



The sip:carrier Handbook mr4.5.1

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1 Introduction

1.1 About this Handbook

This handbook describes the architecture and the operational steps to install, operate and modify the Sipwise sip:carrier.

In various chapters, it describes the system architecture, the installation and upgrade procedures and the initial configuration steps to get your first users online. It then dives into advanced preference configurations such as rewrite rules, call blockings, call forwards, etc.

There is a description of the customer self-care interface, how to configure the billing system and how to provision the system via the provided APIs.

Finally, it describes the internal configuration framework, the network configuration and gives hints about tweaking the system for security and performance.

1.2 Getting Help

1.2.1 Phone Support

Depending on your support contract, you are eligible to contact our Support Team by phone either in business hours or around the clock. Business hours refer to the UTC+1 time zone (Europe/Vienna). Please check your support contract to find out the type of support you've purchased.

Before calling our Support Team, please also open a ticket in our Ticket System and provide as much detail as you can for us to understand the problems, fix them and investigate the cause. Please provide the number of your newly created ticket when asked by our support personnel on the phone.

You can find phone numbers, Ticket System URL, and account information in your support contract. Please make this information available to the persons in your company maintaining the sip:carrier.

1.2.2 Ticket System

Depending on your support contract, you can create either a limited or an unlimited amount of support tickets on our Web-based Ticket System. Please provide as much information as possible when opening a ticket, especially the following:

- **WHAT** is affected (e.g. the whole system is unreachable, or customers can't register or place calls)
- **WHO** is affected (e.g. all customers, only parts of it, and **WHICH** parts - only customers in a particular domain or customers with specific devices, etc.)
- **WHEN** did the problem occur (time frames, or after the firmware of specific devices types have been updated, etc.)

Our Support Team will ask further questions via the Ticket System along the way of troubleshooting your issue. Please provide the information as soon as possible to solve your issue promptly.

1.3 What is the sip:carrier?

The sip:carrier is a SIP based Open Source Class5 VoIP soft-switch platform providing rich telephony services. It offers a wide range of features to end users (call forwards, voicemail, conferencing, call blocking, click-to-dial, call-lists showing near-realtime accounting information, etc.), which can be configured by them using the customer-self-care web interface. For operators, it offers a fully web-based administrative panel, allowing them to configure users, peerings, billing profiles, etc., as well as viewing real-time statistics of the system. For tight integration into existing infrastructures, it provides a powerful REST API.

The sip:carrier comes pre-installed on six+ servers in one+ IBM Flex Chassis, see Section 2. Apart from your product specific configuration, there is no initial configuration or installation to be done to get started.

1.4 What is inside the sip:carrier?

Opposed to other free VoIP software, the sip:carrier is not a single application, but a whole software platform, the Sipwise NGCP (Sipwise Next Generation Communication Platform), which is based on Debian GNU/Linux.

Using a highly modular design approach, the NGCP leverages popular open-source software like MySQL, NGINX, Kamailio, SEMS, Asterisk, etc. as its core building blocks. These blocks are glued together using optimized and proven configurations and workflows and are complemented by functionality developed by Sipwise to provide fully-featured and easy to operate VoIP services.

The installed applications are managed by the NGCP Configuration Framework, which makes it possible to change system parameters in a single place, so administrators don't need to have any knowledge of the dozens of different configuration files of the different packages. This provides a very easy and bullet-proof way of operating, changing and tweaking the otherwise quite complex system.

Once configured, integrated web interfaces are provided for both end users and administrators to use the sip:carrier. By using the provided provisioning and billing APIs, it can be integrated tightly into existing OSS/BSS infrastructures to optimize workflows.

1.5 Who should use the sip:carrier?

The sip:carrier is specifically tailored to companies who want to provide fully-featured SIP-based VoIP service without having to go through the steep learning curve of SIP signalling, integrating the different building blocks to make them work together in a reasonable way. The sip:carrier is already deployed all around the world by all kinds of VoIP operators, using it as Class5 soft-switch, as Class4 termination platform or even as Session Border Controller with all kinds of access networks, like Cable, DSL, WiFi and Mobile networks.

2 System Architecture

2.1 Hardware Architecture

The sip:carrier starts with a minimum deployment of 50.000 subscribers, requiring one chassis with two web servers, two db servers, two load balancers and two proxies. A fully deployed sip:carrier for 250.000 subscribers fills the chassis up with 14 servers, containing two web servers, two db servers, two load balancers and 8 proxies.



Figure 1: Hardware setup for single chassis

The system is based on an IBM Flex Chassis taking up rack space of 10U with 14 computing nodes based on IBM x220 servers.

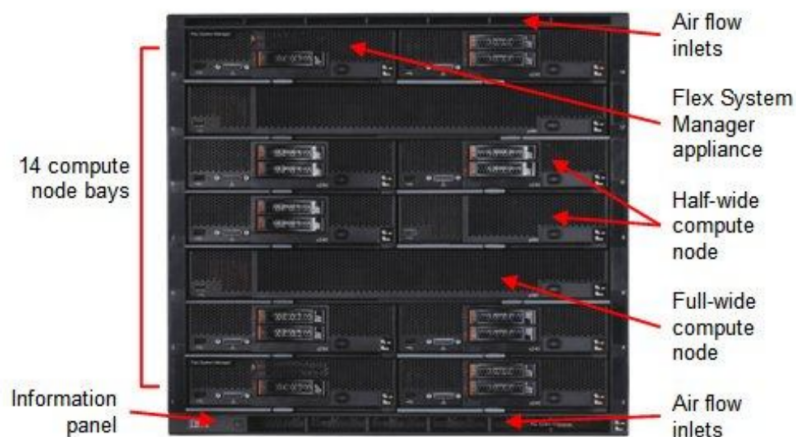


Figure 2: Chassis front view

All nodes are equipped equally with two hard disks in Raid-1 mode.

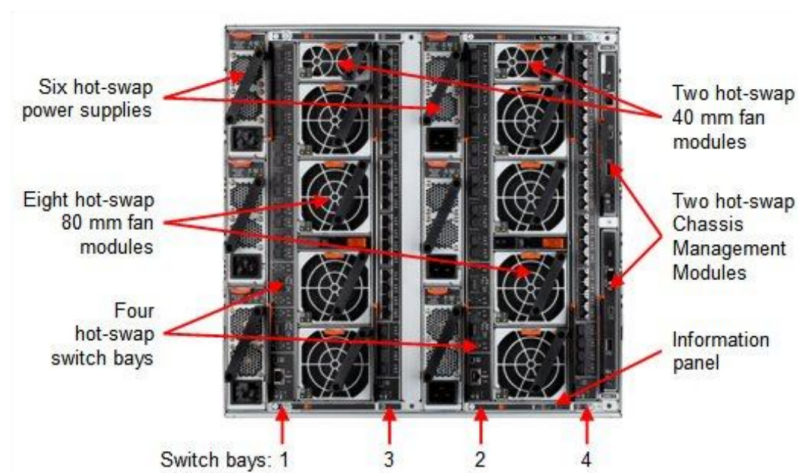


Figure 3: Chassis back view

The power supply is designed fully redundant in an N+N fashion with N=3, for example to feed 3 PSUs with normal power and 3 PSUs with UPS power.



Figure 4: Chassis switch module

Each chassis is equipped with two EN2092 Gigabit Ethernet switches providing 10 GbE uplinks each. Four 10GbE uplinks are optional and need to be licensed separately if needed.

2.2 Component Architecture

The sip:carrier is composed by a cluster of four different node types, which are all deployed in active/standby pairs:

- **Web-Servers** (web1a/web1b): Provide northbound interfaces (CSC, API) via HTTPS for provisioning
- **DB-Servers** (db1a/db1b): Provide the central persistent SQL data store for customer data, peering configuration, billing data etc.
- **Proxy-Servers** (proxy1a/proxy1b .. proxy4a/proxy4b): Provide the SIP and XMPP signalling engines, application servers and media relays to route Calls and IM/Presence and serve media to the endpoints.

- **Load-Balancers** (lb1a/lb1b): Provide a perimeter for SIP and XMPP signalling.

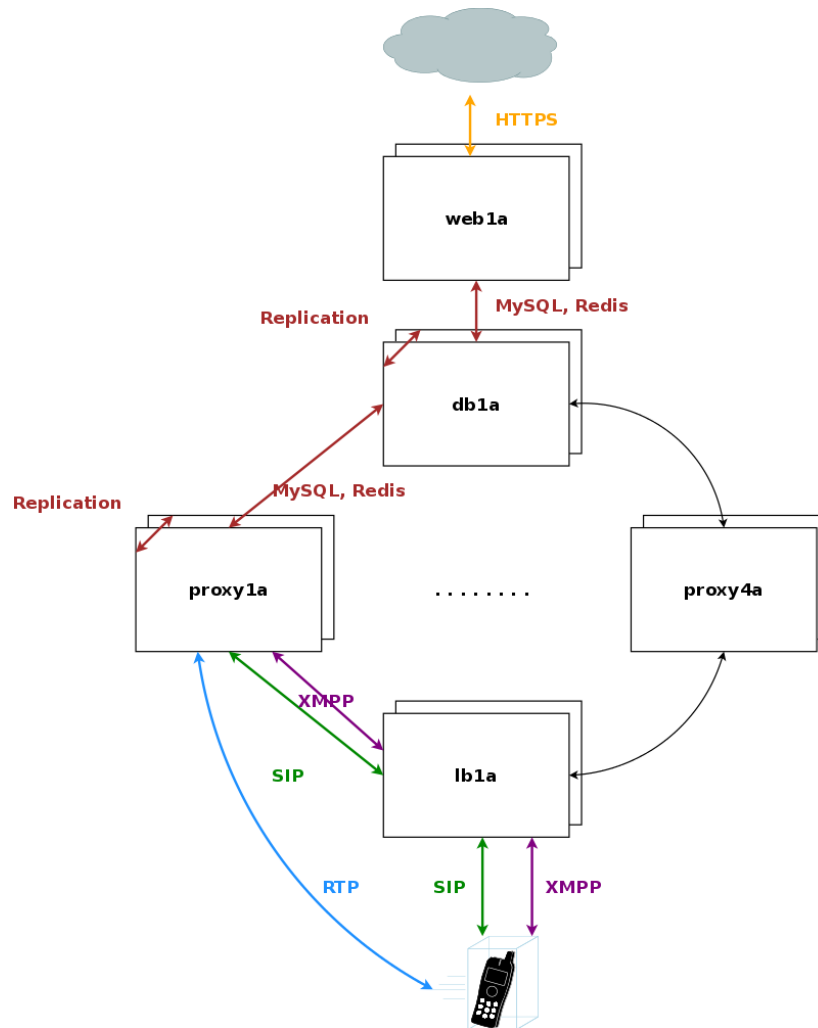


Figure 5: Architecture Overview

The system is provisioned via the web servers on a central pair of db servers. Signalling is entering the system via the lb servers to a cluster of proxies, which in turn communicate directly (caching and shared data) and indirectly (static provisioning data replicated via master/slave) with the db servers. Each pair of proxy is capable of handling any subscriber, so subscribers are not bound to specific "home proxies". Once a call starts on a proxy pair, it is ensured that the full range of services is provided on that pair (voicemail, media, billing, . . .) until call-teardown. Failures on an active proxy node cause a fail-over to the corresponding stand-by node within the proxy pair, taking over the full signalling and media without interruptions.

2.2.1 Provisioning

Any HTTPS traffic for provisioning (web interfaces, northbound APIs) but also for phone auto-provisioning enters the platform on the active web server. The web server runs an nginx instance acting as a reverse proxy for the ngcp-panel process, which in turn provides the provisioning functionality.

The web server is connected to the db server pair, which provides a persistent relational data store via MySQL and a high-performance system cache using Redis key-value store.

API and Web Interface

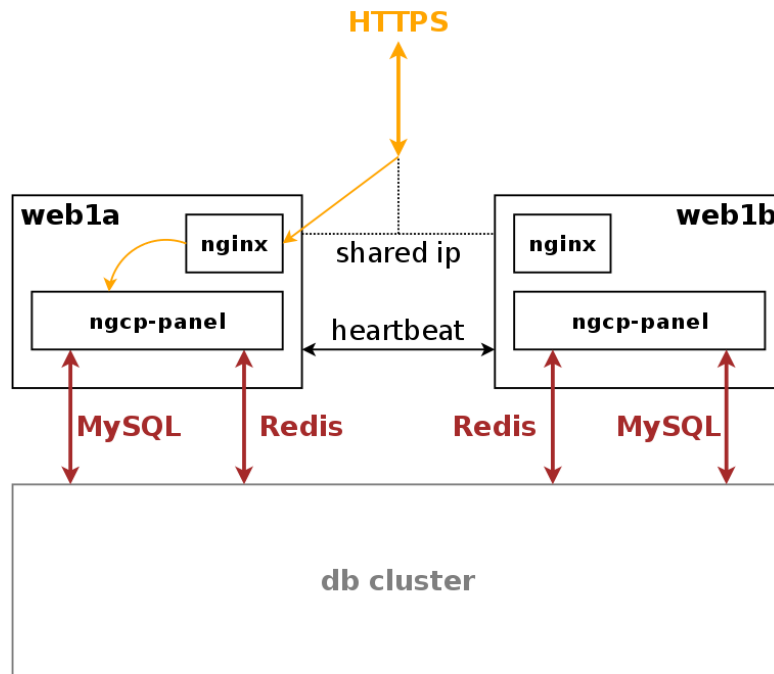


Figure 6: Web Server Overview

The web server pair is an active/standby pair of nodes connected via heartbeat. If one of the servers fail (by losing connection to the outside while the standby server is still connected, or caused by a hardware failure, or if it's down due to maintenance), the standby server takes over the shared IP address of the active node and continues serving the provisioning interface.

Provisioning Database

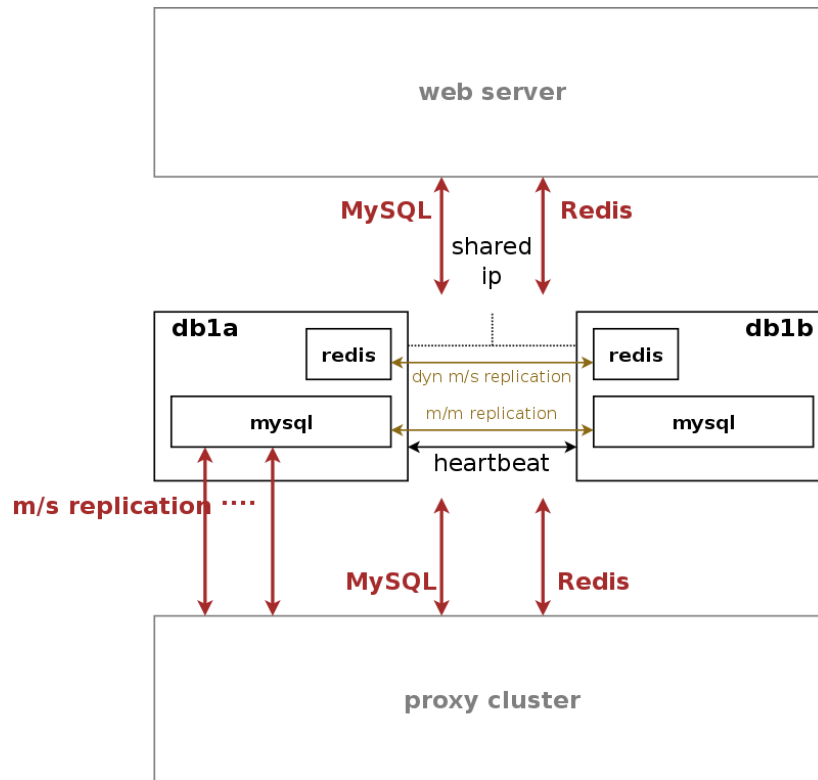


Figure 7: DB Server Overview

The db server pair is another active/standby pair with automatic fail-over. Nodes in the pair are running a MySQL master/master replication with replication integrity checks to ensure data redundancy and safety. Any changes via provisioning interfaces are stored in the MySQL cluster. The second service is a redis master/slave replication with automatic master propagation on fail-over. This redis cluster is used as a high-performance volatile system cache for various components which need to share state information across nodes.

Persistent MySQL Database

The MySQL instances on the db nodes synchronize via row-based master/master replication. In theory, any of the two servers in the pair can be used to write data to the database, however in practice a shared IP is used towards clients accessing the service, so only one node will receive the write requests. This is done to ensure transparent and instant convergence of the db cluster on fail-over for the clients.

On top of that, the first node of the db pair also acts as a master in a master/slave replication towards all proxy nodes in the system. That way, proxies can access read-only provisioning data directly from their local databases, resulting in reduced latency and significant off-loading of read queries on the central db cluster.

Central Redis Cache

A redis master/slave setup is used to provide a high-performance key/value storage for global system data shared across proxies. This includes concurrent call counters for customers and subscribers, as a subscriber could place two simultaneous calls via two different proxy pairs.

2.2.2 Signaling and Media Relay

Any signalling traffic enters and leaves the system via load balancers, which act as a perimeter towards the customer devices and performs NAT handling, DoS and DDoS mitigation. New connections are routed to a random pair of proxy servers, which do the actual routing for SIP and XMPP. The proxy servers also engage media relays for voice and video streams, which bypass the load balancers and communicate directly with the customer devices for performance reasons.

Load Balancing of Signalling

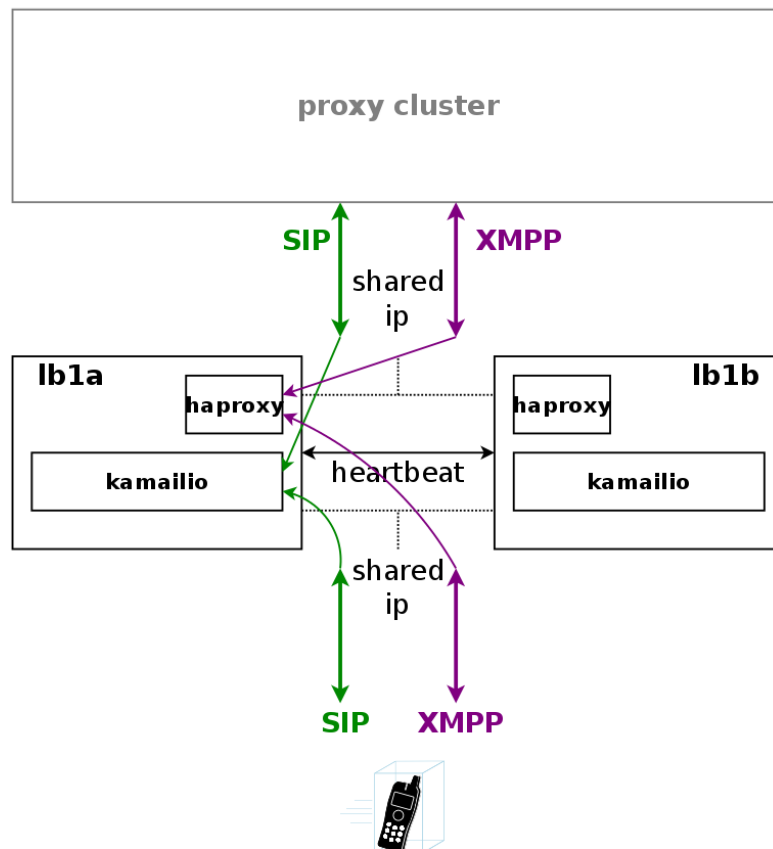


Figure 8: Load Balancer Overview

A node in a load balancer pair runs two services besides the usual heartbeat.

One is a state-less instance of kamailio, providing an extremely fast relay of SIP messages. Kamailio takes care of converting

TCP and TLS connections from the customer devices to UDP for internal communication towards proxies, and it performs far-end NAT traversal by inspecting the SIP messages and comparing it to the actual source address where packets have been received from, then modifying the SIP messages accordingly. If a SIP message is received by the load balancer, it distinguishes between new and ongoing SIP transactions by inspecting the To-Tags of a message, and it determines whether the message is part of an established dialog by inspecting the Route header. Sanity checks are performed on the headers to make sure the call flows adhere to certain rules for not being able to bypass any required element in the routing path. In-dialog messages are routed to the corresponding proxy servers according to the Route defined in the message. Messages initiating a new transaction and/or dialog (registrations, calls etc) are routed to a randomly selected proxy. The selection algorithm is based on a hash over the Call-ID of the message, so the same proxy sending a authentication challenge to an endpoint will receive the authenticated message again.

The second service running on a load balancer is haproxy, which is acting as load balancing instance for XMPP messages. The same way the SIP load balancer routes SIP messages to the corresponding proxy, the haproxy passes XMPP traffic on to the proxy maintaining a session with a subscriber, or randomly selects a proxy in case of a new connection while automatically failing over on timeouts.

Message Routing and Media Relay

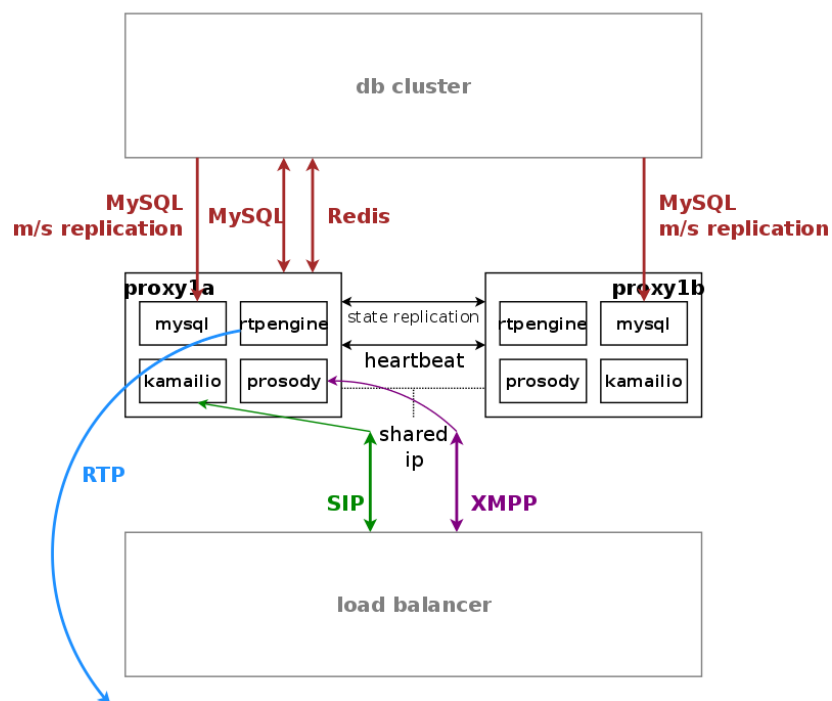


Figure 9: Proxy Server Overview

Proxy servers also come in pairs, and by default there are four pairs of proxies in a standard sip:carrier setup.

The proxies are responsible for doing the actual SIP routing and media handling and the XMPP presence and chat message deliveries. Each proxy pair can handle any subscriber on the overall system, compared to the concept of "home proxies" in other architectures. The advantage of this approach is that the overall system can be scaled extremely easily by adding more proxy pairs without having to redistribute subscribers.

Once a load balancer sends a new message to a proxy, the SIP transaction and/or dialog gets anchored to this proxy. That way it is ensured that a call starting on a proxy is also ended on the same proxy. Hence, the full range of feature handling like media relay, voicemail, fax, billing and rating is performed on this proxy. So, there is no a central point for various tasks, potentially leading to a non-scalable bottleneck. Due to the anchoring, proxies come in pairs and replicate all internal state information to the standby node via redis. In case of fail-over, the full signalling and media are moved to the standby node without interruption.

The complete static subscriber information like authentication credentials, number mappings, feature settings etc. are replicated from the db cluster down to the local MySQL instance of the proxies. The ratio of db read requests of static subscriber data versus reading and writing volatile and shared data is around 15:1, and this approach moves the majority of the static read operations from the central db cluster to the local proxy db.

Volatile and shared information needed by all proxies in the cluster is read from and written to the db cluster. This mainly includes SIP registration information and XMPP connection information.

Billing and rating is also performed locally on the proxies, and only completed CDRs (rated or unrated depending on whether rating is enabled) are transferred to the central db cluster for consumption via the northbound interfaces.

For SIP, the relevant instances on a proxy are kamailio acting as a stateful proxy for SIP registration and call routing, seds acting as a back-to-back user-agent for prepaid billing and application server, rtpengine as media relay and RTP/SRTP transcoder, and asterisk as voicemail server. XMPP is handled by an instance of prosody, and several billing processes mediate start and stop records into CDRs and rate them according to the relevant billing profiles.

2.2.3 Scaling beyond one Hardware Chassis

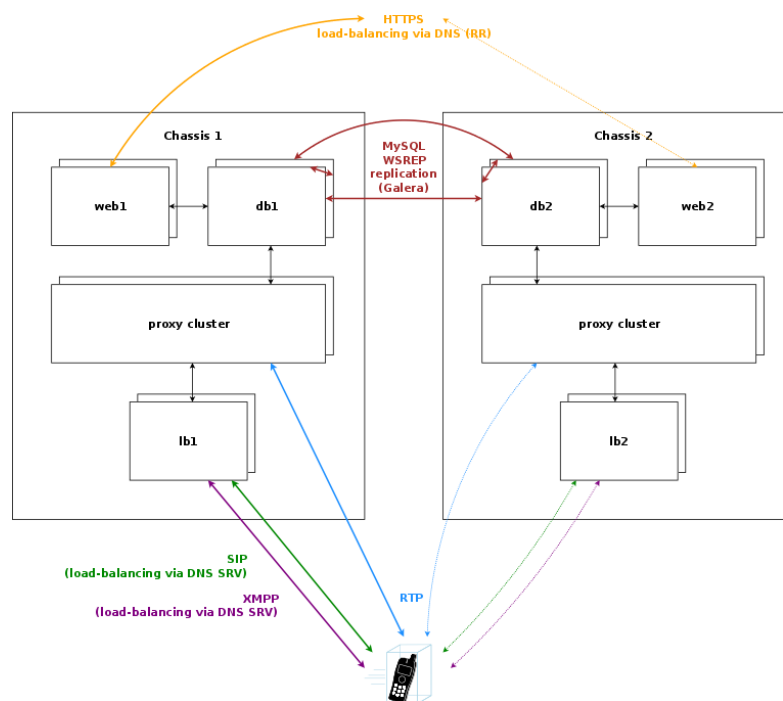


Figure 10: Scaling beyond one chassis

If the sip:carrier is scaled beyond 250.000 subscribers and therefore exceeds one chassis, a second chassis is put into place. This chassis provides another two web servers, two db servers, two load balancers and 8 proxies, doubling the capacity of the system.

Scaling the DB cluster

The DB cluster is the only node type which requires a notable change on the architecture. Once more than one db pair is deployed, the replication mechanism between db nodes changes from master/master between the nodes of the db1 pair to a synchronous multi-master replication over all db nodes on the system using Galera. This change makes it possible to scale both read and write requests over multiple nodes, while being transparent to all other nodes.

Scaling the proxy cluster

New proxy nodes replicate via master/slave from the first db node in the chassis as usual. Since the db cluster holds all provisioning information of all subscribers, the proxy nodes join the cluster transparently and will start serving subscribers as soon as all services on a new proxy are reachable from the load balancers.

Scaling the load balancers

Load balancers are completely stateless, so they start serving subscribers as soon as they are made visible to the subscribers. This could either be done via DNS round-robin, but the better approach is to configure a DNS SRV record, which allows for more fine-grained control like weighting load-balancer pairs and allowing fail-over from one pair to another on the client side.

The load balancers use the Path extension of SIP to make sure during SIP registration that calls targeted to a subscriber are routed via the same load balancer pair which the subscriber used during registration for proper traversal of symmetric NAT at the customer premise.

A SIP or XMPP request reaching a load balancer can be routed to any available proxy in the whole system, or only to proxies belonging to the same chassis as the load balancer, depending on the system configuration.

Scaling the web servers

New web server pairs are made available to web clients via DNS round-robin. Any pair of web servers can be used to read or write provisioning information via the web interfaces or the API.

2.2.4 Architecture for central core and local satellites

Tip

This architecture is not part of the standard deployment and is to be defined in the project plan!

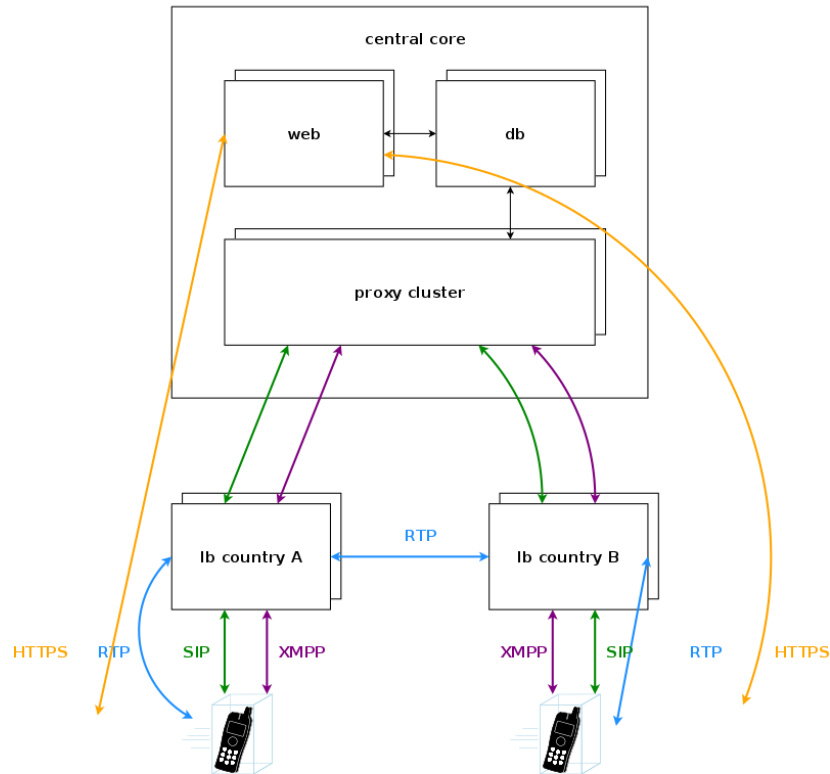


Figure 11: Central core with local breakouts

In case of a geographically distributed system spanning across multiple countries, different regulatory requirements have to be met for signalling and media, especially when it comes to if, where and how subscriber traffic can be intercepted. Countries might have the requirement to intercept traffic in the country, so the signalling and media must be anchored to an element in the country. Also if a media stream stays within a country, it is preferred to keep the media as close to the subscribers as possible to reduce latency, so relaying streams via a central core has to be avoided.

For this scenario, the sip:carrier makes it possible to move the load balancers directly into the countries. DNS settings for subscribers within the country ensure that they will always contact those load balancers, either using separate DNS settings per country for a SIP domain, or using GeoIP mechanisms in DNS to return the closest load balancer based on the location of the subscriber. To anchor media to the countries, the rtpengine instances are moved from the proxies to the load balancers and are controlled via the stateless kamailio instances on the load balancers instead of the kamailio instances on the proxies.

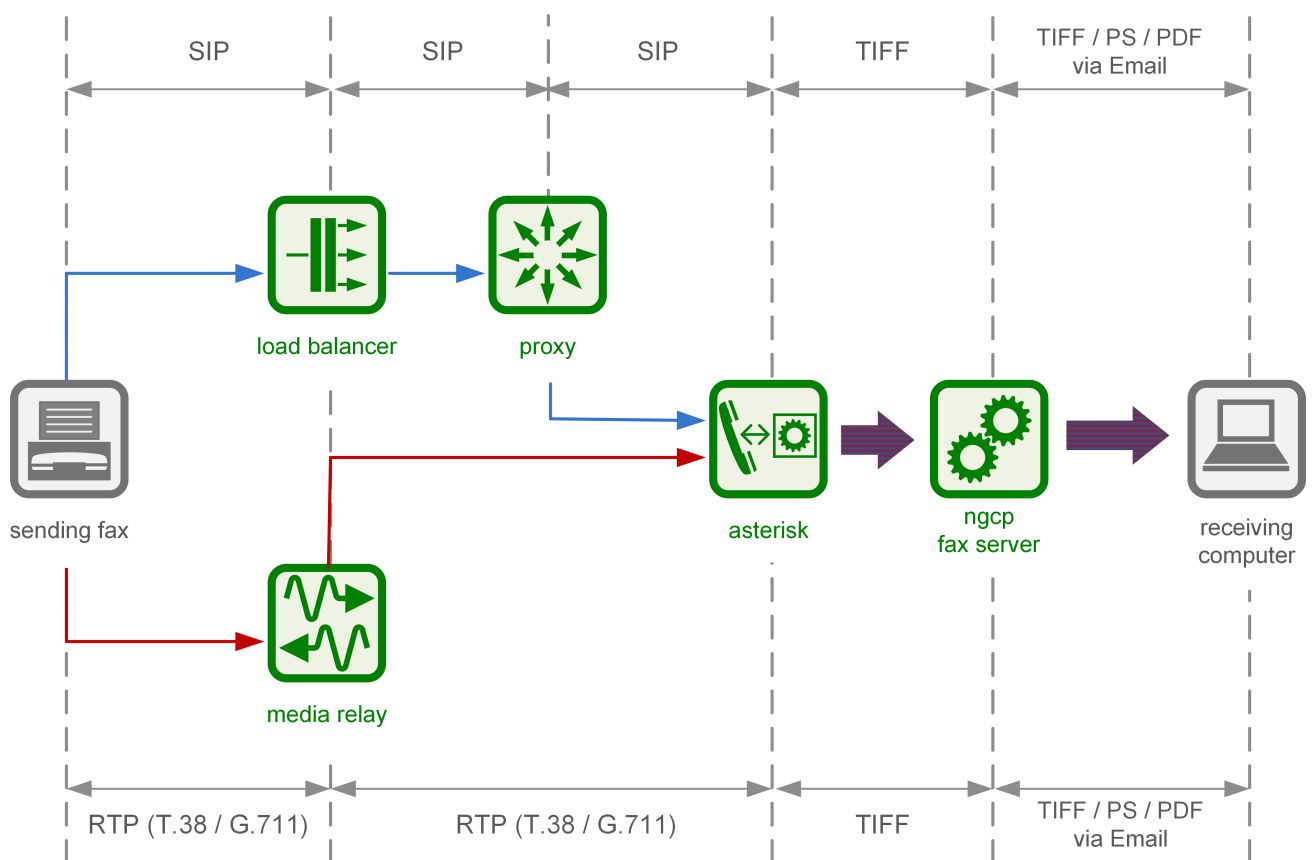
2.3 Fax Server Architecture

There is a Fax Server included in the sip:carrier. The following sections describe its architecture.

The Fax Server is included on the platform and requires no additional hardware. It supports both T38 and G711 codecs and provides a cost-effective paper-free office solution.

2.3.1 Fax2Mail Architecture

To receive faxes via email, a phone call from a sender is connected to the fax application module (Asterisk + NGCP Fax Server) on the sip:carrier. The received fax document is converted to the format the receiver has configured (either PS, PDF or TIFF) via the components outlined in the figure below. The email is delivered to one or more configured addresses.

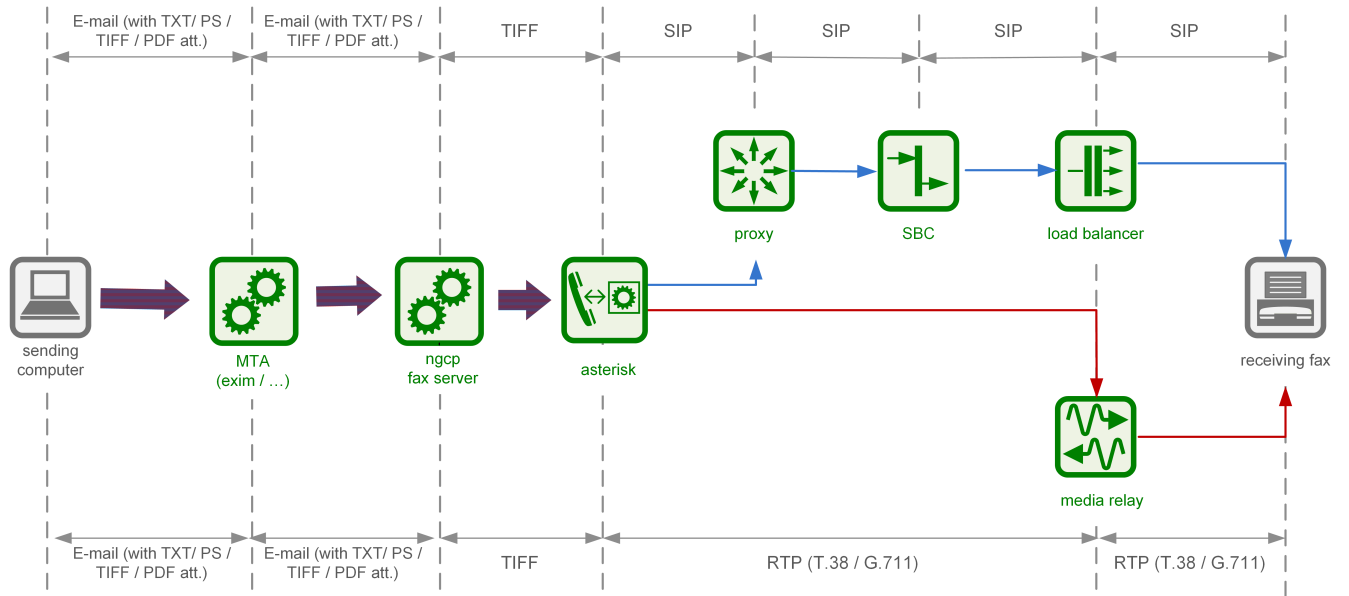


2.3.2 Sendfax and Mail2Fax Architecture

To send faxes via the sip:carrier a sender can use any email client or an interface such as Webfax or REST API.

Currently, supported formats are TXT, PS, TIFF and PDF.

The document is sent to the NGCP Fax Server instance on the sip:carrier. Once successfully queued by the fax server, it is converted to an internal TIFF format and is sent via the components outlined in the below figure to the specified phone number. Of course, a fax device that can receive the document must be connected on the destination side.



3 Upgrading the sip:carrier

3.1 Overview

The sip:carrier system upgrade to mr4.5.1 will perform a couple of fundamental tasks:

- Upgrade NGCP software packages
- Upgrade NGCP configuration templates
- Upgrade NGCP DB schema
- Upgrade the base system within Debian (v8) to the latest package versions

sip:carrier is a PRO-style system which has "A" and "B" pairs of nodes which execute specific roles. The nodes amount here is different and must be clarified ahead of the upgrade on the planning stage.

The way to upgrade sip:carrier is clean and simple:

- upgrade planning
- pre-upgrade steps: customtt, backups
- ensure all nodes "B" are active
- ensure all nodes "A" are inactive
- upgrade all nodes "A" first to the new release
- schedule and perform a switchover to all nodes "A"
- ensure nodes "A" work well (otherwise switchover back to nodes "B")
- upgrade all nodes "B" to the new release
- perform system post-upgrade testing/cleanup

**Warning**

the only allowed way to upgrade sip:carrier is described above. All the other theoretically possible upgrade scenarios can lead to unpredictable results.

**Warning**

Nodes "A" and "B" MUST be used as described in this document. It is NOT allowed to swipe them unless proxy replication (of MySQL on port 3308) is configured on the db01b node.

3.2 Upgrade planning

Have a written answer on the following questions:

- which system should be upgraded (ensure about LAB/LIVE, country, etc.)
- clarify upgrade date and time (ensure timezone) for each stage above
- clarify allowed timeframe for the upgrade (allowed switchover timeframe)
- what should happen if upgrade does not fit allowed timeframe
- request the customer availability on all switchover stages
- gather urgent contact credentials to contact the customer in case of emergency
- force the customer to prepare basic and fast tests to be executed after switchovers to ensure new release works well
- share with the customer the steps you are going to perform and request written confirmation
- ensure that you and the customer have an access to the remote console of the servers: KVM, DRAC

3.3 Preparation

3.3.1 Log into the inactive management server (web01a/db01a).

Tip

Use their real IP so you can switch the cluster forth and back later on.

Switch to the terminal multiplexer under the user *sipwise* (to reuse Sipwise `.screenrc` settings which are user-friendly for handling upgrade in multiple windows):

```
screen -S ngcp-upgrade
```

Become a root inside your screen session:

```
sudo -s
```

Check the system overall status:

```
ngcp-status --all
```

Ensure that all proxy nodes replicate read-only DB (MySQL on 127.0.0.1:3308) from the node db01a. Otherwise, inform your manager about the special state here.

Try to find local changes to the template files by issuing:

```
find /etc/ngcp-config -name \*customtt.tt2
```


You will also need to find the dpkg-dist files under the templates files because people sometimes forget about creating customtt files and edit tt2 files directly. That makes upgrades not to replace the tt2 files. If so, you need to treat the tt2 files as if they were customtt files and make sure you merge the new templates with the changes of the old ones.

```
find /etc/ngcp-config -name \*.tt2.dpkg-dist
```

Also, please check/clean old dpkg backup files (just in case if another engineer did the previous step not carefully enough).

Normally the list should be empty:

```
find /etc/ngcp-config -name \*.tt2.dpkg\*
```

You will have to understand why the changes are there and if they are still needed after the upgrade.

You must create a ticket in the bug tracker to include customtt changes in the following releases (to remove customtt one day).



Warning

Installation may use locally specified apt Debian mirrors. Discuss with a customer possibility to switch on Sipwise APT repositories (at least for the time of upgrades), the public Debian mirrors may not provide packages for old Releases anymore or be at least outdated!

3.3.2 Log into all servers.

Open separate windows for all the servers inside your screen session. (Press `Ctrl+a + c` to open new window, `Ctrl+a+a` or `Ctrl+a + [0-9]` to change the window. `Ctrl+a + "` can open list of all windows for you. `C+a + A` can be used to change the screen name, so you can mark hosts here).

Check the system for locally modified files (move them to appropriate customtt.tt2 files if necessary) on **all** servers:

```
ngcp-status --integrity
```

Make sure the cluster status is ok - on **all** nodes issue manually:

- **ngcpcfg status** - should print OK all the times

Can be checked on all nodes in parallel, using clish and parallel-ssh:

- **ngcp-clish "ngcp version summary"** - ensure all nodes have proper/expected from version across all cluster
- **ngcp-clish "ngcp version package installed ngcp-ngcp-carrier"** - ensure the metapackages version is equal to the ngcp version above
- **ngcp-clish "ngcp version package check"** - ensure all nodes have identical list of debian package installed.

Note

All nodes must be identical before and after the upgrade!

- **ngcp-clish "ngcp cluster ssh connectivity"** - check SSH connectivity from the current node to all other nodes
- **ngcp-clish "ngcp cluster ssh crossconnectivity"** - check SSH connectivity from the all nodes to all other nodes
- **ngcp-clish "ngcp monit summary"** - ensure no errors are there
- **ngcp-clish "ngcp cluster status"** - active nodes (with all services running) should print "all", the other "none"
- **ngcp-clish "ngcp status collective-check"** - should not report any problems.
- **ngcp-clish "ngcp show date"** - date and time must be in sync on all the servers
- **ngcp-clish "ngcp show dns-servers"** - ensure DNS records are correct

Note

to exit from *ngcp-clish* press Ctrl+Z (or type *exit*):

```
root@web01b:~# ngcp-clish
Entering 'clish-enable' view (press Ctrl+Z to exit)...
# exit
root@web01b:~#
```

Run "apt-get update", ensure you have no warnings/errors here.

A cluster failover could be a good idea to see if everything works on the second node too. On the standby node issue:

```
/usr/share/heartbeat/hb_takeover
```

Afterwards, again check *ngcp-status --all*.

Create two test subscribers or retrieve the credentials for two of them. Register a client to the platform and perform a test call between the two to ensure call routing works.

3.4 Upgrade

For upgrading the sip:carrier to mr4.5.1 release, execute the following commands on **inactive management "A" node**:

3.4.1 Upgrading the first inactive management node "A" ONLY (web01a/db01a)

Note

sometimes DB and MGMT roles are assigned to the same host. It is OK.

**Warning**

do NOT execute the current step on web01a and db01a in parallel!

The main goal here is to fill the approx cache with new version of packages. So all the other nodes will get identical version of packages as the first one.

```
NGCP_CURRENT_VERSION=$(cat /etc/ngcp_version)
sed -i "s/$NGCP_CURRENT_VERSION/mr4.5.1/" /etc/apt/sources.list.d/sipwise.list
ngcp-approx-cache-helper --auto --node localhost
apt-get update
apt-get install ngcp-upgrade-pro
```

Note

do NOT worry, ngcp-upgrade-carrier does not exist, use ngcp-upgrade-pro above.

Execute ngcp-upgrade in inactive node as *root*:

```
ngcp-upgrade
```

Note

sip:carrier can be upgraded to mr4.5.1 from previous release or previous build only. The script ngcp-upgrade will find all the possible destination releases for the upgrade and allow to choose the proper one.

Note

If there is an error during upgrade, the ngcp-upgrade script will request you to solve it. Once you fix the problem, just re-execute ngcp-upgrade again and it will continue from the previous step.

Merge/add the customtt configuration templates if needed. Apply the changes to configuration templates if any:

```
ngcpcfg apply 'applying customtt for new release mrX.X on node xxx01a'
```

Send new templates to the shared storage and the other nodes

```
ngcpcfg push --nobuild --noapply all
```

Note

do NOT execute *ngcpcfg push --shared-only* on this stage, it will affect further upgrades due to noticed outdated local ngcpcfg storage. If you did so, run *ngcpcfg push --nobuild --noapply all* once again to pull ngcpcfg changes on all the nodes from glustefs.

3.4.2 Upgrading inactive database node "A" (db*a)

Note

If DB and MGMT roles are assigned to the same host, skip this step as you have upgraded inactive MGMT node "A" above already.

Run the following commands to upgrade inactive DB node "A" (choose the same release version as above and follow on-screen recommendations):

```
NGCP_CURRENT_VERSION=$(cat /etc/ngcp_version)
sed -i "s/$NGCP_CURRENT_VERSION/mr4.5.1/" /etc/apt/sources.list.d/sipwise.list
apt-get update
apt-get install ngcp-upgrade-pro
ngcp-upgrade
```

Note

it is important to upgrade db01a node *before* upgrading any proxy nodes. Otherwise "local" MySQL (127.0.0.1:3308) on proxy nodes may be out of sync if new release has `_not_replicated.up` DB statements.

3.4.3 Upgrading other inactive nodes "A" (lb*a/prx*a)

Run the following commands here (choose the same release version and follow on-screen recommendations):

```
NGCP_CURRENT_VERSION=$(cat /etc/ngcp_version)
sed -i "s/$NGCP_CURRENT_VERSION/mr4.5.1/" /etc/apt/sources.list.d/sipwise.list
apt-get update
apt-get install ngcp-upgrade-pro
ngcp-upgrade
```

3.4.4 Promote ALL inactive nodes "A" to active.

**Warning**

ensure all inactive nodes "A" are:

- upgraded to new release (check `/etc/ngcp_version` or use `ngcp-clish`)
- have been reboot (run `ngcp-status` on each node)

Run on all "A" nodes:

```
/usr/share/heartbeat/hb_takeover
```

Ensure "A" node became active, feel free to reuse `'ngcp-status'` and `'ngcp-clish'` commands described above.

Ensure ALL "B" nodes are inactive now!

3.4.5 Upgrading ALL inactive nodes "B" (web*b/db*b/lb*b/prx*b)

Run the following commands here (choose the same release version and follow on-screen recommendations):

```
NGCP_CURRENT_VERSION=$(cat /etc/ngcp_version)
sed -i "s/$NGCP_CURRENT_VERSION/mr4.5.1/" /etc/apt/sources.list.d/sipwise.list
apt-get update
apt-get install ngcp-upgrade-pro
ngcp-upgrade
```

Note

you can upgrade all inactive "B" nodes together (including mgmt and db roles).

3.5 Post-upgrade checks

When all are finished successfully check that replication is running. Check `ngcp-status --all`. Finally, do a basic functionality test. Check web interface, register two test subscribers and perform a test call between the two to ensure call routing works.

Note

You can find a backup of some important configuration files of your existing installation under `/var/backup/ngcp-mr4.5.1-*` (where * is a place holder for a timestamp) in case you need to roll back something at any time. A log file of the upgrade procedure is available at `/var/backup/ngcp-mr4.5.1-*/upgrade.log`.

4 Administrative Configuration

To be able to configure your first test clients, you will need a Customer, a SIP domain and some subscribers in this domain. Throughout this steps, let's assume you're running the NGCP on the IP address `1.2.3.4`, and you want this IP to be used as SIP domain. This means that your subscribers will have an URI like `user1@1.2.3.4`.

Tip

You can of course set up a DNS name for your IP address (e.g. letting `sip.yourdomain.com` point to `1.2.3.4`) and use this DNS name throughout the next steps, but we'll keep it simple and stick directly with the IP as a SIP domain for now.



Warning

Once you started adding subscribers to a SIP domain, and later decide to change the domain, e.g. from `1.2.3.4` to `sip.yourdomain.com`, you'll need to recreate all your subscribers in this new domain. It's currently not possible to easily change the domain part of a subscriber.

Go to the *Administrative Web Panel (Admin Panel)* running on `https://<ip>:1443/login/admin` and follow the steps below. The default user on the system is *administrator* with the password *administrator*, if you haven't changed it already.

4.1 Creating a Customer

A Customer is a special type of contract on the system acting as billing container for SIP subscribers. You can create as many SIP subscribers within a Customer as you want.

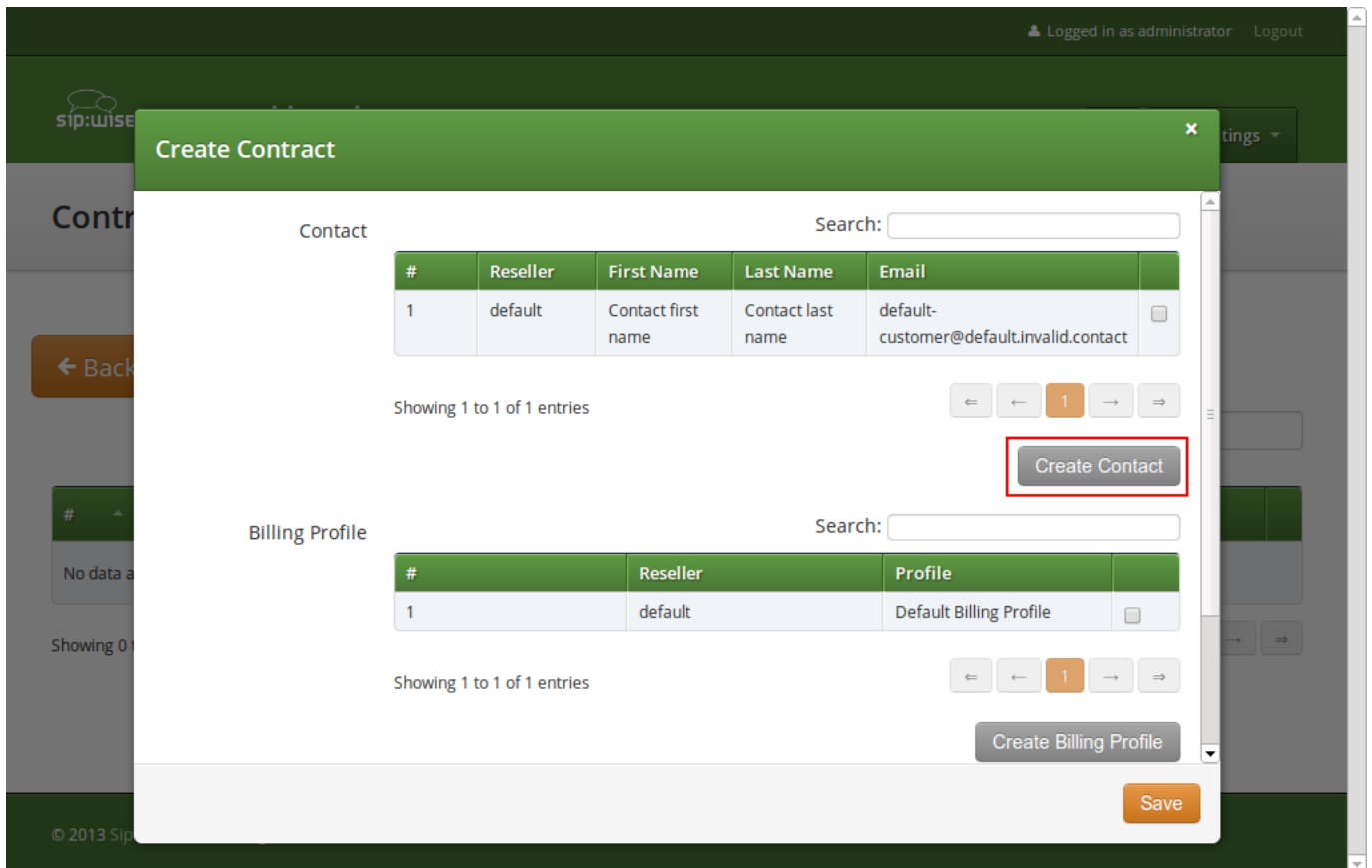
To create a Customer, got to *Settings*→*Customers*.

The screenshot shows the sip:wise NGCP Dashboard interface. At the top right, it indicates the user is logged in as 'administrator' with a 'Logout' link. The dashboard title is 'sip:wise NGCP Dashboard'. A 'Settings' menu is open, listing various configuration options: Administrators, Resellers, Customers (highlighted in orange), Domains, Subscribers, Billing, Peerings, Rewrite Rule Sets, NCOS Levels, Sound Sets, and Security Bans. Below the menu, the dashboard is divided into four main sections: System Status, Resellers, Billing, and a partially visible fourth section. The System Status section shows 'All services running' and three 'Ok' status indicators for Applications, System, and Hardware. The Resellers section shows 9 Resellers, 0 Domains, 0 Customers, and 0 Subscribers. The Billing section shows 6 Billing Profiles, 0.00 Peering Costs, 0.00 Reseller Revenue, and 0.00 Customer Revenue. Each section has a 'Configure' button at the bottom.

Click on *Create Customer*.

The screenshot shows the sip:wise NGCP Dashboard interface. At the top right, it indicates the user is logged in as 'administrator' with a 'Logout' link. The dashboard title is 'sip:wise NGCP Dashboard' and includes a home icon and a 'Settings' dropdown menu. The main section is titled 'Customers'. Below this, there are two buttons: 'Back' and 'Create Customer', with the latter highlighted by a red box. A search input field is located to the right of the buttons. Below the search field is a table with the following headers: '#', 'External #', 'Reseller', 'Contact Email', 'Billing Profile', and 'Status'. The table currently contains no data, displaying the message 'No data available in table'. Below the table, it shows 'Showing 0 to 0 of 0 entries' and navigation controls. The footer of the dashboard contains the copyright notice: '© 2013 Sipwise GmbH, all rights reserved.'

Each *Customer* needs a *Contact*. We can either reuse the default one, but for a clean setup, we create a new *Contact* for each *Customer* to be able to identify the *Customer*. Click on *Create Contact* to create a new *Contact*.



The screenshot shows a web application interface for creating a contract. The main window is titled "Create Contract" and contains two sections: "Contact" and "Billing Profile".

Contact Section:

#	Reseller	First Name	Last Name	Email
1	default	Contact first name	Contact last name	default-customer@default.invalid.contact

Showing 1 to 1 of 1 entries

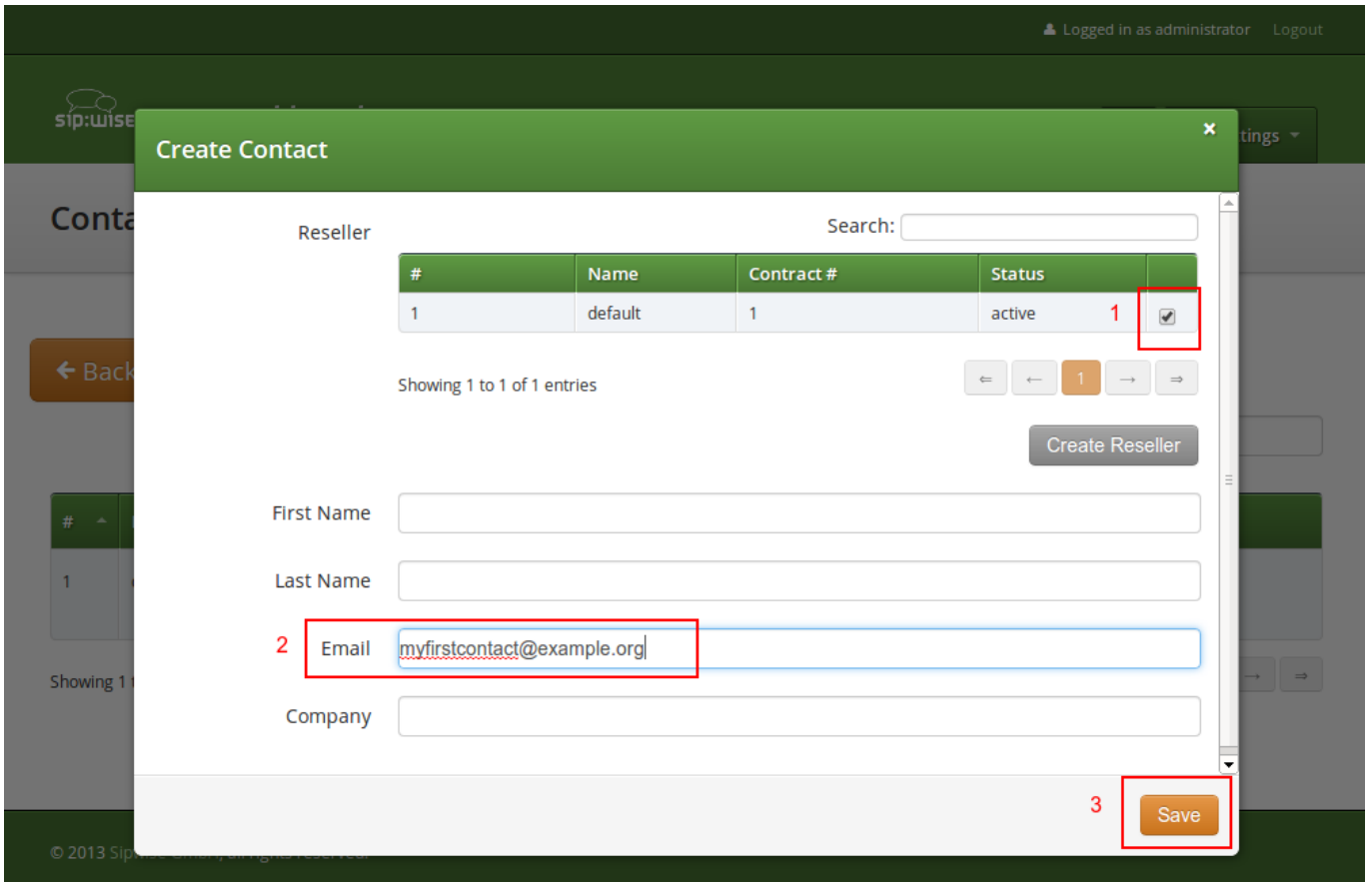
Billing Profile Section:

#	Reseller	Profile
1	default	Default Billing Profile

Showing 1 to 1 of 1 entries

A "Create Contract" button is highlighted with a red box. Other buttons include "Create Billing Profile" and "Save".

We assign the Contact to the default *Reseller*. You can create a new one if you want, but for a simple setup the default *Reseller* is sufficient. Select the *Reseller* and enter the contact details (at least an *Email* is required), then press *Save*.



You will be redirected back to the *Customer* form. The newly created *Contact* is selected by default now, so you only have to select a *Billing Profile*. Again you can create a new one on the fly, but we will go with the default profile for now. Select it and press *Save*.

You will now see your first *Customer* in the list. Hover over the customer and click *Details* to view the details.

The screenshot shows the sip:wise NGCP Dashboard interface. At the top right, it indicates the user is logged in as 'administrator' with a 'Logout' link. The dashboard title 'sip:wise NGCP Dashboard' is on the left, with 'Home' and 'Settings' buttons on the right. The main heading is 'Customers'. Below this are two buttons: 'Back' and 'Create Customer'. A green notification bar states 'Contract successfully created'. A search input field is present. The main content is a table with columns: '#', 'External #', 'Reseller', 'Contact Email', 'Billing Profile', 'Status', and actions. The first row contains the value '20' in the '#' column, 'default' in 'Reseller', 'myfirstcontact@example.org' in 'Contact Email', 'Default Billing Profile' in 'Billing Profile', and 'active' in 'Status'. The actions column for this row contains 'Edit', 'Terminate', and 'Details' buttons, with the 'Details' button highlighted by a red box. Below the table, it says 'Showing 1 to 1 of 1 entries' and includes pagination controls.

#	External #	Reseller	Contact Email	Billing Profile	Status	
20		default	myfirstcontact@example.org	Default Billing Profile	active	Edit Terminate Details

4.2 Creating a Subscriber

In your *Customer* details view, click on the *Subscribers* row, then click the *Create Subscriber*.

Logged in as administrator Logout

sip:wise NGCP Dashboard

Home Settings

Customer Details

Back Edit

Reseller

Contact Details

Billing Profiles

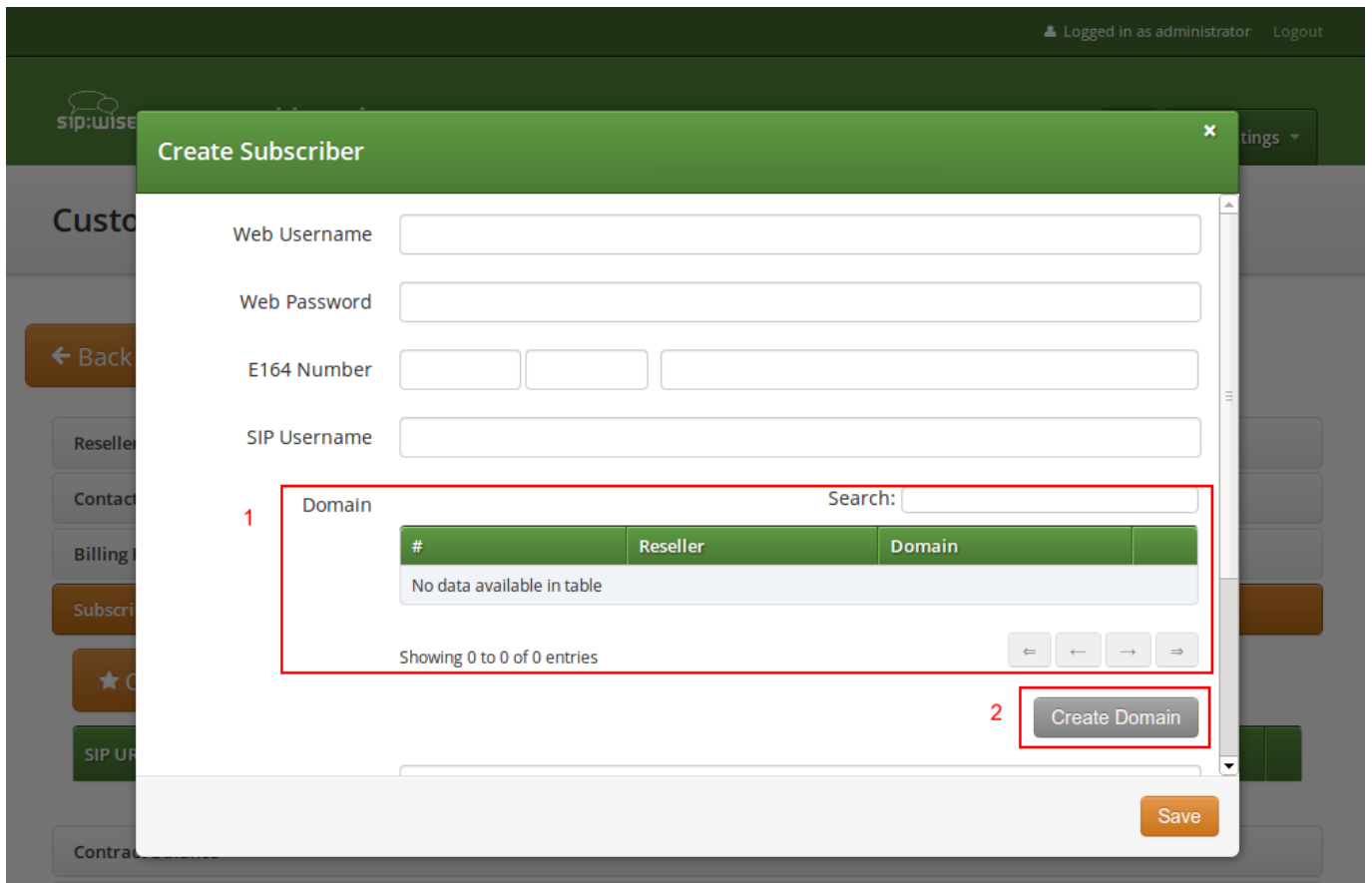
1 Subscribers

2 Create Subscriber

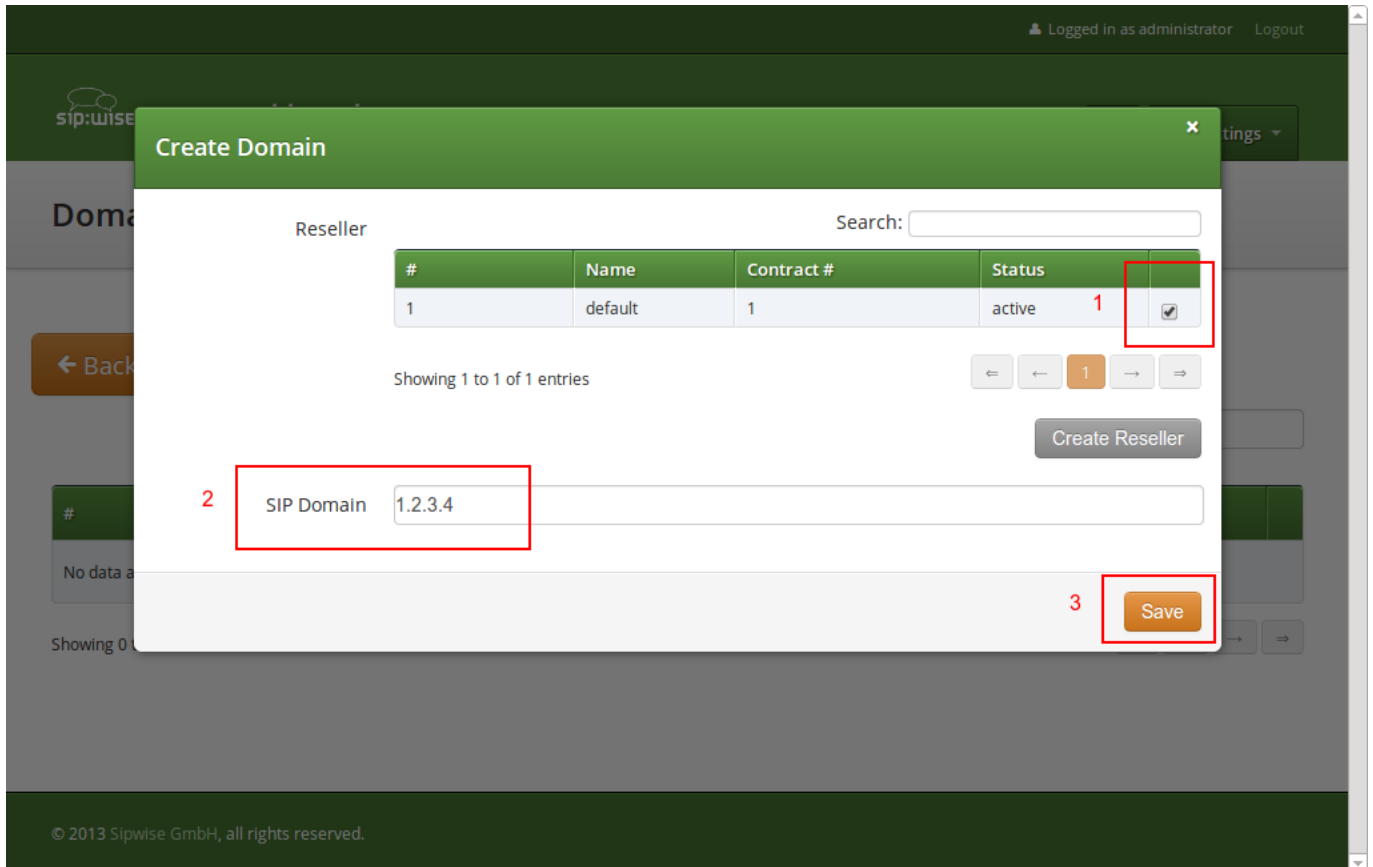
SIP URI	Primary Number	Registered Devices
---------	----------------	--------------------

Contract Balance

As you can see, we don't have any *SIP Domains* yet, so click on *Create Domain* to create one.



Select the *Reseller* (make sure to use the same reseller where your *Customer* is created in) and enter your domain name, then press *Save*.



Your *Domain* will be preselected now, so fill out the rest of the form:

- **Web Username:** This is the user part of the username the subscriber may use to log into her *Customer Self Care Interface*. The user part will be automatically suffixed by the SIP domain you choose for the **SIP URI**. Usually the web username is identical to the **SIP URI**, but you may choose a different naming schema.



Caution

The web username needs to be unique. The system will return a fault if you try to use the same web username twice.

- **Web Password:** This is the password for the subscriber to log into her *Customer Self Care Interface*. It must be at least 6 characters long.
- **E164 Number:** This is the telephone number mapped to the subscriber, separated into *Country Code (CC)*, *Area Code (AC)* and *Subscriber Number (SN)*. For the first tests, you can set a made-up number here and change it later when you get number blocks assigned by your PSTN interconnect partner. So in our example, we'll use 43 as CC, 99 as AC and 1001 as SN to form the phantasy number +43 99 1001.

Tip

This number can actually be used to place calls between local subscribers, even if you don't have any PSTN interconnection. This comes in handy if you use phones instead of soft-clients for your tests. The format in which this number can be dialled so the subscriber is reached is defined in Section 4.6.

Important



NGCP allows a single subscriber to have multiple E.164 numbers to be used as aliases for receiving incoming calls. Also, NGCP supports so called "implicit" extensions. If a subscriber has phone number 012345, but somebody calls 012345100, then NGCP first tries to send the call to number 012345100 (even though the user is registered as 012345). If NGCP then receives the 404 - Not Found response, it falls back to 012345 (the user-part with which the callee is registered).

- **SIP Username:** The user part of the SIP URI for your subscriber.
- **SIP Domain:** The domain part of the SIP URI for your subscriber.
- **SIP Password:** The password of your subscriber to authenticate on the SIP proxy. It must be at least 6 characters long.
- **Status:** You can lock a subscriber here, but for creating one, you will most certainly want to use *active*.
- **External ID:** You can provision an arbitrary string here (e.g. an ID of a 3rd party provisioning/billing system).
- **Administrative:** If you have multiple subscribers in one account and set this option for one of them, this subscriber can administrate other subscribers via the *Customer Self Care Interface*.

The screenshot shows the 'Create Subscriber' form in the NGCP Dashboard. The form has the following elements:

- Web Password:** An empty text input field.
- E164 Number:** A field with three sub-inputs containing '43', '99', and '1001'. This field is highlighted with a red box and labeled '1'.
- SIP Username:** A text input field containing 'testuser1'. This field is highlighted with a red box and labeled '2'.
- Domain:** A section with a search bar and a table of domains. The table has columns for '#', 'Reseller', and 'Domain'. One entry is visible: '# 6', 'Reseller default', 'Domain 1.2.3.4'. A red box highlights the checkbox in the rightmost column of this entry, labeled '3'.
- SIP Password:** A text input field containing 'mysecretpassword'. This field is highlighted with a red box and labeled '4'.
- Save:** An orange button at the bottom right of the form, highlighted with a red box and labeled '5'.

Repeat the creation of *Customers* and *Subscribers* for all your test accounts. You should have at least 3 subscribers to test the functionality of the NGCP.

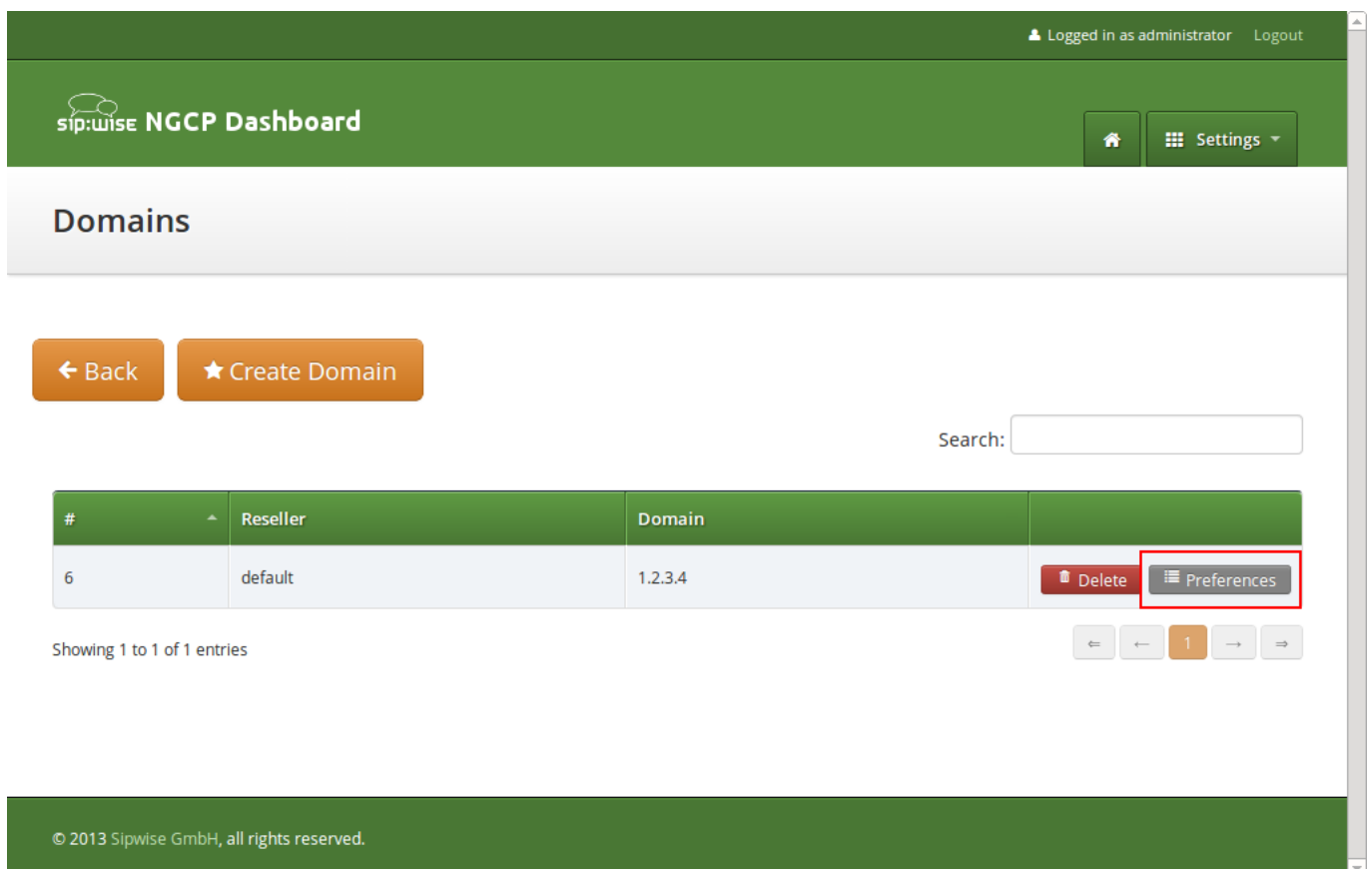
Tip

At this point, you're able to register your subscribers to the NGCP and place calls between these subscribers.

You should now revise the *Domain* and *Subscriber Preferences*.

4.3 Domain Preferences

The *Domain Preferences* are the default settings for *Subscriber Preferences*, so you should set proper values there if you don't want to configure each subscriber separately. You can later override these settings in the *Subscriber Preferences* if particular subscribers need special settings. To configure your *Domain Preferences*, go to *Settings*→*Domains* and click on the *Preferences* button of the domain you want to configure.



The screenshot shows the NGCP Dashboard interface. At the top, it says "Logged in as administrator" and "Logout". The main header is "sip:wise NGCP Dashboard" with a home icon and a "Settings" dropdown menu. Below the header, the section is titled "Domains". There are two orange buttons: "Back" and "Create Domain". A search bar is present with the text "Search:". Below the search bar is a table with the following data:

#	Reseller	Domain	
6	default	1.2.3.4	Delete Preferences

Below the table, it says "Showing 1 to 1 of 1 entries" and there are navigation buttons (back, forward, first, last). At the bottom, there is a copyright notice: "© 2013 Sipwise GmbH, all rights reserved."

The most important settings are in the *Number Manipulations* group.

Here you can configure the following:

- for incoming calls - which SIP message headers to take numbers from
- for outgoing calls - where in the SIP messages to put certain numbers to

- for both - how these numbers are normalized to E164 format and vice versa

To assign a *Rewrite Rule Set* to a *Domain*, create a set first as described in Section 4.6, then assign it to the domain by editing the *rewrite_rule_set* preference.

Domain "1.2.3.4" - Preferences

← Back

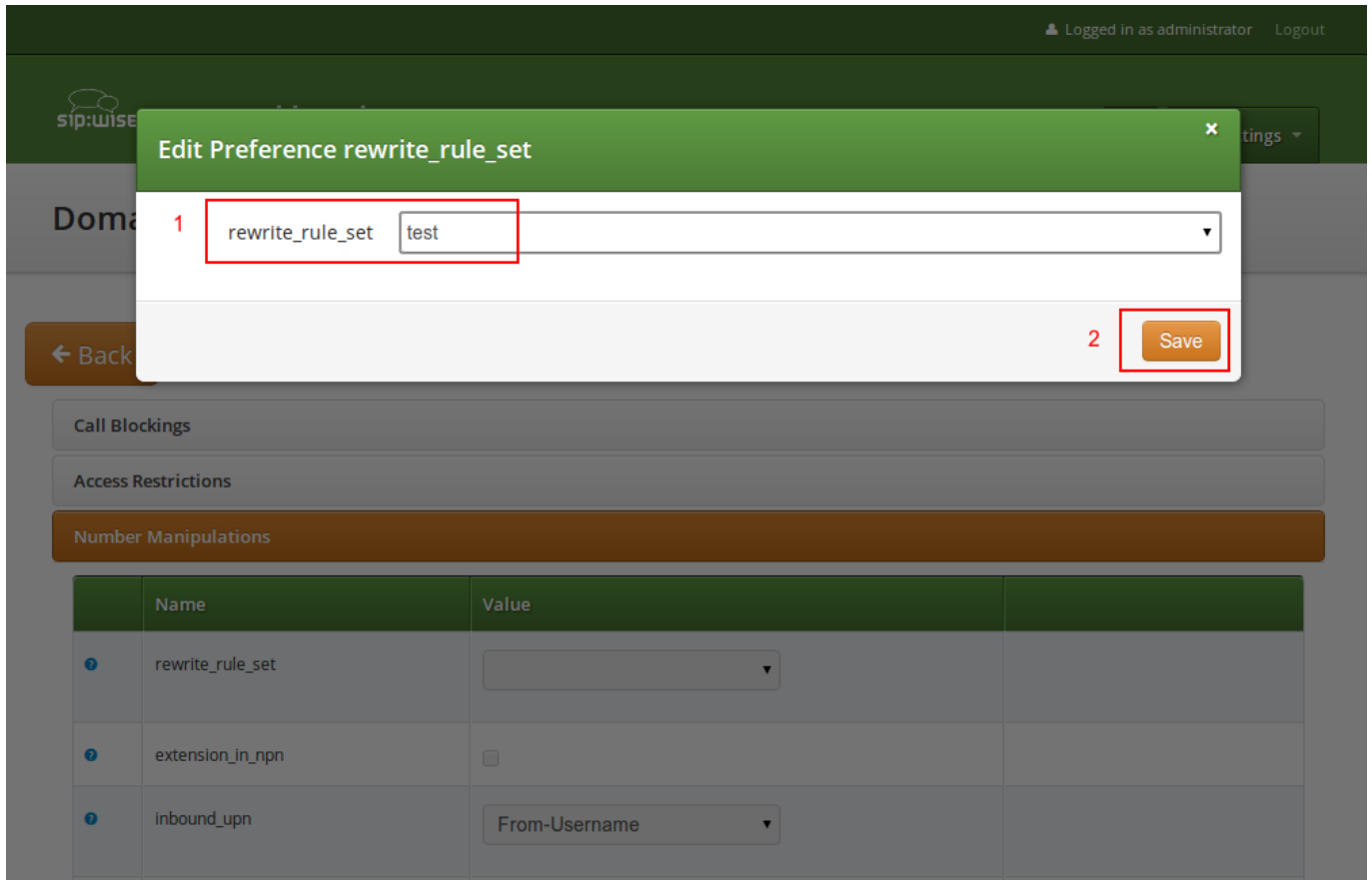
Call Blockings

Access Restrictions

1 **Number Manipulations**

	Name	Value	
i	rewrite_rule_set	<input type="text" value=""/>	2 ✎ Edit
i	extension_in_npn	<input type="checkbox"/>	
i	inbound_upn	<input type="text" value="From-Username"/>	
i	outbound_from_user	<input type="text" value="User-Provided-Number"/>	
i	outbound_from_display	<input type="text" value="None"/>	

Select the *Rewrite Rule Set* and press *Save*.



Then, select the field you want the *User Provided Number* to be taken from for inbound INVITE messages. Usually the *From-Username* should be fine, but you can also take it from the *Display-Name* of the From-Header, and other options are available as well.

4.4 Subscriber Preferences

You can override the *Domain Preferences* on a subscriber basis as well. Also, there are *Subscriber Preferences* which don't have a default value in the *Domain Preferences*.

To configure your *Subscriber*, go to *Settings*→*Subscribers* and click *Details* on the row of your subscriber. There, click on the *Preferences* button on top.

You want to look into the *Number Manipulations* and *Access Restrictions* options in particular, which control what is used as user-provided and network-provided calling numbers.

- For outgoing calls, you may define multiple numbers or patterns to control what a subscriber is allowed to send as user-provided calling numbers using the *allowed_clis* preference.
- If *allowed_clis* does not match the number sent by the subscriber, then the number configured in *cli* (the network-provided number) preference will be used as user-provided calling number instead.
- You can override any user-provided number coming from the subscriber using the *user_cli* preference.

Note

Subscribers preference *allowed_clis* will be synchronized with subscribers primary number and aliases if *oss-bss→provisioning→auto_allow_cli* is set to **1** in */etc/ngcp-config/config.yml*.

Note

Subscribers preference *cli* will be synchronized with subscribers primary number and aliases if *oss-bss→provisioning→auto_sync_cli* is set to **yes** in */etc/ngcp-config/config.yml*.

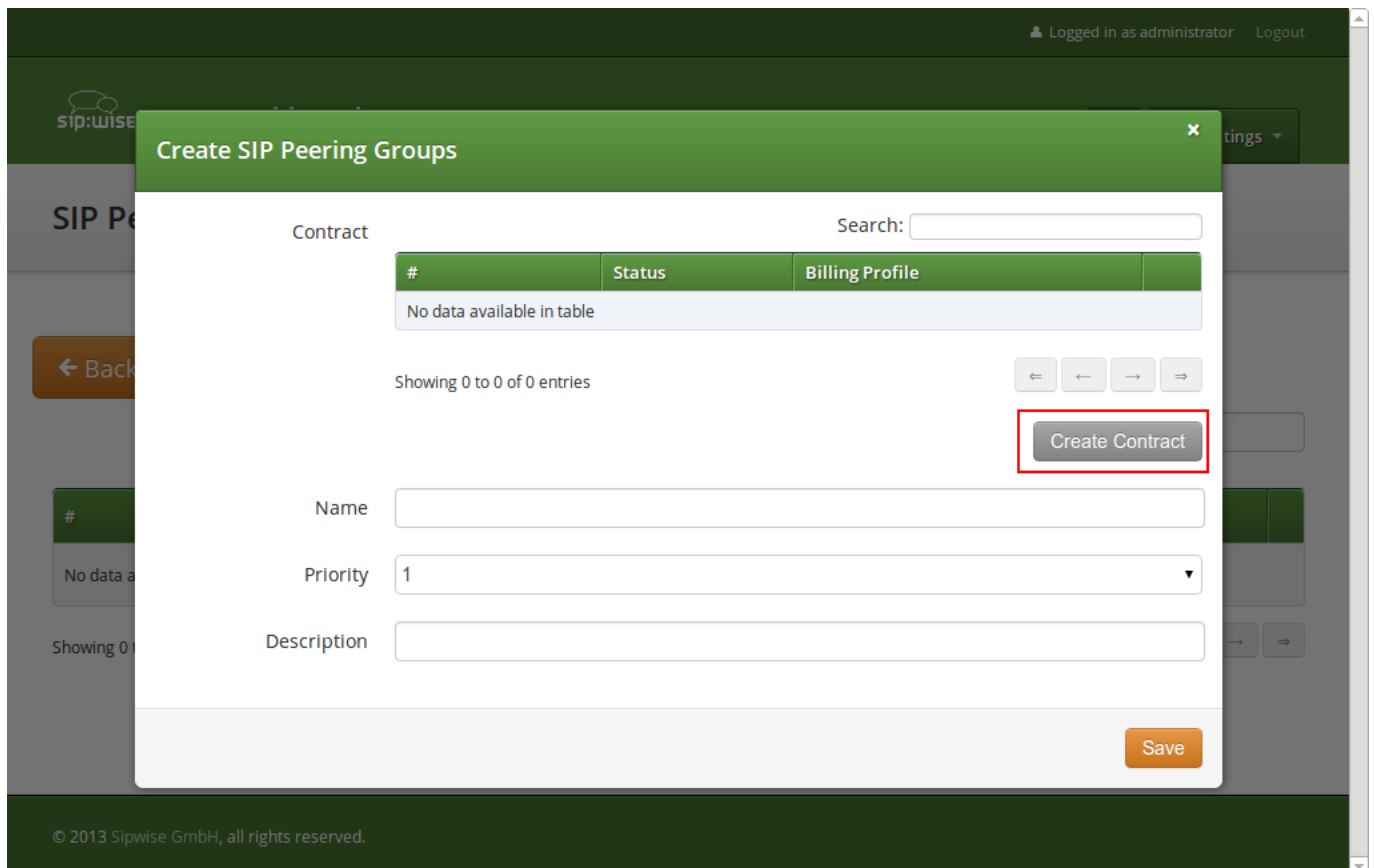
4.5 Creating Peerings

If you want to terminate calls at or allow calls from 3rd party systems (e.g. PSTN gateways, SIP trunks), you need to create SIP peerings for that. To do so, go to *Settings→Peerings*. There you can add peering groups, and for each peering group add peering servers and rules controlling which calls are routed over these groups. Every peering group needs a peering contract for correct interconnection billing.

4.5.1 Creating Peering Groups

Click on *Create Peering Group* to create a new group.

In order to create a group, you must select a peering contract. You will most likely want to create one contract per peering group.



The screenshot shows the 'Create SIP Peering Groups' modal dialog in the Sipwise web interface. The dialog has a green header with the title 'Create SIP Peering Groups' and a close button. Below the header, there is a search bar labeled 'Contract' and a table with columns '#', 'Status', and 'Billing Profile'. The table is currently empty, displaying 'No data available in table' and 'Showing 0 to 0 of 0 entries'. A 'Create Contract' button is highlighted with a red box. Below the table, there are form fields for 'Name', 'Priority' (set to 1), and 'Description'. A 'Save' button is located at the bottom right of the dialog. The background shows the Sipwise interface with a user logged in as administrator.

Click on *Create Contract* create a *Contact*, then select a *Billing Profile*.

The screenshot shows the 'Create Contract' modal window. It contains two tables for selection. The 'Contact' table has the following data:

#	Reseller	First Name	Last Name	Email	
1	default	Contact first name	Contact last name	default-customer@default.invalid.contact	1.1 <input checked="" type="checkbox"/>
17	default			myfirstcontact@example.org	<input type="checkbox"/>

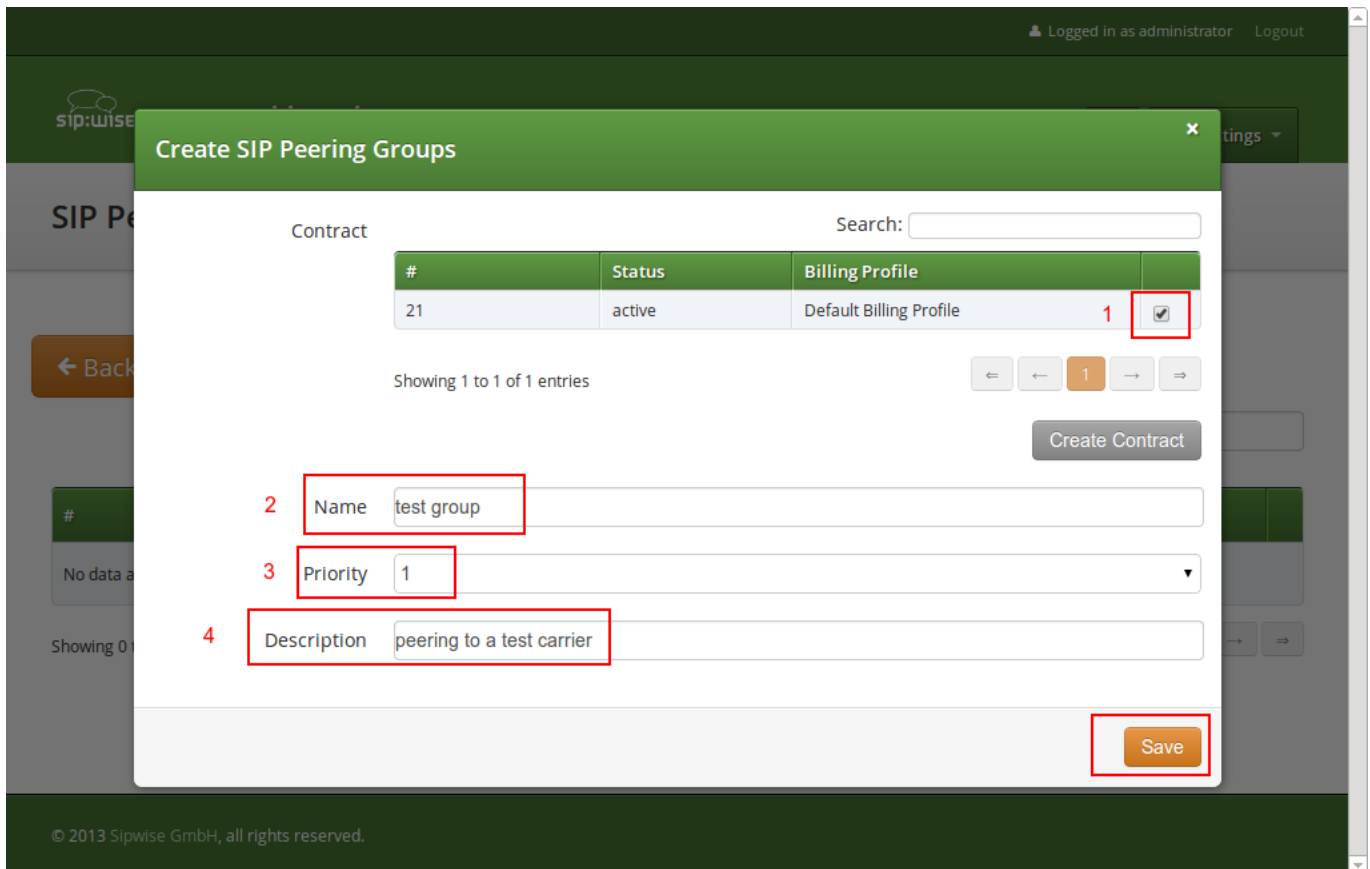
The 'Billing Profile' table has the following data:

#	Reseller	Profile	
1	default	Default Billing Profile	2 <input checked="" type="checkbox"/>

At the bottom right of the modal, there is a 'Save' button highlighted with a red box and labeled '3'.

Click *Save* on the *Contacts* form, and you will get redirected back to the form for creating the actual *Peering Group*. Put a name, priority and description there, for example:

- **Peering Contract:** select the id of the contract created before
- **Name:** test group
- **Priority:** 1
- **Description:** peering to a test carrier



The *Priority* option defines which *Peering Group* to favor if two peering groups have peering rules matching an outbound call. *Peering Rules* are described below.

Then click *Save* to create the group.

4.5.2 Creating Peering Servers

In the group created before, you need to add peering servers to route calls to and receive calls from. To do so, click on *Details* on the row of your new group in your peering group list.

To add your first *Peering Server*, click on the *Create Peering Server* button.

The screenshot shows a web interface for managing peering servers and rules. At the top, there is a section titled "Peering Servers" with two buttons: "← Back" and "★ Create Peering Server". The "Create Peering Server" button is highlighted with a red box and a red number "1". Below this is a search input field. A table with columns: #, Name, IP Address, Hostname, Port, Protocol, Weight, and Via Route Set is shown, with the message "No data available in table". Below the table, it says "Showing 0 to 0 of 0 entries" and has four navigation buttons: ←, ←, →, ⇒.

Below the "Peering Servers" section is a section titled "Peering Rules" with a button "★ Create Peering Rule". Below this is another search input field. A table with columns: #, Callee Prefix, Callee Pattern, Caller Pattern, and Description is shown, with the message "No data available in table". Below the table, it says "Showing 0 to 0 of 0 entries" and has four navigation buttons: ←, ←, →, ⇒.

At the bottom of the interface, there is a green footer bar with the text "© 2013 Sipwise GmbH, all rights reserved."

In this example, we will create a peering server with IP *2.3.4.5* and port *5060*:

- **Name:** test-gw-1
- **IP Address:** 2.3.4.5
- **Hostname:** leave empty
- **Port:** 5060
- **Protocol:** UDP
- **Weight:** 1
- **Via Route:** None

Click **Save** to create the peering server.

Tip

The *hostname* field for a peering server is optional. Usually, the IP address of the peer is used as the **domain** part of the Request URI. Fill in this field if a peer requires a particular hostname instead of the IP address. The IP address must always be given though as the request will always be sent to the specified IP address, no matter what you put into the *hostname* field.

Tip

If you want to add a peering server with an IPv6 address, enter the address without surrounding square brackets into the *IP Address* column, e.g. `::1`.

You can force an additional hop (e.g. via an external SBC) towards the peering server by using the *Via Route* option. The available options you can select there are defined in `/etc/ngcp-config/config.yml`, where you can add an array of SIP URIs in `kamailio→lb→external_sbc` like this:

```
kamailio:
  lb:
    external_sbc:
      - sip:192.168.0.1:5060
```

- sip:192.168.0.2:5060

Execute `ngcpcfg apply added external sbc gateways`, then edit your peering server and select the hop from the *Via Route* selection.

Once a peering server has been created, this server can already send calls to the system.



Important

To be able to send outbound calls towards the servers in the *Peering Group*, you also need to define *Peering Rules*. They specify which source and destination numbers are going to be terminated over this group. To create a rule, click the *Create Peering Rule* button.

Peering Servers

← Back
★ Create Peering Server

Peering server successfully created

Search:

# ^	Name	IP Address	Hostname	Port	Protocol	Weight	Via Route Set
3	test-gw-1	2.3.4.5		5060	1	1	

Showing 1 to 1 of 1 entries ← 1 →

Peering Rules

★ Create Peering Rule ¹

Search:

# ^	Callee Prefix	Callee Pattern	Caller Pattern	Description
No data available in table				

Showing 0 to 0 of 0 entries ← →

Since the previously created peering group will be the only one in our example, we have to add a default rule to route *all* calls via this group. To do so, create a new peering rule with the following values:

- **Callee Prefix:** leave empty
- **Callee Pattern:** leave empty
- **Caller Pattern:** leave empty

- **Description:** Default Rule

The screenshot shows the 'Create Peering Rules' modal in the NGCP Dashboard. The modal is a white box with a green header. It contains four input fields: 'Callee prefix', 'Callee pattern', 'Caller pattern', and 'Description'. The 'Description' field is highlighted with a red box and a red '1'. The text 'Default Rule' is entered in this field. In the bottom right corner of the modal, there is a red '2' pointing to an orange 'Save' button. The background shows the dashboard interface with a table of peering rules and a 'Create Peering Rule' button.

Then click *Save* to add the rule to your group.

Tip

In contrast to the callee/caller pattern, the callee prefix has a regular alphanumeric string and can not contain any regular expression. TIP: If you set the caller or callee rules to refine what is routed via this peer, enter all phone numbers in full E.164 format, that is `<cc><ac><sn>`. TIP: The *Caller Pattern* field covers the whole URI including the subscriber domain, so you can only allow certain domains over this peer by putting for example `@example\.com` into this field.

Peering Servers

[← Back](#)
[★ Create Peering Server](#)

 Search:

# ^	Name	IP Address	Hostname	Port	Protocol	Weight	Via Route Set
3	test-gw-1	2.3.4.5		5060	1	1	

Showing 1 to 1 of 1 entries

⏪ ⏩ 1 ⏪ ⏩

Peering Rules

[★ Create Peering Rule](#)

Peering rule successfully created

 Search:

# ^	Callee Prefix	Callee Pattern	Caller Pattern	Description
1				Default Rule

Showing 1 to 1 of 1 entries

⏪ ⏩ 1 ⏪ ⏩

The selection of peering groups for outgoing calls is done in the following order:

- 1. whether caller or callee pattern matched.
- 2. length of the callee prefix.
- 3. priority of the peering group.
- 4. weight of the peering servers in the selected peering group.

When one or more peering groups are matched for an outgoing call, all servers in the group with the highest priority are tried one by one. A server with higher weight does *not* always take precedence over a server with lower weight, although the former has higher chances to be the first. The weight of a peering server just defines the probability that it will get a call first. In order to find out this probability knowing the weights of peering servers, use the following script:

```
#!/usr/bin/php
<?php

// This script can be used to find out actual probabilities
// that correspond to a list of peering weights.

if ($argc < 2) {
```

```

echo "Usage: lcr_weight_test.php <list of weights (integers 1-254)>\n";
exit;
}

$iters = 10000;

$rand = array();
for ($i = 1; $i <= $iters; $i++) {
    $elem = array();
    for ($j = 1; $j < $argc; $j++) {
        $elem["$j"] = $argv[$j] * (rand() >> 8);
    }
    $rand[] = $elem;
}

$sorted = array();
foreach ($rand as $rand) {
    asort($rand);
    $sorted[] = $rand;
}

$count = array();
for ($j = 1; $j < $argc; $j++) {
    $count["$j"] = 0;
}

foreach ($sorted as $rand) {
    end($rand);
    $count[key($rand)]++;
}

for ($j = 1; $j < $argc; $j++) {
    echo "Peer with weight " . $argv[$j] . " has probability " . $count["$j"]/$iters . "\n";
}
?>

```

Let us say you have 2 peering servers, one with weight 1 and another with weight 2. At the end - running the script as below - you will have the following traffic distribution:

```

# lcr_weight_test.php 1 2

Peer with weight 1 has probability 0.2522
Peer with weight 2 has probability 0.7478

```

If a peering server replies with SIP codes 408, 500 or 503, or if a peering server doesn't respond at all, the next peering server in the current peering group is used as a fallback. The servers within the group are tried one after another from the highest weight to the lowest until the call succeeds. If no more servers are left in the current peering group, the next group which matches the

peering rules is used. And so on.

4.5.3 Authenticating and Registering against Peering Servers

Proxy-Authentication for outbound calls

If a peering server requires the SPCE to authenticate for outbound calls (by sending a 407 as response to an INVITE), then you have to configure the authentication details in the *Preferences* view of your peer host.

Peering Servers

← Back

★ Create Peering Server

Search:

#	^	Name	IP Address	Hostname	Port	Protocol	Weight	
1		test-gw-1	2.3.4.5		5060	1	1	<a>Edit <a>Delete <a>Preferences

Showing 1 to 1 of 1 entries

← ← 1 → →

Peering Rules

★ Create Peering Rule

Search:

#	^	Callee Prefix	Callee Pattern	Callee Pattern	Description	
2					Default Rule	

Showing 1 to 1 of 1 entries

← ← 1 → →

To configure this setting, open the *Remote Authentication* tab and edit the following three preferences:

- **peer_auth_user:** <username for peer auth>
- **peer_auth_pass:** <password for peer auth>
- **peer_auth_realm:** <domain for peer auth>

[← Back](#)

Preference peer_auth_realm successfully updated.

Access Restrictions

Number Manipulations

NAT and Media Flow Control

Remote Authentication

	Name	Value	
	peer_auth_user 1	peeruser1	
	peer_auth_pass 2	peerpass1	
	peer_auth_realm 3	testpeering.com	
	peer_auth_register	<input type="checkbox"/>	
	find_subscriber_by_uuid	<input type="checkbox"/>	

Session Timers

Important



If you do NOT authenticate against a peer host, then the caller CLI is put into the From and P-Asserted-Identity headers, e.g. "+4312345" <sip:+4312345@your-domain.com>. If you DO authenticate, then the From header is "+4312345" <sip:your_peer_auth_user@your_peer_auth_realm> (the CLI is in the Display field, the peer_auth_user in the From username and the peer_auth_realm in the From domain), and the P-Asserted-Identity header is as usual like <sip:+4312345@your-domain.com>. So for presenting the correct CLI in *CLIP no screening* scenarios, your peering provider needs to extract the correct user either from the From Display-Name or from the P-Asserted-Identity URI-User.

Tip

You will notice that these three preferences are also shown in the *Subscriber Preferences* for each subscriber. There you can override the authentication details for all peer host if needed, e.g. if every user authenticates with his own separate credentials at your peering provider.

Tip

If **peer_auth_realm** is set, the system may overwrite the Request-URI with the peer_auth_realm value of the peer when sending the call to that peer or peer_auth_realm value of the subscriber when sending a call to the subscriber. Since this is rarely a desired behavior, it is disabled by default starting with NGCP release 3.2. If you need the replacement, you should set `set_ruri_to_peer_auth_realm: 'yes'` in `/etc/ngcp-config/config.yml`.

Registering at a Peering Server

Unfortunately, the credentials configured above are not yet automatically used to register the SPCE at your peer hosts. There is however an easy manual way to do so, until this is addressed.

Configure your peering servers with the corresponding credentials in `/etc/ngcp-config/templates/etc/ngcp-sems/etc/reg_agent.conf.tt2`, then execute `ngcpcfg apply 'added upstream credentials'`.

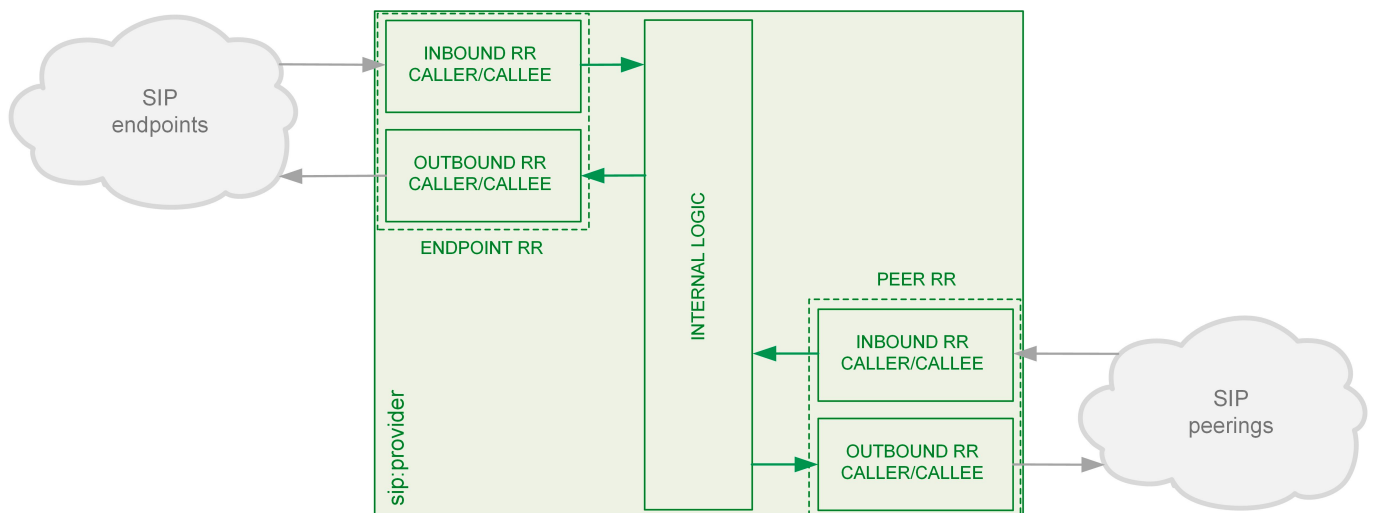


Important

Be aware that this will force SEMS to restart, which will drop all calls.

4.6 Configuring Rewrite Rule Sets

On the NGCP, every phone number is treated in E.164 format `<country code><area code><subscriber number>`. Rewrite Rule Sets is a flexible tool to translate the caller and callee numbers to the proper format before the routing lookup and after the routing lookup separately. The created Rewrite Rule Sets can be assigned to the domains, subscribers and peers as a preference. Here below you can see how the Rewrite Rules are used by the system:



As from the image above, following the arrows, you will have an idea about which type of Rewrite Rules are applied during a call. In general:

- Call from local subscriber A to local subscriber B: Inbound RR from local Domain/Subscriber A and Outbound Rewrite Rules from local Domain/Subscriber B.
- Call from local subscriber A to the peer: Inbound RR from local Domain/Subscriber A and Outbound Rewrite Rules from the peer.
- Call from peer to local subscriber B: Inbound RR from the Peer and Outbound Rewrite Rules from local Domain/Subscriber B.

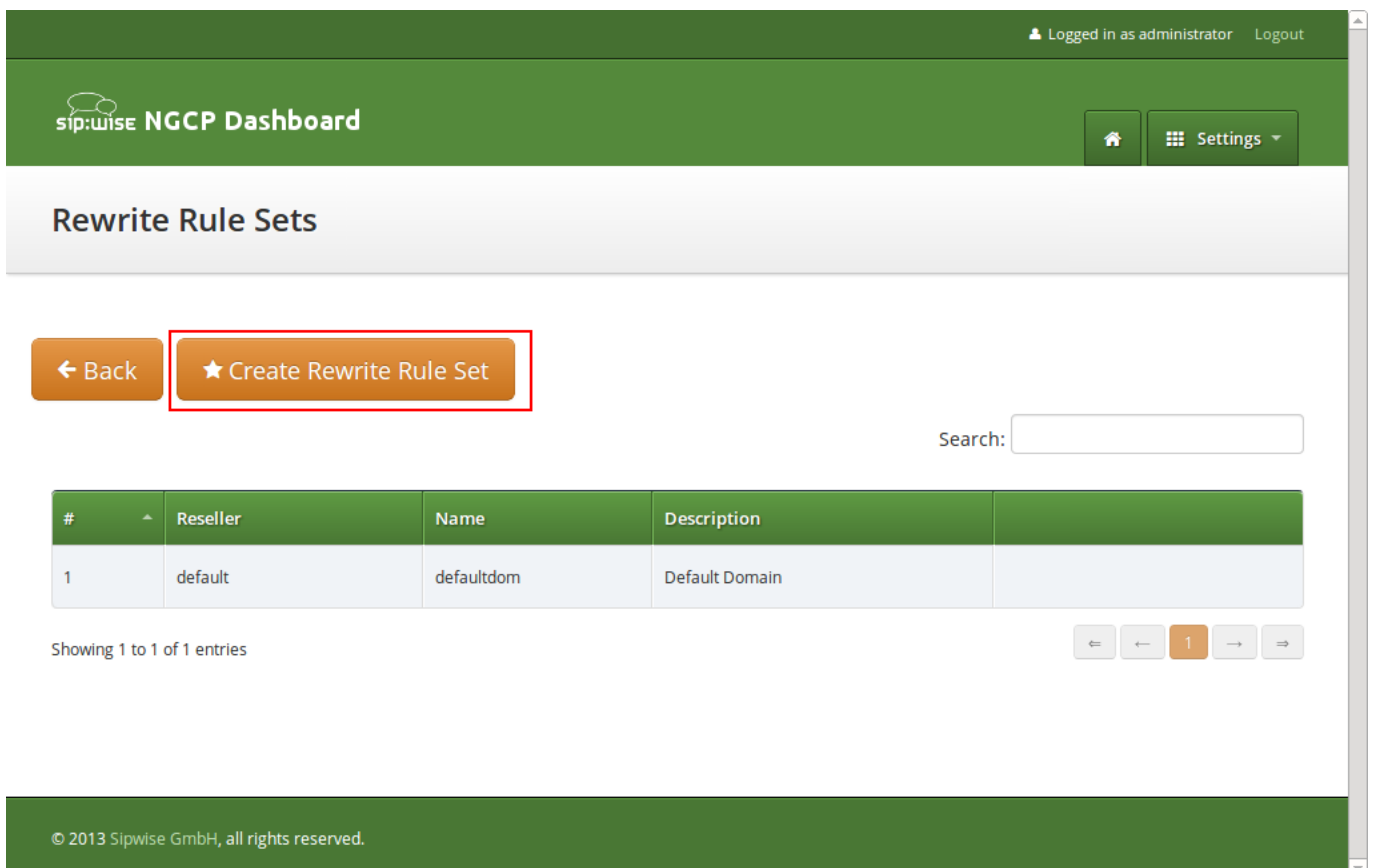
You would normally begin with creating a Rewrite Rule Set for your SIP domains. This is used to control what an end user can dial

for outbound calls, and what is displayed as the calling party on inbound calls. The subscribers within a domain inherit Rewrite Rule Sets of that domain, unless this is overridden by a subscriber Rewrite Rule Set preference.

You can use several special variables in the Rewrite Rules, below you can find a list of them. Some examples of how to use them are also provided in the following sections:

- `${caller_cc}` : This is the value taken from the subscriber's preference CC value under Number Manipulation
- `${caller_ac}` : This is the value taken from the subscriber's preference AC value under Number Manipulation
- `${caller_emergency_cli}` : This is the value taken from the subscriber's preference emergency_cli value under Number Manipulation
- `${caller_emergency_prefix}` : This is the value taken from the subscriber's preference emergency_prefix value under Number Manipulation
- `${caller_emergency_suffix}` : This is the value taken from the subscriber's preference emergency_suffix value under Number Manipulation
- `${caller_cloud_pbx_base_cli}` : This is the value taken from the *Primary Number* field from section *Details* → *Master Data* of the *Pilot Subscriber* for a particular PBX customer.

To create a new Rewrite Rule Set, go to *Settings* → *Rewrite Rule Sets*. There you can create a Set identified by a name. This name is later shown in your peer-, domain- and user-preferences where you can select the rule set you want to use.



The screenshot shows the NGCP Dashboard interface. At the top, it says "Logged in as administrator" and "Logout". The dashboard header includes the "sip:wise NGCP Dashboard" logo and a "Settings" menu. The main heading is "Rewrite Rule Sets". Below this, there are two buttons: "Back" and "Create Rewrite Rule Set", with the latter highlighted by a red box. A search input field is present to the right. Below the buttons is a table with the following data:

#	Reseller	Name	Description
1	default	defaultdom	Default Domain

Below the table, it says "Showing 1 to 1 of 1 entries" and there are navigation controls for the table.

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Click *Create Rewrite Rule Set* and fill in the form accordingly.

The screenshot shows the 'Create Rewrite Rule Sets' dialog box. At the top, it says 'Reseller' and has a search field. Below is a table with the following data:

#	Name	Contract #	Status	
1	default	1	active	1 <input checked="" type="checkbox"/>

Below the table, it says 'Showing 1 to 1 of 1 entries' and has navigation buttons. There is a 'Create Reseller' button. Below that, there are two input fields:

Name: 2

Description: 3

At the bottom right, there is a 'Save' button 4.

Press the *Save* button to create the set.

To view the *Rewrite Rules* within a set, hover over the row and click the *Rules* button.

Logged in as administrator Logout

sip:wise NGCP Dashboard

Home Settings

Rewrite Rule Sets

Back Create Rewrite Rule Set

Rewrite rule set successfully created

Search:

#	Reseller	Name	Description	
1	default	defaultdom	Default Domain	
2	default	domain-dialplan	Dialplan for Domains	Edit Delete Rules

Showing 1 to 2 of 2 entries

← 1 →

The rules are ordered by *Caller* and *Callee* as well as direction *Inbound* and *Outbound*.

Tip

In Europe, the following formats are widely accepted: $+<cc><ac><sn>$, $00<cc><ac><sn>$ and $0<ac><sn>$. Also, some countries allow the areacode-internal calls where only subscriber number is dialed to reach another number in the same area. Within this section, we will use these formats to show how to use rewrite rules to normalize and denormalize number formats.

4.6.1 Inbound Rewrite Rules for Caller

These rules are used to normalize user-provided numbers (e.g. passed in *From Display Name* or *P-Preferred-Identity* headers) into E.164 format. In our example, we'll normalize the three different formats mentioned above into E.164 format.

To create the following rules, click on the *Create Rewrite Rule* for each of them and fill them with the values provided below.

STRIP LEADING 00 OR +

- Match Pattern: $^(00|\+)([1-9][0-9]+)\$$
- Replacement Pattern: $\2$
- Description: International to E.164
- Direction: Inbound

- Field: Caller

REPLACE 0 BY CALLER'S COUNTRY CODE:

- Match Pattern: `^0([1-9][0-9]+)$`
- Replacement Pattern: `${caller_cc}\1`
- Description: National to E.164
- Direction: Inbound
- Field: Caller

NORMALIZE LOCAL CALLS:

- Match Pattern: `^([1-9][0-9]+)$`
- Replacement Pattern: `${caller_cc}${caller_ac}\1`
- Description: Local to E.164
- Direction: Inbound
- Field: Caller

The screenshot shows the 'Create Rule' dialog box in the Sipwise interface. The dialog is a white box with a green header and a close button. It contains several fields: 'Match pattern' with the value '^([00|+)([1-9][0-9]+)\$' and a red box around it labeled '1'; 'Replacement Pattern' with the value '\2' and a red box around it labeled '2'; 'Description' with the value 'International to E.164' and a red box around it labeled '3'; 'Direction' with the value 'Inbound' and a red box around it labeled '4'; 'Field' with the value 'Caller' and a red box around it labeled '5'; and a 'Save' button at the bottom right with a red box around it labeled '6'. The background shows a blurred interface with a 'Back' button and a list of call directions.

Normalization for national and local calls is possible with special variables `${caller_cc}` and `${caller_ac}` that can be used in Replacement Pattern and are substituted by the country and area code accordingly during the call routing.



Important

These variables are only being filled in when a call originates from a subscriber (because only then the cc/ac information is known by the system), so you can not use them when a calls comes from a SIP peer (the variables will be just empty in this case).

Tip

When routing a call, the rewrite processing is stopped after the first match of a rule, starting from top to bottom. If you have two rules (e.g. a generic one and a more specific one), where both of them would match some numbers, reorder them with the up/down arrows into the appropriate position.

Rewrite Rules for domain-dialplan

← Back

★ Create Rewrite Rule

Rewrite rule successfully created

Inbound Rewrite Rules for Caller

	Match Pattern	Replacement Pattern	Description
1	↑ ↓ <input type="checkbox"/> <input type="checkbox"/>	^(00 \+)([1-9][0-9]+)\$	\2 International to E.164
	↑ ↓ <input type="checkbox"/> <input type="checkbox"/> 2	^0([1-9][0-9]+)\$	#{caller_cc}\1 National to E.164
	↑ ↓ <input type="checkbox"/> <input type="checkbox"/>	^([1-9][0-9]+)\$	#{caller_cc}#{caller_ac}\1 Local to E.164

Inbound Rewrite Rules for Callee

Outbound Rewrite Rules for Caller

Outbound Rewrite Rules for Callee

4.6.2 Inbound Rewrite Rules for Callee

These rules are used to rewrite the number the end user dials to place a call to a standard format for routing lookup. In our example, we again allow the three different formats mentioned above and again normalize them to E.164, so we put in the same rules as for the caller.

STRIP LEADING 00 OR +

- Match Pattern: `^(00|\+)([1-9][0-9]+)$`
- Replacement Pattern: `\2`

- **Description:** International to E.164
- **Direction:** Inbound
- **Field:** Callee

REPLACE 0 BY CALLER'S COUNTRY CODE:

- **Match Pattern:** `^0([1-9][0-9]+)$`
- **Replacement Pattern:** `${caller_cc}\1`
- **Description:** National to E.164
- **Direction:** Inbound
- **Field:** Callee

NORMALIZE AREACODE-INTERNAL CALLS:

- **Match Pattern:** `^([1-9][0-9]+)$`
- **Replacement Pattern:** `${caller_cc}${caller_ac}\1`
- **Description:** Local to E.164
- **Direction:** Inbound
- **Field:** Callee

Tip

Our provided rules will only match if the caller dials a numeric number. If he dials an alphanumeric SIP URI, none of our rules will match and no rewriting will be done. You can however define rules for that as well. For example, you could allow your end users to dial `support` and rewrite that to your support hotline using the match pattern `^support$` and the replace pattern `43800999000` or whatever your support hotline number is.

4.6.3 Outbound Rewrite Rules for Caller

These rules are used to rewrite the calling party number for a call to an end user. For example, if you want the device of your end user to show `0<ac><sn>` if a national number calls this user, and `00<cc><ac><sn>` if an international number calls, put the following rules there.

REPLACE AUSTRIAN COUNTRY CODE 43 BY 0

- **Match Pattern:** `^43([1-9][0-9]+)$`
- **Replacement Pattern:** `0\1`
- **Description:** E.164 to Austria National

- **Direction:** Outbound
- **Field:** Caller

PREFIX 00 FOR INTERNATIONAL CALLER

- **Match Pattern:** `^([1-9][0-9]+)$`
- **Replacement Pattern:** `00\1`
- **Description:** E.164 to International
- **Direction:** Outbound
- **Field:** Caller

Tip

Note that both of the rules would match a number starting with 43, so reorder the national rule to be above the international one (if it's not already the case).

4.6.4 Outbound Rewrite Rules for Callee

These rules are used to rewrite the called party number immediately before sending out the call on the network. This gives you an extra flexibility by controlling the way request appears on a wire, when your SBC or other device expects the called party number to have a particular tech-prefix. It can be used on calls to end users too if you want to do some processing in intermediate SIP device, e.g. apply legal intercept selectively to some subscribers.

PREFIX SIPSP# FOR ALL CALLS

- **Match Pattern:** `^([0-9]+)$`
- **Replacement Pattern:** `sipsp#\1`
- **Description:** Intercept this call
- **Direction:** Outbound
- **Field:** Callee

4.6.5 Emergency Number Handling

Configuring Emergency Numbers is also done via Rewrite Rules.

For Emergency Calls from a subscriber to the platform, you need to define an *Inbound Rewrite Rule For Callee*, which adds a prefix `emergency_` to the number (and can rewrite the number completely as well at the same time). If the proxy detects a call to a SIP URI starting with `emergency_`, it will enter a special routing logic bypassing various checks which might make a normal call fail (e.g. due to locked or blocked numbers, insufficient credits or exceeding the max. amount of parallel calls).

TAG AN EMERGENCY CALL

- Match Pattern: `^(911|112)$`
- Replacement Pattern: `emergency_\1`
- Description: Tag Emergency Numbers
- Direction: Inbound
- Field: Callee

To route an Emergency Call to a Peer, you can select a specific peering group by adding a peering rule with a *callee prefix* set to `emergency_` to a peering group.

In order to normalize the emergency number to a valid format accepted by the peer, you need to assign an *Outbound Rewrite Rule For Callee*, which strips off the `emergency_` prefix. You can also use the variables `${caller_emergency_cli}`, `${caller_emergency_prefix}` and `${caller_emergency_suffix}` as well as `${caller_ac}` and `${caller_cc}`, which are all configurable per subscriber to rewrite the number into a valid format.

NORMALIZE EMERGENCY CALL FOR PEER

- Match Pattern: `^emergency_(.+)$`
- Replacement Pattern: `${caller_emergency_prefix}${caller_ac}\1`
- Description: Normalize Emergency Numbers
- Direction: Outbound
- Field: Callee

4.6.6 Assigning Rewrite Rule Sets to Domains and Subscribers

Once you have finished to define your Rewrite Rule Sets, you need to assign them. For sets to be used for subscribers, you can assign them to their corresponding domain, which then acts as default set for all subscribers. To do so, go to *Settings*→*Domains* and click *Preferences* on the domain you want the set to assign to. Click on *Edit* and select the Rewrite Rule Set created before.

The screenshot shows the 'sip:wise NGCP Dashboard' for the domain 'demo.sipwise.com' - Preferences. The interface includes a 'Back' button, a 'Call Blockings' section, an 'Access Restrictions' section with a count of 1, and a highlighted 'Number Manipulations' section. Below this is a table with the following data:

	Name	Value	
?	rewrite_rule_set 2	defaultdom	3 Edit
?	extension_in_npn	<input type="checkbox"/>	
?	inbound_upn	From-Username	
?	outbound_from_user	User-Provided-Number	

You can do the same in the *Preferences* of your subscribers to override the rule on a subscriber basis. That way, you can finely control down to an individual user the dial-plan to be used. Go to *Settings*→*Subscribers*, click the *Details* button on the subscriber you want to edit, then click the *Preferences* button.

4.6.7 Creating Dialplans for Peering Servers

For each peering server, you can use one of the Rewrite Rule Sets that was created previously as explained in Section 4.6 (keep in mind that special variables `${caller_ac}` and `${caller_cc}` can not be used when the call comes from a peer). To do so, click on the name of the peering server, look for the preference called *Rewrite Rule Sets*.

If your peering servers don't send numbers in E.164 format `<cc><ac><sn>`, you need to create *Inbound Rewrite Rules* for each peering server to normalize the numbers for caller and callee to this format, e.g. by stripping leading + or put them from national into E.164 format.

Likewise, if your peering servers don't accept this format, you need to create *Outbound Rewrite Rules* for each of them, for example to append a + to the numbers.

5 Advanced Subscriber Configuration

The sip:carrier provides plenty of subscriber features to offer compelling VoIP services to end customers, and also to cover as many deployment scenarios as possible. In this chapter, we provide the features overview and describe their function and use cases.

5.1 Access Control for SIP Calls

There are two different methods to provide fine-grained call admission control to both subscribers and admins. One is *Block Lists*, where you can define which numbers or patterns can be called from a subscriber to the outbound direction and which numbers or patterns are allowed to call a subscriber in the inbound direction. The other is *NCOS Levels*, where the admin predefines rules for outbound calls, which are grouped in certain levels. The user can then just choose the level, or the admin can restrict a user to a certain level. Also sip:carrier offers some options to restrict the IP addresses that subscriber is allowed to use the service from. The following sections describe these features in detail.

5.1.1 Block Lists

Block Lists provide a way to control which users/numbers can call or be called, based on a subscriber level, and can be found in the *Call Blockings* section of the subscriber preferences.

Trusted Sources			
Call Blockings			
	Name	Value	
?	block_in_mode	<input type="checkbox"/>	
?	block_in_list		
?	block_in_clir	<input type="checkbox"/>	
?	block_out_mode	<input type="checkbox"/>	
?	block_out_list		
?	adm_block_in_mode	<input type="checkbox"/>	
?	adm_block_in_list		
?	adm_block_in_clir	<input type="checkbox"/>	
?	adm_block_out_mode	<input type="checkbox"/>	
?	adm_block_out_list		
?	ncos		

Block Lists are separated into *Administrative Block Lists* (*adm_block_**) and *Subscriber Block Lists* (*block_**). They both have

the same behaviour, but Administrative Block Lists take higher precedence. Administrative Block Lists are only accessible by the system administrator and can thus be used to override any Subscriber Block Lists, e.g. to block certain destinations. The following break-down of the various block features apply to both types of lists.

Block Modes

Block lists can either be *whitelists* or *blacklists* and are controlled by the User Preferences *block_in_mode*, *block_out_mode* and their administrative counterparts.

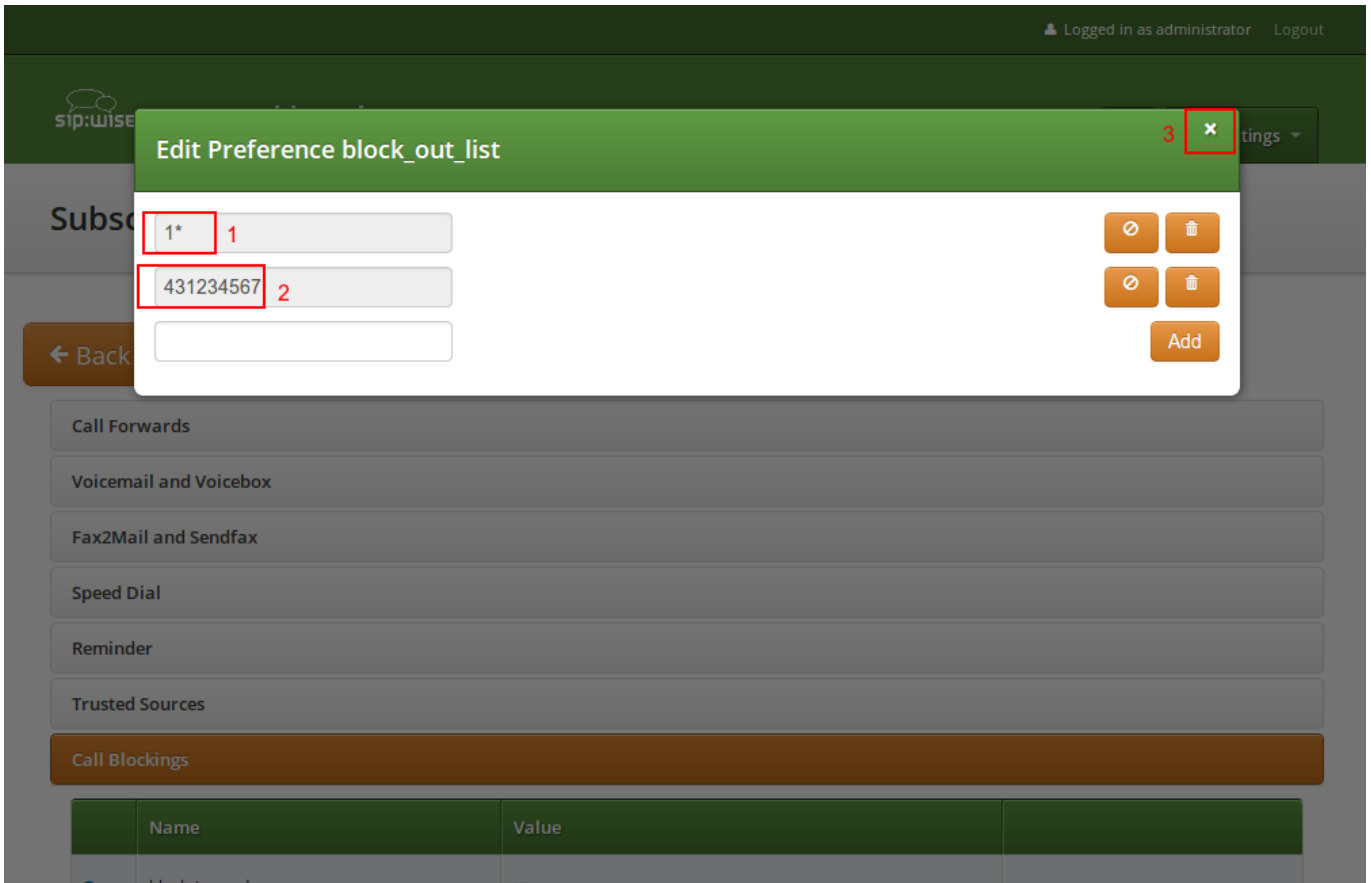
- The *blacklist* mode (option is not checked) tells the system to **allow anything except the entries in the list**. Use this mode if you just want to block certain numbers and allow all the rest.
- The *whitelist* mode indicates to **reject anything except the entries in the list**. Use this mode if you want to enforce a strict policy and allow only selected destinations or sources.

You can change a list mode from one to the other at any time.

Block Lists

The list contents are controlled by the User Preferences *block_in_list*, *block_out_list* and their administrative counterparts. Click on the *Edit* button in the *Preferences* view to define the list entries.

In block list entries, you can provide shell patterns like `*` and `[]`. The behavior of the list is controlled by the *block_xxx_mode* feature (so they are either allowed or rejected). In our example above we have *block_out_mode* set to *blacklist*, so all calls to US numbers and to the Austrian number +431234567 are going to be rejected.



Click the *Close* icon once you're done editing your list.

Block Anonymous Numbers

For incoming call, the User Preference *block_in_clir* and *adm_block_in_clir* controls whether or not to reject incoming calls with number suppression (either "[Aa]nonymous" in the display- or user-part of the From-URI or a header *Privacy: id* is set). This flag is independent from the Block Mode.

5.1.2 NCOS Levels

NCOS Levels provide predefined lists of allowed or denied destinations for outbound calls of local subscribers. Compared to *Block Lists*, they are much easier to manage, because they are defined on a global scope, and the individual levels can then be assigned to each subscriber. Again there is the distinction for user- and administrative-levels.

If case of a conflict, when the Block Lists feature allows a number and NCOS Levels rejects the same number or vice versa, the number will be rejected.

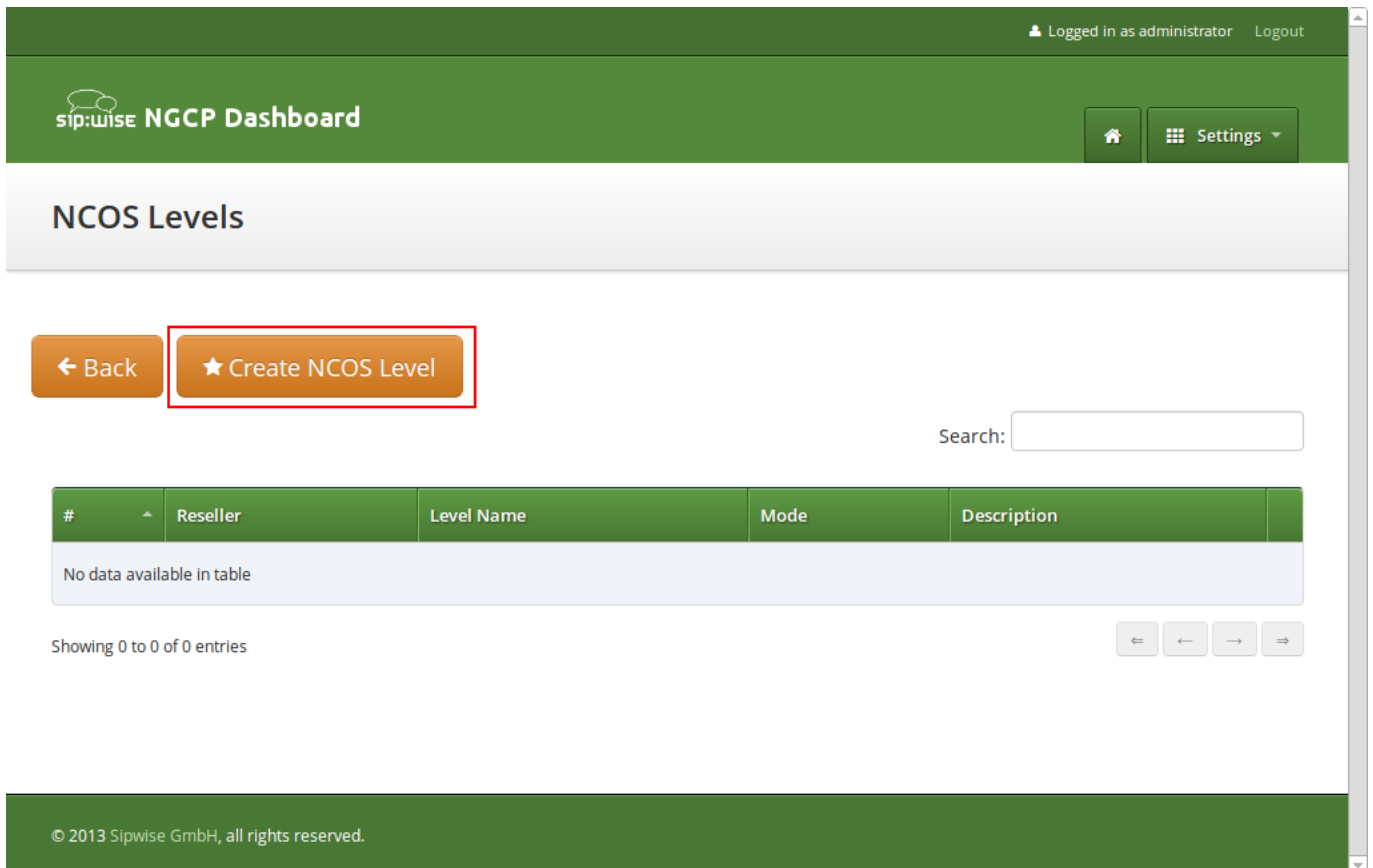
NCOS levels can either be *whitelists* or *blacklists*.

- The *blacklist* mode indicates to **allow everything except the entries in this level**. This mode is used if you want to just block certain destinations and allow all the rest.

- The *whitelist* mode indicates to **reject anything except the entries in this level**. This is used if you want to enforce a strict policy and allow only selected destinations.

Creating NCOS Levels

To create an NCOS Level, go to *Settings*→*NCOS Levels* and press the *Create NCOS Level* button.



The screenshot displays the sip:wise NGCP Dashboard. At the top right, it shows 'Logged in as administrator' and a 'Logout' link. The dashboard header includes the sip:wise logo and 'NGCP Dashboard' text, along with a home icon and a 'Settings' dropdown menu. The main content area is titled 'NCOS Levels'. Below this title, there are two buttons: a 'Back' button and a 'Create NCOS Level' button, which is highlighted with a red border. To the right of these buttons is a search input field labeled 'Search:'. Below the search field is a table with the following columns: '#', 'Reseller', 'Level Name', 'Mode', and 'Description'. The table currently contains no data, displaying the message 'No data available in table'. Below the table, it says 'Showing 0 to 0 of 0 entries' and includes navigation arrows. At the bottom of the dashboard, there is a footer with the text '© 2013 Sipwise GmbH, all rights reserved.'

Select a reseller, enter a name, select the mode and add a description, then click the *Save* button.

Logged in as administrator Logout

Create NCOS Levels

Reseller Search:

#	Name	Contract #	Status	
1	default	1	active	1 <input checked="" type="checkbox"/>

Showing 1 to 1 of 1 entries

Create Reseller

Level Name 2

Mode 3


Description 4

5

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Creating Rules per NCOS Level

To define the rules within the newly created NCOS Level, click on the *Patterns* button of the level.



sip:wise NGCP Dashboard

NCOS Levels

← Back ★ Create NCOS Level

NCOS level successfully created

Search:

#	Reseller	Level Name	Mode	Description	
1	default	test	blacklist	NCOS Test Level	Edit Delete Patterns

Showing 1 to 1 of 1 entries

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In the *Number Patterns* view you can create multiple patterns to define your level, one after the other. Click on the *Create Pattern Entry* Button on top and fill out the form.

Logged in as administrator Logout

sip:wise

Create Number Pattern

Pattern 1

Description 2

3

#	Pattern	Description
2	^439	Austrian Premium Numbers

Showing 1 to 1 of 1 entries

Include local area code

In this example, we block (since the mode of the level is *blacklist*) all numbers starting with 439. Click the *Save* button to save the entry in the level.

The option *include local area code in list* for a blacklist means that calls within the area code of the subscribers are denied, and for whitelist that they are allowed, respectively. For example if a subscriber has country-code 43 and area-code 1, then selecting this checkbox would result in an implicit entry 431 .

Assigning NCOS Levels to Subscribers/Domains

Once you've defined your NCOS Levels, you can assign them to local subscribers. To do so, navigate to *Settings*→*Subscribers*, search for the subscriber you want to edit, press the *Details* button and go to the *Preferences* View. There, press the *Edit* button on either the *ncos* or *adm_ncos* setting in the *Call Blockings* section.

Call Blockings			
	Name	Value	
1	block_in_mode	<input type="checkbox"/>	
	block_in_list		
	block_in_clir	<input type="checkbox"/>	
	block_out_mode	<input type="checkbox"/>	
	block_out_list	1* 431234567	
	adm_block_in_mode	<input type="checkbox"/>	
	adm_block_in_list		
	adm_block_in_clir	<input type="checkbox"/>	
	adm_block_out_mode	<input type="checkbox"/>	
	adm_block_out_list		
	ncos 2	<input type="text" value=""/>	3 <input type="button" value="Edit"/>

You can assign the NCOS level to all subscribers within a particular domain. To do so, navigate to *Settings*→*Domains*, select the domain you want to edit and click *Preferences*. There, press the *Edit* button on either *ncos* or *admin_ncos* in the *Call Blockings* section.

Note: if both domain and subscriber have same NCOS preference set (either *ncos* or *adm_ncos*, or both) the subscriber's preference is used. This is done so that you can override the domain-global setting on the subscriber level.

Assigning NCOS Level for Forwarded Calls to Subscribers/Domains

In some countries there are regulatory requirements that prohibit subscribers from forwarding their numbers to special numbers like emergency, police etc. While the sip:carrier does not deny provisioning Call Forward to these numbers, the administrator can prevent the incoming calls from being actually forwarded to numbers defined in the NCOS list: just select the appropriate NCOS level in the domain's or subscriber's preference *adm_cf_ncos*. This NCOS will apply only to the Call Forward from the subscribers and not to the normal outgoing calls from them.

5.1.3 IP Address Restriction

The sip:carrier provides subscriber preference *allowed_ips* to restrict the IP addresses that subscriber is allowed to use the service from. If the REGISTER or INVITE request comes from an IP address that is not in the allowed list, the sip:carrier will reject it with a 403 message. Also a voice message can be played when the call attempt is rejected (if configured).

By default, *allowed_ips* is an empty list which means that subscriber is not restricted. If you want to configure a restriction, navigate

to *Settings*→*Subscribers*, search for the subscriber you want to edit, press *Details* and then *Preferences* and press *Edit* for the *allowed_ips* preference in the *Access Restrictions* section.

Call Blockings

Access Restrictions

1

	Name	Value	
?	lock		
?	concurrent_max		
?	concurrent_max_out		
?	allowed_clis		
?	reject_emergency	<input type="checkbox"/>	
?	concurrent_max_per_account		
?	concurrent_max_out_per_account		
?	allowed_ips 2		3 <input type="button" value="Edit"/>
?	man_allowed_ips		
?	ignore_allowed_ips	<input type="checkbox"/>	
?	allow_out_foreign_domain	<input type="checkbox"/>	

Press the Edit button to the right of empty drop-down list.

You can enter multiple allowed IP addresses or IP address ranges one after another. Click the *Add* button to save each entry in the list. Click the *Delete* button if you want to remove some entry.

5.2 Call Forwarding and Call Hunting

The sip:carrier provides the capabilities for normal *call forwarding* (deflecting a call for a local subscriber to another party immediately or based on events like the called party being busy or doesn't answer the phone for a certain number of seconds) and *serial call hunting* (sequentially executing a group of deflection targets until one of them succeeds). Targets can be stacked, which means if a target is also a local subscriber, it can have another call forward or hunt group which is executed accordingly.

Call Forwards and Call Hunting Groups can either be executed unconditionally or based on a *Time Set Definition*, so you can define deflections based on time period definitions (e.g. Monday to Friday 8am to 4pm etc).

5.2.1 Setting a simple Call Forward

Go to your *Subscriber Preferences* and click *Edit* on the Call Forward Type you want to set (e.g. *Call Forward Unconditional*).

Logged in as administrator Logout

sip:wise

Edit Call Forward Unconditional

Destination

- Voicemail
- Conference
- 1** **URI/Number**

2 URI/Number

for (seconds)

3

Subso

← Back

Call For

Type

Call Fo

Call Fo

Call Forward Timeout

Call Forward Unavailable

Voicemail and Voicebox

If you select *URI/Number* in the *Destination* field, you also have to set a *URI/Number*. The timeout defines for how long this destination should be tried to ring.

5.2.2 Advanced Call Hunting

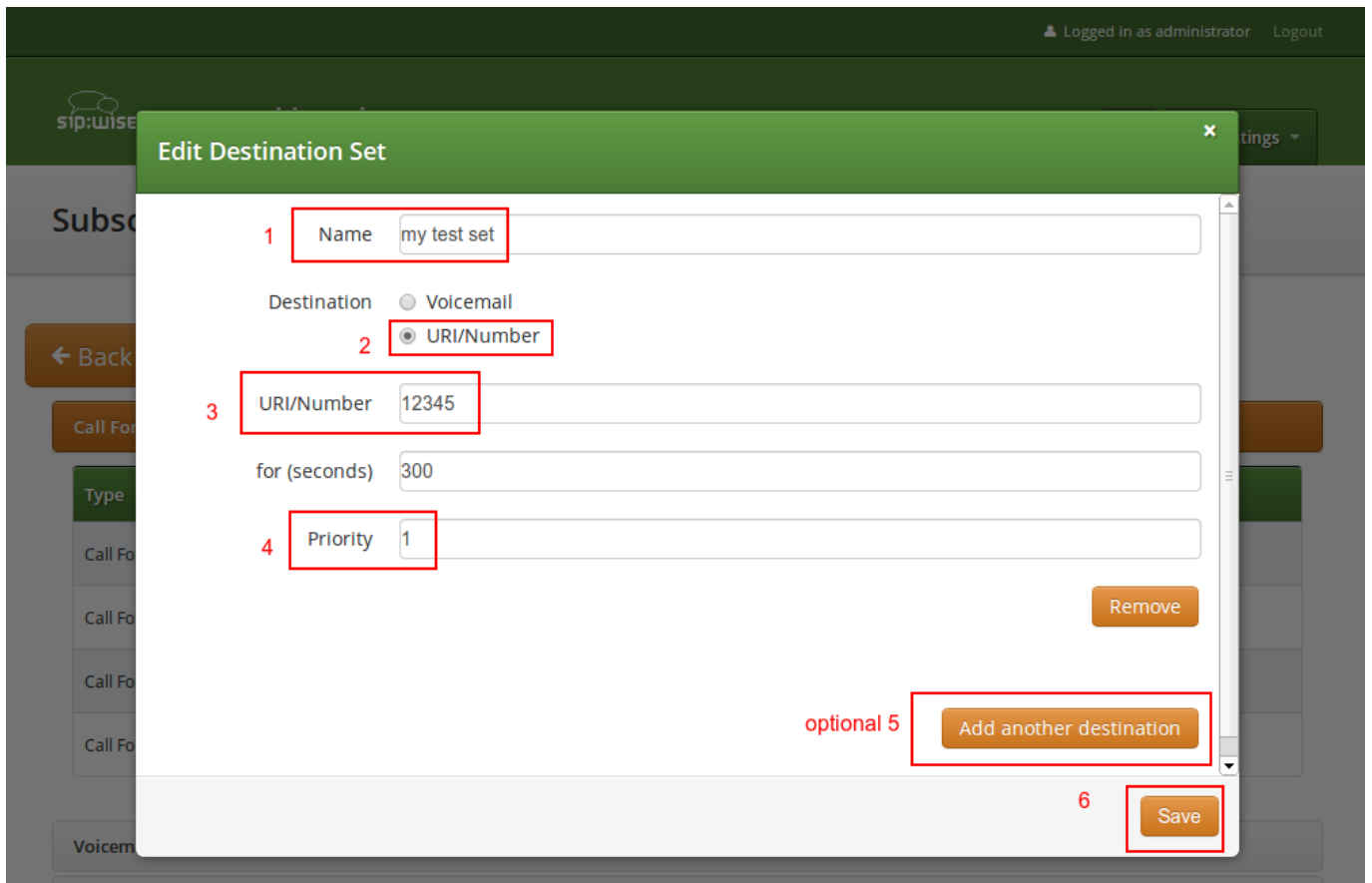
If you want multiple destinations to be executed one after the other, you need to change into the *Advanced View* when editing your call forward. There, you can select multiple *Destination Set/Time Set* pairs to be executed.

A *Destination Set* is a list of destinations to be executed one after another.

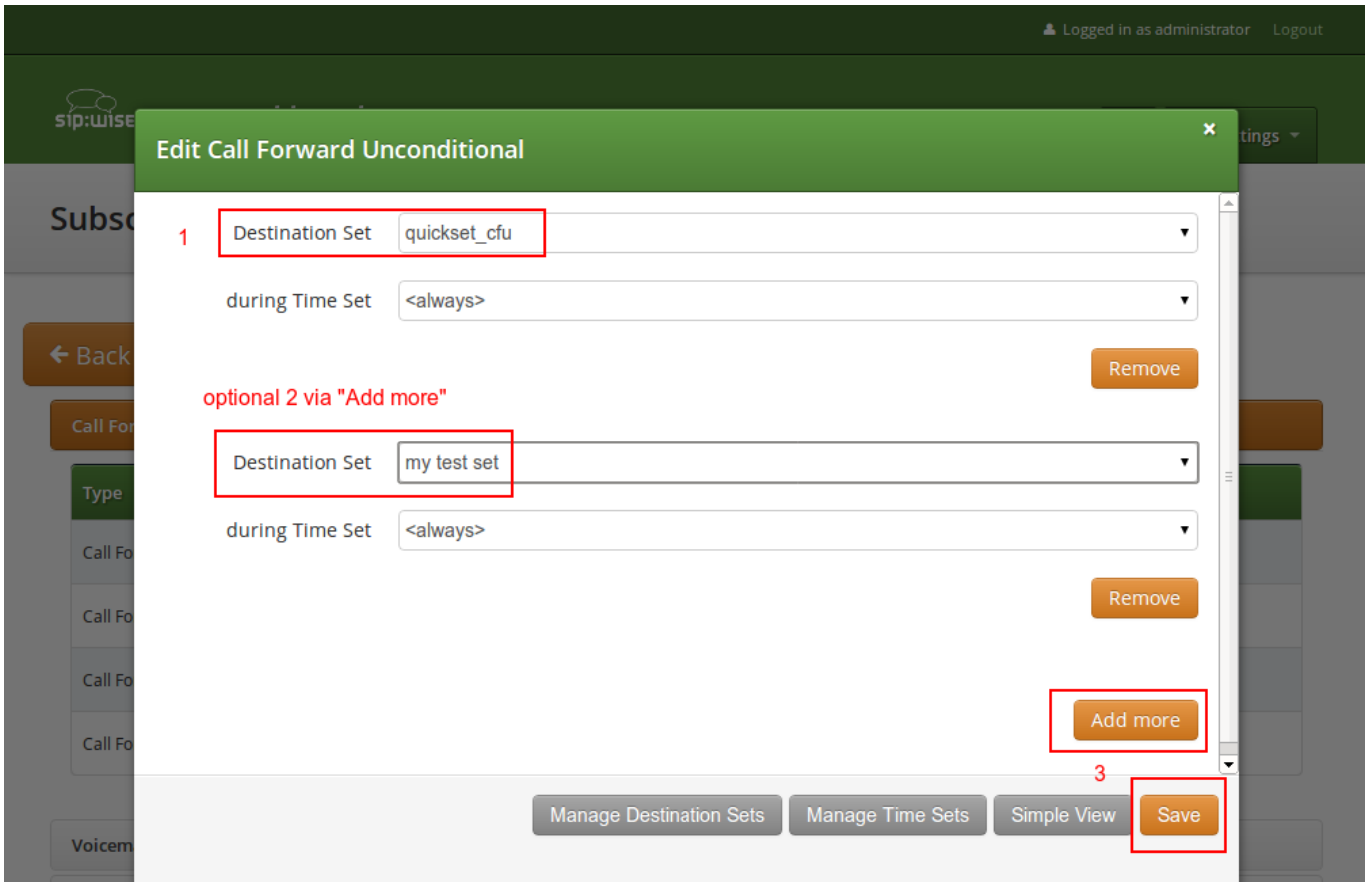
A *Time Set* is a time definition when to execute this *Destination Set*.

Configuring Destination Sets

Click on *Manage Destination Sets* to see a list of available sets. The *quickset_cfu* has been implicitly created during our creation of a simple call forward. You can edit it to add more destinations, or you can create a new destination set.



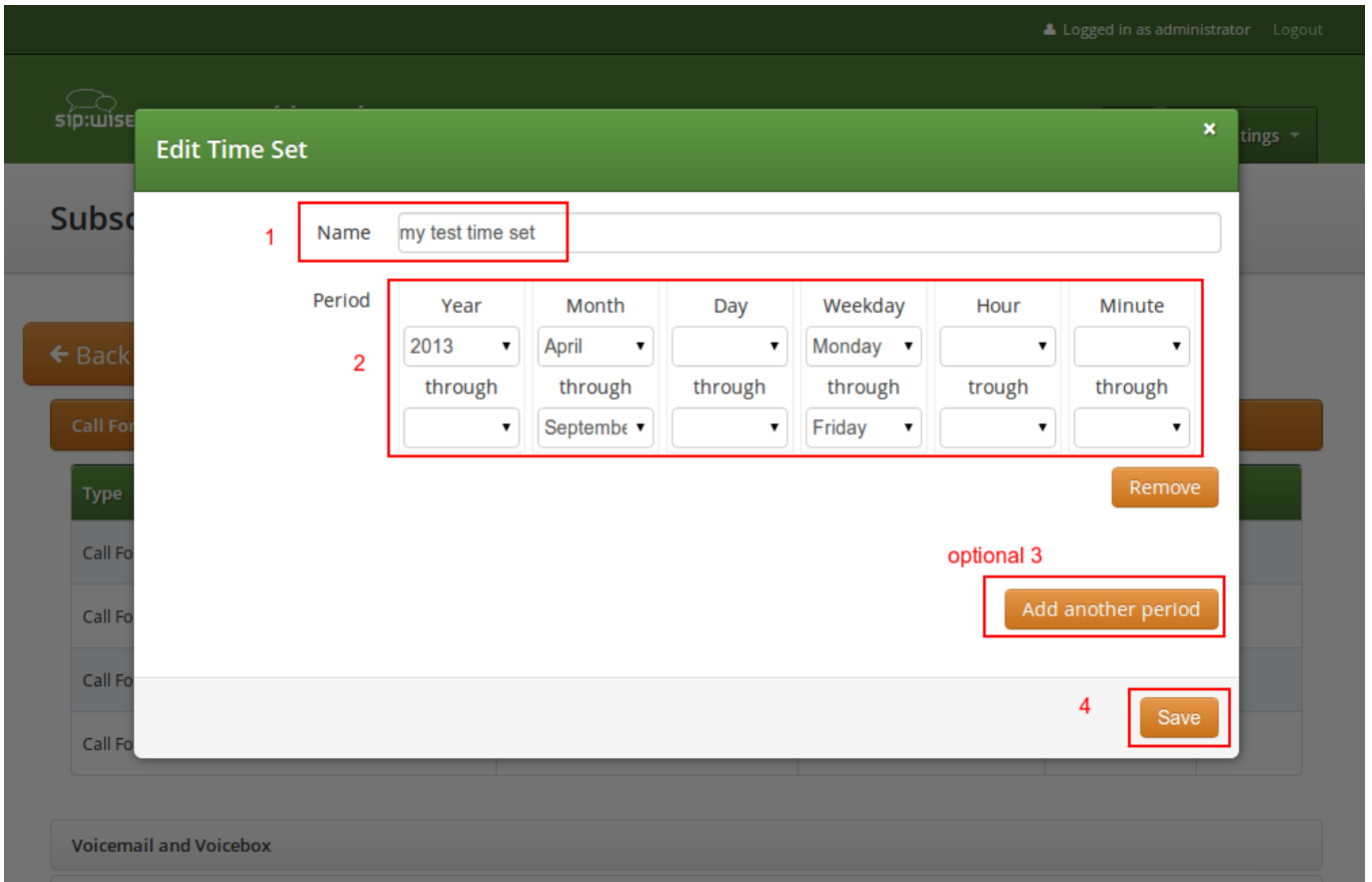
When you close the *Destination Set Overview*, you can now assign your new set in addition or instead of the *quickset_cfu* set.



Press *Save* to store your settings.

Configuring Time Sets

Click on *Manage Time Sets* in the advanced call-forward menu to see a list of available time sets. By default there are none, so you have to create one.



You need to provide a *Name*, and a list of *Periods* where this set is active. If you only set the top setting of a date field (like the *Year* setting in our example above), then it's valid for just this setting (like the full year of *2013* in our case). If you provide the bottom setting as well, it defines a period (like our *Month* setting, which means from beginning of April to end of September). For example, if a CF is set with the following timeset: "hour { 10-12 } minute { 20-30 }", the CF will be matched within the following time ranges:

- from 10.20am to 10:30am
- from 11.20am to 11:30am
- from 12.20am to 12:30am



Important

the period is a *through* definition, so it covers the full range. If you define an *Hour* definition 8-16, then this means from 08:00 to 16:59:59 (unless you filter the *Minutes* down to something else).

If you close the *Time Sets* management, you can assign your new time set to the call forwards you're configuring.

5.3 Header Manipulation

5.3.1 Header Filtering

Adding additional SIP headers to the initial INVITEs relayed to the callee (second leg) is possible by modifying the following template file: `/etc/ngcp-config/templates/etc/ngcp-sems/etc/ngcp.sbcprofile.conf.customtt.tt2`. The following section can be changed:

```
header_filter=whitelist
header_list=[%IF kamailio.proxy.debug == "yes"%]P-NGCP-CFGTEST, [%END%]
P-R-Uri,P-D-Uri,P-Preferred-Identity,P-Asserted-Identity,Diversion,Privacy,
Allow,Supported,Require,RAck,RSeq,Rseq,User-Agent,History-Info,Call-Info
[%IF kamailio.proxy.presence.enable == "yes"%],Event,Expires,
Subscription-State,Accept[%END%] [%IF kamailio.proxy.allow_refer_method
== "yes"%],Referred-By,Refer-To,Replaces[%END%]
```

By default the system will remove from the second leg all the SIP headers which are not in the above list. If you want to keep some additional/custom SIP headers, coming from the first leg, into the second leg you just need to add them at the end of the `header_list=` list. After that, as usual, you need to apply and push the changes. In this way the system will keep your headers in the INVITE sent to the destination subscriber/peer.



Warning

DO NOT TOUCH the list if you don't know what you are doing.

5.3.2 Codec Filtering

Sometimes you may need to filter some audio CODEC from the SDP payload, for example if you want to force your subscribers to do not talk a certain codecs or force them to talk a particular one. To achieve that you just need to change the `/etc/ngcp-config/config.yml`, in the following section:

```
sdp_filter:
  codecs: PCMA,PCMU,telephone-event
  enable: yes
  mode: whitelist
```

In the example above, the system is removing all the audio CODECS from the initial INVITE except G711 alaw,ulaw and telephone-event. In this way the callee will be notified that the caller is able to talk only PCMA. Another example is the `blacklist` mode:

```
sdp_filter:
  codecs: G729,G722
  enable: yes
  mode: blacklist
```

In this way the G729 and G722 will be removed from the SDP payload. In order to apply the changes, as usual, you need to run `ngcpcfg apply Enable CODEC filtering` and push the changes .

5.3.3 Enable History and Diversion Headers

It may be useful and mandatory - specially with NGN interconnection - to enable SIP History header and/or Diversion header for outbound requests to a peer or even for on-net calls. In order to do so, you should enable the following preferences in Domain's and Peer's Preferences:

- Domain's Preferences: `inbound_uprn` = **Forwarder's NPN**
- Peer's Preferences: `outbound_history_info` = **UPRN**
- Peer's Preferences: `outbound_diversion` = **UPRN**
- Domain's Preferences: `outbound_history_info` = **UPRN** (if you want to allow History Header for on-net call as well)
- Domain's Preferences: `outbound_diversion` = **UPRN** (if you want to allow Diversion Header for on-net call as well)

5.4 SIP Trunking with SIPconnect

5.4.1 User provisioning

For the purpose of external SIP-PBX interconnect with sip:carrier the platform admin should create a subscriber with multiple aliases representing the numbers and number ranges served by the SIP-PBX.

- Subscriber username - any SIP username that forms an "email-style" SIP URI.
- Subscriber Aliases - numbers in the global E.164 format without leading plus.

To configure the Subscriber, go to *Settings*→*Subscribers* and click *Details* on the row of your subscriber. There, click on the *Preferences* button on top.

You should look into the *Number Manipulations* and *Access Restrictions* sections in particular, which control the calling and called number presentation.

5.4.2 Inbound calls routing

Enable preference *Number Manipulations*→*e164_to_ruri* for routing inbound calls to SIP-PBX. This ensures that the Request-URI will comprise a SIP-URI containing the dialed alias-number as user-part, instead of the user-part of the registered AOR (which is normally a static value).

5.4.3 Number manipulations

The following sections describe the recommended configuration for correct call routing and CLI presentation according to the SIPconnect 1.1 recommendation.

Rewrite rules

The SIP PBX by default inherits the domain dialplan which usually has rewrite rules applied to normal Class 5 subscribers with inbound rewrite rules normalizing the dialed number to the E.164 standard. If most users of this domain are Class 5 subscribers the dialplan may supply calling number in national format - see Section 4.6. While the SIP-PBX trunk configuration can be sometimes amended it is a good idea in sense of SIPconnect recommendation to send only the global E.164 numbers.

Moreover, in mixed environments with the sip:carrier Cloud PBX sharing the same domain with SIP trunking (SIP-PBX) customers the subscribers may have different rewrite rules sets assigned to them. The difference is caused by the fact that the dialplan for Cloud PBX is fundamentally different from the dialplan for SIP trunks due to extension dialing, where the Cloud PBX subscribers use the break-out code (see Section A.2) to dial numbers outside of this PBX.

The SIPconnect compliant numbering plan can be accommodated by assigning Rewrite Rules Set to the SIP-PBX subscriber. Below is a sample Rewrite Rule Set for using the global E.164 numbers with plus required for the calling and called number format compliant to the recommendation.

INBOUND REWRITE RULE FOR CALLER

- Match Pattern: `^(00|\+)([1-9][0-9]+)$`
- Replacement Pattern: `\2`
- Description: International to E.164
- Direction: Inbound
- Field: Caller

INBOUND REWRITE RULE FOR CALLEE

- Match Pattern: `^(00|\+)([1-9][0-9]+)$`
- Replacement Pattern: `\2`
- Description: International to E.164
- Direction: Inbound
- Field: Callee

OUTBOUND REWRITE RULE FOR CALLER

- Match Pattern: `^([1-9][0-9]+)$`
- Replacement Pattern: `+\1`
- Description: For the calls to SIP-PBX add plus to E.164
- Direction: Outbound
- Field: Caller

OUTBOUND REWRITE RULE FOR CALLEE

- Match Pattern: `^ ([1-9] [0-9]+) $`
- Replacement Pattern: `+\1`
- Description: For the calls to SIP-PBX add plus to E.164
- Direction: Outbound
- Field: Callee

Assign the aforementioned Rewrite Rule Set to the SIP-PBX subscribers.



Warning

Outbound Rewrite Rules for Callee shall NOT be applied to the calls to normal SIP UAs like IP phones since the number with plus does not correspond to their SIP username.

User parameter

The following configuration is needed for your platform to populate the From and To headers and Request-URI of the INVITE request with "user=phone" parameter as per RFC 3261 Section 19.1.1 (if the user part of the URI contains telephone number formatted as a telephone-subscriber).

- Domain's Preferences: `outbound_from_user_is_phone = Y`
- Domain's Preferences: `outbound_to_user_is_phone = Y`

Forwarding number

The following is our common configuration that covers the calling number presentation in a variety of use-cases, including the incoming calls, on-net calls and Call Forward by the platform:

- Domain's Preferences: `inbound_uprn = Forwarder's NPN`
- Domain's Preferences: `outbound_from_user = UPRN (if set) or User-Provided Number`
- Domain's Preferences: `outbound_pai_user = UPRN (if set) or Network-Provided Number`
- Domain's Preferences: `outbound_history_info = UPRN` (if the called user expects History-Info header)
- Domain's Preferences: `outbound_diversion = UPRN` (if the called user expects Diversion header)
- Domain's Preferences: `outbound_to_user = Original (Forwarding) called user` if the callee expects the number of the subscriber forwarding the call, otherwise leave default.

The above parameters can be tuned to operator specifics as required. You can of course override these settings in the Subscriber Preferences if particular subscribers need special settings.

Tip

On outgoing call from SIP-PBX subscriber the Network-Provided Number (NPN) is set to the *cli* preference prefilled with main E.164 number. In order to have the full alias number as NPN on outgoing call set preference *extension_in_npn* = Y.

Externally forwarded call If the call forward takes place inside the SIP-PBX it can use one of the following specification for signaling the diversion number to the platform:

- using **Diversion** method (RFC 5806): configure Subscriber's Preferences: *inbound_uprn* = **Forwarder's NPN / Received Diversion**
- using **History-Info** method (RFC 7044): NGCP platform extends the History-Info header received from the PBX by adding another level of indexing according to the specification RFC 7044.

Allowed CLIs

- For correct calling number presentation on outgoing calls, you should include the pattern matching all the alias numbers of SIP-PBX or each individual alias number under the *allowed_clis* preference.
- If the signalling calling number (usually taken from From user-part, see *inbound_upn* preferences) does not match the *allowed_clis* pattern, the *user_cli* or *cli* preference (Network-Provided Number) will be used for calling number presentation.

5.4.4 Registration

SIP-PBX can use either Static or Registration Mode. While SIPconnect 1.1 continues to require TLS support at MUST strength, one should note that using TLS for signaling does not require the use of the SIPS URI scheme. SIPS URI scheme is obsolete for this purpose.

Static Mode While SIPconnect 1.1 allows the use of Static mode, this poses additional maintenance overhead on the operator. The administrator should create a static registration for the SIP-PBX: go to Subscribers, *Details*→*Registered Devices*→*Create Permanent Registration* and put address of the SIP-PBX in the following format: sip:username@ipaddress:5060 where username=username portion of SIP URI and ipaddress = IP address of the device.

Registration Mode It is recommended to use the Registration mode with SIP credentials defined for the SIP-PBX subscriber.

**Important**

The use of RFC 6140 style "bulk number registration" is discouraged. The SIP-PBX should register one AOR with email-style SIP URI. The sip:carrier will take care of routing the aliases to the AOR with *e164_to_ruri* preference.

Trusted sources

You can do IP-based authentication for subscribers using the Trusted Source mechanism in your subscriber's preferences (*Details*→*Preferences*→*Trusted Sources*) if the SIP-PBX can't authenticate.

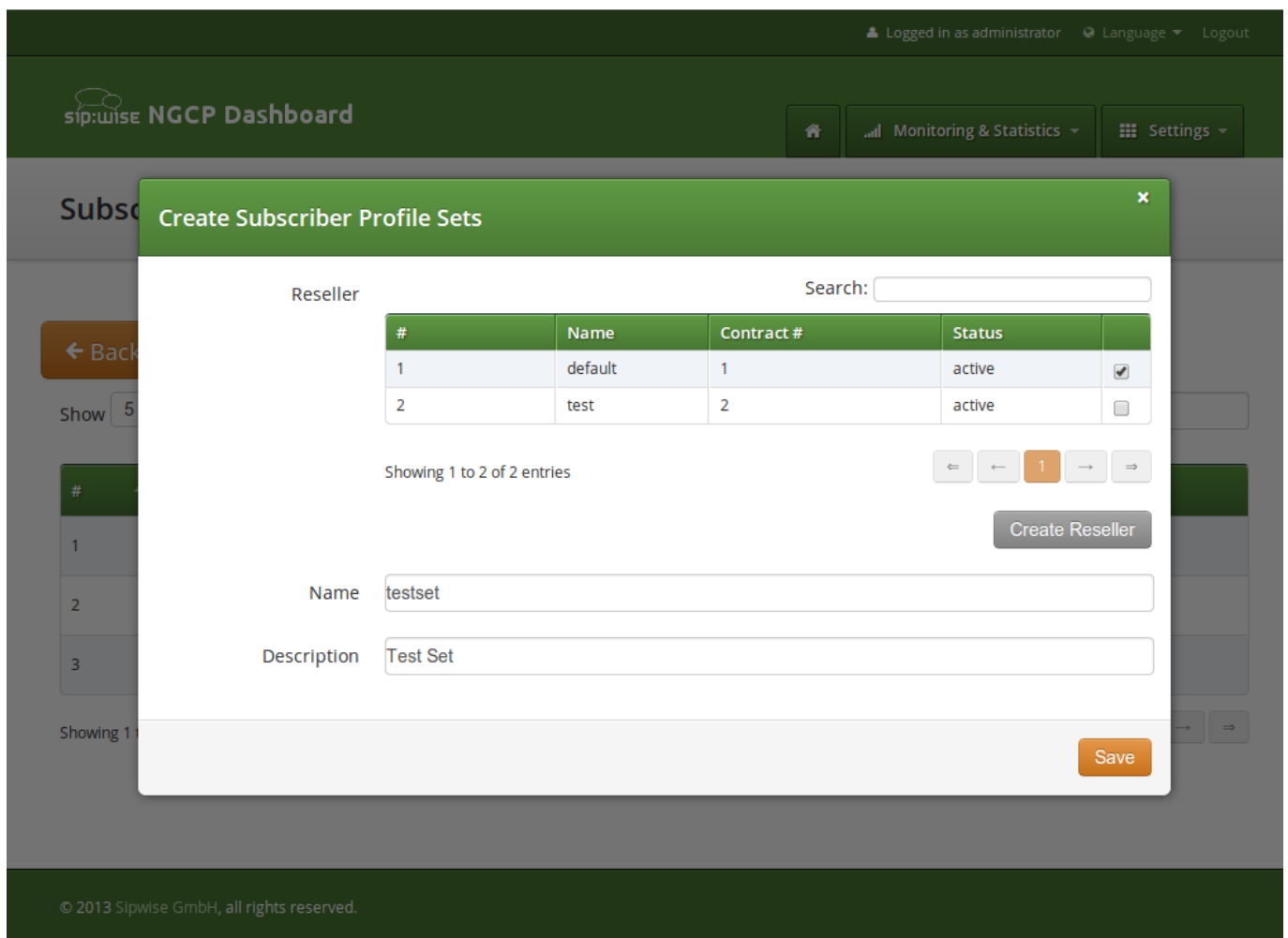
5.5 Limiting Subscriber Preferences via Subscriber Profiles

The preferences a subscriber can provision by himself via the CSC can be limited via profiles within profile sets assigned to subscribers.

5.5.1 Subscriber Profile Sets

Profile sets define containers for profiles. The idea is to define profile sets with different profiles by the administrator (or the reseller, if he is permitted to do so). Then, a subscriber with administrative privileges can re-assign profiles within his profile sets for the subscribers of his customer account.

Profile Sets can be defined in *Settings*→*Subscriber Profiles*. To create a new Profile Set, click *Create Subscriber Profile Set*.



The screenshot shows the 'Create Subscriber Profile Sets' modal window in the sip:wise NGCP Dashboard. The modal is titled 'Create Subscriber Profile Sets' and has a search bar for 'Reseller'. Below the search bar is a table with the following data:

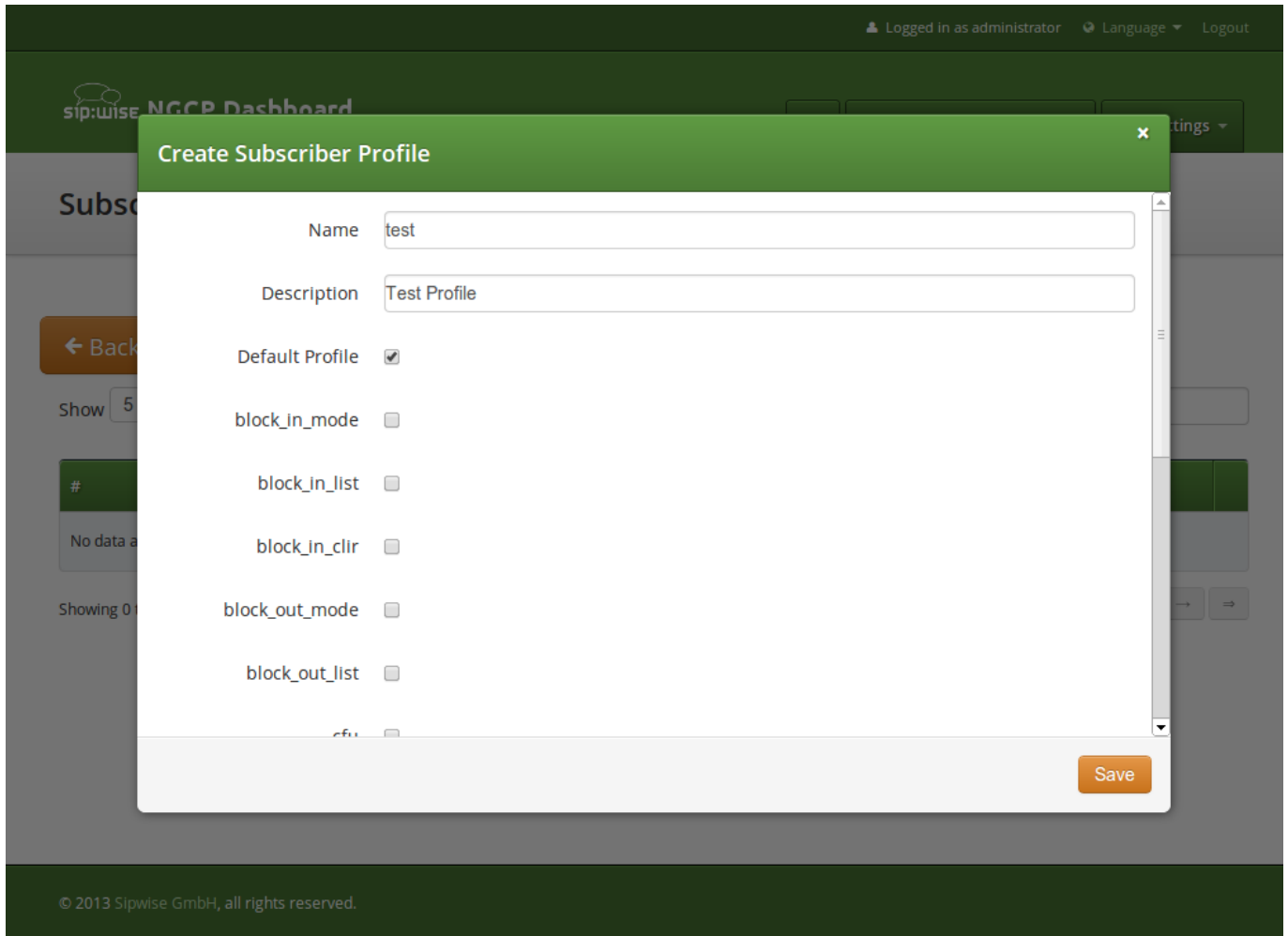
#	Name	Contract #	Status	
1	default	1	active	<input checked="" type="checkbox"/>
2	test	2	active	<input type="checkbox"/>

Below the table, it says 'Showing 1 to 2 of 2 entries' and has navigation buttons. There is a 'Create Reseller' button. Below the table are form fields for 'Name' (containing 'testset') and 'Description' (containing 'Test Set'). A 'Save' button is at the bottom right of the modal. The background shows the dashboard with 'Logged in as administrator', 'Language', 'Logout', 'Monitoring & Statistics', and 'Settings' menus.

You need to provide a reseller, name and description.

To create Profiles within a Profile Set, hover over the Profile Set and click the *Profiles* button.

Profiles within a Profile Set can be created by clicking the *Create Subscriber Profile* button.



Checking the *Default Profile* option causes this profile to get assigned automatically to all subscribers, who have the profile set assigned. Other options define the user preferences which should be made available to the subscriber.

5.6 Creating Trusted Subscribers

In some cases, when you have a device that cannot authenticate itself towards sip:carrier, you may need to create Trusted Subscriber. Trusted Subscribers use IP-based authentication and they have a Permanent SIP Registration URI in order to receive messages from sip:carrier. In order to create a Trusted Subscriber you just need to create a normal subscriber, then Create a Permanent Registration via (*Subscribers*→*Details*→*Registered Devices*→*Create Permanent Registration*) and also you need to add the devices IP as Trusted Source in your subscriber's preferences (*Details*→*Preferences*→*Trusted Sources*). In this way, all messages coming from your device IP will be trusted (and authenticate just via the source IP), on the other side all the SIP messages to your devices will be sent to the SIP URI specified in the Permanent Registration.

5.7 Voicemail System

5.7.1 Accessing the IVR Menu

For a subscriber to manage his voicebox via IVR, there are two ways to access the voicebox. One is to call the URI `voicebox@yourdomain` from the subscriber itself, allowing password-less access to the IVR, as the authentication is already done on SIP level. The second is to call the URI `voiceboxpass@yourdomain` from any subscriber, causing the system to prompt for a mailbox and a PIN.

Mapping numbers and codes to IVR access

Since access might need to be provided from external networks like PSTN/Mobile, and since certain SIP phones do not support calling alphanumeric numbers to dial `voicebox`, you can map any number to the voicebox URIs using rewrite rules.

To do so, you can provision a match pattern like `^(00|\+)12345$` with a replace pattern `voicebox` or `voiceboxpass` to map a number to either password-less or password-based IVR access. Select the `Inbound` direction and the `Callee` field for this rewrite rule.

External IVR access

When reaching `voiceboxpass`, the subscriber is prompted for her mailbox number and a password. All numbers assigned to a subscriber are valid input (primary number and any alias number). By default, the required format is in E.164, so the subscriber needs to enter the full number including country code, for example `4912345` if she got assigned a German number.

You can globally configure a rewrite rule in `config.yml` using `asterisk.voicemail.normalize_match` and `asterisk.voicemail.normalize_replace`, allowing you to customize the format a subscriber can enter, e.g. having `^0([1-9][0-9]+)$` as match part and `49$1` as replace part to accept German national format.

5.7.2 IVR Menu Structure

The following list shows you how the voicebox menu is structured.

- 1 Read voicemail messages
 - 3 Advanced options
 - * 3 To Hear messages Envelope
 - * * Return to the main menu
 - 4 Play previous message
 - 5 Repeat current message
 - 6 Play next message
 - 7 Delete current message
 - 9 Save message in a folder

- * 0 Save in new Messages
- * 1 Save in old Messages
- * 2 Save in Work Messages
- * 3 Save in Family Messages
- * 4 Save in Friends Messages
- * # Return to the main menu

- 2 Change folders
 - 0 Switch to new Messages
 - 1 Switch to old Messages
 - 2 Switch to Work Messages
 - 3 Switch to Family Messages
 - 4 Switch to Friends Messages
 - # Get Back

- 3 Advanced Options
 - * To return to the main menu

- 0 Mailbox options
 - 1 Record your unavailable message
 - * 1 accept it
 - * 2 Listen to it
 - * 3 Rerecord it
 - 2 Record your busy message
 - * 1 accept it
 - * 2 Listen to it
 - * 3 Rerecord it
 - 3 Record your name
 - * 1 accept it
 - * 2 Listen to it
 - * 3 Rerecord it
 - 4 Record your temporary greetings
 - * 1 accept it / or re-record if one already exist
 - * 2 Listen to it / or delete if one already exist
 - * 3 Rerecord it
 - 5 Change your password
 - * To return to the main menu

- * Help

- # Exit

5.7.3 Type Of Messages

A message/greeting is a short message that plays before the caller is allowed to record a message. The message is intended to let the caller know that you are not able to answer their call. It can also be used to convey other information like when you will be available, other methods to contact you, or other options that the caller can use to receive assistance.

The IVR menu has three types of greetings.

Unavailable Message

The standard voice mail greeting is the "unavailable" greeting. This is used if you don't answer the phone and so the call is directed to your voice mailbox.

- You can record a custom unavailable greeting.
- If you have not recorded your unavailable greeting but have recorded your name, the system will play a generic message like: "Recorded name is unavailable."
- If you have not recorded your unavailable greeting, the phone system will play a generic message like: "Digits-of-number-dialed is unavailable".

Busy Message

If you wish, you can record a custom greeting used when someone calls you and you are currently on the phone. This is called your "Busy" greeting.

- You can record a custom busy greeting.
- If you have not recorded your busy greeting but have recorded your name, the phone system will play a generic message: "Recorded name is busy."
- If you have not recorded your busy greeting and have not recorded your name (see below), the phone system will play a generic message: "Digits-of-number-dialed is busy."

Temporary Greeting

You can also record a temporary greeting. If it exists, a temporary greeting will always be played instead of your "busy" or "unavailable" greetings. This could be used, for example, if you are going on vacation or will be out of the office for a while and want to inform people not to expect a return call anytime soon. Using a temporary greeting avoids having to change your normal unavailable greeting when you leave and when you come back.

5.7.4 Folders

The Voicemail system allows you to save and organize your messages into folders. There can be up to ten folders.

The Default Folder List

- 0 - New Messages
- 1 - Old Messages
- 2 - Work Messages
- 3 - Family Messages
- 4 - Friends Messages

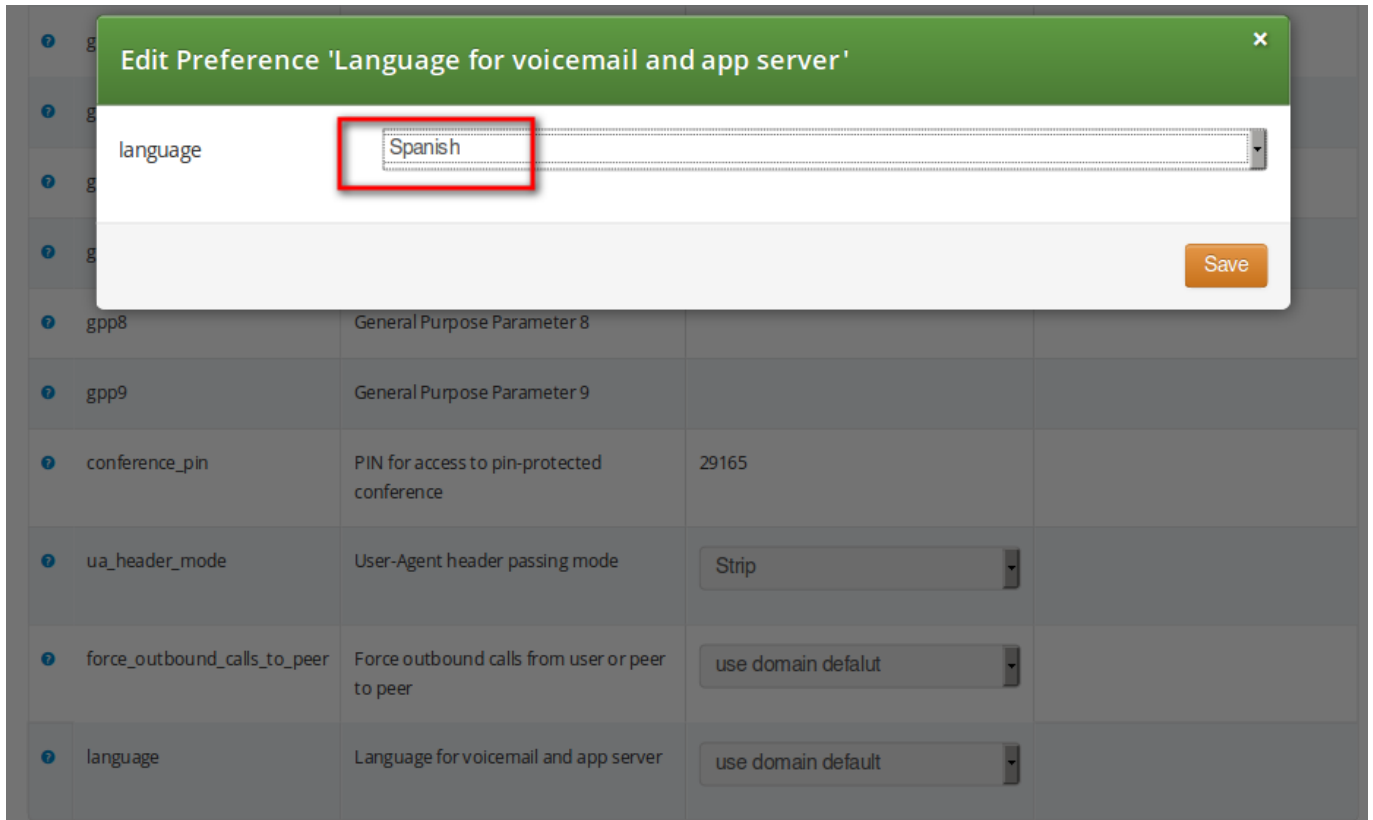
When a caller leaves a message for you, the system will put the message into the "New Messages" folder. If you listen to the message, but do not delete the message or save the message to a different folder, it will automatically move the message to the "Old Messages" folder. When you first log into your mailbox, the Voicemail System will make the "New Messages" folder the current folder if you have any new messages. If you do not have any new messages the it will make the "Old Messages" folder the current folder.

5.8 XMPP Instant Messaging

Instant Messaging (IM) based on XMPP comes with sip:carrier out of the box. sip:carrier uses `prosody` as internal XMPP server. Each subscriber created on the platform have assigned a XMPP user, reachable already - out of the box - by using the same SIP credentials. You can easily open an XMPP client (e.g. Pidgin) and login with your SIP `username@domain` and your SIP `password`. Then, using the XMPP client options, you can create your buddy list by adding your buddies in the format `user@domain`.

5.9 Configuring Subscriber IVR Language

The language for the Voicemail system IVR or Vertical Service Codes (VSC) IVRs may be set using the subscriber or domain preference *language*.



The sip:carrier provides the pre-installed prompts for the Voicemail in the English, Spanish, French and Italian languages and the pre-installed prompts for the Vertical Service Codes IVRs in English only.

The other IVRs such as the Conference system and the error announcements use the Sound Sets configured in NGCP Panel and uploaded by the administrator in his language of choice.

5.10 Sound Sets

The sip:carrier provides the administrator with ability to upload the voice prompts such as conference prompts or call error announcements on the *Sound Sets page*. There is a preference *sound_set* in the *NAT and Media Flow Control* section on Domain and Subscriber levels to link subscribers to the sound set that they should hear (as usual the subscriber preference overrides the domain one). Sound Sets can be defined in *Settings*→*Sound Sets*. To create a new Sound Set, click *Create Sound Set*. Then click the *Files* button.

Logged in as administrator | Language | Logout

NGCP Dashboard

Monitoring & Statistics | Settings

Sound Sets

← Back | ★ Create Sound Set

Sound set successfully created

Show 5 entries | Search:

#	Reseller	Customer	Name	Description	
1	default		Conference		Edit Delete Files
2	default		Early media rejects	Failed call attempt announcements	

Showing 1 to 2 of 2 entries

Note

You may use 8 or 16 bit mono WAV audio files for all of the voice prompts.

5.10.1 Configuring Early Reject Sound Sets

The call error announcements are grouped under *Early Rejects* section. Unfold the section and click *Upload* next to the sound handles (Names) that you want to use. Choose a WAV file from your file system, and click the Loopplay setting if you want to play the file in a loop instead of just once. Click Save to upload the file.

early_rejects			
Name	Filename	Loop	
block_in		■	
block_out		■	
block_ncos		■	
block_override_pin_wrong		■	
locked_in		■	
locked_out		■	
max_calls_in		■	
max_calls_out		■	
max_calls_peer		■	
unauth_caller_ip		■	

The call error announcements are played to the user in early media hence the name "Early Reject". If you don't provide the sound files for any handles they will not be used and the sip:carrier will fallback to sending the error response code back to the user.

Table 1: Early Reject Sound Sets

Handle	Description	Message played
block_in	This is what the calling party hears when a call is made from a number that is blocked by the incoming block list (<i>adm_block_in_list</i> , <i>block_in_list</i> subscriber preferences)	Your call is blocked by the number you are trying to reach.
block_out	This is what the calling party hears when a call is made to a number that is blocked by the outgoing block list (<i>adm_block_out_list</i> , <i>block_out_list</i> subscriber preferences)	Your call to the number you are trying to reach is blocked.
block_ncos	This is what the calling party hears when a call is made to a number that is blocked by the NCOS level assigned to the subscriber or domain (the NCOS level chosen in <i>ncos</i> and <i>adm_ncos</i> preferences)	Your call to the number you are trying to reach is not permitted.

Table 1: (continued)

Handle	Description	Message played
block_override_pin_wrong	Announcement played to calling party if it used wrong PIN code to override the outgoing user block list or the NCOS level for this call (the PIN set by <i>block_out_override_pin</i> and <i>adm_block_out_override_pin</i> preferences)	The PIN code you have entered is not correct.
locked_in	Announcement played on incoming call to a subscriber that is locked for incoming calls	The number you are trying to reach is currently not permitted to receive calls.
locked_out	Announcement played on outgoing call to subscriber that is locked for outgoing calls	You are currently not allowed to place outbound calls.
max_calls_in	Announcement played on incoming call to a subscriber who has exceeded the <i>concurrent_max</i> limit by sum of incoming and outgoing calls or whose customer has exceeded the <i>concurrent_max_per_account</i> limit by sum of incoming and outgoing calls	The number you are trying to reach is currently busy. Please try again later.
	max_calls_out	Announcement played on outgoing call to a subscriber who has exceeded the <i>concurrent_max</i> (total limit) or <i>concurrent_max_out</i> (limit on number of outbound calls) or whose customer has exceeded the <i>concurrent_max_per_account</i> or <i>concurrent_max_out_per_account</i> limit
All outgoing lines are currently in use. Please try again later.	max_calls_peer	Announcement played on calls from the peering if that peer has reached the maximum number of concurrent calls (configured by admin in <i>concurrent_max</i> preference of peering server)
The network you are trying to reach is currently busy. Please try again later.	unauth_caller_ip	This is what the calling party hears when it tries to make a call from unauthorized IP address or network (<i>allowed_ips</i> , <i>man_allowed_ips</i> preferences)

Table 1: (continued)

Handle	Description	Message played
You are not allowed to place calls from your current network location.	relaying_denied	Announcement played on inbound call from trusted IP (e.g. external PBX) with non-local Request-URI domain
The network you are trying to reach is not available.	invalid_speeddial	This is what the calling party hears when it calls an empty speed-dial slot
The speed dial slot you are trying to use is not available.	cf_loop	Announcement played when the called subscriber has the call forwarding configured to itself
The number you are trying to reach is forwarded to an invalid destination.	callee_offline	Announcement played on incoming call to the subscriber which is currently not registered
The number you are trying to reach is currently not available. Please try again later.	callee_busy	Announcement played on incoming call to the subscriber which is currently busy (486 response from the UAS)
The number you are trying to reach is currently busy. Please try again later.	callee_unknown	Announcement that is played on call to unknown or invalid number (not associated with any of our subscribers/hunt groups)
The number you are trying to reach is not in use.	callee_tmp_unavailable	Announcement played on incoming call to the subscriber which is currently unavailable (408, other 4xx or no response code or 30x with malformed contact)
The number you are trying to reach is currently not available. Please try again later.	peering_unavailable	Announcement played in case of outgoing off-net call when there is no peering rule matching this destination and/or source
The network you are trying to reach is not available.	voicebox_unavailable	Announcement played on call to voicebox if the voicemail server is not configured (system operation is impaired)
The voicemail of the number you are trying to reach is currently not available. Please try again later.	emergency_unsupported	Announcement played when emergency destination is dialed but the emergency calls are administratively prohibited for this user or domain (<i>reject_emergency</i> preference is enabled)
You are not allowed to place emergency calls from this line. Please use a different phone.	no_credit	Announcement played when prepaid account has insufficient balance to make a call to this destination

5.11 Conference System

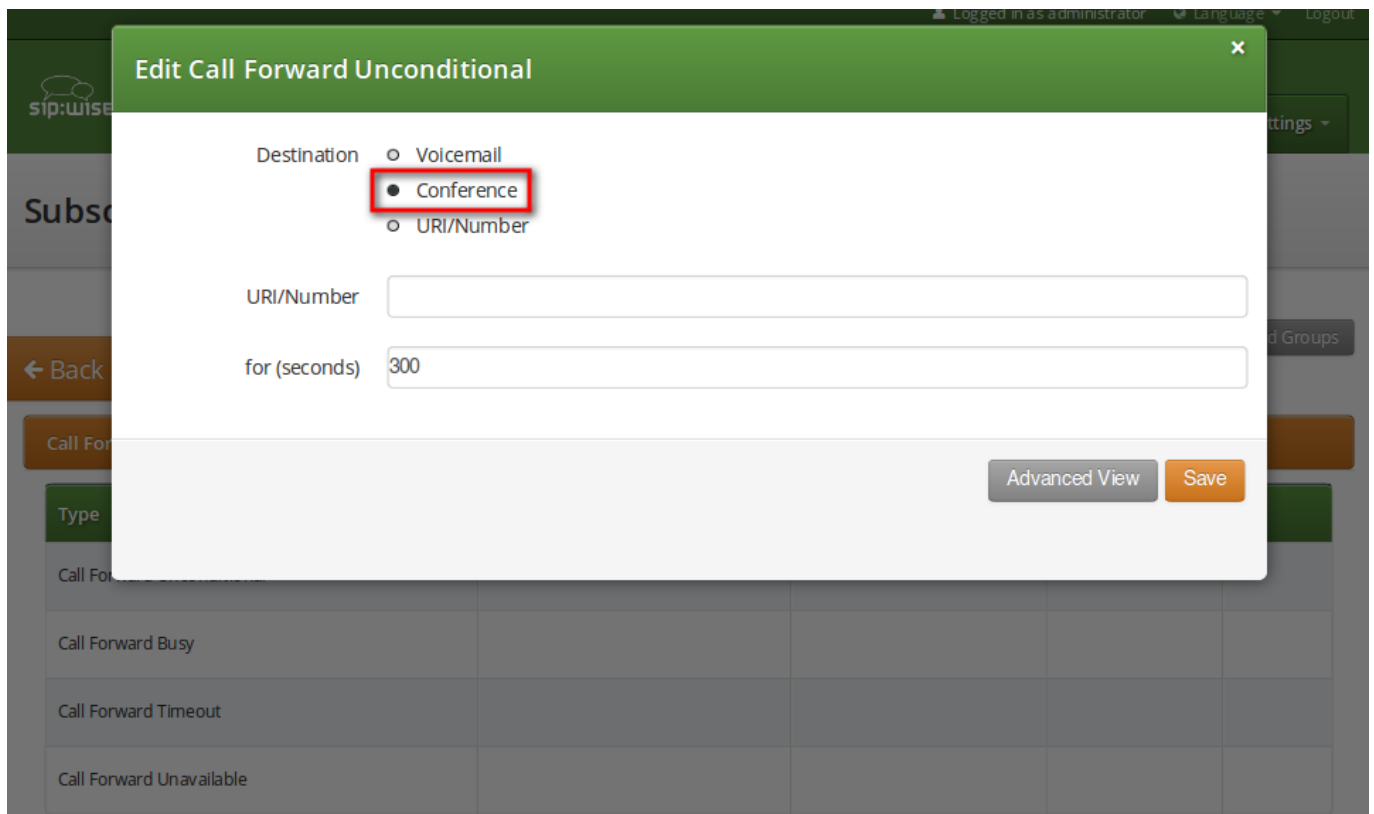
The sip:carrier provides the simple pin-protected conferencing service built using the SEMS DSM scripting language. Hence it is open for all kinds of modifications and extensions.

Template files for the sems conference scripts stored in `/etc/ngcp-config/templates/etc/ngcp-sems/`:

- IVR script: `/etc/ngcp-config/templates/etc/ngcp-sems/dsm/confpin.dsm.tt2`
- Config: `/etc/ngcp-config/templates/etc/ngcp-sems/dsm/confpin.conf.tt2`

5.11.1 Configuring Call Forward to Conference

Go to your *Subscriber Preferences* and click *Edit* on the Call Forward Type you want to set (e.g. *Call Forward Unconditional*).

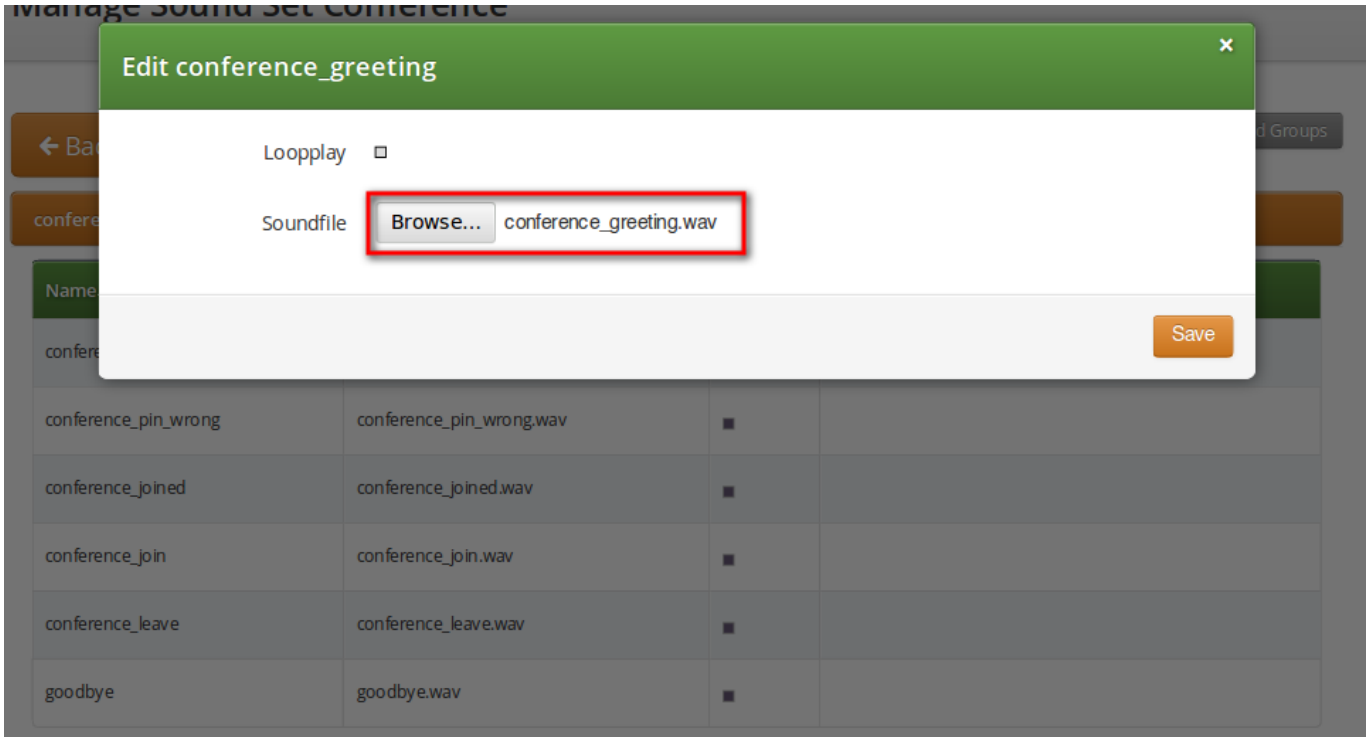


The screenshot shows a modal dialog titled "Edit Call Forward Unconditional". The "Destination" section has three radio button options: "Voicemail", "Conference" (which is selected and highlighted with a red box), and "URI/Number". Below this, there is an empty text input field for "URI/Number" and another text input field for "for (seconds)" containing the value "300". At the bottom right of the dialog are two buttons: "Advanced View" and "Save".

You should select *Conference* option in the *Destination* field and leave the *URI/Number* empty. The timeout defines for how long this destination should be tried to ring.

5.11.2 Configuring Conference Sound Sets

Sound Sets can be defined in *Settings*→*Sound Sets*. To create a new Sound Set, click *Create Sound Set*. Then click the *Files* button.



Upload the following files:

Table 2: Conference Sound Sets

Handle	Message played
conference_greeting	Welcome to the conferencing service.
conference_pin_wrong	You have entered an invalid PIN number. Please try again.
conference_joined	You will be placed into the conference.
conference_join	A person has joined the conference.
conference_leave	A person has left the conference.
goodbye	Goodbye.
conference_pin	Please enter your PIN, followed by the pound key.

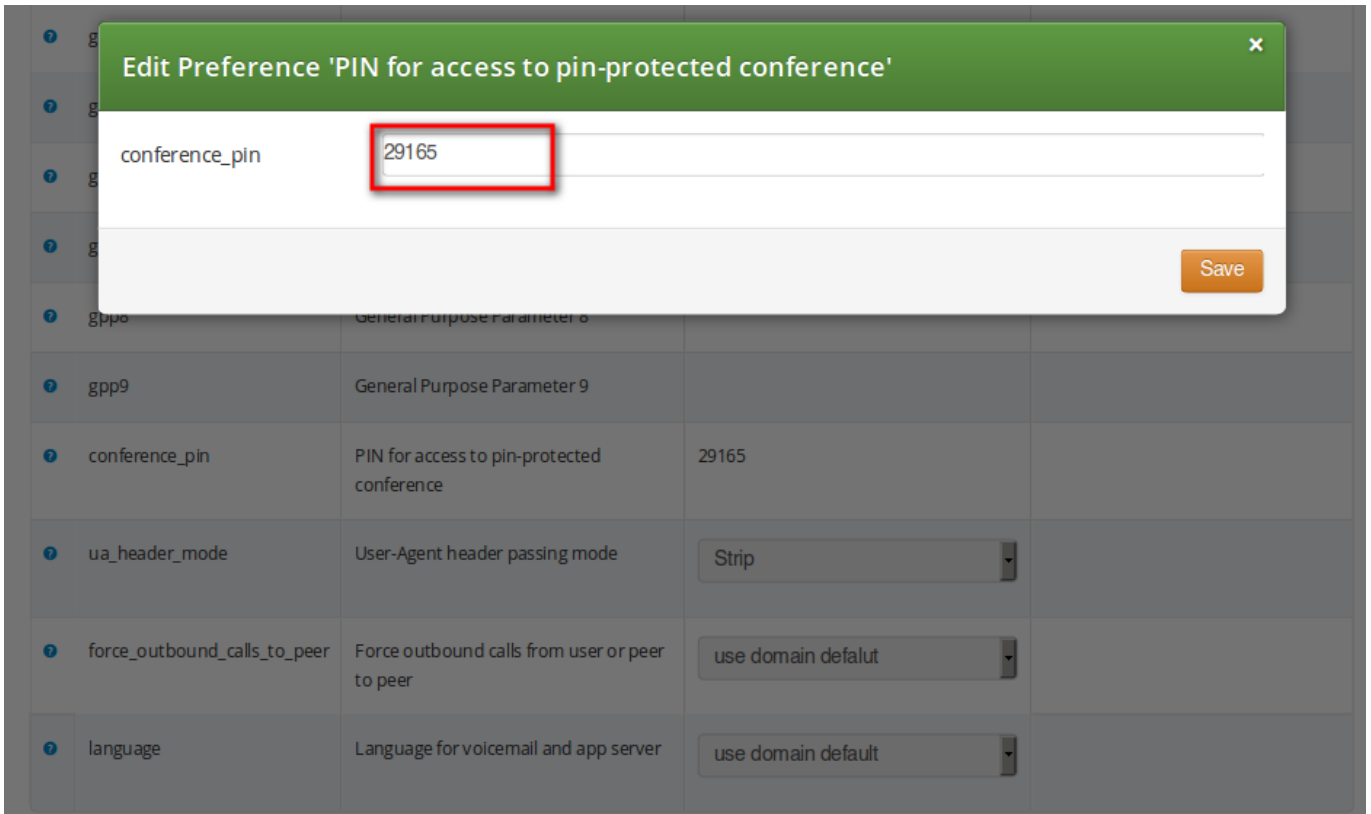
Note

You may use 8 or 16 bit mono WAV audio files.

Then set the preference *sound_set* on the Domain or Subscriber level in order to assign the Sound Set you have just created to the subscriber (as usual the subscriber preference overrides the domain one).

5.11.3 Entering the Conference with a PIN

It is mandatory to configure the PIN code for entrance to the conference on the same subscriber which has the Call Forwarding active. Responsible for this is the `conference_pin` preference in the *Internals* section of subscriber preferences.



When calling the conference IVR you are requested to enter this PIN. Upon the successful entry of the PIN the caller hears the announcement that he is going to be placed into a conference and at the same time this is announced to all participants in the conference.

5.12 Malicious Call Identification (MCID)

MCID feature allows customers to report unwanted calls to the platform operator.

5.12.1 Setup

To enable the feature first edit `config.yml` and enable there `apps:malicious_call:yes` and `kamailio:store_recentcalls:yes`. The latter option enables kamailio to store recent calls per subscriber UUID in the redis DB (the amount of stored recent calls will not exceed the amount of provisioned subscribers).

Next step is to create a system sound set for the feature. In *Settings* → *Sound Sets* either use your already existing *Sound Set* or create a new *Sound Set* and then assign it to your domain or subscribers. In the *Sound Set* there is a fileset *malicious_call_identification* → for that purpose.

Once the *Sound Set* is created the Subscriber's Preferences *Malicious Call Identification* must be enabled under *Subscriber* →

Preferences → *Applications* menu. The same parameter can be set in the Customer's preferences to enable this feature for all its subscribers.

The final step is to create a new *Rewrite Rule* and to route calls to, for instance `*123 → MCID` application. For that you create a *Caller Inbound* rewrite rule `^(*123)$ → malicious_call`

Finally you run `ngcpconfig apply Enabling MCID` to recreate the templates and automatically restart depended services.

5.12.2 Usage

As a subscriber, to report a malicious call you call to either *malicious_call* or to your custom number assigned for that purpose. Please note that you can report only your last received call. You will hear the media reply from the *Sound Set* you have previously configured.

To check reported malicious calls as the platform operator open *Settings* → *Malicious Calls* tab where you will see a list of registered calls. You can selectively delete records from the list and alternatively you can manage the reported calls by using the REST API.

5.12.3 Advanced configuration

By default the expiration time for the most recent call per subscriber is 3600 seconds (1 hour). If you wish to prolong or shorten the expiration time open `constants.yml` and set there `recentcalls:expire:3600` to a new value, and issue `ngcpconfig apply Enabling MCID` afterwards.

5.13 Handling WebRTC Clients

WebRTC is an open project providing browsers and mobile applications with Real-Time Communications (RTC) capabilities. Configuring your platform to offer WebRTC is quite easy and straightforward. This allows you to have a SIP-WebRTC bridge in place and make audio/video call towards normal SIP users from WebRTC clients and vice versa. Sip Provider listens, by default, on the following WebSockets and WebSocket Secure: `ws://your-ip:5060/ws`, `wss://your-ip:5061/ws` and `wss://your-ip:1443/wss/sip/`.

The WebRTC subscriber is just a normal subscriber which has just a different configuration in his Preferences. You need to change the following preferences under *Subscribers* → *Details* → *Preferences* → *NAT and Media Flow Control*:

- **use_rtpproxy**: Always with rtpproxy as additional ICE candidate
- **transport_protocol**: RTP/SAVPF (encrypted SRTP with RTCP feedback)

The `transport_protocol` setting may change, depending on your WebRTC client/browser configuration. Supported protocols are the following:

- Transparent (Pass through using the client's transport protocol)
- RTP/AVP (Plain RTP)
- RTP/SAVP (encrypted SRTP)

- RTP/AVPF (RTP with RTCP feedback)
- RTP/SAVPF (encrypted SRTP with RTCP feedback)
- UDP/TLS/RTP/SAVP (Encrypted SRTP using DTLS)
- UDP/TLS/RTP/SAVPF (Encrypted SRTP using DTLS with RTCP feedback)



Warning

The below configuration is enough to handle a WebRTC client/browser. As mentioned, you may need to tune a little bit your `transport_protocol` configuration, depending on your client/browser settings.

In order to have a bridge between normal SIP clients (using plain RTP for example) and WebRTC client, the normal SIP clients' preferences have to have the following configuration:

transport_protocol: RTP/AVP (Plain RTP)

This will teach Sip Provider to translate between Plain RTP and RTP/SAVPF when you have calls between normal SIP clients and WebRTC clients.

5.14 SIP loop detection

In order to detect a SIP loop (incoming call as a response for a call request) sip:carrier checks the combination of *SIP-URI*, *To* and *From* headers.

This check can be enabled in config.yml by setting `kamailio.proxy.loop_detection.enable: 'yes'`. The system tolerates `kamailio.proxy.loop_d` loops within `kamailio.proxy.loop_detection.expire` seconds. Higher occurrence of loops will be reported with a SIP 482 "Loop Detected" error message

5.15 Call-Through Application

Call-through allows telephony client to dial into an IVR system and specify (in two-stage dialing fashion) a new destination number which is then dialed by the sip:carrier to connect the client to the destination. As the call-through system needs to be protected from unauthorized use, a list of CLIs which are allowed to use the call-through system is stored in the sip:carrier platform.

Table 3: Call-Through Mappings

Column	Description
uuid	The internal UUID of the call-through subscriber
auth_key	Authentication key (CLI)
source_uuid	The internal UUID of the subscriber that is authorized for outgoing call leg (same as uuid in call-through scenario)

5.15.1 Administrative Configuration

Subscriber provisioning

In order to manage the call-through CLIs for subscriber, navigate to *Settings*→*Subscribers*, search for the subscriber you want to edit, press *Details* and then *Preferences*, scroll down to the *Callthrough CLIs* section and press *Edit Callthrough CLIs* button.

Subscriber Callthrough CLIs

Using the NGCP Panel the user then creates Call Forward to destination *Call Through*.

Forward to local user

If the subscriber has a Call Forward to the call-through application but caller's CLI is not in the authorized CLIs list for call-through, sems responds with error back to proxy and proxy advances to the next number in the Call Forward destinations set. User can enter special destination *Local Subscriber* as next target after *Call Through* in the destinations set in order to terminate the call to the subscriber as if the subscriber didn't exist. This way the user may reach the call-through application from his authorized CLI (e.g. mobile number) and all other callers would reach the SIP subscriber's registered phone as usual.


Forward to Callthrough application

Sound Set provisioning

In order for the Callthrough application to work a Sound Set must be created and associated with the Domain or Subscriber.

Sound Sets can be defined in *Settings*→*Sound Sets*. To create a new Sound Set, click *Create Sound Set*. Then click the *Files* button. Administrator can upload the default sounds in one of supported languages or uploaded by the administrator manually in his language of choice.

There is a preference *sound_set* on Domain and Subscriber levels to link subscribers to the sound set that they should hear (as usual the subscriber preference overrides the domain one).



[🏠](#)
[📄 Documentation ▾](#)

Manage Sound Set Calling Card and Call-through

← Back
★ Load Default Files

Sound set successfully loaded with default files.

calling_card

Name	Filename	Loop
and	and.wav	<input type="checkbox"/>
busy_ringback_tone		<input type="checkbox"/>
calling_card_not_found	calling_card_not_found.wav	<input type="checkbox"/>
connecting	connecting.wav	<input type="checkbox"/>
could_not_connect	could_not_connect.wav	<input type="checkbox"/>

Note

You may use 8 or 16 bit mono WAV audio files for all of the voice prompts.

5.15.2 Call Flow

The call arrives at sems application server with Request-URI user `callthrough`.

Internal Header Parameters

The INVITE contains an extra SIP header `P-App-Param` with the following parameters:

Table 4: SIP Header parameters for call-through application

Name	Meaning
uuid	The internal UUID of the call-through subscriber

Table 4: (continued)

Name	Meaning
srcnumber	Caller's CLI for the authentication
outgoing_cli	New CLI to be used by sems application for the outgoing call leg

Caller authorization

Caller is authorized using mapping shown in table above: `select source_uuid from provisioning.voip_cc_mapping where uuid=$uuid and auth_key=$srcnumber;`

If the check fails return the configured error response code. Then proceed with the call setup as follows.

Outgoing call

Sems requests the user to enter destination and starts digit collection. Digit collection process is terminated after 5 seconds (configurable in sems config file) or by pressing the # key. User can start entering destination while the voice prompt is being played.

Sems sends INVITE to the proxy with Request-URI: `sip:$number@$outboundproxy;sw_domain=$subscriber.domain`

`From:$outgoing_cli`

On receiving the 401 or 407 response from the proxy the application authenticates using the digest credentials retrieved for the call-through subscriber from the `voip_subscribers` table: `select s.username, s.password, d.domain from provisioning.voip_subscribers s, provisioning.voip_domains d where s.uuid=$source_uuid and s.domain_id=d.id;`

If the call setup fails the application plays back the "could_not_connect" sound file. If successful the application acts transparently and does not provide any voice announcements or DTMF detection.

CLI configuration

The CLI on the outgoing call from the call-through module is set to the Network-Provided Number (NPN) of the call-through subscriber. There is nothing to configure.

5.16 Calling card application

Calling card application uses a similar concept to call-through except that authorization process operates on the PIN code entered by user using DTMF instead of the CLI. The sip:carrier maps incoming UUID of the pilot subscriber to the list of PINs for calling card

application with their corresponding subscriber UUIDs for outbound call leg using table `provisioning.voip_cc_mapping`
`table {"uuid", "auth_key", "source_uuid"}`

Table 5: Calling Cards

Column	Description
uuid	The internal UUID of the pilot subscriber
auth_key	Authentication key (PIN)
source_uuid	The internal UUID of the subscriber that is authorized for outgoing call leg

5.16.1 Administrative Configuration

TBD. managing calling cards using the NGCP panel.

Subscriber provisioning

In order to use the calling cards service the user creates a Call Forward to destination *Calling Card* for the designated subscriber that will be used as access number for this service.

Sound Set provisioning

In order for the Calling Card application to work a Sound Set must be created and associated with the Domain or Subscriber.

Sound Sets can be defined in *Settings*→*Sound Sets*. To create a new Sound Set, click *Create Sound Set*. Then click the *Files* button. Administrator can upload the default sounds in one of supported languages or uploaded by the administrator manually in his language of choice.

There is a preference *sound_set* on Domain and Subscriber levels to link subscribers to the sound set that they should hear (as usual the subscriber preference overrides the domain one).

sip:wise NGCP Dashboard

[🏠](#)
[📄 Documentation ▾](#)

Manage Sound Set Calling Card and Call-through

← Back
★ Load Default Files

Sound set successfully loaded with default files.

calling_card

Name	Filename	Loop	
and	and.wav	<input type="checkbox"/>	
busy_ringback_tone		<input type="checkbox"/>	
calling_card_not_found	calling_card_not_found.wav	<input type="checkbox"/>	
connecting	connecting.wav	<input type="checkbox"/>	
could_not_connect	could_not_connect.wav	<input type="checkbox"/>	

Note

You may use 8 or 16 bit mono WAV audio files for all of the voice prompts.

CLI configuration

The CLI on the outgoing call from the calling card app can be configured in one of the following ways using subscriber preferences:

1) Show original caller's CLI: the calling card subscriber shall have `allowed_clis:*` (any). Sems application sends the original caller's CLI in the From header, it is validated by the SIP proxy and sent to outside.

2) Show number of the pilot (calling card) subscriber: the calling card subscriber shall have an empty `allowed_clis` and desired number set as value of `user_cli` preference. The SIP proxy overrides the original caller's CLI in UPN with the value of the `user_cli` preference. The peer must have set `outbound_from_user`, `outbound_from_display:User-Provided Number` (UPN).

5.16.2 Call Flow

The call arrives at sems application server with Request-URI user `callingcard`.

Internal Header Parameters

The INVITE contains an extra SIP header `P-App-Param` with the following parameters:

Table 6: SIP Header parameters for calling card application

Name	Meaning
<code>uuid</code>	The internal UUID of the pilot subscriber
<code>outgoing_cli</code>	New CLI to be used by sems application for the outgoing call leg

Caller authorization

- Sems requests the user to enter PIN and starts digit collection. Digit collection process is terminated after 5 seconds (configurable in sems config file) or by pressing the `#` key. User can start entering destination while the voice prompt is being played.
- Sems checks that PIN is valid and belongs to the pilot subscriber using mapping as shown in the table. It fetches UUID of the subscriber to be used for outgoing call leg:

```
select source_uuid from provisioning.voip_cc_mapping where uuid=$uuid and auth_key=$pin;
```
- If the check fails sems will request the user to re-enter PIN up to the configured number of times.
- If successful proceed with the call setup making call on behalf of subscriber determined by the `source_uuid` key as follows.

Outgoing call

Sems application plays back the available balance of the customer. Sems requests the user to enter destination and starts digit collection. Digit collection process is terminated after 5 seconds (configurable in sems config file) or by pressing the `#` key. User can start entering destination while the voice prompt is being played.

Sems sends INVITE to the proxy with Request-URI: `sip:$number@$outboundproxy;sw_domain=$subscriber.domain`

`From:$outgoing_cli`

On receiving the 401 or 407 response from the proxy the application authenticates using the digest credentials retrieved for the subscriber for outgoing call leg from the `voip_subscribers` table:

```
select s.username, s.password, d.domain from provisioning.voip_subscribers s, provisioning.voip_domains d where s.uuid=$source_uuid and s.domain_id=d.id;
```

Voucher recharge

During the destination collection phase in calling card application user can enter special code *1*<pin># (configurable in sems config file) to transfer balance from other calling card customer to the currently authorized customer. Sems transfers all remaining balance from that customer to the current customer.

Billing

The call via calling card application as well as call-through generates three CDRs:

- A to B: The incoming call from any source to the call-through subscriber.
- B to callingcard@app.local or callthrough@app.local: The call forward to the sems application.
- B to C: The outgoing call to the final destination. The three CDRs are handled by the billing process as usual, exported and shown in all call lists. .

6 Customer Self-Care Interfaces

There are two ways for end users to maintain their subscriber settings: via the *Customer Self-Care Web Interface* and via *Vertical Service Codes* using their SIP phones.

6.1 The Customer Self-Care Web Interface

The NGCP provides a web panel for end users (CSC panel) to maintain their subscriber accounts, which is running on `https://<ce-ip>`. Every subscriber can log in there, change subscriber feature settings, view their call lists, retrieve voicemail messages and trigger calls using the click-to-dial feature.

6.1.1 Login Procedure

To log into the CSC panel, the end user has to provide his full web username (e.g. `user1@1.2.3.4`) and the web password defined in Section 4.2. Once logged in, he can change his web password in the *Account* section. This will NOT change his SIP password, so if you control the end user devices, you can auto-provision the SIP password into the device and keep it secret, and just hand over the web password to the customer. This way, the end user will only be able to place calls with this auto-provisioned device and not with an arbitrary soft-phone, but can nonetheless manage his account via the CSC panel.

6.1.2 Site Customization

As an operator (as well as a Reseller), you can change the branding logo of the CSC panel by modifying the CSS via web interface. For changing the branding logo you just need to access the web interface as administrator and move to *Reseller_menu*. Once there click on *Details* button for "default" reseller. Then on *Branding* → *Edit Branding*. Now you can upload your logo and copy/paste the CSS code line in the `CSS__` field. The logo will be visible into the Customer Self Care interface.

Also Reseller can customize their web page (CSC and Admin interface) by uploading their logo and change the CSS. To do that, just access the Admin interface with the Reseller web credentials and then access the *Panel Branding* menu. From them you can upload the logo as explained before. The logo will appear in the CSC web page related to that reseller as well as to the Admin page of the reseller.

You can also enable/disable specific languages a user can choose from in the CSC panel. Currently, English (`en`), German (`de`), Spanish (`es`) and Russian (`ru`) are supported and English is activated by default. You can change the default language provided by CSC by changing the parameter *force_language* in `config.yml`.

6.2 The Vertical Service Code Interface

Vertical Service Codes (VSC) are codes a user can dial on his phone to provision specific features for his subscriber account. The format is `*<code>*<value>` to activate a specific feature, and `#<code>` or `#<code>#` to deactivate it. The *code* parameter is a two-digit code, e.g. `72`. The *value* parameter is the value being set for the corresponding feature.



Important

The *value* user input is normalized using the Rewrite Rules Sets assigned to domain as described in Section 4.6.

By default, the following codes are configured for setting features. The examples below assume that there is a domain rewrite rule normalizing the number format $0<ac><sn>$ to $<cc><ac><sn>$ using 43 as country code.

- **72** - enable *Call Forward Unconditional* e.g. to 431000 by dialing $*72*01000$, and disable it by dialing #72.
- **90** - enable *Call Forward on Busy* e.g. to 431000 by dialing $*90*01000$, and disable it by dialing #90.
- **92** - enable *Call Forward on Timeout* e.g. after 30 seconds of ringing to 431000 by dialing $*92*30*01000$, and disable it by dialing #92.
- **93** - enable *Call Forward on Not Available* e.g. to 431000 by dialing $*93*01000$, and disable it by dialing #93.
- **50** - set *Speed Dial Slot*, e.g. set slot 1 to 431000 by dialing $*50*101000$, which then can be used by dialing *1.
- **55** - set *One-Shot Reminder Call* e.g. to 08:30 by dialing $*55*0830$.
- **31** - set *Calling Line Identification Restriction* for one call, e.g. to call 431000 anonymously dial $*31*01000$.
- **80** - call using *Call Block Override PIN*, number should be prefixed with a block override PIN configured in admin panel to disable the outgoing user/admin block list and NCOS level for a call. For example, when override PIN is set to 7890, dial $*80*789001000$ to call 431000 bypassing block lists.

6.2.1 Vertical Service Codes for PBX customers

Subscribers under the same PBX customer can enjoy some PBX-specific features by means of special VSCs.

NGCP provides the following PBX-specific VSCs:

- **97** - *Call Parking*: during a conversation the subscriber can park the call with his phone to a "parking slot" and later on continue the conversation from another phone. To do that, a destination must be dialled as follows: $*97*3$; this will park the call to slot no. 3. **PLEASE NOTE:**
- Cisco IP phones provide a softkey for Call Parking, that means the subscriber must only dial the parking slot number after pressing "Park" softkey on the phone.
- Other IP phones can perform Call Parking as a *blind transfer*, where the destination of the transfer must be dialled in the format described above.
- Both the caller and the callee can park the call.
- **98** - *Call Unparking*: if a call has been parked, a subscriber may continue the conversation from any extension (phone) under the same PBX customer. To do that, the subscriber must dial the following sequence: $*98*3$; this will pick up the call that was parked at slot no. 3.
- **99** - *Directed Call Pickup*: if a subscriber's phone is ringing (e.g. extension 23) and another subscriber wants to answer the call instead of the original callee, he may pick up the call by dialling $*99*23$ on his phone.

6.2.2 Configuration of Vertical Service Codes

You can change any of the codes (but not the format) in `/etc/ngcp-config/config.yml` in the section `sems→vsc`. After the changes, execute `ngcpcfg apply 'changed VSC codes'`.

**Caution**

If you have the EMTAs under your control, make sure that the specified VSCs don't overlap with EMTA-internal VSCs, because the VSC calls must be sent to the NGCP via SIP like normal telephone calls.

6.3 The Voicemail Interface

NGCP offers several ways to access the Voicemail box.

The CSC panel allows your users to listen to voicemail messages from the web browser, delete them and call back the user who left the voice message. User can setup voicemail forwarding to the external email and the PIN code needed to access the voicebox from any telephone also from the CSC panel.

To manage the voice messages from SIP phone: simply dial internal voicemail access number 2000.

To change the access number: look for the parameter `voicemail_number` in `/etc/ngcp-config/config.yml` in the section `sems→vsc`. After the changes, execute `ngcpcfg apply 'changed voicebox number'`.

Tip

To let the callers leave a voice message when user is not available he should enable Call Forward to Voicebox. The Call Forward can be provisioned from the CSC panel as well as by dialing Call Forward VSC with the voicemail number. E.g. when parameter `voicemail_number` is set to 9999, a Call Forward on Not Available to the Voicebox is set if the user dials *93*9999. As a result, all calls will be redirected to the Voicebox if SIP phone is not registered.

To manage the voice messages from any phone:

- As an operator, you can setup some DID number as external voicemail access number: for that, you should add a special rewrite rule (Inbound Rewrite Rule for Callee, see Section 4.6.) on the incoming peer, to rewrite that DID to "voiceboxpass". Now when user calls this number the call will be forwarded to the voicemail server and he will be prompted for mailbox and password. The mailbox is the full E.164 number of the subscriber account and the password is the PIN set in the CSC panel.
- The user can also dial his own number from PSTN, if he setup Call Forward on Not Available to the Voicebox, and when reaching the voicemail server he can interrupt the "user is unavailable" message by pressing * key and then be prompted for the PIN. After entering PIN and confirming with # key he will enter own voicemail menu. PIN is random by default and must be kept secret for that reason.

7 Billing Configuration

This chapter describes the steps necessary to rate calls and export rated CDRs (call detail records) to external systems.

7.1 Billing Data Import

Service billing on the NGCP is based on billing profiles, which may be assigned to customers and SIP peerings. The design focuses on a simple, yet flexible approach, to support arbitrary dial-plans without introducing administrative overhead for the system administrators. The billing profiles may define a base fee and free time or free money per billing interval. Unused free time or money automatically expires at the end of the billing interval.

Each profile may have call destinations (usually based on E.164 number prefix matching) with configurable fees attached. Call destination fees each support individual intervals and rates, with a different duration and/or rate for the first interval. (e.g.: charge the first minute when the call is opened, then every 30 seconds, or make it independent of the duration at all) It is also possible to specify different durations and/or rates for peak and off-peak hours. Peak time may be specified based on weekdays, with additional support for manually managed dates based on calendar days. The call destinations can finally be grouped for an overview on user's invoices by specifying a zone in two detail levels. (E.g.: national landline, national mobile, foreign 1, foreign 2, etc.)

7.1.1 Creating Billing Profiles

The first step when setting up billing data is to create a billing profile, which will be the container for all other billing related data. Go to *Settings*→*Billing* and click on *Create Billing Profile*.

Reseller

Search:

#	Name	Contract #	Status
1	default	1	active

Showing 1 to 1 of 1 entries

Create Reseller

Handle

Name

Prepaid

Interval charge

Save

The fields *Reseller*, *Handle* and *Name* are mandatory.

- **Reseller:** The reseller this billing profile belongs to.
- **Handle:** A unique, permanently fixed string which is used to attach the billing profile to a customer or SIP peering contract.
- **Name:** A free form string used to identify the billing profile in the *Admin Panel*. This may be changed at any time.
- **Interval charge:** A base fee for the billing interval, specifying a monetary amount (represented as a floating point number) in whatever currency you want to use.
- **Interval free time:** If you want to include free calling time in your billing profile, you may specify the number of seconds that are available every billing interval. See *Creating Billing Fees* below on how to select destinations which may be called using the free time.
- **Interval free cash:** Same as for *interval free time* above, but specifies a monetary amount which may be spent on outgoing calls. This may be used for example to implement a minimum turnover for a contract, by setting the *interval charge* and *interval free cash* to the same values.
- **Fraud monthly limit:** The monthly fraud detection limit (in Cent) for accounts with this billing profile. If the call fees of an account reach this limit within a billing interval, an action can be triggered.
- **Fraud monthly lock:** a choice of *none*, *foreign*, *outgoing*, *incoming*, *global*. Specifies a lock level which will be used to lock the account and his subscribers when *fraud monthly limit* is exceeded.
- **Fraud monthly notify:** An email address or comma-separated list of email addresses that will receive notifications when *fraud monthly limit* is exceeded.

- **Fraud daily limit:** The fraud detection limit (in Cent) for accounts with this billing profile. If the call fees of an account reach this limit within a calendar day, an action can be triggered.
- **Fraud daily lock:** a choice of *none*, *foreign*, *outgoing*, *incoming*, *global*. Specifies a lock level which will be used to lock the account and his subscribers when *fraud daily limit* is exceeded.
- **Fraud daily notify:** An email address or comma-separated list of email addresses that will receive notifications when *fraud daily limit* is exceeded.
- **Currency:** The currency symbol for your currency. Any UTF-8 character may be used and will be printed in web interfaces.
- **VAT rate:** The percentage of value added tax for all fees in the billing profile. Currently for informational purpose only and not used further.
- **VAT included:** Whether VAT is included in the fees entered in web forms or uploaded to the platform. Currently for informational purpose only and not used further.

7.1.2 Creating Billing Fees

Each *Billing Profile* holds multiple *Billing Fees*.

To set up billing fees, click on the *Fees* button of the billing profile you want to configure. Billing fees may be uploaded using a configurable CSV file format, or entered directly via the web interface by clicking *Create Fee Entry*. To configure the CSV field order for the file upload, rearrange the entries in the `www_admin→fees_csv→element_order` array in `/etc/ngcp-config/config.yml` and execute the command `ngcpcfg apply changed_fees_element_order`. The following is an example of working CSV file to upload (pay attention to double quotes):

```
".", "^1", out, "EU", "ZONE EU", 5.37, 60, 5.37, 60, 5.37, 60, 5.37, 60, 0, 0
"^01.+$", "^02145.+$", out, "AT", "ZONE Test", 0.06250, 1, 0.06250, 1, 0.01755, 1, 0.01733, 1, 0
```

For input via the web interface, just fill in the text fields accordingly.

The screenshot shows the 'Create Billing Fees' dialog box. At the top, it says 'Zone' and 'Search:'. Below is a table with columns '#', 'Zone', and 'Zone Detail'. The table contains one entry with '# 2', 'Zone test', and 'Zone Detail test zone'. A red box labeled '2' highlights a checkbox in the table. Below the table, it says 'Showing 1 to 1 of 1 entries'. A red box labeled '1' highlights a 'Create Zone' button. Below the button are input fields: 'Source', 'Destination' (with a red box labeled '3' and containing '*.'), 'Direction' (with a dropdown menu showing 'outbound' and a red box labeled '4'), and 'Onpeak init rate' (with a value of '0'). A 'Save' button is at the bottom right. A red note says 'created by "Create Zone" button below'.

In both cases, the following information may be specified independently for every destination:

- **Zone:** A zone for a group of destinations. May be used to group destinations for simplified display, e.g. on invoices. (e.g. foreign zone 1)
- **Source:** The source pattern. This is a POSIX regular expression matching the complete source URI (e.g. `^.*@sip\.example\.org$` or `^someone@sip\.sipwise\.com$` or just `.` to match everything). If you leave this field empty, the default pattern `.` matching everything will be set implicitly. Internally, this pattern will be matched against the `<source_cli>`@`<source_domain>` fields of the CDR.
- **Destination:** The destination pattern. This is a POSIX regular expression matching the complete destination URI (e.g. `someone@sip\.example\.org` or `^43`). This field must be set.
- **Direction:** `Outbound` for standard origination fees (applies to callers placing a call and getting billed for that) or `Inbound` for termination fees (applies to callees if you want to charge them for receiving various calls, e.g. for 800-numbers). *If in doubt, use Outbound.* If you upload fees via CSV files, use `out` or `in`, respectively.



Important

The {source, destination, direction} combination needs to be unique for a billing profile. The system will return an error if such a set is specified twice, both for the file upload and the input via the web interface.

Important

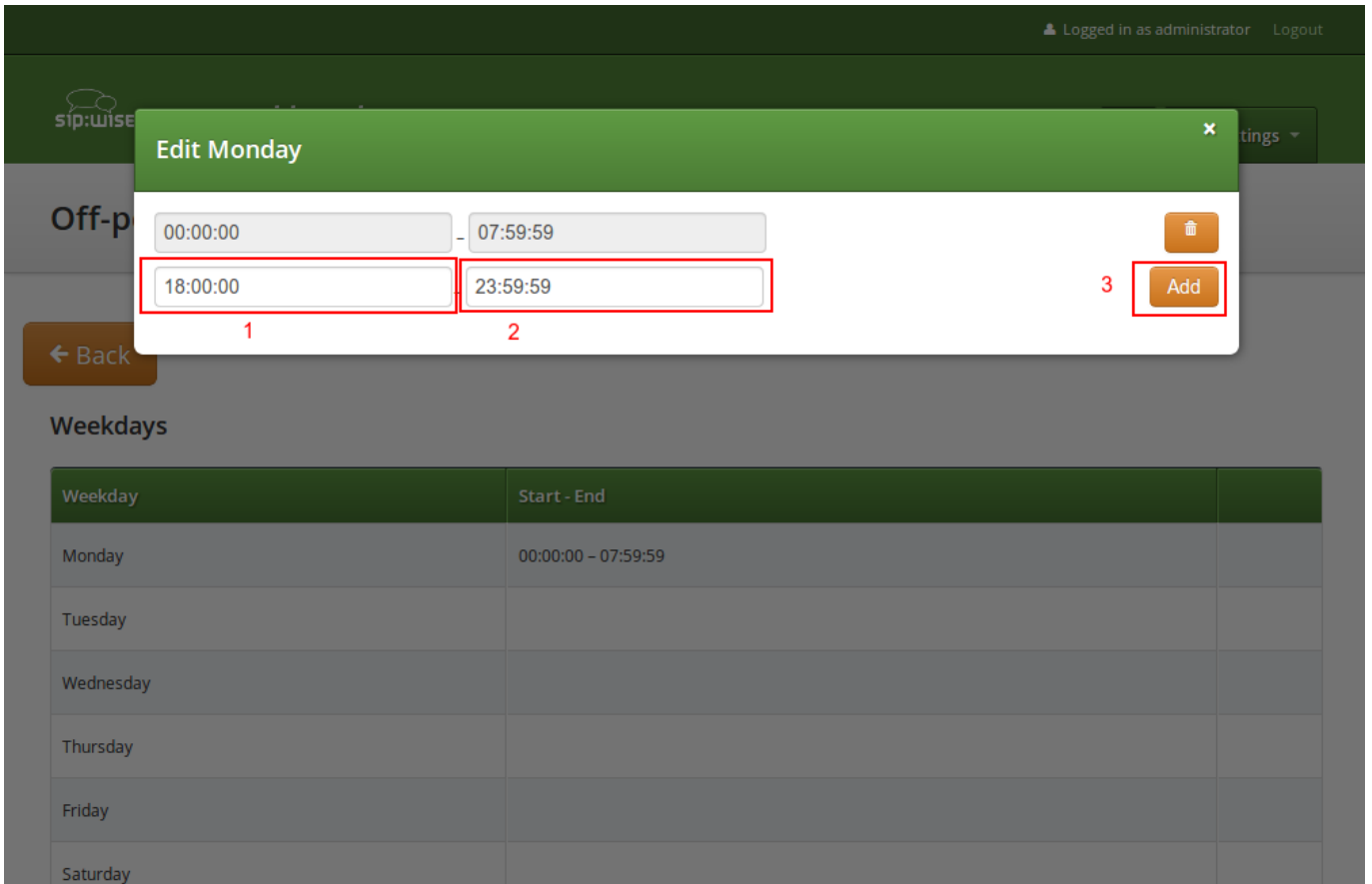
There are several internal services (vsc, conference, voicebox) which will need a specific destination entry with a domain-based destination. If you don't want to charge the same (or nothing) for those services, add a fee for destination `\.local$` there. If you want to charge different amounts for those services, break it down into separate fee entries for `@vsc\.local$`, `@conference\.local$` and `@voicebox\.local$` with the according fees. **NOT CREATING EITHER THE CATCH-ALL FEE OR THE SEPARATE FEES FOR THE `.local` DOMAIN WILL BREAK YOUR RATING PROCESS!**

- **Onpeak init rate:** The rate for the first rating interval in cent (of whatever currency, represented as a floating point number) per second. Applicable to calls during onpeak hours.
- **Onpeak init interval:** The duration of the first billing interval, in seconds. Applicable to calls during onpeak hours.
- **Onpeak follow rate:** The rate for subsequent rating intervals in cent (of whatever currency, represented as a floating point number) per second. Applicable to calls during onpeak hours. Defaults to *onpeak init rate*.
- **Onpeak follow interval:** The duration of subsequent billing intervals, in seconds. Applicable to calls during onpeak hours. Defaults to *onpeak init interval*.
- **Offpeak init rate:** The rate for the first rating interval in cent (of whatever currency, represented as a floating point number) per second. Applicable to calls during off-peak hours. Defaults to *onpeak init rate*.
- **Offpeak init interval:** The duration of the first billing interval, in seconds. Applicable to calls during off-peak hours. Defaults to *onpeak init interval*.
- **Offpeak follow rate:** The rate for subsequent rating intervals in cent (of whatever currency, represented as a floating point number) per second. Applicable to calls during off-peak hours. Defaults to *offpeak init rate* if that one is specified, or to *onpeak follow rate* otherwise.
- **Offpeak follow interval:** The duration of subsequent billing intervals, in seconds. Applicable to calls during off-peak hours. Defaults to *offpeak init interval* if that one is specified, or to *onpeak follow interval* otherwise.
- **Use free time:** Specifies whether free time minutes may be used when calling this destination. May be specified in the file upload as 0, n[o], f[alse] and 1, y[es], t[rue] respectively.

7.1.3 Creating Off-Peak Times

To be able to differentiate between on-peak and off-peak calls, the platform stores off-peak times for every billing profile based on weekdays and/or calendar days. To edit the settings for a billing profile, go to *Settings*→*Billing* and press the *Off-Peaktimes* button on the billing profile you want to configure.

To set off-peak times for a weekday, click on *Edit* next to the according weekday. You will be presented with two input fields which both receive a timestamp in the form of *hh:mm:ss* specifying a time of day for the start and end of the off-peak period. If any of the fields is left empty, the system will automatically insert *00:00:00* (*start* field) or *23:59:59* (*end* field). Click on *Add* to store the setting in the database. You may create more than one off-peak period per weekday. To delete a range, just click *Delete* next to the entry. Click the *close* icon when done.



To specify off-peak ranges based on calendar dates, click on *Create Special Off-Peak Date*. Enter a date in the form of *YYYY-MM-DD hh:mm:ss* into the *Start Date/Time* input field and *End Date/Time* input field to define a range for the off-peak period.

1 Start Date/Time 2013-12-24 00:00:00

2 End Date/Time 2013-12-24 23:59:59

3 Save

Weekday	Start - End
Monday	00:00:00 - 07:59:59 18:00:00 - 23:59:59
Tuesday	
Wednesday	
Thursday	
Friday	

7.1.4 Fraud Detection and Locking

The NGCP supports a fraud detection feature, which is designed to detect accounts causing unusually high customer costs, and then to perform one of several actions upon those accounts. This feature can be enabled and configured through two sets of billing profile options described in Section 7.1.1, namely the monthly (*fraud monthly limit*, *fraud monthly lock* and *fraud monthly notify*) and daily limits (*fraud daily limit*, *fraud daily lock* and *fraud daily notify*). Either monthly/daily limits or both of them can be active at the same time.

Monthly fraud limit check runs once a day, shortly after midnight local time and daily fraud limit check runs every 30min. A background script (managed by cron daemon) automatically checks all accounts which are linked to a billing profile enabled for fraud detection, and selects those which have caused a higher cost than the *fraud monthly limit* configured in the billing profile, within the currently active billing interval (e.g. in the current month), or a higher cost than the *fraud daily limit* configured in the billing profile, within the calendar day. It then proceeds to perform at least one of the following actions on those accounts:

- If **fraud lock** is set to anything other than *none*, it will lock the account accordingly (e.g. if **fraud lock** is set to *outgoing*, the account will be locked for all outgoing calls).
- If anything is listed in **fraud notify**, an email will be sent to the email addresses configured. The email will contain information about which account is affected, which subscribers within that account are affected, the current account balance and the configured fraud limit, and also whether or not the account was locked in accordance with the **fraud lock** setting. It should be noted that this email is meant for the administrators or accountants etc., and not for the customer.

**Important**

You can override these settings on a per-account basis via REST API or the Admin interface.

**Caution**

Accounts that were automatically locked by the fraud detection feature will **not** be automatically unlocked when the next billing interval starts. This has to be done manually through the administration panel or through the provisioning interface.

**Important**

If fraud detection is configured to only send an email and not lock the affected accounts, it will continue to do so for over-limit accounts every day. The accounts must either be locked in order to stop the emails (only currently active accounts are considered when the script looks for over-limit accounts) or some other action to resolve the conflict must be taken, such as disabling fraud detection for those accounts.

7.2 Billing Data Export

Regular billing data export is done using CSV (*comma separated values*) files which may be downloaded from the platform using the *cdrexport* user which has been created during the installation.

There are two types of exports. One is *CDR* (Call Detail Records) used to charge for calls made by subscribers, and the other is *EDR* (Event Detail Records) used to charge for provisioning events like enabling certain features.

7.2.1 File Name Format

In order to be able to easily identify billing files, the file names are constructed by the following fixed-length fields:

```
<prefix><separator><version><separator><timestamp><separator><sequence number><
suffix>
```

The definition of the specific fields is as follows:

Table 7: CDR/EDR export file name format

File name element	Length	Description
<prefix>	7	A fixed string. Always sipwise.
<separator>	1	A fixed character. Always _.
<version>	3	The format version, a three digit number. Currently 007.
<timestamp>	14	The file creation timestamp in the format YYYYMMDDhhmmss.
<sequence number>	10	A unique 10-digit zero-padded sequence number for quick identification.
<suffix>	4	A fixed string. Always .cdr or .edr.

A valid example filename for a CDR billing file created at 2012-03-10 14:30:00 and being the 42nd file exported by the system, is:

```
sipwise_007_20130310143000_0000000042.cdr
```

7.2.2 File Format

Each billing file consists of three parts: one header line, zero to 5000 body lines and one trailer line.

File Header Format

The billing file header is one single line, which is constructed by the following fields:

```
<version>,<number of records>
```

The definition of the specific fields is as follows:

Table 8: CDR/EDR export file header line format

Body Element	Length	Type	Description
<version>	3	zero-padded uint	The format version. Currently 007.
<number of records>	4	zero-padded uint	The number of body lines contained in the file.

A valid example for a Header is:

```
007,0738
```

File Body Format for Call Detail Records (CDR)

The body of a CDR consists of a minimum of zero and a maximum of 5000 lines. Each line holds one call detail record in CSV format and is constructed by the following fields, all of them enclosed in single quotes:

Table 9: CDR export file body line format

Body Element	Length	Type	Description
<id>	1-10	uint	Internal CDR id.

Table 9: (continued)

Body Element	Length	Type	Description
<update_time>	19	timestamp	Timestamp of last modification.
<source_user_id>	36	string	Internal UUID of calling party subscriber.
<source_provider_id>	1-255	string	Internal ID of calling party provider.
<source_ext_subscriber_id>	0-255	string	External ID of calling party subscriber.
<source_subscriber_id>	1-10	uint	Internal ID of calling party subscriber.
<source_ext_account_id>	0-255	string	External ID of calling party customer.
<source_account_id>	1-10	uint	Internal ID of calling party customer.
<source_user>	1-255	string	SIP username of calling party.
<source_domain>	1-255	string	SIP domain of calling party.
<source_cli>	1-64	string	CLI of calling party in E.164 format.
<source_clir>	1	uint	1 for calls with CLIR, 0 otherwise.
<source_ip>	0-64	string	IP Address of the calling party.
<destination_user_id>	1 / 36	string	Internal UUID of called party subscriber or 0 if callee is not local.
<destination_provider_id>	1-255	string	Internal ID of called party provider.
<dest_ext_subscriber_id>	0-255	string	External ID of called party subscriber.
<dest_subscriber_id>	1-10	uint	Internal ID of called party subscriber.
<dest_ext_account_id>	0-255	string	External ID of called party customer.
<destination_account_id>	1-10	uint	Internal ID of called party customer.
<destination_user>	1-255	string	Final SIP username of called party.
<destination_domain>	1-255	string	Final SIP domain of called party.
<destination_user_in>	1-255	string	Incoming SIP username of called party.
<destination_domain_in>	1-255	string	Incoming SIP domain of called party.
<dialed_digits>	1-255	string	The user-part of the SIP Request URI as received by the soft-switch.
<peer_auth_user>	0-255	string	User to authenticate towards peer.
<peer_auth_realm>	0-255	string	Realm to authenticate towards peer.
<call_type>	3-4	string	The type of the call - one of: call: normal call cfu: call forward unconditional cft: call forward timeout cfb: call forward busy cfna: call forward no answer

Table 9: (continued)

Body Element	Length	Type	Description
<call_status>	2-7	string	The final call status - one of: ok: successful call busy: callee busy noanswer: no answer from callee cancel: cancel from caller offline callee offline timeout: no reply from callee other: unspecified, see <call_code> for details
<call_code>	3	uint	The final SIP status code.
<init_time>	23	timestamp	Timestamp of call initiation (invite received from caller). Seconds include fractional part (3 decimals).
<start_time>	23	timestamp	Timestamp of call establishment (final response received from callee). Seconds include fractional part (3 decimals).
<duration>	4-11	fixed precision	Length of call (beginning at start_time) in seconds with 3 decimals.
<call_id>	1-255	string	The SIP call-id.
<rating_status>	2-7	string	The internal rating status - one of: unrated: not rated ok: successfully rated failed: error while rating Currently always ok or unrated, depending on whether rating is enabled or not.
<rated_at>	0 / 19	timestamp	Timestamp of rating or empty if not rated.
<source_carrier_cost>	4-11	fixed precision	The originating carrier cost or empty if not rated. In cent with two decimals. Only available in system exports, not for resellers.
<source_customer_cost>	4-11	fixed precision	The originating customer cost or empty if not rated. In cent with two decimals.
<source_carrier_zone>	0-127	string	The originating carrier billing zone or empty if not rated. Only available in system exports, not for resellers.
<source_customer_zone>	0-127	string	The originating customer billing zone or empty if not rated.
<source_carrier_destination>	0-127	string	The originating carrier billing destination or empty if not rated. Only available in system exports, not for resellers.
<source_customer_destination>	0-127	string	The originating customer billing destination or empty if not rated.

Table 9: (continued)

Body Element	Length	Type	Description
<source_carrier_free_time>	1-10	uint	The number of originating free time seconds used on carrier side or empty if not rated. Only available in system exports, not for resellers.
<source_customer_free_time>	1-10	uint	The number of originating free time seconds used from the customer's account balance or empty if not rated.
<destination_carrier_cost>	4-11	fixed precision	The termination carrier cost or empty if not rated. In cent with two decimals. Only available in system exports, not for resellers.
<destination_customer_cost>	4-11	fixed precision	The termination customer cost or empty if not rated. In cent with two decimals.
<destination_carrier_zone>	0-127	string	The termination carrier billing zone or empty if not rated. Only available in system exports, not for resellers.
<destination_customer_zone>	0-127	string	The termination customer billing zone or empty if not rated.
<destination_carrier_destination>	0-127	string	The termination carrier billing destination or empty if not rated. Only available in system exports, not for resellers.
<destination_customer_destination>	0-127	string	The termination customer billing destination or empty if not rated.
<destination_carrier_free_time>	1-10	uint	The number of termination free time seconds used on carrier side or empty if not rated. Only available in system exports, not for resellers.
<destination_customer_free_time>	1-10	uint	The number of termination free time seconds used from the customer's account balance or empty if not rated.
<source_reseller_cost>	4-11	fixed precision	The originating reseller cost or empty if not rated. In cent with two decimals. Only available in system exports, not for resellers.
<source_reseller_zone>	0-127	string	The originating reseller billing zone or empty if not rated. Only available in system exports, not for resellers.
<source_reseller_destination>	0-127	string	The originating reseller billing destination or empty if not rated. Only available in system exports, not for resellers.
<source_reseller_free_time>	1-10	uint	The number of originating free time seconds used from the reseller's account balance or empty if not rated. Only available in system exports, not for resellers.
<destination_reseller_cost>	4-11	fixed precision	The termination reseller cost or empty if not rated. In cent with two decimals. Only available in system exports, not for resellers.

Table 9: (continued)

Body Element	Length	Type	Description
<destination_reseller_zone>	0-127	string	The termination reseller billing zone or empty if not rated. Only available in system exports, not for resellers.
<destination_reseller_destination>	0-127	string	The termination reseller billing destination or empty if not rated. Only available in system exports, not for resellers.
<destination_reseller_free_time>	1-10	uint	The number of termination free time seconds used from the reseller's account balance or empty if not rated. Only available in system exports, not for resellers.
<line_terminator>	1	string	A fixed character. Always \n (special char LF - ASCII 0x0A).

A valid example of one body line of a rated CDR is (line breaks added for clarity):

```
'15','2013-03-26 22:09:11','a84508a8-d256-4c80-a84e-820099a827b0','1','','1','','
'2','testuser1','192.168.51.133','4311001','0','192.168.51.1',
'94d85b63-8f4b-43f0-b3b0-221c9e3373f2','1','','3','','4','testuser3',
'192.168.51.133','testuser3','192.168.51.133','testuser3','','','call','ok','200',
'2013-03-25 20:24:50.890','2013-03-25 20:24:51.460','10.880','44449842',
'ok','2013-03-25 20:25:27','0.00','24.00','onnet','testzone','platform internal',
'testzone','0','0','0.00','200.00','','foo','','foo','0','0',
'0.00','','','0','0.00','','','0'
```

The format of the CDR export files generated for resellers (as opposed to the complete system-wide export) is identical except for a few missing fields. Reseller CDR CSV files don't contain the fields for *carrier* or *reseller* ratings, neither in *source* nor *destination* direction. Thus, the reseller CSV files have 16 fewer fields.

File Body Format for Event Detail Records (EDR)

The body of a EDR consists of a minimum of zero and a maximum of 5000 lines. Each line holds one call detail record in CSV format and is constructed by the following fields, all of them enclosed in single quotes:

Table 10: EDR export file body line format

Body Element	Length	Type	Description
<event_id>	1-10	uint	Internal EDR id.

Table 10: (continued)

Body Element	Length	Type	Description
<event_type>	1-255	string	The type of the event - one of: start_profile: A subscriber profile has been newly assigned to a subscriber. end_profile: A subscriber profile has been removed from a subscriber. update_profile: A subscriber profile has been changed for a subscriber. start_huntgroup: A subscriber has been provisioned as group. end_huntgroup: A subscriber has been deprovisioned as group. start_ivr: A subscriber has a new call-forward to auto-attendant set. end_ivr: A subscriber has removed a call-forward to auto-attendant.
<customer_external_id>	0-255	string	The external customer ID as provisioned for the subscriber.
<contact_company>	0-255	string	The company name of the customer's contact.
<subscriber_external_id>	0-255	string	The external subscriber ID as provisioned for the subscriber.
<subscriber_number>	0-255	string	The voip number of the subscriber with the highest ID (DID or primary number).
<old_status>	0-255	string	The old status of the event. Depending on the event_type: start_profile: Empty. end_profile: The profile id of the profile which got removed from the subscriber. update_profile: The old profile id which got updated. start_huntgroup: Empty. end_huntgroup: The profile id of the group which got deprovisioned. start_ivr: Empty. end_ivr: Empty.

Table 10: (continued)

Body Element	Length	Type	Description
<new_status>	0-255	string	The new status of the event. Depending on the event_type: start_profile: The profile id which got assigned to the subscriber. end_profile: Empty. update_profile: The new profile id which got updated. start_huntgroup: The current profile id assigned to the group subscriber. end_huntgroup: The current profile id assigned to the group subscriber. start_ivr: Empty. end_ivr: Empty.
<timestamp>	0-255	string	The time when the event occurred.
<line_terminator>	1	string	A fixed character. Always \n (special char LF - ASCII 0x0A).

A valid example of one body line of an EDR is (line breaks added for clarity):

```
"1", "start_profile", "sipwise_ext_customer_id_4", "Sipwise GmbH",
"sipwise_ext_subscriber_id_44", "436667778", "", "1", "2014-06-19 11:34:31"
```

File Trailer Format

The billing file trailer is one single line, which is constructed by the following fields:

```
<md5 sum>
```

The <md5 sum> is a 32 character hexadecimal MD5 hash of the *Header* and *Body*.

To validate the billing file, one must remove the Trailer before computing the MD5 sum of the file. An example bash script to validate the integrity of the file is given below:

```
#!/bin/sh

error() { echo $@; exit 1; }
test -n "$1" || error "Usage: $0 <cdr-file>"
test -f "$1" || error "File '$1' not found"
```

```
TMPFILE="/tmp/${basename "$1"}.${$.}"
```

```
MD5="$(sed -rn '$ s/^[a-z0-9]{32}).*/\1/i p' "$1")  $TMPFILE"
sed '$d' "$1" > "$TMPFILE"
echo "$MD5" | md5sum -c -
rm -f "$TMPFILE"
```

Given the script is located in `cdr-md5.sh` and the CDR-file is `sipwise_001_20071110123000_0000000004.cdr`, the output of the integrity check for an intact CDR file would be:

```
$ ./cdr-md5.sh sipwise_001_20071110123000_0000000004.cdr
/tmp/sipwise_001_20071110123000_0000000004.cdr: OK
```

If the file has been altered during transmission, the output of the integrity check would be:

```
$ ./cdr-md5.sh sipwise_001_20071110123000_0000000004.cdr
/tmp/sipwise_001_20071110123000_0000000004.cdr: FAILED
md5sum: WARNING: 1 of 1 computed checksum did NOT match
```

7.2.3 File Transfer

Billing files are created twice per hour at minutes 25 and 55 and are stored in the home directory of the `cdrexport` user. If the amount of records within the transmission interval exceeds the threshold of 5000 records per file, multiple billing files are created. If no billing records are found for an interval, a billing file without body data is constructed for easy detection of lost billing files on the 3rd party side.

CDR and EDR files are fetched by a 3rd party billing system using SFTP or SCP with either public key or password authentication using the username `cdrexport`.

If public key authentication is chosen, the public key file has to be stored in the file `~/.ssh/authorized_keys2` below the home directory of the `cdrexport` user. Otherwise, a password has to be set for the user.

The 3rd party billing system is responsible for deleting CDR files after fetching them.

Note

The `cdrexport` user is kept in a jailed environment on the system, so it has only access to a very limited set of commandline utilities.

8 Invoices and invoice templates

IMPORTANT: Invoice generation is deprecated since mr4.0+. Current invoice generation will damage billing records.

The sip:carrier allows to generate and send customer invoices for each billing period based on Calls Detailed Records (CDR). Generated invoices can be sent to customers emails using [invoice generation script](#) Section 8.3.

Invoices present billing information from the reseller point of view. Recipients of the invoices are customers. Invoices include information related to the calls made by subscribers associated with the customer.

By default invoice contains information about billing plan fixed fee, calls zones fees and calls detailed information.

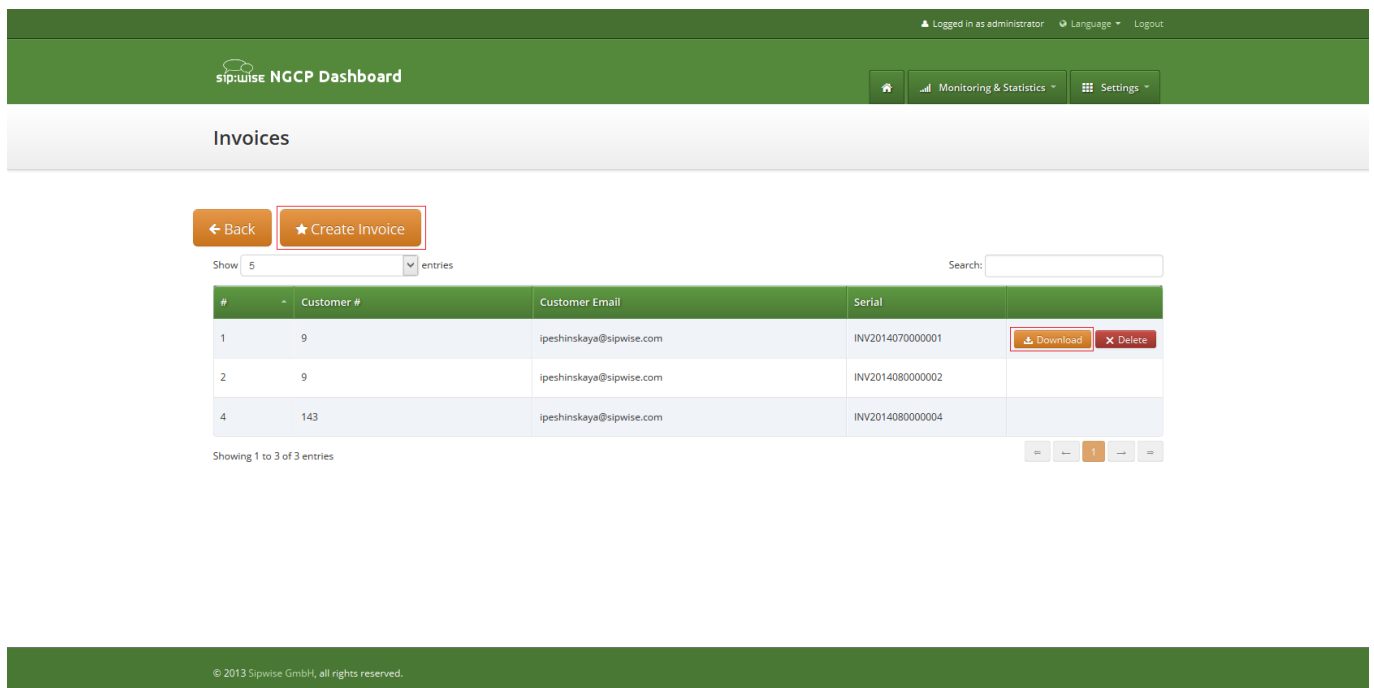
Content and vision of the invoices are customizable by [invoice templates](#) Section 8.2.

Note

The sip:carrier generates invoices in pdf format.

8.1 Invoices management

Invoices can be requested for generation, searched, downloaded and deleted in the invoices interface.



Logged in as administrator | Language | Logout

sip:wise NGCP Dashboard | Monitoring & Statistics | Settings

Invoices

← Back | ★ Create Invoice

Show 5 entries | Search:

#	Customer #	Customer Email	Serial	
1	9	ipeshinskaya@sipwise.com	INV2014070000001	Download Delete
2	9	ipeshinskaya@sipwise.com	INV2014080000002	
4	143	ipeshinskaya@sipwise.com	INV2014080000004	

Showing 1 to 3 of 3 entries

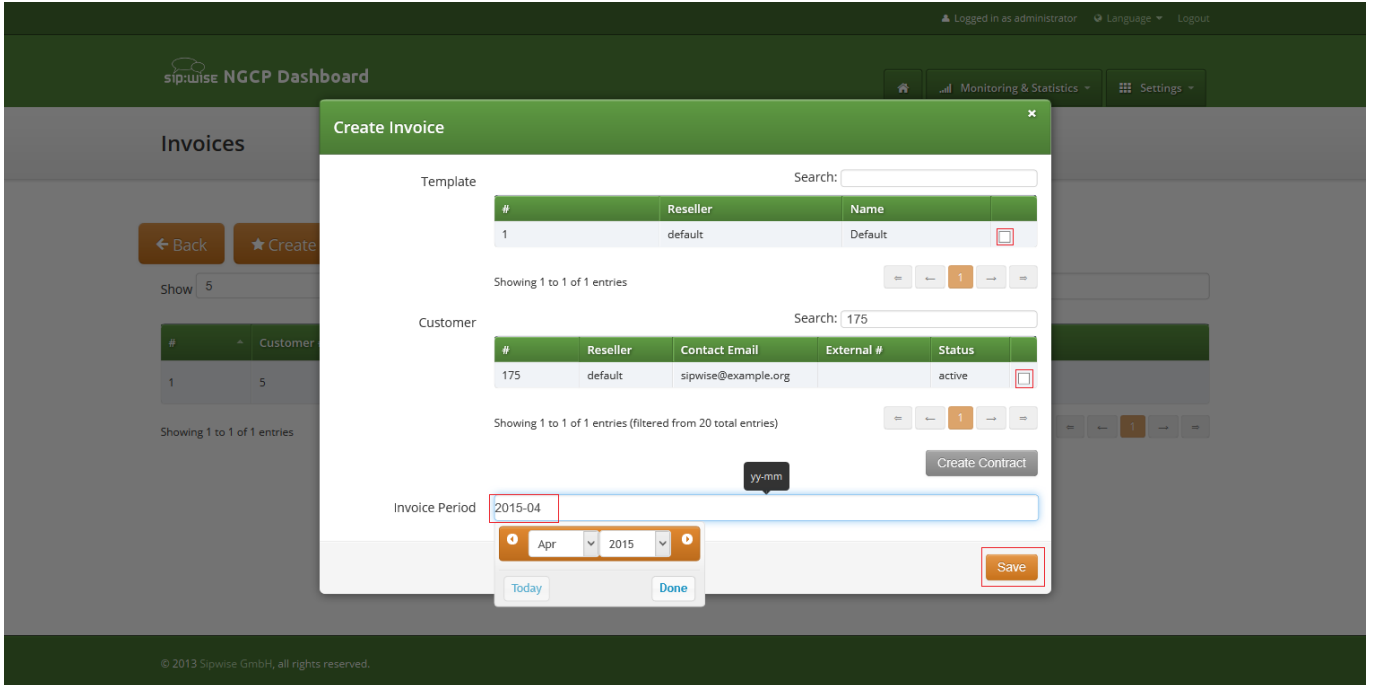
© 2013 Sipwise GmbH, all rights reserved.

To request invoice generation for the particular customer and period press "Create invoice" button. On the invoice creation form following parameters are available for selection:

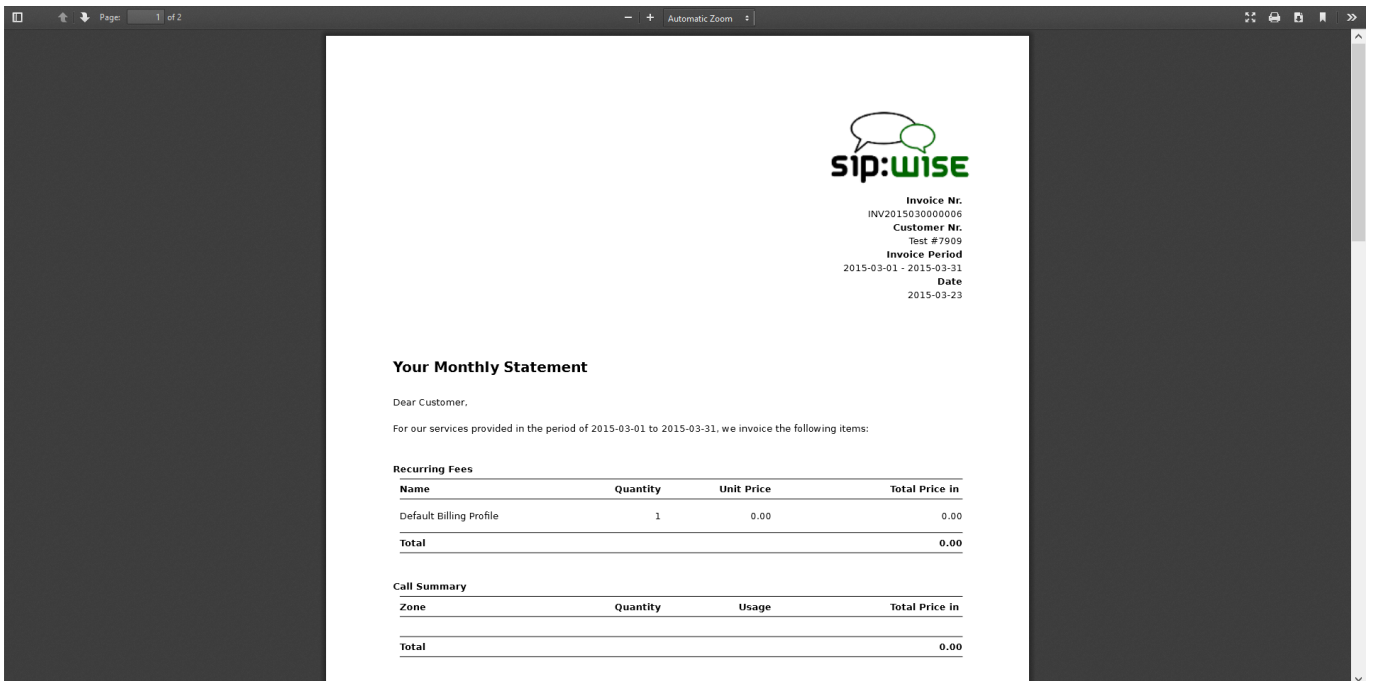
- **Template:** any of existent invoice template can be selected for the invoice generation.
- **Customer:** owner of the billing account, recipient of the invoice.

- **Invoice period:** billing period. Can be specified only as one calendar month. Calls with start time between first and last second of the period will be considered for the invoice

All form fields are mandatory.



Generated invoice can be downloaded as pdf file.



To do it press button "Download" against invoice in the invoice management interface.

Respectively press on the button "Delete" to delete invoice.

8.2 Invoice templates

Invoice template defines structure and look of the generated invoices. The sip:carrier makes it possible to create some invoice templates. Multiple invoice templates can be used to send invoices to the different customers using different languages.



Important

At least one invoice template should be created to enable invoice generation. Each customer has to be associated to one of the existent invoice template, otherwise invoices will be not generated for this customer.

Customer can be linked to the invoice template in the customer interface.

8.2.1 Invoice Templates management

Invoice templates can be searched, created, edited and deleted in the invoice templates management interface.

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Invoice template creation is separated on two steps:

- Register new invoice template meta information.
- Edit content (template itself) of the invoice template.

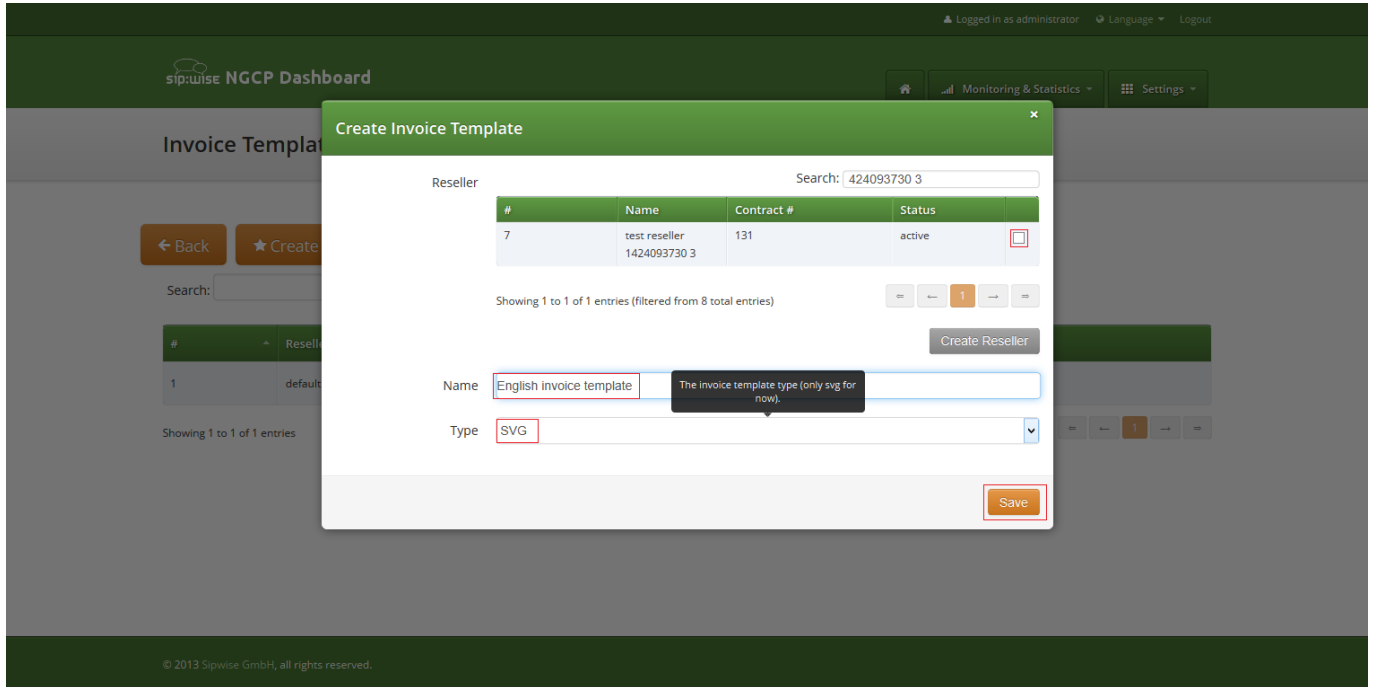
To register new invoice template press "Create Invoice Template" button.

On the invoice template meta information form following parameters can be specified:

- **Reseller:** reseller who owns this invoice template. Please note, that it doesn't mean that the template will be used for the reseller customers by default. After creation, invoice template still need to be linked to the reseller customers.

- **Name:** unique invoice template name to differentiate invoice templates if there are some.
- **Type:** currently sip:carrier supports only svg format of the invoice templates.

All form fields are mandatory.



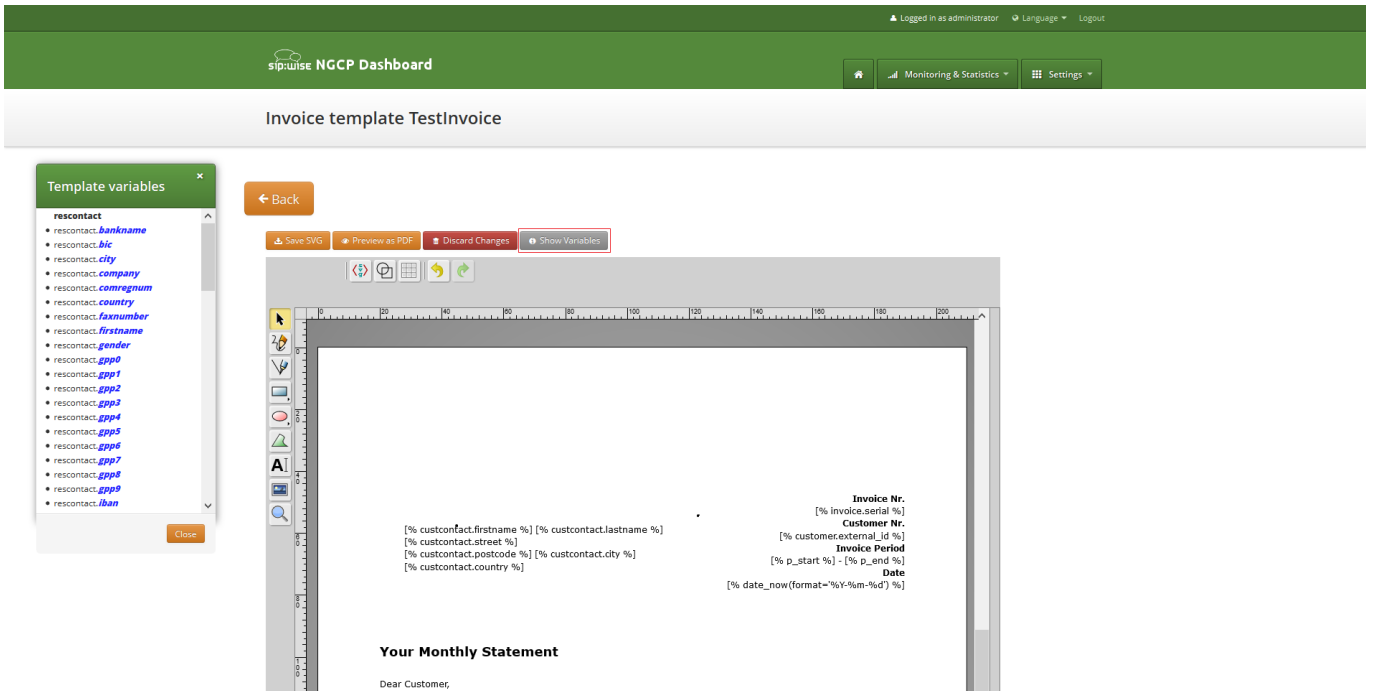
After registering new invoice template you can change invoice template structure in WYSIWYG SVG editor and preview result of the invoice generation based on the template.

8.2.2 Invoice Template content

Invoice template is a XML SVG source, which describes content, look and position of the text lines, images or other invoice template elements. The sip:carrier provides embedded WYSIWYG SVG editor svg-edit 2.6 to customize default template. The sip:carrier svg-edit has some changes in layers management, image edit, user interface, but this [basic introduction](#) still may be useful.

Template refers to the owner reseller contact ("rescontact"), customer contract ("customer"), customer contact ("custcontact"), billing profile ("billprof"), invoice ("invoice") data as variables in the "[%%]" mark-up with detailed information accessed as field name after point e.g. [%invoice.serial%]. During invoice generation all variables or other special tokens in the "[% %]" mark-ups will be replaced by their database values.

Press on "Show variables" button on invoice template content page to see full list of variables with the fields:



You can add/change/remove embedded variables references directly in main svg-edit window. To edit text line in svg-edit main window double click on the text and place cursor on desired position in the text.

After implementation of the desired template changes, invoice template should be [saved](#) Section 8.2.3.

To return to the sip:carrier invoice template **default** content you can press on the "Discard changes" button.



Important

"Discard changes" operation can't be undone.

Layers

Default template contains three groups elements (<g/>), which can be thinked of as pages, or in terms of svg-edit - layers. Layers are:

- **Background:** special layer, which will be repeated as background for every other page of the invoice.
- **Summary:** page with a invoice summary.
- **CallList:** page with calls made in a invoice period. Is invisible by default.

To see all invoice template layers, press on "Layers" vertical sign on right side of the svg-edit interface:

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Save SVG Preview as PDF Discard Changes Show Variables

Invoice Nr. [% invoice.serial %]
Customer Nr. [% customer.external_id %]
Invoice Period [% p_start %] - [% p_end %]
Date [% date_now(format="%Y-%m-%d") %]

[% custcontact.firstname %] [% custcontact.lastname %]
[% custcontact.street %]
[% custcontact.postcode %] [% custcontact.city %]
[% custcontact.country %]

Your Monthly Statement

Dear Customer,

For our services provided in the period of [% p_start %] to [% p_end %], we invoice the following items:

Recurring Fees

Name	Quantity	Unit Price	Total Price in [% cur %]
[% billprof.name %]	1	[% fixfee %]	[% fixfee %]
Total			[% fixfee %]

Call Summary

Zone	Quantity	Usage	Total Price in [% cur %]
			[% zonefee %]

Summary in [% cur %]

Total Summary	[% netfee %]
VAT [% customer.vat_rate %]%	[% vatfee %]
Amount Due	[% allfee %]

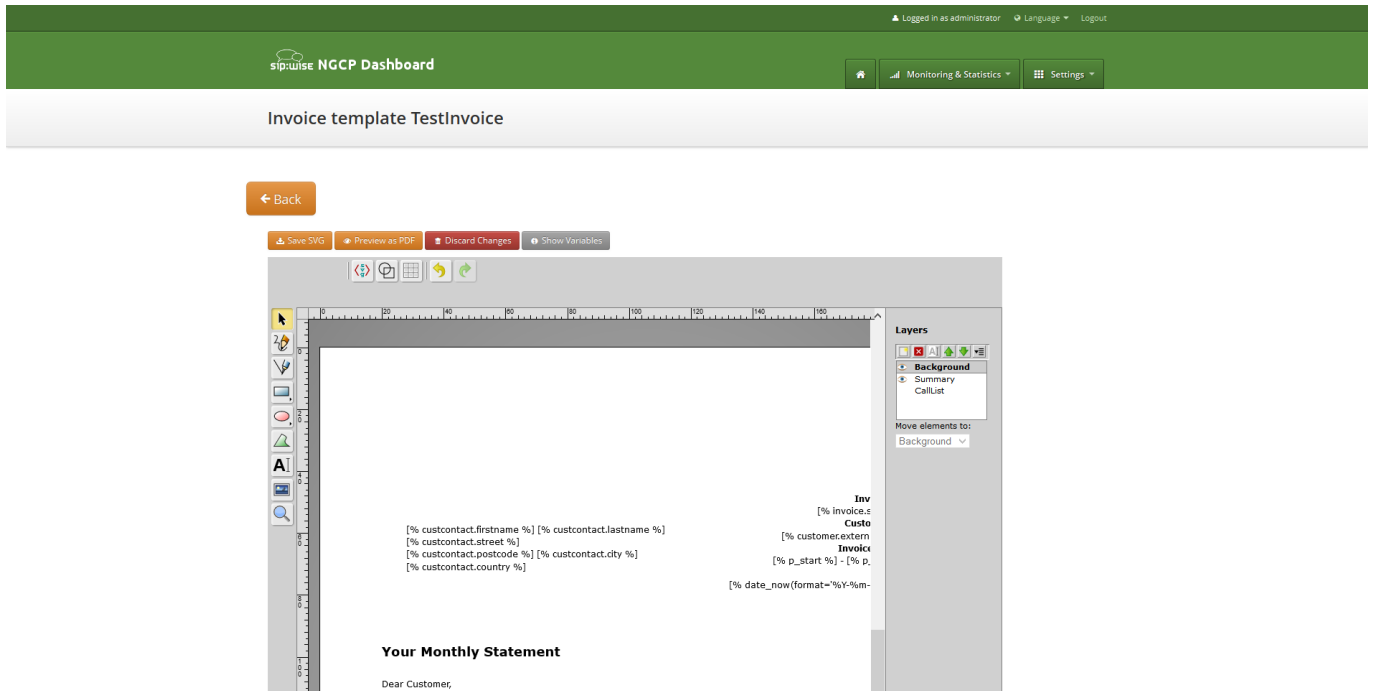
The amount is automatically charged via SEPA within 30 days using Mandate ID MID12345 and Creditor ID CID12345 from your account with IBAN [% rescontact.iban %] and BIC [% rescontact.bic %].

With best regards,
Your [% rescontact.company %] Service Team

[% rescontact.company %] Company Reg.Nr.: [% rescontact.comregnum %]
[% rescontact.street %] VAT.Nr.: [% rescontact.vatnum %]
[% rescontact.postcode %] [% custcontact.city %] IBAN: [% rescontact.iban %]
[% rescontact.country %] Page [% aux.page %] BIC: [% rescontact.bic %]

Layers

Side panel with layers list will be shown.



One of the layers is active, and its element can be edited in the main svg-edit window. Currently active layer's name is **bold** in the layers list. The layers may be visible or invisible. Visible layers have "eye" icon left of their names in the layers list.

To make a layer active, click on its name in the layers list. If the layer was invisible, its elements became visible on activation. Thus you can see mixed elements of some layers, then you can switch off visibility of other layers by click on their "eye" icons. It is good idea to keep visibility of the "Background" layer on, so look of the generated page will be seen.

Edit SVG XML source

Sometimes it may be convenient to edit svg source directly and svg-edit makes it possible to do it. After press on the <svg> icon in the top left corner of the svg-edit interface:

Logged in as administrator | Language | Logout

sip:wise NGCP Dashboard

Monitoring & Statistics | Settings

Invoice template Rechnung_v1

← Back

Save SVG | Preview as PDF | Discard Changes | Show Variables

Invoice Nr. [% invoice.serial %]
 Customer Nr. [% customer.external_id %]
 Invoice Period [% p_start %] - [% p_end %]
 Date [% date_now(format="%Y-%m-%d") %]

[% custcontact.firstname %] [% custcontact.lastname %]
 [% custcontact.street %]
 [% custcontact.postcode %] [% custcontact.city %]
 [% custcontact.country %]

Your Monthly Statement

Dear Customer,

SVG XML source of the invoice template will be shown.

SVG source can be edited in place or just copy-pasted as usual text.

Note

Template keeps sizes and distances in pixels.



Important

When edit svg xml source, please change very carefully and thoughtfully things inside special comment mark-up "`<!--{ }-->`". Otherwise invoice generation may be broken. Please be sure that document structure repeats default invoice template: has the same groups (`<g/>`) elements on the top level, text inside special comments mark-up "`<!--{ }-->`" preserved or changed appropriately, svg xml structure is correct.

To save your changes in the svg xml source, first press "OK" button on the top left corner of the source page:

Invoice template Default

← Back

2 Save SVG Preview as PDF Discard Changes Show Variables

1 OK Cancel

```

<!--{
  [%
    pagewidth = 210;
    pageheight = 297;
    server_process_units = 'none';
    money_signs = 3;
    PROCESS "invoice/default/invoice_template_aux.tt";
    money_format(amount=(billprof.interval_charge * 100), comma='.'); fixfee = aux.val;
    money_format(amount=(zones.totalcost), comma='.'); zonefee = aux.val;
    money_format(amount=(invoice.amount_net * 100), comma='.'); netfee = aux.val;
    money_format(amount=(invoice.amount_vat * 100), comma='.'); vatfee = aux.val;
    money_format(amount=(invoice.amount_total * 100), comma='.'); allfee = aux.val;
    aux = billprof.currency;
    p_start = date_format(thedate=invoice.period_start, format='%Y-%m-%d');
    p_end = date_format(thedate=invoice.period_end, format='%Y-%m-%d');
  -%]
-->
<svg xmlns="http://www.w3.org/2000/svg" xmlns:xlink="http://www.w3.org/1999/xlink" width="210mm" height="297mm" viewBox="0 0 595 842" server-process-units="none">
<!--[ [% MACRO draw_background BLOCK %] ]-->
<g display="inline" font-size="8" font-family="Verdana" class="page">
<title>Background</title>

```

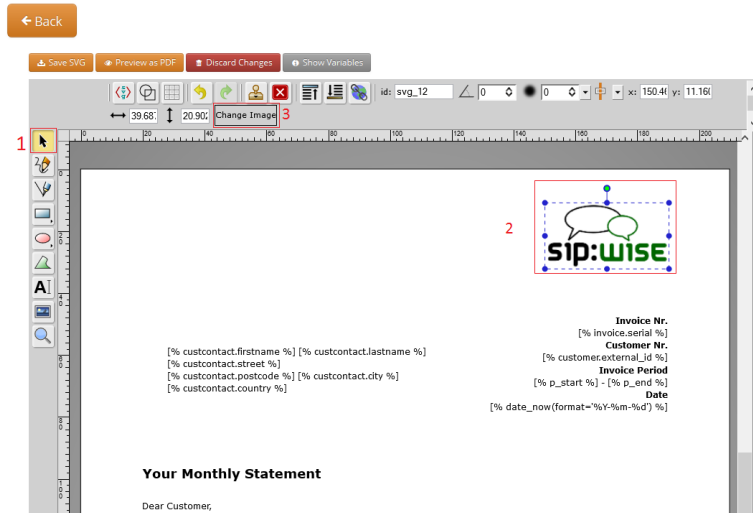
And then [save invoice template changes](#) Section 8.2.3.

Note

You can copy and keep the svg source of your template as a file on the disk before start experimenting with the template. Later you will be able to return to this version replacing svg source.

Change logo image

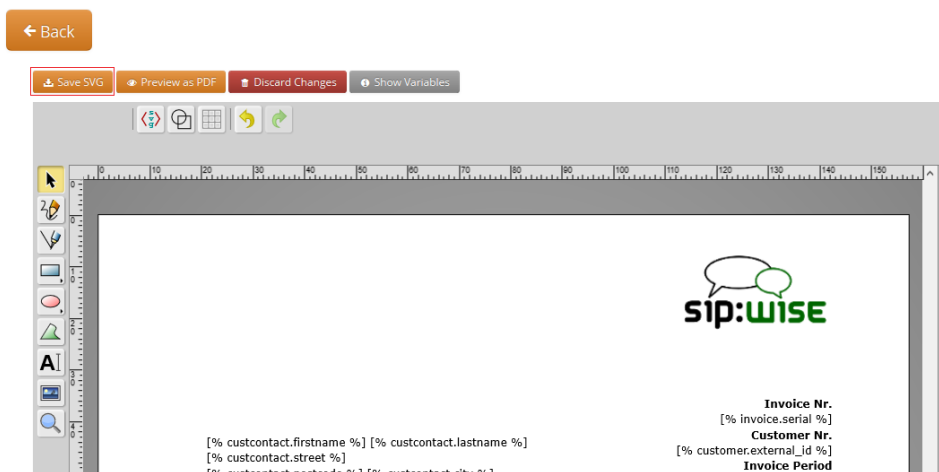
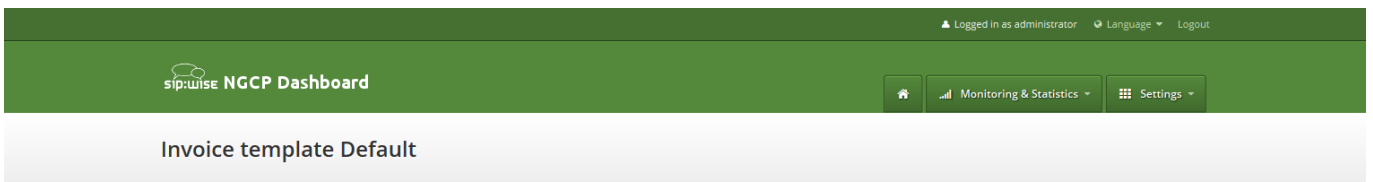
- Make sure that "Select tool" is active.
- Select default logo, clicking on the logo image.
- Press "Change image" button, which should appear on the top toolbar.



After image uploaded [save invoice template changes](#) Section 8.2.3.

8.2.3 Save and preview invoice template content.

To save invoice template content changes press button "Save SVG".



You will see message about successfully saved template. You can preview your invoice look in PDF format. Press on "Preview as PDF" button.

Logged in as administrator Language Logout

sip:wise NGCP Dashboard Monitoring & Statistics Settings

Invoice template Default

[← Back](#)

Invoice template successfully saved



Invoice preview will be opened in the new window.

Note

Example fake data will be used for preview generation.

The screenshot shows a web browser window displaying a preview of an invoice. The invoice includes the sip:wise logo, customer information, and a table of recurring fees.

Customer Information:
 Customerfirst Customerlast
 Customerstreet 12/3
 12345 Customercity
 Customercountry

Invoice Details:
Invoice Nr. 1234567
Customer Nr. Resext1234567890
Invoice Period 2015-04-01 - 2015-04-30
Date 2015-04-05

Your Monthly Statement

Dear Customer,

For our services provided in the period of 2015-04-01 to 2015-04-30, we invoice the following items:

Recurring Fees			
Name	Quantity	Unit Price	Total Price in EUR
Test Billing Profile	1	29.90	29.90
Total			29.90

8.3 Invoices generation

Except invoices generation on demand using web interface, invoices can be generated automatically for all customers using cron and invoice generator script.

Also invoice generation script is responsible for the sending generated invoices to the customers.

Script is located at: `/usr/share/ngcp-panel/tools/generate_invoices.pl`

In short:

- To generate and immediately send invoices for the previous month:

```
perl /usr/share/ngcp-panel/tools/generate_invoices.pl --send --prevmonth
```

- To generate invoices for the previous month without sending:

```
perl /usr/share/ngcp-panel/tools/generate_invoices.pl --prevmonth
```

- To send already generated invoices for the previous month:

```
perl /usr/share/ngcp-panel/tools/generate_invoices.pl --sendonly --prevmonth
```

- Regenerate invoices for the specified period:

```
perl /usr/share/ngcp-panel/tools/generate_invoices.pl --stime="2015-01-01 ↔
    00:00:00" --etime="2015-01-31 00:00:00" --regenerate
```

Some not obvious options:

- **--allow_terminated** Generates invoices for the terminated contracts too.
- **--force_unrated** Generate invoices despite unrated calls existence in the specified generation period.
- **--no_empty** Skip invoices for the contracts without calls in the specified period and with null permanent fee for the billing profile.

To see all possible script options use `--help` or `--man`:

```
/usr/share/ngcp-panel/tools/generate_invoices.pl --man
```

Script will be run periodically as configured by the cron files. Cron files templates can be found at:

- `/etc/ngcp-config/templates/etc/cron.d/ngcp-invoice-gen.tt2`
- `/etc/ngcp-config/templates/etc/cron.d/ngcp-invoice-gen.services`

After applying your configuration cron file will be located at:

- `/etc/cron.d/ngcp-invoice-gen`

Script uses configuration file located at: `/etc/ngcp-invoice-gen/invoice-gen.conf`

Except common DB connection configuration following specific options can be defined in the config file:

- **RESELLER_ID** *1,2,3,... N*

Comma separated resellers id. Invoice generation will be performed only for the specified resellers.

- **CLIENT_CONTRACT_ID** *1,2,3,... N*

Comma separated customers id. Invoice generation will be performed only for the specified customers.

- **STIME** *YYYY-mm-DD HH:MM:SS*

Usually is not necessary. Script option `--prevmonth` will define correct start and end time for the previous month billing period. Generated invoices will include all calls with call start time more then STIME value and less the ETIME value.

- **ETIME** *YYYY-mm-DD HH:MM:SS*

Usually is not necessary. Script option `--prevmonth` will define correct start and end time for the previous month billing period. Generated invoices will include all calls with call start time more then STIME value and less the ETIME value.

- **SEND** *[0/1]*

Generated invoices will be immediately sent to the customers.

- **RESEND** *[0/1]*

Invoices, already sent to the customers, will be sent again.

- **REGENERATE** *[0/1]*

Already presented invoices files will be generated again. Otherwise they will stay intouched.

- **ALLOW_TERMINATED** *[0/1]*

Generate invoices for the already terminated customers too.

- **ADMIN_EMAIL** *your@email.com*

Purposed for notifications about invoices generation fails. Not in use now.

All generated invoices can be seen in the [invoice management interface](#) Section 8.1.

On request each invoice will be sent to the proper customer as e-mail with the invoice PDF in the attachment. Letter content is defined by the invoice email template.

9 Email templates

9.1 Email events

The sip:carrier makes it possible to customize content of the emails sent on the following actions:

- Web password reset requested. Email will be sent to the subscriber, whom password was requested for resetting. If the subscriber doesn't have own email, letter will be sent to the customer, who owns the subscriber.
- New subscriber created. Email will be sent to the newly created subscriber or to the customer, who owns new subscriber.
- Letter with the invoice. Letter will be sent to the customer.

9.2 Initial template values and template variables

Default email templates for each of the email events are inserted on the initial sip:carrier database creation. Content of the default template is described in the corresponding sections. Default email templates aren't linked to any reseller and can't be changed through sip:carrier Panel. They will be used to initialize default templates for the newly created reseller.

Each email template refers to the values from the database using special mark-ups "[%" and "%]". Each email template has fixed set of the variables. Variables can't be added or changed without changes in the sip:carrier Panel code.

9.3 Password reset email template

Email will be sent after subscriber or subscriber administrator requested password reset for the subscriber account. Letter will be sent to the subscriber. If subscriber doesn't have own email, letter will be sent to the customer owning the subscriber.

Default content of the password reset email template is:

Template name	passreset_default_email
From	default@sipwise.com
Subject	Password reset email
Body	<p>Dear Customer,</p> <p>Please go to [%url%] to set your password and log into your self-care ↔ interface.</p> <p>Your faithful Sipwise system</p> <p>--</p> <p>This is an automatically generated message. Do not reply.</p>

Following variables will be provided to the email template:

- [%url%]: specially generated url where subscriber can define his new password.
- [%subscriber%]: `username@domain` of the subscriber, which password was requested for reset.

9.4 New subscriber notification email template

Email will be sent on the new subscriber creation. Letter will be sent to the newly created subscriber if it has an email. Otherwise, letter will be sent to the customer who owns the subscriber.

Note

By default email content template is addressed to the customer. Please consider this when create the subscriber with an email.

Template name	<code>subscriber_default_email</code>
From	<code>default@sipwise.com</code>
Subject	Subscriber created
Body	<pre>Dear Customer, A new subscriber [%subscriber%] has been created for you. Your faithful Sipwise system -- This is an automatically generated message. Do not reply.</pre>

Following variables will be provided to the email template:

- [%url%]: specially generated url where subscriber can define his new password.
- [%subscriber%]: `username@domain` of the subscriber, which password was requested for reset.

9.5 Invoice email template

Template name	<code>invoice_default_email</code>
From	<code>default@sipwise.com</code>
Subject	Invoice #[%invoice.serial%] from [%invoice.period_start_obj.ymd%] to [%invoice.period_end_obj.ymd%]

Body	<p>Dear Customer,</p> <p>Please find your invoice #[%invoice.serial%] for [%invoice. ← period_start_obj.month_name%], [%invoice.period_start_obj.year%] in attachment letter.</p> <p>Your faithful Sipwise system</p> <p>--</p> <p>This is an automatically generated message. Do not reply.</p>
-------------	--

Variables passed to the email template:

- [%**invoice**%]: container variable for the invoice information.

Invoice fields

- [%invoice.**serial**%]
- [%invoice.**amount_net**%]
- [%invoice.**amount_vat**%]
- [%invoice.**amount_total**%]
- [%invoice.**period_start_obj**%]
- [%invoice.**period_end_obj**%]

The fields [%invoice.period_start_obj%] and [%invoice.period_end_obj%] provide methods of the perl package DateTime for the invoice start date and end date. Further information about DateTime can be obtained from the package documentation:
man DateTime

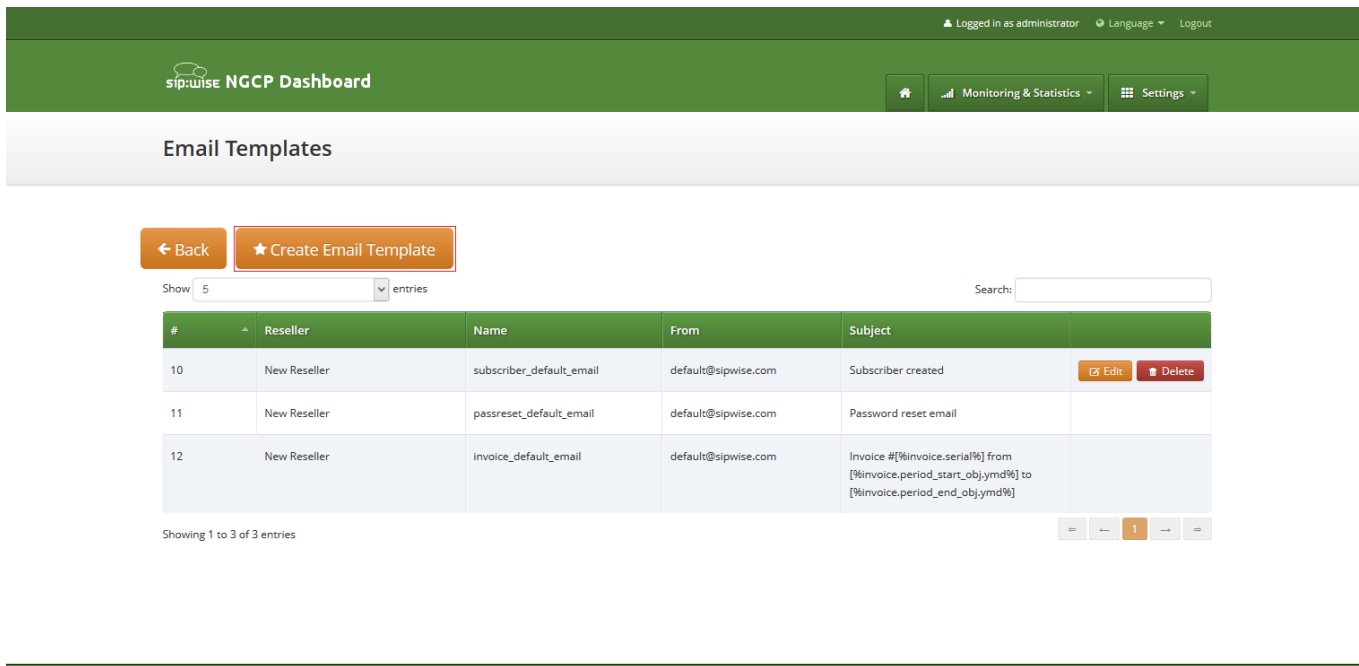
- [%**provider**%]: container variable for the reseller contact. All database contact values will be available.
- [%**client**%]: container variable for the customer contact.

Contact fields example for the "provider". Replace "provider" to client to access proper "customer" contact fields.

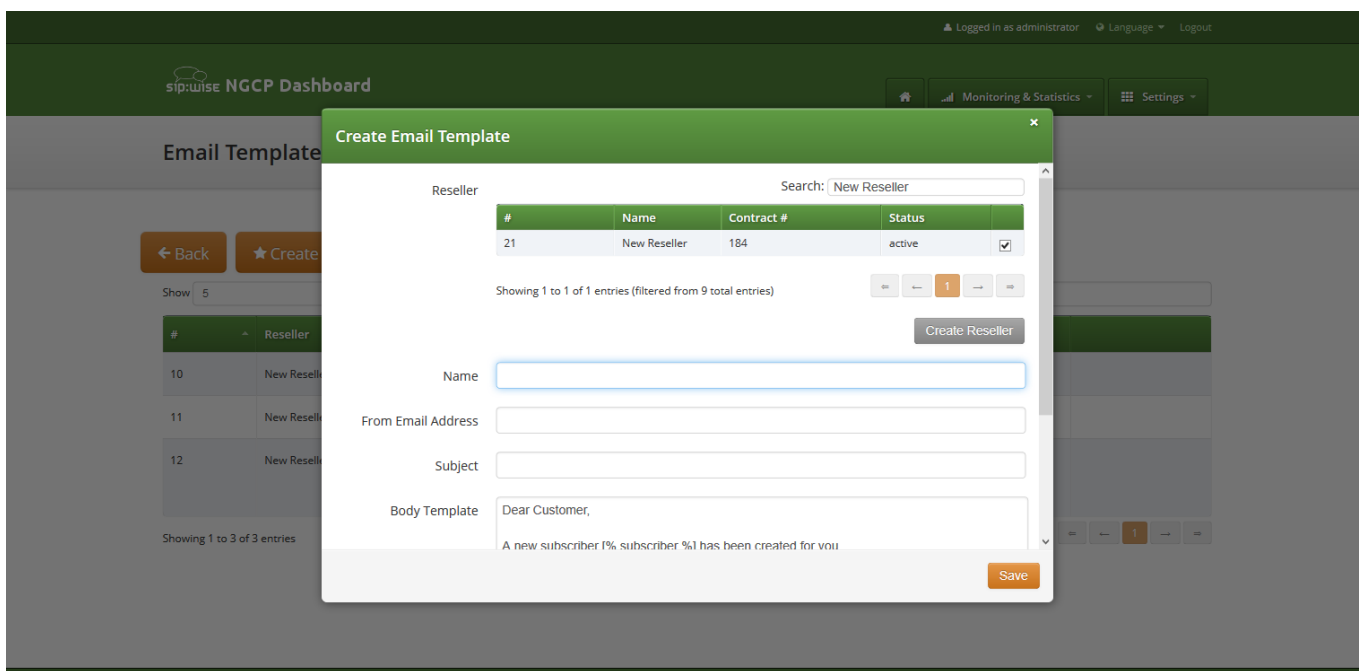
- [%provider.gender%]
- [%provider.firstname%]
- [%provider.lastname%]
- [%provider.comregnum%]
- [%provider.company%]
- [%provider.street%]
- [%provider.postcode%]
- [%provider.city%]
- [%provider.country%]
- [%provider.phonenumber%]
- [%provider.mobilenumber%]
- [%provider.email%]
- [%provider.newsletter%]
- [%provider.faxnumber%]
- [%provider.iban%]
- [%provider.bic%]
- [%provider.vatnum%]
- [%provider.bankname%]
- [%provider.gpp0 - provider.gpp9%]

9.6 Email templates management

Email templates linked to the resellers can be customized in the email templates management interface. For the administrative account email templates of all the resellers will be shown. Respectively for the reseller account only owned email templates will be shown.



To create create new email template press button "Create Email Template".



On the email template form all fields are mandatory:

- **Reseller:** reseller who owns this email template.
- **Name:** currently only email template with the following names will be considered by the sip:carrier on the [appropriate event](#) Section 9.1 :
 - passreset_default_email;
 - subscriber_default_email;

- invoice_default_email;
- **From Email Address:** email address which will be used in the From field in the letter sent by the sip:carrier.
- **Subject:** Template of the email subject. Subject will be processed with the same template variables as the email body.
- **Body:** Email text template. Will be processed with appropriate template variables.

10 Local Number Porting

The sip:carrier comes with two ways of accomplishing local number porting (LNP). One is populating the integrated LNP database with porting data, and the other is accessing external LNP databases via the Sipwise LNP daemon using the LNP API (PRO/CARRIER only).

10.1 Local LNP Database

The local LNP database provides the possibility to define LNP Carriers (the owners of certain ported numbers or number blocks) and their corresponding LNP Numbers belonging to those carriers. It can be configured on the admin panel in *Settings*→*Number Porting* or via the API. The LNP configuration can be populated individually or via CSV import/export both on the panel and the API.

10.1.1 LNP Carriers

LNP Carriers are defined by an arbitrary *Name* for proper identification (e.g. *British Telecom*) and contain a *Prefix* which can be used as routing prefix in LNP Rewrite Rules and subsequently in Peering Rules to route calls to the proper carriers. The LNP prefix is written to CDRs to identify the selected carrier for post processing and analytics purposes of CDRs. LNP Carrier entries also have an *Authoritative* flag indicating that the numbers in this block belong to the carrier operating the sip:carrier. This is useful to define your own number blocks, and in case of calls to those numbers reject the calls if the numbers are not assigned to local subscribers (otherwise they would be routed to a peer, which might cause call loops). Finally the *Skip Rewrite* flag skips executing of LNP Rewrite Rules if no number manipulation is desired for an LNP carrier.

10.1.2 LNP Numbers

LNP Carriers contain one or more LNP Numbers. Those LNP Numbers are defined by a *Number* entry in E164 format (*<cc><ac><sn>*) used to match a number against the LNP database. Number matching is performed on a longest match, so you can define number blocks without specifying the full subscriber number (e.g. a called party number *431999123* is going to match an entry *431999* in the LNP Numbers).

For an LNP Numbers entry, an optional *Routing Number* can be defined. This is useful to translate e.g. premium 900 or toll-free 800 numbers to actual routing numbers. If a Routing Number is defined, the called party number is implicitly replaced by the Routing Number and the call processing is continued with the latter.

An optional *Start Date* and *End Date* allows to schedule porting work-flows up-front by populating the LNP database with certain dates, and the entries are only going to become active with those dates. Empty values for start indicate a start date in the past, while empty values for end indicate an end time in the future during processing of a call, allowing to define infinite date ranges. As intervals can overlap, the LNP number record with a start time closest to the current time is selected.

10.1.3 Enabling local LNP support

In order to activate Local LNP during routing, the feature must be activated in *config.yml*. Set *kamailio→proxy→lnp→enabled* to *yes* and *kamailio→proxy→lnp→type* to *local*.

10.1.4 LNP Routing Procedure

Calls to non-authoritative Carriers

When a call arrives at the system, the calling and called party numbers are first normalized using the *Inbound Rewrite Rules for Caller* and *Inbound Rewrite Rules for Callee* within the rewrite rule set assigned to the calling party (a local subscriber or a peer).

If the called party number is not assigned to a local subscriber, or if the called party is a local subscriber and has the subscriber/-domain preference *lnp_for_local_sub* set, the LNP lookup logic is engaged, otherwise the call proceeds without LNP lookup. The further steps assume that LNP is engaged.

If the call originated from a peer, and the peer preference *caller_lnp_lookup* is set for this peer, then an LNP lookup is performed using the normalized calling party number. The purpose for that is solely to find the LNP prefix of the calling peer, which is then stored as *source_lnp_prefix* in the CDR. If the LNP lookup does not return a result (e.g. the calling party number is not populated in the local LNP database), but the peer preference *default_lnp_prefix* is set for the originating peer, then the value of this preference is stored in *source_lnp_prefix* of the CDR.

Next, an LNP lookup is performed using the normalized called party number. If no number is found (using a longest match), no further manipulation is performed.

If an LNP number entry is found, and the *Routing Number* is set, the called party number is replaced by the routing number. Also, if the *Authoritative* flag is set in the corresponding LNP Carrier, and the called party number is not assigned to a local subscriber, the call is rejected. This ensures that numbers allocated to the system but not assigned to subscribers are dropped instead of routed to a peer.

Important



If the system is serving a local subscriber with only the routing number assigned (but not e.g. the premium number mapping to this routing number), the subscriber will not be found and the call will either be rejected if the called party premium number is within an authoritative carrier, or the call will be routed to a peer. This is due to the fact that the subscriber lookup is performed with the dialled number, but not the routing number fetched during LNP. So make sure to assign e.g. the premium number to the local subscriber (optionally in addition to the routing number if necessary using alias numbers) and do not use the LNP routing number mechanism for number mapping to local subscribers.

Next, if the the LNP carrier does not have the *Skip Rewriting* option set, the *LNP Rewrite Rules for Callee* are engaged. The rewrite rule set used is the one assigned to the originating peer or subscriber/domain via the *rewrite_rule_set* preference. The variables available in the match and replace part are, beside the standard variables for rewrite rules:

- `${callee_lnp_prefix}`: The prefix stored in the LNP Carrier
- `${callee_lnp_basenum}`: The actual number entry causing the match (may be shorter than the called party number due to longest match)

Typically, you would create a rewrite rule to prefix the called party number with the *callee_lnp_prefix* by matching `^([0-9]+)$` and replacing it by `${callee_lnp_prefix}\1`.

Once the LNP processing is completed, the system checks for further preferences to finalize the number manipulation. If the originating local subscriber or peer has the preference *lnp_add_npdi* set, the Request URI user-part is suffixed with `;npdi`. Next, if the preference *lnp_to_rn* is set, the Request URI user-part is suffixed with `;rn=LNP_ROUTING_NUMBER`, where *LNP_ROUTING_NUMBER* is the *Routing Number* stored for the number entry in the LNP database, and the originally called number is kept in place. For example, if *lnp_to_rn* is set and the number *1800123* is called, and this number has a routing number *1555123* in the LNP database, the resulting Request-URI is `sip:1800123;rn=1555123@example.org`.

Finally, the *destination_lnp_prefix* in the CDR table is populated either by the prefix defined in the Carrier of the LNP database if a match was found, or by the *default_lnp_prefix* preference of the destination peer or subscriber/domain.

10.1.5 Transit Calls using LNP

If a call originated from a peer and the peer preference *force_outbound_calls_to_peer* is set to *force_nonlocal_lnp* (the *if callee is not local and is ported* selection in the panel), the call is routed back to a peer selected via the peering rules.

This ensures that if a number once belonged to your system and is ported out, but other carriers are still sending calls to you (e.g. selecting you as an anchor network), the affected calls can be routed to the carrier the number got ported to.

10.1.6 CSV Format

The LNP database can be exported to CSV, and in the same format imported back to the system. On import, you can decide whether to drop existing data prior to applying the data from the CSV.

The CSV file format contains the fields in the following order:

carrier_name carrier_prefix number routing_number start end authoritative skip_rewrite

Table 11: LNP CSV Format

Name	Description
Carrier Name	The <i>Name</i> in the LNP Carriers table (string, e.g. <i>My Carrier</i>)
Carrier Prefix	The <i>Prefix</i> in the LNP Carriers table (string, e.g. <i>DD55</i>)
Number	The <i>Number</i> in the LNP Numbers table (E164 number, e.g. <i>1800666</i>)
Routing Number	The <i>Routing Number</i> in the LNP Numbers table (E164 number or empty, e.g. <i>1555666</i>)
Start	The <i>Start</i> in the LNP Numbers table (YYYY-MM-DD or empty, e.g. <i>2016-01-01</i>)
End	The <i>End</i> in the LNP Numbers table (YYYY-MM-DD or empty, e.g. <i>2016-12-30</i>)
Authoritative	The <i>Authoritative</i> flag in the LNP Carriers table (0 or 1)

Table 11: (continued)

Skip Rewrite	The <i>Skip Rewrite</i> flag in the LNP Carriers table (0 or 1)
--------------	---

10.2 External LNP via LNP API

External LNP relies on the *Sipwise LNP Daemon (lnpd)* which kamailio-proxy is talking to via a defined JSONRPC protocol. The proxy sends the A and B number to lnpd, which in the current release translates it to a SIP Message sent to an external server (typically a Squire SIP-to-INAP gateway. This external gateway is performing an SS7 INAP request to fetch the LNP result, which is passed back as a binary blob in a 3xx response to the lnpd. The lnpd extracts the TCAP body of the response and returns the information back to the proxy.

TODO: describe config, available fields etc.

11 ngcp-faxserver system configuration

The fax solution is available in Pro and Carrier only

- update `/etc/ngcp-config/config.yml` with the correct fax options

```
faxserver:  
  enable: yes  
  fail_attempts: '3'  
  fail_retry_secs: '60'  
  mail_from: 'Sipwise NGCP FaxServer <voipfax@ngcp.sipwise.local>'
```

- update `/etc/ngcp-config/templates/etc/ngcp-faxserver/faxserver.conf.tt2` with the correct fax options under the "User templates" section
- `ngcpcfg` apply *configured fax server*
- `ngcpcfg` push all

11.1 ngcp-faxserver mail2fax configuration

- sip:carrier mail server (Exim in this case) must be configured to receive emails from outside as by default Exim listens on the local interface only
- run `"dpkg-reconfigure exim4-config"` to adjust Exim configuration
- DNS must be configured with a subdomain starting as `mail2fax.yourcompany.com`, that is where the faxes will be sent by users to trigger "mail2fax" or alternatively, edit `/etc/ngcp-config/templates/etc/exim4/conf.d/router/999_mail2fax.tt2` and adjust it to your personal preferences

11.2 ngcp-faxserver per subscriber configuration

- On the GUI interface (`ngcp-panel`) Subscribers → Preferences
- Look up the "Fax Features" section where there are "Fax2Mail and Sendfax" and "Mail2Fax" subsections.

11.3 sending faxes using email clients (mail2fax)

- "To" header must contain sip:carrier the subscriber's number
- "Subject" header must contain the fax destination number
- "Body" should consist of text data and/or PDF attachment(s)
- To use "Secret key", it should be either put in the first row of the body followed by an empty line or included as a text attachment. Once validated, it is removed from the email.

Note: either add the "Secret key" to the body or attach it. Never add both as only one will be recognized and removed, leaving the other one to be sent as a part of the fax.

Example:

- provided there is a subscriber on sip:carrier platform with the 43130111 number, the destination fax is 43130222 and the "Secret key" is "MySecretKey"

```
To: 43130111
Subject: 43130222

MySecretKey

This is a test fax.

Cheers
```

11.4 sending and receiving faxes via the REST API

You can send and receive faxes using the built-in REST API interface and configure fax settings.

11.4.1 configuring fax settings

The following example retrieves the fax settings for the subscriber with ID 3.

Method: GET Content-Type: application/hal+json

<https://127.0.0.1:1443/api/faxserversettings/3>

The output format is as follows (only the relevant output data is shown):

```
"active" : true,
  "destinations" : [
    {
      "destination" : "user@company.com",
      "filetype" : "PDF14",
      "incoming" : true,
      "outgoing" : true,
      "status" : true
    }
  ],
  "name" : null,
  "password" : null
```

The following example updates a specific parameter, Namely, it deactivates the fax feature for the particular subscriber.

Method: PATCH Content-Type: application/json-patch+json

<https://127.0.0.1:1443/api/faxserversettings/3>

```
--data-binary [{"op": "replace", "path": "/active", "value": 0}]
```

11.4.2 sending a fax

The following request sends a pdf file located at /tmp/test_fax.pdf as fax to 431110002 from the subscriber with ID 3.

Method: POST Content-Type: multipart/form-data

<https://127.0.0.1:1443/api/faxes/>

```
--form json={"destination": "431110002", "subscriber_id": 3} --form faxfile=@/tmp/test_fax.pdf
```

11.4.3 receiving a fax

All received faxes are stored on the server and can be retrieved on demand. You can retrieve a stored fax by following these steps:

Firstly, obtain the internal ID of the fax

Method: GET Content-Type: application/json

<https://127.0.0.1:1443/api/faxes/3>

This request returns the list of stored faxes for the subscriber with ID 3.

One of the available faxes is returned like this:

```
"callee" : "431110002",
"caller"  : "431110001",
"direction" : "out",
"duration" : "0",
"filename" : "d9799276-b7d9-454f-98c3-714edf7e3072.tif",
"id"      : 5,
"pages"   : "1",
"quality" : "8031x7700",
"reason"  : "Normal Clearing / SIP 200 OK [1/3]",
"signal_rate" : "14400",
"status"  : "SUCCESS",
"subscriber_id" : 1,
"time"    : "2016-07-30 09:49:59"
```

Now, to retrieve the fax with ID 5, use the following request:

Method: GET Content-Type: application/hal+json

<https://127.0.0.1:1443/api/faxerecordings/5>

By default, the fax is in the TIFF format. It is also possible to request it in a different format (currently supported formats are: PS, PDF, PDF14).

To retrieve the same fax in PDF14, use the following request:

<https://127.0.0.1:1443/api/faxerecordings/5?format=pdf14>

11.4.4 configuring the mail2fax settings

The configuration of mail2fax settings via the REST API is similar to the fax settings configuration.

To get the mail2fax configuration for the subscriber with id 3, use the following request:

Method: GET Content-Type: application/hal+json

<https://127.0.0.1:1443/api/mailtofaxsettings/3>

The output format is as follows (only the relevant output data is shown):

```
"acl" : [],
"active" : false,
"secret_key" : "secretkeypassword",
"secret_key_renew" : "daily",
"secret_renew_notify" : [
  {
    "destination" : "user1@company.com"
  }
]
```

The following set of requests changes the mail2fax configuration:

- the secret key update:

Method: PATCH Content-Type: application/json-patch+json

<https://127.0.0.1:1443/api/faxserversettings/3>

```
--data-binary [ { "op" : "replace", "path" : "/secret_key", "value" : "newsecretkeypassword" } ]
```

- the secret key renewal interval update:

```
--data-binary [ { "op" : "replace", "path" : "/secret_key_renew", "value" : "monthly" } ]
```

- update the list of email addresses that receive the automatic secret key update notifications

```
--data-binary [ { "op" : "replace", "path" : "/secret_renew_notify", "value" : [ { "destination": "user2@company.com" }, { "destination": "user3@company.com" } ] } ]
```

11.4.5 using advanced faxserver and mail2fax settings via the REST API

On the NGCP REST API documentation web page you can find the complete list of available faxserver and mail2fax configuration parameters: <https://127.0.0.1:1443/api/> The information on the web page is relevant for your platform version and may change in next releases.

11.5 fax tests

- To test an incoming fax, dial the corresponding phone/fax number from a fax machine. You should receive the email with the attached fax
- To test an outgoing fax, login to the subscriber self-care interface and send a fax from it
- Mail2Fax, send an email to the configured "mail2fax" subscriber

11.6 Fax Debug

- Use the following log file to debug the fax functionality `/var/log/ngcp/faxserver.log`

12 Provisioning REST API Interface

The sip:carrier provides the REST API interface for interconnection with 3rd party tools.

The sip:carrier provides a REST API to provision various functionality of the platform. The entry point - and at the same time the official documentation - is at <https://<your-ip>:1443/api>. It allows both administrators and resellers (in a limited scope) to manage the system.

You can either authenticate via username and password of your administrative account you're using to access the admin panel, or via SSL client certificates. Find out more about client certificate authentication in the online API documentation.

12.1 Managing Customers and Subscribers

The typical tasks done on the API involve managing customers and subscribers. The following chapter focuses on creating, changing and deleting these resources.

The standard life cycle of a customer and subscriber is:

1. Create customer contact
2. Create customer
3. Create subscribers within customer
4. Modify subscribers
5. Modify subscriber preferences (features)
6. Terminate subscriber
7. Terminate customer

The boiler-plate to access the REST API is described in the online API documentation at [/api/#auth](#). A simple example in Perl using password authentication looks as follows:

```
#!/usr/bin/perl -w
use strict;
use v5.10;

use LWP::UserAgent;
use JSON qw();

my $uri = 'https://ngcp.example.com:1443';
my $ua = LWP::UserAgent->new;
my $user = 'myusername';
my $pass = 'mypassword';
$ua->credentials('ngcp.example.com:1443', 'api_admin_http', $user, $pass);
my ($req, $res);
```

For each customer you create, you need to assign a billing profile id. You either have the ID stored somewhere else, or you need to fetch it by searching for the billing profile handle.

```
my $billing_profile_handle = 'my_test_profile';
$req = HTTP::Request->new('GET', "$uri/api/billingprofiles/?handle=$billing_profile_handle" ←
);
$res = $ua->request($req);
if($res->code != 200) {
    die "Failed to fetch billing profile: ".$res->decoded_content."\n";
}
my $billing_profile = JSON::from_json($res->decoded_content);
my $billing_profile_id = $billing_profile->{_embedded}->{'ngcp:billingprofiles'}->{id};
say "Fetched billing profile, id is $billing_profile_id";
```

A customer is mainly a billing container for subscribers without a real identification other than the *external_id* property you might have stored somewhere else (e.g. the ID of the customer in your CRM). To still easily identify a customer, a customer contact is required. It is created using the */api/customercontacts/* resource.

```
$req = HTTP::Request->new('POST', "$uri/api/customercontacts/");
$req->header('Content-Type' => 'application/json');
$req->content(JSON::to_json({
    firstname => 'John',
    lastname => 'Doe',
    email => 'john.doe@example.com'
}));
$res = $ua->request($req);
if($res->code != 201) {
    die "Failed to create customer contact: ".$res->decoded_content."\n";
}
my $contact_id = $res->header('Location');
$contact_id =~ s/^.+\/(\d+)\$\/$1/; # extract the ID from the Location header
say "Created customer contact, id is $contact_id";
```



Important

To get the ID of the recently created resource, you need to parse the *Location* header. In future, this approach will be changed for POST requests. The response will also optionally return the ID of the resource. It will be controlled via the *Prefer: return=representation* header as it is already the case for PUT and PATCH.



Warning

The example above implies the fact that you access the API via a reseller user. If you are accessing the API as the admin user, you also have to provide a *reseller_id* parameter defining the reseller this contact belongs to.

Once you have created the customer contact, you can create the actual customer.

```
$req = HTTP::Request->new('POST', "$uri/api/customers/");
```

```

$req->header('Content-Type' => 'application/json');
$req->content(JSON::to_json({
    status => 'active',
    contact_id => $contact_id,
    billing_profile_id => $billing_profile_id,
    type => 'sipaccount',
    external_id => undef, # can be set to your crm's customer id
}));
$res = $ua->request($req);
if($res->code != 201) {
    die "Failed to create customer: ".$res->decoded_content."\n";
}
my $customer_id = $res->header('Location');
$customer_id =~ s/^.+\(/(\d+)\$/\1/; # extract the ID from the Location header
say "Created customer, id is $customer_id";

```

Once you have created the customer, you can add subscribers to it. One customer can hold multiple subscribers, up to the *max_subscribers* property which can be set via */api/customers/*. If this property is not defined, a virtually unlimited number of subscribers can be added.

```

$req = HTTP::Request->new('POST', "$uri/api/subscribers/");
$req->header('Content-Type' => 'application/json');
$req->content(JSON::to_json({
    status => 'active',
    customer_id => $customer_id,
    primary_number => { cc => 43, ac => 9876, sn => 10001 }, # the main number
    alias_numbers => [ # as many alias numbers the subscriber can be reached at (or skip ←
        param if none)
        { cc => 43, ac => 9877, sn => 10001 },
        { cc => 43, ac => 9878, sn => 10001 }
    ],
    username => 'test_10001',
    domain => 'ngcp.example.com',
    password => 'secret subscriber pass',
    webusername => 'test_10001',
    webpassword => undef, # set undef if subscriber shouldn't be able to log into sipwise ←
        csc
    external_id => undef, # can be set to the operator crm's subscriber id
}));
$res = $ua->request($req);
if($res->code != 201) {
    die "Failed to create subscriber: ".$res->decoded_content."\n";
}
my $subscriber_id = $res->header('Location');
$subscriber_id =~ s/^.+\(/(\d+)\$/\1/; # extract the ID from the Location header
say "Created subscriber, id is $subscriber_id";

```

**Important**

A domain must exist before creating a subscriber. You can create the domain via `/api/domains/`.

At that stage, the subscriber can connect both via SIP and XMPP, and can be reached via the primary number, all alias numbers, as well as via the SIP URI.

If you want to set call forwards for the subscribers, then perform an API call as follows.

```
$req = HTTP::Request->new('PUT', "$uri/api/callforwards/$subscriber_id");
$req->header('Content-Type' => 'application/json');
$req->header('Prefer' => "return=minimal"); # use return=representation to get full json ←
      response
$req->content(JSON::to_json({
  cfna => { # set a call-forward if subscriber is not registered
    destinations => [
      { destination => "4366610001", timeout => 10 }, # ring this for 10s
      { destination => "4366710001", timeout => 300}, # if no answer, ring that for ←
        300s
    ],
    times => undef # no time-based call-forward, trigger cfna always
  }
}));
$res = $ua->request($req);
if($res->code != 204) { # if return=representation, it's 200
  die "Failed to set cfna for subscriber: ".$res->decoded_content."\n";
}
```

You can set cfu, cfna, cft and cft via this API call, also all at once. Destinations can be hunting lists as described above or just a single number. Also, a time set can be provided to trigger call forwards only during specific time periods.

To provision certain features of a subscriber, you can manipulate the subscriber preferences. You can find a full list of preferences available for a subscriber at `/api/subscriberpreferencedefs/`.

```
$req = HTTP::Request->new('GET', "$uri/api/subscriberpreferences/$subscriber_id");
$res = $ua->request($req);
if($res->code != 200) {
  die "Failed to fetch subscriber preferences: ".$res->decoded_content."\n";
}
my $prefs = JSON::from_json($res->decoded_content);
delete $prefs->{__links}; # not needed in update

$prefs->{prepaid_library} = 'libinewrate'; # switch to inew billing
$prefs->{block_in_clir} = JSON::true; # reject incoming anonymous calls
$prefs->{block_in_list} = [ # reject calls from the following numbers:
  '4366412345', # this particular number
  '431*', # all vienna/austria numbers
```

```

];
$req = HTTP::Request->new('PUT', "$uri/api/subscriberpreferences/$subscriber_id");
$req->header('Content-Type' => 'application/json');
$req->header('Prefer' => "return=minimal"); # use return=representation to get full json ←
      response
$req->content(JSON::to_json($prefs));
$res = $ua->request($req);
if($res->code != 204) {
    die "Failed to update subscriber preferences: ".$res->decoded_content."\n";
}
say "Updated subscriber preferences";

```

Modifying numbers assigned to a subscriber, changing the password, locking a subscriber, etc. can be done directly on the subscriber resource.

```

$req = HTTP::Request->new('GET', "$uri/api/subscribers/$subscriber_id");
$res = $ua->request($req);
if($res->code != 200) {
    die "Failed to fetch subscriber: ".$res->decoded_content."\n";
}
my $sub = JSON::from_json($res->decoded_content);
delete $sub->{_links}; # not needed in update
push @{$sub->{alias_numbers}}, { cc => 1, ac => 5432, sn => $t }; # add this number
push @{$sub->{alias_numbers}}, { cc => 1, ac => 5433, sn => $t }; # add another number

$req = HTTP::Request->new('PUT', "$uri/api/subscribers/$subscriber_id");
$req->header('Content-Type' => 'application/json');
$req->header('Prefer' => "return=minimal"); # use return=representation to get full json ←
      response
$req->content(JSON::to_json($sub));
$res = $ua->request($req);
if($res->code != 204) {
    die "Failed to update subscriber: ".$res->decoded_content."\n";
}
say "Updated subscriber";

```

At the end of a subscriber life cycle, it can be terminated. Once terminated, you can NOT recover the subscriber anymore.

```

$req = HTTP::Request->new('DELETE', "$uri/api/subscribers/$subscriber_id");
$res = $ua->request($req);
if($res->code != 204) {
    die "Failed to terminate subscriber: ".$res->decoded_content."\n";
}
say "Terminated subscriber";

```

Note that certain information is still available in the internal database to perform billing/rating of calls done by this subscriber. Nevertheless, the data is removed from the operational tables of the database, so the subscriber is not able to connect to the system, login or make calls/chats.

Resources modification can be done via the GET/PUT combination. Alternatively, you can add, modify or delete single properties of a resource without actually fetching the whole resource. See an example below where we terminate the status of a customer using the PATCH method.

```
$req = HTTP::Request->new('PATCH', "$uri/api/customers/$customer_id");
$req->header('Content-Type' => 'application/json-patch+json');
$req->header('Prefer' => "return=minimal"); # use return=representation to get full json ←
      response
$req->content(JSON::to_json([
  { op => 'replace', path => '/status', value => 'terminated' }
]));
$res = $ua->request($req); # this will also terminate all still active subscribers
if($res->code != 204) {
  die "Failed to terminate customer: ".$res->decoded_content."\n";
}
say "Terminated customer";
```

13 Configuration Framework

The sip:carrier provides a configuration framework for consistent and easy to use low level settings management. A basic usage of the configuration framework only needs two actions already used in previous chapters:

- Edit `/etc/ngcp-config/config.yml` file.
- Execute `ngcpcfg apply 'my commit message'` command.

Low level management of the configuration framework might be required by advanced users though. This chapter explains the architecture and usage of the NGCP configuration framework. If the basic usage explained above fits your needs, feel free to skip this chapter and return to it when your requirements change.

A more detailed workflow of the configuration framework for creating a configuration file consists of 7 steps:

- Generation or editing of configuration templates and/or configuration values.
- Generation of the configuration files based on configuration templates and configuration values defined in `config.yml`, `constants.yml` and `network.yml` files.
- Execution of `prebuild` commands if defined for a particular configuration file or configuration directory.
- Placement of the generated configuration file in the target directory. This step is called `build` in the configuration framework.
- Execution of `postbuild` commands if defined for that configuration file or configuration directory.
- Execution of `services` commands if defined for that configuration file or configuration directory. This step is called `services` in the configuration framework.
- Saving of the generated changes. This step is called `commit` in the configuration framework.

13.1 Configuration templates

The sip:carrier provides configuration file templates for most of the services it runs. These templates are stored in the directory `/etc/ngcp-config/templates`.

Example: Template files for `/etc/ngcp-sems/sems.conf` are stored in `/etc/ngcp-config/templates/etc/ngcp-sems/`.

There are different types of files in this template framework, which are described below.

13.1.1 .tt2 and .customtt.tt2 files

These files are the main template files that will be used to generate the final configuration file for the running service. They contain all the configuration options needed for a running sip:carrier system. The configuration framework will combine these files with the values provided by `config.yml`, `constants.yml` and `network.yml` to generate the appropriate configuration file.

Example: Let's say we are changing the IP used by kamailio load balancer on interface `eth0` to IP 1.2.3.4. This will change kamailio's listen IP address, when the configuration file is generated. A quick look to the template file under `/etc/ngcp-config/templates/etc/kamailio/` will show a line like this:

```
listen=udp:[% ip %]:[% kamailio.lb.port %]
```

After applying the changes with the `ngcpcfg apply 'my commit message'` command, a new configuration file will be created under `/etc/kamailio/lb/kamailio.cfg` with the proper values taken from the main configuration files (in this case `network.yml`):

```
listen=udp:1.2.3.4:5060
```

All the low-level configuration is provided by these `.tt2` template files and the corresponding `config.yml` file. Anyway, advanced users might require a more particular configuration.

Instead of editing `.tt2` files, the configuration framework recognises `.customtt.tt2` files. These files are the same as `.tt2`, but they have higher priority when the configuration framework creates the final configuration files. An advanced user should create a `.customtt.tt2` file from a copy of the corresponding `.tt2` template and leave the `.tt2` template untouched. This way, the user will have his personalized configuration and the system will continue providing a working, updated configuration template in `.tt2` format.

Example: We'll create `/etc/ngcp-config/templates/etc/lb/kamailio.cfg.customtt.tt2` and use it for our personalized configuration. In this example, we'll just append a comment at the end of the template.

```
cd /etc/ngcp-config/templates/etc/kamailio/lb
cp kamailio.cfg.tt2 kamailio.cfg.customtt.tt2
echo '# This is my last line comment' >> kamailio.cfg.customtt.tt2
ngcpcfg apply 'my commit message'
```

The `ngcpcfg` command will generate `/etc/kamailio/kamailio.cfg` from our custom template instead of the general one.

```
tail -1 /etc/kamailio/kamailio.cfg
# This is my last line comment
```

Tip

The `tt2` files use the [Template Toolkit](#) language. Therefore you can use all the feature this excellent toolkit provides within `ngcpcfg`'s template files (all the ones with the `.tt2` suffix).

13.1.2 `.prebuild` and `.postbuild` files

After creating the configuration files, the configuration framework can execute some commands before and after placing that file in its target directory. These commands usually are used for changing the file's owner, groups, or any other attributes. There are some rules these commands need to match:

- They have to be placed in a `.prebuild` or `.postbuild` file in the same path as the original `.tt2` file.
- The file name must be the same as the configuration file, but having the mentioned suffixes.
- The commands must be `bash` compatible.
- The commands must return 0 if successful.

- The target configuration file is matched by the environment variable `output_file`.

Example: We need `www-data` as owner of the configuration file `/etc/ngcp-ossbss/provisioning.conf`. The configuration framework will by default create the configuration files with `root:root` as owner:group and with the same permissions (`rwX`) as the original template. For this particular example, we will change the owner of the generated file using the `.postbuild` mechanism.

```
echo 'chgrp www-data ${output_file}' \
> /etc/ngcp-config/templates/etc/ngcp-ossbss/provisioning.conf.postbuild
```

13.1.3 .services files

`.services` files are pretty similar and might contain commands that will be executed after the `build` process. There are two types of `.services` files:

- The particular one, with the same name as the configuration file it is associated to.
Example: `/etc/ngcp-config/templates/etc/asterisk/sip.conf.services` is associated to `/etc/asterisk/sip.conf`
- The general one, named `ngcpcfg.services` which is associated to every file in its target directory.
Example: `/etc/ngcp-config/templates/etc/asterisk/ngcpcfg.services` is associated to every file under `/etc/asterisk/`

When the `services` step is triggered all `.services` files associated to a changed configuration file will be executed. In case of the general file, any change to any of the configuration files in the directory will trigger the execution of the commands.

Tip

If the service script has the execute flags set (`chmod +x $file`) it will be invoked directly. If it doesn't have execute flags set it will be invoked under `bash`. Make sure the script is `bash` compatible if you do not set execute permissions on the service file.

These commands are usually `service reload/restarts` to ensure the new configuration has been loaded by running services.

Note

The configuration files mentioned in the following example usually already exist on the platform. Please make sure you don't overwrite any existing files if following this example.

Example:

```
echo '/etc/init.d/mysql restart' \
> /etc/ngcpcfg-config/templates/etc/mysql/my.cnf.services
echo '/etc/init.d/asterisk restart' \
> /etc/ngcpcfg-config/templates/etc/asterisk/ngcpcfg.services
```

In this example we created two `.services` files. Now, each time we trigger a change to `/etc/mysql/my.cnf` or to `/etc/asterisk/*` we'll see that MySQL or Asterisk services will be restarted by the `ngcpcfg` system.

13.2 config.yml, constants.yml and network.yml files

The `/etc/ngcp-config/config.yml` file contains all the user-configurable options, using the **YAML** (YAML Ain't Markup Language) syntax.

The `/etc/ngcp-config/constants.yml` file provides configuration options for the platform that aren't supposed to be edited by the user. Do not manually edit this file unless you really know what you're doing.

The `/etc/ngcp-config/network.yml` file provides configuration options for all interfaces and IP addresses on those interfaces. You can use the `ngcp-network` tool for conveniently change settings without having to manually edit this file.

The `/etc/ngcp-config/ngcpcfg.cfg` file is the main configuration file for `ngcpcfg` itself. Do not manually edit this file unless you really know what you're doing.

13.3 ngcpcfg and its command line options

The shared storage used by all nodes is the shared storage of the mgmt pair.

The `ngcpcfg` utility supports the following command line options:

13.3.1 apply

The `apply` option is a short-cut for the options "check && build && services && commit" and also executes `etckeeper` to record any modified files inside `/etc`. It is the recommended option to use the `ngcpcfg` framework unless you want to execute any specific commands as documented below.

13.3.2 build

The `build` option generates (and therefore also updates) configuration files based on their configuration (`config.yml`) and template files (`.tt2`). Before the configuration file is generated a present `.prebuild` will be executed, after generation of the configuration file the according `.postbuild` script (if present) will be executed. If a `file` or `directory` is specified as argument the build will generate only the specified configuration file/directory instead of running through all present templates.

Example: to generate only the file `/etc/nginx/sites-available/ngcp-panel` you can execute:

```
ngcpcfg build /etc/nginx/sites-available/ngcp-panel
```

Example: to generate all the files located inside the directory `/etc/nginx/` you can execute:

```
ngcpcfg build /etc/nginx/
```

13.3.3 commit

The `commit` option records any changes done to the configuration tree inside `/etc/ngcp-config`. The `commit` option should be executed when you've modified anything inside the configuration tree.

13.3.4 decrypt

Decrypt `/etc/ngcp-config-encrypted.tgz.gpg` and restore configuration files, doing the reverse operation of the *encrypt* option. Note: This feature is only available if the `ngcp-ngcpcfg-locker` package is installed.

13.3.5 diff

Show uncommitted changes between `ngcpcfg`'s Git repository and the working tree inside `/etc/ngcp-config`. If the tool doesn't report anything it means that there are no uncommitted changes. If the `--addremove` option is specified then new and removed files (iff present) that are not yet (un)registered to the repository will be reported, no further diff actions will be executed then. Note: This option is available since `ngcp-ngcpcfg` version 0.11.0.

13.3.6 encrypt

Encrypt `/etc/ngcp-config` and all resulting configuration files with a user defined password and save the result as `/etc/ngcp-config-encrypted.tgz.gpg`. Note: This feature is only available if the `ngcp-ngcpcfg-locker` package is installed.

13.3.7 help

The *help* options displays `ngcpcfg`'s help screen and then exits without any further actions.

13.3.8 initialise

The *initialise* option sets up the `ngcpcfg` framework. This option is automatically executed by the installer for you, so you shouldn't have to use this option in normal operations mode.

13.3.9 pull

Retrieve modifications from shared storage. Note: This option is available in the High Availability setup only.

13.3.10 push

Push modifications to shared storage and remote systems. After changes have been pushed to the nodes the *build* option will be executed on each remote system to rebuild the configuration files (unless the `--nobuild` has been specified, then the build step will be skipped). If hostname(s) or IP address(es) is given as argument then the changes will be pushed to the shared storage and to the given hosts only. You can use *all* as a shortcut to push to the other nodes. If no host has been specified then the hosts specified in `/etc/ngcp-config/systems.cfg` are used. Note: This option is available in the High Availability setup only.

13.3.11 services

The *services* option executes the service handlers for any modified configuration file(s)/directory.

13.3.12 status

The *status* option provides a human readable interface to check the state of the configuration tree. If you are unsure what should be done as next step or if want to check the current state of the configuration tree just invoke *ngcpcfg status*.

If everything is OK and nothing needs to be done the output should look like:

```
# ngcpcfg status
Checking state of ngcpcfg:
OK:  has been initialised already (without shared storage)
Checking state of configuration files:
OK:  nothing to commit.
Checking state of /etc files
OK:  nothing to commit.
```

If the output doesn't say "OK" just follow the instructions provided by the output of *ngcpcfg status*.

Further details regarding the *ngcpcfg* tool are available through *man ngcpcfg* on the Sipwise Next Generation Platform.

14 Network Configuration

Starting with version 2.7, the sip:carrier uses a dedicated *network.yml* file to configure the IP addresses of the system. The reason for this is to be able to access all IPs of all nodes for all services from any particular node in case of a distributed system on one hand, and in order to be able to generate */etc/network/interfaces* automatically for all nodes based on this central configuration file.

14.1 General Structure

The basic structure of the file looks like this:

```
hosts:
  self:
    role:
      - proxy
      - lb
      - mgmt
    interfaces:
      - eth0
      - lo
    eth0:
      ip: 192.168.51.213
      netmask: 255.255.255.0
      type:
        - sip_ext
        - rtp_ext
        - web_ext
        - web_int
    lo:
      ip: 127.0.0.1
      netmask: 255.255.255.0
      type:
        - sip_int
        - ha_int
```

14.2 Available Host Options

There are three different main sections for a host in the config file, which are *role*, *interfaces* and the actual interface definitions.

- *role*: The role setting is an array defining which logical roles a node will act as. Possible entries for this setting are:
 - *mgmt*: This entry means the host is acting as management node for the platform. In a sip:carrier, this option must always be set. In a carrier, this is only set on the nodes of the management pairs. The management node exposes the admin and csc panels to the users and the APIs to external applications and is used to export CDRs.

- *lb*: This entry means the host is acting as SIP load-balancer for the platform. In a sip:carrier, this option must always been set. In a carrier, this is only set on the nodes of the lb pairs. The SIP load-balancer acts as an ingress and egress point for all SIP traffic to and from the platform.
- *proxy*: This entry means the host is acting as SIP proxy for the platform. In a sip:carrier, this option must always been set. In a carrier, this is only set on the nodes of the proxy pairs. The SIP proxy acts as registrar, proxy and application server and media relay, and is responsible for providing the features for all subscribers provisioned on it.
- *db*: This entry means the host is acting as the database node for the platform. In a sip:carrier, this option must always be set. In a carrier, this is only set on the nodes of the database pairs. The database node exposes the mysql and redis databases.
- *rtp*: This entry means the host is acting as the RTP relay node for the platform. In a sip:carrier, this option must always be set. In a carrier, this is only set on the nodes of the RTP relay pairs. The RTP relay node runs the rtpengine.
- *interfaces*: The interfaces setting is an array defining all interface names in the system. The actual interface details are set in the actual interface settings below.
- *<interface name>*: After the interfaces are defined in the *interfaces* setting, each of those interfaces needs to be specified as a separate setting with the following options:
 - *ip*
 - *netmask*
 - *advertised_ip*
 - *type*

There are different *interface types*, which define the services on a particular *interface*. For example the type *ssh_ext* set for a specific interface defines that the SSH daemon will listen on that interface for incoming connections. The list of possible types is as follows (note that you can assign a type only once per node):

- *mon_ext*: interface for monitoring purposes, e.g. for snmpd
- *rtp_ext*: interface for external RTP relay
- *sip_ext*: interface for external SIP communication between the sip:carrier and the end points
- *sip_ext_incoming*: extra listen interface for external SIP traffic (optional)
- *sip_int*: interface for internal SIP communication, e.g. between load-balancer, proxy and application servers
- *ssh_ext*: interface for SSH remote login
- *web_ext*: interface for the subscriber web panel and the subscriber's SOAP/REST APIs
- *web_int*: interface for the administrator web panel, his SOAP/REST APIs and internal API communication
- *aux_ext*: interface for potentially insecure external components like rsyslogd service; e.g. the CloudPBX module can use those services to provide time services and remote logging facilities to end customer devices. The type *aux_ext* is assigned to *lo* interface by default. If it is needed to expose this type to the public, it is recommended to assign the type *aux_ext* to a separate VLAN interface to be able to limit or even block the incoming traffic easily via firewalling in case of emergency, like a (D)DOS attack on rsyslog services.

15 Advanced Network Configuration

You have a typical deployment now and you are good to go, however you may need to do extra configuration depending on the devices you are using and functionality you want to achieve.

15.1 Extra SIP Sockets

By default, the load-balancer listens on the UDP and TCP ports 5060 (*kamailio*→*lb*→*port*) and TLS port 5061 (*kamailio*→*lb*→*tls*→*port*). If you need to setup one or more extra SIP listening ports or IP addresses in addition to those standard ports, please edit the *kamailio*→*lb*→*extra_sockets* option in your */etc/ngcp-config/config.yml* file.

The correct format consists of a label and value like this:

```
extra_sockets:
  port_5064: udp:10.15.20.108:5064
  test: udp:10.15.20.108:6060
```

The label is shown in the `outbound_socket` peer preference (if you want to route calls to the specific peer out via specific socket); the value must contain a transport specification as in example above (udp, tcp or tls). After adding execute `ngcpcfg apply`:

```
ngcpcfg apply 'added extra socket' && ngcpcfg push all
```

The direction of communication through this SIP extra socket is incoming+outgoing. The sip:carrier will answer the incoming client registrations and other methods sent to the extra socket. For such incoming communication no configuration is needed. For the outgoing communication the new socket must be selected in the `outbound_socket` peer preference. For more details read the next section Section 15.2 that covers peer configuration for SIP and RTP in greater detail.



Important

In this section you have just added an extra SIP socket. RTP traffic will still use your *rtp_ext* IP address.

15.2 Extra SIP and RTP Sockets

If you want to use an additional interface (with a different IP address) for SIP signalling and RTP traffic you need to add your new interface in the */etc/network/interfaces* file. Also the interface must be declared in */etc/ngcp-config/network.yml*.

Suppose we need to add a new SIP socket and a new RTP socket on VLAN 100. You can use the *ngcp-network* tool for adding interfaces without having to manually edit this file:

```
ngcp-network --set-interface=eth0.100 --host=slb01a --ip=auto --netmask=auto --type= ↔
  sip_ext_incoming
ngcp-network --set-interface=eth0.100 --host=slb01b --ip=auto --netmask=auto --type= ↔
  sip_ext_incoming
```

```
ngcp-network --set-interface=eth0.100 --host=prx01a --ip=auto --netmask=auto --type= ↔
  rtp_int_100
ngcp-network --set-interface=eth0.100 --host=prx01b --ip=auto --netmask=auto --type= ↔
  rtp_int_100
```

The generated file should look like the following:

```
slb01a:
..
..
  eth0.100:
    hwaddr: ff:ff:ff:ff:ff:ff
    ip: 192.168.1.2
    netmask: 255.255.255.0
    shared_ip:
      - 192.168.1.3
    shared_v6ip: ~
    type:
      - sip_ext_incoming
..
..
  interfaces:
    - lo
    - eth0
    - eth0.100
    - eth1
..
..
prx01a:
..
..
  eth0.100:
    hwaddr: ff:ff:ff:ff:ff:ff
    ip: 192.168.1.20
    netmask: 255.255.255.0
    shared_ip:
      - 192.168.1.30
    shared_v6ip: ~
    type:
      - rtp_int_100
..
..
  interfaces:
    - lo
    - eth0
    - eth0.100
    - eth1
..
```



```
..
slb01b:
..
..
  eth0.100:
    hwaddr: ff:ff:ff:ff:ff:ff
    ip: 192.168.1.4
    netmask: 255.255.255.0
    shared_ip:
      - 192.168.1.3
    shared_v6ip: ~
    type:
      - sip_ext_incoming
..
..
  interfaces:
    - lo
    - eth0
    - eth0.100
    - eth1
..
..
prx01b:
..
..
  eth0.100:
    hwaddr: ff:ff:ff:ff:ff:ff
    ip: 192.168.1.40
    netmask: 255.255.255.0
    shared_ip:
      - 192.168.1.30
    shared_v6ip: ~
    type:
      - rtp_int_100
..
..
  interfaces:
    - lo
    - eth0
    - eth0.100
    - eth1
```

As you can see from the above example, extra SIP interfaces must have type *sip_ext_incoming*. While *sip_ext* should be listed only once per host, there can be multiple *sip_ext_incoming* interfaces. The direction of communication through this SIP interface is incoming only. The sip:carrier will answer the incoming client registrations and other methods sent to this address and remember the interfaces used for clients' registrations to be able to send incoming calls to him from the same interface.

In order to use the interface for the outbound SIP communication it is necessary to add it to `extra_sockets` section in `/etc/ngcp-config/config.yml` and select in the `outbound_socket` peer preference. So if using the above example we want to use the `vlan100` IP as source interface towards a peer, the corresponding section may look like the following:

```
extra_sockets:
  port_5064: udp:10.15.20.108:5064
  test: udp:10.15.20.108:6060
  int_100: udp:192.168.1.3:5060
```

The changes have to be applied:

```
ngcpcfg apply 'added extra SIP and RTP socket' && ngcpcfg push all
```

After applying the changes, a new SIP socket will listen on IP `192.168.1.3` on `slb01` node and this socket can now be used as source socket to send SIP messages to your peer for example. In above example we used label `int_100`. So the new label "int_100" is now shown in the `outbound_socket` peer preference.

Also, RTP socket is now listening on `192.168.1.30` on `prx01` node and you can choose the new RTP socket to use by setting parameter `rtp_interface` to the Label "int_100" in your Domain/Subscriber/Peer preferences.

16 Security and Maintenance

Once the sip:carrier is in production, security and maintenance becomes really important. In this chapter, we'll go through a set of best practices for any production system.

16.1 Sipwise SSH access to sip:carrier

The sip:carrier provides SSH access to the system for Sipwise operational team for debugging and final tuning. Operational team uses user *sipwise* which can be logged in through SSH key only (password access is disabled) from dedicated access server *jump.sipwise.com* only.

To completely remove Sipwise access to your system, please execute as user root:

```
root@myserver:~# ngcp-support-access --disable && apt-get install ngcp-support-noaccess
```

Note

you have to execute the command above on each node of your sip:carrier system!



Warning

please ensure that the script complete successfully:

```
* Support access successfully disabled.
```

If you need to restore Sipwise access to the system, please execute as user root:

```
root@myserver:~# apt-get install ngcp-support-access && ngcp-support-access --enable
```



Warning

please ensure that the script complete successfully:

```
* Support access successfully enabled.
```

16.2 Firewalling

The sip:carrier runs a wide range of services. Some of them need to interact with the user, while some others need to interact with the administrator or with nobody at all. Assuming that we trust the sip:carrier server for outgoing connections, we'll focus only on incoming traffic to define the services that need to be open for interaction.

Table 12: Subscribers

Service	Default port	Config option
Customer self care interface	443 TCP	<code>www_admin→http_csc→port</code>
SIP	5060 UDP, TCP	<code>kamailio→lb→port</code>
SIP over TLS	5061 TCP	<code>kamailio→lb→tls→port + kamailio→lb→tls→enable</code>
RTP	30000-40000 UDP	<code>rtpproxy→minport + rtpproxy→maxport</code>
XCAP	1080 TCP	<code>kamailio→proxy→presence→enable + nginx→xcap_port</code>
XMPP	5222 and 5269 TCP	None, standard XMPP ports for clients (5222) and federation (5269)

Table 13: Administrators

Service	Default port	Config option
SSH/SFTP	22 TCP	NA
Administrator interface	1443 TCP	<code>www_admin→http_admin→port</code>
Provisioning interfaces	2443 TCP	<code>ossbss→apache→port</code>

Caution

To function correctly, the *rtengine* requires an additional *iptables* rule installed. This rule (with a target of `RTPENGINE`) is automatically installed and removed when the *rtengine* starts and stops, so normally you don't need to worry about it. However, any 3rd party firewall solution can potentially flush out all existing *iptables* rules before installing its own, which would leave the system without the required `RTPENGINE` rule and this would lead to decreased performance. It is imperative that any 3rd party firewall solution either leaves this rule untouched, or installs it back into place after flushing all rules out. The complete parameters to install this rule (which needs to go into the `INPUT` chain of the `filter` table) are: `-p udp -j RTPENGINE --id 0`

16.3 Password management

The *sip:carrier* comes with some default passwords the user should change during the deployment of the system. They have been explained in the previous chapters of this handbook.

- The login for the system account *cdrexpert* is disabled by default. Although this is a jailed account, it has access to sensitive information, namely the Call Detail Records of all calls. SSH keys should be used to login this user, or alternatively a really strong password should be used when setting the password via `passwd cdrexpert`.

- The *root* user in MySQL has no default password. A password should be set using the *mysqladmin password* command.
- The administrative web interface has a default user *administrator* with password *administrator*. It should be changed within this interface.
- Generate new password for user *ngcpssoap* to access the provisioning interfaces, see the details in Section 12.



Important

Many NGCP services use MySQL backend. Users and passwords for these services are created during the installation. These passwords are unique for each installation, and the connections are restricted to localhost. You should not change these users and passwords.

16.4 SSL certificates.

The sip:carrier provides default, self-signed SSL certificates for SSL connections. These certificates are common for every installation. Before going to production state, the system administrator should provide SSL certificates for the web services. These certificates can either be shared by all web interfaces (*provisioning*, *administrator interface* and *customer self care interface*), or separate ones for each them can be used.

- Generate the certificates. The *customer self care interface* certificate should be signed by a certification authority to avoid browser warnings.
- Upload the certificates to the system
- Set the path to the new certificates in */etc/ngcp-config/config.yml*:
 - *ossbss*→*apache*→*autoprov*→*sslcertfile* and *ossbss*→*apache*→*autoprov*→*sslcertkeyfile* for the *provisioning interface*.
 - *ossbss*→*apache*→*restapi*→*sslcertfile* and *ossbss*→*apache*→*restapi*→*sslcertkeyfile* for the *REST interface*.
 - *www_admin*→*http_admin*→*sslcertfile* and *www_admin*→*http_admin*→*sslcertkeyfile* for the *admin interface*.
 - *www_admin*→*http_csc*→*sslcertfile* and *www_admin*→*http_csc*→*sslcertkeyfile* for the *customer self care interface*.
- Apply the configuration changes with *ngcpcfg apply 'added web ssl certs'*.

The sip:carrier also provides the self-signed SSL certificates for SIP over TLS services. The system administrator should replace them with certificates signed by a trusted certificate authority if he is going to enable it for the production usage (*kamailio*→*lb*→*tls*→*enable* (disabled by default)).

- Generate the certificates.
- Upload the certificates to the system
- Set the path to the new certificates in */etc/ngcp-config/config.yml*:
 - *kamailio*→*lb*→*tls*→*sslcertfile* and *kamailio*→*lb*→*tls*→*sslcertkeyfile* .
- Apply the configuration changes with *ngcpcfg apply 'added kamailio certs'*.

16.5 Securing your sip:carrier against SIP attacks

The sip:carrier allows you to protect your VoIP system against SIP attacks, in particular **Denial of Service** and **brute-force attacks**. Let's go through each of those attacks and let's see how to configure your system in order to face such situations and react against them.

16.5.1 Denial of Service

As soon as you have packets arriving on your sip:carrier server, it will require a bit of time of your CPU. Denial of Service attacks are aimed to break down your system by sending floods of SIP messages in a very short period of time and keep your system busy to handle such huge amount of requests. sip:carrier allow you to block such kind of attack quite easily, by configuring the following section in your */etc/ngcp-config/config.yml*:

```
security:
  dos_ban_enable: 'yes'
  dos_ban_time: 3600
  dos_reqs_density_per_unit: 50
  dos_sampling_time_unit: 2
```

Basically, as soon as sip:carrier receives more than 50 messages from the same IP in a time window of 2 seconds, that IP will be block for 3600 sec, and you will see in the the kamailio-lb.log a line saying:

```
Nov 9 00:11:53 sp1 lb[41958]: WARNING: <script>: IP '1.2.3.4' is blocked and banned - R=< ↔
null> ID=304153-3624477113-19168@tedadg.testlab.local
```

The banned IP will be stored in kamailio memory, you can check the list via web interface or via the following command:

```
# ngcp-kamctl lb fifo sht_dump ipban
```



Important

You have to run this command on ACTIVE load balancer node.

16.5.2 Bruteforcing SIP credentials

This is a very common attack you can easily detect checking your */var/log/ngcp/kamailio-proxy.log*. You will see INVITE/REGISTER messages coming in with strange usernames. Attackers is trying to spoof/guess subscriber's credentials, which allow them to call out. The very first protection against these attacks is: **ALWAYS USE STRONG PASSWORD**. Nevertheless sip:carrier allow you to detect and block such attacks quite easily, by configuring the following */etc/ngcp-config/config.yml* section:

```
failed_auth_attempts: 3
failed_auth_ban_enable: 'yes'
failed_auth_ban_time: 3600
```

You may increase the number of failed attempt if you want (in some cases it's better to be safed, some users can be banned accidentally because they are not writing the right password) and adjust the ban time. If a user try to authenticate an INVITE (or REGISTER) for example and it fails more then 3 times, the "user@domain" (not the IP as for Denial of Service attack) will be block for 3600 seconds. In this case you will see in your `/var/log/ngcp/kamailio-lb.log` the following lines:

```
Nov 9 13:31:56 sp1 lb[41952]: WARNING: <script>: Consecutive Authentication Failure for ' ←  
sipvicous@mydomain.com' UA='sipvicous-client' IP='1.2.3.4' - R=<null> ID ←  
=313793-3624525116-589163@testlab.local
```

Both the banned IPs and banned users are shown in the Admin web interface, you can check them by accessing the **Security Bans** section in the main menu. You can check the banned user as well by retrieving the same info directly from kamailio memory, using the following commands:

```
# ngcp-kamctl lb fifo sht_dump auth
```



Important

You have to run this command on ACTIVE load balancer node.

16.6 Backup and recovery

16.6.1 Backup

For any service provider it is important to maintain a reliable backup policy as it enables prompt services restoration after any force majeure event. Although the design of sip:carrier implies data duplication and high availability of services, we still strongly suggest you to configure a backup procedure. The sip:carrier has a built-in solution that can help you back up the most crucial data. Alternatively, it can be integrated with any Debian compatible backup software.

What data to back up

- The database

This is the most important data in the system. All subscriber and billing information, CDRs, user preferences, etc. are stored in the MySQL server. It is strongly recommended to have up-to-date dumps of all the databases on corresponding NGCP nodes.

- System configuration

The system configuration files such as `/etc/mysql/sipwise.cnf` and the `/etc/ngcp-config/` directory should be included in the backup as well. We suggest backing up the whole `/etc` folder.

- Exported CDRs (optional)

The `/home/jail/home/cdrexport` directory contains the exported CDRs. It depends on your call data retention policy whether or not to remove these files after exporting them to an external system.

The built-in backup solution

The sip:carrier comes with an easy-to-use solution that creates everyday backups of the most important data:

- The system configuration files. The whole /etc directory is backed up.
- Exported CDRs. The /home/jail/home/cdrexpert directory with csv files.
- All required databases on corresponding servers.

This functionality is disabled by default and can be enabled and configured in the backuptools subsection in the config.yml file. Please, refer to the “C.1.3 backup tools” section of the “NGCP configs overview” chapter for the backup configuration options.

Once you set the required configuration options, apply the changes:

```
ngcpcfg apply 'enabled the backup feature'  
ngcpcfg push all
```

Once you activate the feature, the sip:carrier will create backups in the off-peak time on the standby nodes and put them to the /var/backup/ngcp_backup directory. You can copy these files to your backup server using scp or ftp.

Note

make sure that you have enough free disk space to store the backups for the specified number of days.

16.6.2 Recovery

In the worst case scenario, when the system needs to be recovered from a total loss, you only need 4 steps to get the services back online:

- Install the sip:carrier as explained in chapter 2.
- Restore the /etc/ngcp-config/ directory and the /etc/mysql/sipwise.cnf file from the backup, overwriting your local files.
- Restore the database from the latest MySQL dump.
- Apply the changes to bring the original configuration into effect:

```
ngcpcfg apply 'restored the system from the backup'  
ngcpcfg push all
```

16.7 Reset database

To reset database to its original state you can use the script provided by CE: * Execute *ngcp-reset-db*. It will assign new unique password for the NGCP services and restart all services. IMPORTANT: All existing data will be wiped out without possibility of restoring.

16.8 System requirements and performance

The sip:carrier is a very flexible system, capable of serving from hundreds to several tens of thousands of subscribers in a single node. The system comes with a default configuration, capable of serving up to 50.000 subscribers in a *normal* environment. But there is no such thing as a *normal* environment. And the sip:carrier has sometimes to be tunned for special environments, special hardware requirements or just growing traffic.

Note

If you have performance issues with regards to disk I/O please consider enabling the *noatime* mount option for the root filesystem. Sipwise recommends the usage of *noatime*, though remove it if you use software which conflicts with its presence.

In this section some parameters will be explained to allow the sip:carrier administrator tune the system requirements for optimum performance.

Table 14: Requirement_options

Option	Default value	Requirement impact
cleanup→binlog_days	15	Heavy impact on the harddisk storage needed for mysql logs. It can help to restore the database from backups or restore broken replication.
database→bufferpoolsize	64MB	For test systems or low RAM systems, lowering this setting is one of the most effective ways of releasing RAM. The administrator can check the innodb buffer hit rate on production systems; a hit rate over 99% is desired to avoid bottlenecks.
kamailio→lb→pkg_mem	16	This setting affects the amount of RAM the system will use. Each kamailio-lb worker will have this amount of RAM reserved. Lowering this setting up to 8 will help to release some memory depending on the number of kamailio-lb workers running. This can be a dangerous setting as the lb process could run out of memory. Use with caution.
kamailio→lb→shm_mem	1/16 * Total System RAM	The installer will set this value to 1/16 of the total system RAM. This setting does not change even if the system RAM does so it's up to the administrator to tune it. It has been calculated that 1024 (1GB) is a good value for 50K subscriber environment. For a test environment, setting the value to 64 should be enough. "Out of memory" messages in the kamailio log can indicate that this value needs to be raised.
kamailio→lb→tcp_children	8	Number of TCP workers kamailio-lb will spawn per listening socket. The value should be fine for a mixed UDP-TCP 50K subscriber system. Lowering this setting can free some RAM as the number of kamailio processes would decrease. For a test system or a pure UDP subscriber system 2 is a good value. 1 or 2 TCP workers are always needed.
kamailio→lb→tls→enable	yes	Enable or not TLS signaling on the system. Setting this value to "no" will prevent kamailio to spawn TLS listening workers and free some RAM.
kamailio→lb→udp_children	8	See <i>kamailio→lb→tcp_children</i> explanation

Table 14: (continued)

Option	Default value	Requirement impact
<code>kamailio→proxy→children</code>	8	See <code>kamailio→lb→tcp_children</code> explanation. In this case the proxy only listens udp so these children should be enough to handle all the traffic. It could be set to 2 for test systems to lower the requirements.
<code>kamailio→proxy→*_expires</code>		Set the default and the max and min registration interval. The lower it is more REGISTER requests will be handled by the lb and the proxy. It can impact in the network traffic, RAM and CPU usage.
<code>kamailio→proxy→natping_interval</code>	30	Interval for the proxy to send a NAT keepalive OPTIONS message to the nated subscriber. If decreased, this setting will increase the number of OPTIONS requests the proxy needs to send and can impact in the network traffic and the number of natping processes the system needs to run. See <code>kamailio→proxy→natping_processes</code> explanation.
<code>kamailio→proxy→natping_processes</code>	7	Kamailio-proxy will spawn this number of processes to send keepalive OPTIONS to the nated subscribers. Each worker can handle about 250 messages/second (depends on the hardware). Depending the number of nated subscribers and the <code>kamailio→proxy→natping_interval</code> parameter the number of workers may need to be adjusted. The number can be calculated like $\text{nated_subscribers}/\text{natping_interval}/\text{pings_per_second_per_process}$. For the default options, assuming 50K nated subscribers in the system the parameter value would be $50.000/30/250 = (6,66) 7$ workers. 7 is the maximum number of processes kamailio will accept. Raising this value will cause kamailio not to start.
<code>kamailio→proxy→shm_mem</code>	1/16 * Total System RAM	See <code>kamailio→lb→shm_mem</code> explanation.
<code>rateomat→enable</code>	yes	Set this to no if the system shouldn't perform rating on the CDRs. This will save CPU usage.
<code>rsyslog→external_log</code>	0	If enabled, the system will send the log messages to an external server. Depending on the <code>rsyslog→external_loglevel</code> parameter this can increase dramatically the network traffic.
<code>rsyslog→ngcp_logs_preserve_days</code>	93	This setting will set the number of days ngcp logs under <code>/var/log/ngcp</code> will be kept in disk. Lowering this setting will free a high amount of disk space.

Tip

In case of using virtualized environment with limited amount of hardware resources, you can use the script `ngcp-toggle-performance-config` to adjust sip:carrier configuration for high/low performance:

```
root@spce:~# /usr/sbin/ngcp-toggle-performance-config
```

```

/usr/sbin/ngcp-toggle-performance-config - tool to adjust sip:provider configuration for ↵
    low/high performance

--help          Display this usage information
--high-performance Adjust configuration for system with normal/high performance
--low-performance Adjust configuration for system with low performance (e.g. VMs)

root@spce:~#

```

16.9 Troubleshooting

The sip:carrier platform provides detailed logging and log files for each component included in the system via rsyslog. The main folder for log files is `/var/log/ngcp/`, it contains a list of self explanatory log files named by component name.

The sip:carrier is a high performance system which requires compromise between traceability (maximum amount of debug information being written to hard drive) and productivity (minimum load on IO subsystem). This is the reason why different log levels are configured for the provided components by default.

Most log files are designed for debugging sip:carrier by Sipwise operational team while main log files for daily routine usage are:

Log file	Content	Estimated size
<code>/var/log/ngcp/api.log</code>	API logs providing type and content of API requests and responses as well as potential errors	medium
<code>/var/log/ngcp/panel.log</code> <code>/var/log/ngcp/panel-debug.log</code>	Admin Web UI logs when performing operational tasks on the ngcp-panel	medium

Log file	Content	Estimated size
/var/log/ngcp/cdr.log	mediation and rating logs, e.g. how many CDRs have been generated and potential errors in case of CDR generation or rating fails for particular accounting data	medium
/var/log/ngcp/ha.log	fail-over related logs in case a node in a pair loses connection to the other side, when a standby node takes over or an active node goes standby due to intra-node communication issues or external ping node connection issues	small
/var/log/ngcp/kamailio-proxy.log	Overview of SIP requests and replies between lb, proxy and sems processes. It's the main log file for SIP overview	huge

Log file	Content	Estimated size
<code>/var/log/ngcp/kamailio-lb.log</code>	Overview of SIP requests and replies along with network source and destination information flowing through the platform	huge
<code>/var/log/ngcp/sems.log</code>	Overview of SIP requests and replies between lb, proxy and sems processes	small
<code>/var/log/ngcp/rtp.log</code>	rtpengine related log, showing information about RTP communication	small

**Warning**

it is highly NOT recommended to change default log levels as it can cause system IO overloading which will affect call processing.

Note

the exact size of log files depend on system type, system load, system health status and system configuration, so cannot be estimated with high precision. Additionally operational network parameters like ASR and ALOC may impact the log files' size significantly.

16.9.1 Collecting call information from logs

The easiest way to fetch information about a single call among the log files is the search for the SIP CallID (a unique identifier for a SIP dialog). The call ID is used as call marker in almost all the voip related log file, such as `/var/log/ngcp/kamailio-lb.log` , `/var/log/ngcp/kamailio-proxy.log` , `/var/log/ngcp/sems.log` or `/var/log/ngcp/rtp.log`. Example of kamailio-proxy.log line:

```
Nov 19 00:35:56 sp1 proxy[7475]: NOTICE: <script>: New request on proxy - M=REGISTER R=sip: ←
sipwise.local
F=sip:jdoe@sipwise.local T=sip:jdoe@sipwise.local IP=10.10.1.10:5060 (127.0.0.1:5060) ID ←
=364e4676776621034977934e055d19ea@127.0.0.1 UA='SIP-UA 1.2.3.4'
```

The above line shows the SIP information you can find in a general line contained in `/var/log/ngcp/kamailio-*`:

- `M=REGISTER` : The SIP Method
- `R=sip:sipwise.local` : The SIP Request URI
- `F=sip:jdoe@sipwise.local` : The SIP From header
- `T=sip:jdoe@sipwise.local` : The SIP To header
- `IP=10.10.1.10:5060 (127.0.0.1:5060)` : The source IP where the message is coming from. Between brackets it is shown the local internal IP where the message come from (in this case Load Balancer)
- `ID=364e4676776621034977934e055d19ea@127.0.0.1` : The SIP CallID.
- `UAIP=10.10.1.10` : The User Agent source IP
- `UA=SIP-UA 1.2.3.4` : The SIP User Agent header

In order to collect the full log related to a single call, it's necessary to "grep" the `/var/log/ngcp/kamailio-proxy.log` using the `ID=` string, for example:

```
# grep "364e4676776621034977934e055d19ea@127.0.0.1" /var/log/ngcp/kamailio-proxy.log
```

16.9.2 Collecting SIP traces

The sip:carrier platform provides several tools to collect SIP traces. It can be used the sip:carrier `ngrep-sip` tool to collect SIP traces, for example to fetch traffic in text format from outbound and among load balancer, proxy and sems :

```
# ngrep-sip b
```

see the manual to know all the options:

```
# man ngrep-sip
```

The `ngrep` debian tool can be used in order to make a SIP trace and save it into a `.pcap` file :

```
# ngrep -s0 -Wbyline -d any -O /tmp/SIP_trace_file_name.pcap port 5062 or port 5060
```

The `sngrep` debian graphic tool as well can be used to visualize SIP trace and save them in a `.pcap` file :

```
# sngrep
```

17 Monitoring and Alerting

17.1 Internal Monitoring

The platform uses the internal *monit* service to monitor all essential services. Since the sip:carrier runs in an active/standby mode, not all services are always running on both nodes, some of them will only run on the active node and be stopped on the standby node. The following commands show the most critical services on the platform: `* monit summary` - to get the list of services and their current status, `* monit status` - to get the list of services with detailed status.



Important

When you perform a stop/start/monitor/unmonitor operation on a service, *monit* affects other services that depend on the initial one. Hence, if you stop or unmonitor a service all services that depend on it will be stopped or unmonitored as well.

For example, `monit stop mysql` operation will stop kamailio, sbc, asterisk, prosody and some other services.

If any service ever fails for whatever reason the *monit* daemon quickly restarts it. When that happens, the daemon will send a notification email to the address specified in the `config.yml` file under the `general.adminmail` key. It will also send warning emails to this address under certain abnormal conditions, such as high memory consumption (> 75% is used) or high CPU load.



Important

In order for *monit* to be able to send emails to the specified address, the local MTA (*exim4*) must be configured correctly. If you haven't done so already, run `dpkg-reconfigure exim4-config` to do this. The CE edition's handbook contains more information about this in the *Installation* chapter.

17.2 Statistics Dashboard

The platform's administration interface (described in Section 4) provides a simple graphical overview of the most important system health indicators, such as memory usage, load averages and disk usage. VoIP statistics, such as the number of concurrent active calls, the number of provisioned and registered subscribers, etc. is also present.

17.3 External Monitoring Using SNMP

17.3.1 Overview and Initial Setup

The sip:carrier exports a variety of cluster health data and statistics over the standard SNMP interface. By default, the SNMP interface can only be accessed locally. To make it possible to provide the SNMP data to an external system, the `config.yml` file needs to be edited and the list of allowed community names and allowed hosts/IP ranges must be populated. This list can be found under the `checktools.snmpd.communities` key and it consists of one or more `community/source` value pairs.

The `community` is the allowed community name, while `source` is an IP address or an IP block where to allow the requests from.

The `public` entry with the `localhost` source is used for local testing of SNMP functionality. It is recommended that you leave this entry in place. Other legal `sources` can be formed as single IP addresses or IP blocks in IP/prefix notation, for example `192.168.115.0/24`.

Tip

To locally check if SNMP is working correctly, execute the command `snmpwalk -v2c -cpublic localhost .` (note the trailing dot). This will generate a long list of raw SNMP OIDs and their values, provided that the `default` SNMP community key has been left in place.

Tip

SNMP version 1 and version 2c are supported.

17.3.2 Details

There are two types of information that can be retrieved from SNMP. The first one is the native NGCP cluster overview from the Sipwise MIBs (Management Information Bases). The second is the legacy ad-hoc information using the Net-SNMP extension OIDs, and detailed information for the node running the SNMP daemon using standard OIDs (Object Identifiers).

Sipwise NGCP OIDs

The entire NGCP cluster can be monitored by using the `SIPWISE-NGCP-MIB`, `SIPWISE-NGCP-MONITOR-MIB` and `SIPWISE-NGCP-STATS-MIB`. These OIDs are rooted at the Sipwise NGCP slot `.1.3.6.1.4.1.34274.1.*`.

The MIBs are self-documented, and can be found as part of the `ngcp-snmplib` package. The NGCP SNMP Agent is a part of the `ngcp-snmplib-agent` package, which when installed it should work out-of-the-box as long as the `snmpd` has been properly configured.

The `SIPWISE-NGCP-MIB` acts as the root MIB and provides information about the cluster licensing and layout (which is mostly static data about each node, such as node name, its IP address, its roles, etc.) and information required to access the OIDs from the other MIBs.

The `SIPWISE-NGCP-MONITOR-MIB` provides current monitoring information, global health conditions, the number of provisioned and registered subscribers and devices. It also provides per node information (independently of the number of nodes or their names) on their filesystem, processes, databases, system load, memory, heartbeat status, MTA queues, etc.

The `SIPWISE-NGCP-STATS-MIB` provides accumulated statistics on billing, performance and processed SIP messages.

NOTICE: OIDs under the following trees are not yet implemented: `ngcpMonitorFraud`, `ngcpMonitorPerformance.perfCAPSCurTable` and `ngcpStats`.

Tip

The NGCP SNMP Agent uses *Redis* and the *collectd* RRD files as data sources. This data is essential for accurate and complete monitoring data in the SNMP OID tree. In addition, the *Redis* database must be available on a shared IP address, so that *collectd* can always write to it. Otherwise, *collectd* may not work correctly or even crash.

Legacy OIDs

Note

The following OIDs have been superseded by the Sipwise NGCP OIDs, but they are still provided for backwards compatibility.

All basic system health variables (such as memory, disk, swap, CPU usage, network statistics, process lists, etc.) for the *mgmt_node* can be found in standard OID slots from standard MIBs. For example, memory statistics can be found through the UCD-SNMP-MIB in OIDs such as `memTotalSwap.0`, `memAvailSwap.0`, `memTotalReal.0`, `memAvailReal.0`, etc., which translate to numeric OIDs `.1.3.6.1.4.1.2021.4.*`. In fact, UCD-SNMP-MIB is the most useful MIB for overall system health checks.

Additionally, there's a list of specially monitored processes, also found through the UCD-SNMP-MIB. `UCD-SNMP-MIB::prNames(.1.3.6.1.4.1.2021.2.1.2)` gives the list of monitored processes, `prCount(.1.3.6.1.4.1.2021.2.1.5)` is how many of each process are running and `prErrorFlag(.1.3.6.1.4.1.2021.2.1.100)` gives a 0/1 error indication (with `prErrorMessage(.1.3.6.1.4.1.2021.2.1.101)` providing an explanation of any error).

Tip

Some of these processes are not supposed to be running on the standby node, so you'll see the error flag raised there. A possible solution is to run these SNMP checks against the shared service IP of the cluster.

Furthermore, UCD-SNMP-MIB provides a list of custom external checks. The names of these can be found under the `UCD-SNMP-MIB::extNames(.2)` tree, with `extOutput(.101)` providing the output (one line) from each check and `extResult(.100)` the exit code from each check.

The first of these external checks called `collective_check` provides a combined and overall system health status indicator. It gathers information from both nodes and returns 0 in `extResult.1(.100.1)` if everything is OK and running as it should. If it finds a problem somewhere, but with the system still operational (e.g. a service is stopped on the inactive node), `extResult.1` will return 1 and `extOutput.1` will be set to a string that can be used to diagnose the problem. In case the system is found in a critical and non-operational state, `extResult.1` will return 2, again with an error message set. If you want to keep it really simple, you can just monitor this one OID and raise an alarm if it ever goes to non-zero.

Tip

The 0/1/2 status codes allow for easy integration with *Nagios*.

The remaining external checks simply return statistics on the system, they all return a number in `extOutput` and have `extResult` always set to zero.

The full list of such checks is below. All of these checks have three modes: the first returns the statistics from *sp1* (the first node in the *sip:carrier* pair), the second - from *sp2*, and the third - from whichever node is being queried (which is useful when querying the shared service IP). For example, the local SIP response time from *sp1* is in *sip_check_sp1*, from *sp2* - is in *sip_check_sp2*, and from the host itself - is in *sip_check_self*.

The base OID of the Result and Output OIDs is always `.1.3.6.1.4.1.2021.8.1`, so if you read `.100.1`, the full OID is `.1.3.6.1.4.1.2021.8.1.100.1`.

Name in MIB	Result OID	Output OID	Name	Description
UCD-SNMP-MIB::extNames.1	.100.1	.101.1	collective_check	Summarized platform check
UCD-SNMP-MIB::extNames.2	.100.2	.101.2	sip_check_sp1	SIP response time in seconds on sp1
UCD-SNMP-MIB::extNames.3	.100.3	.101.3	sip_check_sp2	SIP response time in seconds on sp2
UCD-SNMP-MIB::extNames.4	.100.4	.101.4	mysql_check_sp1	Average number of MySQL queries per second on sp1
UCD-SNMP-MIB::extNames.5	.100.5	.101.5	mysql_check_sp2	Average number of MySQL queries per second on sp2
UCD-SNMP-MIB::extNames.6	.100.6	.101.6	mysql_replication_check_sp1	MySQL replication delay in seconds on sp1
UCD-SNMP-MIB::extNames.7	.100.7	.101.7	mysql_replication_check_sp2	MySQL replication delay in seconds on sp2
UCD-SNMP-MIB::extNames.8	.100.8	.101.8	mpt_check_sp1	RAID status on sp1
UCD-SNMP-MIB::extNames.9	.100.9	.101.9	mpt_check_sp2	RAID status on sp2
UCD-SNMP-MIB::extNames.10	.100.10	.101.10	exim_queue_check_sp1	Number of mails undelivered in MTA queue on sp1
UCD-SNMP-MIB::extNames.11	.100.11	.101.11	exim_queue_check_sp2	Number of mails undelivered in MTA queue on sp2
UCD-SNMP-MIB::extNames.12	.100.12	.101.12	provisioned_subscribers_number_sp1	Number of subscribers provisioned on sp1
UCD-SNMP-MIB::extNames.13	.100.13	.101.13	provisioned_subscribers_number_sp2	Number of subscribers provisioned on sp2
UCD-SNMP-MIB::extNames.14	.100.14	.101.14	kam_dialog_active_checks_sp1	Number of active calls on sp1

Name in MIB	Result OID	Output OID	Name	Description
UCD-SNMP-MIB::extNames.15	.100.15	.101.15	kam_dialog_active_checks	Number of active calls on sp2
UCD-SNMP-MIB::extNames.16	.100.16	.101.16	kam_dialog_early_checks	Number of calls in Early Media state on sp1
UCD-SNMP-MIB::extNames.17	.100.17	.101.17	kam_dialog_early_checks	Number of calls in Early Media state on sp2
UCD-SNMP-MIB::extNames.18	.100.18	.101.18	kam_dialog_type_local_checks	Number of active calls local on sp1
UCD-SNMP-MIB::extNames.19	.100.19	.101.19	kam_dialog_type_local_checks	Number of active calls local on sp2
UCD-SNMP-MIB::extNames.20	.100.20	.101.20	kam_dialog_type_relay_checks	Number of active calls routed via peers on sp1
UCD-SNMP-MIB::extNames.21	.100.21	.101.21	kam_dialog_type_relay_checks	Number of active calls routed via peers on sp2
UCD-SNMP-MIB::extNames.22	.100.22	.101.22	kam_dialog_type_incoming	Number of incoming calls on sp1
UCD-SNMP-MIB::extNames.23	.100.23	.101.23	kam_dialog_type_incoming	Number of incoming calls on sp2
UCD-SNMP-MIB::extNames.24	.100.24	.101.24	kam_dialog_type_outgoing	Number of outgoing calls on sp1
UCD-SNMP-MIB::extNames.25	.100.25	.101.25	kam_dialog_type_outgoing	Number of outgoing calls on sp2
UCD-SNMP-MIB::extNames.26	.100.26	.101.26	kam_usrloc_regusers_checks	Number of subscribers with at least one active registration on sp1
UCD-SNMP-MIB::extNames.27	.100.27	.101.27	kam_usrloc_regusers_checks	Number of subscribers with at least one active registration on sp2
UCD-SNMP-MIB::extNames.28	.100.28	.101.28	kam_usrloc_regdevices	Total number of registered end devices on sp1
UCD-SNMP-MIB::extNames.29	.100.29	.101.29	kam_usrloc_regdevices	Total number of registered end devices on sp2
UCD-SNMP-MIB::extNames.30	.100.30	.101.30	mysql_replication_discrepancies	Number of MySQL tables not in sync between sp1 and sp2

Name in MIB	Result OID	Output OID	Name	Description
UCD-SNMP-MIB::extNames.31	.100.31	.101.31	mysql_replication_discrepancy	Number of MySQL tables not in sync between sp1 and sp2
UCD-SNMP-MIB::extNames.32	.100.32	.101.32	sip_check_self	Summarized platform check on active node
UCD-SNMP-MIB::extNames.33	.100.33	.101.33	mysql_check_self	Average number of MySQL queries per second on active node
UCD-SNMP-MIB::extNames.34	.100.34	.101.34	mysql_replication_delay	MySQL replication delay in seconds on active node
UCD-SNMP-MIB::extNames.35	.100.35	.101.35	mpt_check_self	RAID status on active node
UCD-SNMP-MIB::extNames.36	.100.36	.101.36	exim_queue_check_self	Number of mails undelivered in MTA queue on active node
UCD-SNMP-MIB::extNames.37	.100.37	.101.37	provisioned_subscribers	Number of subscribers provisioned on active node
UCD-SNMP-MIB::extNames.44	.100.44	.101.44	kam_usrloc_regusers_check	Number of subscribers with at least one active registration on active node
UCD-SNMP-MIB::extNames.45	.100.45	.101.45	kam_usrloc_regdevices	Total number of registered end devices on active node
UCD-SNMP-MIB::extNames.46	.100.46	.101.46	mysql_replication_discrepancy	Number of MySQL tables not in sync between sp1 and sp2
UCD-SNMP-MIB::extNames.47	.100.47	.101.47	kam_dialog_type_local	Number of active local calls on active proxy X
UCD-SNMP-MIB::extNames.48	.100.48	.101.48	kam_dialog_type_relay	Number of active calls routed via peers on active proxy X
UCD-SNMP-MIB::extNames.49	.100.49	.101.49	kam_dialog_type_incoming	Number of incoming calls on active proxy X

Name in MIB	Result OID	Output OID	Name	Description
UCD-SNMP-MIB::extNames.50	.100.50	.101.50	kam_dialog_type_outgoing	Number of outgoing calls on active proxy X
UCD-SNMP-MIB::extNames.51	.100.51	.101.51	kam_dialog_active_checks	Number of active calls on active proxy X
UCD-SNMP-MIB::extNames.52	.100.52	.101.52	kam_dialog_early_checks	Number of calls in Early Media state on active proxy X

Tip

Some of the checks can be disabled (most are enabled by default) through the `config.yml` file, and those checks will then return an error message or an empty string in their `extOutput`. Enable those checks in the config file to get their output in the SNMP OID tree. The enable/disable flags can be found in the `checktools` section.

A Cloud PBX

The sip:carrier comes with a commercial Cloud PBX module to provide B2B features for small and medium sized enterprises. The following chapters describe the configuration of the PBX features.

A.1 Configuring the Device Management

The *Device Management* is used by admins and resellers to define the list of device models, firmwares and configurations available for end customer usage. These settings are pre-configured for the default reseller up-front by Sipwise and have to be set up for every reseller separately, so a reseller can choose the devices he'd like to serve and potentially tweak the configuration for them. [List of available pre-configured devices](#) Section A.8.

End customers choose from a list of *Device Profiles*, which are defined by a specific *Device Model*, a list of *Device Firmwares* and a *Device Configuration*. The following sections describe the setup of these components.

To do so, go to *Settings*→*Device Management*.

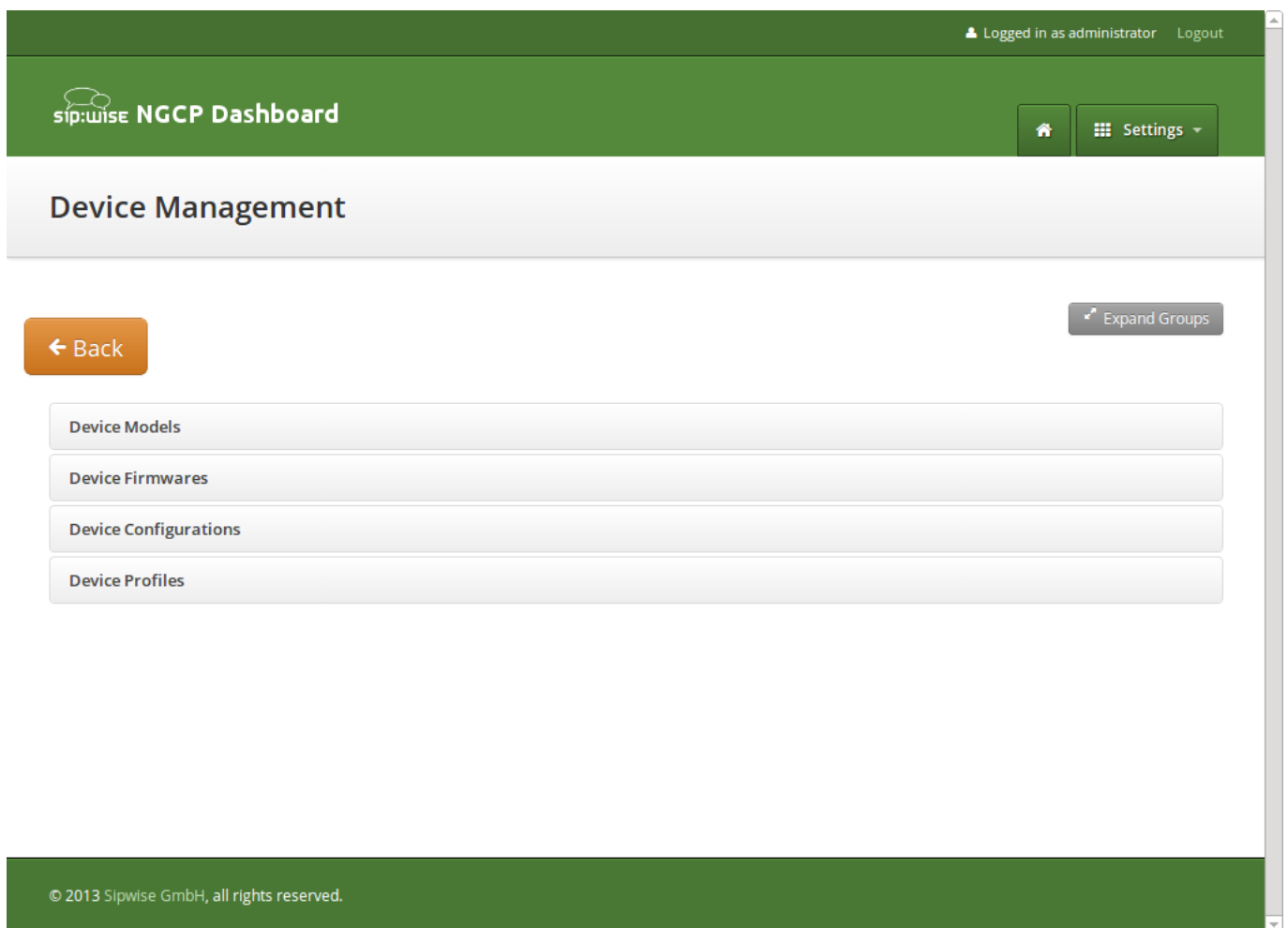


Figure 12: Device Management

A.1.1 Setting up Device Models

A *Device Model* defines a specific hardware device, like the vendor, model name, the number of keys and their capabilities. For example a Cisco SPA504G has 4 keys, which can be used for private lines, shared lines (SLA) and busy lamp field (BLF). If you have an additional attendant console, you get 32 more buttons, which can only do BLF.

In this example, we will create a Cisco SPA504G with an additional Attendant Console.

Expand the *Device Models* row and click *Create Device Model*.

First, you have to select the reseller this device model belongs to, and define the vendor and model name.

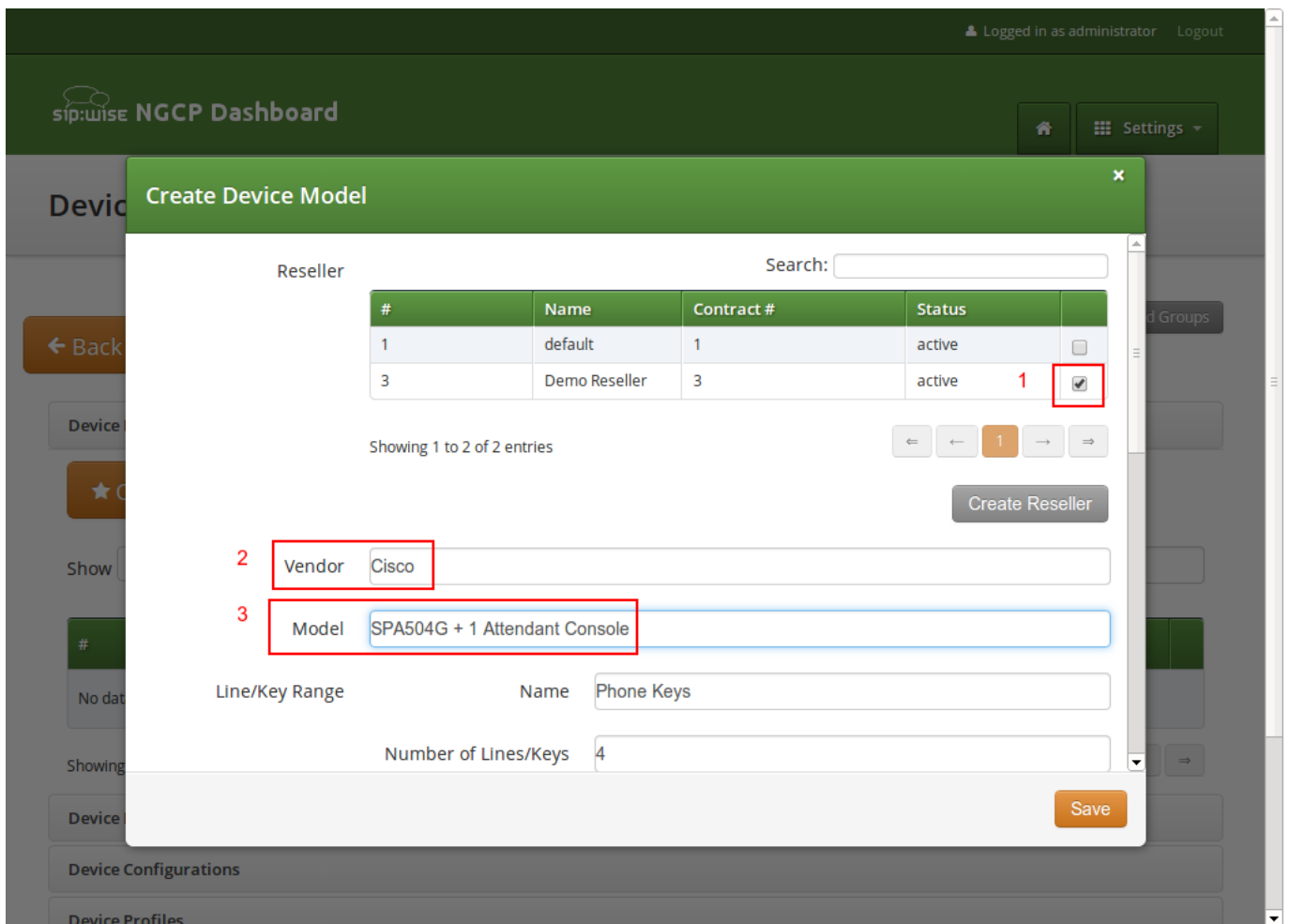


Figure 13: Create Device Model Part 1

In the *Line/Key Range* section, you can define the first set of keys, which we will label *Phone Keys*. The name is important, because it is referenced in the configuration file template, which is described in the following sections. The SPA504G internal phone keys support private lines (where the customer can assign a normal subscriber, which is used to place and receive standard phone calls), shared lines (where the customer can assign a subscriber which is shared across multiple people) and busy lamp field (where the customer can assign other subscribers to be monitored when they get a call, and which also acts as speed dial button to the subscriber assigned for BLF), so we enable all 3 of them.

The screenshot shows the 'Create Device Model' dialog in the NGCP Dashboard. The form is for a Cisco SPA504G + 1 Attendant Console. The 'Line/Key Range' is set to 4, and the 'Name' is 'Phone Keys'. Below this, there are three checked options: 'Supports Private Line', 'Supports Shared Line', and 'Supports Busy Lamp Field'. The 'Number of Lines/Keys' is set to 4. There are 'Remove' and 'Save' buttons at the bottom right of the form.

Figure 14: Create Device Model Part 2

In order to also configure the attendant console, press the *Add another Line/Key Range* button to specify the attendant console keys.

Again provide a name for this range, which will be `Attendant Console 1` to match our configuration defined later. There are 32 buttons on the attendant console, so set the number accordingly. Those 32 buttons only support BLF, so make sure to **uncheck** the private and shared line options, and only check the `busy lamp field` option.

The screenshot shows the 'Create Device Model' form in the NGCP Dashboard. The form is titled 'Create Device Model' and has a close button (X) in the top right. It contains several fields: 'Name' with the value 'Attendant Console 1', 'Number of Lines/Keys' with the value '32', 'Supports Private Line' (checkbox), 'Supports Shared Line' (checkbox), and 'Supports Busy Lamp Field' (checkbox checked). There are 'Remove', 'Add another Line/Key Range', and 'Save' buttons. The background shows the dashboard with 'Device' and 'Settings' menus.

Figure 15: Create Device Model Part 3

The last two settings to configure are the *Front Image* and *MAC Address Image* fields. Upload a picture of the phone here in the first field, which is shown to the customer for him to recognize easily how the phone looks like. The MAC image is used to tell the customer where he can read the MAC address from. This could be a picture of the back of the phone with the label where the MAC is printed, or an instruction image how to get the MAC from the phone menu.

The rest of the fields are left at their default values, which are set to work with Cisco SPAs. Their meaning is as follows:

- *Bootstrap Sync URI*: If a stock phone is plugged in for the first time, it needs to be provisioned somehow to let it know where to fetch its configuration file from. Since the stock phone doesn't know about your server, you have to define an HTTP URI here, where the customer is connected with his web browser to set the according field.
- *Bootstrap Sync HTTP Method*: This setting defines whether an HTTP GET or POST is sent to the Sync URI.
- *Bootstrap Sync Params*: This setting defines the parameters appended to the Sync URI in case of a GET, or posted in the request body in case of POST, when the customer presses the *Sync* button later on.

Finally press *Save* to create the new device model.

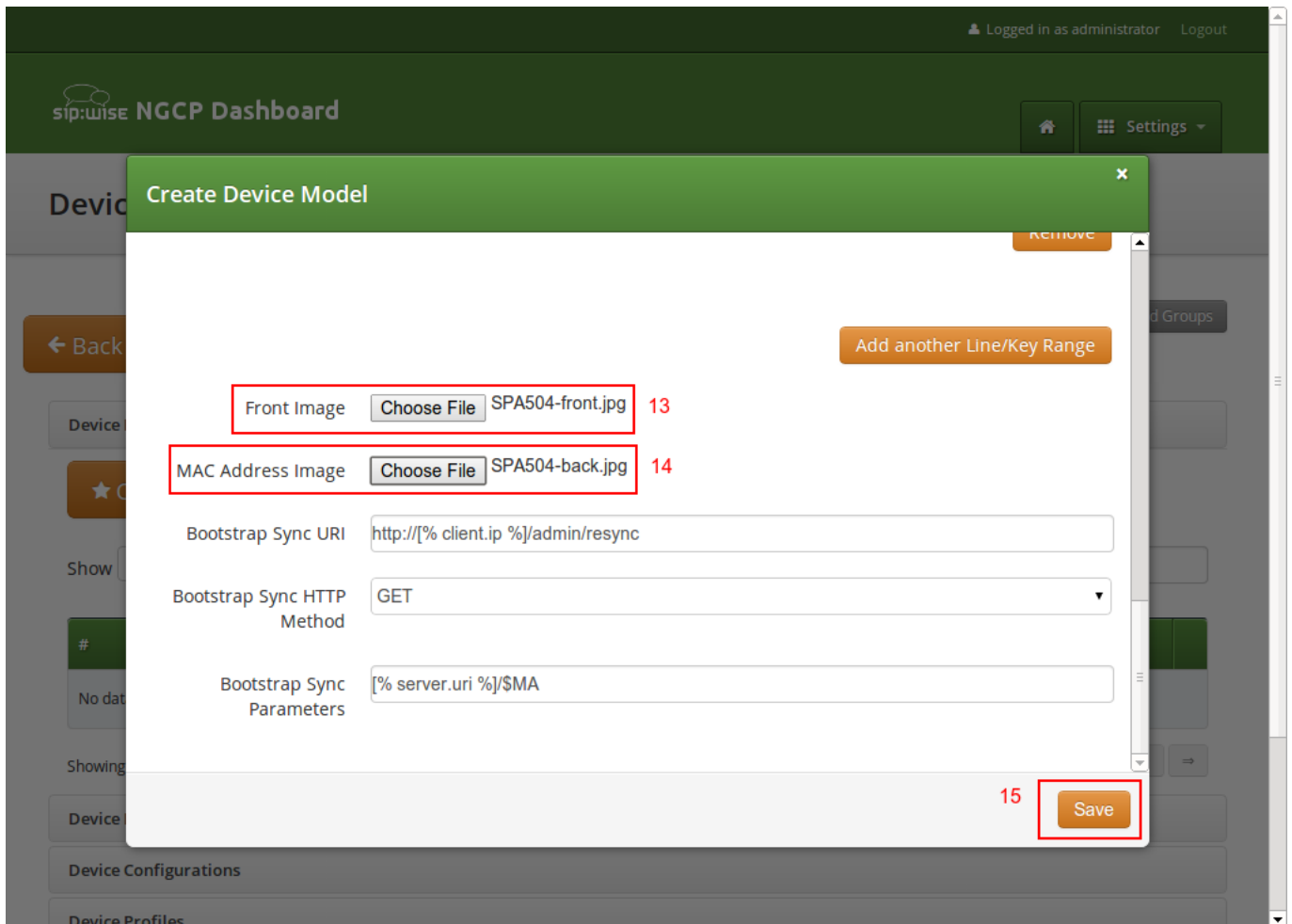


Figure 16: Create Device Model Part 4

A.1.2 Uploading Device Firmwares

A device model can optionally have one or more device firmware(s). Some devices like the Cisco SPA series don't support direct firmware updates from an arbitrary to the latest one, but need to go over specific firmware steps. In the device configuration discussed next, you can return the *next* supported firmware version, if the phone passes the current version in the firmware URL.

Since a stock phone purchased from any shop can have an arbitrary firmware version, we need to upload all firmwares needed to get from any old one to the latest one. In case of the Cisco SPA3x/SPA5x series, that would be the following versions, if the phone starts off with version 7.4.x:

- spa50x-30x-7-5-1a.bin
- spa50x-30x-7-5-2b.bin
- spa50x-30x-7-5-5.bin

So to get an SPA504G with a firmware version 7.4.x to the latest version 7.5.5, we need to upload each firmware file as follows.

Open the *Device Firmware* row in the *Device Management* section and press *Upload Device Firmware*.

Select the device model we're going to upload the firmware for, then specify the firmware version and choose the firmware file, then press *Save*.

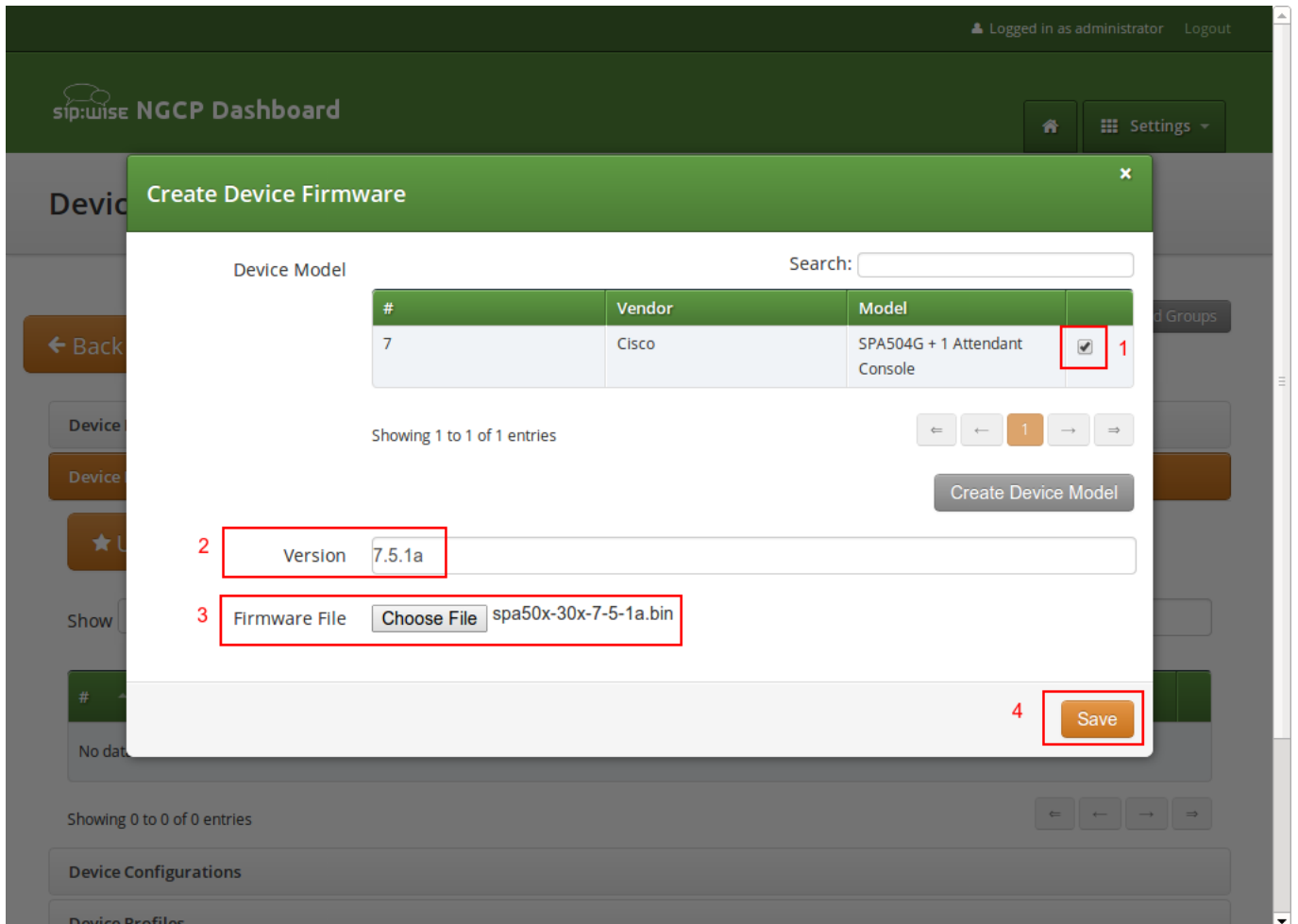


Figure 17: Upload Device Firmware

Repeat this step for every firmware in the list above (and any new firmware you want to support when it's available).

A.1.3 Creating Device Configurations

Each customer device needs a configuration file, which defines the URL to perform firmware updates, and most importantly, which defines the subscribers and features configured on each of the lines and keys. Since these settings are different for each physical phone at all the customers, the Cloud PBX module provides a template system to specify the configurations. That way, template variables can be used in the generic configuration, which are filled in by the system individually when a physical device fetches its configuration file.

To upload a configuration template, open the *Device Configuration* row and press *Create Device Configuration*.

Select the device model and specify a version number for this configuration (it is only for your reference to keep track of different

versions). For Cisco SPA phones, keep the *Content Type* field to `text/xml`, since the configuration content will be served to the phone as XML file.

For devices other than the Cisco SPA, you might set `text/plain` if the configuration file is plain text, or `application/octet-stream` if the configuration is compiled into some binary form.

Finally paste the configuration template into the *Content* area and press *Save*.

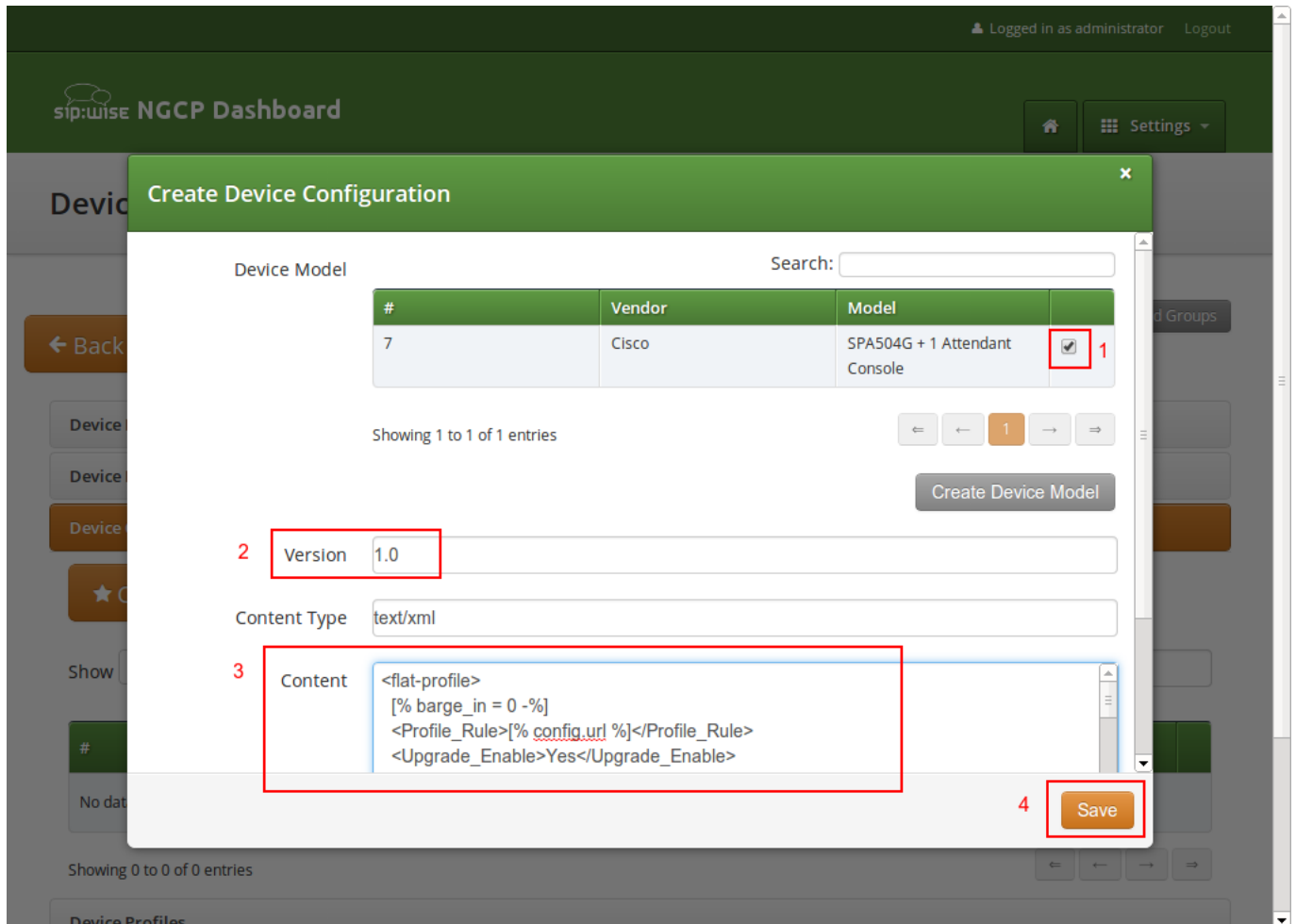


Figure 18: Upload Device Configuration

The templates for certified device models are provided by Sipwise, but you can also write your own. The following variables can be used in the template:

- `config.url`: The URL to the config file, including the device identifier (e.g. `http://sip.example.org:1444/device/autoprov/config/001122334455`).
- `firmware.maxversion`: The latest firmware version available on the system for the specific device.
- `firmware.baseurl`: The base URL to download firmwares (e.g. `http://sip.example.org:1444/device/autoprov/firmware`). To fetch the next newer firmware for a Cisco SPA, you can use the template line `[% firmware.baseurl %]/$MA/from/$SWVER/next`.

- `phone.stationname`: The name of the station (physical device) the customer specifies for this phone. Can be used to show on the display of the phone.
- `phone.lineranges`: An array of lines/keys as specified for the device model. Each entry in the array has the following keys:
 - `name`: The name of the line/key range as specified in the *Device Model* section (e.g. `Phone Keys`).
 - `num_lines`: The number of lines/keys in the line range (e.g. 4 in our `Phone Keys` example, or 32 in our `Attendant Console 1` example).
 - `lines`: An array of lines (e.g. subscriber definitions) for this line range. Each entry in the array has the following keys:
 - * `keynum`: The index of the key in the line range, starting from 0 (e.g. `keynum` will be 3 for the 4th key of our `Phone Keys` range).
 - * `rangenum`: The index of the line range, starting from 0. The order of line ranges is as you have specified them (e.g. `Phone Keys` was specified first, so it gets `rangenum 0`, `Auto Attendant 1` gets `rangenum 1`).
 - * `type`: The type of the line/key, on of `private`, `shared` or `blf`.
 - * `username`: The SIP username of the line.
 - * `domain`: The SIP domain of the line.
 - * `password`: The SIP password of the line.
 - * `displayname`: The SIP Display Name of the line.

Within the configuration template itself, you can use any Template Toolkit directive and any own variables you like (just make sure to not override any of the ones specified above). For documentation on the syntax, please refer to the [Template Toolkit Manual](#).

Tip

In order to change the provisioning base IP and port (default 1444), you have to access `/etc/ngcp-config/config.yml` and change the value `host` and `port` under the `autoprov.server` section.

A.1.4 Creating Device Profiles

When the customer configures his own device, he doesn't select a *Device Model* directly, but a *Device Profile*. A device profile specifies which model is going to be used with which configuration version. This allows the operator to create new configuration files and assign them to a profile, while still keeping older configuration files for reference or roll-back scenarios. It also makes it possible to test new firmwares by creating a test device model with the new firmware and a specific configuration, without impacting any existing customer devices.

To create a *Device Profile* for our phone, open the *Device Profile* row in the *Device Management* section and press *Create Device Profile*.

Select the device configuration (which implicitly identifies a device model) and specify a *Profile Name*. This name is what the customer sees when he is selecting a device he wants to provision, so pick a descriptive name which clearly identifies a device. Press *Save* to create the profile.

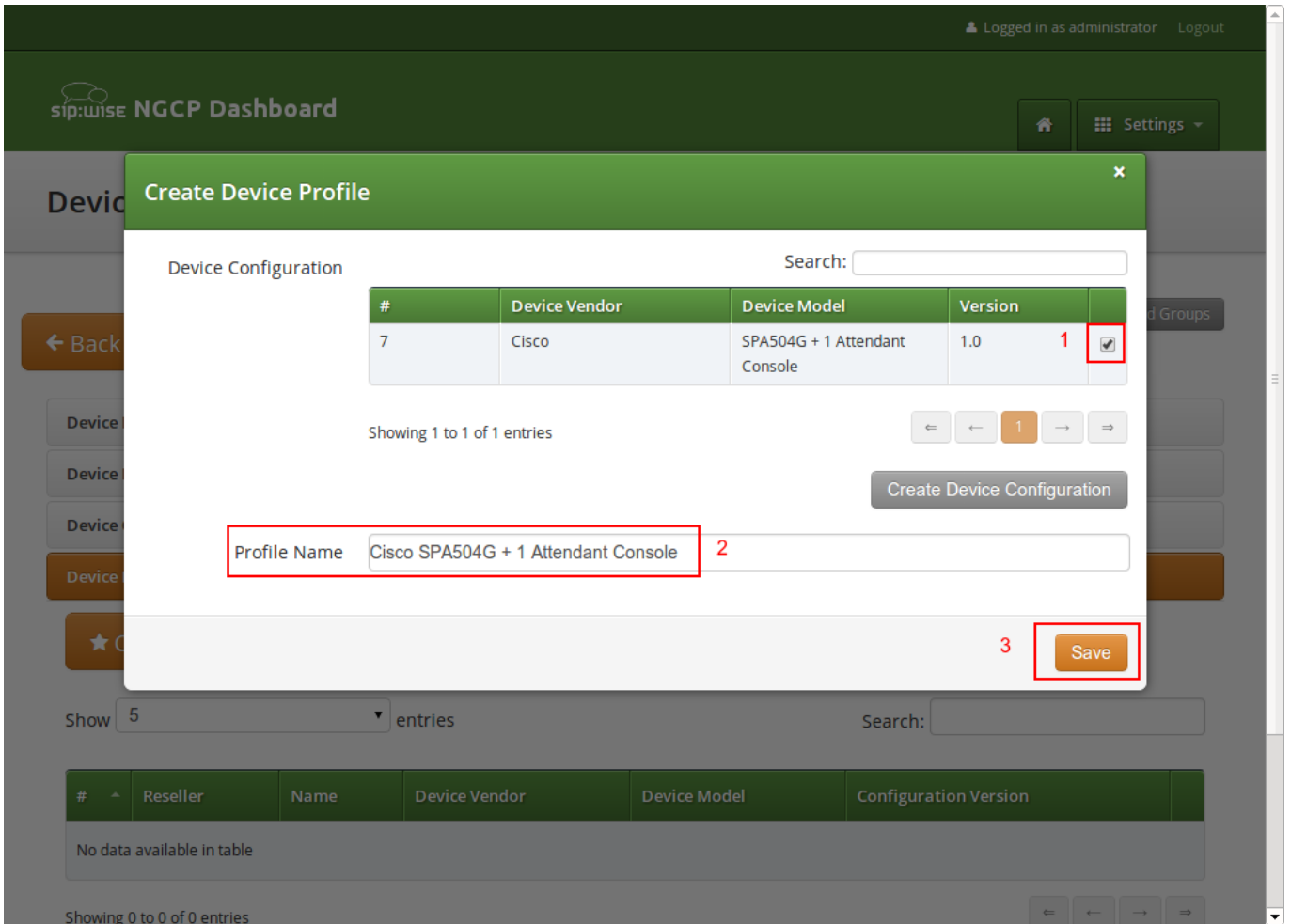


Figure 19: Create Device Profile

Repeat the steps as needed for every device you want to make available to customers.

A.2 Preparing PBX Rewrite Rules

In a PBX environment, the dial-plans usually looks different than for normal SIP subscribers. PBX subscribers should be able to directly dial internal extensions (e.g. 100) instead of the full number to reach another PBX subscriber in the same PBX segment. Therefore, we need to define specific *Rewrite Rules* to make this work.

The PBX dial plans are different from country to country. In the Central European area, you can directly dial an extension (e.g. 100), and if you want to dial an international number like 0049 1 23456, you have to dial a break-out digit first (e.g. 0), so the number to be dialed is 0 0049 1 23456. Other countries are used to other break-out codes (e.g. 9), which then results in 9 0049 1 23456. If you dial a national number like 01 23456, then the number to actually be dialed is 9 01 23456.

Since all numbers must be normalized to E.164 format via inbound rewrite rules, the rules need to be set up accordingly.

Let's assume that the break-out code for the example customers created below is 0, so we have to create a *Rewrite Rule Set* with the following rules.

A.2.1 Inbound Rewrite Rules for Caller

- **Match Pattern:** `^([1-9][0-9]+)$`
- **Replacement Pattern:** `${caller_cloud_pbx_base_cli}\1`
- **Description:** extension to e164
- **Direction:** Inbound
- **Field:** Caller

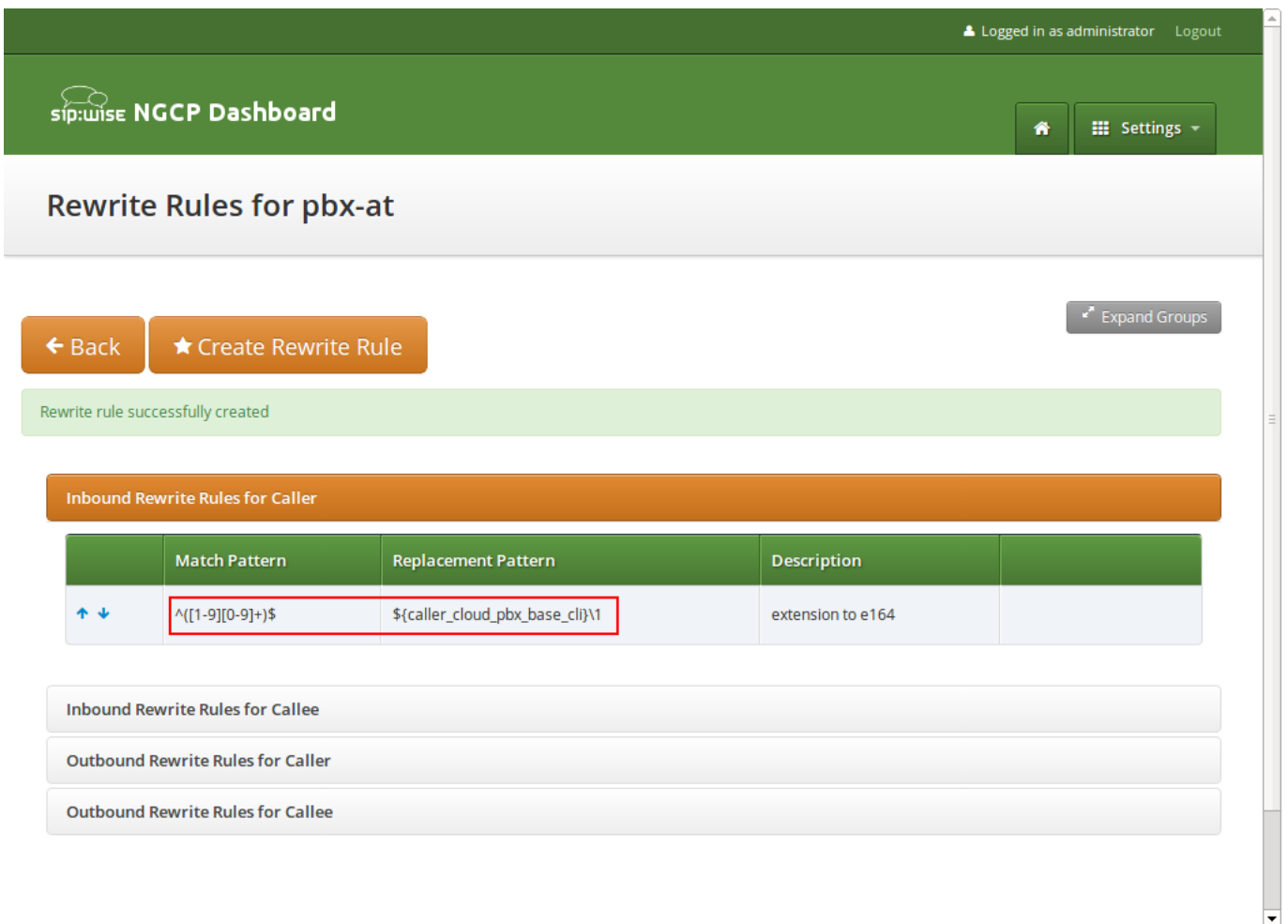


Figure 20: Inbound Rewrite Rule for Caller

A.2.2 Inbound Rewrite Rules for Callee

These rules are the most important ones, as they define which number formats the PBX subscribers can dial. For the break-out code of 0, the following rules are necessary e.g. for German dialplans to allow pbx internal extension dialing, local area calls without area codes, national calls with area code, and international calls with country codes.

PBX INTERNAL EXTENSION DIALIN

- **Match Pattern:** `^([1-9][0-9]+)$`
- **Replacement Pattern:** `${caller_cloud_pbx_base_cli}\1`
- **Description:** extension to e164
- **Direction:** Inbound
- **Field:** Callee

LOCAL DIALING WITHOUT AREA CODE (USE BREAK-OUT CODE 0)

- **Match Pattern:** `^0([1-9][0-9]+)$`
- **Replacement Pattern:** `${caller_cc}${caller_ac}\1`
- **Description:** local to e164
- **Direction:** Inbound
- **Field:** Callee

NATIONAL DIALING (USE BREAK-OUT CODE 0 AND PREFIX AREA CODE BY 0)

- **Match Pattern:** `^00([1-9][0-9]+)$`
- **Replacement Pattern:** `${caller_cc}\1`
- **Description:** national to e164
- **Direction:** Inbound
- **Field:** Callee

INTERNATIONAL DIALING (USE BREAK-OUT CODE 0 AND PREFIX COUNTRY CODE BY 00)

- **Match Pattern:** `^000([1-9][0-9]+)$`
- **Replacement Pattern:** `\1`
- **Description:** international to e164
- **Direction:** Inbound
- **Field:** Callee

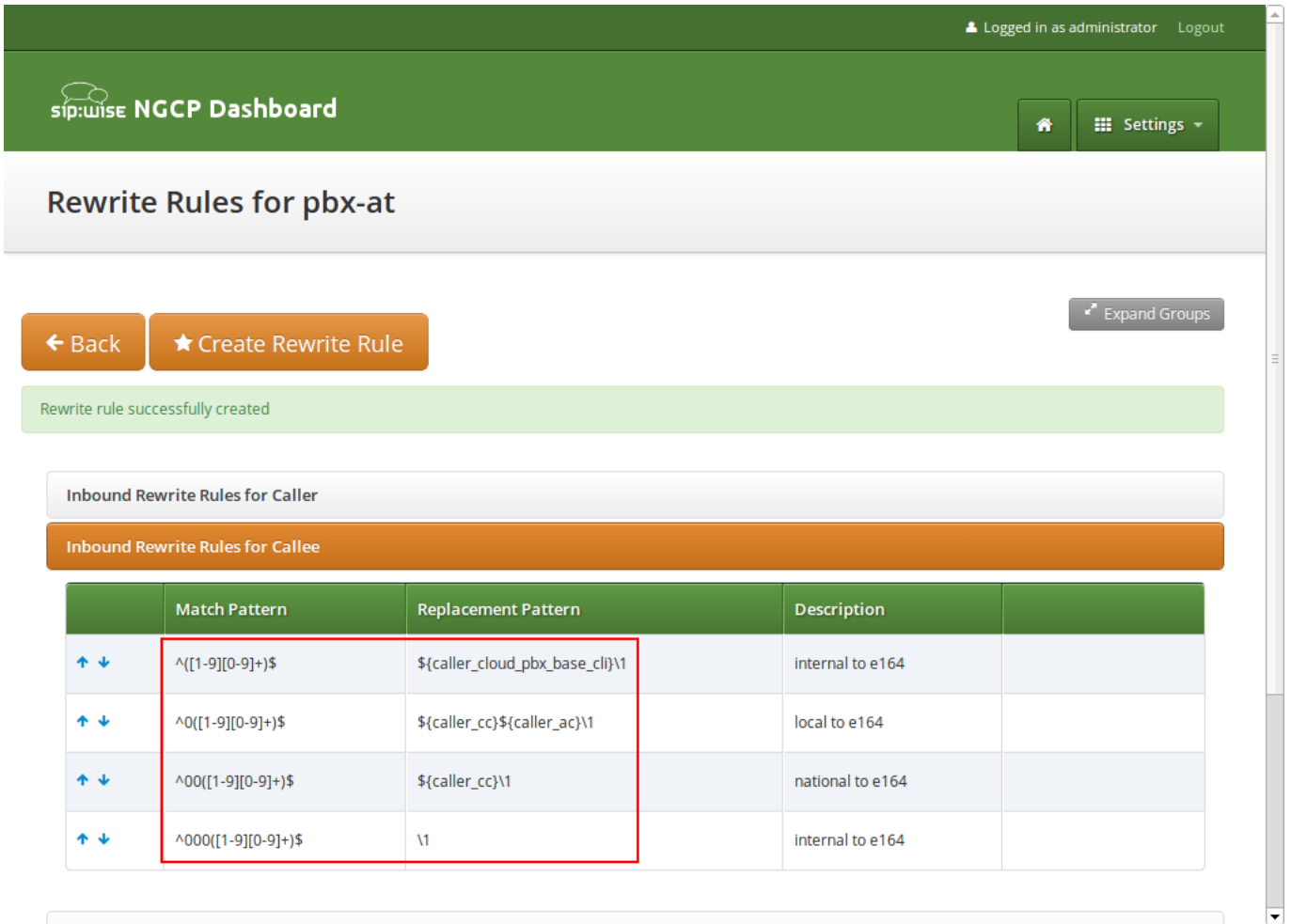


Figure 21: Inbound Rewrite Rule for Callee

A.2.3 Outbound Rewrite Rules for Caller

When a call goes to a PBX subscriber, it needs to be normalized in a way that it's call-back-able, which means that it needs to have the break-out code prefixed. We create a rule to show the calling number in international format including the break-out code. For PBX-internal calls, the caller name will be shown (this is handled by implicitly setting domain preferences accordingly, so you don't have to worry about that in rewrite rules).

ADDING A BREAK-OUT CODE (USE BREAK-OUT CODE 0 AND PREFIX COUNTRY CODE BY 00)

- **Match Pattern:** `^([1-9][0-9]+)$`
- **Replacement Pattern:** `000\1`
- **Description:** e164 to full international
- **Direction:** Outbound
- **Field:** Caller

DISPLAYING THE EXTENSION IN THE CALLER NUMBER FOR PBX-INTERNAL CALLS

- **Match Pattern:** `^@{callee_cloud_pbx_account_cli_list}$`
- **Replacement Pattern:** `${caller_cloud_pbx_ext}`
- **Description:** e164 to full international
- **Direction:** Outbound
- **Field:** Caller

	Match Pattern	Replacement Pattern	Description	Enabled	
↑ ↓	<code>^@{callee_cloud_pbx_account_cli_list}\$</code>	<code>\${caller_cloud_pbx_ext}</code>	Intra-PBX to extension	yes	
↑ ↓	<code>^[[1-9][0-9]+\$</code>	0001	e164 to full international	yes	

Figure 22: Outbound Rewrite Rule for Caller

Create a new *Rewrite Rule Set* for each dial plan you'd like to support. You can later assign it to customer domains and even to subscribers, if a specific subscriber of a PBX customer would like to have his own dial plan.

A.3 Creating Customers and Pilot Subscribers

As with a normal SIP Account, you have to create a *Customer* contract per customer, and one *Subscriber*, which the customer can use to log into the web interface and manage his PBX environment.

A.3.1 Creating a PBX Customer

Go to *Settings*→*Customers* and click *Create Customer*. We need a *Contact* for the customer, so press *Create Contact*.

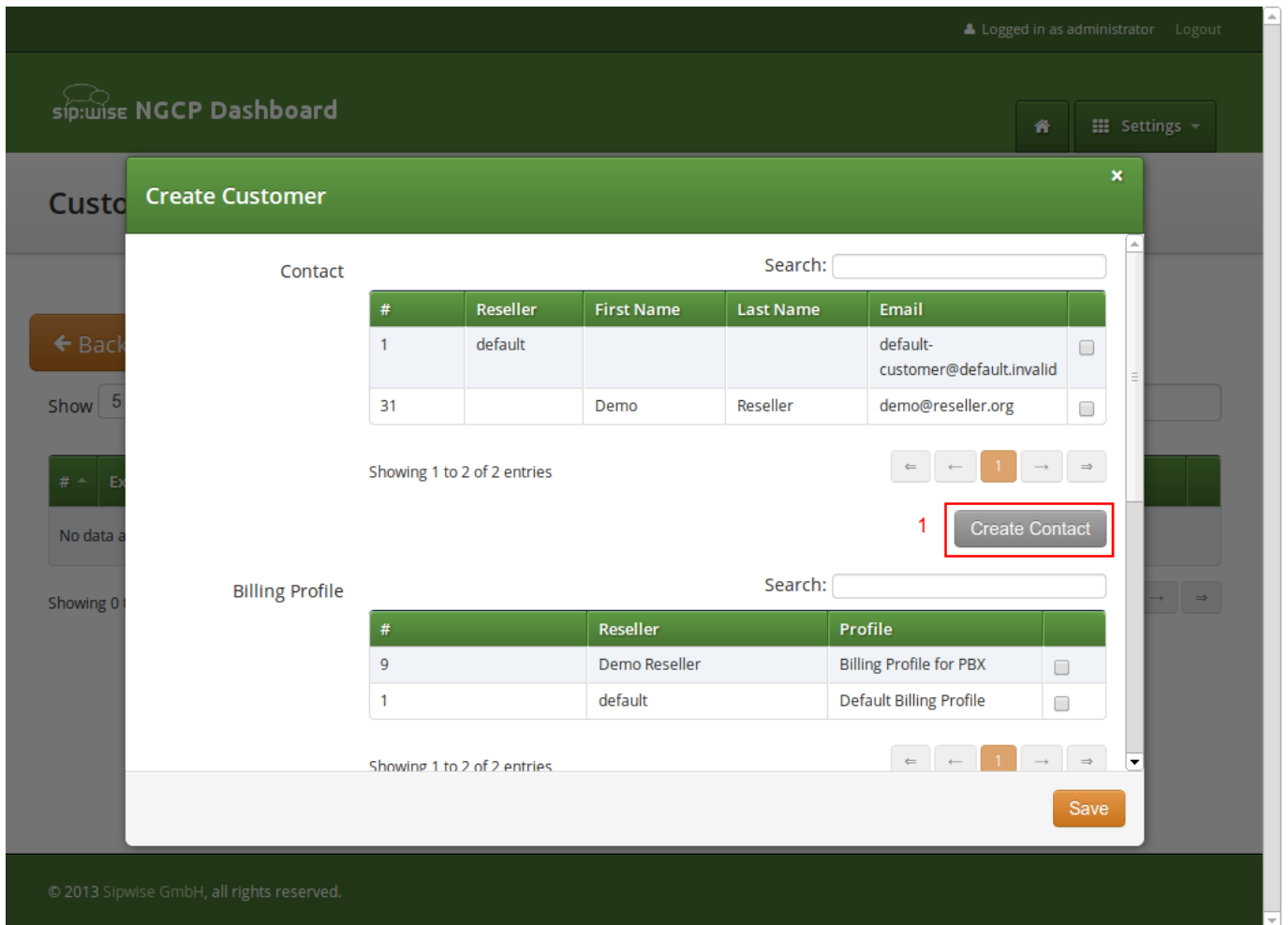


Figure 23: Create PBX Customer Part 1

Fill in the desired fields (you need to provide at least the *Email Address*) and press *Save*.

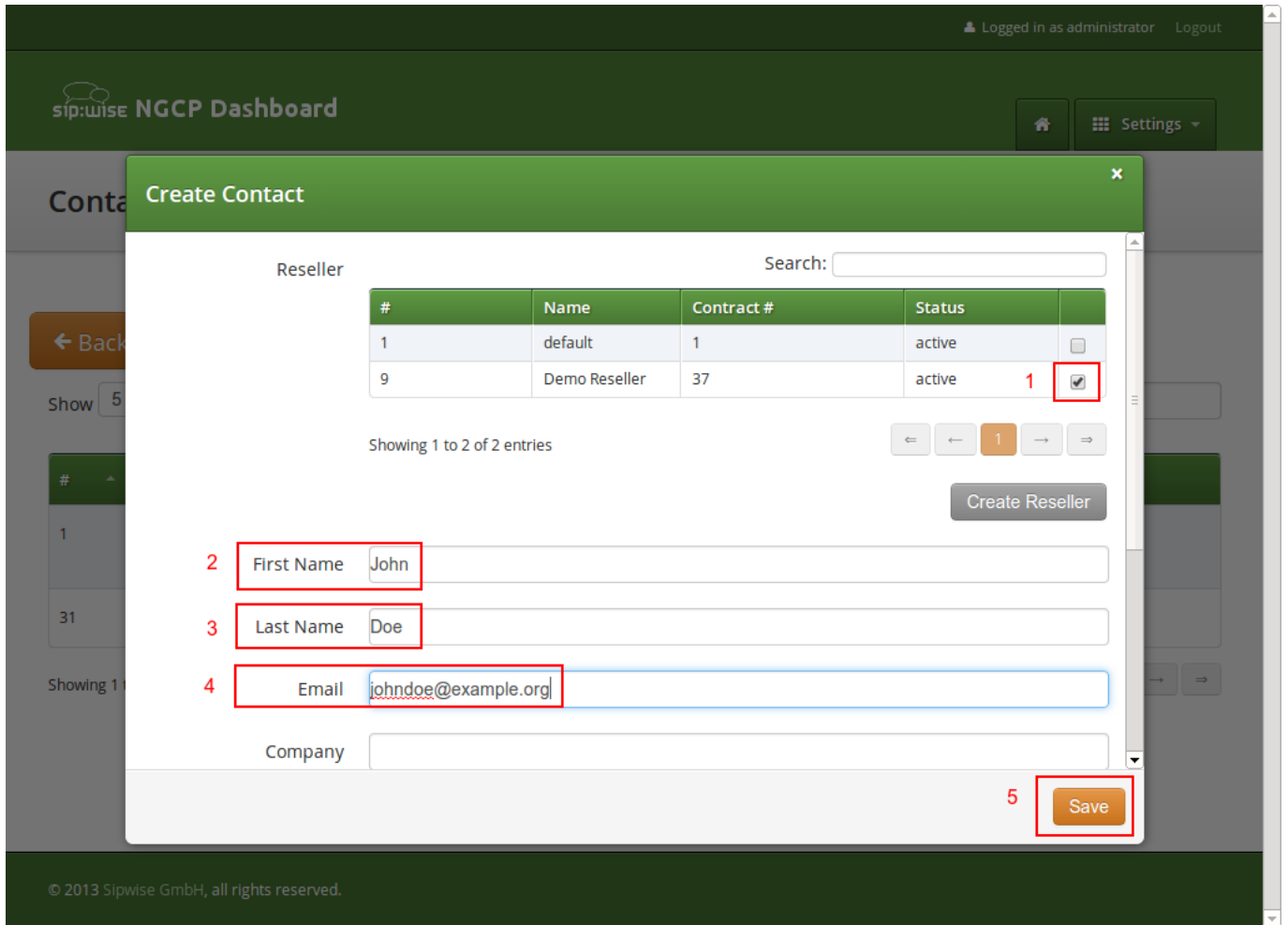


Figure 24: Create PBX Customer Contact

The new *Contact* will be automatically selected now. Also select a *Billing Profile* you want to use for this customer. If you don't have one defined yet, press *Create Billing Profile*, otherwise select the one you want to use.

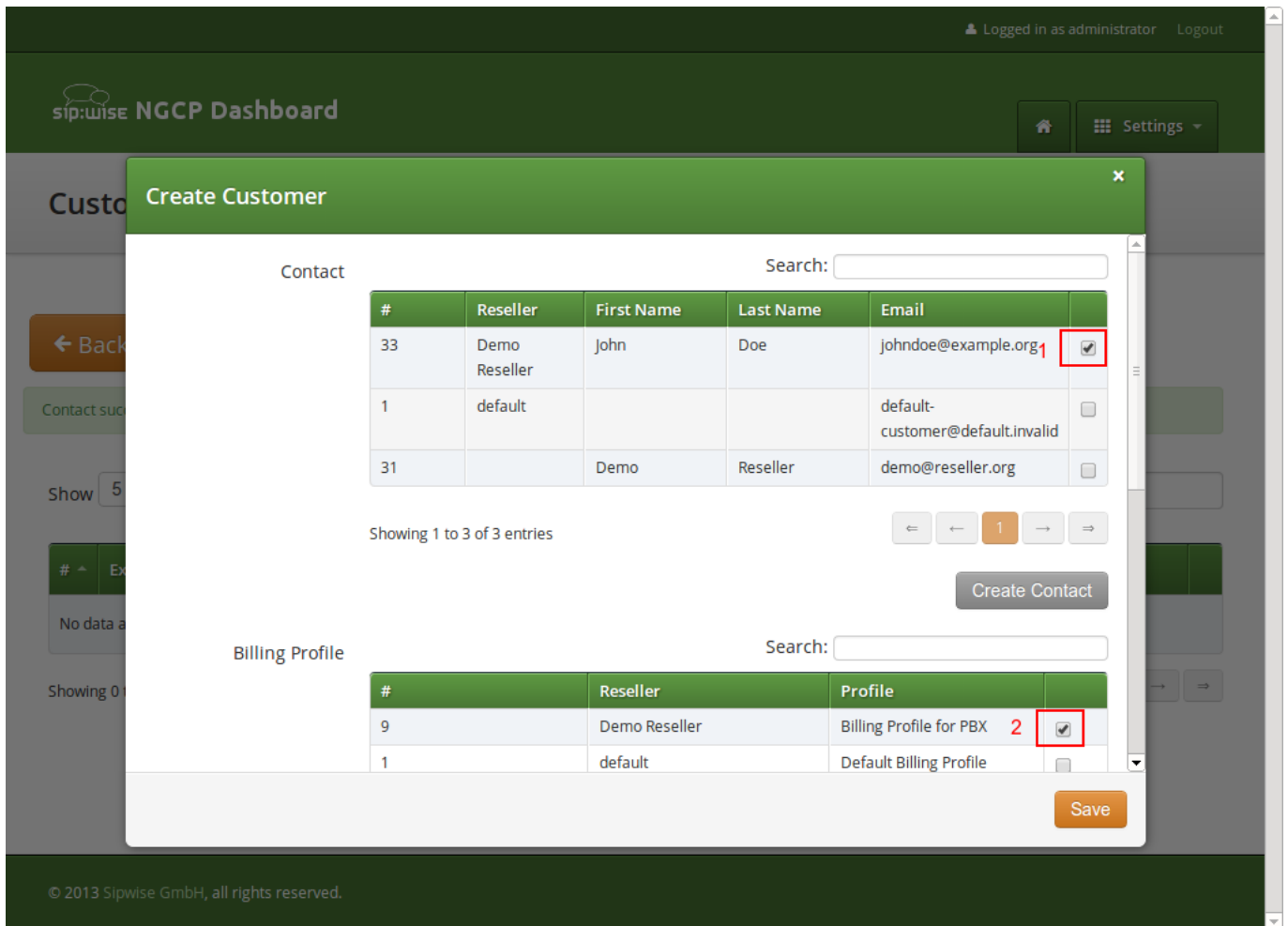


Figure 25: Create PBX Customer Part 2

Next, you need to select the *Product* for the PBX customer. Since it's going to be a PBX customer, select the product *Cloud PBX Account*.

Since PBX customers are supposed to manage their subscribers by themselves, they are able to create them via the web interface. To set an upper limit of subscribers a customer can create, define the value in the *Max Subscribers* field.



Important

As you will see later, both PBX subscribers and PBX groups are normal subscribers, so the value defined here limits the overall amount of subscribers **and** groups. A customer can create an unlimited amount of subscribers if you leave this field empty.

Press *Save* to create the customer.

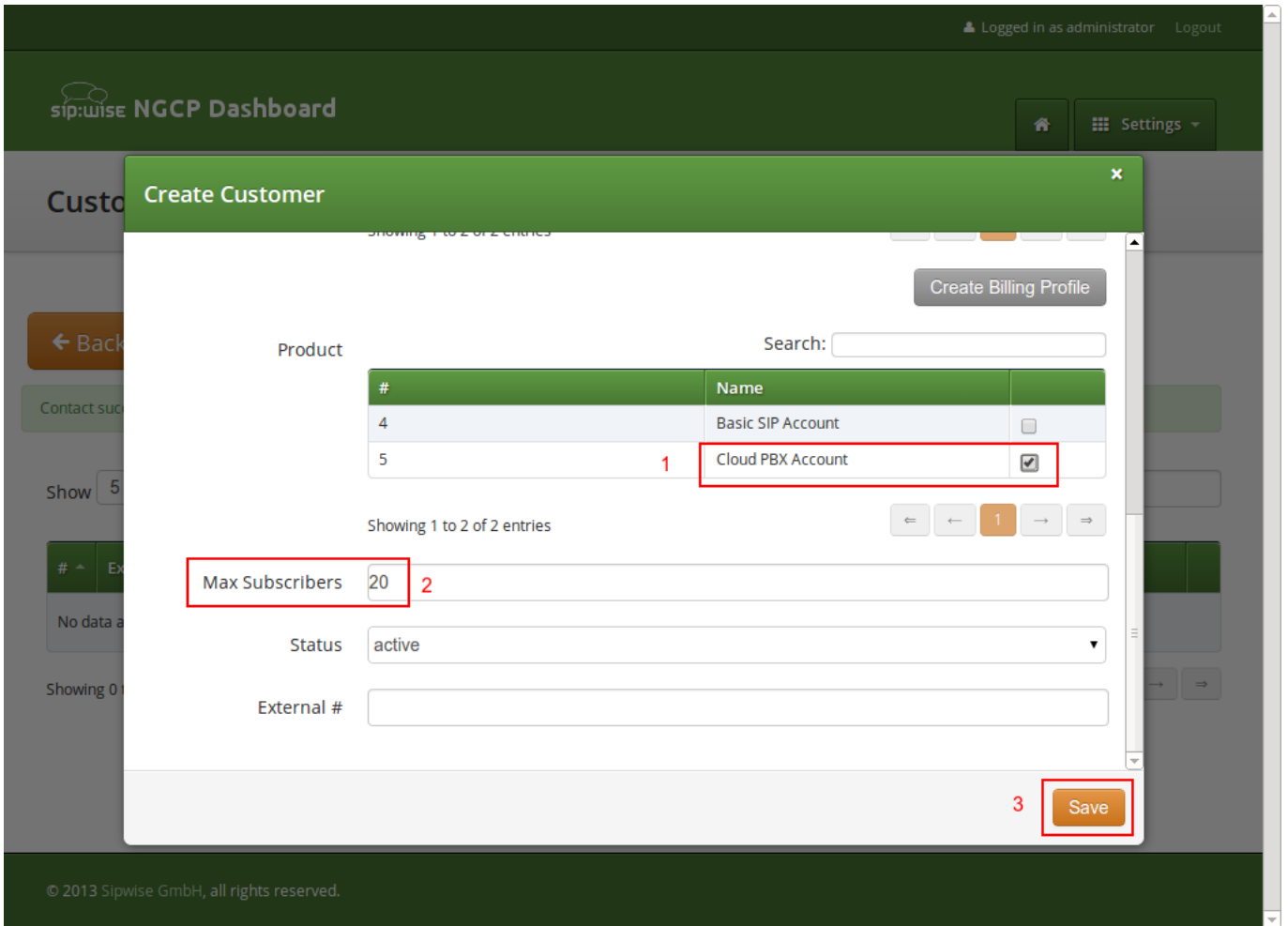


Figure 26: Create PBX Customer Part 3

A.3.2 Creating a PBX Pilot Subscriber

Once the customer is created, you need to create at least one *Subscriber* for the customer, so he can log into the web interface and manage the rest by himself.

Click the *Details* button on the newly created customer to enter the detailed view.

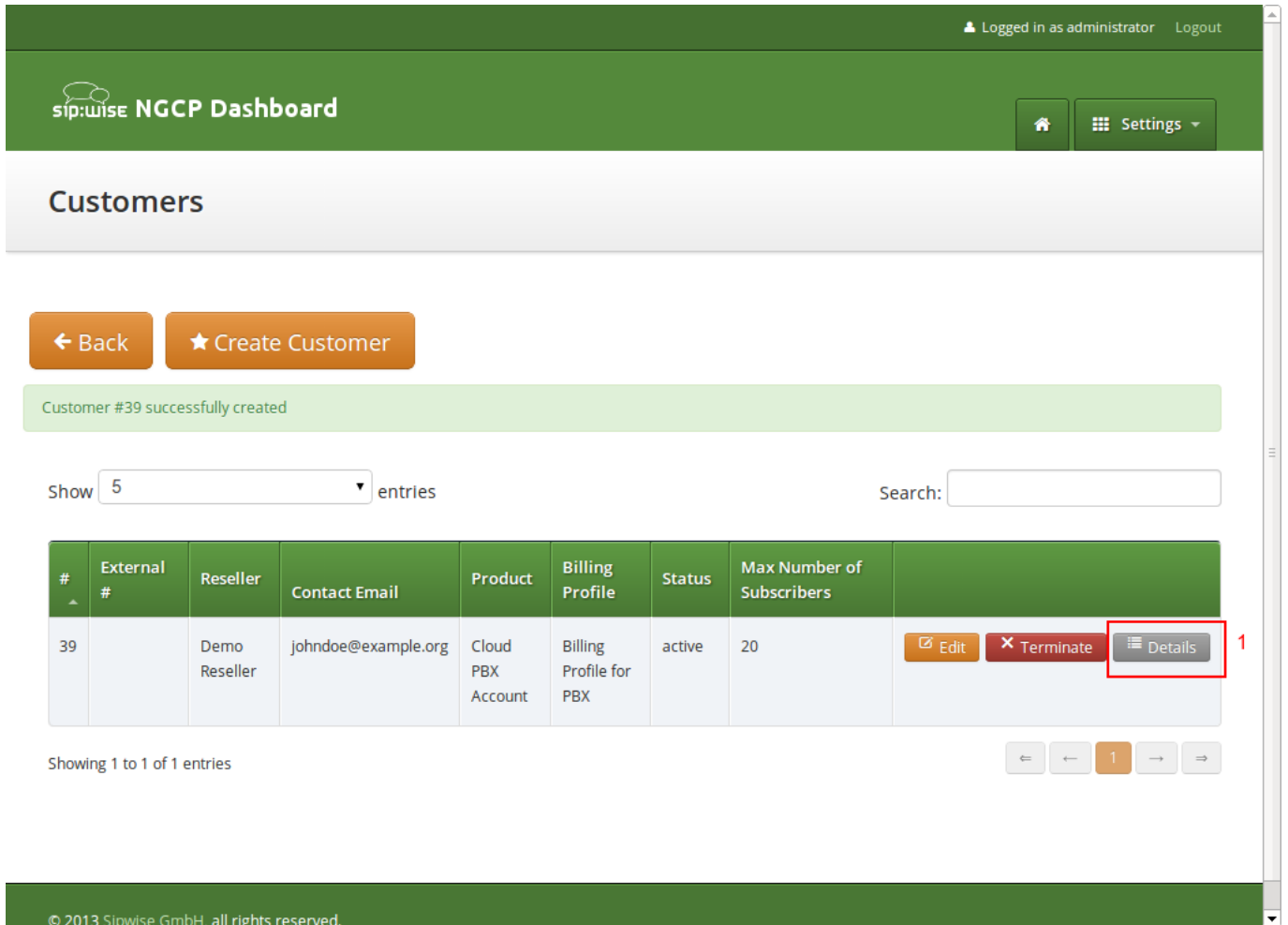


Figure 27: Go to Customer Details

To create the subscriber, open the *Subscribers* row and click *Create Subscriber*.

Logged in as administrator Logout

sip:wise NGCP Dashboard

Customer Details for #39 (Cloud PBX Account)

Expand Groups

Back Edit

Reseller

Contact Details

Billing Profiles

1 Subscribers

0 of maximum 20 subscribers (including PBX groups) created

2 Create Subscriber

SIP URI	Primary Number	PBX Group	Registered Devices
---------	----------------	-----------	--------------------

Sound Sets

Contract Balance

Figure 28: Go to Create Subscriber

For your pilot subscriber, you need a SIP domain, a pilot number (the main number of the customer PBX), the web credentials for the customer to log into the web interfaces, and the SIP credentials to authenticate via a SIP device.

Important

In a PBX environment, customers can create their own subscribers. As a consequence, each PBX customer should have its own SIP domain, in order to not collide with subscribers created by other customers. This is important because two customers are highly likely to create a subscriber (or group, which is also just a subscriber) called *office*. If they are in the same SIP domain, they'd both have the SIP URI *office@pbx.example.org*, which is not allowed, and the an end customer will probably not understand why *office@pbx.example.org* is already taken, because he (for obvious reasons, as it belongs to a different customer) will not see this subscriber in his subscribers list.

Tip

To handle one domain per customer, you should create a wild-card entry into your DNS server like `*.pbx.example.org`, which points to the IP address of `pbx.example.org`, so you can define SIP domains like `customer1.pbx.example.org` or `customer2.pbx.example.org` without having to create a new DNS entry for each of them. For proper secure access to the web interface and to the SIP and XMPP services, you should also obtain a SSL wild-card certificate for `*.pbx.example.org` to avoid certification warnings on customers' web browsers and SIP/XMPP clients.

So to create a new domain for the customer, click *Create Domain*.

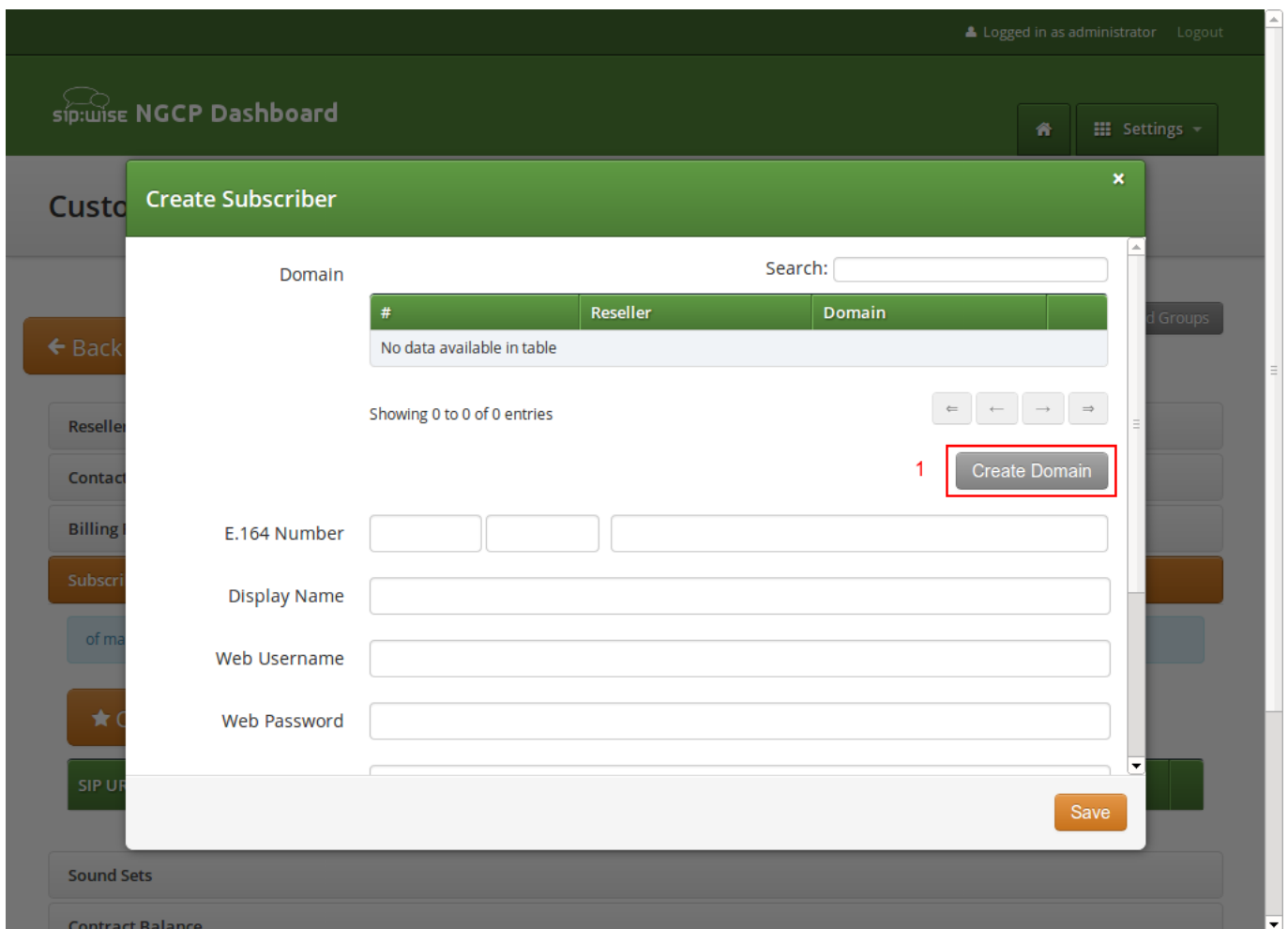


Figure 29: Go to Create Customer Domain

Specify the domain you want to create, and select the PBX *Rewrite Rule Set* which you created in Section A.2, then click *Save*.

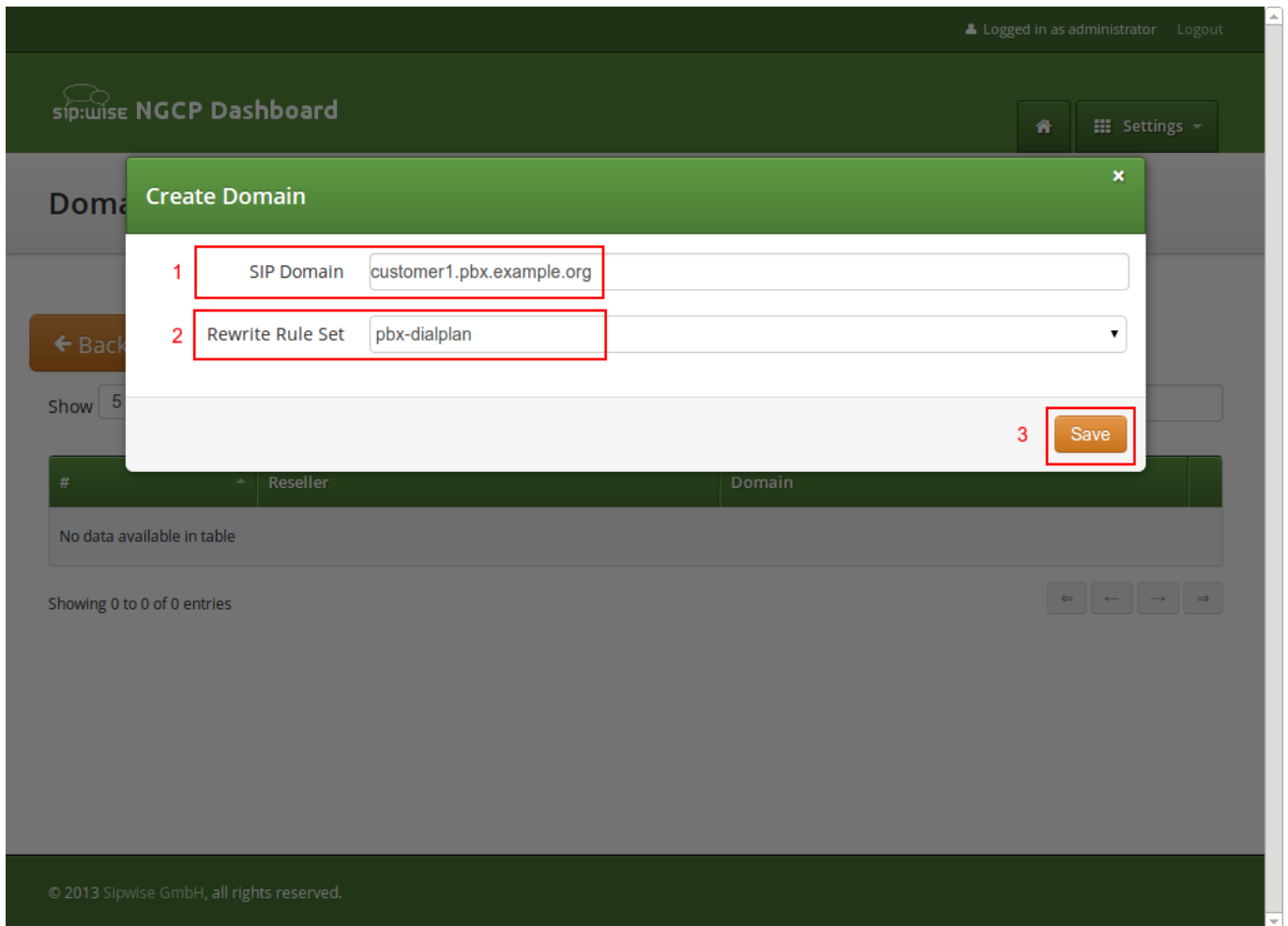


Figure 30: Create Customer Domain

Finish the subscriber creation by providing an E.164 number, which is going to be the base number for all other subscribers within this customer, the web username and password for the pilot subscriber to log into the web interface, and the sip username and password for a SIP device to connect to the PBX.

The parameters are as follows:

- **Domain:** The domain in which to create the pilot subscriber. *Each customer should get his own domain as described above to not collide with SIP usernames between customers.*
- **E.164 Number:** The primary number of the PBX. Calls to this number are routed to the pilot subscriber, and each subsequent subscriber created for this customer will use this number as its base number, suffixed by an individual extension. You can later assign alias numbers also for DID support.
- **Display Name:** This field is used on phones to identify subscribers by their real names instead of their number or extension. On outbound calls, the display name is signalled in the Display-Field of the From header, and it's used as a name in the XMPP contact lists.
- **Web Username:** The username for the subscriber to log into the customer self-care web interface. This is optional, if you don't

want a subscriber to have access to the web interface.

- **Web Password:** The password for the subscriber to log into the customer self-care web interface.
- **SIP Username:** The username for the subscriber to authenticate on the SIP and XMPP service. It is automatically used for devices, which are auto-provisioned via the *Device Management*, or can be used manually by subscribers to sign into the SIP and XMPP service with any arbitrary clients.
- **SIP Password:** The password for the subscriber to authenticate on the SIP and XMPP service.

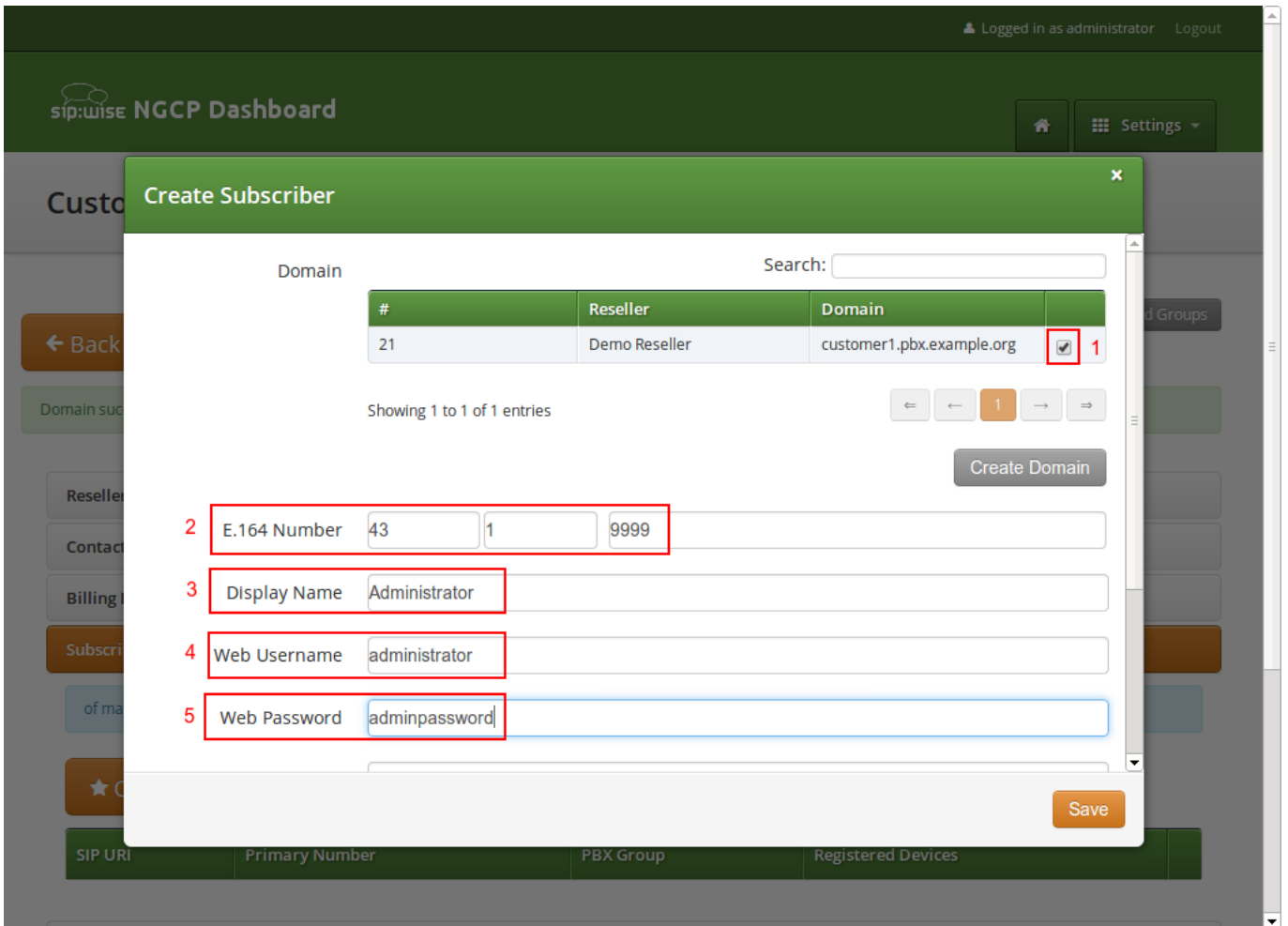


Figure 31: Create Pilot Subscriber Part 1

Customer Details for #39 (Cloud PBX Account)

← Back

Domain sub

Reseller

Contact

Billing

Subscri

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★ C

SIP UP

Sound S

Contract Balance

Fraud Limits

Groups

Create Subscriber

E.164 Number

Display Name

Web Username

Web Password

1 SIP Username

2 SIP Password

Status

External ID

3 Save

Figure 32: Create Pilot Subscriber Part 2

Once the subscriber is created, he can log into the customer self-care interface at <https://<your-ip>/login/subscriber> and manage his PBX, like creating other users and groups, assigning Devices to subscribers and configure the Auto Attendant and more.

A.4 Managing a Customer PBX

With the pilot subscriber created before, the customer can log into the customer self-care interface and manage the PBX.

As an administrator, you can also do this for him, and we will walk through the typical steps as an administrator to configure the different features.

Go to the *Customer Details* of the PBX customer you want to configure, e.g. by navigating to *Settings*→*Customers* and clicking the *Details* button of the customer you want to configure.

A.4.1 Creating more Subscribers

Since we already created a pilot subscriber, more settings now appear on the *Customer Details* view. The sections we are interested in for now are the *Subscribers* and *PBX Groups* sections.

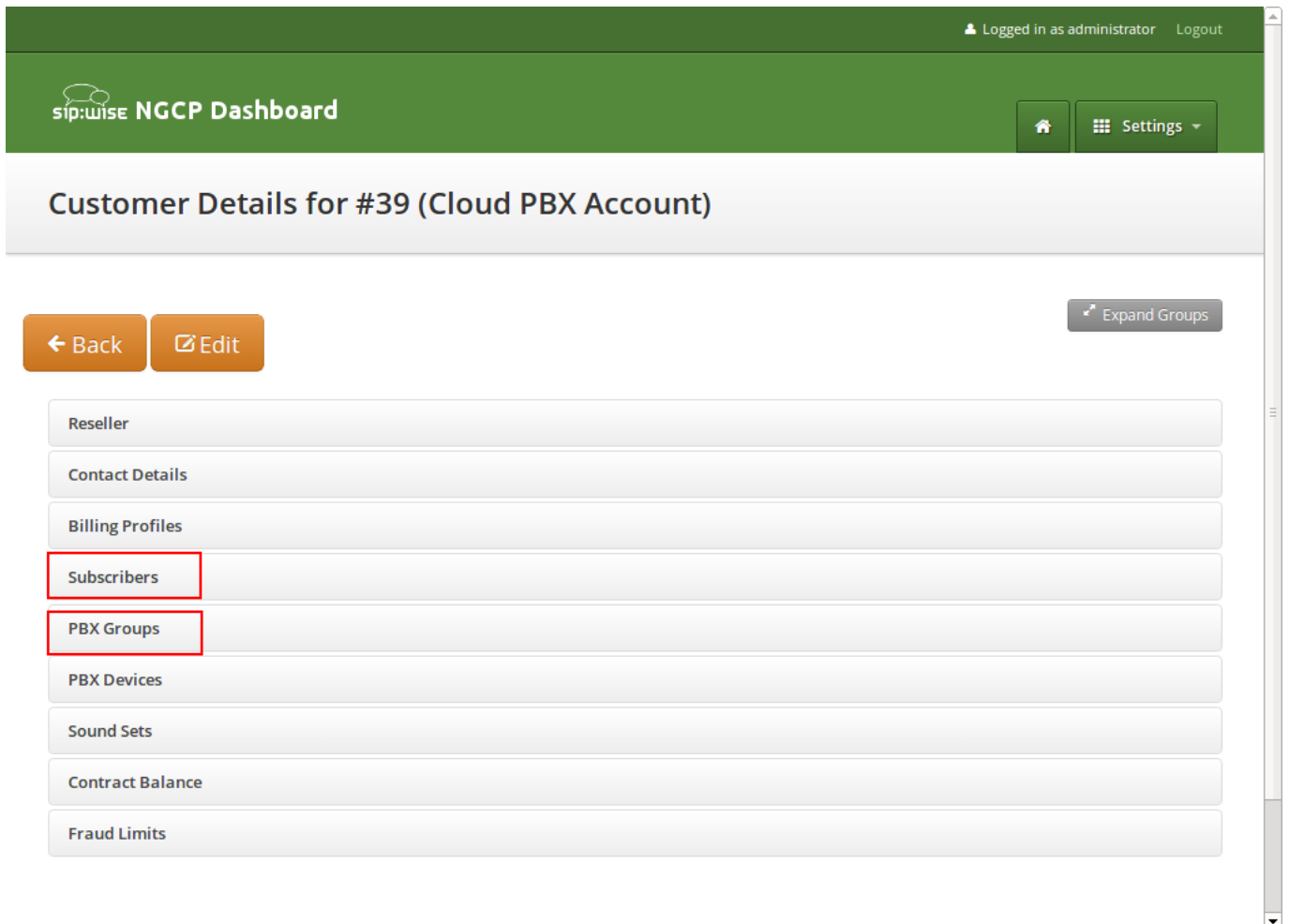
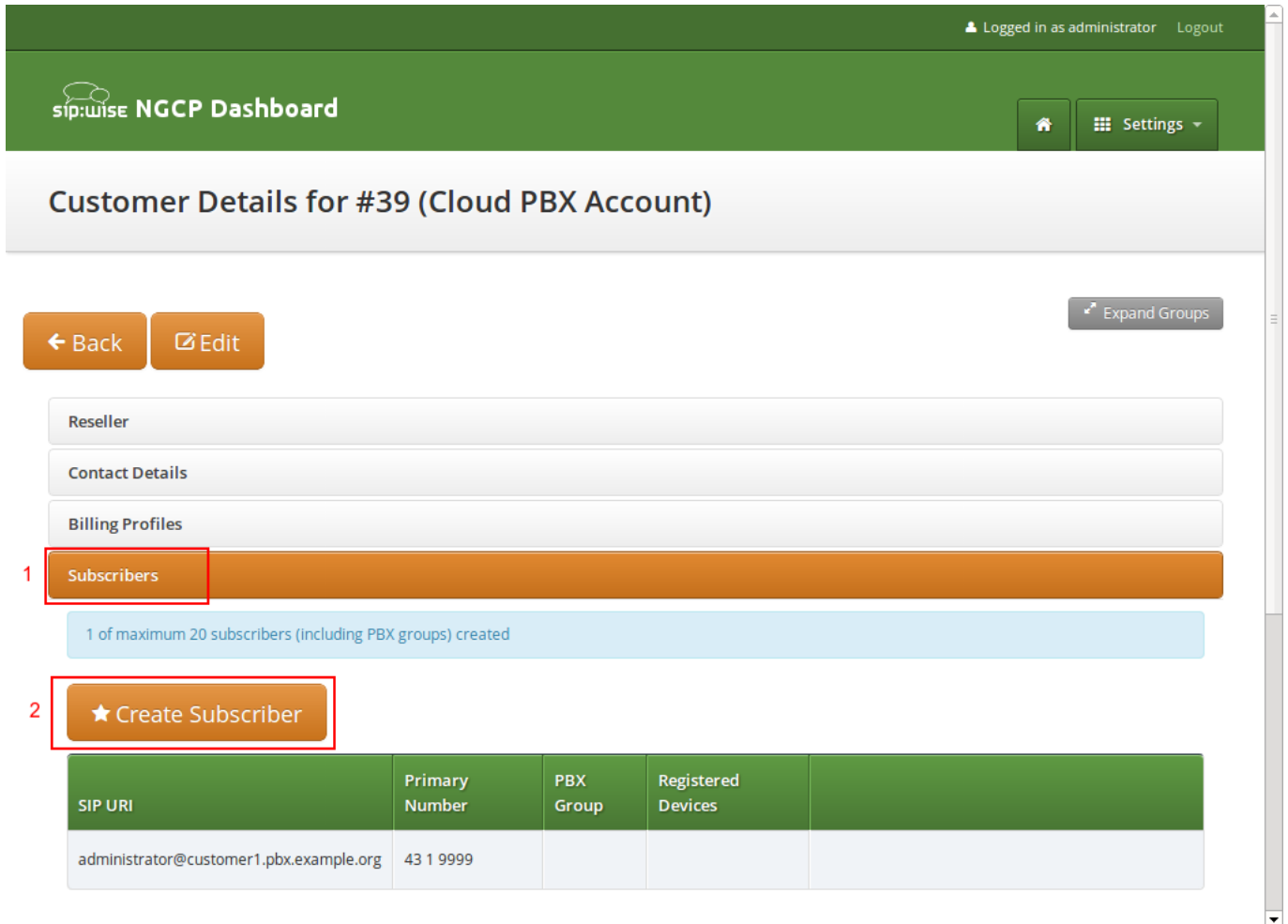


Figure 33: Subscribers and PBX Groups

To create another subscriber for the customer PBX, open the *Subscribers* row and click *Create Subscriber*.



Logged in as administrator Logout

sip:wise NGCP Dashboard

Customer Details for #39 (Cloud PBX Account)

Expand Groups

Back Edit

Reseller

Contact Details

Billing Profiles

1 Subscribers

1 of maximum 20 subscribers (including PBX groups) created

2 ★ Create Subscriber

SIP URI	Primary Number	PBX Group	Registered Devices
administrator@customer1.pbx.example.org	43 1 9999		

Figure 34: Create a Subscriber Extension

When creating another subscriber in the PBX after having the pilot subscriber, some fields are different now, because the *Domain* and *E.164 Number* are already pre-defined at the pilot subscriber level.

What you need to define for a new subscriber is the *Group* the subscriber is supposed to be in. We don't have a group yet, so create one by clicking *Create Group*.

A *PBX Group* has four settings:

- **Name:** The name of the group. This is used to identify a group when assigning it to subscribers on one hand, and also subscribers are pushed as server side contact lists to XMPP clients, where they are logically placed into their corresponding groups.
- **Extension:** The extension of the group, which is appended to the primary number of the pilot subscriber, so you can actually call the group from the outside. If our pilot subscriber number is 43 1 9999 and the extension is 100, you can reach the group from the outside by dialing 43 1 9999 100. Since PBX Groups are actually just normal subscribers in the system, you can assign *Alias Numbers* to it for DID later, e.g. 43 1 9998.
- **Hunting Policy:** If you call a group, then all members in this group are ringing based on the policy you choose. *Serial*

Ringling causes each of the subscribers to be tried one after another, until one of them picks up or all subscribers are tried. Parallel Ringing causes all subscribers in the group to be tried in parallel. Note that a subscriber can have a call-forward configured to some external number (e.g. his mobile phone), which will work as well.

- **Serial Hunting Timeout:** This value defines for how long to ring each member of a group in case of serial hunting until the next subscriber is being tried.

We will only fill in the *Name* and *Extension* for now, as the hunting policy can be changed later if needed. Click *Save* to create the group.

The screenshot shows the 'Create PBX Group' modal in the sip:wise NGCP Dashboard. The form contains the following fields:

- Name:** marketing (highlighted with a red box and '1')
- Extension:** 100 (highlighted with a red box and '2')
- Hunting Policy:** Serial Ringing (dropdown menu)
- Serial Hunting Timeout:** 10
- Save:** (highlighted with a red box and '3')

Below the modal, there is a table with the following data:

SIP URI	Primary Number	PBX Group	Registered Devices
administrator@customer1.pbx.example.org	43 1 9999		

Figure 35: Create a PBX Group

Once the group is created and selected, fill out the rest of the form as needed. Instead of the *E.164 Number*, you can now only choose the *Extension*, which is appended to the primary number of the pilot subscriber and is then used as primary number for this particular subscribers. Again, if your pilot number is 43 1 9999 and you choose extension 101 here, the number of this subscriber is going to be 43 1 9999 101. Also, you can again later assign more alias numbers (e.g. 43 1 9997) to this subscriber for DID.

The rest of the fields is as usual, with *Display Name* defining the real name of the user, *Web Username* and *Web Password* allowing the subscriber to log into the customer self-care interface, and the *SIP Username* and *SIP Password* to allow signing into

the SIP and XMPP services.

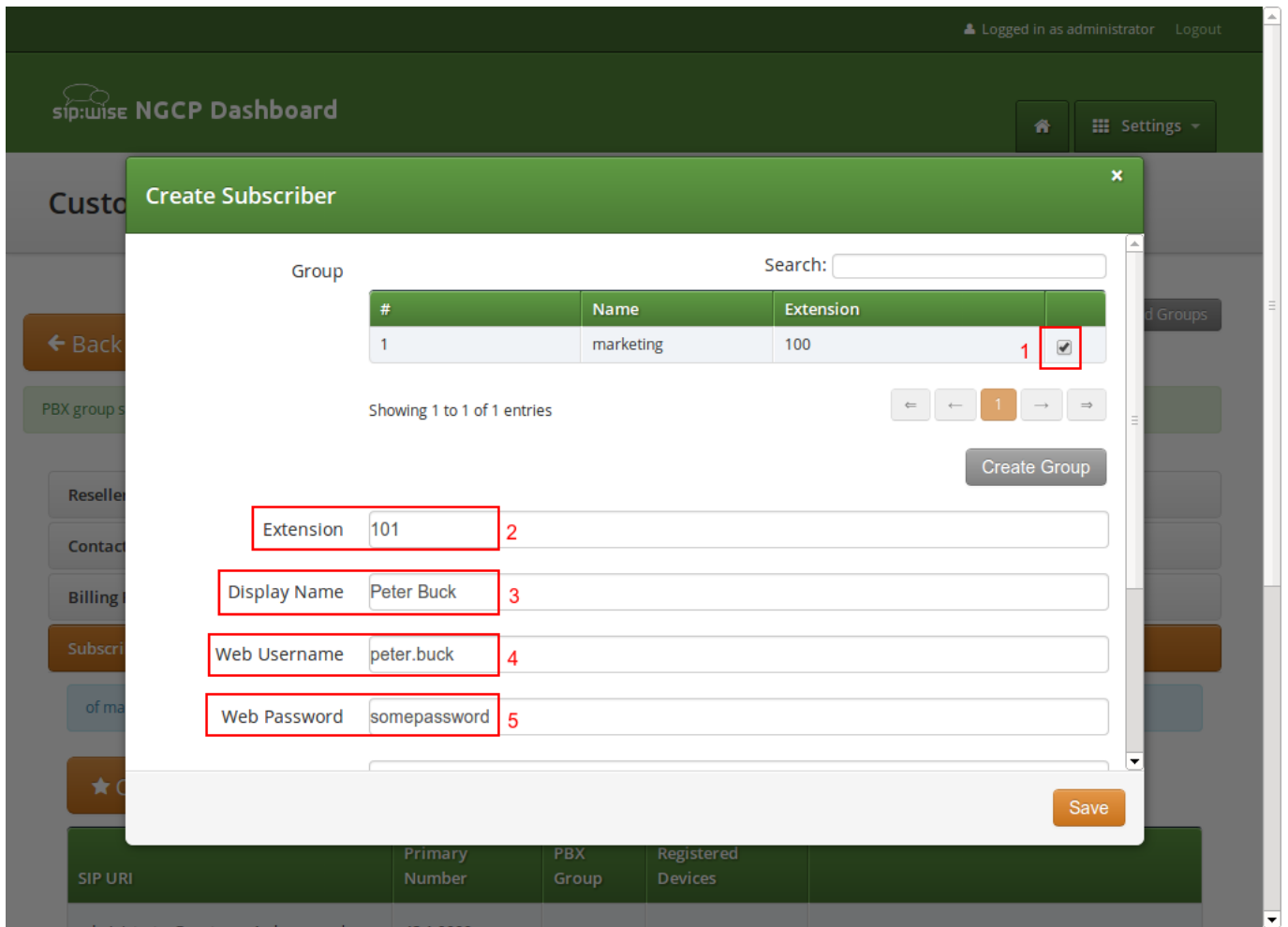


Figure 36: Finish PBX Subscriber Creation Part 1

Click Save to create the subscriber.

Customer Details for #39 (Cloud PBX Account)

← Back

PBX groups

Reseller

Contact

Billing

Subscriber

of ma

★ C

SIP UP

admin

PBX Groups

Create Subscriber

Extension: 101

Display Name: Peter Buck

Web Username: peter.buck

Web Password: somepassword

SIP Username: peter.buck 1

SIP Password: somepassword 2

Status: active

External ID:

3 Save

Figure 37: Finish PBX Subscriber Creation Part 2

Repeat the steps to create all the subscribers and groups as needed. An example of a small company configuration in terms of subscribers and groups might look like this:

Reseller

Contact Details

Billing Profiles

Subscribers

7 of maximum 20 subscribers (including PBX groups) created

★ Create Subscriber

SIP URI	Primary Number	PBX Group	Registered Devices
administrator@customer1.pbx.example.org	43 1 9999		
peter.buck@customer1.pbx.example.org	43 1 9999101	marketing	
michelle.miller@customer1.pbx.example.org	43 1 9999102	marketing	
frank.fowler@customer1.pbx.example.org	43 1 9999201	development	
deborah.dane@customer1.pbx.example.org	43 1 9999202	development	

PBX Groups

PBX Devices

Sound Sets

Figure 38: Example of Subscribers List

Tip

The subscribers can be reached via 3 different ways. First, you can call them by their SIP URIs (e.g. by dialing `frank.fowler@customer1.pbx.example.org`) from both inside and outside the PBX. Second, you can dial by the full number (e.g. `43 1 9999 201`; depending on your rewrite rules, you might need to add a leading `\+` or `00` or leave out the country code when dialing from the outside, and adding a `0` as break-out digit when dialing from the inside) from both inside and outside the PBX. Third, you can dial just the extension (e.g. `201`) from inside the PBX. If the subscriber also has an alias number assigned, you can dial that number also, according to your dial-plan in the rewrite rules.

A.4.2 Assigning Subscribers to Devices

Basically you can register any SIP phone to the system using the SIP credentials of your subscribers. However, the platform supports *Device Provisioning* of certain vendors and models, as described in Section [A.1](#).

To configure a physical device, open the *PBX Devices* row in the *Customer Details* view and click *Create Device*.

You have to set three general parameters for your new device, which are:

- **Device Profile:** The actual device profile you want to use. This has been pre-configured in the *Device Management* by the administrator or reseller, and the customer can choose from the list of profiles (which is a combination of an actual device plus its corresponding configuration).
- **MAC Address/Identifier:** The MAC address of the phone to be added. The information can usually either be found on the back of the phone, or in the phone menu itself.
- **Station Name:** Since you can (depending on the actual device) configure more lines on a phone, you can give it a station name, like `Reception` or the name of the owner of the device.

In addition to that information, you can configure the lines (subscribers) you want to use on which key, and the mode of operation (e.g. if it's a normal private phone line, or if you want to monitor another subscriber using BLF, or if you want it to act as shared line using SLA).

For example, a *Cisco SPA504G* has 4 keys you can use for private and shared lines as well as BLF on the phone itself, and in our example we have an *Attendant Console* attached to it as well, so you have 32 more keys for BLF.

The settings per key are as follows:

- **Subscriber:** The subscriber to use (for private/shared lines) or to monitor (for BLF).
- **Line/Key:** The key where to configure this subscriber to.
- **Line/Key Type:** The mode of operation for this key, with the following options (depending on which options are enabled in the *Device Model* configuration for this device):
 - **Private Line:** Use the subscriber as a regular SIP phone line. This means that the phone will register the subscriber, and you can place and receive phone calls with/for this subscriber.
 - **Shared Line:** The subscriber is also registered on the system and you can place and receive calls. If another phone has the same subscriber also configured as shared line, both phones will ring on incoming calls, and you can pick the call up on either of them. You cannot place a call with this subscriber though if the line is already in use by another subscriber. However, you can "steal" a running call by pressing the key where the shared line is configured to barge into a running call. The other party (the other phone where the shared line is configured too) will then be removed from the call (but can steal the call back the same way).
 - **BLF Key:** The *Busy Lamp Field* monitors the call state of another subscriber and provides three different functionalities, depending on the actual state:
 - * **Speed Dial:** If the monitored subscriber is on-hook, the user can press the button and directly call the monitored subscriber.
 - * **Call Pickup:** If the monitored subscriber is ringing, the user can press the button to pick up the call on his own phone.
 - * **State Indication:** If the monitored subscriber is on the phone, the key is indicating that the monitored subscriber is currently busy.

In our example, we will first configure a private line on the first key, and BLF for another subscriber on the second key.

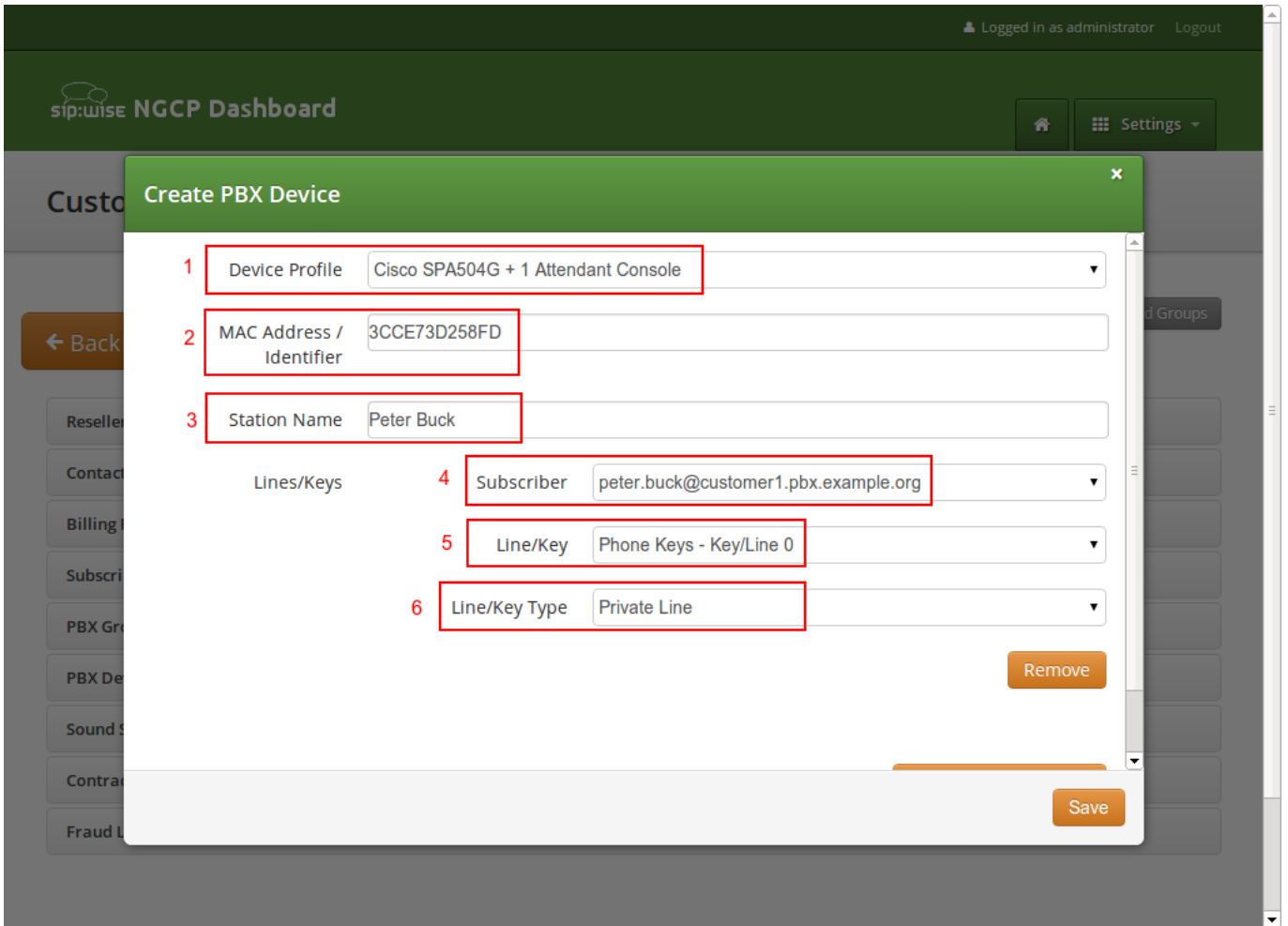


Figure 39: Configuring a PBX Device Part 1

This configures the general options plus the first key. To configure the second key, click *Add another Line/Key* and fill out the second line config accordingly. Click *Save* to save your PBX device configuration.

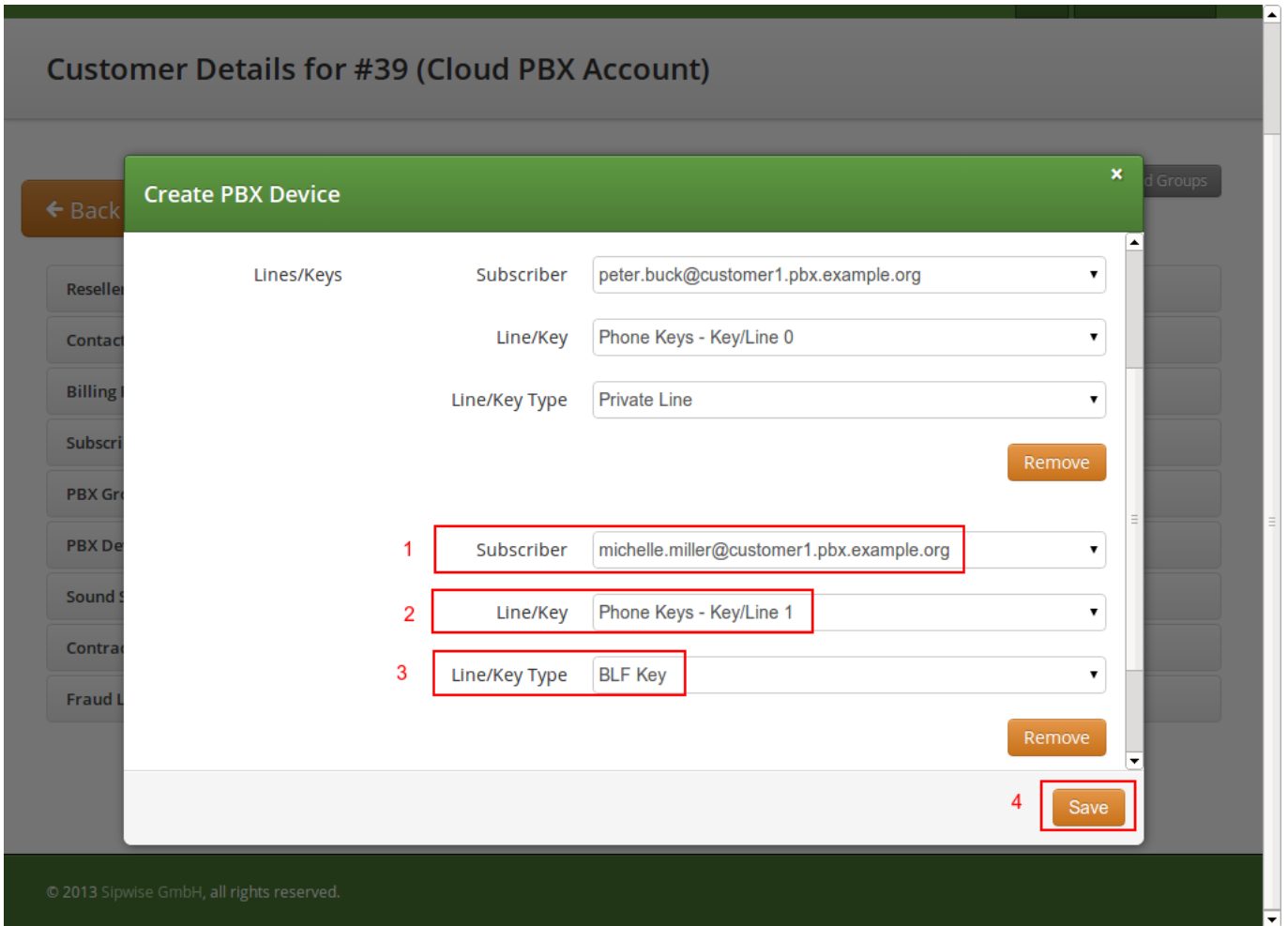


Figure 40: Configuring a PBX Device Part 2

Once the PBX device is saved, you will see it in the list of *PBX Devices*.

Synchronizing a PBX Device for initial Usage

Since a stock device obtained from an arbitrary distributor doesn't know anything about your system, it can't fetch its configuration from there. For that to work, you need to push the URL of where the phone can get the configuration to the phone once.

In order to do so, click the *Sync Device* button on the device you want to configure for the very first time.

Navigation menu: Contact Details, Billing Profiles, Subscribers, PBX Groups, PBX Devices (selected)

★ Create PBX Device

	Station Name	Subscriber	MAC Address / Identifier	Device Profile	
	Peter Buck	Phone Keys/0: private peter.buck@customer1.pbx.example.org Phone Keys/1: blf michelle.miller@customer1.pbx.example.org	3cce73d258fd	Cisco SPA504G + 1 Attendant Console	✕ Delete ✎ Edit 🔄 Sync Device 1

Additional menu items: Sound Sets, Contract Balance, Fraud Limits

Figure 41: Go to Sync Device



Important

As you will see in the next step, you need the actual IP address of the phone to push the provisioning URL onto it. That implies that you need access to the phone to get the IP, and that your browser is in the same network as the phone in order to be able to connect to it, in case the phone is behind NAT.

Enter the IP Address of the phone (on Cisco SPAs, press *Settings* 9, where *Settings* is the paper sheet symbol, and note down the *Current IP* setting), then click *Push Provisioning URL*.

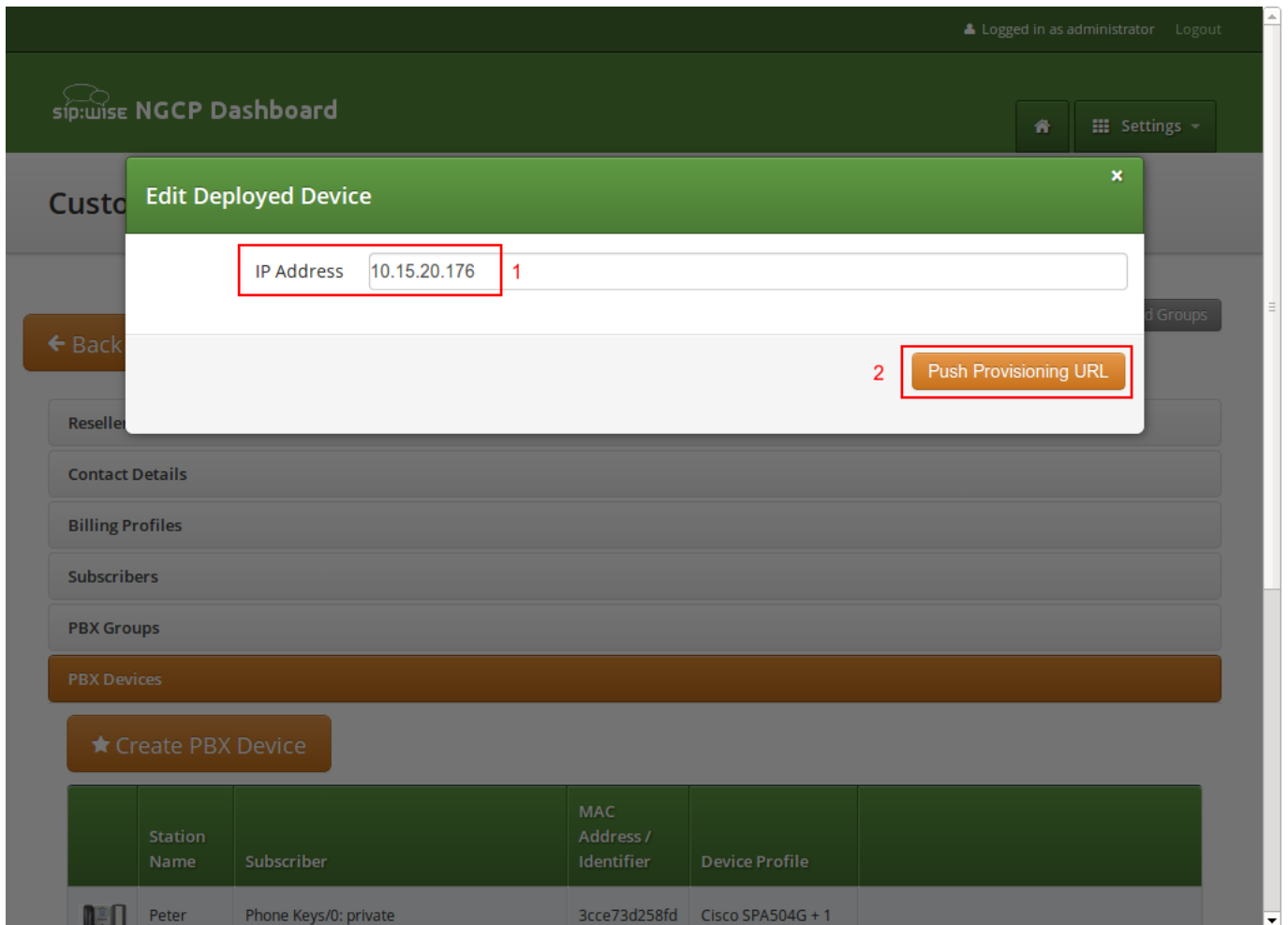
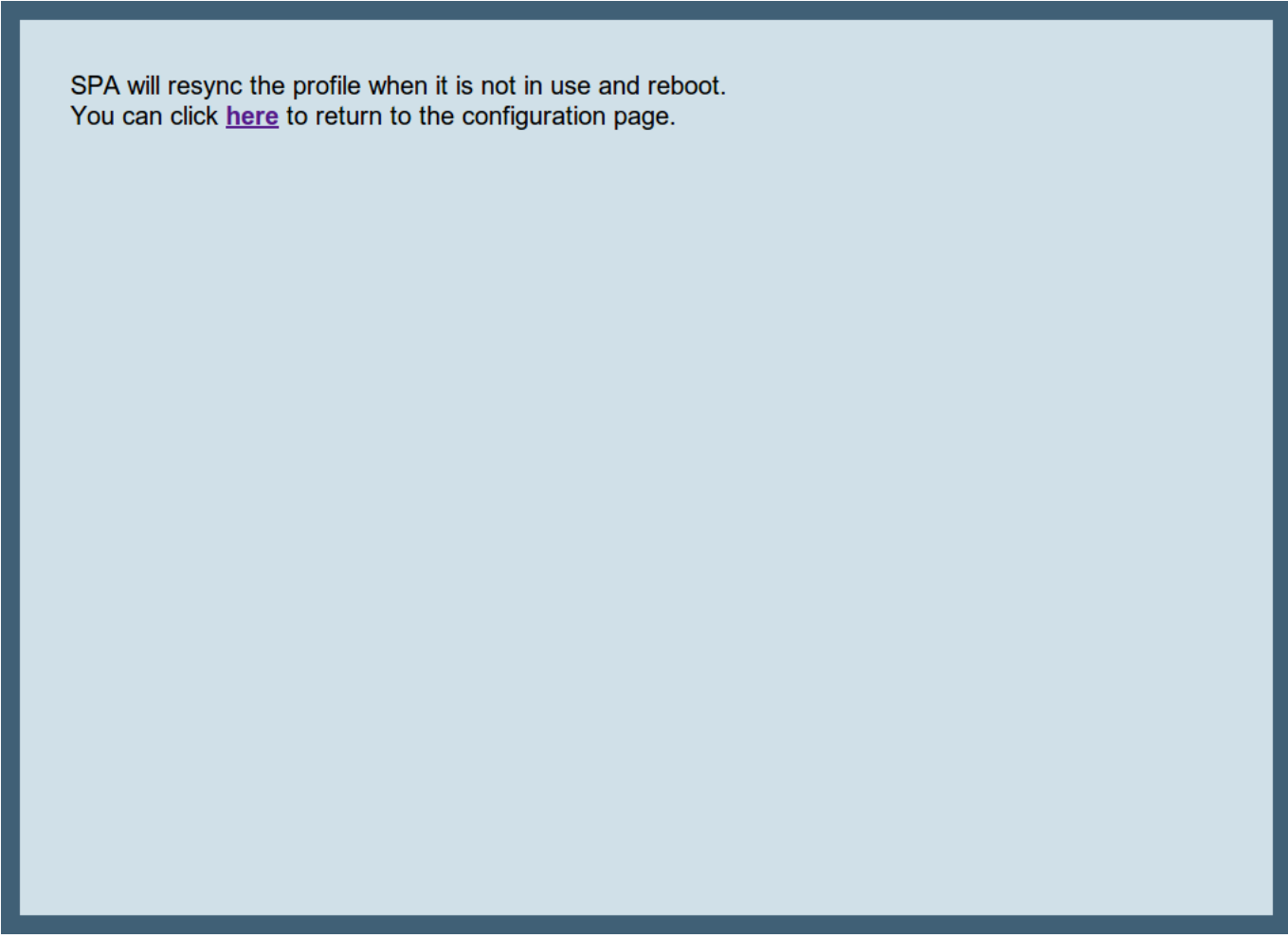


Figure 42: Sync Device

You will be redirected directly to the phone, and the Provisioning URL is automatically set. If everything goes right, you will see a confirmation page from the phone that it's going to reboot.



SPA will resync the profile when it is not in use and reboot.
You can click [here](#) to return to the configuration page.

Figure 43: Device Sync Confirmation from Phone

You can close the browser window/tab and proceed to sync the next subscriber.

Tip

You only have to do this step once per phone to tell it the actual provisioning URL, where it can fetch the configuration from. From there, it will regularly sync with the server automatically to check for configuration changes, and applies them automatically.

A.4.3 Configuring Sound Sets for the Customer PBX

In the *Customer Details* view, there is a row *Sound Sets*, where the customer can define his own sound sets for *Auto Attendant*, *Music on Hold* and the *Office Hours Announcement*.

To create a new sound set, open the *Sound Sets* row and click *Create Sound Set*.

If you do this as administrator or reseller, the Reseller and/or Customer is pre-selected, so keep it as is. If you do this as customer, you don't see any *Reseller* or *Customer* fields.

So the important settings are:

- **Name:** The name of the sound set as it will appear in the *Subscriber Preferences*, where you can assign the sound set to a subscriber.
- **Description:** A more detailed description of the sound set.
- **Default for Subscribers:** If this setting is enabled, then the sound set is automatically assigned to all already existing subscribers which do NOT have a sound set assigned yet, and also for all newly created subscribers.

Fill in the settings and click *Save*.

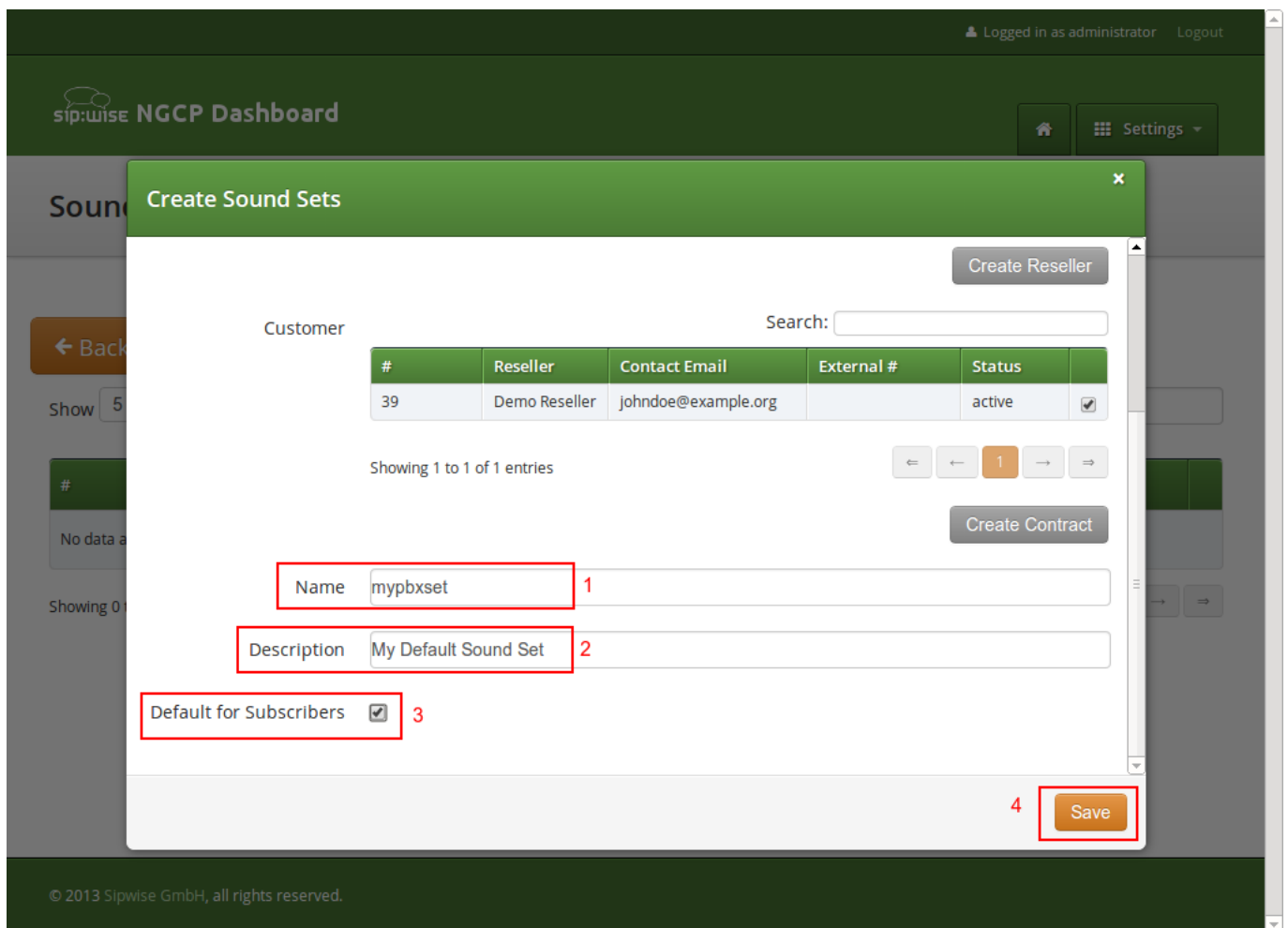


Figure 44: Create Customer Sound Set

To upload files to your Sound Set, click the *Files* button for the Sound Set.

Uploading a Music-on-Hold File

Open the *music_on_hold* row and click *Upload* on the *music_on_hold* entry. Choose a WAV file from your file system, and click the *Loopplay* setting if you want to play the file in a loop instead of just once. Click *Save* to upload the file.

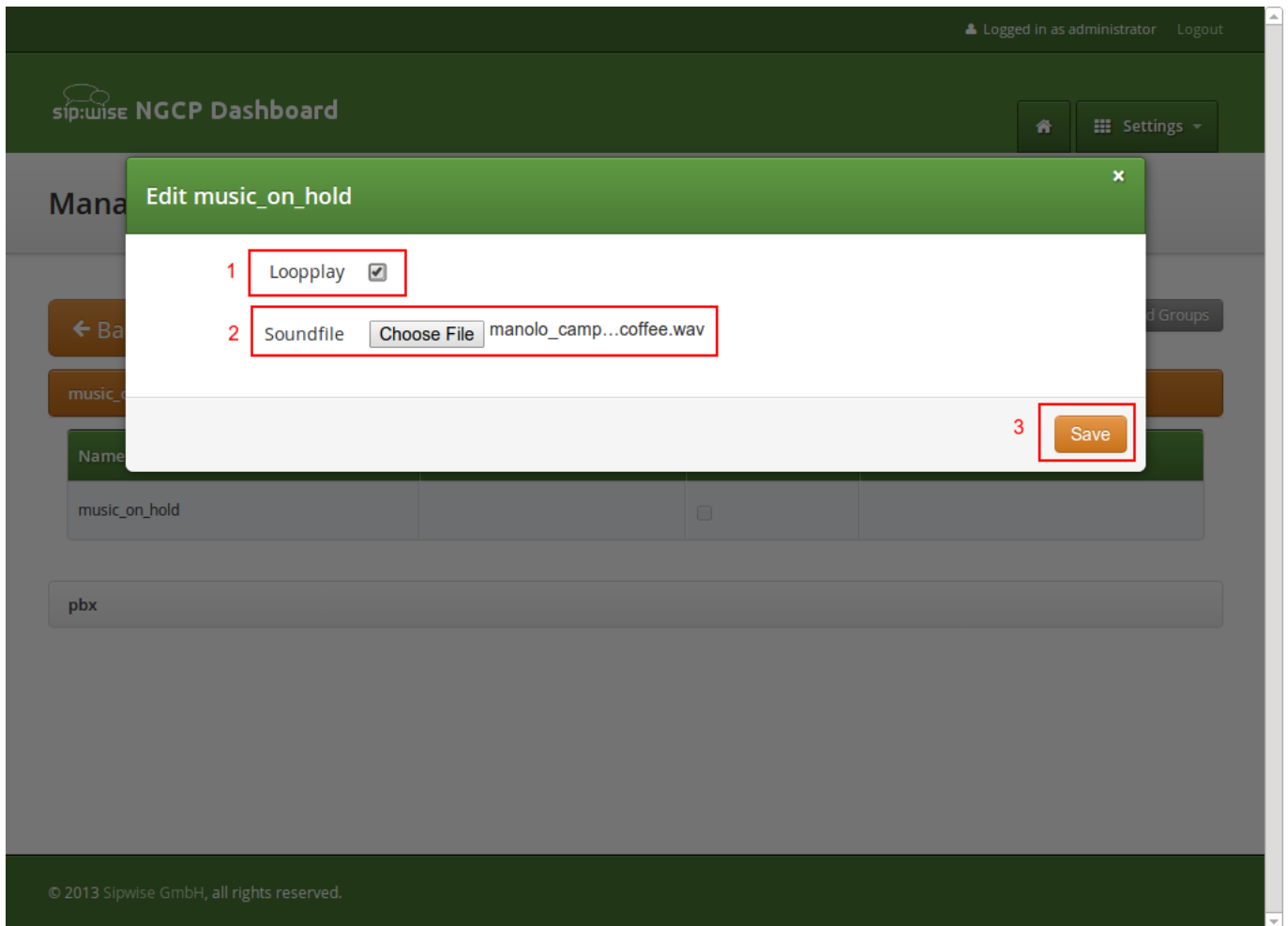


Figure 45: Upload MoH Sound File

Uploading Auto-Attendant Sound Files

When configuring a Call Forward to the *Auto Attendant*, it will play the following files:

- `aa_welcome`: This is the welcome message (the greeting) which is played when someone calls the Auto Attendant.
- each available pair of `aa_X_for/aa_X_option`: Each menu item in the Auto Attendant consists of two parts. The `for` part, which plays something like *Press One for*, and the `option` part, which play something like *Marketing*. The Auto Attendant only plays those menu options where both the `for` part and the `option` part is present, so if you only have 3 destinations you'd like to offer, and you want them to be on keys 1, 2 and 3, you have to upload files for `aa_1_for`, `aa_1_option`, `aa_2_for`, `aa_2_option` and `aa_3_for` and `aa_3_option`.



Important

The sound files only define the general structure of what is being played to the caller. The actual destinations behind your options are configured separately in Section [A.4.4](#).

An example configuration could look like this:

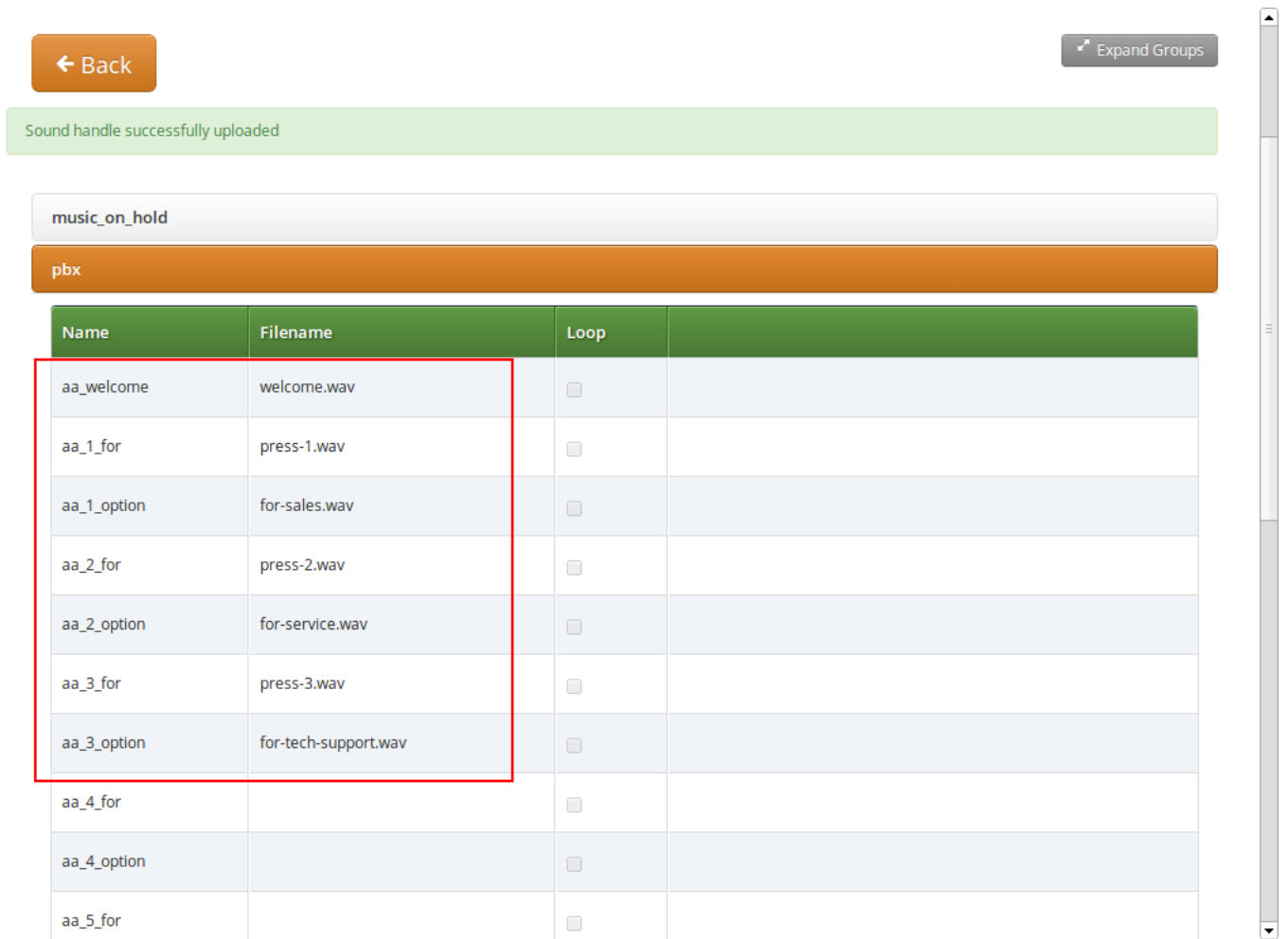


Figure 46: Upload Auto Attendant Sound File

A.4.4 Configuring the Auto Attendant

The Auto Attendant feature can be activated for any subscriber in the Customer PBX individually. There are three steps involved. First, you have to prepare a *Sound Set* to have Auto Attendant sound files. Second, you have to configure the destinations for the various options you provide (e.g. pressing 1 should go to the `marketing` subscriber, 2 to `development` and 3 to some external number). Third, you have to set a Call Forward to the Auto Attendant.

To do so, go to *Customer Details* and in the *Subscribers* section, click the *Preferences* button of the subscriber, where the Auto Attendant should be set.

Preparing the Sound Set

Create a Sound Set and upload the Sound Files for it as described in Section A.4.3. Back in the *Subscriber Preferences* view, set the *Customer Sound Set* preference to the Sound Set to be used. To do so, click *Edit* on the *Customer Sound Set* preference and assign the set to be used.

Configuring the Auto Attendant Slots

In the *Auto Attendant Slots* section, click the *Edit Slots* button to configure the destination options.

Click *Add another Slot* to add a destination option, select the Key the destination should be assigned to, and enter a Destination. The destination can be a subscriber username (e.g. `marketing`), a full SIP URI (e.g. `sip:michelle.miller@customer1.pbx.example.org`) or any external SIP URI or a number or extension (e.g. `491234567` or `101`).

Repeat the step for every option you want to add, then press *Save*.

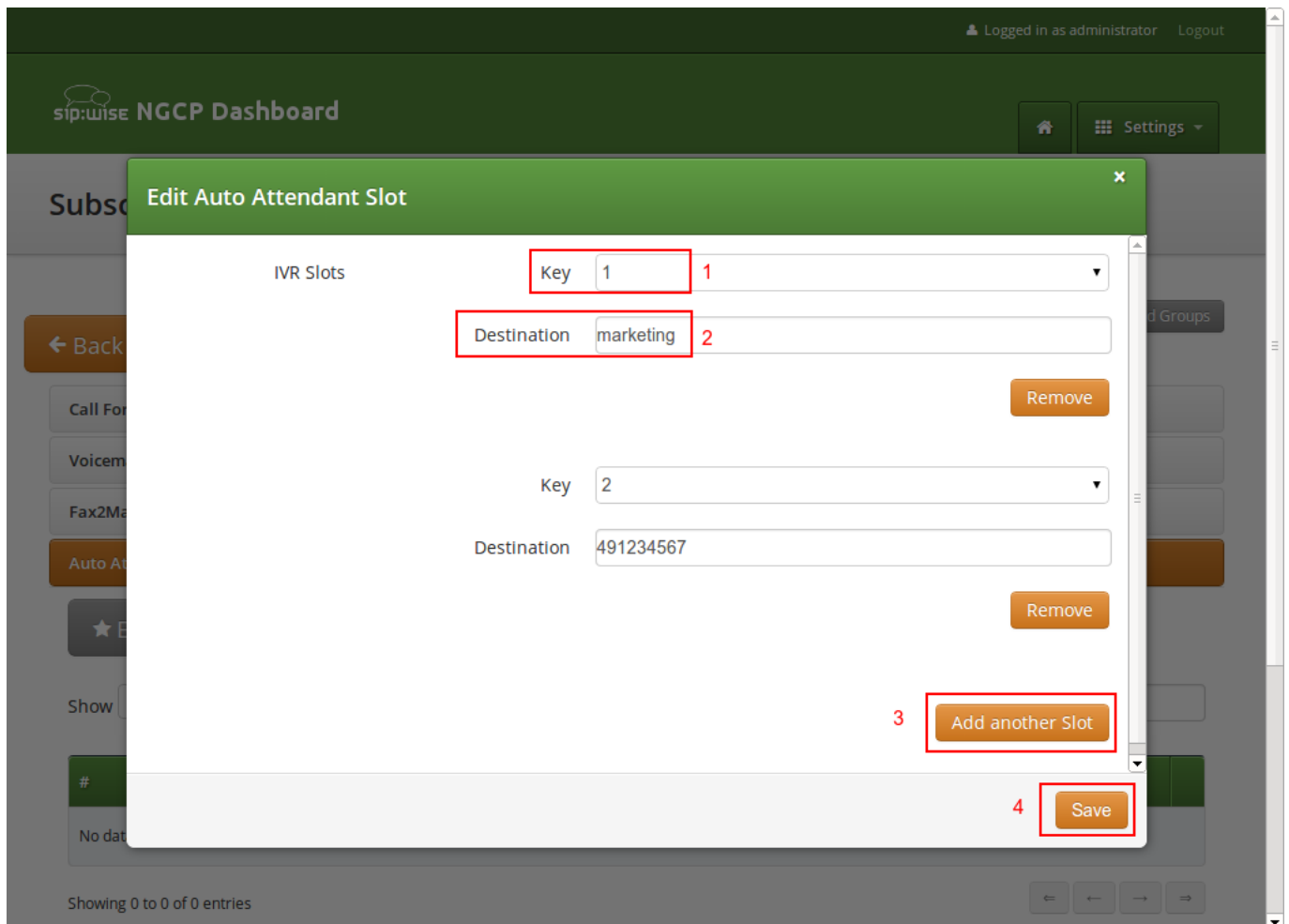


Figure 47: Define the Auto Attendant Slots

Activating the Auto Attendant

Once the Sound Set and the Slots are configured, activate the Auto Attendant by setting a Call Forward to Auto Attendant.

To do so, open the *Call Forwards* section in the *Subscriber Preferences* view and press *Edit* on the Call Forward type (e.g. *Call Forward Unconditional* if you want to redirect callers unconditionally to the Auto Attendant).

Select *Auto Attendant* and click *Save* to activate the Auto Attendant.

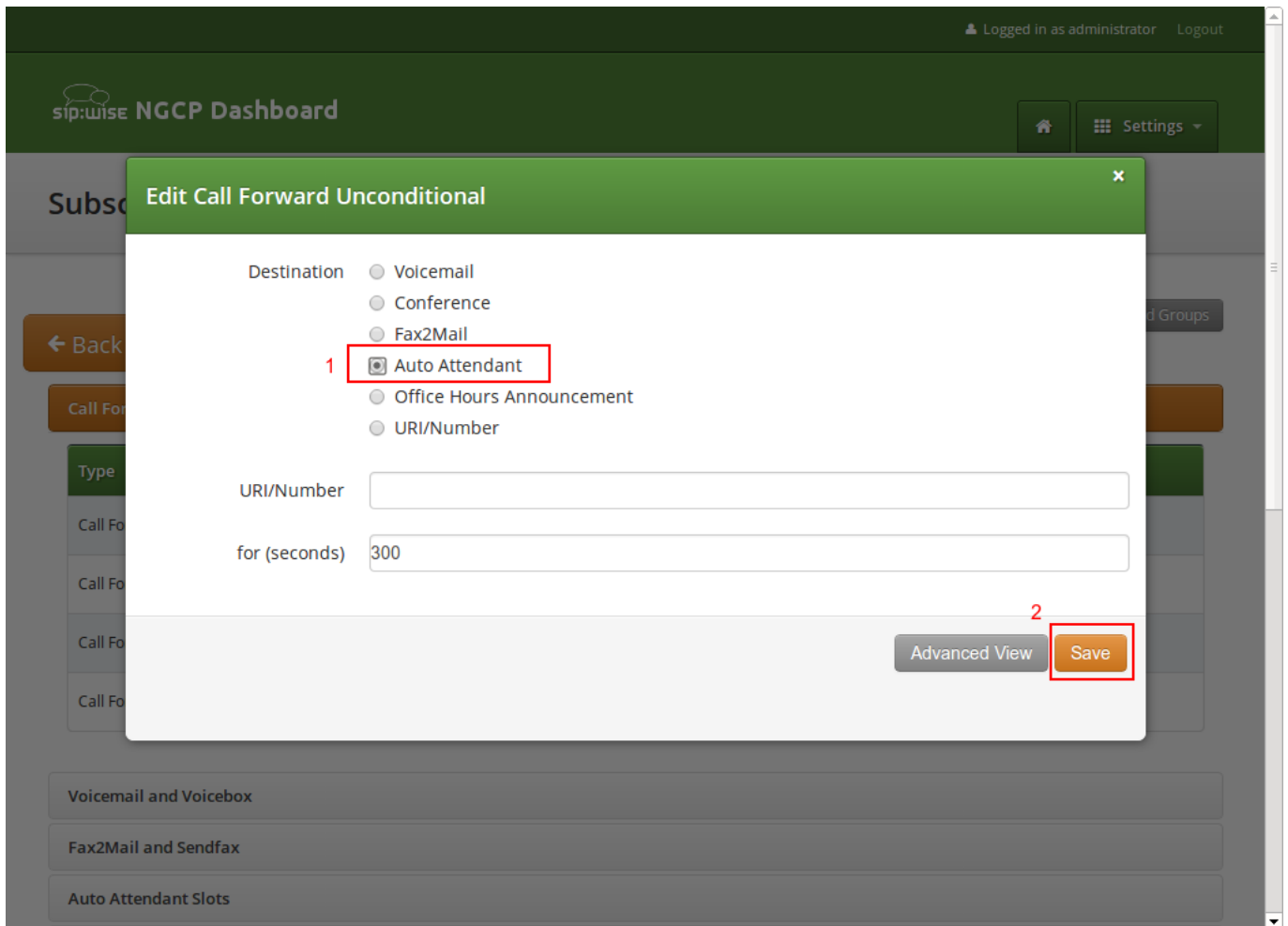


Figure 48: Set a Call Forward to Auto Attendant

Tip

As with any other Call Forward, you can define more complex forwarding rules in the *Advanced View* to only forward the call to the Auto Attendant during specific time periods, or as a fallback if no one picks up the office number.

A.5 Device Auto-Provisioning Security

A.5.1 Server Certificate Authentication

The Cisco SPA phones can connect to the provisioning interface of the PBX via HTTP and HTTPS. When perform secure provisioning over HTTPS, the phones validate the server certificate to check if its a legitimate Cisco provisioning server. To pass this check, the provisioning interface must provide a certificate signed by Cisco for that exact purpose.

The following steps describe how to obtain such a certificate.

First, a new SSL key needs to be generated:

```
$ openssl genrsa -out provisioning.key 2048
```

```
Generating RSA private key, 2048 bit long modulus
...+++
.....+++
e is 65537 (0x10001)
```

Next, a certificate signing request needs to be generated as follows. Provide your company details.



Important

The **Common Name (e.g. server FQDN or YOUR name)** field is crucial here. Provide an FQDN which the phones will later use via DNS to connect to the provisioning interface, for example *pbx.example.org*. Cisco does **NOT** support wild-card certificates.



Important

Leave the password empty when asked for it (press Enter without entering anything).

```
$ openssl req -new -key provisioning.key -out provisioning.csr
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
```

```
Country Name (2 letter code) [AU]:AT
State or Province Name (full name) [Some-State]:Vienna
Locality Name (eg, city) []:Vienna
Organization Name (eg, company) [Internet Widgits Pty Ltd]:Sipwise GmbH
Organizational Unit Name (eg, section) []:Operations
Common Name (e.g. server FQDN or YOUR name) []:pbx.example.org
Email Address []:office@sipwise.com
```

```
Please enter the following 'extra' attributes
to be sent with your certificate request
A challenge password []:
An optional company name []:
```

Finally, compress the `provisioning.csr` file via ZIP and send it to our Cisco sales representative. If in doubt, you can try to send it directly to `ciscosb-certadmin@cisco.com` asking them to sign it.



Important

Only send the CSR file. **Do NOT send the key file, as this is your private key!**

**Important**

Ask for both the signed certificate AND a so-called *combinedca.crt* which is needed to perform client authentication via SSL. Otherwise you can not restrict access to Cisco SPAs only.

You will receive a signed CRT file, which Sipwise can use to configure the PBX provisioning interface.

A.5.2 Client Certificate Authentication

If a client connects via HTTPS, the server also checks for the client certificate in order to validate that the device requesting the configuration is indeed a legitimate Cisco phone, and not a fraudulent user with a browser trying to fetch user credentials.

A.6 Device Bootstrap and Resync Workflows

The IP phones supported by the PBX need to initially be configured to fetch their configuration from the system. Since the phones have no initial information about the system and its provisioning URL, they need to be boot-strapped. Furthermore, changes for a specific device might have to be pushed to the device immediately instead of waiting for it to re-fetch the configuration automatically.

The following sections describe the work-flows how this is accomplished without having the customer directly accessing the phone.

A.6.1 Cisco SPA Device Bootstrap

Initial Bootstrapping

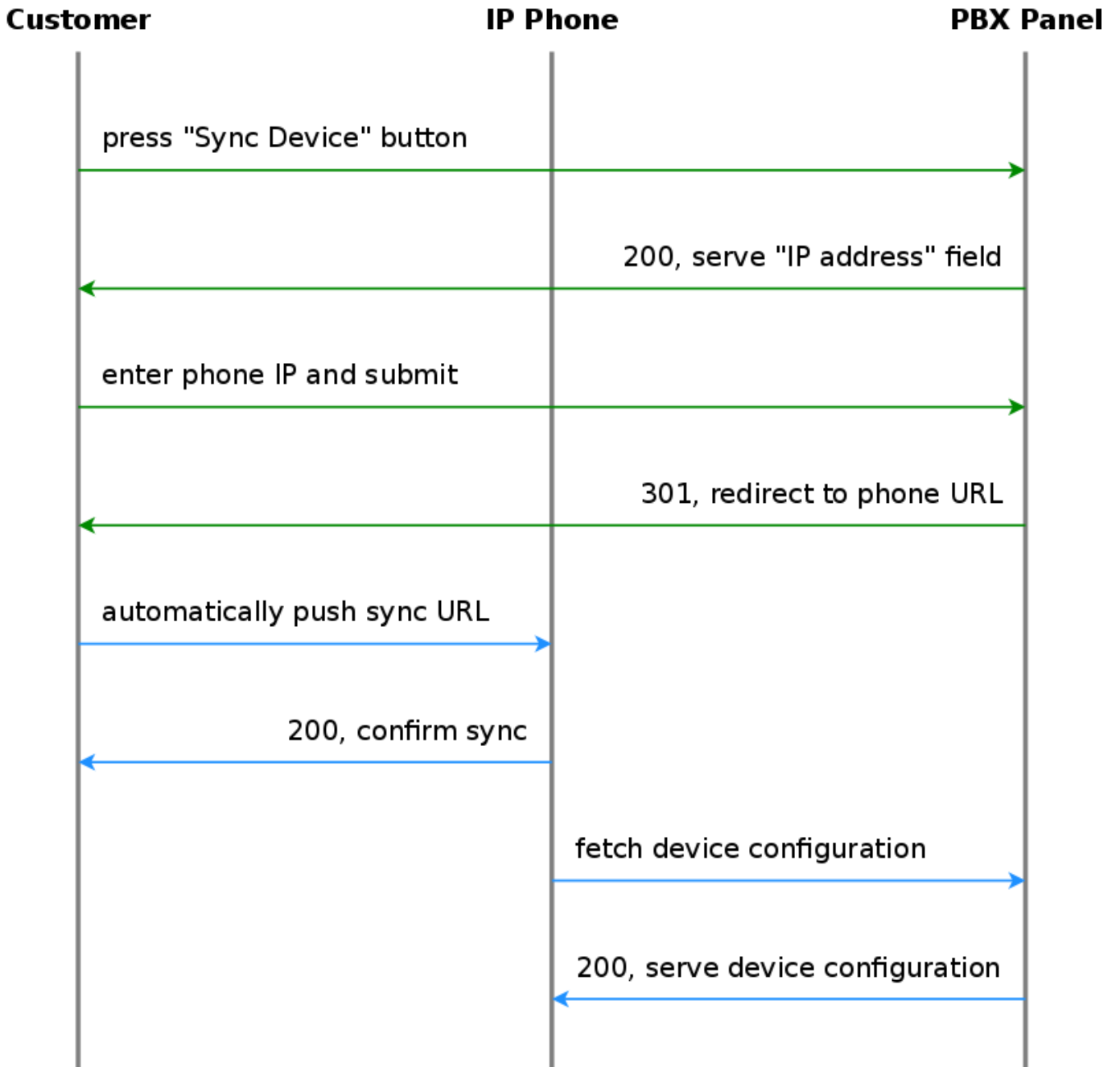


Figure 49: Initially bootstrap a PBX device

Subsequent Device Resyncs

If one of the subscribers configured on a PBX device is registered via SIP, the system can trigger a re-sync of the phone directly via SIP without having the customer enter the IP of the phone again. This is accomplished by sending a special NOTIFY message

to the subscriber:

```
NOTIFY sip:subscriber@domain SIP/2.0
To: <sip:subscriber@domain>
From: <sip:subscriber@domain>;tag=some-random-tag
Call-ID: some-random-call-id
CSeq: 1 NOTIFY
Subscription-State: active
Event: check-sync
Content-Length: 0
```

In order to prevent unauthorized re-syncs, the IP phone challenges the request with its own SIP credentials, so the NOTIFY is sent twice, once without authentication, and the second time with the subscriber's own SIP credentials.

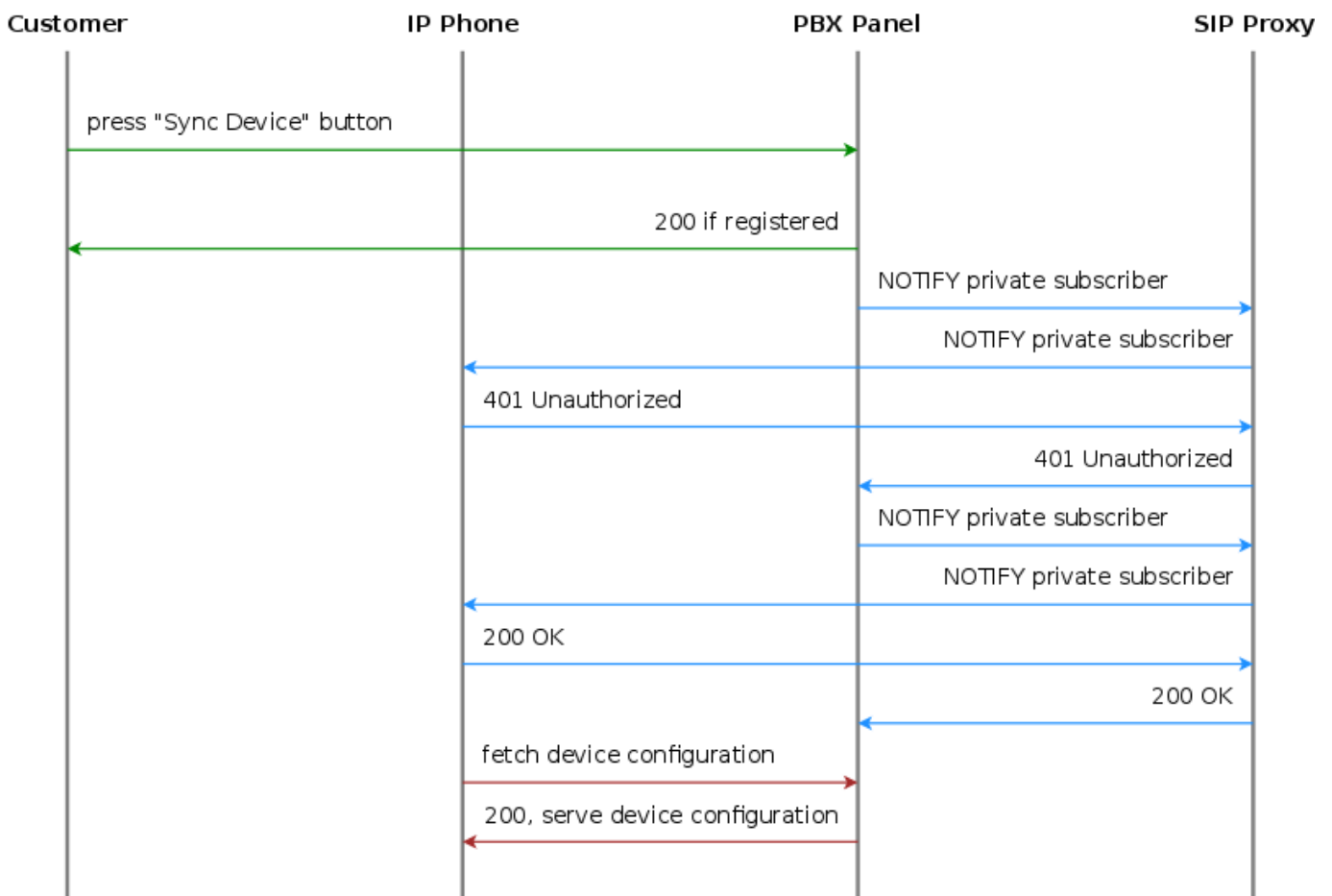


Figure 50: Resync a registered PBX device

A.6.2 Panasonic Device Bootstrap

Initial Bootstrapping

Panasonic provides a zero-touch provisioning mechanism in their firmwares, which causes the factory-reset phones to connect to a Panasonic web service at <https://provisioning.e-connecting.net> to check if a custom provisioning URL is configured for the MAC address of the phone. If an association between the MAC and a provisioning URL is found, the web service redirects the phone to the provisioning URL, where the phone connects to in order to obtain the configuration file.

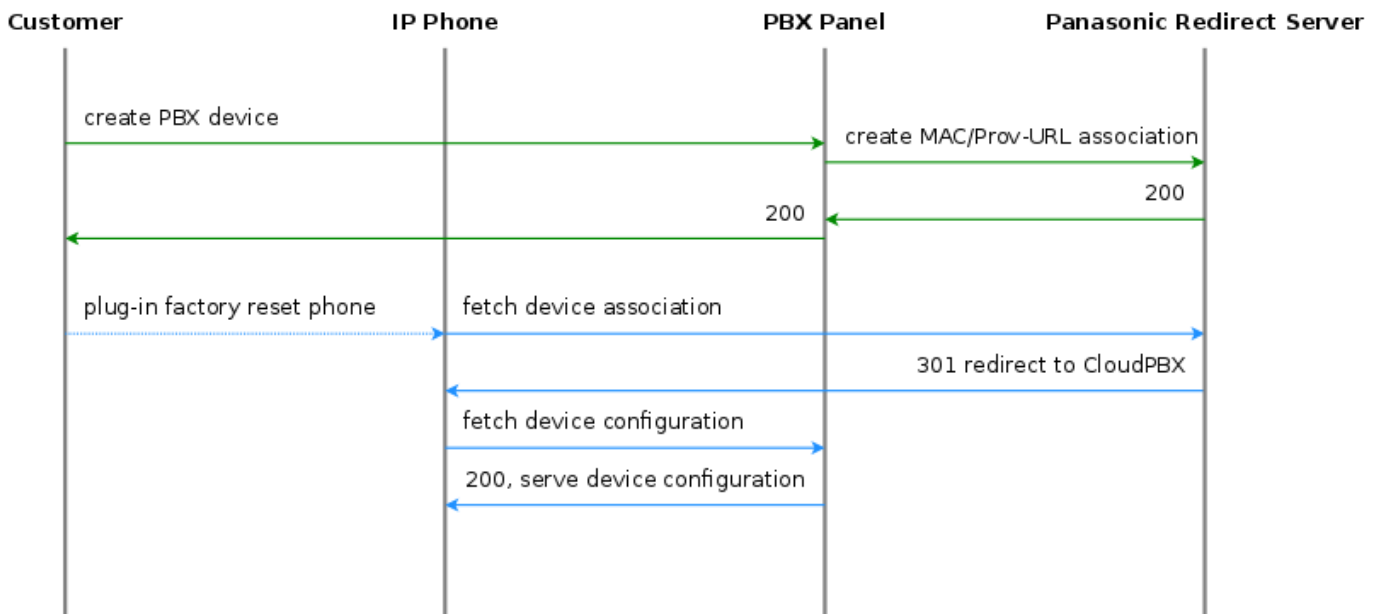


Figure 51: Initially bootstrap a Panasonic phone

The CloudPBX module ensures that when an end customer creates a Panasonic device, the MAC address is automatically provisioned on the Panasonic web service via an API call, so the customer's phone can use the correct provisioning URL to connect to the auto-provisioning server of the CloudPBX.

As a result, no customer interaction is required to bootstrap Panasonic phones, other than just creating the phone with the proper MAC on the CloudPBX web interface.

Factory Reset

For already provisioned phones, the end customer might need to perform a factory reset:

- Press *Settings* or *Setup*
- Enter *#136*
- Select *Factory Setting* and press *Enter*
- Select *Yes* and press *Enter*

- Select *Yes* and press *Enter*

The default username for factory-reset phones is *admin* with password *adminpass*.

Subsequent Device Resyncs

The same procedure as with Cisco SPA phones applies, once a subscriber configured on the phone is registered.

A.6.3 Yealink Device Bootstrap

Initial Bootstrapping

Yealink provides a zero-touch provisioning mechanism in their firmwares, which causes the factory-reset phones to connect to a Yealink web service at <https://rps.yealink.com> to check if a custom provisioning URL is configured for the MAC address of the phone. If an association between the MAC and a provisioning URL is found, the web service redirects the phone to the provisioning URL, where the phone connects to in order to obtain the configuration file.

If both Cisco SPA and Yealink phones are used, an issue with the Cisco-signed server certificate configured on the provisioning port (1444 by default) of the CloudPBX provisioning server arises. Yealink phones by default only connect to trusted server certificates, and the Cisco CA certificate used to sign the server certificate is not trusted by Yealink. Therefore, a two-step approach is used to disable the trusted check via a plain insecure http port (1445 by default) first, where only device-generic config options are served. No user credentials are provided in this case, because no SSL client authentication can be performed. The generic configuration disables the trusted check, and at the same time changes the provisioning URL to the secure port, where the Yealink phone is now able to connect to.

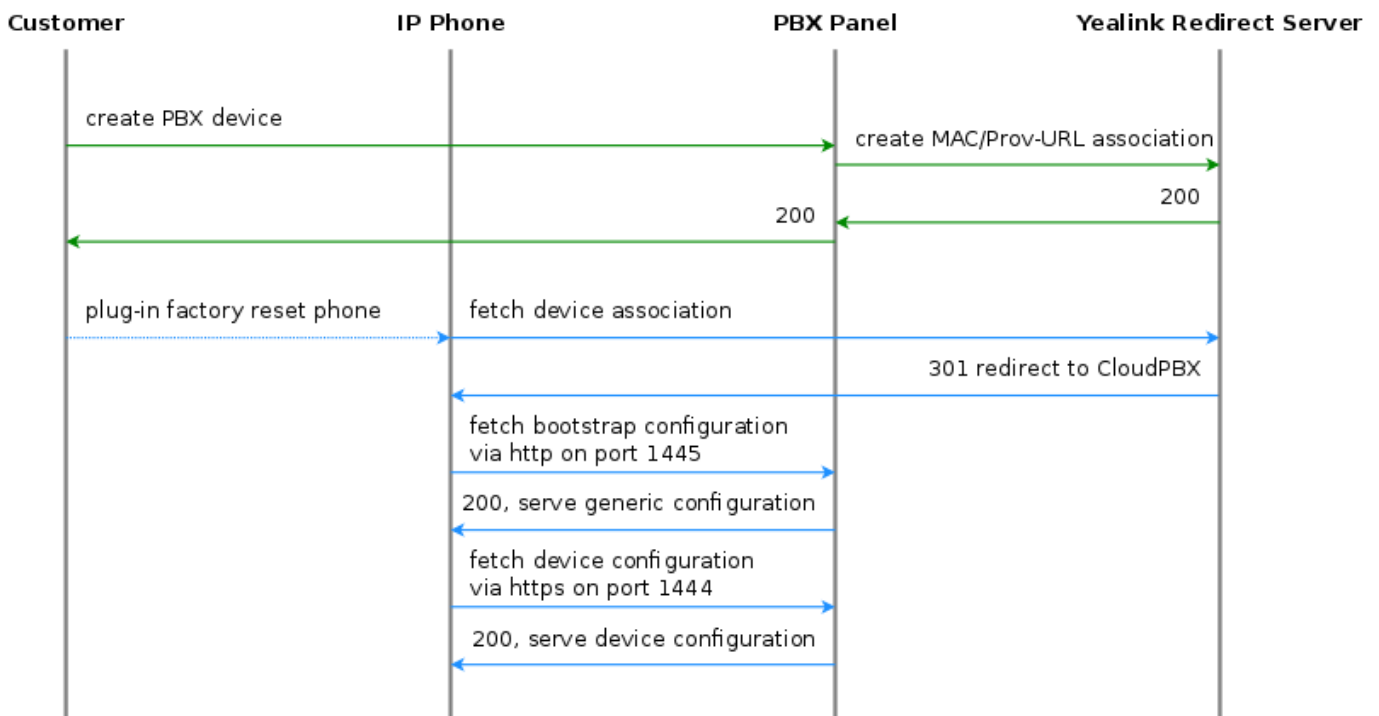


Figure 52: Initially bootstrap a Yealink phone

The CloudPBX module ensures that when an end customer creates a Yealink device, the MAC address is automatically provisioned on the Yealink web service via an API call, so the customer's phone can use the correct insecure bootstrap provisioning URL to connect to the auto-provisioning server of the CloudPBX for the generic configuration, which in turn provides the information on where to connect to for the secure, full configuration.

As a result, no customer interaction is required to bootstrap Yealink phones, other than just creating the phone with the proper MAC on the CloudPBX web interface.

Factory Enable Yealink Auto-Provisioning

Older Yealink firmwares don't automatically connect to the Yealink auto-provisioning server on initial boot, so it needs to be enabled manually by the end customer.

- Log in to `http://phone-ip/servlet?p=hidden&q=load` using `admin` and `admin` as user/password when prompted
- Change `Redirect Active` to `Enabled`
- Press `Confirm` and power-cycle phone

Subsequent Device Resyncs

The same procedure as with Cisco SPA phones applies, once a subscriber configured on the phone is registered.

A.6.4 Audiocodes Mediant Device Bootstrap and Configuration

Initial Bootstrapping

An Audiocodes device provides a zero-touch provisioning mechanism in its firmware which causes a factory-reset device to connect to the URL built into the firmware. This URL is pointing to the NGCP provisioning server (in case of NGCP Carrier: `web01` node) listening on TCP port 1444 for HTTPS sessions.

The prerequisites for the device provisioning are that the device has a routable IP address and can reach the IP address of the NGCP provisioning interface.

The Audiocodes device should request the firmware file or CLI configuration file from the NGCP platform. The firmware versions and CLI config versions are decoupled from each other; the NGCP can not enforce specific version of the firmware on the device. Instead, it should be requested by the device itself. In other words, provisioning is a *pull* and not a *push* process.

NGCP expects the provisioning request from the Audiocodes device after SSL handshake and serves the requested file to the device if the device provides valid MAC address as the part of the URL. The MAC address is used to identify the device to the NGCP platform. The firmware and CLI config files are provided at the following URLs:

- the base URL to download firmwares: `https://<NGCP_IP>:1444/device/autoprov/firmware/001122334455/from/0/latest`
- the base URL to download CLI config: `https://<NGCP_IP>:1444/device/autoprov/config/001122334455`

where 001122334455 should be replaced with the actual device's MAC address and <NGCP_IP> with IP address of the NGCP provisioning interface.

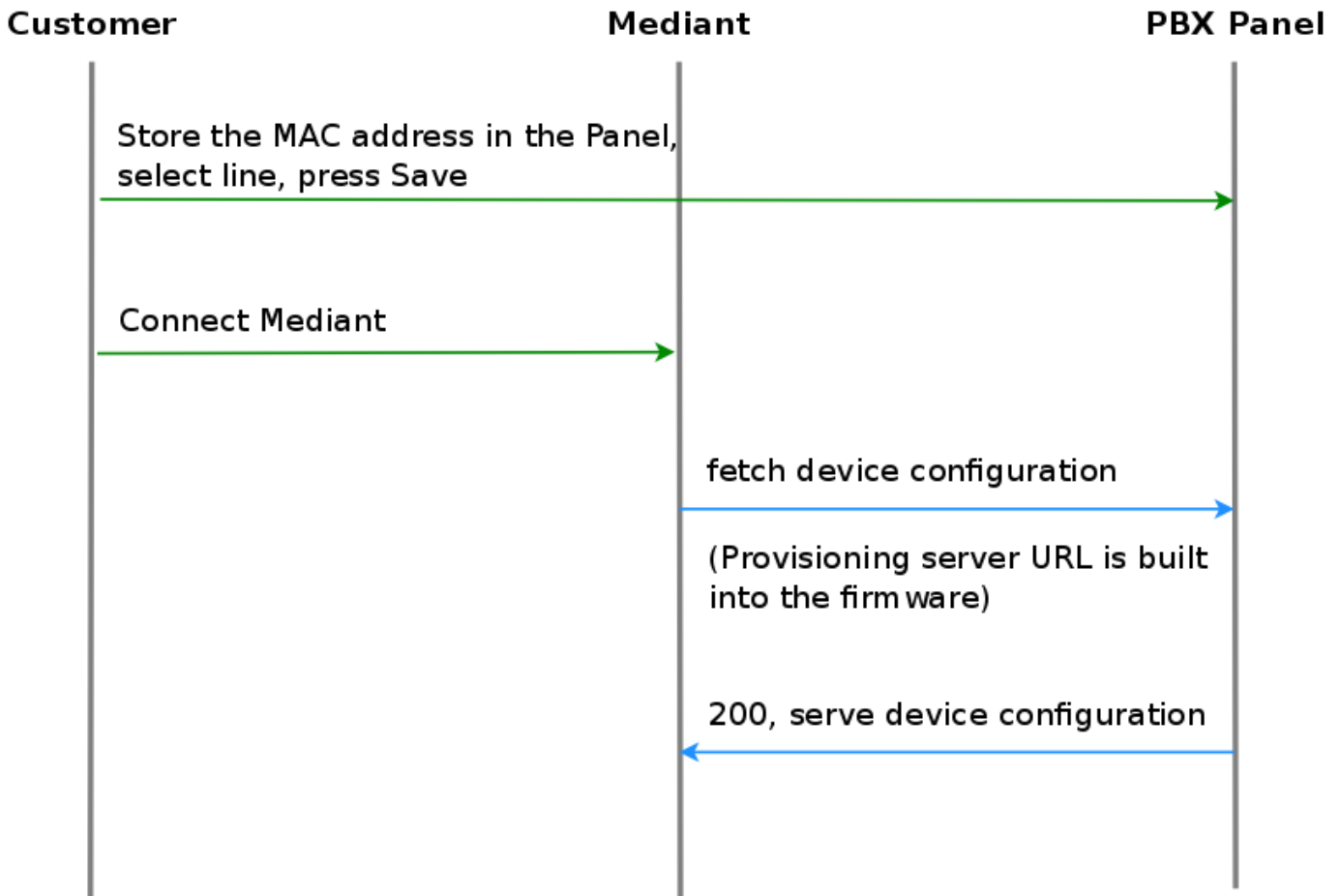


Figure 53: Initially bootstrap a Mediant gateway

Device management basics

The list of device models, firmwares and configurations are global to a reseller and are available for end customer. This data is initially provided by Sipwise as bulk upload of all supported phone models. The firmwares and settings are stored in the database on the DB node pair(s). The NGCP leverages the Cloud PBX module with its template system to generate the configurations and firmware files from database on the fly. Please refer to the following chapters in NGCP handbook for the current information on how to perform device management:

- [Uploading device firmwares](#) Section A.1.2
- [Creating device configuration](#) Section A.1.3
- [Creating device profiles](#) Section A.1.4

Parameterizing the Device Configuration Template

The device-specific parameters are filled in by the system individually when a physical device fetches its configuration file. Parameters from the NGCP panel:

- `username`: Subscriber Details → Master Data → SIP Username
- `password`: Subscriber Details → Master Data → SIP Password
- `domain`: Subscriber Details → Master Data → Domain
- `extension`: Subscriber Details → Master Data → Extension
- `area code`: Subscriber Preferences → Number Manipulations → ac
- `country code`: Subscriber Preferences → Number Manipulations → cc

The produced **CLI config file** has the following structure:

1. SIP account credentials:

```
"sip-definition account 0"
```

- `user-name` [username]
- `password` [password]
- `host-name` [domain]
- `register` reg
- `contact-user` "[country code][area code][extension]"

2. IP Groups:

```
"voip-network ip-group 1" and "voip-network ip-group 2"
```

- `sip-group-name` [domain]

3. Proxy and registration settings:

```
"sip-definition proxy-and-registration"
```

- `set gw-name` [domain]

4. Manipulations:

- `manipulation-name` "from trunk domain":

```
"sbc manipulations message-manipulations 3"
```

```
– action-value "[% line.domain %]"
```

- manipulation-name "clip no screening":

```
"sbc manipulations message-manipulations 8"
```

```
- action-value "'< sip:[country code][area code][extension]@' + param.ipg.dst.host + '
>' "
```

Specific CLI parameters are:

- [IPPBX_Hostname]
- [IPPBX_server_IP]

which are used at the following configuration parameters:

- Proxy settings:

```
"voip-network proxy-ip 1"
```

```
- proxy-address [IPPBX_Hostname]
```

- Manipulations:

```
"sbc manipulations message-manipulations 1"
```

```
- action-value [IPPBX_Hostname]
```

A.7 Device Provisioning and Deployment Workflows

This chapter provides information and hints for preparing and performing the deployment of certain VoIP devices at customer sites, that have a customer-facing interface which also needs customisation.

A.7.1 Audiocodes Mediant Device Provisioning Workflow

Audiocodes ISDN gateways and eSBCs are devices used to connect legacy (ISDN) PBX and IP-PBX to the Sipwise NGCP platform and maintain their operations within the Operator's network. Sipwise NGCP offers a *SipConnect 1.1* compliant signaling and media interface to connect SIP trunks to the platform. In addition to this interface, the Sipwise NGCP provides an auto-provisioning mechanism to configure SIP endpoints like IP phones, media gateways and eSBCs.

Provisioning URL

An Audiocodes device needs to obtain the provisioning URL of the Sipwise NGCP in one way or the other to request its device configuration and subsequently download specific firmwares, obtain SIP credentials to connect to the network facing side, and configure the customer facing side for customer devices to connect either via ISDN or SIP. Typical ways of obtaining the provisioning URL for a SIP endpoint are:

- using DHCP option-66 (in a pre-staging environment or directly at the customer premise) where vendor-specific Redirect Servers are configured in the default configuration or firmware
- getting pre-configured per deployment from the SIP endpoint vendor
- getting pre-configured per deployment by a 3rd party distributor

The assumption is that Audiocodes devices are supplied with a firmware (and all required SSL certificates) being pre-configured and the provisioning URL pointing to an Operator URL the Sipwise NGCP is serving, before handing the devices over to field service engineers doing the truck rolls.

Field Configuration

The Sipwise NGCP provides a SipConnect 1.1 compliant interface on the network side for the Audiocodes devices. This interface clearly defines the numbering formats of the calling and called party, the SIP header mechanisms to provide CLI restriction, the RTP codecs, etc.

On the customer facing side, however, those variables might be different from deployment to deployment:

- An IP-PBX might choose to only send its extension as calling party number, or might choose to send the full number in national format.
- It might choose to use the SIP From-header mechanisms to suppress displaying of the CLI, or use the SIP Privacy header.
- The same uncertainty exists to some extent for a legacy PBX connecting via ISDN to the Audiocodes device.

The assumption here is that a field service engineer is NOT supposed to change the Audiocodes configuration in order to make the customer interface work, as this will lead to big issues in maintaining those local changes, especially if a replacement of the device is necessary. Instead, the Audiocodes configuration must ensure that all different kinds of variants in terms of SIP headers, codecs and number formats are translated correctly to the network side and vice versa. If it turns out that there are scenarios in the field which are not handled correctly, temporary local changes might be performed to finish a truck roll, but those changes MUST be communicated to the platform operator, and the server-side configuration templates must be adapted to handle those scenarios gracefully as well.

For deployments with ISDN interfaces on the customer facing side of the Audiocodes, different *Device Profiles* with specific *Device Configurations* per *Device Model* must exist to handle certain scenarios, specifically whether the ISDN interface is operating in Point-to-Point or Point-to-Multipoint mode. Configuration options like which side is providing the clock-rate are to be defined up-front, and the PBX must be reconfigured to adhere to the configuration.

Network Configuration

On the network facing side, both the ISDN and eSBC style deployments have to be designed to obtain an IP address via DHCP. The definition of the IP address ranges is up to the Operator. It may or may not be NAT-ed, but it is advised to use a private IP range directly routed in the back-bone to avoid NAT.

On the customer facing side, networking is only relevant for the eSBC deployment. In order to make the IP-PBX configuration as stream-lined as possible, a pre-defined network should be established on the customer interface of the Audiocodes device.

Tip

The proposal is to define a network 192.168.255.0/24 with the Audiocodes device using the IP 192.168.255.2 (leaving the 192.168.255.1 to a possible gateway). The IP-PBX could obtain its IP address via DHCP from a DHCP server running on the Audiocodes device (e.g. serving IP addresses in the range of 192.168.255.100-254), or could have it configured manually (e.g. in the range of 192.168.255.3-99). Since the Audiocodes device IP on the customer side is always fixed at 192.168.255.2, the IP-PBX for each customer can be configured the same way, pointing the SIP proxy/registrar or outbound proxy always to this IP.

The customer facing side is outside the Sipwise demarcation line, that's why the network configuration mentioned above only serves as proposal and any feedback is highly welcome. However, it must be clearly communicated how the customer facing network is going to be configured, because the Sipwise NGCP needs to incorporate this configuration into the Audiocodes configuration templates.

A.7.2 Audiocodes Mediant Device Deployment Workflow

Pre-Configuration on Sipwise NGCP platform

1. Before connecting a customer to a SIP trunk, it must be clear which Audiocodes *Device Model* is going to be used (depending on if, which and how many ISDN ports are necessary) and which *Device Profile* for the *Device Model* is required (eSBC mode, ISDN P-to-P or P-to-MP mode). Based on that, the correct physical device must be picked.
2. Next, the customer has to be created on the Sipwise NGCP. This step requires the creation of the customer, and the creation of a subscriber within this customer. For the subscriber, the proper E.164 numbers or number blocks must be assigned, and the correct subscriber preferences must be set for the network interface to adhere to the SipConnect 1.1 interface. This step is automated by a script provided by Sipwise until the provisioning work-flow is fully integrated with Operator's OSS/BSS systems. *Required parameters are:*
 - an external customer id to relate the customer entity on the Sipwise NGCP with a customer identifier in Operator's IT systems
 - a billing profile name
 - a subscriber username and password, the domain the subscriber is configured for
 - the numbers or number blocks assigned to the subscriber, and the network provided number of the subscriber
 - optional information is geographic location information and IP network information to properly map emergency calls
3. Finally, the association between the MAC address of the Audiocodes device and the SIP subscriber to be used on the SIP trunk must be established. This step is also automated by a script provided by Sipwise. *Required parameters are:*
 - the subscriber id
 - the Device Profile to be used
 - and the MAC address of the Audiocodes device

Installation

Once the above requirements are fulfilled and the customer is created on the Sipwise NGCP, the Audiocodes device can be installed at the customer premise.

When the Audiocodes device boots, it requests the configuration file from the Sipwise NGCP by issuing a GET request via HTTPS.

For **authentication and authorization** purposes, the Sipwise NGCP requests an SSL client certificate from the device and will check whether it's signed by a Certificate Authority known to the Sipwise NGCP. Therefore, Audiocodes must provide the CA certificate used to sign the devices' client certificates to Sipwise to allow for this process. Also, the Sipwise NGCP will provide an SSL server certificate to the device. The device must validate this certificate in order to prevent man-in-the-middle attacks. Options here are to have:

- Sipwise provide a self-signed certificate to Audiocodes for Audiocodes or a 3rd party distribution partner to configure it as trusted CA in the pre-staging process
- the Operator provide a certificate signed by a CA which is already in the trust store of the Audiocodes devices.

Once the secured HTTPS connection is established, the Sipwise NGCP will provide a CLI style configuration file, with its content depending on the pre-configured *Device Profile* and subscriber association to the device's MAC address.

The configuration includes the firmware version of the latest available firmware configured for the *Device Model*, and a URL defining from where to obtain it. The configuration details on how the Audiocodes devices manage the scheduling of firmware updates are to be provided by Audiocodes or its partners, since this is out of scope for Sipwise. Ideally, firmware updates should only be performed if the device is idle (no calls running), and within a specific time-frame (e.g. between 1 a.m. and 5 a.m. once a certain firmware version is reached, including some random variation to prevent all devices to download a new firmware version at the same time).

Device Replacement

If a customer requires the replacement of a device, e.g. due to hardware issues or due to changing the number or type of ISDN interfaces, a new association of the new device MAC, its *Device Profile* and the subscriber must be established.

In order to make the change as seamless as possible for the customer, a new device is created for the customer with the new MAC, a proper *Device Profile*, but the same subscriber as used on the old device. Once the new device boots at the customer premise, it will obtain its configuration and will register with the same subscriber as the old device (in case it's still operational). For inbound calls to the customer, this will cause parallel ringing to take place, and it's up to the customer or the field engineer when to re-configure or re-cable the PBX to connect to one or the other device.

Once the old device is decommissioned, the old MAC association can be deleted on the Sipwise NGCP.

A.8 List of available pre-configured devices

Vendor	Model	Available from release
Audiocodes	Mediant800	mr4.1.1.1

Vendor	Model	Available from release
Cisco	ATA112	mr3.4.1.1
Cisco	ATA122	mr3.4.1.1
Cisco	SPA232D	mr3.4.1.1
Cisco	SPA301	mr3.4.1.1
Cisco	SPA303	mr3.4.1.1
Cisco	SPA501G	mr3.4.1.1
Cisco	SPA502G	mr3.4.1.1
Cisco	SPA512G	mr3.4.1.1
Cisco	SPA504G	mr3.4.1.1
Cisco	SPA504G + SPA500S	mr3.7.1.4
Cisco	SPA504G + two SPA500S	mr3.7.1.4
Cisco	SPA514G	mr3.4.1.1
Cisco	SPA508G	mr3.4.1.1
Cisco	SPA509G	mr3.4.1.1
Cisco	SPA525G	mr3.4.1.1
Innovaphone	IP2X2X	mr3.8.3.3
Innovaphone	IP230-X	mr3.8.3.3
Innovaphone	IP232	mr3.8.3.3
Innovaphone	IP222	mr3.8.3.3
Innovaphone	IP240	mr3.8.3.3
Innovaphone	IP22	mr3.8.3.3
Innovaphone	IP111	mr3.8.3.3
Panasonic	KX-UT113	mr3.7.1.1
Panasonic	KX-UT123	mr3.7.1.1
Panasonic	KX-UT133	mr3.7.1.1
Panasonic	KX-UT136	mr3.7.1.1
Panasonic	KX-UT248	mr3.7.1.1
Yealink	SIP-T19P	mr3.7.1.1
Yealink	SIP-T20P	mr3.7.1.1
Yealink	SIP-T21P	mr3.7.1.1
Yealink	SIP-T22P	mr3.7.1.1
Yealink	SIP-T23P	mr3.7.1.1
Yealink	SIP-T23G	mr3.7.1.1
Yealink	SIP-T26P	mr3.7.1.1
Yealink	SIP-T28P	mr3.7.1.1
Yealink	SIP-T32G	mr3.7.1.1
Yealink	SIP-T38G	mr3.7.1.1
Yealink	SIP-T41P	mr3.7.1.1
Yealink	SIP-T42G	mr3.7.1.1
Yealink	SIP-T46G	mr3.7.1.1
Yealink	SIP-T48G	mr3.7.1.1
Yealink	SIP-T28P + EXP39	mr3.8.1.1
Yealink	SIP-T28P + two EXP39	mr3.8.1.1

Vendor	Model	Available from release
Yealink	W52P	mr3.7.1.6

A.8.1 Cisco Devices

IP Phones

Model	IPv6	TLS	SRTP	Auto provisioning	Private Line	Shared Line	Busy Lamp	Extension Boards
SPA301	N	Y	Y	http	1	1	0	N
SPA303	N	Y	Y	http	1-3	1-3	1-2	N
SPA501G	N	Y	Y	http	1-8	1-8	1-7	N
SPA502G	N	Y	Y	http	1	1	0	N
SPA512G	N	N	Y	http	1	1	0	N
SPA504G	N	Y	Y	http	1-4	1-4	1-3	2
SPA514G	N	N	Y	http	1-4	1-4	1-3	N
SPA508G	N	Y	Y	http	1-8	1-8	1-7	N
SPA509G	N	Y	Y	http	1-12	1-12	1-11	N
SPA525G	N	Y	N	http	1-5	1-5	1-4	N

Analog Adapters

Model	IPv6	TLS	SRTP	Auto provisioning	Private Line	Shared Line	Busy Lamp
SPA232D	N	Y	Y	http	1-6	0	0
ATA112	Y	Y	Y	http	1-2	0	0
ATA122	Y	Y	Y	http	1-2	0	0

Extension Boards

Model	Ports	Buttons	Busy Lamp	Supported phones
SPA500S	2	32	1-32	SPA500

A.8.2 Panasonic Devices

IP Phones

Model	IPv6	TLS	SRTP	Auto provisioning	Private Line	Shared Line	Busy Lamp	Extension Boards
KX-UT113	N	N	N	redirect	1-2	1-2	0	N

Model	IPv6	TLS	SRTTP	Auto provisioning	Private Line	Shared Line	Busy Lamp	Extension Boards
KX-UT123	N	N	N	redirect	1-2	1-2	0	N
KX-UT133	N	N	N	redirect	1-4	1-4	1-23	N
KX-UT136	N	N	N	redirect	1-4	1-4	1-23	N
KX-UT248	N	N	Y	redirect	1-6	1-6	1-23	N

A.8.3 Yealink Devices

IP Phones

Model	IPv6	TLS	SRTTP	Auto provisioning	Private Line	Shared Line	Busy Lamp	Extension Boards
SIP-T19P	Y	Y	Y	redirect	1	1	0	N
SIP-T20P	Y	Y	Y	redirect	1	1	0	N
SIP-T21P	Y	Y	Y	redirect	1-2	1-2	1	N
SIP-T22P	Y	Y	Y	redirect	1-3	1-3	1-2	N
SIP-T23P	Y	Y	Y	redirect	1-3	1-3	1-2	N
SIP-T23G	Y	Y	Y	redirect	1-3	1-3	1-2	N
SIP-T26P	Y	Y	Y	redirect	1-3	1-3	1-12	N
SIP-T28P	Y	Y	Y	redirect	1-6	1-6	1-15	2
SIP-T32G	Y	Y	Y	redirect	1-3	1-3	1-2	N
SIP-T38G	Y	Y	Y	redirect	1-6	1-6	1-15	N
SIP-T41P	Y	Y	Y	redirect	1-3	1-3	1-14	N
SIP-T42G	Y	Y	Y	redirect	1-3	1-3	1-14	N
SIP-T46G	Y	Y	Y	redirect	1-6	1-6	1-26	N
SIP-T48G	Y	Y	Y	redirect	1-6	1-6	1-28	N
W52P	N	Y	Y	redirect	1-5	1-5	0	N

A.8.4 Innovaphone Devices

IP Phones

Model	IPv6	TLS	SRTTP	Auto provisioning	Private Line	Shared Line	Busy Lamp	Extension Boards
IP232	N	Y	Y	dhcp	1	0	1-16	2
IP222	N	Y	Y	dhcp	1	0	1-16	2
IP240	N	N	N	dhcp	1	0	1-15	2
IP111	N	Y	Y	dhcp	1	0	1-16	0

Analog Adapters

Model	IPv6	TLS	SRTP	Auto provisioning	Private Line	Shared Line	Busy Lamp
IP22	N	Y	Y	dhcp	1	0	0

Extension Boards

Model	Ports	Buttons	Busy Lamp	Supported phones
IP2X2X	2	64	1-32	IP2x2
IP230-X	2	30	1-30	IP230

A.8.5 Audiocodes Devices

Model	IPv6	TLS	SRTP	Auto provisioning	Private Line	Shared Line	Busy Lamp	Speed Dial
Mediant800	Y	Y	Y	dhcp	1	0	0	N

A.9 Phone features

A.9.1 Cisco phones

SPA301

1) Soft keys

Not available.

2) Hard keys

- vm
- hold/unhold

3) Line keys

Not available.

4) VSC

- directed pickup
- park/unpark

SPA303**1) Soft keys****Idle:**

redial	lcr	dir	dnd >
< cfwd	unpark		

Idle with missed calls:

lcr			miss
-----	--	--	------

Call:

hold	endCall	conf	xfer >
< bxfer	park		

Call on hold:

resume	endCall	newCall	redial >
< dir	cfwd	dnd	

Ringing:

answer	ignore		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- directed pickup

SPA501G**1) Soft keys**

Idle:

redial	lcr	dir	dnd >
< cfwd	unpark		

Idle with missed calls:

lcr			miss
-----	--	--	------

Call:

hold/resume	endCall	conf	xfer >
< bxfer	park		

Call on hold:

resume	endCall	newCall	redial >
< dir	cfwd	dnd	

Ringling:

answer	reject		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- directed pickup

SPA502G**1) Soft keys****Idle:**

redial	lcr	dir	dnd >
< cfwd	unpark		

Idle with missed calls:

lcr			miss
-----	--	--	------

Call:

hold/resume	endCall	conf	xfer >
< bxfer	park		

Call on hold:

resume	endCall	newCall	redial >
< dir	cfwd	dnd	

Ringling:

answer	reject		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

Not available.

4) VSC

- directed pickup

SPA504G**1) Soft keys****Idle:**

redial	lcr	dir	dnd >
< cfwd	unpark		

Idle with missed calls:

lcr			miss
-----	--	--	------

Call:

hold/resume	endCall	conf	xfer >
< bxfer	park		

Call on hold:

resume	endCall	newCall	redial >
< dir	cfwd	dnd	

Ringing:

answer	reject		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- directed pickup

SPA512G**1) Soft keys****Idle:**

redial	lcr	dir	dnd >
< cfwd	unpark		

Idle with missed calls:

lcr			miss
-----	--	--	------

Call:

hold/resume	endCall	conf	xfer >
< bxfer	park		

Call on hold:

resume	endCall	newCall	redial >
< dir	cfwd	dnd	

Ringing:

answer	reject		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

Not available.

4) VSC

- directed pickup

SPA514G**1) Soft keys****Idle:**

redial	lcr	dir	dnd >
< cfwd	unpark		

Idle with missed calls:

lcr			miss
-----	--	--	------

Call:

hold/resume	endCall	conf	xfer >
< bxfer	park		

Call on hold:

resume	endCall	newCall	redial >
< dir	cfwd	dnd	

Ringing:

answer	reject		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- directed pickup

SPA509G**1) Soft keys****Idle:**

redial	lcr	dir	dnd >
< cfwd	unpark		

Idle with missed calls:

lcr			miss
-----	--	--	------

Call:

hold/resume	endCall	conf	xfer >
< bxfer	park		

Call on hold:

resume	endCall	newCall	redial >
< dir	cfwd	dnd	

Ringing:

answer	reject		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- directed pickup

SPA508G**1) Soft keys****Idle:**

redial	lcr	dir	dnd >
< cfwd	unpark		

Idle with missed calls:

lcr			miss
-----	--	--	------

Call:

hold/resume	endCall	conf	xfer >
< bxfer	park		

Call on hold:

resume	endCall	newCall	redial >
< dir	cfwd	dnd	

Ringing:

answer	reject		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- directed pickup

SPA525G**1) Soft keys****Idle:**

Redial	call Rtn	Directory	DND >
< Forward	Unpark		

Idle with missed calls:

Call Rtn			Miss
----------	--	--	------

Call:

Hold	End Call	Conf	Transfer >
BlindXfer	Park		

Call on hold:

Resume	EndCall	EewCall	Redial >
< Directory	Forward	DND	

Ringling:

Answer	Ignore		
--------	--------	--	--

2) Hard keys

- vm
- hold/unhold

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- directed pickup

A.9.2 Yealink phones**T19P****1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringing:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

Not available.

4) VSC

- transfer park
- directed pick up
- park/unpark

T20P**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- transfer park
- park/unpark

T21P**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- transfer park
- park/unpark

T22P**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

T23P**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

T23G**1) Soft keys****Idle:**

History	Dir	DND	Menu
---------	-----	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	EndCall
------	------	------	---------

Call on hold:

Tran	Resume	NewCall	EndCall
------	--------	---------	---------

Ringling:

Answer	FWD		Reject
--------	-----	--	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- unpark
- transfer park

T26P**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- unpark
- transfer park

T28P**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

T32G**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- unpark
- transfer park

T38G**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- unpark
- transfer park

T41P**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

T42G**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

T46G**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

T48G**1) Soft keys****Idle:**

History		DND	Menu
---------	--	-----	------

Idle with missed calls:

Exit			View
------	--	--	------

Call:

Tran	Hold	Conf	Cancel
------	------	------	--------

Call on hold:

Tran	Resume	NewCall	Cancel
------	--------	---------	--------

Ringling:

Answer	FWD	Silence	Reject
--------	-----	---------	--------

2) Hard keys

- vm
- redial
- transfer

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

W52P**1) Soft keys****Idle:**

History	Line
---------	------

Idle with missed calls:

Exit	View
------	------

Call:

Ext. Call	Options
-----------	---------

Call on hold:

Resume	Line
--------	------

Ringing:

Accept	
--------	--

2) Hard keys

- vm
- redirect

3) VSC

- park/unpark
- transfer park

A.9.3 Panasonic phones

KX-UT113

1) Soft keys

Idle:

Settings	Call Log	Phone book	
----------	----------	------------	--

Call:

Blind		Phone book	
-------	--	------------	--

Call on hold:

	Call Log	Phone book	
--	----------	------------	--

Ringing:

Answer		Reject	
--------	--	--------	--

2) Hard keys

- vm

- forward/dnd
- hold/unhold
- redial
- recall
- transfer
- conf

3) Line keys

Not available.

4) VSC

- park/unpark
- transfer park

KX-UT123

1) Soft keys

Idle:

Settings	Call Log	Phone book	
----------	----------	------------	--

Call:

Blind		Phone book	
-------	--	------------	--

Call on hold:

	Call Log	Phone book	
--	----------	------------	--

Ringling:

Answer		Reject	
--------	--	--------	--

2) Hard keys

- vm
- forward/dnd
- hold/unhold

- redial
- recall
- transfer
- conf

3) Line keys

Not available.

4) VSC

- park/unpark
- transfer park

KX-UT133

1) Soft keys

Idle:

Settings	Call Log	Phone book	
----------	----------	------------	--

Call:

Blind		Phone book	
-------	--	------------	--

Call on hold:

	Call Log	Phone book	
--	----------	------------	--

Ringling:

Answer		Reject	
--------	--	--------	--

2) Hard keys

- vm
- forward/dnd
- hold/unhold
- redial
- recall

- transfer
- conf

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- unpark
- transfer park

KX-UT136

1) Soft keys

Idle:

Settings	Call Log	Phone book	
----------	----------	------------	--

Call:

Blind		Phone book	
-------	--	------------	--

Call on hold:

	Call Log	Phone book	
--	----------	------------	--

Ringling:

Answer		Reject	
--------	--	--------	--

2) Hard keys

- vm
- forward/dnd
- hold/unhold
- redial
- recall

- transfer
- conf

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

KX-UT248

1) Soft keys

Idle:

Settings	Call Log	Phone book	
----------	----------	------------	--

Call:

Blind		Phone book	
-------	--	------------	--

Call on hold:

	Call Log	Phone book	
--	----------	------------	--

Ringling:

Answer		Reject	
--------	--	--------	--

2) Hard keys

- vm
- forward/dnd
- hold/unhold
- redial
- recall

- transfer
- conf

3) Line keys

- BLF monitoring
- directed pickup

4) VSC

- park/unpark
- transfer park

A.9.4 Innovaphone

IP222

1) Soft keys

Idle:

Setup	All Calls	Home	Calls	My favorites	Phonebook
-------	-----------	------	-------	--------------	-----------

Call:

Hold	Transfer	Park	Cancel
------	----------	------	--------

Call on hold:

Resume	Transfer	Park	Cancel
--------	----------	------	--------

Ringling:

Answer	Transfer	Silence	Reject
--------	----------	---------	--------

2) Hard keys

- hold
- redial

3) Line keys

- BLF monitoring

4) VSC

- unpark
- transfer park

IP232

1) Soft keys

Idle:

Setup	All Calls	Home	Calls	My favorites	Phonebook
-------	-----------	------	-------	--------------	-----------

Call:

Hold	Transfer	Park	Cancel
------	----------	------	--------

Call on hold:

Resume	Transfer	Park	Cancel
--------	----------	------	--------

Ringling:

Answer	Transfer	Silence	Reject
--------	----------	---------	--------

2) Hard keys

- hold
- redial

3) Line keys

- BLF monitoring

4) VSC

- unpark
- transfer park

IP111**1) Soft keys****Idle:**

Setup	All Calls	Home	Calls	My favorites	Phonebook
-------	-----------	------	-------	--------------	-----------

Call:

Hold	Transfer	Park	Cancel
------	----------	------	--------

Call on hold:

Resume	Transfer	Park	Cancel
--------	----------	------	--------

Ringling:

Answer	Transfer	Silence	Reject
--------	----------	---------	--------

2) Hard keys

- hold
- redial

3) Line keys

- BLF monitoring

4) VSC

- unpark
- transfer park

IP240**1) Soft keys**

Not available.

2) Hard keys

- hold

- redial
- conference
- dnd
- forward

3) Line keys

- BLF monitoring

4) VSC

- transfer park
- unpark

B Sipwise Clients and Apps

You can order two commercial Unified Communication Clients for full end-to-end integration of voice, video, chat and presence features. There are two applications available:

- the sip:phone Desktop Client for Microsoft Windows, Apple OSX, and Linux;
- the sip:phone Mobile App for iOS and Android.

Both clients are fully brandable to the customer's corporate identity. The clients are not part of the standard delivery and need to be licensed separately.

We continuously develop the mobile clients to provide new features, as they do not support the full range of features yet.

B.1 sip:phone Mobile App

The sip:phone Mobile App is a mobile client for iOS and Android that supports voice calls via SIP, as well as presence and instant messaging via XMPP. The following sections describe the steps needed to integrate it into your sip:carrier.

B.1.1 Zero Config Launcher

Part of the mobile apps is a mechanism to sign up to the service via a 3rd party website, which is initiated on the login screen and rendered within the app. During the sign-up process, the 3rd party service is supposed to create a new account and subscriber in the sip:carrier (e.g. automatically via the API) and provide the end user with the access credentials.

The mobile apps come with a zero config mechanism to simplify the end-customer log in using these credentials (especially ruling out the need to manually enter them). It makes it possible to deliver the access credentials via a side channel (e.g. Email, SMS) packed into a URL. The user just clicks the URL, and it automatically launches the app with the correct credentials. The following picture shows the overall workflow.

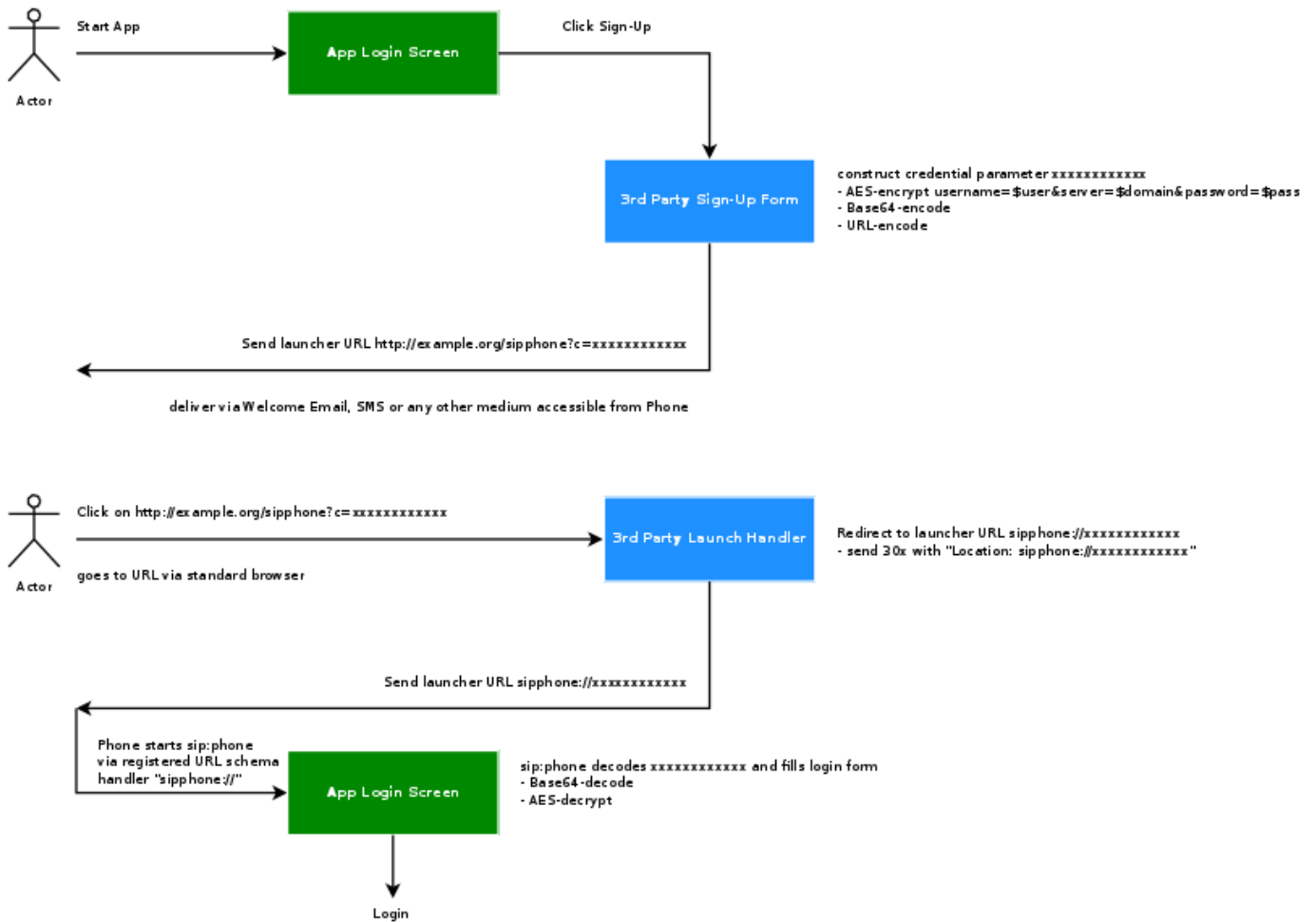


Figure 54: Provisioning Push Workflow

There are two components provided by a 3rd party system. One is the *3rd Party Sign-Up Form*, and the other is the *3rd Party Launch Handler*. The purpose of these components is to allow an end customer to open a link with the access credentials via the sip:phone app.

3rd Party Sign-Up Form

The 3rd Party Sign-Up Form is a website the app shows to the end user when he taps the sign-up link on the app *Login Screen*. There, the end customer usually provides his contact details like name, address, phone number and email address, etc. After validation, the website creates an account and a subscriber in the sip:carrier via the API.

After successfully creating the account and the subscriber, this site needs to construct a specially crafted URL, which is sent back to the end customer via a side channel. Ideally, this channel would be an SMS if you want to verify the end customer’s mobile number, or an email if you want to check the email address.

The sip:phone app registers a URL schema handler for URLs starting with `sipphone://`. If you start such a link, the app performs a Base64 decoding of the string right after the `sipphone://` prefix and then decrypts the resulting binary string via AES using the keys defined during the branding step. The resulting string is supposed to be

`username=$user&server=$domain&password=$password`.

Therefore, the *3rd Party Sign-Up Form* needs to construct this string using the credentials defined while creating the subscriber via the sip:carrier API, then encrypt it via AES, and finally perform a Base64 encoding of the result.

Note

Up until and including version mr4.5.1 of the sip:carrier, the SIP login credentials are used here. Future versions will connect to the REST interface of the sip:carrier using the web credentials first and fetch the SIP credentials along with other settings from there.

An example Perl code performs encoding of such a string. The AES key and initialization vector (`$key` and `$iv`) are the standard values of the sip:phone app and should work until you specified other values during the branding process.

```
#!/usr/bin/perl -w
use strict;
use Crypt::Rijndael;
use MIME::Base64;
use URI::Escape;

my $key = 'iBmTдавJ8joPW3HO';
my $iv = 'tww211Qe6cmwyrp3';

my $plain = do { local $/; <> };
# pkcs#5 padding to 16 bytes blocksize
my $pad = 16 - (length $plain) % 16;
$plain .= pack('C', $pad) x $pad;

my $cipher = Crypt::Rijndael->new(
    $key,
    Crypt::Rijndael::MODE_CBC()
);
$cipher->set_iv($iv);
my $crypt = $cipher->encrypt($plain);
# store b64-encoded string and print to STDOUT
my $b64 = encode_base64($crypt, '');
print $b64, "\n";
# print to STDOUT using URL escaping also
print uri_escape($b64), "\n";
```

This snippet takes a string from STDIN, encrypts it via AES, encodes it via Base64 and sends the result to STDOUT. It also writes the second line with the same string, but this time, the URL is escaped. To test it, you would run it as follows on a shell, granted it's stored at `/path/to/encrypt.pl`.

```
echo -n 'username=testuser&server=example.org&password=testpass' \
| /path/to/encrypt.pl
```

This command would result in the output strings `CI8VN8toaE40w8E4OH2rAuFj3Qev9QdLI/Wv/VaBCVK2yNkBZjxE9`

eafXkkrQfmYdeu01PquS5P40zhUq8Mfjg== and CI8VN8toaE40w8E4OH2rAuFj3Qev9QdLI%2FWv%2FVaBCVK2yNkBZjxE9eafXkkrQfmYdeu01PquS5P40zhUq8Mfjg%3D%3D. The sip:phone can use the former string to automatically fill in the login form of the Login Screen if started via a Link like sipphone://CI8VN8toaE40w8E4OH2rAuFj3Qev9QdLI/Wv/VaBCVK2yNkBZjxE9eafXkkrQfmYdeu01PquS5P40zhUq8Mfjg==.

Here is the same code in PHP.

```
#!/usr/bin/php
<?php
$key = "iBmTдавJ8joPW3H0";
$iv = "twW21lQe6cmYwrp3";

$clear = fgets(STDIN);
$cipher = fnEncrypt($clear, $key, $iv);

echo $cipher, "\n";
echo urlencode($cipher), "\n";

function fnEncrypt($clear, $key, $iv) {
    $pad = 16 - strlen($clear) % 16;
    $clear .= str_repeat(pack('C', $pad), $pad);
    return rtrim(base64_encode(mcrypt_encrypt(
        MCRYPT_RIJNDAEL_128, $key, $clear,
        MCRYPT_MODE_CBC, $iv)), "\0");
}
?>
```

Similar to the Perl code, you can call it like this:

```
echo -n 'username=testuser&server=example.org&password=testpass' \
| /path/to/encrypt.php
```

However, a URL with the sipphone:// schema is not displayed as a link in an SMS or an Email client and thus can not be clicked by the end customer, so you need to make a detour via a regular http:// URL. To do so, you need a *3rd Party Launch Handler* to trick the phone to open such a link.

Therefore, that the *3rd Party Sign-Up Form* needs to return a link containing a URL pointing to the *3rd Party Launch Handler* and pass the URL escaped string gathered above to the client via an SMS or an Email. Since it is the regular http:// link, it is clickable on the phone and can be launched from virtually any client (SMS, Email, etc.), which correctly renders an HTML link.

A possible SMS sent to the end customer (via the phone number entered in the sign-up form) could, therefore, look as follows (trying to stay below 140 chars).

```
http://example.org/p?c=CI8VN8toaE40w8E4OH2rAuFj3Qev9QdLI
%2FWv%2FVaBCVK2yNkBZjxE9eafXkkrQfmYdeu01PquS5P40zhUq8Mfjg%3D%3D to launch sipphone
```

An HTML Email could look like this:

```
Welcome to Example.org,
```

```
<a href="http://www.example.org/sipphone?c=CI8VN8toaE40w8E40H2rAuFj3Qev9QdLI%2FWv%2FVaBCVK2yNkBZjxE9eafXkkrQfmYdeu01PquS5P40zhUq8Mfjg%3D%3D">
click here
</a> to log in.
```

That way, you can do both: verify the contact details of the end customer, and send the end customer the login credentials in a secure manner.

3rd Party Launch Handler

The URL `http://www.example.org/sipphone` mentioned above can be any simple script, and its sole purpose is to send back a 301 Moved Permanently or 302 Moved Temporarily with a `Location:sipphone://xxxxxxxxxxxx` header to tell the phone to open this link via the sip:phone app. The `xxxxxxxxxxxx` is the plain (non-URL-escaped) string generated by the above script.

An example CGI script performing this task follows.

```
#!/usr/bin/perl -w
use strict;
use CGI;

my $q = CGI->new;
my $c = $q->param('c');
print CGI::redirect("sipphone://$c");
```

The script simply takes the URL parameter `c` from the URL `http://www.example.org/sipphone?c=CI8VN8toaE40w8E40H2rAuFj3Qev9QdLI%2FWv%2FVaBCVK2yNkBZjxE9eafXkkrQfmYdeu01PquS5P40zhUq8Mfjg%3D%3D` crafted above and puts its content into a `Location` header using the `sipphone://` schema, and finally sends a 301 Moved Permanently back to the phone.

The phone follows the redirect by opening the URL using the sip:phone app, which in turn decrypts the content and fills in the login form.

Note

Future versions of the sip:carrier will be shipped with this launch handler integrated into the system. Up until and including the version mr4.5.1, this script needs to be installed on any webserver manually.

B.1.2 Mobile Push Notification

The *mobile push* functionality provides the remote start of a mobile application on incoming calls via the Google GCM or the Apple APNS notification services. It enables you to offer your subscribers a modern and convenient service on mobile devices.



Caution

Although suspending an application on a phone and waking it up via the mobile push notification service extends battery life, the whole mobile push notification concept is the best effort framework provided by Apple and Google for iOS and Android respectively, and therefore does not guarantee 100% reliability.

Architecture

If the *mobile push* functionality is enabled and there are no devices registered for a subscriber, the call-flow looks as follows.

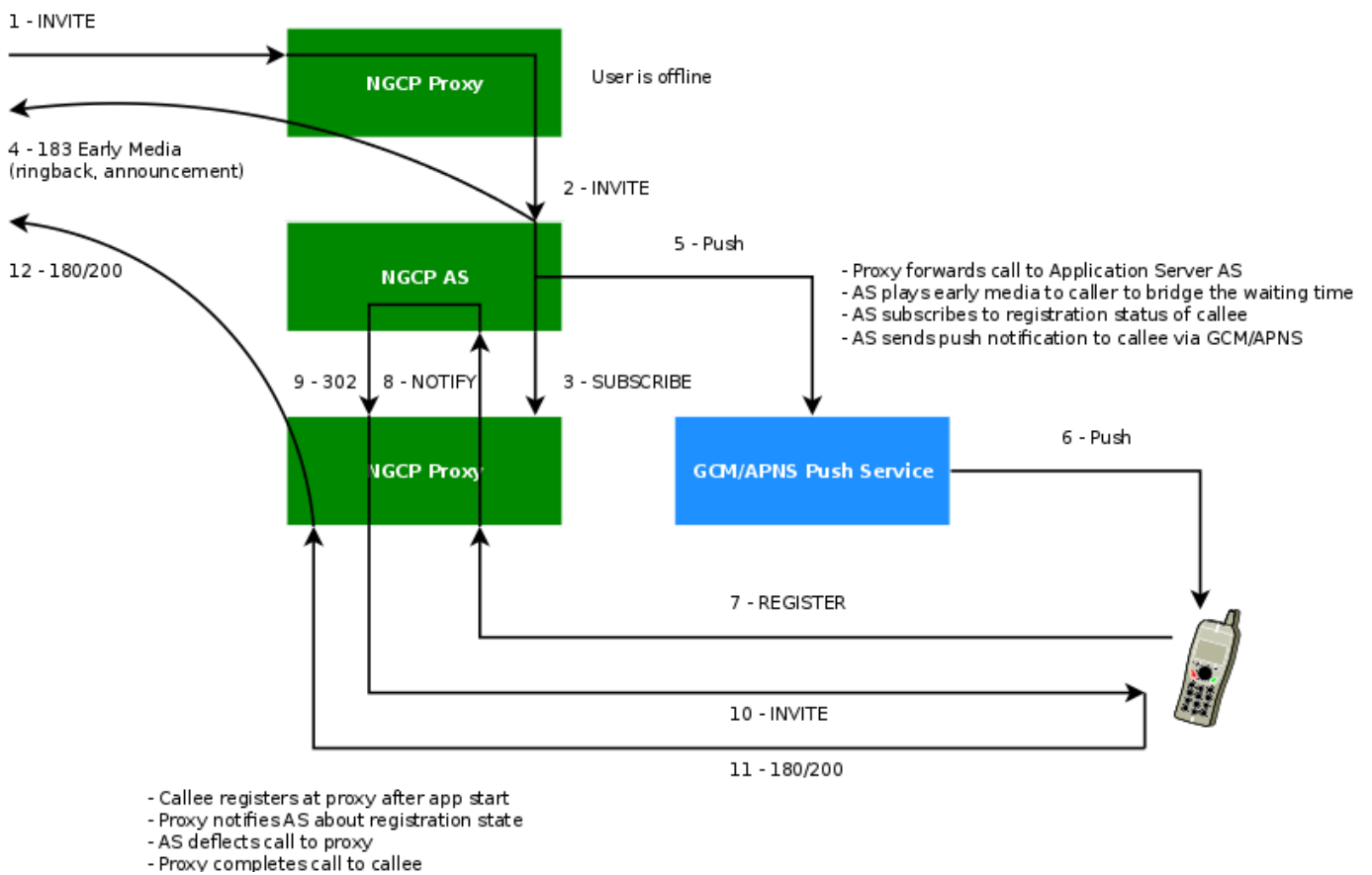


Figure 55: Mobile Push Workflow

1. The caller sends INVITE to proxy
2. The callee is offline, proxy forwards the call to AS (application server)
3. AS subscribes to the callee's registration events on proxy
4. AS sends early media to the caller as a feedback, as the call initiation process might take a while
5. AS sends the push request to GCM/APNS service
6. GCM/APNS service delivers the push request to the callee

7. The callee accepts the push request and confirms the mobile application start (unattended on Android), then the mobile application registers to proxy
8. Proxy sends registration notification to AS
9. AS deflects the call back to proxy
10. Proxy sends INVITE to the callee
11. The callee accepts the call
12. The response is sent back to the caller. Hence, the call setup is completed

In the case of a time-out (no registration notification within a particular time), the application server rejects the call request with an error.

The Configuration Checklist

Follow this checklist to make sure you've completed all the steps. If you miss anything, the service may not work as expected.

Name	Description	Link
Obtain a trusted SSL certificate from a CA	Required for either application	Section B.1.2
Create an Apple developer account and enable the push notification service	For iOS mobile application	Section B.1.2
Obtain the Apple certificate for the app	For iOS mobile application	Section B.1.2
Obtain the API key for the app from Google	For Android mobile application	Section B.1.2
Provide the required information to developers	It is required to make beta builds and publish the apps	Section B.1.2
Adjust the configuration	Adjust the config.yml file and apply the changes (usually performed by Sipwise)	Section B.1.2
Recheck your DNS Zone configuration	Check that the DNS Zone is correctly configured	Section B.1.2
Add DNS SRV records	Create specific DNS SRV records for SIP and XMPP services	Section B.1.2
Check NTP configuration	Ensure that all your servers show exact time	Section B.1.2
Enable Apple/Google Mobile Push in the Admin Panel	It can be enabled for a domain or separate subscribers	Section B.1.2
Configure a mobile application	Check that subscribers can easily install and use your application	Section B.1.2

Obtain the Trusted SSL Certificate

A *trusted* SSL certificate is required, and we suggest obtaining it before starting the configuration.

The mobile application uses respective iOS/Android libraries to establish a secure TLS connection with certain sip:carrier services, such as SIP/XMPP/pushd(https). A *signed* SSL certificate is required to guarantee the security of this connection.

Any Certificate Authority (CA) such as Verisign and others can provide you with the required trusted SSL certificate (a certificate and the key files) which you will use in the configuration below.

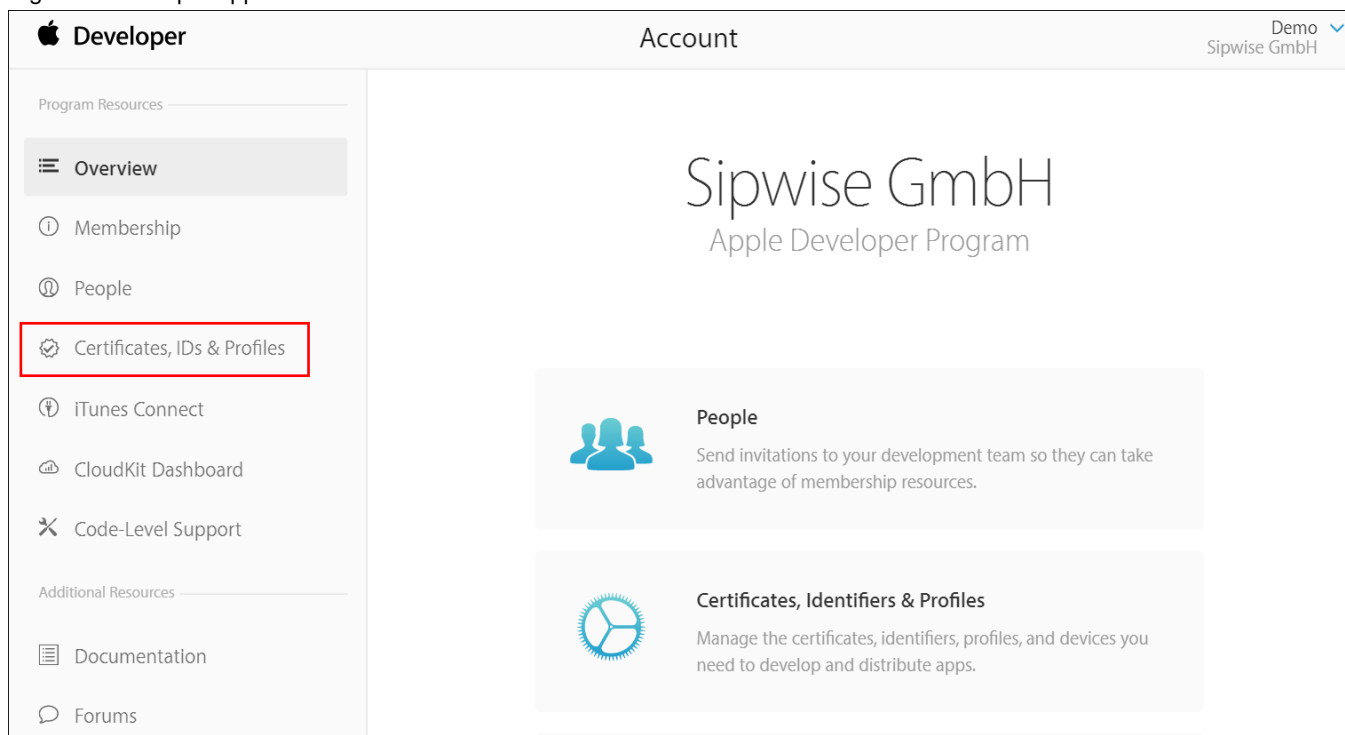
Create an Apple Account and Enable the Push Notification Service

Below is a brief instruction on how to create an Apple account and enable the Push Notification Service in it. You may need to perform additional steps depending on your project.

Note

You may only create an Apple account (step 1 below) and enroll into the Apple Developer Program (step 2 below) and Sipwise developers will do the rest. Still, you can perform all the steps by yourself.

1. Create an Apple developer account to get the Apple ID for your company. For this, go to developer.apple.com/account
2. Enrol in the Apple Developer Program. It is required to configure push notifications as you will need a push notification certificate for your App ID, which requires the Apple Developer Program membership. Go to developer.apple.com/programs for more details.
3. Register an App ID:
 - Sign into developer.apple.com/account.

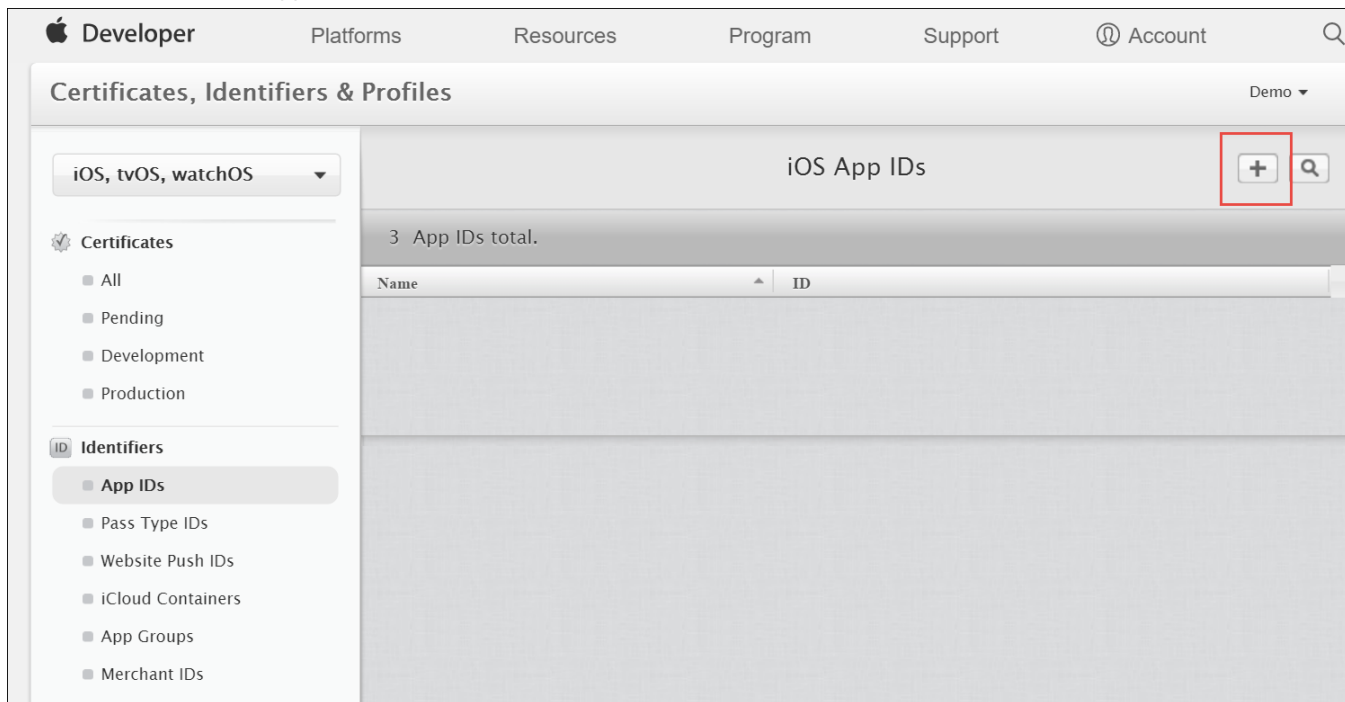


The screenshot shows the Apple Developer account interface. The top navigation bar includes the Apple logo, the word 'Developer', and the account name 'Sipwise GmbH' with a 'Demo' dropdown. The left sidebar lists various program resources, with 'Certificates, IDs & Profiles' highlighted by a red box. The main content area features the company name 'Sipwise GmbH' and 'Apple Developer Program'. Below this, there are two main sections: 'People' (with a group of three people icon) and 'Certificates, Identifiers & Profiles' (with a gear icon).

- Click *Certificates, IDs & Profiles*.



- Under *Identifiers*, select *App IDs*.



- Click the *Add* button (+) in the upper-right corner.

ID

Registering an App ID

The App ID string contains two parts separated by a period (.) — an App ID Prefix that is defined as your Team ID by default and an App ID Suffix that is defined as a Bundle ID search string. Each part of an App ID has different and important uses for your app. [Learn More](#)

App ID Description

Name:

You cannot use special characters such as @, &, *, ', "

- Enter a name for the App ID in the *App ID Description* block. This helps you identify the App ID later.

- Apple TV
- Apple Watch
- iPad
- iPhone
- iPod Touch

Provisioning Profiles

- All
- Development
- Distribution

App ID Prefix

Value: XD7GAT4I26 (Team ID)

App ID Suffix

Explicit App ID

If you plan to incorporate app services such as Game Center, In-App Purchase, Data Protection, and iCloud, or want a provisioning profile unique to a single app, you must register an explicit App ID for your app.

To create an explicit App ID, enter a unique string in the Bundle ID field. This string should match the Bundle ID of your app.

Bundle ID:

We recommend using a reverse-domain name style string (i.e., com.domainname.appname). It cannot contain an asterisk (*).

Wildcard App ID

This allows you to use a single App ID to match multiple apps. To create a wildcard App ID, enter an asterisk (*) as the last digit in the Bundle ID field.

- Select *Explicit App ID* and enter the app’s bundle ID in the *Bundle ID* field. Note that an explicit App ID exactly matches the bundle ID of an app you are building — for example, com.example.push. An explicit App ID can *not* contain an asterisk (*).

App Services

Select the services you would like to enable in your app. You can edit your choices after this App ID has been registered.

Enable Services:

- App Groups
- Associated Domains
- Game Center
- In-App Purchase
- Inter-App Audio
- Wallet
- Push Notifications
- Personal VPN

- In the App Services section enable Push Notifications. Click *Continue* to submit the form

ID Confirm your App ID.

To complete the registration of this App ID, make sure your App ID information is correct, and click the submit button.

App ID Description: **com example push**

Identifier: **XD7GAT4I26**

Data Protection: ● Disabled

Game Center: ● **Enabled**

iCloud: ● Disabled

In-App Purchase: ● **Enabled**

Inter-App Audio: ● Disabled

Passbook: ● Disabled

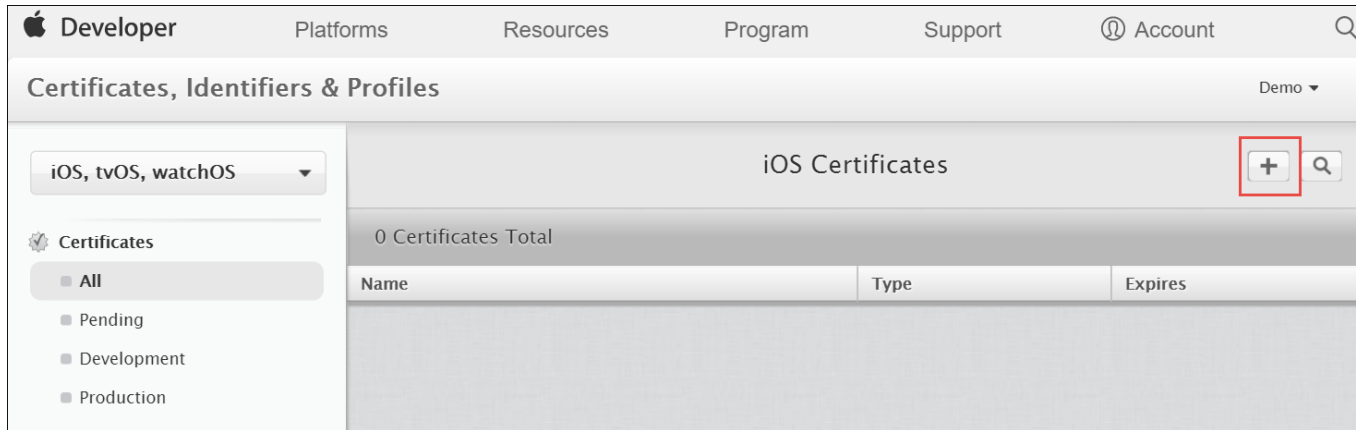
Push Notifications: ● **Enabled**

- Click *Submit* to create the App ID.

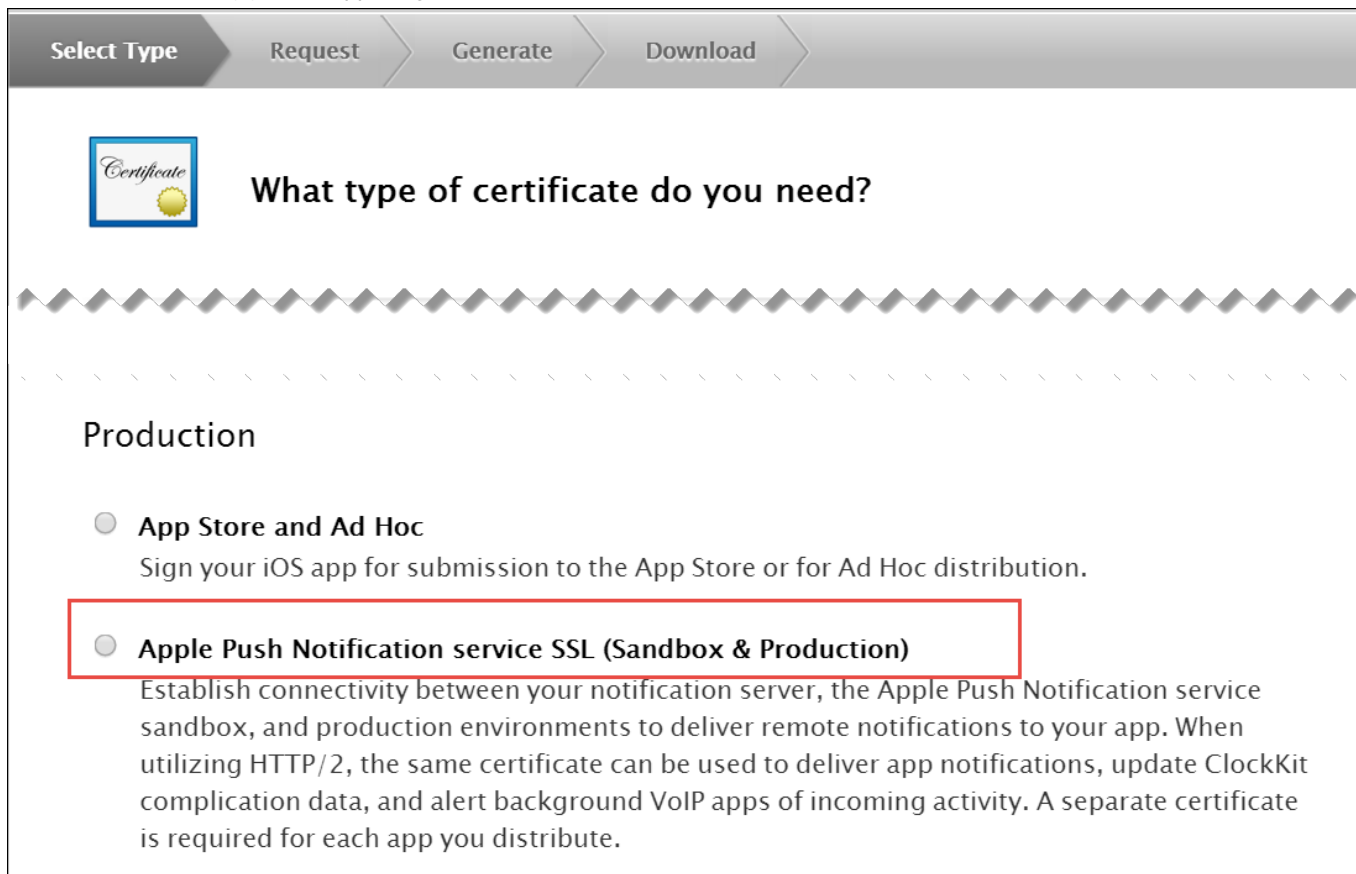
Obtain an Apple SSL Certificate and a Private Key

1. Create a CSR (Certificate Signing Request):

- Sign into developer.apple.com/account/ios/certificate.




- Click the *Add* button (+) in the upper-right corner.



- Select *Apple Push Notification service SSL (Sandbox & Production)* as the certificate type and click *Continue*.

Select Type Request Generate Download



Which App ID would you like to use?


All App IDs that you want to enable for remote notifications require their own Apple Push Notification service SSL certificate. The App ID-specific SSL certificate allows your server to connect to the Apple Push Notification service. Note that only explicit App IDs with a specific Bundle Identifier can be used to create an Apple Push Notification service SSL certificate.

Select an App ID for your Apple Push Notification service SSL Certificate (Sandbox & Production)

App ID:

- Select your App ID and click *Continue*.

Select Type Request Generate Download



About Creating a Certificate Signing Request (CSR)

To manually generate a Certificate, you need a Certificate Signing Request (CSR) file from your Mac. To create a CSR file, follow the instructions below to create one using Keychain Access.

Create a CSR file.

In the Applications folder on your Mac, open the Utilities folder and launch Keychain Access.

Within the Keychain Access drop down menu, select Keychain Access > Certificate Assistant > Request a Certificate from a Certificate Authority.

- In the Certificate Information window, enter the following information:
 - In the User Email Address field, enter your email address.
 - In the Common Name field, create a name for your private key (e.g., John Doe Dev Key).
 - The CA Email Address field should be left empty.
 - In the "Request is" group, select the "Saved to disk" option.
- Click Continue within Keychain Access to complete the CSR generating process.

- Read the information about creating a CSR.
- Follow the instructions to create a CSR using Keychain Access in MAC.


Note

If you do not have access to a Mac, you can still create a CSR in Linux or Windows using OpenSSL, for example.

2. Get the Certificate and Private Key

- When you have the CSR file return to the browser and click *Continue*.

Select TypeRequestGenerateDownload




Generate your certificate.

When your CSR file is created, a public and private key pair is automatically generated. Your private key is stored on your computer. On a Mac, it is stored in the login Keychain by default and can be viewed in the Keychain Access app under the "Keys" category. Your requested certificate is the public half of your key pair.

Upload CSR file.
Select .certSigningRequest file saved on your Mac.

- Click *Choose File...* in your browser.

Select Type Request Generate Download



Generate your certificate.


When your CSR file is created, a public and private key pair is automatically generated. Your private key is stored on your computer. On a Mac, it is stored in the login Keychain by default and can be viewed in the Keychain Access app under the "Keys" category. Your requested certificate is the public half of your key pair.

Upload CSR file.
Select .certSigningRequest file saved on your Mac.

CertificateSigningRequest.certSigningRequest

- Select the CSR file you just created and saved and click *Continue*.


Select Type
Request
Generate
Download



Your certificate is ready.

Download, Install and Backup

Download your certificate to your Mac, then double click the .cer file to install in Keychain Access. Make sure to save a backup copy of your private and public keys somewhere secure.



Name: Apple Push Services: com.example.push

Type: Apple Push Services

Expires: Jun 26, 2017

Download

- Click *Download* to download the certificate (give it the **aps.cer** name).
- Open the downloaded certificate file (it should automatically be opened in Keychain Access, otherwise open it manually in Keychain Access).
- Find the certificate you just opened/imported in Keychain Access.
- Expand the certificate to show the Private Key.
- Select only the Private Key portion of the certificate, right-click on it and select *Export "Common Name"...* from the menu.
- Choose a location (e.g. Desktop) and filename to export the .p12 file to and click *Save*.
- **Optionally** pick a password for the .p12 file to protect its private key contents and click *OK*. (You will then need to enter your log-in password to permit the export).

3. Generate a PEM file from the p12 file:

- Open up your terminal and run the following commands to create a PEM file from the p12 file (If you input a password for the p12 file, you will need to enter it here):

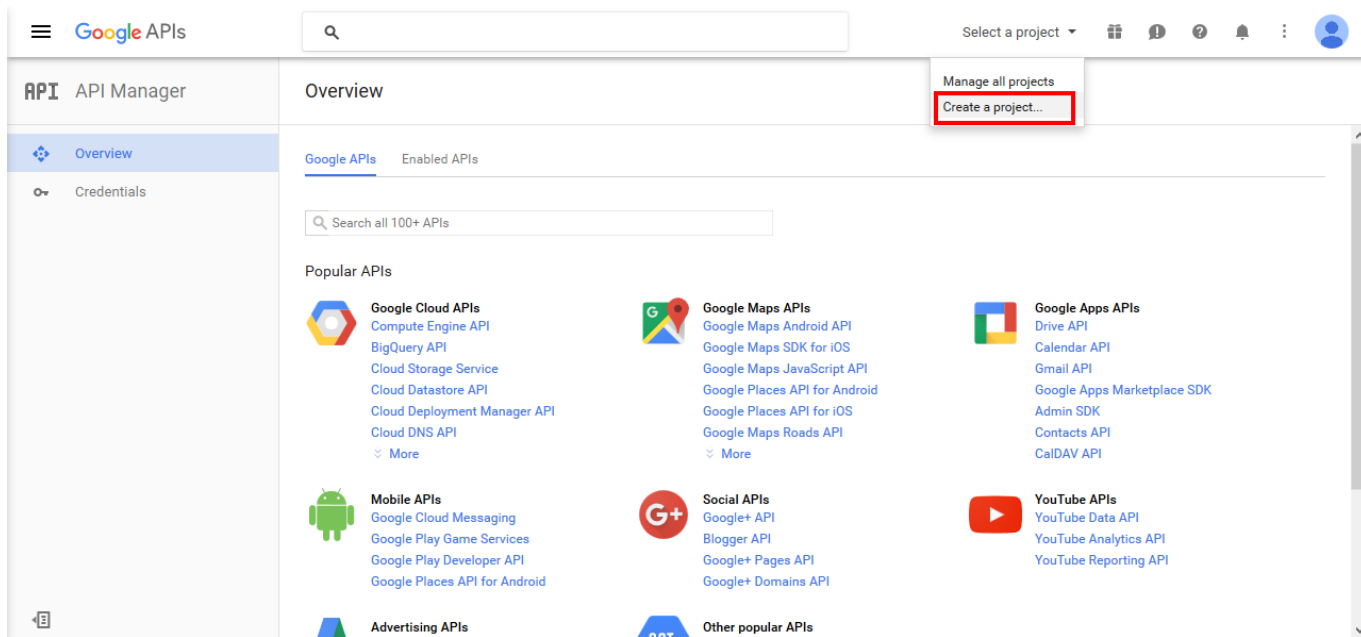
```
cd ~/Desktop
openssl x509 -in aps.cer -inform der -out PushChatCert.pem
openssl pkcs12 -in PushChatCert.p12 -out PushCertificate.pem -nodes -clcerts
openssl pkcs12 -nocerts -out PushChatKey.pem -in PushChatKey.p12
```

Obtain the API Key for the App from Google

You can use Google Cloud Messaging (GCM) to send push notifications to your subscribers with Android-based mobile devices. Google Cloud Messaging is a free service that acts as an intermediary between the NGCP and devices of your subscribers. Google's Cloud Connection Server (CCS), a part of GCP, manages the persistent connections with mobile devices to deliver your push notifications.

While communicating with CCS, the NGCP identifies itself using an API key. To get it, follow the steps below.

1. Create a new project in the Google APIs Console page. For this go to code.google.com/apis/console.



2. Click *Create a Project*.

review

le APIs Enab

Search all 100+ A

ilar APIs

- Google Cl
- Compute
- BigQuery
- Cloud Sto
- Cloud Dat
- Cloud Dep
- Cloud DNS
- More

New Project

Project name ?

Your project ID will be mychat-1320 ? [Edit](#)

[Show advanced options...](#)


Please email me updates regarding feature announcements, performance suggestions, feedback surveys and special offers.

Yes No

I agree that my use of any services and related APIs is subject to my compliance with the applicable [Terms of Service](#).

Yes No

[Create](#) [Cancel](#)

 **Mobile APIs**
Google Cloud Messaging

 **Social APIs**
Google+ API

3. Input the project name, agree with the *Terms of Service* and click *Create*.







API Manager

- Overview
- Credentials

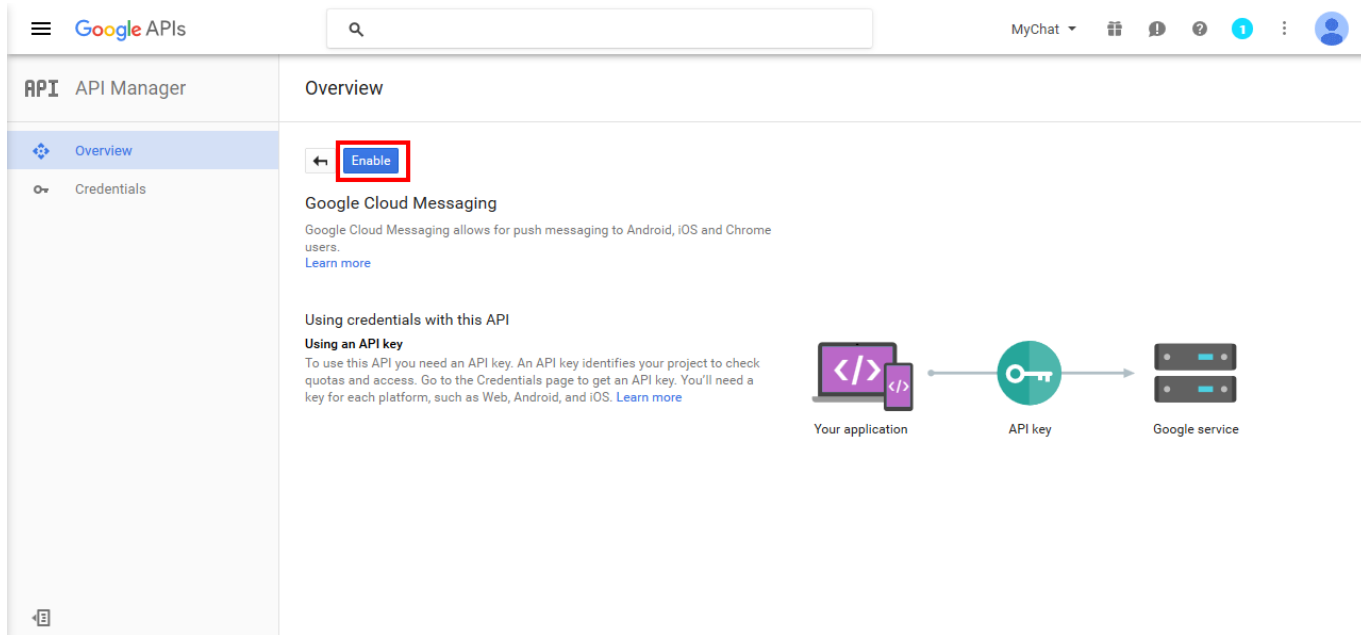
Overview

Google APIs Enabled APIs (0)

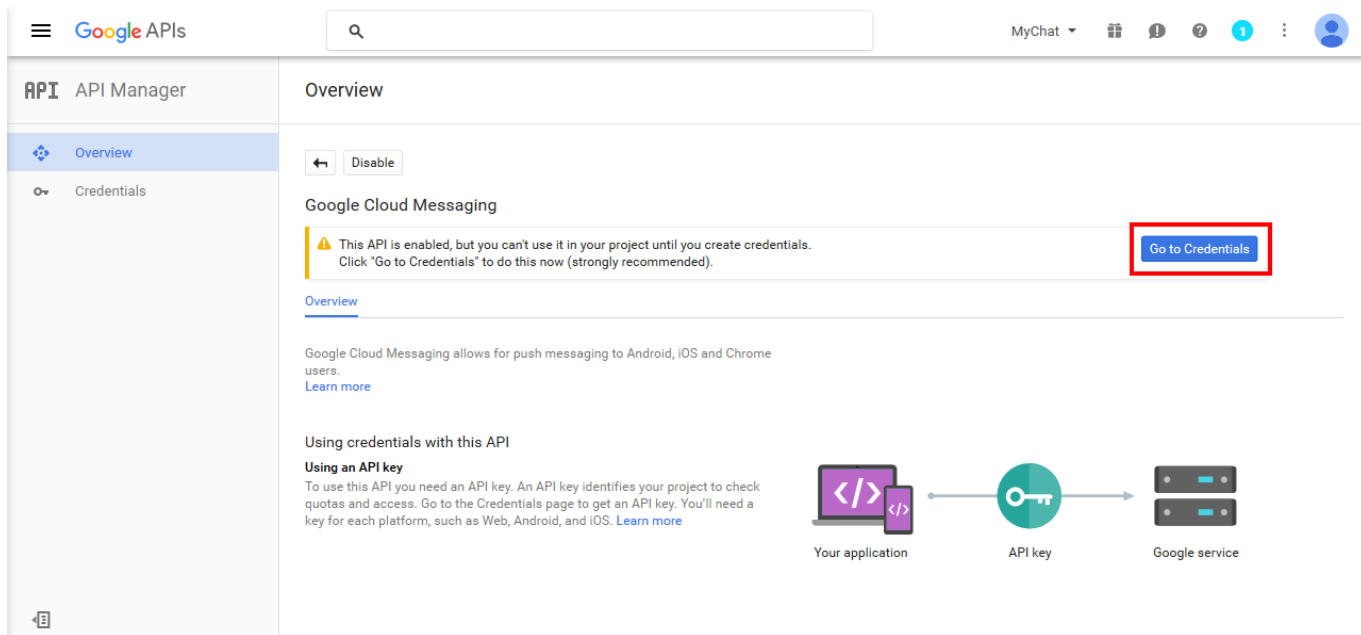
Popular APIs

 Google Cloud APIs <ul style="list-style-type: none">Compute Engine APIBigQuery APICloud Storage ServiceCloud Datastore APICloud Deployment Manager APICloud DNS APIMore	 Google Maps APIs <ul style="list-style-type: none">Google Maps Android APIGoogle Maps SDK for iOSGoogle Maps JavaScript APIGoogle Places API for AndroidGoogle Places API for iOSGoogle Maps Roads APIMore	 Google Apps APIs <ul style="list-style-type: none">Drive APICalendar APIGmail APIGoogle Apps Marketplace SDKAdmin SDKContacts APICalDAV API
 Mobile APIs <ul style="list-style-type: none">Google Cloud MessagingGoogle Play Game ServicesGoogle Play Developer APIGoogle Places API for Android	 Social APIs <ul style="list-style-type: none">Google+ APIBlogger APIGoogle+ Pages APIGoogle+ Domains API	 YouTube APIs <ul style="list-style-type: none">YouTube Data APIYouTube Analytics APIYouTube Reporting API

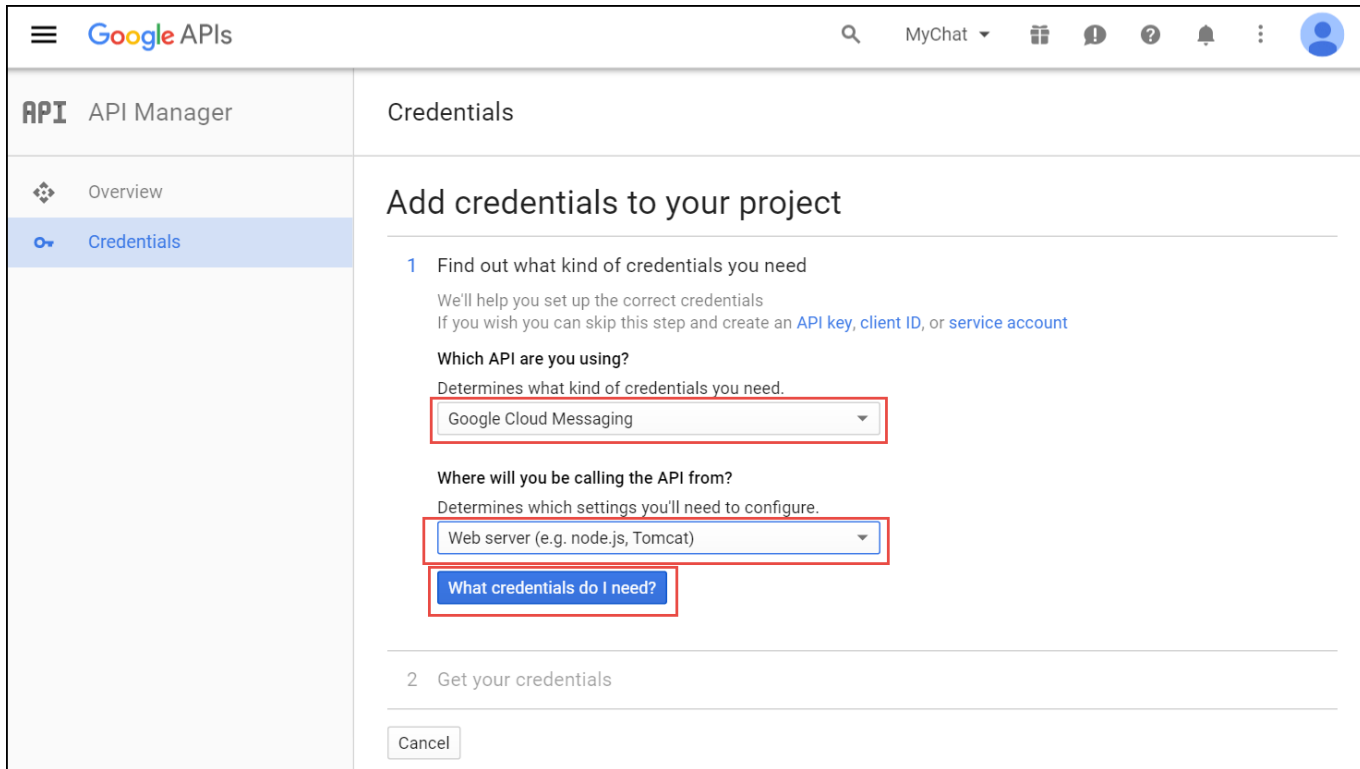
4. Click *Google Cloud Messaging* on the Overview page.



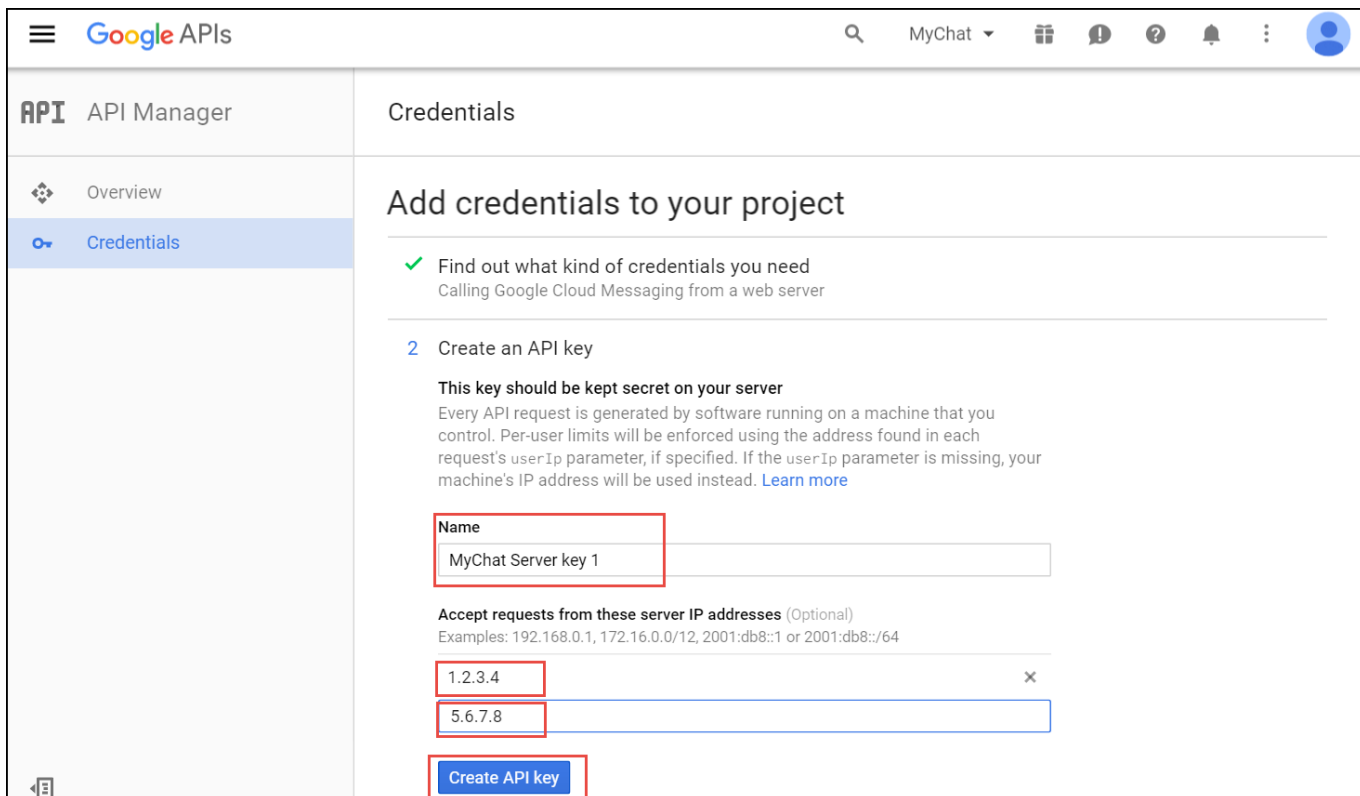
5. Click *Enable* for the Google Cloud Messaging.



6. Click *Go to Credentials*.



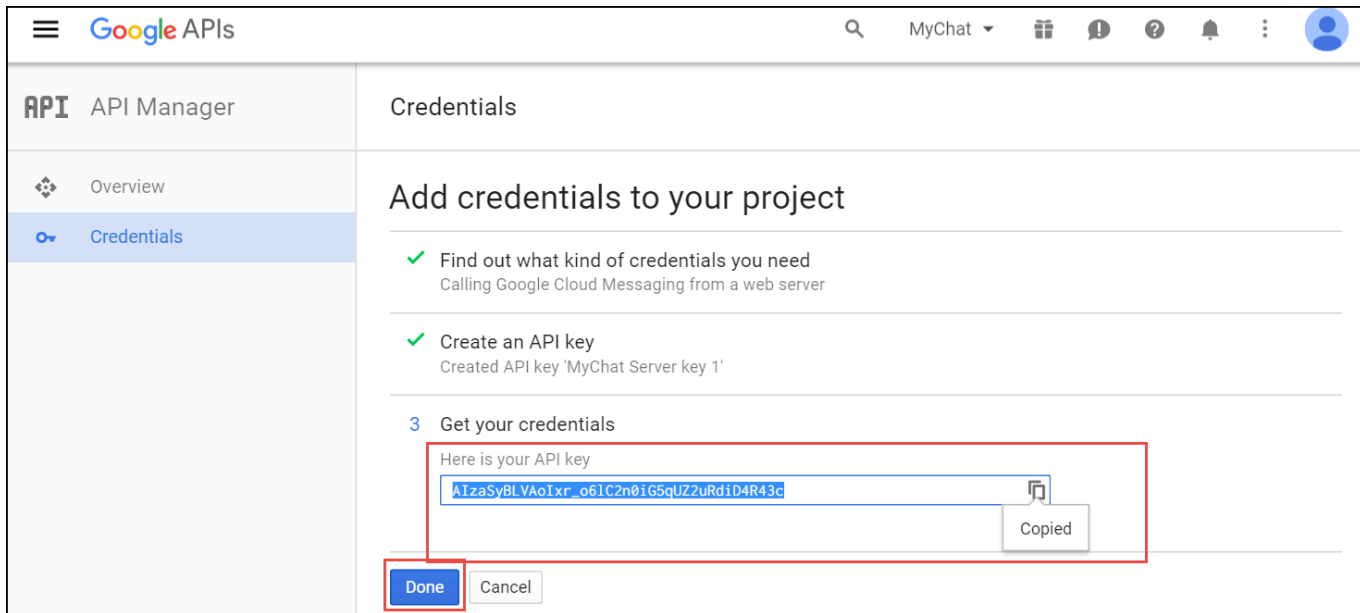
7. Select Google Cloud Messaging and Web Server from the corresponding lists and click *What credentials do I need?*



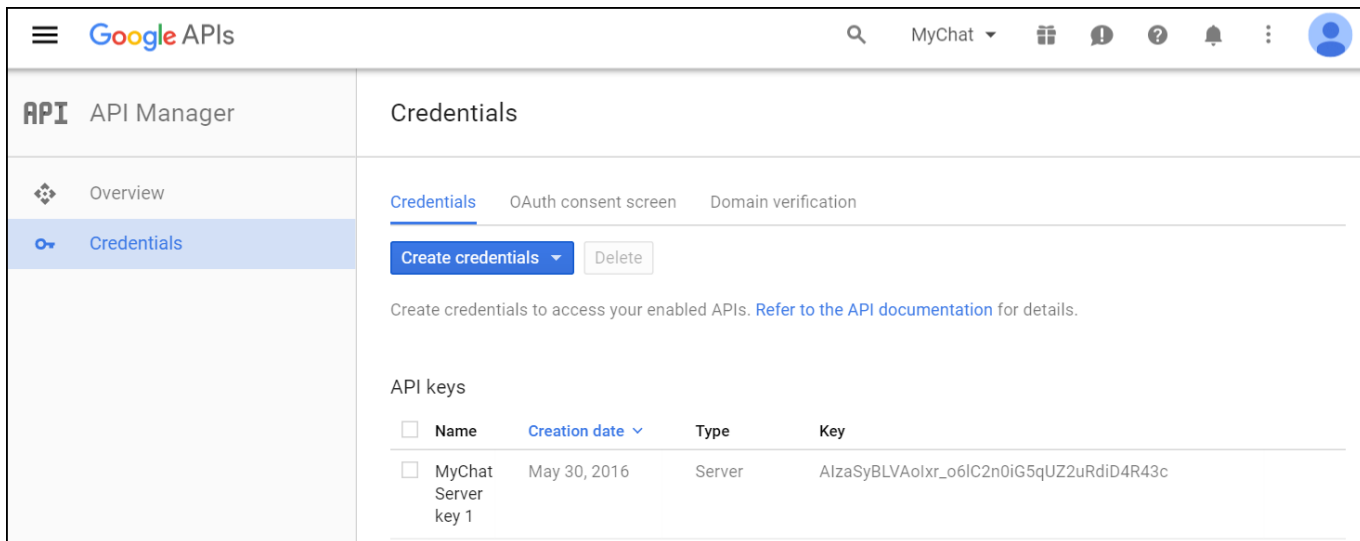
8. Adjust the API Key name and input the IP addresses of *all* your load balancers under *Accept requests from these server IP addresses*. Click *Create API key*.

Note

You may skip adding the IP addresses, otherwise list *ALL* your load balancers.



9. Copy your API key and click *Done*. Save the API key for future use.



Provide the Required Information to Developers

Please, provide Sipwise developers with the following files and information so that they can make beta builds and submit the application to the App Store:

- Access to your Apple developer account
- The trusted SSL certificate and its private key
- The Apple SSL certificate and its private key

For the Android application, provide the following:

- Access to your Google developer account
- Google application API key

Adjust the sip:carrier Configuration (Usually Performed by Sipwise)

1. Upload the Apple SSL certificate (**PushChatCert.pem**) and the private key (**PushChatKey.pem**) to `/etc/ngcp-config/ssl/`
2. Upload the trusted SSL certificate (**CAsigned.crt**) and the private key (**CAsigned.key**) to `/etc/ngcp-config/ssl/`
3. Specify the corresponding paths and names in the pushd section of the config.yml file:

- apns: section (For iOS mobile application)
 - certificate: `'/etc/ngcp-config/ssl/PushChatCert.pem'`
 - enable: yes
 - key: `'/etc/ngcp-config/ssl/PushChatKey.pem'`
- enable: yes
- gcm: section (for Android mobile application)
 - enable: yes
 - key: `'google_server_api_key_here'`
- ssl: yes
- sslcertfile: `/etc/ngcp-config/ssl/CAsigned.crt`
- sslcertkeyfile: `/etc/ngcp-config/ssl/CAsigned.key`

You can find an example of `/etc/ngcp-config/config.yml` configuration in the [config.yml overview section](#).

4. Apply your changes:

```
ngcpcfg apply 'enabled the backup feature.'
ngcpcfg push all
```

Recheck Your DNS Zone Configuration

Check that your **NS** and **A** DNS records are correctly configured.

Let's consider the following example: * the load-balancers have the lb01a.example.com and the lb01b.example.com names * the shared name is lb01.example.com and the shared IP address is 1.1.1.1 * the service name is voipservice.example.com

The following DNS records must be present:

Server Name	Record type	IP Address
lb01a.example.com	A	1.2.3.4
lb01b.example.com	A	5.6.7.8
lb01.example.com	A	1.1.1.1
voipservice.example.com	A	1.1.1.1

Add SRV Records to DNS

Add at least one record for each service: **xmpp-server**, **xmpp-client**, **sips**.

A regular SRV record has the following form:

```
_service._proto.name. TTL class SRV priority weight port target
```

- **service**: the symbolic name of the service (xmpp-server, xmpp-client, sips).
- **proto**: the transport protocol of the desired service (TCP).
- **name**: the domain name (ending in a dot).
- **TTL**: standard DNS time to live field.
- **class**: the standard DNS class field (this is always IN).
- **priority**: the priority of the target host (lower value means more preferred).
- **weight**: a relative weight for records with the same priority (the higher the value, the more requests will be sent).
- **port**: the TCP or UDP port of the service.
- **target**: the canonical hostname of the machine providing the service (ending in a dot).

Here are examples of the SRV records:

```
_xmpp-server._tcp.voipservice.example.com. 18000 IN SRV 10 50 5269 voipservice.example.com.  
_xmpp-client._tcp.voipservice.example.com. 18000 IN SRV 10 50 5222 voipservice.example.com.  
_sips._tcp.voipservice.example.com. 18000 IN SRV 10 100 5061 voipservice.example.com.
```

You can always check whether the required SRV records are configured by executing the following commands:

```
dig SRV _xmpp-client._tcp.voipservice.example.net  
dig SRV _xmpp-server._tcp.voipservice.example.net  
dig SRV _sips._tcp.voipservice.example.net
```

Check NTP Configuration

We strongly suggest that the clocks of all the nodes within the platform are synchronized. To ensure this, check that the NTP service is correctly configured on all your sip:carrier servers and works reliably. Execute the following command for quick test of time synchronization:

```
ntpq -p
```

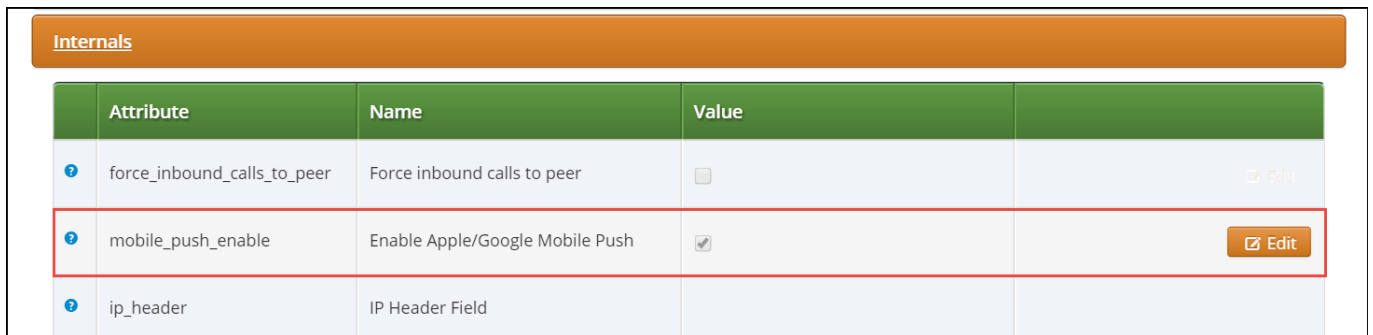
If the current node synchronizes with an NTP server, this server will be marked by the star (*) symbol.

Enable Apple/Google Mobile Push

It can be enabled for a domain or separate subscribers in the Admin Panel.

To enable the service for a domain:

1. Go to *Settings*→*Domains* and click on the *Preferences* button of the domain you want to enable Apple/Google Mobile Push for.
2. Go to the *Internals* group and enable the **mobile_push_enable** parameter.



The screenshot shows a table titled "Internals" with the following data:

Attribute	Name	Value	
force_inbound_calls_to_peer	Force inbound calls to peer	<input type="checkbox"/>	Edit
mobile_push_enable	Enable Apple/Google Mobile Push	<input checked="" type="checkbox"/>	Edit
ip_header	IP Header Field		

Perform Tests

Perform tests when the application is available:

1. Download and install the application.
2. Open the application and input your registration username in the username@domain.name format and password.
3. Review the quality of application branding.
4. Make test calls.
5. Test the presence functionality.
6. Test the chat and group chat.
7. Test messaging.
8. Test the sharing functionality (e.g. pictures, video and voice messages and maps).
9. Check the application phone book integration with the phone's one

Make sure that the subscribers can start using your services in the easiest possible way.

C NGCP configs overview

C.1 config.yml overview

Config.yml is the main configuration YAML file used by Sipwise NGCP. After every changes it need to run the command `ngcpcfg apply my commit message` to apply changes (followed by `ngcpcfg push` in the PRO version to apply changes to sp2). The following is a brief description of the main variables contained into `/etc/ngcp-config/config.yml` file.

C.1.1 asterisk

The following is the asterisk section:

```
asterisk:
  log:
    facility: local6
  rtp:
    maxport: 20000
    minport: 10000
  sip:
    bindport: 5070
    dtmfmode: rfc2833
  voicemail:
    enable: 'no'
    fromstring: 'Voicemail server'
    greeting:
      busy_custom_greeting: '/home/user/file_no_extension'
      busy_overwrite_default: 'no'
      busy_overwrite_subscriber: 'no'
      unavail_custom_greeting: '/home/user/file_no_extension'
      unavail_overwrite_default: 'no'
      unavail_overwrite_subscriber: 'no'
    mailbody: 'You have received a new message from ${VM_CALLERID} in voicebox ${VM_MAILBOX} on ${VM_DATE}.'
    mailsubject: '[Voicebox] New message ${VM_MSGNUM} in voicebox ${VM_MAILBOX}'
    max_msg_length: 180
    maxgreet: 60
    maxmsg: 30
    maxsilence: 0
    min_msg_length: 3
    normalize_match: '^00|\+([1-9][0-9]+)$'
    normalize_replace: '$1'
    serveremail: voicebox@sip.sipwise.com
```

- `log.facility`: rsyslog facility for asterisk log, defined in `/etc/asterisk/logger.conf`.
- `rtp.maxport`: RTP maximum port used by asterisk.

- `rtp.minport`: RTP minimum port used by asterisk.
- `sip.bindport`: SIP asterisk internal bindport.
- `voicemail.greetings.*`: set the audio file path for voicemail custom unavailable/busy greetings
- `voicemail.mailbody`: Mail body for incoming voicemail.
- `voicemail.mailsubject`: Mail subject for incoming voicemail.
- `voicemail.max_msg_length`: Sets the maximum length of a voicemail message, in seconds.
- `voicemail.maxgreet`: Sets the maximum length of voicemail greetings, in seconds.
- `voicemail.maxmsg`: Sets the maximum number of messages that may be kept in any voicemail folder.
- `voicemail.min_msg_length`: Sets the minimum length of a voicemail message, in seconds.
- `voicemail.maxsilence`: Maxsilence defines how long Asterisk will wait for a contiguous period of silence before terminating an incoming call to voice mail. The default value is 0, which means the silence detector is disabled and the wait time is infinite.
- `voicemail.serveremail`: Provides the email address from which voicemail notifications should be sent.
- `voicemail.normalize_match`: Regular expression to match the From number for calls to voicebox.
- `voicemail.normalize_replace`: Replacement string to return, in order to match an existing voicebox.

C.1.2 autoprov

The following is the autoprovisioning section:

```
autoprov:
  hardphone:
    skip_vendor_redirect: 'no'
  server:
    bootstrap_port: 1445
    ca_certfile: '/etc/ngcp-config/ssl/client-auth-ca.crt'
    host: localhost
    port: 1444
    server_certfile: '/etc/ngcp-config/ssl/myserver.crt'
    server_keyfile: '/etc/ngcp-config/ssl/myserver.key'
    ssl_enabled: 'yes'
  softphone:
    config_lockdown: 0
    webauth: 0
```

- `autoprov.skip_vendor_redirect`: Skip phone vendor redirection to the vendor provisioning web site.

C.1.3 backuptools

The following is the backup tools section:

```
backuptools:
  cdreexport_backup:
    enable: 'no'
  etc_backup:
    enable: 'no'
  mail:
    address: noc@company.org
    error_subject: '[ngcp-backup] Problems detected during daily backup'
    log_subject: '[ngcp-backup] Daily backup report'
    send_errors: 'no'
    send_log: 'no'
  mysql_backup:
    enable: 'no'
    exclude_dbs: 'syslog sipstats information_schema'
  rotate_days: 7
  storage_dir: '/var/backup/ngcp_backup'
  temp_backup_dir: '/tmp/ngcp_backup'
```

- `backuptools.cdreexport_backup.enable`: Enable backup of `cdreexport` (.csv) directory.
- `backuptools.etc_backup.enable`: Enable backup of `/etc/*` directory.
- `backuptools.mail.address`: Destination email address for backup emails.
- `backuptools.mail.error_subject`: Subject for error emails.
- `backuptools.mail.log_subject`: Subject for daily backup report.
- `backuptools.mail.send_error`: Send daily backup error report.
- `backuptools.mail.send_log`: Send daily backup log report.
- `backuptools.mysql_backup.enable`: Enable daily mysql backup.
- `backuptools.mysql_backup.exclude_dbs`: exclude mysql databases from backup.
- `backuptools.rotate_days`: Number of backups to keep stored.
- `backuptools.storage_dir`: Storage directory of backups.
- `backuptools.temp_backup_dir`: Temporary storage directory of backups.

C.1.4 bootenv

The following is the bootenv section:

```
bootenv:
  dhcp:
    boot: '/srv/tftp/pxelinux.0'
    enable: 'yes'
    end: 192.168.1.199
    expire: 12h
    start: 192.168.1.101
  http_port: 3000
  ro_port: 9998
  rw_port: 9999
  tftp:
    enable: 'yes'
    root: '/srv/tftp'
```

- bootenv.dhcp.enable: enable dnsmasq DHCP server
- bootenv.dhcp.boot: PXE image boot location
- bootenv.dhcp.start: first IP of DHCP scope
- bootenv.dhcp.end: last IP of DHCP scope
- bootenv.dhcp.expire: DHCP leasing expiration
- bootenv.http_port: HTTP port for iPXE boot files/configs
- bootenv.ro_port: HTTP port for read-only access to Approx cache
- bootenv.rw_port: HTTP port for read-write access to Approx cache
- bootenv.tftp.enable: enable tftp server for PXE boot
- bootenv.tftp.root: root folder for tftp server

C.1.5 cdreexport

The following is the cdr export section:

```
cdreexport:
  daily_folder: 'yes'
  export_failed: 'no'
  export_incoming: 'no'
  exportpath: '/home/jail/home/cdreexport'
  full_names: 'yes'
  monthly_folder: 'yes'
```

- cdreexport.daily_folder:: Set yes if you want to create a daily folder for CDRs under the configured path.
- cdreexport.export_failed: Export CDR for failed calls.

- `cdrexport.export_incoming`: Export CDR for incoming calls.
- `cdrexport.exportpath`: The path to store CDRs in .csv format.
- `cdrexport.full_names`: Use full namen for CDRs instead of short ones.
- `cdrexport.monthly_folder`: Set `yes` if you want to create a monthly folder (ex. 201301 for January 2013) for CDRs under configured path.

C.1.6 checktools

The following is the check tools section:

```
checktools:
  collcheck:
    cpuidle: 0.1
    dfused: 0.9
    eximmaxqueue: 15
    loadlong: 2
    loadmedium: 2
    loadshort: 3
    maxage: 600
    memused: 0.7
    siptimeout: 15
    swapfree: 0.5
  active_check_enable: 1
  asr_nsr_statistics: 1
  exim_check_enable: 0
  force: 0
  kamilio_check_concurrent_calls_enable: 0
  kamilio_check_dialog_active_enable: 1
  kamilio_check_dialog_early_enable: 1
  kamilio_check_dialog_incoming_enable: 1
  kamilio_check_dialog_local_enable: 1
  kamilio_check_dialog_outgoing_enable: 1
  kamilio_check_dialog_relay_enable: 1
  kamilio_check_shmem_enable: 1
  kamilio_check_usrloc_regdevices_enable: 1
  kamilio_check_usrloc_regusers_enable: 1
  mpt_check_enable: 1
  mysql_check_enable: 1
  mysql_check_replication: 1
  oss_check_provisioned_subscribers_enable: 1
  sip_check_enable: 1
  sipstats_check_num_packets: 1
  sipstats_check_num_packets_perday: 1
  sipstats_check_partition_size: 1
  snmpd:
    communities:
```

```
public:
  - localhost
```

- `checktools.collcheck.cpuidle`: Sets the minimum value for CPU usage (0.1 means 10%).
- `checktools.collcheck.dfused`: Sets the maximum value for DISK usage (0.9 means 90%).
- `checktools.collcheck.loadlong/loadlong/loadshort`: Max values for load (long, short, medium term).
- `checktools.collcheck.maxage`: Max age in seconds.
- `checktools.collcheck.memused`: Sets the maximum value for MEM usage (0.7 means 70%).
- `checktools.collcheck.siptimeout`: Max timeout for sip options.
- `checktools.collcheck.swapfree`: Sets the minimum value for SWAP free (0.5 means 50%).
- `checktools.exim_check_enable`: Exim queue check plugin for collectd.
- `checktools.active_check_enable`: Active node check plugin for collectd.
- `checktools.asr_nsr_statistics`: enable/Disable ASR/NSR statistics.
- `checktools.force`: Perform checks even if not active from `ngcp-check_active` command.
- `checktools.kamailio_check_*`: Enable/Disable SNMP collective check plugin for Kamailio.
- `checktools.mpt_check_enable`: MPT raid SNMP check plugin.
- `checktools.mysql_check_enable`: MySQL SNMP check plugin.
- `checktools.mysql_check_replication`: MySQL replication check.
- `checktools.oss_check_provisioned_subscribers_enable`: OSS provisioned subscribers count plugin.
- `checktools.sip_check_enable/sipstats_check_*`: Enable/Disable SIP check plugins.
- `checktools.snmpd.communities`: Sets the snmp community and sources (separated by comma , - ex. source: 127.0.0.1, 10.10.10.2, 10.10.10.3).

C.1.7 cleanuptools

The following is the cleanup tools section:

```
cleanuptools:
  acc_cleanup_days: 90
  archive_targetdir: '/var/backups/cdr'
  binlog_days: 15
  cdr_archive_months: 2
  cdr_backup_months: 2
  cdr_backup_retro: 3
  compress: gzip
  sql_batch: 10000
  trash_cleanup_days: 30
```

- `cleantools.acc_cleanup_days`: Clean up ACC entry older then 90 days.
- `cleantools.binlog_days`: Expire MySQL binlogs after 15 days.
- `cleantools.cdr_archive_months`: How many months worth of records to keep in the table and not move into the monthly archive tables.
- `cleantools.cdr_backup_months`: How many months worth of records to keep in the table and not move into the monthly backup tables.
- `cleantools.cdr_backup_retro`: How many months to process for backups, going backwards in time. Using the example above, with this value set to "3", the months October, September and August would be backed up, while any older records would be left untouched.
- `cleantools.sql_batch`: How many records to process within a single statement.
- `cleantools.trash_cleanup_days`: Clean up `acc_trash` and `acc_backup` entry after 30 days.

C.1.8 database

The following is the database section:

```
database:  
  bufferpoolsize: 24768M
```

- `database.bufferpoolsize`: `InnoDB_buffer_pool_size` value in `/etc/mysql/my.cnf`

C.1.9 faxserver

The following is the fax server section:

```
faxserver:  
  enable: yes  
  fail_attempts: '3'  
  fail_retry_secs: '60'  
  mail_from: 'Sipwise NGCP FaxServer <voipfax@ngcp.sipwise.local>'
```

- `faxserver.enable`: *yes/no* to enable or disable `ngcp-faxserver` on the platform respectively.
- `faxserver.fail_attempts`: Amount of attempts to send a fax after which it is marked as *failed*.
- `faxserver.fail_retry_secs`: Amount of seconds to wait between "fail_attempts".
- `faxserver.mail_from`: Sets the e-mail From Header for incoming fax.

C.1.10 general

The following is the general section:

```
general:
  adminmail: adjust@example.org
  companyname: sipwise
  lang: en
```

- `general.adminmail`: Email address used by monit to send notifications to.
- `general.lang`: Sets sounds language (e.g: *de* for German)

C.1.11 haproxy

The following is the haproxy section:

```
haproxy:
  admin: 'no'
  admin_port: 8080
  admin_pwd: iKNPFuPFHMCHh9dsXgVg
  enable: 'no'
```

- `haproxy.enable`: enable haproxy

C.1.12 heartbeat

The following is the heartbeat section:

```
heartbeat:
  hb_watchdog:
    action_max: 5
    enable: 'yes'
    interval: 10
    transition_max: 10
  pingnodes:
    - 10.60.1.1
    - 192.168.3.4
```

- `heartbeat.hb_watchdog.enable`: Enable heartbeat watchdog in order to prevent and fix split brain scenario.
- `heartbeat.hb_watchdog.action_max`: Max errors before taking any action.
- `heartbeat.hb_watchdog.interval`: Interval in secs for the check.
- `heartbeat.hb_watchdog.transition_max`: Max checks in transition state.

- heartbeat.pingnodes: List of pingnodes for heartbeat. Minimum 2 entries, otherwise by default NGCP will set the default gateway and DNS servers as pingnodes.

C.1.13 intercept

The following is the legal intercept section:

```
intercept:
  captagent:
    port: 18090
    schema: http
  enabled: 'no'
```

- intercept.captagent.enable: Enable captagent for Lawful Interception (additional NGCP module).

C.1.14 kamailio

The following is the kamailio section:

```
kamailio:
  lb:
    debug: 'no'
    extra_sockets: ~
    max_forwards: 70
    nattest_exception_ips:
      - 1.2.3.4
      - 5.6.7.8
    pkg_mem: 16
    port: 5060
    security:
      dos_ban_enable: 'yes'
      dos_ban_time: 300
      dos_reqs_density_per_unit: 50
      dos_sampling_time_unit: 5
      dos_whitelisted_ips: ~
      dos_whitelisted_subnets: ~
      failed_auth_attempts: 3
      failed_auth_ban_enable: 'yes'
      failed_auth_ban_time: 3600
    shm_mem: 2012
    start: 'yes'
    strict_routing_safe: 'no'
    tcp_children: 8
    tcp_max_connections: 2048
  tls:
    enable: 'no'
```



```
port: 5061
sslcertfile: '/etc/kamailio/kamailio-selfsigned.pem'
sslcertkeyfile: '/etc/kamailio/kamailio-selfsigned.key'
udp_children: 8
use_dns_cache: 'on'
proxy:
  allow_info_method: 'no'
  allow_peer_relay: 'no'
  allow_refer_method: 'no'
  authenticate_bye: 'no'
  cf_depth_limit: 10
  children: 8
  debug: 'no'
  default_expires: 3600
  enum_suffix: e164.arpa.
  filter_100rel_from_supported: 'yes'
  fritzbox:
    enable: 'no'
    prefixes:
      - 0$avp(caller_ac)
      - $avp(caller_cc)$avp(caller_ac)
      - '\+$avp(caller_cc)$avp(caller_ac)'
      - 00$avp(caller_cc)$avp(caller_ac)
    special_numbers:
      - 112
      - 110
      - 118[0-9]{2}
  foreign_domain_via_peer: 'no'
  ignore_auth_realm: 'no'
  keep_original_to: 'no'
  max_expires: 43200
  max_gw_lcr: 128
  max_registrations_per_subscriber: 5
  min_expires: 60
  nathelper_dbro: 'no'
  natping_interval: 30
  natping_processes: 7
  nonce_expire: 300
  pbx:
    hunt_display_indicator: '[h]'
  perform_peer_lcr: 0
  pkg_mem: 16
  port: 5062
  presence:
    enable: 'yes'
    max_expires: '3600'
    reginfo_domain: example.org
  proxy_lookup: 'no'
```

```
set_ruri_to_peer_auth_realm: 'no'  
shm_mem: 2012  
start: 'yes'  
tcp_children: 4  
use_enum: 'no'  
usrloc_dbmode: 1
```

- `kamailio.lb.debug`: Enable intensive debug level.
- `kamailio.lb.extra_sockets`: Add here extra sockets for Load Balancer.
- `kamailio.lb.max_forwards`: Set the value for the Max Forwards SIP header for outgoing messages.
- `kamailio.lb.nattest_exception_ips`: List of IPs that don't need the NAT test.
- `kamailio.lb.shm_mem`: Shared memory used by Kamailio Load Balancer. The default value is auto generated by the system, depending on your system architecture.
- `kamailio.lb.pkg_mem`: PKG memory used by Kamailio Load Balancer. The default value is auto generated by the system, depending on your system architecture.
- `kamailio.lb.security.dos_ban_enable`: Enable/Disable DoS Ban.
- `kamailio.lb.security.dos_ban_time`: Sets the ban time.
- `kamailio.lb.security.dos_reqs_density_per_unit`: Sets the requests density per unit (if we receive more than * `lb.dos_reqs_density_per_unit` within `dos_sampling_time_unit` the user will be banned).
- `kamailio.lb.security.dos_sampling_time_unit`: Sets the DoS unit time.
- `kamailio.lb.security.dos_whitelisted_ips`: Write here the whitelisted IPs.
- `kamailio.lb.security.failed_auth_attempts`: Sets how many authentication attempts allowed before ban.
- `kamailio.lb.security.failed_auth_ban_enable`: Enable/Disable authentication ban.
- `kamailio.lb.security.failed_auth_ban_time`: Sets how long a user/IP has be banned.
- `kamailio.lb.strict_routing_safe`: Enable strict routing handle feature.
- `kamailio.lb.tls.enable`: Enable TLS socket.
- `kamailio.lb.tls.port`: Set TLS listening port.
- `kamailio.lb.tls.sslcertificate`: Path for the SSL certificate.
- `kamailio.lb.tls.sslcertkeyfile`: Path for the SSL key file.
- `kamailio.proxy.allow_info_method`: Allow INFO method.
- `kamailio.proxy.allow_peer_relay`: Allow peer relay. Call coming from a peer that doesn't match a local subscriber will try to go out again, matching the peering rules.
- `kamailio.proxy.allow_refer_method`: Allow REFER method. Enable it with caution.

- `kamailio.proxy.authenticate_bye`: Enable BYE authentication.
- `kamailio.proxy.cf_depth_limit`: CF loop detector. How many CF loops are allowed before drop the call.
- `kamailio.proxy.debug`: Enable intensive debug level.
- `kamailio.proxy.default_expires`: Default expires value in seconds for REGISTER messages.
- `kamailio.proxy.foreign_domain_via_peer`: Enable calls to foreign domains via peers.
- `kamailio.proxy.shm_mem`: Shared memory used by Kamailio Proxy. The default value is auto generated by the system, depending on your system architecture.
- `kamailio.proxy.pkg_mem`: PKG memory used by Kamailio Proxy. The default value is auto generated by the system, depending on your system architecture.
- `kamailio.proxy.enum_suffix`: Sets ENUM suffix - don't forget . (dot).
- `kamailio.proxy.filter_100rel_from_supported`: Enable filtering of *100rel* from Supported header, to disable PRACK.
- `kamailio.proxy.fritzbox.enable`: Enable detection for Fritzbox special numbers. Ex. Fritzbox add some prefix to emergency numbers.
- `kamailio.proxy.fritzbox.prefixes`: Fritybox prefixes to check. Ex. *0\$avp(caller_ac)*
- `kamailio.proxy.fritzbox.special_numbers`: Specifies Fritzbox special number patterns. They will be checked with the prefixes defined. Ex. *112*, so the performed check will be *sip:0\$avp(caller_ac)112@* if prefix is *0\$avp(caller_ac)*
- `kamailio.proxy.ignore_auth_realm`: Ignore SIP authentication realm.
- `kamailio.proxy.keep_original_to`: Not used now.
- `kamailio.proxy.max_expires`: Sets the maximum expires in seconds for registration.
- `kamailio.proxy.max_gw_lcr`: Defines the maximum number of gateways in `lcr_gw` table
- `kamailio.proxy.max_registrations_per_subscriber`: Sets the maximum registration per subscribers.
- `kamailio.proxy.min_expires`: Sets the minimum expires in seconds for registration.
- `kamailio.proxy.natping_interval`: Sets the NAT ping interval in seconds.
- `kamailio.proxy.nathelper_dbro`: Default is "no". This will be "yes" on CARRIER in order to activate the use of a read-only connection using `LOCAL_URL`
- `kamailio.proxy.nonce_expire`: Nonce expire time in seconds.
- `kamailio.proxy.perform_peer_lcr`: Enable/Disable Least Cost Routing based on peering fees.
- `kamailio.proxy.port`: SIP listening port.
- `kamailio.proxy.presence.enable`: Enable/disable presence feature
- `kamailio.proxy.presence.max_expires`: Sets the maximum expires value for PUBLISH/SUBSCRIBE message. Defines expiration of the presentity record.

- `kamailio.proxy.presence.reginfo_domain`: Set FQDN of the NGCP domain used in callback for mobile push.
- `kamailio.proxy.set_ruri_to_peer_auth_realm`: Set R-URI using peer auth realm
- `kamailio.proxy.use_enum`: Enable/Disable ENUM feature.

C.1.15 mediator

The following is the mediator section:

```
mediator:  
  interval: 10
```

- `mediator.interval`: Running interval of mediator.

C.1.16 nginx

The following is the nginx section:

```
nginx:  
  status_port: 8081  
  xcap_port: 1080
```

- `nginx.status_port`: Status port used by nginx server
- `nginx.xcap_port`: XCAP port used by nginx server

C.1.17 ntp

The following is the ntp server section:

```
ntp:  
  servers:  
    - 0.debian.pool.ntp.org  
    - 1.debian.pool.ntp.org  
    - 2.debian.pool.ntp.org  
    - 3.debian.pool.ntp.org
```

- `ntp.servers`: Define your NTP server list.

C.1.18 ossbss

The following is the ossbss section:

```
ossbss:
  apache:
    port: 2443
    proxylisten: 1080
    restapi:
      sslcertfile: '/etc/ngcp-panel/api_ssl/api_ca.crt'
      sslcertkeyfile: '/etc/ngcp-panel/api_ssl/api_ca.key'
    serveradmin: support@sipwise.com
    servername: "\"myserver\""
    ssl_enable: 'yes'
    sslcertfile: '/etc/ngcp-config/ssl/myserver.crt'
    sslcertkeyfile: '/etc/ngcp-config/ssl/myserver.key'
  frontend: 'no'
  htpasswd:
    -
      pass: '{SHA}w4zj3mxbmynIQ1jsUEjSkN2z2pk='
      user: ngcpsoap
  logging:
    apache:
      acc:
        facility: daemon
        identity: oss
        level: info
      err:
        facility: local7
        level: info
    ossbss:
      facility: local0
      identity: provisioning
      level: DEBUG
    web:
      facility: local0
      level: DEBUG
  provisioning:
    allow_ip_as_domain: 1
    allow_numeric_usernames: 0
    auto_allow_cli: 1
    carrier:
      account_distribution_function: roundrobin
      prov_distribution_function: roundrobin
    credit_warnings:
      -
        domain: example.com
        recipients:
          - nobody@example.com
        threshold: 1000
    faxpw_min_char: 0
```

```

log_passwords: 0
no_logline_truncate: 0
pw_min_char: 6
routing:
  ac_regex: '[1-9]\d{0,4}'
  cc_regex: '[1-9]\d{0,3}'
  sn_regex: '[1-9]\d+'
tmpdir: '/tmp'

```

- `ossbss.frontend`: Enable/disable SOAP interface. Set value to `fcgi` to enable old SOAP interface.
- `ossbss.htpasswd`: Sets the username and SHA hashed password for SOAP access. You can generate the password using the following command: `htpasswd -nbs myuser mypassword`.
- `ossbss.provisioning.allow_ip_as_domain`: Allow or not allow IP address as SIP domain (0 is not allowed).
- `ossbss.provisioning.allow_numeric_usernames`: Allow or not allow numeric SIP username (0 is not allowed).
- `ossbss.provisioning.faxpw_min_char`: Minimum number of characters for fax passwords.
- `ossbss.provisioning.pw_min_char`: Minimum number of characters for sip passwords.
- `ossbss.provisioning.log_password`: Enable logging of passwords.
- `ossbss.provisioning.routing`: Regexp for allowed AC (Area Code), CC (Country Code) and SN (Subscriber Number).

C.1.19 pbx (only with additional cloud PBX module installed)

The following is the PBX section:

```

pbx:
  bindport: 5085
  enable: 'no'
  highport: 55000
  lowport: 50001
  media_processor_threads: 10
  session_processor_threads: 10
  xmlrpcport: 8095

```

- `pbx.enable`: Enable Cloud PBX module.

C.1.20 prosody

The following is the prosody section:

```

prosody:
  ctrl_port: 5582
  log_level: info

```

- `prosody.ctrl_port`: XMPP server control port.
- `prosody.log_level`: Prosody loglevel.

C.1.21 pushd

The following is the pushd section:

```
pushd:
  apns:
    certificate: '/etc/ngcp-config/ssl/PushChatCert.pem'
    enable: yes
    endpoint: gateway.push.apple.com
    feedback_endpoint: feedback.push.apple.com
    feedback_interval: 3600
    key: '/etc/ngcp-config/ssl/PushChatKey.pem'
    socket_timeout: 0
  enable: yes
  gcm:
    enable: yes
    key: 'google_api_key_here'
    priority:
      call: high
      groupchat: normal
      invite: normal
      message: normal
  one_device_per_subscriber: no
  port: 45060
  processes: 4
  ssl: yes
  sslcertfile: /etc/ngcp-config/ssl/CAsigned.crt
  sslcertkeyfile: /etc/ngcp-config/ssl/CAsigned.key
  unique_device_ids: no
```

- `pushd.enable`: Enable/Disable the Push Notification feature.
- `pushd.apns.certificate`: Specify the Apple certificate for push notification https requests from the NGCP to an endpoint.
- `pushd.apns.enable`: Enable/Disable Apple push notification.
- `pushd.apns.key`: Specify the Apple key for push notification https requests from the NGCP to an endpoint.
- `pushd.gcm.enable`: Enable/Disable Google push notification.
- `pushd.gcm.key`: Specify the Google key for push notification https requests from the NGCP to an endpoint.
- `pushd.ssl`: The security protocol the NGCP uses for https requests from the app in the push notification process.
- `pushd.sslcertfile`: The trusted certificate file purchased from a CA

- `pushd.sslcertkeyfile`: The key file that purchased from a CA
- `pushd.unique_device_ids`: Allows a subscriber to register the app and have the push notification enabled on more than one mobile device.

C.1.22 qos

The following is the QOS section:

```
qos:  
  tos_rtp: 184  
  tos_sip: 184
```

- `qos.tos_rtp`: TOS value for RTP traffic.
- `qos.tos_sip`: TOS value for SIP traffic.

C.1.23 rate-o-mat

The following is the rate-o-mat section:

```
rateomat:  
  enable: 'yes'  
  loopinterval: 10  
  splitpeakparts: 0
```

- `rateomat.enable`: Enable/Disable Rate-o-mat
- `rateomat.loopinterval`: How long we shall sleep before looking for unrated CDRs again.
- `rateomat.splitpeakparts`: Whether we should split CDRs on peaktime borders.

C.1.24 redis

The following is the redis section:

```
redis:  
  database_amount: 16  
  port: 6379  
  syslog_ident: redis
```

- `redis.database_amount`: Set the number of databases in redis. The default database is DB 0.
- `redis.port`: Accept connections on the specified port, default is 6379
- `redis.syslog_ident`: Specify the syslog identity.

C.1.25 reminder

The following is the reminder section:

```
reminder:
  retries: 2
  retry_time: 60
  sip_fromdomain: voicebox.sipwise.local
  sip_fromuser: reminder
  wait_time: 30
  weekdays: '2, 3, 4, 5, 6, 7'
```

- `reminder.retries`: How many times the reminder feature have to try to call you.
- `reminder.retry_time`: Seconds between retries.
- `reminder.wait_time`: Seconds to wait for an answer.

C.1.26 rsyslog

The following is the rsyslog section:

```
rsyslog:
  elasticsearch:
    action:
      resumeretrycount: '-1'
    bulkmode: 'on'
    dynSearchIndex: 'on'
    enable: 'yes'
    queue:
      dequeuebatchsize: 300
      size: 5000
      type: linkedlist
  external_address:
  external_log: 0
  external_loglevel: warning
  external_port: 514
  external_proto: udp
  ngcp_logs_preserve_days: 93
```

- `rsyslog.elasticsearch.enable`: Enable/Disable Elasticsearch web interface
- `rsyslog.external_address`: Set the remote rsyslog server.
- `rsyslog.ngcp_logs_preserve_days`: Specify how many days to preserve old rotated log files in `/var/log/ngcp/old` path.

C.1.27 rtpproxy

The following is the rtp proxy section:

```
rtpproxy:
  allow_userspace_only: 'yes'
  maxport: 40000
  minport: 30000
  rtp_timeout: 21600
  rtp_timeout_onhold: 3600
```

- `rtpproxy.allow_userspace_only`: Enable/Disable the user space failover for rtpengine (*yes* means enable). By default rtpengine works in kernel space.
- `rtpproxy.maxport`: Maximum port used by rtpengine for RTP traffic.
- `rtpproxy.minport`: Minimum port used by rtpengine for RTP traffic.
- `rtpproxy.rtp_timeout`: Maximum limit in seconds for a call (6h).
- `rtpproxy.rtp_timeout_onhold`: Maximum limit in seconds for an onhold (1h).

C.1.28 security

The following is the security section:

```
security:
  firewall:
    blacklist_networks_4: ~
    blacklist_networks_6: ~
    enable: 'yes'
    sipwise_support_access: 'no'
    whitelist_networks_4: ~
    whitelist_networks_6: ~
```

- `security.firewall.enable`: Enable/Disable security configuration for IPv6 and IPv4 (`sysctl_ipv6.conf`, `sysctl_ipv4.conf`).

C.1.29 sems

The following is the SEMS section:

```
sems:
  bindport: 5080
  conference:
    enable: 'yes'
    max_participants: 10
  debug: 'no'
```

```
highport: 50000
lowport: 40001
media_processor_threads: 10
prepaid:
  enable: 'yes'
sbc:
  calltimer_enable: 'yes'
  calltimer_max: 3600
  outbound_timeout: 6000
  sdp_filter:
    codecs: PCMA,PCMU,telephone-event
    enable: 'yes'
    mode: whitelist
  session_timer:
    enable: 'yes'
    max_timer: 7200
    min_timer: 90
    session_expires: 300
session_processor_threads: 10
vsc:
  block_override_code: 80
  cfb_code: 90
  cfna_code: 93
  cft_code: 92
  cfu_code: 72
  clir_code: 31
  directed_pickup_code: 99
  enable: 'yes'
  park_code: 97
  reminder_code: 55
  speedial_code: 50
  unpark_code: 98
  voicemail_number: 2000
xmlrpcport: 8090
```

- `sems.conference.enable`: Enable/Disable conference feature.
- `sems.conference.max_participants`: Sets the number of concurrent participant.
- `sems.highport`: Maximum ports used by sems for RTP traffic.
- `sems.debug`: Enable/Disable debug mode.
- `sems.lowport`: Minimum ports used by sems for RTP traffic.
- `sems.prepaid.enable`: Enable/Disable prepaid feature.
- `sems.sbc.calltimer_max`: Sets the maximum call duration for inter-domain calls.
- `sems.sbc.outbound_timeout::`: Sets the maximum call duration for outboud calls.

- `sems.sbc.session_timer.enable`: Enable/Disable session timers (deprecated, use the web interface configuration).
- `sems.vsc.*`: Define here the VSC codes.

C.1.30 snmpagent

The following is the SNMP Agent section:

```
snmpagent:
  daemonize: '1'
  debug: '0'
  update_interval: '30'
```

- `daemonize`: Enable/Disable `ngcp-snmp-agent` daemonization.
- `debug`: Enable/Disable debug output.
- `update_interval`: Sets the interval in seconds used to update the fetched data.

C.1.31 sshd

The following is the `sshd` section:

```
sshd:
  listen_addresses:
    - 0.0.0.0
```

- `sshd`: specify interface where SSHD should run on. By default `sshd` listens on all IPs found in `network.yml` with type `ssh_ext`. Unfortunately `sshd` can be limited to IPs only and not to interfaces. The current option makes it possible to specify allowed IPs (or all IPs with `0.0.0.0`).

C.1.32 voisniff

The following is the voice sniffer section:

```
voisniff:
  admin_panel: 'no'
  daemon:
    bpf: 'port 5060 or 5062 or ip6 proto 44 or ip[6:2] & 0x1fff != 0'
    external_interfaces: 'eth0 eth1'
  filter:
    exclude:
      -
        active: 0
        case_insensitive: 1
        pattern: '\ncseq: *\d+ +(register|notify|options)'
```

```
include: []
internal_interfaces: lo
mysql_dump_threads: 4
start: 'no'
threads_per_interface: 10
partitions:
  increment: 700000
  keep: 10
```

- `voisniff.admin_panel`: Enable/Disable SIP STATS on Admin interface. Default is *no*.
- `voisniff.daemon.external_interfaces`: Define binding interfaces.
- `voisniff.daemon.start`: Change to *yes* if you want `voisniff` start at boot. Default is *no*.

C.1.33 www_admin

The following is the WEB Admin interface (`www_admin`) section:

```
www_admin:
  ac_dial_prefix: 0
  apache:
    autoprov_port: 1444
  billing_features: 1
  callingcard_features: 0
  callthru_features: 0
  cc_dial_prefix: 00
  conference_features: 1
  contactmail: adjust@example.org
  dashboard:
    enabled: 1
  default_admin_settings:
    call_data: 0
    is_active: 1
    is_master: 0
    read_only: 0
    show_passwords: 1
  domain:
    preference_features: 1
    rewrite_features: 1
    vsc_features: 0
  fastcgi_workers: 2
  fax_features: 1
  fees_csv:
    element_order:
      - source
      - destination
```

```
- direction
- zone
- zone_detail
- onpeak_init_rate
- onpeak_init_interval
- onpeak_follow_rate
- onpeak_follow_interval
- offpeak_init_rate
- offpeak_init_interval
- offpeak_follow_rate
- offpeak_follow_interval
- use_free_time
http_admin:
  autoprov_port: 1444
  port: 1443
  serveradmin: support@sipwise.com
  servername: "\"myserver\""
  ssl_enable: 'yes'
  sslcertfile: '/etc/ngcp-config/ssl/myserver.crt'
  sslcertkeyfile: '/etc/ngcp-config/ssl/myserver.key'
http_csc:
  autoprov_bootstrap_port: 1445
  autoprov_port: 1444
  port: 443
  serveradmin: support@sipwise.com
  servername: "\"myserver\""
  ssl_enable: 'yes'
  sslcertfile: '/etc/ngcp-config/ssl/myserver.crt'
  sslcertkeyfile: '/etc/ngcp-config/ssl/myserver.key'
logging:
  apache:
    acc:
      facility: daemon
      identity: oss
      level: info
    err:
      facility: local7
      level: info
peer:
  preference_features: 1
peering_features: 1
security:
  password_allow_recovery: 0
  password_max_length: 40
  password_min_length: 6
  password_musthave_digit: 0
  password_musthave_lowercase: 1
  password_musthave_specialchar: 0
```

```
password_musthave_uppercase: 0
password_sip_autogenerate: 0
password_sip_expose_subadmin: 1
password_web_autogenerate: 0
password_web_expose_subadmin: 1
speed_dial_vsc_presets:
  vsc:
    - '*0'
    - '*1'
    - '*2'
    - '*3'
    - '*4'
    - '*5'
    - '*6'
    - '*7'
    - '*8'
    - '*9'
subscriber:
  auto_allow_cli: 0
  extension_features: 0
  voicemail_features: 1
```

- `www_admin.http_admin.*`: Define the Administration interface and certificates.
- `www_admin.http_csc.*`: Define the Customers interface and certificates.
- `www_admin.contactmail`: Email to show in the GUI's Error page.