

Configuring Cisco SPA5xx IP Telephones in an Asterisk® Environment:

Zero-Touch Installation



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Introduction	3
Audience	3
Scope	3
Related Documents	3
Overview	4
Summary of Tasks in this Document	4
Requirements	4
Network Diagram	5
The SPA5XX IP Phone's Boot Process	6
Configuring Asterisk for a SPA5xx IP Phone	7
Configuring the Asterisk Server	8
The sip.conf File	8
The extensions.conf File	8
Loading the Modified Asterisk Configuration Files	9
The SPA5xx Configuration Files	9
Resolving spa\$PSN.cfg	9
Building the spa5xxG.cfg Files	10
Building the spa\$MAC.xml Files	10
Configuring the Provisioning Server	12
Additional Tasks	13
Extracting a Configured Phone's Configuration	13
Forcing a Phone to Retrieve a Configuration	13
Rebooting a Remote Phone	13
Debug and syslog Logs	14
Traces Showing Entire Zero Touch Sequence	14
Gathering Information for Support	22

Introduction

This document assumes that you have read the Asterisk: Configuring Cisco SPA5xx phones with the Web-UI document available on the [Cisco IP Phone Community](#) site.

The Cisco® SPA5xx IP Telephone family is the next generation of small business IP phones that are perfectly suited to interoperate with Asterisk systems. This new family of phones inherits all of the features that Asterisk users loved in the Sipura > Linksys > Cisco SPA9xx family of phones. Like the SPA9xx family of IP phones, the SPA5xx phones fully support secure, automated provisioning and configuration.

The following table provides a summary of the SPA5xx phone family's features:

IP Phone	Line Keys	Color	Attendant Console	WiFi	BlueTooth	PoE	PC Switch Port	Wideband Audio G.722
SPA525G	5	Y	Y	Y	Y	Y	Y	Y
SPA509G	12	Y	Y	N	N	Y	Y	Y
SPA508G	8	N	Y	N	N	Y	Y	Y
SPA504G	4	N	Y	N	N	Y	Y	Y
SPA502G	1	N	Y	N	N	Y	Y	Y
SPA501G	8	n/a	Y	N	N	Y	Y	Y

Audience

This application note is targeted to Asterisk administrators, users, enthusiasts, and those wanting to automate the installation and configuration of the Cisco SPA5xx IP phone family. Readers of this document are expected to be familiar with IP networking and the administration tasks involved with configuring VoIP in an Asterisk environment.

Scope

This scope of this document is limited to automatically configuring the SPA5xx IP phones in an Asterisk environment and does not address the following topics:

- Installing an Asterisk server
- Advanced Asterisk configuration
- Installing or configuring the DHCP, TFTP, and HTTPS servers and services. This document only demonstrates using TFTP for provisioning. HTTPS must be used for production sites.
- Security

Refer to the Related Documents for additional configuration and background information.

Related Documents

- Asterisk: <http://www.asterisk.org>
- Asterisk Book from O'Reilly: <http://www.asteriskdocs.org/>
- [Cisco SPA500 User Guide](#)
- [Cisco SPA500 Series and WIP310 IP Phone Administration Guide](#)
- [Cisco IP Telephony Devices Provisioning Guide](#)
- Cisco Community Central: [Small Business Community IP Phone Support](#)

Overview

Configuring the SPA5xx IP Phone in an Asterisk environment is no different from configuring a SPA9xx IP Phone. For the purposes of this document, the SPA525G 5-line color IP phone with BlueTooth, MP3, and wideband audio support is used in most examples.

By the end of this document, you will be able to connect SPA5xx IP phones to your network and watch them automatically configure, upgrade their firmware and then register against an Asterisk server in a short amount of time. You will be able to make and receive calls in less than five minutes.

Summary of Tasks in this Document

You must complete the following tasks in order to deploy a SPA5xx IP phone in an Asterisk environment:

1. Configure the Asterisk Server
 - a. Edit the `sip.conf` file
 - b. Edit the `extensions.conf` file
 - c. Reload Asterisk modules
2. Configure the DHCP server for Option 66
3. Configure the TFTP server
4. Prepare the IP Phones' `/spa$PSN.cfg` and `/spa$MA.xml` configuration files
5. Load the IP Phones' configuration files on the TFTP server
6. Connect the SPA5xx IP phones to the network
7. Test the phones for appropriate behavior

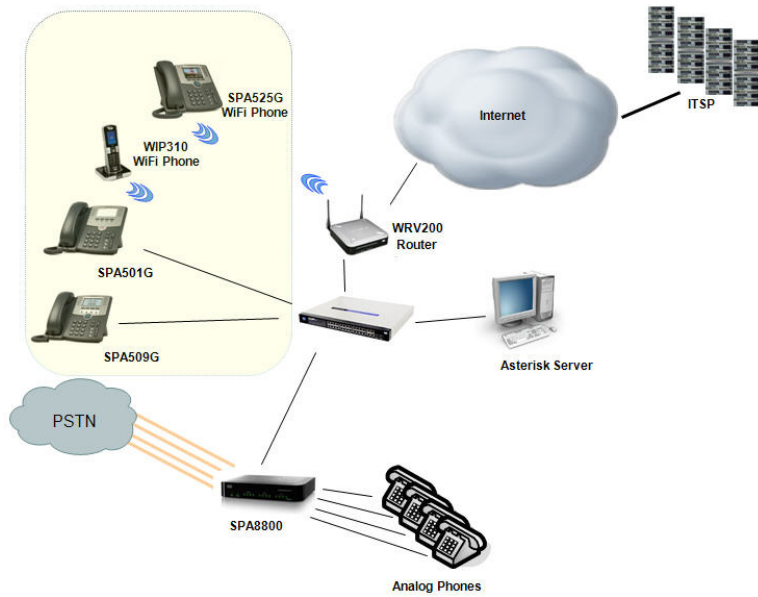
Requirements

You need the following equipment and services:

- A functional Asterisk server
- The new phones' Asterisk extensions and access credentials
- The new phones' MAC addresses
- A functional LAN with available network connectivity for the new SPA5xx phones
- A functional DHCP server with available IP addresses and Option 66 support
- A functional TFTP server and administrative access to the server
- An outbound call route. This route can be via an Internet Telephony Service Provider (ITSP), the PSTN, or both
- A sniffer such as Wireshark to help you visualize the phone's boot process
- A syslog server. Included in Linux/UNIX, free for Windows platforms from [SolarWinds](#)

Network Diagram

The network diagram shows a typical Asterisk environment where analog phones and wired and wireless IP phones are deployed. This document describes automating the IP phones in the colored rectangle in the diagram.

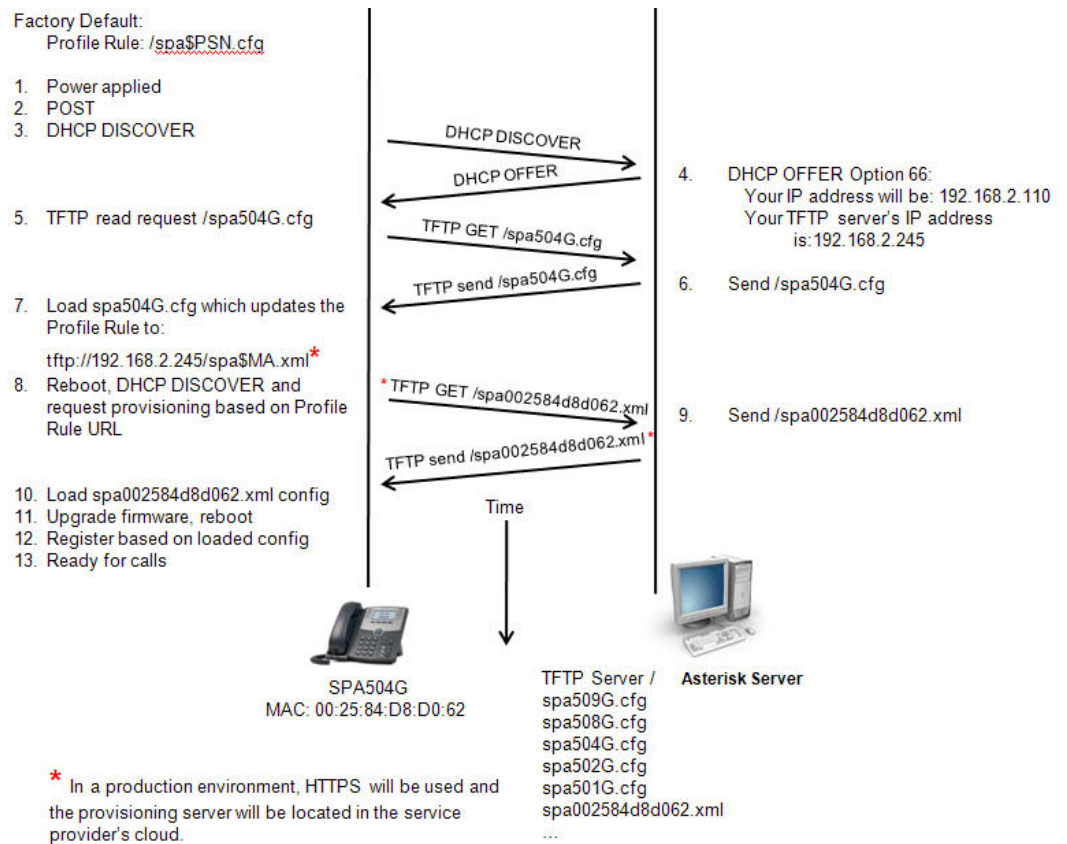


The SPA5XX IP Phone's Boot Process

This section provides you with a basic understanding of the Cisco SPA5xx IP phone's boot process. There are two files that play an important role in a zero-touch configuration. This section shows how the phone first requests a generic file so that it can then request its configuration file from a provisioning server.

A factory-default IP phone powers-up and locates its IP address from a DHCP server. The DHCP server can include Option-66 in its DHCP OFFER. Option 66 is simply the TFTP server's IP address. The phone requests its configuration from the specified sever. The phone configures itself and is ready for use.

Following is a summary of this process between a SPA504G and a Linux server which also acts as the Asterisk server:



1. Power is applied to the phone.
2. The phone performs power on self-tests.
3. The phones broadcast DHCP DISCOVER to the LAN.
4. The Asterisk server responds with a DHCP OFFER for an IP address. The offer includes option 66 which points to the IAD as a TFTP server.
5. The phone reads its factory default profile rule which causes the phone to request of the specified server, a configuration file based on its model number, example `spa504G.cfg`
6. The TFTP server sends the requested file to the phone.

7. The phone receives the generic model-related configuration file. This configuration file contains an updated profile rule which will cause the phone to request a MAC address-based configuration from the specified provisioning server.
8. The phone resyncs based on the time specified in its Resysnc_Periodic field. It reboots, acquires a dynamic IP address from the DHCP server, and then sends an HTTPS request for the MAC-specific configuration file to the specified provisioning server. This server can be local or located in a service provider's network cloud.
9. The provisioning server sends the phone a unique configuration file based on the phone's MAC address.
10. The phone receives and loads the configuration which can include an Upgrade_Rule parameter.
11. The phone may request a firmware upgrade and will then reboot.
12. The phone registers based on its configuration file.
13. The phone is ready for use.

Configuring Asterisk for a SPA5xx IP Phone

Before you configure your Asterisk server for the SPA5xx IP phone, you need to gather some basic information:

1. Extension numbers and assignments for each SPA5xx extension to be configured.
In this document, I use 151, 152 for line keys 1 and 2 of the 5 available on the SPA525G.
2. Line 1 will be display "Fred 151".
3. Line 2 will display "Sally".
4. The phone will display "Asterisk" at the top-right.



Configuring the Asterisk Server

Once you have gathered all of the basic information, configure the Asterisk server. Edit the

`sip.conf` and the `extensions.conf` file on the Asterisk server.

The `sip.conf` File

Following is a sample of the minimum `sip.conf` content:

```
...
...
;
[151]
type=friend
nat=no
secret=151secret
context=fxsgroup
host=dynamic
regext=151
;
[152]
type=friend
nat=no
secret=152secret
context=fxsgroup
host=dynamic
regext=152
;
...
...
```

The `extensions.conf` File

Following is a sample of the minimum `extensions.conf` content:

```
...
...
[fxsgroup]
...
...
;
exten => 151,1,Dial(SIP/151,60,rT)
exten => 152,1,Dial(SIP/152,60,rT)
;

;inbound calls from ITSP
[itsp1]
...
...
exten =>
3615551212,2,Dial(SIP/101&SIP/102&SIP/152&SIP/151&SIP/200&SIP/242,25,rt)
...
...
;
```


Loading the Modified Asterisk Configuration Files

1. Connect to the Asterisk console:

```
$ sudo asterisk -r
*CLI>
```

2. Use the reload command to load the changed configuration:

```
*CLI> module reload
```

This completes the Asterisk server configuration. You must now configure the `spa525G.cfg` and the `spa<MAC address>.xml` files and place them on the TFTP server.

The SPA5xx Configuration Files

There are two files that play an important role in a zero-touch configuration.

- `spa$PSN.cfg`—Example `spa525G.cfg`
- `spa$MAC.xml`—Example `spa002584d8d147.cfg`

This section describes where these files are located, their contents, and how to build them from scratch.

Variables are fully described in the [Cisco IP Telephony Devices Provisioning Guide](#)

Resolving spa\$PSN.cfg

As part of a phone's boot process, it performs a DHCP DISCOVER. If the DHCP OFFER from the DHCP server includes DHCP Option 66, the phone sends a TFTP read request for a configuration file, `/spa$PSN.cfg` by default. You can view this parameter with the phone's web-UI:

Voice tab > Provisioning tab > Configuration Profile > Profile Rule:

- The `$PSN` in `spa$PSN.cfg` resolves to the phone's model number. For example SPA504G IP phones will request the `/spa504G.cfg` file. Note that the request is for a fully qualified path so the TFTP server must be configured to serve `/spa5xG` files and not `5xG` files. Pay close attention to the `/`.

Building the *spa5xxG.cfg* Files

The *spa5xxG* configuration files must be built and loaded on the TFTP server before a phone can boot in a zero-touch configuration. The configuration file must point to the Asterisk server which is also playing the role of provisioning server. This enables automatic provisioning.

The TFTP server must have the following config files loaded in order to serve all possible Cisco SPA5xx IP phone models:

- /spa525G.cfg
- /spa509G.cfg
- /spa508G.cfg
- /spa504G.cfg
- /spa502G.cfg
- /spa501G.cfg

The *spa5xG.cfg* file must contain a minimum of an URL to a provisioning server which will provide the phones' complete profile. This example includes resync on reset, which is on by default and a periodic resync of 10 seconds. The periodic resync is short in this example so that a newly connected phone will wait for 10 seconds after booting before it requests its full configuration pointed to by the URL.

```
<flat-profile>
<Resync_On_Reset>Yes</Resync_On_Reset>
<Resync_Periodic>10</Resync_Periodic>
<Profile_Rule>tftp://192.168.2.245/xml/spa$MA.xml</Profile_Rule>
</flat-profile>
```

Building the *spa\$MAC.xml* Files

The *\$MA* variable resolves to the phone's MAC address with lower case hex digits and no colon delimiters. For example a phone with a MAC address of 00:25:84:D8:D0:62 will request the *spa002584d8d062.xml* file.

This means that a unique configuration file is required for each IP phone to be provisioned. The production version of this URL should for example, resolve to your Asterisk server.

Create the contents of the xml configuration file as follows:

1. Run the SPA Profile Compiler (SPC) for each model of phone. The SPC is available from Cisco.com for both Linux and Windows operating systems.

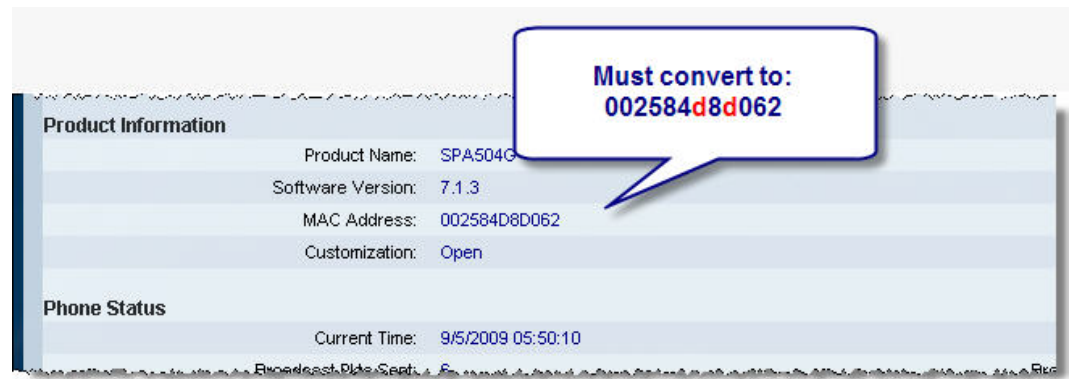
The following syntax will create a configuration template:

```
C:\>spa5x5g-sip-7-3-0-spc-win32-i386.exe --sample-xml spa5x5G.xml
```

Note: You can extract the configuration from a previously configured phone. This is described in the Extracting a Configured Phone's Configuration section.

2. Rename the *spa5x5G.xml* file to include the phone's MAC address. For example, *spa002584d8d062.xml*

The phone's MAC address is located on the back of the phone and is also available on the phone's web-ui from the Voice tab > Info tab > Product Information > MAC Address: as shown below. You must convert any upper case A-F characters to lowercase to a-f characters in the file name when using the *\$MA* variable in the profile rule. The *\$MAC* variable can be used if you prefer to use uppercase characters.



3. The phone must display the following when configured:



Edit the spa002584d8d062.xml file to configure the phone appropriately:

- a. Phone displays Asterisk at the top-right:

```
<Station_Name ua="na">Asterisk</Station_Name>
```

- b. Register Line key 1 to the Asterisk server as extension 151, a password of 151secret, and a label of Fred 151:

```
<Proxy_1_ua="na">192.168.2.245</Proxy_1_>
<User_ID_1_ua="na">151</User_ID_1_>
<Password_1_ua="na">151secret</Password_1_>
<Short_Name_1_ua="na">Fred 151</Short_Name_1_>
```

- c. Register Line key 2 to the Asterisk server as extension 152, a password of 152secret, and a label of Sally. Display Asterisk152 in SIP data:

```
<Display_Name_1_ua="na">Asterisk151</Display_Name_1_>
<Display_Name_2_ua="na">Asterisk152</Display_Name_2_>
```

- d. Register Line key 2 as extension 152 with a label of Sally:

```
<Proxy_2_ua="na">192.168.2.245</Proxy_2_>
<User_ID_2_ua="na">152</User_ID_2_>
<Password_2_ua="na">152secret</Password_2_>
<Short_Name_2_ua="na">Sally</Short_Name_2_>
<Extension_2_ua="na">2</Extension_2_>
```

- e. Disable the unused Line keys 3-5:

```
<Extension_3_ua="na">Disabled</Extension_3_>
<Extension_4_ua="na">Disabled</Extension_4_>
<Extension_5_ua="na">Disabled</Extension_5_>
```

- f. Modify the profile rule to point to the provisioning server and the phone's configuration file:

```
<Profile_Rule ua="na">tftp://192.168.2.245/xml/spa$MA.xml</Profile_Rule>
```

- g. Apply a firmware update rule so that the phone will always be at release 7.2.30 and provide a path to the upgrade server:

```
<Upgrade_Rule ua="na">($SWVER ne 7.2.30)? tftp://192.168.2.245/sw/spa525g-7-2-30.bin</Upgrade_Rule>
```

- h. Clear the default Vertical Service Activation Codes:

```
<!-- Vertical Service Activation Codes -->
<Call_Return_Code ua="na"></Call_Return_Code>
<Blind_Transfer_Code ua="na"></Blind_Transfer_Code>
<Call_Back_Act_Code ua="na"></Call_Back_Act_Code>
<Call_Back_Deact_Code ua="na"></Call_Back_Deact_Code>
<Cfwd_All_Act_Code ua="na"></Cfwd_All_Act_Code>
<Cfwd_All_Deact_Code ua="na"></Cfwd_All_Deact_Code>
<Cfwd_Busy_Act_Code ua="na"></Cfwd_Busy_Act_Code>
<Cfwd_Busy_Deact_Code ua="na"></Cfwd_Busy_Deact_Code>
<Cfwd_No_Ans_Act_Code ua="na"></Cfwd_No_Ans_Act_Code>
<Cfwd_No_Ans_Deact_Code ua="na"></Cfwd_No_Ans_Deact_Code>
<CW_Act_Code ua="na"></CW_Act_Code>
<CW_Deact_Code ua="na"></CW_Deact_Code>
<CW_Per_Call_Act_Code ua="na"></CW_Per_Call_Act_Code>
<CW_Per_Call_Deact_Code ua="na"></CW_Per_Call_Deact_Code>
<Block_CID_Act_Code ua="na"></Block_CID_Act_Code>
<Block_CID_Deact_Code ua="na"></Block_CID_Deact_Code>
<Block_CID_Per_Call_Act_Code ua="na"></Block_CID_Per_Call_Act_Code>
<Block_CID_Per_Call_Deact_Code ua="na"></Block_CID_Per_Call_Deact_Code>
<Block_ANC_Act_Code ua="na"></Block_ANC_Act_Code>
<Block_ANC_Deact_Code ua="na"></Block_ANC_Deact_Code>
<DND_Act_Code ua="na"></DND_Act_Code>
<DND_Deact_Code ua="na"></DND_Deact_Code>
<Secure_All_Call_Act_Code ua="na"></Secure_All_Call_Act_Code>
<Secure_No_Call_Act_Code ua="na"></Secure_No_Call_Act_Code>
<Secure_One_Call_Act_Code ua="na"></Secure_One_Call_Act_Code>
<Secure_One_Call_Deact_Code ua="na"></Secure_One_Call_Deact_Code>
<Paging_Code ua="na"></Paging_Code>
<Call_Park_Code ua="na"></Call_Park_Code>
<Call_Pickup_Code ua="na"></Call_Pickup_Code>
<Call_UnPark_Code ua="na"></Call_UnPark_Code>
<Group_Call_Pickup_Code ua="na"></Group_Call_Pickup_Code>
<Media_Loopback_Code ua="na"></Media_Loopback_Code>
<Referral_Services_Codes ua="na"></Referral_Services_Codes>
<Feature_Dial_Services_Codes ua="na"></Feature_Dial_Services_Codes>
<!-- Vertical Service Announcement Codes -->
```

4. Copy each phone's unique configuration to the server identified in the spa5xxG.cfg files and make the files available using the protocol identified in the spa5xxG.cfg files. Recall the " tftp://192.168.2.245/xml/spa\$MA.xml " used in the earlier example.

Configuring the Provisioning Server

Now that the two configuration files have been built, you are ready to make them available to the provisioning server who will in turn, make the files available to booting phones.

This example demonstrates deploying the Asterisk server as the provisioning server and using TFTP as the provisioning protocol. A production environment should use HTTPS and perhaps a cloud-based provisioning server.

Configure TFTP on the Asterisk server to serve each phone's configuration profile. For example if you are adding two SPA5xx IP phones with MAC addresses of 00:25:84:06:11:56 and 00:25:84:D8:D1:47. The TFTP server must serve the following files:

- /spa002584061156.xml
- /spa002584d8d147.xml

If using Linux/UNIX, be sure to change each file's mode to be readable. [chmod 444 *.xml]

You have now completed all relevant tasks.

Connect the phones to the network and apply power if not using PoE.

The phones will boot, download their configuration, upgrade firmware if applicable, reboot, register, and be ready to make calls.

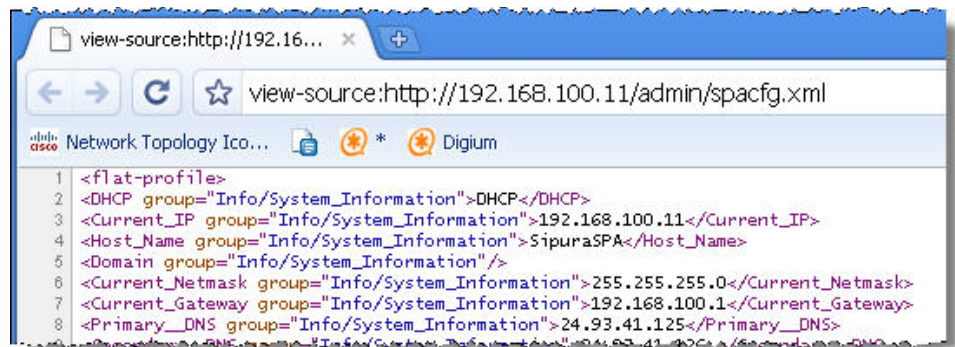
Additional Tasks

This section includes some tasks to assist an Asterisk Administrator.

Extracting a Configured Phone's Configuration

If you already have a configured and working phone, you can use the `spacfg.xml` command to display, in a browser, the phone's configuration. You can use this browser output as input for the xml configuration file. For example: Using Google's Chrome use the following URL:

`view-source:http://<IP_address_of_phone>/admin/spacfg.xml`



Copy and paste the contents of the browser into a file named for the MAC address of the phone. For example: `spa002584d8d147.xml`.

Note: Use the View Source menu option for Internet Explorer and Firefox browsers.

Forcing a Phone to Retrieve a Configuration

At some point in time, you will need to force a previously deployed and operational phone to retrieve a specific configuration. If you have an error in a phone's configuration profile, this is an easy way to direct the phone to the appropriate configuration. The phone will retrieve the configuration and subsequently update its profile rule. Here is how you can achieve this.

Force a phone to update its Provisioning tab > Configuration Profile > Profile Rule.

`http://<Phone_IP_Address>/admin/resync?tftp://<Server_IP_Address>/<new_config>`

Rebooting a Remote Phone

It is often more efficient to reboot a phone via the network. This will cause the phone to reboot and request the file specified in its Profile Rule. Here is how to accomplish this:

`http://<Phone_IP_Address>/admin/reboot`

Note: You cannot force a phone resync if the Admin access has been disabled in a profile.

Note: you cannot factory reset a password protected phone if you do not have its admin password.

Debug and syslog Logs

The SPA5xx supports writing debug and syslog messages to syslog servers. One server can be used, or separate servers can be used to receive messages. Four levels of verbosity are supported, 0 for no messages, 1 for terse, through 3 for verbose message output. Following is an example of enabling debug level 3 and sending messages to be logged at the 192.168.2.245 syslog server:

```
<Debug_Server ua="na">192.168.2.245</Debug_Server>
<Debug_Level ua="na">3</Debug_Level>
```

Traces Showing Entire Zero Touch Sequence

This section details at a trace-level, the 23 steps that a factory reset SPA5xx IP phone performs, from when it first boots until it registers with the Asterisk server

1. The SPA525G performs a DHCP DISCOVER

```
Frame 55 (590 bytes on wire, 590 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Broadcast
(ff:ff:ff:ff:ff:ff)
Internet Protocol, Src: 0.0.0.0 (0.0.0.0), Dst: 255.255.255.255 (255.255.255.255)
User Datagram Protocol, Src Port: bootpc (68), Dst Port: bootps (67)
Bootstrap Protocol
  Message type: Boot Request (1)
  Hardware type: Ethernet
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x3bb63176
  Seconds elapsed: 0
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 0.0.0.0 (0.0.0.0)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 0.0.0.0 (0.0.0.0)
  Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
  Server host name not given
  Boot file name not given
  Magic cookie: (OK)
  Option: (t=53,l=1) DHCP Message Type = DHCP Discover
  Option: (t=61,l=7) Client identifier
  Option: (t=60,l=13) Vendor class identifier = "Cisco SPA525g"
  Option: (t=55,l=13) Parameter Request List
  End Option
  Padding
```

2. The DHCP server responds with a DHCP OFFER

Observe the TFTP server name in Option 66

```
Frame 59 (369 bytes on wire, 369 bytes captured)
Ethernet II, Src: Vmware_1c:33:a3 (00:0c:29:1c:33:a3), Dst: 00:25:84:06:11:56
(00:25:84:06:11:56)
Internet Protocol, Src: 192.168.2.245 (192.168.2.245), Dst: 192.168.2.167
(192.168.2.167)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)
Bootstrap Protocol
  Message type: Boot Reply (2)
  Hardware type: Ethernet
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x3bb63176
  Seconds elapsed: 0
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 192.168.2.167 (192.168.2.167)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 0.0.0.0 (0.0.0.0)
  Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
  Server host name not given
  Boot file name not given
  Magic cookie: (OK)
```

```
Option: (t=53,l=1) DHCP Message Type = DHCP Offer
Option: (t=54,l=4) Server Identifier = 192.168.2.245
Option: (t=51,l=4) IP Address Lease Time = 30 minutes
Option: (t=1,l=4) Subnet Mask = 255.255.255.0
Option: (t=3,l=4) Router = 192.168.2.254
Option: (t=6,l=8) Domain Name Server
Option: (t=42,l=20) Network Time Protocol Servers
Option: (t=58,l=4) Renewal Time Value = 15 minutes
Option: (t=59,l=4) Rebinding Time Value = 26 minutes, 15 seconds
Option: (t=66,l=13) TFTP Server Name = "192.168.2.245"
End Option
```

3. The SPA525G responds with a DHCP REQUEST for the offered parameters

```
Frame 60 (590 bytes on wire, 590 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Broadcast
(ff:ff:ff:ff:ff:ff)
Internet Protocol, Src: 0.0.0.0 (0.0.0.0), Dst: 255.255.255.255 (255.255.255.255)
User Datagram Protocol, Src Port: bootpc (68), Dst Port: bootps (67)
Bootstrap Protocol
  Message type: Boot Request (1)
  Hardware type: Ethernet
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x3bb63176
  Seconds elapsed: 0
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 0.0.0.0 (0.0.0.0)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 0.0.0.0 (0.0.0.0)
  Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
  Server host name not given
  Boot file name not given
  Magic cookie: (OK)
  Option: (t=53,l=1) DHCP Message Type = DHCP Request
  Option: (t=61,l=7) Client identifier
  Option: (t=60,l=13) Vendor class identifier = "Cisco SPA525g"
  Option: (t=50,l=4) Requested IP Address = 192.168.2.167
  Option: (t=54,l=4) Server Identifier = 192.168.2.245
  Option: (t=55,l=13) Parameter Request List
  End Option
  Padding
```

4. The DHCP server responds with a DHCP ACK

```
Frame 61 (369 bytes on wire, 369 bytes captured)
Ethernet II, Src: Vmware_1c:33:a3 (00:0c:29:1c:33:a3), Dst: 00:25:84:06:11:56
(00:25:84:06:11:56)
Internet Protocol, Src: 192.168.2.245 (192.168.2.245), Dst: 192.168.2.167
(192.168.2.167)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)
Bootstrap Protocol
  Message type: Boot Reply (2)
  Hardware type: Ethernet
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x3bb63176
  Seconds elapsed: 0
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 192.168.2.167 (192.168.2.167)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 0.0.0.0 (0.0.0.0)
  Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
  Server host name not given
  Boot file name not given
  Magic cookie: (OK)
  Option: (t=53,l=1) DHCP Message Type = DHCP ACK
  Option: (t=54,l=4) Server Identifier = 192.168.2.245
  Option: (t=51,l=4) IP Address Lease Time = 30 minutes
  Option: (t=1,l=4) Subnet Mask = 255.255.255.0
  Option: (t=3,l=4) Router = 192.168.2.254
  Option: (t=6,l=8) Domain Name Server
  Option: (t=42,l=20) Network Time Protocol Servers
  Option: (t=58,l=4) Renewal Time Value = 15 minutes
```

Configuring Cisco SPA5xx IP Telephones in an Asterisk® Environment

```
Option: (t=59,l=4) Rebinding Time Value = 26 minutes, 15 seconds
Option: (t=66,l=13) TFTP Server Name = "192.168.2.245"
End Option
```

- The SPA525G reads its Profile Rule because it received DHCP Option 66 information. It resolves `/spa$PSN.cfg` to `/spa525G.cfg` and uses the IP address supplied in DHCP Option 66 to request the `/spa525G` of the server, using TFTP.

```
Frame 172 (82 bytes on wire, 82 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Vmware_1c:33:a3
(00:0c:29:1c:33:a3)
Internet Protocol, Src: 192.168.2.167 (192.168.2.167), Dst: 192.168.2.245
(192.168.2.245)
User Datagram Protocol, Src Port: epnsdp (2051), Dst Port: tftp (69)
Trivial File Transfer Protocol
  Opcode: Read Request (1)
  Source File: /spa525G.cfg
  Type: octet
  Option: timeout\000 = 20\000
  Option: tsize\000 = 0\000
```

- The TFTP (Asterisk) server responds by starting to send the requested file

```
Frame 173 (65 bytes on wire, 65 bytes captured)
Ethernet II, Src: Vmware_1c:33:a3 (00:0c:29:1c:33:a3), Dst: 00:25:84:06:11:56
(00:25:84:06:11:56)
Internet Protocol, Src: 192.168.2.245 (192.168.2.245), Dst: 192.168.2.167
(192.168.2.167)
User Datagram Protocol, Src Port: 49255 (49255), Dst Port: epnsdp (2051)
Trivial File Transfer Protocol
  Opcode: Option Acknowledgement (6)
  Option: timeout\000 = 20\000
  Option: tsize\000 = 245\000
```

- The SPA525G acknowledges the part that it has received and the process continues until the entire file has been transferred to the SPA525G

```
Frame 174 (60 bytes on wire, 60 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Vmware_1c:33:a3
(00:0c:29:1c:33:a3)
Internet Protocol, Src: 192.168.2.167 (192.168.2.167), Dst: 192.168.2.245
(192.168.2.245)
User Datagram Protocol, Src Port: epnsdp (2051), Dst Port: 49255 (49255)
Trivial File Transfer Protocol
  Opcode: Acknowledgement (4)
  Block: 0
```

- The SPA525G reads the contents of the `spa525G.cfg` file which are:

```
<flat-profile>
<Resync_On_Reset>Yes</Resync_On_Reset>
<Resync_Periodic>10</Resync_Periodic>
<Profile_Rule>tftp://192.168.2.245/xml/spa$MA.xml</Profile_Rule>
</flat-profile>
```

- The SPA525G replaces the contents of its Profile Rule per the instructions of the `spa525G.cfg` file. `tftp://192.168.2.245/xml/spa$MA.xml`
- The SPA525G's resync periodic timer counts down from 10 seconds.
In a production environment this would probably be a longer period of time.
- Once the resync periodic timer reaches zero, the SPA525G reads its Profile Rule and resolves `spa$MA.xml` to `spa 002584061156.xml`. It uses the URL supplied in Profile Rule to request the `/xml/spa 002584061156.xml` file.
It uses TFTP in this example, but a production environment would use HTTPS which is more secure.

```
Frame 331 (94 bytes on wire, 94 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Vmware_1c:33:a3
(00:0c:29:1c:33:a3)
Internet Protocol, Src: 192.168.2.167 (192.168.2.167), Dst: 192.168.2.245
(192.168.2.245)
User Datagram Protocol, Src Port: weblogin (2054), Dst Port: tftp (69)
Trivial File Transfer Protocol
  Opcode: Read Request (1)
```


Configuring Cisco SPA5xx IP Telephones in an Asterisk® Environment

```
Source File: /xml/spa002584061156.xml
Type: octet
Option: timeout\000 = 20\000
Option: tsize\000 = 0\000
```

12. The server responds by starting to send the configuration file

```
Frame 333 (67 bytes on wire, 67 bytes captured)
Ethernet II, Src: Vmware_1c:33:a3 (00:0c:29:1c:33:a3), Dst: 00:25:84:06:11:56
(00:25:84:06:11:56)
Internet Protocol, Src: 192.168.2.245 (192.168.2.245), Dst: 192.168.2.167
(192.168.2.167)
User Datagram Protocol, Src Port: 58095 (58095), Dst Port: weblogin (2054)
Trivial File Transfer Protocol
  Opcode: Option Acknowledgement (6)
  Option: timeout\000 = 20\000
  Option: tsize\000 = 67269\000
```

13. The SPA525G loads the configuration that it has just received. Included in the configuration is the following upgrade rule

```
( $SWVER ne 7.2.30 )? tftp://192.168.2.245/sw/spa525g-7-2-30.bin
```

The rule determines if the current version of firmware *\$SWVER* is not equal to 7.2.30. This phone shipped from the factory with 7.1.3 installed. Because 7.1.3 is not equal to 7.2.30, the upgrade rule activates. The phone requests a firmware upgrade specified in the upgrade rule URL: `tftp://192.168.2.245/sw/spa525g-7-2-30.bin`

```
Frame 660 (92 bytes on wire, 92 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Vmware_1c:33:a3
(00:0c:29:1c:33:a3)
Internet Protocol, Src: 192.168.2.167 (192.168.2.167), Dst: 192.168.2.245
(192.168.2.245)
User Datagram Protocol, Src Port: weblogin (2054), Dst Port: tftp (69)
Trivial File Transfer Protocol
  Opcode: Read Request (1)
  Source File: /sw/spa525g-7-2-30.bin
  Type: octet
  Option: timeout\000 = 20\000
  Option: tsize\000 = 0\000
```

14. The server responds by starting to send the configuration file

```
Frame 661 (70 bytes on wire, 70 bytes captured)
Ethernet II, Src: Vmware_1c:33:a3 (00:0c:29:1c:33:a3), Dst: 00:25:84:06:11:56
(00:25:84:06:11:56)
Internet Protocol, Src: 192.168.2.245 (192.168.2.245), Dst: 192.168.2.167
(192.168.2.167)
User Datagram Protocol, Src Port: 33081 (33081), Dst Port: weblogin (2054)
Trivial File Transfer Protocol
  Opcode: Option Acknowledgement (6)
  Option: timeout\000 = 20\000
  Option: tsize\000 = 11261440\000
```

15. The SPA525G reboots after it receives the updated firmware.

16. The SPA525G loads the new firmware and performs a DHCP DISCOVER.

```
Frame 857 (590 bytes on wire, 590 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Broadcast
(ff:ff:ff:ff:ff:ff)
Internet Protocol, Src: 0.0.0.0 (0.0.0.0), Dst: 255.255.255.255 (255.255.255.255)
User Datagram Protocol, Src Port: bootpc (68), Dst Port: bootps (67)
Bootstrap Protocol
  Message type: Boot Request (1)
  Hardware type: Ethernet
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x8c67e536
  Seconds elapsed: 0
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 0.0.0.0 (0.0.0.0)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 0.0.0.0 (0.0.0.0)
  Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
  Server host name not given
```

Configuring Cisco SPA5xx IP Telephones in an Asterisk® Environment

```
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP Discover
  Option: (53) DHCP Message Type
  Length: 1
  Value: 01
Option: (t=61,l=7) Client identifier
  Option: (61) Client identifier
  Length: 7
  Value: 01002584061156
  Hardware type: Ethernet
  Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
Option: (t=60,l=13) Vendor class identifier = "Cisco SPA525g"
  Option: (60) Vendor class identifier
  Length: 13
  Value: 436973636F2053504135323567
Option: (t=55,l=13) Parameter Request List
  Option: (55) Parameter Request List
  Length: 13
  Value: 01020306070F2A2C3A3B429697
  1 = Subnet Mask
  2 = Time Offset
  3 = Router
  6 = Domain Name Server
  7 = Log Server
  15 = Domain Name
  42 = Network Time Protocol Servers
  44 = NetBIOS over TCP/IP Name Server
  58 = Renewal Time Value
  59 = Rebinding Time Value
  66 = TFTP Server Name
  150 = Private
  151 = Private
End Option
Padding
```

17. The server responds with a DHCP OFFER.

```
Frame 863 (369 bytes on wire, 369 bytes captured)
Ethernet II, Src: Vmware_1c:33:a3 (00:0c:29:1c:33:a3), Dst: 00:25:84:06:11:56
(00:25:84:06:11:56)
Internet Protocol, Src: 192.168.2.245 (192.168.2.245), Dst: 192.168.2.167
(192.168.2.167)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)
Bootstrap Protocol
  Message type: Boot Reply (2)
  Hardware type: Ethernet
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x8c67e536
  Seconds elapsed: 0
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 192.168.2.167 (192.168.2.167)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 0.0.0.0 (0.0.0.0)
  Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
  Server host name not given
  Boot file name not given
  Magic cookie: (OK)
  Option: (t=53,l=1) DHCP Message Type = DHCP Offer
    Option: (53) DHCP Message Type
    Length: 1
    Value: 02
  Option: (t=54,l=4) Server Identifier = 192.168.2.245
    Option: (54) Server Identifier
    Length: 4
    Value: C0A802F5
  Option: (t=51,l=4) IP Address Lease Time = 30 minutes
    Option: (51) IP Address Lease Time
    Length: 4
    Value: 00000708
  Option: (t=1,l=4) Subnet Mask = 255.255.255.0
    Option: (1) Subnet Mask
    Length: 4
```

Configuring Cisco SPA5xx IP Telephones in an Asterisk® Environment

```
Value: FFFFFFF0
Option: (t=3,l=4) Router = 192.168.2.254
Option: (3) Router
Length: 4
Value: C0A802FE
Option: (t=6,l=8) Domain Name Server
Option: (6) Domain Name Server
Length: 8
Value: 185D297D185D297E
IP Address: 24.93.41.125
IP Address: 24.93.41.126
Option: (t=42,l=20) Network Time Protocol Servers
Option: (42) Network Time Protocol Servers
Length: 20
Value: 4812CD9C4834BE1ACEFB2427D82D392643DE95AB
IP Address: 72.18.205.156
IP Address: 72.52.190.26
IP Address: 206.251.36.39
IP Address: 216.45.57.38
IP Address: 67.222.149.171
Option: (t=58,l=4) Renewal Time Value = 15 minutes
Option: (58) Renewal Time Value
Length: 4
Value: 00000384
Option: (t=59,l=4) Rebinding Time Value = 26 minutes, 15 seconds
Option: (59) Rebinding Time Value
Length: 4
Value: 00000627
Option: (t=66,l=13) TFTP Server Name = "192.168.2.245"
Option: (66) TFTP Server Name
Length: 13
Value: 3139322E3136382E322E323435
End Option
```

18. The SPA525G performs a DHCP REQUEST

```
Frame 864 (590 bytes on wire, 590 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Broadcast
(ff:ff:ff:ff:ff:ff)
Internet Protocol, Src: 0.0.0.0 (0.0.0.0), Dst: 255.255.255.255 (255.255.255.255)
User Datagram Protocol, Src Port: bootpc (68), Dst Port: bootps (67)
Bootstrap Protocol
Message type: Boot Request (1)
Hardware type: Ethernet
Hardware address length: 6
Hops: 0
Transaction ID: 0x8c67e536
Seconds elapsed: 0
Bootp flags: 0x0000 (Unicast)
Client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 0.0.0.0 (0.0.0.0)
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 0.0.0.0 (0.0.0.0)
Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
Server host name not given
Boot file name not given
Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP Request
Option: (53) DHCP Message Type
Length: 1
Value: 03
Option: (t=61,l=7) Client identifier
Option: (61) Client identifier
Length: 7
Value: 01002584061156
Hardware type: Ethernet
Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
Option: (t=60,l=13) Vendor class identifier = "Cisco SPA525g"
Option: (60) Vendor class identifier
Length: 13
Value: 436973636F2053504135323567
Option: (t=50,l=4) Requested IP Address = 192.168.2.167
Option: (50) Requested IP Address
Length: 4
Value: C0A802A7
```

Configuring Cisco SPA5xx IP Telephones in an Asterisk® Environment

```
Option: (t=54,l=4) Server Identifier = 192.168.2.245
  Option: (54) Server Identifier
  Length: 4
  Value: C0A802F5
Option: (t=55,l=13) Parameter Request List
  Option: (55) Parameter Request List
  Length: 13
  Value: 01020306070F2A2C3A3B429697
  1 = Subnet Mask
  2 = Time Offset
  3 = Router
  6 = Domain Name Server
  7 = Log Server
  15 = Domain Name
  42 = Network Time Protocol Servers
  44 = NetBIOS over TCP/IP Name Server
  58 = Renewal Time Value
  59 = Rebinding Time Value
  66 = TFTP Server Name
  150 = Private
  151 = Private
End Option
Padding
```

19. The server responds with a DHCP OFFER.

```
Frame 865 (369 bytes on wire, 369 bytes captured)
Ethernet II, Src: Vmware_1c:33:a3 (00:0c:29:1c:33:a3), Dst: 00:25:84:06:11:56
(00:25:84:06:11:56)
Internet Protocol, Src: 192.168.2.245 (192.168.2.245), Dst: 192.168.2.167
(192.168.2.167)
User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)
Bootstrap Protocol
  Message type: Boot Reply (2)
  Hardware type: Ethernet
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x8c67e536
  Seconds elapsed: 0
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 192.168.2.167 (192.168.2.167)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 0.0.0.0 (0.0.0.0)
  Client MAC address: 00:25:84:06:11:56 (00:25:84:06:11:56)
  Server host name not given
  Boot file name not given
  Magic cookie: (OK)
Option: (t=53,l=1) DHCP Message Type = DHCP ACK
  Option: (53) DHCP Message Type
  Length: 1
  Value: 05
Option: (t=54,l=4) Server Identifier = 192.168.2.245
  Option: (54) Server Identifier
  Length: 4
  Value: C0A802F5
Option: (t=51,l=4) IP Address Lease Time = 30 minutes
  Option: (51) IP Address Lease Time
  Length: 4
  Value: 00000708
Option: (t=1,l=4) Subnet Mask = 255.255.255.0
  Option: (1) Subnet Mask
  Length: 4
  Value: FFFFFFF0
Option: (t=3,l=4) Router = 192.168.2.254
  Option: (3) Router
  Length: 4
  Value: C0A802FE
Option: (t=6,l=8) Domain Name Server
  Option: (6) Domain Name Server
  Length: 8
  Value: 185D297D185D297E
  IP Address: 24.93.41.125
  IP Address: 24.93.41.126
Option: (t=42,l=20) Network Time Protocol Servers
```

Configuring Cisco SPA5xx IP Telephones in an Asterisk® Environment

```
Option: (42) Network Time Protocol Servers
Length: 20
Value: 4812CD9C4834BE1ACEFB2427D82D392643DE95AB
IP Address: 72.18.205.156
IP Address: 72.52.190.26
IP Address: 206.251.36.39
IP Address: 216.45.57.38
IP Address: 67.222.149.171
Option: (t=58,l=4) Renewal Time Value = 15 minutes
Option: (58) Renewal Time Value
Length: 4
Value: 00000384
Option: (t=59,l=4) Rebinding Time Value = 26 minutes, 15 seconds
Option: (59) Rebinding Time Value
Length: 4
Value: 00000627
Option: (t=66,l=13) TFTP Server Name = "192.168.2.245"
Option: (66) TFTP Server Name
Length: 13
Value: 3139322E3136382E322E323435
End Option
```

20. The SPA525G reads its Profile Rule and resolves spa\$MA.xml to

spa 002584061156.xml. It uses the URL supplied in Profile Rule to request the /xml/spa 002584061156.xml file.

```
Frame 1046 (94 bytes on wire, 94 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Vmware_1c:33:a3
(00:0c:29:1c:33:a3)
Internet Protocol, Src: 192.168.2.167 (192.168.2.167), Dst: 192.168.2.245
(192.168.2.245)
User Datagram Protocol, Src Port: clearvisn (2052), Dst Port: tftp (69)
Trivial File Transfer Protocol
Opcode: Read Request (1)
Source File: /xml/spa002584061156.xml
Type: octet
Option: timeout\000 = 20\000
Option: tsize\000 = 0\000
```

21. The server responds by starting to send the configuration file

```
Frame 1048 (67 bytes on wire, 67 bytes captured)
Ethernet II, Src: Vmware_1c:33:a3 (00:0c:29:1c:33:a3), Dst: 00:25:84:06:11:56
(00:25:84:06:11:56)
Internet Protocol, Src: 192.168.2.245 (192.168.2.245), Dst: 192.168.2.167
(192.168.2.167)
User Datagram Protocol, Src Port: 40596 (40596), Dst Port: clearvisn (2052)
Trivial File Transfer Protocol
Opcode: Option Acknowledgement (6)
Option: timeout\000 = 20\000
Option: tsize\000 = 67269\000
```

22. The SPA525G send a registration request to the Asterisk server for Line 1

```
Frame 1369 (696 bytes on wire, 696 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Vmware_1c:33:a3
(00:0c:29:1c:33:a3)
Internet Protocol, Src: 192.168.2.167 (192.168.2.167), Dst: 192.168.2.245
(192.168.2.245)
User Datagram Protocol, Src Port: sip (5060), Dst Port: sip (5060)
Session Initiation Protocol
Request-Line: REGISTER sip:192.168.2.245 SIP/2.0
Message Header
Via: SIP/2.0/UDP 192.168.2.167:5060;branch=z9hG4bK-a3bdad3f
From: "Asterisk151" <sip:151@192.168.2.245>;tag=cde6e186eb355485o0
To: "Asterisk151" <sip:151@192.168.2.245>
Call-ID: 428c2895-45069ccb@192.168.2.167
CSeq: 50704 REGISTER
Max-Forwards: 70
Authorization: Digest
username="151",realm="asterisk",nonce="430ca543",uri="sip:192.168.2.245",algorithm
=MD5,response="f2d75f9ff607539clb9dcc0ec7cfff32"
Contact: "Asterisk151" <sip:151@192.168.2.167:5060>;expires=0
User-Agent: Cisco/SPA525G-7.2.30
Content-Length: 0
Allow: ACK, BYE, CANCEL, INFO, INVITE, NOTIFY, OPTIONS, REFER, UPDATE
Supported: replaces
```

23. The SPA525G send a registration request to the Asterisk server for Line 2

```
Frame 1372 (677 bytes on wire, 677 bytes captured)
Ethernet II, Src: 00:25:84:06:11:56 (00:25:84:06:11:56), Dst: Vmware_1c:33:a3
(00:0c:29:1c:33:a3)
Internet Protocol, Src: 192.168.2.167 (192.168.2.167), Dst: 192.168.2.245
(192.168.2.245)
User Datagram Protocol, Src Port: sip-tls (5061), Dst Port: sip (5060)
Session Initiation Protocol
Request-Line: REGISTER sip:192.168.2.245 SIP/2.0
Message Header
  Via: SIP/2.0/UDP 192.168.2.167:5061;branch=z9hG4bK-57d5e64f
  From: "Sally" <sip:152@192.168.2.245>;tag=52be517ec967e4ed01
  To: "Sally" <sip:152@192.168.2.245>
  Call-ID: 1061ddb3-9c03a45@192.168.2.167
  CSeq: 14046 REGISTER
  Max-Forwards: 70
  Authorization: Digest
username="152",realm="asterisk",nonce="4ada8e3b",uri="sip:192.168.2.245",algorithm
=MD5,response="755413682582a131206a9a9f44d26d0e"
  Contact: "Sally" <sip:152@192.168.2.167:5061>;expires=0
  User-Agent: Cisco/SPA525G-7.2.30
  Content-Length: 0
  Allow: ACK, BYE, CANCEL, INFO, INVITE, NOTIFY, OPTIONS, REFER, UPDATE
  Supported: replaces
```

The SPA525G IP phone now has the most current firmware, is customized for use, registered to the Asterisk server and ready to make calls in less than 5 minutes since it was connected to the network.

<end>

Gathering Information for Support

In the event that you need to reach out for support, collect the following information first:

A. SPA5xx's configuration

Web-UI > Admin Login > Advanced >

Browser > File > Save As > [save entire page as SPA5xxVoice.html]

B. SPA5xx syslog log from debug output:

Web-UI > Admin Login > Advanced >

System tab > Syslog & Debug Server: and Debug Level: 3

Configuring this is described fully at:

C. Voice tab

D. Asterisk sip.conf

E. Asterisk extensions.conf

F. WireShark trace



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