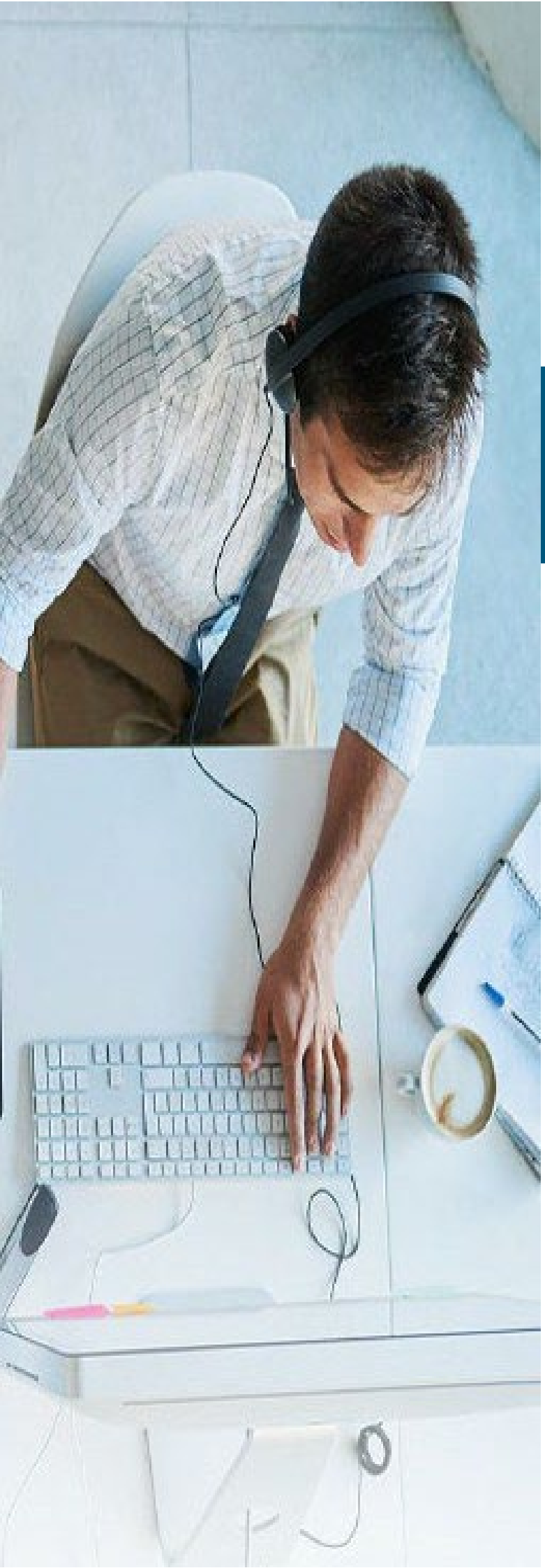

CALL RECORDING

System Admin Guide

MOMENTUM

Powered By: miarec

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1. Introduction

This guide from MiaRec (the vendor) provides information about how to manage the MiaRec platform for System Admins.
It is targeted to service provider-level and above administrators and engineers who develop, support and maintain the entire system for multiple customer tenants.

Note to Tenant Admins: This guide is provided as a reference only for better understanding of the underlying technology and services.
Many of the sections, tools, and tasks described in this guide are not available at the Tenant Admin level.

Important: Requests for changes to be made to the standard customer Call Recording Tenant setup would require Service Provider assistance. The standard Tenant setup is designed to ensure compliant usage and secured call recording data.

Alterations to the Standard Tenant setup are likely to incur professional services charges or changes to support SLAs by the Service Provider.

2. Single Sign-On

2.1 Single Sign-On

Single sign-on (SSO) is a session and user authentication service that permits a user to use one set of login credentials – for example, a name and password – to access multiple applications.

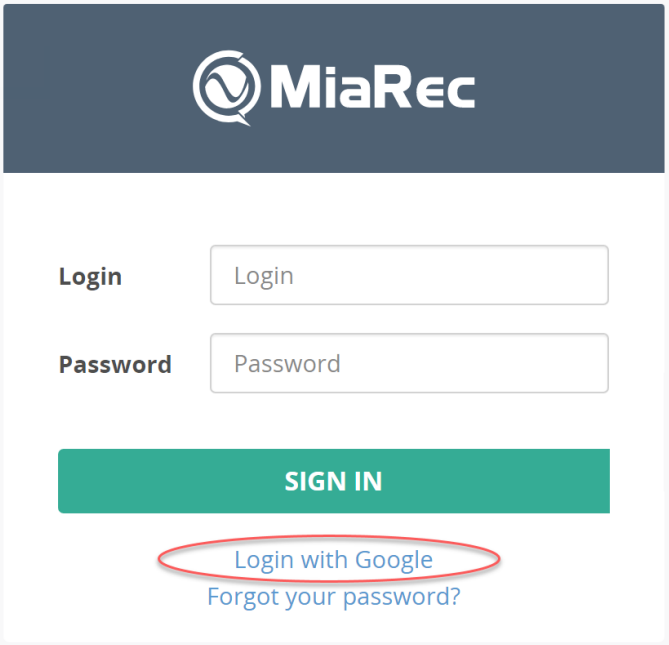
MiaRec currently supports the following Security SAML 2.0 compliant Identity Providers (IdP):

- OneLogin
- Azure AD
- Google G Suite

Other SAML 2.0 compliant Identity Providers may be supports as well, but not tested yet.

2.2 How SAML works

Security Assertion Markup Language (SAML) is a standard protocol that gives identity providers (IdP) a secure way to let a service provider (SP) such as MiaRec know who a user is. It does this by sending MiaRec a cryptographically signed XML document confirming users' identities, along with some basic user information.



Once configured, users can authenticate with the following process:

1. The user navigates to your MiaRec account (e.g. https://recordings.example.com/).
2. MiaRec presents the user with an additional login option (Login with {name of your provider}).
3. When clicked, the user's browser will be redirected to the identity providers.
4. The identity provider authenticates the user.
5. Once authenticated, the browser is redirected to MiaRec with a SAML assertion.
6. MiaRec verifies the SAML assertion and locates the corresponding user record in internal DB.
7. The user is granted access to MiaRec.
8. The user is redirected to original link.

2.3 How to set up SAML 2.0 Single Sign-On with Google G-Suite

This article describes how to setup single sign-on in MiaRec application using Google G-Suite as a SAML 2.0 Identity Provider.

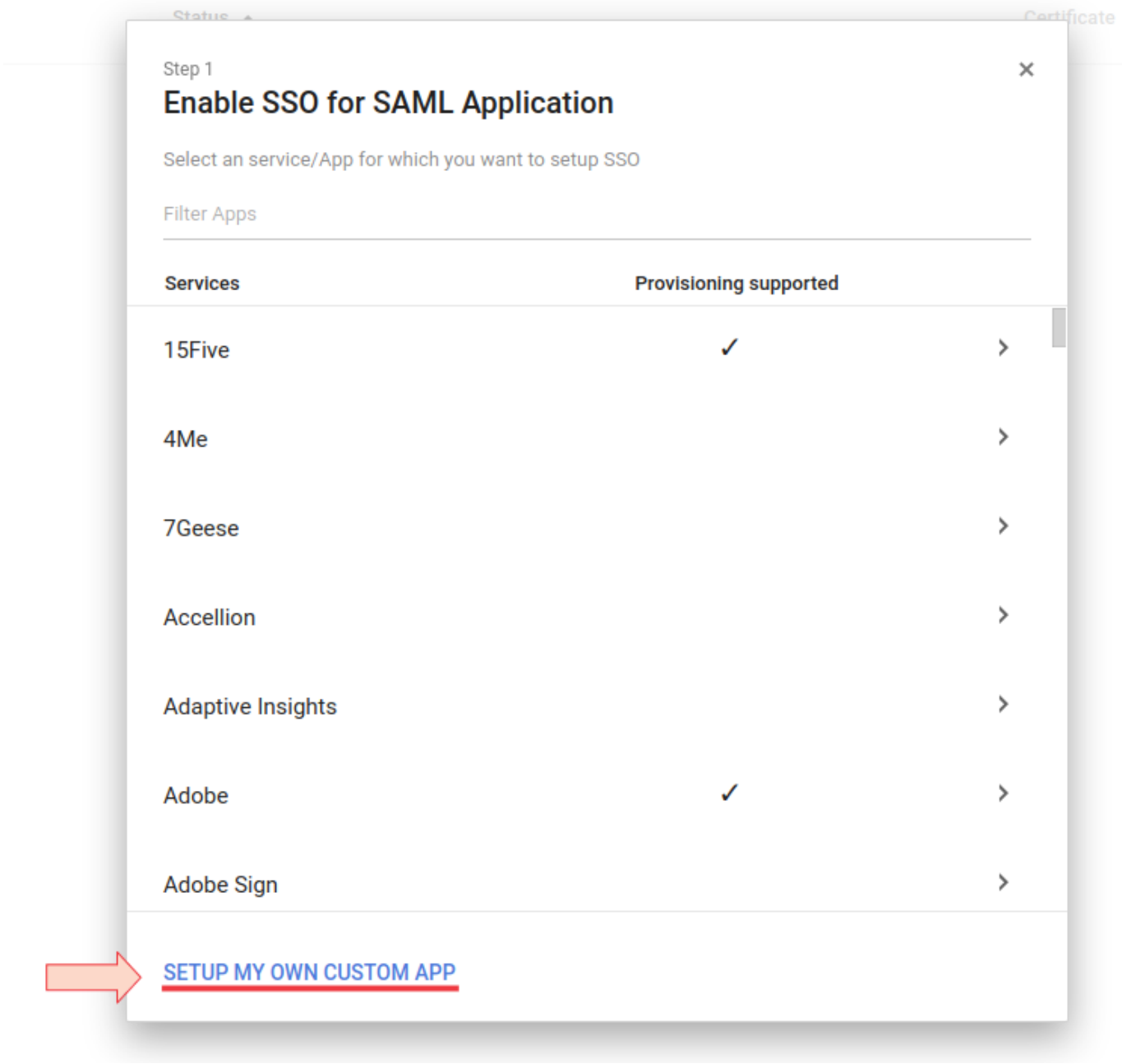
Once configured, users can use their G Suite credentials to sign in to MiaRec application.

2.3.1 Step 1. Create SAML App in Google G-Suite

Sign in to your Google Admin console (at admin.google.com) using an administrator account.

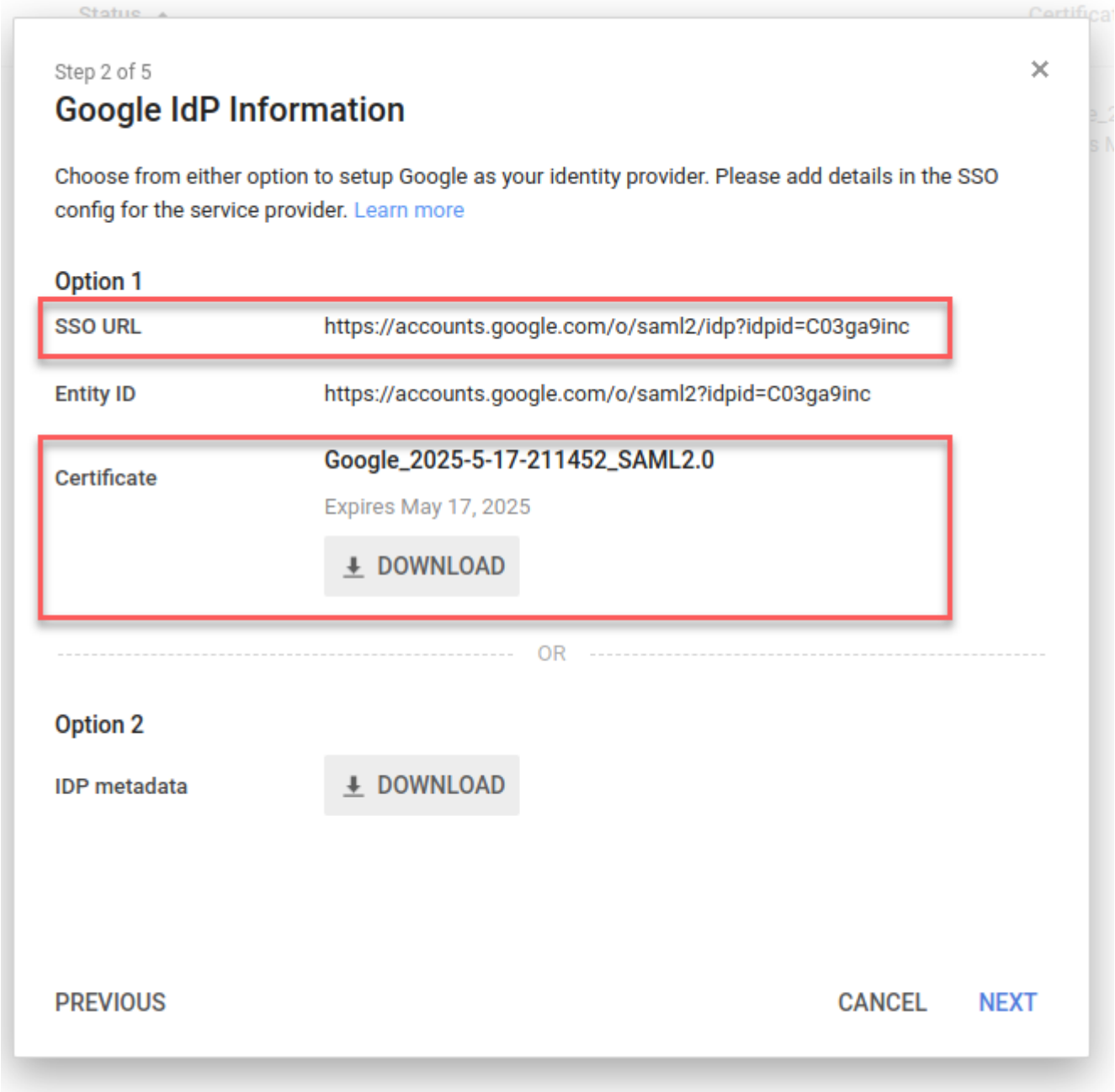
Go to **Apps > SAML apps**.

Click the plus (+) icon at the bottom right, then click **Set up my own custom app**.



In the **Google IDP Information** window, under **Option 1**:

- Note the **SSO URL** attribute. It is required for the next step.
- Click the **DOWNLOAD** button for **Certificate**. Save the file to your computer and open it in a text editor. This certificate is required for the next step.



Before you click the **Next** button in the **Google IdP Information** window, it is necessary configure MiaRec application first. Do not close this page yet, we will return to this process later.

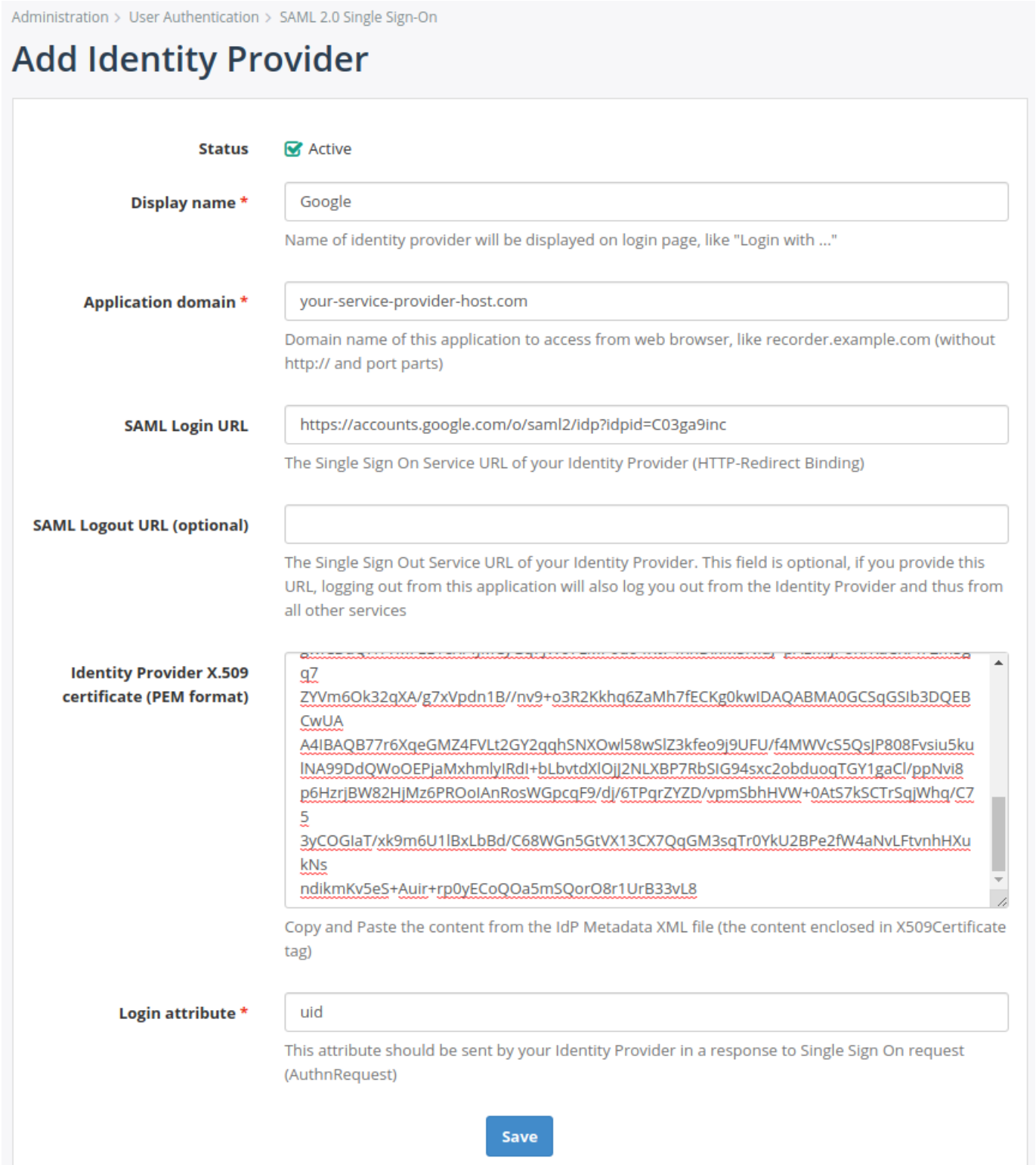
2.3.2 Step 2. Set up Identity Provider in MiaRec

In another web browser tab, log in to MiaRec web portal as an administrator.

Navigate to **Administration > User Authentication > SAML 2.0 Single Sign On** and click **Add** to create the new Identity Provider.

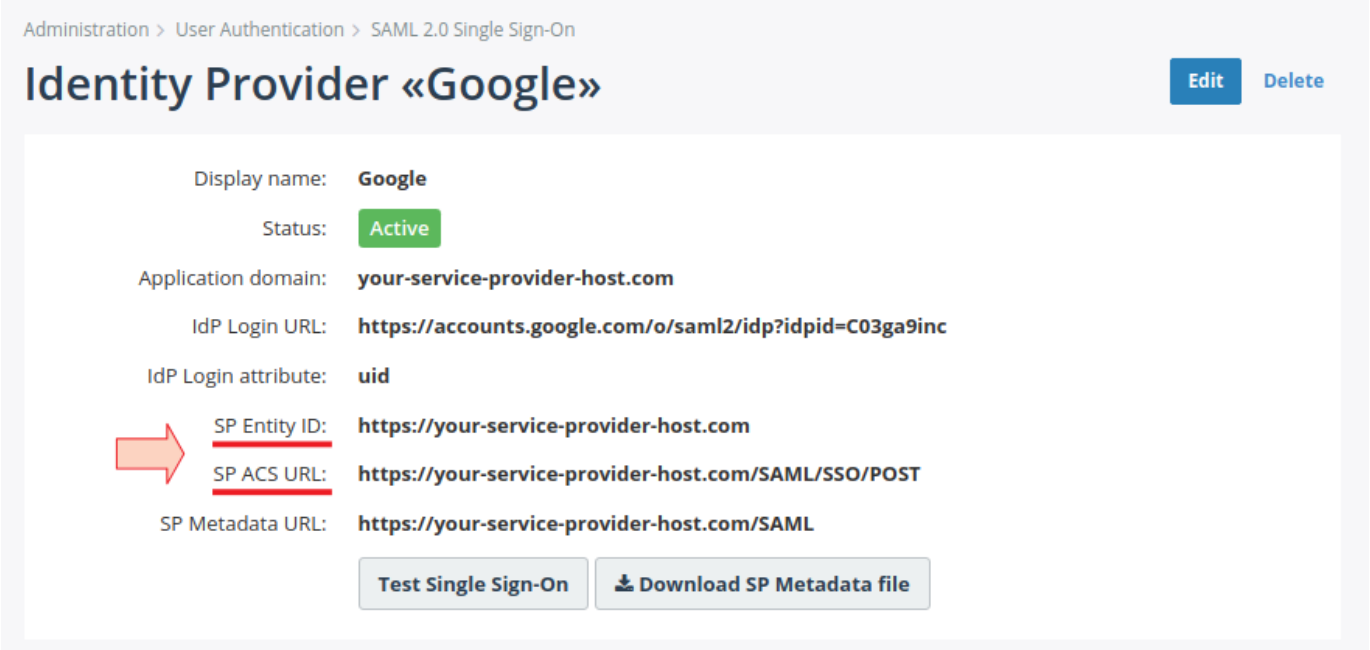
On this page you need to configure:

- **Application domain**. It should be the domain name that your users type in their web browser to access MiaRec web portal. By design, MiaRec supports multiple SAML Identity Providers. For example, you may create multiple sub-domains for different groups (or different tenants in a multi-tenant enviornment), like *customer1.example.com* and *customer2.example.com*. Each subdomain can be associated with its own SAML Identity Provider.
- **SAML Login URL** should be the same as **SSO URL** copied from Google Admin console in the previous step.
- Leave the **SAML Logout URL** empty.
- For the **Identity Provider X.509 certificate** parameter, use a content of the downloaded certificate file in the previous step. Omit the enclosing lines `-----BEGIN CERTIFICATE-----` and `-----END CERTIFICATE-----` if any.
- **Login attribute** set to **email.**



Click the **Save** button.

You will be redirected to the details page of the newly created Identity Provider, like shown in the following screenshot. On the details page, locate **Assertion Consumer Service URL (ACS URL)** and **Entity ID**. They are required for the next step.



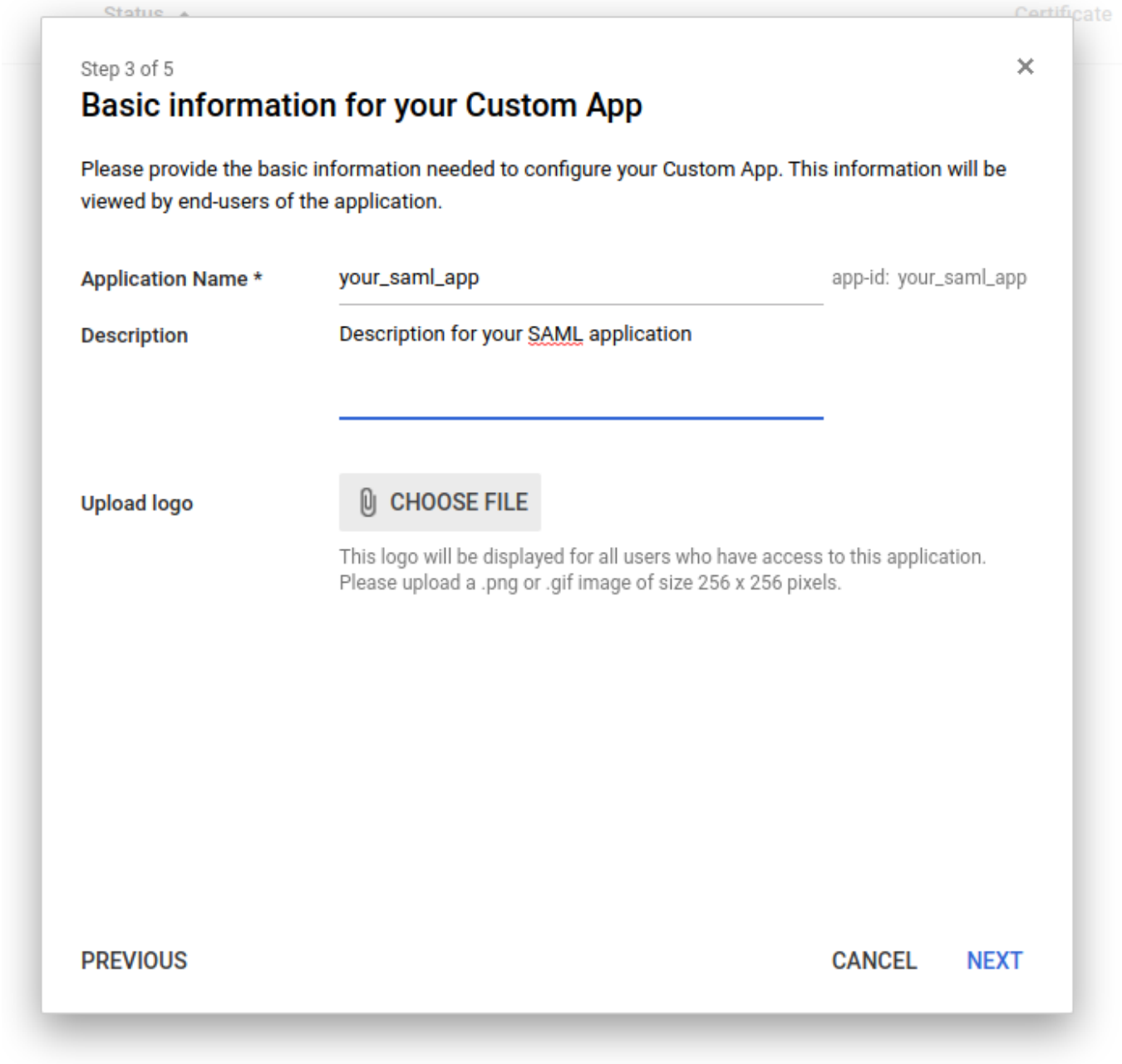
2.3.3 Step 3. Create SAML App in Google G-Suite (continued)

Go back to the previously opened Google Admin console page (see Step 1. Create SAML App in Google G-Suite).

Note, if you accidentally closed that window, then sign in to your Google Admin console (at admin.google.com) using an administrator account. Go to **Apps > SAML apps**. Click the plus **(+)** icon at the bottom right, then click **Set up my own custom app**.

In the **Google IdP Information** window, click the **Next** button.

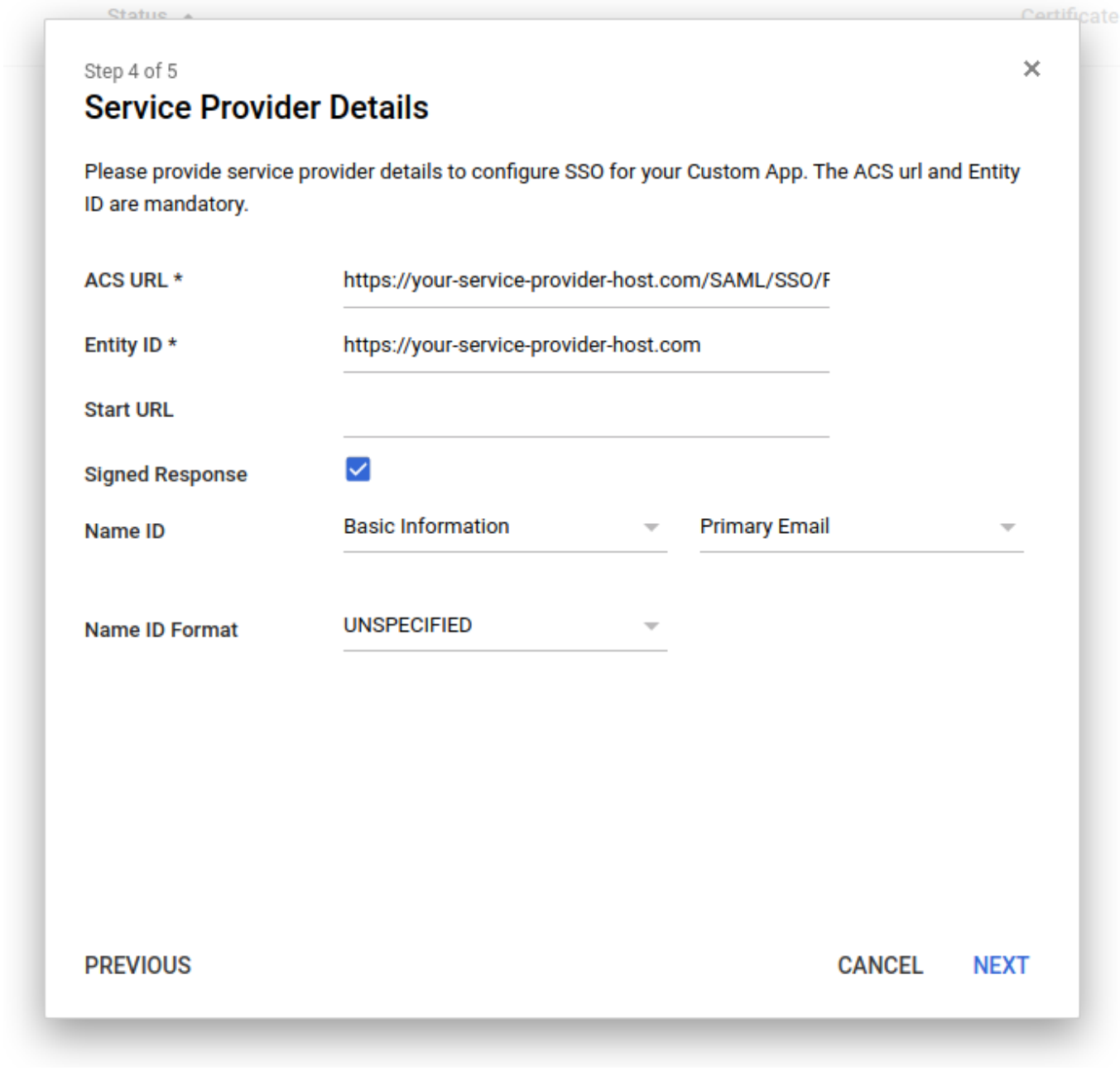
In the **Basic information** window, add a desired application name (for example, “MiaRec”) and an optional description.



Click **Next**.

In the **Service Provider Details** window, enter an **ACS URL** and **Entity ID** from the Identity Provider details page in MiaRec (see Step 2. Set up Identity Provider in MiaRec).

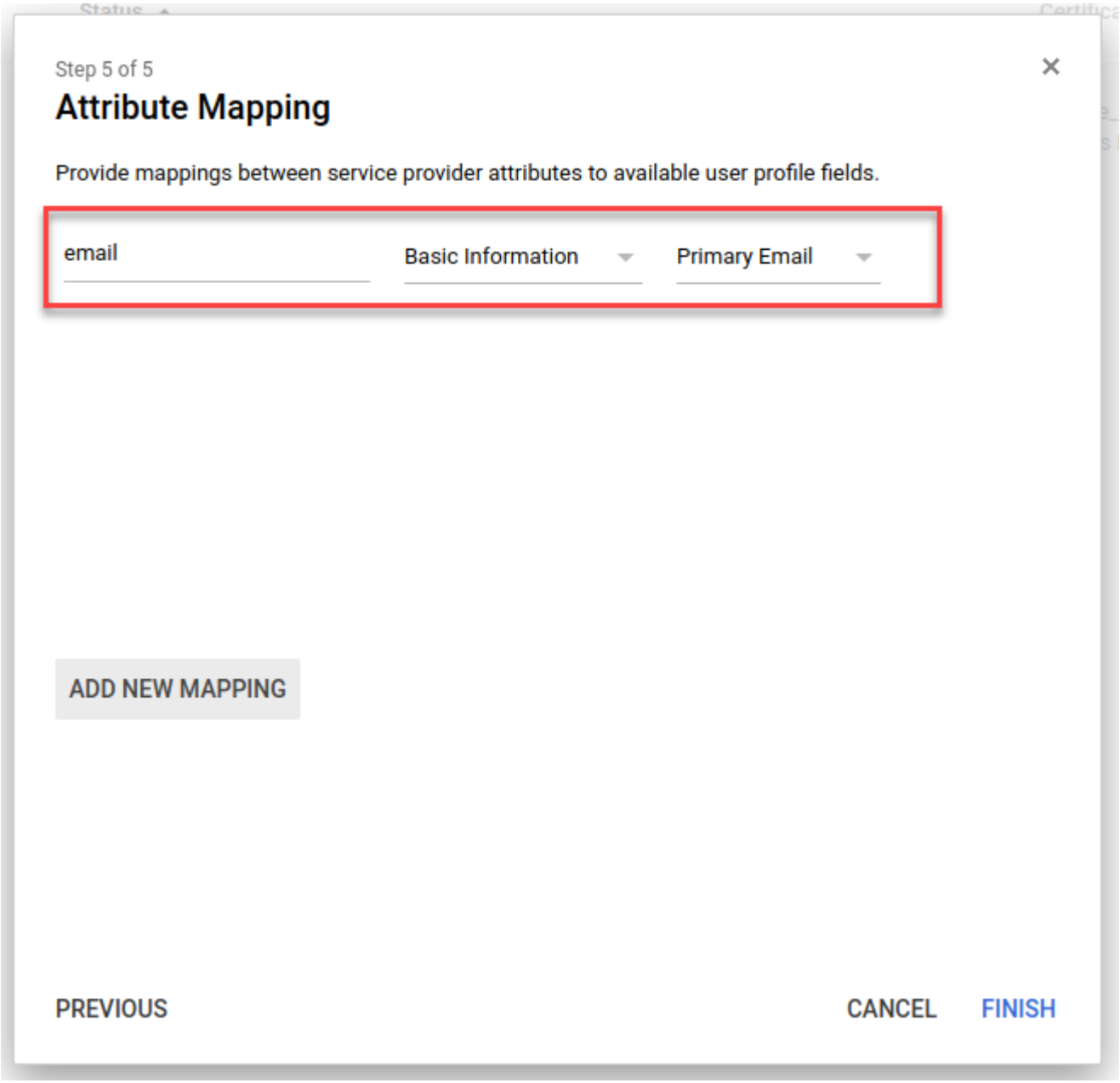
It is recommended to set the **Signed Response** checkbox checked. For all other settings, use default values.



Click **Next**.

Configure attribute mapping

In the **Attribute Mapping**, click **Add new mapping** and map the `email` attribute `Primary Email`. This attribute will be passed by Google to MiaRec during the authentication process.

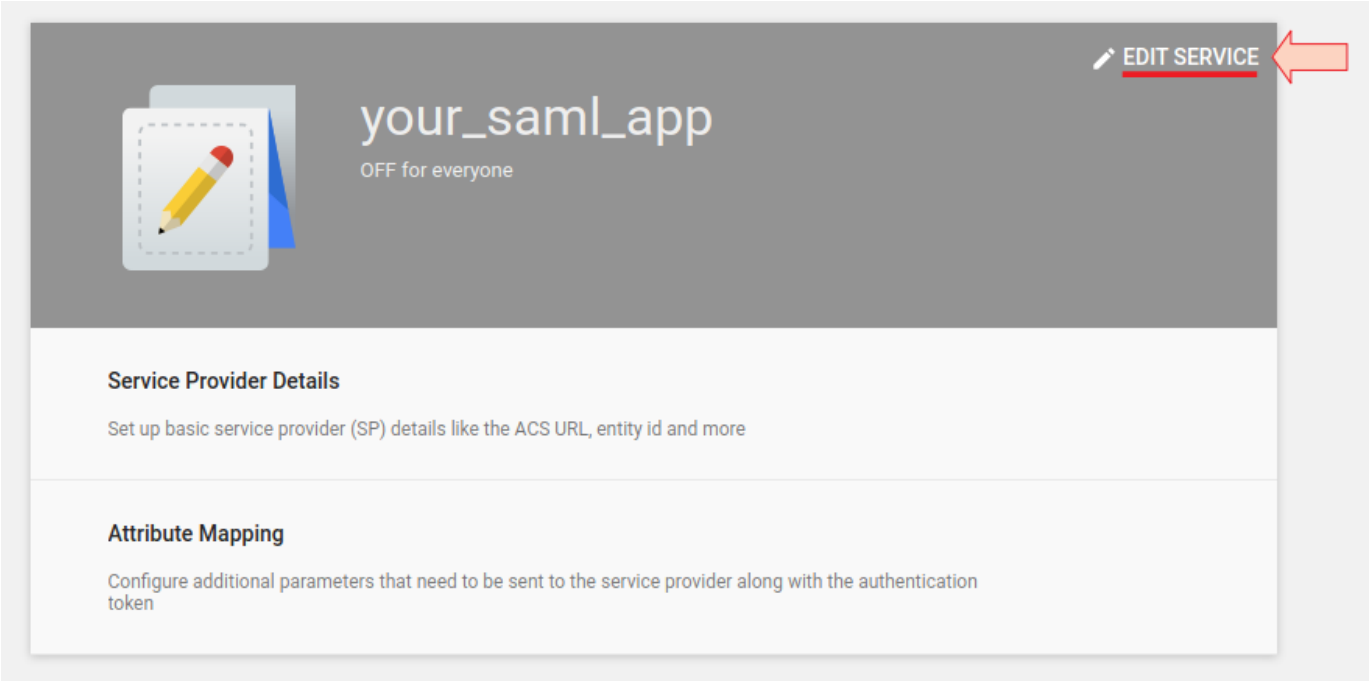


Click **Finish**.

2.3.4 Step 4. Enable MiaRec SAML application for users in Google G-Suite

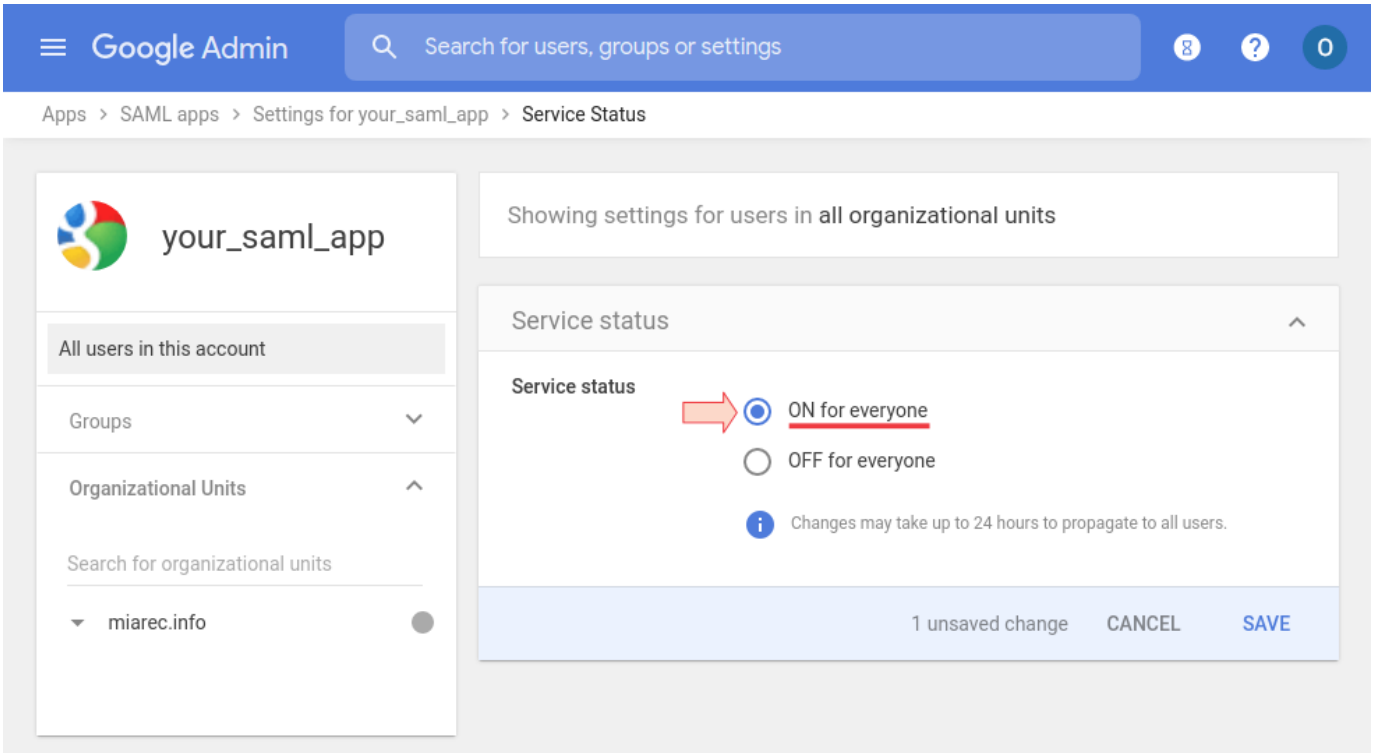
From the Google Admin console Home page, go to **Apps > SAML apps**.

Select your newly created SAML app and click **Edit Service**.



Click **On for everyone**

Note, alternatively, you can turn the service ON for a particular organization unit or group by selecting the unit or group respectively in the left pane.

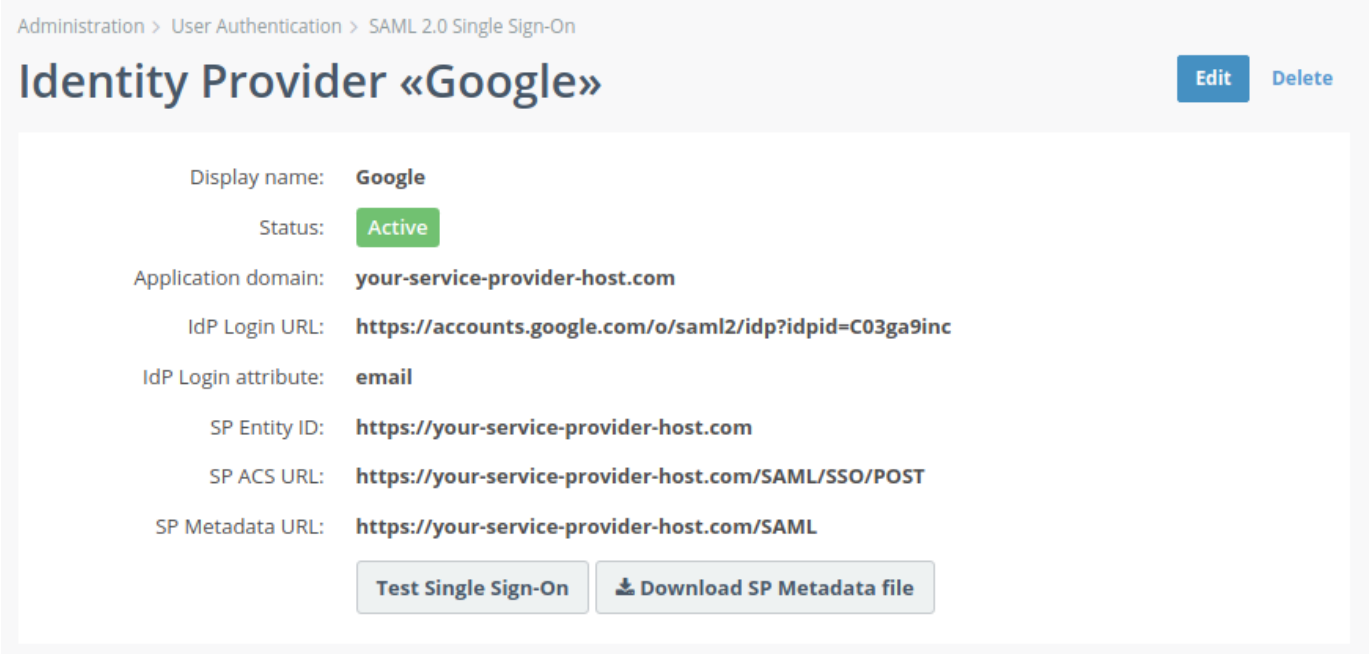


Click **Save.**

Changes typically take effect in minutes, but can take up to 24 hours. For details, see How changes propagate to Google services.

2.3.5 Step 5. Verify SSO between Google G-Suite and MiaRec

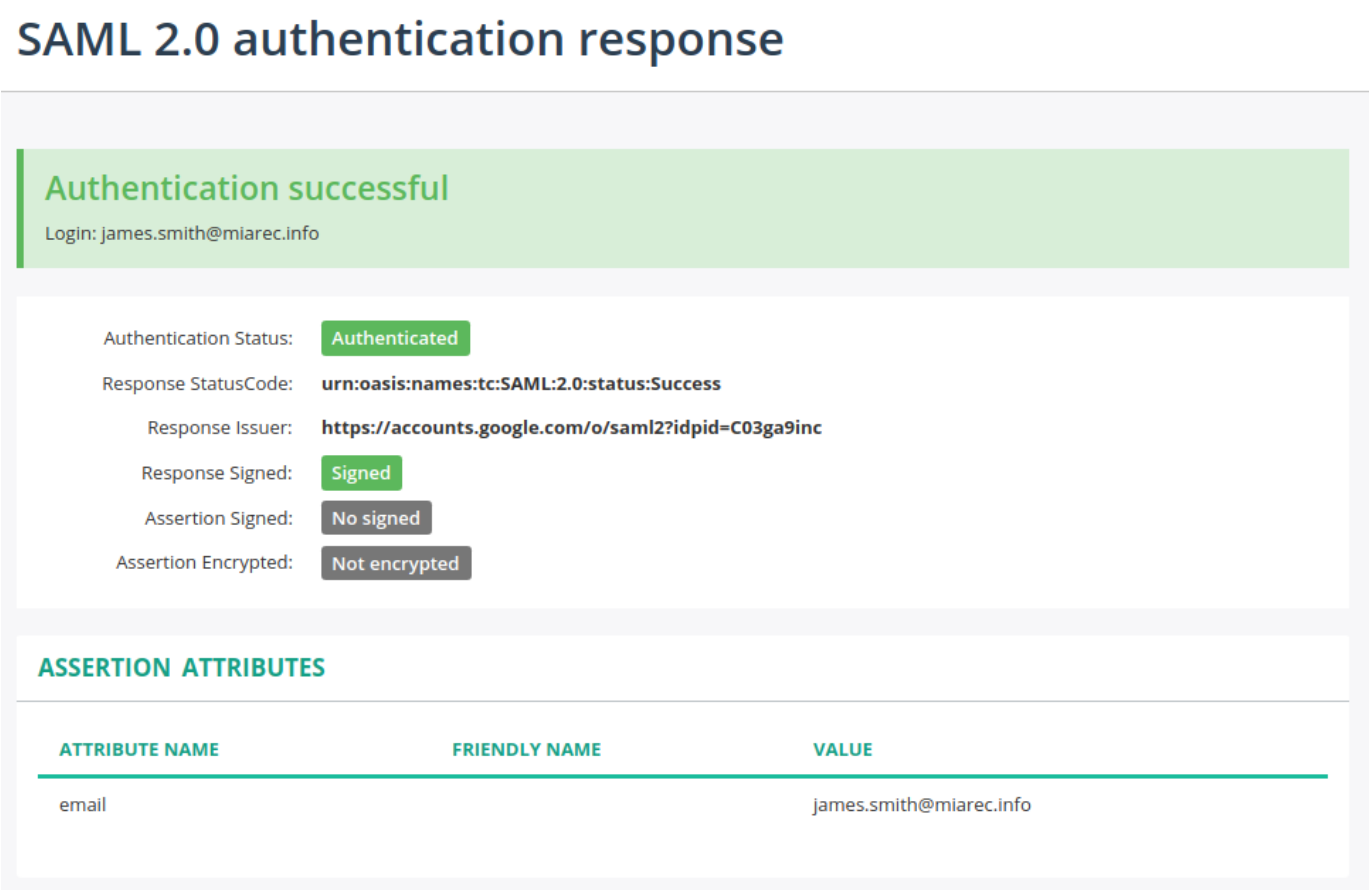
In MiaRec web portal, navigate to **Administration > User authentiction -> SAML 2.0 Single Sign-On** and select the Identity Provider, that you created in the previous steps.



Click the **Test Single Sign-On** button.

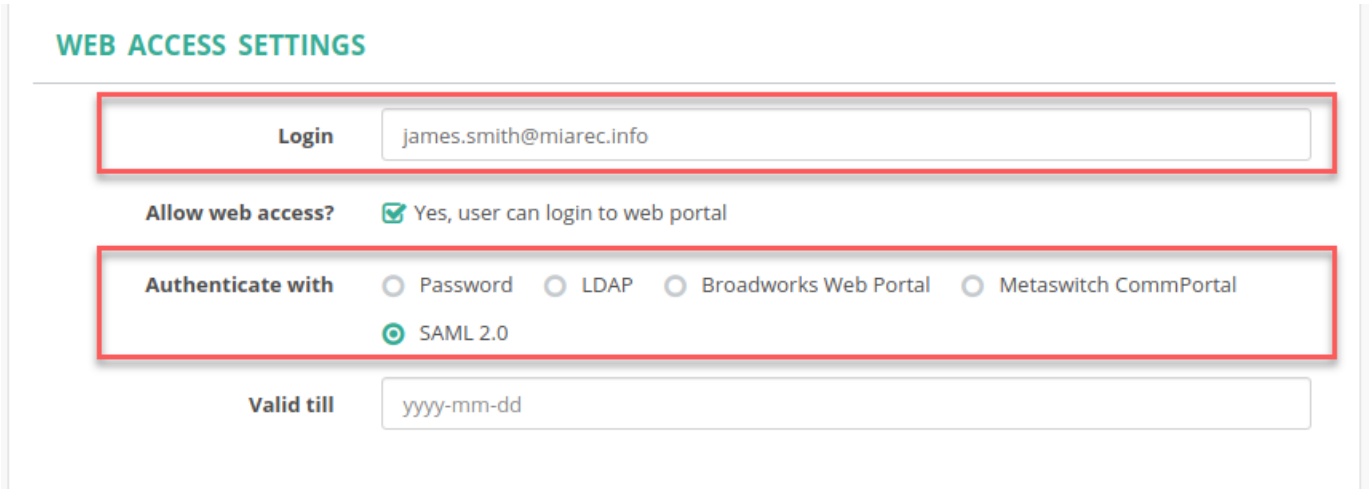
MiaRec will send an authentication request to Google and then display the actual response from it.

In the response message, locate the **Assertion attributes** section. This section lists all attributes that the Identity Provider sends back to MiaRec. Make sure the `email` attribute is in the response. Otherwise, go back to step Configure attribute mapping.



2.3.6 Step 6. Enable SAML authentication for users in MiaRec

In MiaRec web portal, navigate to **Administration > User management > Users**. Click **Edit** for an individual user or **Bulk Edit** for multiple selected users and change **Authenticate with** to **SAML 2.0**.



Make sure the **Login** attribute in MiaRec matches to the user's email used to login to Google.

Now, users should be able to login to MiaRec using the **Single Sign On** feature.

3. Two-step Verification

3.1 Two-step verification

Two-step verification enhances security of web accounts. When activated, it requires two forms of identification to access the MiaRec application: login credentials, and one-time passcode that is sent via text message (sms) to a registered phone number, email or Authy application.

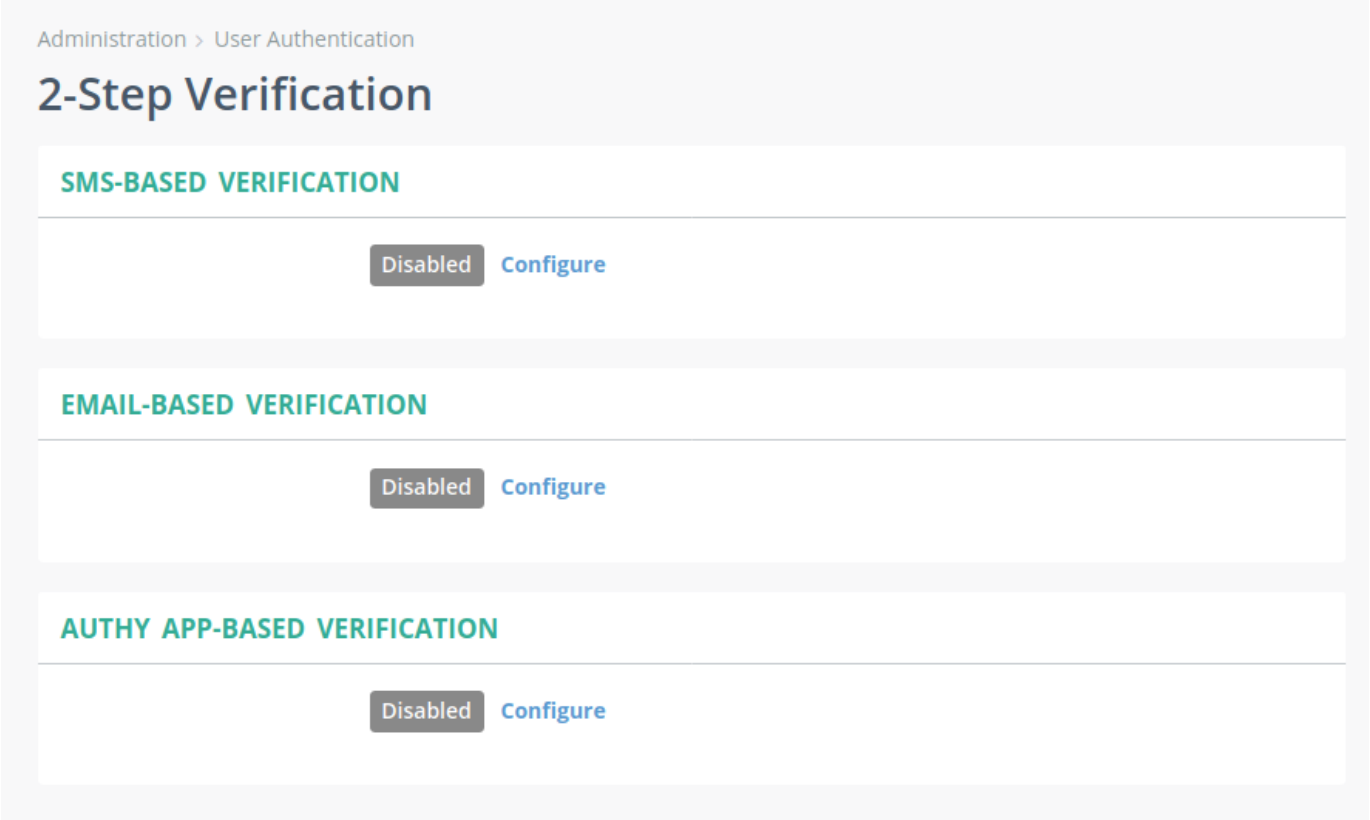
3.2 Setup two-step verification

3.2.1 Overview

Two-step verification enhances security of web accounts. When activated, it requires two forms of identification to access the MiaRec application: login credentials, and one-time passcode that is sent via text message (sms) to a registered phone number, email or Authy application.

Two-Step Verification is configured from the Admin Console.

Log in to MiaRec Web portal as system administrator and navigate to **Administration > User Authentication > 2-Step Verification** page.



Here, you can enable one or more Two-Step Verification methods:

- SMS-based verification
- Email-based verification
- Authy app-based verification

Two-Step Verification is turned on, if at least one method is configured and enabled.

Two-Step Verification can be enforced for a user or for a tenant. Enforcing for a tenant takes precedence over enforcing for a user.

3.2.2 SMS-based verification

This article explains how to set up two-step verification using SMS.

REQUIREMENTS

- Twilio account

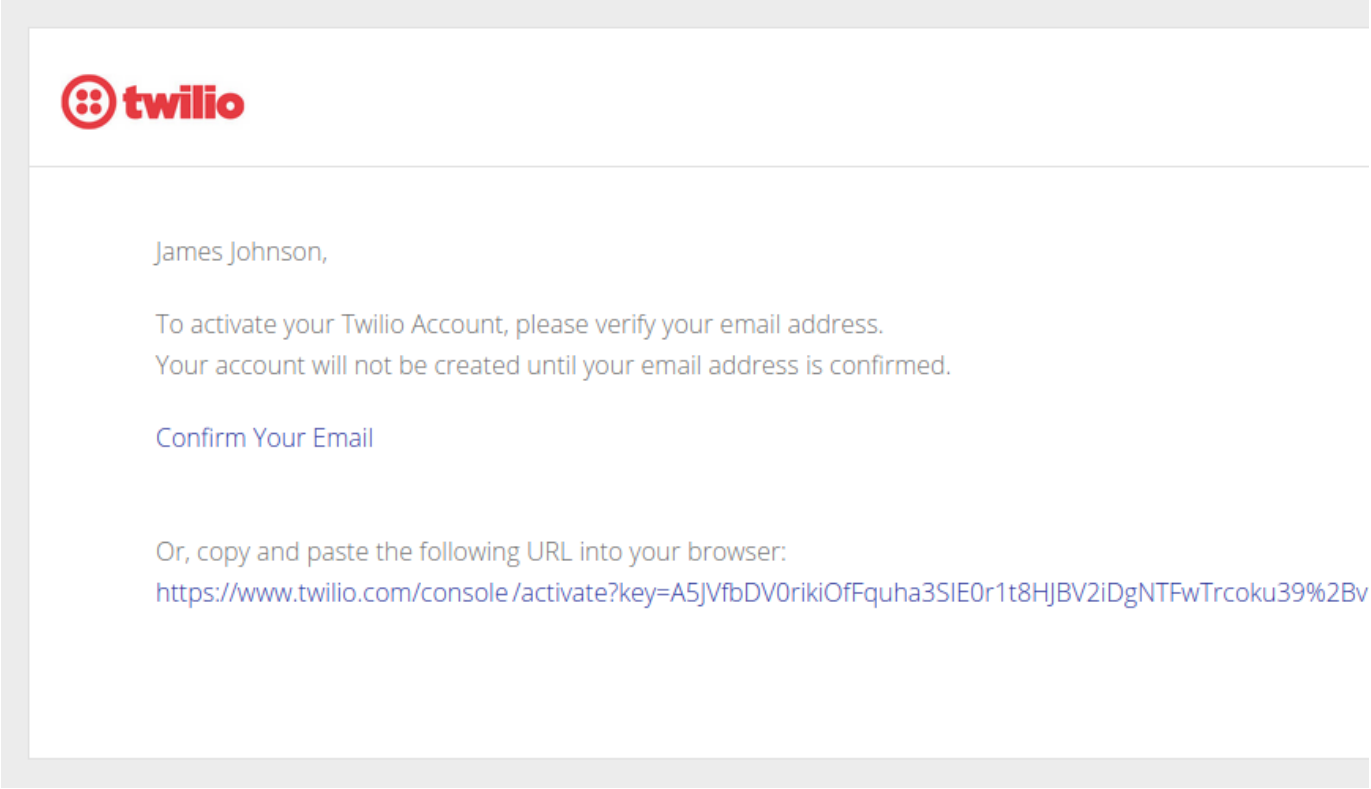
Note, SMS-based application uses Twilio service for sending text messages. Check Twilio SMS Pricing page.

CREATE TWILIO PROJECT ACCOUNT

If you do not have a Twilio account, then sign-up for account at Twilio site.

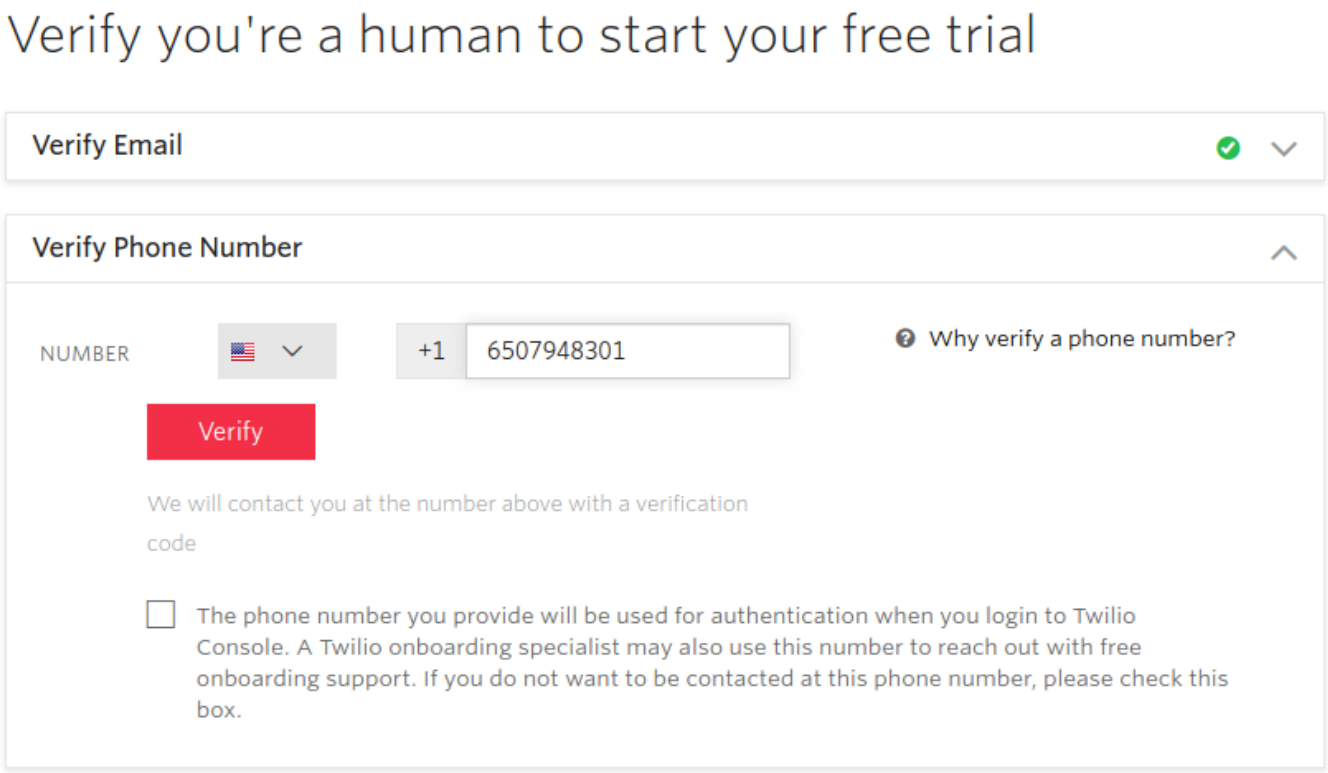
As a part of the sign-up process, you will need to confirm your email address and phone number.

Check your inbox for the **Confirm your email** message from Twilio.



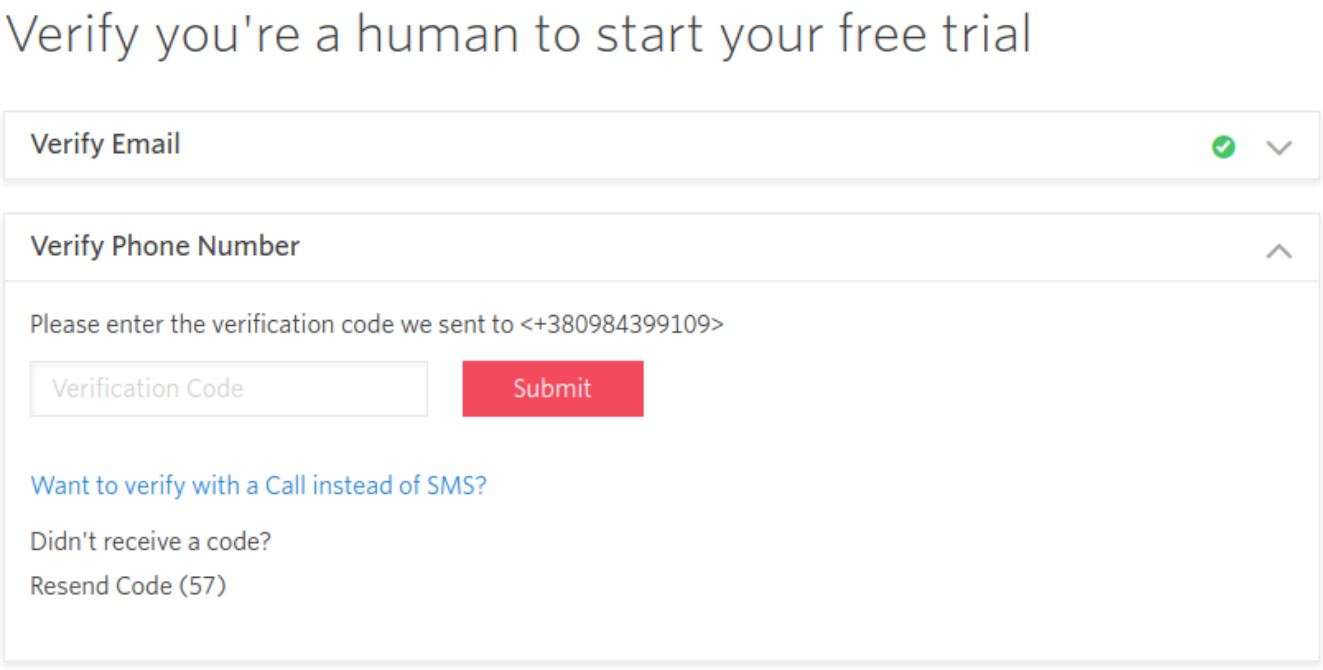
Then, follow the instructions in the email.

Once email is verified, you will be redirected to the **Verify Phone Number** step.



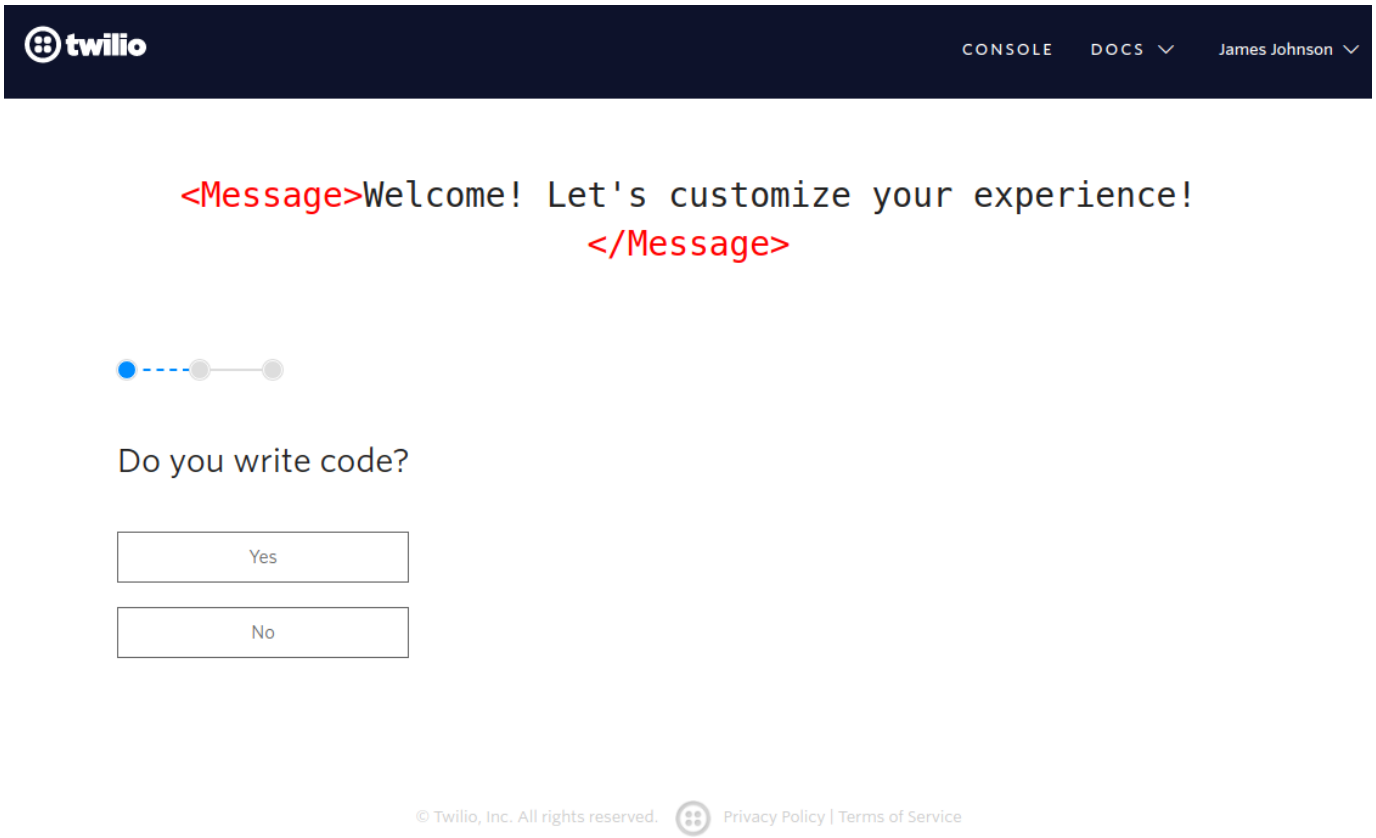
Enter your phone number for verification, and then click **Verify**.

A verification code will be sent in a text message to your phone number.



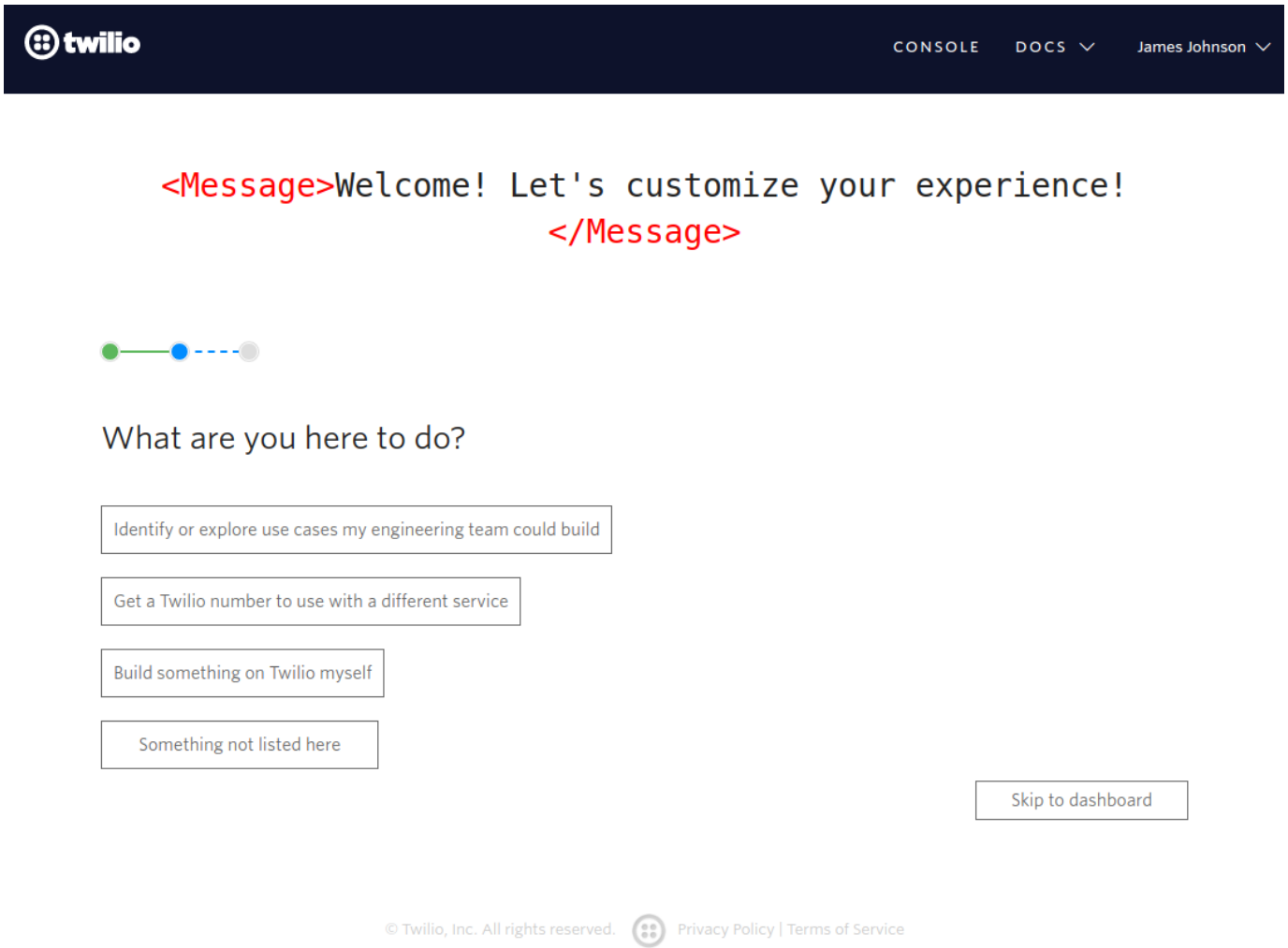
Enter the code, and then click **Submit**.

You will see the message *Welcome! Let's customize your experience! Do you write code?*.

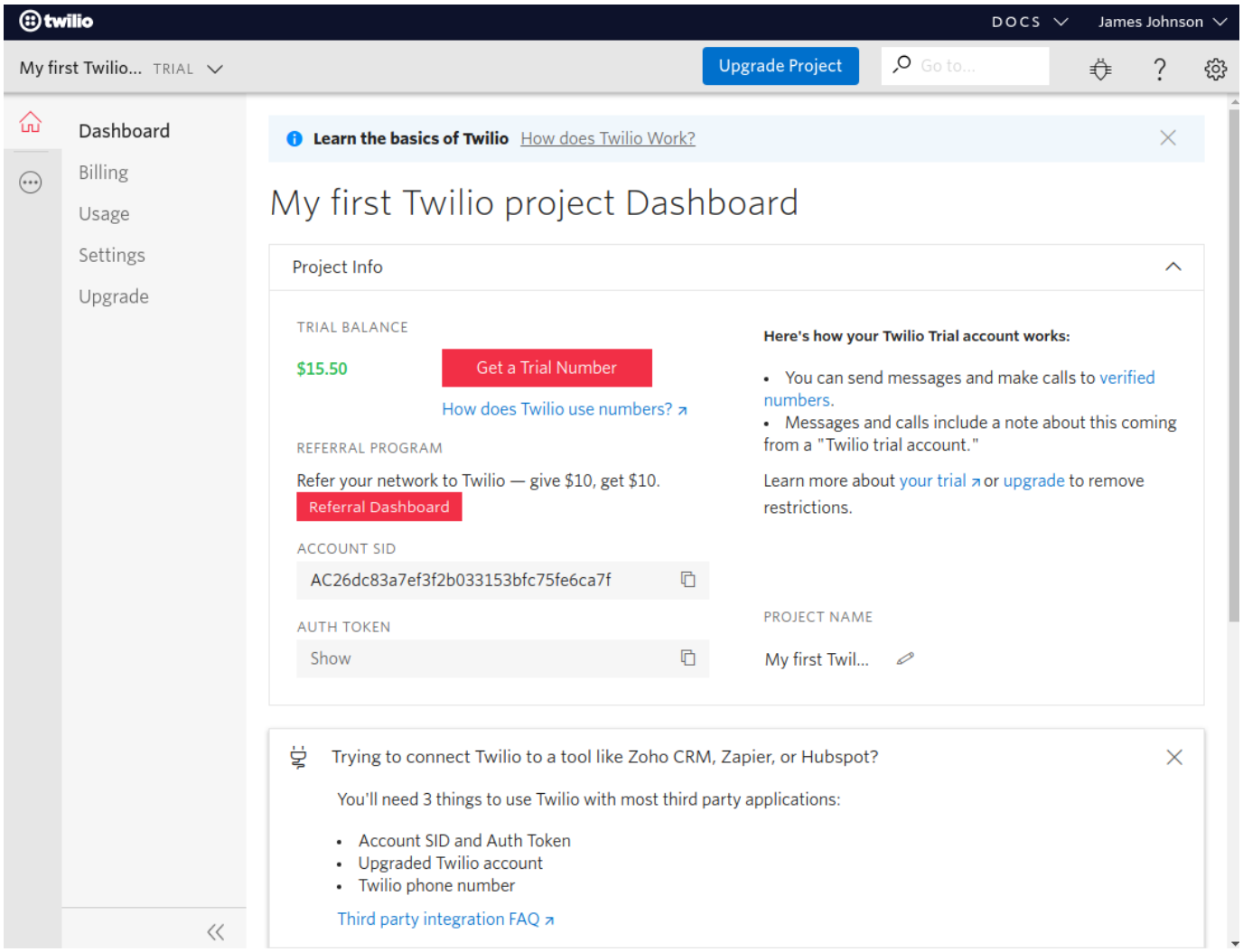


Answer **No**.

Next, you will see *What are you here to do?* question.



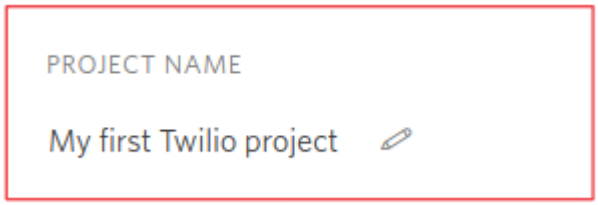
Click the **Skip to dashboard** button.



The new Twilio account is created. It is also recommended to enable 2FA on your Twilio account to help protect the Twilio account.

[Optional] Rename the new project

Once account is created and verified, the new project is also created. The new project has the default name, which can be changed from the **Twilio Dashboard** page.



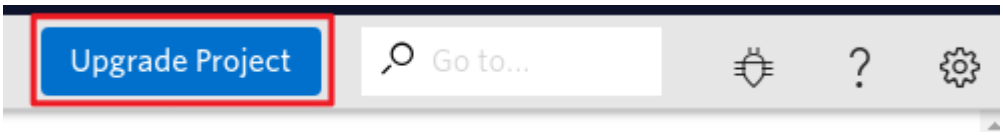
UPGRADE TWILIO PROJECT ACCOUNT

Initially, the new project is in a trial mode. Twilio offers a trial to all customers who sign up, which includes a free balance for you to experiment with. But the trial account has many limitations, so you will need to upgrade to a Twilio paid account.

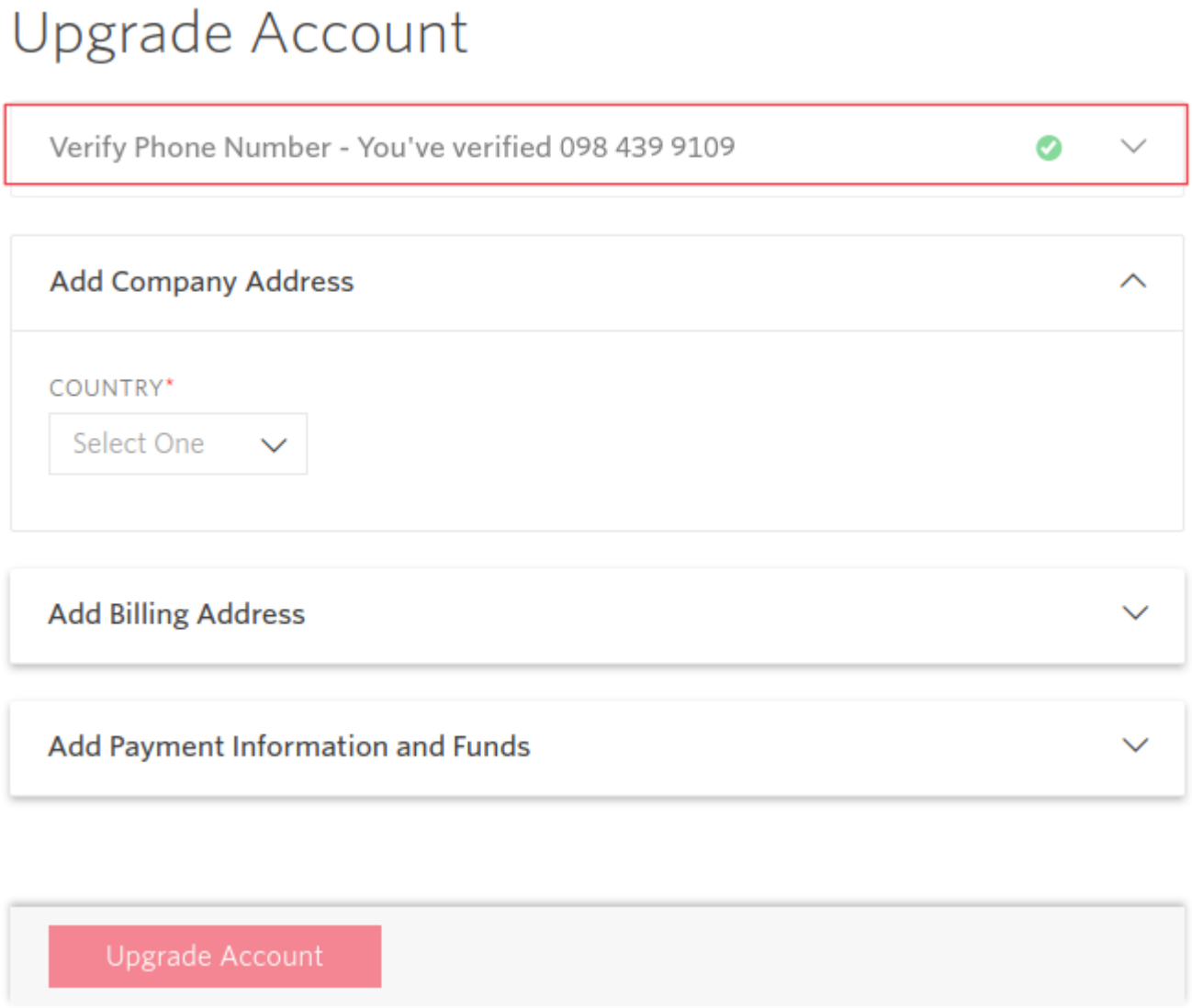
To upgrade your Twilio project account, and remove all trial limitations, you'll need to add your billing information and charge your initial account balance.

Login to your Twilio project at Twilio Dashboard.

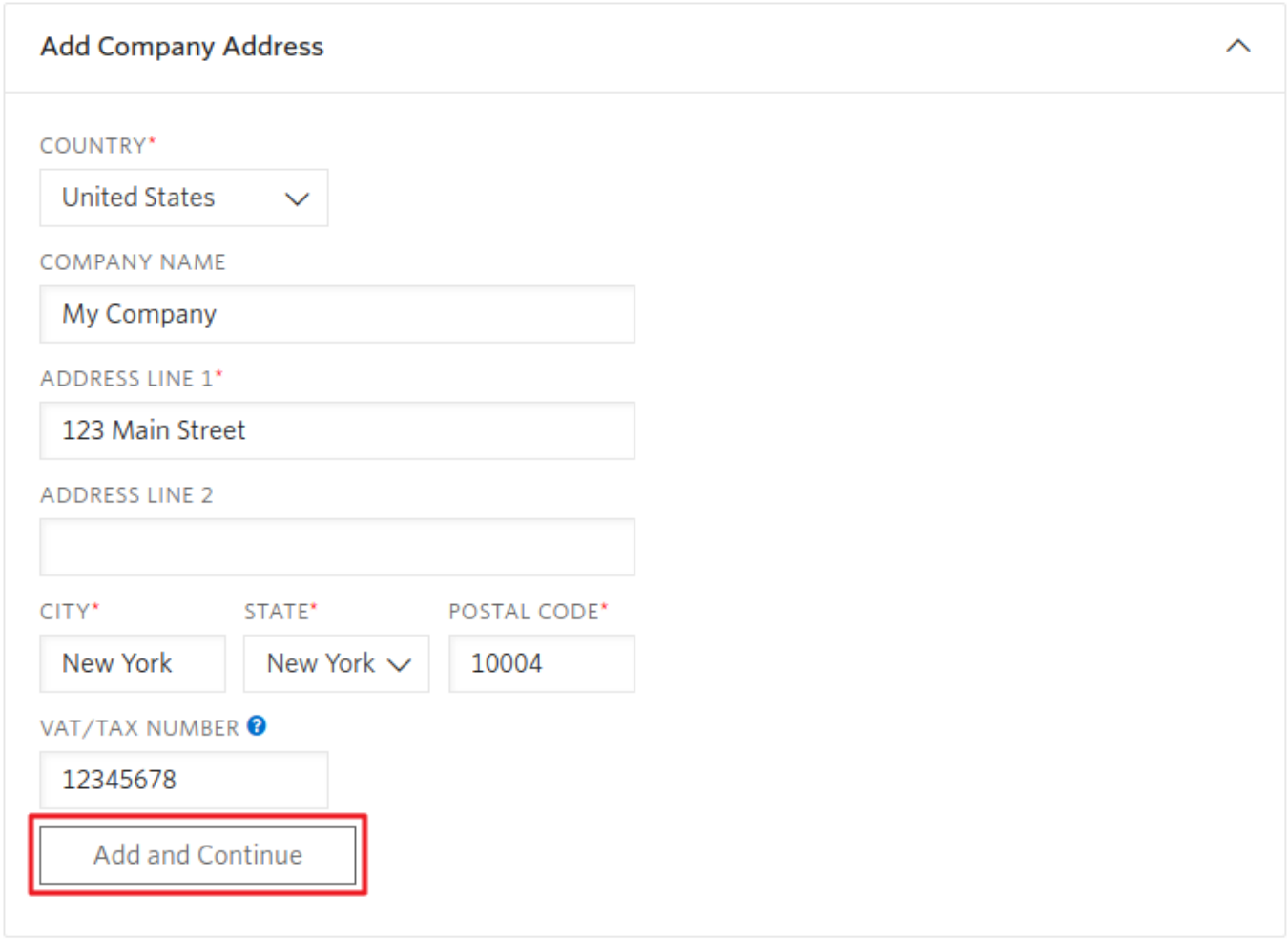
Click **Upgrade Project** at the top of the screen.



Verify the phone number if you have not verified it yet. If you followed our instructions, then the phone number should be already verified. Otherwise, enter your phone number for verification, and then click **Verify**.

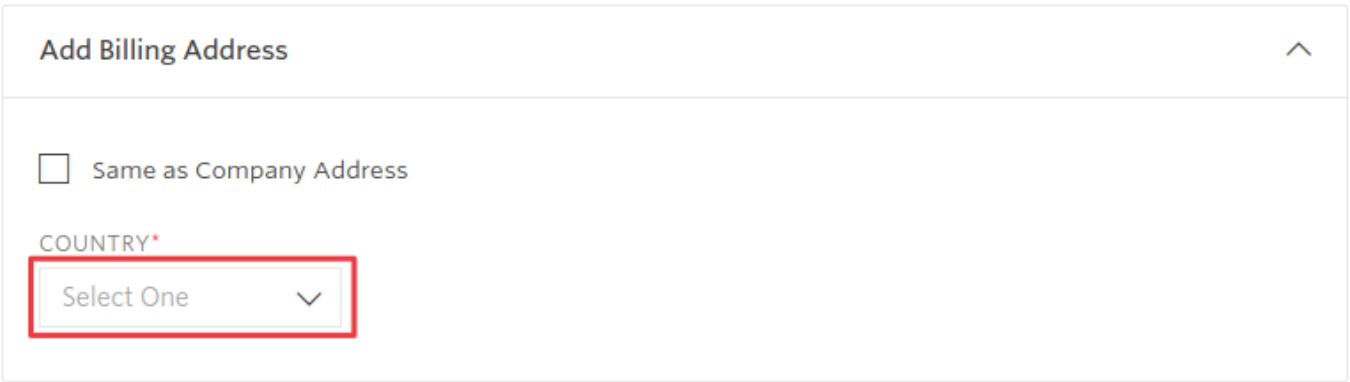


In the “Add Company Address” section, select the country where you will consume Twilio services. When the section expands, enter your service address, and then click **Add and Continue**.



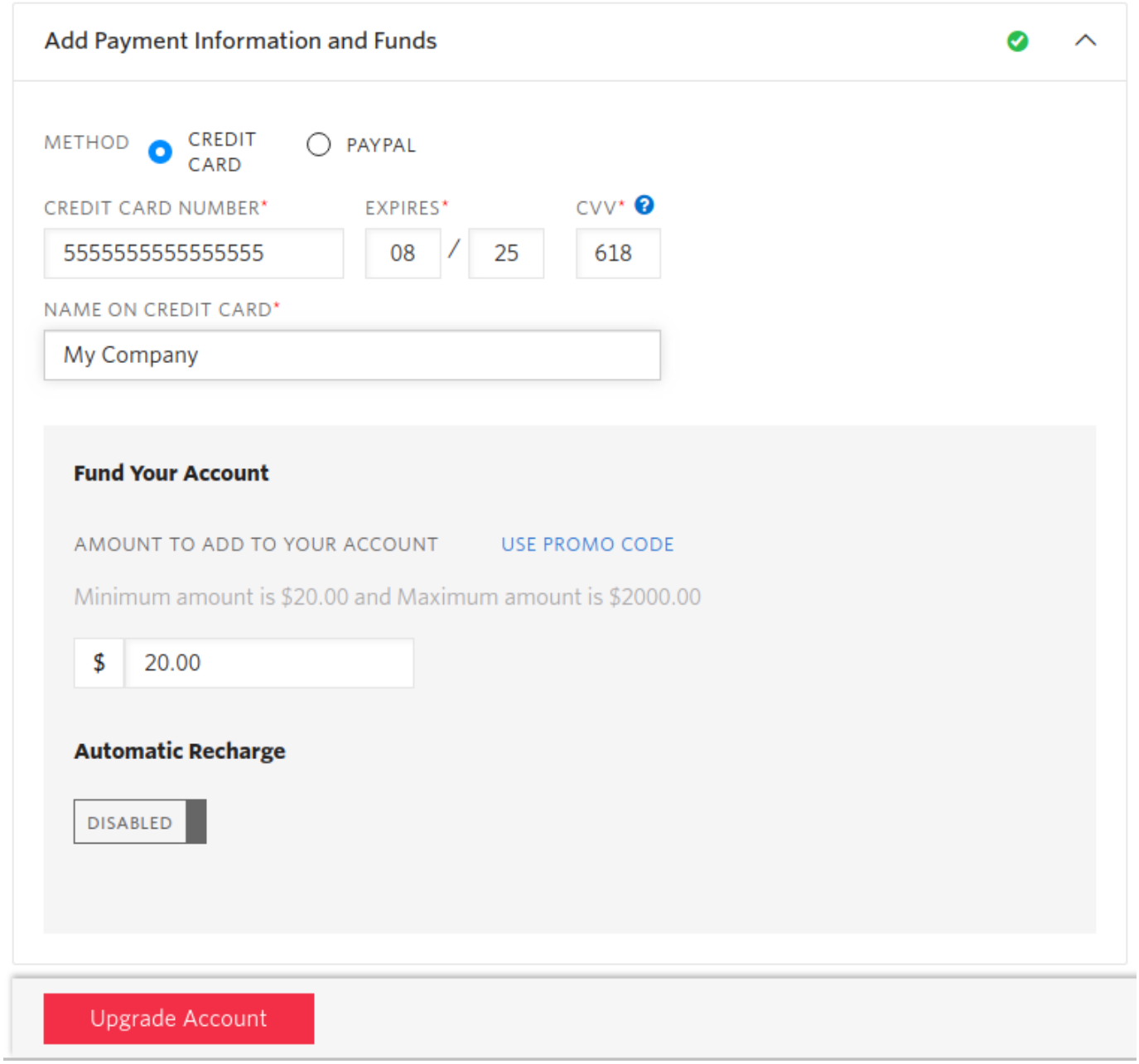
In the “Add a Billing Address” section, select the country for your billing address. When the section expands, enter your billing address, and then click **Add and Continue**.

Note: If your service and billing addresses match, click **Same as Company Address**.



In the “Add Payment Information and Funds” section, enter credit card details or a paypal account, and the desired initial funds (default $20), then click **Upgrade Account**.

Note: To upgrade using a promo code, click **Use Promo Code**.



Notice: Enable the **Automatic Recharge** switch to automatically charge your payment source, and refill your project balance when it falls below $10. Disabling this option allows your project to hit zero (or negative) balance, and would require you to manually add funds to prevent account suspension.

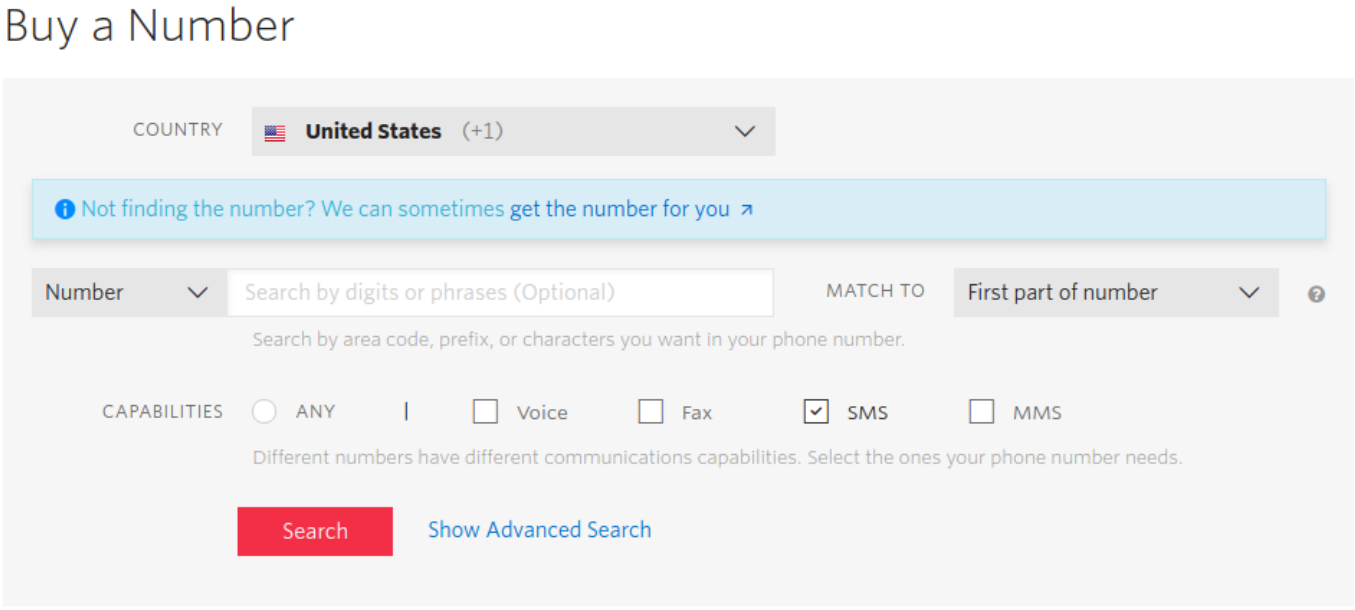
SEARCH FOR AND BUY A TWILIO PHONE NUMBER

You must buy a Twilio phone number in order to send SMS through Twilio services.

Twilio's Console site allows users to quickly search for and provision phone numbers on your project. From the Console search, you can filter phone numbers based on location, phone number type, capabilities, and more - all with our easy to use GUI. Continue reading for step-by-step instructions.

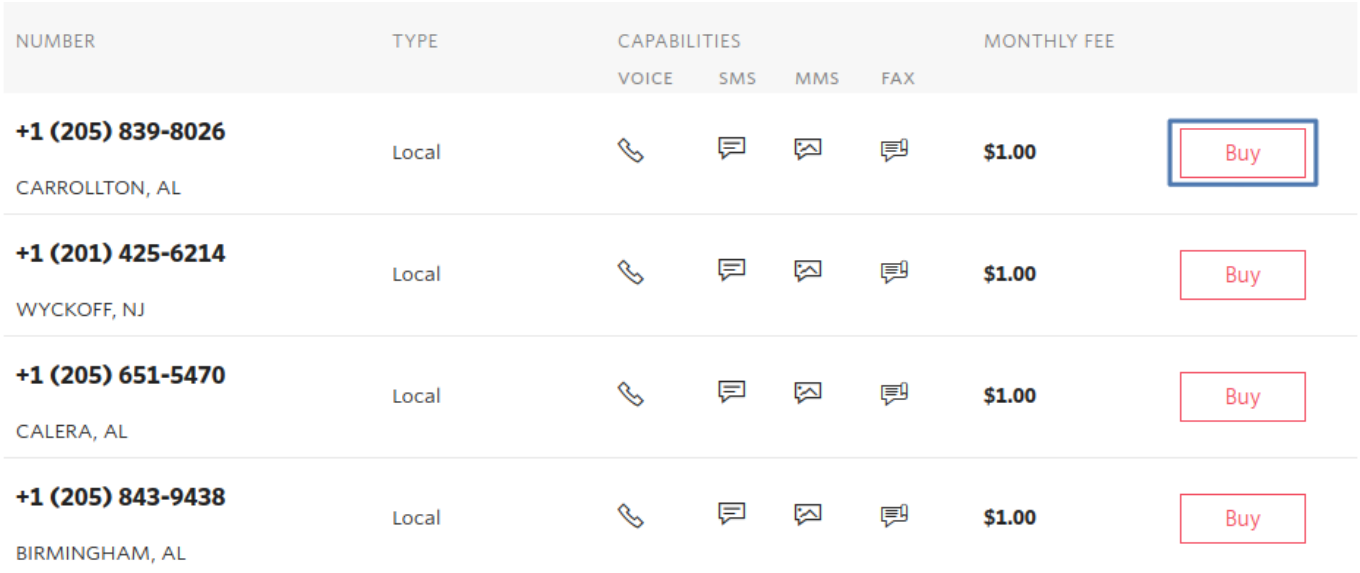
Open the Buy a Number page in Twilio Console.

Enter the criteria for the phone number you need, and then click **Search**.



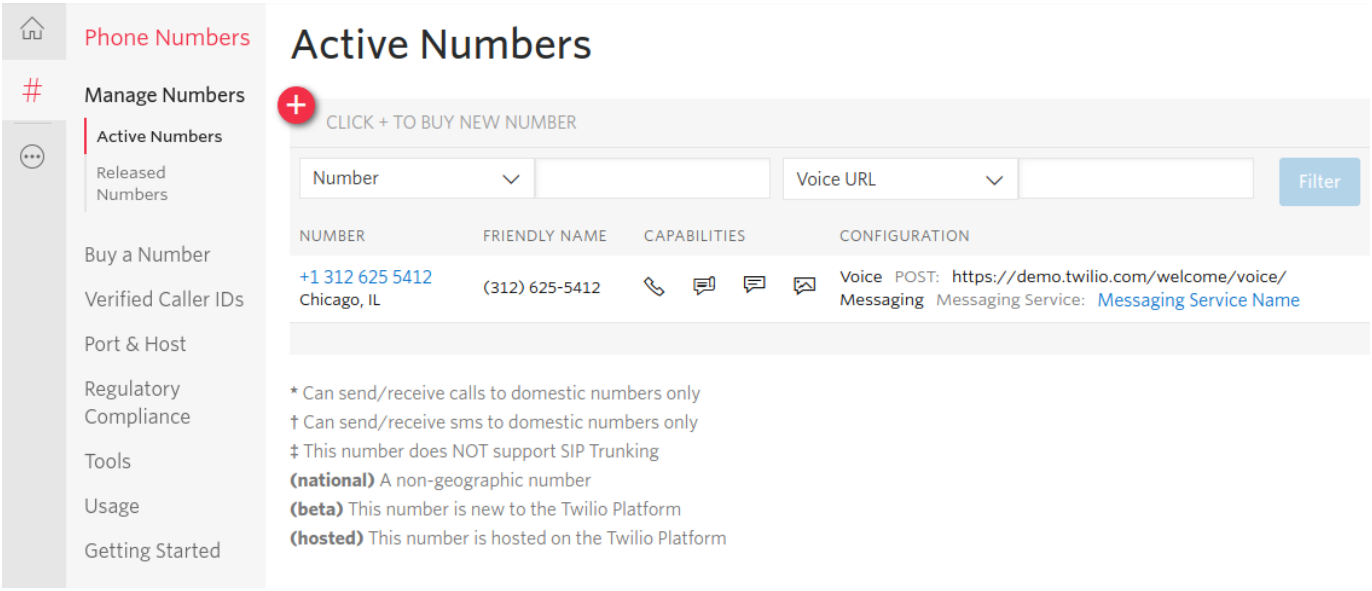
- **Country**: Select the country from the drop-down menu.
- **Number** or **Location**: Select the desired option to search by digits/phrases, or a specific City or Region.
- **Capabilities**: Two-step verification using SMS requires at least **SMS** capability.
- **Show Advanced Search**: Click this link to show options for the phone number type (local, mobile, toll-free), local address requirements, and to allow beta number results.

Search results will be displayed with the phone number, location, type, capabilities, and price listed. Click **Buy** to purchase a phone number for your current project or sub-account.



After your phone number has been successfully purchased, your Twilio account will be charged for the full monthly price of the phone number.

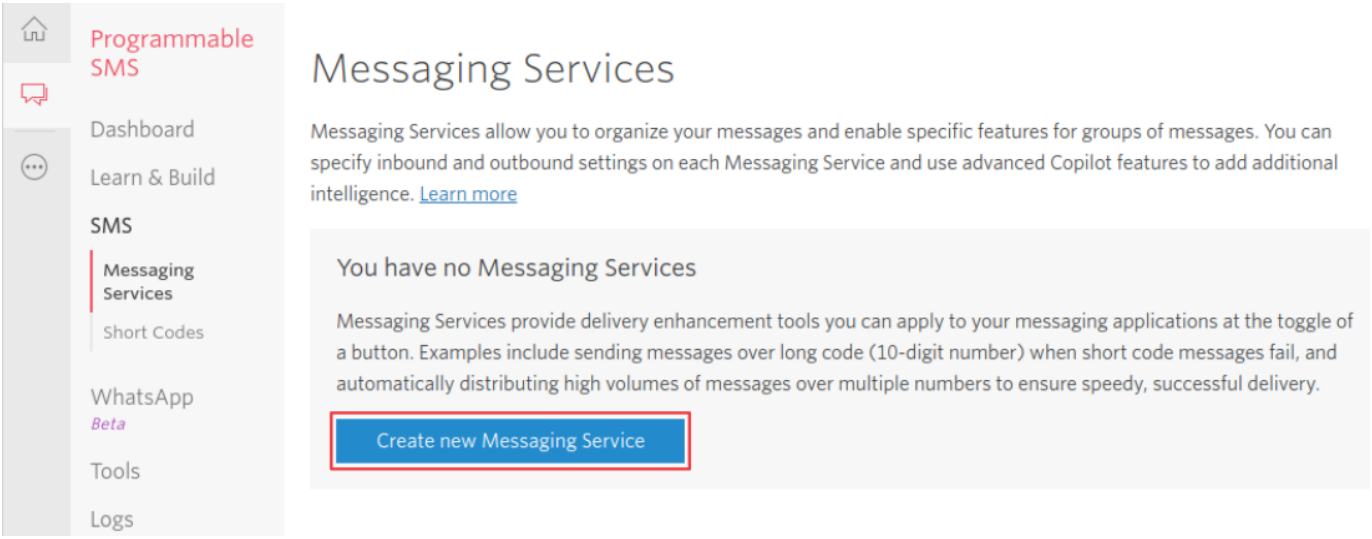
You can find the list of the purchased numbers on the **Active Numbers** page.



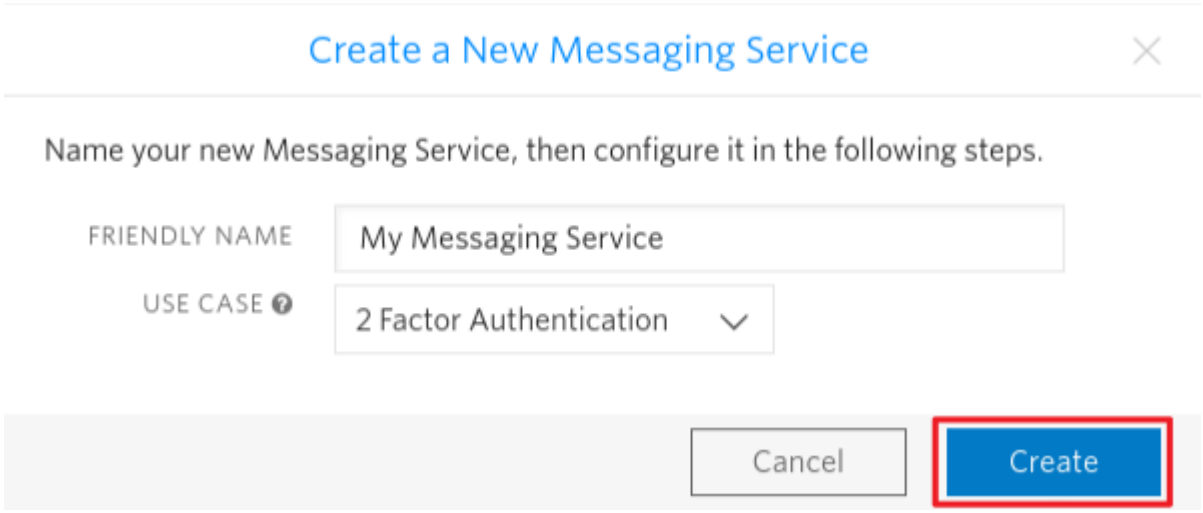
[OPTIONAL] CREATE A MESSAGING SERVICE

This step is optional. A single Twilio phone number has a throughput of 1 SMS per second. For most of MiaRec deployments, a 1 SMS/second limit is sufficient. If this rate is not sufficient for your load, then you need to use a Messaging Service with Copilot to combine multiple Twilio phone numbers into a group. For example, a group of 5 phone numbers has a combined throughput of 5 SMS messages per second. The Messaging Service automatically balances a traffic among multiple phone numbers.

To create a new Messaging service, naviagate to the **Messaging Services** page in Twilio Console and click the **Create new Messaging Service** button.



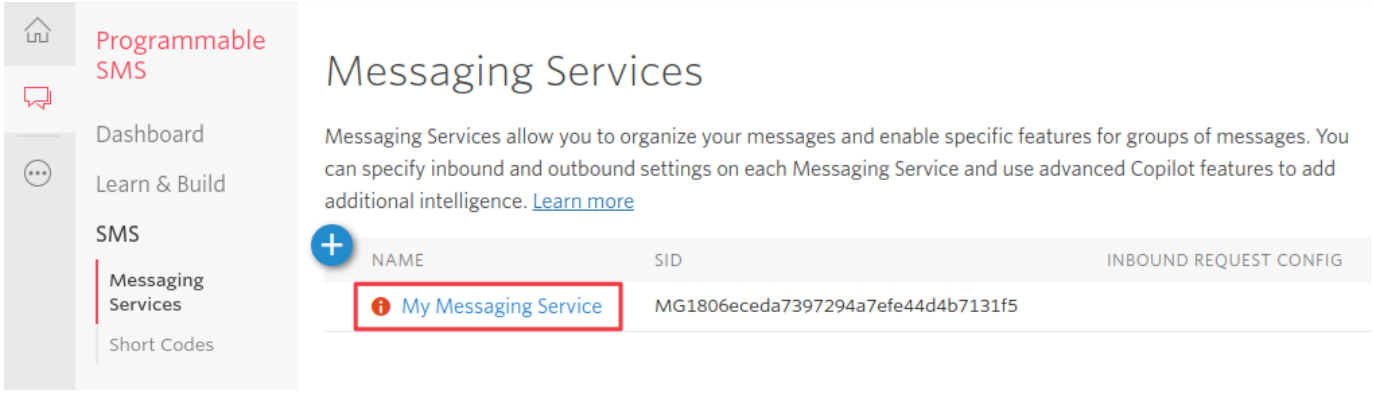
- Specify a **Friendly name** for the new Messaging Service.
- Select “2 Factor Authentication” as a **Use case**.



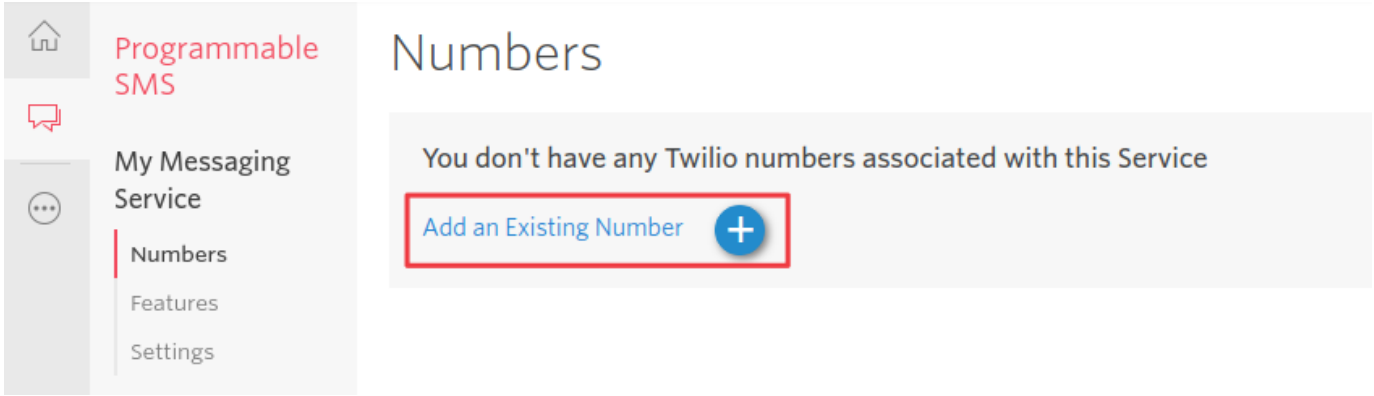
Click the **Create** button to create a new Messaging Service.

Add phone numbers to a Messaging Service

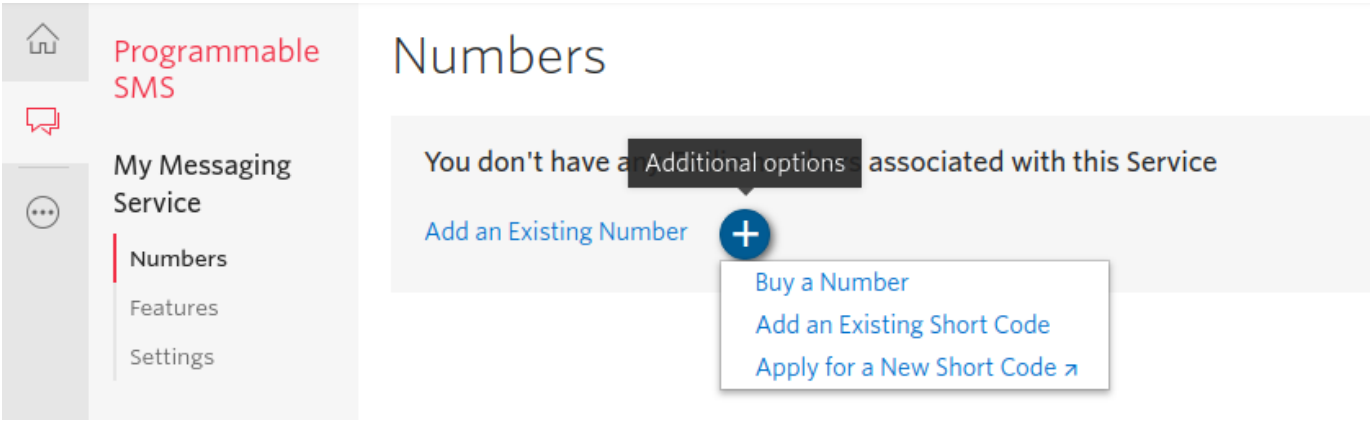
Navigate to the **Messaging Services** page in Twilio Console and click on the name of the created messaging service.



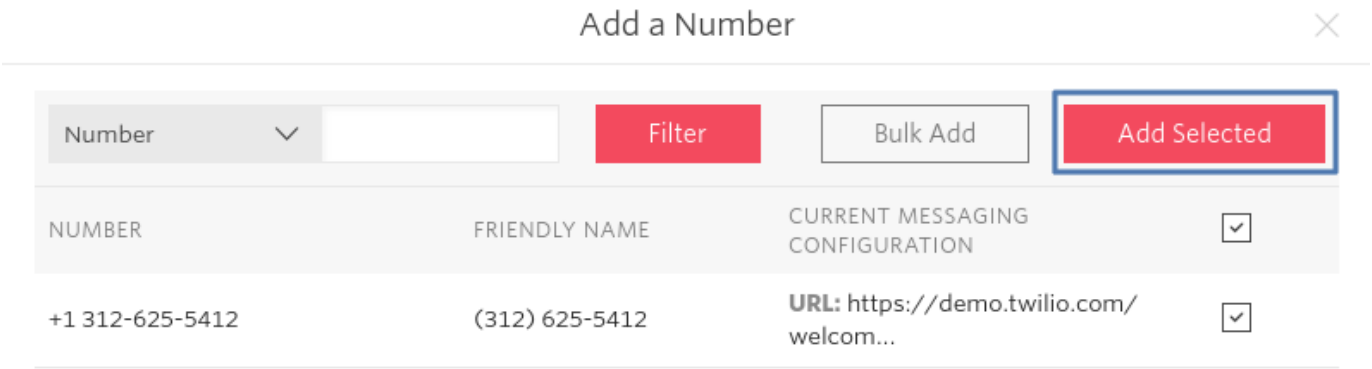
Click **Add an Existing Number** to add the previously purchased Twilio phone number to the messaging service.



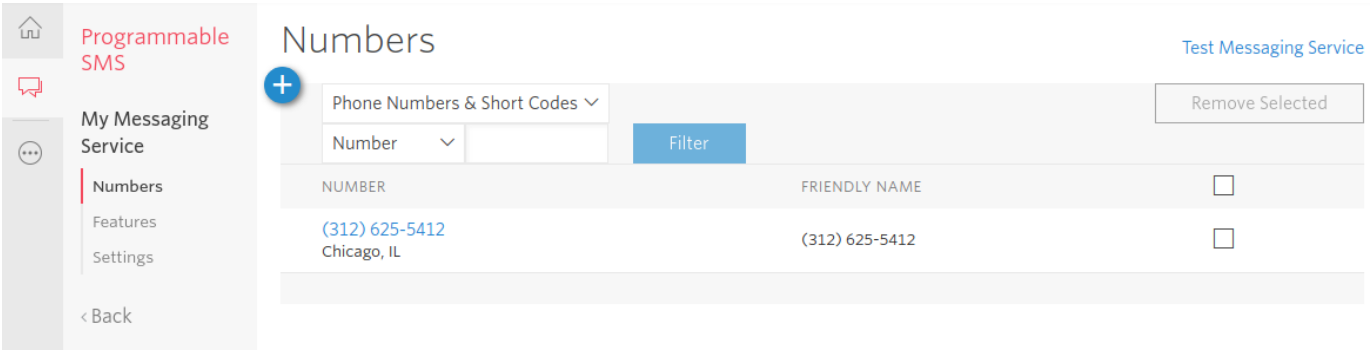
There is an "Additional options" **(+)** button that allows you to buy a new phone number right here.



Select phone numbers to add and click the **Add Selected** button.



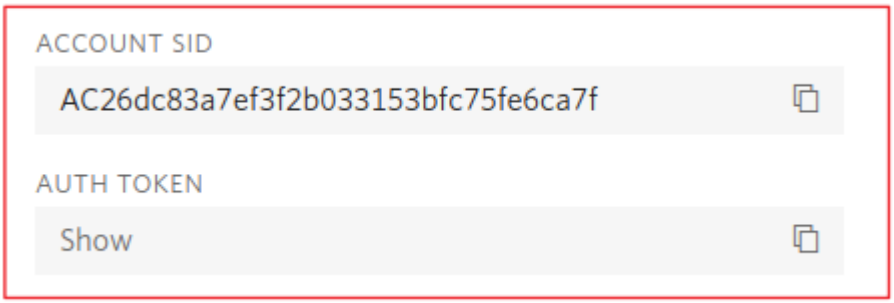
You can find the added phone numbers on messaging service's "Numbers" page.



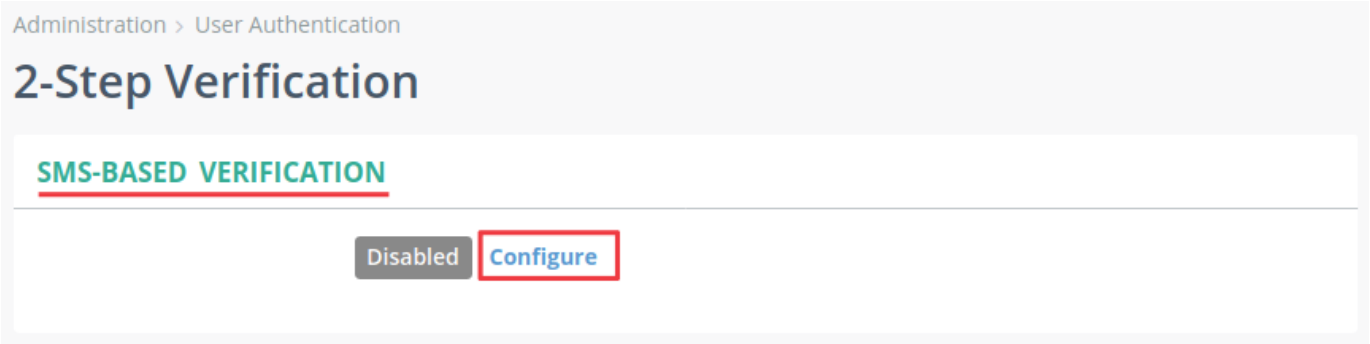
After you have added the phone numbers to the Messaging Service, it is ready to go.

SETUP SMS-BASED VERIFICATION IN MIAREC

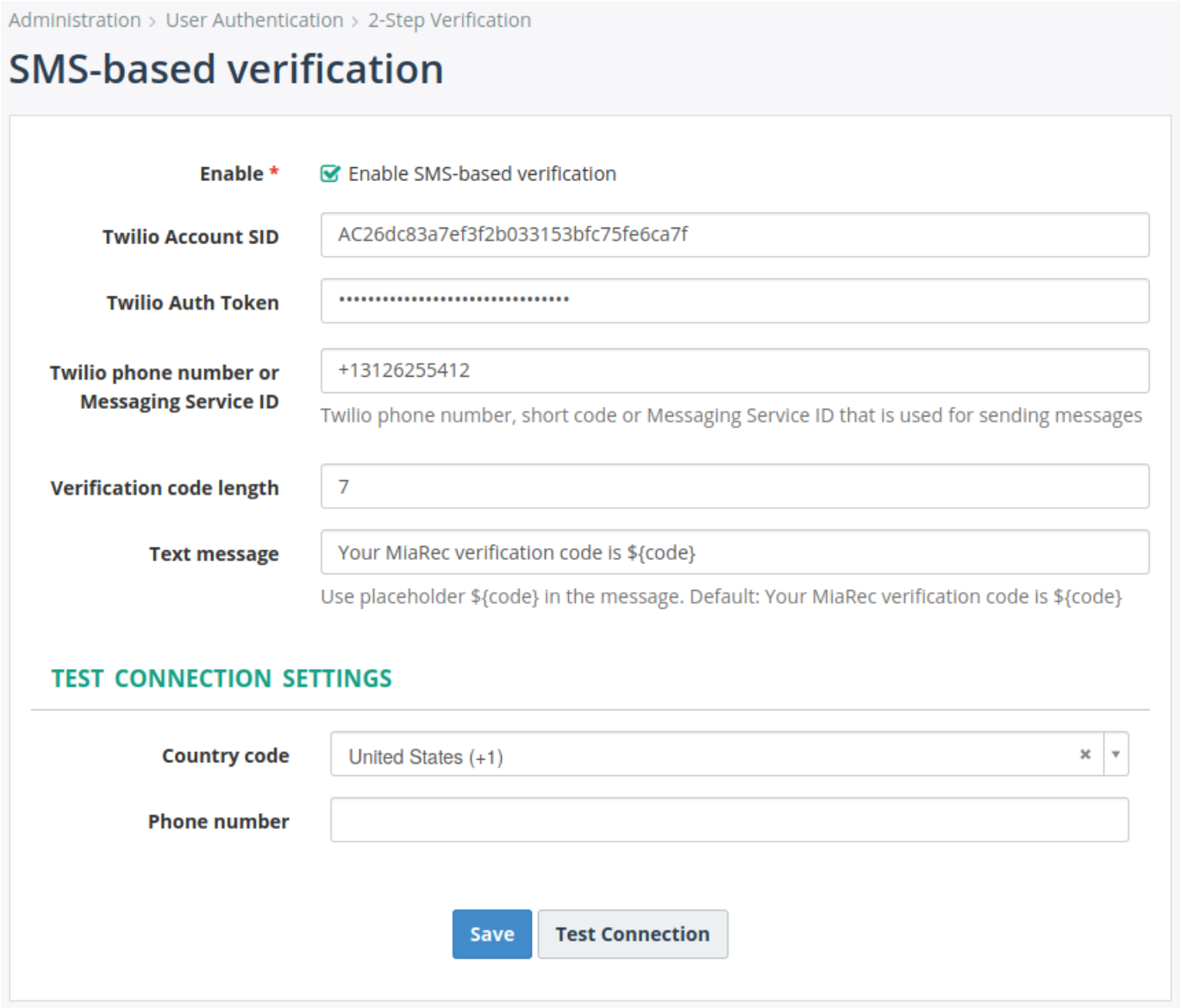
Open Twilio Dashboard, navigate to **Project Info** of the previously created project and locate **Account SID** and **Auth Token**. These values are required for the next steps.



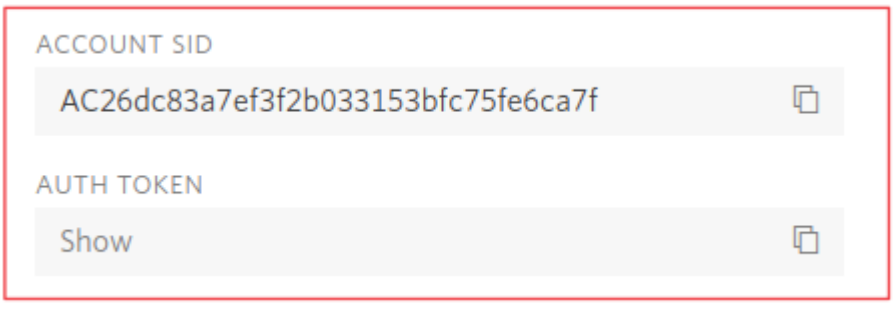
In MiaRec Web portal, go to **Administration > User Authentication > 2-Step Verification** page.



Click the **Configure** link for the **SMS-based verification** setting.



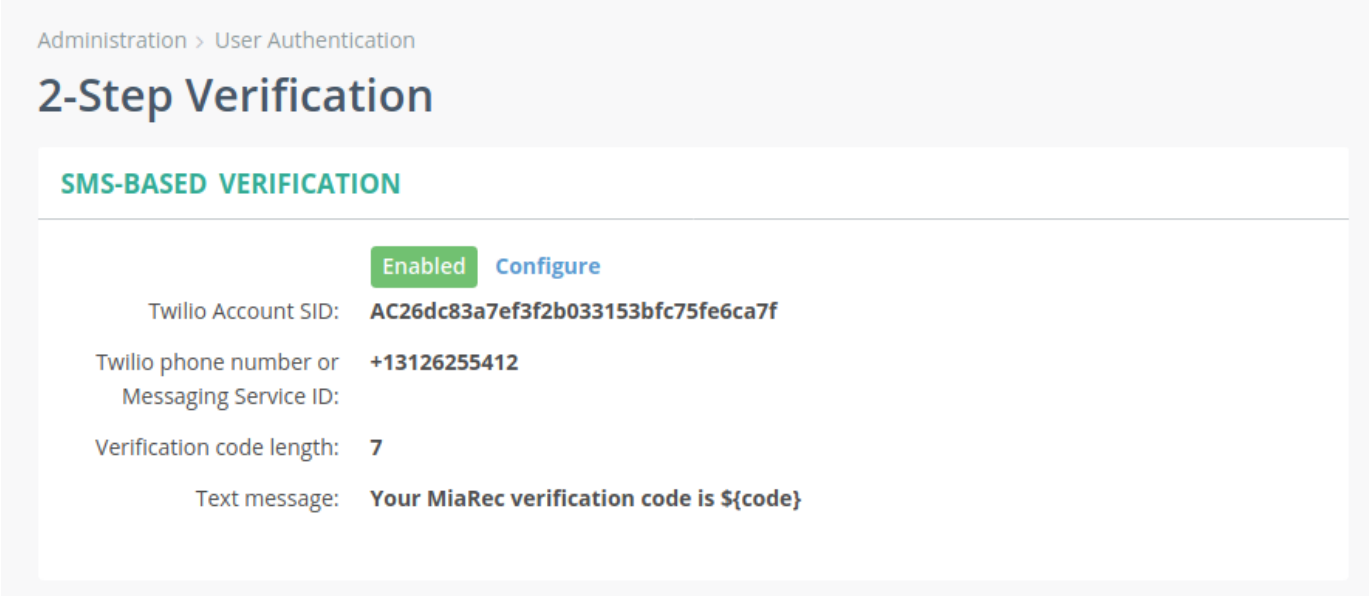
- Set **Enable** checkbox.
- Configure **Twilio Account SID** and **Twilio Auth Token** fields with the corresponding values of the previously created Twilio account.



- **Twilio phone number or Messaging Service ID** field specifies a phone number, Short Code, or Messaging Service that sends the message. This must be a Twilio phone number that you own, formatted with a '+' and country code, e.g. +16175551212 (E.164 format). You can also use a Messaging Service SID, if it was setup in the previous steps.
- Specify the **Verification code length** field to define the length of a verification code. Minimum is 6, maximum is 8.
- Optionally, modify the **Text message** field to define the SMS message text with verification code that will be sent to a user.

The **Test Connection Settings** section allows you to test sending of SMS to the specified number. Specify **Country code**, **Phone number** and press **Test Connection** button. If you successfully receive the test SMS, then your SMS-based verification settings are ready to go.

After you verify that all settings are correct, click the **Save** button.



3.2.3 Email-based verification

This article explains how to set up two-step verification using email.

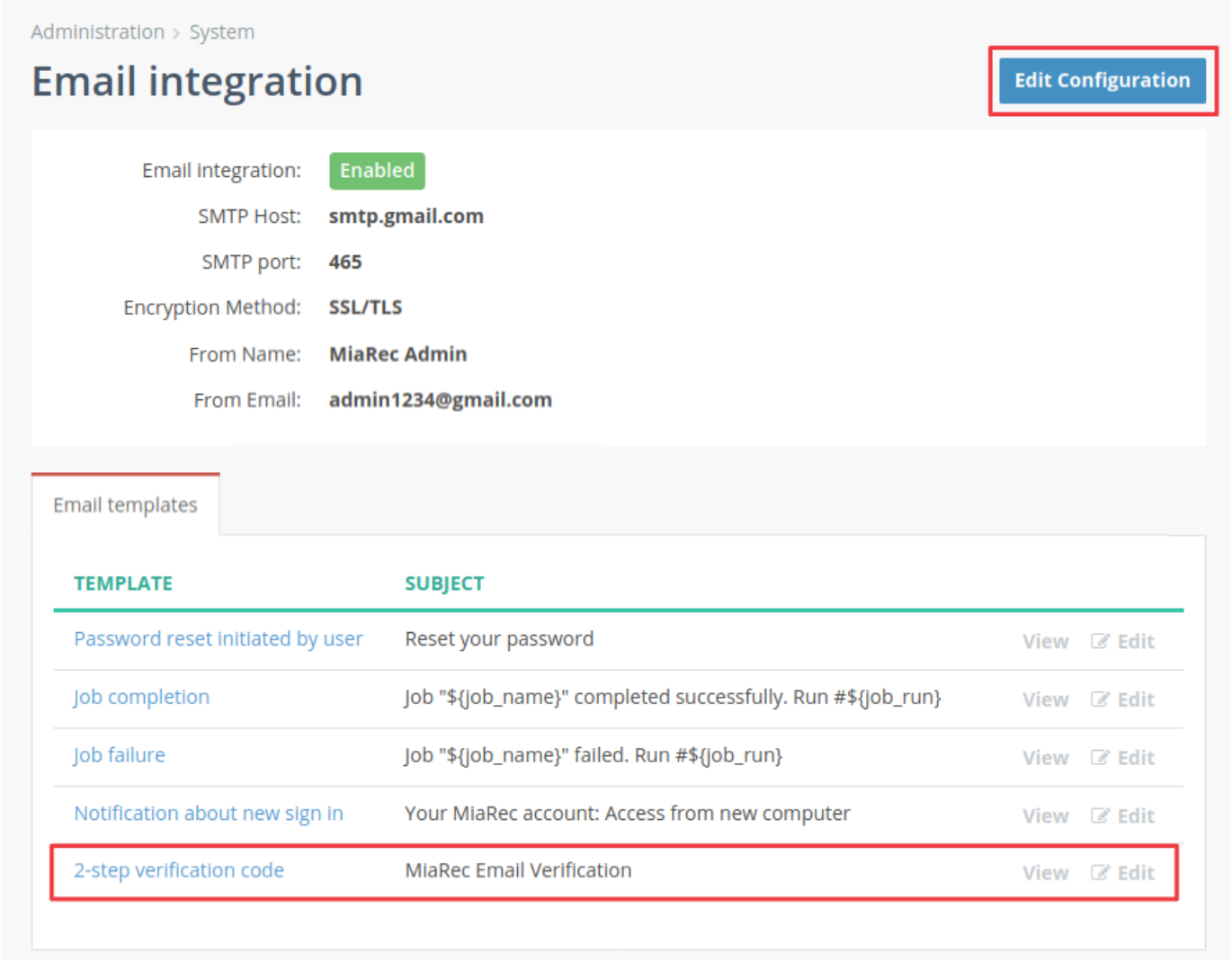
REQUIREMENTS

- Configured SMTP settings

CONFIGURE SMTP SETTINGS

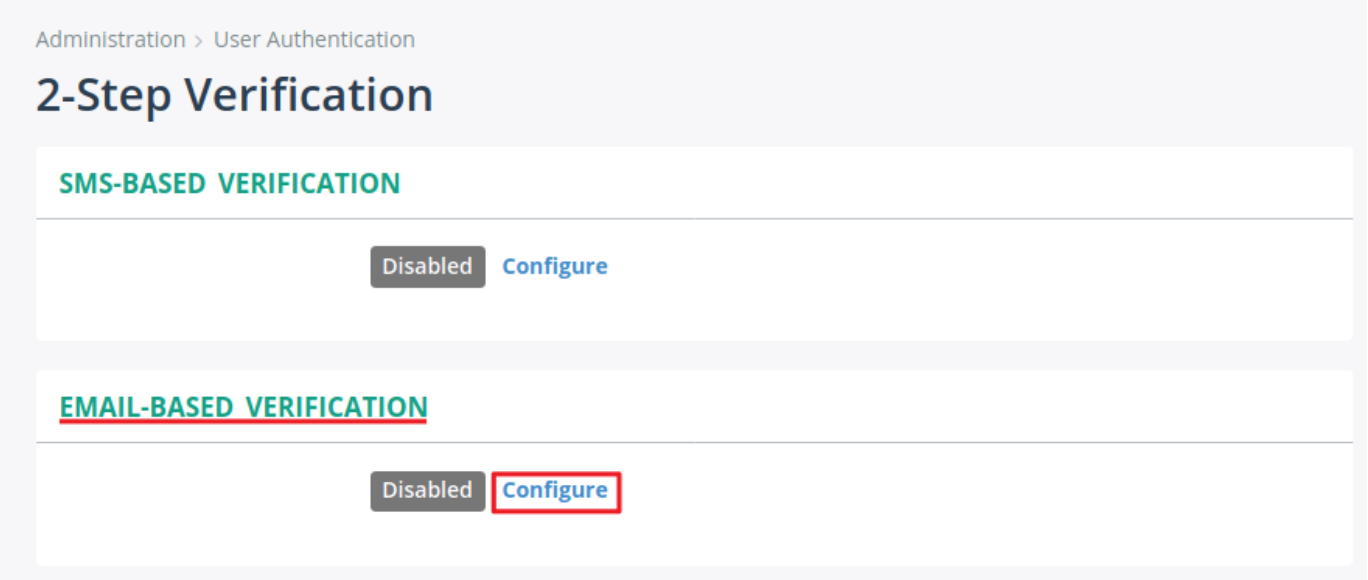
Navigate to **Administration > System > Email integration**.

- Click the **Edit Configuration** button to configure SMTP settings.
- Edit the **2-step verification code** template to change Email-based verification text message.

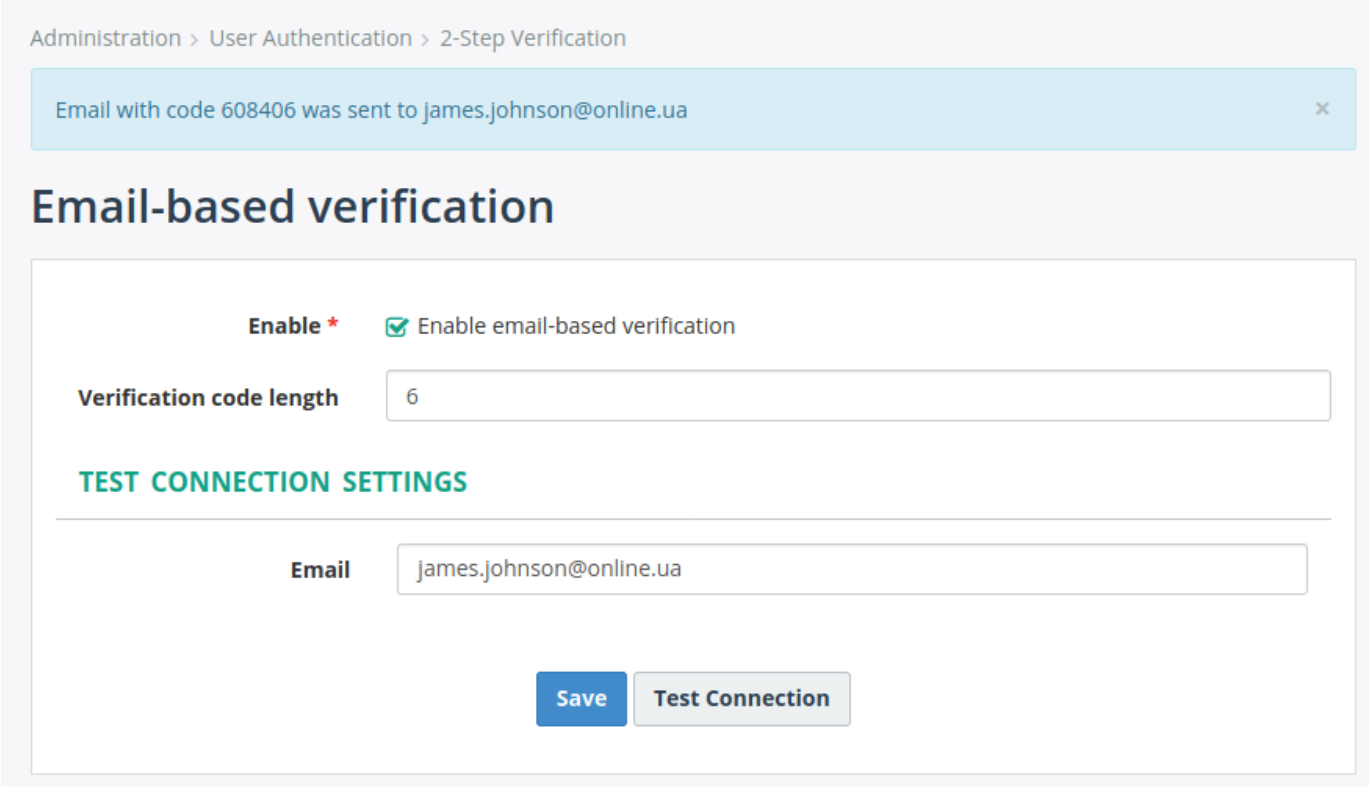


SETUP EMAIL-BASED VERIFICATION

In MiaRec Web portal, go to **Administration > User Authentication > 2-Step Verification** page.



Click the **Configure** link for the **Email-based verification** setting.



- Select the **Enable** checkbox.
- Specify the **Verification code length** field to define the length of a verification code. Minimum is 6, maximum is 8.
- You can test the connection settings to make sure that Email-based verification is configured properly. Specify the test email address and press **Test connection** button. If the settings are correct, then you should receive a test email with a verification code.

```
Hi admin,

You recently requested access to your account.
Here is the code you need to login:

608406

The code is required to complete the login.
No one can access your account without also accessing this email.

If you are not attempting to login then please change your password,
and consider changing your email password as well to ensure your account security.
```

An alert about successful sending of email should appear at the top of the form.

- Click the **Save** button.

3.2.4 Authy app-based verification

This article explains how to set up two-step verification using Authy application.

REQUIREMENTS

- Twilio account

  Create a Twilio account if you do not have one.

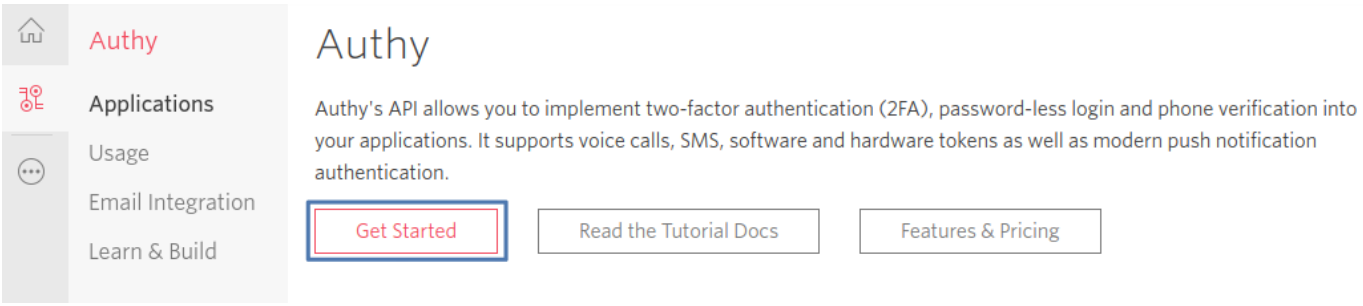
  - Create Twilio project account
  - Upgrade Twilio project account

Note, Authy app-based application is a paid service from Twilio. Check Authy Pricing page.

CREATE AUTHY APPLICATION

Navigate to the Authy Applications page in the Twilio Console.

If you do not have Authy application yet, then click the **Get Started** button to create one.

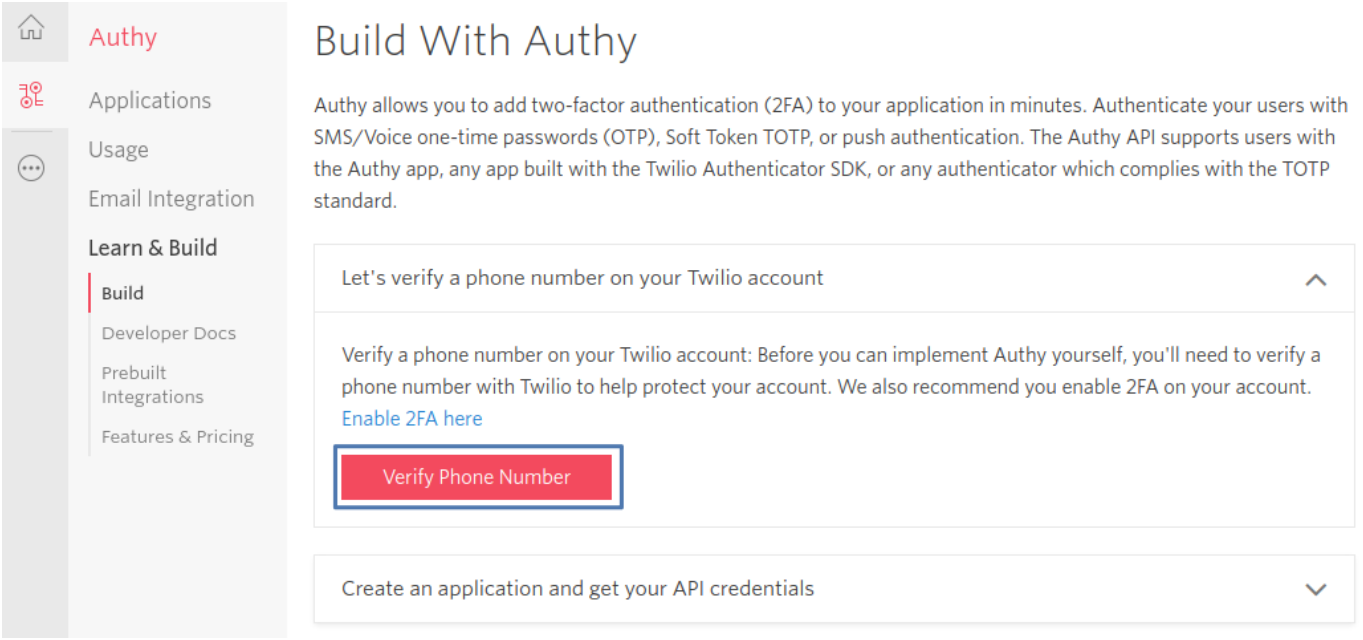


The **Build With Authy** page is displayed.

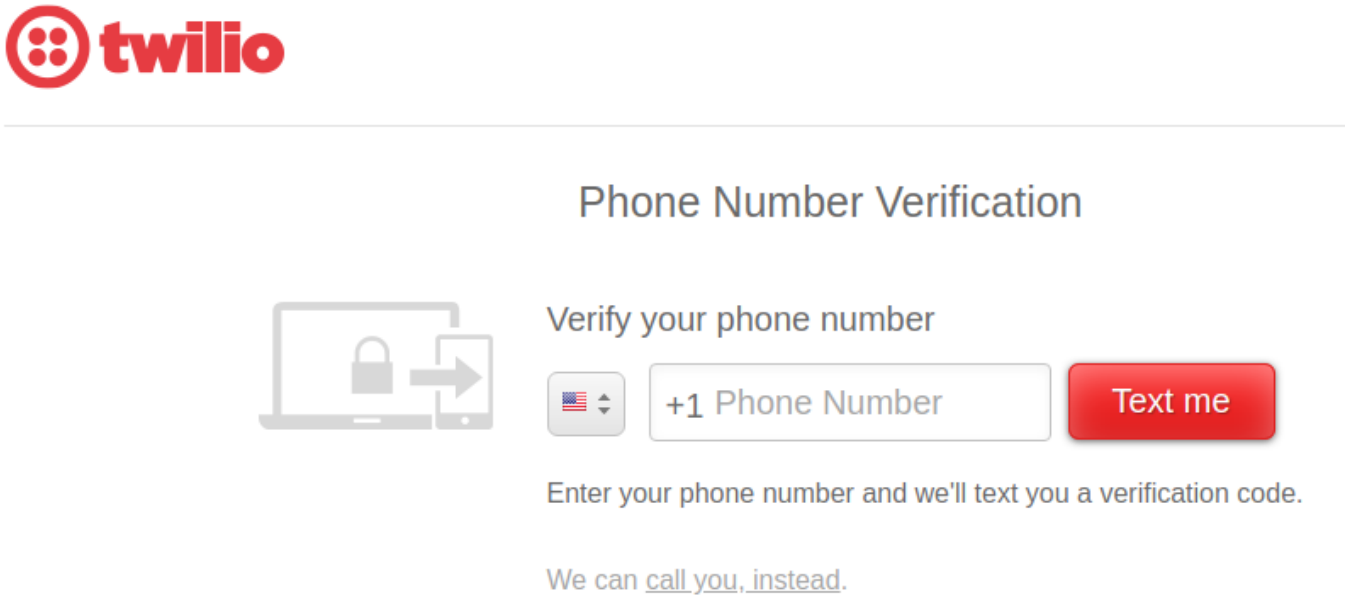
You need to complete at least the first two steps:

- Verify a phone number
- Create an application and get your API credentials.

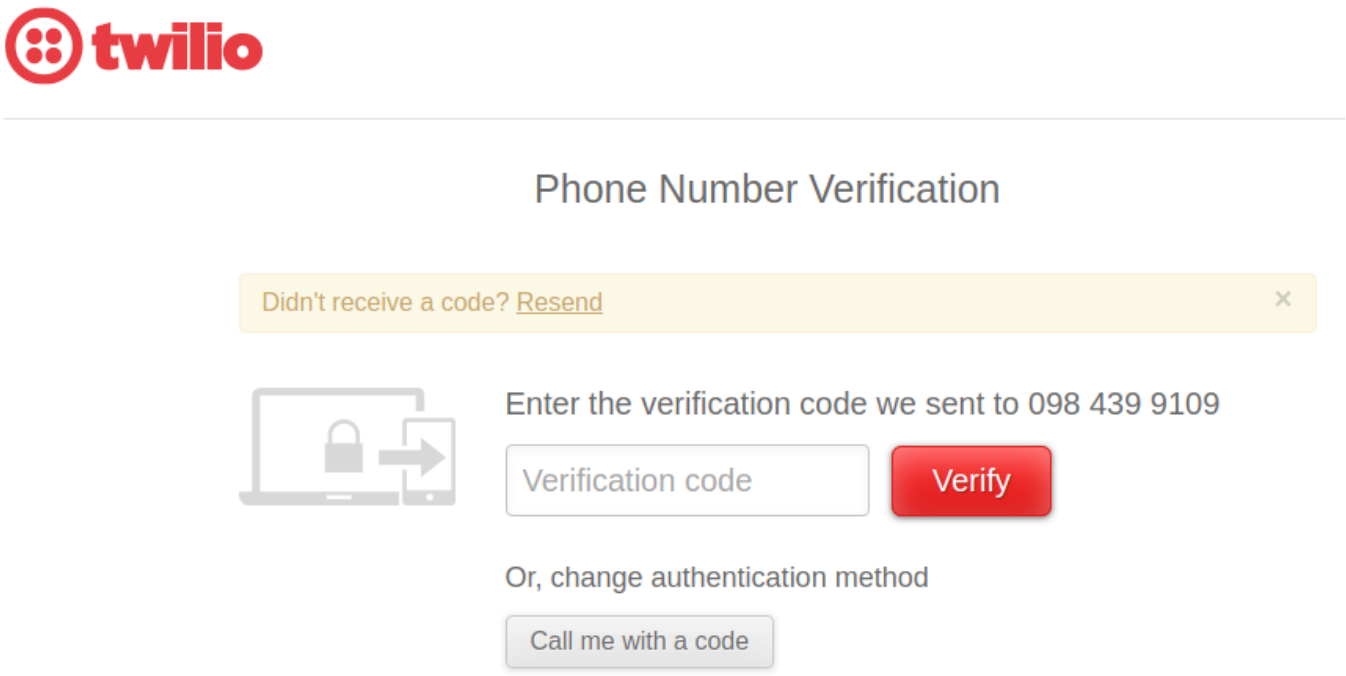
Click the **Verify Phone Number** button.



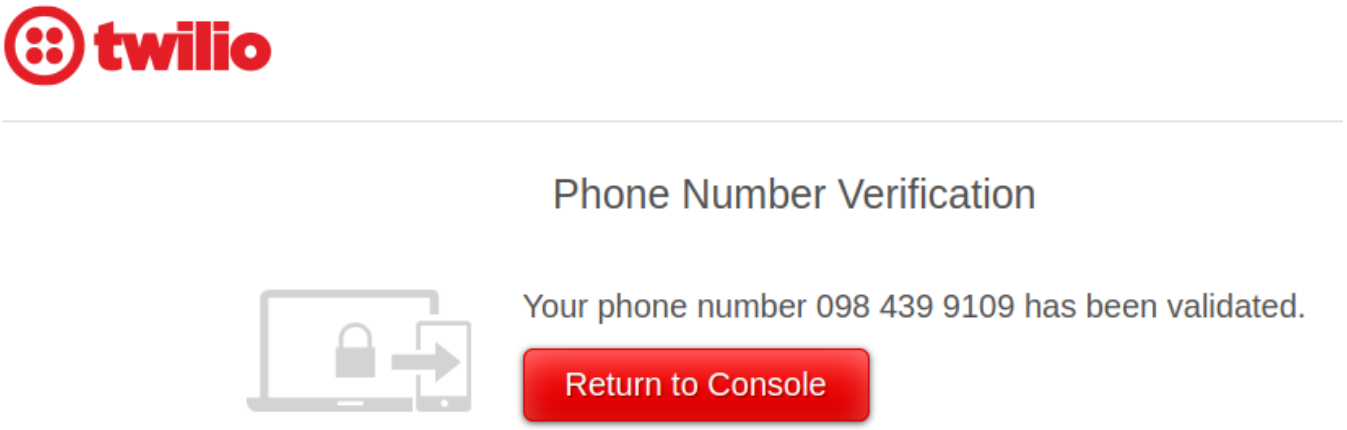
Next, specify the country and the phone number. Click the **Text me** button.



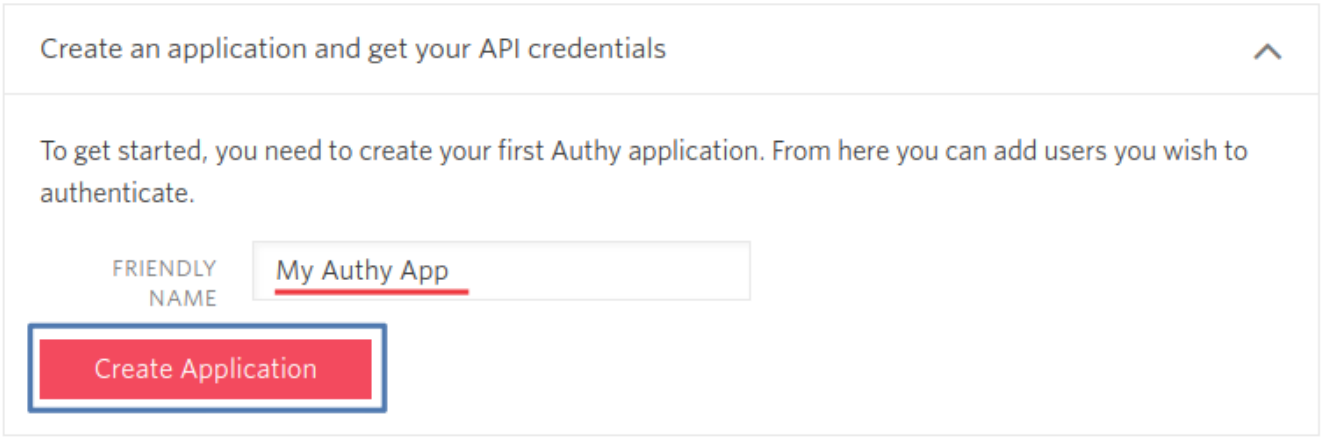
Check text messages on your phone. You should get the Twilio code. Enter the code into the **Verification code** field and click the **Verify** button.



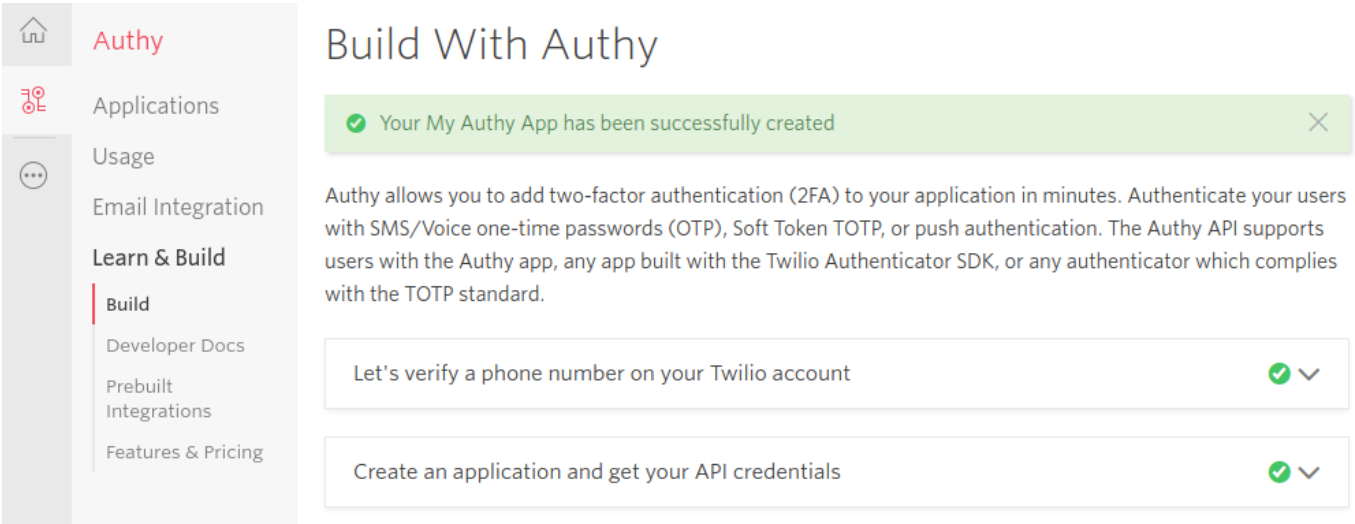
When you enter the correct code, then you will see a message about the successful verification of the phone number. Click the **Return to Console** button.



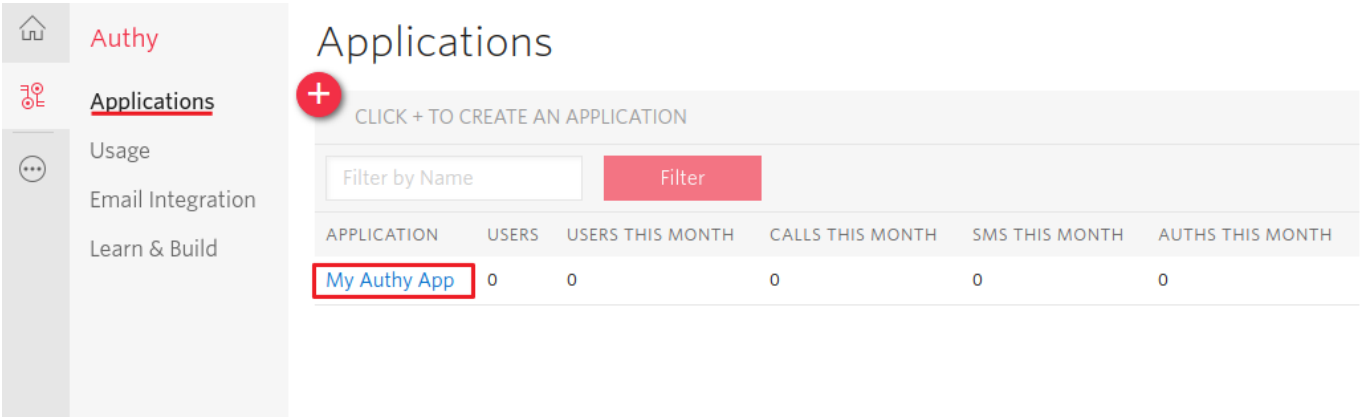
A browser page will be returned to the **Build With Authy** page. Once you confirm your phone number, the next step is to create an Authy application if you do not already have one created. Specify the name for new Authy application and click the **Create Application** button.



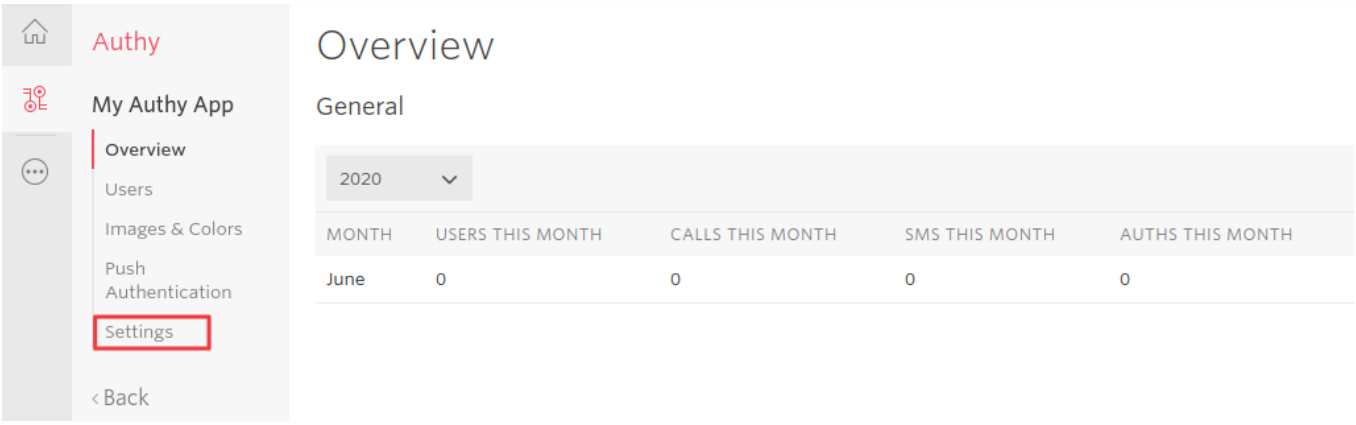
The new Authy application is created.



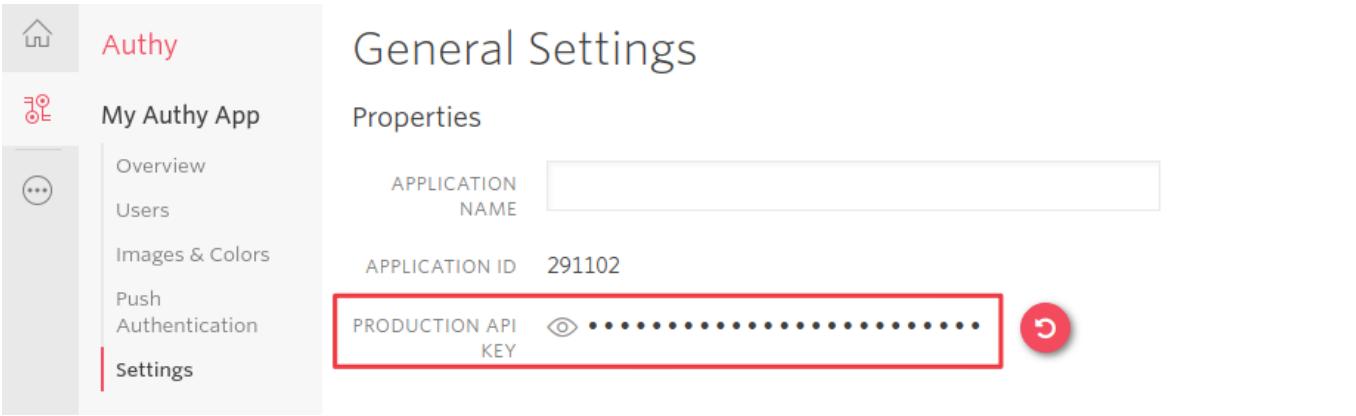
Navigate to the Authy Applications page, locate the newly created Authy application and click its name.



In the **Overview** page, click the **Settings** link.



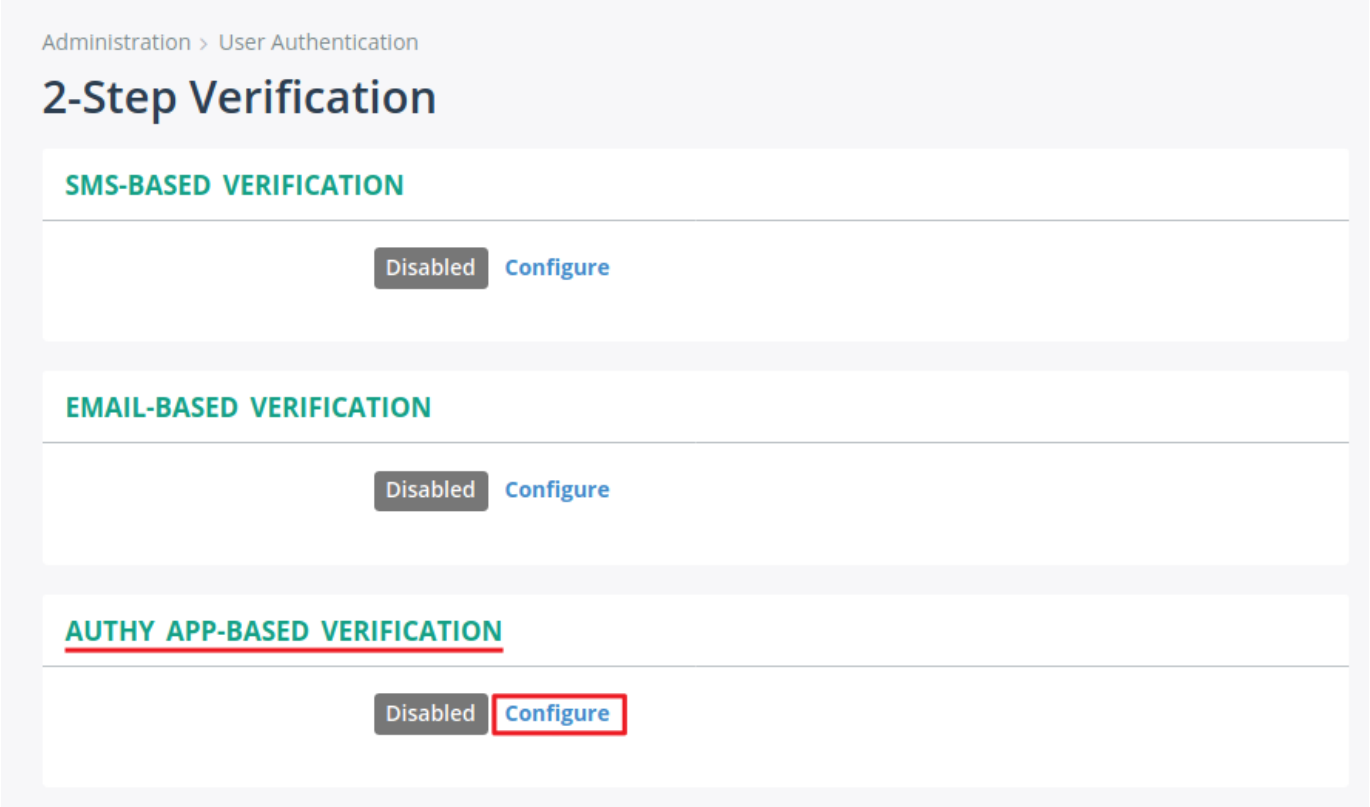
Locate **Production API Key** on the **General Settings** page. Click the Eye pictogram in order to view the API Key. Copy it. This API Key is required in the next steps.



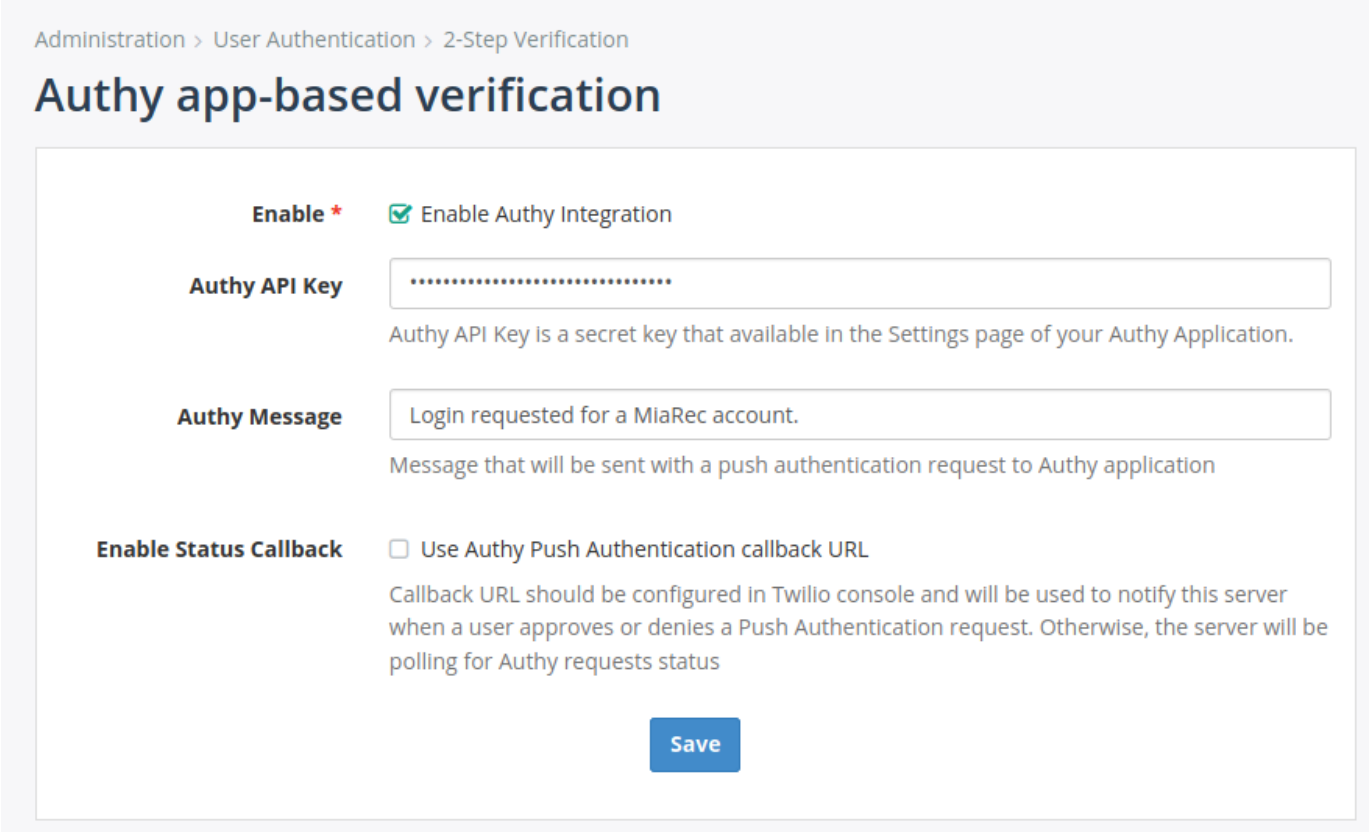
SETUP AUTHY APP-BASED VERIFICATION

The **Authy app-based verification** settings page is available from the Admin Console.

In MiaRec Web portal, go to **Administration > User Authentication > 2-Step Verification** page.



Click the **Configure** link for the **Authy app-based verification** setting.



- Set **Enable** checkbox.
- Specify **Authy API Key** which was taken from the previous step.
- Change a default **Authy Message** if desired. This message will be shown to users in Authy application.
- Configure **Status Callback** as desired. See below for information.
- Press **Save** button.

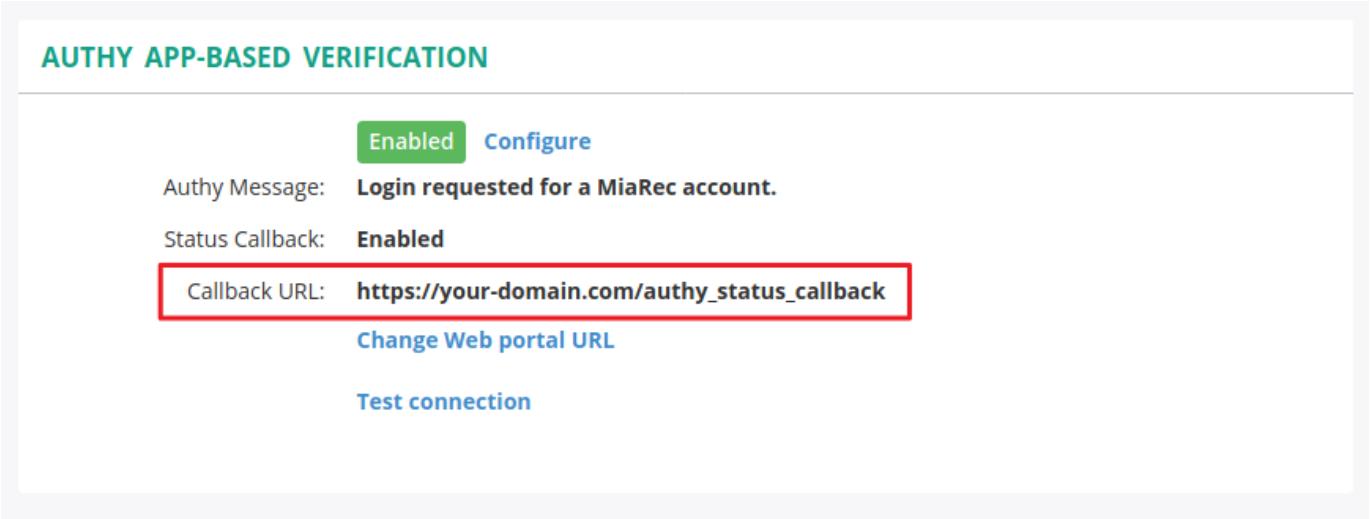
[OPTIONAL] ENABLE STATUS CALLBACK

If the **Status Callback** is **Disabled**, then MiaRec Web portal will be polling for Authy Push Authentication requests status.

If the **Status Callback** is **Enabled**, then the Authy Webhooks API will be used to notify MiaRec Web portal of the status of the Push Authentication request.

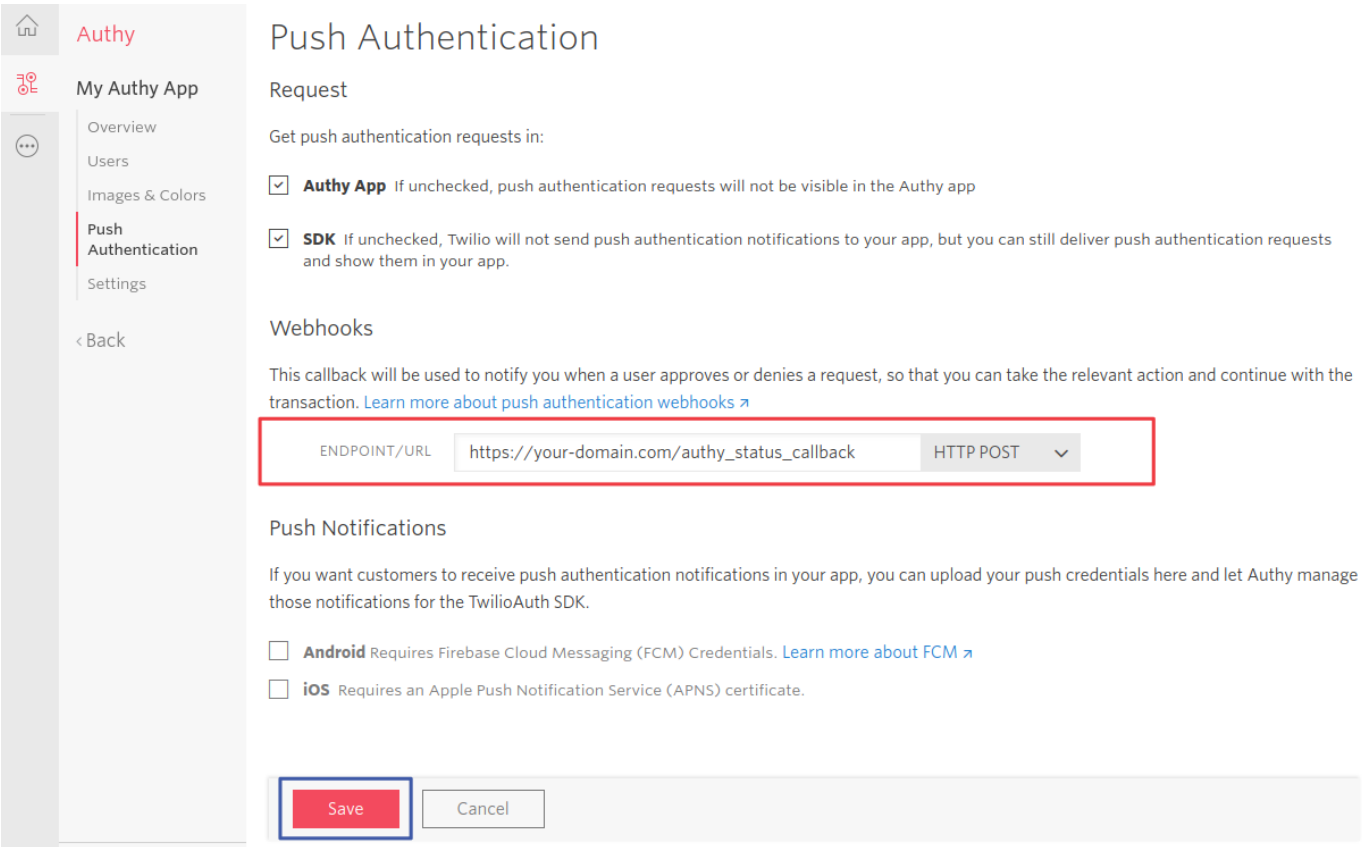
In this case, you need to configure **Webhook URL** in Authy Application Push Authentication settings page. Your MiaRec Web portal must be accessible from the Internet for this use case.

First, you need to locate the proper callback URL. In MiaRec Web portal, go to **Administration > User Authentication > 2-Step Verification** page. Find the Callback URL under **Authy app-based verification** section.



If your Web portal URL is not configured yet, click the **Change Web portal URL** link to edit the Web portal URL. Remember or copy **Callback URL**

In Twilio Console, navigate to the **Authy Application Settings** page. Click the **Push Authentication** link to open the required settings page.

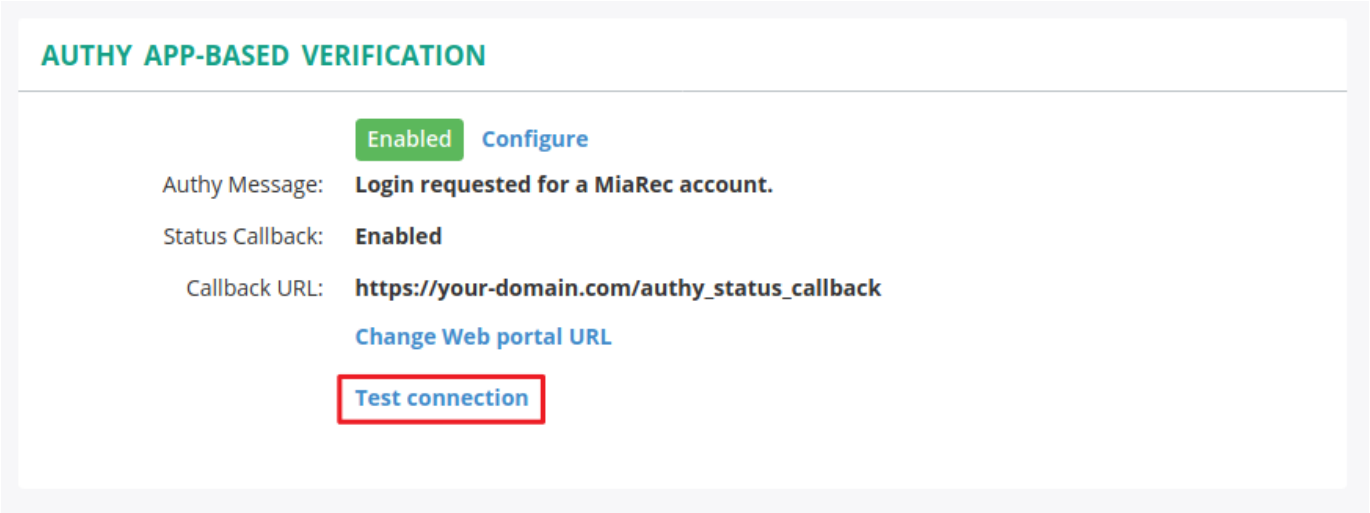


Put the Callback URL into the **ENDPOINT/URL** field. Leave the method equals to *"HTTP POST"*. Click the **Save** button.

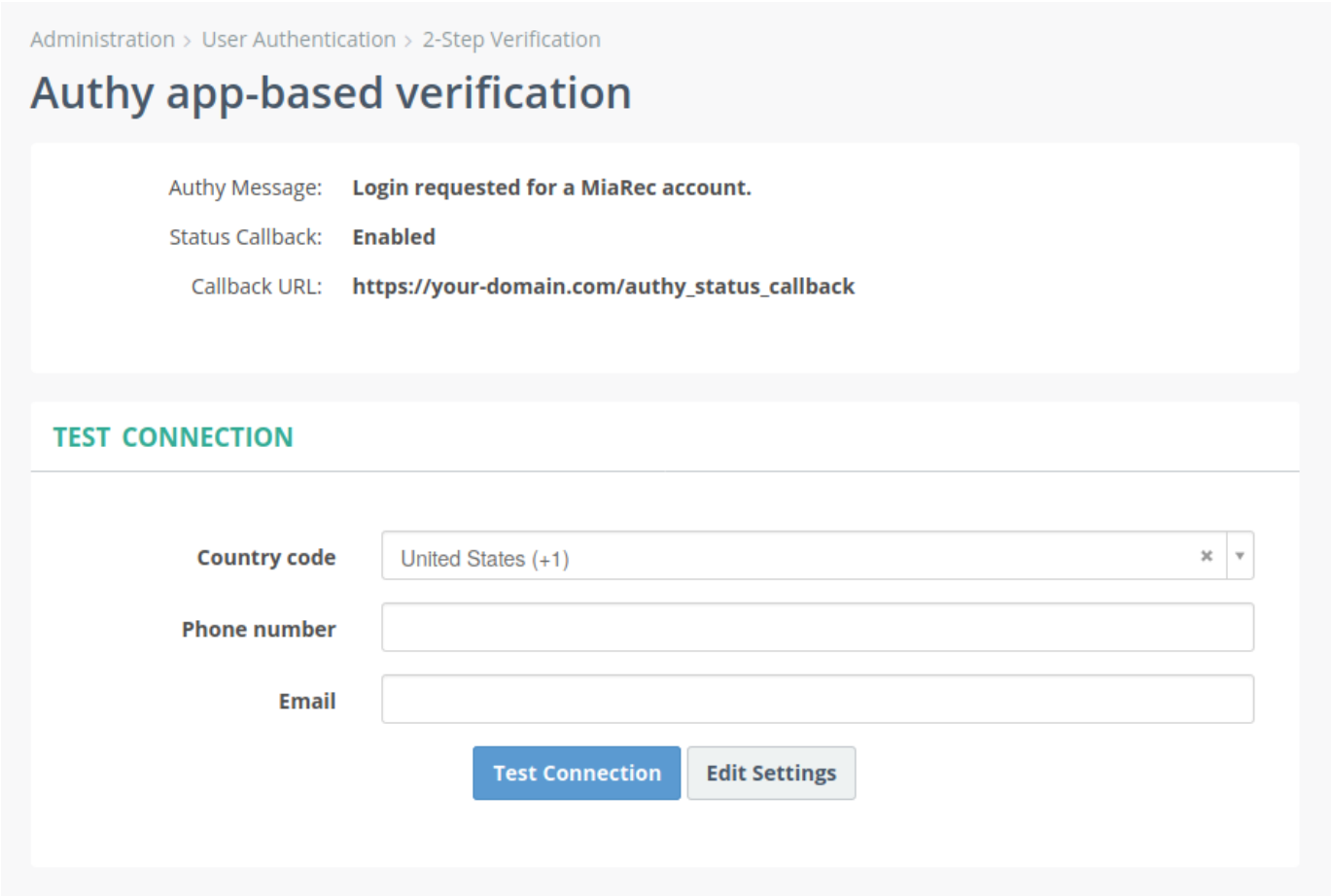
TEST CONNECTION

In MiaRec Web portal go to **Administration > User Authentication > 2-Step Verification** page.

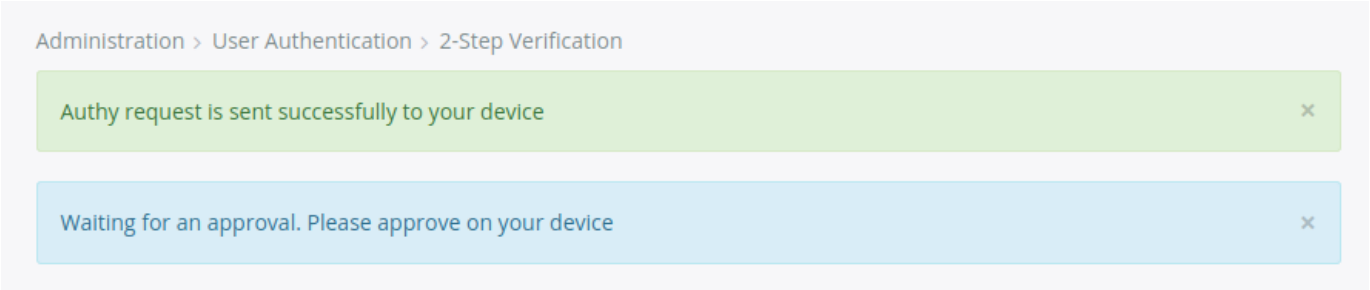
Click the **Test connection** link.



Authy app-based verification form is opened.



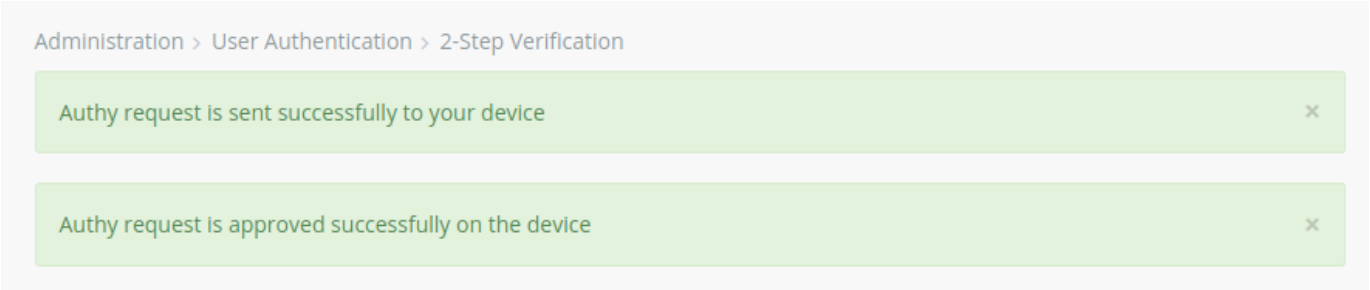
- Specify your country code, phone number, and email. You should have Authy Application set up on your device. Specified phone number should be turned into Authy secure account.
- Click the **Test connection** button.



The two alerts should appear on the top of the form. One is about successful sending request (“Authy request is sent successfully to your device”). The other is about awaiting for an approval (“Waiting for an approval. Please approve on your device”).

You should receive an Authy Push Authentication request on your device. Click the **Approve** button on it.

When the authentication request is approved the second alert should replace with “Auhy request is approved successfully on your device”, signaling that it works.



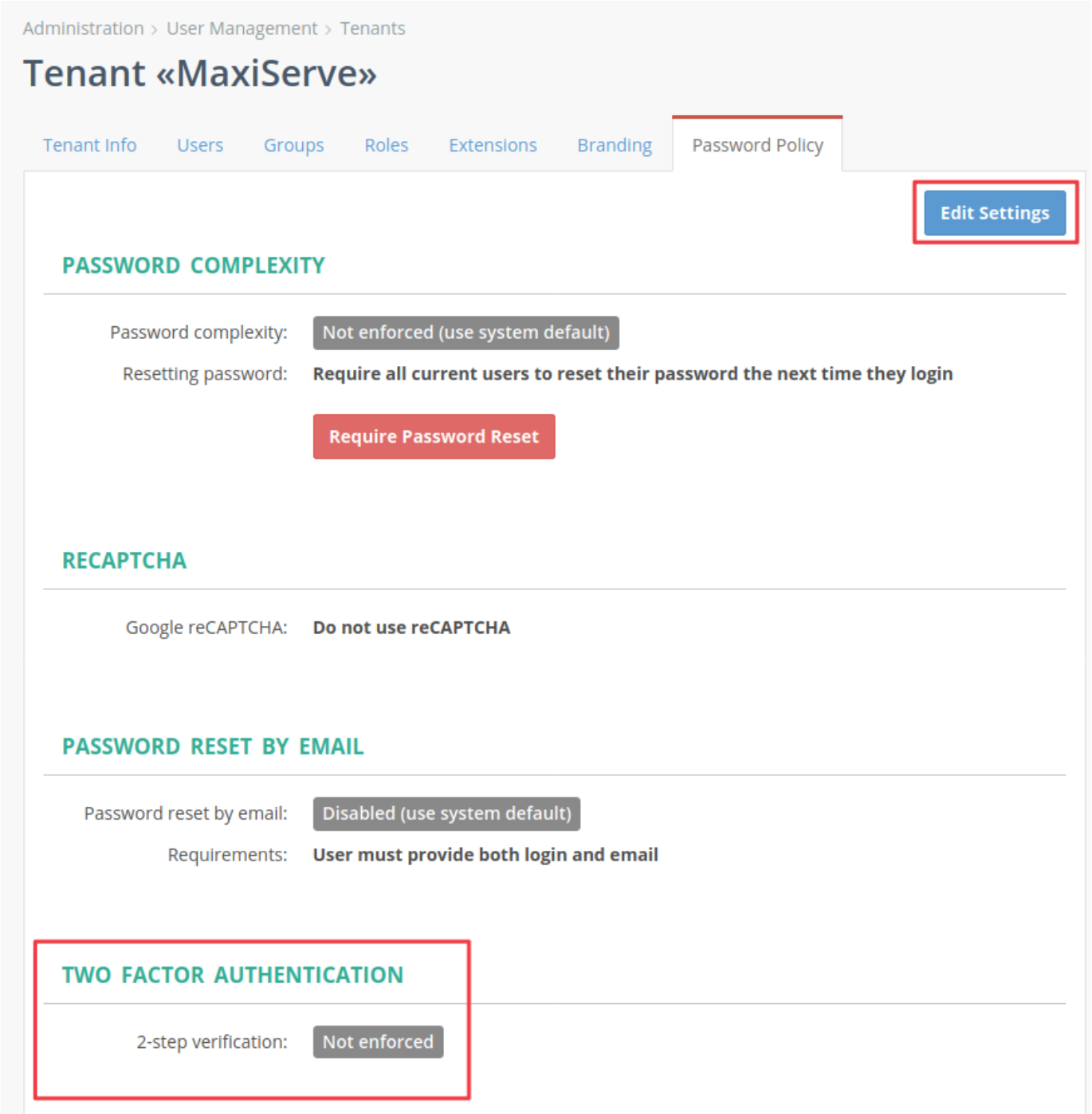
3.3 Enforce two-step verification

Two-Step Verification can be enforced for a user or for a tenant. Enforcing for a tenant takes precedence over enforcing for a user.

Enforce Two-Step Verification for a tenant

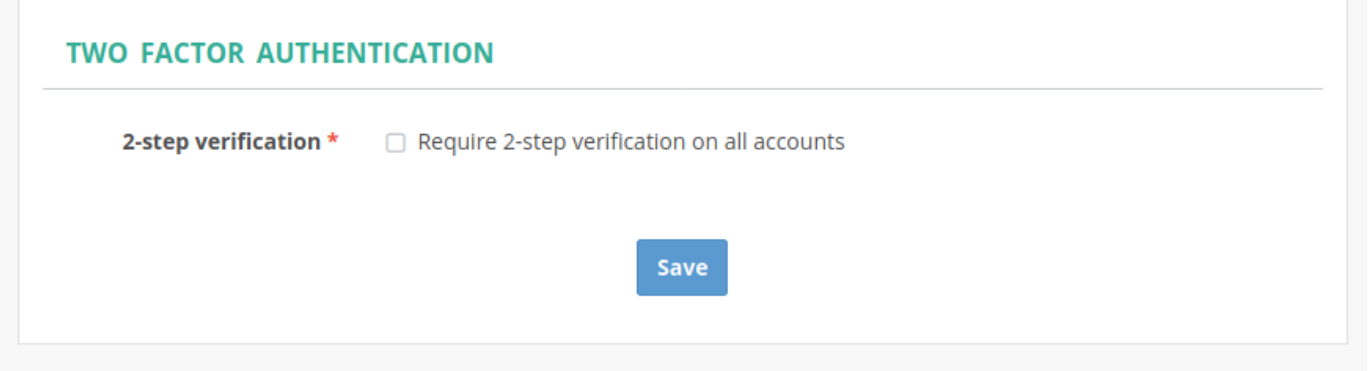
If Two-Step Verification is enforced for the tenant, then each active user of the tenant will be required to verify Two-Step Verification by login to the web portal.

Open a tenant view page and navigate to the **Password Policy** tab.



Under **Two factor authentication** section there is information about whether Two-Step Verification is enforced or not.

Click the **Edit Settings** button. Password Policy Edit Form is opened.



Select the **Require 2-step verification on all accounts** checkbox and click the **Save** button.

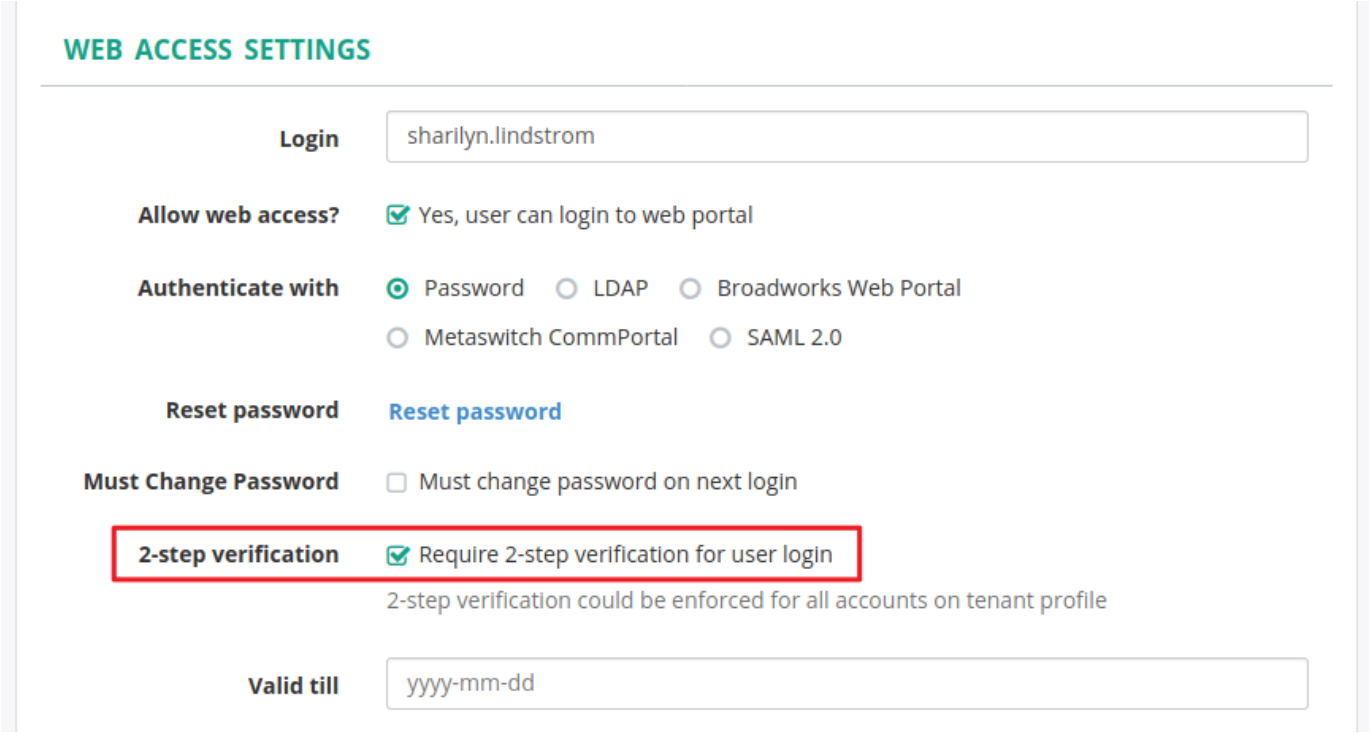
The tenant's **Password Policy** view is opened. Under **Two factor authentication** section there should be information that Two-Step Verification is enforced.

Enforce two-step verification for a user

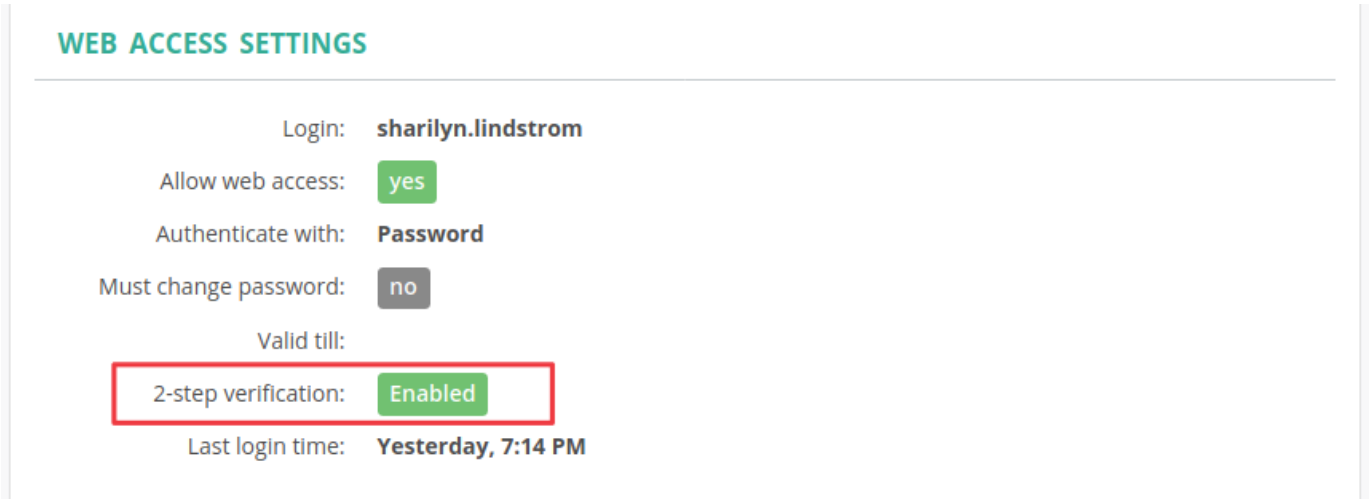
Two-Step Verification can be enforced for a particular user. The user will be asked to verify Two-Step Verification when he/she is logging in to the Web portal.

Open User Edit Form in order to enforce Two-Step Verification for a particular user.

Select the **Require 2-step verification for user login** checkbox.



Press the **Save** button. Two-Step Verification is enforced for the user.

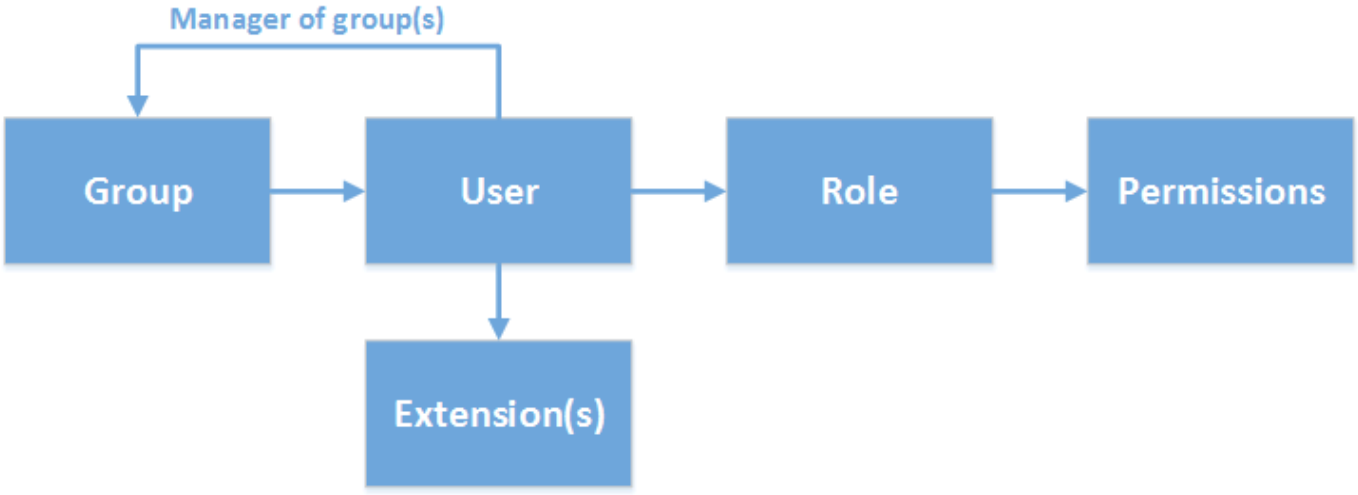


You can use the **Bulk User Edit** form to enable Two-Step Verification for multiple users at once.

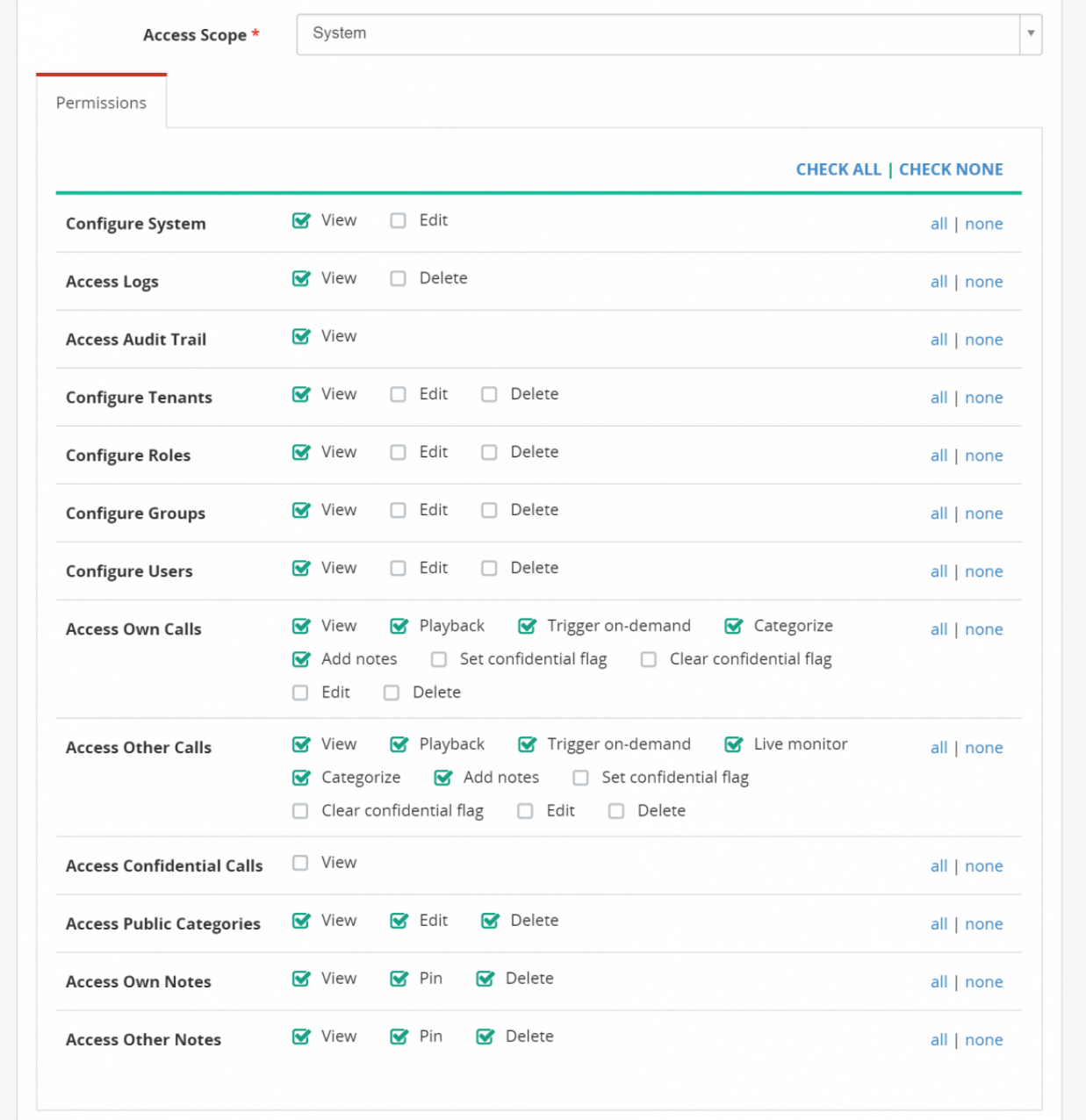
4. User Management

4.1 Understanding user roles and permissions

MiaRec software provides role-based access control feature with granular permissions. Each user account is associated with one role. And each role is configured with a set of permissions.



Each role is associated with a set of permissions, which are granted to users of this role. Permissions include such privileges like "Configure System", "Configure Users", "Playback calls", "Delete calls" etc.



By default the following roles are pre-created in MiaRec system, but administrator may create new roles or modify existing ones:

Root Administrator

Users of this role have unlimited access to system.

Administrator

Users of this role have a set of permissions as configured by Root Administrator. By default users of type Administrator can create/edit other user accounts.

Supervisor

Supervisor has access to call recordings, which are associated with users in his/her managed group(s). They cannot create/edit other user accounts.

Agent | **User Self View**

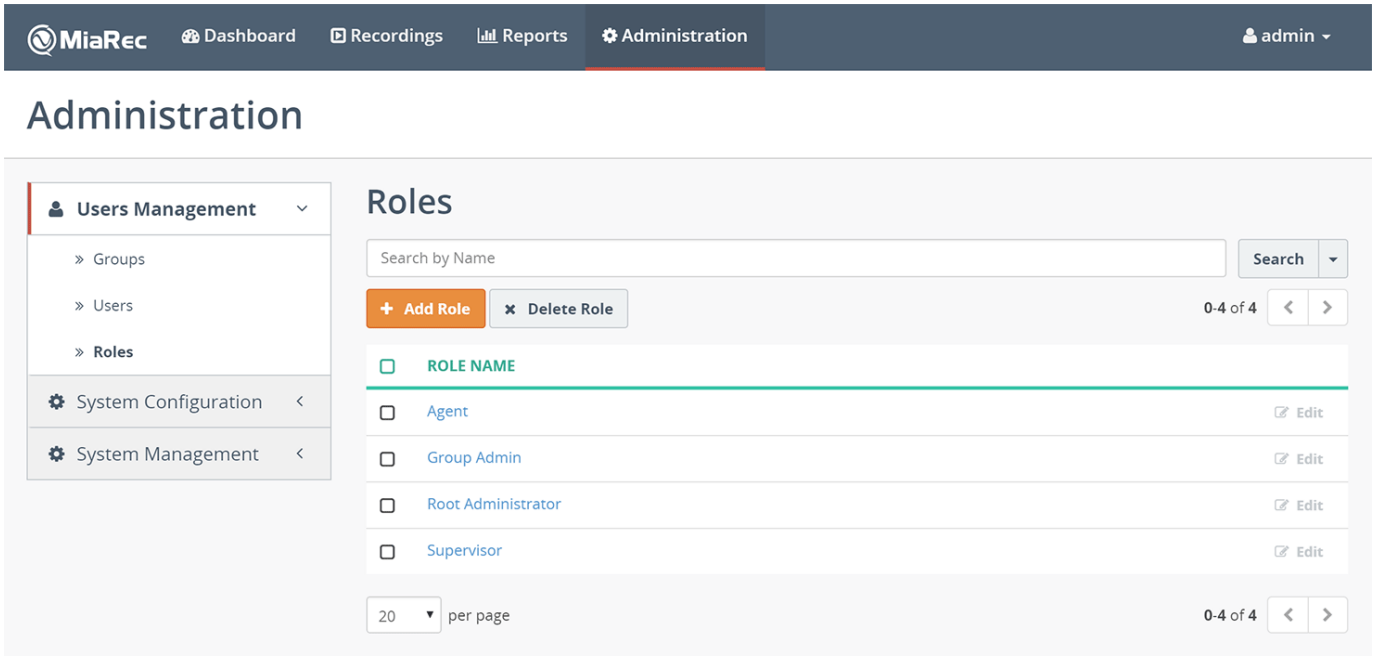
Agents have access to own call recordings only.

4.2 Roles

Each user in MiaRec system should be assigned a role. The role defines what system resources are accessible by user and what operations are permitted on these resources.

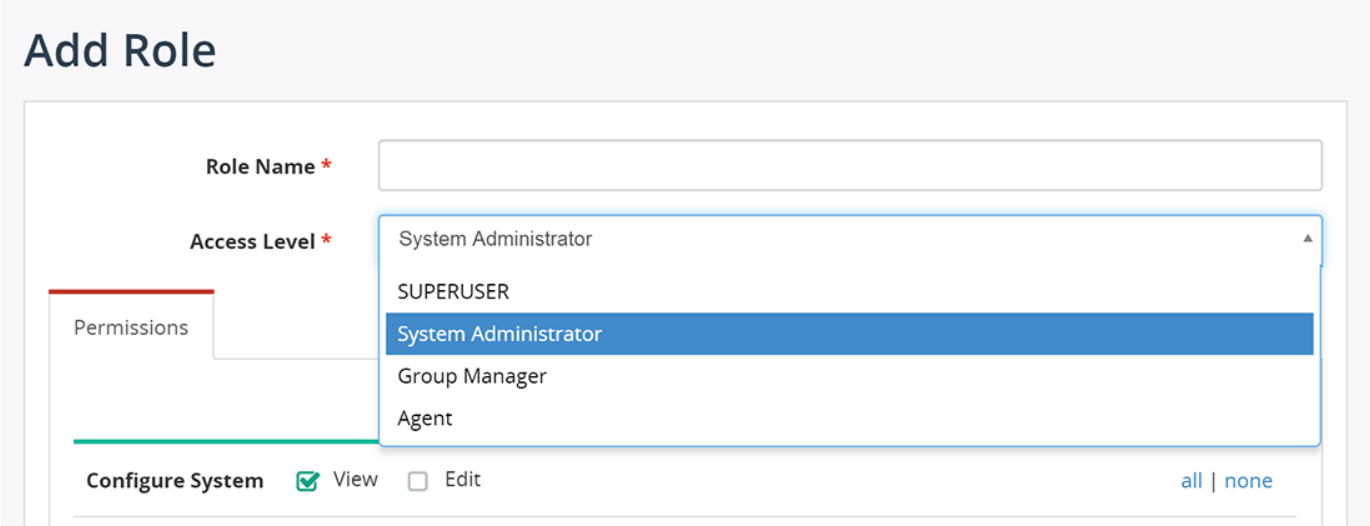
4.2.1 List of roles

Navigate menu **Administration -> Users Management -> Roles** to see a list of available roles. During installation MiaRec automatically pre-creates a few roles. Administrator may create new roles or modify existing ones.



4.2.2 Configure access scope

Access scope setting specifies which resources are accessible by user of such role.



Access scope	Description
SUPERUSER	User with such role has unrestricted access to the system.
System	User with such role has access to all resources on the system (users, groups, calls), but the operations are restricted by permissions. One exception from this rule is when multi-tenancy is enabled and user belongs to particular tenant account. In this case access is limited to tenant resources only.
Managed Groups	User with such role has access only to resources within the managed groups. A list of managed groups is configured in user's profile. The group manager may see only users and their calls, for which he/she is a manager. Other users/calls are not visible to group manager.
User	User with such role has access only to own call recordings.

4.2.3 Configure permissions

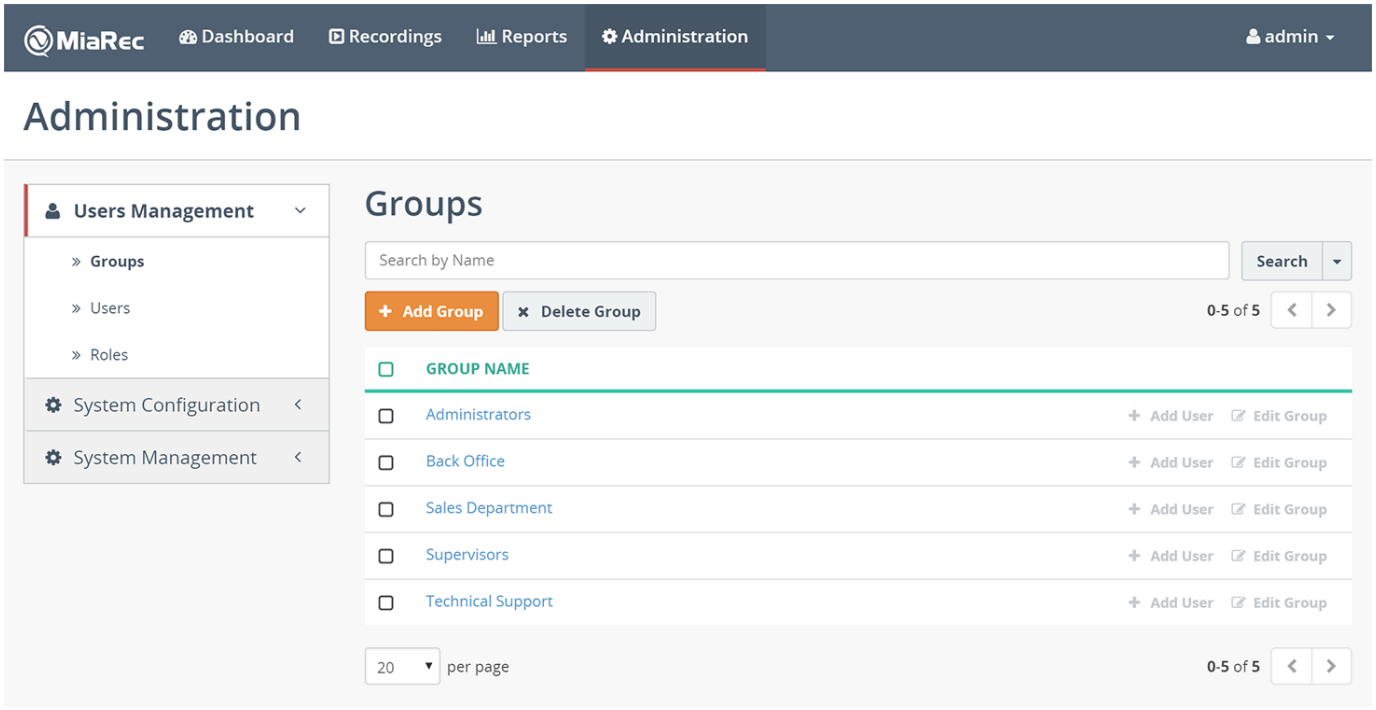
Permissions setting specifies what operations are permitted on the accessible resources. These operations include view, edit, delete, playback etc.

4.3 Groups

Each user should belong to one of groups. Most of users are just members of their group, but some of users may be managers of groups. A single user may be a manager of multiple groups at the same time.

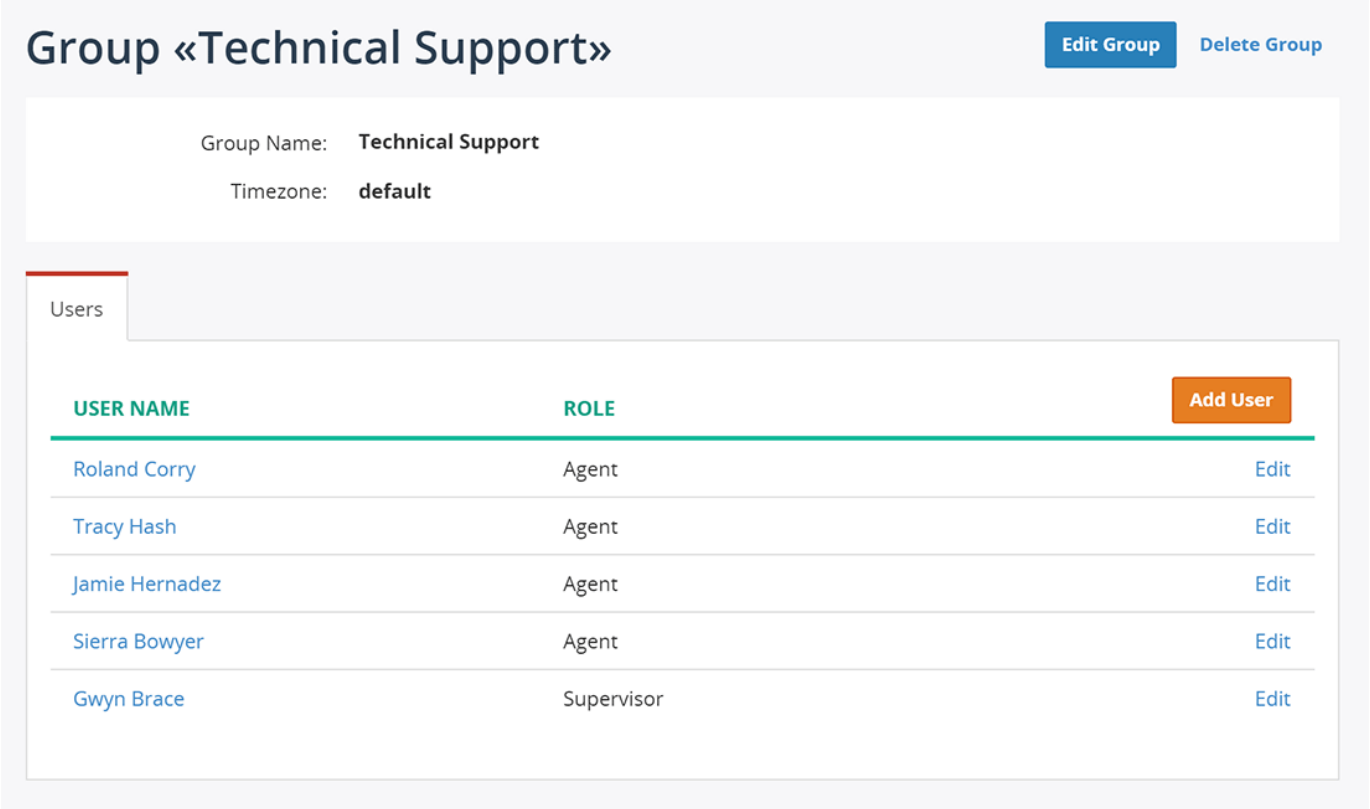
4.3.1 List of groups

Navigate menu Administration -> Users Management -> Groups to see a list of available groups. During installation MiaRec automatically pre-creates a few sample groups. Administrator may create new groups or edit existing ones.



4.3.2 View group

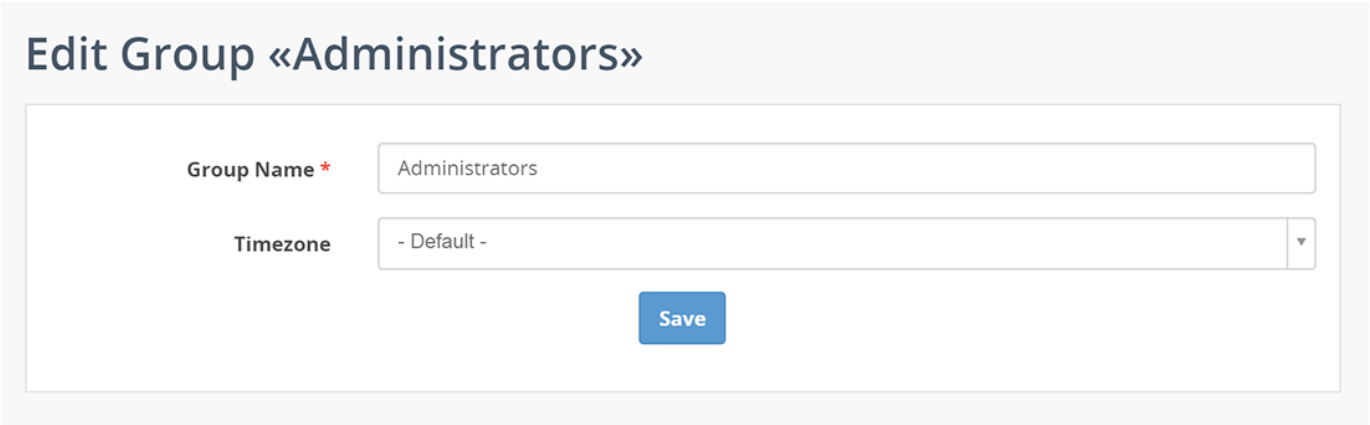
The group's profile page displays a list of all users, who are member of this group.



4.3.3 Edit group settings

Configuration of group includes the following options:

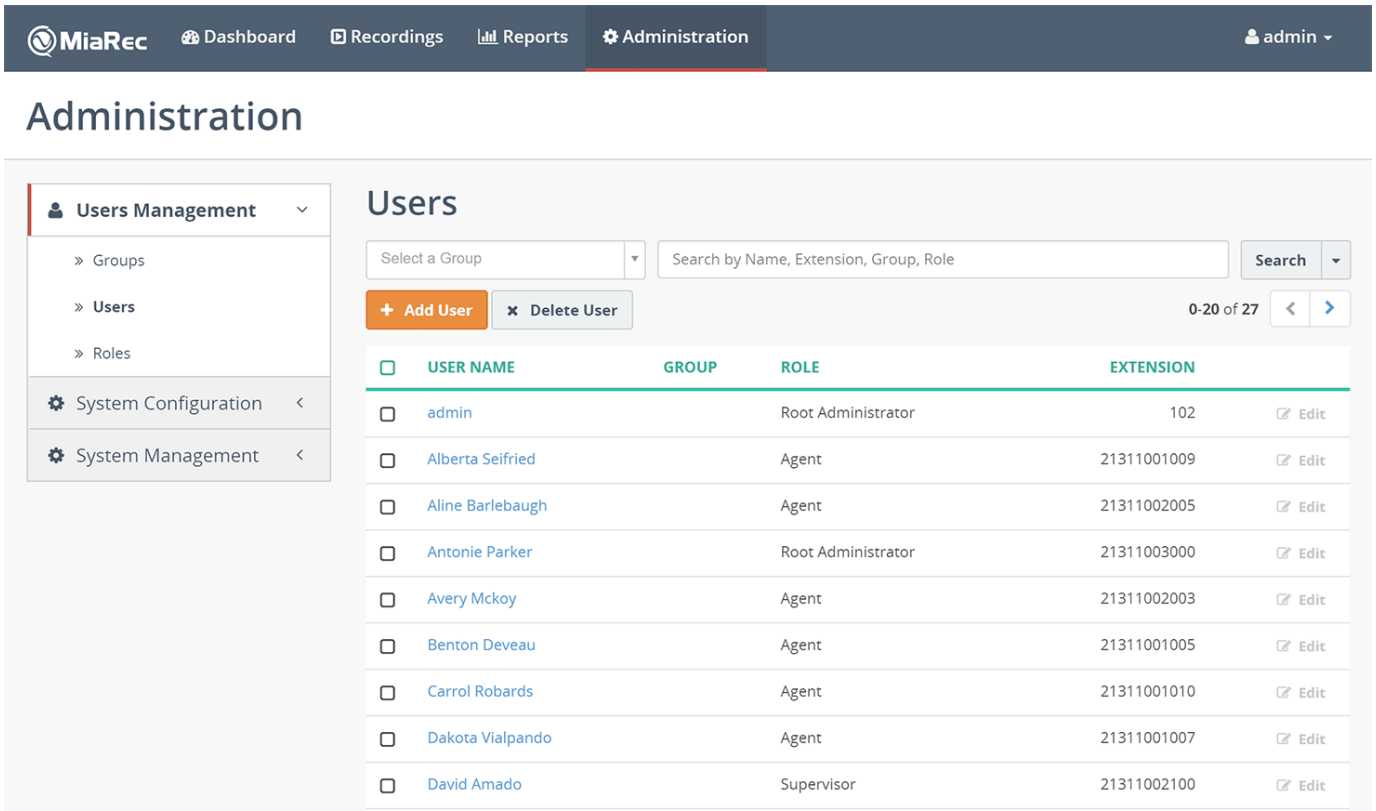
- **Group name**
- **Timezone**, which will be used by default for each user in this group. The timezone setting may be overridden on user's profile page.



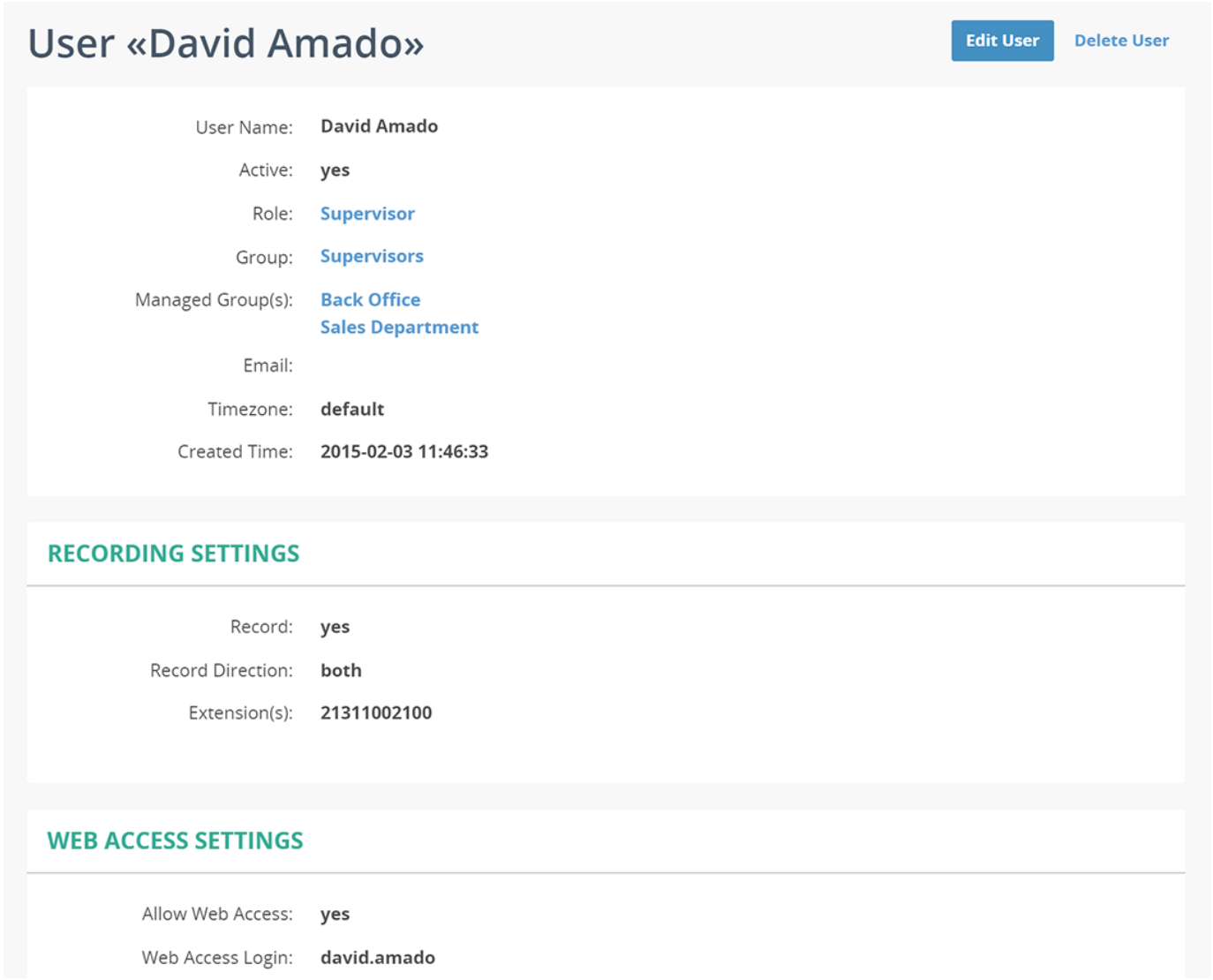
4.4 Users

4.4.1 List of users

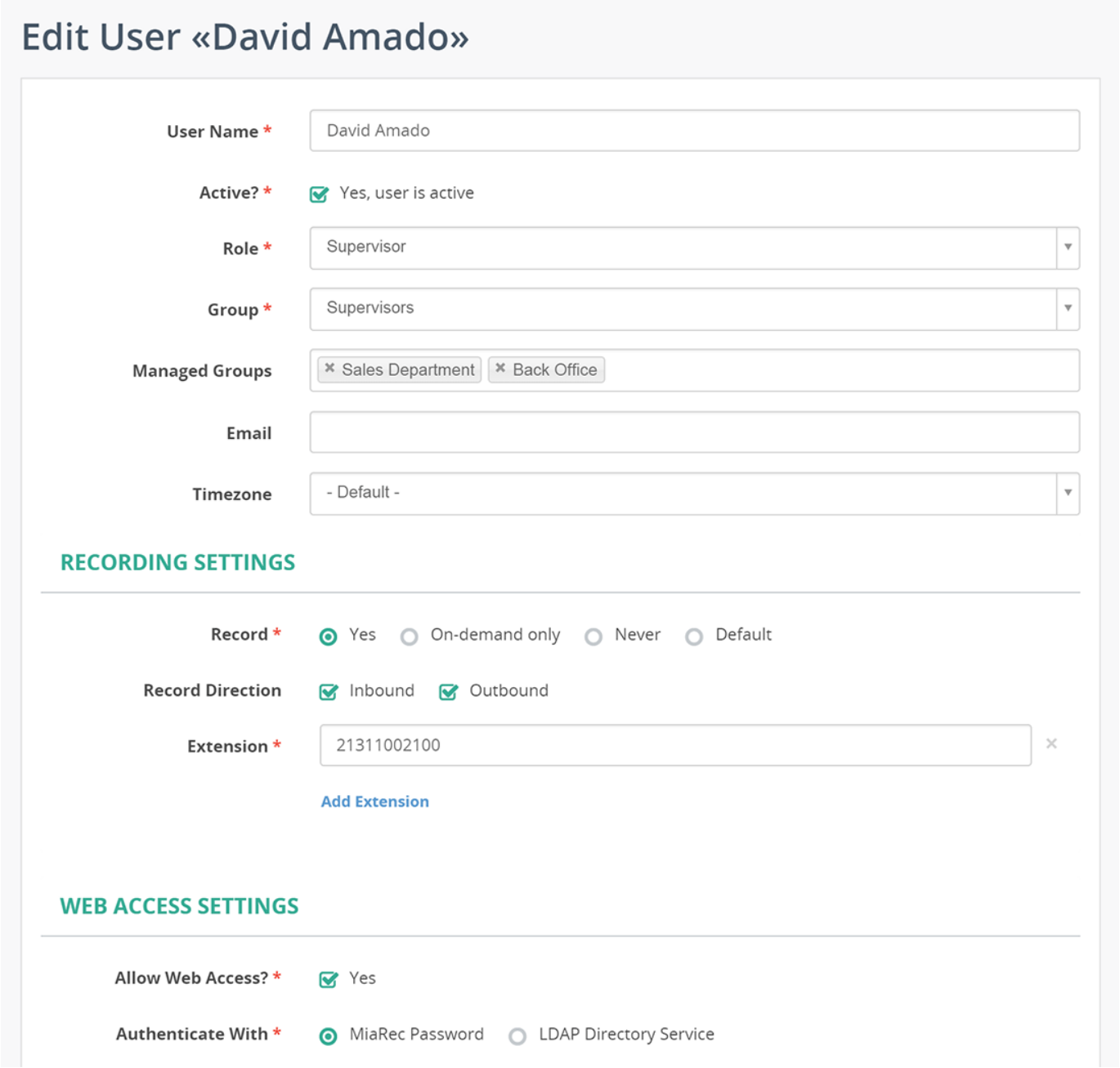
Navigate menu **Administration -> Users Management -> Users** to see a list of users. You can search users by name, group, role or extension.



4.4.2 View user

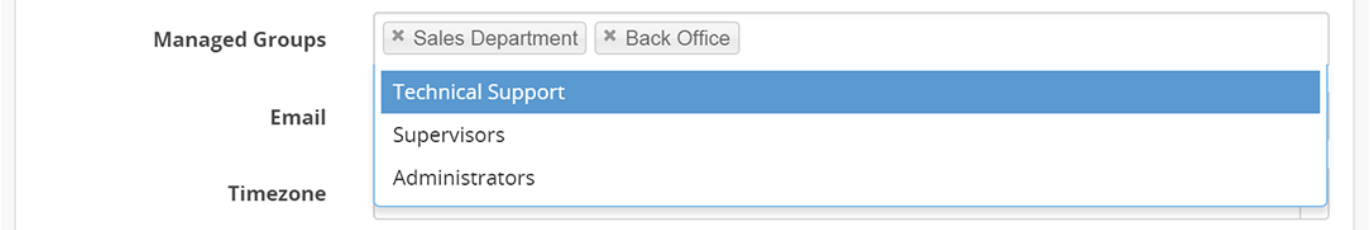


4.4.3 Add/edit user



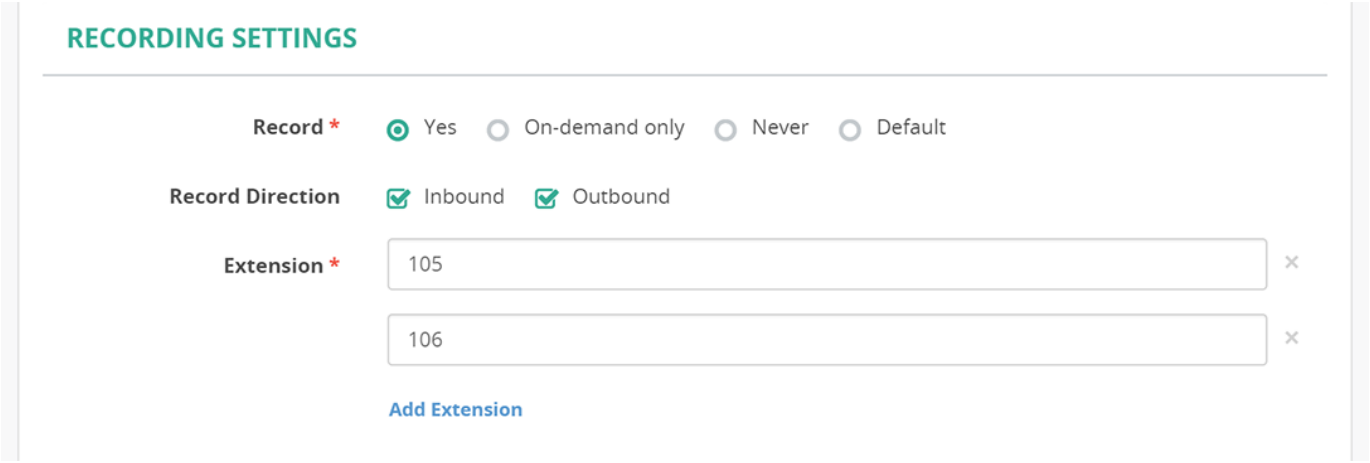
4.4.4 Managed groups

If the user's role has access level "Group Manager", then you can configure which groups are managed by this user. The group manager has access only to users and their calls recordings, which belong to his managed groups. You may select one or more managed groups from a list.



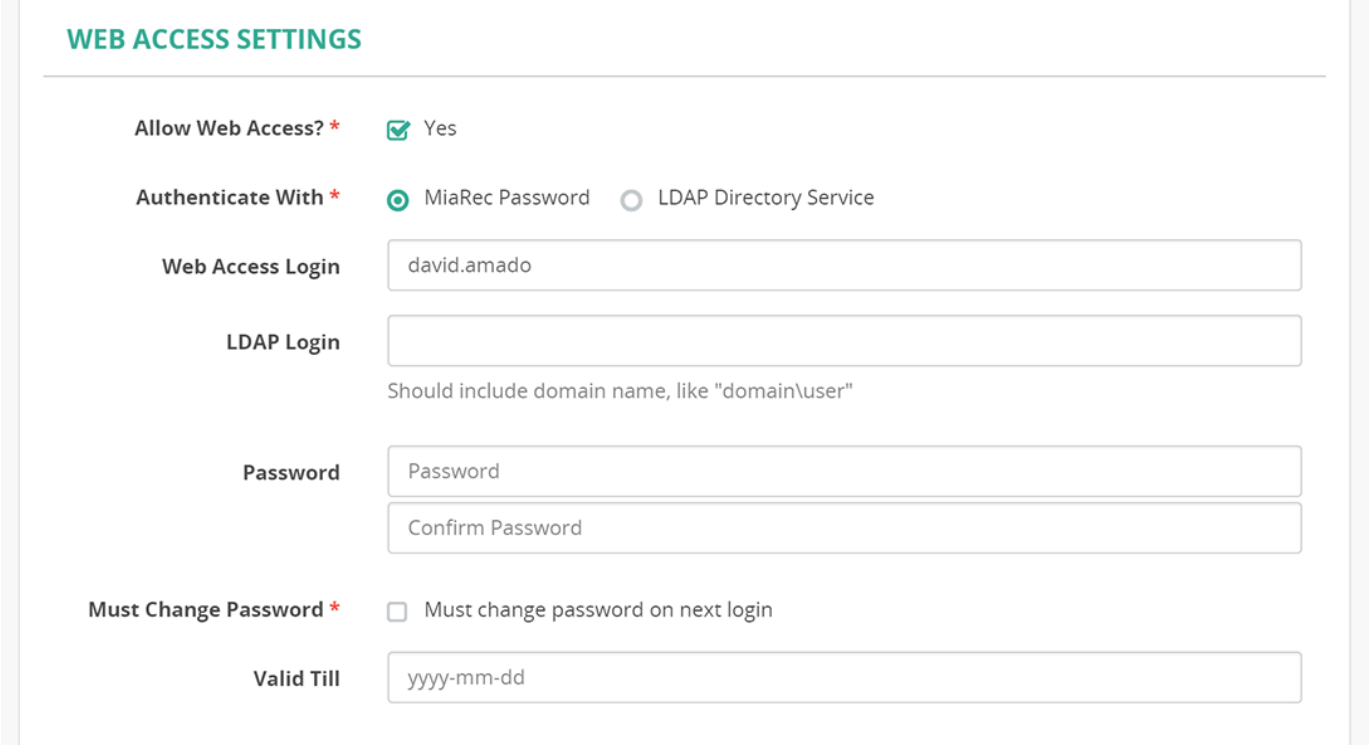
4.4.5 Recording settings

If it is necessary to record such user, then you need to specify which extensions are assigned to this user. MiaRec uses the extensions configuration to automatically associate call recordings with users. One user may have more than one extension.



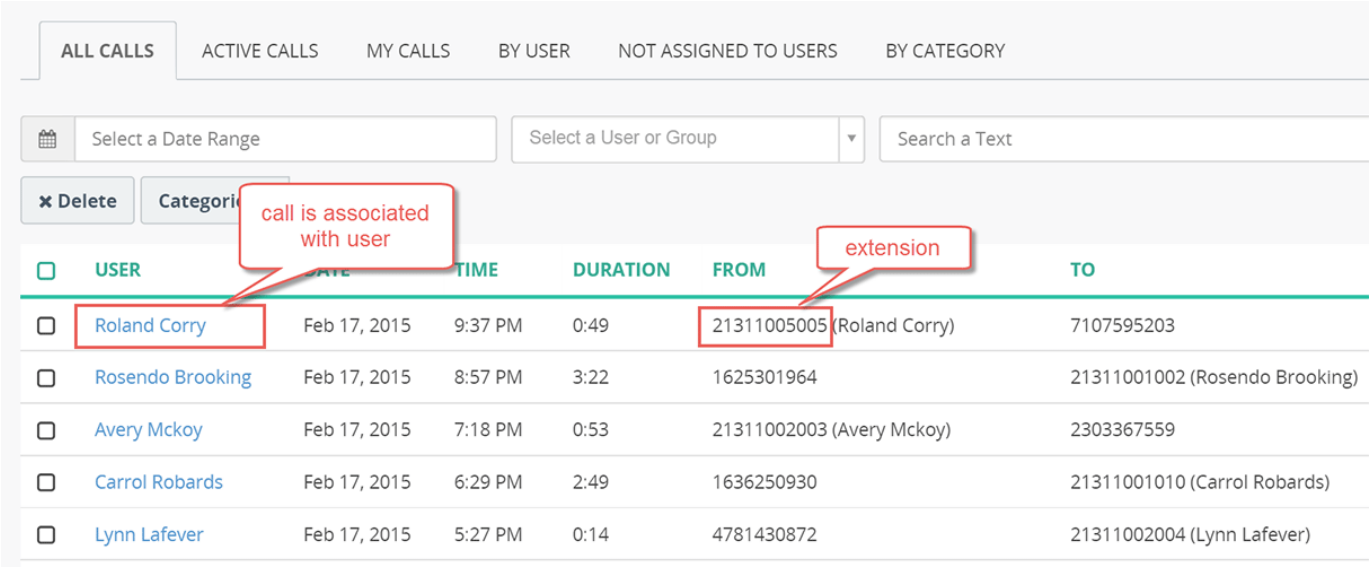
4.4.6 Web access settings

If the user needs access to MiaRec web portal, then administrator may create login for him/her.



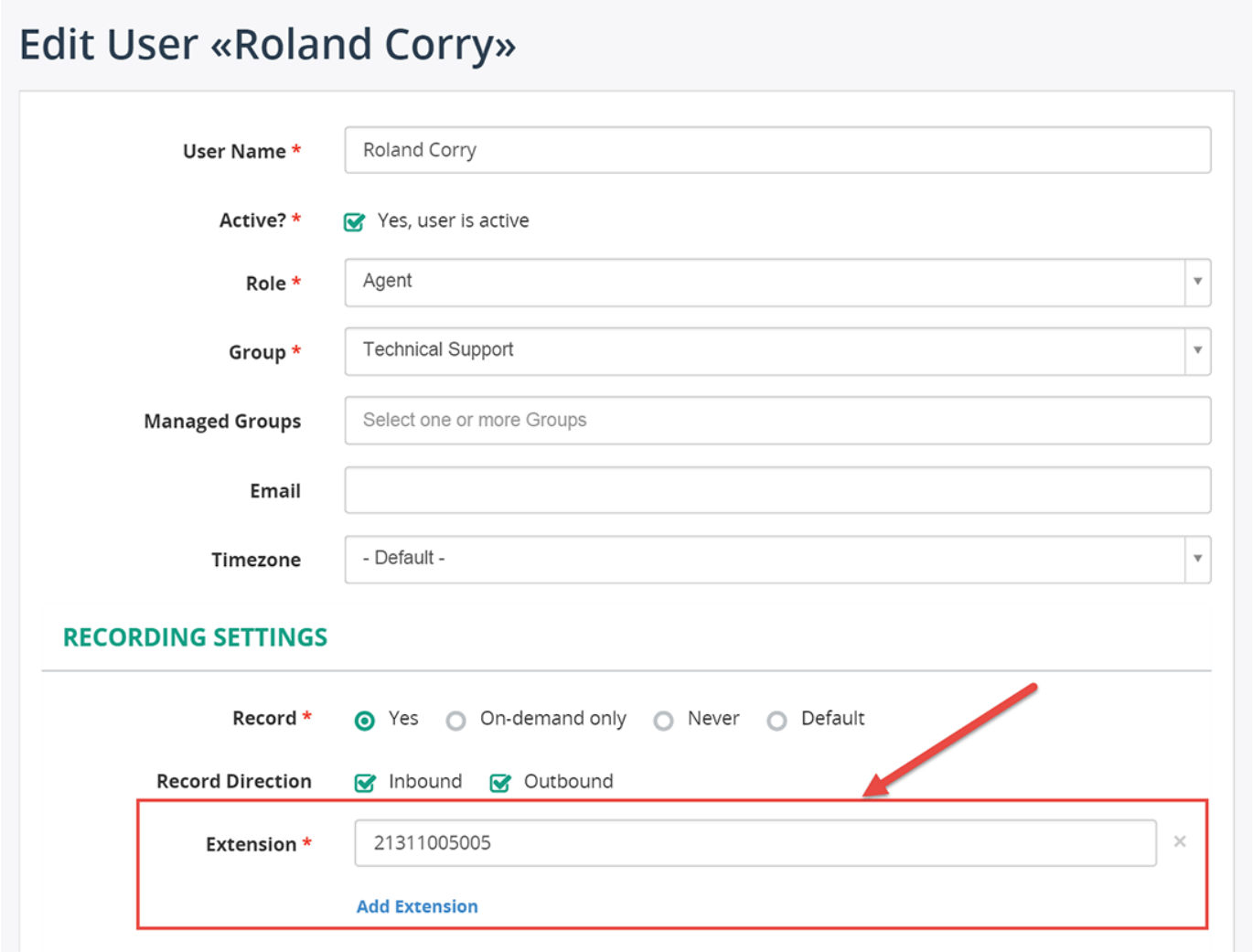
4.5 Associating calls with users

MiaRec automatically associates calls to users based on user's extension.



Administrator should configure extension on user's profile page. In below screenshot user "Roland Corry" is configured with extension "21311005005". When MiaRec recognizes a call with extension "21311005005", then such call is automatically associated with user "Roland Corry".

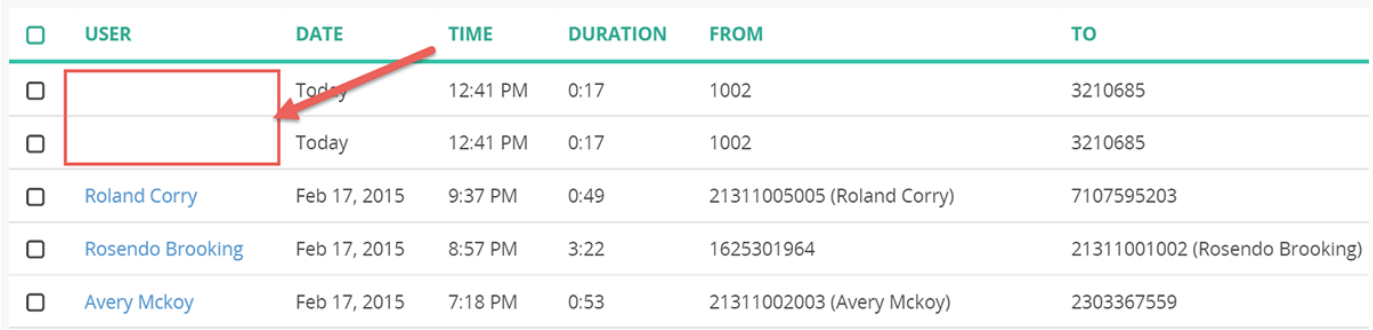
Such call association allows quick filtering of calls by user name. Also, this information is used when granting access to recordings. For example, supervisor will be able to view only call recordings, which are associated with users in his/her group.



4.5.1 What happens when MiaRec records call with unknown extension?

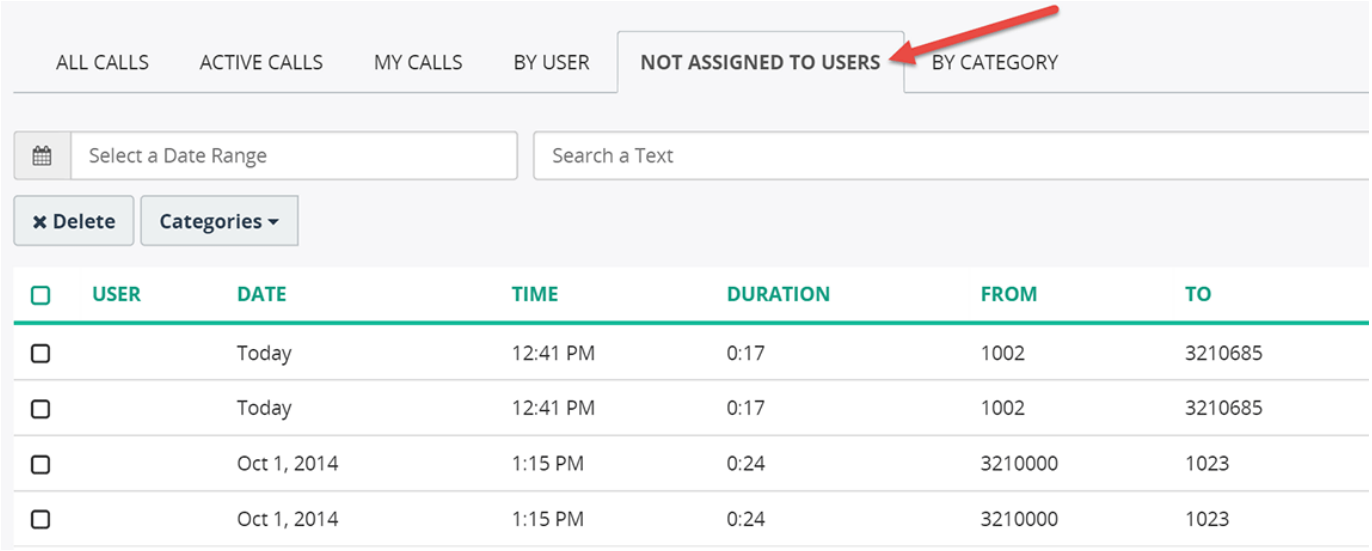
If MiaRec doesn't recognize extension for newly recorded call, then a default recording rule applies for the call. By default, MiaRec is configured to record such unknown calls, but this behavior may be changed by administrator (see section [Filters::OnCallStart] inside configuration file MiaRec.ini).

When call with unknown extension is recorded, then the column "User" will be empty (as shown in below screenshot).

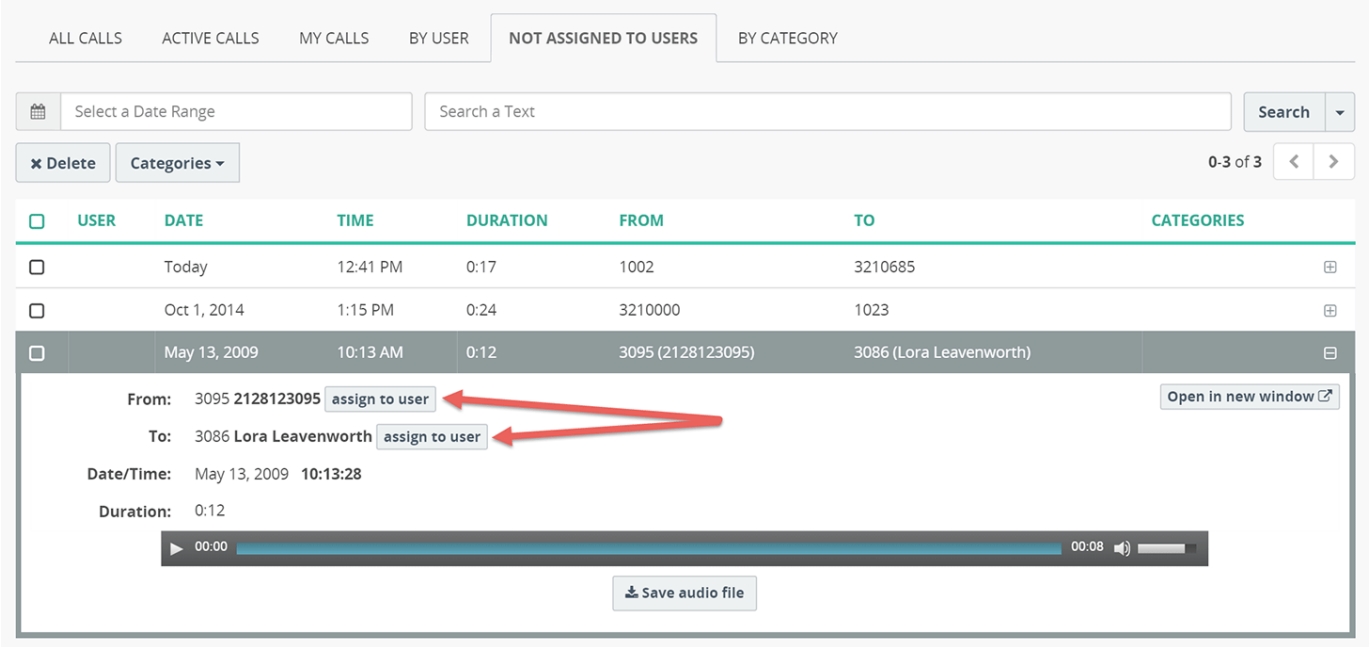


USER	DATE	TIME	DURATION	FROM	TO
	Today	12:41 PM	0:17	1002	3210685
	Today	12:41 PM	0:17	1002	3210685
Roland Corry	Feb 17, 2015	9:37 PM	0:49	21311005005 (Roland Corry)	7107595203
Rosendo Brooking	Feb 17, 2015	8:57 PM	3:22	1625301964	21311001002 (Rosendo Brooking)
Avery Mckoy	Feb 17, 2015	7:18 PM	0:53	21311002003 (Avery Mckoy)	2303367559

Also, these calls are shown in panel "Not assigned to users" (visible only to administrators).



Administrator can manually assign the call to one of existing users. First, he needs to click on a call to display call details. Then he needs to click on button "Assign to user".



New page will be opened with the following options:

Extension

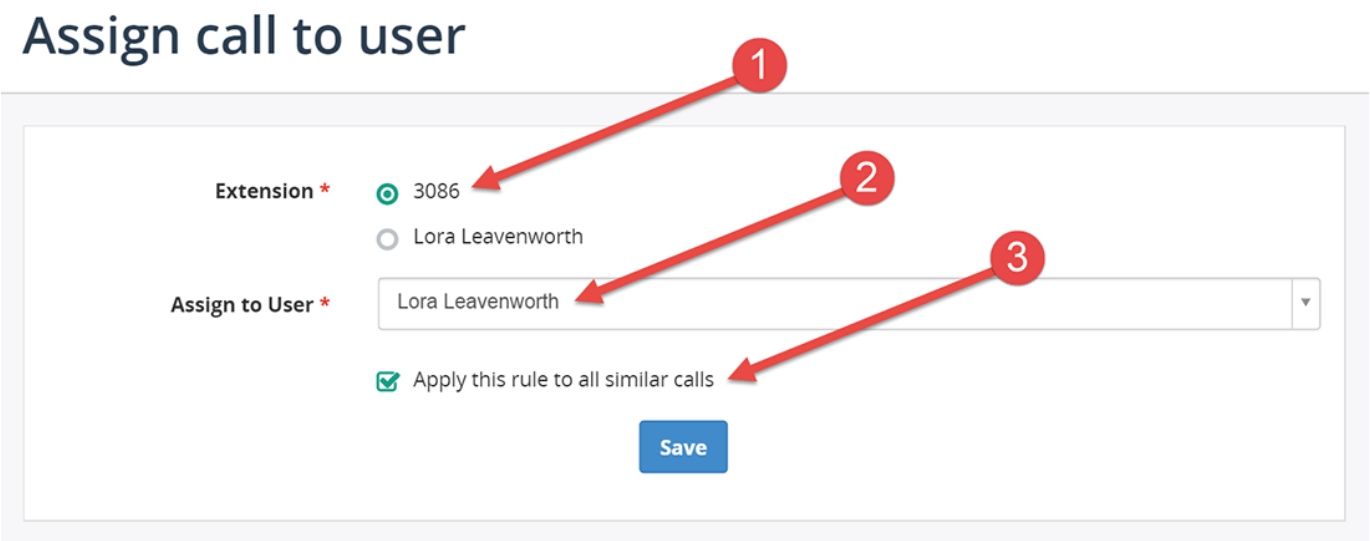
Administrator should decide whether to use phone number or optional phone name to associate calls to users.

Assign to User

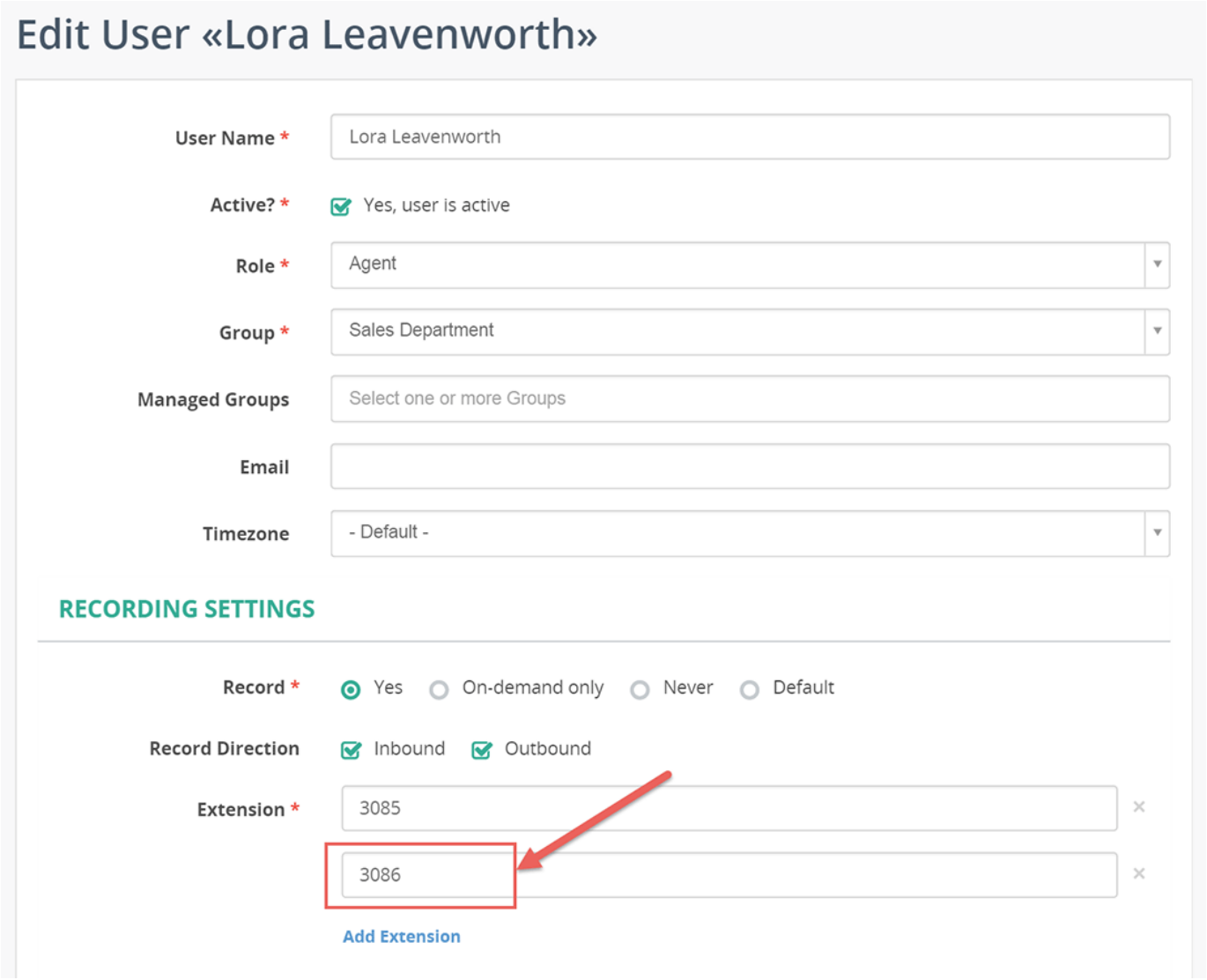
The user to associate this call with.

Apply this rule to all similar calls

When checked, then other calls with the same extension will be automatically assigned to this user. Note, MiaRec will search only calls, which are not assigned yet to any of users.



Upon clicking the on "Save" button the recorded calls will be searched and automatically assigned to the selected user. Additionally, the selected extension will be automatically added to user (as shown in below screenshot).



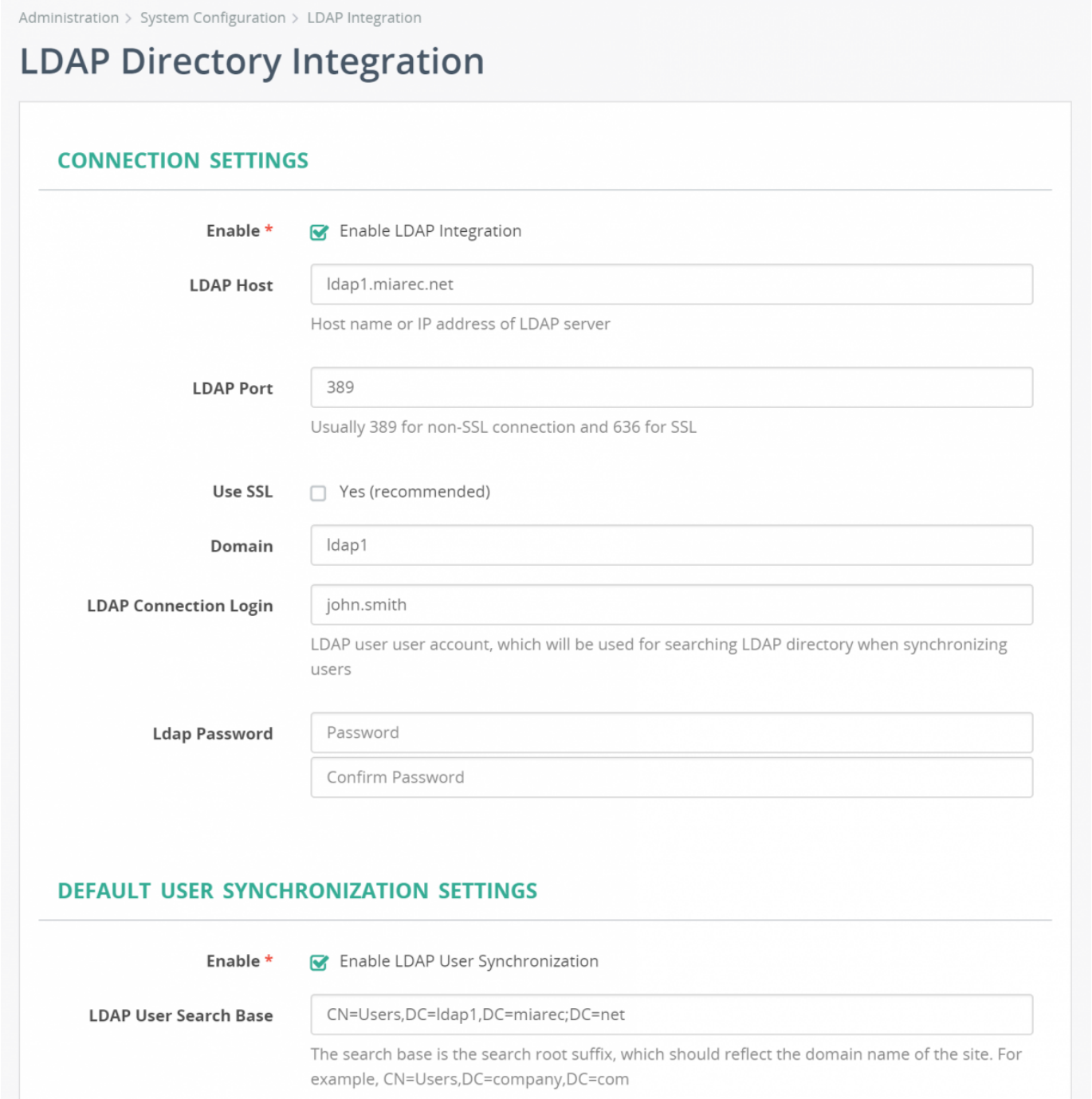
4.6 Configuring LDAP integration

MiaRec supports LDAP (Active Directory) integration to accomplish two tasks:

- LDAP authentication
- LDAP user synchronization

4.6.1 LDAP authentication

Navigate to **Administration -> System Configuration -> LDAP Integration** to configure LDAP autentication.



How it works

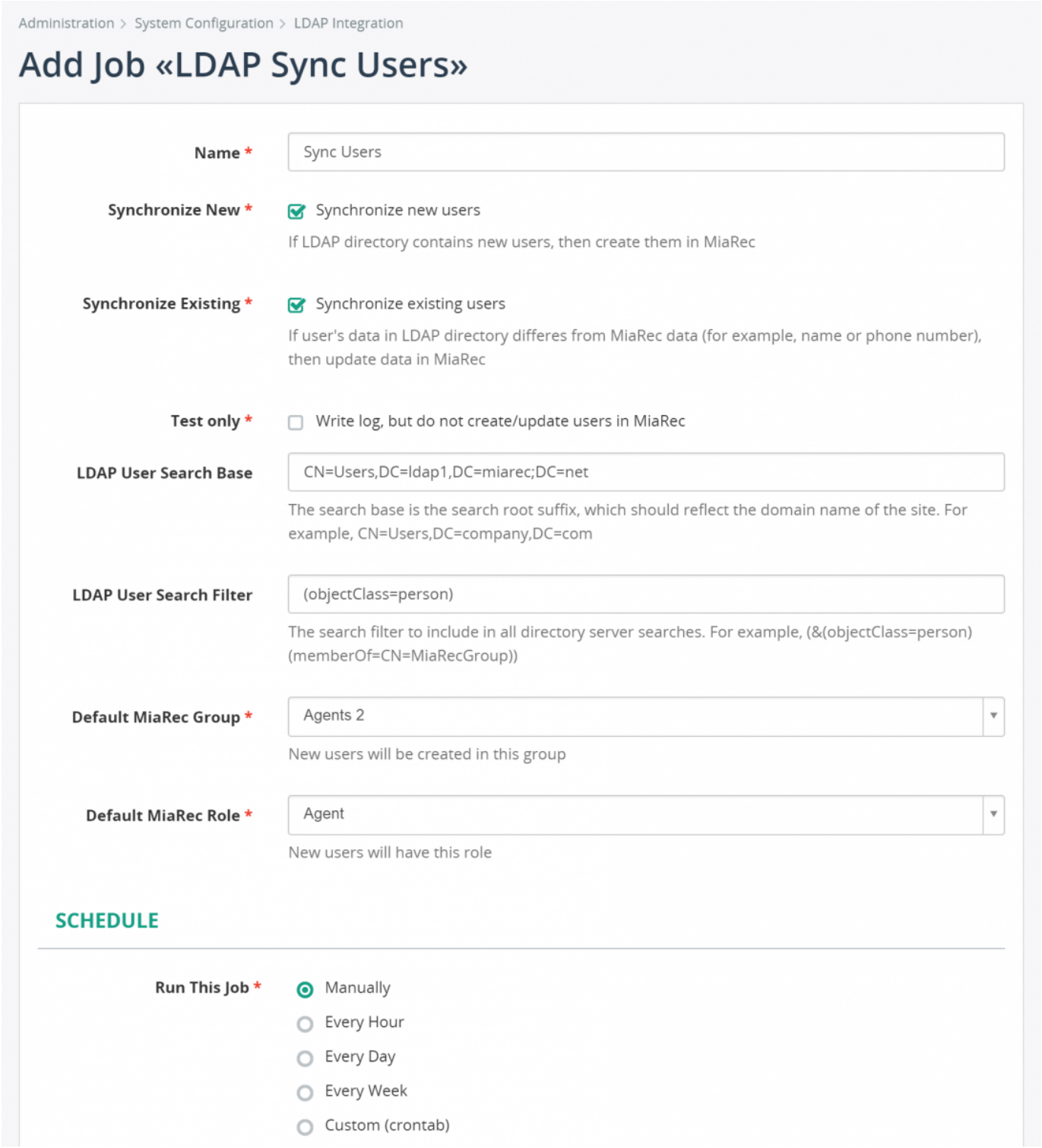
When user tries to login to MiaRec web portal, his/her login and password is verified on LDAP server. If login and password are accepted by LDAP server, then user is allowed to login to MiaRec web portal.

Such feature allows to manage users' passwords in one location only (on your LDAP server). MiaRec doesn't store user's passwords in own database in this scenario. If user's password is changed in LDAP server, then MiaRec will automatically accept such new password during login phase. Also, when user account is removed/deactivated in LDAP server, then such user will not be able to login to MiaRec web-portal too.

Please, note, MiaRec doesn't accept automatically login from any LDAP user in your system. It is required that user account has been previously created in MiaRec and appropriate access permissions have been granted to user. On user's profile page administrator may specify whether user's password should be stored locally (in encrypted one-way hash form) or LDAP authentication is enabled for such user.

4.6.2 LDAP user synchronization

When LDAP user synchronization is enabled, then MiaRec will automatically scan LDAP directory for new user accounts and create MiaRec users.



How it works

First you need to create LDAP user synchronization job. This job may be started manually or by schedule (for example, every night).

If MiaRec detects new user account in LDAP server, then during synchronization the same account will be created in MiaRec. This newly created user will be added into pre-configured default user group and a default role will be assigned to user.

If LDAP database contains phone number for users, then such phone number will be automatically added as an extension to user.

When phone number is updated in LDAP server, then during synchronization such change will be applied to MiaRec user record also. For, example, when phone number in LDAP server is moved from one user to another, then MiaRec will move corresponding extension to new user too.

When phone number is removed from LDAP user account, but the same phone number is not assigned to any other users, then MiaRec will do nothing during synchronization. The extension will not be removed from user account. This is by design. It allows you to add extensions to MiaRec users manually on his/her profile page, and such manually created extensions will not be removed during synchronization if your LDAP server is missing phone number info.

4.7 Multi-tenancy

4.7.1 Understanding multi-tenancy

MiaRec supports a multi-tenant configuration. Multi-tenancy involve an architecture where a single package application can serve multiple customers. Each and every client or company that is created under such multi tenant architecture is referred to as a tenant. A multi-tenant software enables users to setup separate tenant partitions where one tenant cannot have access to the configurations or data of other tenants.

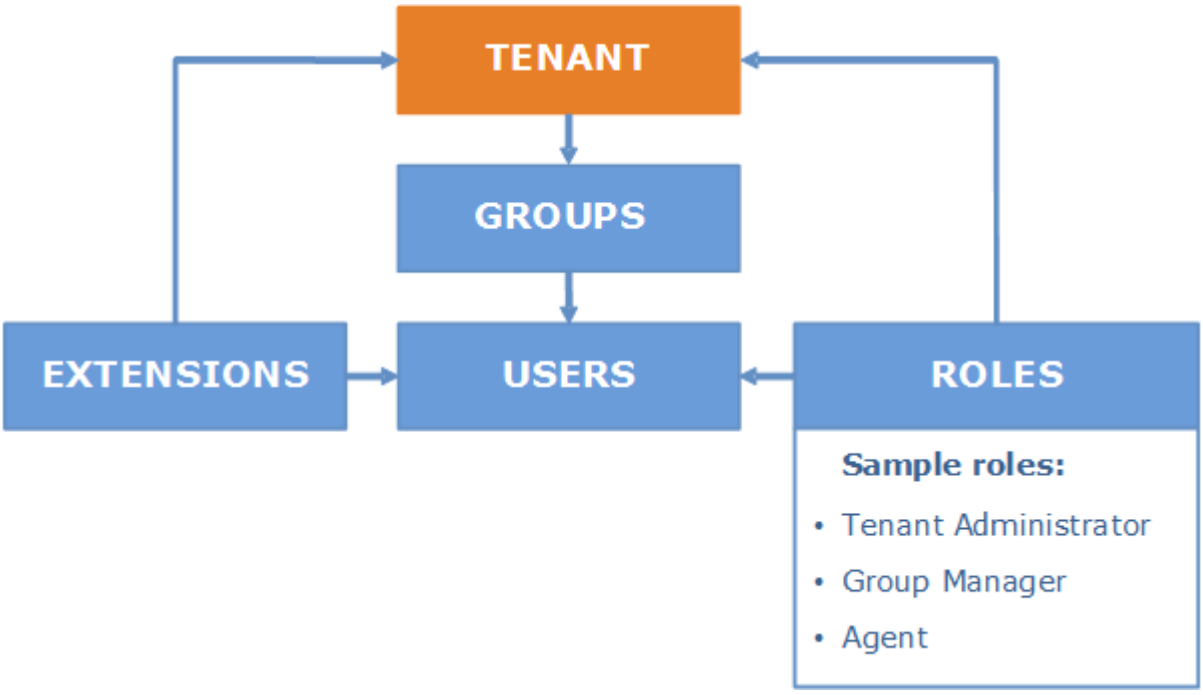
Who should use a multi-tenant configuration?

Multi-tenancy is the best suited for service provides and/or BPO contact centers, who record calls on behalf of other business organizations.

How it works

Each and every tenant has own set of users, groups, roles, and extensions. Tenant users have access to data only within boundaries of own tenant account. Tenant's data is isolated from each other.

MiaRec provides self-service capability to tenants. For example, tenant administrator may reset own users' passwords, modify role permissions, move existing user into another group, etc.



Frequently asked questions

1. **How call recordings are associated with tenant?**

   Each tenant has a pre-configured set of extensions. MiaRec uses this data to automatically associate calls to users. 2. **Can tenant administrator change own extensions?**

   No. The extensions are configured by system administrator. The tenant administrator may only re-allocate available extension from one user to another. 3. **Is it required to give tenants an access to admin interface?**

   No, it is not required. It's possible to create tenant users with read-only access to MiaRec web-portal and skip creation of tenant administrator role.

4.7.2 Enable multi-tenancy in MiaRec

In MiaRec web portal navigate to **Administration -> System Configuration -> Advanced Settings**. Click on **Edit settings** and change Multitenancy settings from **disabled** to **enabled**.

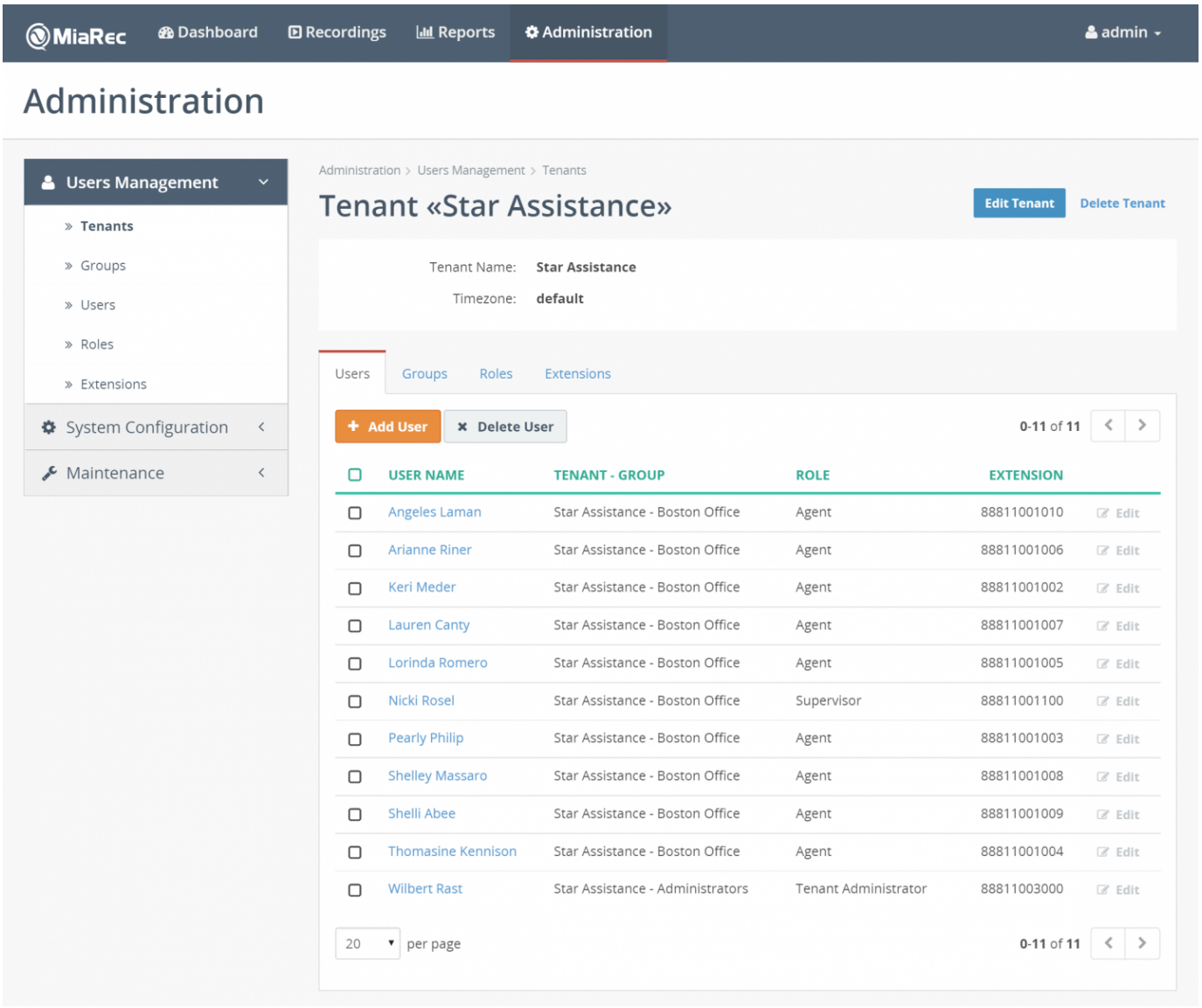
Now you should be able to see **Tenants** configuration inside administration interface.

4.7.3 Add tenant

To create a new tenant account navigate to **Administration -> Users Management -> Tenants** and complete the following steps:

1. Create new tenant account
2. Create at least one group. For example, "Users".
3. Create at least one role with appropriate permissions. For example, "Agent role". Optionally, you may create tenant admin account who will be able to manage own tenant users (reset users passwords, edit role permissions, create new groups, etc).
4. Create users and assign extensions to them.

Extension in MiaRec is a "phone number", "phone name" and/or "broadworks user ID". If you are using Broadworks platform, then it is recommended to enter your users' broadworks ID's as extensions. For other platforms it is recommended to use users phone number as an extension. Using of phone name is recommended in cases when multiple users share the same extension and only the phone name part is unique.



5. Storage Management

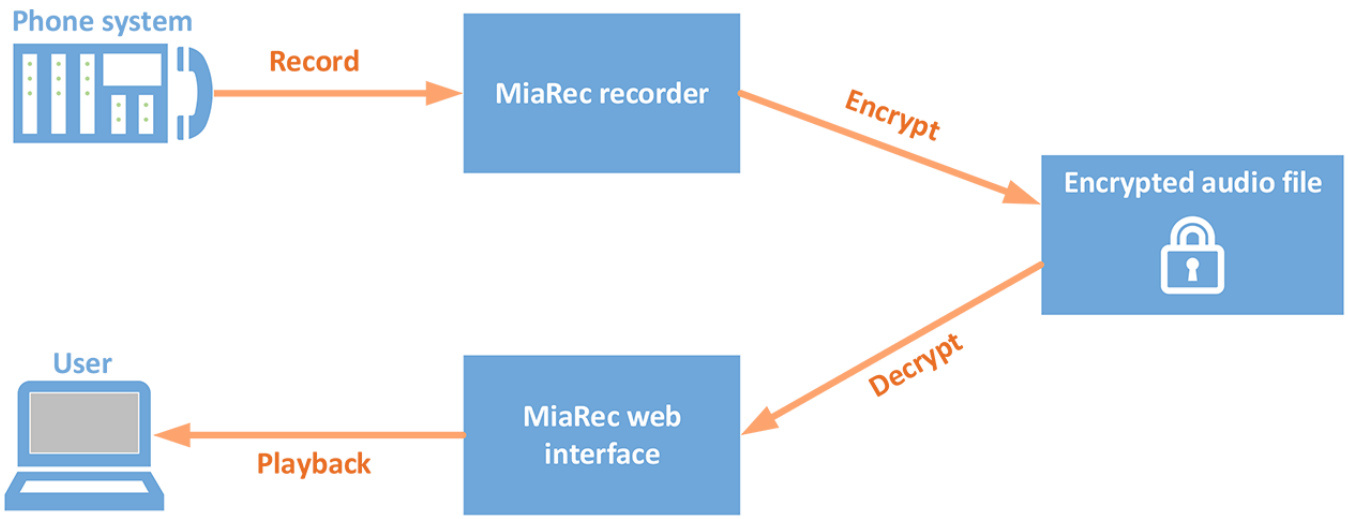
5.1 Audio file encryption

5.1.1 File encryption overview

MiaRec provides rock-solid audio encryption functionality, ensuring all call recordings are securely stored. MiaRec encryption functionality helps companies confidently adhere to the highest corporate security standards and comply with legal regulations such as PCI-DSS, HIPAA, Dodd-Frank, and Sarbanes-Oxley.

Some key features of MiaRec audio file encryption:

- Asymmetric encryption, where a public key is used for encrypting and a private key is used for decrypting
- Administrator has control over who can play back (decrypt) the recordings
- In a multi-tenant mode, each tenant has it's own unique encryption key
- Encryption is applied to backup data, as well



Audio file encryption vs role-based access control

MiaRec role-based access control system provides protection of data from unauthorized access to the MiaRec web-portal. Everyone accessing the system must be an authenticated user with associated set of permissions.

Audio file encryption provides an additional layer of security over the role-based access control system in MiaRec. If encryption is enabled, then audio files are stored on a hard disk in encrypted format. This insures that even if unauthorized user gains physical access to the storage system, he/she has no ability to play back recordings because he/she doesn't have the private encryption key.

Download of encrypted recordings

When a user downloads individual call recordings through MiaRec web-portal, the file is decrypted in flight. The file is saved on the user's computer in unencrypted form.

However, when a user uses the bulk download feature and downloads multiple call recordings in ZIP archive, then the downloaded files are retrieved in encrypted form. The user cannot play back such call recordings unless he/she imports them into the MiaRec system together with private encryption key.

Encryption for backups

Use of file encryption is beneficial for backup data, as well. All recordings in backup archive can be encrypted.

Encryption in multi-tenant environment

In multi-tenant mode, each tenant has it's own encryption key. Even if an audio file from one tenant becomes available to another tenant, the latter could not play back, because the file is encrypted with a different key.

Additionally, in a multi-tenant hosted environment, MiaRec supports the following usage scenario: Tenant may provide the service provider with the public encryption key only. The tenant doesn't is not required to disclose their own private key to the service provider. This means that nobody on the service provider side - even system administrators - would be able to play back tenants' call recordings. To play back such call recordings, they should be uploaded to tenant's private network and imported into a local instance of MiaRec software.

Encryption algorithms

MiaRec encrypts every call recording with asymmetric encryption. For every recording, MiaRec generates a random AES encryption key. This symmetric encryption key is then encrypted using asymmetric encryption (one key for encryption - often referred to as the "public" key - and a different key for decryption - often referred to as the "private" key).

MiaRec uses Advanced Encryption Standard (AES) for symmetric encryption (256-bit key) and the Rivest-Shamir-Adleman (RSA) public key algorithm for asymmetric encryption (2,048-bit keys).

The details and theory behind the asymmetric encryption method is beyond the scope of this article. However, a good primer is available at https://en.wikipedia.org/wiki/Public-key_cryptography. In short, a public key is used for encrypting data and private key is used for decrypting it. The public key doesn't need to be stored securely. Anyone can access the public key, but no one can use the public key to decrypt the data that the public key encrypted. The only way users can decrypt data is with the private key.

User access to encryption keys

Administrators need to grant particular users access to encryption key(s) before they can play back (decrypt) audio files. Note, the administrator may grant access only to those encryption keys which are granted to him/her. If administrator (even if he/she has role "Root administrator") has no access to the encryption key, then he/she cannot grant access to other users for the same key.

MiaRec software never stores encryption keys in the database in plain text for security reasons. Even if an unauthorized party gains access to database files, he/she could not retrieve the private keys because they are stored in encrypted format. There is no way to gain user's private key without knowing the user's password.

5.1.2 Configuration check-list

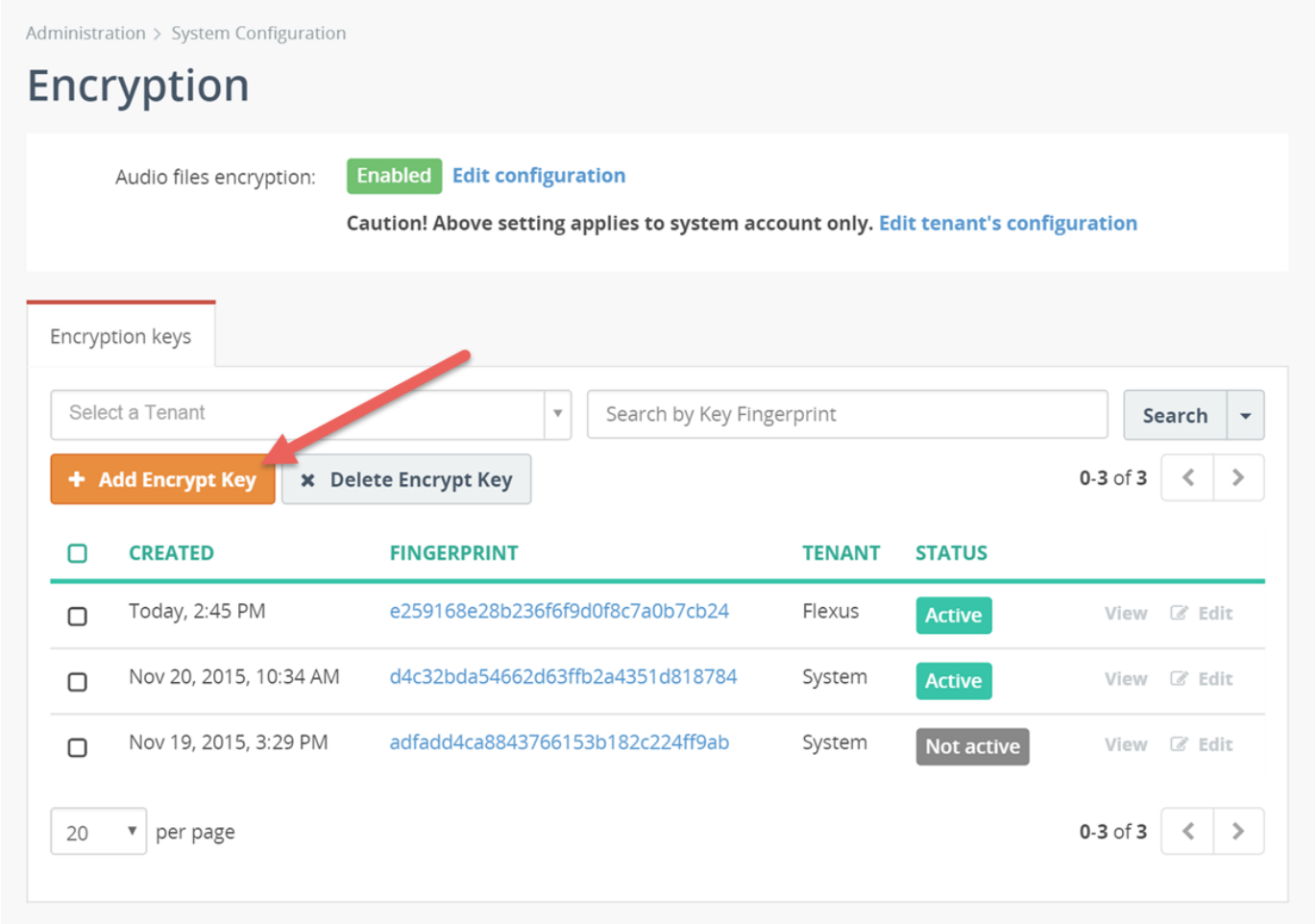
Configure MiaRec audio file encryption as follows:

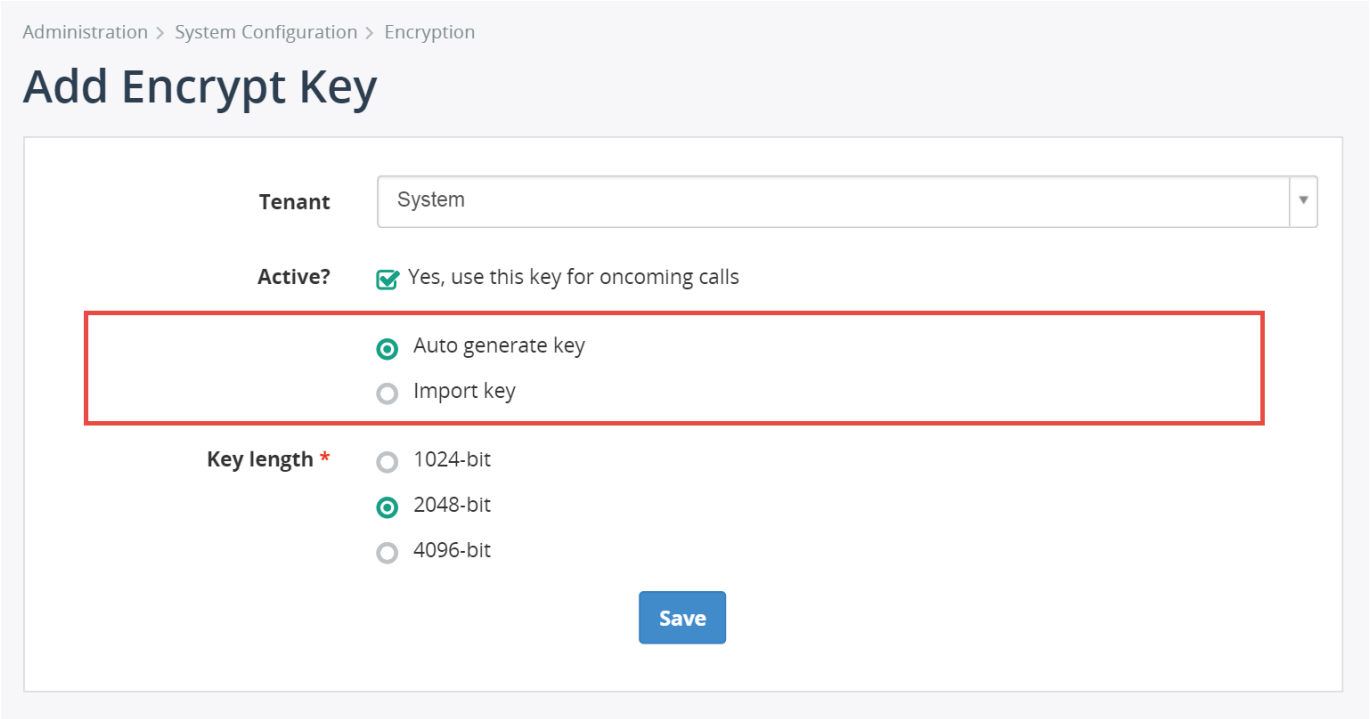
1. Create new encryption key or use existing one for System or Tenant (in multi-tenant mode)
2. Export/backup new encryption key and save it in secure place for recovery purposes
3. Grant access to encryption key to authorized users
4. Enable audio file encryption on System or Tenant profile.

5.1.3 Create new encryption key

Navigate to **Administration -> Storage -> File Encryption** to create new encryption key.

Note, in multi-tenant version, you need to create key for "System" account first. Then you can create tenant encryption key. On System account, you do not need to enable "Audio file encryption" unless you record calls into System tenant (which is not recommended).

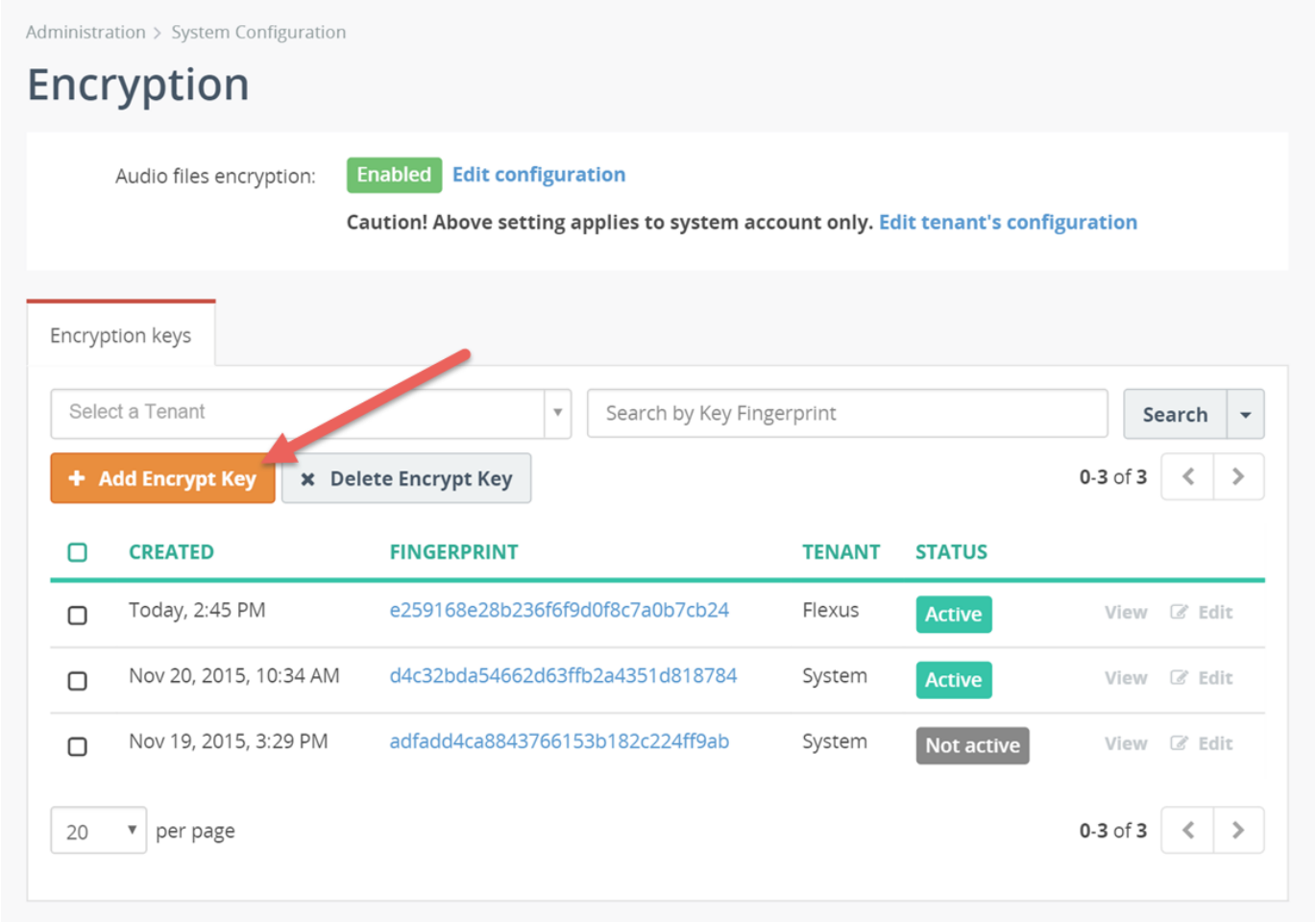


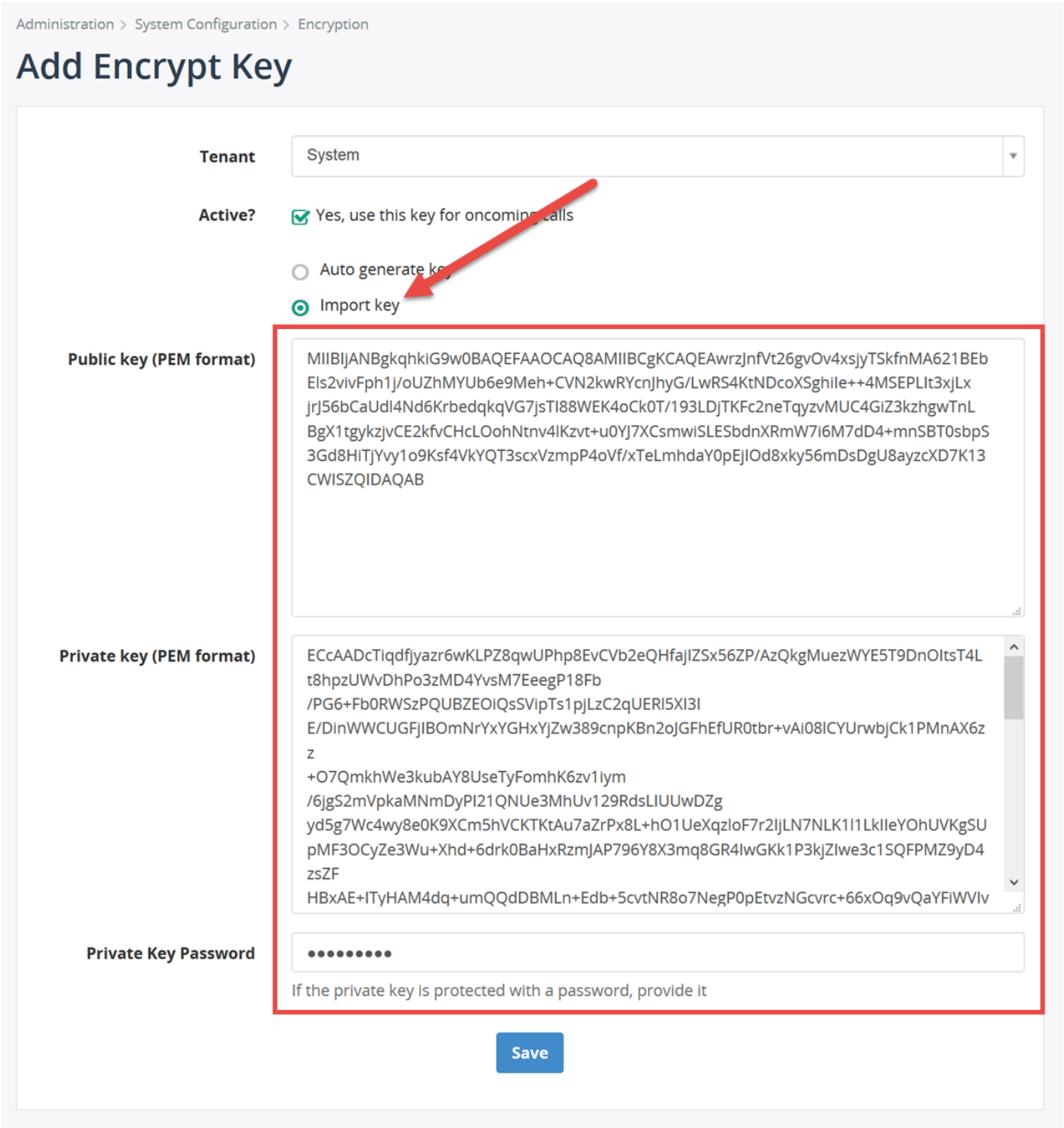

Administration > System Configuration > Encryption
Add Encrypt Key
Tenant
System
Active?
Yes, use this key for oncoming calls
Auto generate key
Import key
Key length *
1024-bit
2048-bit
4096-bit
Save

5.1.4 Import encryption key

Encryption key can be imported from the existing key rather than generated from scratch.

Navigate to **Administration -> Storage -> File Encryption** to import the existing encryption key.

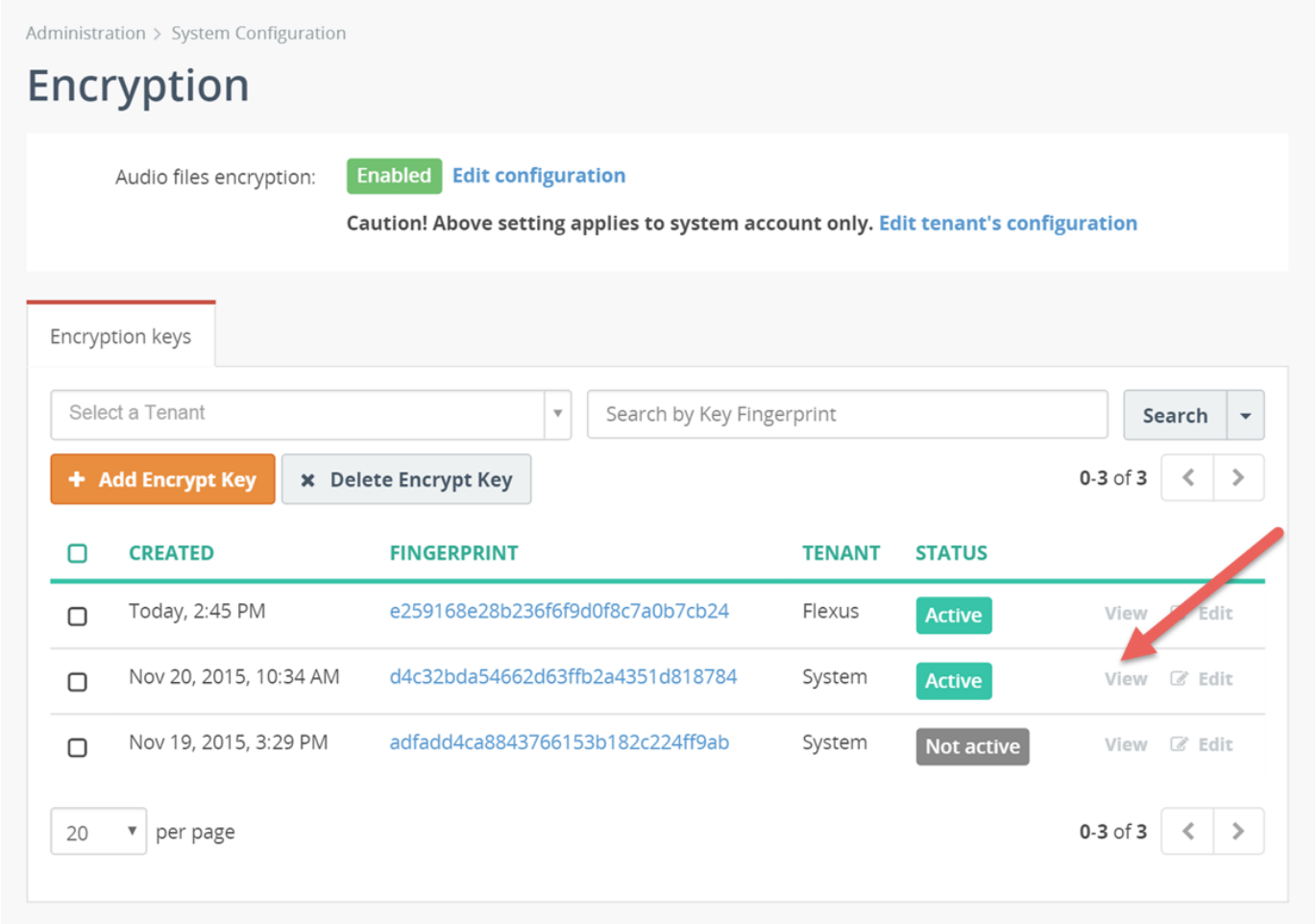


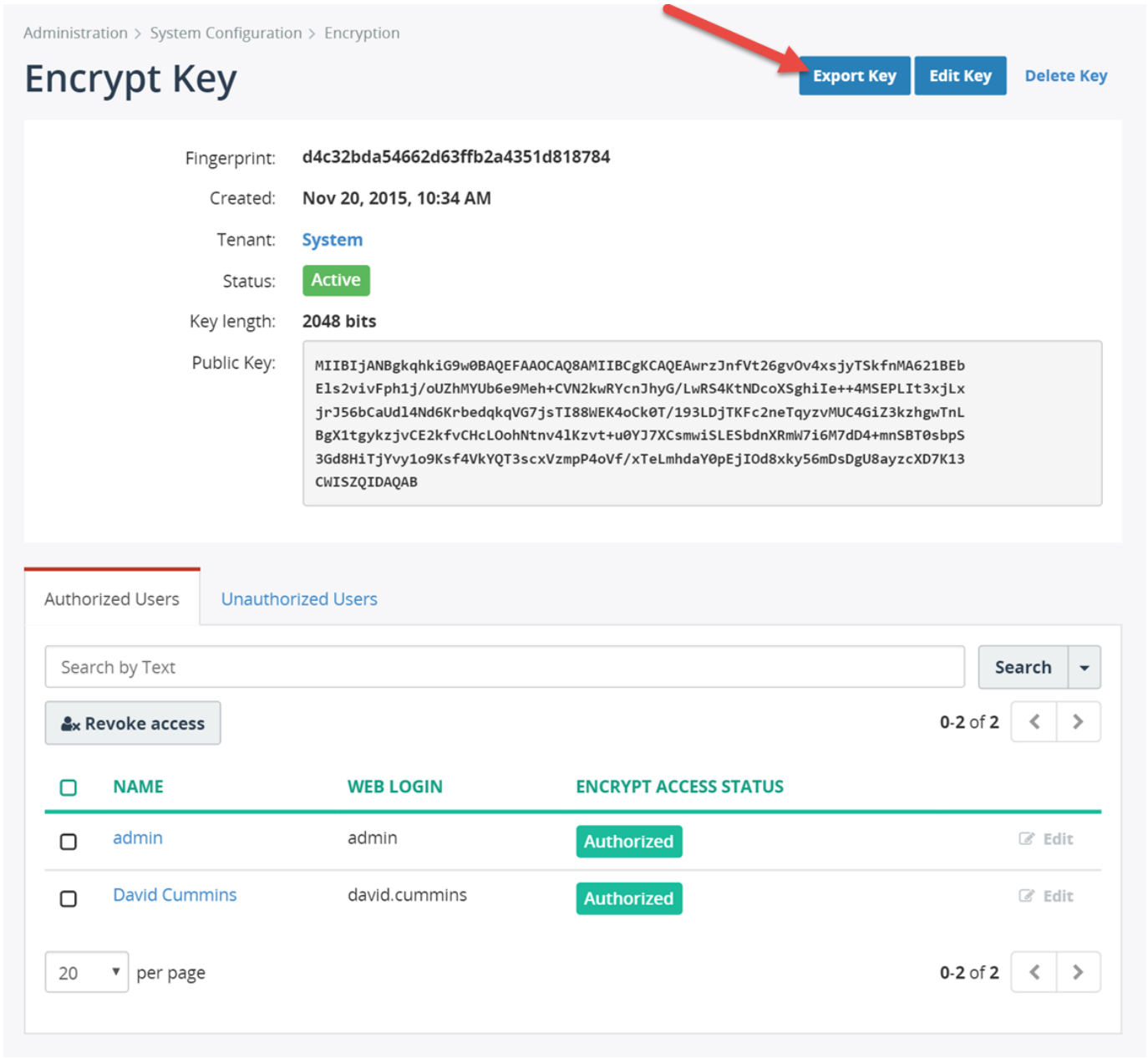

Administration > System Configuration > Encryption
Add Encrypt Key
Tenant
System
Active?
Yes, use this key for oncoming calls
Auto generate key
Import key
Public key (PEM format)
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAwrzJnfVt26gvOv4xsjyTSkfnMA621BEb
Els2vivFph1j/oUZhMYUb6e9Meh+CVN2kwRYcnJhyG/LwRS4KtNDcoXSghiIe++4MSEPLIt3xjLx
jrJ56bCaUdl4Nd6KrbedqkqVG7jsTI88WEK4oCk0T/193LDjTKFc2neTqyzvMUC4GiZ3kzhgwTnL
BgX1tgykzjvCE2kfvCHcLOohNtnv4lKzvt+u0YJ7XCsmwiSLESbdnXRmW7i6M7dD4+mnSBT0sbpS
3Gd8HiTjYvy1o9Ksf4VkYQT3scxVzmpP4oVf/xTeLmhdaY0pEJIOd8xky56mDsDgU8ayzcXD7K13
CWISZQIDAQAB
Private key (PEM format)
ECcAADcTiqdfjyazr6wKLPZ8qwUPhp8EvCVb2eQHfajIZSx56ZP/AzQkgMuezWYE5T9DnOItsT4L
t8hpzUWvDhPo3zMD4YvsM7EeegP18Fb
/PG6+Fb0RWSzPQUBZEOiQsSVipTs1pjLzC2qUERl5XI3I
E/DinWWCUGFjIBOmNrYxYGHxYjZw389cnpKBn2oJGFhEfUR0tbr+vAi08lCYUrwbjCk1PMnAX6z
z
+O7QmkhWe3kubAY8UseTyFomhK6zv1iym
/6jgS2mVpkaMNmDyPI21QNUe3MhUv129RdsLIUUwDZg
yd5g7Wc4wy8e0K9XCm5hVCKTKtAu7aZrPx8L+hO1UeXqzloF7r2IjLN7NLK1I1LkIIeYOhUVKgSU
pMF3OCyZe3Wu+Xhd+6drk0BaHxRzmJAP796Y8X3mq8GR4IwGKk1P3kjZIwe3c1SQFPMZ9yD4
zsZF
HBxAE+ITyHAM4dq+umQQdDBMLn+Edb+5cvtNR8o7NegP0pEtvzNGcvrc+66xOq9vQaYFiWVIv
Private Key Password
If the private key is protected with a password, provide it
Save

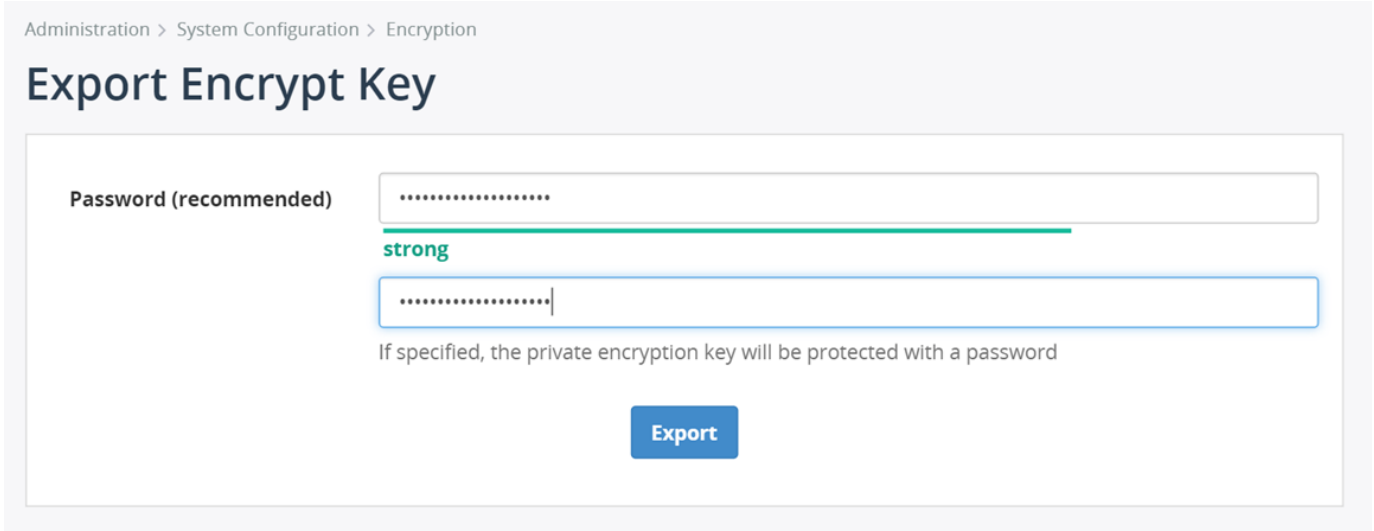
5.1.5 Export encryption key

Navigate to **Administration -> Storage -> File Encryption** to export the existing encryption key.

It is highly recommended to export all existing keys and store them in secure place for backup purposes. You may need such backup copies when all authorized people forgot their passwords or database is destroyed and you need to recover the audio files from archive.




Administration > System Configuration > Encryption
Encrypt Key
Export Key
Edit Key
Delete Key
Fingerprint: d4c32bda54662d63ffb2a4351d818784
Created: Nov 20, 2015, 10:34 AM
Tenant: System
Status: Active
Key length: 2048 bits
Public Key:
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAwrzJnfVt26gvOv4xsjyTSkfnMA621BEb
Els2vivFph1j/oUZhMYUb6e9Meh+CVN2kwRYcnJhyG/LwRS4KtNDcoXSghiIe++4MSEPLIt3xjLx
jrJ56bCaUdl4Nd6KrbedqkqVG7jsTI88WEK4oCk0T/193LDjTKFc2neTqyzvMUC4GiZ3kzhgwTnL
BgX1tgykzjvCE2kfvCHcLOohNtnv4lKzvt+u0YJ7XCsmwiSLESbdnXRmW7i6M7dD4+mnSBT0sbpS
3Gd8HiTjYvy1o9Ksf4VkYQT3scxVzmpP4oVf/xTeLmhdaY0pEjIOd8xky56mDsDgU8ayzcXD7K13
CWISZQIDAQAB
Authorized Users
Unauthorized Users
Search by Text
Search
Revoke access
0-2 of 2
NAME
WEB LOGIN
ENCRYPT ACCESS STATUS
admin
admin
Authorized
Edit
David Cummins
david.cummins
Authorized
Edit
20
per page
0-2 of 2


Administration > System Configuration > Encryption
Export Encrypt Key
Password (recommended)
strong
If specified, the private encryption key will be protected with a password
Export

Administration > System Configuration > Encryption

Export Encrypt Key

Fingerprint: **d4c32bda54662d63ffb2a4351d818784**

Public Key:

```
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAwrzJnfVt26gvOv4xsjyTSkfnMA621BEb
Els2vivFph1j/oUZhMYUb6e9Meh+CVN2kwRYcnJhyG/LwRS4KtNDcoXSghiIe++4MSEPLIt3xjLx
jrJ56bCaUdl4Nd6KrbedqkqVG7jsTI88WEK4oCk0T/193LDjTKFc2neTqyzvMUC4GiZ3kzhgwTnL
BgX1tgykzjvCE2kfvCHcLOohNtnv4lKzvt+u0YJ7XCsmwiSLESbdnXRmW7i6M7dD4+mnSBT0sbpS
3Gd8HiTjYvy1o9Ksf4VkYQT3scxVzmpP4oVf/xTeLmhdaY0pEjIOd8xky56mDsDgU8ayzcXD7K13
CWISZQIDAQAB
```

Private Key:

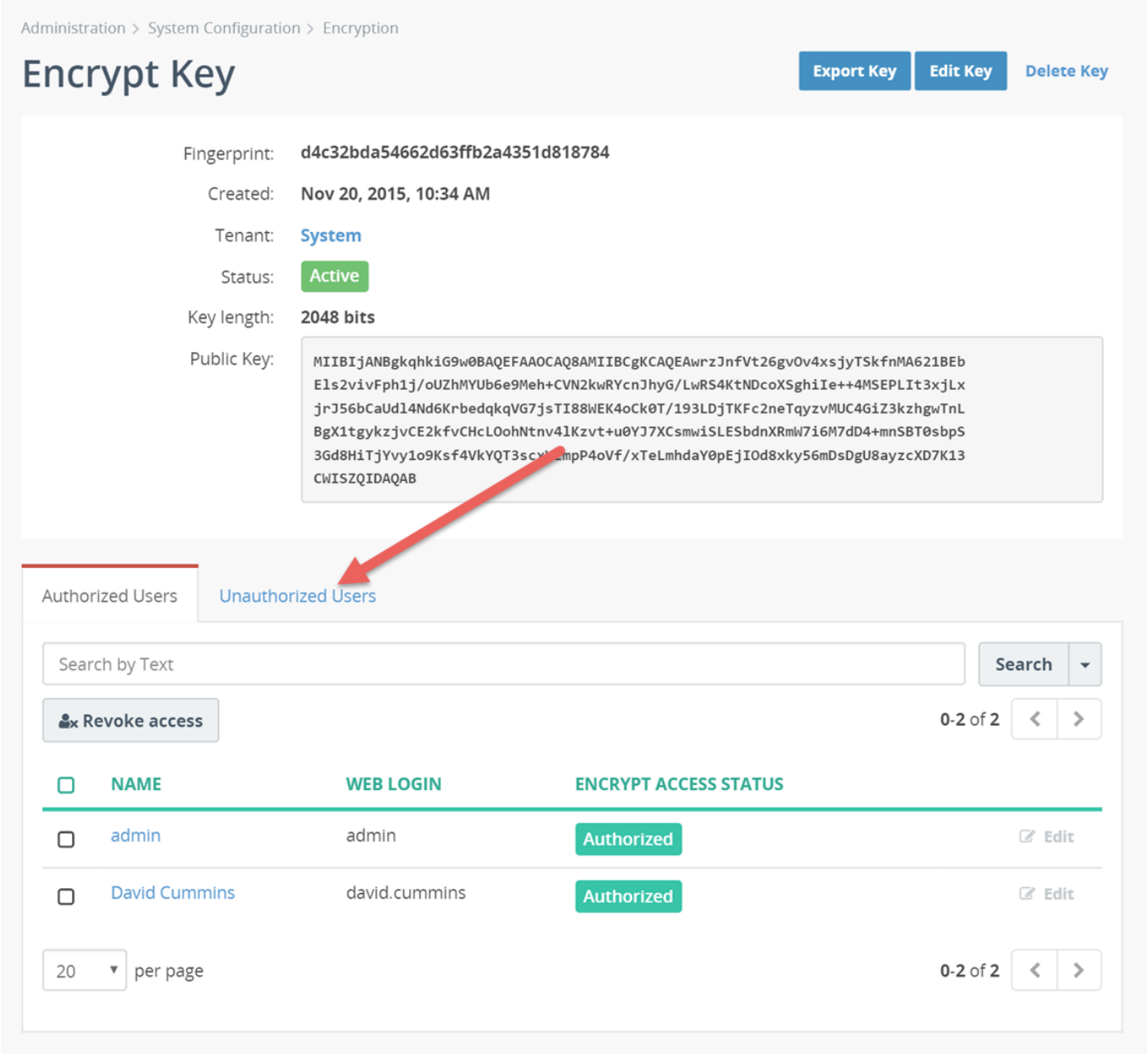
```
ECcAADcTiqdfjyazr6wKLPZ8qwUPhp8EvCVb2eQHfajIZSx56ZP/AzQkgMuezWYE5T9DnOItsT4L
t8hpzUWvDhPo3zMD4YvsM7EeegP18Fb/PG6+Fb0RWSzPQUBZEOiQsSVipTs1pjLzC2qUERl5XI3I
E/DinWWCUGFjIBOmNrYxYGHxYjZw389cnpKBn2oJGFhEfUR0tbr+vAi08lCYUrwbjCk1PMnAX6zz
+O7QmkhWe3kubAY8UseTyFomhK6zv1iym/6jgS2mVpkaMNmDyPI21QNUe3MhUv129RdsLIUUwDZg
yd5g7Wc4wy8e0K9XCm5hVCKTKtAu7aZrPx8L+hO1UeXqzloF7r2IjLN7NLK1l1LkIIeYOhUVKgSU
pMF3OCyZe3Wu+Xhd+6drk0BaHxRzmJAP796Y8X3mq8GR4IwGKk1P3kjZIwe3c1SQFPMZ9yD4zsZF
HBxAE+ITyHAM4dq+umQQdDBMLn+Edb+5cvtNR8o7NegP0pEtvzNGcvrc+66xOq9vQaYFiWVIv6MI
v3O2sikmbYhTsj3nNLJo4nKTibIkJSAlejKExVhgPVcdqVA06/CeKTvsKn637T9jNpLVWLTO83nE
aNdUjJkGO1iP/5wwtUmFt49xTSXL9TaDb178/2PwbiTplt9kKPt7ZB/DmJunxQcCPWZskknczZFS
YfpIsC3RCERlcjUlEoV9ZZebwNmhrJe0pZVkm7a+TipA9oTHwl5VY7R9DaNvRXMZshkW0Qoe+wGZ
z/jHCOeiTSNVOe0XrkMf94JpDASFh8G5qdaBZcO2r3MiBUEO/B8m22HEM2Ih/4OTvCkoI3xgs4qK
DGp9IKy6MdolyR6nNFJzCuGlq6+TeDhcT9ZGkQPsqarqz2JHfz68hl/1vGwQpBQO+cMmzAd5jK7Z
x0ZzZ+taiLnq13M9vXjKMYpFzHi6NWL4cLCqQs/auwsmAOW1msvIBHiiVJvPsqZDLkJrIvkDg4DH
nkJc3NuT+PCnKQrVQnLHsfY7ietNaTZQy3Y1jijftccWzWeFXaKzOteOLjqLfbzn2lYeCdMJ7BAs
P6n+ARbUZsw2r3ZVjyQnSC5+TpYKCWgPpl/djMWJdDM4GELNaBf+xQLBHmSnMFcYseG/+0I3t+q1
NY2TgtvvY7l28wfogonEPs9JwbxcMwaabaAskajL/KBn4uNu+H/BF5iUhgJWC+D66I+5939kiuw0
7RgfbfqIUjtZsdV2+IyWb9ZleLJzjpwXR/gbnvMql6AOYXuX+GzglOHr146Hp/LV31TwmG4uCeNp
RqyBDO+qUPtURWw9z4VdCLtnrlYxvDpWQvwLL6l+Rfezm20Tywh1MCZSkRrh4QbkUF9bl+crKDNj
O6Zs86EOrjPvCLA92ZPsWHqBr4eEcXJ3WgrTqakeVn/B2uMU1RkZ7ZV7ktQNOE+DH85ne+2HYU/j
oje8VIZAS95i50T/K4c6jIHfNII+fEdSblY1By4XrRVdflzrdCaMqtnUfzlB12fYs5M8tzfDUDYn
WsEk1k6dMaI/x8aaziNrNgzKY/1o5XfCeJj0NMVxc0pLYWb45R0AsyCfA6YdZSW5Cz6hTYuQKJI6
ka6eoabKH5Ywoul5Z874+AdIcxxdpyln1UEPjcMDDyAgdRwMvc+iQ3e8
```

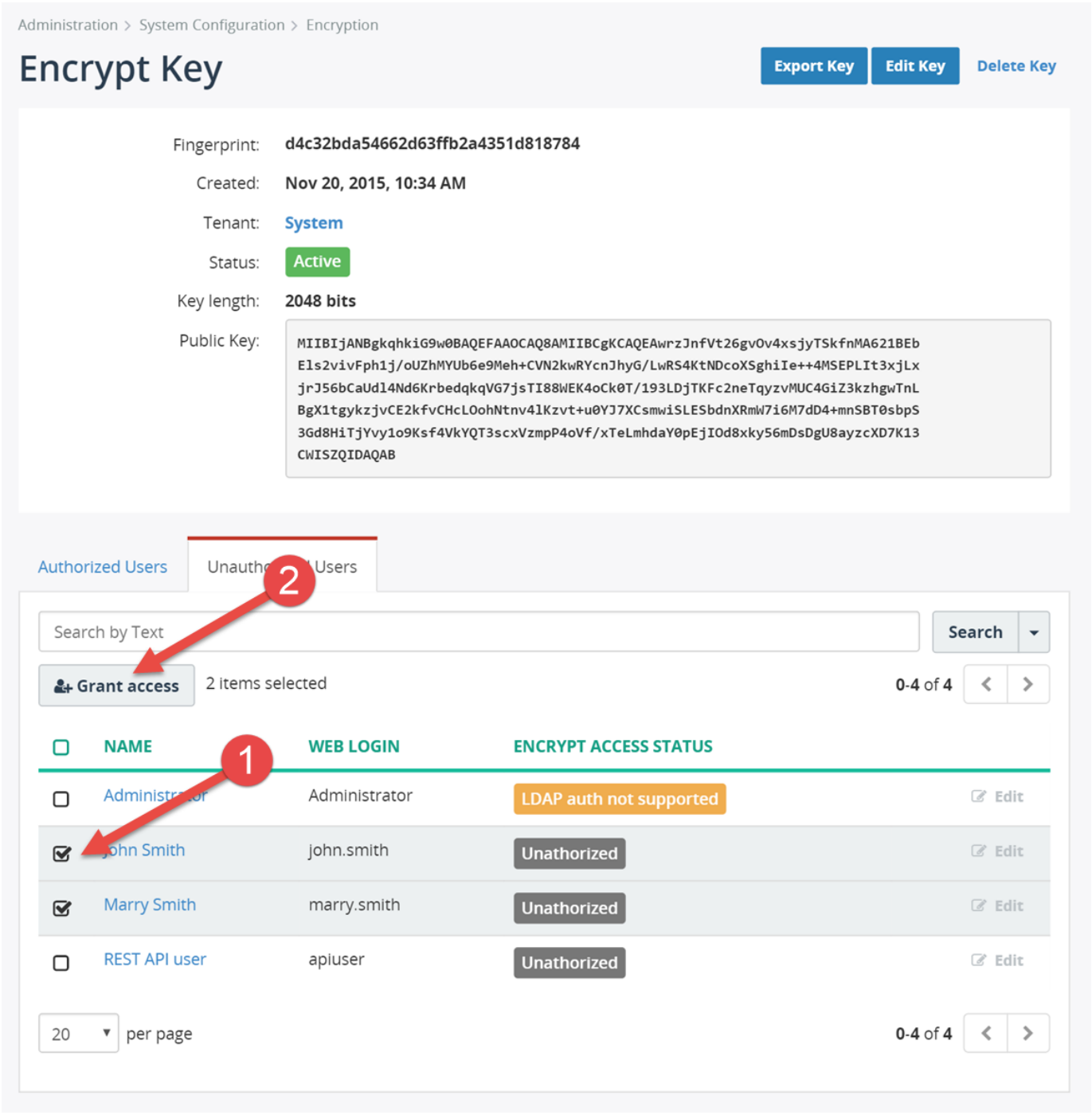
5.1.6 Grant access to encryption key

Navigate to **Administration -> Storage -> File Encryption**, select the appropriate key and authorize users to access the data encrypted with the same key.

Administrators need to grant particular users access to encryption key(s) before they can play back (decrypt) audio files. Note, the administrator may grant access only to those encryption keys which are granted to him/her. If administrator (even if he/she has role "Root administrator") has no access to the encryption key, then he/she cannot grant access to other users for the same key.

MiaRec software never stores encryption keys in the database in plain text for security reasons. Even if an unauthorized party gains access to database files, he/she could not retrieve the private keys because they are stored in encrypted format. There is no way to gain user's private key without knowing the user's password.

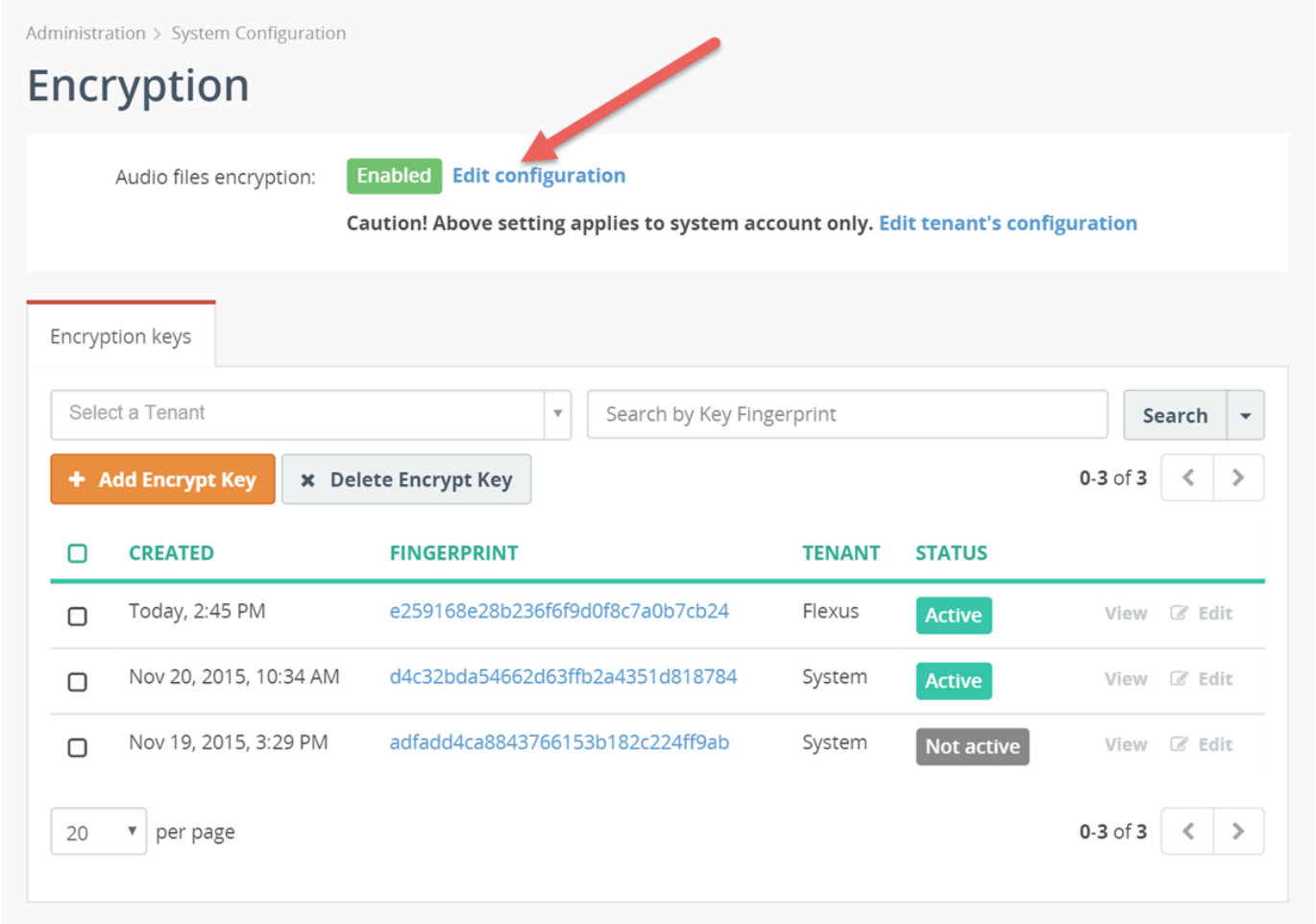


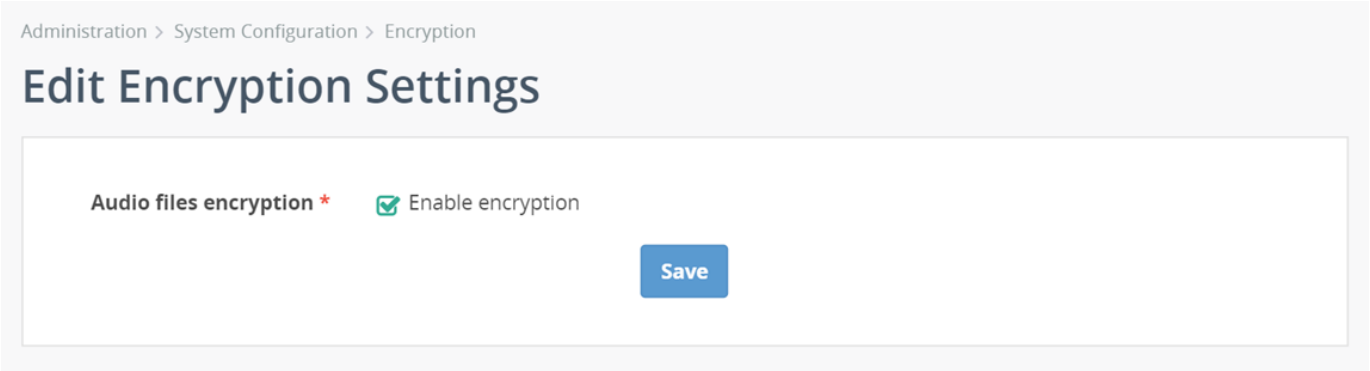

Administration > System Configuration > Encryption
Encrypt Key
Export Key
Edit Key
Delete Key
Fingerprint: d4c32bda54662d63ffb2a4351d818784
Created: Nov 20, 2015, 10:34 AM
Tenant: System
Status: Active
Key length: 2048 bits
Public Key:
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAwrzJnfVt26gvOv4xsjyTSkfnMA621BEb
Els2vivFph1j/oUZhMYUb6e9Meh+CVN2kwRYcnJhyG/LwRS4KtNDcoXSghiIe++4MSEPLIt3xjLx
jrJ56bCaUdl4Nd6KrbedqkqVG7jsTI88WEK4oCk0T/193LDjTKFc2neTqyzvMUC4GiZ3kzhgwTnL
BgX1tgykzjvCE2kfvCHcLOohNtnv4lKzvt+u0YJ7XCsmwiSLESbdnXRmW7i6M7dD4+mnSBT0sbpS
3Gd8HiTjYvy1o9Ksf4VkYQT3scxVzmpP4oVf/xTeLmhdaY0pEjIOd8xky56mDsDgU8ayzcXD7K13
CWISZQIDAQAB
Authorized Users
Unauth Users
2
Search by Text
Search
Grant access
2 items selected
0-4 of 4
NAME
WEB LOGIN
ENCRYPT ACCESS STATUS
1
Administrator
Administrator
LDAP auth not supported
Edit
John Smith
john.smith
Unathorized
Edit
Marry Smith
marry.smith
Unathorized
Edit
REST API user
apiuser
Unathorized
Edit
20
per page
0-4 of 4

5.1.7 Enable file encryption

Non-multi-tenant configuration

In a non-multi-tenant configuration, navigate to **Administration -> Storage -> File encryption** and click **Edit configuration** to enable encryption for all data.

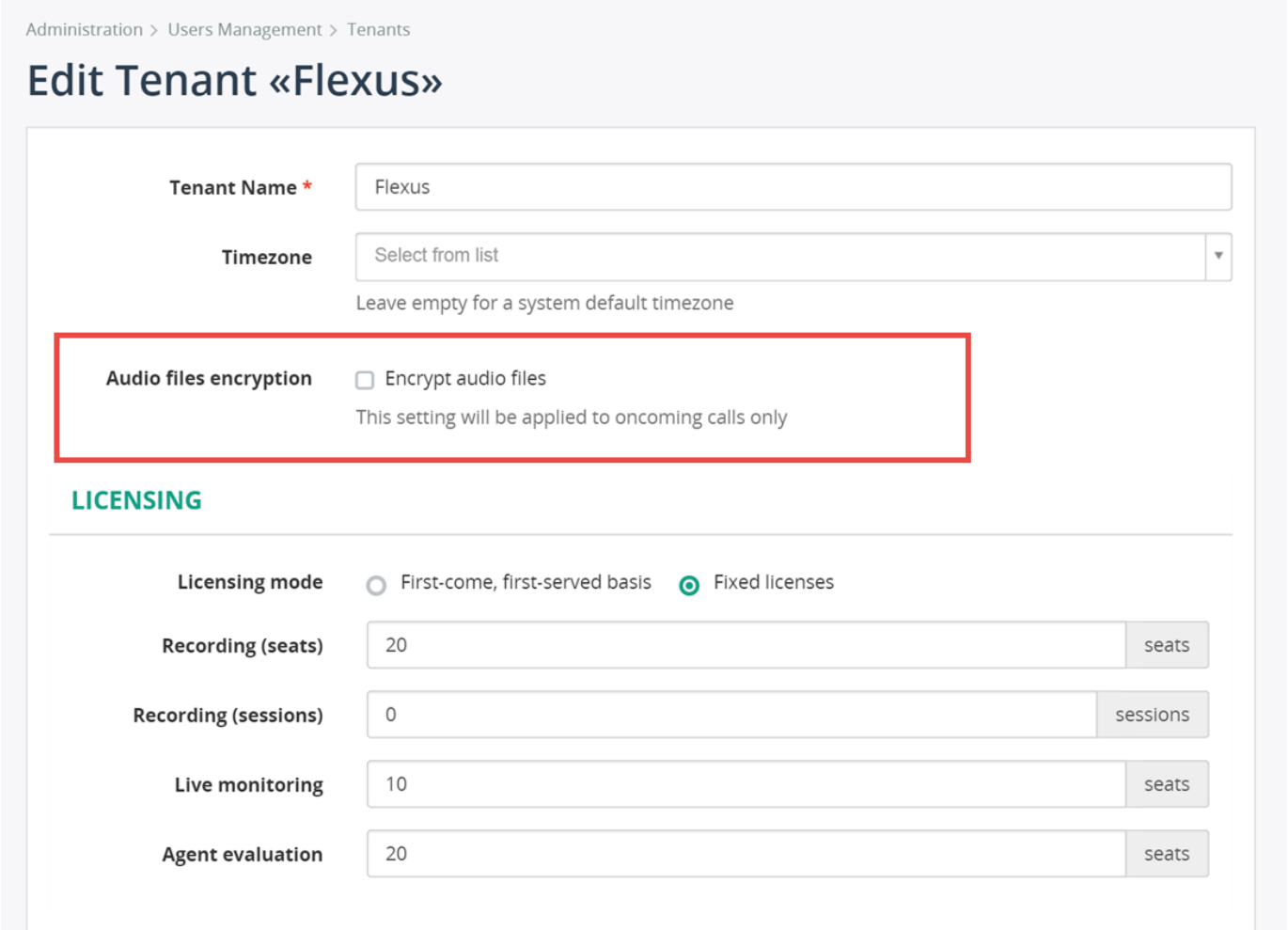




Multi-tenant configuration

In a multi-tenant configuration, navigate to **Administration -> Storage -> File encryption**, select the appropriate tenant profile, then click **Edit configuration** to enable encryption for this particular tenant.

Alternatively, you can enable encryption on tenant profile under **Administration -> User Management -> Tenants**.


Administration > Users Management > Tenants
Edit Tenant «Flexus»
Tenant Name *
Flexus
Timezone
Select from list
Leave empty for a system default timezone
Audio files encryption
Encrypt audio files
This setting will be applied to oncoming calls only
LICENSING
Licensing mode
First-come, first-served basis
Fixed licenses
Recording (seats)
20
seats
Recording (sessions)
0
sessions
Live monitoring
10
seats
Agent evaluation
20
seats

5.1.8 Export of the encrypted files

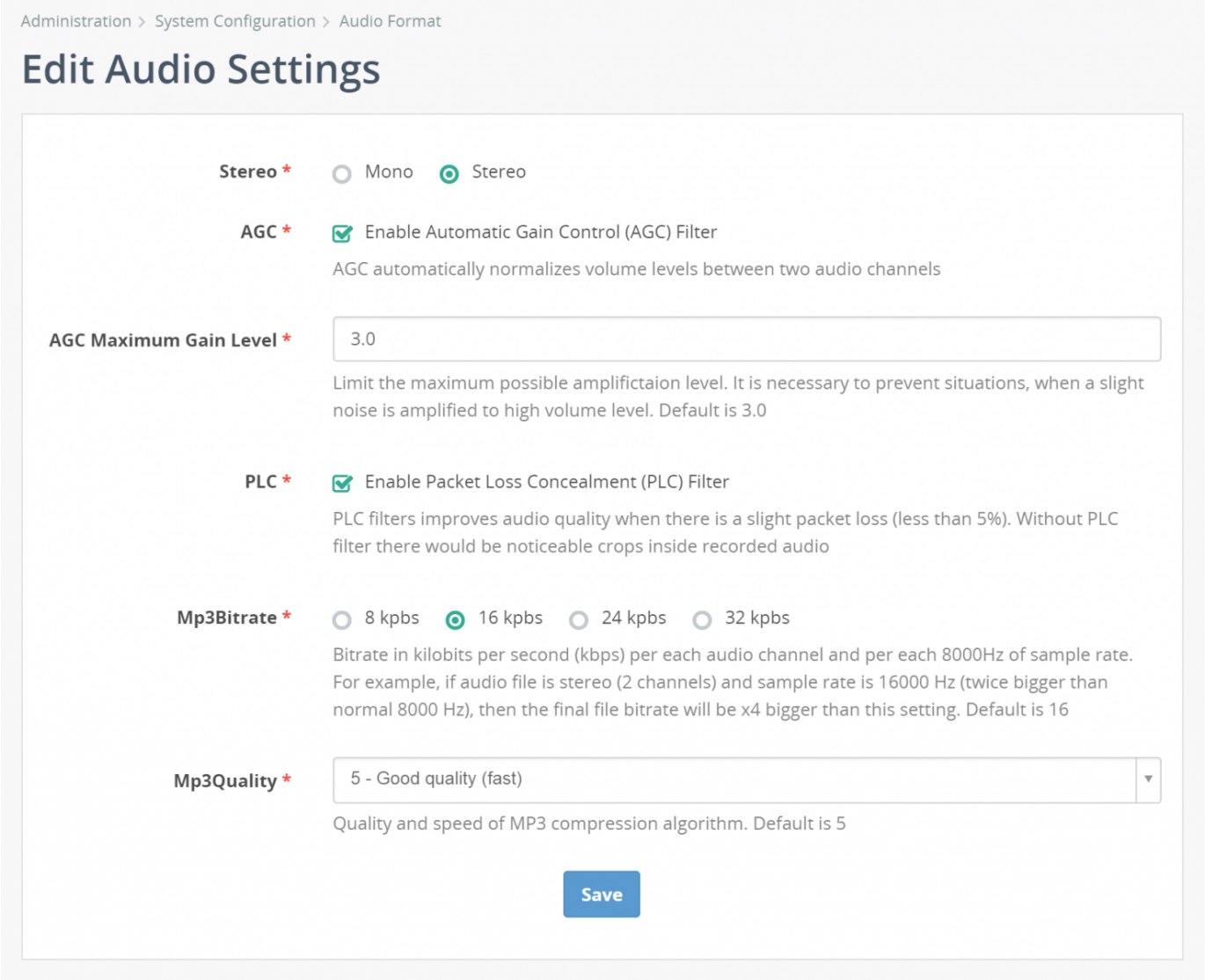
An important aspect of any file encryption facility's design is that file data is never available in unencrypted form except to users that access the file via the encryption facility. This restriction particularly affects backup process, when data is exported to external storage.

MiaRec addresses this problem by keeping files in encrypted form during backup process. The backup utility don't have to be able to decrypt file data before backup.

It is safe to export encrypted files to backup archive. The backup archive may be imported back to the same system or to new system during recovery process. When importing data to new system, it is necessary to import old encryption key as well.

5.2 Audio settings

Navigate to **Administration -> System Configuration -> Audio Settings** to change audio format (stereo/mono), MP3 bitrate and other settings.

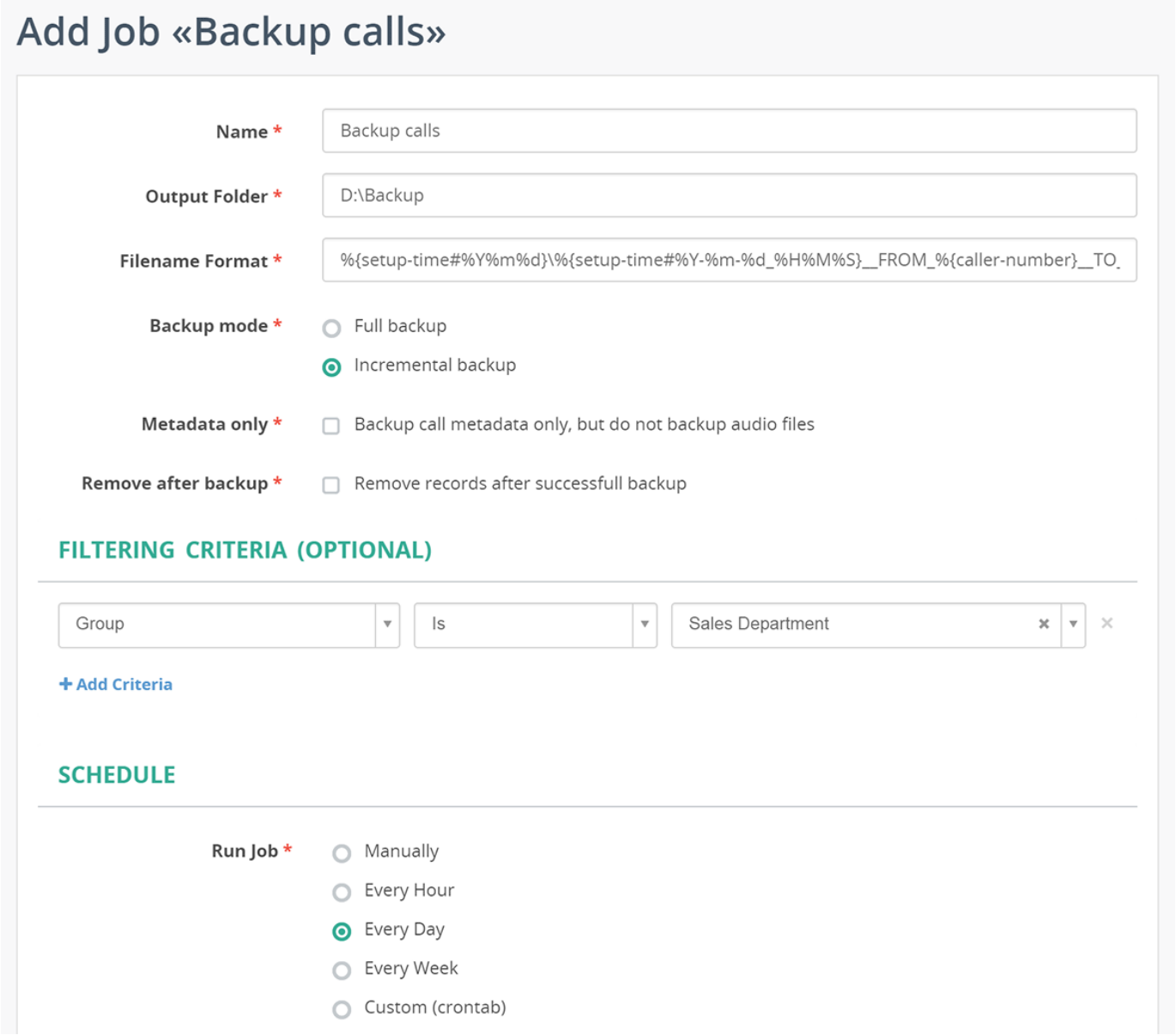


5.3 Backup and restore

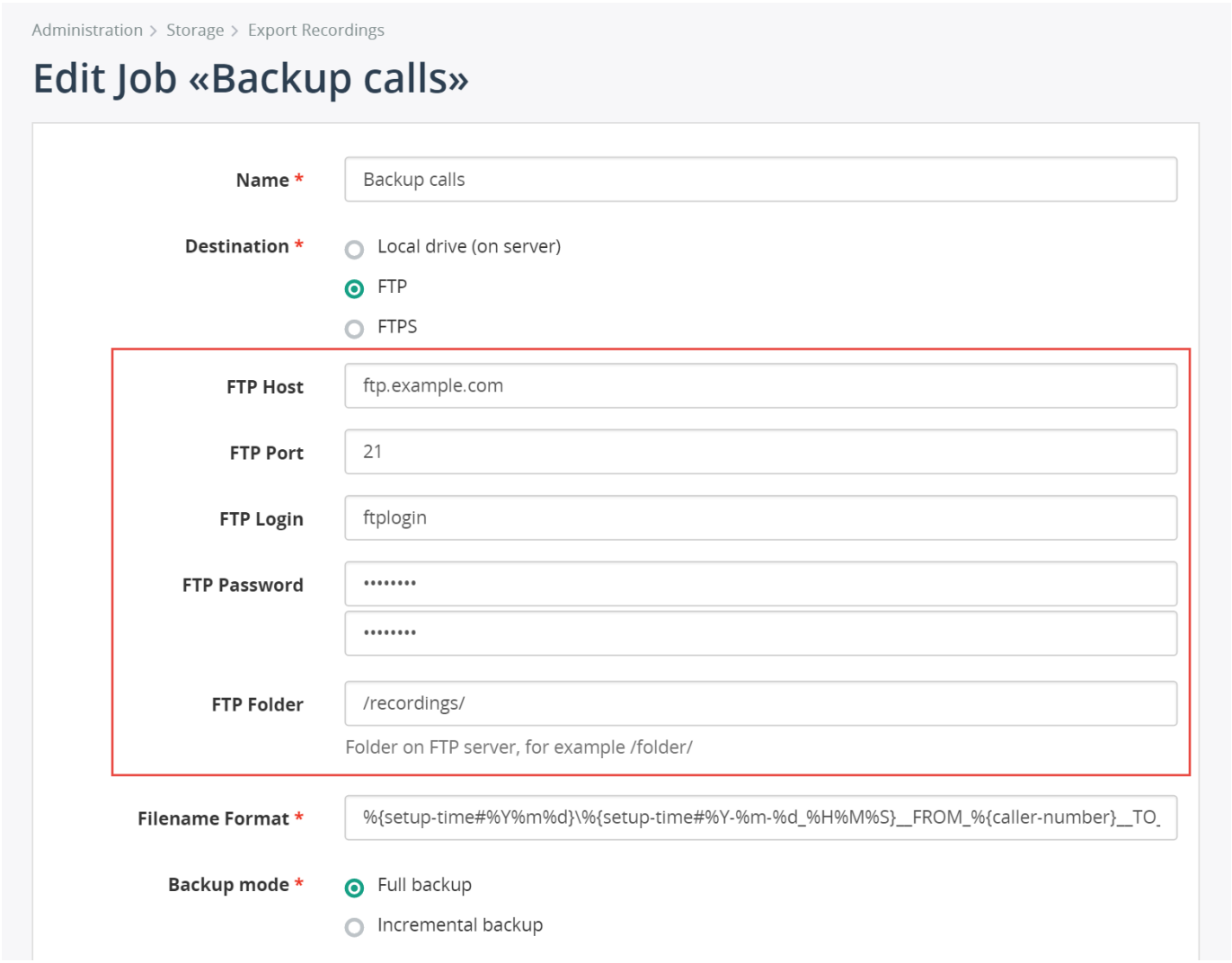
5.3.1 Backup call recordings

Navigate to **Administration -> Storage -> Export Recordings** to create backup job. In version before March 2016, navigate to menu **Administration -> Maintenance -> Backup Calls**.

Backup job may be started manually or by schedule (for example, every night/week etc).

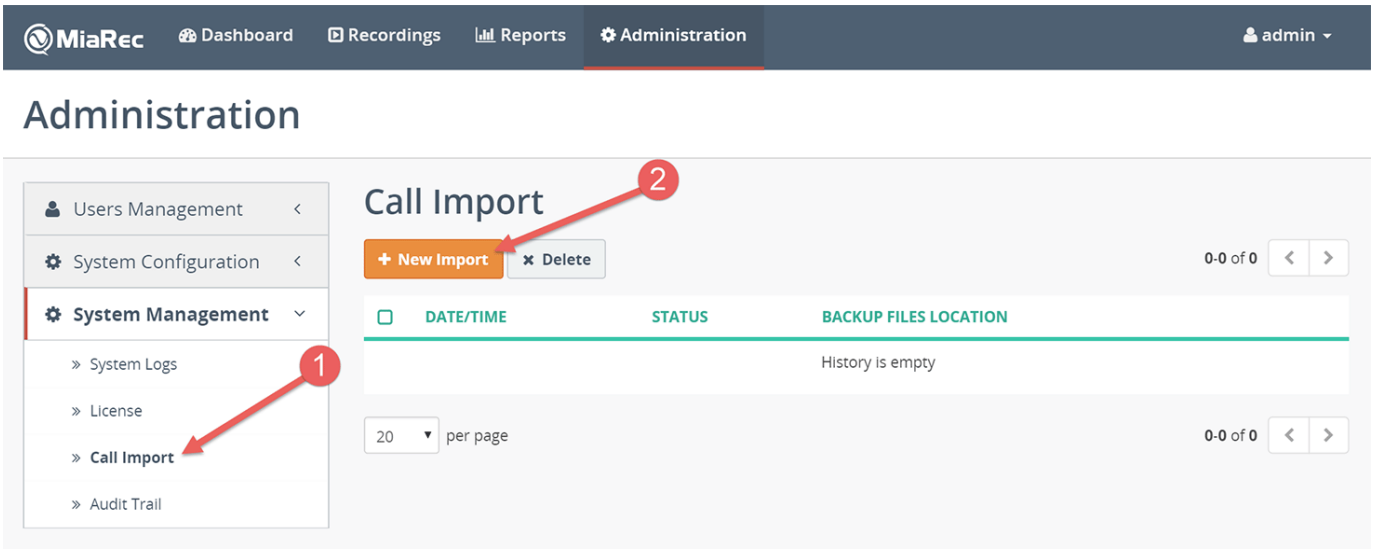


Export to FTP server:

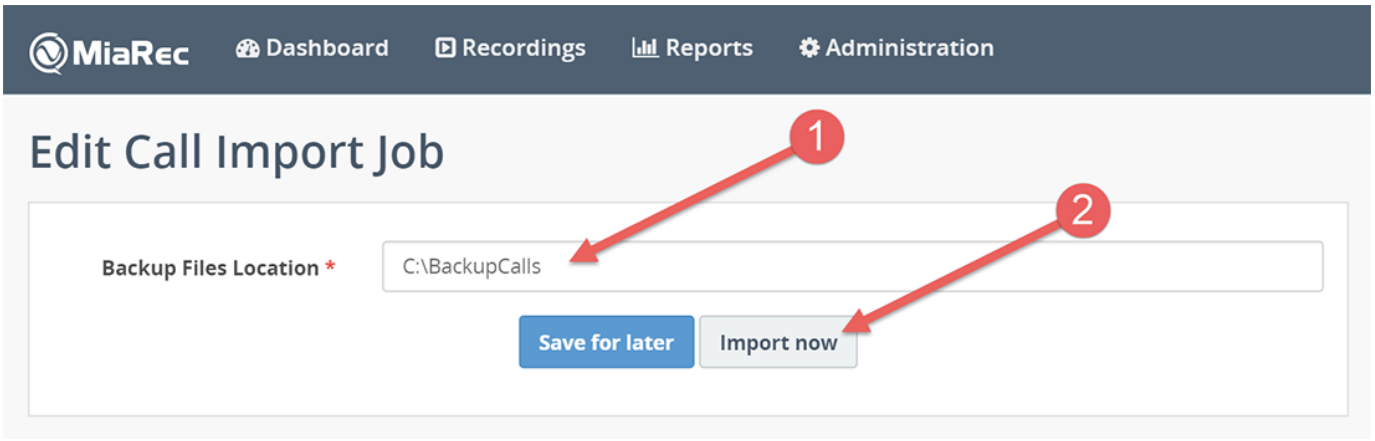

Administration > Storage > Export Recordings
Edit Job «Backup calls»
Name *
Backup calls
Destination *
Local drive (on server)
FTP
FTPS
FTP Host
ftp.example.com
FTP Port
21
FTP Login
ftplogin
FTP Password
FTP Folder
/recordings/
Folder on FTP server, for example /folder/
Filename Format *
%{setup-time#%Y%m%d}\%{setup-time#%Y-%m-%d_%H%M%S}__FROM_%{caller-number}__TO_
Backup mode *
Full backup
Incremental backup

5.3.2 Restore call recordings

Navigate to **Administration -> Storage -> Import Recordings** to create job. In version before March 2016, navigate to menu **Administration -> Maintenance -> Restore Calls**



In "Edit Call Import Job" form specify the location of backup files and click on **Import now** button.



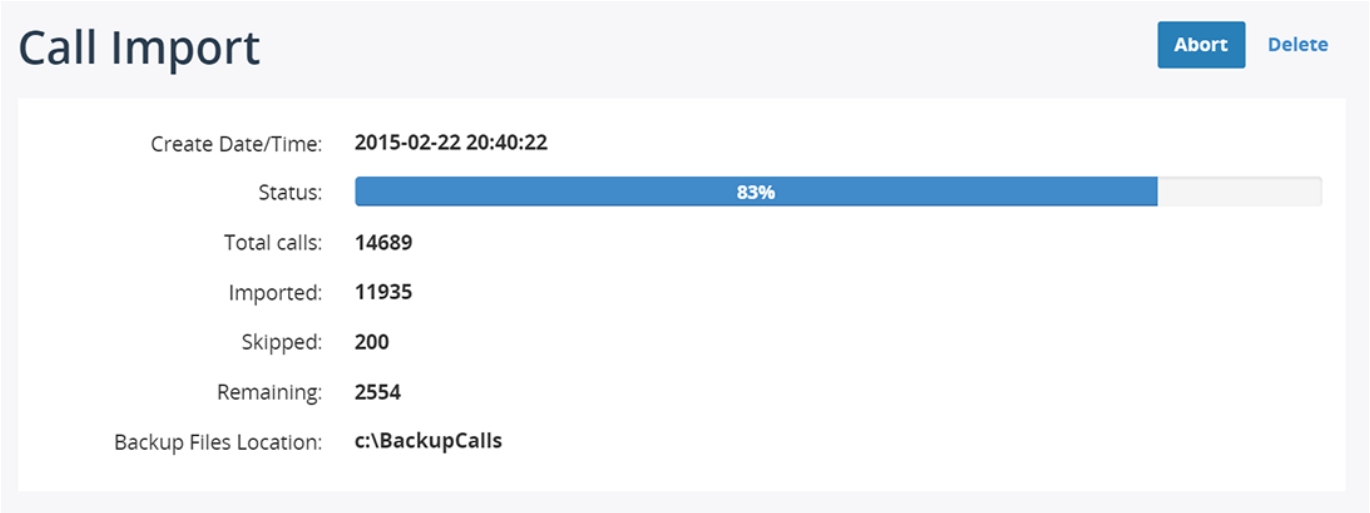
Additional steps in case the backup files are located on network share

It is important to note, that backup files will be accessed by a program application running on MiaRec server rather than from the computer on which you open MiaRec web portal. This means that even if you can access backup files from your own computer, the same files may be unaccessible from MiaRec server.

If backup files are stored on a network share, then on Windows servers you should use correct UNC path like \server\dir, on Linux servers you should mount the network share to a local file system, for example, /mount/backup.

When using UNC path on Windows, take into account that such path will accessed by a process running as a Windows service application. By default service applications are running under credentials of LOCAL_SYSTEM user account. This is internal user account, which has no access to network. To solve this issue, you would need to change parameters of "MiaRec Celery" service and run it under credentials of some user account, which can access the backup network share.

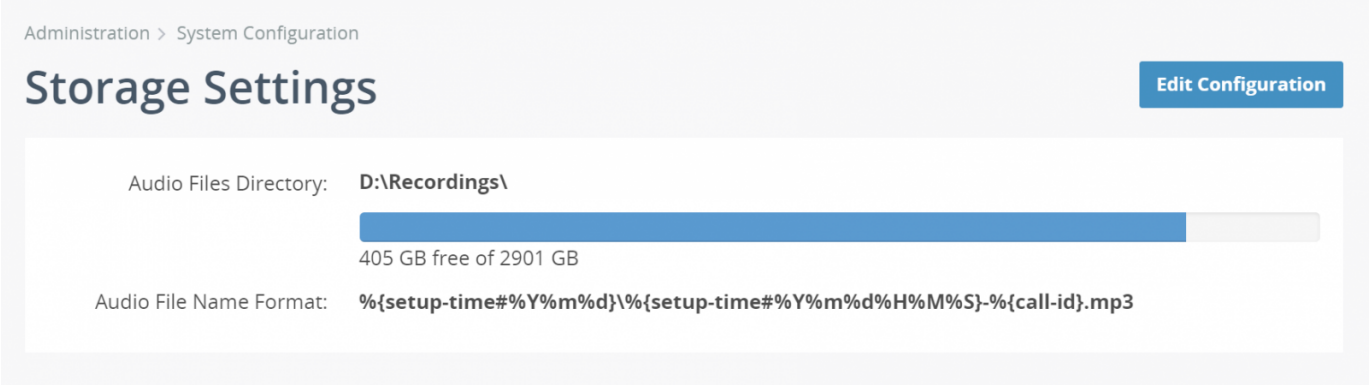
The process of call importing will be started and the progress will be displayed on web-page.


Call Import
Abort
Delete
Create Date/Time:
2015-02-22 20:40:22
Status:
83%
Total calls:
14689
Imported:
11935
Skipped:
200
Remaining:
2554
Backup Files Location:
c:\BackupCalls

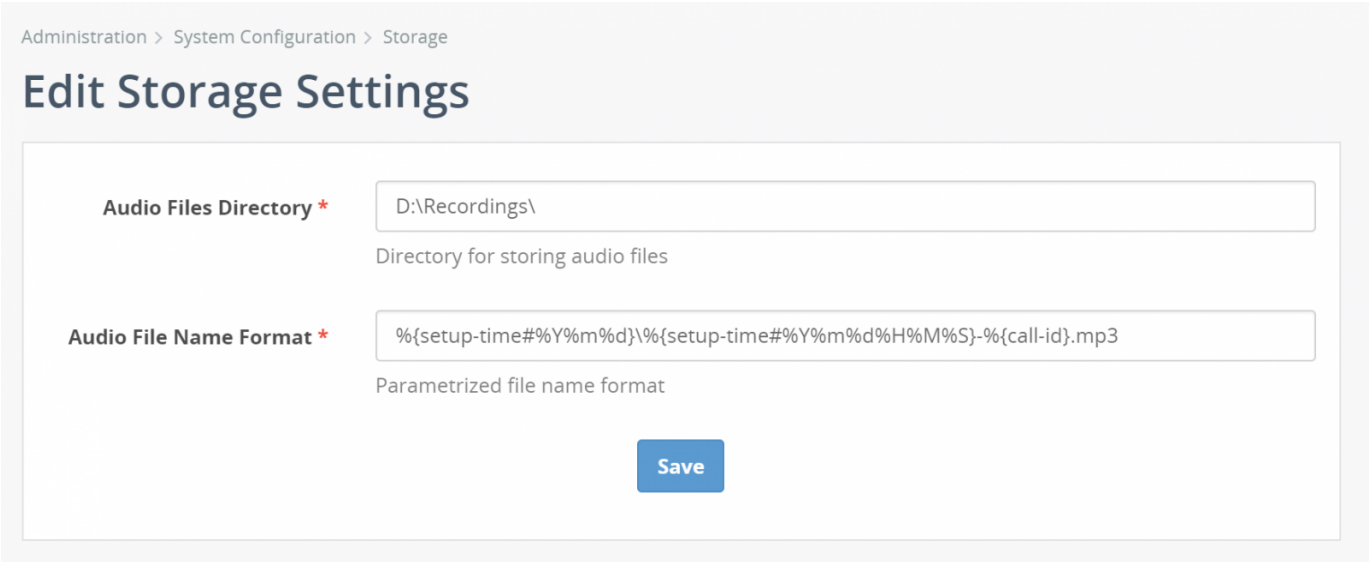
5.4 Location for audio files

5.4.1 Location for audio files

Navigate to **Administration -> System Configuration -> Storage** to view/edit location of audio files and filename format.



Click on **Edit Configuration** to modify settings.



Audio File Name Format is a parametrized format of audio file name. This is very powerful way of configuring audio files location. Parameters are described in details in article File name format.

See also:

- File name format
- Time formatting inside file name

5.4.2 File name format

MiaRec supports flexible naming of audio files. It is possible to include date/time, ip-address, phone number and other call parameters into file name.

Example:

```
C:\Recordings\%{setup-time#%Y%m%d}\%{setup-time#%Y-%m-%d-%H%M%S}.mp3
```

In above example audio files are stored inside directory C:\Recordings\.

For each day a new sub-directory is created (for example, C:\Recordings\20110203\ for 3rd of February 2011). This is done with the help of parametrized string **%{setup-time#%Y%m%d}**, which is converted to date (read details about parametrized strings below).

The file name consists of a date and time of when a call is started, for example, 20110203104522.mp3.

If two or more calls are started at the same time, then MiaRec appends a unique number at the end of file name, for example, 20110203104522_2.mp3, 20110203104522_3.mp3 etc.

Parameters have the following format:

```
%{parameter-name} or
%{parameter-name#format-string}
```

where:

- **parameter-name** is a name of call parameter (see Table 1)
- **#format-string** is an optional format of call parameter (see Time formatting).

Examples:

- %{caller-number}
- %{setup-time#%Y%m%d}

Table 1. Supported parameters inside file path

Parameter	Description
%{call-id}	Unique id of a call, which is assigned to each recorded call by MiaRec
%{parent-call-id}	Id of a call, which is a parent to the current call. The meaning of this parameter depends on particular voip protocol. For example, for Avaya H.323 protocol, when call is put on hold and then retrieved from hold, the new audio file will be created. In this case %{parent-call-id} points to the very first call part.
%{protocol-call-id}	Id of a call, which is assigned by IP PBX. This value is valid only for supported voip protocol (SIP, Skinny, H.323 and MGCP). For example, for SIP protocol this value is retrieved from header "Call-ID" inside SIP INVITE message.
%{protocol-tracking-id}	Id of a call interaction assigned by IP PBX. Usually IP PBX assigned the same tracking id to related calls, like transferred from one agent to another. For Avaya Aura Communication Manager, it is UCID. For Broadworks, it is extTrackingID. Available since August 2018
%{call-state}	Phase (state) of the call. It is a numeric value, one of: • **0 - Idle** • **1 - Initiated**. The first phase of a call: the caller sent invitation to the callee • **2 - Accepted**. The callee received invitation and confirmed this • **3 - Alerting**. The callee started ringing • **4 - Connected**. The call was answered • **5 - Disconnecting**. The call was initiated for disconnecting by one of parties • **6 - Disconnected**. The call was completed (disconnected) • **7 - Hold**. The call was put on Hold • **8 - Transferred**. The call was transferred to the third party • **9 - Deleted**. The call was deleted from the disk.
%{record-state}	State of the audio recording. It is a numeric value, one of: • **10 - Active**. Call is active at the moment and recording is in progress • **20 - Partial recording**. Recording of call was stopped because of not enough licenses • **30 - Finished**. Call is finished. Audio was recorded in full • **40 - Ignored**. Call is ignored by recording filters.
%{voip-protocol}	

Parameter	Description
	Voip protocol of the call. It is a numeric value, one of: • **0 – Unknown** (not recognized protocol). Call is recorded from RTP packets • **1 - SIP** • **2 - H.323** • **4 - SCCP (Cisco Skinny)** • **5 - MGCP** • **6 - Avaya** (H.323 protocol with proprietary extensions) • **7 - Nortel UNISTIM** • **8 - TAPI** • **9 - MGCP PRI Backhaul** (it is used between Cisco CCM and Voice Gateway) • **10 - Alcatel** (proprietary protocol used by Alcatel OmniPCX) • **11 - Avaya RTP** (passive recording w/o signaling) • **12 - Avaya TSAPI** (TSAPI + port mirroring recording) • **13 - SIPREC** • **14 - Cisco Built-in-Bridge** • **15 - NEC SIP** (SIP protocol with NEC proprietary extensions) • **16 - ED137** • **17 - Cisco Built-in-Bridge passive** • **18 - SIPREC passive** • **19 - Avaya DMCC**
%{protocol-call-direction}	Call direction reported by IP PBX, available for active recording interfaces only. It is a numeric value, one of: • **0 - Unknown** • **1 - Outbound** • **2 - Inbound** Available since August 2018
%{setup-time}	Time when call was established (when a called party received incoming call message). See Time formatting
%{alerting-time}	Time when phone started ringing on called party side. See Time formatting
%{connect-time}	Time when call was answered. See Time formatting
%{disconnect-time}	Time when call was disconnected. See Time formatting
%{duration}	Duration of voice part of a call in seconds. This is a difference beween %{connect-time} and %{disconnect-time}
%{total-duration}	Total duration of a call in seconds. This is a difference beween %{setup-time} and %{disconnect-time}
%{filename}	Name of audio file without full path (for example, 20110410104600.mp3) Caution! This value is available only to a recording engine when file is initially created. It is not available to post-processing jobs, like export, relocate, etc.
%{filename-full}	Full path to the file, including directory (for example, C:\Recordings\20110410104600.mp3) Caution! This value is available only to a recording engine when file is initially created. It is not available to post-processing jobs, like export, relocate, etc.
%{filename-dir}	Directory path to the file, excluding drive letter (for example, \Recordings)

Parameter	Description
	Caution! This value is available only to a recording engine when file is initially created. It is not available to post-processing jobs, like export, relocate, etc.
%{caller-number} or %{callee-number}	Phone number of caller/callee
%{caller-name} or %{callee-name}	Name of caller/callee. This parameter is protocol-dependent. For example, for SIP protocol name is extracted from "From" and "To" sip headers
%{caller-id} or %{callee-id}	Id of a caller/callee. This paramter is protocol-dependent. For example, for SIP protocol it is SIP URI
%{caller-ip} or %{callee-ip}	Ip-address of caller/callee
%{caller-port} or %{callee-port}	Port of caller/callee
%{caller-mac} or %{callee-mac}	Mac-address of caller/callee
%{transfer-from-number} %{transfer-from-name} %{transfer-from-id}	Name, number and id of party, from which the call was transferred. This parameter is available only for Skinny protocol.
%{transfer-to-number} %{transfer-to-name} %{transfer-to-id}	Name, number and id of party, to which the call was transferred. This parameter is available only for Skinny protocol.
%{sip-header-invite}	Value of specific SIP header inside INVITE message. The name of header is specified after hash (#) symbol. Examples: • %{sip-header-invite**#User-Agent**} • %{sip-header-invite**#X-My-header**} Caution! This value is available only to a recording engine when file is initially created. It is not available to post-processing jobs, like export, relocate, etc.
%{BroadWorks-userID}	Broadworks User ID
%{BroadWorks-groupID}	Broadwors Group ID
%{BroadWorks-serviceProviderID}	Broadworks Service Provider ID
%{MetaSwitch-recorderParty}	Metaswitch CFS User Extension
%{MetaSwitch-userName}	Metaswitch CFS User Name

Parameter	Description
%{MetaSwitch-businessGroup}	Metaswitch CFS Business Group Name
%{MetaSwitch-systemName}	Metaswitch CFS System Name
%{agent-id}	Avaya Agent ID
%{agent-name}	Avaya Agent Name
%{orig-caller-number}	Originally Caller Number (if different from caller-number)
%{orig-caller-name}	Originally Caller Name (if different from caller-name)
%{orig-callee-number}	Originally Dialed Number (if different from callee-number)
%{orig-callee-name}	Originally Dialed Name (if different from callee-name)
%{user-id} %{user-name}	ID, name of user, the call recording is assigned to. If the call is an internal (i.e. assigned to multiple users), then this value points to the first user only. Note: this value is available in post-processing jobs only (Export/Replication/File relocation). It is not available for the initial filename creation by the recorder process (configured at menu Administration -> Storage -> File Location) Available since May 2018.
%{group-id} %{group-name}	ID, name of group, the call recording is assigned to. If the call is an internal (i.e. assigned to multiple users) or user belongs to multiple groups, then this value points to the first group only. Note: this value is available in post-processing jobs only (Export/Replication/File relocation). It is not available for the initial filename creation by the recorder process (configured at menu Administration -> Storage -> File Location) Available since May 2018.
%{tenant-id} %{tenant-name}	ID, name of tenant, the call recording is assigned to. Note: this value is available in post-processing jobs only (Export/Replication/File relocation). It is not available for the initial filename creation by the recorder process (configured at menu Administration -> Storage -> File Location) Available since May 2018.
%{acd-number} %{acd-name} %{acd-id}	Number/name/id of ACD. Broadworks and Avaya envorinments only. Available since July 2018.

Example 1

```
C:\Recordings\%{setup-time#%Y%m%d%H%M%S}.mp3
```

%{setup-time#%Y%m%d%H%M%S} will be replaced with a date and time of when a call was started. For example, if a call was started on 1st of May 2007 at 10:56:34, it will be stored into directory ‘C:\Recordings’ with the filename ‘20070501105634.mp3’.

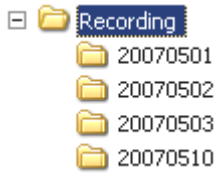
Note: If two or more calls were started at the same time, a unique decimal suffix will be added to every file name (expect the first one), like: ‘20070501105634_2.mp3’, ‘20070501105634_3.mp3’ etc.

Example 2

```
C:\Recordings\%{setup-time#%Y%m%d}\File.mp3
```

This example contains a parameterized string inside a directory path. This means that files will be stored into sub-directories with name %{setup-time#%Y%m%d} (which will be replaced by a date of a call, for example, '20070501'). If such directory doesn't exist, it will be created automatically.

In this example calls will be grouped into directories by date, like:



For every new day a separate directory will be created (a directory is not created if no calls were recorded at that day).

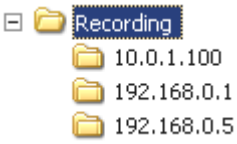
Audio file names in this example will be File.mp3, File_2.mp3, File_3.mp3 and so on.

Example 3

```
C:\Recordings\%{caller-ip}\File.mp3
```

\ %{caller-ip} will be replaced with ip-address of a caller, for example 192.168.0.1.

Calls will be grouped into directories by caller ip-address, like:



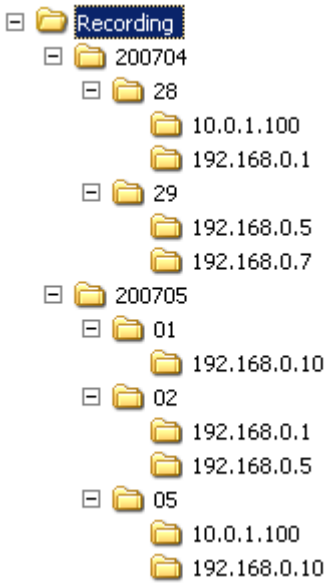
Example 4

```
C:\Recordings\%{setup-time#%Y%m}\%{setup-time#%d}\%{caller-ip}\File.mp3
```

In this example multiple parameter replacements occur:

- **%{setup-time#%Y%m}** will be replaced with a year and month of a call (YYYYMM). For 1st of May 2007 it will be 200705.
- **%{setup-time#%d}** will be replaced with a day of a call (DD). For 1st of May 2007 it will be 01.
- **%{caller-ip}** will be replaced with an ip-address of a caller, for example 192.168.0.1.

Calls will be grouped into directories by months, then by days and then by callers' ip-addresses, like:



See also:

- Time formatting

5.4.3 Time formatting inside file name

All date/time parameters support a formatting attribute. Formatting attribute is specified after hash (#) symbol.

For example:

- %{setup-time#%Y} will return year, like: 2011
- %{setup-time#%m} will return month, like: 02
- %{setup-time#%Y-%m} will return both year and month, like: 2011-02

Table 1. Formatting codes

Code	Description
%a	Abbreviated weekday name
%A	Full weekday name
%b	Abbreviated month name
%B	Full month name
%d	Day of month as decimal number (01 – 31)
%H	Hour in 24-hour format (00 – 23)
%I	Hour in 12-hour format (01 – 12)
%j	Day of year as decimal number (001 – 366)
%m	Month as decimal number (01 – 12)
%M	Minute as decimal number (00 – 59)
%p	A.M./P.M. indicator for 12-hour clock
%S	Second as decimal number (00 – 59)
%U	Week of year as decimal number, with Sunday as first day of week (00 – 53)
%w	Weekday as decimal number (0 – 6; Sunday is 0)
%W	Week of year as decimal number, with Monday as first day of week (00 – 53)
%y	Year without century, as decimal number (00 – 99)
%Y	Year with century, as decimal number
%%	Percent sign
%u	Microseconds as decimal number

Table 2. Examples of time formatting

Format string	Result
%Y-%m-%d	2004-11-10
%H%M%S	160201
%I%M%S	040201
%d %b %Y, %A	10 Nov 2004, Wednesday

Note, for all examples, we used the same date/time, which is “10th of November 2004 16:02:01”. This day is a Wednesday.

Read also:

- File name format

5.5 Replication

5.5.1 MiaRec multi-master asynchronous replication

MiaRec solution implements data replication with the following characteristics:

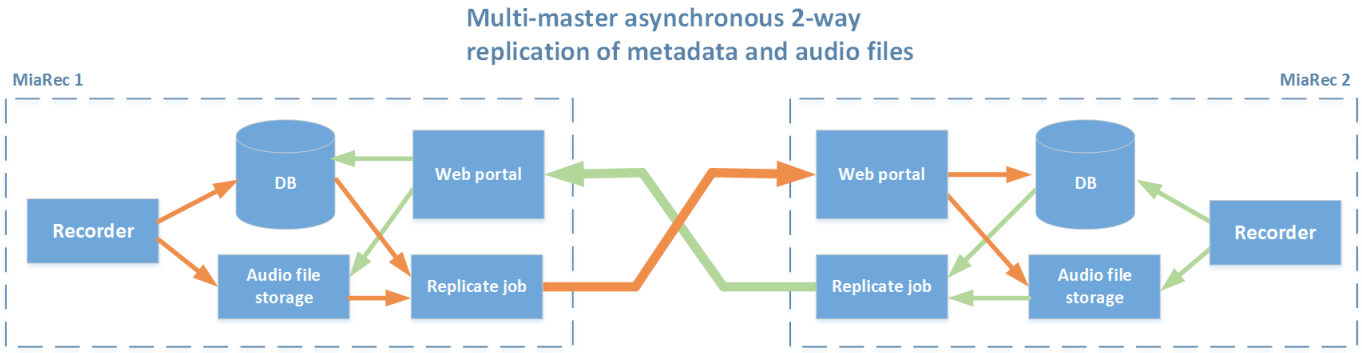
- Multi-master
- One-way, two-way or N-way
- Asynchronous
- Application-level
- GEO distributed
- Continuous, manual or scheduled
- Auto resume after network breakdown

This articles describes in details each of these characteristics and compares MiaRec solution with alternatives. The competitive solutions are built usually on file-storage based replication and have a number of weaknesses discussed below.

How it works

When recording of each individual call is completed, MiaRec pushes it into queue for automatic replication to other server(s) in a cluster. Such data replication may be started immediately upon call completion or scheduled to specific time of day (for example, at night).

Besides replication of call recordings, MiaRec replicates also user data in one-way or two-way directions. The updates to user data is automatically uploaded to other servers in a cluster.



Replication architecture of MiaRec has the following characteristics:

- **Multi-master.** Any of servers in a cluster can be used for recording tasks at any time. It is possible to use multiple recorders simultaneously for load balancing purposes.
- **Asynchronous replication.** Data is replicated asynchronously. Data synchronization can be triggered by schedule (once per hour/day/week) or continuously upon each individual call completion. It works seamlessly in GEO-redundant architecture when datacenters are located too far from each other. In a contrast, other solution may use synchronous replication, which require low latency (less than 5ms) connection between datacenters, this is equal to maximum 100km distance between servers. With a synchronous replication, if a link between datacenters is down even for 1 second, the redundant server is removed from a cluster and manual re-synchronization is required between servers. Automatic restore of cluster is not possible by design with synchronous replication.
- **Application-level replication.** MiaRec implements replication internally on application level. It has a few advantages: cost, easy management and selective replication. In a contrast, other solutions may use replication on database level or disk level (SAN). SAN replication is supported only in highly expensive enterprise SAN disk arrays. In both of these competitive solusions (database replication and SAN replication) the selective replication is not supported.

Multi-master vs master-slave replication

Multi-master replication (MiaRec)

All servers run as master servers, thus you can record calls on any of servers at any time or even simultaneously to multiple servers.

This makes system highly flexible in a way that any operation can be processed in any server which enables better load balancing.

However, such flexibility brings the challenge of keeping servers consistent. A conflict occurs if more than one server tries to update the same object. In MiaRec we solved this issue with the following mechanisms:

1. Careful design of database structure from scratch to address unique redundancy requirements. We do not use integer auto-incremental fields for IDs. Instead we use UUID all over the database to guarantee uniqueness through multiple servers.
2. Replication is implemented on application level instead of database engine or disk-level. More about this later.

Master-slave replication (other vendors)

In master-slave replication, there is only one server in the system which is capable of recording data. All other replicating servers are called slaves and can only accept read-only requests.

In master-slave replication, the master server becomes overwhelmed and system suffers from scalability due to using a single server for write operations (call recording).

Setup of automatic fail-over mechanism can be tricky. When master server becomes unavailable, one of the slaves can be promoted as a master. When the master server is back, it usually stays in off-line mode and requires manual re-synchronization of servers to assure data consistency. Such synchronization process is quote time consuming and it is recommended to have at least 3 servers in a cluster (1 master and 2 slaves) in order to avoid single point of failure situations while master server is in off-line mode.

If such configuration is used in GEO-redundant setup, it may create too much burden to administration staff in case of frequent issues with connection between datacenters.

Asynchronous vs synchronous replication

Asynchronous replication (MiaRec)

In asynchronous replication, an incoming request is processed and get committed on the receiving server without propagating it to other replicating servers simultaneously. Instead, committed request are deferred and sent to all other replicating servers asynchronously. Once replicating servers receive these deferred request, they process them and make themselves synchronized.

Asynchronous replication utilizes network resources intelligently, creates less traffic, and provides higher performance. Deferring multiple request and propagating them all as a big chunk of requests is much more efficient rather than to propagate each of them separately. Operation latency is reduced as opposed to synchronous replication because a server can go ahead and process a request without need to talk with other servers to commit it. It also provides better scalability since response time of a server is independent from the number of replicating servers, and generated network traffic is proportional to the number of replicating servers. Moveover, network latency introduced due to the geographical distance between replicating servers can be tolerated and hidden since requests are deferred and propagated asynchronously.

Additionally, asynchronous replication can be scheduled to execute during less busy hours, like at night or weekends.

Synchronous replication (other vendors)

In synchronous replication, incoming requests are propagated to and processed by all replicating servers immediately. The benefits of synchronous replication is to guarantee that data is consistent at all servers at any time.

While propagating requests and synchronizing servers, two-phase commit protocol is used. When a request comes in a sever, the same request is also forwarded immediately to all replicating servers. All servers have to process incoming request to see if it is OK to be committed, and have to inform the propagating server in this regard. If and only if all replicating servers inform that request can be committed, then second message is propagated to commit the request in all replicating servers. If any replicating server complains about the request, than abort message is propagated and all servers have to disregard the request.

Although it ensures that replicating servers are synchronized immediately when a request is committed and prevent consistencies may occur otherwise, it generates huge network traffic due to high number of sends and receives to decide to commit or abort. It increases processing latency which degrades operation performance since operation has to wait until all replicating servers have been synchronized. Scalability also suffers from increasing number of replicating metadata servers that tend to create exponentially growing network traffic and processing latency that ends up with longer response time.

Synchronous replication is not suitable for GEO-redundancy when distance between datacenters is more than 100km.

Application-level vs Storage array-based replication

Application-level replication (MiaRec)	Storage array-based replication (other vendors)
MiaRec replication mechanism is based on knowledge of data. This allows it to selectively replicate only the necessary data. For example, administrator may enable continuous (as soon as possible) replication for call recording data and for the rest of data (like logs) schedule replication during off-hours (at night, for example).	Storage array-based replication is expensive. Usually it is available only in enterprise SAN disk arrays.
Additionally, it is possible to set filtering criteria for replication. For example, replicate only call recordings of particular tenant(s) or group(s).	It doesn’t have knowledge of data that is stored on disk. As a result, it is not possible to configure selective replication. You need to replicate an entire SAN or nothing.
Having knowledge of data allows MiaRec application to resolve conflicts intelligently. For example, if the same user record is updated from multiple servers simultaneously, then administrator may decide to resolve conflicts automatically based on priorities or manually.	Storage array-based replication works only for a pair of SAN arrays of exactly the same vendor/ model and size. It is not possible to mix SANs from different vendors or even different models of the same vendor.
In a contrast to storage array-based replication (SAN), MiaRec replication mechanism supports any storage, like NAS, local, virtual environment. It doesn’t depend on hardware. It is possible to mix different storage types in the same clustomer, for example, replicate form local or NAS storage to SAN.	SAN replication usually supports both asynchronous and synchronous replication, but the latter is not suitable in GEO-redundant environment because it works only for a distance up to 100km between datacenters.
MiaRec application-level replication supports multi-master architecture, which is not possible with a storage array-based replication. As a result, utilization of hardware is much better due to using second storage in load balancing configuration. MiaRec supports also replication to multiple servers simultaneously.	When using SAN replication in asynchronous mode, it suffers from ineffectiveness of investments. One of SAN-arrays in a pair is used in passive mode most of the time until disaster occurs.
Application-level replication is tolerant to temporary problems with a link between replicating servers. In case of problems with a link between datacenters, MiaRec replication process is postponed and automatically resumed when link is restored. No data loss occurs due to in this case.	In case of DR, a switch from primary SAN to the secondary usually occurs automatically, but a reverse operation requires the manual intervention of human. In case of problems with a link between datacenters, data on primary and secondary SAN arrays becomes inconsistent and requires manual re-synchronization, which is very time consuming.

5.5.2 Use cases for replication

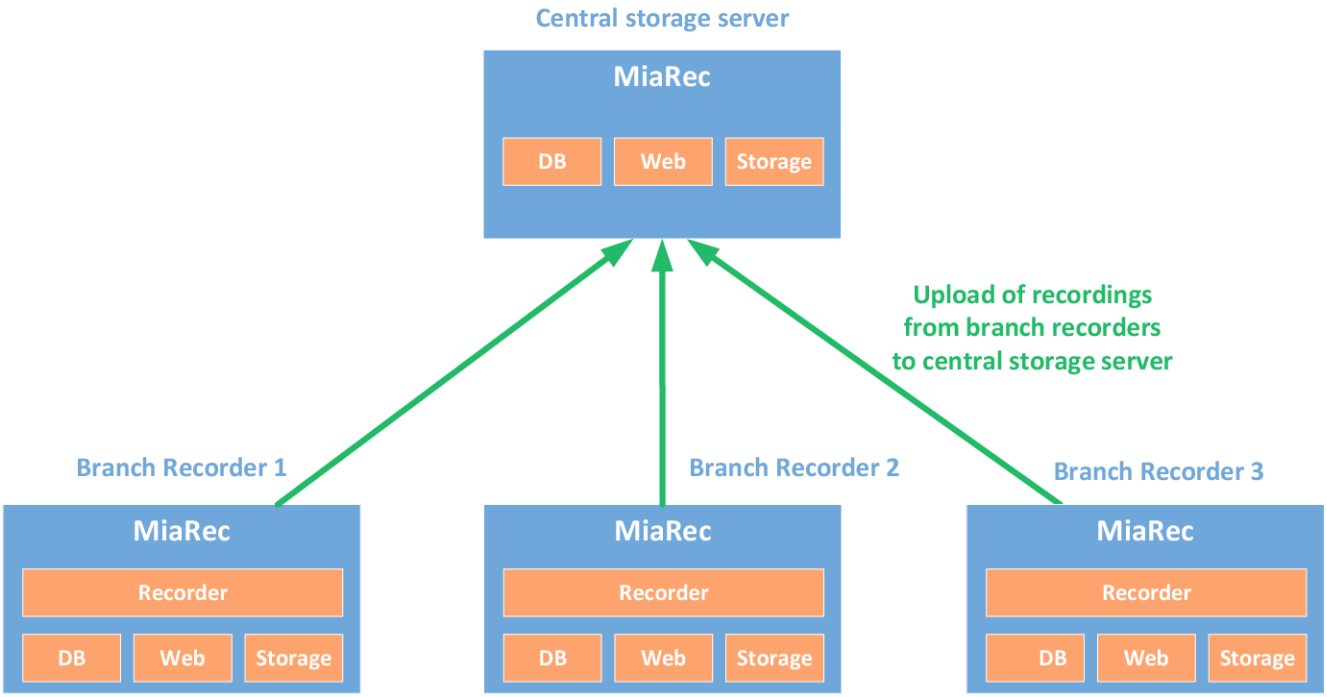
MiaRec supports advanced replication mechanism between two or more MiaRec servers.

Such replication may be configured one-way or two-way. MiaRec server may play role of **target** (recipient) or **source** (sender) or both roles at the same time.

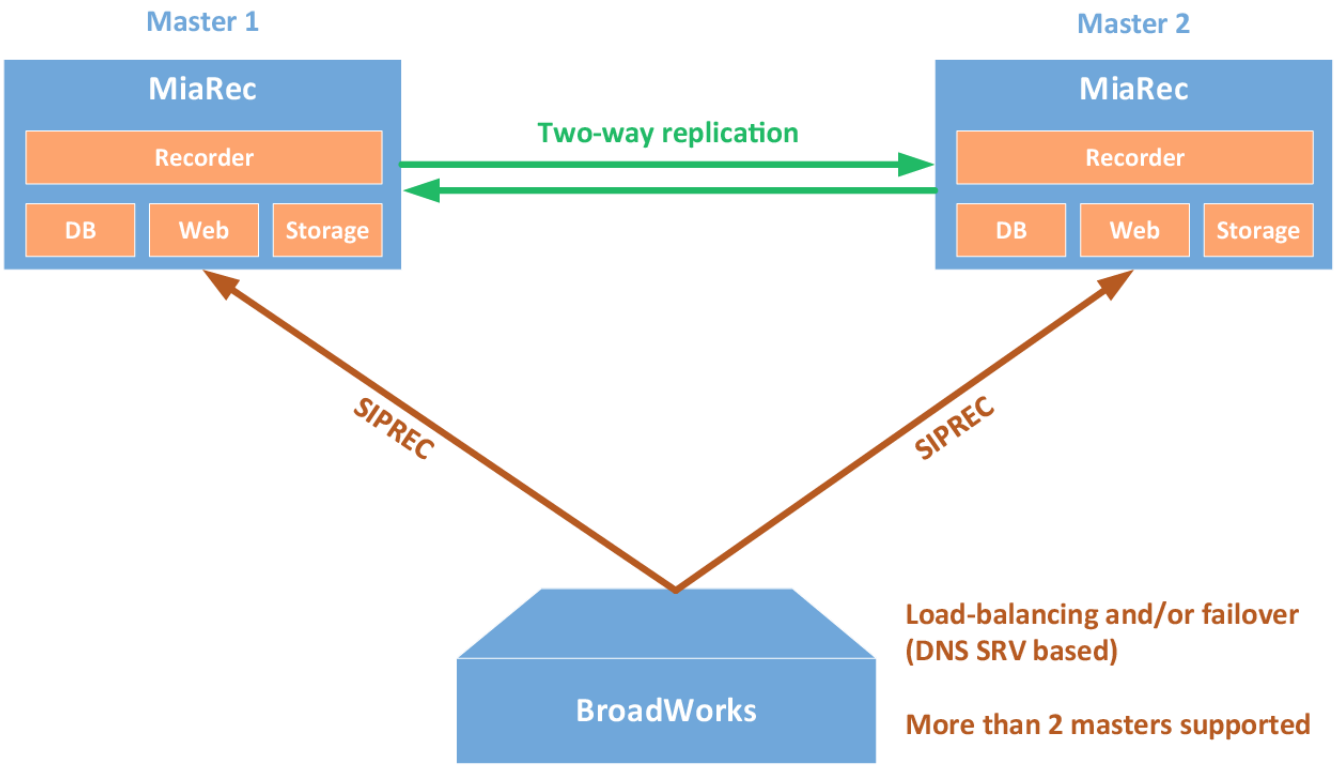
The following scenarios are supported:

Replication to backup storage

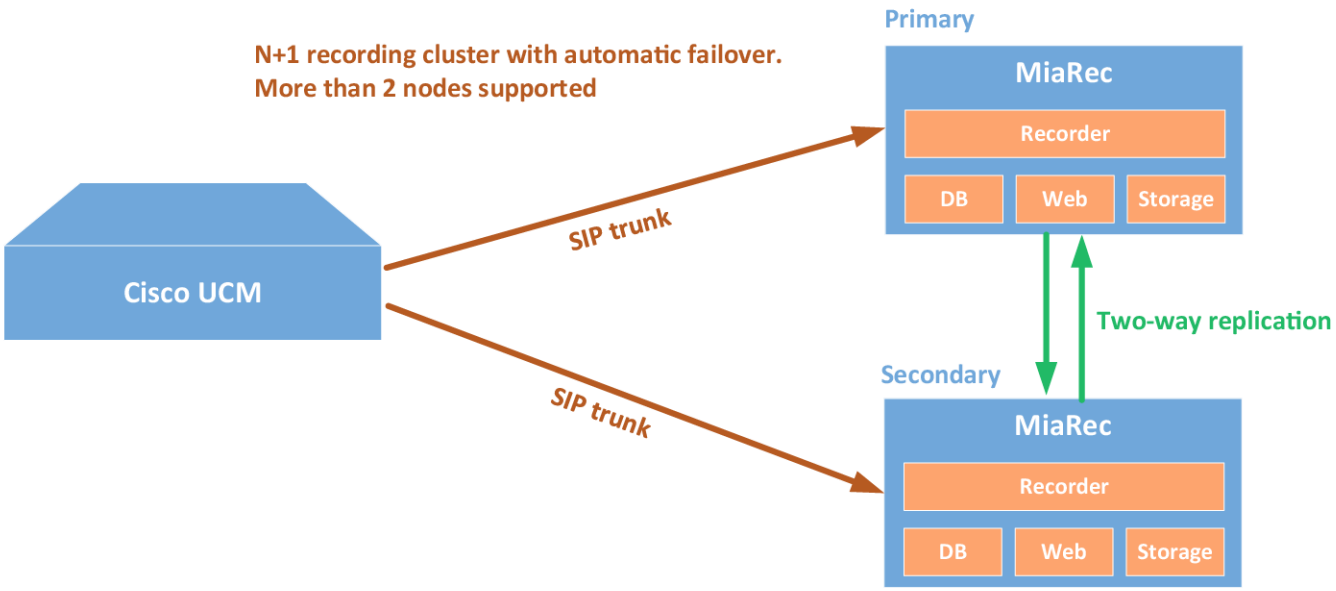
Replication to centralized storage



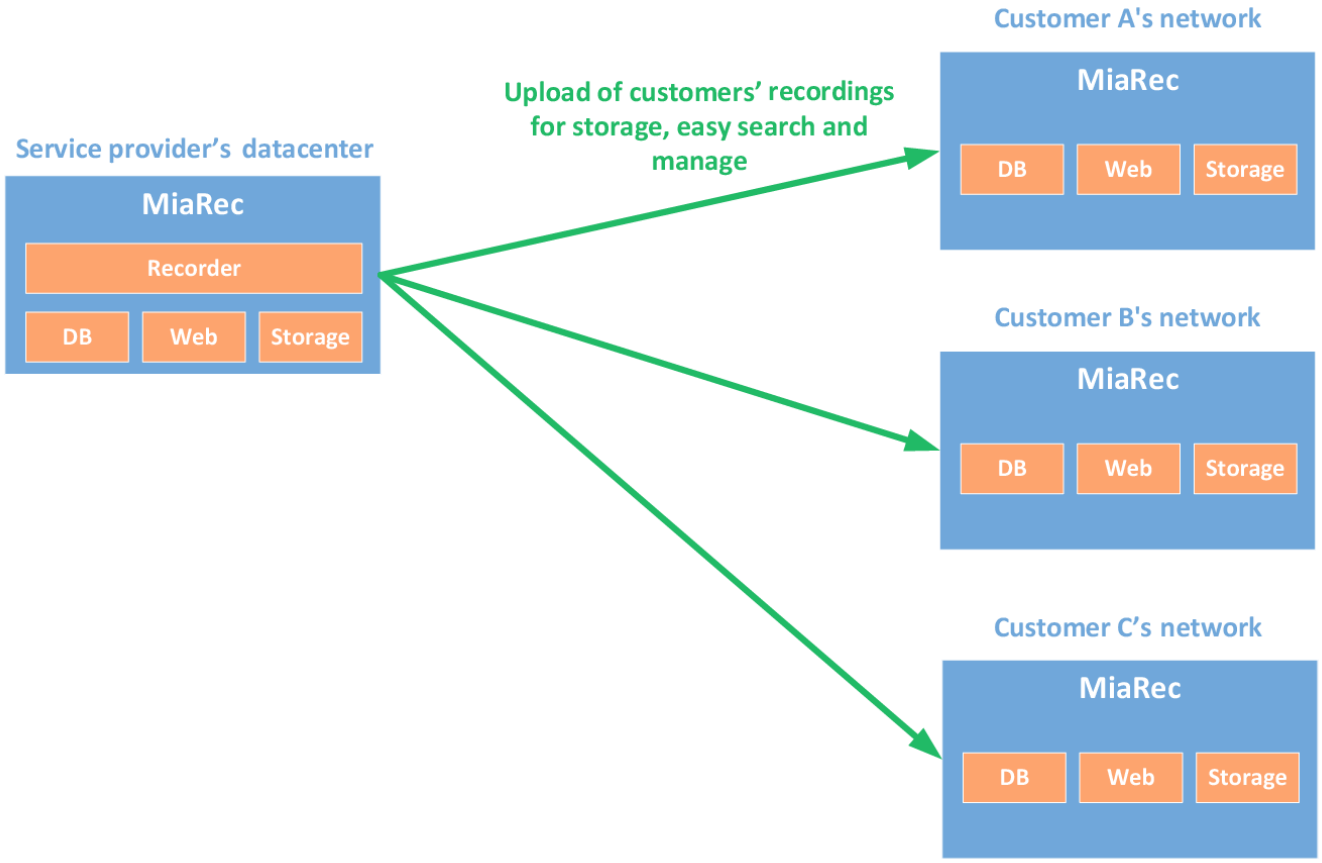
Redundant recorder with BroadWorks SIPREC



Redundant recorder with Cisco Built-in-Bridge



Upload call recordings from service provider to customer network



5.5.3 Configuring target server (recipient)

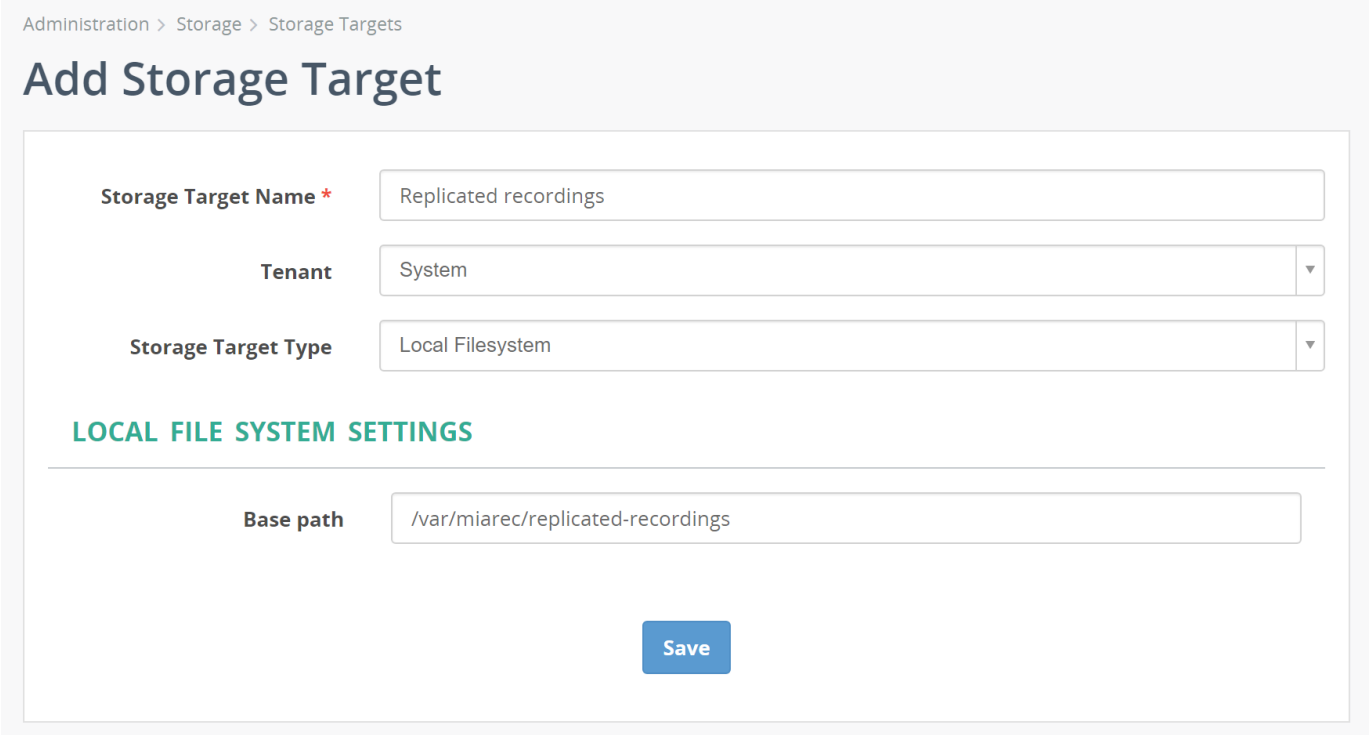
Step 1. Create Storage Target for the received recordings

Navigate to **Administration -> Storage -> Storage Targets**, click **Add** button to create new storage target for the received files from a remote server.

Supported storage target types:

- Local File System (the same server, where the web portal component is running on)
- Network Share (SMB)
- FTP/FTPS Server
- SFTP Server
- Amazon S3 bucket

In this example, we create a Local File System storage target, i.e. the received files will be stored on the local server, where the MiaRec web portal is running on.



When Local File System storage is used and the web portal is running on Linux, then you need to change ownership to the folder on disk. Execute the following command (change the file path as necessary):

On Centos:

```
chown -R apache:apache /var/miarec/replicated-recordings
```

On Ubuntu:

```
chown -R www-data:www-data /var/miarec/replicated-recordings
```

Caution! Do not use the same folder for storing the locally recorded files as well as replicated files as it will cause permission issues. The locally recorded files are stored by default at `/var/miarec/recordings`.

Step 2. Create the incoming replication token.

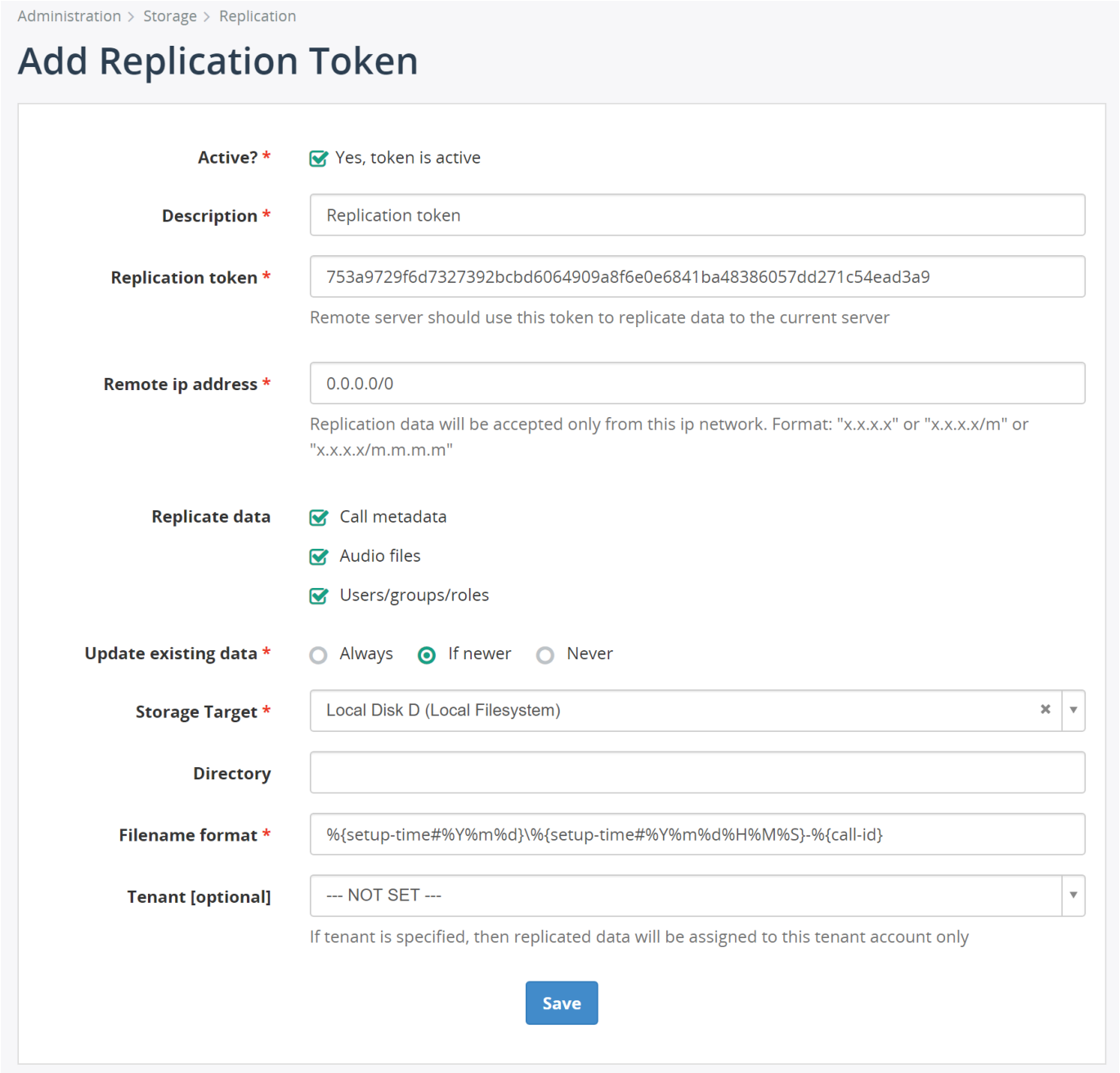
Navigate to **Administration -> Storage -> Replication** to configure incoming replication token

Click on **Add token** button to create a secure token for incoming replication. This secure token will be used by the sender server to upload data to the target server.

Fill out the following parameters:

- **Replication token**. A replication token, auto-generated. Optionally, it can be modified.
- **Remote ip address** (recommended). The IP-address or IP network mask of the sender server. This parameter can be set to "0.0.0.0/0" to accept replication data from any IP-address.
- **Replicate data**. Data that is replicated
- **Update existing data**. A conflict resolution strategy when the same record is updated on both servers.
- **Storage target**. A location of the received data (audio files)
- **Directory** (optional). A sub-directory within the Storage Target path
- **Filename format**. A format for filenames and, optionally, directories. The replication process can inject various call metadata attributes into file/directory names. For example, it can create directory for each day in format `YYYYMMDD` and then include `caller-number` and `called-number` into file name. More details about file name format **Tenant** (optional). When specified, the replicated data will be imported into the specified tenant account.

The same target server may receive data from multiple source servers. You will need to create a token for each source server.



Hit **Save** button.

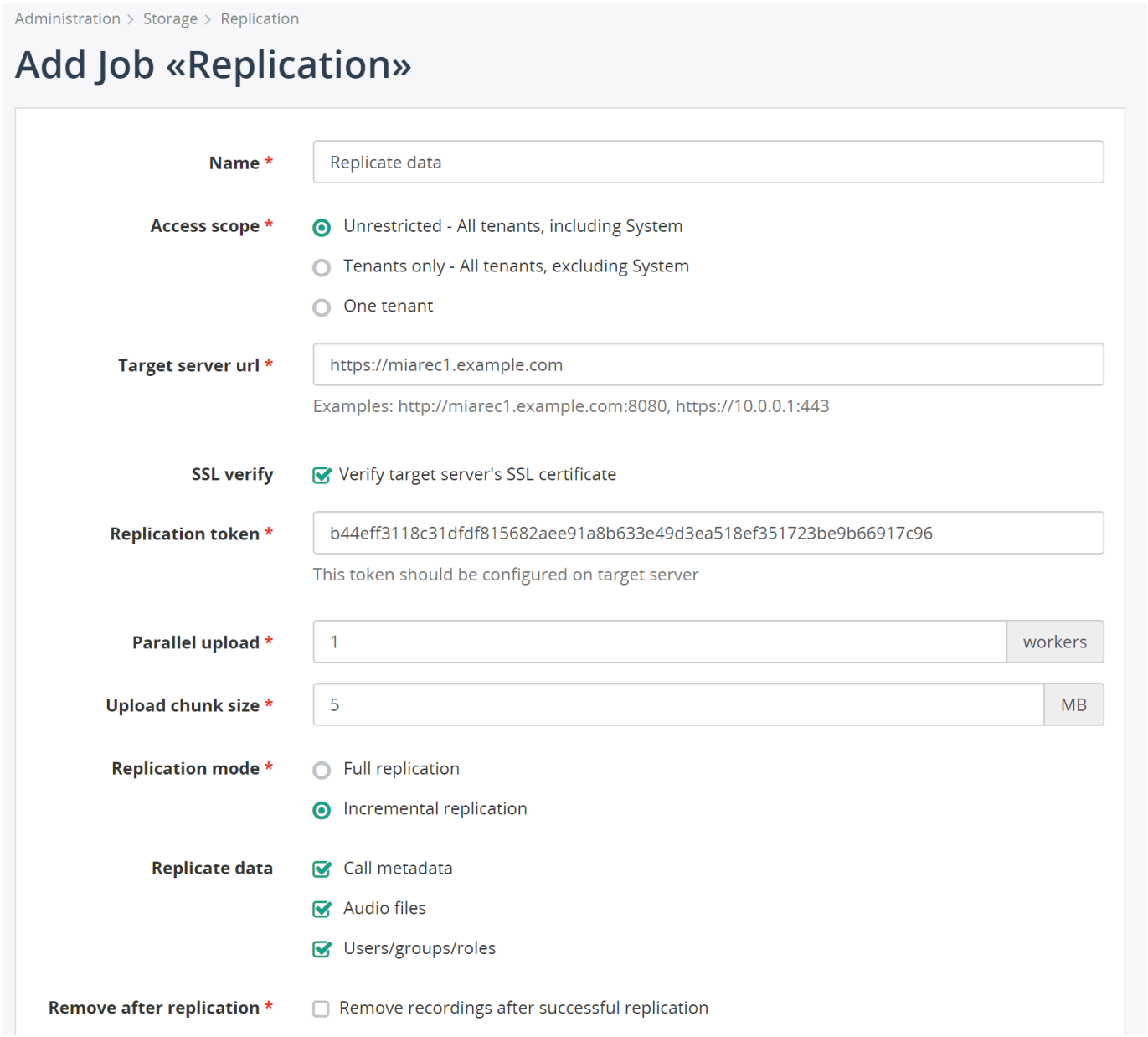
5.5.4 Configuring replication server (sender)

Navigate to **Administration -> Storage -> Replication -> Outgoing Replication** on the source (sender) replication server to create an outgoing replication job.

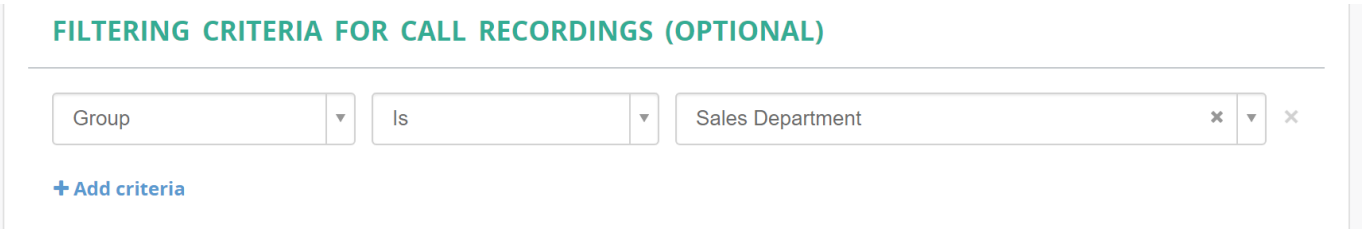
Click **New Job** button to create the replication job. If necessary, you may create multiple replication jobs to upload the same recordings to multiple target servers simultaneously.

Fill out the required configuration parameters:

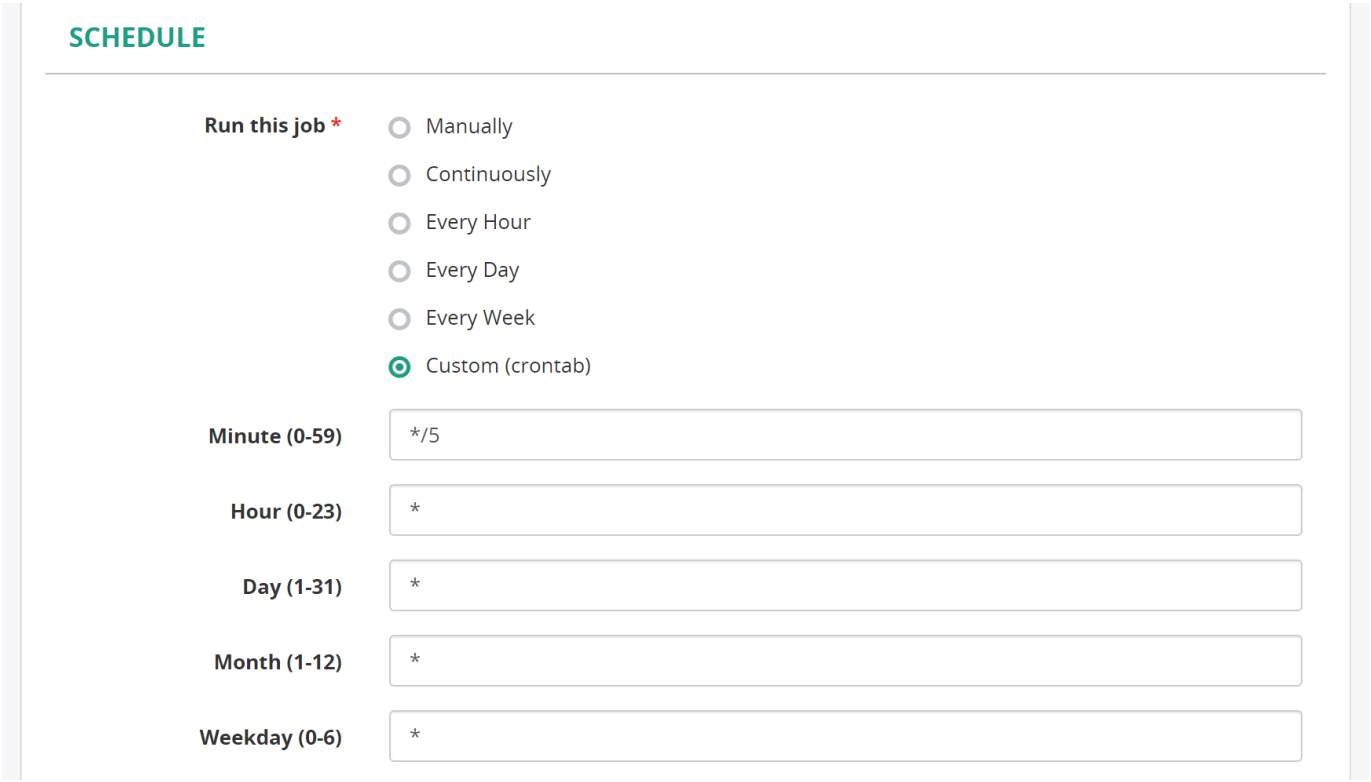
- **Access scope** (visible in multi-tenant version only). Specifies what tenants are replicated to the target server.
- **Target server url**. The URL (domain or IP-address) or the target server web portal.
- **SSL verify**. If enabled and a domain name is used for the **Target server url**, then the sender automatically verifies the target server's SSL certificate (recommended).
- **Replication token**. A secure replication token created on the target server. See the previous step
- **Parallel upload**. A number of parallel upload workers sending data simultaneously. Depending on network latency, an increase of the parallel workers may improve a replication speed due to better bandwidth utilization.
- **Upload chunk size**. A maximum file chunk per one upload request. Depending on network bandwidth/latency, an increase of this attribute may improve a replication speed.
- **Replication mode**. Full or incremental replication mode.
- **Full replication mode** will upload all call recordings to target server everytime the job is started. It will gracefully skip upload process if the target server contains such recordings already.
- **Incremental replication mode** remembers which records have been uploaded already to the target server and do not process them on next start. Such mode is useful when job is scheduled for periodic replication (every hour/day etc). It will work a lot faster than the full replication mode because it will skip automatically the previously uploaded recordings.
- **Replicate data**. Type of data to be replicated (audio files, call metadata, users configuration).
- **Remove after replication**. The recordings can be deleted automatically after successful replication.



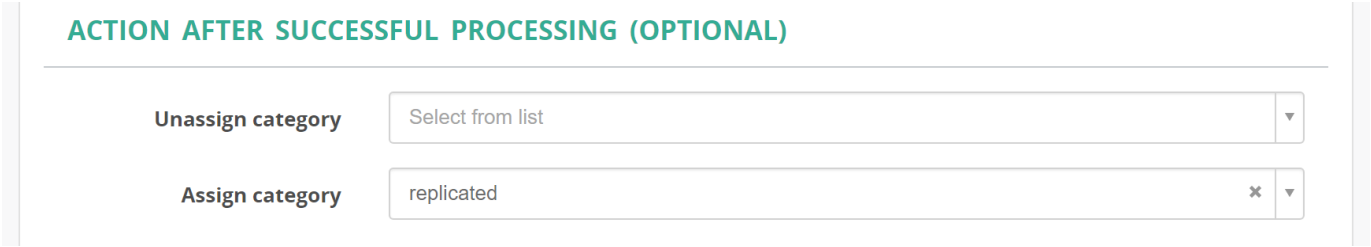
Each replication job supports filtering criteria to limit what call recordings are uploaded to the target server. For example, you may configure replication for specific group of users only.



Replication job may be started manually or automatically by schedule. Schedule may be configured by time (for example every hour/day/week) or automatic continuous replication. With continuous replication call recordings are uploaded to the target server immediately upon call completion.



Optionally, the replication process may assign/unassign a category once the recording is replicated. This capability can be used to create a chain of post-processing, like relocate files first, then replicate, then transcribe, etc.



Status of replication job is available on job page. For incremental replication mode MiaRec stores statistics of replicated calls per day.

5.6 Retention policy

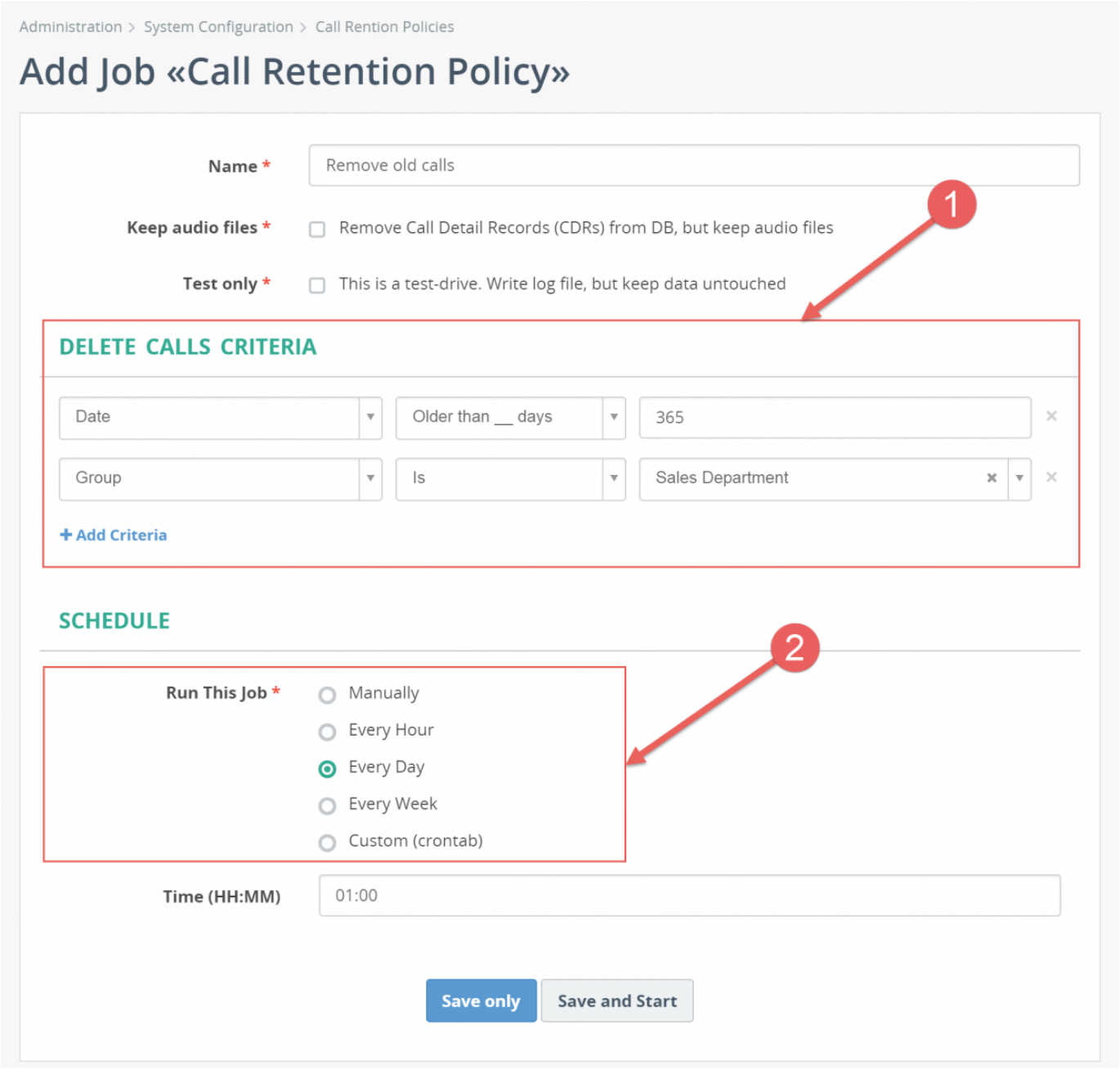
Navigate to **Administration -> Storage -> Retention Policies** to add one or more retention policies.

You can create more than one retention policies. For example, one group of users will have retention period 3 years, while other groups will have retention period 7 years.

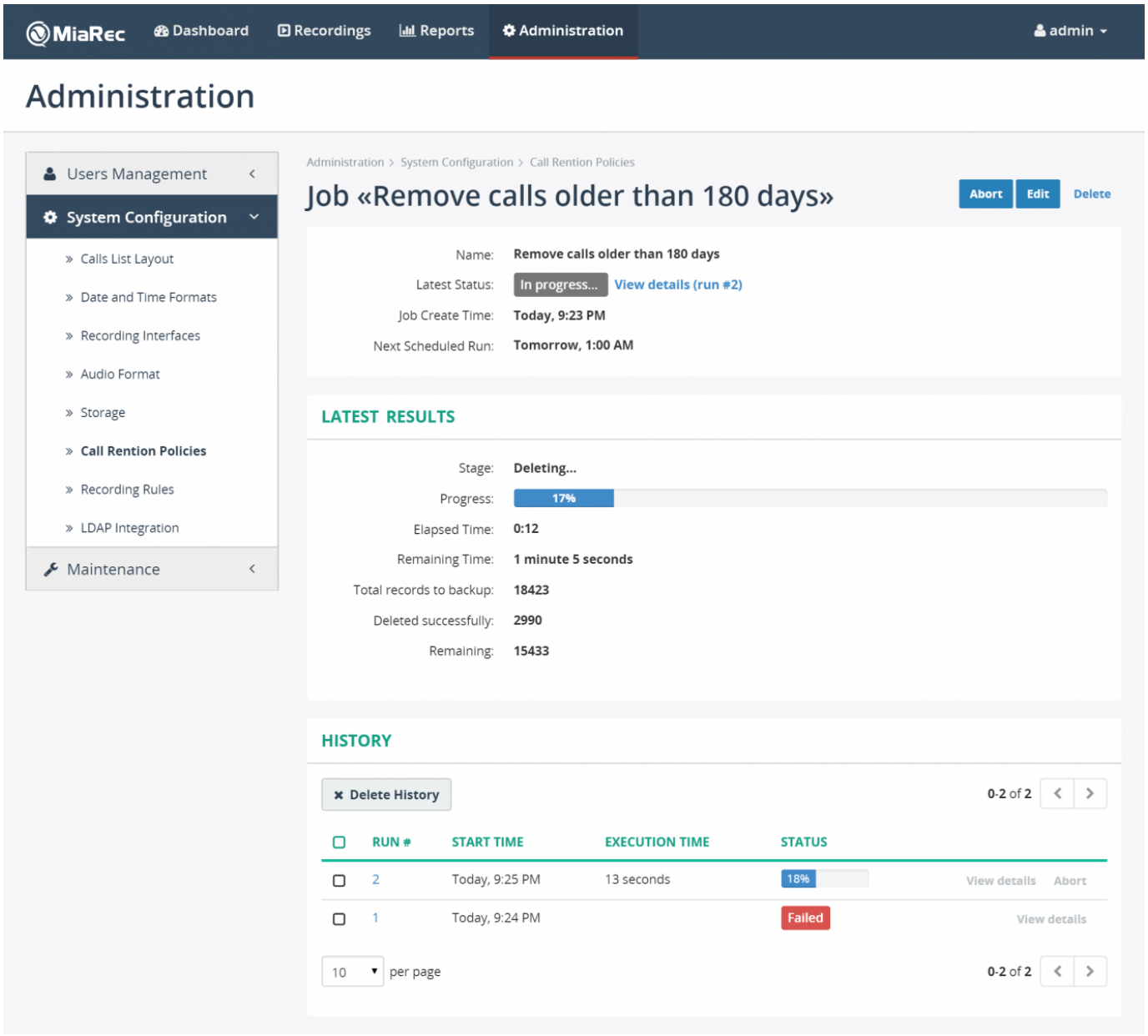
Click on "New Job" to create a retention policy job.

Inside the job settings you can specify the filtering criteria, for example, delete recording that are older than 180 days, limit to a particular group of users, etc.

Retention job may be started manually or automatically by schedule.



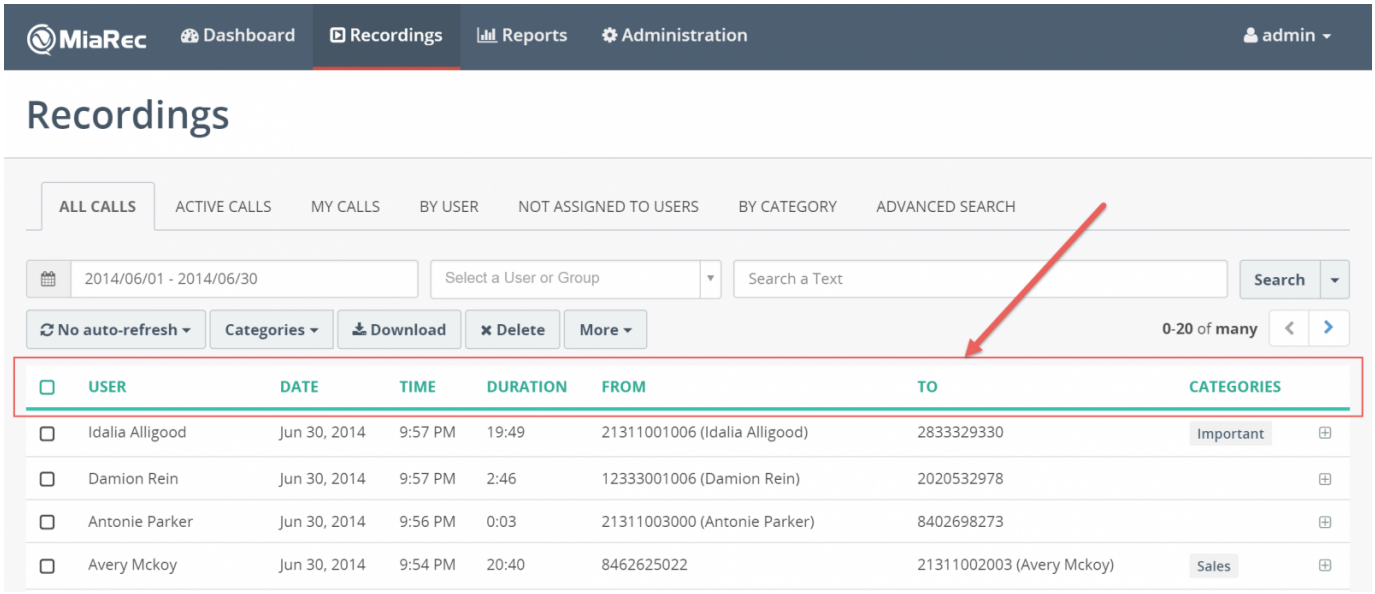
Results of a retention job execution are displayed on the job page.


MiaRec
Dashboard
Recordings
Reports
Administration
admin
Administration
Users Management
System Configuration
Calls List Layout
Date and Time Formats
Recording Interfaces
Audio Format
Storage
Call Rention Policies
Recording Rules
LDAP Integration
Maintenance
Administration > System Configuration > Call Rention Policies
Job «Remove calls older than 180 days»
Abort
Edit
Delete
Name: Remove calls older than 180 days
Latest Status: In progress... View details (run #2)
Job Create Time: Today, 9:23 PM
Next Scheduled Run: Tomorrow, 1:00 AM
LATEST RESULTS
Stage: Deleting...
Progress: 17%
Elapsed Time: 0:12
Remaining Time: 1 minute 5 seconds
Total records to backup: 18423
Deleted successfully: 2990
Remaining: 15433
HISTORY
Delete History
0-2 of 2
RUN #
START TIME
EXECUTION TIME
STATUS
2 Today, 9:25 PM 13 seconds 18% View details Abort
1 Today, 9:24 PM Failed View details
10 per page
0-2 of 2

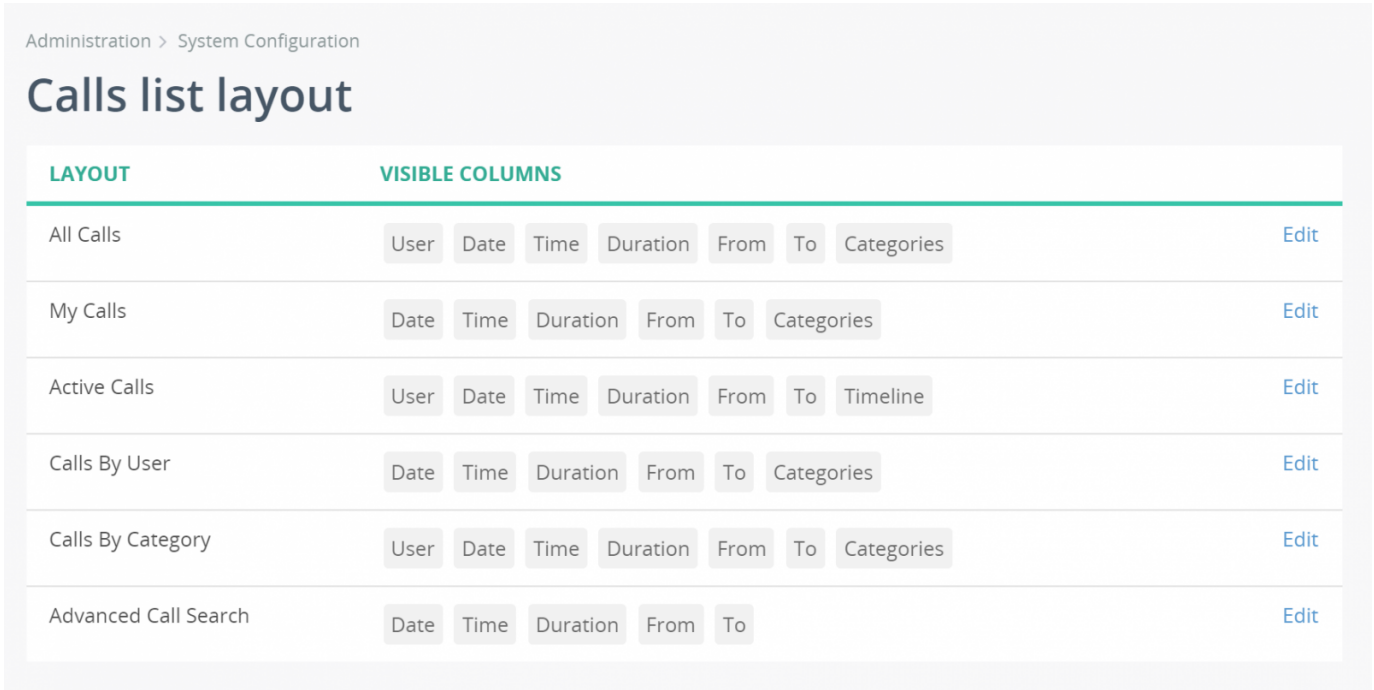
6. Customization

6.1 Calls list layout

A list of visible columns is configurable.

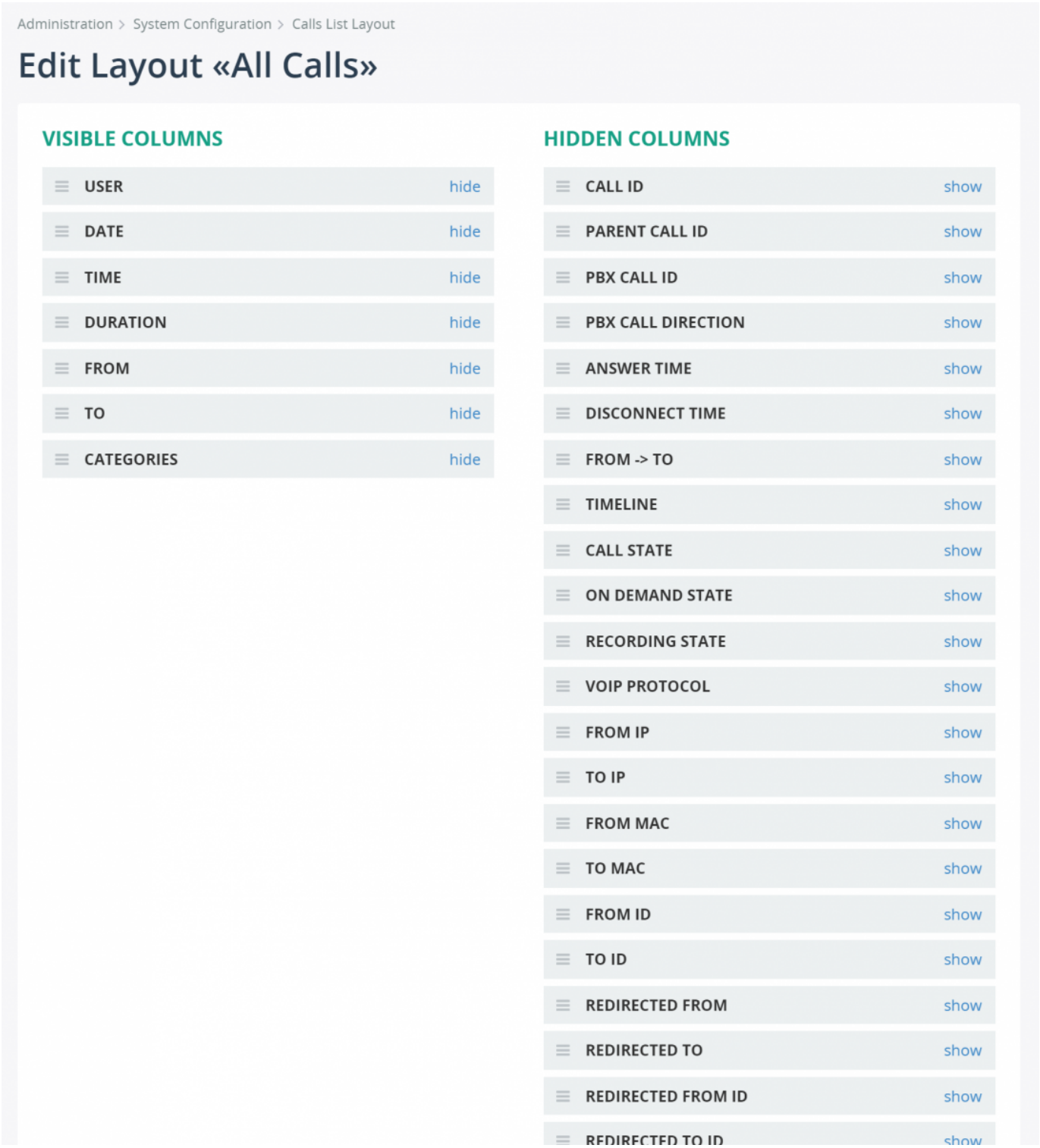


Navigate to **Administration -> System Configuration -> Calls List Layout** to specify which columns are visible.



Click on **Edit** button for appropriate list to change visible columns and their orders.

You can drag-and-drop columns to change their order.

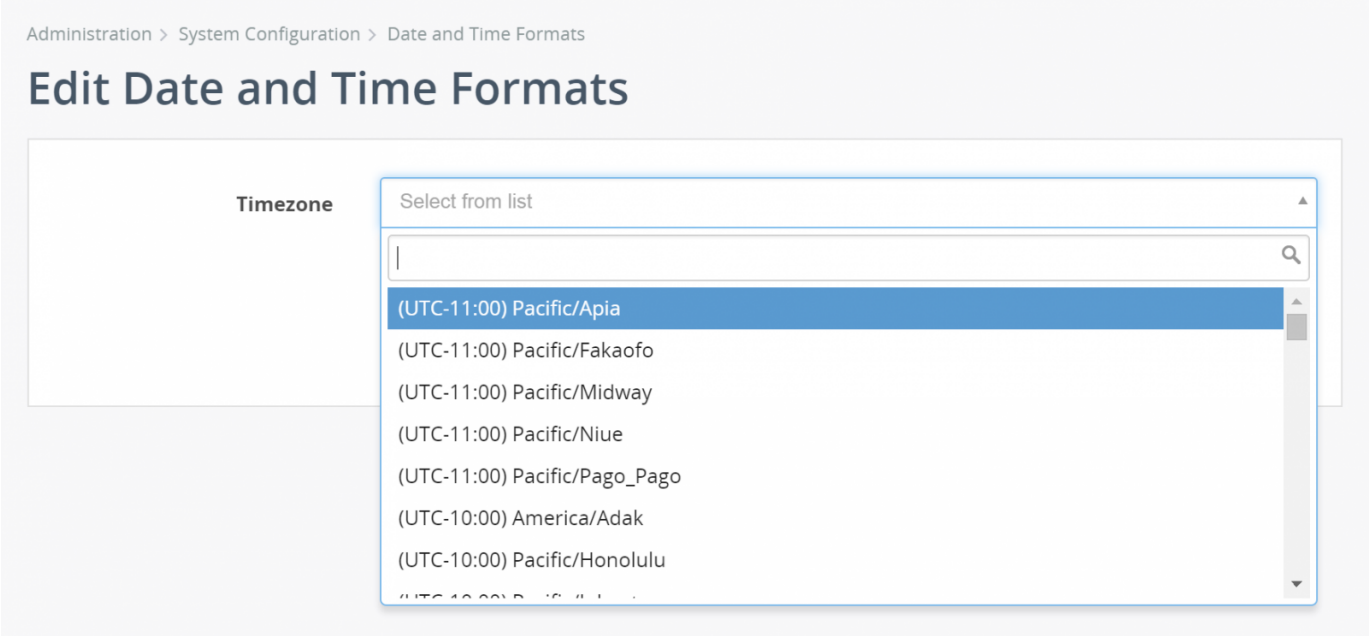

Administration > System Configuration > Calls List Layout
Edit Layout «All Calls»
VISIBLE COLUMNS
USER hide
DATE hide
TIME hide
DURATION hide
FROM hide
TO hide
CATEGORIES hide
HIDDEN COLUMNS
CALL ID show
PARENT CALL ID show
PBX CALL ID show
PBX CALL DIRECTION show
ANSWER TIME show
DISCONNECT TIME show
FROM -> TO show
TIMELINE show
CALL STATE show
ON DEMAND STATE show
RECORDING STATE show
VOIP PROTOCOL show
FROM IP show
TO IP show
FROM MAC show
TO MAC show
FROM ID show
TO ID show
REDIRECTED FROM show
REDIRECTED TO show
REDIRECTED FROM ID show
REDIRECTED TO ID show

6.2 Timezone settings

By default MiaRec uses timezone settings of the server on which is running.

Navigate to **Administration -> System Configuration -> Date and Time Formats** to change a default timezone value.

This timezone value will be used for all users as a default value. Additionally it is possible to specify unique timezone value for tenant, group or individual user. Navigate to tenant/group/user profile web-page to edit timezone value.



6.3 Translate MiaRec to other language

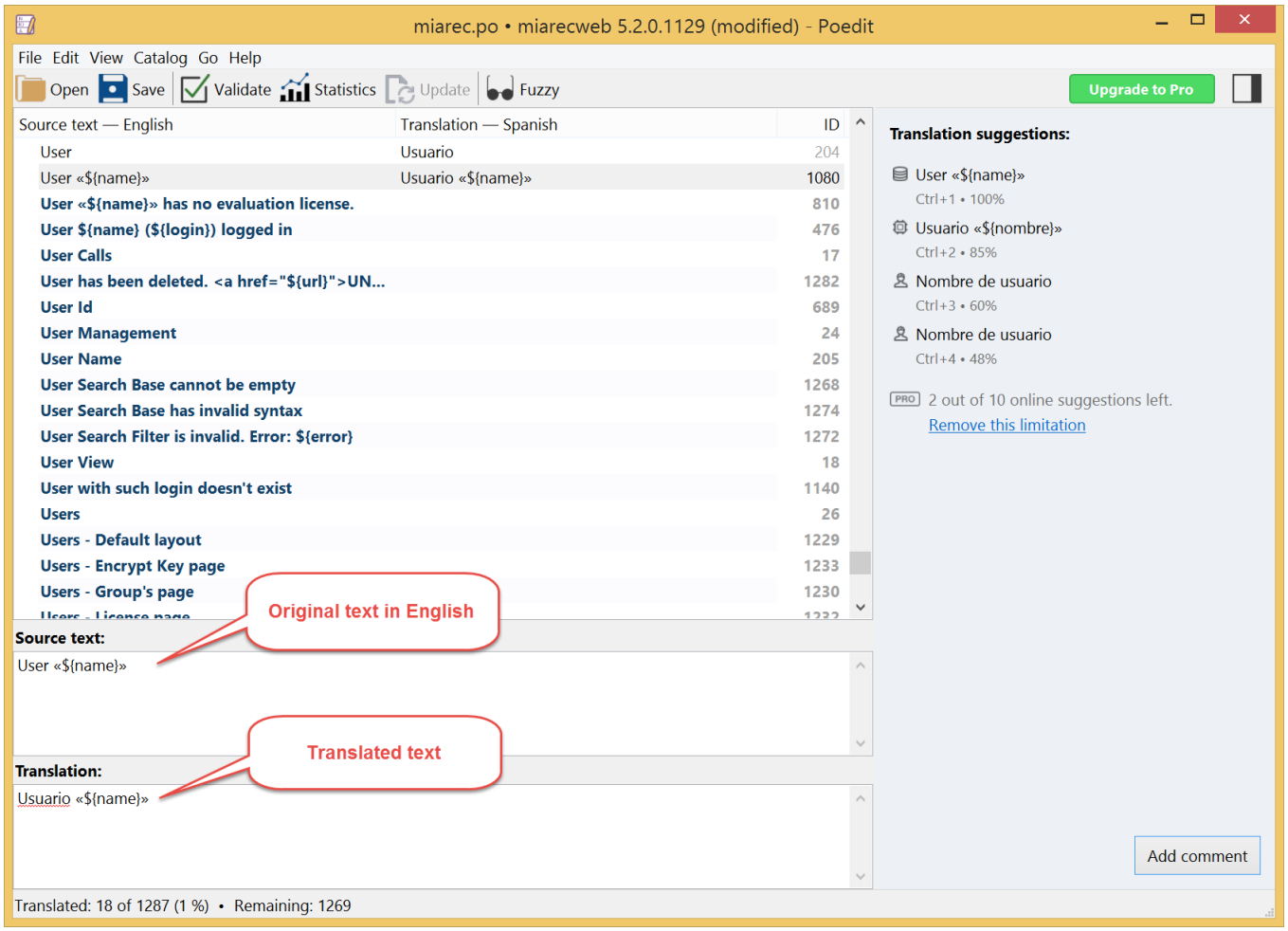
MiaRec offers internationalization and localization of user interface. If you would like to edit existing translation or create translation for new language, you can use POEdit application or any other application supporting **gettext** *.po file format.

First, you need to contact MiaRec team and ask for *.po file for your language.

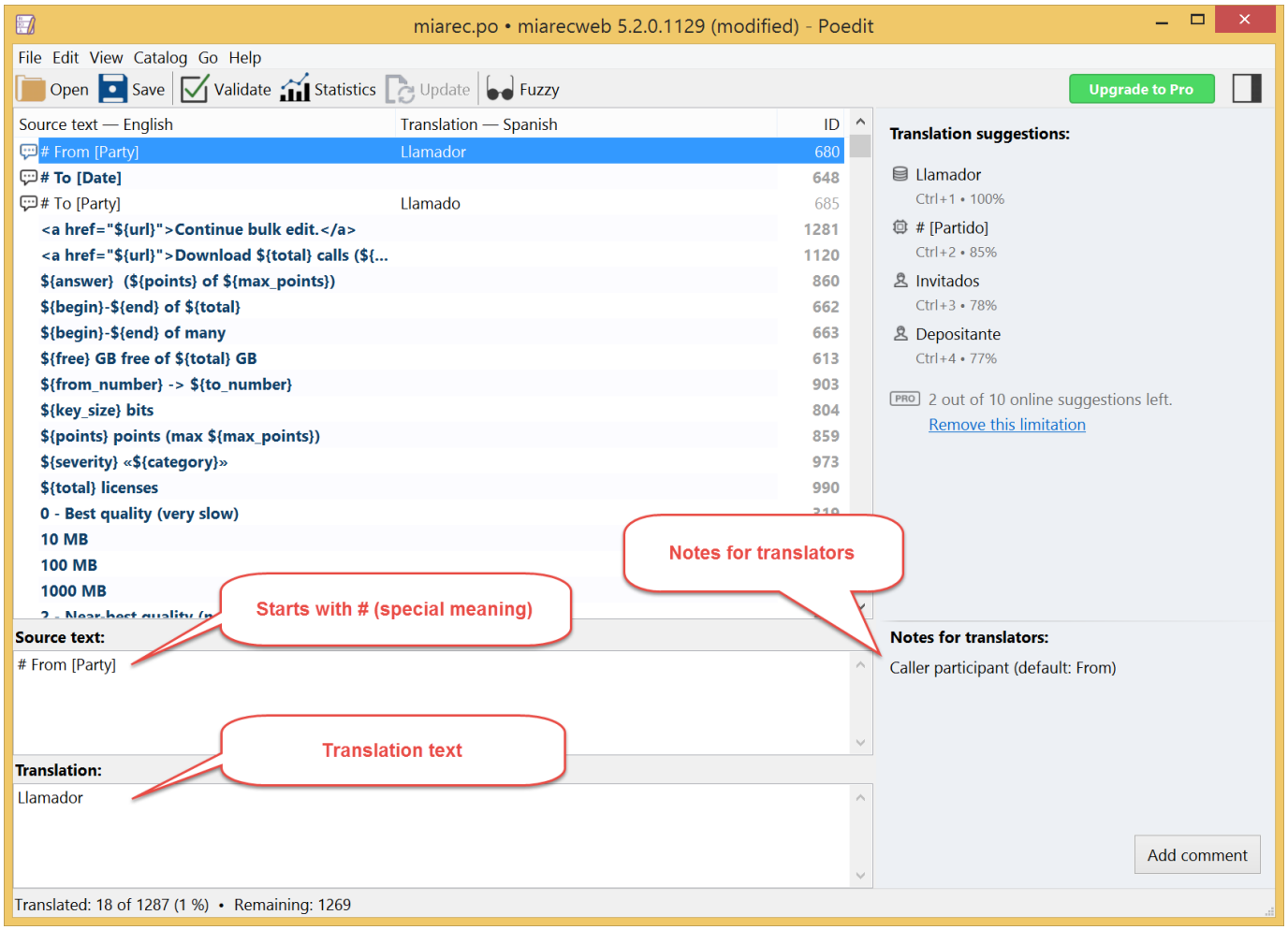
Once you have PO file, open it in POEdit application and translate english phrases to your language. When finished, send the PO file back to MiaRec team for inclusion into distributive.

You need to know a few formats, which are used in MiaRec to represent text:

1. Text within `${ }` brackets should be kept AS IS (not translated). These are placeholders, which will be replaced with appropriate values when displaying in UI. For example, text `User ${name}` may be displayed in UI as `User David`



2. Text starring with `#` (hash) symbol has special meaning. It doesn't not need to be translated word-by-word. It is used to distinguish words, which have the same writing, but different meaning. For example, word "from" may be used together with date value or as label for "caller party". In PO file you will find "# From [date]" and "# From [party]", which are both displayed in English as "From", but in other languages it may require different translations, for example, in Spanish they are translated to "desde" and "Llamador" correspondingly. Pay attention to notes in the right bottom corner of POEdit application.


miarec.po • miarecweb 5.2.0.1129 (modified) - Poedit
File Edit View Catalog Go Help
Open Save Validate Statistics Update Fuzzy
Upgrade to Pro
Source text — English
Translation — Spanish
ID
From [Party]
Llamador
680
To [Date]
648
To [Party]
Llamado
685
Continue bulk edit.
1281
<a href="${url}">Download ${total} calls (${...
1120
${answer} (${points} of ${max_points})
860
${begin}-${end} of ${total}
662
${begin}-${end} of many
663
${free} GB free of ${total} GB
613
${from_number} -> ${to_number}
903
${key_size} bits
804
${points} points (max ${max_points})
859
${severity} «${category}»
973
${total} licenses
990
0 - Best quality (very slow)
10 MB
100 MB
1000 MB
Translation suggestions:
Llamador
Ctrl+1 • 100%
[Partido]
Ctrl+2 • 85%
Invitados
Ctrl+3 • 78%
Depositante
Ctrl+4 • 77%
PRO 2 out of 10 online suggestions left.
Remove this limitation
Notes for translators
Starts with # (special meaning)
Source text:
From [Party]
Notes for translators:
Caller participant (default: From)
Translation text
Translation:
Llamador
Add comment
Translated: 18 of 1287 (1 %) • Remaining: 1269

7. Security

7.1 MiaRec and Apache Log4j vulnerability CVE-2021-44228 statement

Various information security news outlets reported on the discovery of critical vulnerability CVE-2021-44228 in the Apache Log4j library (CVSS severity level 10 out of 10).

This articles explains how this vulnerability affects the MiaRec application.

In short:

The MiaRec application is not affected by CVE-2021-44228.

Longer explanation:

MiaRec application is not written in Java. It doesn't use Log4j library, so it is not affected by CVE-2021-44228.

MiaRec uses Apache httpd web server as one of its components. This product is not written in Java either, i.e. it is not affected by CVE-2021-44228.

7.2 PCI scanners and false positives

This article describes how to deal with some vulnerabilities reports generated by automated scanner tools.

Who is this article for?

This article is for MiaRec customers who use automated scanners to test MiaRec server(s) against know security vulnerabilities. The scanners may report false positive vulnerabilities.

What is a false positive?

Some security scanning and auditing tools make decisions about vulnerabilities based solely on the version number of components they find. This results in false positives as the tools do not take into account backported security fixes. Old version may not have the reported vulnerability if the fix is already applied to it.

What is a Security Backporting?

> Note, this article applies to MiaRec installations on Linux OS only. On Windows version, we use a different approach to deal with security vulnerabilities reports.

The term "backporting" describes the action of taking a fix of a security flow out of the most recent version of an upstream package and applying that fix to an older version of the package.

MiaRec software is deployed on Centos or RedHat operating system (FYI, Centos is based on RedHat Enterprise Linux distributive). RedHat (a company) uses Security Backporting Practice to apply the most recent fixes to older versions of the software packages.

To keep the server secure and patched, it is enough to run the command:

```
yum update
```

To see a list of all patches/fixes applied to the system, install `yum-changelog` package with:

```
sudo yum install yum-changelog
```

For example, to check all the backported patches to "httpd" (Apache) package, run:

```
yum changelog all httpd
```

This command will show all currently installed patches as well as all available patches, that may be installed with `yum update <package>` command.

Example of output:

```
==================== Installed Packages ====================
httpd-2.4.6-80.el7.centos.1.x86_64       installed
* Tue Sep 19 05:00:00 2017 Lubo? Uhliarik <luhliari@redhat.com> - 2.4.6-69
- Resolves: #1493065 - CVE-2017-9798 httpd: Use-after-free by limiting
  unregistered HTTP method

* Tue Jul 25 05:00:00 2017 Lubo? Uhliarik <luhliari@redhat.com> - 2.4.6-68
- Resolves: #1463194 - CVE-2017-3167 httpd: ap_get_basic_auth_pw()
  authentication bypass

...

==================== Available Packages ====================
httpd-2.4.6-93.el7.centos.x86_64         base
* Tue Oct  8 05:00:00 2019 Lubos Uhliarik <luhliari@redhat.com> - 2.4.6-93
- Resolves: #1677496 - CVE-2018-17199 httpd: mod_session_cookie does not respect
  expiry time

* Thu Aug 22 05:00:00 2019 Joe Orton <jorton@redhat.com> - 2.4.6-92
- htpasswd: add SHA-2 crypt() support (#1486889)

...
```

As you can see, the `yum changelog` output includes information about what `CVE-` vulnerabilities have been fixed with each update. You can save this output into a file for later review, or use `grep` command to check if a certain vulnerability is already fixed:

```
yum changelog all httpd > httpd_patches.txt

yum changelog all httpd | grep "CVE-2019-0220"
```

Why not simply upgrade the vulnerable software to the most recent version?

None of software exists in isolation. Any individual software component usually needs to integrate with other software components. All these components work together as a tightly integrated, complex solution.

An update of a single component to the latest version may cause compatibility issues to other components. To keep a software solution reliable and stable, we recommend to use security backporting rather than version upgrades as a solution to security issues.

We still use version upgrades for MiaRec solution from time to time, when it makes sense. Anyway, we perform a thorough testing of the new package version(s) to guarantee compatibility and stability of a whole solution.

How to treat reports from PCI scanner vulnerabilities?

Any report should be reviewed by the qualified personnel to determine if it contains false positives.

Vulnarebilties are usually named with "CVE-" prefix. If a report complaints that version of a system package is old, execute `yum changelog <package>` command and search for the corresponding CVE issue number. There are high chances that this issue has been already fixed/backported.

To keep system secure and updated, run periodically the system update command:

```
yum update
```

Note, the `yum update` command my require a server reboot. It is highly recommended to do it during maintenance window and begin with a secondary MiaRec server first. When a stability of the secondary server is confirmed, continue to the primary MiaRec server (in a few days).

Submit to PCI scanner vendor the print of `yum changelog` command. They can review it and mark your server as non-vulnerable to that particular issue.

Contact MiaRec team if you have any questions.

7.3 Security hardening for Apache web server

7.3.1 1. Enable HTTPS (SSL)

It is highly recommended to use HTTPS (encrypted) communication rather than HTTP.

7.3.2 2. Disable deprecated SSL/TLS protocols, allow TLS v1.2 only

It is recommended to disable SSL version 3.0 protocol, and force clients to use more secure TLS v1.2

Edit file `/etc/httpd/conf.d/ssl.conf` (for Centos 7), locate the **SSLProtocol** line, if its commented out with a **#**, remove the hash (#) symbol and change it to the following:

```
SSLProtocol TLSv1.2
```

Now to increase the security strength we can also disable the weaker ciphers, located the **SSLCipherSuite** line, uncomment it and make it:

```
SSLCipherSuite HIGH:MEDIUM:!SSLv3:!kRSA:!RC4:!3DES
```

7.3.3 3. Disable TRACE method

Add the following line to the end of file `/etc/httpd/conf/httpd.conf`:

```
TraceEnable off
```

7.3.4 4. Enable HTTP Strict Transport Security

The Strict-Transport-Security header is a security enhancement that restricts web browsers to access web servers solely over HTTPS. This ensures the connection cannot be establish through an insecure HTTP connection which could be susceptible to attacks.

All major modern browsers currently support HTTP strict transport security except for Opera Mini and versions previous of Internet Explorer.

Edit file `/etc/httpd/conf.d/ssl.conf` (for Centos 7), locate the line `<VirtualHost _default_:443>` and add the following lines there:

```
<VirtualHost _default_:443>
  <IfModule mod_headers.c>
    Header always set Strict-Transport-Security "max-age=63072000; includeSubDomains; preload"
  </IfModule>
```

7.3.5 5. Hide version information from response.

By default, Apache sends back to clients a response that includes a description of the generic OS-type of the server as well as information about compiled-in modules, like `Server: Apache/2.4.2 (Unix) PHP/4.2.2 MyMod/1.2`.

Exposing information about the server version increases the ability of attackers to exploit certain vulnerabilities, if they are not patched yet.

To hide the server version information, add the following line to the end of file `/etc/httpd/conf/httpd.conf`:

```
ServerTokens Prod
```

With these changes, a response from the web server will contain `Server: Apache` infoonly.

7.3.6 6. Reduce MIME type security risks

The following change helps prevent attacks based on MIME-type confusion.

Add the following line to the end of file `/etc/httpd/conf/httpd.conf`:

```
Header set X-Content-Type-Options "nosniff"
```

7.3.7 7. Enable X-XSS-Protection

The X-XSS-Protection header is designed to enable the cross-site scripting (XSS) filter built into modern web browsers. This is usually enabled by default, but using it will enforce it. It is supported by Internet Explorer 8+, Chrome, and Safari.

Add the following line to the end of file `/etc/httpd/conf/httpd.conf`:

```
Header set X-XSS-Protection "1; mode=block"
```

7.3.8 8. Configure X-Frame-Options

The X-Frame-Options header is designed to prevent site content embedded into other sites. It is recommended to use as a defence against Clickjacking attacks.

Add the following line to the end of file `/etc/httpd/conf/httpd.conf`:

```
Header set X-Frame-Options: "SAMEORIGIN"
```

7.3.9 9. Reload Apache configuration

Centos 7:

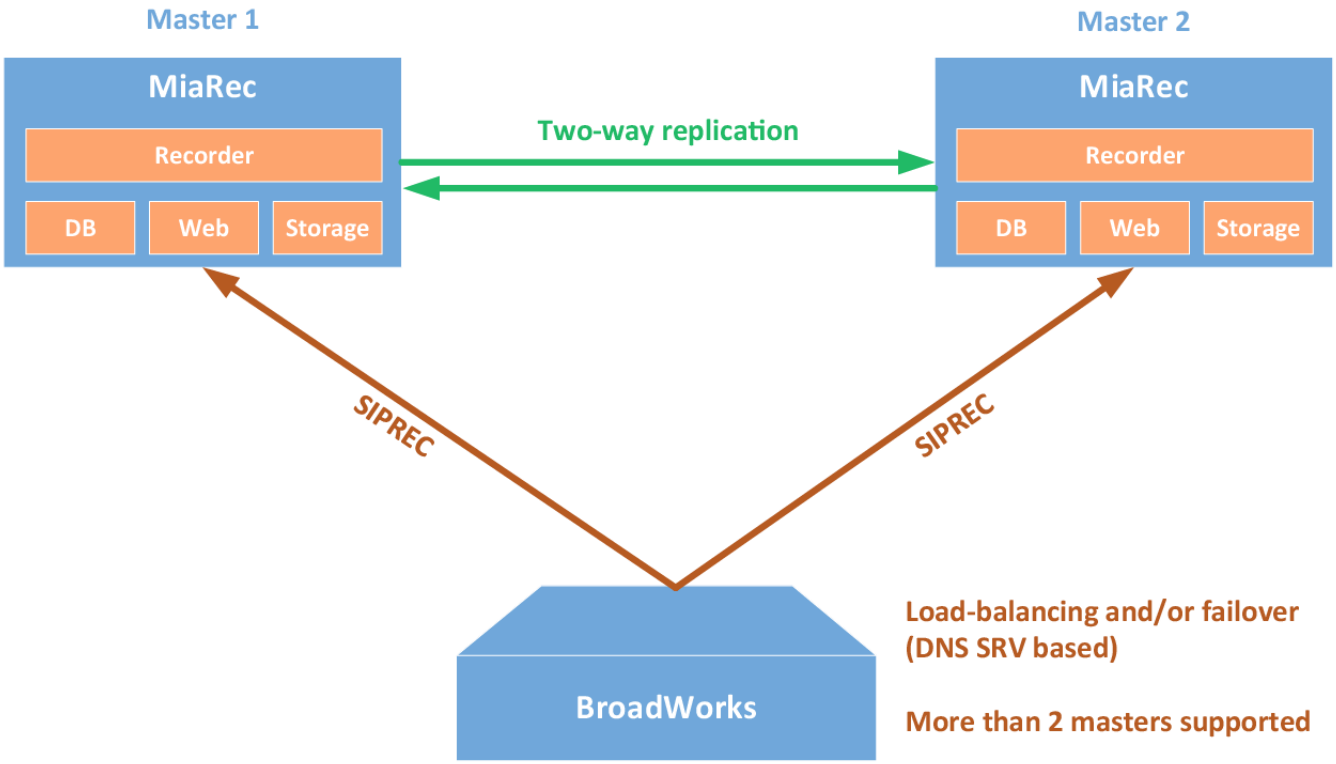
```
service httpd reload
```

8. High availability

8.1 Overview

MiaRec implements a redundant, high availability architecture.

Below diagram show a network design of redundant recording in BroadWorks environment. Similar design applies to Cisco Built-in-Bridge recording interface, SIPREC recording interface for Metaswitch CFS, Metaswitch Perimeta SBC, Avaya SBC, Oracle/AcmePacket SBC.



8.1.1 Supported features

- Automatic fail over to the next available server in a cluster
- Load balancing of recording traffic between multiple servers
- More than 2 master servers in a cluster
- Geographical redundancy
- Replication of data may be continuous (immediately upon call completion) or by schedule (at night during low load hours).

8.1.2 How it works

A MiaRec cluster supports 2 and more servers. Any server in a cluster may receive recordings at any time. Upon call completion, audio files and call metadata is automatically uploaded/synchronized to other servers in a cluster.

This document describes implementation of redundancy for BroadWorks SIPREC and Cisco SIP Trunk built-in-bridge recording methods. Implementation of recording interface for these two platforms is based on similar principles with some variations.

Redundancy - new recordings

At the beginning of call recording, the phone system (Broadworks / Cisco UCM) sends SIP INVITE to the first available server in a cluster. If the primary server is down or its network is disconnected, it cannot respond to the SIP invitation. The usual SIP processing in this case is to deliver the invitation to the next recording server in the preference list.

Redundancy - in-progress recordings

If a recording server fails, all active recordings will be interrupted. If failure was caused by issues with network, then call recordings will be completed automatically by timeout (configurable). If failure was caused by hardware/software issue with recording process, then such recordings will remain in ACTIVE state till administrator manually mark them as completed. In both cases, the recording data will contain media from the beginning of call till the failure moment (unless there is issue with disk system).

MiaRec supports advanced architecture in order to achieve fault-tolerant architecture for in-progress calls. This architecture involves a dedicated recording server, which is configured in passive recording mode. Currently it is tested only for Cisco BiB protocol, but may work for SIPREC protocol with other phone platforms as well. The Cisco BiB network traffic, which is sent to the primary recording server, should be mirrored to a redundant server, which works in passive recording mode. This server records a copy of each call that is captured by the primary server. In case of the primary server failure in a middle of call, the redundant server has ability to continue recording of such call till the call disconnect. Such mechanism is based on architecture of Cisco Built-in-Bridge mechanism. Once media forking is activated, Cisco IP phone continues to send RTP packets to the primary recorder even if the latter is not reachable anymore. The phone doesn’t stop sending of RTP packets even if it receives “port is unreachable” ICMP error message. The redundant server continues to capture such RTP packets till call completes. This allows to achieve 100% redundancy for call recording.

Redundancy - completed recordings

After a recording is complete, MiaRec adds the call recording into queue for automatic replication to other server(s) in a cluster. Such data replication may be started immediately upon call completion or scheduled to specific time of day (for example, at night).

8.1.3 Geographical redundancy

MiaRec servers in a cluster may reside in different datacenter for geographical redundancy. There is no requirement for minimum latency between servers. It is only required that bandwidth between datacenters is enough to process data replication.

Data replication may configured as continuous (immediately upon call completion) or by schedule at specific time (for example, at night during low load hours).

Although there is no requirement to the 100% of availability of network link between datacenters. In case of unavailability of the target replication server, the replication process will be retried when network connection is restored.

The source replication server uses queue for data replication. The call recording is removed from queue only after successful replication. Overhead on queue is insignificant (it uses only a hundred of bytes per call recording in replication queue).

8.2 High availability for BroadWorks SIPREC recording

High availability and automatic failover for SIPREC interface is based on two technologies:

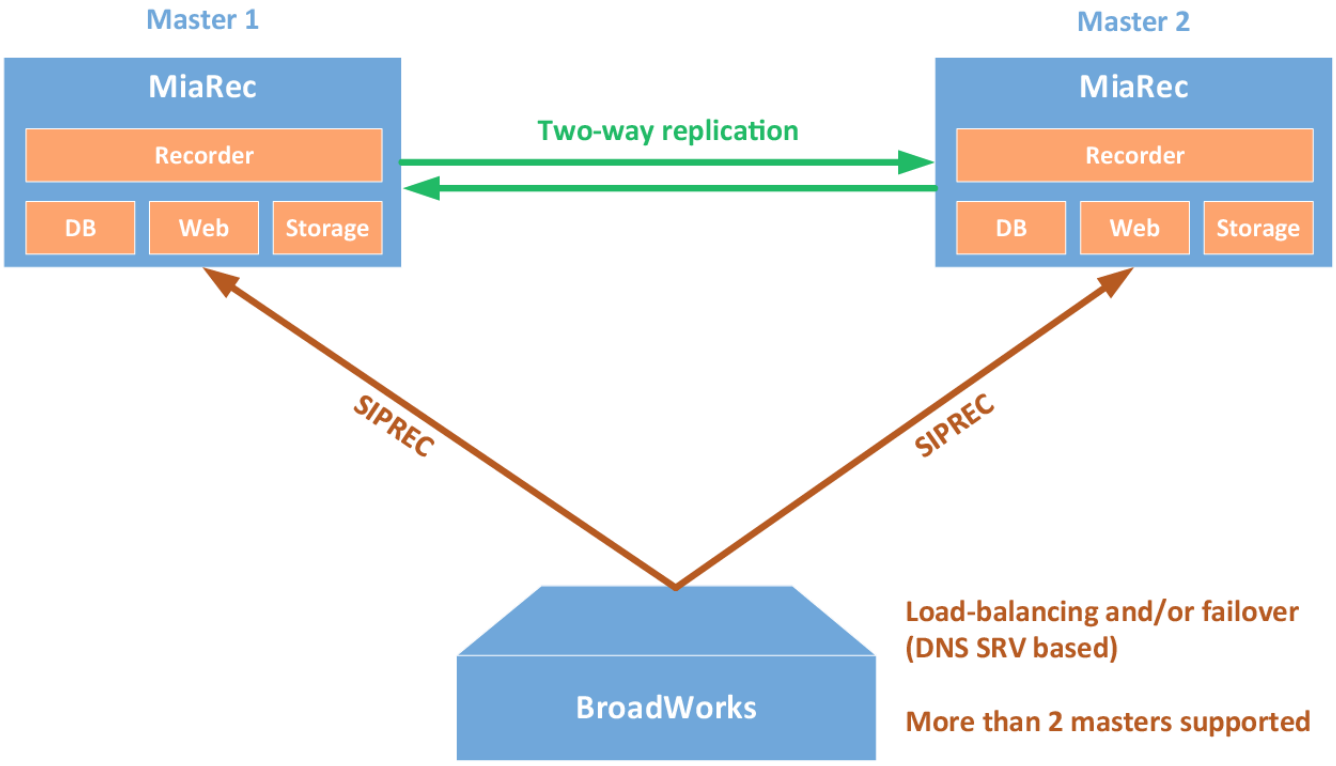
- DNS SRV for automatic failover (requires Broadworks R22+)
- MiaRec call replication

8.2.1 How it works

BroadWorks platform supports DNS SRV records for SIPREC interface. This allows building of the following configurations:

- Multiple recording servers and split SIPREC traffic between them (load balancing)
- Multiple recording servers with automatic failover from a primary server to a secondary one.
- A combination of above two variants.

MiaRec supports automatic call replication between two or more recording servers. Audio file and call metadata is automatically uploaded to replication target server(s) upon call completion or by schedule (for example, at night).



8.2.2 Example of DNS SVR records

```
# _service._proto.name.  TTL    class   SRV   priority  weight    port   target.
_sip._tcp.example.com.   86400  IN      SRV   10        40        5060   miarec1.example.com.
_sip._tcp.example.com.   86400  IN      SRV   10        30        5060   miarec2.example.com.
_sip._tcp.example.com.   86400  IN      SRV   10        30        5060   miarec3.example.com.
_sip._tcp.example.com.   86400  IN      SRV   20        0         5060   miarec4.example.com.
```

The first three records share a priority of 10, so the weight field's value will be used by BroadWorks to determine which recording server to contact. The sum of all three values is 100, so "miarec1" will be used 40% of the time. The remaining two hosts "miarec2" and "miarec3" will be used for 30% of requests each. If "miarec1" is unavailable, these two remaining servers will share the load equally, since they will each be selected 50% of the time.

If all three servers with a priority of 10 are unavailable, the records with the next lowest priority value will be chosen, which is “miarec4”. This might be a machine in another physical location, presumably not vulnerable to anything that would cause the first three servers to become unavailable.

Limitations:

- The load balancing provided by SRV records is inherently limited, since the information is essentially static. Current load of servers is not taken into account.
- In case of failover from one server to another, the currently active recordings on the failed server are interrupted. A new recording server will handle only new SIPREC requests.

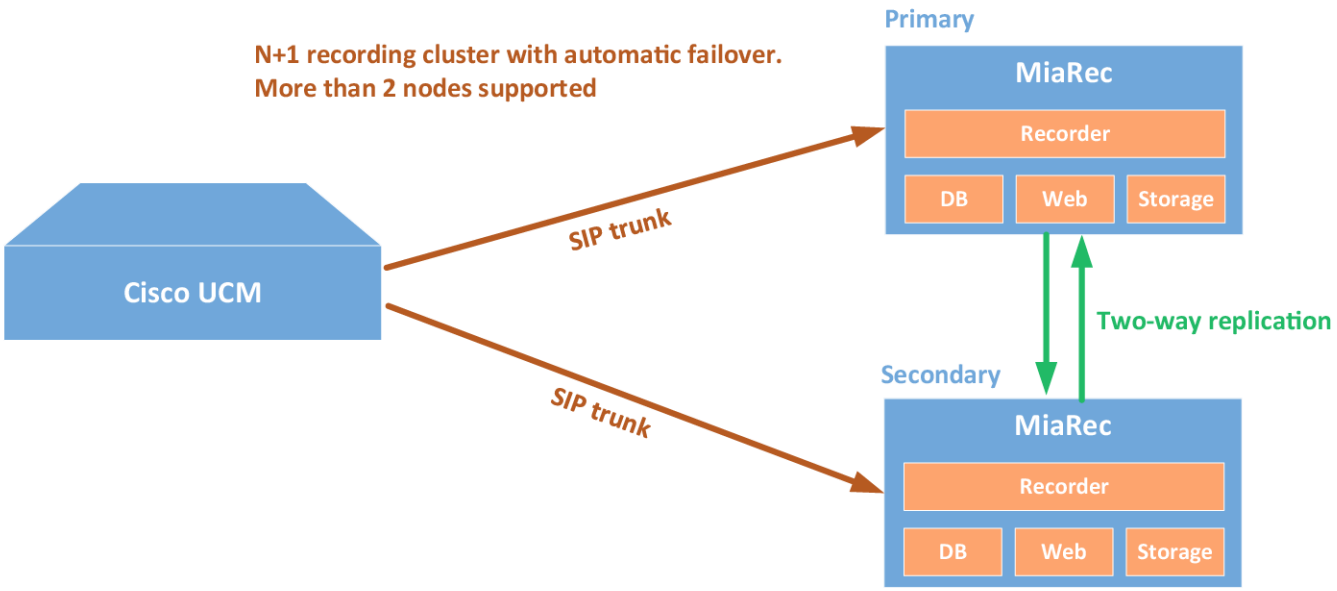
Check also: MiaRec automatic replication

8.3 High availability for Cisco Built-in-bridge recording

High availability and automatic failover for Cisco active recording interface is based on the following technologies:

- MiaRec automatic replication between multiple servers in a cluster
- Multiple SIP Trunks or DNS SRV for automatic failover and/or load balancing
- SIP OPTIONS Ping feature in Cisco UCM for fast detection of server unavailability

8.3.1 How it works



The recording server in Cisco UCM is configured as a SIP Trunk. Cisco UCM supports configuration of multiple SIP Trunks with automatic failover between them.

Additionally, Cisco UCM starting from v.8.5(1) supports SIP OPTIONS Ping feature. Cisco UCM periodically sends a SIP OPTIONS (ping) message to each recording server to detect its availability. If the recording server is unavailable – indicated by either no response, response of “408 Request Timeout” response of “503 Service Unavailable”, Cisco UCM marks this recording server as unavailable. If the recording server is available – indicated by any other responses other than “503” or “408”, Cisco UCM marks this recording server as available. Cisco UCM will send new INVITE only to “available” recording servers.

MiaRec supports automatic call replication between two or more recording servers. Audio file and call metadata is automatically uploaded to replication target server(s) upon call completion or by schedule (for example, at night).

Alternatively, instead of configuring multiple SIP Trunks in Cisco UCM it is possible to configure a single SIP Trunk pointing to DNS SRV records. The multiple recording servers are configured as SRV records. Such configuration allows to build automatic failover and load balancing configurations with multiple recording servers.

8.3.2 Example of DNS SRV records:

```
# _service._proto.name. TTL class SRV priority weight port target.
_sip._tcp.example.com. 86400 IN SRV 10 40 5060 miarec1.example.com.
_sip._tcp.example.com. 86400 IN SRV 10 30 5060 miarec2.example.com.
_sip._tcp.example.com. 86400 IN SRV 10 30 5060 miarec3.example.com.
_sip._tcp.example.com. 86400 IN SRV 20 0  5060 miarec4.example.com.
```

The first three records share a priority of 10, so the weight field’s value will be used by Cisco UCM to determine which recording server to contact. The sum of all three values is 100, so “miarec1” will be used 40% of the time. The remaining two hosts

“miarec2” and “miarec3” will be used for 30% of requests each. If “miarec1” is unavailable, these two remaining servers will share the load equally, since they will each be selected 50% of the time.

If all three servers with priority 10 are unavailable, the records with the next lowest priority value will be chosen, which is “miarec4”. This might me a machine in another physical location, presumably not vulnerable to anything that would cause the first three servers to become unavailable.

Limitations:

- Load balancing provided by SRV records is inherently limited, since the information is essentially static. Current load of servers is not taken into account.
- In case of failover from one server to another, the currently active recordings on a failed server are interrupted. The new recording server will handle only new SIP requests.

Check also: MiaRec automatic replication

9. Maintenance

9.1 Troubleshooting

9.1.1 Log files

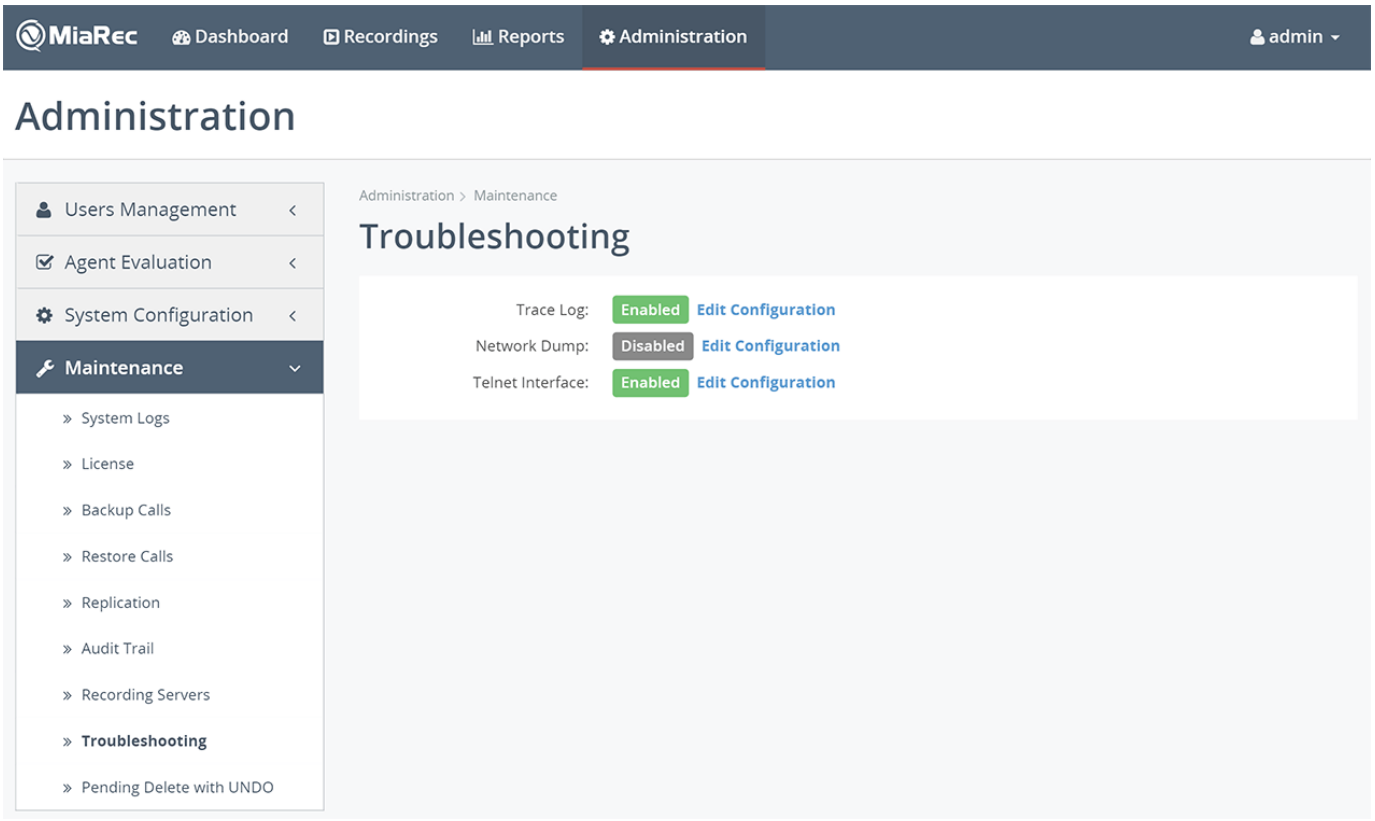
MiaRec solution consists of multiple components. Most of these components have own log file location.

MiaRec component	Location
Call recording service (MiaRec)	• Log messages inside DB (accessible via web UI menu Administration -> System Management -> System Log) • If trace is enabled, the trace files are located in Data\log\trace (on Windows) or /var/log/miarec/trace (on Linux)
Web portal	• Log messages inside DB (accessible via web UI menu Administration -> System Management -> System Log) • Apache service logs own messages into directory Data\log\apache (on Windows) or /var/log/httpd/ (on Linux)
Celery scheduler	Log files are located in directory Data\log\celery (on Windows) or /var/log/miarecweb/celery/ or /var/log/celery/ (on Linux)
Redis (cache system)	Log files are located in directory Data\log\redis (on Windows) or /var/log/redis_*/ (on Linux)
System Logs	Event Viewer Logs (on Windows) or /var/log/messages (on Linux)

9.1.2 MiaRec recorder trace

MiaRec supports writing detailed trace information into text file. Such trace information may be useful during problem investigation.

Navigate to menu **Administration -> Maintenance -> Troubleshooting** and click **Configure** button at the **Trace** option.



In the next configuration page you can specify:

- Full path to the trace log file
- Trace level depth (recommended log level for troubleshooting is 5)
- Log rotation settings

Administration > Maintenance > Troubleshooting

Edit Trace Log Settings

Enable * ☑ Enable writing of trace log information into file

Trace log file name * C:\MiaRecTrace\trace.log

Full path to file trace log file

Trace Level * 5

Depth of trace information (from 1 to 10). Default is 5

Overwrite If Exists * ☐ Overwrite the old trace file if it exists already

Rotate * Daily (once per day)

When rotating the log file will be ranmed into new one with name "*.yyyyMMdd-hhmmss.EXT" (EXT is file extension)

Rotate Day * 1

For weekly rotation, one of [Mon, Tue, Wed, Thu, Fri, Sat, Sun, 1, 2, 3, 4, 5, 6, 0]. For monthly rotation a day from 1 to 31. For monthly rotation a day from 1 to 31

Rotate Time * 23:55

For hourly rotation format is MM (minutes). For daily, weekly and monthly rotation format is HH:MM (hour and minutes)

Save

9.2 Increase/expand an EXT4 filesystem in RHEL 6 / CentOS 6

This guide will explain how to grow an EXT4 filesystem on VMWare Virtual Machine without a reboot.

Verify if your server has EXT4 file system (you should see "ext4" in the Type column):

```
# df -Th

Filesystem           Type   Size  Used Avail Use% Mounted on
/dev/mapper/vg_miarec-lv_root
                     ext4    50G   24G   24G  50% /
tmpfs                tmpfs  939M  4.0K  939M   1% /dev/shm
/dev/sda1            ext4   477M   48M  405M  11% /boot
/dev/mapper/vg_miarec-lv_home
                     ext4    73G   52M   69G   1% /home
```

To increase the disk size of Virtual Machine, you need to do 2 major steps:

1. First, you need to increase the disk's size in your vSphere Client or through the CLI. This will increase the "hardware" disk that your Virtual Machine can see.
2. Then, you need to utilize that extra space by partitioning it.

9.2.1 Step 1. Increase a hardware disk size in VMWare ESXi host

Checking if you can extend the current disk or need to add a new one

This is rather important step, because a disk that has been partitioned in 4 primary partitions already can not be extended any more. To check this, log into your server and run `fdisk -l` at the command line.

```
# fdisk -l

Disk /dev/sda: 137.4 GB, 137438953472 bytes
255 heads, 63 sectors/track, 16709 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x000c4605

Device Boot         Start         End      Blocks   Id  System
/dev/sda1   *           1          64      512000   83  Linux
Partition 1 does not end on cylinder boundary.
/dev/sda2              64       16710   133704704   8e  Linux LVM
```

If it looks like that, with only 2 partitions, you can safely extend the current hard disk in the Virtual Machine.

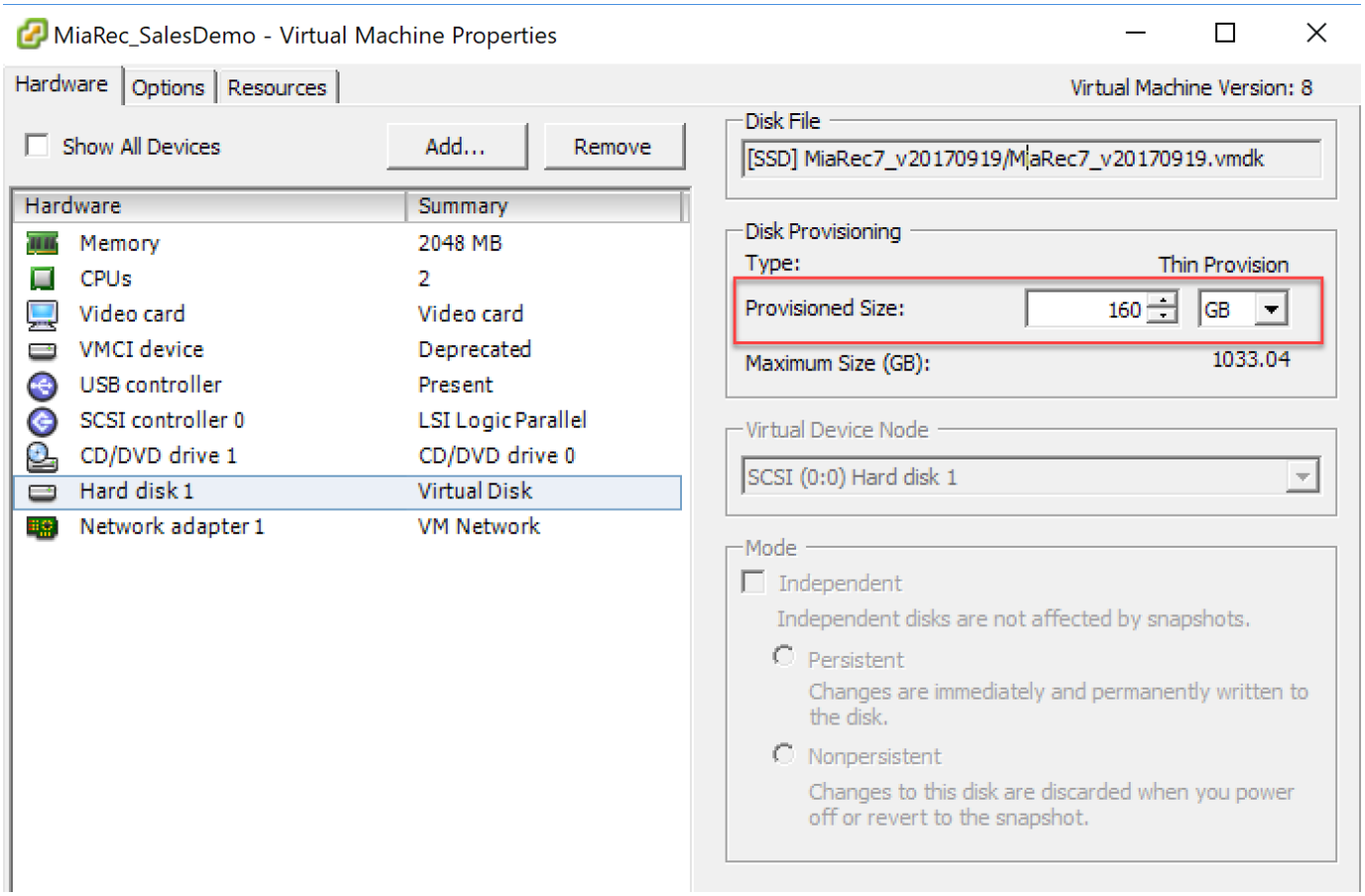
However, if it looks like this:

```
# fdisk -l

Disk /dev/sda: 187.9 GB, 187904819200 bytes
255 heads, 63 sectors/track, 22844 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          25      200781   83  Linux
/dev/sda2              26        2636    20972857+  8e  Linux LVM
/dev/sda3            2637       19581   136110712+  8e  Linux LVM
/dev/sda4           19582       22844    26210047+  8e  Linux LVM
```

It will show you that there are already 4 primary partitions on the system, and you need to add a new Virtual Disk to your Virtual Machine. You can still use that extra Virtual Disk to increase your LVM size, so don't worry.

Adding diskspace to Virtual Machine

Using VMWare vSphere Client, open the properties of the virtual machine and increase the **Provisioned Size**.



If the "Provisioned Size" area (top right corner) is greyed out, consider turning off the VM first (if it does not allow "hot adding" of disks/sizes), and check if you have any snapshots made of that VM. You can not increase the disk size, as long as there are available snapshots.

Alternatively, if you already have 4 primary paritions, you can also choose **"Add..."** to add new Hardware **"Virtual Disk"** to your VM, with the desired extra space.

9.2.2 Step 2. Extend partition within a Virtual Machine

Partitioning the unallocated space: if you've increased the disk size

Once you've changed the disk's size in VMware, boot up your VM again if you had to shut it down to increase the disk size in vSphere. If you've rebooted the server, you won't have to rescan your SCSI devices as that happens on boot. If you did not reboot your server, rescan your SCSI devices as such.

First, check the name(s) of your scsi devices.

```
# ls /sys/class/scsi_device/
1:0:0:0  2:0:0:0
```

Then rescan the scsi bus. On this machine, we have two devices. Execute the following commands to re-scan them. Below you can replace the '1:0:0:0' with the actual scsi bus name found with the previous command. Each colon is prefixed with a slash, which is what makes it look weird.

```
# echo 1 > /sys/class/scsi_device/1\:0\:0\:0/device/rescan
# echo 1 > /sys/class/scsi_device/2\:0\:0\:0/device/rescan
```

That will rescan the current scsi bus and the disk size that has changed will show up.

Execute `fdisk -l` to check if new size if visible to the Virtual Machine:

```
# fdisk -l

Disk /dev/sda: 171.8 GB, 171798691840 bytes
```

Partitioning the unalloced space: if you've added a new disk

If you've added a new disk on the server, the actions are similar to those described above. But instead of rescanning an already existing scsi bus like show earlier, you have to rescan the host to detect the new scsi bus as you've added a new disk.

```
# ls  /sys/class/scsi_host/
drwxr-xr-x  3 root root 0 Feb 13 02:55 .
drwxr-xr-x 39 root root 0 Feb 13 02:57 ..
drwxr-xr-x  2 root root 0 Feb 13 02:57 host0
```

Your host device is called `host0`, rescan it as such:

```
# echo "- - -" > /sys/class/scsi_host/host0/scan
```

It won't show any output, but running `fdisk -l` will show the new disk.

Create the new partition

Once the rescan is done (should only take a few seconds), you can check if the extra space can be seen on the disk.

```
# fdisk -l

Disk /dev/sda: 171.8 GB, 171798691840 bytes
255 heads, 63 sectors/track, 20886 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x000c4605

Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          64      512000   83  Linux
Partition 1 does not end on cylinder boundary.
/dev/sda2              64       16710   133704704   8e  Linux LVM
```

Using `fdisk`, create a new partition on the `/dev/sda` device. Enter `n`, to create a new partition:

```
# fdisk /dev/sda

WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): n
```

Now choose `p` to create a new primary partition. Please note, your system can only have 4 primary partitions on this disk! If you've already reached this limit, create an extended partition.

```
Command action
   e   extended
   p   primary partition (1-4)
p
```

Choose your partition number. Since we already had `/dev/sda1` and `/dev/sda2`, the logical number would be `3`.

```
Partition number (1-4): 3
```

Choose the first and last sectors for new partition, if you hit ENTER, then by default new partition will use all available disk space.

```
First cylinder (16710-20886, default 16710): <ENTER>
Using default value 16710
Last cylinder, +cylinders or +size{K,M,G} (16710-20886, default 20886): <ENTER>
Using default value 20886
```

Now type `t` to change the partition type. When prompted, enter the number of the partition you've just created in the previous steps. When you're asked to enter the "Hex code", enter `8e`, and confirm by hitting enter.

```
Command (m for help): t
Partition number (1-4): 3
Hex code (type L to list all codes): 8e
Changed system type of partition 3 to 8e (Linux LVM)
```

Once you get back to the main command within fdisk, type `w` to write your partitions to the disk. You'll get a message about the kernel still using the old partition table, and to reboot to use the new table. The reboot is not needed as you can also rescan for those partitions using `partprobe`.

```
Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.

WARNING: Re-reading the partition table failed with error 16: Device or resource busy.
The kernel still uses the old table. The new table will be used at
the next reboot or after you run partprobe(8) or kpartx(8)
Syncing disks.
```

Run the following to scan for the newly created partition:

```
# partprobe -s
/dev/sda: msdos partitions 1 2 3
```

If that does not work for you, you can try to use "partx" to rescan the device and add the new partitions. In the command below, change /dev/sda to the disk on which you've just added a new partition.

```
# partx -v -a /dev/sda
```

If that still does not show you the newly created partition for you to use, you have to reboot the server. Afterwards, you can see the newly created partition with fdisk.

```
# fdisk -l

Disk /dev/sda: 171.8 GB, 171798691840 bytes
255 heads, 63 sectors/track, 20886 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x000c4605

Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          64      512000   83  Linux
Partition 1 does not end on cylinder boundary.
/dev/sda2              64       16710   133704704   8e  Linux LVM
/dev/sda3           16710       20886    33549067   8e  Linux LVM
```

Extend the Logical Volume with the new partition

Now, create the physical volume as a basis for your LVM. Please replace /dev/sda3 with the newly created partition.

```
# pvcreate /dev/sda3

Physical volume "/dev/sda3" successfully created
```

Now find out how your Volume Group is called. In our example, it has name **cl**

```
#  vgdisplay
--- Volume group ---
VG Name               vg_miarec
...
```

Let's extend that Volume Group by adding the newly created physical volume to it.

```
# vgextend vg_miarec /dev/sda3

Volume group "vg_miarec" successfully extended
```

With `pvscan`, we can see our newly added physical volume, and the usable space (32GB in this case).

```
# pvscan

PV /dev/sda2   VG vg_miarec   lvm2 [127.51 GiB / 0    free]
```

```
PV /dev/sda3   VG vg_miarec   lvm2 [31.99 GiB / 31.99 GiB free]
Total: 2 [159.50 GiB] / in use: 2 [159.50 GiB] / in no VG: 0 [0   ]
```

Now we can extend Logical Volume (as opposed to the Physical Volume we added to the group earlier).

First, check the logical volumes available on system using command `ls /dev/VolGroupName` (in our example volume group name is `vg_miarec`):

```
# ls /dev/vg_miarec
lv_home  lv_root  lv_swap
```

We have `lv_home`, `lv_root` and `lv_swap` logical volumes. To extend the logical volume `lv_root`, execute command:

```
# lvextend /dev/vg_miarec/lv_root /dev/sda3
Size of logical volume vg_miarec/lv_root changed from 50.00 GiB (12800 extents) to 81.99 GiB (20990 extents)
Logical volume lv_root successfully resized
```

All that remains now, it to resize the file system to the volume group, so we can use the space. Replace the path to the correct /dev device with the name of volume group on your system.

```
# resize2fs /dev/vg_miarec/lv_root

resize2fs 1.41.12 (17-May-2010)
Filesystem at /dev/vg_miarec/lv_root is mounted on /; on-line resizing required
old desc_blocks = 4, new_desc_blocks = 6
Performing an on-line resize of /dev/vg_miarec/lv_root to 21493760 (4k) blocks.
The filesystem on /dev/vg_miarec/lv_root is now 21493760 blocks long.
```

Execute `df -h` to confirm that new disk size is available to the Virtual Machine.

```
# df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/mapper/vg_miarec-lv_root
                       81G   24G   54G  31% /
tmpfs                 939M  4.0K  939M   1% /dev/shm
/dev/sda1             477M   48M  405M  11% /boot
/dev/mapper/vg_miarec-lv_home
                       73G   52M   69G   1% /home
```

9.3 Increase/expand an XFS filesystem in RHEL 7 / CentOS 7

This guide will explain how to grow an XFS filesystem on VMWare Virtual Machine without a reboot.

Verify if your server has XFS file system (you should see "xfs" in the Type column):

```
# df -Th

Filesystem          Type      Size  Used Avail Use% Mounted on
/dev/mapper/cl-root xfs       143G   27G  117G  19% /
devtmpfs            devtmpfs  908M     0  908M   0% /dev
tmpfs               tmpfs     918M  4.0K  918M   1% /dev/shm
tmpfs               tmpfs     918M   90M  828M  10% /run
tmpfs               tmpfs     918M     0  918M   0% /sys/fs/cgroup
/dev/sda1           xfs      1014M  184M  831M  19% /boot
/dev/mapper/cl-home xfs       8.0G   33M  8.0G   1% /home
tmpfs               tmpfs     184M     0  184M   0% /run/user/0
```

To increase the disk size of Virtual Machine, you need to do 2 major steps:

1. First, you need to increase the disk's size in your vSphere Client or through the CLI. This will increase the "hardware" disk that your Virtual Machine can see.
2. Then, you need to utilize that extra space by partitioning it.

9.3.1 Step 1. Increase a hardware disk size in VMWare ESXi host

Checking if you can extend the current disk or need to add a new one

This is rather important step, because a disk that has been partitioned in 4 primary partitions already can not be extended any more. To check this, log into your server and run `fdisk -l` at the command line.

```
# fdisk -l

Disk /dev/sda: 137.4 GB, 137438953472 bytes, 268435456 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x000aa739

Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *        2048     2099199     1048576   83  Linux
/dev/sda2         2099200   268435455   133168128   8e  Linux LVM
```

If it looks like that, with only 2 partitions, you can safely extend the current hard disk in the Virtual Machine.

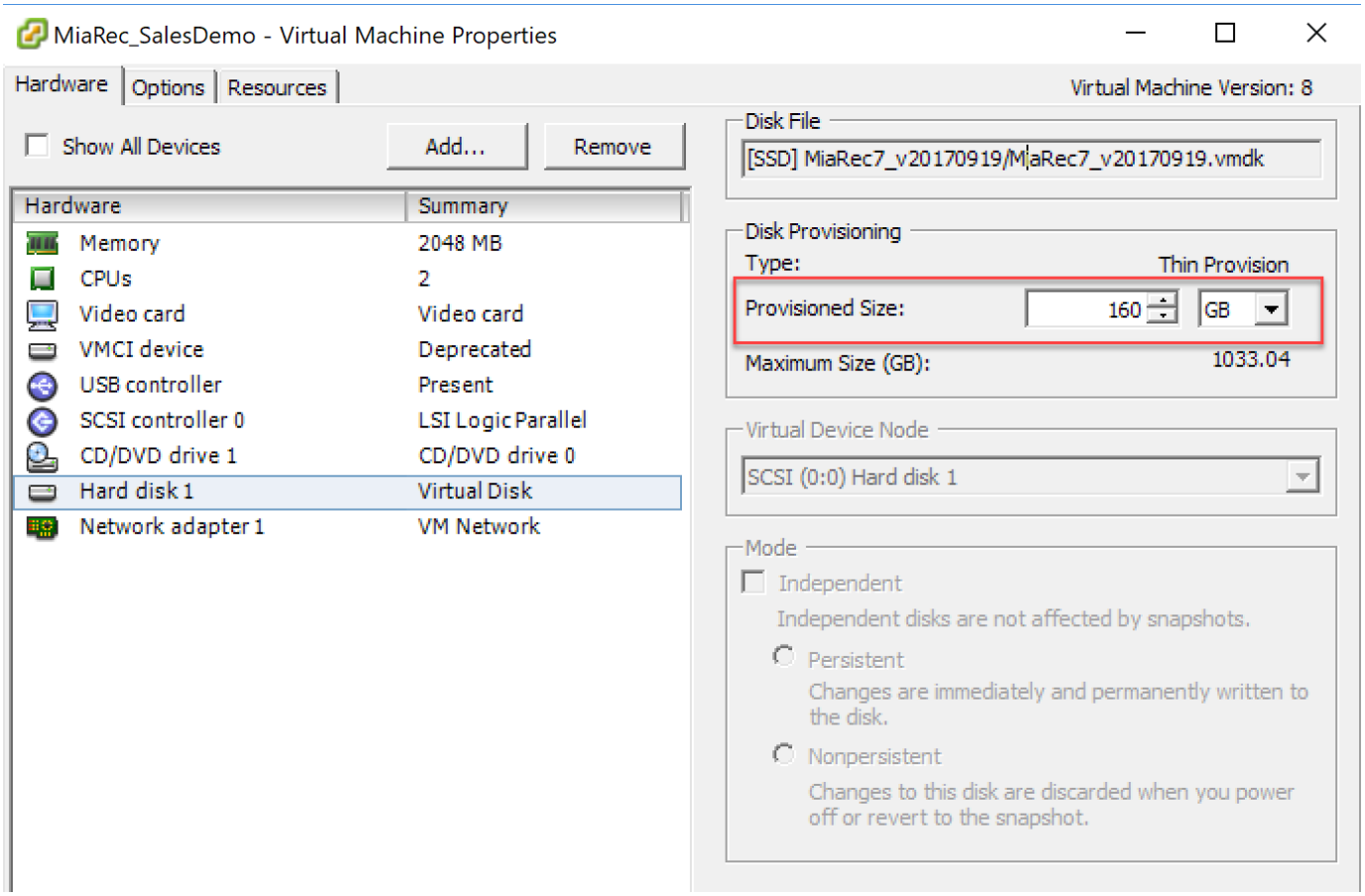
However, if it looks like this:

```
# fdisk -l

Disk /dev/sda: 187.9 GB, 187904819200 bytes
255 heads, 63 sectors/track, 22844 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *           1          25      200781   83  Linux
/dev/sda2              26        2636    20972857+  8e  Linux LVM
/dev/sda3            2637       19581   136110712+  8e  Linux LVM
/dev/sda4           19582       22844    26210047+  8e  Linux LVM
```

It will show you that there are already 4 primary partitions on the system, and you need to add a new Virtual Disk to your Virtual Machine. You can still use that extra Virtual Disk to increase your LVM size, so don't worry.

Adding diskspace to Virtual Machine

Using VMWare vSphere Client, open the properties of the virtual machine and increase the **Provisioned Size**.



If the "Provisioned Size" area (top right corner) is greyed out, consider turning off the VM first (if it does not allow "hot adding" of disks/sizes), and check if you have any snapshots made of that VM. You can not increase the disk size, as long as there are available snapshots.

Alternatively, if you already have 4 primary paritions, you can also choose **"Add..."** to add new Hardware **"Virtual Disk"** to your VM, with the desired extra space.

9.3.2 Step 2. Extend partition within a Virtual Machine

Partitioning the unallocated space: if you've increased the disk size

Once you've changed the disk's size in VMware, boot up your VM again if you had to shut it down to increase the disk size in vSphere. If you've rebooted the server, you won't have to rescan your SCSI devices as that happens on boot. If you did not reboot your server, rescan your SCSI devices as such.

First, check the name(s) of your scsi devices.

```
# ls /sys/class/scsi_device/
1:0:0:0  2:0:0:0
```

Then rescan the scsi bus. On this machine, we have two devices. Execute the following commands to re-scan them. Below you can replace the '1:0:0:0' with the actual scsi bus name found with the previous command. Each colon is prefixed with a slash, which is what makes it look weird.

```
# echo 1 > /sys/class/scsi_device/1\:0\:0\:0/device/rescan
# echo 1 > /sys/class/scsi_device/2\:0\:0\:0/device/rescan
```

That will rescan the current scsi bus and the disk size that has changed will show up.

Execute `fdisk -l` to check if new size if visible to the Virtual Machine:

```
# fdisk -l

Disk /dev/sda: 171.8 GB, 171798691840 bytes, 335544320 sectors
```

Partitioning the unalloced space: if you've added a new disk

If you've added a new disk on the server, the actions are similar to those described above. But instead of rescanning an already existing scsi bus like show earlier, you have to rescan the host to detect the new scsi bus as you've added a new disk.

```
# ls  /sys/class/scsi_host/
total 0
drwxr-xr-x  3 root root 0 Feb 13 02:55 .
drwxr-xr-x 39 root root 0 Feb 13 02:57 ..
drwxr-xr-x  2 root root 0 Feb 13 02:57 host0
```

Your host device is called `host0`, rescan it as such:

```
# echo "- - -" > /sys/class/scsi_host/host0/scan
```

It won't show any output, but running `fdisk -l` will show the new disk.

Create the new partition

Once the rescan is done (should only take a few seconds), you can check if the extra space can be seen on the disk.

```
# fdisk -l

Disk /dev/sda: 171.8 GB, 171798691840 bytes, 335544320 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x000aa739

Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *        2048     2099199     1048576   83  Linux
/dev/sda2         2099200   268435455   133168128   8e  Linux LVM
```

Using `fdisk`, create a new partition on the `/dev/sda` device. Enter `n`, to create a new partition:

```
# fdisk /dev/sda
Welcome to fdisk (util-linux 2.23.2).

Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.


Command (m for help): n
```

Now choose `p` to create a new primary partition. Please note, your system can only have 4 primary partitions on this disk! If you've already reached this limit, create an extended partition.

```
Partition type:
   p   primary (2 primary, 0 extended, 2 free)
   e   extended
Select (default p): p
```

Choose your partition number. Since we already had `/dev/sda1` and `/dev/sda2`, the logical number would be `3`.

```
Partition number (3,4, default 3): 3
```

Choose the first and last sectors for new partition, if you hit ENTER, then by default new partition will use all available disk space.

```
First sector (268435456-335544319, default 268435456): <ENTER>
Using default value 268435456
Last sector, +sectors or +size{K,M,G} (268435456-335544319, default 335544319): <ENTER>
Using default value 335544319
Partition 3 of type Linux and of size 32 GiB is set
```

Now type `t` to change the partition type. When prompted, enter the number of the partition you've just created in the previous steps. When you're asked to enter the "Hex code", enter `8e`, and confirm by hitting enter.

```
Command (m for help): t
Partition number (1-3, default 3): 3
Hex code (type L to list all codes): 8e
Changed type of partition 'Linux' to 'Linux LVM'
```

Once you get back to the main command within fdisk, type `w` to write your partitions to the disk. You'll get a message about the kernel still using the old partition table, and to reboot to use the new table. The reboot is not needed as you can also rescan for those partitions using `partprobe`.

```
Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.

WARNING: Re-reading the partition table failed with error 16: Device or resource busy.
The kernel still uses the old table. The new table will be used at
the next reboot or after you run partprobe(8) or kpartx(8)
Syncing disks.
```

Run the following to scan for the newly created partition:

```
# partprobe -s
/dev/sda: msdos partitions 1 2 3
```

If that does not work for you, you can try to use "partx" to rescan the device and add the new partitions. In the command below, change /dev/sda to the disk on which you've just added a new partition.

```
# partx -v -a /dev/sda
```

If that still does not show you the newly created partition for you to use, you have to reboot the server. Afterwards, you can see the newly created partition with fdisk.

```
# fdisk -l

Disk /dev/sda: 171.8 GB, 171798691840 bytes, 335544320 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x000aa739

Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *        2048     2099199     1048576   83  Linux
/dev/sda2         2099200   268435455   133168128   8e  Linux LVM
/dev/sda3       268435456   335544319    33554432   8e  Linux LVM
```

Extend the Logical Volume with the new partition

Now, create the physical volume as a basis for your LVM. Please replace /dev/sda3 with the newly created partition.

```
# pvcreate /dev/sda3

Physical volume "/dev/sda3" successfully created
```

Now find out how your Volume Group is called. In our example, it has name **cl**

```
#  vgdisplay
--- Volume group ---
VG Name               cl
...
```

Let's extend that Volume Group by adding the newly created physical volume to it.

```
# vgextend cl /dev/sda3

Volume group "cl" successfully extended
```

With `pvscan`, we can see our newly added physical volume, and the usable space (32GB in this case).

```
# pvscan
PV /dev/sda2   VG cl              lvm2 [127.00 GiB / 4.00 MiB free]
PV /dev/sda3   VG cl              lvm2 [32.00 GiB / 32.00 GiB free]
Total: 2 [158.99 GiB] / in use: 2 [158.99 GiB] / in no VG: 0 [0   ]
```

Now we can extend Logical Volume (as opposed to the Physical Volume we added to the group earlier).

First, check the logical volumes available on system using command `ls /dev/VolGroupName` (in our example volume group name is `cl`):

```
# ls /dev/cl
home  root  swap
```

We have `home`, `root` and `swap` logical volumes. To extend the logical volume `root`, execute command:

```
# lvextend /dev/cl/root /dev/sda3
Size of logical volume cl/root changed from 111.00 GiB (28415 extents) to 142.99 GiB (36606 extents).
Logical volume cl/root successfully resized.
```

All that remains now, is to resize the file system to the volume group, so we can use the space. Execute `xfs_growfs` command as shown below (replace `cl-root` with the name of volume group on your system).

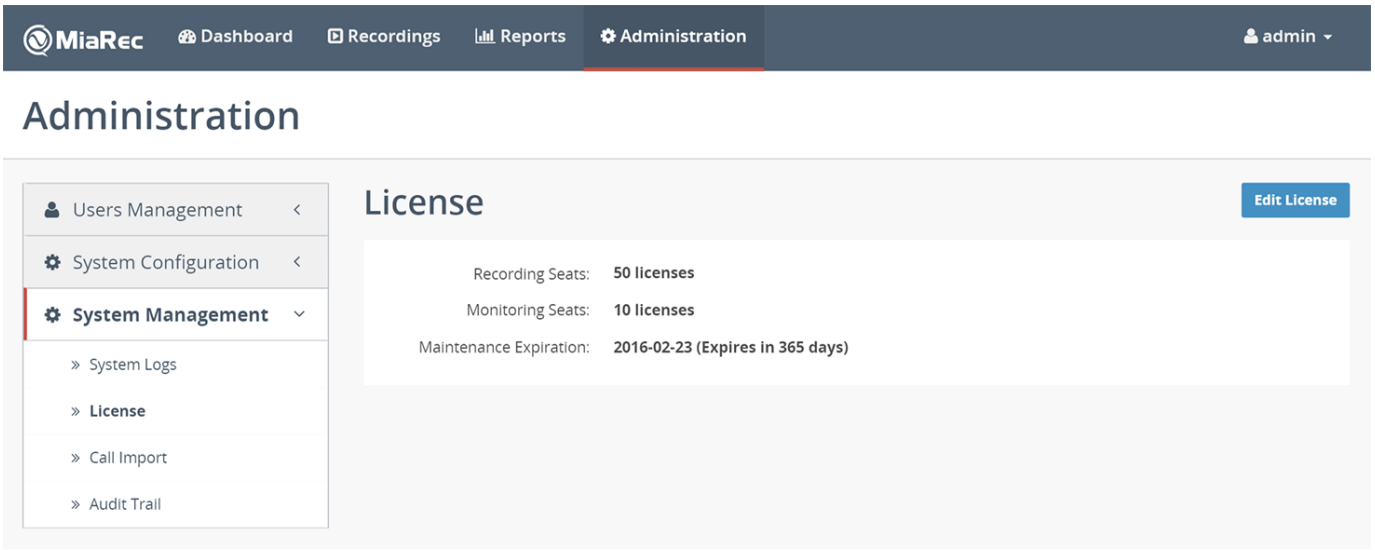
```
# xfs_growfs /dev/mapper/cl-root
meta-data=/dev/mapper/cl-root    isize=512    agcount=4, agsize=7274240 blks
         =                       sectsz=512   attr=2, projid32bit=1
         =                       crc=1        finobt=0 spinodes=0
data     =                       bsize=4096   blocks=29096960, imaxpct=25
         =                       sunit=0      swidth=0 blks
naming   =version 2              bsize=4096   ascii-ci=0 ftype=1
log      =internal               bsize=4096   blocks=14207, version=2
         =                       sectsz=512   sunit=0 blks, lazy-count=1
realtime =none                   extsz=4096   blocks=0, rtextents=0
data blocks changed from 29096960 to 37484544
```

Execute `df -h` to confirm that new disk size is available to the Virtual Machine.

```
# df -h
Filesystem           Size  Used Avail Use% Mounted on
/dev/mapper/cl-root  143G   27G  117G  19% /
devtmpfs             908M     0  908M   0% /dev
tmpfs                918M  4.0K  918M   1% /dev/shm
tmpfs                918M   89M  830M  10% /run
tmpfs                918M     0  918M   0% /sys/fs/cgroup
/dev/sda1           1014M  184M  831M  19% /boot
/dev/mapper/cl-home  8.0G   33M  8.0G   1% /home
tmpfs                184M     0  184M   0% /run/user/0
```

9.4 License

Navigate to menu **Administration -> System Management -> License**.



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