterface ID of the Connection or Peer Connection in the SBC / Gateway	"CALL_START"	String (20)
legId	Leg id of the SBC / Gateway	"CALL_END"	String (11)
Path	String – describes the path.	"CALL_START"	String (200)

Two CDR format options are available:

- Clear text (separating each value with "|")
- As JSON

Here's an example of an ARM signaling CDR as *clear text*, sent at the end of a call (which was terminated normally):

Format:

```
|routerIp |seq |cdrReportType|appType |sessionId |callId
|numOfEndCall|pconOrConName |direction |nodeName |nodeId |nodeIp
|srcUri |srcUriBeforeMap |dstUri |dstUriBeforeMap |armSetupTime
|armReleaseTime |sbcSetupTime |sbcConnectTime |sbcReleaseTime
|sbcAlertTime
|alertDuration|voiceDuration|completeDuration|sipTerminationReason
|sipTerminationReasonDesc |routeSeq|sipInterface |legId |path
```

Value:

```
|10.7.2.52 |4 |CALL_END |HYBRID |19938a1649dd3edf
|212364459381201017443 2@10.7.12.203 | |ARM_3.4_23.27 |NA
|10.7.12.203 - Hybrid |3 |10.7.12.203 | |302@10.7.6.36 |
|101;tgrp=to101@10.7.12.203 | |2018-05-01T06:43:39.957Z
|17:44:32.466 UTC Fri Jan 08 2010 |17:44:35.316 UTC Fri Jan 08
2010 |17:44:37.077 UTC Fri Jan 08 2010 |17:44:32.575 UTC Fri Jan
08 2010 |2741 |1760 |4611 |BYE |BYE |-1 | |2 |null
```

Here's an example of an ARM signaling CDR as json, sent at the end of a call (that was terminated normally):

```
jsonCdr={"routerIp":"10.7.2.52","seq":4,"cdrReportType":"CALL_END"
,"cdrApplicationType":"HYBRID","sessionId":"19938a1649dd3edf","cal
lId":"212364459381201017443 2@10.7.12.203","numOfEndCall":"","pconO
rConnectionName":"ARM_3.4_23.27","direction":"NA","nodeId":"3","no
deName":"10.7.12.203 -
Hybrid","nodeIp":"10.7.12.203","srcUri":"","srcUriBeforeMap":"302@
```

```
10.7.6.36","dstUri":"","dstUriBeforeMap":"101;tgrp=to101@10.7.12.2
03","armSetupTime":"","armReleaseTime":"2018-05-
01T06:43:39.957Z","sbcSetupTime":"17:44:32.466 UTC Fri Jan 08
2010","sbcConnectTime":"17:44:35.316 UTC Fri Jan 08
2010","sbcReleaseTime":"17:44:37.077 UTC Fri Jan 08
2010","sbcAlertTime":"17:44:32.575 UTC Fri Jan 08
2010","alertDuration":"2741","voiceDuration":"1760","completeDurat
ion":"4611","sipTerminationReason":"BYE","sipTerminationReasonDesc
":"BYE","routeSeq":-1,"sipInterface":"","legId":2,"path":null}
```

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