Spectralink PIVOT Call Server Redundancy

This technical bulletin explains how to configure call server redundancy for Spectralink PIVOT handsets.

System Affected

Spectralink PIVOT (all models)

Description

Call Server Redundancy

Interruption of critical communications can occur when Wi-Fi phones are not able to make or receive calls. This not-uncommon situation occurs when the SIP call server is taken offline for maintenance, the server fails, or the connection between the handset and the active server fails. In a redundant environment two or more servers are deployed so that when one fails, another one can take over. This is server redundancy.

With redundancy, a phone registered to one server (the "active" server) will "failover" to another server when the active server fails.

The two most common redundant server setups are:

- Call servers have a preferred order. The phone prefers some servers over others based on the servers' rank and priority (for example, a primary server and one or more backup servers). In this scenario, the phone will register to the highest rank and priority server available (the most preferred server.

- Call servers have the same rank and priority. The phone does not prefer one server over another and remains registered to any available server until the server fails. This scenario is referred to as load balancing.

In the first scenario when the primary server fails or is taken off line for maintenance or otherwise becomes inoperative a phone registered to the primary server will "failover" to a secondary server. When ranked more preferred server becomes available, the phone will

unregister from its currently active server and register to it. This behavior is termed "failback" because the phone returns to the most preferred available, not because the secondary server has failed.

In the second, load-balancing scenario, there are no preferred, primary or otherwise ranked servers; a phone will register and remain registered to any available call server. If that server fails, the phone will failover to another available server and will remain with that server until it, too, fails. When a failed server becomes available again, phones will be able to register to it when their active server fails or when the phone reboots. In this fashion, the call servers balance and share the load among the many phones that they serve.

Admin Tip: Configuring DHCP for redundancy

Please see **Error! Reference source not found.** for details on configuring DNS records to support redundancy.

Configuring the redundant environment

SIP phones register with a SIP call server which provides telephony functions. For a seamless transition, the redundant SIP call servers must be configured identically to the primary call server. This way each phone is recognized by the redundant call server and the call server can perform the exact same functions as the primary server.

In other situations, the redundant servers may provide fewer telephony services than the primary. In either case, all servers must support at least the same extension numbers and user credentials as well as the same SIP transport settings (protocol, port number, QoS values, etc.).

In a load balancing environment, all SIP call servers should be provisioned identically.

Every type of call server has different configuration parameters and it is beyond the scope of this document to describe how to configure SIP call servers. See www.spectralink.com/PIVOT for interoperability information for SIP call servers that have been tested for use with PIVOT by Spectralink.

Identifying the redundant call servers in the phone

Periodically the PIVOT phone will attempt to discover a list of addresses of candidate SIP servers. The list is built using the parameter(s) in the **Admin settings> SIP phone> SIP server** configuration field of the PIVOT device. Instead of pointing to just one server, the value(s) in this field must point to the list of redundant servers. For this purpose, a "serverspec" is used. A serverspec is a callserver or list of callservers and its value can determine rank and priority, if desired. Each serverspec value may be discovered via:

- a DNS SRV record query (possibly returning multiple servers in the case of a redundant environment),

- a DNS A-name record query (that may return multiple servers to facilitate a load balancing environment),

- or it may be an IP address.

Below we illustrate several examples where the serverspec values may take the form of a DNS SRV record, a DNS A-name record, or an IP address to illustrate what the corresponding SIP URI and DNS server configuration might look like as a result of the serverspec values.

The SIP server field will accept values in the form of "domain; serverspec1; serverspec2; serverspec3; serverspec4" where the domain value is required and the serverspec values are optional (if only the domain is specified, it is also treated as serverspec1). In a ranking system, the candidate server list is then built by sequentially adding addresses in preferential order as they are discovered by DNS queries for the values the administrator provides for serverspec1 through serverspec4.

During operation the phone will attempt to maintain a registration for the address-of-record with the format [sip:extension@domain]. The phone maintains registration with the highest preference server that is responding, and will not register to multiple servers simultaneously.

SIP server addresses can take several different formats, and the examples given in this document should help demonstrate how to utilize the SIP server domain and serverspec values to achieve a SIP URI of the form your call server environment requires.

SIP server field entries

Redundancy hinges on the entry in the SIP status field. Navigate to **Settings> Admin settings> SIP phone** to populate the field. This field is also available in the CMS.
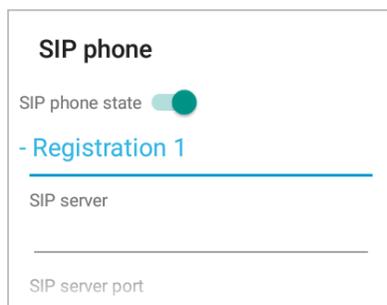
Our examples illustrate four different methods of populating the SIP server field and demonstrate how each method sets call server rank or priority to establish the preferred server or the equality of servers, as in load balancing. The first three methods configure a preferred call server. The fourth method illustrates load balancing. The first method uses IP addresses and the other three methods use DNS records.

SIP server field entry options

- IP addresses can be entered directly in the SIP server field if a DNS server is not readily available or the customer cannot easily modify the DNS server utilized by the 87-Series phones.

- DNS A-Name records: A-name records allow you to set preference by entering the A-name in the order of preference in the SIP server field. Appendix A details how to set up the A-name records for the servers in the redundancy pool. These A-names can then be entered directly into the SIP server field. A-names are also needed to create DNS SRV records.

- DNS SRV records: DNS SRV records contain a list of A-names for the call servers in the redundancy pool. The SRV record contains call server priority data. Only the domain is entered in the SIP server field and the DNS server manages the candidate servers by their specified priority. DNS SRV records can be used for setting up a preferred server if the same rank but different priorities are set. It is also a method for load balancing where each server has the same priority.

    If the facility also deploys Spectralink 84-Series handsets, the DNS SRV method is the recommended style of deployment.

Spectralink recommends: Use DNS
Static addresses will help eliminate the phones' dependency on a DNS server; however DNS Servers offer an administrator the flexibility to change or modify the call server addresses the phones will attempt to contact on the fly. Customers should weigh the benefit of each method for deployment when considering whether to use DNS or static IP addresses, and consider that a failure to query the DNS server could result in the phones' inability to achieve registration. If DNS records are used to specify the SIP server address, the best practice is to provide multiple DNS Server addresses to the 87-Series phone in order to help mitigate the problem where the 87-Series phone is unable to resolve the call server IP address.
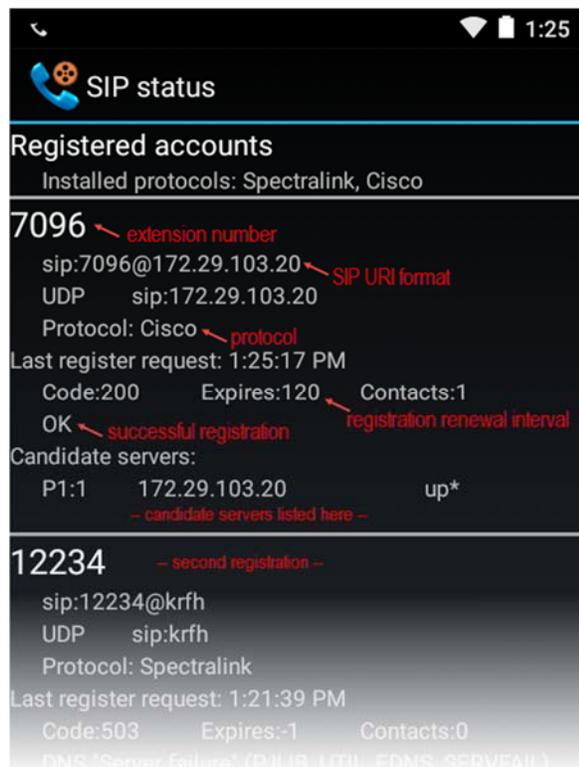
Registration status

The registration icon displays in the status bar along with a notification in the notification drawer: Swipe down to view the notification.
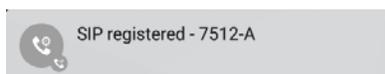
If registration fails, you will see the failed registration icon in the status bar and a notification in the notification drawer.
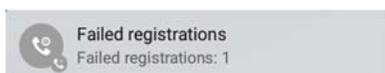
Tap the notification to open the SIP status screen which shows registration data and the list of candidate servers.

Call server status

Per normal SIP operation, we periodically refresh our SIP registration. We do this at least every 5 minutes and more often if the call server has been configured to do so.

Failed

If the response to the REGISTER request claims the SIP account does not exist (404) or that the authentication credentials are bad (401or 403), the state of the server is "failed".

Up

The status is set to "up" if the response to the SIP options requests is less than 500.

Down

The status is "down" if the response to our SIP options requests is a 408 request timeout or an internally generated 503 response. These responses indicate network or other connection problems.

Note: What if the network is down?

If the Wi-Fi network is down or if the LAN network is down, the phone will not update server status nor evaluate the failover algorithm. While the network is down, the phone will remain frozen on the current call server so that it can pick up where it left off when the network is restored.

The list of candidate call servers

PIVOT's SIP phone application verifies the status of the candidate call servers by pinging each server on the list with a valid SIP options request. The phone then compiles a report that is displayed in the SIP Status Display (accessible by tapping the SipService notification). This information is used both for detecting a need to re-register to a higher priority server when one becomes available, and for speeding up the failover process when multiple candidates are available and some are inoperable. Server status is marked:

- * (marked with an asterisk *) = active,
- up,
- down,
- failed,
- unknown.

The example on the right shows three discovered servers—one active, one up but inactive, and one down.

The status of the candidate servers is maintained by periodically pinging the candidates and by analyzing the servers' responses to the SIP options and re-registration requests.

The redundant environment

The redundant environment is set up when all of these conditions are met:

- The redundant servers are appropriately provisioned to support the registration of the PIVOT phone on any one of the defined servers,

- The SIP server field on the PIVOT device contains the appropriate domain and serverspec values to allow the PIVOT device to locate all of the appropriate servers,

- The SIP phone is registered to a server,

- The SIP phone has pinged and found each of the candidate servers and determined that their current status is "up".

Preferred server examples

In a preferred server configuration there is a preferred server and a redundant server. Should the preferred server fail or become unavailable, the 87-Series phone will "failover" to the redundant server. Once the preferred server again becomes available, the 87-Series phone detects that the preferred server is available, and will "failback" to the preferred server.

In a preferred server configuration, the phone always remains registered to the preferred server as long as it is responding to SIP Registrations, Invites, and SIP Option requests. The 87-Series phone periodically (about every five minutes) sends SIP Option messages to all candidate servers to determine their current availability. As long as the redundant server responds to the Option messages and if the preferred server fails, the 87-Series phone will "failover" to the redundant server. Thereafter, the 87-Series phone remains registered to the redundant server until the preferred server comes back on-line. Within approximately 5 minutes, the 87-Series phones detect that the preferred server is available, and will failback to the preferred server.

Call Server Setup

In the preferred server examples, two SIP servers are available for the phone to register to—a preferred server and a redundant server. For the sake of our example, SIP Registrations and Invites use the format *<Extension_Number>@<SIP_Domain>*. The SIP Domain is named *TestDomain.local*.

- Preferred server: SIPServer1 (**172.29.102.138)** This PBX has a DNS A-Name record with the FQDN name of *SIPServer1.TestDomain.local*, which will point to the IP address of *172.29.102.138*. This is the server we configured the phone to prefer.

- Redundant server: SIPServer2: **172.29.102.139** This PBX will have a DNS A-Name record with the name *SIPServer2.TestDomain.local*, which will point to the IP address of *172.29.102.139*. This is the server we want the phone to failover to in the event that SipServer1 becomes unavailable.

- SIP Domain: **TestDomain.local**

Method 1: Using IP addresses (without the use of DNS)

In the IP address method, we simply indicate the domain name and the IP addresses of the two servers, putting the IP addresses in the preferred order:

SIP server: **TestDomain.local; 172.29.102.138; 172.29.102.139**

Once the phone and servers are fully configured and available on the network, you can view the registration information by pulling down the Notification bar and tapping the SIP registered notification. The Candidate servers section shows the result:
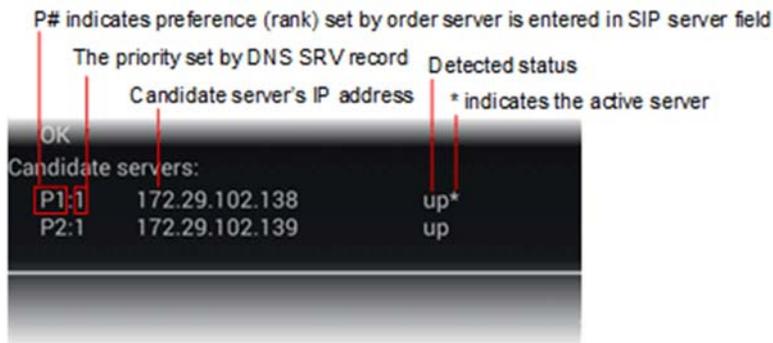
P1 and P2 in the left column indicate server rank. The preferred server is "P1". You can see that they are ranked in the order that their IP addresses were entered in the SIP server field. In the second column you see that Priority for both is "1" because the DNS SRV records were not used to set priority and "1" is the default. Both call servers have responded to the phone and the preferred server is the active one.

Method 2: Using DNS A-Name records

Preference is established using DNS A-name records by entering the A-names in the order of preference in the SIP server field.

In our example, this is the entry for the SIP server field:

SIP server: **TestDomain.local; SIPServer1.TestDomain.local; SIPServer2.TestDomain.local**

Admin Tip: SIP Server field values

When the SIP server field is populated with multiple semicolon-separated values, the first value is used only for constructing the SIP URI and the handset does not attempt DNS resolution on it.

Admin Tip: Additional configuration requirements

Configure the DNS server to return the IP addresses that correspond to the names of SIPServer1 and SIPServer2. Detailed steps for a Windows-based DNS server are shown in Appendix A: Section 1 and Section 2.

Once the phone and servers are fully configured and available on the network, you can view the registration information by pulling down the Notification bar and tapping the SIP registered notification.

P1 and P2 in the first column indicate call server rank. You can see that they are ranked in the order that the DNS A-name records were entered in the SIP server field. The "P1" server is the preferred server. Priority for both is "1" because DNS SRV records were not used to set priority and "1" is the default. Both call servers have responded to the phone and the preferred server is the active one.

Method 3: Using DNS SRV records

DNS SRV records use a priority field in the SRV record for each A-name record and this establishes server priority and sets preference. Because the work is done behind the scenes by the DNS server, only the Domain name is required in the SIP server field.

SIP server: **TestDomain.local**

Admin Tip: DNS resolution on a Domain name

When the SIP server configuration field is populated with multiple, semicolon-separated values, the first value is used only for constructing the SIP URI and the handset does not attempt DNS resolution on it. Since our example has only a single value in the SIP server field, the phone attempts DNS resolution.

Admin Tip: Additional configuration requirements

Configure the DNS Server to return the IP addresses, and port numbers that correspond to the location where SIP Service can be found for the Domain, *TestDomain.local* (the SIPServer1 and SIPServer2 addresses and port number 5060) when the phone queries the DNS Server for the *TestDomain.local* SRV record. Detailed steps are shown in Appendix A: Section 1, Section 2 and Section 3.

The P1 for both servers indicates that both have the same rank. Server preference is established by priority set in the DNS SRV records. Both call servers have responded to the phone and the preferred server, the one with the higher priority, is the active one. The order of the servers in the list reflects the order of the servers reported by the DNS query.

Method 4: Load balancing

Load Balancing is a DNS server configuration that distributes phone registrations evenly across a pool of SIP call servers. This feature is sometimes referred to as "round robin" distribution. When configuring this scenario, each of the SIP servers should offer equivalent functionality and should all be equally of capable processing the SIP Registrations and Invites of the devices connected to them. The SIP servers should be capable of communicating with each other on the back end to relay information to each other about which server should be contacted to establish a call to any phone registered to any one particular device.

With load balancing, the 87-Series phone remains registered to the first server it receives in the candidate list when it first contacts the DNS server as long as that original server continues to respond to SIP Registrations, Invites, and SIP Option requests. The phone periodically (about every five minutes) sends SIP Option messages to all candidate servers to determine their current availability. The DNS server provides a refreshed list of responding candidate servers which displays in the order received from the DNS server. As long as the other call servers are responding and if the original server in the list fails to respond, the phone will "failover" to the next available server in the list. Thereafter, the 87-Series phone remains registered to that next server. Since all servers are considered to be the same Rank and Priority the phone would not "failback" to the first server should it become available again.

The candidate server list is rebuilt whenever the phone sends a DNS query (approximately every two hours). If servers have been added to the DNS server record the phone queries for, they will now appear on the candidate list. If servers have been removed from the DNS server's record, they will no longer appear on the list. Although the active server may move to a different position on the list (because the DNS server reports its results in a different order), the phone does not register to a different server until the active server fails to respond, the SIP service is restarted or reconfigured, or the phone itself is rebooted.

Complete re-distribution of all phones would require all servers to be on-line and a reboot of all 87-Series devices. This should occur organically over time as servers are brought up and batteries are removed and replaced.

A call server pool established with A-Name records permits DNS load balancing because it is the method that permits equal Rank and Priority among all candidate servers. In our example, the call server pool is dubbed "fourAnames".

Call Server Setup

In the load balancing example, we have a pool of four SIP servers available for the phone to register to. Although they have no particular rank or priority, the load needs to be balanced across the pool.

For the sake of our example, SIP Registrations and Invites use the format *<Extension_Number>@<SIP_Domain>*. The SIP Domain is named *TestDomain.local*.

- SIP PBX 1: **172.29.102.138**
- SIP PBX 2: **172.29.102.139**
- SIP PBX 3: **172.29.102.140**
- SIP PBX 4: **172.29.102.141**
- SIP Domain: **TestDomain.local**

Using DNS A-Name records for DNS Load Balancing

The phone re-queries for DNS names entered in the SIP server field every two hours and rebuilds the candidate server list. The phone will failover to the next available server if the active server fails. As different phones boot up at different times, each receives candidate servers in a different order. As the 87-Series phones register to the first server received, and as the servers are reordered each time they are sent, load balancing is accomplished.

In our example, this is the entry for the SIP server field:

SIP server: **TestDomain.local; fourAnames.TestDomain.local**

> **Admin Tip: Additional configuration requirements**
>
> Configure the DNS Server to return the four IP addresses that should be considered candidates. Detailed steps are shown Appendix A. Follow Section 1 first and then skip to Section 4.

Once the phone and servers are fully configured and available on the network, you can view the registration information by pulling down the Notification bar and tapping the SIP registered notification.

P1 for all call servers – no preference is desired

The same priority is set for all call servers in DNS SRV records

Candidate server's IP address   Detected status
                                * indicates the active server

```
Candidate servers:
   P1:1      172.29.102.140        up*
   P1:1      172.29.102.139        up
   P1:1      172.29.102.138        up
   P1:1      172.29.102.141        up
```

The P1:1 shown next to each candidate server indicates that no server is preferred or has a higher rank or priority. Individual servers are not entered in the SIP server field. All call servers have responded to the phone and the first server is the active one. Note that when the phone updates its cache of DNS server results (approximately every two hours) the phone remains registered to the original server but the order in the candidate list will change. Like this:

```
Candidate servers:
   P1:1      172.29.102.138        up
   P1:1      172.29.102.141        up
   P1:1      172.29.102.140        up*
   P1:1      172.29.102.139        up
```

Load balancing occurs when a different phone is powered up and receives a list of call servers from the DNS server in a different order which causes it to register to a different topmost server on its call server list:

```
Candidate servers:
   P1:1      172.29.102.141        up*
   P1:1      172.29.102.140        up
   P1:1      172.29.102.139        up
   P1:1      172.29.102.138        up
```

Document Status Sheet

Document Control Number: CS-18-09

Document Title: Spectralink PIVOT Call Server Redundancy

Revision History: I01 – Released *October 24, 2018*
                      I02 – Released
                      I03 – Released

Date: *October 24, 2018*

Status: ☒Draft   ☐Issued   ☐Closed

Distribution Status: ☐Author Only   ☒Internal   ☐Partner   ☐Public

Copyright Notice

© 2018 Spectralink Corporation All rights reserved. Spectralink^{TM}, the Spectralink logo and the names and marks associated with Spectralink's products are trademarks and/or service marks of Spectralink Corporation and are common law marks in the United States and various other countries. All other trademarks are property of their respective owners. No portion hereof may be reproduced or transmitted in any form or by any means, for any purpose other than the recipient's personal use, without the express written permission of Spectralink.

All rights reserved under the International and pan-American Copyright Conventions. No part of this manual, or the software described herein, may be reproduced or transmitted in any form or by any means, or translated into another language or format, in whole or in part, without the express written permission of Spectralink Corporation.

Do not remove (or allow any third party to remove) any product identification, copyright or other notices.

Notice

Spectralink Corporation has prepared this document for use by Spectralink personnel and customers. The drawings and specifications contained herein are the property of Spectralink and shall be neither reproduced in whole or in part without the prior written approval of Spectralink, nor be implied to grant any license to make, use, or sell equipment manufactured in accordance herewith.

Spectralink reserves the right to make changes in specifications and other information contained in this document without prior notice, and the reader should in all cases consult Spectralink to determine whether any such changes have been made.

NO REPRESENTATION OR OTHER AFFIRMATION OF FACT CONTAINED IN THIS DOCUMENT INCLUDING BUT NOT LIMITED TO STATEMENTS REGARDING CAPACITY, RESPONSE-TIME PERFORMANCE, SUITABILITY FOR USE, OR PERFORMANCE OF PRODUCTS DESCRIBED HEREIN SHALL BE DEEMED TO BE A WARRANTY BY SPECTRALINK FOR ANY PURPOSE, OR GIVE RISE TO ANY LIABILITY OF SPECTRALINK WHATSOEVER.

Warranty

The *Product Warranty and Software License and Warranty* and other support documents are available at http://support.spectralink.com.

Contact Information

US Location	Denmark Location	UK Location
+1 800-775-5330	+45 7560 2850	+44 (0) 20 3284 1536
Spectralink Corporation	Spectralink Europe ApS	Spectralink Europe UK
2560 55th Street	Bygholm Soepark 21 E Stuen	329 Bracknell, Doncastle Road
Boulder, CO 80301	8700 Horsens	Bracknell, Berkshire, RG12 8PE
USA	Denmark	United Kingdom
info@spectralink.com	infoemea@spectralink.com	infoemea@spectralink.com