



# Grandstream Networks, Inc.

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## SIP Device Provisioning Guide

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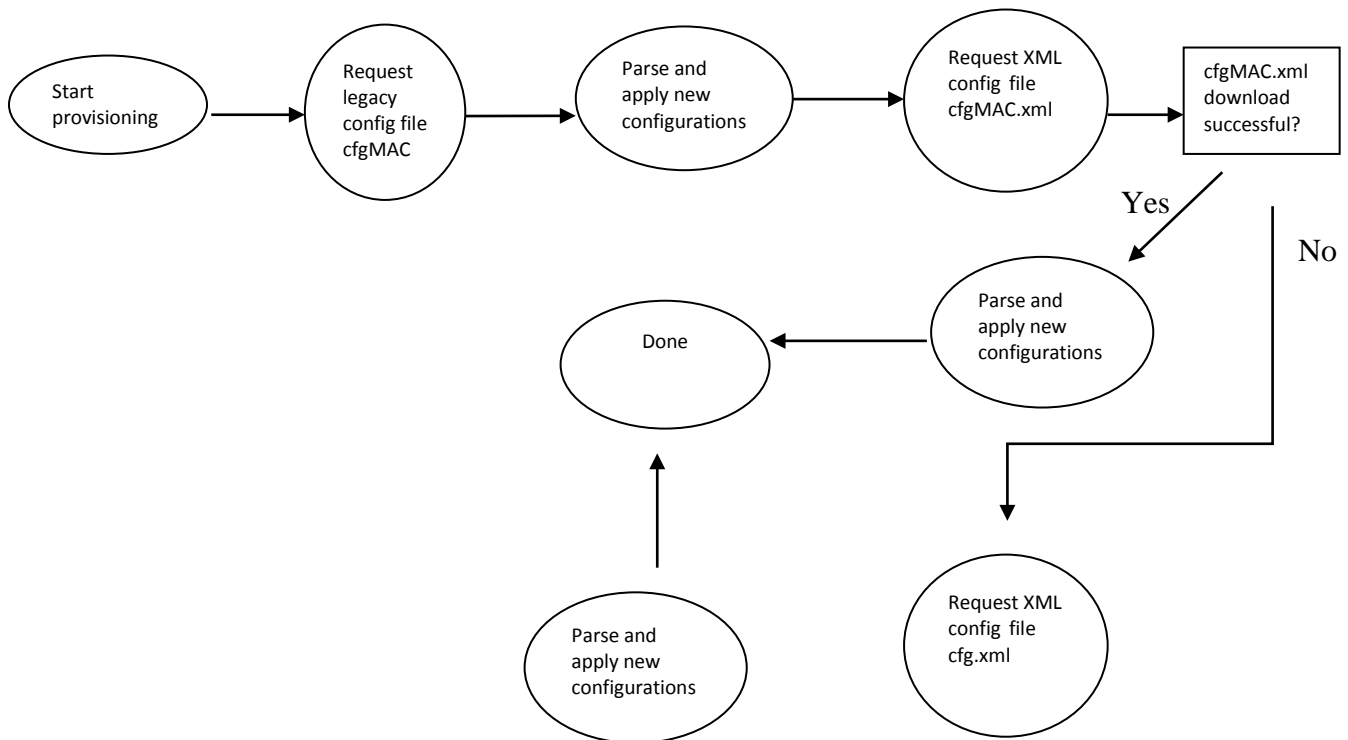
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## OVERVIEW

Grandstream SIP Devices can be configured via Web Interface as well as via Configuration File through TFTP or HTTP/HTTPS download. All Grandstream SIP devices support a proprietary binary format configuration file. Product families such as GXP21xx/1xxx, GXV31xx, GXP2200, HT50x, HT70x, GXW40xx, DP71x and GXV32xx accept configuration files in XML format in addition to the legacy proprietary binary format. The XML provisioning implementation also allow generic XML configuration file on top of the MAC based configuration file.

When Grandstream device boots up or reboots, it issues a request for a configuration file named “cfgMAC”, where “MAC” is the MAC address of the device, for example “cfg000b820102ab”. The configuration file name should be in lower case. The file “cfgMAC” is a proprietary binary format configuration file that must be generated by Grandstream configuration tools. For devices that support XML provisioning, they will also issue a request for a XML configuration file “cfgMAC.xml”.

## PROVISIONING FLOW



**Figure 1: Provisioning Flow.**

Note that the provision program will apply and reload the settings after downloading the legacy binary cfgMAC config file. This means that a provision/re-direction server can redirect the device to a XML provision server without reboot. It can also be used to send the XML encryption password.

If the download of cfgMAC.xml file is not successful, the provision program will download the generic cfg.xml file. This approach can be used to design a two-phase provision process. One example for such process is a user self-provision system using PIN codes. The provision server will first hand out a generic XML configuration file that allows the device to make calls to the automated provision center. After the user enters the number and PIN code, the actual per device configuration file is generated.

## **CONFIGURATION PARAMETERS**

A configuration parameter is associated with each particular field in the web configuration page. A parameter consists of a Capital letter P and 2 to 3 (Could be extended to 4 in the future) digit numeric numbers. i.e., P2 is associated with “Admin Password” in the Advanced Page. For a detailed parameter list, please refer to the corresponding firmware release configuration template.

## **GENERATE CONFIGURATION FILES**

Grandstream offers free Configuration File generator software in both Linux/Unix and Windows platform. Both Configuration File Generators can be downloaded from Grandstream official web site at <http://www.grandstream.com/support/tools> .

## **TFTP OR HTTP/HTTPS FOR CONFIGURATION FILE**

Traditionally, TFTP is used for Configuration File download. However, it is more popular today with HTTP/HTTPS, which is more reliable and has NO NAT issue.

## **CONFIGURATION FILE ENCRYPTION**

Grandstream Configuration Generator allows user to ENCRYPT the generated Configuration File with AES 128 bit encryption. Windows version allows user to choose not to encrypt the Configuration File, but it is recommended to use Encryption for security purpose.

## **FIRMWARE AND CONFIGURATION FILE PREFIX AND POSTFIX**

Prefix and postfix for both firmware and configuration files are supported.

Parameter P232 and P233 are for Prefix and Postfix for Firmware, respectively.  
Parameter P234 and P235 are for Prefix and Postfix for Configuration File, respectively.

Firmware Prefix and Postfix allows device to download the firmware name with the matching Prefix and Postfix.

In addition, when Parameter P238 (Check New Firmware only when F/W pre/suffix changes) is set to 1, the device will only issue the Firmware Upgrade request if there are changes in the firmware Prefix or Postfix.

Following are the firmware **BASIC NAMES** related to BT100: “boot.bin”, “bt-110.bin”, “html110.bin”, “vocbt.bin”, “vp.bin”.

Service provider can use “gs\_” as prefix, and “\_1.0.7.5” as postfix, the above files will be changed to: “gs\_boot.bin\_1.0.7.5”, “gs\_bt-110.bin\_1.0.7.5”, “gs\_html110.bin\_1.0.7.5”, “gs\_vocbt.bin\_1.0.7.5”, “gs\_vp.bin\_1.0.7.5”

The purpose for this is that now, ALL of the firmware with different version can be stored in one single directory, and they can be differentiated by using prefix or postfix, i.e., all files with a postfix of “\_1.0.7.5” belong to the firmware version 1.0.7.5.

Same rule applies to configuration files, i.e., for configuration file named “cfg000b82000001”, there can be 3 versions: “gs\_cfg000b82000001\_cfg001”, “gs\_cfg000b82000001\_cfg002”, and “gs\_cfg000b82000001\_cfg003”. Here, the **BASIC NAME** of the configuration file is “cfg000b82000001”, but there are 3 different versions, the one that will be accepted is the one with matching prefix and postfix specified in the current configuration.

## **FIRMWARE SERVER AND CONFIGURATION FILE SERVER**

In addition to the Prefix and Postfix for firmware and configuration files, different server paths for firmware upgrade or Configuration File Server can be specified in different FQDN, i.e.:

Firmware Server Path:   
Config Server Path:

The parameters are P192 and P237 for Firmware and Config Server respectively.

## **MANAGING FIRMWARE AND CONFIGURATION FILE DOWNLOAD**

When parameter P194 (Auto Upgrade) is set to 1, Service Provider can use P193 (Auto Check Interval) to have the devices periodically check with either Firmware Server or Config Server, whenever they are defined. This allows the device periodically check if there are any new changes need to be taken on a scheduled time. By defining different intervals in P193 for

different devices, Service Provider can distribute the Firmware or Configuration File download schedule to reduce the Firmware or Provisioning Server load at any given time.

### **PRE-CONFIGURATION AND CONFIGURATION REDIRECTION**

For mass deployment, Grandstream provides TFTP/HTTP redirection service. This service is free. Here is how redirection works. By default all Grandstream products point to our provisioning system. When a unit is powered up, it will automatically contact our provisioning server. Our provisioning server will then redirect the unit to customer's TFTP/HTTP/HTTPS server. The unit will reboot and send further provisioning request asking for configuration file (or firmware file) from customer's TFTP/HTTP/HTTPS server.

Below is the information we need from service providers for TFTP/HTTP redirection:

1. MAC address range, this should be printed on the carton box
2. Your TFTP/HTTP server IP address
3. Your company name and address

Here is what service providers should do:

1. Create configuration files for all the devices and put them on your TFTP/HTTP server
2. Download the latest official release from <http://www.grandstream.com/support/firmware> and put them on your TFTP/HTTP server (same directory as above)
3. After we inform you that the devices have been entered into our central provisioning database, please take out a few devices to test. Upon powering up, they should contact our provisioning server [fm.grandstream.com/gs](http://fm.grandstream.com/gs) first, and then get redirected to your TFTP/HTTP server and pull out the firmware files and the configuration files. They will be upgraded to the latest firmware with your configurations.

Grandstream also offers pre-configuration of our devices in factory, but this will incur an extra cost to the product ordered.

### **AUTOMATIC PROVISIONING WITHIN LAN**

Grandstream products support DHCP Option 66 or 43 for automatic provisioning within a Local Area Network. The provisioning server URL is embedded inside standard option 66 or 43 of DHCP responses. All Grandstream product families support DHCP Option 66 while the new product series GXP21xx/1xxx supports both DHCP Option 66 and 43.

Grandstream SIP devices send out DHCP DISCOVER with the following information:

Time	Source	Destination	Protocol	Info
1 12:42:59.045285	0.0.0.0	255.255.255.255	DHCP	DHCP Discover - Transaction ID 0xfabdd51d
2 12:42:59.048435	192.168.40.3	192.168.40.175	DHCP	DHCP Offer - Transaction ID 0xfabdd51d
3 12:42:59.069242	0.0.0.0	255.255.255.255	DHCP	DHCP Request - Transaction ID 0xfabdd51d
4 12:42:59.072624	192.168.40.3	192.168.40.175	DHCP	DHCP ACK - Transaction ID 0xfabdd51d
5 12:43:20.835893	172.18.31.163	255.255.255.255	DHCP	DHCP Inform - Transaction ID 0x627301a3
6 12:43:20.928351	192.168.40.178	255.255.255.255	DHCP	DHCP Inform - Transaction ID 0xca60c599

- Option: (t=61,l=1) Client identifier
- Option: (t=60,l=19) vendor class identifier = "Grandstream GXP1400"
- Option: (t=57,l=2) Maximum DHCP Message Size = 576
- Option: (t=55,l=9) Parameter Request List

DHCP Server can be configured to send the following information in its DHCP OFFER. Please notice that in this example, an [HTTP://URL](#) is provided in the Option 66 "TFTP Server Name" field. Device will then issue HTTP requests instead of the traditional TFTP requests to the server. This design allows more flexibility in device provisioning. While all Grandstream SIP devices support DHCP Option 66, only new product series GXP21xx/1xxx, HT50x, HT70x, GXW40xx, DP71x, GXP2200, GXV31xx and GXV32xx support this additional flexibility.

Time	Source	Destination	Protocol	Info
1 20:29:49.355363	0.0.0.0	255.255.255.255	DHCP	DHCP Discover - Transaction ID 0x28cf0916
2 20:29:49.355797	10.0.0.1	255.255.255.255	DHCP	DHCP Offer - Transaction ID 0x28cf0916
3 20:29:49.379890	0.0.0.0	255.255.255.255	DHCP	DHCP Request - Transaction ID 0x28cf0916
4 20:29:49.380055	10.0.0.1	255.255.255.255	DHCP	DHCP ACK - Transaction ID 0x28cf0916
5 20:30:09.924840	10.0.0.114	10.0.0.1	HTTP	GET /management/provisioning/gxp.txt HTTP/1.1
6 20:30:09.969086	10.0.0.1	10.0.0.114	HTTP	Continuation or non-HTTP traffic

- Option: (t=58,l=4) Renewal Time value = 4 days
- Option: (t=59,l=4) Rebinding Time value = 7 days
- Option: (t=51,l=4) IP Address Lease Time = 8 days
- Option: (t=54,l=4) DHCP Server Identifier = 10.0.0.1
- Option: (t=3,l=4) Router = 10.0.0.1
- Option: (t=6,l=4) Domain Name Server = 4.2.2.2
- Option: (t=66,l=40) TFTP Server Name = "http://10.0.0.1/management/provisioning"
- Option: (t=43,l=3) vendor-specific information

## XML PROVISIONING SCHEMA AND EXAMPLE FILE

The general XML syntax consists of a list of name-value pairs. P-Value is the element and the value of the element is represents the value for that particular configuration that the corresponding P-Value represents. For the complete P-value list, please refer to the legacy configuration templates at

<http://www.grandstream.com/support/tools>

### Example XML configuration file (cfgxxxxxxxxxxxx.xml):

```
<?xml version="1.0" encoding="UTF-8" ?>
<gs_provision version="1">
  <mac>000b82123456</mac>
  <config version="1">
    <P271>0</P271>
    <P270>Account name</P270>
  </config>
</gs_provision>
```

The mac element is not mandatory. It is designed this way because not all provision systems support MAC address. If it is present, the provision program will validate the mac element with the actual MAC address on the device.

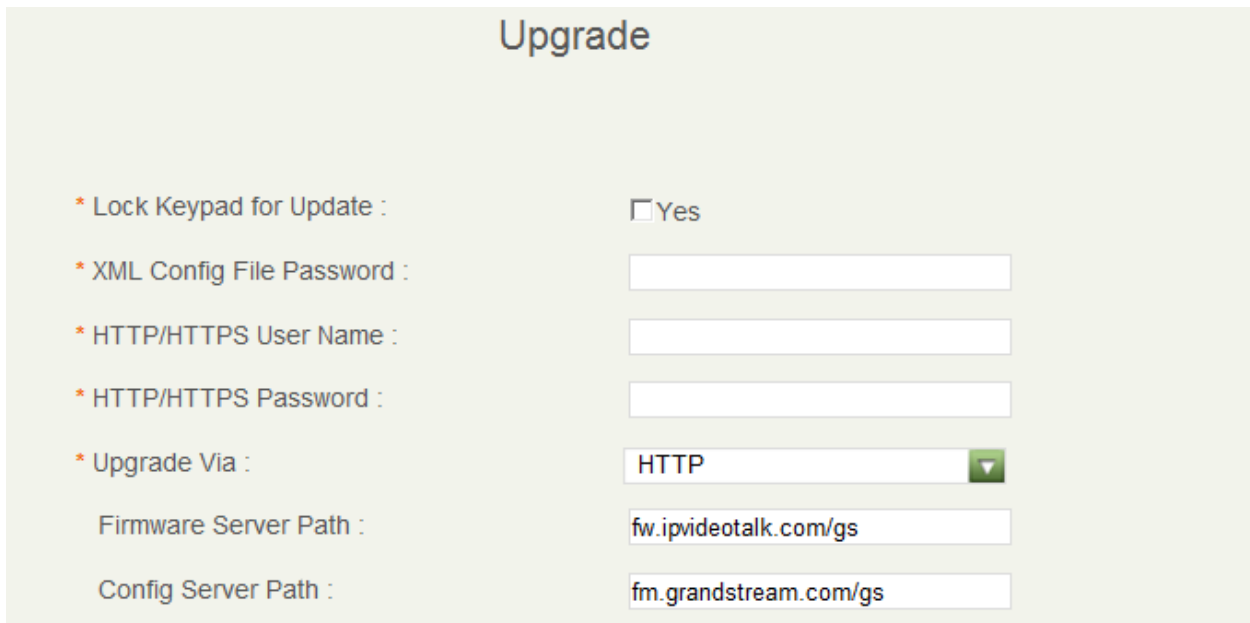
## XML FILE ENCRYPTION

The XML configuration file may be encrypted using AES-256-CBC algorithm. The encryption password is defined in P1359 (XML Config File Password) of the configuration file. The encryption may use salt to enhance security. The algorithm to derive the key and IV from a password is the same as the one used by OpenSSL:

The OpenSSL command-line to encrypt the file is as follows:

```
Openssl enc -e -aes-256-cbc -k password -in config.xml -out cfgxxxxxxxxxxxx.xml
```

Alternatively, users can also set the XML Config File Password in the web UI of the phone.



**Upgrade**

\* Lock Keypad for Update :  Yes

\* XML Config File Password :

\* HTTP/HTTPS User Name :

\* HTTP/HTTPS Password :

\* Upgrade Via :  ▼

Firmware Server Path :

Config Server Path :

**Figure 2: Using web UI to define the XML Configuration File Password**

When the XML configuration file is encrypted using this method, the phone would only be able to decrypt and parse the file if user set the XML Config File Password in P1349 of binary configuration file or in the web UI.



## SECURE PROVISIONING

Although the XML configuration file can be encrypted and the encryption algorithm itself is regarded as safe and strong by using AES with 256-bit key length, it remains a question on how to bootstrap and provision the initial XML encryption password. There are several methods to provide solutions to this:

1. Use legacy binary configuration file to set the initial XML encryption password. The legacy binary file is encrypted and it generally regarded safe.
2. Use HTTPS and use client side authentication. This is the industry standard approach and has the strongest safety.